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Assessment of Sewerage Tariff in Accra

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Abstract
Adequate sewerage tariff determination has been a challenge to the Accra Metropolitan Assembly (AMA) for effective management of sewerage in Accra. Hence the aim of this study is to assess the current tariff system for provision of sewerage services and how its review can improve upon the system in Accra. The study which was conducted from July 2009 to December 2009 looked at the sewerage tariff model being implemented, willingness and ability of sewerage users to pay for the service, full cost recovery tariff and operation and maintenance (O&M) cost recovery tariff as well as the amount of subsidies to be paid to support proper delivery of sewerage services in Accra. While the *Statistical Package for Social Sciences* was used to analyse data to determine the willingness and ability to pay for sewer usage, the *Average Incremental Cost* was used to determine the O&M and full cost recovery tariffs. The results indicated that while full cost recovery tariff and O&M cost recovery tariff per month were determined to be GH¢ 17.06 per household (GH¢ 2.06/m^3) and GH¢ 7.12 per household (GH¢ 0.86/m^3) respectively, the current average sewer user fee is GH¢ 5.14 per household (GH¢ 0.62/m^3). Therefore the current sewer user fee is inadequate to generate enough revenue for the service provider to increase the level of service needed by customers. It is therefore recommended that sewer user charges should be increased progressively to achieve O&M cost recovery and full cost recovery, subject to affordability. Also major industrial polluters should be charged on a two-part tariff system based on volume of wastewater and level of pollution. Public education and awareness of tariff increases should be done for customers to understand the main components of the tariff and what the increased revenue resulting from increased tariff will be used for, so as to enhance payment. For the regulatory body (ies) to fix realistic tariffs or request for the right amount of subsidy within a particular period time, elaborate studies on sewer user fees must be conducted regularly (once every other year).
Keywords: Sewerage, block tariff/pricing, fixed charges and gap financing, Fair/Equity pricing

1.0 Introduction

Tariffs are used basically by utility service providers to recover costs and achieve financial stability. However they are also for efficient allocation of scarce resources, equitable income distribution, and fiscal viability. Even the most carefully designed tariff cannot accomplish all these objectives without trade-offs among them (Laredo, 1991).

The underlying principle of a utility tariff is that the beneficiaries of the public service should pay the costs, but the controversy surrounding this principle is the question of; which costs a tariff should cover (Russell and Shin, 1996a). There are arguments that utilities are necessities to the society, therefore various governments or the states should fully bear the cost or partly bear the cost through subsidies.

A utility service provider must meet the costs of capital, operations and maintenance, short-term loans, and fund reserves (i.e. full cost). The extent of these costs is determined by the levels of service provided. The levels of service are also influenced by several institutional and technical factors.

The terminology "*Cost centers"* is an accounting device for separating costs into discrete units or activities and facilitates the design of tariffs. Usually realistic tariffs establishment also take into account the efficiency of operations, the utility's institutional capability, and the accurate prediction of ability and willingness to pay.

For sewerage, once the costs of providing the services have been correctly identified, a suitable method of cost recovery is then selected. The most commonly used method in Africa is the operation and maintenance cost recovery while in most of the advanced countries full cost recovery method is usually used. Consequently sewerage tariffs in most advanced countries are higher than those of the developing countries (Global Water International, 2005).

Sewerage financing has been a great challenge to most countries of which Ghana is no exception. Since wastewater treatment is a basic sanitation need, an essential service and reliant on expensive infrastructure for collection and treatment, pricing principles are critical as the basis of tariff design. The revenue needed to build and operate the infrastructure is from a wide range of different tariffs and charges that apply to different types of customers. Primarily, since the wellbeing of the disadvantaged and vulnerable households is of much concern, the focus is usually on domestic tariffs and the need to ensure that essential usage is affordable for all.

However sewerage tariff over the years in Ghana has not been considered as a serious matter as the then Ghana

Water and Sewerage Corporation employed a cross-subsidy from the water system to manage the sewerage system. Not until the year 2005, when the sewerage functions of the then Ghana Water and Sewerage Corporation was divulged to the Accra Metropolitan Assembly, was the sewerage tariff considered an important issue. However, no tariff study has been conducted to ascertain the appropriate sewerage user fee and if possible the level of subsidy for the proper management of sewerage systems in Accra. Hence the need to encourage efficient use of sewers and raise sufficient revenue to secure the sustainability of the wastewater industry.

The study intended to assess the current tariff system for provision of sewerage services and how its review can improve upon the system in Accra. Specifically the study had the following objectives to achieve:

Assess the tariff model which the GWCL and SHC were using and the current tariff model being used by AMA.

To assess the willingness and ability of the customers to pay for the sewerage services.

To determine the adequacy of tariff and subsidy level for the provision of sewerage services in the city of Accra.

To determine the roles and functions of authorized bodies (e.g. Public Utility Regulatory Commission-PURC and the Accra Metropolitan Assembly) in determining sewerage tariffs.

To make recommendations to improve the sewerage tariff and sewerage services in the city of Accra.

The study was intended to provide the regulatory and the management bodies base-line information about sewerage tariffs for future use. It was also intended to serve as a sewer-charge guideline for other cities in Ghana that are using or intend to use sewerage as a system of collection and transportation of wastewater to be treated

Due to budgetary limitations and easy – access – to – information constraints, the sample size (number of respondents/households) was chosen according to the researcher's resources and limited information was obtained for the study. The study focused on the communities in the Accra Metropolis (Dansoman, Accra Central, James Town, Ussher Town, parts of Osu, parts of Ridge and Labone) with sewerage facilities. The study also focused on having interactions with stake-holding organisations - Accra Metro Sewerage Unit of Accra Metropolitan Assembly, Ghana Water Company Limited/Aqua Vitens Rand Limited, State Housing Company Limited and Public Utility Regulatory Commission.

2.0 Literature Review

Utility tariff for public services affects the welfare of communities, districts, municipalities and metropolis and the financial performances of public utilities (Gunatilake and Carangal-San, 2008). Various international and local development banks provide significant proportion of assistance to many countries and companies in the sectors where utility tariff plays an important role.

2.1 Objectives of Setting Wastewater Tariff

The design of a sewerage tariff structure is usually undertaken within the context of a set of objectives (Dole et al, 2006). These objectives offer the basis on which the tariff structure and the tariff levels are developed. Sewerage tariffs are generally developed on the basis of the following main objectives:

2.1.1 Good Governance

The objective requires that the tariff should be simple, transparent and predictable. According to Dole and Bartlett (2004), a tariff is simple if customers can easily understand their own charges, and if every component is needed to meet the tariff's goals. Also a tariff is transparent if customers understand and accept the basis for the tariff and a transparent tariff should be set through a clear and explicit process that involves the public, both in the collection of information and making decisions. A minimum standard for predictability is that changes are announced well before they take place, and that major changes are introduced gradually.

2.1.2 Financial Sustainability

The sewerage tariffs need to be capable of generating revenues sufficient for the financial sustainability of the wastewater system and the responsible operating entity. Financial sustainability guarantees that the sewerage services can be provided over a longer term. For sustainability of the service, it is necessary to generate sufficient revenues to cover both all the cash flow needs and make sufficient provision for asset replacement. Cash flow needs may be defined as cash operating costs in addition to any debt service costs (both interest and principal) for which the wastewater utility is responsible. Nonetheless meeting only the cash flow needs does not provide for financial sustainability and therefore the more thorny issue of full cost recovery needs to be applied. Where a wastewater company has to achieve full cost recovery in stages, tariffs ought to initially meet cash flow needs and over the medium to long term, move to achieve full cost recovery.

2.1.3 Distributive Justice

This basically implies that tariffs are affordable and help the poor satisfy their basic needs, when other ways are not available. According to the National Guidelines for Wastewater Tariffs for China, affordability is associated to the concept of universal access. The wastewater utility provides a social good and society has the responsibility to provide that good for all. In the case of water supply, this relates to some physical or socially approved minimum – life line amounts. For wastewater, however, the disbenefits involved in not disposing of wastewater hygienically suggest that society has a duty to intervene. Research has shown that investment in

wastewater infrastructure and treatment has a positive correlation with improvement of quality of life of disadvantaged sections of the community. This is because such investment constitutes an important public health intervention for both city dwellers through effective collection and downstream water users through wastewater treatment. Also it is almost always the disadvantaged sections of communities who are most exposed to public health risks. Charging systems therefore need to balance affordability with accessibility, with the need for financial sustainability of service provision. The affordability threshold for combined water and wastewater charges is about 5% of monthly household income (Unesco-IHE–Delft, 1999). In most developing countries, for the average income household, affordable combined water and wastewater bill ranges from 1.5% to 2.9% and for the low income household, ranges from 2.2% to 3.6% of household income (Clark et al, 2006).

The use of affordability thresholds in sewerage tariff setting is a means of ensuring the service is affordable and hence accessible to the large majority of users. However there will always be a small minority of financially disadvantaged users unable to pay charges without assistance. Hence welfare payments or other public subsidies for very poor households should be made by the government and include a realistic allowance for wastewater charges.

2.1.4 Economic Efficiency

The purpose of economic efficiency is to promote the efficient use of national resources and it is defined as a condition whereby society gets the highest social welfare (overall satisfaction of individuals in a society) from its scarce resources (Dole et al; 2006). Equilibrium based economic theory says that Economic Efficiency occurs where the marginal tariff (usage charge) is equal to the utility's marginal costs. This means the usage charge should never be less than short run variable costs, such as chemicals and electricity and any other variable O&M costs.

2.1.5 Fair/Equity Pricing

The aim of fair pricing is to be able to demonstrate that charges are "fair" to all customers. This is most easily done when the charge is based on the costs of service provision as can be traced to or caused by each customer (Ng, 1987). In the case of wastewater charging, price fairness/equity involves introduction of Polluter Pays Principle (PPP). The polluter should bear the expenses (pollution prevention and control) of carrying out the measures decided by authorities to ensure that the environment is in an acceptable state (Gunatilake et al, 2008). This is a simple reformulation of the price equity principle, that people should pay the costs they cause at the wastewater treatment plant to treat their effluent discharge. As municipal wastewater treatment plants are designed to mainly remove suspended solids and other pollutants, it is the levels of the pollutants that are most commonly used to assess pollution load. The use of formula to assess pollution load and apply this for wastewater charging was first implemented in the UK in the 1950s (http://www.adb.org/Projects/Wastewater-Tariffs/chinese/documents/mainreport-vol1.pdf).

A formula known as the "Mogden Formula", Charge = V + B x Or + S x Sr

Where: V = unit of currency/m^3 charge for collection and flow element;

B = unit of currency/m^3 charge for secondary treatment;

S = unit of currency /m^3 charge for sludge processing and disposal;

Or = Ratio of an industry's Chemical Oxygen Demand (COD) concentration to the average Domestic COD

Sr = Ratio of an industry's Suspended Solids (SS) concentration to the average Domestic SS

was used, and has subsequently been modified and adapted for use in many other countries.

2.2 Other Possible Objectives of Setting Wastewater Tariff

Other objectives of setting sewerage tariff might also be relevant, like using the tariff to extend service to people without connections. Social acceptability, which is charges set to achieve economic and financial objectives, must be consistent with the ability and willingness of users of the system to pay (Madi et al, 2003). The latter is an important factor that must be considered seriously.

2.3 Different Methods of Tariff/Pricing

Though all the above stated objectives are important for successful sewerage tariff system, governments and financial institutions have found it extremely important to concentrate on financial sustainability of wastewater companies. For without it, sewerage services cannot be provided over a long period time. Therefore the various different methods of tariff pricing have usually stemmed out of financial sustainability objectives of wastewater companies.

The several approaches to achieving financial objectives will be explained in the following sub headings.

2.3.1 Leave Tariffs As They Are and Hope for the Best

Setting of utility tariff has advanced with time. For example, tariff setting in the electricity and telecommunications sectors in many developing countries have reached advanced stage and financial sustainability in these sectors has been somewhat successful. In contrast to the good performance in these sectors, tariff for household water supply and sewerage services has shown mixed performance. Some developing countries struggle, even to introduce some tariff, let alone achieve cost recovery. Consequently, one should

consider some tariff as better than no tariff.

Hence with this approach which is also known as "The Head in Sand Approach", the wastewater company always uses non-revised, historical charges for present and future pricing. This usually leads to the companies unable to meet their financial obligations and as a result provides low level of service to customers. More often, companies that use this approach do not last long with passage of time. Companies normally do not go by this approach but are often pushed to this state by regulatory bodies and governments.

2.3.2 Increment of Tariffs In Line With Inflation

With this approach, the Wastewater Company monitors inflation in the country over a period of time (e.g. Quarterly, semi annually or annually) and usually revises the tariffs at a frequency as would be directed by the regulatory body. This increment may not come anywhere near the actual cost for the provision of the service but at least it is more or less acceptable politically. If inflation fluctuates the revenue for the wastewater company also fluctuates and financial planning becomes difficult.

2.3.3 Tariff Aimed At Full Recovery of Operation and Maintenance Costs

This approach aims at setting the sewerage tariff to cover the full cost of operation and maintenance. The approach does not consider equipment replacement cost and expansion cost (Donkor, 2000).

2.3.4 Tariff to Recover Full Operation and Maintenance Cost plus Depreciation

This approach ensures that operation and maintenance cost as well as cost of using up all fixed assets are included in the tariff. The approach considers equipment replacement cost but excludes expansion cost (Donkor, 2000).

2.3.5 Setting Tariff Targeted at Rate of Return on Capital

In the case where some assets are old and there have been quite a lot of improvement projects, it is desirable to generate a surplus over and above the cash requirements to provide a contribution to future investment. This tends to give a measure of independence and reduces reliance on outside funding. This method considers historical costs as the best indication of what customers should pay in the present.

The Rate of Return on Capital approach can be summarised mathematically as follows:

Expected Annual Revenue – Expected Annual Cost (including Depreciation) = Annual Surplus (Profit)

Expected Annual Revenue = Expected Annual Cost (including Depreciation) + Agreed Annual Surplus Target

Agreed Annual Surplus Target is taken as proportional to the size of the wastewater utility (i.e. percentage of fixed assets).

Expected Total Annual Revenue = Expected Annual Cost (including Depreciation) + x% of Return on fixed assets.

Again,

Expected Total Annual Revenue = Total Annual Volume of wastewater treated x tariff per cubic metre

Therefore,

Total Annual Volume of wastewater treated x tariff per cubic metre = Annual Cost (including Depreciation) + x% of Return on fixed assets

Tariff per cubic metre of wastewater

$$= \frac{Expected\ Annual\ Cost\ (including\ Depreciation)\ +\ x\%\ of\ Return\ on\ fixed\ assets}{Total\ Annual\ Volume\ of\ Wastewater\ Treated}$$

It therefore implies that

Tariff per cubic metre of wastewater = $\frac{Expected\ Total\ Annual\ Revenue}{Total\ Annual\ Volume\ of\ Wastewater\ Treated}$

Consider a simplified scenario for a wastewater company:

Table 2.1: Simplified Scenario for Setting Tariff Targeted At Rate of Return on Capital

	GH¢/ m^3	m^3	GH¢	GH¢
Operating Expenses				50,000
Depreciation				30,000
Net Fixed Assets			1,000,000	
Agreed Profit , 10% on fixed assets				100,000
Total Revenue				180,000
Annual Volume of Wastewater Treated		500,000		
Average Tariff	0.36			

Source: Unesco-IHE – Delft, 1999

2.3.6 Long Run Marginal Cost and Average Incremental Cost

This method considers future cost as the best indicator of what customers should pay now (Heathrow and Stansted, 2003-2008). Many Economists believe that it is beneficial if the rates charged signals to the customer the value of input resources used in the provision of the services.

