AN ASSESSMENT OF RURAL WATER SUPPLY SUSTAINABILITY IN MONZE DISTRICT, ZAMBIA

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A dissertation submitted to the University of Bristol in accordance with the requirements of the degree of 'Master of Science' by advanced study in 'Water & Environmental Management' in the Faculty of Engineering.

Graduate School of Engineering January 2012 11,987 words

Abstract

This study was commissioned by WaterAid in Zambia to investigate the functionality of water points installed with its support in Monze District and to better understand how more effective programmes could be designed in future. The research was initiated partly in response to estimates published by the Rural Water Supply Network (RWSN) stating that between 20% and 70% of handpumps in sub-Saharan Africa do not work at any one time. The RWSN cite several factors for the high failure rate, which can be broadly framed into components of social, financial, technological, institutional and environmental.

Using a case study approach to explore the status of sampled water points, semi-structured interviews were held with 20 communities to investigate components of sustainability. Qualitative responses were assessed in relation to key variables and four point rating schemes were developed to aid the analysis of trends and challenges.

Key findings are that whilst water point committees were established to manage installed water points, the substantial majority were no longer fulfilling all their roles and responsibilities; consequently, communities were frequently not collecting or managing sufficient funds to pay for repairs and maintenance; without sufficient funds, spare parts could not be purchased. A conceptual framework illustrates how components of sustainability inter-relate.

Reconsidering options to professionalise the management of water points are encouraged together with the development of lifecycle cost analysis to inform financing arrangements, which could contribute to designing more effective and sustainable programmes in future.

Acknowledgements

Completing this study formed a significant focus of my six month secondment to the WaterAid Zambia team between August 2009 and February 2010. The secondment was made possible by Jerry Adams (Head of Programme Effectiveness Unit), John Kandulu (Head of Southern Africa Region), Mahesh Mishra (Country Representative – Zambia), and Girish Menon (Director of International Programmes), and I thank them all for providing me with the opportunity. Thanks also to Richard Carter (Head of Technical Support) whose knowledge of water supply sustainability helped to guide this study.

Special thanks go to Mr Chijikwa from Department of Health in Monze who provided invaluable knowledge of the area and translation services throughout all village meetings. Thanks to Mundia Matongo from WaterAid's Lusaka office for his support and contributions throughout. Thanks also to Febby Busiku and Layford Jere from WaterAid's Monze office for providing background information and patience in answering my many questions.

Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Taught Postgraduate Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, this work is my own work. Work done in collaboration with, or with the assistance of others, is indicated as such. I have identified all material in this dissertation which is not my own work through appropriate referencing and acknowledgement.

Any views expressed in the dissertation are those of the author and in no way represent those of the University of Bristol.

The dissertation has not been presented to any other University for examination either in the United Kingdom or overseas.

SIGNED: DATE:

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Abbreviations

APM	Area Pump Minder
CSO	Central Statistical Office
DAPP	Development Aid from People to People
DFID	Department For International Development
GRZ	Government of the Republic of Zambia
JMP	Joint Monitoring Programme
MDG	Millennium Development Goal
NGO	Non-Governmental Organisation
NRWSSP	National Rural Water Supply and Sanitation Programme
RWSN	Rural Water Supply Network
SOMAP	Sustainable Operation and Maintenance Programme
WPC	Water Point Committee
ZMK	Zambian Kwacha

Currency

Indicative exchange rates as at December 2011

1 Pound Sterling (GBP) = Zambian Kwacha (ZMK) 7,991

1 US dollar (USD) = Zambian Kwacha (ZMK) 5,155

1. Introduction

The Joint Monitoring Programme (JMP) is the official United Nations body responsible for monitoring progress towards Millennium Development Goal (MDG) 7, target 7c. This target aims to “halve, by 2015, the proportion of people without sustainable access to safe drinking-water and basic sanitation” (JMP, 2011).

A lack of access to a sufficient quantity of water prevents people from keeping themselves and their environment clean. A systematic review of the effect of washing hands with soap found that it could reduce diarrhoea by 45% (Curtis and Cairncross, 2003). Globally, diarrhoea is the second biggest killer of children (Ross and Cumming, 2009). Other benefits associated with improved access to water include a reduction in time spent collecting and carrying water, improved school attendance, enhanced food production, and positive changes to livelihoods (WaterAid, 2011).

Using data from 2008, the latest estimates from the JMP indicate that 884 million people do not have access to an improved water source. At the current rate of progress, it is anticipated that the MDG target for access to improved water will be met. However, the worldwide average obscures notable regional variations; sub-Saharan Africa is not on track to achieve its region-wide target of 75% of the population having access to improved water. The latest estimates from the JMP indicate access to improved water in sub-Saharan Africa is 60% (JMP regional snapshot, 2010).

1.1 Challenge of sustainability

The concept of community managed water supplies grew from the first International Drinking Water Supply and Sanitation Decade of the 1980s. During the decade, water points were installed, but governments lacked the human capacity and financial resource to manage and maintain them. The solution was to encourage community ownership of water points, including their long-term maintenance (Schouten, 2006).

Whilst organisations have defined community management with different degrees of participation and involvement of community members, some areas of consistency exist. The most important element identified by Schouten (2006) was a water committee to manage the water point, as well as contribute funds to pay for its maintenance and repair.

However, data published by the Rural Water Supply Network (RWSN) challenges the success of the community management model. The RWSN estimate that between 20% and 70% of handpumps in sub-Saharan Africa do not work at any one time (Harvey, 2007). Furthermore, the RWSN identify several reasons for the high failure rate, including *inappropriate technology; poor construction; lack of community involvement and subsequent sense of ownership; poor community organisation or cohesion; lack of follow-up support and/or training; the unavailability or high cost of spare parts, energy, and professional support services* (RWSN, 2010).

The failure of water points to provide lasting access to improved water is a waste of financial and human resources. Repeated rehabilitation competes for limited resources with the need to provide improved access for people who do not have it. Un-sustained water points deprive people of intended health and livelihood benefits, and jeopardises the potential for achieving the MDG target for (and ultimately universal access to) improved water.

1.2 Purpose of this study

In response to the challenge of sustainability, WaterAid in Zambia commissioned this study to investigate the functionality of water points installed with its support and to better understand how more effective programmes could be developed. For the purpose of this study, functionality refers to whether water points worked at the time of our field visits.

Zambia is a large landlocked nation in southern Africa, where the JMP estimate access to improved water is 60% (JMP regional snapshot, 2010). Zambia's MDG target for safe drinking water is 75%; the country is not on-track to meet this (JMP, 2011). Data published by the RWSN estimates that 32% of handpumps in Zambia are not working (Harvey, 2007).

WaterAid has worked in Zambia since 1994 following a severe drought in the country (WaterAid, 2009). Initially based in Monze district, WaterAid worked with partners to install protected hand-dug wells fitted with windlasses (WaterAid, 2008, p 11), and boreholes fitted with India Mark 2 handpumps (WaterAid, 2008, p15; Harvey and Skinner, 2002). Between 1994-5 and 2003-04, WaterAid primarily installed protected dug wells, but from 2004-05 more boreholes were installed, partly in response to working in locations with less favourable hydrogeology for hand dug wells.

Between 1994-95 and 2007-08, WaterAid installed 285 water points in 379 communities in Monze district; table 1 presents the total number installed each year. Details of water projects in 2000-01 and sanitation projects in 2004-05 and 2005-06 were missing from the dataset.

WaterAid has supported limited long-term monitoring of installed water points and there is a lack of data concerning how many water points are still in use.

	Year of Installation														Total
	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	
Water	2	9	20	17	23	5	0	16	24	24	9	27	63	46	**285**
Sanitation	1	10	13	21	19	24	18	17	14	38	27		122	130	**454**
Total	**3**	**19**	**33**	**38**	**42**	**29**	**18**	**33**	**38**	**62**	**9**	**54**	**185**	**176**	**739**

Table 1: The Number of Water and Sanitation Interventions Supported by WaterAid Zambia between 1994/95 and 2007/08

This study was initiated in August 2009, with field-work taking place between August and November. The four objectives for the study were:

1. To establish what percentage of a sample of water points were still working.
2. To identify factors that influenced whether water points continued to be used.
3. To develop a conceptual framework illustrating how the identified factors linked together.
4. To make recommendations for improving rates of long-term functionality.

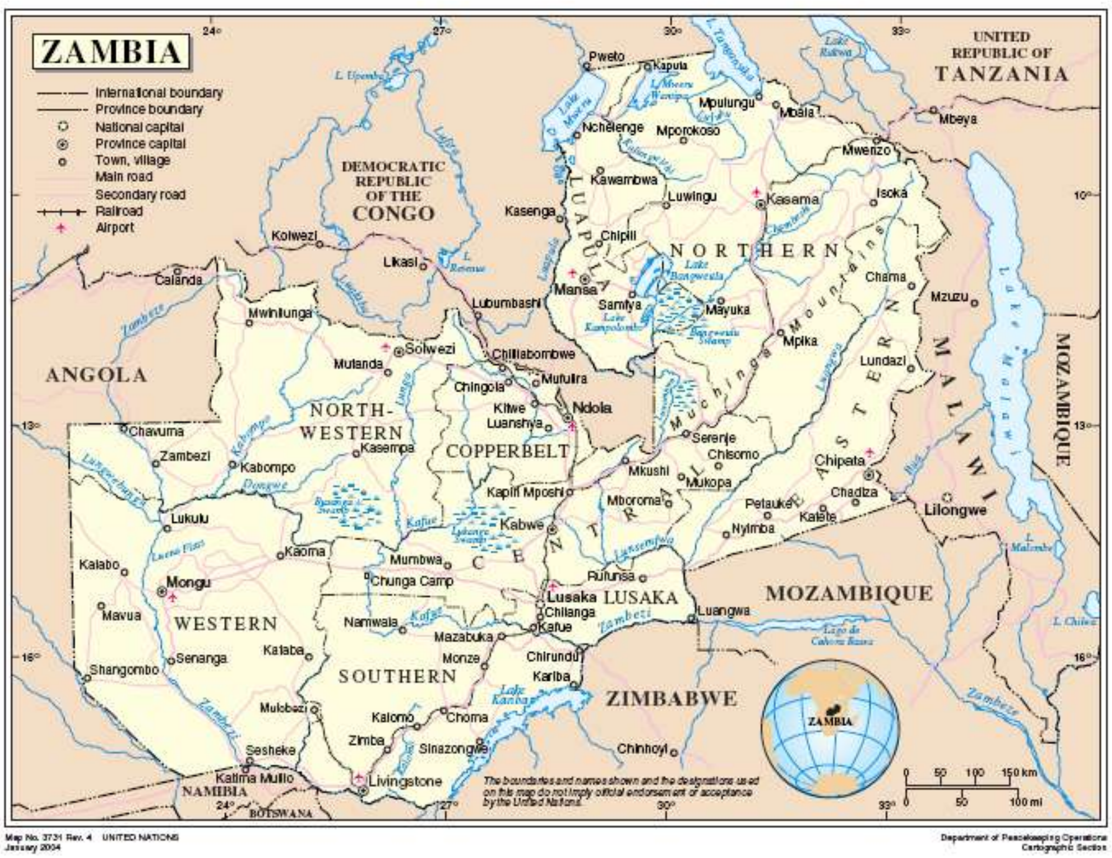

Figure 1: Map of Zambia (source: **http://www.uncdf.org/newimages/countries/map_zambia.jpg**)

2. Literature review

Abrams (1998) defined sustainability as whether or not a water point continues to work over time. He stated that if water continues to flow then all the elements required for sustainability must be in place. Those elements were identified as:

- Money for recurring expenses and the occasional repair,
- Acceptance from consumers of the service,
- An adequate source supplying the service,
- The service must have been properly designed,
- Sound construction quality.

Abrams categorised these elements into social, financial, technical, institutional and environmental factors; and described each factor as being necessary for sustainability, but noted none would be sufficient in itself.

A review of definitions of sustainability by Parry-Jones et al (2001) identified the same five categories outlined by Abrams. The review also noted the importance of community participation and coherent government policies, but recognised there was 'no definitive way to subdivide the concept' of sustainability. Spare parts supply chains and maintenance systems (Harvey and Reed, 2003) as well as mechanisms for ongoing monitoring (Harvey and Reed, 2004) have also been identified as factors required for sustainability to be achieved.

2.1 Social

Key components of the 'social' category identified by Abrams (1998) and Parry-Jones et al (2001) are the principles of community participation and community management. Gine and Perez-Foguet (2008) conclude that community participation has gained widespread acceptance as a prerequisite for sustainability; but community management has not.

Under community management, a committee of community members is given responsibility for managing the water supply (Harvey and Reed, 2006a). The community management model is the most widely adopted approach to managing rural water supplies in Africa (Harvey and Reed, 2004). However, as identified by Carter (2009), communities are not always motivated to manage water points effectively. Consequently, many communities experience a gradual decline of the service prior to a major breakdown, which is resolved only through an external rehabilitation programme (RWSN, 2009).

Sara and Katz (1997) found the sustainability of water supplies was improved by the existence of a community management committee. However, Colin (1999) found that in many projects, the community management model was built on the premise that it would succeed, without necessarily investigating the risks and constraints associated with it. With an estimated 30% of handpumps not working in Africa, Harvey (2009) argues there is evidence that only limited success has been achieved through the approach.

2.2 Financial

The ‘financial’ sub-category of sustainability includes issues of community financing and the cost of operation, maintenance and repairs (Harvey and Reed, 2004). Whittington et al (2008) identified that a substantial minority of rural communities in Boliva, Peru and Ghana were not collecting sufficient revenues to pay operation and maintenance costs and a significant minority were not collecting revenues at all. Gine and Perez-Foguet (2008) also noted the failure of community revenues to generate sufficient funds for required repairs, informing their view that communities should chose technologies and set tariffs that are affordable and commensurate with their economic status. Baumann (2006) stated the inability of communities to collect sufficient revenue for repairs could reduce the life expectancy of installed water supplies.

While securing finance for operation and maintenance is a major part of the maintenance task, Kleemeier (2000) states that community members are usually reluctant to pay when everything appears to be working. Manyena et al (2008) found the majority of communities willing to pay, but that not all had the ability to pay the real cost of repair and maintenance work. With highly seasonal cash flows and little spare cash existing in rural communities, Whittington et al (2008) observe that communities are not moving towards a financially sustainable future.

The need for realistic and transparent financing mechanisms where contributions are well managed and invested in maintenance and repair was emphasised by Gine and Perez-Foguet (2008). Nedjoh et al (2003) argue that a lack of knowledge regarding maintenance costs, inadequate tariffs and high rates of defaulting combined with ineffective collections and poor financial management undermines the ability of communities to establish such financing mechanisms.

However, Wood (1994) stated that for some rural communities, handpumps may represent an unaffordable technology and suggested more austere rope and buckets as a lower-cost alternative.

2.3 Technical

Components of the ‘technical’ category include technology choice and community acceptance, construction quality and spare parts. As part of a demand-driven approach to enhance community ownership of installed water services, Whittington et al (2008) identified the need to involve households in the choice of technology thus ensuring engineering designs were responsive to local needs. A global study by Katz and Sara (1997) found that sustainability was higher in communities where informed choices about technology type and level of service were made.

Katz and Sara also found that construction quality had a major impact on sustainability; poor quality lowered the chances that systems would be sustained.

When breakdowns occur, access to a supply of spare parts is essential for repairs to be made. Harvey and Reed (2006b) state that there are very few examples of sustainable supply chains in Africa, and that many water supply projects continue to replicate ineffective approaches to supply chain development (Harvey, 2009). Harvey and Reed (2006b) highlight the single biggest barrier to sustainable supply chains run by the small scale private sector is a lack of profit.

2.4 Institutional

The 'institutional' category of sustainability relates to external support being available to communities from NGOs, national and local government institutions, as well as the private sector (Harvey and Reed, 2004). Carter et al (1999) state that community enthusiasm for maintaining facilities wanes within two or three years after installation, hence the need for on-going support that enables community institutions to overcome the challenges of managing water points (Carter, 2009).

