Life-cycle costs approach for WASH services that last

Life-Cycle Costs in Ghana

Briefing Note 9: Cost study of small towns water schemes in central region, Ghana

Dec. 2012

WASHCost project partners have developed a methodology for costing sustainable water, sanitation and hygiene (WASH) services by assessing life-cycle costs and comparing them against levels of service provided. The approach has been tested in Ghana, Burkina Faso, Mozambique and Andhra Pradesh (India). The aim of the life-cycle costs approach is to catalyse learning to improve the quality, targeting and cost effectiveness of service delivery.

IIn Ghana, Kwame Nkrumah University of Science and Technology (KNUST), International Water and Sanitation Centre (IRC), and Community Water and Sanitation Agency (CWSA) are using the WASHCost Life-Cycle Cost Approach to identify the true costs of providing sustainable Water, Sanitation and Hygiene costs in rural and peri-urban areas. This briefing note presents findings on cost drivers of capital investment of small towns piped water schemes and draws out the implications for policy and practice in Ghana's WASH sector.

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Front page photo
IRC-Ghana Team

WASHCost is a five year action research project investigating the cost of providing water, sanitation and hygiene services to rural and peri-urban communities in Ghana, Burkina-Faso, Mozambique and India (Andhra Pradesh). The objectives of collecting and disaggregating the cost data over the full life-cycle of WASH services are able to analyse cost per infrastructure and service level, and to better understand the cost drivers and through this understanding to enable more cost effective and equitable service delivery. WASHCost is focused on exploring and sharing an understanding of the true cost of sustainable services (see www.washcost.info).

Life cycle costs in Ghana:

Cost study of small towns water schemes in central region, Ghana

WASHCost briefing note No 9 report on findings on the cost of providing water services in small towns using piped water systems in Ghana. It unearths the factors affecting sustainable water service delivery and provides cost information for planning sustainable water service in the small towns in Ghana. The work is based on the results of a study on 12 small towns water supply systems in Central region of Ghana.

Introduction

Access to water in Ghana has been increasing steadily with achievement of the MDG target for water ahead of time. However, the increased water coverage is threatened by high levels of non-functional systems, estimated at 30 % or more in Ghana. The high rate of non functional water systems adversely affects the delivery of sustainable water services. The lack of attention to all the water service life cycle costs is one of the threats to the delivery of sustainable water services.

A good understanding of the cost of providing water services is important for planning, budgeting and implementing sustainable water services. However, the level of understanding of these costs in Ghana is limited. For example, it is not well known how much it cost to maintain a small town piped water system to deliver a desired level of service. It is therefore essential to understand the, importance of the cost components, the magnitude and relative magnitude of the life cycle costs and the consequence of ignoring the life cycle costs for water services delivery.

This briefing note presents findings on the cost of providing water services in small towns using piped water systems in Ghana. It unearths the factors affecting sustainable water service delivery and provides cost information for planning sustainable water service in the small towns in Ghana. The work is based on the results of a study on 12 small towns water supply systems in Central region of Ghana.

Description of the water systems in the study

The study was conducted on twelve (12) small town water systems constructed in the Central Region in 1998. The water systems were part of a project that was implemented before the establishment of the Community Water and Sanitation Agency (CWSA). As a result the implementation did not follow the full ideals of Community Ownership and Management (COM), a key management concept adopted by CWSA for the rural, small towns and peri-urban WASH sub-sector. The water systems vary with respect to the population served, water technologies, water sources (surface water or ground water), energy sources (national electricity grid, solar, diesel generator set) etc. (see Table 1 for details).

Table 1: Water systems used for the study

Water System	Design Population.	Power Source			Water Source	
		Gen Set[4]	Solar	National Grid	Borehole	River
Assin Breku	5,452	√			√	
Akonfode	3,163	√			√	
Twifo Mampong (1)	3,844	√			√	
Aboransa (1)	10,784	√			√	
Assin Praso (2)	4,474	√				√
Denkyira Nkotomso (1)	1,579		√		√	
Twifo Nwamaso	4.446		√		√	
Assin Awisem	1,700		√		√	
Gyeikrodua	3,483			√	√	
Fosuansa	1,949			√	√	
Gyambra	1,407			√	√	
Fanti Nyankomase	2,552			√	√	

Note: (1) Systems with iron removal unit, and (2) System equipped with treatment plant

These water systems were financed in line with CWSA guidelines. The financing arrangement for delivering small town water services based on the guidelines of Community Water and Sanitation Agency (CWSA) are for the government (and development partners) to provide the majority of the Capital Expenditure with the communities contributing 5%[1] of the capital expenditure. The beneficiary communities are required to pay fully the operations and maintenance cost of the facilities. The responsibility for rehabilitation of the water systems lies with the District or Municipal Assembly (local government) and the Water and Sanitation Development Board (WSDB) who are the community representatives.

