ASSESSING THE SCOPE FOR ASSET MANAGEMENT IN RURAL GHANA



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CONTENTS

TABLES

FIGURES

ABBREVIATIONS

AMP	Asset Management Plan
CB	Composite Budget
CMMS	Computerized Maintenance Management System
COM	Community Ownership and Management
CWSA	Community Water and Sanitation Agency
DA	District Assembly
DANIDA	Danish International Development Agency
DDF	District Development Facility
DiMES	District Monitoring and Evaluation System
DSA	Daily subsistence allowances
DWD	District Works Department
DWSP	District Water and Sanitation Plan
DWST	District Water and Sanitation Team
EHOs	Environmental Health Officers
FOAT	Functional Operational Assessment Tool
GoG	Government of Ghana
IAM	Infrastructure Asset Management
IRC	International Water and Sanitation Centre
MDG	Millennium Development Goal
MLGRD	Ministry of Local Government and Rural Development
MoFEP	Ministry of Finance and Economic Planning
MOM	Monitoring of Operations and Maintenance
MTEF	Medium Term Expenditure Framework
MWRWH	Ministry of Water Resources Works and Housing
NDPC	National Development Planning Commission
O&M	Operation and maintenance
PWDs	People with Disabilities
RCC	Regional Co-ordinating Council
RLF	Regional Learning Facilitator
RWSN	Rural Water supply network
RWST	Regional Water and Sanitation Team
SIP	Strategic Investment Plan
SIS	Sector Information System
T&T	Travel and Transport
Triple-S	Sustainable services at Scale
WASH	Water, Sanitation and Hygiene
WSMTs	Water and Sanitation Management Teams

1 INTRODUCTION

There is a growing body of evidence that rural water supply systems in the developing world are not being sustainably managed, demonstrated by rates of system failure approximated at between 30% and 40% at any one time (Baumann, 2006; RWSN, 2010). A common cause of breakdowns has been the inability of service providers to ensure the timely maintenance and renewal of water supply assets across their service life. This is linked to inadequate mechanisms of financial planning and budgeting that do not account for the life-cycle costs maintaining a water service over time (Pezon and Franceys, 2010).

The impact of system failure on community services can be profound. Once a primary component of water supply system has failed, it can often be months until financial resources from communities, government or more often donors can be mobilised to rehabilitate the system. Without improved asset maintenance and financial planning, it likely that premature breakdowns will keep happening and the cycle of unsustainable rural services will continue. This represents a high cost way of providing rural communities with poor services (Burr and Fonseca, 2012).

A key challenge faced by water service providers is that supply systems are very capital intensive – that is, they are expensive to construct - therefore as system components age and begin to fail they find it difficult to finance and budget for the inevitable costs of major maintenance and rehabilitation. Allied to this, service providers, particularly in rural areas, often fail to perform the necessary ongoing preventative maintenance of key infrastructure hastens the breakdown of system components causing a gradual degradation of services over time to the point of complete failure.

In the developed world, over the last three decades, water service providers have been forced to confront these issues as vast networks of infrastructure that has been put in place over the previous century have begun to fail and breakdown. This reality has precipitated the development of a raft of management tools and guidelines to help them structure the management of maintenance of complex asset systems in the most cost effective way while, crucially, safeguarding the continued delivery of an agreed upon level of service. This body of work is termed asset management.

In rural Ghana water coverage rates have been rapidly increasing across the country yet there is a real concern about the sustainability of water supply systems. Therefore ensuring a systematic approach to asset management is becoming more important in rapidly developing countries such as Ghana. However, it is unclear which asset management principals applied in the developed world can be adequately replicated in a rural African context and requires further study.

1.1 Objectives of the study

This report has three broad aims:

1. To examine the need for improved asset management of water supply facilities in rural and small town areas of Ghana
2. To determine what “appropriate” asset management can be applied to the rural Ghana context
3. To provide recommendations on how these techniques can be integrated within the current policy and monitoring framework.

1.2 Scope of study

The report focuses on decentralised water service provision under a Community Ownership and Management (COM) structure. In small communities day to day management is overseen by Water and Sanitation Management Teams (WMSTs) for small communities and small towns services are overseen either directly, or under delegated management, by Water and Sanitation Management Teams for small towns. Specific field data collection, focus group discussions and key informant interviews were conducted in two districts: Akatsi district, in Volta region and East Gonja in the Northern Region. In addition a series of interviews were conducted with CWSA members at regional and head office level, as well as review of relevant literature, project documents and policy guidelines that help inform the scope for asset management practices within the Ghana context. A key data source for understanding the current service delivery in Ghana was the detailed baseline assessments undertaken by the Triple-S across three rural districts.

The report is structured as follows. Firstly it outlines the concept background of asset management techniques and how these can improve service delivery. Secondly the review of COM model in Ghana detailing the key roles and responsibilities of key actors at different stages of an assets life. Thirdly outlined what opportunities and challenges exist in implementing asset management in Ghana.

1.3 Exploring water service delivery in Ghana – Triple – S project

Triple-S initiative seeks to promote a move from project based, one-off construction of water supply systems to indefinitely sustainable rural water services delivered at scale. One key facet of this approach is trying to transform the current fragmented approach to service delivery into something more planned and integrated.

In Ghana, the Triple-S team recognizes that while the provision of rural services has largely been a success, with rising coverage rates and significant progress towards the Millennium Development Goals (MDG) target for water, it is now crucial to consider how the newly constructed infrastructure can be sustained in the long-term (IRC/AguaConsult, 2011).

Triple-S is now exploring the key threats to sustainable service delivery in rural Ghana and to work with government and sector stakeholders to research, document and address these issues. To achieve this, the Triple-S team has undertaken performance monitoring of key technical, financial and management functions of rural water services in three districts. It is also looking at ways this systematic monitoring can be used for improved planning and decision making and to understand how improved asset management could be applied into the rural Ghana context, under different service delivery models. This study is a first step in this process.

2 DEFINING ASSET MANAGEMENT

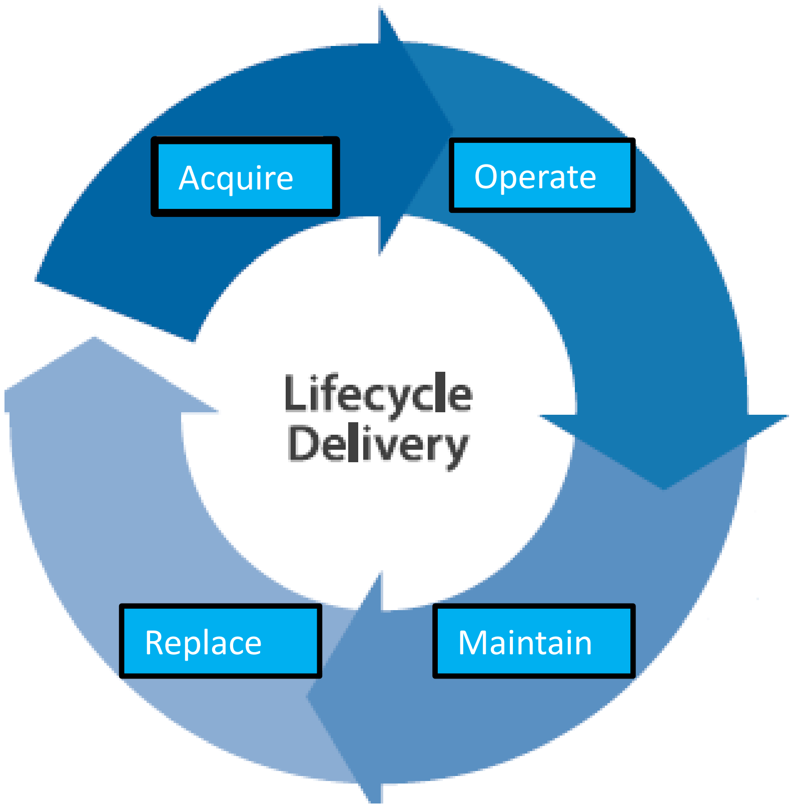
In different sectors the term “asset management” is interpreted in a variety of ways. In the financial sector for example the asset refers to financial assets such as cash, bonds or stock. In the case of capital intensive industries, such as water supply, asset management is specifically focussed on physical infrastructure assets and how they are managed throughout their life cycle – this is commonly referred to as Infrastructure Asset Management (IAM).

Infrastructure asset management is defined as a series of “systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan” (PAS-55). In simplified terms IAM seeks to put a systematic process in place that provides “the right amount of work on the right assets in the right time period for the right price” throughout the life cycle of an asset (Emery, 2005) These definitions highlight that the purpose of IAM is not focussed on exclusively on cost saving but more on the balance between achieving agreed levels of system performance at the right price. To better understand how IAM aims to achieve these goals, the report will explore the key concepts and tools that underpin this approach.

2.1 Asset life-cycle costs

All assets wear out over time. A water system consists of a number of components each of which will have a different life-cycle and different maintenance needs at different points in time. The life-cycle costs framework classifies the different types of costs incurred by an asset (or system of assets) throughout its service life - from construction through operation, maintenance, management and finally replacement (Figure 1).

FIGURE 1: EXAMPLE PHYSICAL ASSET LIFE-CYCLE



The WASHCost[1] research project (2008-2012) sought a much better understanding of the life-cycle costs of different assets across different countries. To do this the project developed a comprehensive methodology to collect, analyse and understand the different costs associated with the different phases

[1] www.washcost.info

of an asset life. These are detailed in Table 1. This framework details the costs associated with constructing and maintaining an asset but also the costs associated with managing an asset – including the salaries of staff, monitoring and support activities. This is an important distinction to explore.

TABLE 1: MAIN COST COMPONENTS OF A LIFE-CYCLE COSTS APPROACH FOR THE WATER SECTOR

Cost components		Brief description
Capital expenditure The costs of providing a service where there was none before; or of substantially increasing the scale or level of services.	Capital expenditure hardware (CapEx)	Capital invested in constructing or purchasing fixed assets such as concrete structures, pumps and pipes to develop or extend a service.
	Capital expenditure software (CapEx)	The costs of one-off work with stakeholders prior to construction or implementation, extension, enhancement and augmentation (including costs of one-off capacity building activities).
Recurrent expenditure[2] Service maintenance expenditure associated with sustaining an existing service at its intended level.	Operational expenditure (OpEx)	Operating minor maintenance expenditure: typically comprises regular expenditure such as labour, fuel, chemicals, materials, and purchases of any bulk water.
	Capital maintenance expenditure (CapManEx)	Asset renewal and replacement cost: occasional and 'lumpy' costs that seek to restore the functionality of a system, such as replacing pump rods or foot valves in handpumps, or a diesel generator in motorised systems.
	Cost of capital (CoC)	Cost of interest payments on micro-finance and loans used to finance capital expenditure. Cost of any returns to shareholders by small-scale private providers.
	Expenditure on direct support (ExpDS)	Expenditure on support activities for service providers, users or user groups.
	Expenditure on indirect support (ExpIDS)	Expenditure on macro-level support, including planning and policy making to decentralised district, municipal or local government.

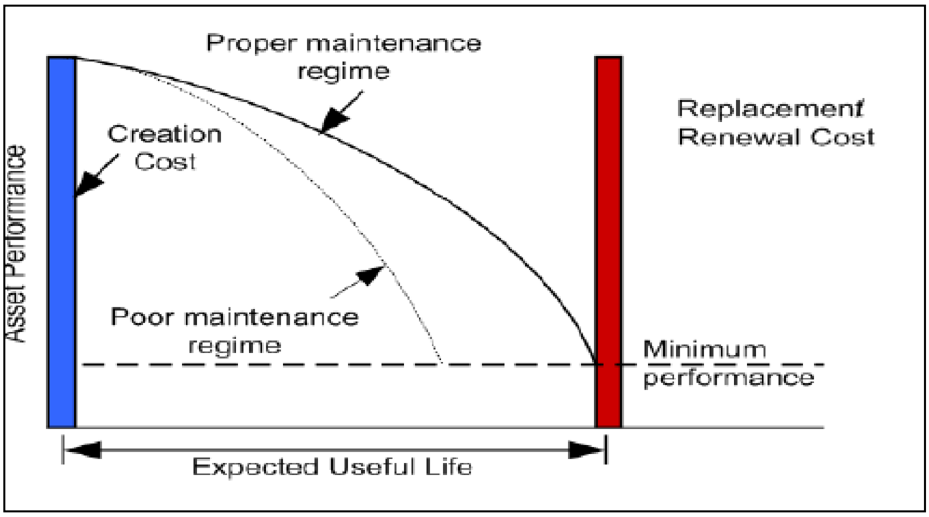
Source: Based on Fonseca et al., 2011.

[2] In much of the WASH literature, costs associated with maintaining an existing service at its intended level are referred to as 'post-construction' costs. This usage reflects the historic tendency of the sector to focus on providing hardware where none had previously existed (hence 'construction costs' and subsequently 'post-construction' costs). This is not a term usually used in the WASHCost approach as it seems to undervalue the variety and importance of recurrent costs. Once a service has been provided for the first time, all costs become 'post-construction'.

TABLE 2: SELECTED FIELDS OF AN ASSET REGISTER

Traditionally IAM has maintained a narrow focus on finding the lowest cost means of maintaining the functional capacity of an asset over its entire lifespan. This involves understanding how different maintenance regimes can impact on the lifespan of a component and consequent trading off the life-cycle costs of one approach against the other. Figure 2 shows the theoretical impact of a poor maintenance regime on the service life and performance of an asset.

FIGURE 2: EXAMPLE IMPACT OF MAINTENANCE ON THE LIFESPAN OF AN ASSET



Source: DWAF, 2008

It is however very clear that the ability to budget for and implement an effective maintenance and renewal regime is inextricably linked to broader institutional arrangements and other resources available to the service provider. These include information resources – such as records of asset condition, maintenance history and value; financial resources - such as available cash to meet the costs of service creation, renewal, monitoring and management; and, human resources – including the knowledge, leadership and capacity of actors (Institute of Asset Management, 2008). The WASHCost life-cycle costs framework recognises the costs involved in ensuring these resources are available throughout at different points of the asset life cycle and is a useful framework through which to asses asset management.

Importantly for the purposes of infrastructure asset management, institutional costs are only considered insofar as the interface with the management of physical assets.

2.2 Asset Register

IAM is predicated on knowing key information about your system asset, such as: what assets they have, where they are, what condition they are in, their ability to perform their given function and their estimated remaining useful life. This information is captured in a database know as an asset register.

The register is the most important resource of IAM and can be used to capture indicators that can inform how maintenance of assets can be scheduled and prioritised. These indicators look at the probability and consequences of asset failure, and helps capture when it is likely to repair or replace an asset at a given moment. Some potential data fields that can be used are shown in Table 2.

Category in asset register	Definition and use
Redundancy	An asset is said to have redundancy when another system/asset can fully or partially fulfil its function if it fails. In general a water system should be designed to have sufficient redundancy so that a component can be taken out of service for necessary maintenance.
Criticality	Critical assets are defined as those that are considered to have a high risk of failing (ie. if they are ageing or in poor condition) and have major consequences if they do fail (major expense, system failure, safety concerns). Asset that are not critical, or degrade rather than fail suddenly may be most appropriately managed by repairing them on a reactive basis (e.g., below ground assets such as distribution pipes). This approach can be termed reactive maintenance or fix on failure. However for those assets that can fail suddenly and completely, such as mechanised assets – preventative maintenance maybe required.
Condition	Condition refers to the structural integrity of an asset which may or may not have an effect on performance. Information on an assets condition can be used to more effectively to schedule preventive maintenance to ensure the continuity of service. There are many grading systems that can be used to assess asset condition ranging from the very simple to the highly complex
Expected useful life	Using design standards a useful lifespan can be assigned to components of the water supply system. There are however many factors that can affect the actual lifespan achieved by a asset – such as a quality of construction materials, the maintenance regime of infrastructure, the usage of the infrastructure, or the hydro-geological context where the system is located. As recognised by Whittington (2009) asset life-spans in different contexts can be foreshortened by poor construction quality and/or inappropriate asset specification, below standard installation and/or maintenance. The result is that assets constructed or installed at the same time do not all fail at the same time.
Adjusted/ remaining useful life	Indicators such as performance or condition and activities such as preventative maintenance can reduce or extend the remaining useful life of an asset. This remaining life of an asset can also be used to calculate its residual financial value.
Performance	Performance refers to the capability of an asset to meet a defined service standard. The ongoing performance on an asset can be measured in many ways, for example, the daily pumping record for a mechanised system, or leakage and stroke tests for a handpump. Deteriorating performance could signal the need to hasten replacement.
Maintenance history	This tracks the minor and major maintenance that have been performed on a particular asset – noting the work undertaken and the costs incurred.