In recognising that communities cannot autonomously manage services Gine and Perez-Foguet (2008) call for appropriate institutional support where governments don't neglect their responsibilities and trained technicians encourage and motivate communities, as well as monitor service performance. Support activities identified by Whittington et al (2008) included assistance with maintenance and repairs, accounting and tariffs, technical training, free repairs, manuals and other materials, as well as access to spare parts. Whittington et al (2008) found no evidence that free repairs or technical assistance were positively associated with sustainability; the most promising support activities identified were those relating to administrative management and system operation.
A study of rural water supplies in Zimbabwe by Manyena et al (2008) identified the centrality of pump minders to the maintenance system. Pump minders held

responsibility for carrying out regular maintenance and repair work and received allowances from the local government. However, pump minders did not have transport, spare parts, or enough tools to carry out operation and maintenance of handpumps, which consequently limited their ability to provide on-going support.

2.5 Environmental

An important 'environmental' consideration identified by Abrams (1998) was the adequacy of the water resource. Abrams stated the same quantity and quality of water should be reliably available, regardless of the length of time since its commission. While an assessment of water resources was outside the scope of this study, the reliability of water sources was incorporated.

An assessment of borehole reliability by Harvey (2004) demonstrated the importance of drilling wells at specific times of the year; well depth in relation to dynamic water level; and the depth of the pump cylinder below the dynamic water level when installing reliable boreholes.

Water supply schemes implemented to improve access for domestic consumption may not give sufficient consideration to other uses of water within rural communities (RWSN, 2009). Butterworth and Smout (2005) state that non-domestic small-scale productive uses of water should receive greater attention when community projects are designed.

2.6 Links between categories

Subdividing sustainability into different categories illustrates the broadness and complexity of the issue, but fails to demonstrate the interdependencies that may take place between them.

Carter et al (1999) developed the conceptual framework in Figure 2, which shows how the components of sustainability relate and interlink; a weakness in any one element in the chain could jeopardize service sustainability. While relationships between components of sustainability are illustrated by the framework, not all appear connected. It is not clear whether changes to 'continuing support' would directly affect 'motivation' or whether any adjustment to 'motivation' would materialise as a consequence of knock-on effects brought on by alternations in 'cost recovery' and 'maintenance'. The nature of a chain implies that all components are connected and dependent upon one-another, however the two ends of the sustainability chain are not attached.

A chain is only as strong as its weakest link. Whilst the sustainability chain does not identify one component as being more significant than the rest, Carter et al (1999) do make particular reference to the importance of community participation and continuing support for achieving permanent water and sanitation services.

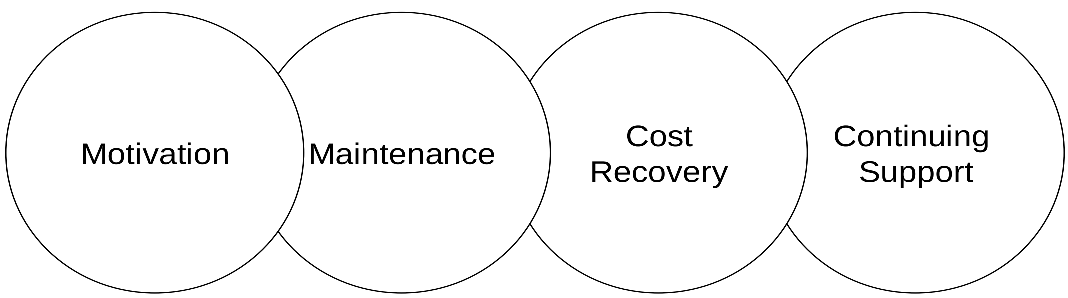

Figure 2: The sustainability chain, Carter et al, 1999

2.7 Summary

Literature reviewed for this study suggests the construction of a water point is merely one part of ensuring water supplies provide sustainable improvements in access. The reviewed literature included research from countries in sub-Saharan Africa, South America, and Asia. Drawing evidence from that literature and using the framework of social, financial, institutional, technological and environmental, the issues affecting sustainability could be summarised as:

- **Social:** Is the community management model effective?
- **Financial:** Are communities able to collect and manage contributions that cover the cost of repair and maintenance work?
- **Technical:** Have good quality water points been constructed? Are spare parts available, accessible and affordable?
- **Institutional:** What on-going (technical and managerial) support is provided to communities?
- **Environmental:** Does the water point provide a reliable supply of water?

The existing literature lacks a systematic application of lessons and evidence from previous studies to understand their significance and inter-connectedness. This study addresses that deficiency. Through a multiple case study approach, this research explored the issues identified above with a sample of communities supported by WaterAid in Monze District, Zambia.

3. Methodology

This research used a multiple case study approach to explore the significance of different components of sustainability on a sample of water points. Feagin, Orum and Sjoberg (1991) state that the case study approach is an ideal methodology when a holistic, in-depth investigation is needed. A frequent criticism of case study methodology is that its dependence on a single case renders it incapable of providing a generalising conclusion. However, Tellis (1997) argues that criticism is directed at the statistical and not the analytical generalisation that is the basis of case studies. Proponents of case study research also highlight that in explorative research, case studies offer the advantage of open ended questions and probing to elicit responses rather than forcing a choice from fixed responses (Mack et al, 2005).

3.1 Sampling constraints

It is important to understand the strengths and limitations of findings presented in this study. A 'gold standard' methodology would consist of a statistically representative, randomised sample from the total number of water points installed each year by WaterAid and other implementing organisations. An assessment of water point use and analysis of influential factors could then be confidently conducted to ascertain their significance. Furthermore, the significance of differences in approach adopted by different implementing organisations could be assessed.

Insufficient time and resources were available to identify, locate and assess all water points installed in Monze district and understand the different approaches used by other implementing organisations. WaterAid's project inventory contained information relating to only those water points installed with its support.

In addition, WaterAid wanted to use the same sample of communities as the basis for two independent studies; this study explored the sustainability of installed water points, a second study investigated the sustained use of sanitation facilities. WaterAid do not always support improvements to both water and sanitation in all communities. Therefore only those communities where both water and sanitation had been supported could be included.

To give a greater focus to communities with more experience of managing water points, we decided not to include water points installed during or after 2006-07.

These criteria reduced the pool of potential communities to 43, where a total of 61 water points had been installed. Table 2 disaggregates the potential pool by year, indicates the statistically representative sample size and the sample selected from WaterAid's inventory. Appendix 4 sets out how the statistically representative sample size was calculated. A purposive sample was made by selecting approximately 50% of the water points supported in any given year.

	Year of Installation											**Total**
	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	
Total water points installed	5	6	5	6	3	0	6	9	7	7	7	**61**
Statistical representation	5	6	5	6	3	0	6	9	7	7	7	**61**
Purposive sample	2	2	2	4	3	0	3	4	6	5	3	**34**

Table 2: The total population of installed water points, the statistically representative sample size and the purposive sample selected for this study

3.2 Data collection

The use of semi-structured in-depth interviews with relevant focus groups is a recognised and valid approach for conducting research through case studies in order to explore and describe relationships (Mack et al, 2005). Quoting Yin (1984 and 1994), Tellis (1997) highlighted the importance of developing a protocol for conducting research to enhance reliability and validity.

As part of the protocol, two visits were made to each selected community. The first introduced the study and the team to community members, while also agreeing a date for the second visit with the village headman. This initial visit also provided an opportunity to validate information in WaterAid's inventory.

The second visit comprised in-depth, semi-structured interviews with users of the water point, members of the Water Point Committee (WPC), and the village headman. Discussions allowed us to understand the history of installed water points and the community's experience of using and managing it. Appendix 3 contains key questions covered in each meeting. Key questions provided a framework around which discussions were based, with supplementary questions used to explore responses and elicit greater detail. Visits to water points were made, photographs taken and GPS references noted. Appendix 1 and 2 present an assessment of installed water points and a brief overview of each community.

The research team comprised three people; two WaterAid staff and a representative from the Department of Health, who used to be WaterAid's partner in Monze District. Mr Chijikwa from the Department of Health, provided extensive local knowledge and translations during community discussions.

Every effort was made to ensure communities understood the purpose of this research was to learn from their experience of managing their water point. However, communities associate WaterAid with the provision of water and there may have been instances where groups were economical with the truth. It was noted that when asking questions, communities invariably requested financial assistance, or more water points.

3.3 Problems with the data

WaterAid's inventory did not always match the actual situation reported by communities. More discrepancies were discovered in recent years, suggesting the inventory has not been kept up to date. Consequently, sampled communities had significantly more recently installed water points than expected, including some installed in 2006-07 and 2007-08 that were not in the inventory. Inclusion of these water points meant interesting findings were made regarding the speed of deterioration.

WaterAid's inventory contained no data for 2000-01, but in one sampled community a windlass had been installed that year. Three communities were unable to recall having worked with WaterAid, thus alternatives had to be found.

WaterAid's inventory did not contain any data relating to water points installed by other organisations. Meetings with sampled communities found that eight boreholes fitted with India Mark 2 handpumps and three rope pumps installed on protected dug wells had been installed by other organisations[1].

Table 3 illustrates the disparities between data contained in WaterAid's inventory and data collected through community meetings. Table 4 presents a disaggregation of water point type, year of installation and implementing agency.

	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	**Total**
Inventory data	0	2	2	2	4	3	0	3	4	6	5	3	0	0	**34**
Community data	1	4	1	3	4	3	1	1	7	1	5	13	1	1	**46**

Table 3: Disparities between data in WaterAid's inventory and data reported by sampled communities

[1] The Department for Water Affairs, Development Aid from People to People (DAPP) and another unknown agency had supported this work.

		94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	**Total**
Water Aid	Wind-lass		2	1	3	3	2	1	1	1	1	1	4			**20**
	Rope pump															**0**
	Hand pump									2		4	7	1	1	**15**
Other agen-cies	Wind-lass															**0**
	Rope pump									1			2			**3**
	Hand pump	1	2			1	1			3						**8**
Total		**1**	**4**	**1**	**3**	**4**	**3**	**1**	**1**	**7**	**1**	**5**	**13**	**1**	**1**	**46**

Table 4: Implementing agency, water point type and year of installation for sampled communities

3.4 Data analysis

In the 20 sampled communities, 46 water points had been installed, of which 35 were done with WaterAid support. In total, 20 windlasses had been installed, however WaterAid had replaced one with a handpump and another agency[2] replaced three with rope pumps. Subsequently two communities discarded the rope pumps and restored their windlass facilities. The replacement of two windlasses with alternative devices meant that 44 water points were assessed in this study.

In defining a methodology for participatory assessments of water supply services, Dayal et al (2000) and Sugden (2001) both propose approaches to scoring key variables of sustainability. To identify trends and challenges, a scoring of key variables was carried out for sampled water points. Four point rating schemes were developed to analyse key variables of sustainability. Specifically these were for: water point functionality; water point committee status; community financing mechanisms; water point reliability.

Each variable and score categories are defined below.

[2] Communities were not able to recall the name of the organisation

Water point functionality

Score		Explanation
0	Not used	No water is being abstracted.
1	Used, but defective	Access to water is unreliable or poor quality repairs (or no repair works) have been undertaken.
2	In use, but environmental deterioration	Access to water is reliable, but the protective fencing, soak away, and surrounding cement apron are not well maintained; the environment around the water point is unclean.
3	Functioning to design	The water point provides reliable access to water and is being maintained to a standard close to that of when first installed.

Water point committee status

Score		Explanation
0	No WPC	The WPC is not operating. Or the WPC is operational, but is not carrying out maintenance work or managing financial contributions.
1	Maintenance, but not financing	The WPC is operational and performing maintenance activities to the water point. However, financial contributions are not being managed.
2	Financing, but not maintenance	The WPC is operational and is managing the collection of financial contributions from community members. However, maintenance activities are not performed.
3	Both financing and maintenance	The WPC is operational and is managing the collection of financial contributions from community members as well as water point maintenance activities.

Community financing mechanisms

Score		Explanation
0	No payment	No money is being collected to pay for future repair, maintenance or rehabilitation work.
1	Contribute when a failure occurs	There is no plan for the regular collection of funds. Community members contribute (either cash or in-kind) in the event of water point failure.
2	Regular but inadequate contributions	Community members regularly contribute (either cash or in-kind) to a fund to specifically pay for future repair and maintenance work. However, the contributions are insufficient to pay for likely long-term costs.
3	Well structured financing mechanism	Well structured financing mechanisms are based on an assessment of lifecycle costs and sufficient funds are being collected to pay for likely repair and maintenance work.

Water point reliability

Score		Explanation
0	Not reliable	Fails to supply water throughout the year
1	Reliable	Year round supply of water

Assessing the scores of each sampled water point allowed comparisons to be made between water points, as well as between the variables, thus informing our understanding of their significance. Appendix 1 presents a results table following application of each rating scheme to all sampled water points. The table also includes data on water point reliability; the number of reported failures; water coverage in the community; and whether water was abstracted for cattle and / or brick making. The analysis, interpretation and discussion of these data is presented in the following chapters[3].

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[3] Since the completion of this research, WaterAid have committed to undertaking post-implementation surveys in all country programmes on an annual basis to better understand the longer-term use of installed services. The pilot phase of testing post-implementation surveys used a similar case study approach and analysis tools as defined in this chapter. Due to the confidentiality of findings from the post-implementation survey in Zambia, specific data cannot be quoted in this report.

4. Findings

The majority of water points sampled in this research do not provide reliable access to water and are not maintained to a standard close to that when they were first installed. Only 7% of water points were assessed to be functioning to design; 23% of sampled water points were not being used. The assessed functionality status of all sampled water points is presented in Table 5.

Score		Windlass		Rope Pump		Hand-pump		Total	
0	Not used	1	6%	2	67%	7	30%	**10**	**23%**
1	Used, but defective	16	89%	0	0%	8	35%	**24**	**55%**
2	In use, but environmental deterioration	0	0%	1	33%	6	26%	**7**	**16%**
3	Functioning to design	1	6%	0	0%	2	9%	**3**	**7%**
Total		**18**		**3**		**23**		**44**	

Table 5: Water point functionality status

4.1 Windlasses

The majority of communities are not maintaining windlasses. Used but defective water points either no longer had windlasses in place or did not provide a reliable source of water, or both. Rather than repair or replace damaged windlasses, communities used ropes and buckets to access water. Figure 3 shows the functionality status of windlasses by year of installation.

Only two communities had carried out repairs to windlasses. In one village, the community replaced their wooden windlass, originally installed in 2003-04, with an improved metal one, which was easier to operate; and in the other, an individual paid for repair work following the collapse of concrete lining rings.

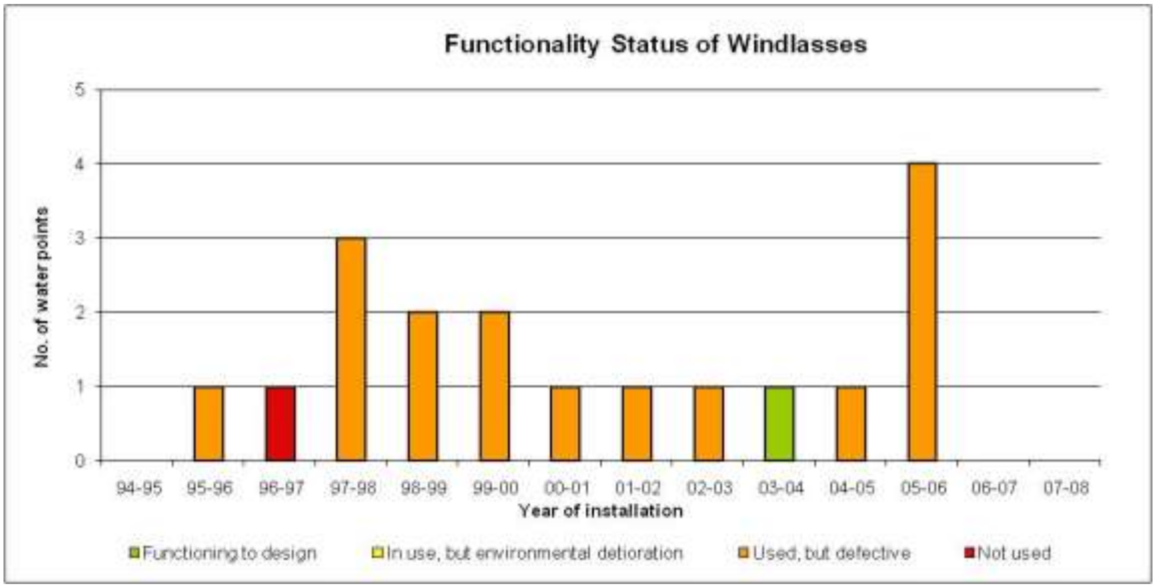


Figure 3: Functionality status of windlasses, by year of installation

4.2 Rope pumps

Two of the three installed rope pumps were used for less than a year before being removed and discarded. Communities cited continual breakdowns and poor service as reasons for abandoning the device. This finding is consistent with a study of water points by RuralNet (2008) where 32 rope pumps were surveyed and 40% were not in use. The RuralNet research concluded that the high failure rates dissuaded communities from maintaining rope pumps.