Rather than set rates by reference to existing or historical costs, rates should reflect the cost of providing the

additional (incremental) services required to meet the increased demand. Thus the customer is informed of the true cost of providing additional services and through adjustments to their usage can indicate their willingness to utilise the service at that rate.

Marginal costs are additional operating cost for additional unit of output. Short Run Marginal Cost includes variable costs that are directly attributed to the provision of an extra unit of the service (Russell and Shin, 1996b). For example, the additional pumping cost, operating and maintenance cost incurred in the sewage treatment. Where extensions of capacity are required to allow for increasing treatment, marginal costs includes the necessary investment cost (Long Run Marginal Cost).

However, strict application of marginal operating cost can cause large and sudden fluctuations in tariff and hence revenue (Gunatilake et al, 2008). Therefore the World Bank, the African Development Bank, Asian Development Bank and other donor or financial agencies favour the average incremental cost (AIC). AIC represents the average or long run marginal cost over a long period of time.

That is, the Average Incremental Cost approach sets the tariff equal to the cost of treating sewage from the recent or the next most feasible investment which will usually be more expensive in real terms. Average Incremental Cost is determined by assuming the most economic output where Long Run Marginal Costs is equal to the Long Run Marginal Revenue.

Mathematically this implies

Future lifecycle Revenue = Lifecycle Cost of providing enhanced collection and treatment systems.

Taking into account the time value of money in the future,

But Present Value of Lifecycle Revenue = Present Value of [Tariff x Lifecycle of treated sewage volume]

Hence Present Value of [Tariff x Lifecycle of treated sewage volume] = Present Value of Lifecycle Costs

Tariff x Present Value of [Lifecycle of treated sewage volume] = Present Value of Lifecycle Costs

Therefore, Tariff = $\frac{\text{Present Value of Lifecycle Costs}}{\text{Present Value of Lifecycle of treated sewage volume}}$

The present values are determined by discounting the cash flows and production of sewage volumes at a discount which is usually the Weighted Average Cost of Capital (WACC).

For the above formula AIC is calculated mainly by taking the present value of incremental capital, operating and maintenance costs and dividing through by the present value of incremental outputs. Broadly speaking, AIC estimate reflects a per volume charge that if applied to incremental volumes and maintained in real terms over the forecast period, will allow the sewage organisation to recover the incremental cost of providing the new capacity assuming forecasts of costs and demand turn out correct.

Suppose a wastewater company is constructing a new treatment facility which will treat 300,000 cubic metres of waste annually. Let the capital cost be GH¢1,000,000 which will be disbursed in 2 years as GH¢ 500,000 per year and an annual estimated O & M cost be GH¢ 20,000. Assuming the lifecycle of the facility is 5 years and the discounting rate is 10%. The AIC will be calculated as follows:

Table 2.2: A Simplified Scenario for Calculation of Average Incremental Cost

Year	Discounting Factor @ 10% Discount Rate	Cost	Present value of cost	Sewage Treated	Present value of Sewage Treated @10% Discount Rate
1	0.9091	500,000	454,550		
2	0.8264	500,000	413,200		
3	0.7513	20,000	15,026	300,000	225,390
4	0.6830	20,000	13,660	300,000	204,900
5	0.6209	20,000	12,418	300,000	186,270
6	0.5645	20,000	11,290	300,000	169,350
7	0.5132	20,000	10,264	300,000	153,960
	Total Present Cost		930,408	Total Present Value of Sewage Treated	939,870
Average Incremental Cost = $\frac{930,408}{939,870}$ = GH¢ 0.99/m^3					

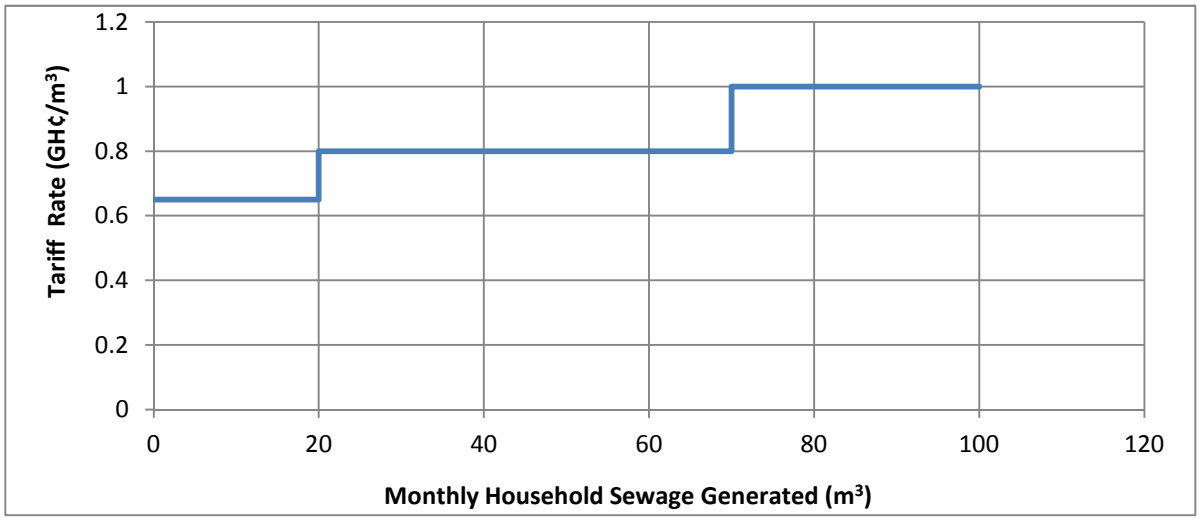
Source: Unesco-IHE – Delft, 1999

2.3.7 Block Tariff / Pricing

Block Tariff is a system of price discrimination intended to make utility rates efficient. Thus aimed at efficient use and penalize excessive use of the service. In other words, a block tariff pricing scheme is one in which the tariff for the utility changes with different consumption ranges (http//:www.adb.org/Documents/Books/Asian_Water_Supplies). With an inclining block tariff, the price of the

utility will be low for consumption up to a certain limit usually known as the lifeline. The rationale for the lifeline is to promote equity (i.e. the low-income in society can also have a fair access of the utility) and to ensure affordability for low-income households. Any consumption exceeding this limit will be charged a higher price [for example 0 – 20 units (lifeline) at GH¢ 0.65, 20 – 70 units at GH¢ 0.90 etc.]. There may be further price jumps at higher utilization thresholds. Declining block tariffs work in the opposite manner, beginning with the highest price and shifting to lower prices at higher consumption thresholds.

Figure 2.1: Example of Block Tariff System



Source: Unesco-IHE – Delft, 1999

2.3.8 Fixed Charges and Gap Financing

When a wastewater company generates revenue surplus, this surplus can be managed to satisfy other objectives of tariff setting such as distributive justice by subsidizing connection charges or by providing a subsidized block of the service to the poor. Pricing of wastewater charges could also result in a revenue deficit. When such a situation is encountered there are three possible ways to fill the financial deficit: (i) Government subsidies (ii) higher lump sum connection charges and (iii) fixed charges over and above the long run marginal cost.

Provision of subsidies to public sewerage utilities to fill the gap may result in a general decline in efficient management of the utility. This may be largely due to inadequate incentives for cost-cutting measures by the wastewater company management. However, in most developing countries, governments generally face pressing needs other than subsidizing sewerage and other utility services, therefore, subsidies often become unsustainable. Higher lump sum connection charges will allow filling the financing gap but may result in change in customer behaviour. Some customers, who may otherwise connect to the service, may not get a connected. Therefore, higher connection charges may eventually further increase the financing gap due to a lower number of households connected to the system. The lowest income category is more likely to remain unconnected under high connection charge regimes and this will eventually exclude the poorest segments of the society from the essential services of sewerage and perhaps other services.

The discussions above show that the general tendency is to favour fixed charges compared to the other methods of gap financing for wastewater utilities. The basic economic logic for fixed charges lies on the premise that it does not alter the customer's behaviour, i.e., the quantity of sewage produced would not be affected by the fixed charge. This, however, happens only when the fixed charge is comparatively small compared to the usage charge. In addition to the above reasons, fixed charges are in some cases preferred because it provides constant revenue which enhances financial planning.

2.4 Sewerage in Ghana

The sewerage system is not common in Ghana. Apart from a few areas in Accra, Kumasi, Tema, Sekondi - Takoradi, Tamale, Akosombo and Obuasi, where sewerage networks and treatment facilities are provided, all other urban centres rely mostly on on-site systems, particularly, Pit Latrines, Ventilated Improved Pit Latrines (VIPs), Pan Latrines, Aqua Privies, and Septic Tanks. Apart from certain areas in Accra, Kumasi and Tema, where users of sewerage system pay for the service, sewer users (institutions, private organisations, hotels et cetera) in other areas do not pay sewer user fees as the system is owned by the institutions or the organisations.

2.4.1 Sewerage in Greater Accra Region

Tema

Tema is the only city with a comprehensive waterborne sewerage system. The Tema sewerage system continues to operate at a less optimal level as a result of increasing operation and maintenance costs, mainly electricity

consumption costs. About 60% of the total housing stock in the communities is connected to the network (TMA, 2009). Each household is charged a flat annual sewerage tariff of GH¢10.00 (TMA, 2009).

Accra

In Accra, approximately 15% of the city area, mainly the central area, is served by a piped waterborne sewerage network of about 30 km length (Wassel et al, 2005) with about 1100 house connections. The sewerage user fee in the Central Accra is a surcharge of 35% on the water bill. However areas like Dansoman and Teshie-Nungua Estates with sewers do not pay sewerage user fees.

2.4.2 Improvement of Sewerage in Accra

Accra Sewerage Improvement Project (ASIP)

The ASIP is a project being funded jointly by the African Development Bank (AfDB) and the Government of Ghana (GoG) to improve on the sanitation in the city of Accra through the provision of sewerage system and sewage treatment facilities at Densu Delta and Legon. According to AMSU of AMA the estimated cost of the project, net of taxes and customs, is UA 51.74 million (US$ 77.57 million). The AfDB's contribution is UA 46.0 million (US$ 68.95 million) representing 88.91% while the GoG's contribution is UA 5.74 million (US$ 8.60 million), representing 11.09 % of the total project costs.

The project is to last for a period of 5 years. However the principal of the loan is expected to be paid over a period of forty (40) years after a ten (10) year grace period. The interest rate on the principal is three-quarters of one percent (0.75 %) per annum and a commitment charge of one half percent (0.5 %) per annum on undisbursed portion of the principal.

2.5 Institutional Framework for Sewerage in Accra

2.5.1 Ghana Water Company Limited

The Ghana Water and Sewerage Corporation (GWSC), under the Ministry of Water Resources, Works and Housing (MWRWH), until recently, was responsible for the development, operation and management of water supply and sewerage systems for domestic and industrial purposes throughout the country. The then GWSC derived its mandate from the Ghana Water Act (1963). In the early years of the 1990s, the Government of Ghana had a sector restructuring programme aimed at separating responsibilities for urban water supply, sewerage and rural water and sanitation. This was followed by sectoral reforms in 1995. Consequently, the GWSC was restructured as a limited liability company named "Ghana Water Company Limited (GWCL)"and now operates as an asset holding company for urban water supply systems and with the right to contract with the private sector. The contracted private company to operate the urban water supply is the Aqua Vitens Rand Limited (AVRL)

2.5.2 Accra Metro Sewerage Unit of the Accra Metropolitan Assembly

As a result of the Government sector restructuring programme in the 1990s, to improve on delivery of environmental sanitation, the Government of Ghana by an Act of Parliament, Act 462, transferred the sanitation and sewerage functions from central government to the metropolitan, municipal and district assemblies under the oversight responsibility of the MLGRD. Hence the AMA instituted in 2005 the Accra Metro Sewerage Unit (AMSU) to handle all sewerage issues in the city of Accra. However its operations as a Unit of the AMA began in 2007. AMSU with a currently staff strength is 90, is headed by a Director and has three divisions – Accounting, Engineering and Health/Environment & Safety.

2.5.3 State Housing Company (SHC) Limited

Until recently, the SHC managed the sewerage systems in the areas they developed and constructed the sewerage system. In 2007 the SHC transferred the ownership, operation and maintenance of the sewerage system at Dansoman and Teshie Nungua Estates to the AMA. However the Assembly is yet to fully take over the billing of the residents of these two areas. A survey conducted in these areas by the AMA showed that GWCL supplies potable water to these areas. Hence it will be easy for the AMA to bill the residents.

2.5.4 Public Utility Regulatory Commission (PURC)

The Public Utilities Regulatory Commission (PURC) was set up by Government of Ghana in October 1997 under Act 538 to regulate the provision of utility services in the electricity and water sectors (PURC, 1998 and 2009). By virtue of the Energy Commission of Ghana Act, 1997 (Act 541), PURC's mandate also includes the regulation of tariffs with respect to the supply, transportation and distribution of electric power and natural gas and also the bulk storage and transportation of petroleum products. Under Section 4 of Act 538, the Commission is an independent body and is not subject to the direction or control of any authority in the performance of its functions. For administrative purposes, it comes under the umbrella of the Office of the President of the Republic of Ghana.

Entities whose operations currently fall within the Commission's purview are mainly the Electricity Company of Ghana (ECG) Ltd., Volta River Authority (VRA), the Ghana Grid Company (Gridco) and Ghana Water Company Limited (GWCL).

The main functions of the PURC are as follows:

To provide guidelines on rates chargeable for provision of utility services;

To examine and approve rates chargeable for provision of utility services;
To protect the interest of consumers and providers of utility services;
To monitor standards of performance for provision of services;
To initiate and conduct investigations into standards of quality of service given to consumers;
To promote fair competition among public utilities;
To conduct studies relating to economy and efficiency of public utilities;
To make such valuation of property of public utilities as it considers necessary for the performance of its functions;
To collect and compile such data on public utilities as it considers necessary for the performance of its functions;
To advise any person or authority in respect of any public utility;
To maintain a register of public utilities;
To issue regulations necessary for the effective implementation of the Act;
To receive, investigate complaints and settle disputes between consumers and public utilities; and
To perform such other functions as are incidental to the foregoing.

2.6 Billing and Collection of Sewerage Charges in Accra

The Central Business District, parts of Ridge, Osu and Labone are the only communities in Accra that have been paying sewer user fees over the years. Billing and collection of Sewerage Tariff/Charges, has been handled by the GWCL/AVRL. Sewerage Charge was a major component of the overall water tariff in Ghana under the regulatory jurisdiction of the Public Utilities Regulatory Commission (PURC). As part of the Gazetted Water Tariff, a 35% sewerage surcharge on volume of water consumed by houses with sewer connections was paid by consumers to the GWCL. After the sewerage function of GWCL was ceded to the AMA, joint billing has been agreed between AMA and GWCL/AVRL where, GWCL/AVRL continues to bill and collect the 35% sewerage surcharges, on a commission basis, to be transferred to AMA's dedicated account. Payments are made by the various categories of costumers, particularly, the domestic, commercial, industrial and public institutions as shown in Table 2.3 below, either directly at the offices of the GWCL or through licensed private revenue collectors.