The criteria that should be monitored in the asset register depends on the goals of the asset management plan; the complexity of the asset base; the financial resources available and the agreed upon level of services to be delivered. In a water utility, for example, managers may seek a very detailed understanding of asset on condition and performance in real to guide operational decision making and long term investment, this level of monitoring will not be appropriate for smaller schemes. Additionally it is not necessary to capture every single component of a water system in an asset register. The smallest component captured in the asset register should be what is understood by operators as a unit to be managed e.g. a submersible pump, a storage tank, distribution network etc. An example of a simple asset register can be seen in Table 3.

TABLE 4: EXAMPLE OF SIMPLE ASSET REGISTER

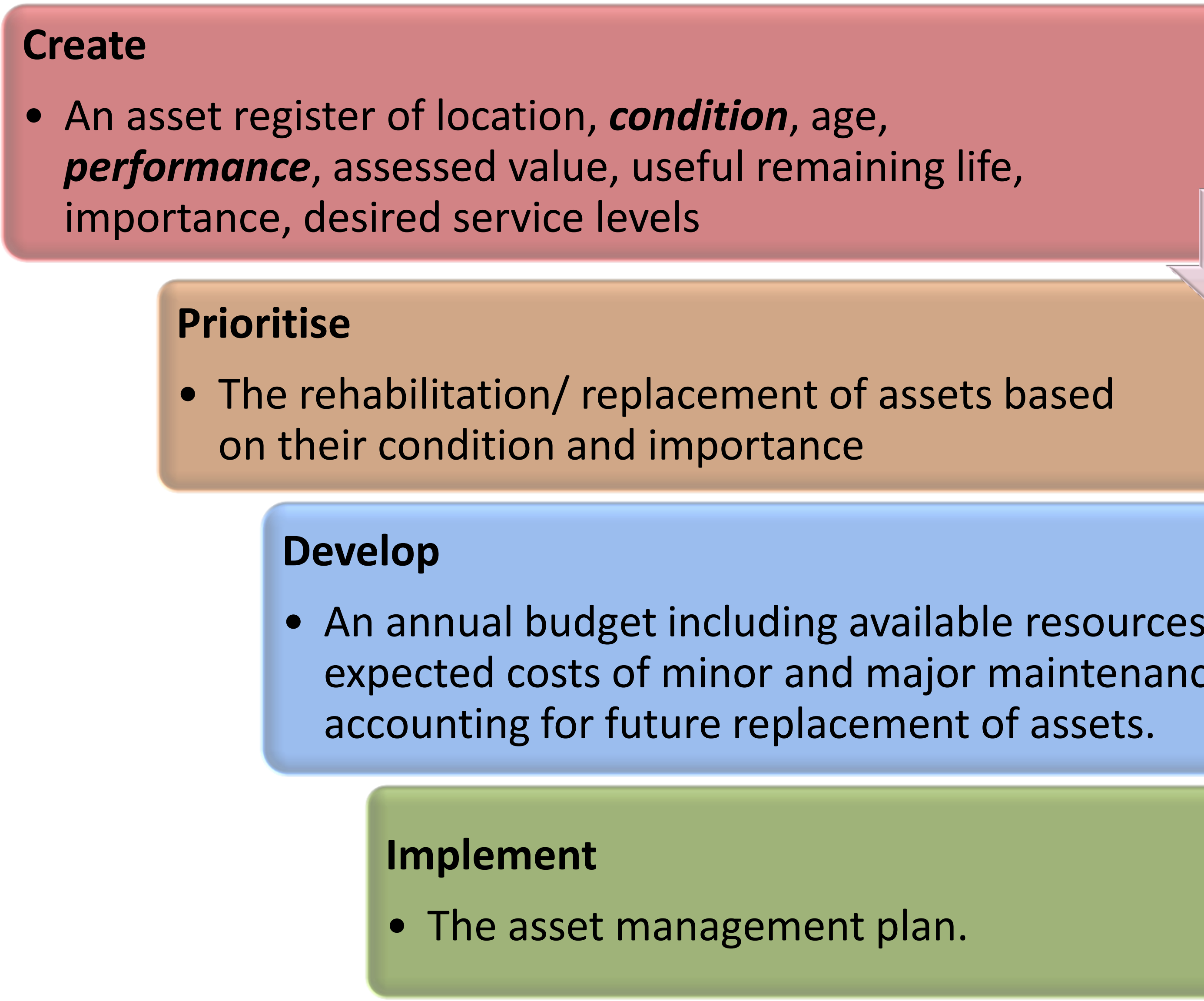
Example System Inventory Worksheet						
Date Worksheet Completed/Updated: *8/14/02*						
Asset	Expected Useful Life	Condition	Service History	Adjusted Useful Life	Age	Remaining Useful Life
Well 1 (1993)	*30*	*Good*		*30*	*9*	*21*
Well 1 pump	*10*	*Good*	*Rehab (1996)*	*10*	*9*	*1*
Well 2 (1993)	*30*	*Good*		*30*	*9*	*21*

Source: EPA, 2003

2.3 Asset management plan

The Asset Management Plan (AMP) is regularly updated document that utilises key information on asset condition, financial resource and performance (service level) standards to ensure that sufficient human and financial resources are in place to meet the short, medium and long term costs of providing a service. A simplified schematic of the AMP process is shown in Figure 3.

FIGURE 4: SIMPLE ASSET MANAGEMENT PLANNING PROCESS



Source: Authors creation, 2013

Asset management planning helps service providers have a better idea of how much money is required to maintain and preserve their assets while maintaining desired levels of service. This can be the basis for more effectively determining the service provider's long term financing strategy and to review whether the tariff structure is sufficient to meet the long term needs of the system. The amount of much money will be budgeted and how maintenance schedules are to be determined will depend on the methods used to monitor the performance of the system.

2.4 Budgeting techniques: Asset depreciation and condition based assessments

Information captured in the asset register can be used to inform financial planning and budgeting. Two commonly used methodologies to inform budgeting are aged based depreciation and condition based management.

Using aged based depreciation each system asset is valued at its purchase price and assigned an estimated life-span. The value of each asset is depreciated by a defined percentage each year – normally calculated according to the design life of the component. The depreciated value is treated as an operating expense and therefore in theory when an asset requires rehabilitation or replacement sufficient resources have been budgeted to finance these. This approach is heavily influenced by the lifespan assigned to a particular asset – if infrastructure does not achieve its design life then there will be a budgeting shortfall and vice versa. The advantage of this approach is that the monitoring requirements are relatively minor primarily involving tracking the age and factoring in the rehabilitation/replacement of assets.

Alternatively, under condition based management the "value" of an asset is determined by its condition and performance, rather than its age. Routine monitoring allows the condition of an asset to be accurately tracked and consequently maintenance to be undertaken as when is needed. It is therefore expected that maintenance cost can be minimised with little threat to service performance. To translate asset condition into an effective budgeting approach a number of different matrices can be used – a simple one is shown in Table 5 (for more detailed, asset specific, assessment matrices on mechanical and electrical assets; water pipes; and civil infrastructure please see Annex A: Condition Matrices). The effectiveness of this approach depends on how regularly monitoring can be undertaken and the systems in place to convert the data into a maintenance action.

Table 6: Simple condition rating matrix

Rank	Description of Condition
1	**Very Good Condition** Only normal maintenance required
2	**Minor Defects Only** Minor maintenance required (5%)
3	**Maintenance Required to Return to Accepted Level of Service** Significant maintenance required (10-20%)
4	**Requires Renewal** Significant renewal/upgrade required (20-40%)
5	**Asset Unserviceable** Over 50% of asset requires replacement

Source: National asset management steering group (2006)

2.5 Monitoring and Asset management

It should be remembered that asset monitoring represents a cost in itself and should not happen for its own sake. Asset management planning can be data intensive and in creating an asset register the cost and effort of collecting information should be weighed against the added value that it brings to improving service delivery or minimising costs in other areas.

In developing country context, where the capacities for monitoring are often low, a useful notion to keep in mind is the Pareto (80/20) Principle. This principal states that a relatively small proportion of effort (20%), around 80% of the full result can be achieved. Further effort beyond the 20% will suffer from diminishing returns. In the context of IAM this principal suggests that a systematic but rapid scan of infrastructure condition, critical problems etc. maybe sufficient for improved financial planning and more practicable and cost effective than more detailed assessments (Bhagwan, 2009).

2.6 Contextual variations

There is not, nor should there be, a one size fits all approach to asset management. Approaches and policies undertaken for utilities in the developed world will be necessarily different for rural and small town areas in the developing world. Other than evident differences in financial and technical resources, one significant difference between these two contexts is how the supply system is financed and managed – this has implications for the implementation of asset management.

In the developed world, water service providers tend have responsibility for the construction, maintenance and renewal of physical assets but also have control over the human, financial and information assets relating to this infrastructure. In rural areas in the developing world these responsibilities tend to be fragmented across a number of different community, local government, private sector, and international organisations. This means a credible asset management plan must have a detailed understanding of the roles, responsibilities and capabilities of these different actors to define how processes of financial planning, budgeting, monitoring and implementation can be harmonised across these actors.

3 METHODOLOGY

The methodology for this report is divided into 2 different phases. The first phase focussed on understanding the current status of infrastructure asset management in rural Ghana. A key resource for this was the comprehensive Triple-S baseline inventory of infrastructure and services in the two focus districts Akatsi and East Gonja – this study has also been updated by a second round of data collection in 2013. These datasets provided detailed indicators of asset functionality as well as information on the technical and financial management of water services by local and district service providers. The processing aimed to give an overview of the effectiveness of current infrastructure asset management in Ghana and well as insights into the overall management and performance of service providers.

The second phase sought to gain an understanding of the asset management techniques and strategies that would be appropriate to the rural Ghanaian context given existing policy and monitoring frameworks. This required an in depth appreciation of the reality of how current planning, budgeting and investment decisions are made at all stages of the service delivery cycle: at local level – within the small towns and small communities themselves; at district level – through the municipal district assembly and at both regional and national level through the Community Water and Sanitation Agency (CWSA) and relevant government ministries.

A series of 21 semi-structured key informant interviews with a cross section of staff district assemble and CWSA staff; 7 site visits and focus groups conducted in small communities, 3 site visits and focus group discussions in small towns and 2 focus group discussions with private sector area mechanics. A summary of the interviews conducted and communities visited can be seen in Annex B: Interviews and focus group discussions.

The communities chosen to visit were by and large those that were expected to provide better informants and quantitative data. These were typically communities that were well known to district assembly staff and were relatively easy reach of each district capital. It is important to note that these individual communities may not be representative of either the Water and sanitation management teams for small communities, or small towns. For example, the small communities visited were chosen because they were known to have an existing water and sanitation management team for small communities and would be happy to share information with the study team. To ensure a more representative picture of the district, focus group discussions were conducted with district Environmental Health Assistants (EHAs) with the specific aim to access these broader issues.

3.1 Sample districts

Akatsi District[3] is located in south-eastern part of Volta region in eastern Ghana. As of 2011 the population of the district was estimated at 117,606 and had formal water coverage rates of 62% (Akatsi DWSP 2011-2014), slightly above the regional average. The district receives an average of 1,084 mm of rainfall per year spread between a wet season (May – October) and dry season (December – March) of about equal lengths.

East Gonja district is located at the southern edge of the Northern region. The region is large and dispersed with a population of 127,304 spread over nearly 11,000km^2.East Gonja has one major rainfall season between April and September, however the rains can often be irregular with total annual rainfall ranging between 1000 – 1500mm. About 59,813 representing 47% of the total population have access to water in the district as at the end of 2011 (CWSA, 2011).

Table 7 shows a comparison of core district characteristics. It shows that East Gonja is a much larger district than Akatsi and suffers from lower coverage rates and more challenging hydro-geological conditions.

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[3] In 2012 Akatsi district assembly was divided into Akatsi North (maintaining Akatsi town as the district capital) and Akatsi South (with Ave Dakpa as the district capital). The original baseline study by Triple-S was undertaken when Akatsi was a single district and therefore for the purpose of this report Akatsi refers to old district boundaries encompassing Akatsi North and South.

TABLE 8: COMPARISON OF SAMPLE DISTRICTS

Characteristic	Akatsi District	East Gonja district
Population	117,606	127,304
Area/km^2	1,077	10,787
Population density (persons per km/sq)	115	13
Mean household size	4	4
Average annual rainfall	1084 mm	1050 mm
Number of improved point sources	249	122
Number of piped systems	6	8
Formal water coverage rates	62%	47%
Borehole success rate*	In Akatsi district, and in Volta region as a whole, boreholes tend to be fairly low yielding. Typical depth to the aquifer range for 45 – 60m. The typical success rate of borehole drilling is around 80%.	In the worst areas towards the north of the district success rates can be as low as 25%. 45% - 55% is typical across the district.

Sources: Ministry of food and agriculture – Republic of Ghana (http://mofa.gov.gh), http://www.statsghana.gov.gh/docfiles/pop_by_region_district_age_groups_and_sex_2010.pdf, Ghana district.gov.gh

Interviews with hydro-geologists: Naa Dogoli (Volta region - Akatsi district), Mr Aduakye (Northern region - East Gonja district).

4 RURAL WATER GOVERNANCE IN GHANA

For the most part rural water services in Ghana are governed under a decentralised community ownership and management model (COM). The COM model can take different forms and how it is implemented depends on variety of factors including community characteristics such as size, socio-economic status and heterogeneity as well as the complexity of the supply infrastructure that is in place. This study focuses on the two established in COM models in Ghana: Water and Sanitation Management Teams for small communities and Water and Sanitation Management Teams for small towns.

4.1 Water and Sanitation Management Teams for small communities

The management of water points by Water and Sanitation Management teams is a very common approach in small rural communities (with a population of between 75 and 2,000). Water and Sanitation Management Teams consists of between 5-9 members and in theory a team should be set up for each water point in a community. The WSMT has responsibility for managing the day to day running of the water point including setting and collecting tariffs. The routine maintenance of the point sources systems is the responsibility of pump caretakers, who are normally members of the team. In the event of minor breakages of fast wearing parts and for routine inspections, the community is required to engage the services of an area mechanic to undertake the repair.

CWSA guidelines advocate that a volumetric water tariff is charged and collected by water point vendors. This type of collection is termed “pay as you fetch”. In reality many communities decide on alternative tariffs structures, for example through a fixed rate monthly fee, or by emergency fund mobilisation when infrastructure fails. The type of formal infrastructure put in place in small communities largely depends on community size, as shown in Table 9.

TABLE 10: WATER SUPPLY OPTIONS FOR SMALL COMMUNITIES IN GHANA

Community size	Guideline water supply option
75-299	A hand-dug well with a handpump is to serve a population of not more than 150. Where the construction of a hand dug is not feasible, a borehole fitted with a handpump shall be provided.
300-1200	A borehole with handpump is to serve a population of not than more than 300.
1201-2000	A limited reticulated system based on a spring, groundwater or surface water source, transmission, storage and limited distribution network.

Adapted from Community Water and Sanitation Agency (2010a)

The cost of constructing rural point source systems, as well as small town piped systems, is nearly entirely financed by domestic and international donor organisations. According to CWSA (2007) approximately 88% of the capital costs of WASH facilities in 2006 were sourced from partner organisations with less than 12% from domestic sources. Indeed improving rural coverage rates are testament to the effective mobilisation of funds, mainly from European countries.