4.3 Handpumps

Figure 4 presents the functionality status of handpumps by year of installation and Table 6 provides an overview of handpump status, breakdowns and repairs.

The finding that 30% of sampled handpumps (7 of 23) were not working is similar to RWSN data estimating that 32% of handpumps in Zambia are not working. Of the seven handpumps, three were installed but never functioned[4]; three required replacement riser pipes but communities had insufficient money to pay for spare

[4] The three failed installations were attempted in 1995-96, and two in 2002-03. They were not supported by WaterAid but the implementing agency was unknown.

parts; and one handpump required a new chain but no money was available to pay for the part.

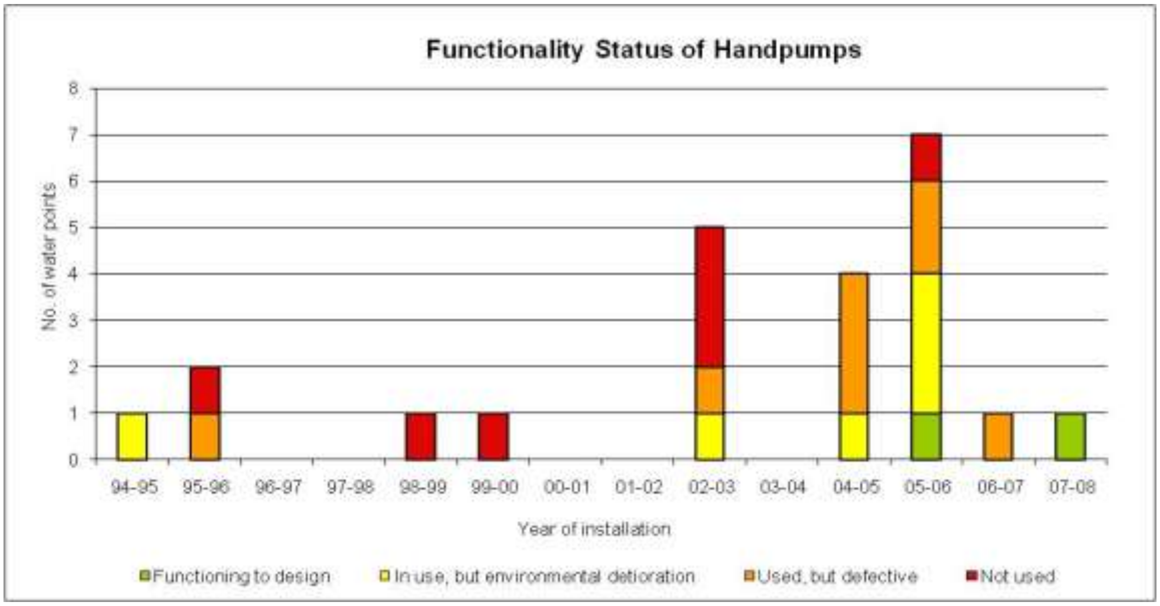


Figure 4: Functionality status of handpump, by year of installation

Findings revealed that 35% of handpumps (8 of 23) were in use, but access to water was unreliable or poor quality repairs had been undertaken. Four handpumps had experienced failures to riser pipes where the quality of repair work had affected functionality. In at least three cases (possibly all four[5]), insufficient money was available to pay for replacement pipes. Failed pipes were removed and discarded, thus raising the height of the cylinder in the borehole and thereby reducing the depth from which water could be abstracted. Damaged riser pipes had been repaired by another community by welding the affected areas; however the community stated that little further welding could be done and they had insufficient money to purchase new pipes.

Three other 'used, but defective' water points did not provide reliable access, but were yet to experience a major breakdown.

[5] Riser pipes on a handpump in Hanamoonga village failed, but it was unclear whether all damaged pipes were replaced. The pump was 22 meters above total well depth, but the water level and other information relating to the borehole was unavailable.

26% of handpumps (6 of 23) provided reliable access to water, but had signs of environmental deterioration. Three handpumps had experienced failures to riser pipes and in all cases spare parts had been provided at zero-cost to the community by another organisation[6]. The other three handpumps had yet to experience a breakdown.

Both handpumps functioning to design had yet to experience a failure.

Score	Breakdowns and Repairs
0	• 3 handpumps were installed but did not work • 3 handpumps required new pipes, but communities had insufficient money to pay for them, thus water points became unused • 1 handpump required a new chain, but the community had not raised sufficient money, thus water point became unused
1	• 4 handpumps required new pipes, but communities had not raised sufficient money to pay for them. Inadequate repairs had been performed • 4 handpumps were yet to experience a major breakdown, but were not reliable water sources
2	• 3 handpumps were yet to break down • 3 handpumps required new pipes, which were supplied at no cost to the community
3	• No reported failures for the 2 handpumps

Table 6: An overview of handpump status, breakdowns and repairs

[6] Two communities reported that the Department for Water Affairs and DAPP had supplied replacement pipes; the third community was unable to recall who provided them.

5. Discussion

A thorough discussion of components influencing sustainability of sampled water points is presented in this chapter. Handpumps will be discussed first, followed by a sub-section for windlasses and rope pumps.

5.1 Handpumps

9% of handpumps (2 of 23) were providing reliable access to water and being maintained to a standard close to that when first installed. This section discusses factors the social, financial, technical, institutional and environmental factors that influenced functionality.

5.1.1 Social

Within a few years of being established, WPCs cease to fulfil all their obligations. Communities reported that WPCs did not fulfil their roles because members did not want to meet, because there was nothing for them to do, and because over time people died, or moved away and were not replaced. This supports Carter's (2009) position that communities are not always motivated to manage water points effectively. Figure 5 presents the status of WPCs, by year of establishment.

No WPC: 35% (8 of 23)

WPCs were not operating at four non-functional handpumps. This includes three unsuccessfully installed handpumps where a WPC was never established. The other non-functional handpump had been out of service for more than a year. Failures to riser pipes had occurred on three occasions and the community had twice paid for replacement parts. After a third failure, the community were unwilling to pay for more repair work.

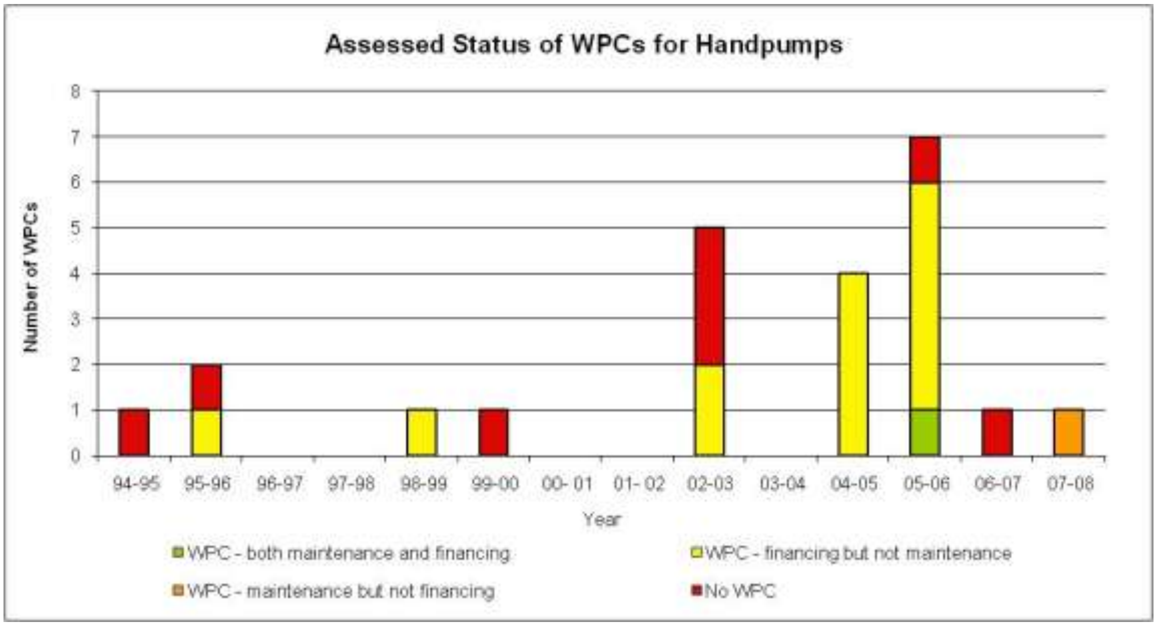


Figure 5: Water Point Committee Status, by year of establishment

Four handpumps continued to function without a WPC. Two of the more recently installed water points (2006-07 and 2005-06), as well as one from 2002-03, had no WPC despite them being established and trained as part of the community management approach. Communities stated the reason WPCs were not operating was because there was nothing for them to do. However, the area surrounding these water points was not maintained and had deteriorated significantly.

The oldest handpump in the sample (installed in 1994-95) never had a WPC established. The handpump had never broken down and continues to provide reliable service to the five households who use it as their domestic water source.

Manages maintenance but not financing: 4% (1 of 23)

The WPC for most recently installed water point (2007-08) had no system for collecting household financial contributions, but the area surrounding the handpump was being maintained.

Manages financing but not maintenance: 57% (13 of 23)

The environment surrounding all water points in this category were showing signs of deterioration as repairs to protective fencing, soak aways and concrete aprons are not taking place.

Three WPCs managed household contributions for non-functional handpumps. However, repairs had not been undertaken due to insufficient funds being available to pay for spare parts. Two handpumps broke down more than a year ago and the third failed around 4 weeks prior to our visit.

Four WPCs managed contributions for functional but defective water points. Three handpumps experienced failures to riser pipes, but insufficient funds to pay for spare parts were available, so damaged pipes were removed and not replaced. Another community were able to purchase one new riser pipe, but it was unclear how many required replacing[5].

Six WPCs managed contributions for functional but deteriorating water points. Three handpumps experienced failures to riser pipes, but insufficient funds were available to purchase replacement parts. Free spare parts were provided by other organisations[6]. Another community had replaced damaged riser pipes, but the source of the pipes was not established. The two other handpumps had not experienced a major breakdown.

Manages both maintenance and financing: 4% (1 of 23)

Only one WPC managed both maintenance and financing. The water point (installed in 2005-06) was functioning to design and has not yet broken down. Household contributions were made annually, but not all households were always able to pay.

Conclusion

Sara and Katz (1997) found that the sustainability of water points was improved by the existence of a WPC. Findings from this study indicate that although the majority of WPCs continue to operate, they are not fulfilling all their roles and responsibilities. The inability of communities to contribute sufficient money to pay for replacement parts is a significant factor affecting the long-term use of installed water points.

The environment surrounding 92% of sampled water points was not being maintained. Where major breakdowns had occurred, three communities received external assistance to repair the water point; eight communities had not raised sufficient funds to pay for quality repairs; only two communities had paid for replacement parts. These findings support the RWSN position (2009) that water points decline gradually prior to major breakdown, and that external support is required to resolve the breakdown.

Membership of WPCs is a voluntary (unpaid) role. Incentives to invest personal time in maintaining a shared resource were not evident and it appears altruism is not motivation enough.

5.1.2 Financial

In some villages there was a strong feeling that water should be free. The concept of paying to maintain a service, rather than paying to use the water was not appreciated. A need exists to ensure communities understand that maintaining and repairing handpumps will cost money.

Table 7 presents findings from the assessment of community financing mechanisms. It is concerning that a significant proportion of WPCs have not established or maintained processes for collecting financial contributions.

Score		Handpump	
0	No Payment	9	39%
1	Contribute when a failure occurs	5	22%
2	Regular but inadequate contributions	9	39%
3	Well structured system of financing	0	0%
Total		**23**	

Table 7: Community Financing Mechanisms for handpumps

No payment: 39% (9 of 23)

Nine communities were not collecting any contributions. WPCs for the three unsuccessfully installed handpumps were never established and no household contributions were collected for them.

Five water points had no active WPC to manage financial contributions. The other water point had a WPC, but it had not established a financing mechanism. Five of these six facilities have yet to break down and thus have yet to require funds to pay for repair work; the other water point failed more than a year ago and is yet to be repaired.

No financial contributions are being collected at three of WaterAid's most recently installed water points. Communities believed that as the service was yet to fail, contributions were not necessary. This belief differs considerably from training provided to WPC members who are encouraged to collect regular contributions to pay for repair work.

Contribute when a failure occurs: 22% (5 of 23)

Five WPCs had adopted a reactive approach to managed financial contributions; however none had collected sufficient money to pay for repair work.

Three handpumps were not functional as insufficient funds were available to pay for replacement parts. Two handpumps broke down more than a year ago and the third failed around 4 weeks prior to our visit.

A fourth water point had broken down several times, but riser pipes had been removed and not replaced as the community could not afford new ones.

Pipes on the fifth water point had failed on two occasions, but insufficient money was available to cover repair costs. On both occasions the Department for Water Affairs provided spare parts at no cost to the community.

Regular but inadequate contributions: 39% (9 of 23)

An assessment of adequacy was based on whether communities were able to pay for likely future repairs. Different communities collected different amounts from households based on affordability[7].

Communities stated that not all households always paid the agreed amount. In one village, 78 households accessed a handpump and each paid between ZMK5,000 and ZMK10,000. The WPC collected funds for two years (despite the water point being installed almost four years ago) and should have collected around ZMK1.4 million. The maintenance fund actually contained only ZMK230,000 and a total of ZMK75,000 had been spent on repairs and maintenance. More than ZMK1,000,000 was either unaccounted for, or had not been contributed. The community said contributing was hard when no one had any money.

All nine handpumps were working at the time of our fieldwork. Three handpumps were being used but the quality of service had deteriorated as damaged pipes were removed and not replaced[5]. One community had paid for replacement pipes, however its maintenance fund was empty. Two communities received free replacement pipes by other organisations as they had insufficient money to

[7] Amounts collected by communities varied between ZMK1,000 to ZMK10,000 per household per year

purchase them. The other three handpumps had not yet experienced a failure to riser pipes.

Well Structured System of Financing: 0% (0 of 23)

Household contributions were established on what communities believed they could afford rather than an objective assessment of lifecycle cost. Few communities knew which handpump components may require replacement and none were aware of how much spare parts cost.

Conclusion

Revenue collection took place only in communities with a functioning WPC. However, contributions collected by WPCs are below the amount required to pay for maintenance and repair. This supports findings by Whittington et al (2008) that communities are not moving towards a financially sustainability future. The collection and management of household contributions by sampled communities is less positive than those presented by Whittington et al; a substantial minority were not collecting any revenues at all, and a significant minority were engaged in reactive revenue collection when breakdowns occurred.

Establishing community financing structures based on a self-assessment of affordability rather than an objective assessment of likely costs seems counter-intuitive. The cost of handpump parts is established through market processes; the producer must cover manufacturing costs, the distributor must cover logistical costs, the retailer must cover their costs, and they all must make a profit. If communities are unaware of real costs, and base revenue collection on subjective levels of affordability, they could be fighting a losing battle. Evidence from this study shows, regardless of the financing mechanism, only one community had raised sufficient funds to pay for replacement pipes, from the ten communities that needed them.

Ensuring communities are aware of the real cost of maintaining handpumps is essential for informing the establishment of appropriate tariffs (Gine and Perez-Foguet, 2008). If communities are unable to afford handpump maintenance, it would be necessary to consider alternative approaches to financing that ensure water points are sustained beyond their first major breakdown.

Wood's (1999) conclusion that for some communities, handpumps may represent an unaffordable technology resonates with the statement from one community that contributing money is difficult when no one has any.

