Results-based funding to provide safe drinking water services for public schools and healthcare facilities in Zambia

March 2025

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Executive summary

In October 2024, the Permanent Secretaries of the Ministries of Local Government and Rural Development, Education, Health, and Water Development and Sanitation signed a Memorandum of Understanding to pilot a results-based contract to deliver safe drinking water to rural schools and healthcare facilities in Zambia. The results-based contract will ensure repairs to water systems are completed in three days and water safety is improved in Mumbwa – one of Zambia's 116 districts. The motivation for this initiative is aligned to the Presidential directive to provide piped water in all public facilities. The drought emergency has amplified the importance of this directive with significant economic and social hardship increasing attention on the quality and management of drinking water services.

The provision of safe drinking water services faces two significant challenges: the non-functionality of water supply infrastructure and the risks of bacterial and chemical contamination, which remain uncertain due to a lack of reliable data. Interviews conducted in July 2024 with 33 schools in Mumbwa district highlighted key issues, including low technical capacity, inadequate budget allocations, and bureaucratic delays that prolong the resolution of faults in piped water systems. As a result, schools may close, feeding programs can be disrupted, and children are often required to fetch water from external sources. These challenges ultimately weaken both educational and health outcomes.

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Results-based contracts present a viable solution to improving the reliability and safety of water services. Under this approach, a professional service provider is required to meet agreed performance metrics for drinking water services each quarter before a payment is made. This marks a shift from current policies and practices, which place the responsibility for managing drinking water on school and healthcare facility administrations without effective monitoring or accountability mechanisms.

A Zambian NGO, ECHO, has been awarded the contract for piloting the 'SafeManzi' model – a professional water service delivery model in Mumbwa district, Central Province, from November 2024 to December 2025. Based on a baseline assessment, 159 schools and healthcare facilities in Mumbwa district have been shortlisted, of which 100 have been selected for the pilot contract. The remaining institutions require investment in major rehabilitation work to upgrade the water supply infrastructure to be suitable for a results-based contract. The contract schedules a payment for each water site of up to USD 100 (ZMW 2,600) per quarter based on three performance indicators: a) repair all infrastructure faults within three days, b) ensure a low Sanitary Inspection score, and c) conduct microbiological testing and response actions to manage safe water provision. Priority chemical testing will be introduced at the end of the pilot in collaboration with national laboratories meeting quality assurance standards.

The SafeManzi model can be scaled to national scale, enabling Zambia, by 2030, to become the first country in Africa to provide safely-managed drinking water in all public institutions. This would complement government initiatives and commitments to improve nutritional outcomes, increase education attendance and attainment, and reduce gendered inequalities. To achieve this scale, policymakers must address five key issues. First, sustainable funding is essential, covering both initial infrastructure and ongoing operational costs. Second, development partners should align their efforts to maximize efficiency and sustainability. Third, a national results-based contracting system should facilitate the transition to piped systems. Fourth, effective public management strategies are needed for hiring and overseeing professional service providers. Lastly, data validation must align with government systems to support contract-driven outcomes.

SafeManzi's expansion hinges on sustainable government funding and support from development partners, with experience in outcome-based funding. Zambia's results-based contract experience in road infrastructure offers a model, though adaptations for water infrastructure are necessary. The shift from handpumps towards piped schemes highlights the need for iterative investments and strategies. Key to the national programme's success will be a robust data validation system and reliable financial mechanisms to ensure transparent, timely payments. This initiative, supported by Zambia's active NGO sector, requires structured procurement processes and results-based funding to ensure equitable and long-term access to clean water in public facilities. In this document, we discuss how this approach could be scaled from the pilot, with contracts that could be managed in four regional hubs for a national model.

1. Introduction

On the 16th of August 2022, the President of the Republic of Zambia, H.E. Hakainde Hichilema proposed that every school and healthcare facility in Zambia should have reticulated (piped) water by the end of 2024. A severe drought in 2024 has led to major economic and social hardship across the country reinforcing Zambia's commitment to provide long-term and sustainable solutions for water security. This includes addressing the variable and often unknown performance of drinking water services in over 10,731 government schools and 2,780 healthcare facilities in 116 districts. The education and health of over 4 million primary and secondary school students depend on reliable and safe water for drinking, hygiene, sanitation, food and cleaning the facilities. The same applies to all rural residents wishing to access health services when they are sick, pregnant or injured. Schools and healthcare facilities without safe water cannot deliver high quality services and regularly close when water supplies fail.

Rethinking the current policy of devolving daily water service responsibilities to headteachers and health managers includes examining the potential of results-based contracting (or payment for results). Results-based contracting reallocates responsibilities and funding based on verified results at scale (McNicholl et al, 2021). First, key performance indicators of reliability and water safety are identified. Second, service delivery is reallocated to a professional service provider responsible for all facilities in a district. Third, the service provider is paid after delivering verified results against the indicators. The approach improves policy accountability, funding transparency, regulatory compliance, and allocative efficiency. Globally, the World Bank and other development agencies are applying payment for results programming due to the unsatisfactory performance of existing approaches which promote 'access' (building infrastructure) without inadequate or no provision for 'services' (safe drinking water).