4.2 Water and Sanitation Management Teams for small towns

Management by WSMTs is a common model for the majority of small town piped systems in Ghana. Members of WSMTs are elected and have been delegated the management of the system by District Assemblies (DA’s). The roles and functions of WSMTs vary depending on the size and complexities of each scheme. If the scheme is small (i.e.: serving between 2,000 and 10,000 people) the management, operation, maintenance and the financial management of the system is normally undertaken by WSMT members and by salaried technical and operator staff. Although with these schemes and increasingly with the larger schemes serving over 10,000 people, the technical and management functions of the WSMTs are being contracted to the private sector. This can range from simple operation and maintenance contracts with local professionals, to the transfer of whole system management to the private sector with oversight from WSMTs.

Under different management arrangements the responsibility for service functions can change (for an overview of the technical and management functions undertaken by WSMT, operators or the private sector please see Annex C: Small town roles and responsibilities). However under all arrangement the WSMT shall exercises an overall management responsibility for the Small Town system and required to ensure that sound administrative, technical and financial management practices are being observed (CWSA, 2010b).

4.2.1.1 Financial management under a WSMT

If the system is managed by the WSMT the financial management of the system is subject to guidelines from the Ministry of Local Government and Rural Development (MLGRD) and the CWSA. MLGRD bye-laws state that in order to safeguard the financial viability of the system all WSMTs should operate three bank accounts – an operational account, a capital account and sanitation account (Table 11).

TABLE 12 ACCOUNT TYPES FOR FINANCIAL MANAGEMENT OF SMALL TOWNS

Account type	Uses	Allocations
Operational account	To cover costs associated with water production, consumption, minor maintenance, water treatment and tariff collection	Not more than70% of net revenue
Capital account	To be used for significant repairs, replacement and extensions to the water system	Not less than 20% of net revenue – the district assembly may also contribute to this account.
Sanitation account	To cover general provision of communal sanitation and ensuring the environmental safety of the areas.	Not less than 10% of net revenue (after servicing operation and maintenance costs)

In line with these accounts, the guidelines set by CWSA state that tariffs should be designed to cover operational expenses as well as replacement and rehabilitation of mechanised assets (those with a lifespan of less than 10 years) and sanitation assets. All tariffs should be collected as part of a volumetric "pay as you fetch" approach utilising water vendors at public stand-posts and water meters for household connections. In theory the cost of extending or expanding the small town system to new areas shall be met by the DA alongside contributions from the accumulated revenue.

4.3 Role of the District Assembly and CWSA

Under both management approaches the District Assembly is the legal owner of the asset and is ultimately responsible for ensuring that the system continues to function. Within the district assembly, the overall governance of WASH services falls to the District Water and Sanitation Team[4] (DWST). The DWSTs play an important role in supporting community leadership and management of infrastructure. They also monitor the performance of the water system, help to set tariffs and

[4] Some districts no longer have a dedicated DWST; these have been replaced by a District Works Department (DWD). The DWDs are not solely focussed on WASH issues and advise on a broad range of technical projects undertaken within the district.

undertake technical and financial audits of the WSMTs for small towns. The DWST and CWSA are also supplied with a series of technical, financial and management of key performance indicators through which to evaluate the performance of small town water systems – these include criteria such: daily production/consumption, percentage of unaccounted for water; profitability, bill collection efficiency, cost of contracted out services (CWSA 2010b)

Monitoring information from both management models should theoretically be readily updated in the DiMES (District Monitoring and Evaluation System) software hosted within the DWST/DWD office. Regional CWSA officers provide technical assistance and support to the DWST/DWD and sometimes directly to communities.

In addition the DAs do occasionally contribute their own funds to the rehabilitation or expansion of water systems. CWSA guidelines state that “major repairs or borehole rehabilitation outside the technical and financial capacity of the community shall be undertaken with the assistance of the DA” CWSA (2010a). A definition of what is “outside the capacity of the community” is not provided and therefore interventions by the DA tend to be decided on case by case basis. CWSA operates at national and regional levels and is mandated to facilitate the provision of safe and reliable water services to rural areas. This takes various forms including: the training and capacity building of DA staff, WSMT for small communities and small towns; direct technical and human resource assistance in planning and implementing water supply projects; issuing advice on guidelines for the governance of rural water systems and assisting in the monitoring of system performance.

4.4 Dispersed roles and responsibilities

The above sections have shown that under COM of rural water systems the roles and responsibilities for financing the key life-cycle costs of asset management (i.e. those associated with constructing, maintaining, renewing and monitoring an asset) are fragmented amongst number of different sectors stakeholders, often with overlapping responsibilities. These mandated roles are summarised below in Table 13, however this does not represent whether this systems are functioning and whether funds are effectively mobilised by these actors.

TABLE 14: WHO SHOULD PAY: LIFE-CYCLE COSTS UNDER COMMUNITY OWNERSHIP AND MANAGEMENT

Life-cycle cost component	Under WSMT for small communities	Under WSMT for small towns (+ operators/private sector) management
Capital expenditure hardware	National and international donors	National and international donors
	National, local, regional government	National, local, regional government
Capital expenditure software	Donors: The costs of training and community mobilisation should be included as part of the hardware contract	Donors: The costs of training and community mobilisation should be included as part of the hardware contract
Operational expenditure	Communities: Generated through tariffs or ad hoc revenue mobilisation	Communities: Generated through tariffs
Capital maintenance expenditure (hardware)	Communities: Generated through tariffs or ad hoc revenue mobilisation	Communities: Generated through tariffs. These are expected to cover the replacement of all assets with a lifespan of less than 10 years -not less that 20% of net revenue should be allocated towards rehabilitation and expansion

	District Assembly: When the levels of the expenditure goes beyond the capacity of the community the DA should meet the costs of rehabilitation	District Assembly: Works with WSMT to meet costs of system rehabilitation
Capital maintenance expenditure (software)	District assembly: The costs of periodic refresher training of WSMTs	District assembly: The costs of periodic refresher training of WSMTs
Expenditure on direct support	District Assembly: Backstopping, performance monitoring, auditing, ongoing support	District Assembly: Backstopping, performance monitoring, auditing
	CWSA: Monitoring overall water provision to advice the DA	CWSA: Technical and Managerial/Financial Audit of Water Supply systems; Monitoring overall water provision to advise the DA

This following section critically reviews how the extent to which these roles are being fulfilled and the affect this is having on effective asset management. Initially an overview is given based on the detailed Triple-S baseline studies in this district followed by more detailed consideration of the challenges been faced by rural and small town communities based on the activities undertaken as part of this study.

5 THE NEED FOR IAM IN RURAL GHANA

5.1 Overview

The Triple-S baseline study examined the current state of water supply assets and the service providers that manage them across all the systems in Akatsi and East Gonja districts and identified a number of cross-cutting issues. In small communities in both districts between a quarter and a third of all point sources were completely broken down, with a further 30-50% partially functioning[5] (Triple-S 2012a, Triple-S 2012b). Moreover between 30-40% of point sources are broken down for over 18 days a year – representing a sub-standard reliability (according to WASHCost service indicators (Moriarty, 2010). In East Gonja, the comparatively poor coverage of rural sources combined with wide-spread handpump breakdowns mean that boreholes are often over-crowded.

These factors have had an impact on water consumption with 39% of residents in East Gonja and 49% of residents in Akatsi failing to reach the guideline standard of 20 litres of water per person per day. The general poor functionality of rural point sources and the consequent impact on the services delivered demonstrate that asset maintenance is not happening in a timely manner.

For small town systems in East Gonja, the baseline study showed that 5 of the 7 systems are under three years old and tellingly it is only these newer systems that are fully functioning. The two older systems are in Salaga and Kpalbe. Salaga is the district capital and at the time of writing the system has been completely broken down for some months and is awaiting a major rehabilitation by the World Bank. The 6 year old system in Kpalbe is only partially functioning.

There were similar worrying signs for sustainability in Akatsi district where, according to the baseline study, none of the WSMTs for small towns exhibited sound financial management, accounting and auditing practices and none of them undertook scheduled preventive maintenance. CWSA guidelines state that each district is required to have a facility management plan detailing the ongoing maintenance requirements of each system and scheduling how these were to be collected. None of the WSMTs for small towns could locate these confirming that routine maintenance was not systematically planned or executed. When little or no preventative maintenance is done on complex systems containing mechanical and non-mechanical assets, the failure of key infrastructure is likely to happen much sooner than expected, with significant cost implications.

One common factor in more successful small-town schemes was the ability to fund capital maintenance from their capital accounts. Indeed when sufficient finances are not set aside, it is left to donors and the district assembly to service these costs. This funding is often unreliable and often leads to extended periods of service downtime or sub-optimal performance. A study of CapManEx by small town water teams, Asante (2012) noted that none of the WSMT's sampled had received monies from the district assemblies into the their capital accounts– furthermore as shown by Adank et al. (2013), WSMT's do not tend to charge a tariff that is sufficient to service capital maintenance costs.

Simply financing major maintenance may not treat the root causes of the problem which may be that sufficient financial management and maintenance regimes are in place to ensure that the service keeps going. This overview shows that under both service delivery models there are a number of issues that need to be addressed to improve the current standards of asset management – primarily how life-cycle costs are financed. To better understand these – a selection of WSMTs for small communities and towns were interviewed as part of the

[5] Borehole functionality was determined by the stroke and leakage tests. The stoke test measures the number of strokes of a handpump to fill a size 34 bucket (20 litres) within 1 minute. To pass the stoke test the bucket must be filled by no more than 40 strokes for the Afridev and Ghana Modified India Mark II handpumps and no more than 30 strokes for Nira AF-85 hand pumps. For the leakage test, pumping is resumed after 5 minutes rest following the stroke test. If water flows from the hand pump within 5 strokes, the pump has passed the leakage test. If the borehole with handpump fails both of these tests it is classed as "non-functional", if it fails one of these test it is classed as "partially functional" and if it passes both it is classed as "functional".

study and a range of project documents, studies and guidelines were reviewed at regional and district assembly level. The results are summarised below with the detailed case studies found in Annex D: Case studies.

5.2 Water and Sanitation Management Teams for small communities

5.3 Operations and minor maintenance

Evidence from the baseline study shows that for those WSMTs that kept financial records, the average annual operational and maintenance expenditure per point source was 57 cedis (29.4US$) per year. Interviews with area mechanics suggest, however, that that the ideal operating expenditure, that ensures periodic inspection and replacement of fast wearing parts (as per CWSA guidelines), is somewhat higher at around 120 cedis (62 US$). This includes the labour charge of the area mechanic (varying between 30 - 50 cedis for each call out), transport costs and the replacement of small fast wearing parts such as the cup leather or o-ring.

In many cases preventative maintenance is not undertaken. Community focus groups highlight that the perception of many WSMT informants is that beyond the occasional greasing above ground components the preventive maintenance requirements for a handpump are limited. In most cases fix on failure approach is seen as the most appropriate solution. The practice is most prevalent in East Gonja district where it is common to not charge a volumetric or monthly tariff (only 38% of communities do[6]). Therefore funds are only mobilised once the asset has failed with no money set aside for ongoing maintenance. This approach can keep a borehole running, if funds can be mobilised and an area mechanic is available, but as shown by the high percentage of partially functional sources, there may be a range of minor or major repairs that could improve functionality but are not fully addressed unless the handpump stop working altogether.

According to national guidelines, operating cost that should be borne through community tariffs is water quality testing. CWSA guidelines state that full bacteriological, physical and chemical analysis of water quality should take place twice a year – the typical cost of each water quality test is estimated at 150 GHC[7] (US$78). None of the communities visited had undertaken their own testing –except initial testing by the construction contractor. Upon discussion, a number of communities had complaints over the taste of the water, but did not see it as their responsibility to pay for further testing. In any case the water quality tests are supposed to carried out by recognised institutions such as Ghana Water Company or the Water Research Institute and it is improbable that WSMTs would be able to organise testing without DA prompting and assistance. In a large district like East Gonja, where some communities have very occasional contact with DWST/DWD staff, it is especially unlikely that this testing would be carried out unless serious health concerns were raised. Cleary occasional water quality testing should take place – however twice per year seems an unrealistic expense. It may be more realistic to for water quality testing to be undertaken on a bi-annual basis – this would reduce the expected operational expenditure burden on communities to 205 GHC (US$104) per year.

If a borehole and handpump systems was managed to these guideline standards the typical operation expenditure would be around 430 GHC (US$ 215) per year (Table 15). This is over 8 times more than existing community expenditure and it seems well beyond what communities are currently willing (or able) to spend.

TABLE 16: POTENTIAL OPEX FOR BOREHOLE AND HANDPUMPS ACCORDING TO CWSA GUIDELINES

Activity	Cost/GHC	Cost/US$

[6] Triple-S baseline raw data

[7] Estimate sourced from an unpublished bill of quantities from the Northern district regional CWSA office

Greasing and general upkeep	10	5
Annual inspection and replacement of fast-wearing parts	120	62
2 X Water quality testing	300	158
Annual OpEx	430	215

Box 1: Leather or rubber cup seal

An unverified suggestion from Akatsi districts was that in order to encourage community WMST members to fund a periodic inspection of their handpump, government suppliers started promoting the use of rubber cup-seals over the leather alternatives. The theory was that with regular use the rubber cup-seal was expected to last around 1 year, compared to 5 years for a leather seal. The rubber seal would be the source of more common minor failures and would mean that the community would be forced to engage the service of an area mechanic to fix and inspect the handpump for more fundamental problems with pump-rods, cylinders or seals etc. Certainly in interviews there were reports of rubber seals lasting under 6 months – however there was no evidence to suggest that while repairing these seals the area mechanics were asked to do a detailed inspection of handpump functionality.

5.4 Capital maintenance

No single entity has sole responsibility for financing major capital maintenance (i.e. the repairs or replacement of cylinders or rising mains or even the redevelopment of the borehole). In theory the primary responsibility for major repair lies with the community. When the problem outstrips their means they can engage financial and technical support from the district assembly. In practice, often neither group assumes full responsibility for these repairs and often the systems are left as broken down or partially functional for long periods. If the community is lucky, the systems may be rehabilitated as part of an international donor project or through ad hoc interventions by the district assembly - this latter case is particularly common in East Gonja where the perception of the communities interviewed is that district assemblies, and not community tariffs should cover these costs.

Box 2: Who should finance CapManEx?

Different interviewees had very different response as to who should finance these costs. Some of regional CWSA officers were very clear that under COM, the communities should have responsibility for assets and should bear all maintenance, rehabilitation and replacement costs. In this scenario the role of the district assemblies and the CWSA is therefore to provide the technical guidance and appropriate sensitisation to make sure communities undertake these roles. However the perspectives were somewhat different within the DAs. Generally they more readily accepted the limits to community resources and were, at times, more responsive to the political pressure that communities can exert, resulting in funds occasionally being made available for repair and rehabilitation. The guidelines leave the question of capital maintenance funding fairly open, which leaves scope for both the district and communities to abdicate themselves from responsibility for these actions.

From the baseline study data it was shown that between 30-60% of WSMTs in these two districts did not execute corrective maintenance in a timely manner, meaning the system suffers extended period of downtime. The main stated barriers to performing corrective maintenance were the ability to effectively mobilise community funds (both districts), to engage an area mechanic (Akatsi), and the lack of an effective demand for a functional water point – particularly in the wet season (both districts).

Analysis of community records and focus group discussion emphasises that the seasonality of demand for formal water sources is a recurring issue. Throughout the dry season (December to April) formal water consumption tends to be very high, this then drops off considerably in the wet season. The records of one of the communities visited (Ave Afiadenyigba, in Akatsi district) show that water consumption from formal sources, and therefore revenue, is between three and four times higher in the dry season, than the wet season (for more details see Annex D: Case studies).

A contributing factor to this issue is self-supply. Household water storage and rainwater harvesting are very common in East Gonja and therefore during the wet months water consumption from formal community sources falls to nearly nothing. As a result for lengthy periods the effective demand to use expensive borehole and handpump system is not sufficient to support its ongoing maintenance and management. This is not however to say that the demand for formal sources is not there.

Box 3: WaterHealth Centre's

The case of the WaterHealth centre in Salaga town and its environs demonstrates this. During the district visit large queues were seen outside a decentralised WaterHealth centre. The water here cost double the price of borehole water (10 pesewas per bucket), and in a far more inconvenient location at around 2 kms from the town centre. Informal conversations with those in the queue showed that most were using the private source for drinking water and would use the nearby surface water source for all other uses. They would not use the borehole and handpump source as it was considered worse value for money.