Water service costing framework

The framework for costing water service delivery is based on a life cycle costing approach. Life cycle costs (LCC) represent the aggregate costs of ensuring delivery of adequate, equitable and sustainable Water, Sanitation and Hygiene (WASH) service to a population in a specified area, not just for a few years, but indefinitely. The diagram below (see Figure 1) shows the main cost components of WASH service delivery –more detail can be found in WASHCost Briefing note No 1.

Figure 1: Life-cycle cost components

Data and analysis

The cost data for the study was obtained from a review of project completion reports, contract payment certificates and operational records that were obtained from the system management level. These costs include the capital expenditure (CapEx), operational and minor expenditure (OpEx), and capital maintenance expenditure (CapManEx). A component of the capital expenditure (CapEx) is for the CapEx enhancement, which is the cost for upgrading the facilities to be able to extend services new users or improve services beyond the initial designed norms. In analysing the data, cost were adjusted to current values (2010) using the GDP deflators from the World Bank. The design population of the water systems were used to calculate cost per person. The annual cost was computed by finding the average operational cost for the number of years of available data.

Capital expenditure

The initial capital expenditure for providing the water schemes are shown in Figure 1 for all the water systems. The results in Figure 1 show an inter quartile range of USD 52 - 92 and a mean of USD 74. This suggests a wide range of cost likely due to disparities in size or complexity of the systems, type of technologies etc.

[1] Recently the community contribution for small town has been reduced from 5% to 2.5 % of the capital expenditure

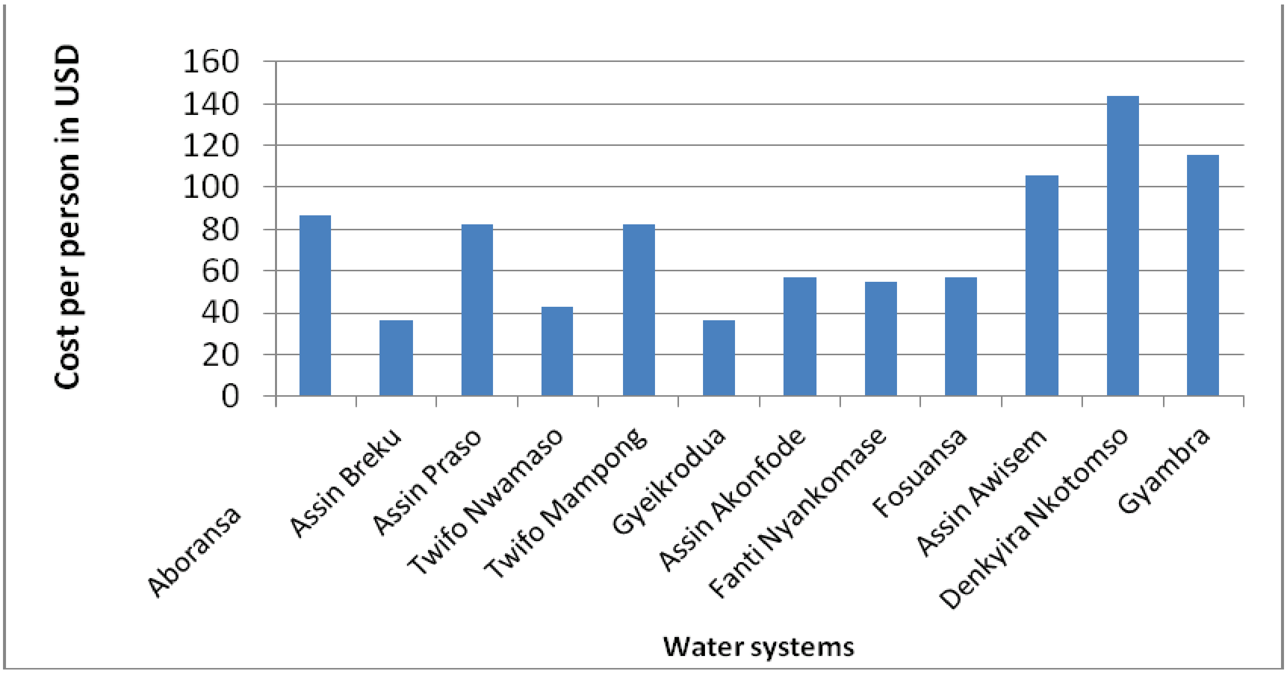

Figure 2: Capital expenditure of the water systems

However, six out of the twelve (12) water systems constructed in 1998 consistently provided water services to the users up to the time of the survey in 2009. The remaining six broke down 1 to 2 years after handing over to communities and were rehabilitated a year or two before the survey (see Table 3).