Existing policies and regulation on rural water services across Africa have not yet delivered or sustained the desired results on the ground. In response, there has been growing interest in different types of outcome-based funding. In brief, the funding model creates incentives for measurable outcomes rather than paying for inputs. The World Bank has been supporting Payment for Results programmes in Benin, the Democratic Republic of the Congo, Horn of Africa, Kenya and Nigeria to link capital expenditure with long term operational outcomes. Payment for Results programmes have become an increasingly common instrument for water loans and grants. Bilateral donors, including the UK Foreign, Commonwealth & Development Office (FCDO), and the Netherlands' Directorate-General for International Cooperation (DGIS), have funded initiatives in Ghana, Kenya, Mali, Uganda, Tanzania, and Zambia. These programmes focus on developing and testing professional service delivery models to ensure reliable access to safe drinking water. Payments are released only after performance metrics, such as water quality and service reliability, have been verified.

Since 2018, Uptime Global has designed and executed results-based contracts in 16 countries guaranteeing reliable drinking water for over five million rural people at an average cost of less than USD1 per person per year (McNicholl and Hope, 2024). The University of Oxford has supported Uptime to expand the contract design to include water safety monitoring and managed actions for schools and healthcare facilities under the SafePani model with the Government of Bangladesh (Hope et al, 2021). The SafePani costed analysis (REACH, 2023) estimates a similar subsidy requirement, which will be co-funded within the national budget in one district by the Government of Bangladesh from 2024 to 2030 aligned to the Sustainable Development Goal (SDG) Target 6.1 commitments.

Robust data verification processes are foundational to successfully applying outcome based approaches. Rural drinking water services are notoriously difficult to monitor and regulate. The National Water Supply and Sanitation Council (NWASCO), Zambia's regulator for water services, has shown leadership for urban water services in Africa over the last 20 years and is now focussing more on the rural water sector. NWASCO is contributing to the new framework for rural water supply regulation that is being developed under the leadership of the Eastern and Southern Africa Water and Sanitation Regulators Association (ESAWAS) with input from the World Health Organisation (WHO). Uptime and the University of Oxford are discussing with NWASCO, ESAWAS, and WHO to align Uptime's verification processes with the evolving regulatory environment. Uptime has developed a data integrity approach for rural drinking water systems that combines data validation with verification through site visits and data audits (Armstrong et al, 2024). This ongoing process provides the empirical basis to release quarterly payments to professional service providers and promotes continuous improvement.

This report explains the logic and multiple benefits of results-based contracts. The logic is simple and well-rehearsed: government and donors pay for validated results, this improves transparency, accountability and public finance management. The benefits for water users in schools and healthcare facilities are substantial, particularly in improving the health of students and patients by ensuring access to safe drinking water. Reliable water supply also supports personal and facility hygiene, enables school feeding programmes to operate as planned, and enhances resilience to climate impacts such as droughts, floods, and heatwaves. Furthermore, teachers and healthcare professionals can focus on their core responsibilities – educating children and caring for the sick – without being burdened by the challenges of managing water supplies.

We now provide details of the architecture and costs for a pilot results-based contract in Mumbwa district in Zambia, drawing on a diagnostic study of 159 public schools and healthcare facilities with 116 handpumps and 43 submersible pumps with piped schemes. The costed analysis is structured in three components – service hubs, maintenance services, and water safety – with costs disaggregated as one-off and recurring items for each component. The report illustrates how a results-based contract could strengthen the existing government systems and explores how the programme could be scaled to the national level by 2030.

2. SafeManzi

The SafeManzi model[1] is a professional water service delivery model for schools and healthcare facilities in Zambia, designed as a results-based contract with payments on specific performance metrics. It draws on two bodies of empirical evidence. First, since 2018, Uptime has designed, modified and executed contracts in 16 countries providing reliable drinking water to over 5 million rural people. Second, the University of Oxford has co-designed a results-based contract with the Government of Bangladesh targeting public schools and clinics in the coastal zone called SafePani. SafePani specifically addressed water safety with three key components: a) assessing water safety, through chemical and microbial testing, and sanitary Inspections, b) reporting results to relevant local users, national and sub-national government, and c) taking managed actions to mitigate risks based on the results (Charles et al, 2023).

Based on results of the pilot SafePani programme, the Government of Bangladesh has allocated core budget to co-fund the work from 2024 to 2030 for 1,174 schools and healthcare centres in one of 64 districts. The average annual cost per person of both Uptime and SafePani is less than USD 1 per year (REACH, 2023).

Zambia has a well-established policy and regulatory framework for drinking water services, primarily focused on urban piped systems and rural water points. However, public facilities are under growing pressure due to tightening budgets, increasing student numbers, and the rising costs of maintaining modern piped systems compared to traditional handpumps. The long-standing approach of assigning responsibility for managing critical water infrastructure to school and healthcare facility managers is increasingly recognised as inadequate, often leading to uneven and unsatisfactory outcomes. A recent analysis of policy frameworks and regulations, including interviews with government officials and water managers in schools (Mumbwa district) and healthcare facilities, provides further evidence of the need to rethink existing policy approaches (Muchelenje, 2024).

The budget allocation for the water sector, like several others, has declined in recent years. Government data shows that funding dropped from nearly ZMW 2 billion (USD 80 million) in 2021 to less than ZMW 0.9 billion (USD 36 million) in 2025. While the Constituency Development Fund (CDF) and other budgetary instruments, along with support from development partners, may help offset these reductions, the current budget allocation transferred from the Treasury to the Ministry of Education for schools is widely considered inadequate by school managers.