5.4.1.1 The cost of hand-pump CapManEx

An assessment of 66 completely broken down boreholes and handpumps in Akatsi showed that in most cases the handpump did not need replacing but significant repairs were required. A small minority of these (6) required minor repairs. This indicates that in most cases communities are willing to accept responsibility for relatively cheap repairs – however when major breakdowns occur in some areas it is evident that communities can't or won't finance these.

The average cost of repair for the significantly broken down systems from this was 376 cedis (US$194), inclusive of materials and labour. This compares to outright replacement cost of a handpump at between 900 – 1400 cedis (US$465 - 723), depending on the handpump make. It is reasonable to assume that under normal usage a handpump will require this type of major repair once every 5 years – equating to annual capital maintenance cost for the handpump of 75 GHC (US$ 38).

Clearly if preventative ongoing maintenance is occurring it may extend the time before significant CapManEx is required. Existing data does not permit a detailed assessment of the trade-off between preventative and corrective maintenance. However if it is assumed that preventative maintenance has a significant impact on the life-span of the handpump, then some interesting results may be inferred (Table 17). This indicates that in annual budgeting terms there is very little financial difference between undertaking annual preventative maintenance regime (167 GHC per year) compared to a regime where you only occasionally grease the hand-pump (193 GHC per year). This suggests that for many communities a fix on failure approach to system management is valid – but only if the WSMTs are able to adequately budget to cover this cost when it arises.

TABLE 18: POSSIBLE TRADE-OFF BETWEEN OPERATIONAL AND CAPITAL MAINTENANCE EXPENDITURE FOR HAND-PUMP SYSTEMS

Scenario	Annual preventative maintenance (OpEx)/ GHC*	Interval until major repair required/ yrs	Annual major corrective maintenance (CapManEx)/GHC	Total cost /GHC
Scenario 1: Annual preventative maintenance undertaken	120	8	47	167

Scenario 2: Irregular preventative maintenance undertaken	60	4	94	154
Scenario 3: Greasing but no preventative maintenance	5	2	188	193
Scenario 4: No preventative maintenance at all	0	1	376	376

*This does not include water quality testing as it is not considered to affect the technical functioning of the handpump. The WSMTs would be expected to continue to fund periodic testing throughout this period.

5.4.1.2 The cost of borehole CapManEx

In some cases a borehole may need re-developing to improve falling yield, or in some cases re-siting if the well has collapsed or groundwater conditions have changed. If initial siting and development of the borehole was done well, borehole CapManEx is likely to be a very infrequent expense (perhaps every 30 years). Most current estimates give the cost of a 60m borehole (including siting, drilling and development) at between 10,500 and 11,000 GHC (US$ 5000-5200) – but of course these costs can vary greatly (A collection of found unit costs for borehole drilling can be found in Annex G: System unit costs). To budget for the replacement of a borehole at these prices would represent around 350-365 GHC per year. Alternatively to budget for the redevelopment of the borehole (approx 2,500 – 3,500 GHC) represents 83-115 GHC per year.

From interviews conducted in this study there were no examples from either a district assembly, or a community financing the re-development or replacement of a borehole. As with capital expenditures these were primarily covered through project expenditure, with occasional financing from local NGOs and government agencies.

5.4.1.3 Revenue collection

Understanding how much both operational maintenance and capital maintenance costs also focuses attention on the amount of revenue communities are, or should be collecting, and therefore the activities they may be able to cover. An examination of the revenue collection by communities - suggests that it is much lower than maybe expected or planned for.

In those communities visited who practiced ‘pay as you fetch’, the tariffs charged were between 2.5 pesewas (1 US cents) and 5 pesewas (2 US cents) per 20 litre bucket. CWSA guidelines state that there should be no more than 300 users per borehole and household surveys suggest that most people access between 10 and 20 litres of water per day. As Table 19 shows, even on the cheapest volumetric tariff, with only 50 daily users, enough revenue should be raised to cover the combined annual costs of operational and handpump capital maintenance expenditure.

TABLE 20: EXAMPLE INCOME FROM BOREHOLE AND HANDPUMPS UNDER DIFFERENT TARIFFS

Tariff	Number of users per day	Gross daily income/GHC	Less 20% for vendor/GHC	Net daily income/GHC	Net monthly income/GHC	Net annual income/GHC
2.5 pesewas (1 cent) per bucket	50	1.3	0.3	1 ($0.4)	30 ($12)	365 ($146)
	100	2.5	0.5	2 ($0.8)	60 ($24)	730 ($292)
	200	5.0	1.0	4 ($1.6)	120 ($48)	1460 ($584)
	300	7.5	1.5	6 ($2.4)	180 ($72)	2190 ($876)
5.0pesewas (2 cents)	50	2.5	0.5	2 ($0.8)	60 ($24)	730 ($292)

per bucket	100	5.0	1.0	4 ($1.6)	120 ($48)	1460 ($584)
	200	10.0	2.0	8 ($3.2)	240 ($96)	2920 ($1168)
	300	15.0	3.0	12 ($4.8)	360 ($144)	4380 ($1752)

The reality is that communities sampled from this study and as part of the baseline survey, the actual income received per borehole was only a fraction of this potential at fewer than 10 cedis a month per borehole.

The seasonality of demand is clearly an issue for communities as is the effective demand for borehole and hand-pump sources. This challenge does not appear as affordability - none of the interviews of the WSMTs found the common tariffs of between 2.5-5 pesewas (1-2 US cents) was unaffordable. Other issues related to financial management could explain this shortfall, although this remains an area that requires further research.

5.4.1.4 Drivers of borehole and handpump functionality

Further analysis of the Triple-S data collected in 2011 and in 2013 does suggest some broad correlations between how these small community systems are managed and their functionality over time. Two key and interrelated factors are identified: 1) tariff structure implemented by the community; 2) The routine maintenance of the infrastructure.

Those communities that charge a monthly levy for water services – either in terms of a fixed charge or a volumetric pay as you fetch tariff – tend to have higher rates of borehole functionality (between 17%-24% higher) than those communities that do not have a fixed monthly charge (Table 21).

TABLE 22: PERCENTAGE OF FUNCTIONING BOREHOLE AND HANDPUMP SYSTEMS UNDER DIFFERENT TARIFF STRUCTURES

Type of tariff	Percentage of borehole and handpump's functional/partially functional	
	2011	2013
Monthly levy	74% (n=27)	69% (n=59)
Pay as you fetch	69% (n=159)	69% (n=139)
No fixed tariff	50% (n=67)	52% (n=84)

Furthermore even though borehole and handpump systems do not have significant ongoing maintenance requirements, Table 23 shows that periodic maintenance is having a large impact on functionality. For example in 2011 in the 64 communities that did not carry out any periodic maintenance there were just 41% functioning or partially functioning boreholes. This is much worse than the 73% functional/partially functional boreholes achieved in the 181 communities that practiced annual periodic maintenance. The practice of routine maintenance is clearly inter-linked to other financial and management indicators such as tariff collection and also the general financial management, such as maintaining a bank account and a store of petty cash.

TABLE 24: PERCENTAGE OF FUNCTIONING BOREHOLE AND HANDPUMP SYSTEMS UNDER DIFFERENT MAINTENANCE REGIMES

Routine maintenance - Composite indicator score	Percentage of borehole and handpump's functional/partially functional	
	2011	2013

No periodic maintenance	41% (n=64)	54% (n=101)
Periodic maintenance carried out	67% (n=9)	56% (n=9)
Periodic maintenance carried out at least once a year	73% (n=181)	70% (n=171)

5.4.1.5 General issues and observations

In addition to the above a number of general issues were apparent from community visits.

- WSMT members -The role is voluntary and deciding contentious issues such as water tariff setting and collection can be a cause of great anxiety and concern for members. Consequently, team members can be poorly motivated and resignations are common. In some cases members are replaced, although new members will not receive the initial training when the point source was set up. In other cases the WSMTs simply disband.
- Better financial management and the ones with the most experienced WSMT secretaries. Some of those interviewed had been on the team for over 15 years and were the driving force behind effective water point management.
- The communities that practiced 'pay as you fetch' and had the most transparent financial management.
- Significant amounts of money is put into the training of water and sanitation board members however there is no evidence that the district is financing re-refresher training of community members, except within project settings.
- During site visits in the Akatsi district there was visible appreciation of the work that the environmental health assistants do in supporting the community WSMTs. They seemed a very effective link between DWST staff and community members and the absence of these links was noticeable in East Gonja.

5.5 Expenditure on direct support

The District Assemblies in both Akatsi and East Gonja and the existing DWST find it very difficult to fulfil the functions that are laid out in the guidelines. These responsibilities can roughly be divided into three categories: monitoring, management support and financial support.

In terms of monitoring both district assemblies are clear that without project support there would be very little DWST/DWD monitoring of small community sources. In Akatsi district for example, in previous years the DWST prepared a series of operational budgets to expand their community monitoring activities. These were approved by the district assembly and incorporated into the finalised medium term development plan - which is the basis of common fund disbursements. However the funds did not materialise because the common fund allocations to the DAs were delayed and did not meet expectations resulting in DWST monitoring being cut from the budget. Repeated failure to secure funds meant that the DWST no longer bothers to prepare operational budgets.

The management support provided to district assemblies often goes hand in hand with monitoring. Theoretically, monitoring analysis should identify communities experiencing issues with WSMTs management or technical problems with systems. Quarterly actions plans should be developed on the basis of monitoring detailing priority actions to be followed up by the DWST. However, once again without funding for travel, transport and logistics this is unlikely to happen. Consequently is a credible concern that without donor funding all monitoring activities will cease.

Additionally it is also important to bear in mind that district employees often have few incentives to conduct proactive monitoring, as a poverty of data has become the norm in many district, the incentives such as daily subsistence allowances (DSA) are an important motivation for staff in the district. As one staff member commented "you do not feel obliged to do anything" in terms of monitoring and reports.

Another way to promote increased community monitoring is to encourage more active oversight from the CWSA. Interviews with the CWSA head office staff suggest that although the agency is not in a position to regulate the DA they should be more proactive in their backstopping. One possible entry point is the oversight of district monitoring which then feeds into the CWSA Strategic Investment Plan (SIP). When monitoring is not been adequately done by the districts these things should be commented on as a matter of course by the regional CWSA office, if necessary involving the Regional Co-ordinating Council or the Ministry for Local Government and Rural Development.

Finally, aside donor funded activities; there was very little evidence that the district assemblies were willing or able to fund the rehabilitation of small community facilities (the exception being a flurry of activity in selected communities ahead of the general election).

5.5.1.1 Synthesis

It must be recognised that the sharp increases in rural coverage rates in Ghana also means that district teams have a lot more assets to monitor, more WSMTs to support and more facilities to maintain. The funding for these tasks needs to be commensurate with the tasks that are supposed to be performed.

DANIDA that have been working with District Assemblies in Ghana for over 15 years recognize the importance of continued functioning of the facilities to a large extent depends on the amount of DA support for DWSTs and EHOs in terms of transport and logistics. An evaluation report of the DANIDA work in district assemblies concluded:

"There is very little evidence of DA capacity to sustain the DWSTs by providing more financial and logistic support. In addition, in many communities the WSMTs, which are key to sustainability, do not have sufficiently robust accountability systems and motivation to operate sustainably (Particip GmbH 2008)."

Similarly Akari (2003) finds that the lack of support to communities is a major handicap to sustainable systems. Even communities that employ good practice in system management and fund mobilisation, these will require ongoing monitoring and support to prevent these systems from falling apart over time.
As the details above has shown these activities are not taking place and the core life-cycle costs are not being adequately financed – particularly capital maintenance and expenditure on direct support. This shortfall in small community financing is shown in Table 25 which compares the theoretical responsibilities of stakeholders, as defined by government strategies and guidelines, with current observed practices.

TABLE 26: HOW THE LIFE-CYCLE COSTS OF SMALL COMMUNITY SYSTEMS ARE FINANCED IN THEORY AND PRACTICE

Organisation	Capital expenditure		Operational expenditure		Capital maintenance expenditure		Expenditure on direct support	
	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Communities								
District Assembly								
CWSA								
Donors								
Others: Church groups etc…								

Key: *Green fill = commonly financed, Orange fill – occasional financed, Red fill – rarely financed, no fill – not financed*

5.6 Water and Sanitation Management Teams for small town systems

The three site visits undertaken to Akatsi system and Ave Dakpa system in Akatsi district and the Salaga system in East Gonja are detailed in Annex D: Case studies. Of these only the Ave Dakpa WSMT was able to provide financial records and proved to be most informative respondent of the systems. The Salaga system was almost entirely broken down at the time of the site visit so only limited information was available.

5.7 Financial management

Under this approach staff salaries along with the costs of operations, maintenance and the capital maintenance/replacement of mechanical assets are designed to be financed through tariffs. However the reality is that for the majority of water boards this does not happen.

In the two districts, the baseline study established that all the WSMTs do not operate operational, sanitation and capital maintenance accounts as required by the CWSA guidelines. As a result those that generate more income than expenditure seem to be performing well when the infrastructure is new, but they are not budgeting for capital maintenance costs of the mechanical assets. As illustrated by the older systems in East Gonja, as systems age, both the required expenditure on operation minor and major maintenance costs increase, but as these have not been budgeted for this also greatly increases the probability of service collapse.

5.7.1.1 Operational and Capital Maintenance expenditure

All the WSMTs visited do not allocate money to a capital account to budget for more major maintenance; all expenditure on the balance sheet comes out of the operational account. In accordance with the life-cycle cost approach the financial records of the Ave Dakpa system can be separated between operations and minor maintenance and capital maintenance expenditure. Table 27 shows that in Ave Dakpa, the majority of operational expenditure goes to salaries (69%) followed by other core running costs such as electricity bills (19%). Expenditure on minor maintenance is just 5% of total OpEx, corresponding to only 0.1 GHC per person, per year.

TABLE 28: OPERATIONAL EXPENDITURE FOR AVE DAKPA WATER SYSTEM IN AKATSI DISTRICT (2012)

Salaries	4659	1.2	69%
Sitting allowance	360	0.1	5%
Electricity bill	1286	0.3	19%
Minor maintenance	357	0.1	5%
Administration	50	0.0	1%
Total	6712	2	100%

Although the Ave Dakpa system is only 5 years old one of the submersible pumps has already been replaced. This is considered capital maintenance expenditure – as it is major cost that in theory should occur infrequently – and constitutes a third of the annual expenditure of the small town board over this period (Table 16). This expense was covered out of the water board operational account and, as the financial reserves of the system are limited, it is likely to have impacted on the ability of the board to fund necessary repair and preventative maintenance - evidenced by the identified problems with water treatment, non-functioning standpipes and a broken bulk meter – which in turn may lead to further premature breakdowns and deteriorating performance.

TABLE 29: CAPITAL MAINTENANCE EXPENDITURE FOR AVE DAKPA IN AKATSI DISTRICT (2012)

Activities	Expenditure/GHC	Expenditure per person/ GHC	Expenditure per person/ per year/GHC
2 X electrical motors	3,100	0.8	0.2
1 X electrical pump	750	0.2	0.0
Workmanship	350	0.1	0.0
Total	4,200	1.1	0.3

No comparative figures were available from the area of study. However examination and analysis of project documents suggest that these levels are well below what may be required for a small town scheme of an equivalent size presented in Table 17.

TABLE 30: ESTIMATED OPERATIONAL AND CAPITAL MAINTENANCE EXPENDITURE FOR A SMALL TOWN SCHEME

Unit cost	Cost per year/ GHC (2011)
Operational expenditure	2.4
Capital maintenance (depreciation – assets with life span < 10 years)	1.6
Capital maintenance (depreciation – all assets)	9.5

Source: Derived from costing report form Bankamba small town system – for breakdown of cost data please see Annex E: Small town unit costs estimates

The monthly income statements of Ave Dakpa emphasise the seasonal variations in revenue collection between dry and wet seasons, from a minimum of 1,067 GHC in July to a high of 2,776 GHC in January. The average monthly income is 1,868GHC. The population served by the system is estimated at 4,500, meaning that per person monthly income is just 0.4 GHC per month – although in reality it is highly likely that less people are being served by the system.