Table 3: Water systems that failed and their main reasons

Water System	Reason for breakdown	Year of breakdown	Year of rehabilitation
Assin Praso	Failure of water intake structure for the case of the surface water system	2002	2008
Assin Akonfode	Depletion of borehole water source	2001	2008
Twifo Nwamaso	Failure of solar based water systems	2000	2007
Denkyira Nkotomso	Failure of solar based water systems	2001	2007
Assin Awisem	Failure of solar based water systems	2001	2008
Fosuansa	emergent of water quality problem	2007	2008

The problems that led to the break down were beyond the capability of the community members and WSDBs (local facilities management). The regional and district level structures responsible for monitoring and provision of continued support (backstopping) to the WSDBs were not firmly established at the time. Since then CWSA has improved the district level structures with the implementation of the National Community Water and Sanitation Programme (NCWSP).

The COM concept was actually introduced on this project where water point committees were established for each of the water systems. That explains why the study was able to access operations and maintenance records kept by the water committees. The district and regional level structures required for post project monitoring and provision of continued support to the water systems were rather not firmly established at the time. The project consultants rather facilitated a one year service contract between the water committees and a private sector person to see to the maintenance of the electromechanical installations. This arrangement perhaps was not adequate to address the immediate post project difficulties that were encountered.

The relationship between the CapEx and CapManEx for the systems that suffered prolonged breakdown and later rehabilitated is shown Figure 3 below.

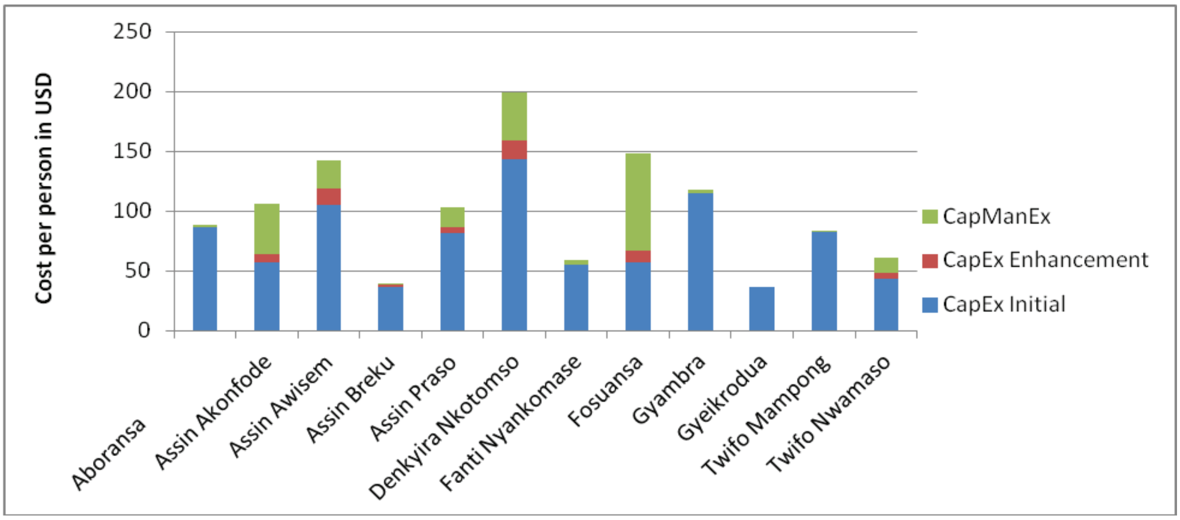

Figure 3: Capital expenditure versus capital maintenance expenditure

All the systems with significant CapEx enhancement and CapManEx were the water systems that suffered breakdown and were rehabilitated. The cost of extending the infrastructure (CapEx enhancement) and the rehabilitation (CapManEx) as a percentage of the initial investment (CapEx) was 87% for Fosuansa and 160 % for the Assin Akonfode water systems. In the case of Assin Akonfode, the cost of rehabilitation and extension which covered a new WSDB building, civil works for the water system was far higher than the original investment due to these additional intensive hardware provisions.