1 SafeManzi means 'safe water' blending English and Bantu words.

School grants are calculated based on two factors: the number of pupils and the school's distance from the district centre. As a result, smaller and more remote schools often receive significantly lower funding than larger, centrally located schools. In Mumbwa, school grants range from ZMW 32 (USD 1.28) to ZMW 56 (USD 2.24) per pupil (Muchelenje, 2024). Within these grants, only 15% is allocated for general maintenance, which can be used for operational costs. However, school managers report that this allocation is often insufficient to cover all maintenance needs. Additionally, any changes require obtaining quotes and securing permissions to prevent fund misappropriation, a process that can be time-consuming, particularly for schools in more remote areas.

The capacity of teachers to fix repairs is limited and training on new piped systems can be forgotten or undermined when teachers are reassigned. Breakdowns are often misdiagnosed, resulting in repairs taking several days to months. The free education policy has positively increased class numbers though increased demand on water systems. A number of schools which attempt to stop community water use have encountered problems with vandalism of school infrastructure. Moreover, loadshedding affects piped systems dependent on the national grid, which can damage submersible pumps. However, the majority of rural schools depend on handpumps, which avoid loadshedding challenges though the quality of water is often uncertain and rarely monitored. In sum, limited budgets, uneven technical capacity, unreliable energy, and inadequate monitoring systems create a difficult context for schools to sustainably deliver safe drinking water services every day as mandated by national government.

Photo © Uptime/ECHO survey 2024

The current water service policy and regulatory landscape in Zambia has largely focussed on community water supplies in rural areas. Public institutions do not have clear and consistent policy provision which is effectively managed and regulated to ensure drinking water services are sufficient, safe and reliable. Government departments and the regulator are working to address this gap. SafeManzi reflects a new approach to strengthen existing structures within government by providing a consistent, accountable and scalable response to monitoring and managing drinking water services across public schools and healthcare facilities.

The SafeManzi work commenced in January 2024 aiming to provide safe and reliable water services to all schools and healthcare facilities in Zambia, with the vision to scale up from a pilot phase in selected districts to national level by 2030. Uptime Global contracted the Zambian non-profit organisation ECHO (Empowering Communities Helping Others) to pilot a results-based funding model in Mumbwa districts, following discussion with government partners.

January to October 2024

Diagnostic Phase

Identify service provider

Conduct baseline surveys and water safety assessment

Build networks with national and district government offices

Develop costed model to design results-based contract

November 2024 to December 2025

Pilot Phase

Rehabilitation of existing water supply infrastructure in Mumbwa District

Operation and maintenance services

- Water safety assessments (Sanitary inspection, water quality monitoring)
- Repair and maintenance work

Quarterly reporting on performance indicators

Design | January to August 2025

Scale-up design

Design results-based contract

- Revise costs estimates
- Payment formula

Institutional coordination

Implementation | September 2025 to August 2030

National Scale-up

Contract service providers

Technical assistance

- Prepare guidelines
- Training
- Data verification

Figure 1: Timeline of SafeManzi

3. Diagnostic study in Mumbwa district

The Diagnostic Phase (Jan – Oct 2024) aimed to assess the current state of water supply services in schools and healthcare facilities across Mumbwa. The objective was to identify infrastructure availability, reliability, and water quality issues, and to design a cost-effective, results-based model for professional water service delivery. To address the data gaps, baseline and water infrastructure surveys were conducted across all primary and secondary schools, as well as healthcare facilities in the district (Figure 2).