Nevertheless over this period income exceeds expenditure, meaning the remaining cash in hand of the operational account is 6,553 GHC. The system however is not achieving the performance of its design specifications either in terms of water quality or functioning water points. This combined with the growing population of the town means that residents may find that water points become increasingly crowded and, the system as a whole may not be able to meet demand and users are likely to access alternative informal water sources or purchase bottled water. In the current situation the falling technical performance of the water system is not exclusively related to a lack of financial resources, as the system is still relatively new, but more to do with weak technical and managerial capacity. In the short term the WSMT would benefit from more technical backstopping from the regional CWSA office to arrest falling performance and an alternative option would be some form of delegated management contract. In the medium term the income of the system should be more systematically set to aside to budget for the inevitable capital maintenance costs.

5.7.1.2 *Expenditure of direct support*

The district assembly is required to monitor the performance of the small town system, help to set and approve tariffs and undertake technical and financial auditing of the WSMT. The community water and sanitation agency is also supposed to provide technical backstopping and guidance where required. However DA's are still not sufficiently resourced and the auditing or monitoring of small town systems does not take place outside project support. In interviews it was apparent that DWSTs need to be given more support to understand the roles and responsibilities in supporting and monitoring WSMTs, ensuring they have the capacity to do so and that they prioritise these actions.

Similarly it is clear that training given to WSMTs is not sufficient or adequate to secure the sustainable management of small town systems. The evidence of premature system failure in these two study areas is stark and represents millions of dollars in wasted investment as well as consequent impact on water services. Approved maintenance regimes, financial guidelines are not followed; it seems that the existence of guidelines – or the dissemination of literature - is really not enough to guarantee the ongoing function of systems. As identified by in relation to small town systems (Soley and Thogersen 2002)

With the completion of the facility the interest wanes significantly and it becomes very difficult to institute effective and efficient O&M mechanisms for sustainability. At this point, they must be convinced through other means to readily adopt best management practices. Simply telling them what they are supposed to do at this stage have proven ineffective.

The "other means" identified are periodic financial and technical audits of the small town systems. MLGRD bye-laws state that to ensure sustainability district assemblies should undertake an audit of the system every year. This provides the necessary oversight and accountability to WSMTs, so problems can be identified and pro-active measures taken to solve them and also provides an entry point for CWSA assistance in approving technical evaluations and recommendations.

Soley and Thogersen (2002) state that in two-thirds of the cases the recommendations from the audit team were taken up and acted upon by WSMT. The cost of undertaking an audit was estimated by an interviewee who has conducted them as a consultant at between 1500 – 2000 cedis for one medium sized system, and up to 4,000 cedis for more complex systems.

5.7.1.3 *Synthesis*

As Table 18 maps out it, once again the key life-cycle costs necessary for the effective management of assets are not financed in a systemic or adequate manner and the consequences for system sustainability are damming.

TABLE 31: HOW THE LIFE-CYCLE COSTS OF SMALL TOWN SYSTEMS ARE FINANCED, IN THEORETICAL AND IN PRACTICE

Organisation	Capital expenditure		Operational expenditure		Capital maintenance expenditure (mechanical assets)		Capital maintenance expenditure (long life assets)		Expenditure on direct support	
	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Communities										
District Assembly										
CWSA										
Donors										

Key: *Green fill = commonly financed, Orange fill – occasionally financed, Red fill – rarely finance, No fill – not financed.*

5.7.1.4 Common challenges faced

Under COM it is clear that management and financing structures are fragile and require ongoing support. In this respect many of the failings of community structures can, in part, be brought back to a failure of agencies to adequately support these structures.

Indeed, every new facility that a donor constructs represents an "ownership cost" to the DWST/DWD and the CWSA. They are mandated to ensure that this system is monitored; that community management is effective and on occasion to finance system repair and replacement. However, although projects provide logistical, administrative and monitoring support in the short term – these are not being translated into longer term sustainability.

There needs to be an appreciation of the realistic amount of resources that can be mobilized in different contexts, particularly when the bulk of responsibilities are decentralised to rural district and community actors. Any guidelines put in place must be cognizant of the financial and capacity constraints that district and communities operate under.

One example of this is the DiMES monitoring system. The CWSA has shown a commitment to monitoring in the roll out of the DiMES monitoring system in every district across the country. However without partners to fund the data collection and with WASH monitoring not being prioritized through common fund allocations, the district water and sanitation teams have been largely unable to ensure that data is collected. This is recognised across all WASH governance levels and has a direct effect on how planning is undertaken; Mr Kubabom, the director of Planning and Investment at CWSA, recognizes that:

> *This is where we fall short; we do not have enough support from government in terms of our administrations and our operations budget. To be able to go out and monitor what the situation is in communities.*

The challenge is ensuring mechanisms and processes are in place that enables these decentralised actors to access adequate funds in order to fulfil their obligations. The following section examines how this process works in rural Ghana.

6 PLANNING GUIDELINES

Historically it is clear that post-construction support to WSMTs for small towns and communities are generally provided within a project framework and funds are not mobilized after the project has departed. This section provides a critical overview of the planning and budgeting processes from the district through regional and national levels. It aims to assess whether these processes lead to a judicious allocation of resources that enables the district assembly and other key actors to perform their functions and are therefore able to meet the life-cycle costs of service delivery that lie at the heart of improved IAM.

6.1 Planning

The decentralisation of water service management has meant a multitude of actors at national, regional and district level play a role in the planning and budgeting of WASH services. The WASH planning process begins at district level through the development of the District Water and Sanitation Plan (DWSP). This document sets out the strategic WASH plan of the DA detailing how it will attempt to address the water and sanitation requirements of small communities and towns, incorporating plans for capital expenditure on new systems and for the rehabilitation and augmentation of existing systems. The DWSP should also include, but rarely does, expected software expenditure by the district on capacity building and support to existing communities and stakeholders. The DWSP is to be updated every four years and should feed into WASH objectives of the Medium Term Development Plan (MTDP).

The MTDP forms the basis for central government allocations to district assemblies primarily through the common fund - but also through the district development fund. The MTDP goes through a series of revisions as a result of the DA liaising with the Regional Co-ordinating Council (RCC) and National Development Planning Commission (NDPC). Once MTDPs have been agreed they are collated by the RCC into national development plan which becomes the basis for the eventual budgetary allocations for each district. These revisions aim to ensure the MTDP is consistent and reflective of national government and district assembly priorities as well as being realistic given the likely financial resources available (Government of Ghana, 2013). The Ministry of Local Government and the Ministry of Finance and Economic Planning (MoFEP) administer these allocations culminating with MoFEP controller general instructing the administrator of the common fund to release the determined amount in to district assembly accounts.

Evidence from interviews with district assembly staff and previous studies, notably Imoro et al. (2009), show that in practice there is often little crossover between the objectives, details and targets of the DWSP and those in the MTDP and this impacts on how funds are budgeted.

6.2 Budgeting

The approved MTDP forms the basis of the annual composite budget (CB). The role of composite budgeting across all district assemblies only began relatively recently and so the processes involved are fairly new to DA's. CB aims to integrate the budgets of all decentralised departments and agencies under the district assembly into a single master budget. This vests more authority with the district assemblies who will now sign all the warrants to release funds from a particular budget line – a departure from previous arrangements that were administered through individual government ministries.

The preparation of the composite budget is guided by the priorities laid out in the MTDP and by a series pre-determined expenditure ceilings for salaries (termed compensation), different goods/services, capital and recurrent expenditures. Under Composite Budgeting a number of activities are allocated ring-fenced common fund expenditure, including 28% on national youth employment programmes, 2% to be used to support people with disabilities and 0.5% on training. The remaining allocations are determined according to the remaining budget, combining internally generated funds with government disbursements. Funds are mobilised and warrants raised only when the CB has been finalised – and by and large if an activity has not been included in the CB (outside of contingency spending) it will not be possible to mobilise funds. The composite budget is prepared for four years but it is revised every year based on availability of funds, progress towards the MTDP targets and Medium Term Expenditure Framework (MTEF) guidelines.

6.3 Analysis

The DWD/DWST teams members interviewed in this study characterised the items captured in the DWSP (and subsequently summarised in the MTDP) as a wish list that did not bear much relation to how funds are mobilised and how facilities are constructed.

In essence the DWSP and the WASH component of the MTDP are very focussed on expanding rural coverage through new infrastructure construction. In the Akatsi MTDP (2010 – 2013)[8] for example the only planned expenditure on water is all related to capital expenditure hardware and software including: Drilling 25 new boreholes – including WSMT for small communities training and Water quality testing – and constructing a piped scheme at Xavi. The MTDP does not wholly capture what is planned in the DWSP but more importantly none of these activities are to be financed through government expenditure but by development partners. Therefore these items will not need to be included in the composite budgeted and will bear no relation to, and have no influence on common fund allocations.

This is perhaps unsurprising, the composite budget is not supposed to cover every aspect of the MTDP as donor funding is expected and actively sought to finance certain activities. The main concern is that this process is solely orientated about constructing new infrastructure. The costs of maintaining and supporting the management of this infrastructure are not addressed in this planning and budgeting process. In the sample CB framework viewed in this study – there is no standard budget line for monitoring, community engagement and other core DWST/DWD activities. As has been shown support and monitoring activities are crucial for sustaining and supporting community management structures which are in turn crucial for the maintenance of asset performance and functionality.

Box 4: Un-co-ordinated donor activities: By-passing planning

Evidence from district assemblies demonstrates that donor projects often by-pass the district planning process altogether. Evidence from the Akatsi district show that DWSP for the period 2008 – 2011 contained plans for the construction of 80 new boreholes and the extension of two piped system. Of the 80 planned boreholes only 13 were executed and the pipe system extensions did not occur. During this period, unplanned donor activity was common with some 53 unplanned boreholes drilled (38 of them successful). Often this drilling is undertaken independently and without the knowledge of the district assembly. According to DA staff, these projects often do not follow CWSA guidelines on demand creation and community sensitisation and consequently WSMTs for small communities are not formed to manage the system once the construction has concluded, further threatening the likely longevity of the system. Once the new capital expenditure does not follow the priority list set out in the DWSP, new construction will not necessarily be focused on low coverage areas that are seen to have the greatest need and is more open to political influence.

Box 5: Ring- fencing monitoring?

In response to criticism relating to the treatment of "people with disabilities" (PWDs), the 2006 Disability Law was passed. This law requires district assemblies to cede between 2% of common fund allocations to activities aimed at improving conditions for PWDs. The continued neglect of district monitoring, not just in WASH but across all sectors, means that it may be time to advocate for a ring-fenced monitoring budget to be shared across district departments.

[8] Unpublished – copy shared with the author

7 EXISTING MONITORING FRAMEWORKS

7.1 District Monitoring and Evaluation System

7.1.1 Description

The DiMES monitoring tool is a Microsoft Access based database set up to capture data on a wide range of details of water and sanitation infrastructure, including: the specifications, performance and maintenance of existing and newly constructed facilities; the communities where they are located; and the projects that financed them. The DiMES tool is hosted and managed by district assembly staff and has been rolled out across the country. In theory the system would be updated as part of periodic monitoring at the district level. Information from each district assembly are collated at regional CWSA level and then once again at CWSA head office for a national overview. The compiled data emanating from DiMES has a direct impact on the Strategic Investment Plan developed by CWSA head office. Theoretically - collating this data at different governance levels facilitates strategic planning and equitable investments based on areas of greatest need. As explained in the DiMES user manual:

DiMES is structured in such a way that it can support all the administrative structures of the country, where data could be gathered and entered directly and once at the point of data generation and distributed to all other relevant and respondent administrative units, and used for all the functionality of the system, namely, planning for investments, management and monitoring and evaluation.[9]

7.1.1.1 DiMES in use

District Assembly and CWSA staff key informants, recognise a number of problems with the current database – variously stating that in its present guise DiMES is over-elaborate; not fully functional and very difficult to use. For example in just one category, termed "facility data management", there are 158 unique data fields that can be entered covering the identification, characteristics, costs, and hydro-geological information of single supply asset. Of the 158 fields only 7 are typically filled and are one-off entries recording asset location and identification codes. A further 8 fields are occasionally populated and the remaining fields are, in almost all cases, left blank. Across all the input categories of DiMES only a handful of fields have been systematically filled, leaving many hundreds blank. Interviews with districts and CWSA staff confirms that DiMES is only updated to show new system constructions, which are then used to generate coverage figures. Coverage has then become the de facto metric for an area of greatest need. Therefore streamlined, fully functional DiMES could have a real impact on investment decision making for capital costs, but also for recurrent costs with "need" based on key IAM criteria such as criticality, performance, redundancy and risk.

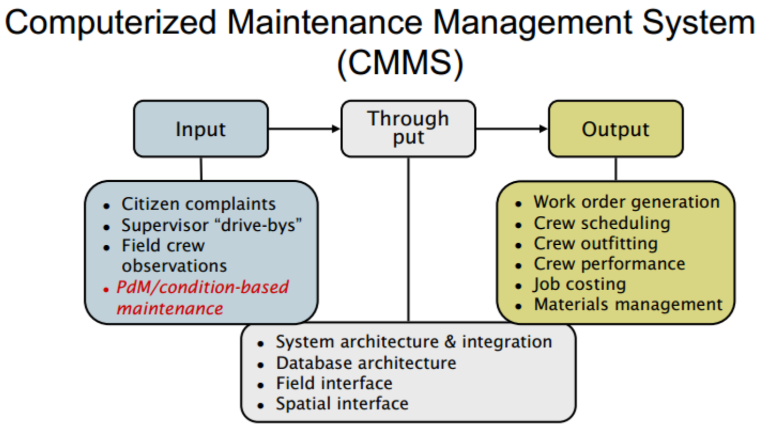
There are plans for IRC to support CWSA in revising the DiMES framework, streamlining the indicators it is designed to capture and linking it directly with the mobile monitoring of water services. A revision of DiMES would aim to be able to incorporate appropriate asset management indicators for small communities and small towns.

The Sustainable Rural Water and Sanitation Project (SRWSP) will support the establishment of a robust Sector Information System to facilitate the collection of data, its analysis and the generation of accurate information to properly monitor and evaluate M&E access to water supply and sanitation services, the quality of those services and their sustainability. The SIS will rely on the reception of timely data on, among others: access to water and sanitation services, the quality and reliability of those services; and the operational and financial performance of water and sanitation facilities. The SIS will also collect and organize information with regard to investments financed by GOG, DPs, NGOs, private sector, etc. and any relevant water and sanitation related issues, including users' satisfaction and cost of services and products. The SIS is expected to be user-friendly and internet-based and to provide key sector actors, NDPC and the public in general with relevant data/information. With the extensive development of the DIMES for the rural and small town water and sanitation sector, it is expected that the revised DiMES will become an integral part of the SIS.

An example of how the architecture of this type of decision making tool can be seen in Computerized Maintenance Management System (CMMS) schematic (Figure 4). In this case the input values represent information on asset condition – these are automatically interpreted by the programmable back end to the system, to automatically produce a work order output. This does not necessarily have to be restricted to strictly asset "performance" but could also include work order based on the "performance" of WSMTs for small communities and towns. How these indicators are defined and interpreted and work order prioritised will depend on what indicators can reasonably be expected to be monitored.