5.1.3 Technological

There was limited evidence that communities were actively involved in the choice of technology, identified by Katz and Sara (1997) as a factor contributing to higher rates of sustainability. Prior to 2003-04, WaterAid primarily installed windlasses fitted to hand-dug wells. Subsequently, boreholes with handpumps became WaterAid's preferred option, partly in response to working in less favourable hydro-geological locations, as well as an understanding that water quality from hand-dug wells may not meet required standards. In sampled communities, opinion was divided regarding preferences for technologies; some believed hand-dug wells were better as they cost less, others believed boreholes were better as water quality was higher.

Through the Zambian Government's Sustainable Operation and Maintenance Project (SOMAP), the Southern Water and Sewerage Company stock spare parts for India Mark 2 handpumps. However, the cost of various spare parts and the lifetime of different handpump components are not known by communities. This inhibits the ability of WPCs to plan effectively, and highlights a weakness in the supply chain of providing an appropriate level of service to its customers.

Failing pipes were the most common cause of handpump breakdown. Although pipes were available through SOMAP, communities were not replacing them. The cost of replacement pipes through SOMAP had increased more than 70% in recent years, from less than ZMK100,000 to ZMK170,000. The rationale for the increase appeared to be linked to the need for SOMAP to be profitable; the cost of parts increased due to the low turnover of stock whilst the need to cover overheads remained. The failure to generate profit was recognised by Harvey and Reed (2006) as a significant barrier to establishing sustainable supply chains. Perpetually rising costs makes the task of raising adequate funds challenging for WPCs, and may result in fewer parts being purchased.

WaterAid were not supporting the supply chain by either providing subsidies to reduce the cost of parts, commenting on its business model, or by purchasing capital items through it.

Factors influencing the high rate of pipe failure were not explored as part of this study, but WaterAid and partner staff suggested aggressive groundwater was prevalent throughout the country. The use of galvanised steel pipes may therefore not be appropriate if the chemical composition of water is causing rapid corrosion. Neither WaterAid nor SOMAP supplied pipes in plastic or other materials more resistant to corrosion.

5.1.4 Institutional – Software support

Several research papers (Abrams (1998), Carter (2009) Carter et al (1999), and Harvey and Reed (2003)) have emphasised the important role on-going external support can have in promoting water point sustainability. The most promising support activities found by Whittington et al (2008) were those relating to administrative management and system operation. However, in sampled communities very limited support had been provided by WaterAid, NGO partners or the local government.

Although training materials are used to build the capacity of WPC members, if they lack capacity to organise, lead and inspire, they are likely to be under-resourced when attempting to motivate community members to contribute to the cost of repairs, resolve conflicts, or make informed decisions.

External support directed towards improving arrangements for maintaining water points as well as mechanisms to more effectively manage household contributions could be worthwhile initiatives. Support visits could also provide an opportunity to share experiences between communities thus disseminating good practice and reducing the potential for mistakes to be replicated.

Zambia's National Rural Water Supply and Sanitation Programme makes reference to both Area Development Committees and District-WASHE (Water, Sanitation and Hygiene Education) groups that work to develop plans for water and sanitation facilities. However, it does not specify what support they will provide, or how that support will be delivered. None of the sampled communities referred to meeting representatives from either group.

5.1.5 Institutional – Hardware support

A network of trained Area Pump Minders (APMs) operate throughout Monze District and perform repairs to handpumps. Manyena et al (2008) recognised the importance of hardware support provided to communities by pump minders as part of an effective maintenance system. All sampled villages were aware of APMs, but not all were aware of the costs charged by them.

APMs had collectively agreed to levy a fee of ZMK80,000 per repair, however some communities reported paying less. It was not established whether APMs were actively undercutting one another to get more business, or whether communities were successful in negotiating more favourable terms. Communities were satisfied with the services provided by APMs, but many were dissatisfied with the amounts they charged.

In some instances, communities had attempted to replicate the work of APMs to lower repair costs, but not all attempted repairs were successful. On several occasions communities requested that WaterAid train an individual from their village to become a minder for their water point. If the individual were required to undertake repairs but received no payment, as with other roles assigned to WPC members, there is no guarantee that the responsibilities would be fulfilled.

5.1.6 Environmental

Communities should be provided with a reliable source of water, regardless of seasonal fluctuations, that permits benefits associated with the provision of access to safe water to be realised. For sampled boreholes, 14 (66%) provided a year round supply. Figure 6 shows borehole reliability by year of installation.

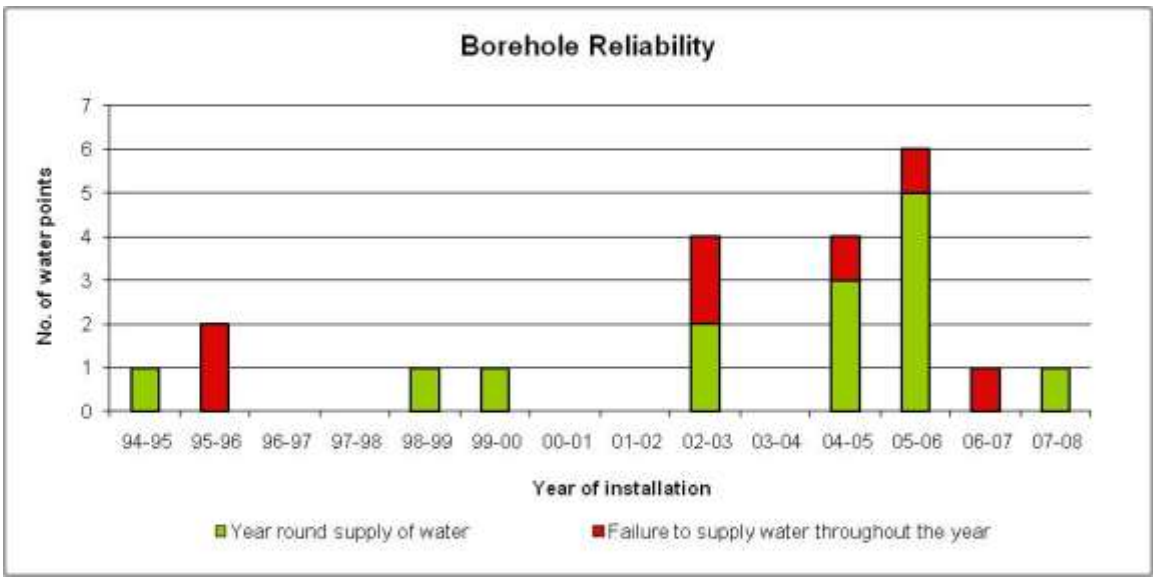


Figure 6: Borehole reliability by Year of Installation

Two of the three unreliable boreholes supported by WaterAid do not provide access to water towards the end of the dry season, when water levels are at their lowest. The other borehole was sited in a location prone to flooding, where the apron would become submerged, thus raising concerns for water quality.

Three of the four unreliable boreholes not installed by WaterAid had never worked. No data was available for the other unreliable borehole.

The majority of communities did not have copies of their drilling record, or know specific information relating to borehole depth, water levels, or yield. WaterAid's inventory did not record this information. Results from water quality testing were also unknown by communities and not recorded by WaterAid. Table 8 presents information from communities regarding installed boreholes.

Village Name	Date of Completion	Borehole Depth (m)	Water Level (m)	Pump Depth (m)	Reli-ability	WaterAid supported
Chicheleko	2005				Yes	Yes
Chikuni	1995				No	No
	Nov 2004	30	6		Yes	Yes
Chobana	2002				Yes	Yes
	Nov 2005				No	Yes
Haloma	1999	60	3		Yes	No
Hamasaka	Nov 2005	51	21.4		Yes	Yes
Hambalamatu	1998				Yes	No
Hamwaala	2002				No	No
	2002				No	No
Hanamoonga	1995				No	No
	Nov 2004	58		36	No	Yes
Havuuka	2003			39	Yes	No
Makala	2004				Yes	Yes
	Jan 2008			36	Yes	Yes
Munachilala	Nov 2005	75		51	Yes	Yes
Muzyambe	Nov 1994	49.5	8.3		Yes	No
Sihubwa	Oct 2005	HDW + 9*			Yes	Yes
Sikanyona	Sept 2004			18	Yes	Yes
Simukale	Nov 2006				No	Yes
Sinyendeende	Nov 2005			33	Yes	Yes

Table 8: Borehole Data Provided by Sampled Villages

* An existing hand dug well was deepened by 9 metres as part of the rehabilitation work, but the original depth was unknown.

Harvey (2004) highlights the importance of recording borehole completion date, borehole depth, water level, pump depth and results from yield tests to support monitoring work. WaterAid should collect and permanently record this specific information to inform future monitoring and evaluation processes.

In addition to handpumps being used for domestic purposes, five communities reported that water was also used for making bricks. The quantities being abstracted for brick making were unknown, but all water points supporting those enterprises had experienced a failure.

Reviewing the functionality of handpumps installed in 2005-06, it is apparent that facilities supporting brick making have suffered more breakdowns than those which do not. Table 9: Number of failures to handpumps installed in 2005-06

* This single failure has never been repaired and the system remains non-functional

presents information relating to handpumps installed during 2005-06. Two other handpumps used by brick makers, both installed in 2004-05, have each experienced several breakdowns.

Village name	Number of households	Number of failures	Other uses	Status
Chobana	25	1	Cattle and Brick making	1
Hamasaka	27	0	Cattle	3
Sihubwa	67	1*	Unknown	0
Sihubwa	67	0	None	2
Munachilala	78	1	Cattle	2
Chicheleko	55	2	Cattle and Brick making	2
Sinyendeende	38	3	Cattle and Brick making	1

Table 9: Number of failures to handpumps installed in 2005-06

* This single failure has never been repaired and the system remains non-functional

Individuals who used water points to support brick making enterprises did not contribute any additional revenues. However, these limited data suggest that water points used for brick making experience more breakdowns than those that do not. Further research into abstraction quantities and its impact on failure rates is needed to substantiate this possible link.

The introduction of stratified financial contributions, where individuals who use more, pay more, may be a mechanism for generating additional funds to support handpump repair and maintenance.

5.2 Windlasses and Rope Pumps

As illustrated in Table 5, just 1 of 21 (5%)[8] windlasses and rope pumps provided reliable access to water and were being maintained to a standard close to that of when first installed. This section discusses factors the social, financial, technical, institutional and environmental factors that influenced functionality.

5.2.1 Social

The vast majority of windlasses, and all rope pumps, had no WPC managing the service. As with handpumps, communities reported that over time, WPCs ceased to fulfil their responsibilities. A far greater proportion of WPCs for windlasses (as compared to handpumps) were no longer operating. Figure 7 presents the status of WPCs, by year of establishment.

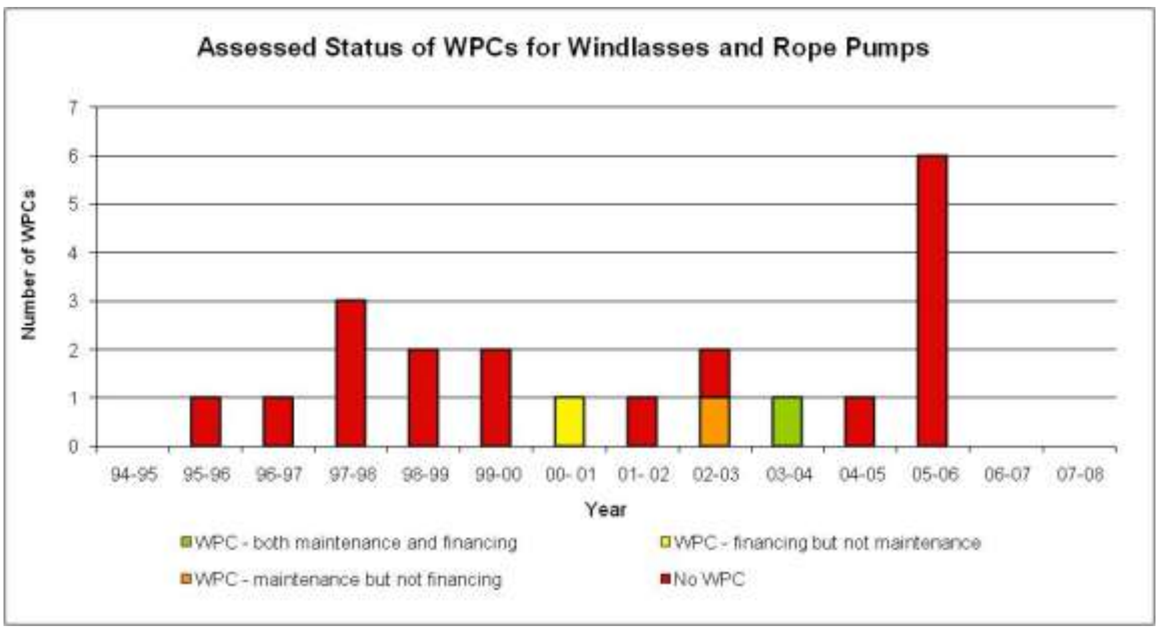


Figure 7: Water Point Committee Status, by year of establishment

8 18 windlasses and 3 rope pumps were installed in sampled communities. Only 1 windlass (6% of all windlasses) was providing reliable access and was well maintained.

No WPC: Windlass – 82% (15 of 18), Rope pump – 100% (3 of 3)

WPCs were not operating at 11 non-functional windlasses; all the windlasses had been removed and community members were accessing water using ropes and buckets. Despite this, the most common reason for WPCs no longer operating was that there was nothing for them to do. No plans were in place to repair broken windlasses.

Four windlasses were in use where no WPC was operational. Two communities reported that no breakdowns had occurred, whilst one repair had been required for each of the other water points. Both breakdowns related to collapsed lining rings in the well. One community had not attempted to repair the failure. In the other community, one individual had paid a mason to repair the collapsed lining ring. Although the individual had requested other community members to contribute to the cost of repair work, none had done so.

Two rope pumps were discarded by communities who re-installed windlass. In both communities, WPCs continued to maintain the windlasses. The third rope pump is operational, but has no WPC to maintain it; however, a community member has previously carried out repair work.

Manages maintenance but not financing: Windlass – 6% (1 of 18)

The WPC have maintained the protective fence and keep the surrounding environment clean. The water point is close to the village headman's house and although he is not part of the WPC, he ensures the water point is maintained and kept clean. Although no household contributions have been collected, the community stated that if repairs were required, households would be able to finance the work.

Manages financing but not maintenance: Windlass – 6% (1 of 18)

A community made regular contributions where two handpumps and a windlass had been installed. Community members who used the windlass paid the same as those using either handpump. No money had been spent on the windlass, but repairs had been required to both handpumps. The windlass device was still in use, but the protective fencing, apron and soak away facility had not been maintained.

Manages both maintenance and financing: Windlass – 6% (1 of 18)

The water point was installed close to the village headman's home. Although the headman was not part of the WPC, it was evident from discussions with community members that he played an important role in ensuring the water point was maintained and kept clean. The community had paid for a replacement metal windlass due to their dissatisfaction with the originally installed wooden version.

Conclusion

There is a stark contrast between those with and those without a WPC. All three windlasses with an operational WPC remained functional and in use; where no WPC was operating, 11 windlasses had been removed. As discussed in 5.1.1, a lack of external support and few incentives exist to encourage and motivate WPC members over the long-term.

In four communities, a motivated individual had either facilitated repair work or ensured that water points were maintained. In two cases, the motivated individual was the village headman, but it was not established why these individuals were more engaged than headman in other communities. Although water points had been installed close to the headmen's homes, this was also the case for several other communities where headmen were less motivated to manage water points.

5.2.2 Financial

Windlasses and rope pumps are simpler technologies than handpumps, but money is still needed to pay for repairs. Table 10 presents the assessment of community financing mechanisms; it is concerning that so few communities are contributing funds to permit repairs to be made.

Rating		Windlass		Rope pump	
0	No Payment	15	82%	3	100%
1	Contribute when a failure occurs	2	12%	0	0%
2	Regular but inadequate contributions	1	6%	0	0%
3	Well structured system of financing	0	0%	0	0%
Total		**18**		**3**	

Table 10: Community financing mechanisms for windlasses and rope pumps

No payment: Windlass – 82% (15 of 18), Rope pump – 100% (3 of 3)

Fifteen communities made no payment towards the maintenance and repair of installed windlasses.