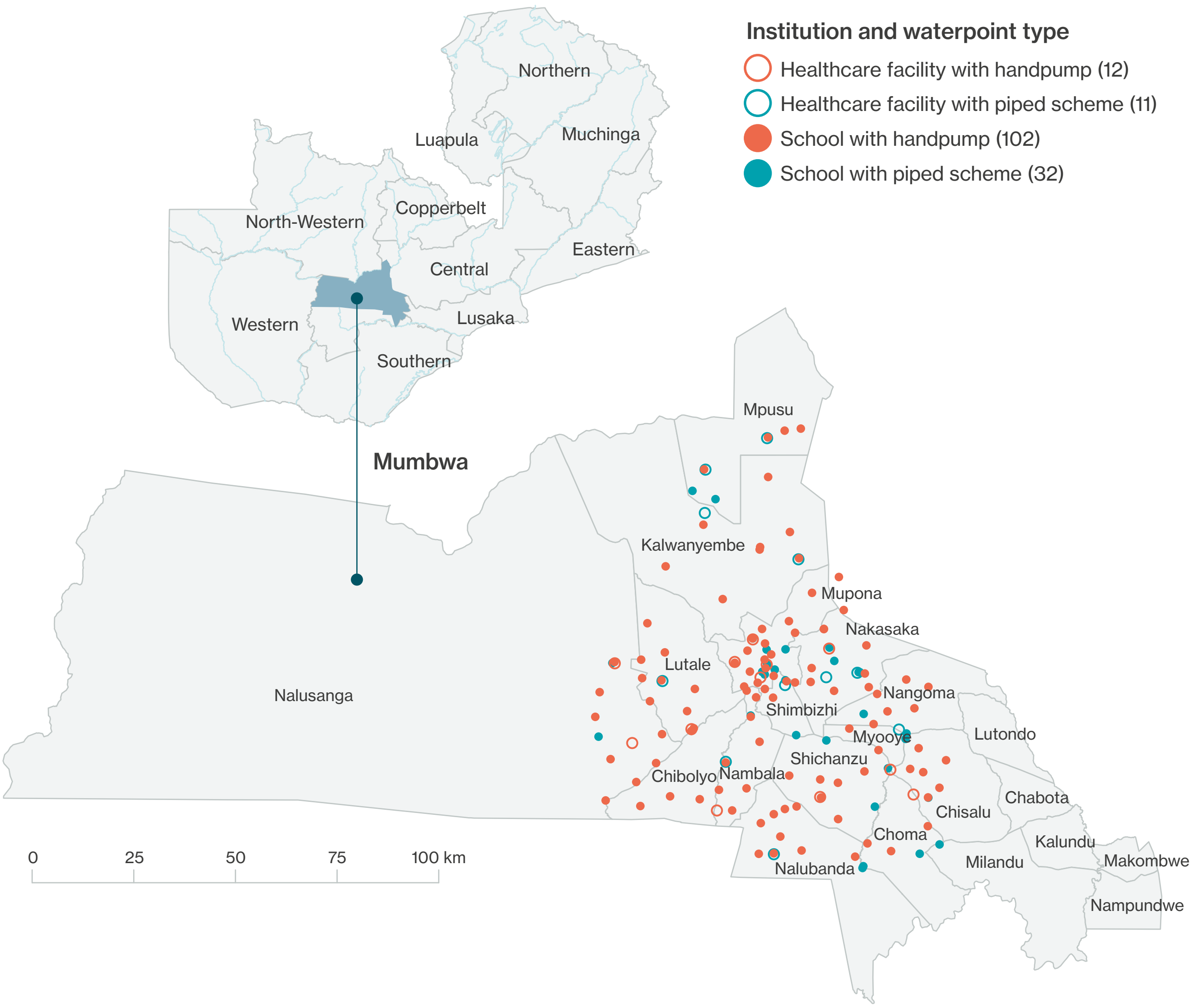


Figure 2: Map of Mumbwa district showing locations of schools and healthcare facilities (Data source: Uptime/ECHO Baseline survey 2024)

The surveys were carried out on the mWater platform by a diverse team of 12 enumerators representing various organisations, ECHO, the Ministry of Health, the Ministry of Infrastructure, the Ministry of Community Development, the Department of Water Resource Development, and Mumbwa Town Council. The baseline survey gathered data on the socio-demographic characteristics of the institutions and the condition of their water supply, sanitation, and hygiene facilities. This was followed by a water infrastructure survey, which collected detailed information on the technical specifications, ownership, management, usage patterns, repair and maintenance activities, rehabilitation needs (for handpumps only), and sanitary inspections of all waterpoints used by these institutions over the past year. For piped schemes, a more detailed technical assessment was conducted during a follow-up visit to evaluate the current state of the system and identify rehabilitation requirements for optimal service delivery.

The baseline survey included 222 institutions, comprising 191 schools and 31 healthcare facilities. The water infrastructure survey identified 250 water points across these institutions, of which 157 were handpumps and 93 were piped water schemes. Technical assessments were completed for 67 of these 93 piped schemes. Of these, 159 institutions have been shortlisted for the pilot phase, covering 43 piped schemes and 116 handpumps (Table 1). Private institutions and those within the military base were excluded. For institutions with multiple water points, only the primary source was selected, provided it was not utility-managed or installed by the World Food Program for irrigation purposes. The technical specifications, functionality and reliability, funding and management of the selected 159 piped schemes and handpumps are detailed below.

Table 1: Number of schools and healthcare facilities surveyed in Mumbwa district (Data source: Uptime/ECHO Baseline survey 2024)

Institution type	Number	Staff	Students	Population served	Inpatient beds	Monthly outpatients
Healthcare facility	**24**	**262**		**526,225**	**195**	**17,712**
Health centre	11	69		254,022	74	5,632
Health post	12	68		113,993	11	9,680
Hospital	1	125		158,210	110	2,400
School[1]	**135**	**1,769**	**103,620**			
Early childhood education	4	10	283			
Primary & Secondary school	80	694	55,555			
Primary school	35	481	34,246			
Secondary school	16	584	13,536			
Total	**159**	**2,039**				

1 The Zambian education system categorises schools as early childhood education (Pre-school, ages 3 to 6 years), primary school (Grades 1 – 7, ages 7 to 13 years), and (junior and/or senior) secondary school (Grades 8 – 12, ages 14 to 17 years), though there are schools offering Grades 1-4, Grades 1-9, Grades 8-9 or Grades 1-12.