FIGURE 5: EXAMPLE SCHEMATIC FOR A COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM

[9] CWSA (2009) "District monitoring and evaluation system operations guide and user manual"

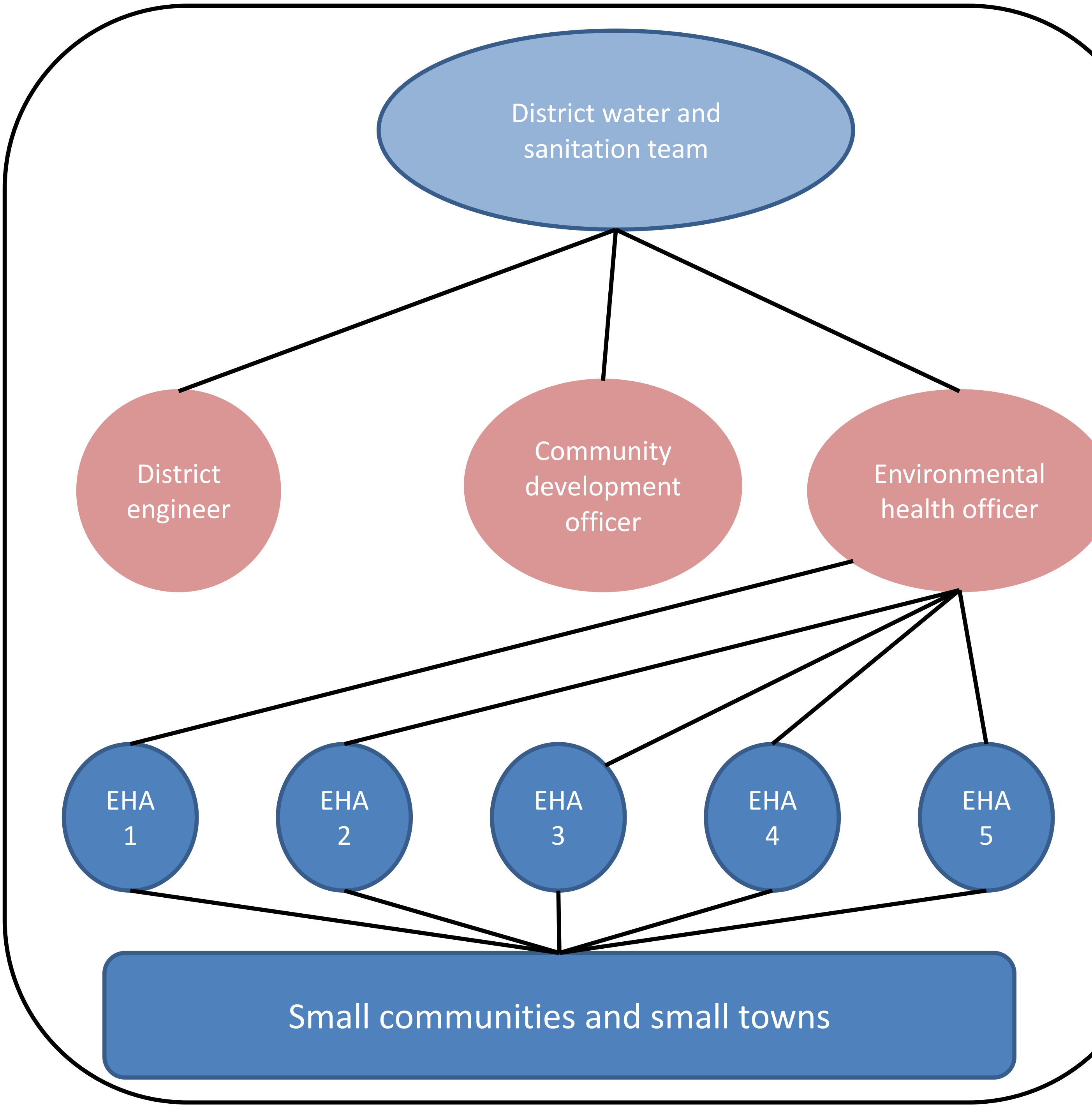


In developing DiMES National sector stakeholders have shown good commitment in building country-led monitoring systems. It is also incumbent of the monitoring system to make an efficient use of the financial and time resources as possible.

7.2 An effective district monitoring framework

Traditionally the DWST constitutes three core members: a district engineer, community development officer and the environmental health officer that have overall responsibility for planning and supporting water and sanitation service provision. However, key "software" aspects of the DWST, such as community engagement, mobilisation and monitoring is devolved to the environmental health assistants that are based at area councils spread across the district. Each district is zoned into a set of area councils and EHA's tend to be dedicated to a defined area of intervention and interact with community members on a number of issues including building awareness and commitment from households towards the latrine constructions as well as general engagement on improving community hygiene and sanitary practices (Figure 5).

FIGURE 6: COMPOSITION OF THE DISTRICT WATER AND SANITATION TEAM



Source: Authors own drawing, 2013

In Akatsi district the successive DANIDA and Triple-S projects have also utilized EHA's as part of both data collection and the monitoring of community performance. DANIDA's monitoring operations and maintenance initiative sought to:

1. Assist the non-performing WSMTs for small communities to improve in revenue generation.
2. Ensure WSMTs for small communities and Community members perform their roles and responsibilities
3. Identify a number of poorly-performing boreholes at risk communities in the district and make appropriate planning recommendations

The EHA's were tasked with collecting this information from the communities and reported it back to the core DWST members on a quarterly basis. The DWST used this data to generate a quarterly action plan for most communities and allocate resources (financed by DANIDA) accordingly. The main aim of the plan will be to improve upon the roles and responsibilities of WSMTs for small communities and community members on the issues of Operation and Maintenance of water and sanitation facilities.

Given the history of district finances, the costs of quarterly monitoring are too high – especially in a context where new systems are proliferating and the monitoring burden increasing. Annual or bi-annual monitoring is a lot more reasonable given resource constraints. Further quick wins can be made through better co-ordination of the monitoring visits of EHA staff with other district departments such as health and education. There is no clear reason why dual monitoring could be done during EHA community visits. This will require further co-ordination and exploration with district staff.

In recent years there has been a shift away from the DWST structure, and district oversight of water and sanitation services now coming through the newly created District Works Department. The DWD typically consists of an engineer responsible for roads; water etc employed by the district and not specifically focused on water and sanitation issues, but rather addresses the combined technical and engineering duties of the DA.

In interviews conducted in this study, concerns expressed by regional CWSA and DWST representatives that this structure has no clear role for the environmental health officer – and by extension the EHA's – and consequently there is a risk that the links with WSMTs for small communities will be severely weakened. Additionally at this stage it is unclear how monitoring will be managed under the DWD system.

Given the monitoring responsibilities of the districts – the involvement of the EHA's seems to be vital if this work is to be undertaken. It is worth noting that the relationships between DWSTs/DWDs and the EHA's does vary from district to district and therefore how the EHA's are involved will be different.

7.3 Ideal ExpDS

The amount service providers and service authorities should be spending on monitoring and supporting water delivery is a contested point and will have different answers in across different countries and across different water supply technologies. Under a decentralised community ownership and management it is acknowledged that ongoing support is provided to communities in the years after a system has been constructed and a management team trained and orientated is vitally important.

This has prompted further exploration of the "ideal" levels of support expenditure required under a COM's system using an activity based modelling framework. Drawing on expert opinions from across CWSA and district assemblies, the estimated cost of direct support was estimated at around GHC 44,745GHC for a typical district assembly in Ghana. This includes the costs of periodic monitoring visits to small communities, annual financial audits of piped schemes and the logistical and administrative support that would enable the district water and sanitation members to undertake the work. This does not, however, include the core staffing costs of district staff but does include DSA allowances for stays in the communities.

Applying this lump sum figure to Akatsi and East Gonja district populations yields an ExpDS of 0.4 GHC per person. This may not sound a great deal, but to put this figure into context – it represents 4-5% of the total common allocation to each district assemble (taking the average of the last 3 years). This shows the challenge of implementing these regimes without ongoing donor support (Table 19).

TABLE 32: "IDEAL" DIRECT SUPPORT EXPENDITURE AS A PERCENTAGE OF DISTRICT COMMON FUND ALLOCATIONS

District	Population	Proposed	Proposed	Common fund disbursement	ExpDS as a

		ideal direct support expenditure	expenditure per person per year	2010	2011	2012	Three year average	percentage of common fund
East Gonja	127,304	44,745	0.4	923,474	1,269,802	853,256*	923,474	5%
Akatsi*	117,606	44,745	0.4	695,521	1,311,546	1,080,501**	1,003,534	4%

*In 2012 - Akatsi district was divided into Akatsi North and Akatsi South

**No 4th quarter data was available for East Gonja in 2012. This total has been generating by estimating the 4th quarter dispersal as the average of the 1st - 3rd quarter dispersal

Reflections for stakeholders suggest that this level of expenditure on supporting community systems cannot be financed without donor support. Indeed the "ideal" direct support was considered unrealistically high by key stakeholders.

A useful comparison can be made between the "ideal" direct support expenditure and the actual expenditure of the Triple-S project in supporting ongoing infrastructure data collection and monitoring. The following figures (Table 20) refer to expenditure on a single round of district data collection and does not include any of the initial cost of purchasing the data collection equipment or software or salaries.

What this data does show is the expected additional cost to DWD/DWST of undertaking systematic data collection. In East Gonja region the district infrastructure survey was completed by a team of 6 people over a 25 day period, the data was subsequently validated and shared. This amounts to an annual expenditure of 0.1 GHC per person.

TABLE 33: EXPENDITURE ON A SINGLE ROUND OF DISTRICT DATA COLLECTION

Activity	Inputs/Item Description	No. of Days	Qty/ Participation	Unit Cost/GHC	Total Cost/GHC
To collect the data	Enumerators allowance	25	6	50	7,500
	Internet connection	1	6	100	600
	Enumerator T&T (Additional - not covered in the Triple - S budget)	25	6	15	2,250
	Sub-Total				**10,350**
To validate the data	Food	3	10	15	450
	T&T	3	8	10	240
	RLF	3	1	120	360
	Driver	3	1	80	240
	RWST	3	1	65	195
	Sub-Total				**1,485**
To share the data	Feeding	1	30	15	450
	Rapporteur allowance	1	1	70	70
	T & T	1	30	10	300
	RLF	1	1	120	120
	Driver	1	1	80	80
	Sub-Total				**1,020**
Annual total					**12,855**

Annual total per person	7.10

7.3.1 Incentivizing Expenditure on Direct Support

District funds are a highly contested scarce resource. One way to incentivize expenditure on district support is through the District Development Facility Functional Organizational Assessment Tool (DDF-FOAT). The DDF-FOAT financially reward districts based on their performance against a number of financial, administrative and management benchmarks. The fund is financed by the Government of Ghana and selected development partners and the performance based grants on offer are often quite significant. There is an expectation that CWSA and the MWRWH will be able to advocate for the inclusion of WASH service monitoring as part of the key performance indicators of the DDF-FOAT and therefore provide an incentive to district councils to prioritise these activities.

7.4 Outlining asset management for rural Ghana

7.4.1 Asset management under WSMT for small communities

As highlighted in previous sections, for the asset management of boreholes and hand pumps the tasks for preventative maintenance are relatively minor. Ideally communities would engage in periodic maintenance of hand pumps including a general inspection and replacement of fast wearing parts. However in small communities - whether preventative maintenance or fix on failure approach is taken - the dynamic reporting of asset condition, degradation and maintenance schedules may not be appropriate (similar conclusions have been reached in Uganda by Biteete and Lishout, 2013). In this context, any potential benefits accrued from improved maintenance scheduling are likely to be outweighed by the costs of collecting, processing and acting upon this information.

Under COM, the interface between the management of the physical assets and the human “assets” of the WSMTs for small communities’ has been shown to very important. If the WSMT for small communities’ has collapsed or is poorly functioning, it is more difficult for the communities set and collects tariffs and to mobilise financial “assets” for minor and more major repairs. It is therefore perhaps more important, that basic key performance indicators of the WSMT for small communities’ are tracked.

Additionally for Strategic Investment Planning purposes it is also important to track the criticality and redundancy of community water points. This means that repair and rehabilitation can be target on areas where few alternative formal sources exist.

The Triple-S baseline constitutes an infrastructure assessment has taken place on all the point sources across the two districts. This provides detailed data of the characteristics (such as make and depth), functional performance of all sources. Where data was available the rehabilitation record of assets and operation expenditure was also collected. At the aggregate level this data can be very important to see what the expected financing gap will be for rural point sources as they begin to fail and require major repair and rehabilitation. This information could help determine further life-cycle costs financing guidelines.

It is clear that for small communities, the most appropriate and convenient and strategic place for an asset management system to be hosted is within an adapted DiMES framework – hosted and updated by district water and sanitation teams with results aggregated to regional CWSA level.

Table 34 details the proposed key inputs and outputs for an asset management tool for small communities. These indicators focus on inputs that relate directly or indirectly to the physical asset, including a selection of the Triple-S performance monitoring indicators on service levels and WSMT for small communities’. The majority of these indicators have already been collected as part of the Triple-S baseline and in total the criteria that require annual or bi-annual monitoring would represent a reduction in the number of indicators used.

TABLE 35: PROPOSED KEY INPUTS AND OUTPUTS FOR ASSET MANAGEMENT PLAN[10]

Category	Fields (inputs)	Frequency	Location	Triple-S indicator?	Outputs
Location	Borehole ID, geo-reference, community size	One off	Asset register	Yes	
Information	Year of construction, year of rehabilitation, installation cost, level of redundancy	One-off/ occasional with new facilities	Asset register	Mostly	Residual asset life, current asset value, criticality of asset, effective coverage
Specification	Depth, handpump type, basic geology, capacity	One off	Asset register	Partly	
Functionality	leakage test, operational expenditure, capital maintenance expenditure, cash in hand	Annually/ Bi-annually	Asset register	Mostly	"Probability of failure/ consequence of failure" matrix
Service level	WSMT for small communities performance indicators: No. days downtime, water quality testing, tariff structure, tariff levels, income	Annually/ Bi-annually	Performance indicator	Yes	Action plan for support, training, sentisation. Calculation of combined service score

Often it is the case in rural water supply that the "squeaky hinge gets the oil", and failing systems are rewarded with donor investment. Over time this framework would provide information on past WSMT and service performance and could provide a systematic way to reward capable management with more aspirational limited piped services.

Key next steps:

- Finalise indicators for regular monitoring
- Make estimate of annual required district monitoring budget
- Create, refine and share logic for productions of work plans within a CMMS system

7.4.2 Asset management under WSMT for small towns

The greater complexity and costs associated with small town piped systems means that more in depth knowledge is needed about system assets. Neither the Triple-S study, the WSMTs, or the district assemblies keep a register of small town assets and no actors are monitoring the condition or performance of these assets, so very little data currently exists.

[10] The arrows on the table represent interdependencies between the inputs and outputs of different fields.

In part because there is no data and impart because of weak WSMTs for small towns governance and external support the performance of small town systems in these two districts is in many ways more distressing that the situation in small communities.

In this scenario the need for improved asset management is clear, but the path to reach it is less so. Unlike WSMTs for small communities the complexity of the larger piped schemes may mean that an active management system should be hosted by WSMT for small towns operators or private delegated managers rather than something that is administered by district assemblies. This means that the asset register will be compiled, completed and updated by local staff – which will also be subject to the generated work orders. Aside from monitoring by the operators – the asset register could be thoroughly reviewed, revised and updated through an annual technical audit.

Along-side a detailed asset register (which would have to be created from scratch) there are a number of common key performance indicators for reticulated systems:

- Average daily per capita daily consumption (in l/c/d)
- Physical loss ratio (in %)
- Total number of private connection
- Revenue collection efficiency (in %)
- Balance of the operational account
- Balance of renewal & extension account

There would also be a capacity to maintain financial records with the same system – that would also be subject to financial auditing measure.

As different indicators would be being collected, and the systems would be hosted separately, it is expected that independent systems would be generated for small community and small town schemes.

8 CONCLUSION

The drive towards improving water coverage in Ghana has led to a proliferation of water supply assets across rural communities. Although this hardware is expensive and often technically complex – making sure this infrastructure is constructed is proving to be the easy bit of rural water supply. What is more difficult is sustaining management, planning and budgeting systems and processes that ensure that this infrastructure continue to function over time.

Financing of the different life-cycle costs of maintaining the infrastructure is not the responsibility of a sole service provider, but spread amongst a variety of community, governmental and donor organisations. Asset management planning should be responsive to these challenges and also to the complexities of the services being provided. For small communities this may mean that instead of detail maintenance schedules for WSMT, asset management planning should seek to systematise the support provided by district assemblies to community organisations and provide donors and planners with robust and accurate data that enables them to better prioritise services expansion or enhancement. This support does come at a cost well above significantly beyond existing levels. It is up to national, regional and district stakeholders to prioritise, based on principals of good governance, the ongoing, annual expenditure on WASH monitoring and community support.