In eleven communities, windlass mechanisms had been removed and households used ropes and buckets to access water. Communities did not state the water point had failed, despite the windlass having been removed. Communities did not perceive a failure to the windlass as being a failure to the water point, as water can still be accessed from the well.

Four communities made no payment for repair and maintenance work, but the windlasses remained in use. Well lining rings had collapsed at one water point and the concrete well cover had broken in another. No plans were in place to repair the damage.

Repairs to the rope on the functioning rope pump were paid for by an individual motivated to maintain it. Other households in the community had not been requested to make financial contributions. The two other rope pumps had been discarded and were no longer in use.

Contribute when a failure occurs: Windlass – 12% (2 of 18)

One community had replaced and upgraded their windlass. In 2005, two years after the original installation, households contributed ZMK100,000 to pay a local welder to construct a metal cylinder. Collections had also been made to purchase replacement ropes and buckets.

An individual in another village paid ZMK65,000 to repair lining rings that had collapsed in 2007, 10 years after the water point had been installed. No other household had contributed to the repair.

Regular but inadequate contributions: Windlass – 6% (1 of 18)

Regular household contributions were collected in one community. However, the community had three water points (two handpumps and one windlass), each with a separate WPC. Although the WPCs were autonomous, the funds collected by them were pooled to pay for repairs to any of the water points. Each household theoretically paid the same amount (ZMK500 per month) regardless of the water point they used, but not all households were always paying. While some of the revenue had been spent on the handpumps, none had been invested in the windlass. Households using the windlass felt this was fair because the water point was not reliable and they used the handpumps when it failed.

Well structured system of financing

Although communities, or in some cases, individuals within communities had paid for repairs, the approach to financing was reactive rather than pre-planned. The lifecycle cost of windlasses and rope pumps had not been calculated and revenues were not collected in preparation or failure.

Conclusion

The significant majority of communities were not collecting household contributions. Whilst the financial demands of managing windlasses were less than those for handpumps, the willingness to pay remained low.

However, a lack of financing may not be the most significant factor influencing whether or not windlasses are maintained. The fact that so few communities undertake repairs, preferring instead to use ropes and buckets, suggests a level of dissatisfaction with the technology.

5.2.3 Technological

Windlass functionality

To protect wells from contamination, closable flaps were built into lining lids to prevent contaminants from falling into the water. However, nine of these had perished and not been replaced. The flap, frame and hinges were all metal, and in all cases, the hinges were the cause of failure. The flap moved through 180 degrees to rest on the well cover, placing strain on the hinge joint, which eventually gave way. Consequently, water in the well is open to sources of contamination. Communities believed the quality of water in these wells was not as good as water from handpumps.

As discussed for handpumps in 5.1.3, there was limited evidence that communities were actively involved in the decision to select and install windlasses. Community members stated that windlasses were heavy and hard to use.

The finding that communities fail to repair windlasses raises concerns over their appropriateness as a technology. Two options would appear to present themselves, 1) improve the windlass design using higher quality, more robust materials that improve performance, 2) cease to install windlasses.

The use of higher quality windlasses that are easier to use may lead to a greater willingness by communities to sustain them. However, as discussed in section 5.1, handpumps were not always being managed and maintained, so there is limited evidence to suggest higher quality windlasses would be. To enhance community ownership, Whittington et al (2008) identified the importance of technology choice. Developing an understanding of which technologies communities find appropriate and acceptable, as well as affordable may lead to improved rates of sustained use, as found by Katz and Sara (1997).

Although windlasses had been removed from 61% (11 of 18) of water points, community members continued to access water from hand-dug wells. Whilst the quality of access had declined, hand-dug wells represent an improvement from unprotected traditional sources used by communities before they were installed. This improvement from 'what was there before' has similarities to the 'Self Supply' approach, which encourages communities to incrementally improve existing sources (Sutton, 2009). An important distinction however is that Self Supply encourages incremental improvement, whereas the use of ropes and buckets on sampled water points is the result of a decline to the installed technology.

Spare parts were accessible through the local economy meaning a specific supply chain did not have to be set up to ensure parts were available. For example, a mason supported repairs to a well lining, a welder constructed a replacement windlass, and ropes, chains and buckets were bought at local markets. The problem was that the majority of windlasses were not being repaired, even though the well was still being used.

Rope Pump

Three rope pumps had been installed in sampled villages. Due to continual breakdowns, two rope pumps were used for less than a year before being removed and replaced by the original windlass. Opinion was split regarding the appropriateness of rope pumps in the third village; those using it to support gardening viewed it quite favourably, whereas households taking water for drinking were less impressed with the quality of service.

A study of water supply technologies in Zambia (RuralNet, 2008) observed 32 rope pumps and found that 40% were not used. The RuralNet study noted a high failure rate with the technology and concluded it dissuaded communities from maintaining facilities.

The design and construction of an appropriate rope pump mechanism appeared to have started from the drawing board, rather than being based on detailed specifications available from the Rural Water Supply Network or other organisations with experience of developing the technology.

5.2.4 Institutional – Software support

As with handpumps (section 5.1.4), very limited external support was available to WPCs from either national or local government, NGOs, the private sector or non-profit organisations.

5.2.5 Institutional – Hardware support

No specific system for providing hardware support exists for windlasses or rope pumps. Where repairs had been undertaken, communities made use of skilled individuals and the local market.

5.2.6 Environmental

Between November and January, when water levels are at their lowest, 11 hand-dug wells fail to provide access to water. Communities reported that as the wells were being constructed, digging ceased when water was reached, which could be a key factor influencing their reliability. No village reported the use of a dewatering pump during construction. Figure 8 shows hand-dug well reliability by year of installation; 9 (45%) were reliable.

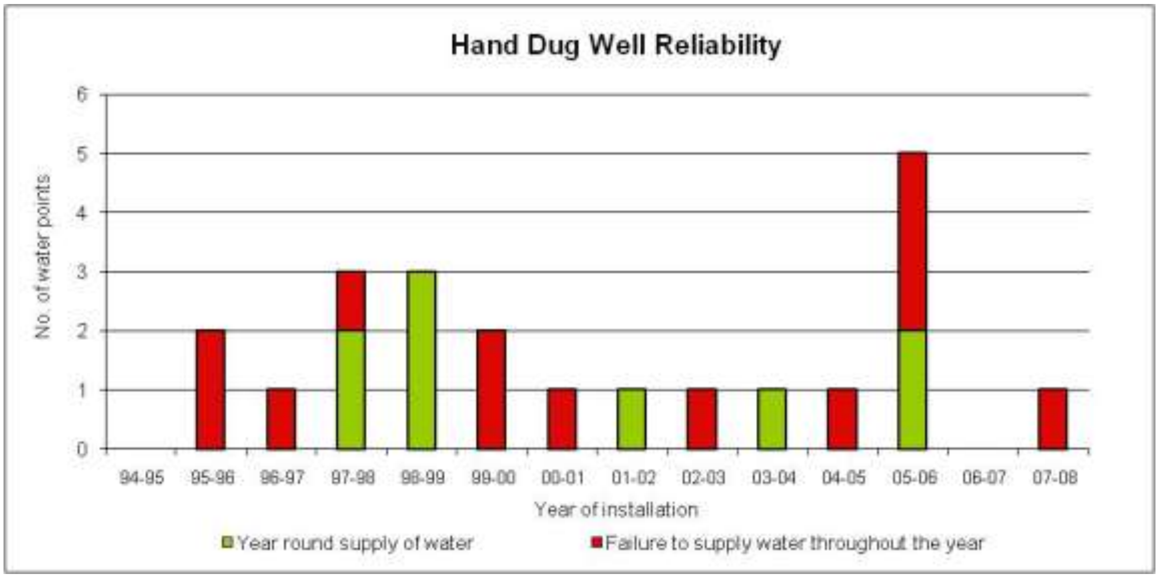


Figure 8: Hand-dug well reliability, by year of installation

As outlined by Harvey (2004), the timing of construction and well depth in relation to water levels are important considerations for developing reliable water points. It was unfortunate that more data concerning completion dates, well depth and yield was not available from sampled communities, or WaterAid. Formal inspections of hand-dug wells following the completion of digging operations, but prior to lining work commencing, were rare. The introduction of a sign-off procedure following an inspection to confirm and record key characteristics would be helpful for future monitoring activities.

6. Conclusion

This study explored the experiences of different communities in managing their water points to better understand factors which influenced sustainability. The sub-categorisation of sustainability outlined by Parry-Jones et al (2001) and identification of key questions from the literature review formed the basis of discussions with sampled communities as well as the subsequent analysis of collected data.

Findings from the study demonstrate that:

- **Social:** WPCs were established to manage installed water points, however the substantial majority were no longer fulfilling all their roles and responsibilities;
- **Financial:** Communities were frequently not collecting or managing sufficient funds to pay for repairs and maintenance;
- **Technical:** Without sufficient funds, spare parts could not be purchased. Without an effective spare parts supply chain, parts could not be easily located;
- **Institutional:** Without external support to rejuvenate motivation and interest by WPC members, their interest in managing the water point waned;
- **Environmental:** Without reliable access to an improved water source, communities may have no choice but to use unimproved sources.

6.1 Handpumps

The inability of communities to raise sufficient money to pay for repairs was found to significantly affect water point functionality. Information presented in Table 6 demonstrates the importance of having sufficient money to pay for repairs; of the 10 water points where pipe failures had occurred, no community had financed the purchase of replacements due to a lack of funds.

For financial contributions to be effectively managed, WPCs (or another management body) need to exist. As illustrated in Table 5, many WPCs were not performing all of their roles and responsibilities. Section 5.1.4 highlighted the importance of providing on-going support to WPCs that develops their managerial and administrative skills.

Findings from this study support the assertion by Harvey (2009) that only limited success has been achieved through the community management model.

6.2 Windlasses and Rope Pumps

Only one community had performed a repair to an installed windlass. More than 60% of windlasses had not been maintained. Households used ropes and buckets to get water from hand-dug wells when windlasses were no longer functional. Section 5.2.3 highlighted the importance of appropriate and acceptable technologies.

Section 5.2.1 showed that the majority of WPCs were no longer operating. As with handpumps, it is important for on-going support to be available for WPCs that maintains their motivation and skills.

7. Conceptual framework of sustainability

Although components of sustainability can be separated into standalone factors for analysis, findings from this study indicate that all components must function effectively for sustainability to be achieved. A weakness or failure of one component can affect the integrity of how other components operate. Figure 9 presents a conceptual framework demonstrating interdependencies between components as well as illustrating the importance of them all operating effectively.

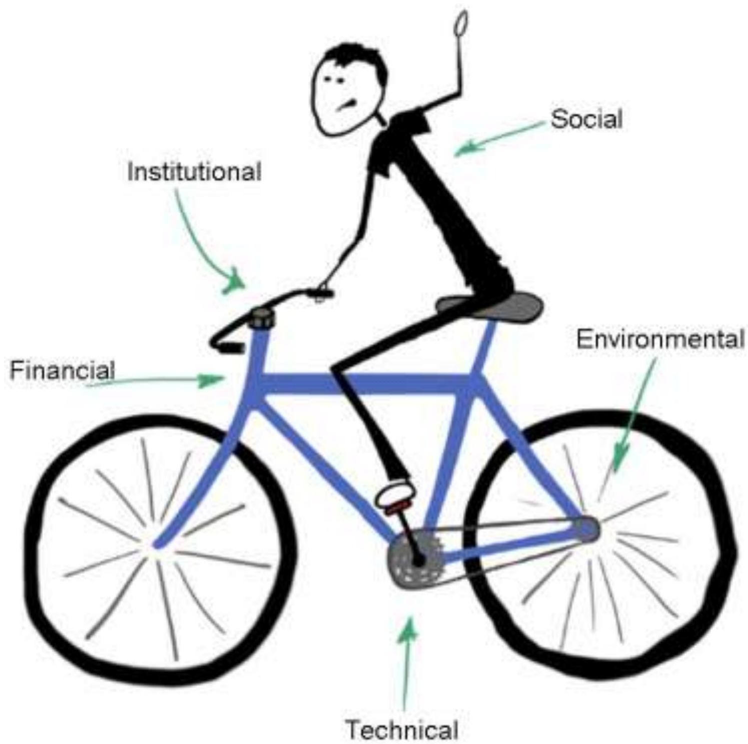


Figure 9: The Sustainability Bicycle[9]

A bicycle has been used to illustrate that components of sustainability depend upon each other; for a bike to work effectively, it needs a frame, handle bars, wheels, a crank and chain, and someone to ride it. Without any one of these, the bike will not work as it should. For sustainability, the social, financial, technical,

[9] Illustration by Jamie Bevan, 2011. http://www.jamiebevan.com/all/

institutional and environmental components must also be in place and working effectively. If there are deficiencies or failures in any of the components, sustainability of the water point will be compromised. Components of the bike are not analogies for components of sustainability; there are not particular characteristics of a wheel that make it inherently more representative of the environmental component than any other. What the conceptual framework portrays is the importance that all components depend upon each other in order for the system to work effectively.

7.1 Social

WPCs are responsible for collecting household contributions to finance repairs, perform preventative maintenance and look after water points. If WPCs cease to function, or fail to perform all the tasks required of them, water points deteriorate as maintenance and repair work is not managed. Therefore, social components of sustainability can impact upon financial considerations, but can also be affected by institutional components and the extent of available ongoing external support.

7.2 Financial

Money is needed to pay for repair and maintenance work, without it, required spare parts and technical support cannot be paid for. In sampled communities, contributions were collected only where a WPC still operated. Where revenue was collected, the amount was below that required to pay for maintenance and repair. The financial component therefore has an impact on some technical considerations and is directly affected by WPCs.

7.3 Technical

It is essential that installed technologies are appropriate, acceptable and affordable to communities. Without access to appropriate and affordable spare parts, water points that fail cannot be effectively repaired. Yet, without sufficient money, spare parts cannot be purchased (the financial component), and without adequate technical support and expertise (the institutional component), repairs cannot be effectively performed.

7.4 Institutional

WPCs in Monze District had limited access to on-going managerial (software) support. Without assistance and encouragement to perform well, or structured monitoring and evaluation, WPCs fail to fulfil all their given responsibilities.

Area Pump Mechanics in Monze District provide technical (hardware) support to communities, enabling them to overcome technical challenges, carry out repairs or replace damaged components. However, a lack of available funds and accessible spare parts has restricted the extent of support APMs have been able to provide to WPCs.

7.5 Environmental

The environmental considerations outlined by Abrams (1998) noted the importance of an adequate and reliable water resource, regardless of the length of time since its commission. An assessment of water resources was not in the scope of this study, however the seasonal failure of 30% of boreholes and more than 50% of hand dug wells means those communities were not supported with an adequate or reliable supply of water. Not being provided with a reliable source of water could affect the social component in terms of the willingness of community members to pay for repairs and motivation of WPCs to manage the water point.

8. Recommendations

This study is based on case studies from sampled villages in one district of Zambia. Therefore, recommendations emerging through analysis of collected data should be viewed in that context. Completing similar research in other districts, or other countries, may challenge or substantiate the findings and recommendations presented. The following recommendations should be considered by WaterAid globally, but have specific relevance for Zambia.

8.1 Social

Alternative management structures: Options to professionalise how water points are managed should be investigated, including the potential for devolving responsibility for collecting household contributions away from the WPC. Establishing contractual obligations with specific quality standards for the District Council, Area Development Committee or other third party would the reduce the burden of responsibility on WPC members.

Incentives: Options and incentives to encourage more proactive maintenance of facilities by WPCs should be explored. One option may be for members of WPCs to be elected for a set period of time. Positions would attract incentives to encourage good performance.

8.2 Financial

Calculate example lifecycle costs: Developing a more thorough understanding of an average lifecycle cost for an India Mark 2 handpump in Monze district would inform how much communities need to raise to sustain their water point. If the amount for handpumps is unrealistic given the ability (and willingness) of communities to pay, there are implications for both WaterAid and Zambia's National Rural Water Supply and Sanitation Programme.