3.1 State of water supply services

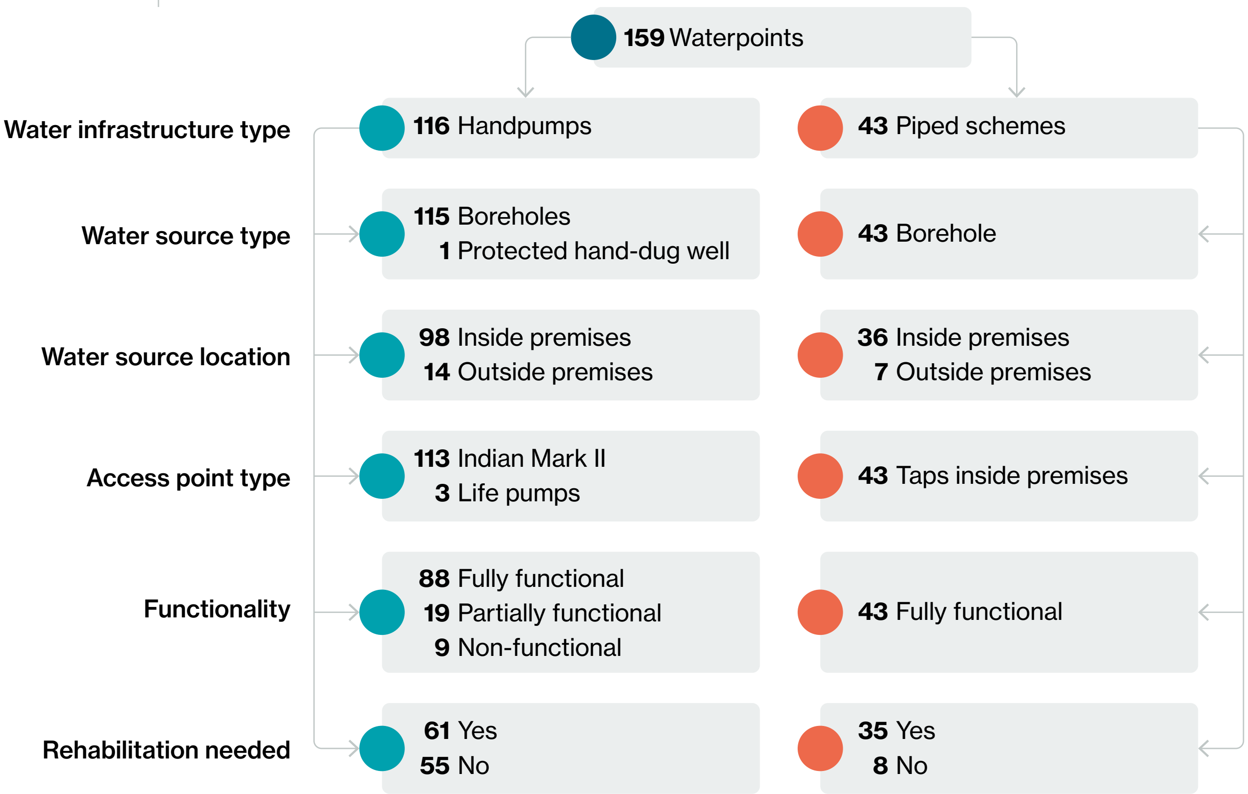


Figure 3: Breakdown of waterpoints by infrastructure type, location, functionality and rehabilitation needs for the pilot phase in Mumbwa district

Handpumps

Most of the handpumps were India Mark II (113 of 116) (Figure 3), being installed on machine-drilled boreholes or manually drilled boreholes with an average depth of 50m. About two-thirds of these handpumps were installed by national or local government (74 of 116), with the rest being funded by donor organisations, private individuals or the institution's own funds. Operation and maintenance responsibilities are mainly borne by the school or healthcare facility (84 of 116), with one of five being managed by user committees (23 of 116). Most of these handpumps are located inside premises and are used by households in the community as well. About two-thirds of these handpumps are used free of charge (74 of 116), while some require monthly fees ranging from ZMW 5 to 25 per household, and others rely on users making ad hoc contributions. A few of the boreholes dry up during certain months of the year, around July to October.

In March 2024, 88 of the 116 handpumps were fully functional while 19 were partially functional and 9 were non-functional for an average of 5 months mostly due to lack of funds or spare parts. Reported functionality challenges included delays in water production caused by damaged or leaking pipes and faulty cylinders, frequent breakdowns requiring repairs and rehabilitation, low discharge and yield necessitating excessive physical effort (numerous strokes) to extract water, and the need to supplement water supply from neighbours or alternative sources. Respondents recalled that 42 of the 116 handpumps had at least one repair or maintenance activity in the previous year (total 74 events) and 62 had none, while no data was available for the remaining 12 handpumps. The repairs cost an average of ZMW 2000, with two-thirds being completed conducted between 1-3 days.

Piped schemes

All the piped schemes are groundwater based, equipped with submersible pumps on machine or manually-drilled boreholes that are mostly located inside the school or healthcare facility premises (36 of 43). The schemes are powered by grid electricity (22 of 43) or solar energy (18 of 43) with storage tanks of 2,500 to 10,000 litres capacity. Water is available for more than 8 hours a day for 70 percent of the piped schemes, dropping to 4 – 8 hours a day for 27 percent of the schemes and 2-4 hours a day for the remaining. All piped schemes had taps on the school or healthcare facility premises, with 55 percent having household connections or public taps as well. Only 5 of the 43 piped schemes had some form of user payment structure.

At the time of survey, all piped schemes were fully functional, though several functionality challenges were reported, including inadequate water availability and frequent breakdowns, causing students to bring water from home or dependence on neighbouring households and institutions. Vandalism, leaks, and unreliable power sources further exacerbate the situation, with some systems switching to generators after solar panel theft.

Construction of the piped schemes were mostly funded by national or local government (28 percent) or donor organisations (58 percent), with the remaining being installed through the institution's own funds or private individuals. Compared to handpumps, which have been installed since the 1990s, the piped schemes have mostly been installed after 2015. Only 7 of the 43 piped schemes incurred any repair or maintenance activity in the past one year, with costs ranging from ZMW 1,600 to ZMW 10,000.