Operational and minor maintenance expenditure

Seven (7) out of Twelve (12) water systems had consistent, valid and available operational records that were used for analysing the operational and minor maintenance expenditure (OpEx). The operational and minor maintenance expenditure was disaggregated as follows personnel (salaries, bonus, sitting allowance), minor maintenance (and preventive maintenance), operations and administration (fuel. energy cost, hospitality, office supplies etc). The results of the OpEx in cost per person per year are shown in Figure 4 below. It reveals that the majority of the operational and minor maintenance goes into personnel followed by operations and administration, and then minor maintenance.

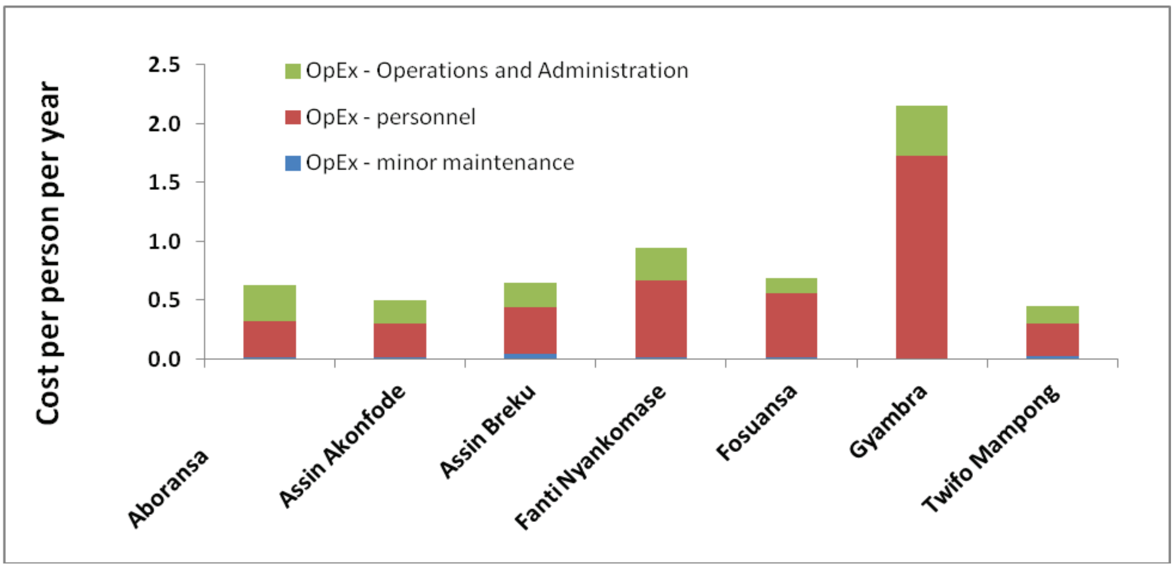

Figure 4: Operational and minor maintenance expenditure of the systems

Gyambra water system has a very high total OpEx because system is serving a small community with comparatively least design population of 1,407.
The trend analysis of the operational expenditure for the 10 year period is shown below. All the cost values are in current (year 2010) value.