Household contributions: Alternative approaches to collecting contributions should be investigated. Potential options include:

1) users pay a small fee for each container filled,
2) a more stratified and equitable approach to distribute contributions across wealthier / poorer houses,
3) monthly / annual contributions are maintained, but households and individuals who use more, pay more.

Enterprise investment: Pilot approaches to invest contributions in livestock, agricultural land, enterprise initiatives or other activities that go beyond the current practice of keeping cash in the treasurer's home should be tested.

Co-financing: Based on the calculated lifecycle cost, if it is unrealistic for communities to contribute the required amount, the potential for sharing repair costs with the local government should be explored.

8.3 Technical

Riser pipes: Investigations should be made into the potential for sourcing plastic pipes that can be fitted to India Mark 2 handpumps. Pilot projects to test the suitability of the pipes should be designed and closely monitored. Potential sites for pilot projects could include sampled villages from this study with a known history of frequent pipe failure.

Support to the supply chain: WaterAid should support the supply chain by sharing estimated lifecycle cost and monitoring data. Working with the supply chain to build more accurate lifecycle costs based on the sale of parts would benefit the supply chain (in terms of stock control) and communities.

8.4 Institutional

On-going support: WaterAid and relevant partners (including the local government) should develop long-term plans to work with WPCs following successful installation of water points. Specific support in the area of financial regulation and contribution management appear particularly pertinent.

Monitoring: Robust arrangements for routine monitoring and inspection visits should be made with local government representatives. In addition to assessing system and WPC performance, the visits would provide an opportunity to share lessons and experiences between communities.

8.5 Environmental

Hand-dug well and borehole data: Important information concerning well and borehole depth was not available. A properly controlled and certified permanent record of the following data should be held:

- Total well depth,
- Static and dynamic water levels,
- Pump height (where applicable),
- Yield test results, and
- Completion date.

Results from water quality tests should also be permanently held by WaterAid.

8.6 Further Research

More and better information: Replicating similar research in other areas of Zambia (and other countries) could build a more comprehensive understanding of how to support sustainable water services[10]. More focused research into alternative approaches to community management models, financing and technologies would complement this.

[10] As mentioned in footnote 3, WaterAid have carried five post-implementation surveys since this research was completed. For reasons of confidentiality, specific findings from surveys in Zambia cannot be quoted in this report. However, the findings do generally corroborate findings from this research, thus adding to the degree of confidence in these findings as well as the validity of the conclusions and recommendations made.

9. Appendices

Appendix A Assessed Status of Water Points

Table 1.1 on the following page provides a brief overview of each sampled water point. The following notes provide an explanation of abbreviations and scoring assessments.

Village – is the name of the sampled village.

WP Type – HDW refers to Hand Dug Wells, BH to boreholes.

Lifting device – these were either windlasses, rope pumps or handpumps.

WA – whether or not WaterAid supported the water point.

New or rehab – illustrates if the intervention was new, or a rehabilitation

Year – is the financial year of installation.

Fun – whether the water point functional at the time of the field visit.

Score		Explanation
0	Not used	No water is being abstracted.
1	Used, but defective	Access to water is unreliable or poor quality repairs (or no repair works) have been undertaken.
2	In use, but environmental deterioration	Access to water is reliable, but the protective fencing, soak away, and surrounding cement apron are not well maintained; the environment around the water point is unclean.
3	Functioning to design	The water point provides reliable access to water and is being maintained to a standard close to that of when first installed.

WPC – status of the Water Point Committee at the time of the field visit

Score		Explanation
0	No WPC	The WPC is not operating. Or the WPC is operational, but is not carrying out maintenance work or managing financial contributions.
1	Maintenance, but not financing	The WPC is operational and performing maintenance activities to the water point. However, financial contributions are not being managed.
2	Financing, but not maintenance	The WPC is operational and is managing the collection of financial contributions from community members. However, maintenance activities are not performed.
3	Both financing and maintenance	The WPC is operational and is managing the collection of financial contributions from community members as well as water point maintenance activities.

CF – community financing. Different approaches to managing household contributions.

Score		Explanation
0	No payment	No money is being collected to pay for future repair, maintenance or rehabilitation work.
1	Contribute when a failure occurs	There is no plan for the regular collection of funds. Community members contribute (either cash or in-kind) in the event of water point failure.
2	Regular but inadequate contributions	Community members regularly contribute (either cash or in-kind) to a fund to specifically pay for future repair and maintenance work. However, the contributions are insufficient to pay for likely long-term costs.
3	Well structured financing mechanism	Well structured financing mechanisms are based on an assessment of lifecycle costs and sufficient funds are being collected to pay for likely repair and maintenance work.

Rel – reliability. The ability of the water point in providing a year round supply.

Score		Explanation
0	Not reliable	Fails to supply water throughout the year
1	Reliable	Year round supply of water

Failures – the number of reported breakdowns to the water point

No. of HH – is the number of households using the water source.

Coverage – is the percentage of households accessing the water point.

Quant – is the average quantity of water collected by households per day.

Cattle and **Bricks** – denote whether communities use the water point for either cattle or brick making enterprises.

Table 1.1 on the following page provides a brief overview of each sampled water supply intervention.

Village	HH in village	WP type	Lifting device	WA	New or Rehab	Year	Fun	WPC	CF	Rel	Failures	No. of HH	Coverage	Quant	Cattle	Bricks
Chicheleko	75	HDW	Windlass	Y	Rehab	2005-06	0	0	0	N	0	12	97%	160	✔	
		HDW	Windlass	Y	Rehab	2005-06	0	0	0	N	0	8				
		HDW	Windlass	Y	Rehab	2005-06	0	0	0	N	0	18				
		BH	Handpump	Y	Rehab	2005-06	2	2	1	Y	2	35				✔
Chikuni	67	BH	Handpump	Y	New	2004-05	2	2	2	Y	0	15	39%	100	✔	
		BH	Handpump	N	New	1995-96	2	2	2	N	6	11				
Chobana	70	HDW	Windlass	Y	Rehab	2000-01	2	2	2	N	0	30	100%	100	✔	
		HDW	Rope pump	Y	Rehab	2002-03					Many					
		BH	Handpump	Y	Rehab	2002-03	2	2	2	Y	1	15			✔	
		BH	Handpump	Y	New	2005-06	2	2	2	N	1	25			✔	✔
Haloma	28	HDW	Windlass	Y	New	2003-04	3	3	1	Y	1	13	46%		✔	
		HDW	Rope pump	Y	Rehab	2005-06					Many					
		BH	Handpump	N	New	1999-00	0	0	0	Y	2				✔	
Hamasaka	22	BH	Handpump	Y	New	2005-06	3	3	2	Y	0	22	100%	120	✔	
Hambalamatu	56	BH	Handpump	N		1998-99	0	2	1	Y	20		45%	120	✔	
		HDW	Windlass	Y	New	2004-05	2	0	0	N	0	25				
Hamwaala	32	HDW	Windlass	Y	New	1996-97	0	0		N			0%			
		BH	Handpump	N	New	2002-03	0	0		N						
		BH	Handpump	N	New	2002-03	0	0		N						
Hanamoonga	86	HDW	Windlass	Y	Rehab	2005-06	1	0	0	Y	0	9	44%	120		
		BH	Handpump	Y	New	2004-05	1	2	2	N	1	29				
		BH	Handpump	N		1995-96	0	0		N						
Havuuka	84	HDW	Windlass	Y	New	1995-96	0	0	0	N	0	30	36%	100	✔	
		BH	Handpump	N		2002-03	0	2	1	Y	4	65				
Kabuyu	29	HDW	Windlass	Y	New	2002-03	2	1	0	N	0	20	86%	140	✔	
Kazemba	36	HDW	Windlass	Y	Rehab	1997-98	1	0	0	N	1	16	44%	120	✔	
Makala	48	BH	Handpump	Y	Rehab	2004-05	1	2	1	Y	16	28	100%	160	✔	✔
		BH	Handpump	Y	New	2007-08	3	1	0	Y	0	20				
Munachilala	45	HDW	Windlass	Y	Rehab	2001-02	1	0	0	Y	1	18	100%	140	✔	
		BH	Handpump	Y	New	2005-06	2	2	2	Y	1	45				
Muzyamba	46	HDW	Windlass	Y	New	1997-98	0	0	0	Y	0	13	39%	120	✔	
		BH	Handpump	N	New	1994-95	2	0	0	Y	0	5				
Mweemba	17	HDW	Windlass	Y	Rehab	1998-99				Y			65%	120		
		HDW	Rope pump	Y	Rehab	2005-06	2	0	0		Many	11				
Sihubwa	67	HDW	Handpump	Y	Rehab	2005-06	2	0	0	Y	0	67	100%			
	67	BH	Handpump	Y	Rehab	2005-06	0	2	1	Y	4		0%			
Sikanyona	38	BH	Handpump	Y	Rehab	2004-05	1	2	2	Y	6	38	100%	140	✔	✔
Simukale	104	HDW	Windlass	Y	New	1999-00	0	0	0	N	0	15	45%	140	✔	
		HDW	Windlass	Y	New	1999-00	0	0	0	N	0	7				
		BH	Handpump	Y	New	2006-07	2	0	0	N	0	25				
Sintambo	48	HDW	Windlass	Y	New	1998-99	0	0	0	Y	0	15	85%	100		
		HDW	Windlass	Y	New	1997-98	0	0	0	Y	0	16				
		HDW	Windlass	Y	New	1998-99	0	0	0	Y	0	10				
Sinyendeende	38	HDW	Windlass	Y	New	1995-96				N			100%	140		
		HDW	Handpump	Y	Rehab	2002-03	2	0	0		0	5				
		BH	Handpump	Y	New	2005-06	1	2	2	Y	3	38			✔	✔

Appendix B Brief Narrative of Each Sampled Village

Muzyamba Village

Village	WA Water Point name	Ward	RHC	Chief
Muzyamba	Nakaye	Mwanza West	ZCA	Mwanza

Name of Headman	Number of households		Population of the village	
Mr John Cheembo	2002	2009	2002	2009
	50ish	46	330ish	400ish

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	1997-98	S 16 ° 14.440
BH	Handpump	N	New	1994-95	E 027 ° 35.346

Both the hand dug well and the borehole provide reliable sources of water to households accessing them throughout the year. However, only 13 households used the HDW and only 5 accessed the handpump. Twelve other households used a water point located in a neighbouring village, whilst the remaining households used unimproved water sources.

As can be seen from the photographs, the windlass was not operating and people accessed water by using their own ropes and buckets. The windlass was apparently stolen shortly after installation and has not been replaced. The handpump has never broken down or required any remedial work. The borehole is 49.50 metres deep, and the water level was recorded as being 8.3 meters. No protective fencing exists, the apron is badly cracked and the soak away facility uncared for.

No water point committee exists for either facility.

No recurrent financing mechanism is in place for either facility.

Improved facilities within the village give it a coverage rate of

39%, however other households are accessing improved sources within neighbouring villages that are easier and closer to access.

The average quantity of water drawn by households is 120 litres, but it was stated that depending how many people were in the home, and the distance between the home and the water point, affected the quantity of water used. Some households used the facilities to water cattle, but no brick making enterprises were supported by them.

Chobana Village

Village	WA Water Point name	Ward	RHC	Chief
Chobana	Chobana WA BH	Chona	Nampeyo	Chona

Name of Headman	Number of households		Population of the village	
	1999	2009	1999	2009
Mr Fredrick Mulilo	41	70	300+	440

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	Rehab	2000-01	S 16 ° 21.119 E 027 ° 38.700
HDW	Rope pump	Y	Rehab	2002-03	
BH	Handpump	Y	Rehab	2002-03	S 16 ° 21.060 E 027 ° 39.373
BH	Handpump	Y	New	2005-06	S 16 ° 21.407 E 027 ° 38.664




The hand dug well does not provide a reliable source of water. Between October and January, when water levels are at their lowest, the source 'dries up'. In 2002-03 the original windlass system was removed from the hand dug well and replaced with a rope pump. However, the rope pump suffered continual failures and the community decided to re-instate the windlass due to its superior performance. The remains of the rope pump are in photograph B. There was no protective fencing around the facility, which is used by 30 households.

The older borehole was previously a windmill driven system, however when that failed, the community were unable to get it repaired. In 1993, Africare converted it to a handpump, which WaterAid subsequently rehabilitated 10 years later. It provides the only reliable water source in the village. Pipes have required replacing in the facility, but these were provided free of charge. No protective fencing exists, the soak is poor and cracks are evident in the surrounding apron. 15 households use the facility.

The newer borehole is not a reliable source, does not have a protective fence and the soak away has been poorly maintained. Photograph D relates to this facility. Replacement rubbers have been required, but to date, that is the only breakdown experienced with the facility, which is used by 25 households.

All the facilities have independent WPCs who began collecting K500 / HH / month in 2008. Not all households pay all of the time. However, in theory, money collected is pooled to cover the cost of repair for any of the three facilities.

There are 70 households in Chobana, and all are served by the three facilities.

The average quantity of water drawn by households is 100 litres, but it was stated that depending how many people were in the home, and the distance between the home and the water point, affected the quantity of water used. Some households used the facilities to water cattle, and the newer borehole supports brick making enterprises but the amount of water drawn for the activity was not known.

Chikuni Village

Village	WA Water Point name	Ward	RHC	Chief
Chikuni	Chikuni Halwiindi	Chona	Nampeyo	Chona

Name of Headman	Number of households		Population of the village	
	2004	2009	2004	2009
	60	67	300ish	350ish

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
BH	Handpump	Y	New	2004-05	S 16 ^{o} 22.251 E 027 ^{o} 40.918
BH	Handpump	N	New	1995-96	S 16 ^{o} 21.337 E 027 ^{o} 41.024

The WaterAid supported borehole does provide a reliable source of water. However, the older facility does not; between October and January, when water levels are at their lowest, the source 'dries up'. In the photographs above, the older facility is A and the WaterAid supported one is B

The WaterAid facility is showing signs of deterioration with gaps in the protective fencing, but the system itself functions well. The facility has yet to experience a failure and 15 households use it from Chikuni whilst 22 other households access it from the neighbouring village of Halwiindi. The older facility has deteriorated further and looks even less well maintained, with poorer fencing, unclean surrounds and a blocked soak away. It has experienced six failures and eleven households depend on it for access.

Both facilities have independent WPCs. The WaterAid supported facility collects ZK1000 / HH / year while households using the older facility contribute ZK5000 / HH / year. Not all households pay all of the time however. Only ZK82,000 is in the maintenance fund for the WaterAid facility, which is insufficient to cover the cost of replacement pipes. The maintenance fund for the older facility has no money left in it after the remaining ZK40,000 were invested to purchase a goat.

There are 67 households in Chikuni, meaning the 2 facilities provide access for only 39%. The remaining 41 households in the village get their water from the river.

The average quantity of water drawn by households is 100 litres, but it was stated that depending how many people were in the home, and the distance between the home and the water point, affected the quantity of water used. Some households used the WaterAid supported facility to water cattle, however brick making enterprises are not supported by either water point.

Haloma Village

Village	WA Water Point name	Ward	RHC	Chief
Haloma	Haloma	Chongo East	Luyaba	Choongo

Name of Headman	Number of households		Population of the village	
	2007	2009	2007	2009
Mr S. B. N. Hibajene	25	28	294	300+

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	2003-04	S 16 ° 08.417 E 027 ° 21.471
HDW	Rope pump	Y	Rehab	2005-06	
BH	Handpump	N	New	1999-00	S 16 ° 08.361 E 027 ° 20.893

The WaterAid supported HDW provides reliable access to water. The WPC coordinated the management and financing of a replacement (and improved) windlass facility, paying a local welder to manufacture a metal cylinder. There's a well constructed fence, clean surroundings and effective soak away which waters a small banana plantation. 13 households regularly use the facility, but when neighbouring handpumps fail, more people use it. A rope pump was fitted to the facility, but was removed within a year of installation due to continual breakdown.