Table 2.3: Existing Water and Sewerage Charges

Category of Consumer	Monthly Consumption	Water Rates	Sewerage Surcharge
	1000 Litres or 1 m^3 or 1unit	GH¢/ 1000 Litres	35 %
Metered Domestic	0-20	0.66	0.23
	20 and Above	0.91	0.32
Metered Commercial & Industrial	Flat Rate	1.10	0.39
Metered Public Institutions & Government Departments	Flat Rate	1.10	0.39

Source: Aqua Vitens Rand Limited

2.7 Advantages and Disadvantages of Water and Sewer Joint Billing

2.7.1 Disadvantages of Joint Billing System

The disadvantages of joint billing of water and sewer charges as identified by both the AMA and GWCL include:
Loss of identity on the bills that will be distributed, since customers may not recognize AMA as the sewer service provider;
Lack of direct control over income collection
Restrictions in tariff structure, since the GWCL/AVRL computerized billing system may exclude sewer charges to heavily-polluting customers (restaurants, food processors, slaughterhouses) where wastewater flows and pollution loads are used in wastewater billing,
However the disadvantages can be dealt with in a number of ways as stated below:
Public awareness measures can diminish the problem of loss identity.
Lack of direct control over income collection can be overcome by mutual trust between the AMA and GWCL/AVRL and by a suitable agreement (regular updates of connected sewer customers) that protects the interests of the Sewerage Department of AMA.
The AMA can provide GWCL with information on the heavily-polluting customers so that they are billed separately by GWCL as either commercial or industrial.

2.7.2 Advantages of Joint Water and Sewer Billing

The advantages of combined billing of water and sewer charges as identified by both the AMA and GWCL/AVRL include:
Cost savings, by elimination of duplicate computer systems and staff in GWCL/AVRL and AMSU for billing and collection.
The ease of enforcement in bill collection, by the threat of disconnection of water services.
Customers understand bill better when chargeable volume of both water and sewage are shown on one bill rather

than two.
Customer convenience, by making one payment to one organization rather than separate payments.
Currently the AMSU/AMA prefers the joint billing because the benefits of combined billing greatly outweigh any possible disadvantages.

2.8 Regulation of Sewerage Tariffs

The charges for all services rendered by the AMA are fixed, billed and collected by the Assembly. Since the Accra Metropolitan Assembly currently does not fix the sewer fees through its Fee Fixing Committee; and GWCL/AVRL still bills and collects sewer fees. It therefore implies that, with the regulation of water tariffs, the sewerage tariffs are also regulated indirectly by PURC as sewerage charges are a percentage of water tariffs.

3.0 Methodology

3.1 Description of the Study Area

In order to mainly determine the willingness and ability to pay for sewer services, the residents of some sewered areas in the city of Accra were interviewed. The areas were Dansoman, Mudor, James Town, Ussher Town, Accra Central, Ridge, and parts of Osu and Labone. Refer to Appendix IV for the locations of these localities in Accra. All the study areas are residential areas in Accra with well laid out streets and all social amenities.

3.2 Data Gathering

3.2.1 Interview with Stake Holding Organisations

The study included interviews with officials of various stake holding organisations to determine variables (e.g. Capital cost, operation and maintenance cost, average sewage flows) that constitutes the sewerage tariff models that was used by GWCL and the current tariff model being used by AMA. Questions were framed in simple language for the required responses. Relevant secondary data at various institutions' libraries were also used as part of data collection in the research. The stake holding organisations were Ghana Water Company Limited (GWCL)/Aqua Vitens Rand Limited (AVRL), State Housing Company (SHC) and Accra Metro Sewerage Unit (AMSU) of the Accra Metropolitan Assembly (AMA).

3.2.2 Interview with Residents

3.2.2.1 Determination of Sample Size

Sample size determination for data collection is based on probability. One principle of sample size is, the smaller the population, the bigger the sampling ratio (sample size divided by population size) has to be for an accurate sample - one with high probability of yielding the same results as the population (Neuman, 2007). However, larger populations permit smaller sampling ratios for equally good samples (Wonnacott et al, 1990 and Neuman, 2007). This is because as population size grows the returns in accuracy for sample size shrinks. Again, Neuman, 2007 argues that for large populations (over 10 million) accuracy can be achieved by using sampling ratio of 0.025 percent or sample size of 2500. Therefore the size of population ceases to be relevant once the sampling ratio is very small and samples of 2500 are accurate for population of about 200 million. Sample selection should be determined by replication logic (Yin, 1994). By the replication logic there is no need having a large sample size if the study is likely to yield the same information throughout. Hence the choice of sample size was guided by the replication logic.

3.2.2.2 Design and Administration of Questionnaires

The study objectives were used as guide to design the questionnaires. On a pilot basis, the initial questionnaires were administered at some parts of Dansoman and James Town to find out the shortfalls in the questionnaires before the actual administration of the questionnaires at the designated communities. Both Dansoman and James Town are sewered communities in Accra and ten (10) households from each community were interviewed. The actual survey concentrated on some sewered communities in the Accra Metropolitan Area. The communities surveyed were Dansoman, Mudor, James Town (including Ussher Town), Accra Central, parts of Osu, Ridge and parts Labone. In all, five hundred (500) households were interviewed. The survey was conducted from July 2009 and December 2009; a period of six months.

The maps of the areas where the questionnaires were to be administered were obtained from the AMA and Department of Town and Country Planning. The communities were grouped into five and each grouped community was divided equally (in terms of area) into ten. Then ten houses were selected at random from each of the ten sub-areas for the administering of the questionnaires. The questionnaires were administered mainly during the weekends at the highly residential areas like Ridge, Labone and Dansoman when many of the residents were at home. For areas like Mudor, James Town, Ussher Town, Accra Central, and parts of Osu, the questionnaires were administered during working days. This was because many of the residents were self employed and were available for the interview. Sometimes the questions had to be translated to the local dialect for appropriate responses.

3.2.2.3 Data handling, Presentation and Analysis of Findings

The obtained data were scrutinized, rechecked, coded and analyzed using Statistical Package for Social Sciences

(SPSS), 16.0 version computer software program. Statistical parameters like frequencies, percentages and arithmetic means were determined. The areas for the survey were grouped as follows: (i) Dansoman (ii) Mudor/James Town (iii) Accra Central (iv) Parts of Osu/Ridge and (v) Parts of Labone. The survey was limited to 500 households; 100 households at each of the five grouped communities mentioned above. The reasons for this limited number were (a) some respondents were suspicious and hesitant to cooperate; and (b) logistical, time and budget limitations. Still, this sample provided sufficiently consistent information to be used to achieve the objective of the study.

In order to ensure collection of reliable information, the following measures were applied: (a) *Knowledgeable respondents*: Interviewing only knowledgeable persons and persons of 18 years and above who could provide detailed information increased the chances for getting reliable feedback.

(b) *Mitigation of respondents' suspicions*: Explaining to respondents that the information provided was for academic purposes and would be treated confidentially. Also observing few issues that would please the respondents and using them as a starter discussion prior to interviews, considerably helped in gaining respondents' trust and getting more reliable information.

(c) *Data crosscheck*: Confirming parts of the quantitative data (e.g. water bills and sewer user fees) from staff of GWCL/AVRL and AMA.

3.3 Determination of Tariff Using Average Incremental Cost (AIC) Method

The average incremental cost for the purpose of this work is used interchangeably with Average Incremental Financial Cost (AIFC). AIFC is the average incremental cost of wastewater treated expressed in financial prices. This is calculated in order to provide a reference point for proper development of wastewater tariffs and as a means of assessing tariffs necessary to raise funds for sustainability of wastewater collection and treatment in Accra.

The AIC is usually an estimate of the full cost of providing wastewater management services. However in this study an estimate of the operation and maintenance cost of providing wastewater management services was also considered since charging for full cost has always been difficult for utility service providers (especially water and electricity) in Ghana.

In using AIFC, it implies financial prices were used as the basis for determining capital, administrative, operating and maintenance costs. Financial prices are the actual monetary cash flows incurred by the AMA and by equity holders in the AMA – in this case Government of Ghana. The wastewater flow for which customers paid for was actually made used of as the basis for estimating the incremental volume of wastewater. In calculating AIFC, all the prices were expressed on a constant basis. Thus inflation was excluded. Also the US dollar which was used in the calculation of all investment, operational and maintenance cost was converted to Ghana cedi (GH¢).

The discount rate used to calculate AIFC was the Weighted Average Cost of Capital (WACC).

AIFC is calculated as follows:

$$\text{AIFC}=\frac{(CC_{n+}\ OMC_n)/(1+r_{WACC})^n}{\text{QWn}\ /(1+r_{WACC})^{\text{n}}}$$

Where:

AIFC = Average Incremental Financial Cost in US$ per m^3 of wastewater.

CCn = Total capital cost of project in year n, expressed in US$.

OMCn = Total cost of operations and maintenance in year n, expressed in US$.

QWn = Projected wastewater flow in year n, expressed in m^3 of wastewater.

r_{WACC} = Discount Rate.

3.3.1 Determining the Appropriate Discount Rate

A discount rate, r_{WACC} was used to calculate the present value of future costs and the present value of future wastewater flows. The discount rate used in calculating the AIFC is the WACC. The WACC is the weighted average cost of capital to the AMA and is calculated as the weighted average of the cost of equity and debt used to finance the capital investment. For the analysis a discount rate of 4% was used as per the calculation shown below.

Table 3.4: Capital Structure for the Development of Sewerage in Accra

Percentage Debt (AfDB and WB Loan)	Percentage Equity (Ghana Government Contribution)	Cost of Debt (r_D)	Average Cost of Equity (r_E)
88.91%	11.09%	0.75%	30.00%

Source: Wassel et al, 2005 and Bank of Ghana

$$\text{WACC} = \frac{D}{D+E}r_D + \frac{E}{D+E}r_E$$

WACC = 0.8891 x 0.75 + 0.1109 x 30

WACC = 3.993%
= 4.0%

3.3.2 Capital Costs

All planned capital expenditure over the forecast period was included in the AIFC calculation. Since costs are to be expressed in constant prices, allowances for inflation were excluded.

3.3.3 Operating and Maintenance Costs

All projected operating and maintenance costs including administrative cost over the forecast period associated with capital costs were included in the AIFC calculation. Like capital costs, incremental operating and maintenance costs were expressed in constant terms.

3.3.4 Wastewater Flow

The wastewater flow incorporated into the AIFC analysis was that which was attributable to capital costs over the forecast period. For the purposes of calculating the AIFC, only the flow for which tariffs would be applied and paid by customers were included.

3.3.5 Depreciation Assumptions

Depreciation is based on straight line analysis with the following rates:

- Land and Buildings: 2.5%
- Equipment : 10%
- Trucks and Vehicles: 25%
- Sewage System: 2%
- Plant and Machinery: 10%

All assets are bought at the end of the year. (Wassel et al, 2005)

4.0 Results and Discussion

4.1 Tariff Model Used By State Housing Company Limited Developed Areas

4.1.1 Dansoman

The information obtained from SHC showed that the residents in the areas developed by the company do not pay sewer user fees. This was because the company had no laid down model for the billing and collection of the sewer user fees. Five Communal Septic Tanks with its associated sewerage network were constructed for the various catchment areas in Dansoman for the treatment of human liquid waste. These five Communal Septic Tanks were to be operated and maintained by the residents who purchased the SHC properties. Since there was no sense of ownership among the residents coupled with lack of appropriate tariff model which resulted in lack of funds, the sewerage network with its treatment plants have broken down with time.

4.1.2 Teshie-Nungua Estates

The situation at Teshie-Nungua Estates was similar to that at Dansoman. There was no tariff model for billing and collection of sewer user fees. Hence the residents paid no sewer user fee for the operation, maintenance and extension of the sewerage system.

4.2 Tariff Model Used By Ghana Water Company Limited (GWCL)

The GWCL used to handle the sewerage network in Accra Central, Accra East and Accra West. Hence the former name of the organization - Ghana Water and Sewerage Corporation. The sewage tariff model developed by the GWCL was a thirty-five percent (35%) surcharge of volume of water used by all customers who were connected to the sewerage system.

4.3 Tariff Model Used By Accra Metropolitan Assembly

Since the sewerage functions were divulged from GWCL to the Accra Metropolitan Assembly (AMA) in 2005, the Assembly has been using the same tariff model as was being used by the GWCL. In other words a thirty-five percent (35%) surcharge of the tariff for the volume of water used by the customer. The Assembly also has an agreement with the GWCL/AVRL for joint water and sewerage billing and collection. In this agreement both the water bill and the sewer charge are on the same sheet. The customer then pays the collective bill to GWCL who then transfers the sewer fees collected to AMSU of AMA. As at the time of this research, the GWCL/AVRL and AMA had agreed on a five percent (5%) commission on the collected sewer charge for GWCL.

4.4 Willingness and Ability To Pay Survey

A survey was conducted at Dansoman, Mudor, James Town (including Ussher Town), Accra Central, parts of Osu, parts of Ridge and Labone, involving five hundred (500) residents. The survey was done between July 2009 and December 2009: a period of six months. The results are shown in the subsections below. The survey concentrated on the domestic sewered communities of the areas mentioned above. In the case of commercial, institutional and industrial customers, it has been established by the AMA that the aforementioned categories of customers have higher willingness and ability to pay for sewer usage and therefore the study did not consider the willingness and ability to pay of this category of sewer users.

The results are classified as sewered communities previously under the SHC and sewered communities

previously under GWCL. However the survey results also considered all communities together.

4.4.1 Sewered Community Previously Managed By the SHC

Dansoman

At Dansoman, the survey areas included Dansoman A to C, Appiah Danquah, Railway Quarters, Tunga, and Last Stop. In all one hundred (100) households were interviewed.

Source of Water For Residents of Dansoman

Generation of sewage is as a result of water consumption. Therefore sewage has a strong relationship with water consumption. From the survey results at Dansoman, all the responding households indicated Ghana Water Company Limited (GWCL)/Aqua Vitens Rand Limited (AVRL) supplied them with potable water as shown in Table 4.1.

TABLE 4.5: SOURCE OF WATER FOR RESIDENTS OF DANSOMAN

Source of Water	Frequency	Percentage	Cumulative Percentage
Ghana Water Company Limited	100	100.0	100.0

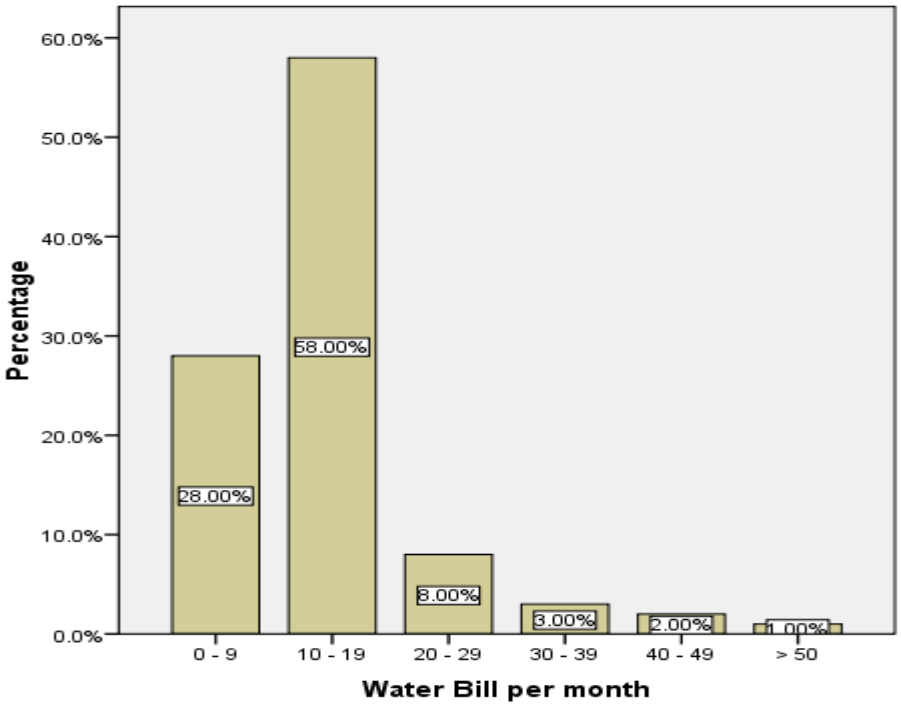
Source: Field Data

Water Bill Payment Pattern

The GWCL/AVRL uses the block system of billing for domestic water users and according to AVRL, customers pay GH¢ 0.66 per cubic metre (1 unit) of water for the first twenty (20) cubic metres and GH¢ 0.91 per additional cubic metre of water consumed. From the field data collected, Figure 4.1 shows the pattern of potable water bill payment to GWCL/ AVRL at Dansoman.