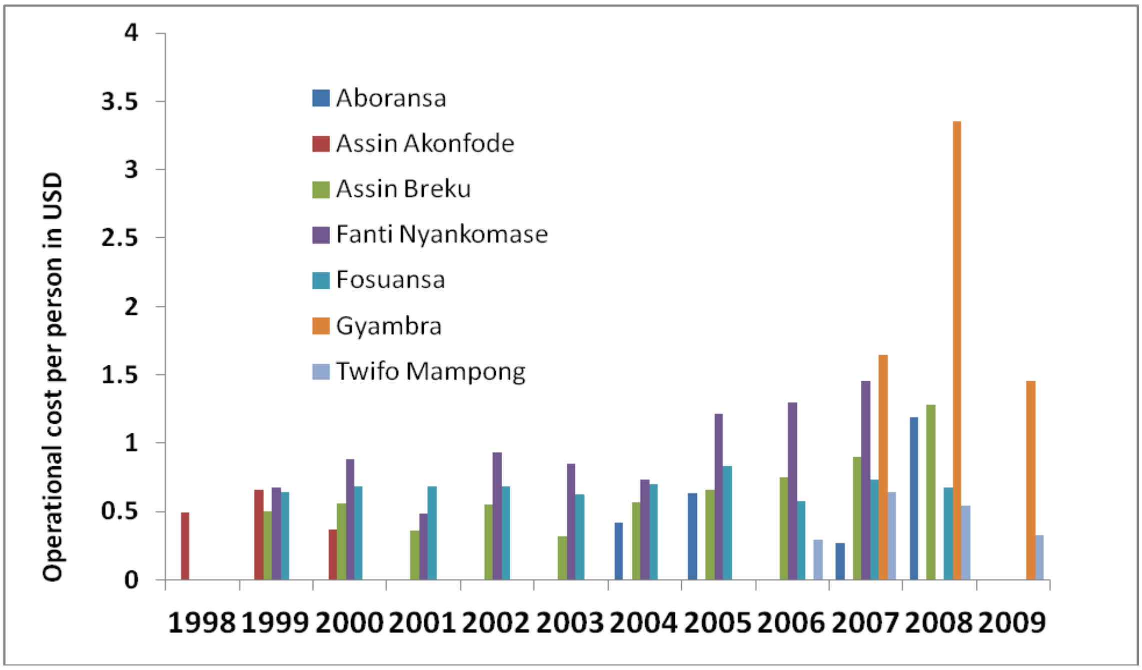

Figure 5: Trend for operational and minor maintenance

The trend in Figure 4 above shows that the cost of operational and minor maintenance increases with age. In the case of CapManEx only two water systems had consistent data over a ten year period. The two water schemes were obviously part of the well performing water systems that did not undergo any major maintenance. The analysis of the data from these two systems does not show any trend suggesting that CapManEx is irregular (see figure 6).

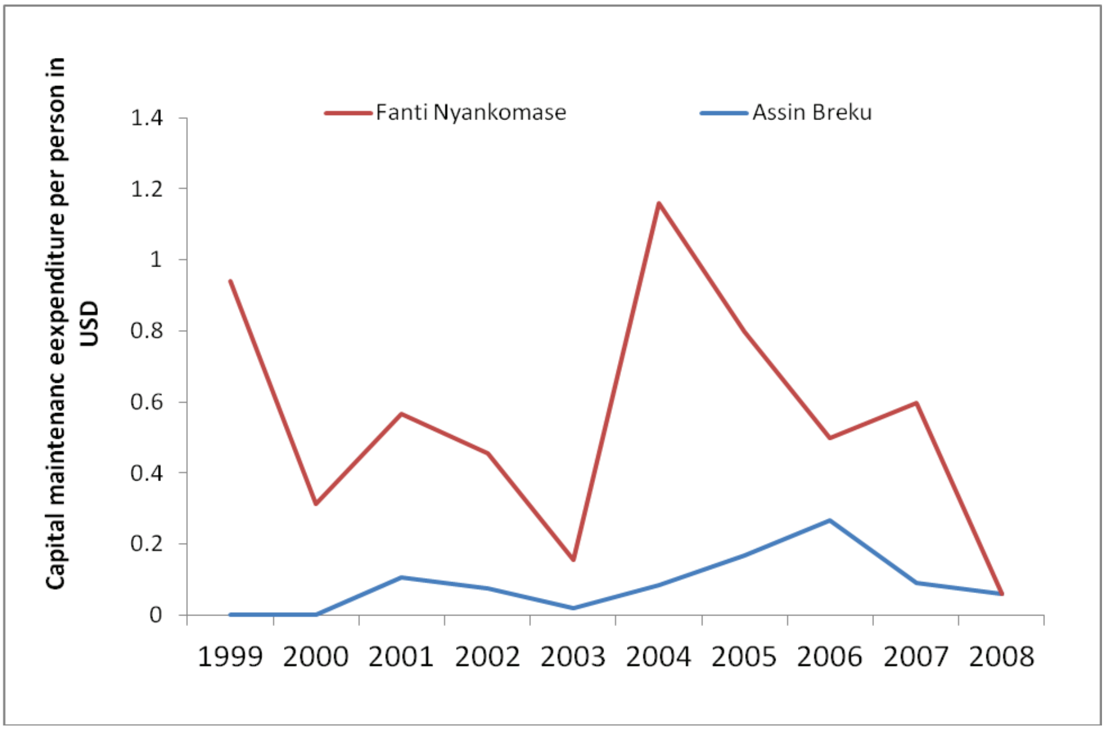

Figure 6: Trend of CapManEx

The expenditure for extending the water systems, Capital expenditure for enhancement computed in cost per person for seven systems are shown in Figure 7.