3.2 Infrastructure rehabilitation needs

Technical assessments identified that two-thirds of the handpumps need minor to major rehabilitation works to address existing damages to parts of the water supply infrastructure, like collapsed spoon drains, eroded body and handles, and clogged soak pits, mechanical issues with pumps, including stiff handles and faults in cylinders and pipes, and contamination risks from animals due to the lack of fencing and stagnant water. These rehabilitation works were disaggregated into low (ZMW 1200 on average), moderate (ZMW 17,000 on average) and high (ZMW 27,000 on average) costs with 53 percent, 7 percent and 40 percent of the 116 handpumps in each of the three categories, respectively.

Similarly, for piped schemes, the scope of rehabilitation work has been categorised into low (<ZMW 10,000), moderate (ZMW 10,000 – 30,000) and high (>ZMW 30,000) costs with 49 percent, 23 percent and 28 percent of the 43 piped schemes in Mumbwa in each of the three categories, respectively. Those in the low-cost category require mostly minor fixes in taps and pipes and valve replacements. Rehabilitation works for the moderate cost category involve fencing and structural foundations, in addition to replacement of taps and valves. High-cost rehabilitation mostly involves major structural reinforcement or reinstallation to improve foundation stability, such as replacement of wooden tank stands.

3.3 Water safety assessment

Water safety assessment involved three components – sanitary inspections, user perceptions of water safety, and laboratory analysis of water samples for chemical and microbial parameters.

Sanitary inspection

The purpose of the sanitary inspections is to understand if the water system is capable of providing safe water. Sanitary inspections capture risks associated with (1) poor quality of water infrastructure; and (2) local pollution sources, which may be the responsibility of the institution or wider community issues. The quality of the infrastructure can generally be addressed by service providers with appropriate funding, for example ensuring adequate housing of the infrastructure.

The sanitary inspections were performed through physical observations during the waterpoint surveys in accordance with guidance from the WHO, using checklists to identify the presence or absence of hazards for water supply components. For handpumps, sanitary risk comprises scores for the borehole (or protected hand-dug well) and the handpump, while for groundwater-based piped schemes, it includes scores for the borehole, distribution pipes, tanks, and taps. The categorisation of risk for each component is based on the number of hazards identified – Low risk (0 – 2 hazards), Intermediate risk (3 – 5 hazards) and High risk (6 or more hazards) (Table 2).

Table 2: Risk scores of handpumps and piped schemes identified through sanitary inspection

Waterpoint	Sanitary risk	Handpump Risk	Borehole Risk	Tank Risk	Pipes Risk	Tap Risk
Handpump (n=116)	Low (0 – 2 hazards)	74%	4%			
	Moderate (3 – 5 hazards)	22%	81%			
	High (>=6 hazards)	4%	15%			
Piped scheme (n=43)	Low (0 – 2 hazards)		88%	100%	91%	70%
	Moderate (3 – 5 hazards)		12%	0%	9%	30%
	High (>=6 hazards)		0%	0%	0%	0%

User perceptions of water safety

The water infrastructure survey collected data on user perceptions of water safety through the responses of headteachers and deputy head teachers for schools, the health professionals in charge at healthcare facilities as well as environmental health technicians. A quarter of respondents reported concerns about water quality. Concerns were more commonly reported for handpumps (30 percent of respondents reported concerns) than for piped schemes (10 percent). Of those who reported concerns, they were most commonly related to appearance (64 percent) and taste (56 percent), with fewer concerns about smell (33 percent) or specific reference to microbial contamination (5 percent). Water treatment was reported to never be practiced at 82 percent of institutions. Only 7 percent of institutions reported using water treatment all the time, using either alum for sedimentation and/or inline chlorination or batch chlorination for disinfection, which included 12 percent of piped systems and 5 percent of handpumps. Batch chlorination was also common where treatment was reported to occur sometimes or when needed.

Water quality testing

Water samples were collected from the surveyed waterpoints by staff from the Ministry of Health and ECHO, utilising the protocol and sampling procedure stipulated by the Ministry of Health guidelines. A total of 238 samples, including duplicates, were analysed at the University of Zambia Laboratory (UNZA Lab) in Lusaka. The analyses focused on:

1. Physicochemical parameters: turbidity, electrical conductivity, pH.
2. Priority chemicals: arsenic, fluoride, iron, lead, manganese.
3. Bacteriology: *E. coli*, thermotolerant coliforms, total coliforms.

Photo © Uptime/ECHO survey 2024

Prior to bacteriological sampling, waterpoints spouts / taps were decontaminated to remove localised contamination associated with spout / tap hygiene. Despite efforts, challenges with sample transportation, analytical method limitations, and data reporting affected data reliability. Due to long travel times, microbiological samples likely underestimated contamination risks, with only 3 percent of samples positive for *E. coli* and 11 percent for faecal coliforms. The rate of contamination is likely to be higher if a local laboratory is used to ensure samples are processed quickly, and will be expected to vary seasonally with higher faecal contamination in rainy periods.

Electrical conductivity test results were all below the Zambian Bureau of Standards limit of 1500 μS/cm. Iron was visible at some sites, with detection aligned with user concerns; 8 percent of samples exceeded the permissible limit of 0.3 mg/L. Additionally, 19 percent of samples had turbidity levels above the limit of 5 NTU, potentially affecting chlorination efficacy.

Geogenic hazards appeared limited, but further verification is needed. Fluoride exceeded the permissible limit of 1.5 mg/L in 3 percent of samples. Arsenic, lead, and manganese levels were at or below detection limits, but the lack of calibration information and unclear labelling hindered data accuracy assessment.