From Figure 4.1, eighty-six percent (86%) of the respondents pay up to GH¢ 19.00 per month for water and one percent (1%) pays more than GH¢ 50.00 per month for water. The mean water bill paid by households at Dansoman was calculated to be GH¢ 11.63.

FIGURE 4.2: WATER BILL PAYMENT PER MONTH AT DANSOMAN



Source: Field Data

Income Levels

From Table 4.2 seventy-six percent (76%) of the respondents earn between GH¢ 200.00 and GH¢ 800.00 per month. Eighteen percent (18%) earn up to GH¢ 200.00 and six percent (6%) of the respondents earn above GH¢ 800.00 per month.

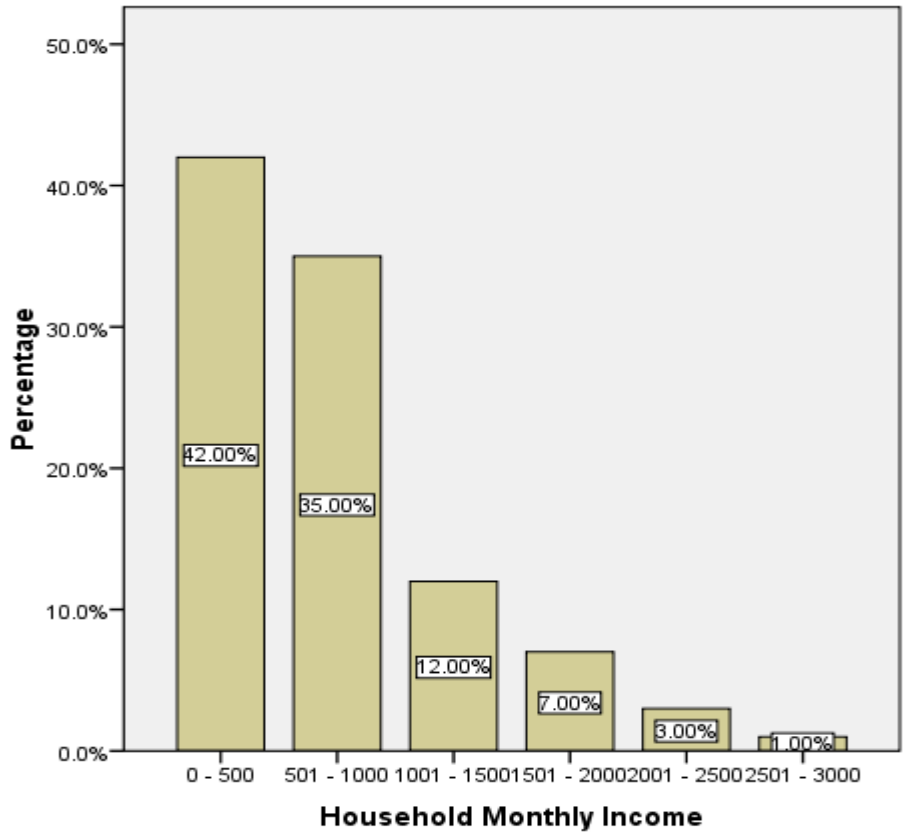
TABLE 4.6: MONTHLY INCOME

Monthly Income	Percentage	Cumulative Percentage
0 – 200	18.0	18.0
201 – 400	40.0	58.0
401 – 600	23.0	81.0
601 – 800	13.0	94.0
801 – 1000	5.0	99.0
1201- 1400	1.0	100.0

Source: Field Data

The average monthly income of the respondents was calculated to be GH¢ 401.41. Figure 4.2 shows the household income pattern of respondents. Majority of the responding households (89%) earn up to GH¢ 1500 per month. Of these forty-two (42%) earn GH¢ 0 – 500 and thirty-five percent (35%) earn between GH¢500.00 and GH¢1000.00. The average household income for the respondents at Dansoman is GH¢ 735.29

FIGURE 4.3: HOUSEHOLD MONTHLY INCOME



Area Connectivity of Sewerage Network and Household Connections

It was discovered from the survey results that the suburbs at Dansoman had the sewer network and all the residents interviewed at the aforementioned areas in Dansoman had their homes connected to the sewer network as shown by Table 4.3 and Table 4.4 respectively.

TABLE 4.7: AREA COVERED BY SEWERAGE NETWORK

Area Covered by Sewerage Network	Percent	Cumulative Percent
Yes	100.0	100.0
No	0	0

Source: Field Data

TABLE 4.8: PREMISE CONNECTED TO SEWER

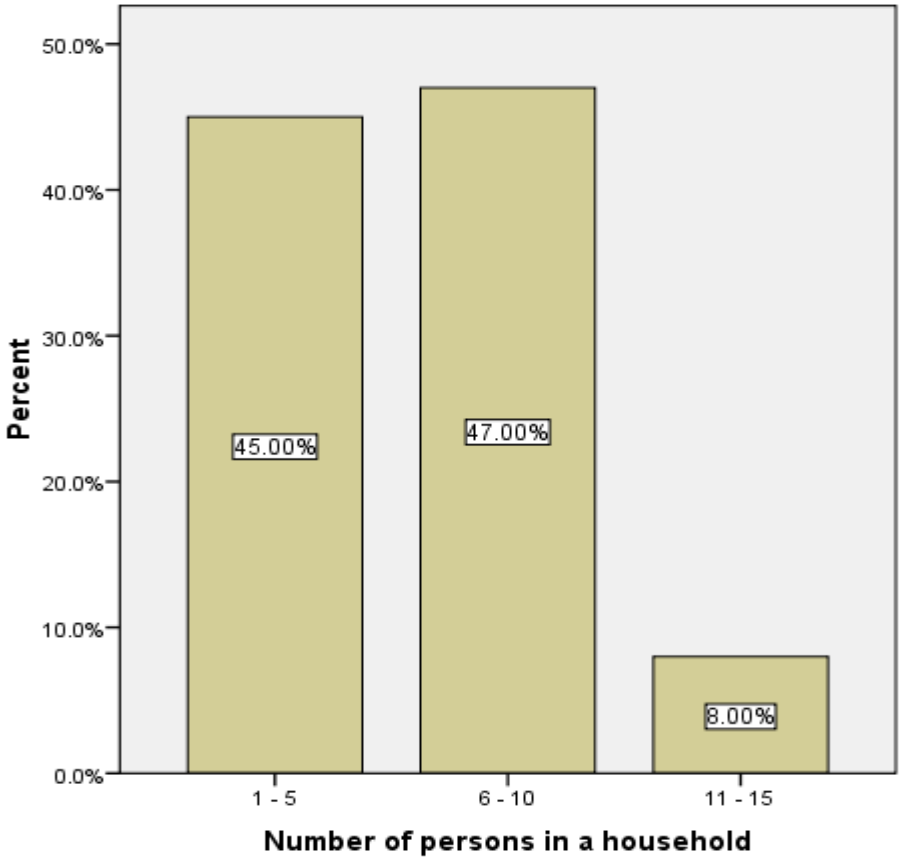
Premise Connected to Sewerage Network	Percent	Cumulative Percent
Yes	100.0	100.0
No	0	0

Source: Field Data

Number of Persons per Household

Figure 4.3 shows the family size of the respondents. 47% of the respondents have family size of 6-10 and 45% have family size of 1 – 5. A few have family size between 10 and 15. On the average the household size is about 6.

FIGURE 4.4: HOUSEHOLD SIZE



Ranking of Sewerage Service

Though respondents do not pay for sewerage services, when asked to rank sewerage services on the scale of 1 – 10 in their community, 79% ranked sewerage services less than 5. No respondent ranked the service from 6 – 8. There is therefore a strong indication that sewerage services are not the best as 79% of the respondents ranked the service below 5 as shown in Table 4.5 below.

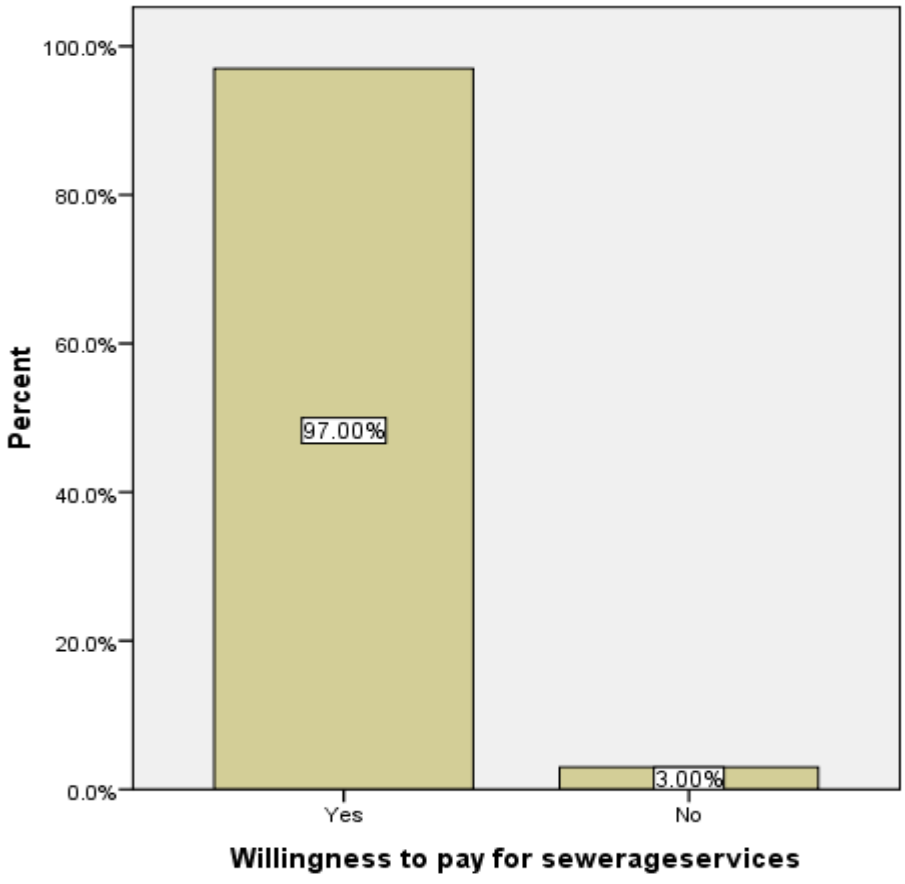
TABLE 4.9: RANKING OF QUALITY OF SEWERAGE SERVICES PROVISION

Ranking of Quality of Sewerage Services Provision	Percentage	Cumulative Percentage
1	42.0	42.0
2	14.0	56.0
3	7.0	63.0
4	16.0	79.0
5	15.0	94.0
9	6.0	100.0

Willingness to Pay More for Improved Services

Almost all respondents, 97% were willing to pay for improved services as shown in Figure 4.4. This probably was due to the inconvenience residents go through when there is blockage of sewer line or sewer over flow in household inspection chambers. The 3% which were not willing to pay for improved services did not believe that there can be improved sewer service in Ghana.

FIGURE 4.5: WILLINGNESS TO PAY FOR SEWERAGE SERVICES



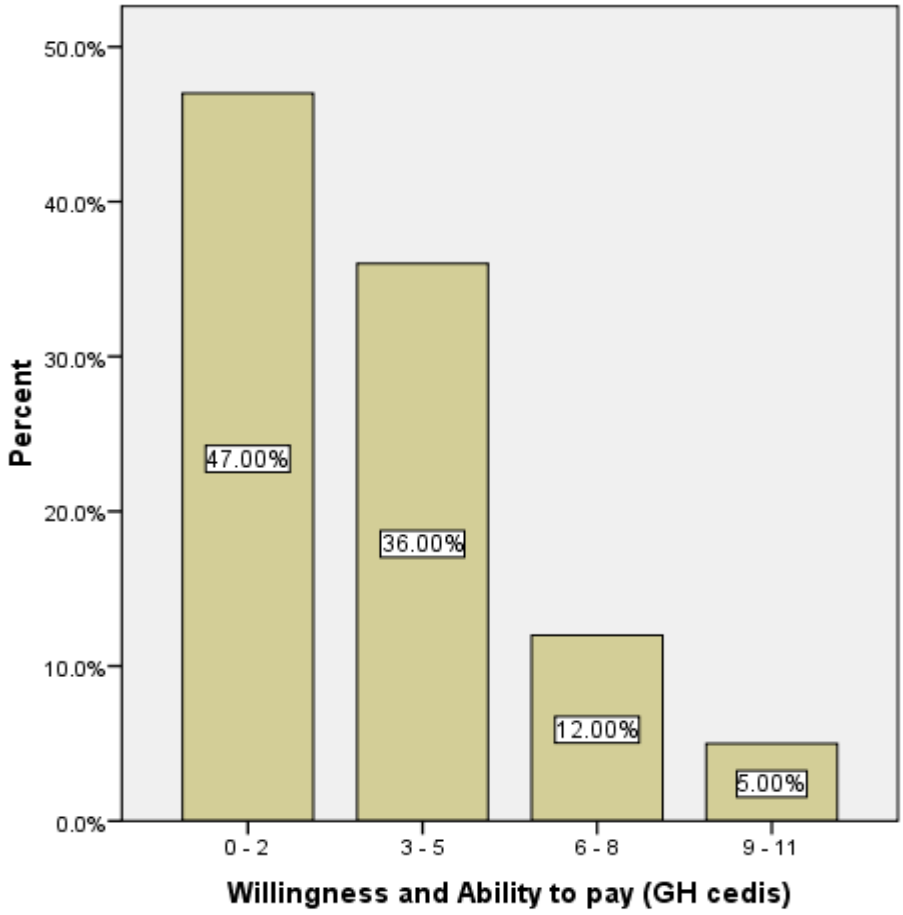
Ability to Pay

With the respondents' willingness to pay, they also expressed how much they would be able to pay. Figure 4.5 shows the various amounts the respondents were able and willing to pay for sewerage. 47% of the respondents expressed that they will be able to pay up to GH¢ 2.00 per month for improved sewerage services and 36% expressed their ability to pay up to GH¢ 3.00 – 5.00 for improved sewerage services.

Hence about 83% of the respondents stated they would be able to pay up to GH¢5.00 per month for improved sewerage services. The mean sewer user fee the respondents indicated they will be able to pay as calculated was

GH¢ 3.25 per month.

FIGURE 4.6: AMOUNT WILLING AND ABLE TO PAY FOR SEWERAGE SERVICES



4.4.2 Sewered Community Previously Managed by GWCL

The sewered communities surveyed which were managed by the GWCL and had been transferred to the AMA, are Accra Central, James Town/Ussher Town, Ridge, parts of Osu and Labone. In all four hundred (400) households were interviewed in a period of six months (July 2009 – December 2009).