For small town systems the location and specifications of an asset management system is less clear. At present even basic information on the small town assets are not available and a large amount of additional information is required. Furthermore, ongoing research needs to establish where the most appropriate place to host and manage a decision making framework would be, and how monitoring information could interface between district assemblies and the WSMT for small towns' members or private operators.

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10 ANNEX

10.1 Annex A: Condition Matrices

TABLE 36: CONDITION RATING FOR WATER PIPES

Condition Rating for Water Pipes	
Rating	**Description**
Excellent	No failures. Complies with engineering standards.
Good	Few failures. Few areas not complying with engineering standards.
Fair	Failures beginning to occur. Significant areas not complying with engineering standards.
Poor	Regular failures occurring and significant corrosion. Increases operating costs resulting. Many must be replaced.
Failing	Significant failures and should be substantially reconstructed.

TABLE 37: CONDITION GRADING MATRIX FOR MECHANICAL AND ELECTRICAL ASSETS

Grade	Condition	Description
0	Non-existent	Asset abandoned or no longer exists.
1	Very Good	Plant in sound physical condition designed to meet current standards. Operable and well-maintained. Asset likely to perform adequately within routine maintenance for 10 years or more. No work required.
2	Good	Acceptable physical condition but not designed to current standards, or showing minor wear. Deterioration has minimal impact on asset performance. Minimal short-term failure risk but potential for deterioration or reduced performance in medium term (5 – 10 years). Only minor work required (if any).
3	Fair	Functionally sound plant and components, but showing some wear with minor failures and some diminished efficiency. Minor components or isolated sections of the asset need replacement or repair but asset still functions safely at adequate level of service. For example, bearing and gland wear becoming evident and some corrosion present. Deterioration beginning to be reflected in performance and higher attendance for maintenance. Failure unlikely within 2 years but further deterioration likely and major replacement required within next 5 years. Work required but asset is still serviceable.
4	Poor	Plant and components function but require a high level of maintenance to remain operational. Likely to cause a marked deterioration in performance in short-term. Likely need to replace most or all of assets within 2 years. No immediate risk to health or safety but work required within 2 years to ensure asset remains safe. Substantial work required in short-term, asset barely serviceable.
5	Very Poor	Failed or failure imminent. Plant and component effective life exceeded and excessive maintenance costs incurred. A high risk of breakdown with a serious impact on performance. No life expectancy. Health and safety hazards exist which present a possible risk to public safety, or asset cannot be serviced/operated without risk to personnel. Major work or replacement required urgently.

TABLE 38: CONDITION RATING MATRIX FOR CIVIL INFRASTRUCTURE

Grade	Condition	Description
0	Non-existent	Asset abandoned or no longer exists.
1	Very Good	Sound physical condition. Asset likely to perform adequately without major work for 25 years or more.
2	Good	Acceptable physical condition; minimal short-term failure risk but potential for deterioration in long-term (10 years plus). Only minor work required (if any).
3	Fair	Significant deterioration evident; failure unlikely within next 2 years but further deterioration likely and major replacement likely within next 10 years. Minor components or isolated sections of the asset need replacement or repair now but asset still functions safely at adequate level of service. Work required but asset is still serviceable.
4	Poor	Failure likely in short-term. Likely need to replace most or all of asset within 2 years. No immediate risk to health or safety but works required within 2 years to ensure asset remains safe. Substantial work required in short-term, asset barely serviceable.
5	Very Poor	Failed or failure imminent. Immediate need to replace most or all of asset. Health and safety hazards exist which present a possible risk to public safety or asset cannot be serviced/operated without risk to personnel. Major work or replacement required urgently.

Source for above tables: National asset management steering group (2006)[11]

10.2 Annex B: Interviews and focus group discussions

TABLE 39: KEY INFORMANT INTERVIEWS

Date	Interviewee	Organisation	Position
24-01-13	Mr Emmanuel Gaze	CWSA Head Office	Director Technical Services
24-01-13	Mr Benedict Kubabom	CWSA Head Office	Director Planning and Investment
25-01-13	Mrs Esinu Abbey	CWSA Head Office	IT co-ordinator
25-01-13	Ms Charlotte Engmann	CWSA Head Office	WASH Coordinator
29-01-13	Naa Dogoli	CWSA Regional Office - Volta	Regional Director of CWSA
28-01-13	Mr Johnson Ampah	CWSA Regional Office - Volta	CWSA Regional Engineer
28-01-13	Mr Sylvester Eyramh	CWSA Regional Office - Volta	Extension service specialist with the MoM unit
29-01-13	Mr. Oscar Philip Ahianyo	CWSA Regional Office - Volta	Extension service specialist

[11] National asset management steering group (2006), **"International infrastructure management manual.** 3rd. ed". Association of Local Government Engineering N.Z. Inc., Thames, New Zealand

07-02-13	Mr John Aduakye	CWSA Regional Office – Northern	Hydro-geologist – CWSA Northern region
08-02-13	Mr Moses Bagbile	CWSA Regional Office – Northern	Extension service specialist
08-02-13	Mr Steve Anonlan	CWSA Regional Office – Northern	Extension service specialist
07-02-13	Ms Patricia Gyamfi	CWSA Regional Office – Northern	IT specialist
04-02-13	Mr Seth Damasah	Akatsi South District Assembly	District WASH Engineer
31-01-13	Mr. Jacob Nunekpeku	Akatsi South District Assembly	Planning officer
30-01-13	Mr. Sammy Davor	Akatsi South District Assembly	Environmental health officer
11-02-13	Mr. Bashiru Shaibu	East Gonja District Assembly	Environmental health officer
11-02-13	Mr. Osuman Memuna	East Gonja District Assembly	Community officer
11-02-13	Mr. Yakubu Braimah	East Gonja District Assembly	Engineer DWD
11-02-13	Alhaji Abdul Karim Y. Iddrisu		District Coordinating Director
12-02-13	Mr. Khalid Abubakari	East Gonja District Assembly	Planning officer
12-02-13	Alhaji Mahama Zakaria	East Gonja District Assembly	Finance officer

TABLE 40: FOCUS GROUPS AND MULTI-STAKEHOLDER INTERVIEWS

Date	Description	Location	Small town/community name
02-02-13	WSMT for small communities focus groups	Akatsi district	Ave Afiadenyigba (New town)
04-02-13		Akatsi district	Agbagblakope
04-02-13		Akatsi district	Agbedrafor
04-02-13		Akatsi district	Agornu Kporkblortey
04-02-13		Akatsi district	Adzikame Agbalekope
04-02-13		Akatsi district	Adzikame Gavorkope
11-02-13		East Gonja	N/A (Environs of Salaga Town)
31-01-13	Area mechanics of focus group	Akatsi district	N/A
31-01-13	Environmental health assistant focus group	Akatsi district	N/A
31-01-13	WSMTs for small towns group interview	Akatsi district	Akatsi
02-02-13	WSMTs for small towns interview + site visit	Akatsi district	Ave Dakpa
11-02-13	WSMTs for small towns interview + site visit	East Gonja district	Salaga
11-02-13	Area mechanics focus groups	East Gonja district	N/A

Annex C: Small town roles and responsibilities

The two tables below detail the financial management and technical responsibilities of WSMTs for small communities and relevant public and private sector institutions.

TABLE 41: FINANCIAL MANAGEMENT FUNCTIONS AND RESPONSIBILITIES IN SMALL TOWN MANAGEMENT

Activity	Responsible Unit				
	WSMT for small towns	**WSMT for small towns - Operating Staff**	**Private Sector Staff**	**District Assembly**	**Regional CWSA Office**
Tariff	Sets tariff			Approves tariff	Monitoring and provide technical backstopping where necessary
Meter Reading/Bill collection	Cashier may collect revenue from households		Main responsibility		
Banking	Monitored by cashier/treasurer		Partially responsible		
Accounting	Monitored by cashier/accountant		Partially responsible		
Financial Reporting	Presented to community		Partially responsible		
Checking from financial accounts	Monthly oversight			Twice a year	
Savings and investment	WSMTwith advice from private sector		Partially responsible		
Expenditure	Approves all expenditure		Partially responsible		
Budgeting	Preliminary approval		Partially responsible		
Stocktaking	Partially responsible	Partially responsible	Partially responsible		

TABLE 42: TECHNICAL FUNCTIONS AND RESPONSIBILITIES IN SMALL TOWN MANAGEMENT

	RESPONSIBILITY UNIT					
Activity	WSDB Operator	WSDB Manager	Private Sector Staff	WSDB	MMDAs	CWSA Regional Staff
Pump Operation	x		x			
Trouble Shooting	x		x			
Routine Maintenance	x		x			
Periodic Maintenance	x		x			
Breakdown Maintenance	x		x			
Rehabilitation of System				x	x	
Expansion of System				x		
Water Quality Monitoring	x		x			
Data Collection*	x		x			
Data Interpretation and Reporting		x	x	x		
Monitoring **		x	x	x	x	x
Supervision of Operatives		x	x			
Operation of Production Plant and Source Protection Monitors	x	x	x			

- pump starting/stopping time *
- pump down time *
- quantity of water produced *
- power consumed *
- fuel, lubricants consumed *
- chemical consumption*
- water quality parameters *
- personnel time used in operation and maintenance *
- spare parts, materials consumed for each maintenance activity *
- water quality * *
- water quantity **
- cost effectiveness **
- unaccounted for water **
- % down time **
- effectiveness of hygiene education **

Source: Community Water and Sanitation Agency (CWSA), (2010b), "Small Town Operation and Maintenance Guidelines", Ministry of Water Resources, Works and Housing

10.3 Annex D: Case studies

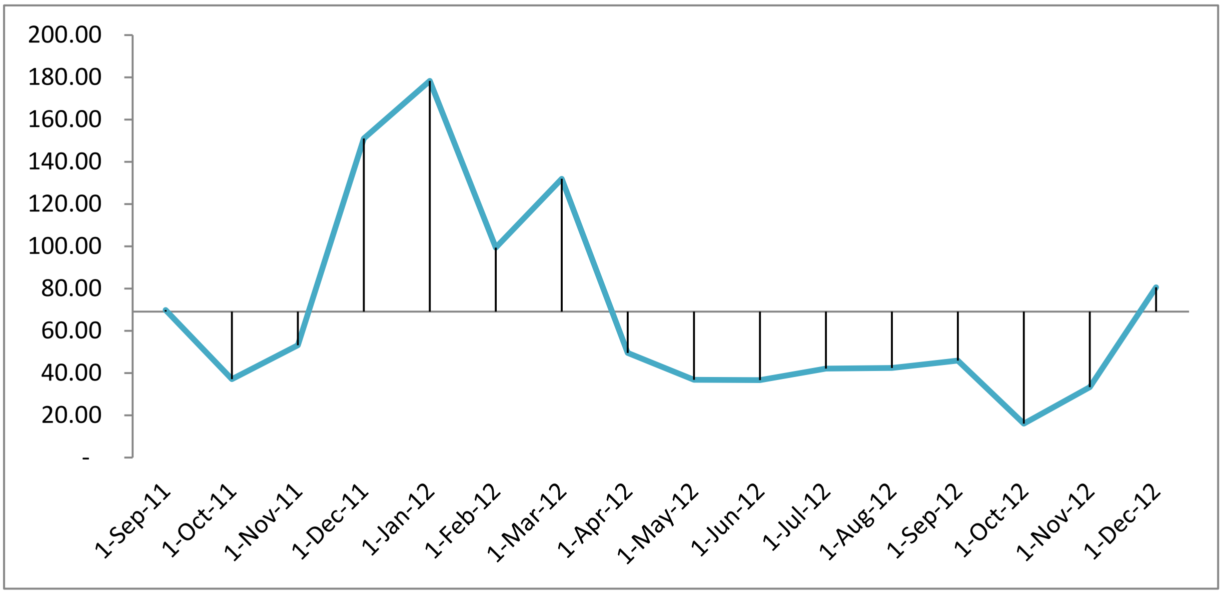
10.3.1 Small communities WSMT

Ave Afiadenyigba (New town)

Ave Afiadenyigba has four borehole and handpump systems and a population of approximately 1,678 (representing an average of 420 people per borehole). The WSMT keep very detailed records of operational and maintenance income and expenditure and share this information with the community every year. Figure 6 shows 16 months of income from the 4 boreholes. Over this period one of the boreholes had been padlocked for a 5 month period during the dryer months and another had been broken down for two months awaiting repair. The average monthly income from 4 boreholes was 69 cedis (equating to 207GHC per borehole, per year and just 0.6 GHC per borehole/per day). The revenue collected is very seasonal peaking in the dry season between December and March (Average monthly revenue = 117 GHC). In the wetter months between May and October, revenue drop by near 4 times to a monthly average of 31 GHC.

The total maintenance expenditure over the period was less that the revenue received at 704 GHC (176 GHC per borehole, equating to 132 GHC per borehole per year) – this included three occasions when the area mechanic had to be called for minor repairs and most repairs were undertaken promptly. No significant preventative maintenance was carried out during this period - although at the time of the site visit the overall balance of the account was over 500 GHC and could have financed more major repairs for a single handpump.

FIGURE 7: MONTHLY WATER REVENUE - IN COMPARISON TO AVERAGE REVENUE - AVE AFIADENYIGBA



Water management in Ave Afiadenyigba was considered a success story by district staff. However even in these areas it is clear that alternative sources (rainwater and surface water-sources) are used for domestic and drinking purposes during the wet season.

A further 6 small communities were visited in this study however due to the lack of records keeping with WSMTs no detailed accounts were made available. In East Gonja interviews with the area mechanics, WSMTs, and district staff emphasized that most households had on site provisions for rainwater harvesting and storage and therefore in the wet seasons formal point sources are abandoned for long periods if a tariff is charged; if no tariff is levied communities may continue to use the source but are not compelled to finance any repairs of breakdown.

10.3.1.1 Small town systems

Ave Dakpa small town system

The Ave Dakpa small town water system was handed over to the WSMT for small towns in March 2008. At the time of construction the system was designed to serve approximately 3,500 people through 10 stand-posts and 16 household connections. The system is supplied by two mechanised boreholes connected to 120m^3 overhead storage tank which then flows via gravity through the distribution network.

Current status

Of the 10 standpipes, only 4 are still open for public use. Four of these stand posts have broken down and the other two are located in an area that cannot attract an attendant and so have been locked. Ave Dapka has become the capital of the newly created district of Akatsi North and this has prompted an expansion of the town population to around 4,500 people.

Interviews with the Ave Dakpa WSMT highlighted that in addition to the broken down stand-posts the system suffers from a number of other problems due to the poor quality of initial construction. One of the two borehole sources is low yielding and this causes a reduction in the possible pumping hours from the borehole and causes periods of low pressure in the distribution system. This is especially a problem in the dry season. Additionally one of the submersible pumps and motors has already had to be replaced; the bulk meter is broken; and the chlorine dosing system has been abandoned as no chlorine tablets have been purchased. The system operators employ a fix on failure approach to the distribution network – a facility management plan was drawn up when the system was constructed to guide regular monitoring and maintenance practices but this is not followed although the repair of the bulk meter has not been prioritised meaning that any leakages that exist within the distribution network cannot be pinpointed.