The borehole used to provide reliable access. It was 60 metres deep and water was first encountered at 3 meters. However, at the time of visit it was not functional. 60 households from 3 or 4 villages used the water point, and all were supposed to regularly contribute. The facility suffered two failures, the first associated with damaged pipes, however they could not be afforded so the damaged pipes were removed and discarded. The second and fatal failure was the chain. This has not been replaced and consequently the facility remains out of action. Lately, spare parts for a nearby school pump have been taken from the handpump, including the handle. There is no WPC for the handpump, however there did use to be one. Some questions were noted regarding the

possibility of the WPC misusing collected funds, but it was not clear from the discussions what had transpired.

There are 28 households in Chikuni. With the one functional facility, access to improved sources stands at 46%. The remaining households access water from shallow wells and neighbouring facilities.

Some households used the WaterAid supported facility to water cattle, however brick making enterprises are not supported by either water point.

Hamasaka Village

Village	WA Water Point name	Ward	RHC	Chief
Hamasaka	Hamasaka	Chongo East	Keemba	Choongo

Name of Headman	Number of households		Population of the village	
	2005	2009	2005	2009
Polson Bbilika	17	22	105	135

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
BH	Handpump	Y	New	2005-06	S 16 ^{o} 06.010 E 027 ^{o} 24.122

The facility provides reliable access to water throughout the year. The area surrounding the water point is well maintained and the protective fencing offers a resistant barrier to unwelcome guests. All 22 households within the village access their water from the handpump. Five households from neighbouring villages also use the facility, and a school borehole is also accessible.

The WPC collects ZK10,000 from the 27 households accessing the facility, however some are not always able to pay. The handpump is yet to experience a failure.

The average quantity of water drawn by households is 120 litres, but it was stated that depending how many people were in the home, and the distance between the home and the water point, affected the quantity of water used. Some households used the WaterAid supported facility to water cattle, however brick making enterprises are not supported by either water point.

Hamwaala Village

Village	WA Water Point name	Ward	RHC	Chief
Hamwaala	Hamwaala	Malundu	Hakunkula	Hamusonde

Name of Headman	Number of households		Population of the village	
Patison Malungo	2009			2009
	32			243

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	1996-97	S 16^{o} 02.395 E 027^{o} 10.035
BH	Handpump	N	New	2002-03	
BH	Handpump	N	New	2002-03	

None of the facilities supported in Hamwaala ever functioned. The HDW was constructed by the community who dug until they reached an impassable rock. Even though there was not much water in the well, they lined the facility after collecting cement from the local clinic. No one came to check the well prior to lining work commencing.

The two borehole facilities were installed by an unknown agency without participation by the community.

Currently all 32 households access water from the nearby river, which is also home to crocodiles. Each year several cattle and pigs are taken by crocodiles and two people have also been attacked.

Mweemba Village

Village	WA Water Point name	Ward	RHC	Chief
Mweemba	Chimweta	Chona	ZCA	Chona

Name of Headman	Number of households		Population of the village	
Andrew Banji Choobe	1998	2009	1998	2009
	83	17	unknown	117

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	Rehab	1998-99	S 16 ^{o} 15.912 E 027 ^{o} 35.580
HDW	Rope pump	Y	Rehab	2005-06	

WaterAid supported construction of a HDW in 1998-99 which was subsequently rehabilitated 2005-06. The original windlass system was replaced with a rope pump which the community continue to maintain. Reliable access to water is provided throughout the year. No WPC exists for the facility, however it is contained within a garden plot so is securely fenced and protected from animals. Individuals who use the garden also ensure the surroundings of the water point are clean. The rope pump has failed many times and repairs are undertaken by one individual within the village. Initially, households contributed towards the repair however no structure for recurrent funding was in place at the time of visit.

11 households regularly use the facility, but it is additionally shared with 5 households from neighbouring villages. There are 17 households within Mweemba, meaning a coverage rate of 65% from the supported HDW; the remaining households access a private well, or rely upon shallow wells.

The average quantity of water drawn by households is 120 litres, but it was stated that depending how many people were in the home, and the distance between the home and the water point, affected the quantity of water used. Neither cattle nor brick making enterprises were supported, however it was noted that water is drawn to support gardening activities.

The community additionally stated that households using the rope pump to support gardening initiatives viewed the facility quite favourably as modifications to the system allowed easy irrigation of their plants. However, households relying on the water point for domestic purposes were less enthusiastic about the service provided by it.

Hanamoonga Village

Village	WA Water Point name	Ward	RHC	Chief
Hanamoonga	Hanamoonga	Chona	Nampeyo	Chona

Name of Headman	Number of households		Population of the village	
	2002	2009	2002	2009
Bonapass Mazuba	74	86	Unknown	Unknown

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	Rehab	2005-06	S16° 20.624 E027° 41.738
BH	Handpump	Y	New	2004-05	S 16° 15.912 E 027° 35.580
BH	Handpump	N		1995-96	S16° 20.893 E027° 41.324

The rehabilitated HDW provides reliable access to water for nine households and has never suffered a breakdown. Although the windlass system is in place, no bucket is attached to the chain; individuals employed buckets and ropes to access water. Cracks in the surrounding apron were reportedly permitting surface water to enter the well. No WPC for the facility exists and no recurrent funding mechanism was operational at the time of the field visit.

The WaterAid supported borehole does not provide reliable access to water for the community. It was stated that the handpump had suffered a failure in 2006 related to damaged pipes. Collected contributions allowed the WPC to purchase one new pipe and pay the APM to fit it. However, it was unclear how many pipes actually required replacing at that time, or whether the water point provided reliable access prior to failure. The borehole is 58 metres deep, and 12 pipes are attached to the handpump, resulting in 22 meters existing between the bottom of the well and the end of the pipe. It may be possible that insufficient pipes were purchased at the time of failure to replace the damaged items. Fencing around the water point was incomplete. 29 households accessed water from the handpump.

A borehole supported by DAPP had been installed but never worked. It was unclear why WaterAid had not undertaken a rehabilitation of this facility rather than installing a new system. Apparently DAPP have been contacted many times over the 13 years since the handpump was unsuccessfully implemented but to date are yet to rehabilitate it.

There are 86 households within the village; the WaterAid supported interventions provide improved access to 44% of the population. It was reported that three private HDWs exist which some households are able to access, however many rely on unimproved sources.

Kazemba Village

Village	WA Water Point name	Ward	RHC	Chief
Kazemba	Kazemba	Katimba	Hatontola	Monze

Name of Headman	Number of households		Population of the village	
	1998	2009	1998	2009
Philip Michelo	24	39	Unknown	200ish

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	Rehab	1997-98	S16^{o} 23.249 E027 ^{o} 13.739

The WaterAid supported HDW does not provide reliable access to water for the community. During the time of year when water levels are at their lowest, no water is available. Although the windlass facility is in place, no chain or bucket are attached as households access water through individual ropes and buckets. No WPC for the facility exists, however one individual within the village managed a repair to the system. Lining rings in the well collapsed and he paid for cement and a well liner to extract the broke rings and install replacements; to date, no other household has contributed to the cost of that repair. The surrounding fence, soak away facility and apron are deteriorating.

16 households within Kazemba access water from the facility, however there are 36 in the village and no other improved water source exists within its boundaries. The remaining 20 households get water from improved sources in neighbouring villages or from unimproved sources nearer their homes.

On average, 120 litres of water are collected by households each day. Additionally, water for cattle is drawn from it when water is available.

Sihubwa Village

Village	WA Water Point name	Ward	RHC	Chief
Sihubwa	Hakauka	Katimba	Hatontola	Monze

Name of Headman	Number of households		Population of the village	
Philip Michelo		2009		2009
		67		Unknown

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Handpump	Y	Rehab	2005-06	S16^{o} 23.782 E027^{o} 09.177
BH	Handpump	Y	Rehab	2005-06	S16^{o} 24.950 E027^{o} 09.208

WaterAid supported the rehabilitation of two facilities within Sihubwa. Photograph A relates to the first water point, which was not functional at the time of the field visit having failed in November 2008. Three new pipes were required for the handpump, however insufficient money existed to cover their purchase and consequently, the water point has remained out of action ever since. The WPC was apparently still operational, but did not have any roles to perform; recurrent contributions were collected at the time of a break down and although some had been made, it was insufficient to cover the cost of repair. Evidently, the WPC were no longer cleaning or fencing the facility either. Upon learning the cost of repair, the community expressed a desire to restart the WPC and begin collecting contributions to fund repair work. Shallow wells had been used by households whilst the handpump was inoperable.

Of the 67 households in Sihubwa, all depended upon the handpump and all previously accessed it.

The second facility, photographed in picture B, was beyond the boundary of Sihubwa but supported by WaterAid at the same time. A

HDW was rehabilitated and Afri-dev handpump installed, which provide reliable access to water for the 67 households that rely upon it. It is a coincidence that 67 households use this facility as apparently none are from the village of Sihubwa; the distance to it is too great for people to journey multiple times each day. To date, no failures have occurred to the facility. No WPC exists to support its management or maintenance. The protective fencing is inadequate and the soak away facility unproductive. No recurrent financing mechanism is in place. This was the only Afri-dev handpump witnessed within sampled villages and users were unclear how they would access spare parts in the event of system failure.

Munachilala Village

Village	WA Water Point name	Ward	RHC	Chief
Munachilala	Munachilala	Choongo West	Keemba	Choongo

Name of Headman	Number of households		Population of the village	
	2001	2009	2001	2009
Munema Munachilala	unknown	45	unknown	250ish

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	Rehab	2001-02	$S16^{0}$ 04.477 $E027^{0}$ 22.102
BH	Handpump	Y	New	2005-06	

Both the HDW and borehole provide reliable access to water. There is no WPC for the windlass facility, which has suffered one breakdown since it was installed; the cement lid on top of the well opening has collapsed and fallen into the water. A make-shift lid has been constructed of wood, no attempt has been made to organise a replacement or to remove the broken lid from the water. There is no protective fencing for the facility, nor a cement surround and soak away. 18 households from a neighbouring village use the water point – no household in Munachilala does as the borehole is considerably closer.

Protective fencing for the handpump facility could be improved, as photograph A demonstrates. The facility has a functioning WPC who collect recurrent contributions, however as demonstrated within the main report, recurrent financing is not good. The handpump has suffered one breakdown, which related to damaged pipes. Replacement pipes were provided free of charge by DAPP. All 45 households in the village access the facility and it is additionally shared with several households from a second neighbouring community. It was estimated by the community that the depth of the borehole was 75 metres, with the pump at 51 metres. However the estimate by the village could be quite inaccurate.

The average quantity of water drawn by households is 140 litres, but it was stated that depending how many people were in the home, and the distance between the home and the water point, affected the quantity of water used. Some households used either water point to water cattle, however brick making enterprises are not supported by either facility.

Hambalamatu Village

Village	WA Water Point name	Ward	RHC	Chief
Hambalamatu	Hambalamatu	Siantotola	Hatontola	Monze

Name of Headman	Number of households		Population of the village	
Amon Chuula	2005	2009	2005	2009
	>56	56	Unknown	300+

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
BH	Handpump	N		1998-99	S16^0 23.569
HDW	Windlass	Y	New	2004-05	E027 ^{0} 13.911

The WaterAid supported HDW and windlass were functional and in use. However, the well did not provide a reliable source of water to dependant households, failing when water levels were at their lowest. The facility was clean, however almost no protective fencing remained and the soak away facility was unproductive. No WPC exists for the HDW and no recurrent financing structure is in place to generate and collect funds for maintaining the system. 25 households use the water from the 56 within the village. Additionally, nine households from neighbouring villages also access water from the well. The water point provides water for cattle, however brick making enterprises are not supported by it.

The handpump facility was not implemented with WaterAid support. The facility failed in 2007 and is yet to be repaired. The handpump has a long history of failures, with some households within the group suggesting it could have experienced as many as 20. Pipes were the cause of many breakdowns and were the reason for the current non-functionality. Previously households have purchased replacement pipes for the system, but were unwilling to invest more money to repair the system again. Households previously accessing water from the handpump were now reliant upon unimproved sources. With 56 households in the village and only one functioning water point, coverage in Hambalamatu was 45%.

Sintambo Village

Village	WA Water Point name	Ward	RHC	Chief
Sintambo	Sintambo A, B and C	Mwanza West	ZCA	Mwanza

Name of Headman	Number of households		Population of the village	
	1998	2009	1998	2009
Charles Matimba	40	48	260ish	329

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	1998-99	$S16^0$ $E027^0$
HDW	Windlass	Y	New	1997-98	
HDW	Windlass	Y	New	1998-99	



WaterAid supported the implementation of all three HDWs in Sintambo, and all provide reliable, year round access to water for dependant households. However, none of the windlass facilities have been maintained; all have deteriorated and not been replaced. In all cases, households were accessing water using individual ropes and buckets. None of the water points had protective fencing, and all the surrounding aprons were cracked. None of the facilities had a WPC and no recurrent financing mechanisms were operational.

In total, Sintambo is home to 48 households, 85% of which are covered by the three facilities. The remaining households access a private household well as an improved alternative source. Eight households from neighbouring villages use the three HDWs.

On average, each household collects around 100 litres of water each day for domestic purposes. Water for cattle and / or brick making enterprises is not supported by any of the HDWs.

Kabuyu Village

Village	WA Water Point name	Ward	RHC	Chief
Kabuyu	Kabuyu	Bbombo	Hatontola	Monze

Name of Headman	Number of households		Population of the village	
	2002	2009	2002	2009
Philliman Hibanyama	19	29	100ish	150ish

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	2002-03	S16^0 23.746
BH	Windmill	N		1959	E027 ^{0} 19.041

WaterAid supported the implementation of a HDW and windlass in Kabuyu, which does not provide a reliable source of water throughout the year. At a nearby farm, an old borehole does provide year round access but the facility has severely deteriorated and an improvised handpump constructed of wooden beams is used to access water in the well.

The windlass system remains in use and no failures to it were reported by the group. A WPC is in operation and undertakes cleaning of the facility as well as maintaining the protective fencing. Materials used for fencing include barbed wire which prevents access by cattle, but many dogs, goats and chickens were observed around the water point during discussions. No money is currently collected for the HDW facility. 20 households use the water point from Kabuyu and an additional 5 households from neighbouring villages also access water from the well. It was stated that in addition to domestic use, cattle are also watered from the facility.

The old borehole was installed by the original owner of a farm. It was previously attached to a pump driven by a windmill, however over time, the mechanism has failed and not been repaired. A WPC for the facility exists and in addition to maintaining the locally manufactured pump, collects money for maintenance of the facility. Many of the households using the HDW contribute to maintenance of the borehole, although it was made clear that money collected for the borehole could not be spent on the HDW. Five households regularly use the facility however this number increases when the HDW fails to provide sufficient water. No cattle or brick making facilities are supported by the borehole.

Remaining households within the village (4), access water from either a private household well or from unimproved sources. On average, each household collects 140 litres of water for domestic purposes each day.

Simukale Village

Village	WA Water Point name	Ward	RHC	Chief
Simukale	Kasikili	Chisekesi	Rusangu	Monze

Name of Headman	Number of households		Population of the village	
	2000	2009	2001	2009
George Namweemba	unknown	104	unknown	unknown

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	1999-00	$S16^{0}$ 22.584 $E027^{0}$ 29.012
HDW	Windlass	Y	New	1999-00	
BH	Handpump	Y	New	2006-07	



The two HDWs supported by WaterAid do not provide access to a reliable source of water for dependant households. In both cases, the windlass facility has deteriorated and not been replaced; households access water using individual ropes and buckets. Neither water point has a functioning WPC and no funds are collected to support repair and maintenance activities. The protective fencing of the water points was ineffective, the closable flaps missing, and the aprons were cracked. Collectively, it was reported that only 22 households accessed water from the facilities, although 6 households from neighbouring villages were also regular users of the water points. Additionally, when handpumps in neighbouring villages failed, the number of people using the HDWs also increased. In both cases, cattle were also watered from the wells.

The recently installed handpump is located in an area prone to flooding. Although water can be accessed throughout the year, concerns regarding its quality exist as the cement apron becomes submerged in the height of the wet season. No WPC for the handpump is operational and no funds are collected as it was reported that the system is yet to breakdown. No protective fencing has been constructed and the soak away facility is unproductive. 25 households use the handpump, and cattle are also watered from it.

In total, Simukale is home to 104 households, however it was reported that only 47 were accessing the implemented improved sources, giving 47% coverage. Other households were stated to use unimproved sources. On average, 140 litres of water are collected by households from the improved facilities each day.