Source of Water

In all the communities surveyed, the respondents indicated that, their water supply is from the GWCL /AVRL as shown in Table 4.6.

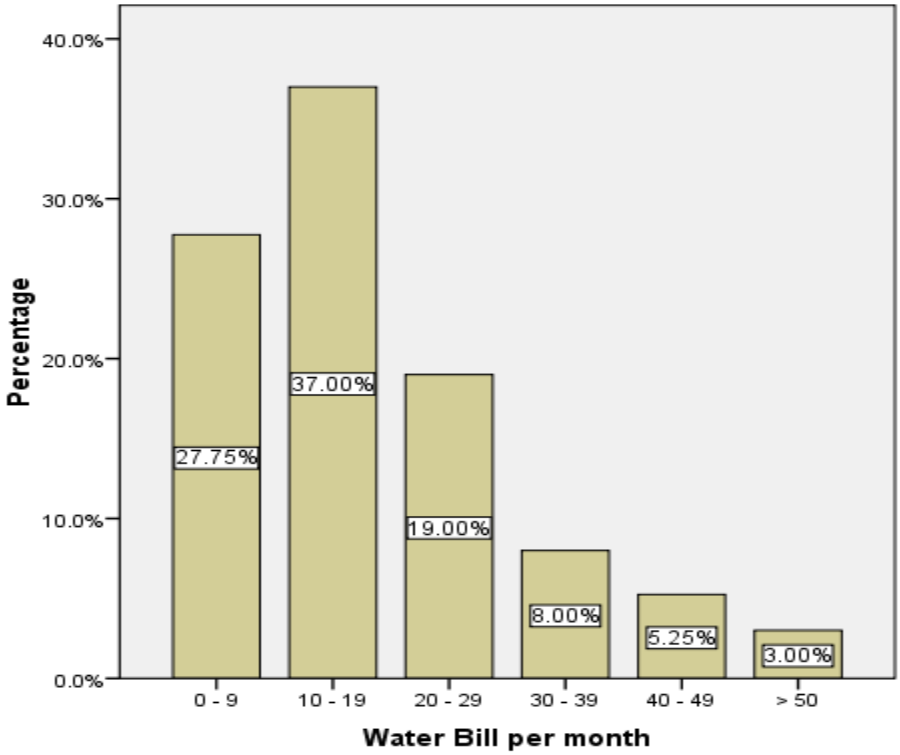
TABLE 4.10: SOURCE OF WATER FOR THE SEWERED COMMUNITIES PREVIOUSLY UNDER THE GWCL

Source of Water	Frequency	Percentage	Cumulative Percentage
GWCL/AVRL	400	100.0	100.0

Water Bill Payment Pattern of the Sewered Communities Previously Under GWCL

Figure 4.6 below shows the pattern of potable water bill payment pattern of the sewered communities in question. More than half of the respondents – about sixty-five percent (65%) pay up to GH¢ 19.00 per month for water. The mean water bill paid by households per month was calculated to be GH¢ 18.00.

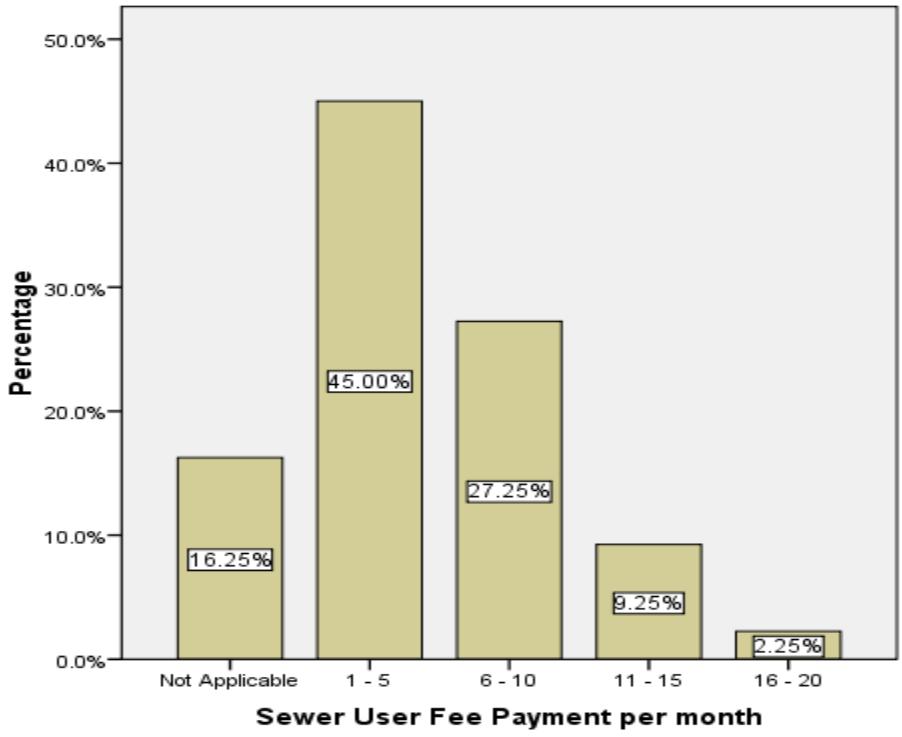
Figure 4.7: Water Bill Payment Pattern of the Sewered Communities Previously Under GWCL



Sewer User Fee Payment Pattern of the Sewered Communities Previously Under GWCL

Figure 4.7 below shows the pattern of sewer user fee payment pattern of the sewered communities in question. 16.25% of the respondents do not pay for sewers since their premises are not connected to the main sewers though their areas are covered by the trunks sewers. To these respondents the sewer services are not the best and that is the reason for not connecting. Hence the houses which were to connect to the sewers after the initial mass connections refused to connect. Such respondents use on-site treatment (septic tanks). From the survey, 45%, 27.25%, 9.25%, and 2.25% of the respondents pay GH¢ 1 – 5, GH¢ 6 – 10, GH¢ 11 – 15 and GH¢ 16 – 20 respectively. The average sewer user fee was calculated to be GH¢ 5.14.

Figure 4.8: Sewer User Fee Payment Pattern of the Sewered Communities Previously Under GWCL



Income Levels

Monthly Income Levels

Table 4.7 shows the monthly incomes of the sewered communities previously managed by GWCL. 70% of the respondents earn a monthly income of up to GH¢ 600. Out of the 30% who earn above GH¢ 600, 13.5%, 8.0%, 3.8%, 2.8% and 2% earn a monthly income between GH¢ 601 – 800, GH¢ 801 – 1000, GH¢1001 – 1200, GH¢1201- 1400, and above GH¢1401 respectively. The average monthly income was about GH¢500.00

TABLE 4.11: MONTHLY INCOMES OF THE SEWERED COMMUNITIES PREVIOUSLY MANAGED BY GWCL

Monthly Income	Frequency	Percentage	Cumulative Percentage
1 - 200	41	10.2	10.2
201 - 400	134	33.5	43.8
401 - 600	105	26.2	70.0
601 - 800	54	13.5	83.5
801 - 1000	32	8.0	91.5
1001 - 1200	15	3.8	95.2
1201- 1400	11	2.8	98.0
>1401	8	2.0	100.0

Household Monthly Income

Below is Figure 4.8 showing the household income pattern of the respondents. Majority of the responding households (65%) earn up to GH¢ 1000 per month. 8% earn between GH¢2000 to GH¢3000 per month. It can be inferred that only a few of the responding households earn high incomes. The mean household income was calculated to be about GH¢ 975.

Number of Persons per Household

Figure 4.9 shows the household size of the surveyed communities in question. About 50% of the respondents have family size of 1- 5 and 46% have family size of 6 – 10. A few households have family size between 11 and 15. On the average the household size is about 6.

FIGURE 4.8: HOUSEHOLD MONTHLY INCOME

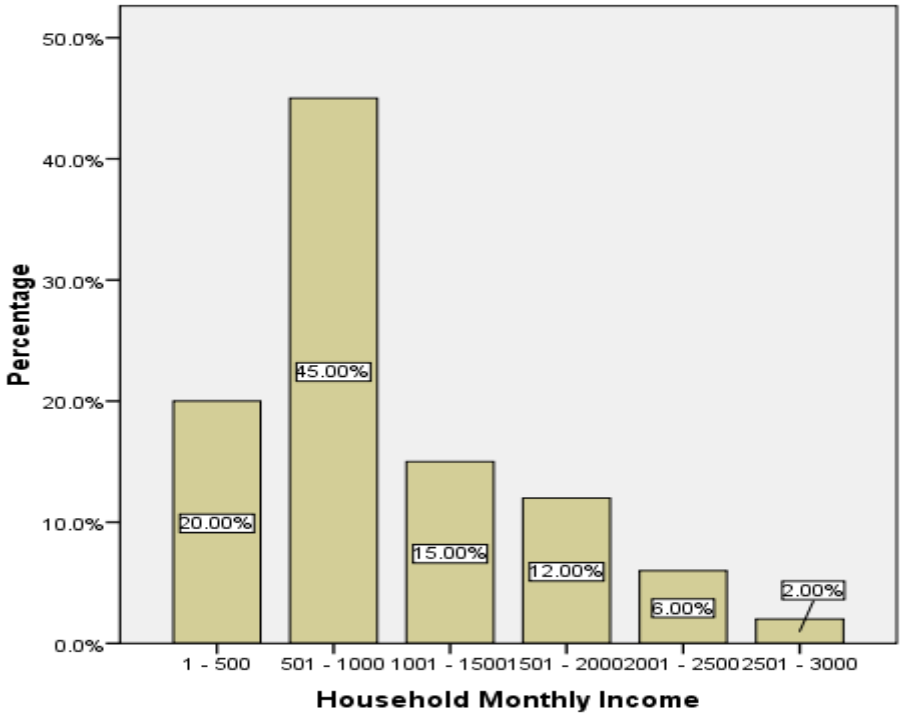
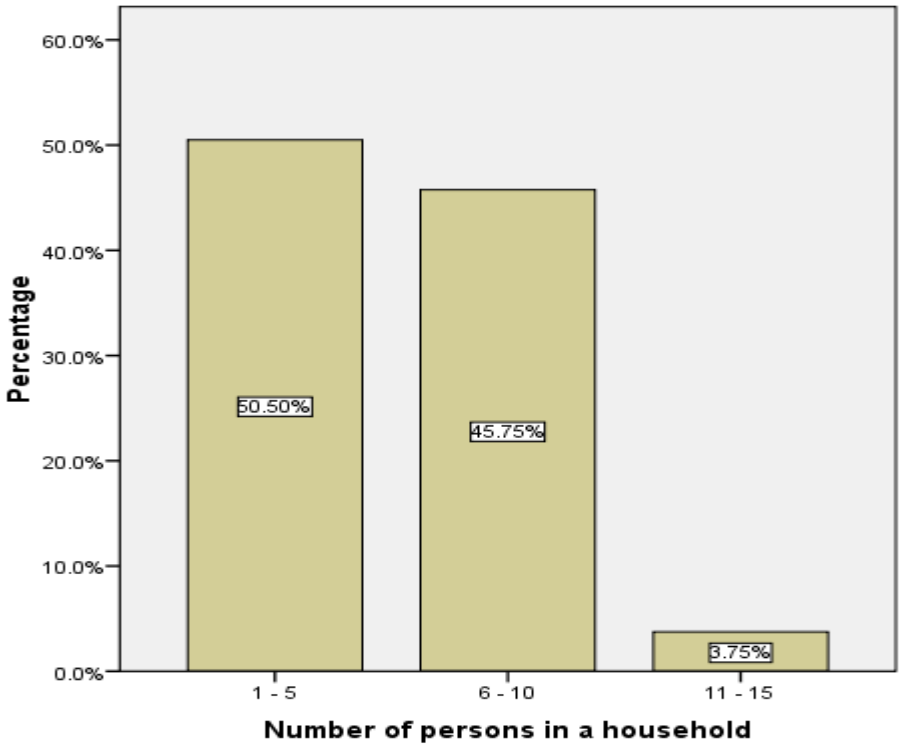


FIGURE 4.9: HOUSEHOLD SIZE



Area Connectivity of Sewerage Network and Household Connections

Form the survey it was discovered that about 11% of the residents in the areas considered sewered have no knowledge that their communities are sewered hence their properties are not connected to the sewer system as shown in Table 4.8. Table 4.9 points out that about 16% of the responding households are not connected to the sewer network though their communities are sewered. It can therefore be inferred from Tables 8 and 9 that about 5% of those who know that their respective communities are sewered have not connected their wastewater to the sewers thereby potentially reducing prospective revenue to the Sewerage Unit of AMA. These households use the septic tanks for the wastewater treatment.

TABLE 4.12: AREA COVERED BY SEWERAGE NETWORK

Area Covered by Sewerage Network	Frequency	Percentage	Cumulative Percentage
No	43	10.8	10.8
Yes	357	89.2	100.0
Total	400	100.0	

TABLE 4.13: PREMISE CONNECTED TO SEWER

Premise Connected to Sewer	Frequency	Percent	Cumulative Percent
No	65	16.2	16.2
Yes	335	83.8	100.0
Total	400	100.0	

Ranking of Sewerage Service

As shown in Table 4.10 below, more than 65% of the respondents ranked provision of sewerage services in their community less than 5 on the scale of 1 to 10. It is therefore a strong indication that provision of sewerage services in the surveyed communities is not the best, resulting in some residents refusing to connect to the sewage system thereby reducing the revenue of the AMSU.

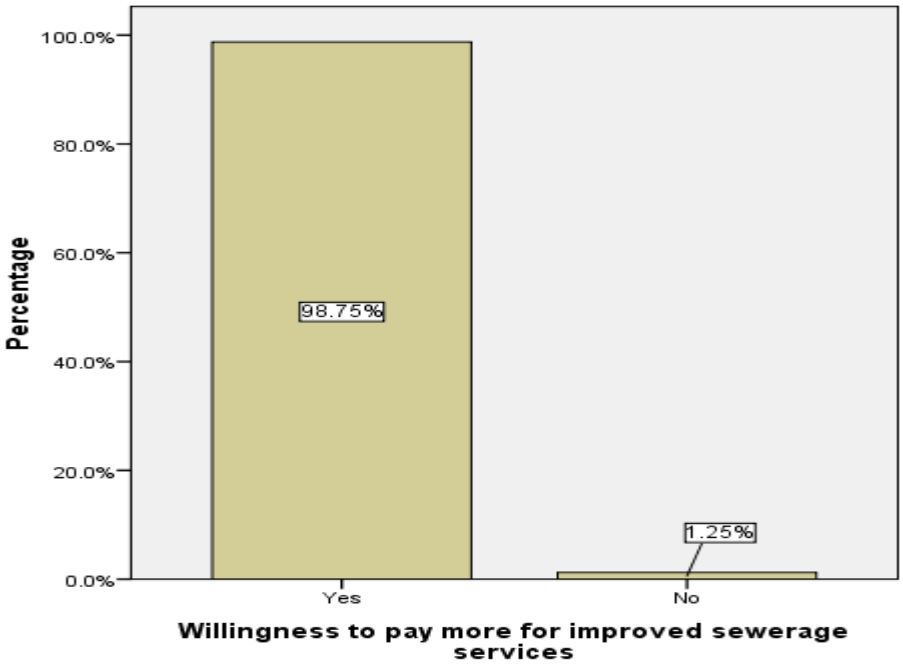
TABLE 4.14: RANKED QUALITY OF SEWERAGE SERVICES PROVISION

Ranking of Quality of Sewerage Services	Frequency	Percentage	Cumulative Percentage
1	73	18.2	18.2
2	60	15.0	33.2
3	57	14.2	47.5
4	72	18.0	65.5
5	76	19.0	84.5
6	26	6.5	91.0
7	18	4.5	95.5
8	10	2.5	98.0
9	8	2.0	100.0

Willingness to Pay More for Improved Sewerage Services

Almost all the respondents were willing to pay more for improved sewerage services as shown in Figure 4.10. This was attributed to lack of space for the construction of septic tanks for household toilets and long distances to nearest Public Toilets and its associated risk especially at night.