The baseline sampling revealed some faecal contamination and high iron and fluoride levels. However, further water quality testing is required to determine a trend in the results. User surveys suggest more widespread water quality issues than indicated by the test results. Single-time grab sampling offers limited health risk indications as water quality varies, especially during rainy periods. Continued monitoring and improved methods are essential for better water quality characterisation.

4. Estimating costs for pilot phase

The pilot phase aims to develop and test a professional water service delivery model to address the identified water safety and reliability risks. This model will operate under a results-based contract to ensure both value for money and the model's sustainability through strengthened systems and processes. The service provider will be responsible for:

1. **Repair and Preventative Maintenance**: Maintaining the water supply infrastructure through timely repairs and preventive measures, with a target of repairing breakdowns within three days.
2. **Enhanced Water Safety**: Reducing sanitary risks and ensuring consistent monitoring of chemical and microbial parameters to improve overall water safety.
3. **Responsive Actions**: Providing feedback to users and relevant authorities, promptly disinfecting sources when faecal contamination is detected, and taking immediate action to mitigate risks.

The baseline and water infrastructure surveys, along with technical assessments, have provided cost estimates for a one-year pilot phase of professional water service delivery by ECHO across selected schools and healthcare facilities in Mumbwa district. These cost projections informed the structure of the results-based contract for the pilot, with payments linked to achieving key performance indicators for reliability and water safety.

The costs are broken down into three main components: service hubs, maintenance services, and water safety (Figure 4), further disaggregated into one-off set-up and annual recurring costs for each component. According to the cost estimates (Table 3), the total set-up cost for 159 waterpoints in Mumbwa district is projected at ZMW 3.2 million (USD 129,040), which equates to ZMW 20,289 (USD 812) per waterpoint. The estimated annual recurring cost is ZMW 1.6 million (USD 63,613), or ZMW 10,002 (USD 400) per waterpoint.

Of the annual recurring costs, 34 percent will be allocated to service hubs, 57 percent to maintenance services, and 9 percent to water safety. These disaggregated costs will enable precise allocation of resources to support reliable and safe water service delivery under the pilot model.

	1. Service hubs	2. Maintenance services	3. Water safety
One-off set-up costs	• Office set-up • Baseline surveys • Inception workshop • Trainings	• Rehabilitation of existing infrastructure • Equipment	• District laboratory set-up • Baseline chemical tests
Recurring annual costs	• Staff salaries • Allowances for local government employees • Review meetings	• Repair and maintenance (materials, labour and transport)	• Water sample collection • *E.coli* tests and managed action • Sanitary inspection

Figure 4: Cost components to estimate the costs for professional water service delivery for schools and healthcare facilities

4.1 Service hubs

ECHO's headquarters in Lusaka and local office in Mumbwa will act as service hubs, with the Executive Director, Programme Manager and Accountant being based in Lusaka, and the Project Manager, Technical Coordinator, and Data Manager being based in Mumbwa. A Laboratory Officer will also be recruited to be based at the Ministry of Health District (H1) laboratory to support the existing Laboratory Officer. System strengthening activities, including training of Environmental Health Technicians on water sample collection, Area Pump Menders on water point maintenance, and district officers for data management, will be part of the professional service delivery work. In addition, there will be district validation workshops at inception and quarterly review meetings with district health, WASH and education offices and utility companies in the service area.

The one-off set-up costs, estimated to be ZMW 660,000 (USD 26,400), will include purchase of laptops and office furniture for the new employees, baseline surveys (already completed), inception meetings and trainings. The recurring annual costs, estimated to be ZMW 541,000 (USD 21,600), will include salaries for the staff mentioned above, remuneration for district government for their time contributions, and event costs associated with review meetings.

4.2 Maintenance services

Maintenance services comprise the one-off costs for rehabilitating existing water supply infrastructure and purchasing equipment for ongoing repair work and the annual recurring costs for breakdown and routine maintenance disaggregated for handpumps and piped schemes. The total cost for infrastructure rehabilitation, as outlined in section 2.3, will be ZMW 2.17 million (USD 86,700), with an average of ZMW 12,600 (USD 504) per handpump and ZMW 16,500 (USD 658) per piped scheme.

These include material, labour and transport costs, as well as the cost of installing sensors on handpumps (ZMW 800 per waterpoint) and flow meters on piped scheme (ZMW 2100 per waterpoint).

The annual recurring expenses, amounting to ZMW 911,000 (USD 36,400) per year, include the cost of spare parts and the remunerations for the Area Pump Menders conducting the repairs. We allocated ZMW 5,000 (USD 200) per handpump and ZMW 7,000 (USD 280) per piped scheme, acknowledging the wide range of repair needs, with an annual expenditure on ZMW 30,000 (USD 1,200) for allowance and transport of Area Pump Menders.

4.3 Water safety

Ensuring water safety at schools and healthcare facilities will involve routine sanitary inspections, monitoring for microbiological contamination, and promptly disinfecting sources where contamination is identified. Chemical analysis will also be conducted at all sites.

Given concerns regarding the validity and limitations of water quality results from the diagnostic phase, all waterpoints will be re-tested upon completion of rehabilitation works in the pilot phase. Chemical analyses will be carried out at the Food and Drugs Control Laboratory in Lusaka, with samples collected by district Environmental Health Technicians following proper protocols for collection, handling, and transport. All samples will be tested for arsenic, fluoride, and manganese, with an additional 10 percent tested for lead. Iron will not be re-tested, as it can be detected by taste and does not present safety risks. To ensure accuracy, one duplicate and one field blank sample will be tested for every ten samples collected. Testing costs for arsenic, fluoride, and manganese are ZMW 500 (USD 20) per sample (total of 191 samples, including duplicates and blanks), and ZMW 200 (USD 8) per sample for lead (total of 19 samples).