Chicheleko Village

Village	WA Water Point name	Ward	RHC	Chief
Chicheleko	Chicheleko	Manungu	Manungu	Monze

Name of Headman	Number of households		Population of the village	
Mr Charles Malambo	2009		2009	
	75		Unknown	

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	Rehab	2005-06	$S16^{0}$ 19.218 $E027^{0}$ 30.290
HDW	Windlass	Y	Rehab	2005-06	
HDW	Windlass	Y	Rehab	2005-06	
BH	Handpump	Y	Rehab	2005-06	

WaterAid supported rehabilitation work to four facilities in 2005-06. None of the HDWs provided households with a reliable source of water throughout the year. And none of the windlass facilities had been maintained; all households were using individual ropes and buckets to collect water. None of the water points had a functional WPC and no recurrent financing mechanism was operational for the HDWs. In total, 38 households were using the three HDWs from Chicheleko, but it was reported a small number of neighbouring households also accessed water from the wells. Cattle were being watered from all of the wells.

The rehabilitated handpump does provide reliable water throughout the year. A WPC exists and is still functional, holding responsibility for coordinating repairs to the facility. Although households are required to contribute in the event of a breakdown, for both of the two reported failures, insufficient funds were available to cover the total cost. In both instances, the Department for Water Affairs reportedly provided replacement pipes to the community at no cost. At the time of the field visit, it was noted that the entire handpump moved when being operated. The group believed nuts at the base of the facility required tightening, however cracks within the apron were also observed. No protective fencing surrounded the water point and the soak away facility was unproductive. It was reported that 35 households use the handpump, which is also used to water cattle and support brick making enterprises.

97% of the households with Chicheleko reportedly used the improved sources.

Sinyendeende Village

Village	WA Water Point name	Ward	RHC	Chief
Sinyendeende	Sinyendeende B	Mayaba	Manungu	Monze

Name of Headman	Number of households		Population of the village	
	2004	2009	2004	2009
Peter Chilawu	29	38	Around 300	Around 370

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	1995-96	S16^0 18.428 E027 ^{0} 26.531
HDW	Handpump	Y	Rehab	2002-03	S16^0 18.342 E027 ^{0} 26.415
BH	Handpump	Y	New	2005-06	S16^0 18.428 E027 ^{0} 26.531

Initially, a HDW with windlass was supported by WaterAid. However, the facility did not provide reliable access to water. The well was 30 metres deep, and could not be manually excavated beyond that depth. In 2002-03, the facility was rehabilitated and a handpump was installed. However, the well was not deepened at this time so continued to provide unreliable access to water. As it may be possible to note from photograph A, the well lid also houses a lid that enables households to use buckets and ropes to access water; this was apparently installed to facilitate access in the event of handpump failure. Having an unsealed well however means the water is open to sources of contamination. No WPC exists for the facility, which has never broken down. No protective fencing surrounds the handpump.

It was reported that only a very small number, if any, households use that facility however. In 2005-06 a new borehole and handpump were installed approximately 400 metres from the older facility. It was unclear why rehabilitation work to the existing handpump had not taken place. The new handpump does provide reliable access to water; however three failures have occurred to it. A WPC exists and collects regular contributions from households, however not all are contributing all of the time. Insufficient money was available to cover the cost of repairs, consequently the community removed damaged pipes without installing replacements. It was reported that all 38 households within Sinyendeende use the new facility, which also supports both water for cattle and brick making enterprises.

On average, each household reportedly collects 140 litres of water for domestic purposes.

Havuuka Village

Village	WA Water Point name	Ward	RHC	Chief
Havuuka	Havuuka	Choongo West	Keemba	Choongo

Name of Headman	Number of households		Population of the village	
	1996	2009	1996	2009
Record Chimuka	42ish	85	Unknown	Unknown

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
HDW	Windlass	Y	New	1995-96	S16^{0} 17.094 E027 ^{0} 25.776
BH	Handpump	N		2002-03	

The WaterAid supported HDW apparently never had a windlass mechanism provided, despite brick supporting structures being constructed. The facility does not provide a reliable source of water for dependant households and individuals access water using ropes and buckets. No WPC exists and no recurrent funding mechanism is in place. No protective fencing exists, the apron is cracked and the soak away does not perform well. Cattle are watered from the well. When water is not available, the 30 households using it, access water from alternative improved and unimproved sources.

A significant alternative source was reported to be a handpump facility in Gaali village. Of the 85 households in Havuuka, 15 were reported to use the Gaali handpump. However, while the facility provides reliable access to water, at the time of the field visit, it was not functional as four pipes required replacement. Although a WPC exists and collects money from households in the event of a breakdown, insufficient funds were available to cover the cost of repair works. In total, 80 households use the handpump and all were theoretically paying ZK10,000 in the event of a breakdown, which would more than cover the cost of replacing four pipes, which indicates that not all households are willing, or able, to pay for handpump repairs. Households are currently accessing water from unimproved sources. At the time of visit, only 36% of households had access to an improved water source. On average, each household collects 100 litres of water for domestic purposes.

Makala Village

Village	WA Water Point name	Ward	RHC	Chief
Makala		Keemba	Keemba	Choongo

Name of Headman	Number of households		Population of the village	
	2001	2009	2001	2009
Yuroram Ng'andu	58	48	Unknown	Unknown

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
BH	Handpump	Y	Rehab	2004-05	S16^0 03.589 E027^0 22.067
BH	Handpump	Y	New	2007-08	S16^0 03.791 E027^0 21.916

WaterAid supported the implementation of both boreholes within Makala village. The first was a rehabilitation to an existing facility provided by the Government, which was in need of remedial works. A WPC for the facility exists and collects contributions from households to fund repair work, however a number of failures to pipes within the system have occurred which could not be adequately financed. Rather than replace damaged pipes with new ones, the failed pipes have been removed and welded as a temporary measure, or removed. It was reported that very little welding could be done to the pipes and no money was in the maintenance fund to support the purchase of replacements. 28 households in Makala reportedly used the facility, together with an additional 20 from neighbouring villages, but only 13 contributed when the last failure occurred. Cattle and brick making enterprises are both supported by the rehabilitated handpump.

The new handpump also provides reliable access to water for dependant households, and has a well constructed wooden fence and clean surroundings. The WPC is still operational, however it is not collecting any funds to finance repair and maintenance work as the facility is yet to breakdown. 20 households use the facility from Makala.

All 48 households within the village access either of the two boreholes. However, the new facility has been located approximately 500 metres from the rehabilitated water point. It was not clear why the facilities were located in such close proximity.

On average, each household collects around 160 litres of water for domestic purposes.

Sikanyona Village

Village	WA Water Point name	Ward	RHC	Chief
Sikanyona	Sikanyona	Keemba	Keemba	Choongo

Name of Headman	Number of households		Population of the village	
	2004	2009	2004	2009
Paddle Miyoba	32	38	Unknown	300+

WP type	Lifting device	WA	New or Rehab	Year	GPS coordinates
BH	Handpump	Y	Rehab	2004-05	$S16^0$ 01.882 $E027^0$ 24.293

The rehabilitated borehole provides reliable access to households throughout the year. Prior to rehabilitation work, the facility was originally a windmill driven system which deteriorated and was replaced with a handpump in 1994 by Afri-care. WaterAid rehabilitated the facility 10 years later, by providing a new handpump.

A WPC for the facility exists and collects funds from households on a regular basis. However the level of funding is insufficient to cover the cost of necessary works. The handpump has failed at least six times due to damaged pipes, and in each case, the offending pipe has been removed and discarded, rather than replaced. Originally, 12 pipes were attached to the handpump, currently only 6 remain.

All 38 households within the village use the water point, together with 29 households from neighbouring villages. On average, each household collects approximately 140 litres of water for domestic purposes. Additionally, water is used for cattle and to support brick making enterprises.

Appendix 3 Guiding Questions for Group Discussions

Sustainability factor	**Open ended questions**
Social	• When was the water point installed? • Who does the water point belong to? • Who manages the water point? • What do members of the water point committee do? • Is the water point working today?
Financial	• Before the water point was installed, did you contribute anything towards it (cash or in-kind)? • How much do you contribute to operation and maintenance of the water point? • How was it agreed that you should contribute that amount? • Does every household pay the same? • Who collects and manages the contributions? • How much is currently available for maintenance and repair?
Technical	• Has the water point ever broken down or required a repair? • How did you manage the repair and what did it cost? • Where did you get the spare parts from? • Is this the only water point used by community members? *Observe quality of construction and finishing, as well as presence of protective fencing and soak away.*
Institutional	• Since the water point was installed, have people from WaterAid, the local government or other organisations been back to your community? ○ What happened at that time? What support did they provide? • When the water point does break down, do you know who to contact with the relevant tools and technical training to carry out the repair? • What the water point does breakdown, what will you do?

Environmental	• Does the water point provide water at all times throughout the year? • Has use of the water point changed since it was first installed? • Have land management practices / uses changed?

Appendix 4 Statistical significance

Appendix B of WaterAid's Guidance for Post-Implementation Monitoring (Carter, 2010) states the formula for calculating statistical representation for a small population as follows:

$$n' = n/(1+(n-1)/N)$$

Where n' is the corrected sample size, n is the sample size calculated for a large population, and N is the actual size of the (small) population. The guidance paper calculated that, based on a 95% confidence limit and ±5% margin of error, n=384.

To achieve a statistically representative sample for each year of investigation for this study would mean applying the following:

n'=384/(1+(384-1)/total number of water points installed each year)

As the table below shows, all water points installed in a given year would need to be included in the sample for statistical representation. If the total population (rather than annualised population) was used for statistical validity, the required sample size would be 53, as demonstrated below.

	Year of Installation											
	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	**Total**
Total water points installed	5	6	5	6	3	0	6	9	7	7	7	**61**
Statistically representation	5	6	5	6	3	0	6	9	7	7	7	**61**

n'=384/(1+(384-1)/61)
n'=384/7.278689
n'=52.7787

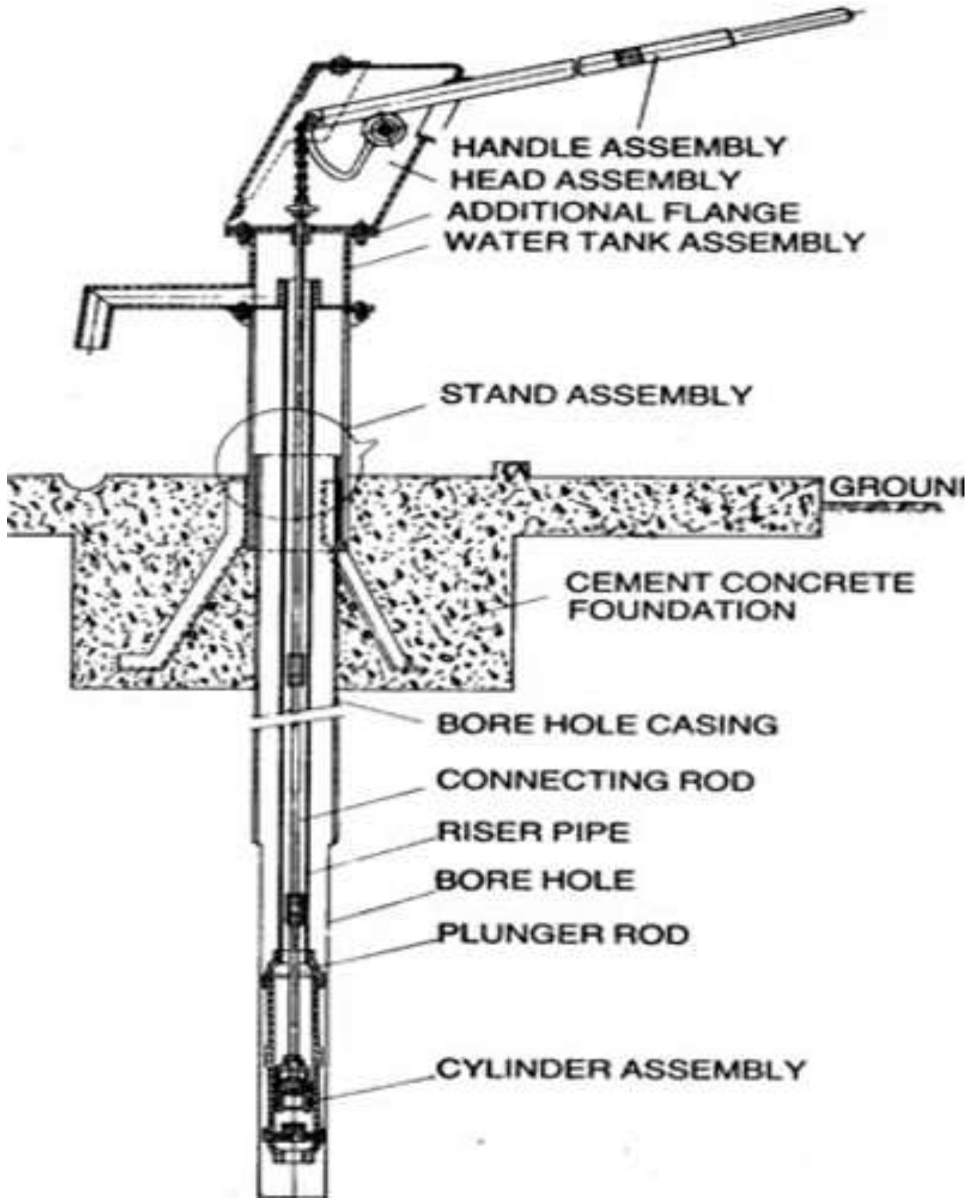
Time and resource constraints limited the total number of communities included in this study to 20, meaning it would not be possible to achieve statistical representation with a 95% confidence limit and ±5% margin of error.

Appendix 5 SOMAP Spare Parts Price List

Obtained from the Water and Sewerage Company, Monze.

Item	Price (Kwacha)
Bearings	99,000
Bolts - inspection cover	2,000
Bolts and nuts	3,000
Bushes	2,500
Chain and coupling	33,000
Chain bolt	3,000
Check valve	17,000
Crude bush cover	38,000
Cylinder	377,000
Cylinder rubber seal	3,000
Grease 1000g	32,000
Grease 200g	5,000
Grease 500g	19,000
Handpump set	2,400,000
Inspection bushes	2,500
Lower foot valve	74,000
Lower valve	74,000
Pedestal	577,000
Pipe socket	9,900
Pipes	170,000
Plunger	74,000
Press handle	274,000
Pump head	502,000
Pump rods	97,000
Rod socket	3,000
Rubber cap	17,000
Rubber seal large	2,000
Rubber seal small	2,000
Sealing rings	2,000
Spacer	2,000
Spares kit (standard)	150,000
Spares kit (UNICEF)	220,000
Upper foot valve	74,000
Washer	2,000
Water tank	324,000

Appendix 6 Diagram of India Mark 2 Handpump



Source: http://www.shaktigroup.in/images/india_II.gif

Appendix 7 Schedule of Fieldwork

	August					September																							
	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18tl	19th	20th	21st	22nd	23rd	24th
	Thur	Fri	Sat	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Mon	Tue	Wed	Thu
Visit 1 - phase 1																													
Muzyambe																													
Hanamoonga																													
Chikuni																													
Choobana																													
Hambuba																													
Haloma																													
Hamasaka																													
Munachilala																													
Hamwaala																													
Nakalanga																													
Mweembe																													
Kazemba																													
Sihubwa																													
Masaka																													
Hambalamatu																													
Hatontola																													
Back to Lusaka																													
Write up and prep																													
Review V1																													
Prep for visit 2																													
Travel to Monze																													
Visit 2 - phase 1																													
Muzyambe																													
Choobana																													
Chikuni																													
Haloma																													
Hamasaka																													
Write up and prep																													
Hamwaala																													
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Hanamoonga																													
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Sihubwa																													
Hambalamatu																													
Write up and prep																													
Visit 1 - phase 2																													
Simukale																													
Chicheleko																													
Sinyendeende																													
Makala																													
Hahuka																													
Sikanyona																													
Visit 2 - phase 2																													
Sintambo																													
Write up and prep																													
Kabuyu																													
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Write up																													

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