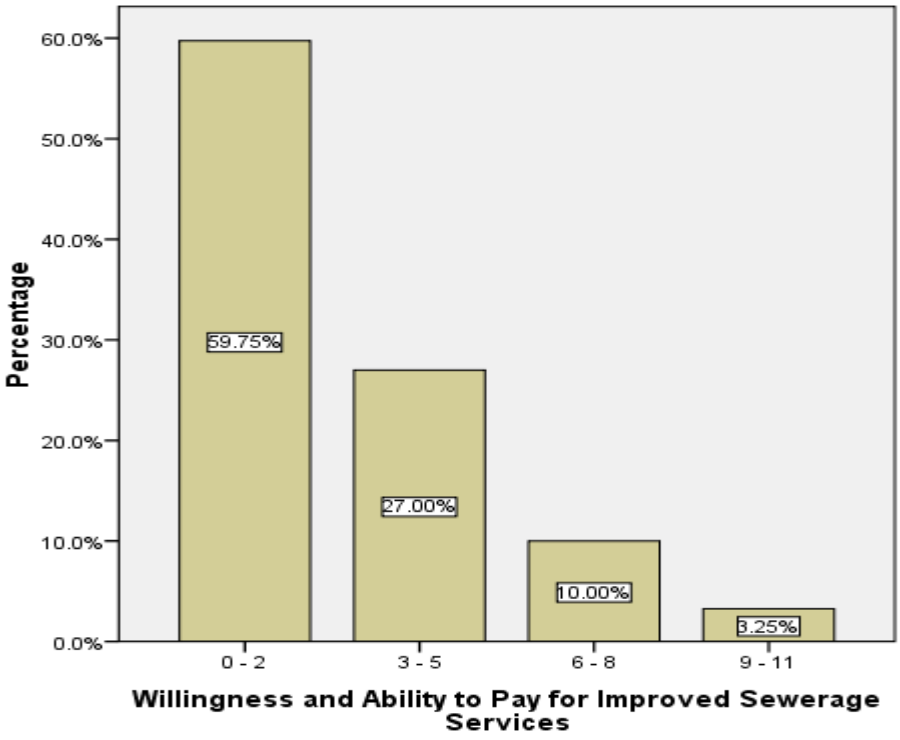
FIGURE 4.10: WILLINGNESS TO PAY FOR SEWERAGE SERVICES



Ability to Pay for Improved Sewerage Services

Besides their willingness to pay, the respondents also expressed their ability to pay for improved sewerage services. Figure 4.11 shows the various amounts the respondents were willing and able to pay for improved sewerage services. About 60% of the respondents expressed their willingness and ability to pay up to GH¢ 2.00 per month for improved sewerage services. About 87% of the respondents stated they will be able to pay up to GH¢5.00 per month for improved sewerage services as against the 83% in the Dansoman Area. The mean sewer user fee the respondents indicated they will be able to pay was calculated as GH¢ 2.70 per month.

FIGURE 4.11: AMOUNT WILLING AND ABLE TO PAY FOR SEWERAGE SERVICES



4.4.3 Combination of Survey Results from Dansoman and Other Sewered Areas

Combining the results of sewered areas previously managed by SHC and GWCL, the summary is as shown in Table 4.11 below.

From Table 4.11 it could be inferred that the percentage of household income used for water and sanitation (sewage) is 2.36%. This figure is within the recommended affordability threshold 5% of water and sanitation/sewage (Unesco-IHE Delft, 1999).

TABLE 4.15: SUMMARY OF DATA ON SEWERED AREAS PREVIOUSLY MANAGED BY SHC AND GWCL

PARAMETER	DANSOMAN (AVERAGE DATA)	OTHER SEWERED AREAS CONSIDERED (AVERAGE DATA)	OVERALL AVERAGE DATA (20% FOR DANSOMAN & 80% OTHERS)	WATER & SEWERAGE COST AS % OF HOUSEHOLD INCOME
HOUSEHOLD INCOME PER MONTH (GH¢)	735.29	975	927.06	
WATER BILL PER MONTH (GH¢)	11.63	18	16.73	
SEWER FEE PER MONTH (GH¢)	0	5.14	5.14	
WILLINGNESS TO PAY SEWER FEE (% OF SURVEY)	97	98.75	98.40	
ABILITY TO PAY SEWER FEE PER MONTH (GH¢)	3.25	2.7	2.81	
HOUSEHOLD SIZE	6	6	6	
				2.36

4.5 Adequacy Of Sewer Tariff And Provision Of Subsidy

SHC

Since the SHC put the ownership and maintenance of the sewers in the hands of the residents there was no financial records of the sewerage system at Dansoman and other communities that had sewers developed by SHC.

GWCL

GWCL/AVRL also had no separate financial records for the sewerage system they operated and maintained. They only had knowledge of what had been billed and what had been collected but entire sewerage accounts were bundled with that of water. Currently the collected sewer charges are transferred to AMA/AMSU accounts.

AMA

The Sewerage Unit of AMA which was set up in 2007 had some financial records – Income and Expenditure Account for 2007 and 2008. Table 4.12 shows summary of the Income and Expenditure Statements. It could be inferred that though revenue increased in 2008, the corresponding expenditure outstripped the revenues of the Sewerage Unit. Hence for the two years of sewerage operation, the AMA is running into deficit with the current sewer user fee module employed (35% surcharge on volume of water consumption). This was as a result of operational and maintenance cost increasing with maintenance of the sewers. Therefore it is highly probable that the 35% surcharge on volume of water consumption paid as sewer user fee is inadequate.

TABLE 4.16: SUMMARY OF THE INCOME AND EXPENDITURE STATEMENT

	2008 (GH¢)	2007 (GH¢)
Revenue	247,739.75	240,970.72
Expenditure	257,182.46	204,424.01
Surplus/Deficit	(9,442.71)	36,546.71

Source: Accra Metro Sewerage Unit of Accra Metropolitan Assembly

4.6 Determination Of Sewage Tariff Using The Average Incremental Cost (AIC)

The AIC is calculated by dividing

The present value of all incremental capital, operating and maintenance cost (PVC)

by

The present value of the incremental sewage production or treatment over the specified life of the facilities (PV WW)

Therefore AIC = $\frac{\text{PVC (\$)}}{\text{PV WW (m}^3\text{)}}$

In the determination of sewerage tariff, full cost recovery and operation and maintenance (O & M) cost recovery were considered separately using the AIC formula. With the full cost recovery, investment cost and O & M cost are recovered from the sewerage tariffs. However with the O & M cost recovery, only the operation and maintenance cost are recovered.

In the determination of the sewerage tariff, financial data was obtained from Sewerage Unit of the AMA. Investment cost (loan obtained by the Government of Ghana) for construction and expansion, staff strength which translates into personnel remuneration and other recurrent operation and maintenance expenses such as utilities, fuel as well as other administrative costs were also considered.

4.6.1 Capital Costs Used In the Determination of AIC

The capital cost of approximately seventy-eight million US dollars (US$ 78 million) was used for calculations.11.09% being equity and 88.91% being debt. Cost of debt is 0.75% (ASIP Appraisal Report, 2005) and the cost of equity used is 30% (Bank of Ghana)

4.6.2 Operation and Maintenance Expenses Used In the Determination of AIC

The anticipated staff strength of 284 with their grades and salary structure are show in Table 4.13. The forecast of the operation and maintenance cost, interest and principal payment are shown in Tables 4.14 and 4.15 (Pages 45 - 52). Table 4.14 shows the interest and principal payment of the loan as well as the forecast of operation and maintenance expenses from 2013 to 2030. Table 4.15 shows only the forecast of operation and maintenance expenses from 2013 to 2030.

TABLE 4.17: GRADE LEVEL AND SALARY STRUCTURE OF ANTICIPATED STAFF

JUNIOR STAFF

Grade Level	Salary (US$)	Salary (GH¢)
J 1	120.00	169.20
J 2	170.00	239.70
J 3	220.00	310.20
J 4	270.00	380.70
J 5	320.00	451.20
J 6	370.00	521.70
J 7	420.00	592.20
J 8	470.00	662.70
J 9	520.00	733.20
J 10	570.00	803.70

MIDDLE LEVEL STAFF

Grade Level	Salary (US$)	Salary (GH¢)
ST 11	670.00	944.70
ST 12	770.00	1,085.70
ST 13	870.00	1,226.70
ST 14	970.00	1,367.70
ST 15	1,070.00	1,508.70
ST 16	1,170.00	1,649.70
ST 17	1,270.00	1,790.70
ST 18	1,370.00	1,931.70
ST 19	1,470.00	2,072.70
ST 20	1,500.00	2,115.00

Grade Level	Salary (US$)	Salary (GH¢)
AA 11	670.00	944.70
AA 12	770.00	1,085.70
AA 13	870.00	1,226.70
AA 14	970.00	1,367.70
AA 15	1,070.00	1,508.70
AA 16	1,170.00	1,649.70
AA 17	1,270.00	1,790.70
AA 18	1,370.00	1,931.70
AA 19	1,470.00	2,072.70
AA 20	1,500.00	2,115.00

SENIOR STAFF

Grade Level	Salary (US$)	Salary (GH¢)
S 21	1,300.00	1,833.00
S 22	1,500.00	2,115.00
S 23	2,000.00	2,820.00
S 24	2,250.00	3,172.50
S 25	2,500.00	3,525.00
S 26	2,750.00	3,877.50
S 27	3,000.00	4,230.00
S 28	3,250.00	4,582.50
S 29	3,500.00	4,935.00
S 30	4,000.00	5,640.00

Source: Manpower Audit Report -Nitoks Consults (2009)

4.6.3 Forecast of Sewage Flows Used In the Determination of AIC

In the determination of the sewage flows the incremental sewage flows for the existing sewage plant and future sewage plants for the years 2009 to 2030 for the city of Accra, data were obtained from the Accra Sewerage Improvement Project Appraisal Report (2005). Using the discounting rate of 4% (WACC), the present value of the total average anticipated sewage flows were calculated. The calculations are shown in Table 4.16

TABLE 4.18: FORECAST OF SEWAGE FLOWS

SEWAGE FLOW FORECAST M^3							
	Year	Existing Sewage Plant Average Sewage Flow Per Day	Densu Delta Average Sewage Flow Per Day	Legon Average Sewage Flow Per Day	Average Daily Total Sewage Flow	Annual Sewage Flows	PV of Annual Sewage Flows @ 4%
0	2009	5064			5,064	1,848,360	1,848,360
1	2010	5070			5,070	1,850,550	1,779,375
2	2011	5804			5,804	2,118,460	1,958,635
3	2012	6538			6,538	2,386,370	2,121,474
4	2013	8,000	1,000	1,500	10,500	3,832,500	3,276,037
5	2014	8,500	1,500	2,250	12,250	4,471,250	3,675,042
6	2015	9,000	2,000	3,000	14,000	5,110,000	4,038,507
7	2016	9,500	2,500	3,750	15,750	5,748,750	4,368,578
8	2017	10,000	3,000	4,500	17,500	6,387,500	4,667,284
9	2018	10,500	3,500	5,250	19,250	7,026,250	4,936,550
10	2019	11,000	4,000	6,000	21,000	7,665,000	5,178,199
11	2020	11,500	4,500	6,750	22,750	8,303,750	5,393,958
12	2021	12,000	5,000	7,500	24,500	8,942,500	5,585,459
13	2022	12,500	5,500	8,250	26,250	9,581,250	5,754,250
14	2023	13,000	6,000	9,000	28,000	10,220,000	5,901,795
15	2024	13,500	6,500	9,750	29,750	10,858,750	6,029,478
16	2025	14,000	7,000	10,500	31,500	11,497,500	6,138,609
17	2026	14,500	7,500	11,250	33,250	12,136,250	6,230,426
18	2027	15,000	8,000	12,000	35,000	12,775,000	6,306,099
19	2028	16,000	8,500	12,500	37,000	13,505,000	6,410,046
20	2029	16,120	8,558	12,673	37,351	13,633,115	6,221,976
21	2030	16,120	8,558	12,673	37,351	13,633,115	5,982,669
							103,802,807

Source: Wassel et al, 2005

4.6.4 Calculation of AIC Based On Full Cost Recovery

Having determined the future annual capital, operation and maintenance cost and loan charges, the sum of the annual capital and recurrent cost were determined. With the discounting rate of 4%, the present values of all future annual cost were calculated and the total present cost calculated as US$ 151,617,603. The summary of the calculations is shown on Table 4.17. Knowing the total present value of annual sewage flows as 103,802,807 m^3, the sewage tariff is calculated as

$$\text{Sewage Tariff} = \frac{\text{PVC (\$)}}{\text{PV WW (m3)}}$$

$$\text{Sewage Tariff} = \frac{\text{US\$ 151,617,603}}{\text{103,802,807 (m}^3\text{)}}$$

$$\text{Sewage Tariff} = \text{US\$ 1.46/ m}^3$$

Using the present US dollar to Ghana Cedi exchange rate of US$ 1.00 to GH¢1.41 the full cost recovery sewage tariff is GH¢ 2.06 / m^3 of sewage.

4.6.5 Calculation of AIC Based On Operation and Maintenance (O & M) Recovery

Similarly, having determined the future annual operation and maintenance cost, the present values were calculated with a discounting rate of 4% and the total present operation and maintenance cost calculated as US$ 63,588,777. The total present value of annual sewage flows was 103,802,807 m^3. The summary of the calculation is shown on Table 4.18. Hence the sewage tariff is calculated as

$$\text{Sewage Tariff} = \frac{\text{PVC (\$)}}{\text{PV WW (m3)}}$$

Sewage Tariff = $\frac{\text{US\$ } 63{,}588{,}777}{103{,}802{,}807 \ (\text{m}^3)}$

Sewage Tariff = US$ 0.61/ m^3

Using the US dollar to Ghana Cedi exchange rate of US$ 1.00 to GH¢1.41 the O & M cost recovery sewage tariff is GH¢ 0.86 / m^3 of sewage.