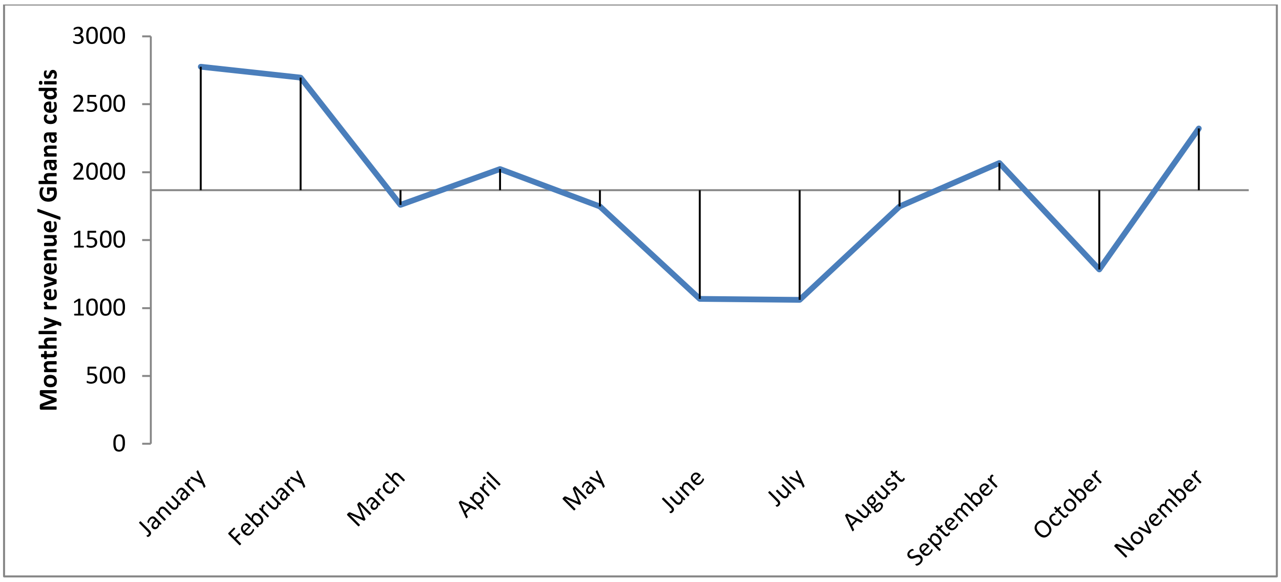
FIGURE 9: BROKEN BULK WATER METER

FIGURE 8: DISUSED CHLORINATION SYSTEM

Financial management

Financial records on income and expenditure were available for an 11 month period between January – November 2012. The monthly income statements emphasise the seasonal variations in revenue collection between dry and wet seasons, from a minimum of 1,067 GHC in July to a high of 2,776 GHC in January. The average monthly income is 1,868GHC (Figure 9).

FIGURE 10: MONTHLY WATER REVENUE - IN COMPARISON TO AVERAGE REVENUE - AVE DAKPA SMALL TOWN SYSTEM



The WSMT does not allocate money to a capital account to budget for more major maintenance; all expenditure on the balance sheet comes out of the operational account. In accordance with the life-cycle cost approach these expenditure can be segregated between operations and minor maintenance and capital maintenance expenditure. Table 28 shows that in Ave Dakpa, the majority of operational expenditure goes on salaries (69%) followed by other core running costs such as electricity bills (19%). Expenditure on minor maintenance is just 5% of total OpEx, corresponding to only 0.1 GHC per person, per year.

TABLE 43: OPERATIONAL EXPENDITURE FOR AVE DAKPA WATER SYSTEM (2012)

Activities	Expenditure/GHC	Expenditure per person per year /GHC	Percentage distribution
Salaries	4659	1.2	69%
Sitting allowance	360	0.1	5%
Electricity bill	1286	0.3	19%
Minor maintenance	357	0.1	5%
Administration	50	0.0	1%
Total	6712	2	100%

The replacement of the submersible pump and motor is considered capital maintenance expenditure – as it is major cost that in theory should occur infrequently – and constitutes a third of the annual expenditure of the small town board over this period. This expense was covered out of the WSMT operational account and, as the financial reserves of the system are limited, it is likely to have impacted on the ability of the WSMT to fund necessary repair and preventative maintenance - evidenced by the identified problems with water treatment, non-functioning standpipes and a broken bulk meter – which in turn may lead to further premature breakdowns and deteriorating performance.

TABLE 44: CAPITAL MAINTENANCE EXPENDITURE FOR AVE DAKPA (2012)

Activities	Expenditure/GHC	Expenditure per person/ GHC	Expenditure per person/ per year/GHC
2 X electrical motors	3,100	0.8	0.2
1 X electrical pump	750	0.2	0.0
Workmanship	350	0.1	0.0
Total	4,200	1.1	0.3

Over this period, the total income exceeds expenditure, meaning the remaining cash in hand of the operational account is 6,553 GHC. The system however is not achieving the performance of its design specifications either in terms of water quality or functioning water points. This combined with the growing population of the town means that residents may find that water points become increasingly crowded and, considering the low yielding source, the system as a whole may not be able to meet demand and users are likely to access alternative informal water sources or purchase bottled water. In the current situation the falling technical performance of the water system is not exclusively related to a lack of financial resources but more to do with weak technical and managerial capacity. In the short and medium term the WSMT would benefit from more technical backstopping from the regional CWSA office to arrest falling performance and a preferred option would be for delegated management contract.

The WSMT is not depreciating the critical assets of the system, or assessing their condition and performance. It is therefore likely that in the longer term, when more assets start failing a financial shortfall will occur. Preventative maintenance is not taking place on key mechanical assets – and the daily maintenance of assets is not systematic.

Salaga small town system

The water system in Salaga, the district capital of East Gonja, has been almost completely broken down for around 6 months and is awaiting rehabilitation by the World Bank. No financial or technical records of the system were made available, and there is little evidence that these records are maintained. The only information on the system is from interviews with the system manager and operators and from a site visit to the pumping station and treatment plan. The running down of the Salaga system was described by one worker as a complete failure of "management, maintenance, accounting and oversight".

The source of the Salaga system is a surface water reservoir, pumping to a rapid sand filtration treatment plant. The treatment plan is in a complete state of disrepair. The settling and sand filtration tanks were very dirty and in need of backwashing – chemicals for flocculation were also required. One of the pumps from the treatment plant was not working and the remaining pump only operated intermittently, meaning that almost all the water points in Salaga town did not function. The occasional repairs at the pumping station that had happened in the previous year had been funded by the district assembly and not from the WSMT revenues.

Once rehabilitation has been completed, critical issues around the operations and financial management of the system will need to be addressed to prevent the new system from following a failing in a similar fashion.

10.4 Annex E: Small town unit costs estimates

These figures are derived from a project report for Bankamba small town system built in Kpandai district. The system was built in 2005 but the cost figures have been brought to current costs 2011

Description	Numb er of	Lifes pan	Cost per item/	Capital costs/	Percentage estimate	OpEx per year/ GHC	CapManE x per year	OpEx per person year/	CapManEx per person, per

	items		GHC (2011)	GHC 2011	for OpEx	(2011)	(GHC)	GHC (2011)	year (GHC)
Drilling +works	2	40	50,585	101,170	0%		2,529	0.0	0.7
Submersible pump and hydraulic equipment	2	10	16,424	32,849	3%	985	3,284.86	0.3	0.9
Electrical equipqment	2	10	13,698	27,395	2%	411	2,739	0.1	0.7
Storage tank (100m 3)	1	30	144,853	144,853	1%	1,449	4,828	0.4	1.3
Solar generator	1	15	195,921	195,921	1%	1,959	13,061	0.5	3.6
Standpipes	6	15	1,597	9,581	2%	192	638	0.1	0.2
Distribution pipes (75mm)	906	15	31	27,901	1%	140	1,860	0.0	0.5
Contingency (10%)		10	58,634	58,634			5,863	0.0	1.6
Staff Costs						3,739		1.0	0.0
Total						8,874	34,806	2.4	9.5
< 10 year assets									1.6

10.5 Annex F: Hand-pump spare parts

Two sources were used to generate the spare parts list. 1) IRC-CWSA (2013) "Assessment of the current situation of handpump spare parts, area mechanic services and the use of mobile phone technology for repair services (Draft Report)" provided a list of price list of fast moving spare part costs for 2012. This was augmented with a 2007 spare parts list sourced from a spare parts dealer. Comparison with the IRC-CWSA (2013) cost list showed an increase of 42% for all spare parts between 2007 and 2012. This same 42% increase had then been applied to the all spare items not included in the original list.

All items shaded in the grey in the tables below are taken from IRC-CWSA (2013)

TABLE 45: SPARE PART COSTS NIRA HANDPUMP

Component	Unit cost/GHC
Handle with the Pipe	337.51
Handle Pipe	103.72
Sleeve Bearing	115.93
Socket Head Hexagonal screw	9.66
Spring Cutter	8.66
Plunger Body	26.22
Piston Seal (Green)	61.01
Rod Plug	18.63

Pump Rod	115.91
Plunger Nipple	54.91
Plunger Ring	58.65
Cylinder pipe	113.94
Bottom valve body	103.58
Plunger bottom valve (black)	13.05
Standing plate	232.25
Base plate	264.29
Cylinder pipe (D50)	113.94
Handle nipple	85.28
Rod nipple	45.15
Rising main (3m)	147.09
Pump rod (3m)	128.45
Riser coupling	37.44
Muffler for pipe	46.52
Muffler for rod	62.48
Pump stand	440.48
Plunger bottom valve (blue)	50.16
Gasket	45.15
Cylinder foot coupling	60.20
Nut	7.13

TABLE 46: SPARE PART COSTS AFRIDEV HANDPUMP

Component	Unit cost/GHC
Fulcrum Pin	21.18
Rod Hanger Pin	17.87
Handle Plastic Bearings Inner /Outer	5.3
Stand Bolt M 12 x 40	0.53
Stand Nut M 12	0.33
Washer dia. 12 mm	0.33
Rubber Rising Main Centraliser	2.98
Rubber Pump Rod Centralisers	1.32
Flapper	1.66
Plunger U-seal	0.99

Bobbin Valve	1.66
Plunger Foot valve	8.94
Foot Valve Receiver O-Ring	0.33
Double Coupler	10
Complete cylinder with Brass liner	112.91
suction pipe	25.04
Rope (per meter)	0.81
Sovent cement	5.99
Cleaning fluid carbon	3.26
Tetra Chloride	2.18
Top sleeve	2.18
Foldable spanner	15.23
Fishing tool	31.30
Pump head assembly	93.03
Handle assembly	133.18
T-Bar	61.27
Rod hanger with pump rod	37.55
Rising main (3 meters)	32.66
Top pump rods (hook and eye)	74.39
Pump rods hook and eye (ss)	78.77
Hook connector (SS)	14.69
Plunger rod hook and eye (ss)	40.83
Stand assembly	133.18
Steel cone	37.55
Rubber cone	8.98

TABLE 47: SPARE PART COSTS GHANA MODIFIED INDIA MARK II

Component	Unit cost/GHC
Chain with coupling	13.9
Hexagonal Bolt M 12 x 40mm	0.53
Hexagonal Nut M12	0.2
Washers dia. 12mm	0.33
Acetal Rod Centraliser	7.61

Hexagonal Coupling M12	18.54
Lock Nut M12	4.63
Acetal Rod Spacer	4.63
Nitrile rubber bucket 2.5" old	1.39
Nitrile rubber bucket 2.5" new	2.71
Nitrile rubber bucket 2"	1.32
Plunger Assembly 2.5" (New)	55.61
Plunger Assembly 2" (New)	47.66
Bobin Piston Valve 2"	1.66
Check Valve guide 2.5"	11.92
Check Valve guide 2"	11.92
Brass Cylinder 2" Barrel	126.69
Brass Cylinder 2.5" Barrel	161.98
Rubber pump stabiliser	11.97
Vasleine (0.8KG)	15.23
Foot valve (complete) 2.5	30.78
Foot valve (complete) 2.5	21.66
Coversion head	151.08
Handle assembly	99.39
Riser pipe (s42)	172.54
0-ring	1.91
Upper adaptor (male)	37.55
Upper adaptor (female)	37.55
Stand	133.18
Flange gasket	20.14
Water tank	96.27
Riser pipe holdr with FL	49.88
Tools - Pipe vice	441.85
Tools - Pipe lifter	111.32
Tools - Pope wrench	78.77

10.6 Annex G: System unit costs

At CWSA head office a number of documents were mined for cost information – the results of these are shown below.

TABLE 48: BILL OF QUANTITIES FOR A 60 METER BOREHOLE

Activity	Unit	Quantity	Unit Cost	Total Cost/GHC	Total Cost/US $
Mobilisation and demobilization					
Mobilisation per borehole	l/s	1	140	140	$69
De-mobilisation per borehole	l/s	1	140	140	$69
Mounting and dismounting	BH	1	300	300	$147
				Movement	
Movement between worksites (8 out of 10 districts)+A34	km	30	50	1,500	$735
Movement between worksites (Northern region and Brong Affo region only)	km	20	100	2,000	$980
Borehole drilling for diameter 125 mm (includes application of appropriate tech. Air drilling, mud drilling, reverse circulation drilling etc...)					
Drilling through overburden and highly weathered rock	m	20	42	840	$412
Drilling through partially weathered to fresh crystalline consolidated, unconsolidated type of rock	m	40	55	2,200	$1,078
Borehole construction (installation of screen, pvc pipes and screens.					
Supply and install pvc plain pipes and centralisers with a finished diameter of 125mm	m	45	30	1,350	$662
Supply and install pvc slotted pipes (screens) and centralisers with a finished diameter of 125mm	m	16	40	640	$314
Supply gravel pack (2-4mm)	m	25	10	250	$123
Supply cement mix and grout seal above gravel	m	1	20	20	$10
Backfill space above grout	m	29	10	290	$142
Supply cement mix above grout	m	4	20	80	$39
Borehole development (including egg. airlifting, mechanical surging, jetting, backwash over pumping)	hrs	3	100	300	$147
Pumping test (constant rate of discharge and pumping test)					
Supply, install and remove pump test equipment	l/s	1	300	300	$147
Conduct minimum six hours pumping test	hrs	6	45	270	$132
Conduct 90% recovery test on HPs	hrs	3	35	105	$51
Water quality test					
Take and store a WQ sample	l/s	1	40	40	$20
Physical/chemical analysis	l/s	1	250	250	$123
bacteriological analysis	l/s	1	350	350	$172
Marginal and unsuccessful BHs (marginal = less than 10m	l/s	1	105	105	$51

per minute)					
Borehole capping and/Bail plug	l/s	1	30	30	$15
Borehole concrete pad	l/s	1	1,000	1,000	$490
Total (8 out of 10 districts)				10,500	$5,145
Total (Northern region and Brong Affo region only)				11,000	$5,390

TABLE 49: HARDWARE UNIT COSTS FROM THE STRATEGIC INVESTMENT PLAN (2008 - 2015)

Hardware Unit costs		Value original year (2008)/US $	Current cost value (2011)/US$	Current cost per person (2011)
Boreholes	Number constructed	1,632	1,632	
	Total Cost	$10,608,000	$17,291,040	
	Unit cost	$6,500	$10,595	$35
Hand dug well	Number constructed	1,493	1,493	
	Total Cost	$4,479,000	$7,300,770	
	Unit cost	$3,000	$4,890	$16
Piped system (rural)	Number constructed	173	173	
	Total Cost	$31,238,610	$50,918,934	
	Unit cost	$180,570	$294,329	$294
Piped system (small Town)	Number constructed	35	35	
	Total Cost	$12,766,250	$20,808,988	
	Unit cost	$364,750	$594,543	$36

TABLE 50: SOFTWARE UNIT COSTS FROM THE STRATEGIC INVESTMENT PLAN (2008 - 2015)

Software Unit costs		Value original year (2008)/US $	Current cost per person (2011)
WSMT for small communities	Number constructed	3140	3140
	Total Cost	$1,884,000	$3,070,920
	Unit cost	$600	$978
District WatSan Team	Number constructed	33	33
	Total Cost	$16,500	$26,895
	Unit cost	$500	$815

Small town Consultancy	Number constructed	66	66
	Total Cost	$240,000	$391,200
	Unit cost	$3,636	$5,927

TABLE 51:UNIT COSTS FOR 2010 INVESTMENT FOR CHINESE CONSTRUCTION PROJECT

Hardware Unit costs		Value original year (2010)/US $	Current cost value (2011)/US$	Current cost per person (2011)
Boreholes	Number constructed	5,000	5,000	
	Total Cost	$42,500,000	$49,300,000	
	Unit cost	$8,500	$9,860	$33
Small town piped system	Number constructed	120	120	
	Total Cost	$120,000,000	$139,200,000	
	Unit cost	$1,000,000	$1,160,000	$116
Small communities piped scheme	Number constructed	100	100	
	Total Cost	$65,000,000	$75,400,000	
	Unit cost	$650,000	$754,000	$151
Limited mechanised scheme	Number constructed	200	200	
	Total Cost	$10,000,000	$11,600,000	
	Unit cost	$50,000	$58,000	$29