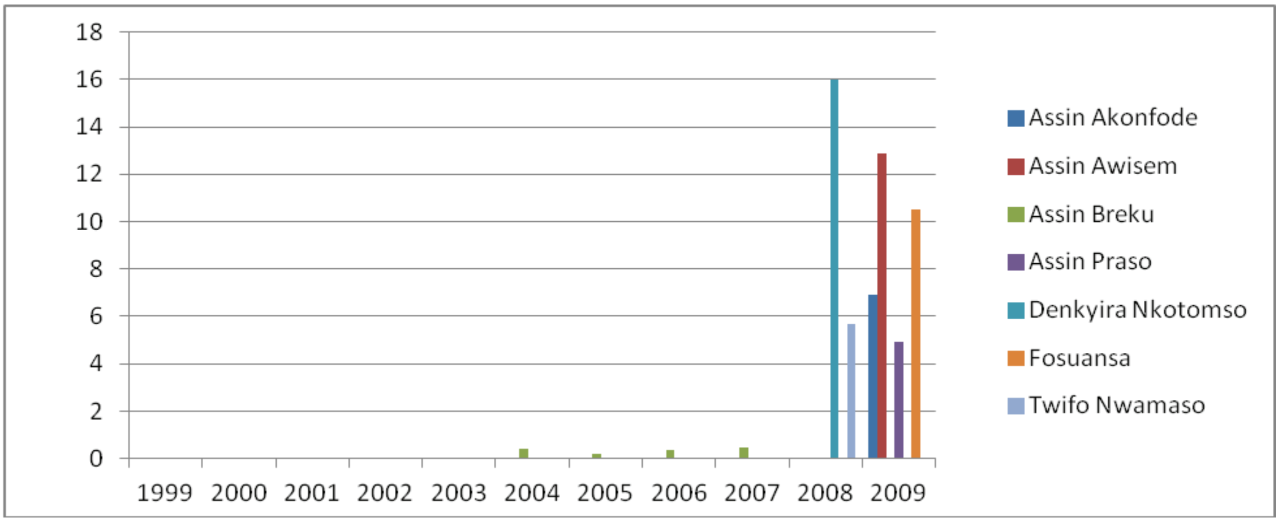

Figure 7: CapEx enhancement in USD per person

The expenditure was made during the rehabilitation of broke down water systems. The major expenditure on CapEx enhancement was primarily in building permanent offices for the WSDBs and the construction of additional public standpipes. The need for capital investment to expand the systems usually start after 10 years of constriction

Assin Breku is the only water system which was not part of the rehabilitated systems but spent on capital expenditure to enhance the water system. The Assin Breku system has increased their original number of standpipes from six (6) to twelve (12) at the time of the study. The addition standpipes were provided in 2004, 2005, 2006 and 2007 (see figure 7). The magnitude of the CapEx enhancement was relatively small compared to the systems that were rehabilitated.

Conclusions and policy implication

Arrangement for ensuring sustainable water services demands the availability of funds to pay for the initial investment, operations, repairs, replacement, rehabilitation and the expansion of the systems as the demand grows beyond what was designed for. This means that all the service life cycle cost has to be accounted for.

This study has revealed that a significant proportion (50%) of the water schemes broke down and did not deliver water services due to the lack of funds to pay for repairs, replacement and additional investment to enhance the schemes. One of the reasons for this was that the necessary structures for sustainability such as the district and regional level structures responsible for monitoring and providing continued support to the communities were not firmly established at the time. As a result some of the water schemes were down for about six years before the water service could be restored. The problems leading to the breakdown were problems with the surface water intake structure, yield of the borehole and solar powered water systems. Unfortunately, the WSDB and the District Assemblies were unable to address the needs of the schemes by paying for the repairs and rehabilitation. As a result it took over 5 years for the systems to be repaired with funds from donors and facilitated by CWSA-Central Regional Office. CWSA has put in place the necessary structure to avert pre-matured failure of small town water system. This shows that the CWSA structures are working well.

All the small town water systems constructed before 2003 are getting to the end of their design life. This mean that the need for capital maintenance and capital expenditure for extending the water scheme will increasingly become important. The need to rehabilitate and expand water schemes will therefore be inevitable. There is the need for clarity on the responsibility of the stakeholders as well as mechanism to ensure that the funds for addressing the needs of rehabilitation and expansion are in place especially as the earlier small towns water schemes are getting close to their end of the design period. The question that arises is what are the mechanisms for addressing these legitimate concerns?

WASHCost briefing note series

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