TABLE 4.19: SUMMARY OF CALCULATION OF SEWAGE TARIFF ON THE BASIS OF FULL COST RECOVERY

a	b	C			D			e	f	g
		Capital Cost			Recurrent Cost					
	Year	GoG Disbursement Schedule (US$)	AfDB Loan Disbursement Schedule (US$)	World Bank loan Disbursement Schedule (US$)	Commitment Charge (AfDB) (US$)	Service Charge (AfDB) (US$)	O & M cost with Payment of Principal & Interest on Principal	Total Capital Cost & Recurrent Cost (US$)	Discount Factor at 4% Discount Rate	Present Value of Total Capital & Recurrent Cost (US$)
0	2009							0	1.0000	0
1	2010	840,000.00	1,440,000.00	100,000.00	337,800.00	517,500.00	0	3,235,300	0.9615	3,110,865
2	2011	2,310,000.00	32,280,000.00	100,000.00	176,400.00	1,038,881.25	0	35,905,281	0.9246	33,196,451
3	2012	4,065,000.00	26,895,000.00	50,000.00	41,925.00	1,564,172.86	0	32,616,098	0.8890	28,995,592
4	2013	900,000.00	4,875,000.00		17,550.00	2,093,404.16	5,768,434	13,654,389	0.8548	11,671,829
5	2014	495,000.00	3,510,000.00		0.00	2,626,604.69	5,994,822	12,626,426	0.8219	10,378,002
6	2015						6,179,242	6,179,242	0.7903	4,883,545
7	2016						6,194,230	6,194,230	0.7599	4,707,106
8	2017						6,201,724	6,201,724	0.7307	4,531,539
9	2018						6,216,712	6,216,712	0.7026	4,367,780
10	2019						6,224,206	6,224,206	0.6756	4,204,851
11	2020						6,921,700	6,921,700	0.6496	4,496,205
12	2021						6,921,700	6,921,700	0.6246	4,323,274
13	2022						6,921,700	6,921,700	0.6006	4,156,994
14	2023						6,921,700	6,921,700	0.5775	3,997,110
15	2024						6,921,700	6,921,700	0.5553	3,843,375
16	2025						6,921,700	6,921,700	0.5339	3,695,552
17	2026						6,921,700	6,921,700	0.5134	3,553,416
18	2027						6,921,700	6,921,700	0.4936	3,416,746
19	2028						6,921,700	6,921,700	0.4746	3,285,333
20	2029						6,921,700	6,921,700	0.4564	3,158,974
21	2030						8,301,700	8,301,700	0.4388	3,643,065
								Total Present Cost		151,617,603

Source: Wassel et al, 2005

TABLE 4.20: SUMMARY OF CALCULATION OF SEWAGE TARIFF ON THE BASIS OF O & M RECOVERY

	Year	Total Operation & Maintenance cost (US$)	Discount Factor at 4% Discount Rate	Present Value of Operation & Maintenance Cost (US$)	Annual Sewage Flows (m^3/yr)	Present Value Annual Sewage Flows (m^3/yr)
0	2009		1.0000	0	1,848,360	1,848,360
1	2010		0.9615	0	1,850,550	1,779,375
2	2011		0.9246	0	2,118,460	1,958,635
3	2012		0.8890	0	2,386,370	2,121,474
4	2013	5,249,059	0.8548	4,486,918	3,832,500	3,276,037
5	2014	5,475,447	0.8219	4,500,418	4,471,250	3,675,042
6	2015	5,659,867	0.7903	4,473,075	5,110,000	4,038,507
7	2016	5,674,855	0.7599	4,312,424	5,748,750	4,368,578
8	2017	5,682,349	0.7307	4,152,037	6,387,500	4,667,284
9	2018	5,697,337	0.7026	4,002,874	7,026,250	4,936,550
10	2019	5,704,831	0.6756	3,853,980	7,665,000	5,178,199
11	2020	5,712,325	0.6496	3,710,618	8,303,750	5,393,958
12	2021	5,712,325	0.6246	3,567,902	8,942,500	5,585,459
13	2022	5,712,325	0.6006	3,430,675	9,581,250	5,754,250
14	2023	5,712,325	0.5775	3,298,726	10,220,000	5,901,795
15	2024	5,712,325	0.5553	3,171,852	10,858,750	6,029,478
16	2025	5,712,325	0.5339	3,049,857	11,497,500	6,138,609
17	2026	5,712,325	0.5134	2,932,555	12,136,250	6,230,426
18	2027	5,712,325	0.4936	2,819,764	12,775,000	6,306,099
19	2028	5,712,325	0.4746	2,711,312	13,505,000	6,410,046
20	2029	5,712,325	0.4564	2,607,031	13,633,115	6,221,976
21	2030	5,712,325	0.4388	2,506,760	13,633,115	5,982,669
			Total Present Cost of O & M	63,588,777	Total Present Vale of Sewage Flow	103,802,807

Source: Wassel et al, 2005

4.7 Determination of Subsidy

Generally utility bills are paid on monthly basis in Ghana. According to Merritt and Ricketts (1999) wastewater production per flush of a water closet (WC) facility ranges from 1.6 gal (7.2 litres) to 3.5 gal (15.8 litres) with

average number of visits per person per day being 4. Hence with an average household size of 6, using average of 2.55gal (11.5 litres) per flush for a month (30days), the wastewater produced is 8,280 litres (8.28 m^3). Therefore for full cost recovery (GH¢ 2.06 / m^3), the average sewer bill per month is GH¢ 17.06 and for operation and maintenance cost recovery (GH¢ 0.86 / m^3), the average sewer bill per month is GH¢ 7.12.

4.7.1 Subsidy For full cost recovery

Using full cost recovery sewer charge per month (GH¢ 17.06) and considering the willingness and ability to pay figure (GH¢ 2.81/month or GH¢ 0.34 / m^3), the subsidy to be paid per household per month is GH¢ 17.06 - GH¢ 2.81 which is GH¢ 14.25 (GH¢ 1.72 / m^3). However considering the current average sewer user fee paid (GH¢ 5.14/month or GH¢ 0.62/ m^3), the subsidy to be paid will be GH¢ 17.06 - GH¢ 5.14 which is GH¢ 11.92 (GH¢ 1.44/ m^3).

4.7.2 Subsidy For operation and maintenance cost recovery

Using the O & M cost recovery sewer charge per month (GH¢ 7.12) and considering the willingness and ability to pay figure (GH¢ 2.81), the subsidy to be paid per household per month is GH¢ 7.12 - GH¢ 2.81 which is GH¢ 4.31 (GH¢ 0.52 / m^3). However considering the current average sewer user fee paid (GH¢ 5.14), the subsidy to be paid will be GH¢ 7.12 - GH¢ 5.14 which is GH¢ 1.98 (GH¢ 0.24/ m^3).

5.0 Summary, Conclusion and Recommendations

5.1 Summary

The study assessed the current tariff system for provision of sewerage services and how the tariff review could improve upon the revenue potential of sewerage system in Accra. The study is intended to provide the tariff regulatory body and AMA base-line information about sewerage tariffs for future use and also serve as a sewage user charge guideline for other cities in Ghana that has or intend to use sewerage system.

The second chapter of the report looked at the various types of sewerage tariff employed worldwide. It also looked at the past and present sewerage tariff models applied by the various sewerage management organisations. The methodology for the data gathering was looked at in the third chapter. In the fourth chapter the Average Incremental Cost method was used to determine the appropriate sewage user fee. With the SPSS, the willingness and ability to pay for sewage was also determined. Hence the subsidy levels for Full Cost and O & M Cost recovery were obtained.

5.2 Conclusion

The SHC had no tariff model hence the residents of Dansoman never paid any sewer user fees. However the GWCL had a tariff model which was thirty-five percent (35%) surcharge on the volume of water used by customers. This GWCL tariff model is what AMA is currently using to bill the sewer users.

The current sewer user fee (35% surcharge on water consumption) is inadequate to generate enough revenue for the service provider to increase the level of service needed by the customers. Hence majority of the respondents (79% at Dansoman and 65% at areas previously managed by GWCL) ranked the level of service below 5 on a scale of 1 to 10.

About 98% of all the respondents expressed their willingness to pay for sewer services. Nevertheless the average ability to pay for the service was GH¢ 2.81 per month which is approximately GH¢ 0.34/m^3 of sewage generated in a month.

Household ability to pay for sewerage services falls short of realistic tariff for both full cost recovery and O & M cost recovery tariffs. Consequently subsidy levels of GH¢ 11.92 per month translating to GH¢ 1.44/m^3 of sewage and GH¢ 1.98 per month translating to GH¢ 0.24/m^3 of sewage for full cost recovery and O & M cost recovery respectively should be paid to support the running the service effectively.

The study showed that households should pay GH¢ 2.06 /m^3 of sewage for full cost recovery or GH¢0.86 / m^3 of sewage for O & M cost recovery. These amounts to GH¢ 17.06 per month and GH¢ 7.12 per month respectively.

5.3 Recommendations

Sewage charges should be based on the volume of metered public water supply or self-supplied groundwater.

Practically, it is currently difficult to exactly determine wastewater generated by individual households as there are no wastewater meters to determine how the customer should be billed. Therefore to recover the O & M cost and then the full cost recovery for effective running of sewerage facilities in Accra, the current 35% surcharge of sewerage fees on the water consumption should be increased gradually to 95% (0.86/0.91) over a period of two years. However the full cost recovery should be gradually introduced over a period of five to ten years.

There should be public education and awareness of tariff increases for customers to understand the main components of the tariff and what the increased revenue resulting from the increased tariff will be used for (e.g. rehabilitation, new works, debt servicing, interest payment, et cetera) to enhance payment. In that case there will be minimum complaints and will not leading to tariff increase rejection by the general public.

Over time, major industrial polluters should be charged on a two-part tariff based on volume of wastewater generated and level of pollution load.

Since household income profile varies greatly the block tariff system should be used to achieve the distributive justice objective in tariff setting.
Water tariff increment must be reviewed regularly to affect sewerage tariff as sewerage tariff still remains a percentage of water tariffs.
The AMA which is managing the sewerage facilities in Accra should improve sewerage service delivery to compensate the gradual increase in tariffs.
There should be no exemptions, discounts or delays in payment for governmentally-well-connected industries or institutions

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Appendix I
Sample Questionnaire on Assessment of Sewage Tariff in Accra
The information being sought for is intended for academic research only.
Name of researcher: P.Q. Eleke-Abpoagye and Stephen E. D. Ackon
Name of academic Institution: Methodist University College Ghana

SURVEY AREA: ……

PERSONAL INFORMATION

1. Name of Respondent: ……
2. Address: ……
3. House Number: ……
4. Sex: Male [ ] Female [ ]
5. Age: 18 – 29 [ ] 30 – 39 [ ] 40 – 49 [ ] 50 – 59 [ ] 60 – 69 [ ] 70 – 79 [ ] 80 – 89 [ ] 90 – 99 [ ]
6. Marital Status: Single [ ] Married [ ]Divorced [ ] Widowed [ ] Others [ ]
7. Educational level: Illiterate [ ] Primary [ ] Middle School/JSS [ ] Secondary [ ] Tertiary [ ]
8. Profession: ……
9. Occupation: ……
10. What is your monthly income? GH¢ 50 - 199 [ ] GH¢200 – 499 [ ] GH¢500 – 999[ ] GH¢1000 – 1499 GH¢1500 – 1900 [ ] GH¢2000 – 5000 [ ] Others: GH¢…….
11. What is your household monthly income? GH¢ 50 - 199 [ ] GH¢200 – 499 [ ] GH¢500 – 999[ ] GH¢1000 – 1499GH¢1500 – 1900 [ ] GH¢2000 – 5000 [ ] Others: GH¢……

WATER

12. What is the main source of your water supply?
    GWCL [ ] Borehole/Well [ ] Tanker service/Stand pipe [ ]Others [ ] …….
13. How much do you pay for water supply per month?
    GH¢……
14. Where do you pay your water bills?
    Bank [ ] GWCL Office [ ] Private Contractors [ ] ECG Office [ ]
15. How often do you pay your water bill?
    Weekly [ ] Monthly [ ] Quarterly [ ] Semi-annually [ ] Annually [ ]

SEWERAGE

16. Is your area/community covered by sewerage network? Yes [ ] No [ ]
17. If Yes, is your premise connected to the sewerage network? Yes [ ] No [ ]
18. If yes, how often are you required to pay for sewerage services?
    Weekly [ ] Monthly [ ] Quarterly [ ] Semi-annually [ ] Annually [ ]
19. How often would you like to pay your sewerage bill?
    Weekly [ ] Monthly [ ] Quarterly [ ] Semi-annually [ ] Annually [ ]
20. How much do you pay for sewerage services at the frequency of payment stated above?
    GH¢ ……
22. If your premise is connected to the sewerage network, where do you pay the bill?
    Bank [ ] GWCL Office [ ] Private Contractors [ ] ECG Office [ ]
23. How would you rank the quality of sewerage services on a scale of 1 - 10? ……..
24. If your ranking is below 8**,** what are your suggestions for improvement?
    ……
25. For efficient services, what maximum amount are you willing to pay per month?
    GH¢5 [ ] GH¢10 [ ] GH¢15 [ ] GH¢20 [ ] GH¢25 [ ]aboveGH¢25 [ ]

NON SEWERED

26. If there is no sewerage network in your community, how do you dispose your bodily waste substances?
Pit Latrine [ ] KVIP [ ] Septic tank [ ] Public Toilet [ ] Aqua privy [ ]
Neighbourhood [ ] Others …….
27. How much do you pay per month for your method of disposal?
GH¢ ……
28. Do you find your means of disposal convenient? Yes [ ] No [ ]
29. Which of the following disposal methods do you prefer?
Sewerage [ ] KVIP [ ] Septic tank [ ] Public Toilet [ ] Aqua privy [ ]
Pit Latrine [ ] Neighbourhood [ ] Others …….
30. If you get what you proposed, will you be willing to pay more for disposal of liquid waste?
Yes [ ] No [ ]
31 How much are you willing to pay for disposal of liquid waste per month?
GH¢5 [ ] GH¢10 [ ] GH¢15 [ ] GH¢20 [ ] GH¢25 [ ] aboveGH¢25 [ ]
32. Which type of customer category do you belong?
Domestic [ ] Commercial [ ] Institutional [ ] Industrial [ ] Others [ ]……

If Domestic

33. How many persons live in your household? …….
34. How many are below eighteen? ……

If Commercial

35. Which of the commercial categories do you belong?
Hotel [ ] Restaurant [ ] Cinema [ ] Guest House [ ] Public Toilet [ ]
Hairdressing Salon [ ] Vehicle Washing Bay [ ] Others [ ] ……..
36. How many workers are there? .....
37. Number of customers per day ……
38. Total number of beds (Hotel & Guest House) ……..

If Institutional

39. Army [ ] Navy [ ] Airforce [ ] Police [ ] Academic Institution [ ]
Others ……..
40. How many residential building are there? …….
41. How many office building are there? ……
42. How many workers are there? ……..
43. How many residents are there? ……

If Industrial

44. Which of the industrial categories do you belong?
Agricultural [ ] Manufacturing [ ] Warehousing [ ] Others……
45. How many buildings are there in the establishment? ……..
46. Total workforce …….

Others

47. State ……..

Appendix III

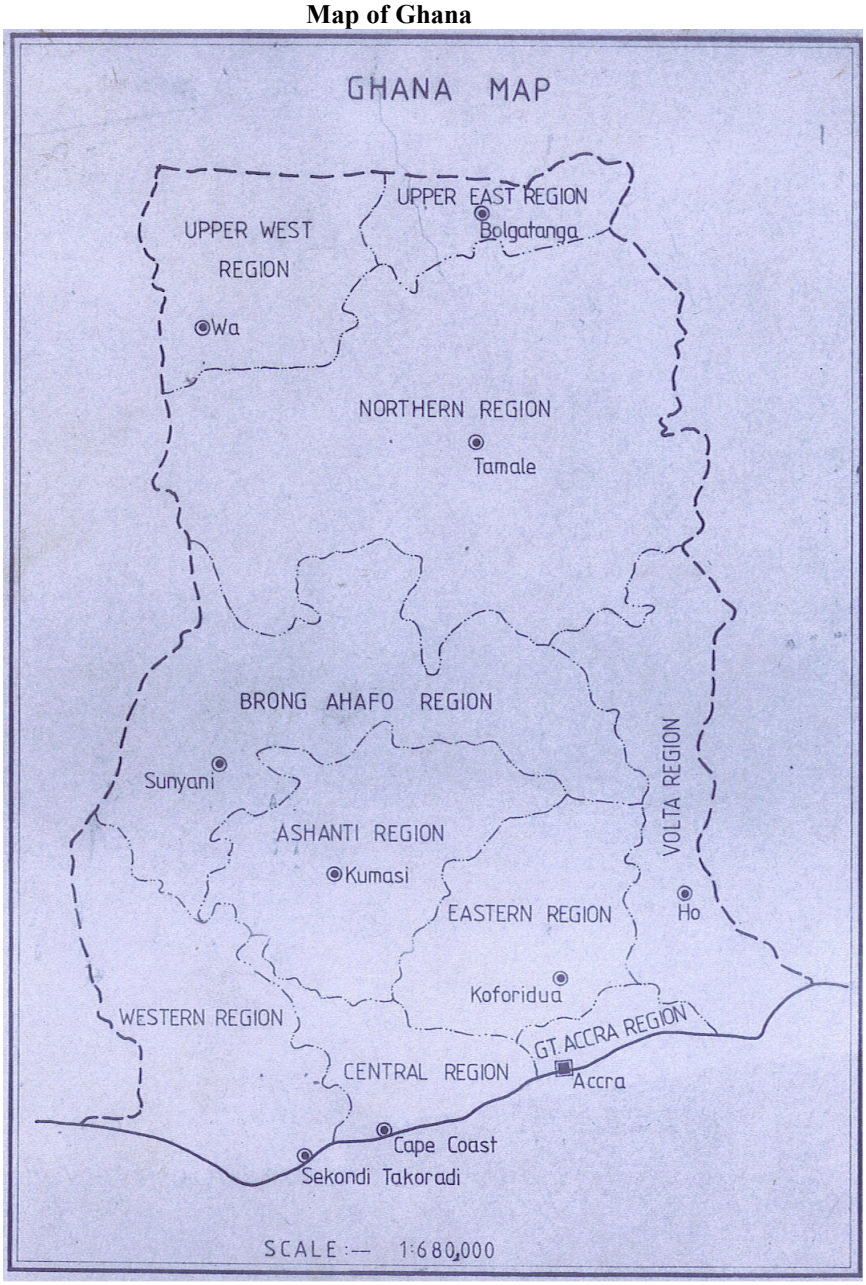
Water and wastewater tariffs for some selected cities around the world

City	Country	Domestic drinking water tariff in US$ per m^3	Domestic wastewater tariff in US$ per m^3	Total domestic tariff in US$ per m^3
Copenhagen	Denmark	2.84	2.39	5.22
Berlin	Germany	2.56	2.56	5.11
Manchester	UK	2.00	2.05	4.05
Amsterdam	Netherlands	1.85	1.63	3.48
Birmingham	UK	1.96	1.25	3.21
Rotterdam	Netherlands	1.65	1.63	3.28
Marseille	France	1.61	1.50	3.11
Paris	France	1.53	1.37	2.90
Vienna	Austria	1.59	2.88	4.47
Cape Town	South Africa	0.61	0.72	1.33
Fortaleza	Brazil	0.60	0.60	1.20
Cairo*	Egypt	0.87	–	0.87
Casablanca *	Morocco	1.03	–	1.03
Bamako*	Mali	0.51	–	0.51
Lagos	Nigeria	0.37	1.27	1.64
Kinshasa*	Congo	0.33	–	0.33
Johannesburg*	South Africa	0.29	–	0.29
Nairobi	Kenya	0.24	0.26	0.50
Addis Ababa*	Ethiopia	0.22	–	0.22
Algiers*	Algeria	0.21	–	0.21
Rabat*	Morocco	0.21	–	0.21
Antananarivo*	Madagascar	0.15	–	0.15
Mumbai	India	0.13	0.19	0.32

(*= water and wastewater tariff combined,) Source: Global Water Intelligence, (2005).

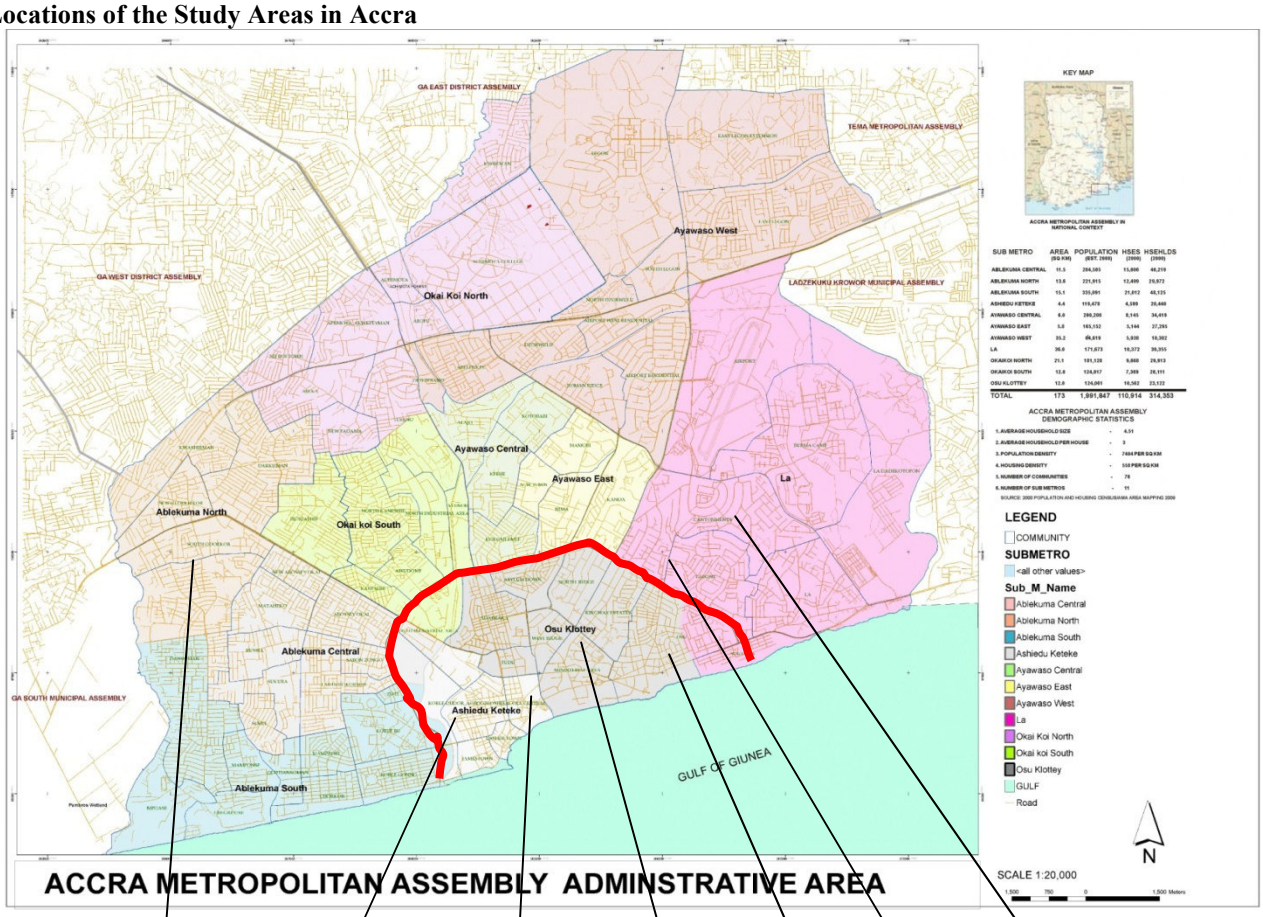
Appendix IV

Map of Ghana



Source: Department of Town and Country Planning

Appendix V
Locations of the Study Areas in Accra



Source: Accra Metropolitan Assembly

Table 4.14: ACCRA METRO SEWERAGE UNIT - Forecast of Operation and Maintenance Expenses, Interest and Principal Payment of the Loan from 2013 To 2030

	2013	2014	2015	2016	2017	2018	2019	2020	2021
ENGINEERING EXPENSES	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**
Payroll	1,002,379	1,182,086	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147
Fuel	131,760	131,760	131,760	131,760	131,760	131,760	131,760	131,760	131,760
Maintenance (cesspool, tractors, flush trucks)	123,600	123,600	123,600	123,600	123,600	123,600	123,600	123,600	123,600
Operation & Maintenance (Major equipment)	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766
Utilities	73,440	73,440	73,440	73,440	73,440	73,440	73,440	73,440	73,440
Tools/Supplies	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Office Supplies	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Laboratory Expense	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Total	**1,429,945**	**1,609,652**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**
ADMINISTRATIVE EXPENSES									
Payroll (All Dep't Except Engineering)	636,480	683,160	728,520	728,520	728,520	728,520	728,520	728,520	728,520
Fuel and Maintenance cost of vehicles	15,282	15,282	15,282	25,470	30,564	40,752	45,846	50,940	50,940
Utilities	53,316	53,316	53,316	53,316	53,316	53,316	53,316	53,316	53,316
Office Supplies	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Inssurance	32,400	32,400	32,400	37,200	39,600	44,400	46,800	49,200	49,200
Postage	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Depreciation	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436
Interest Expense on Loan	519,375	519,375	519,375	519,375	519,375	519,375	519,375	519,375	519,375
Loan Repayment Schedule	0	0	0	0	0	0	0	690,000	690,000
Total Adminitrastive Expenses	**4,338,489**	**4,385,169**	**4,430,529**	**4,445,517**	**4,453,011**	**4,467,999**	**4,475,493**	**5,172,987**	**5,172,987**
Grand Total O & M, Int. & Prin Payment	**5,768,434**	**5,994,822**	**6,179,242**	**6,194,230**	**6,201,724**	**6,216,712**	**6,224,206**	**6,921,700**	**6,921,700**

Source: **Manpower Audit Report -Nitoks Consults (2009)**

Table 4.14: ACCRA METRO SEWERAGE UNIT - Forecast of Operation and Maintenance Expenses, Interest and Principal Payment of the Loan from 2013 To 2030 (Continued)

	2022	2023	2024	2025	2026	2027	2028	2029	2030
ENGINEERING EXPENSES	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**
Payroll	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147
Fuel	131,760	131,760	131,760	131,760	131,760	131,760	131,760	131,760	131,760
Maintenance (cesspool, tractors, flush trucks)	123,600	123,600	123,600	123,600	123,600	123,600	123,600	123,600	123,600
Operation & Maintenance (Major equipment)	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766
Utilities	73,440	73,440	73,440	73,440	73,440	73,440	73,440	73,440	73,440
Tools/Supplies	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Office Supplies	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Laboratory Expense	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Total	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**
ADMINISTRATIVE EXPENSES									
Payroll (All Dep't Except Engineering)	728,520	728,520	728,520	728,520	728,520	728,520	728,520	728,520	728,520
Fuel and Maintenance cost of vehicles	50,940	50,940	50,940	50,940	50,940	50,940	50,940	50,940	50,940
Utilities	53,316	53,316	53,316	53,316	53,316	53,316	53,316	53,316	53,316
Office Supplies	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Inssurance	49,200	49,200	49,200	49,200	49,200	49,200	49,200	49,200	49,200
Postage	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Depreciation	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436
Interest Expense on Loan	519,375	519,375	519,375	519,375	519,375	519,375	519,375	519,375	519,375
Loan Repayment Schedule	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	2,070,000
Total Adminitrastive Expenses	**5,172,987**	**5,172,987**	**5,172,987**	**5,172,987**	**5,172,987**	**5,172,987**	**5,172,987**	**5,172,987**	**6,552,987**
Grand Total O & M, Int. & Princ Payment	**6,921,700**	**6,921,700**	**6,921,700**	**6,921,700**	**6,921,700**	**6,921,700**	**6,921,700**	**6,921,700**	**8,301,700**

Source:

Table 4.15: ACCRA METRO SEWERAGE UNIT - Forecast of Operation and Maintenance Expenses from 2013 To 2030

	2013	2014	2015	2016	2017	2018
ENGINEERING EXPENSES	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**
Payroll	1,002,379	1,182,086	1,321,147	1,321,147	1,321,147	1,321,147
Fuel	131,760	131,760	131,760	131,760	131,760	131,760
Maintenance (cesspool, tractors, flush trucks)	123,600	123,600	123,600	123,600	123,600	123,600
Operation & Maintenance (Major equipment)	6,766	6,766	6,766	6,766	6,766	6,766
Utilities	73,440	73,440	73,440	73,440	73,440	73,440
Tools/Supplies	2,000	2,000	2,000	2,000	2,000	2,000
Office Supplies	3,000	3,000	3,000	3,000	3,000	3,000
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000
Laboratory Expense	72,000	72,000	72,000	72,000	72,000	72,000
Total	**1,429,945**	**1,609,652**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**
ADMINISTRATIVE EXPENSES						
Payroll (All Dep't Except Engineering)	636,480	683,160	728,520	728,520	728,520	
Fuel and Maintenance cost of vehicles	15,282	15,282	15,282	25,470	30,564	
Utilities	53,316	53,316	53,316	53,316	53,316	
Office Supplies	10,000	10,000	10,000	10,000	10,000	
Inssurance	32,400	32,400	32,400	37,200	39,600	
Postage	1,200	1,200	1,200	1,200	1,200	
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	
Depreciation	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	
Total Adminitrastive Expenses	**3,819,114**	**3,865,794**	**3,911,154**	**3,926,142**	**3,933,636**	
Grand Total O & M	**5,249,059**	**5,475,447**	**5,659,867**	**5,674,855**	**5,682,349**	

Source: **Manpower Audit Report -Nitoks Consults (2009)**

Table 4.15: ACCRA METRO SEWERAGE UNIT - Forecast of Operation and Maintenance Expenses from 2013 To 2030 (Continued)

	2022	2023	2024	2025	2026	2027	2028	2029	2030
ENGINEERING EXPENSES	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**	**US$**
Payroll	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147	1,321,147
Fuel	131,760	131,760	131,760	131,760	131,760	131,760	131,760	131,760	131,760
Maintenance (cesspool, tractors, flush trucks)	123,600	123,600	123,600	123,600	123,600	123,600	123,600	123,600	123,600
Operation & Maintenance (Major equipment)	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766	6,766
Utilities	73,440	73,440	73,440	73,440	73,440	73,440	73,440	73,440	73,440
Tools/Supplies	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Office Supplies	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Laboratory Expense	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Total	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**	**1,748,713**
ADMINISTRATIVE EXPENSES									
Payroll (All Dep't Except Engineering)	728,520	728,520	728,520	728,520	728,520	728,520	728,520	728,520	728,520
Fuel and Maintenance cost of vehicles	50,940	50,940	50,940	50,940	50,940	50,940	50,940	50,940	50,940
Utilities	53,316	53,316	53,316	53,316	53,316	53,316	53,316	53,316	53,316
Office Supplies	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Inssurance	49,200	49,200	49,200	49,200	49,200	49,200	49,200	49,200	49,200
Postage	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Miscellaneous Expense	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Depreciation	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436	3,055,436
Total Adminitrastive Expenses	**3,963,612**	**3,963,612**	**3,963,612**	**3,963,612**	**3,963,612**	**3,963,612**	**3,963,612**	**3,963,612**	**3,963,612**
Grand Total O & M	**5,712,325**	**5,712,325**	**5,712,325**	**5,712,325**	**5,712,325**	**5,712,325**	**5,712,325**	**5,712,325**	**5,712,325**

Source: **Manpower Audit Report -Nitoks Consults (2009)**