E. coli will be tested as an indicator of recent faecal contamination after rehabilitation and then quarterly for piped systems and biannually for handpumps. *E. coli* testing will be performed at the District (H1) lab to ensure sample processing within six hours of collection and to integrate monitoring into the Ministry of Health's surveillance structure. The AquaSafe Water Safety Laboratory kit, commonly known as a 'portalab' kit,[2] is used by some district labs in Zambia to do membrane filtration tests for thermotolerant (faecal) coliforms. To support the Mumbwa district lab, resources such as training, funding for staff time, and additional supplies – including AquaSafe WSL equipment and *E. coli* growth media – will be provided. Additionally, field-based Aquagenx Compartment Bag Tests (CBTs)[3] will be available as a secondary method for quality assurance checks and for use when district lab testing is not feasible (e.g., due to long travel times, adverse weather, or emergency repurposing of lab resources during events like cholera outbreaks).

2 The portalab contains a probe and all consumables (pH buffer solutions, conductivity standards, probe storage solutions for 300 tests) to test pH, temperature, electrical conductivity, turbidity and residual chlorine. It also contains all the consumables needed to carry out 300 *E. coli* tests except for the growth media (chromogenic coliform agar which will be bought separately).

3 The CBT EC+TC MPN Kit offers rapid test for detecting *E. coli* and Total Coliforms in water in remote and difficult to access sites. It comes with a set of reagents and containers (plastic bags) that in a minimum of 24 hr can check the presence/absence of *E. coli* and the Most Probable Number (MPN) of *E. coli* colonies in the water.

If *E. coli* is detected at any waterpoint, identified sanitary hazards will be reviewed, and corrective actions taken. These waterpoints will be retested to confirm that contamination has been eradicated. Based on provincial and district data, it is conservatively estimated that approximately 33 percent of waterpoints may be contaminated.

The set-up cost comprises purchase of tools for water sample collection and transportation; equipment for pH, conductivity, turbidity and *E. coli* analysis at the district laboratory; and for priority chemical tests as outlined above. Sampling and transport tools include 500ml plastic sterile bottles, metal tongs, lighters, cooler boxes, ice packs and backpacks for taking the equipment into the field. Analysis equipment includes an Aquasafe® WSL50 Premium portalab, a refrigerator with a freezer compartment, and an incubation container for CBTs. The total set-up costs amount to ZMW 363,000 (USD 14,500), 34 percent of which will be spent on priority chemical analysis. The recurring cost items comprise consumables for general physicochemical and bacteriological testing, including calibration and storage solutions, chromogenic agar and membrane filters, and other miscellaneous items, estimated for 292 samples from 159 waterpoints. The total recurring cost, including transport and allowances for sample collection and sanitary inspection, will be ZMW 137,000 (USD 5,470) amounting to ZMW 859 (USD 34) per waterpoint.

Table 3: Cost estimates (as of 2024) for the one-year pilot phase in Mumbwa district comprising 159 waterpoints across 159 institutions

Costs		Currency	Service hubs	Maintenance services	Water Safety	Total
One-off set-up costs	Total	USD	26,400	86,700	14,500	128,000
		ZMW	660,000	2,170,000	363,000	3,190,000
	Per waterpoint	USD	166	546	91	803
		ZMW	4,150	13,600	2,280	20,100
Annual recurring costs	Total	USD	21,600	*36,400*	5,470	63,500
		ZMW	541,000	911,000	137,000	1,590,000
	Per waterpoint	USD	136	229	34	400
		ZMW	3,400	5,730	859	9,990

4.4 Results-based contract design

Based on the costed analysis and discussion with government partners, 100 of the shortlisted 159 institutions (one waterpoint per institution) have been selected for the pilot phase, excluding the ones requiring major investments for rehabilitation. The results-based contract for the pilot phase has been set at a maximum of USD 100 per quarter per waterpoint. The payment will be determined by performance metrics on the monitoring, reporting and managed actions for waterpoint reliability and water safety (Table 4).

For water safety requirements, a phased implementation plan has been designed to enable the service provider to adapt to water safety standards while progressively meeting stricter performance and accountability criteria. From November to December 2024, sanitary inspections will be conducted without penalties, and *E. coli* testing will begin for sites identified to have a low-risk sanitary inspection score indicating they are likely capable of providing safe water, with managed actions if needed but no penalties applied. Sanitary inspections and *E. coli* testing will continue in Quarter 1 (Jan–Mar 2025), focusing on accurate reporting. Accountability is introduced in Quarter 2 (Apr–Jun 2025) for maintaining low-risk inspection scores, and *E. coli* testing and reporting are tied to payments. In Quarter 3 (Jul–Sep 2025), accountability extends to managed actions for *E. coli* detection, with penalties for delays in corrective measures. Quarter 4 (Oct–Dec 2025) demands full accountability for inspections, *E. coli* testing, reporting, and managed actions, with an additional requirement for chemical testing for contaminants by year-end.

Table 4: Quarterly payments scheduled for pilot results-based contract in Mumbwa district

Performance indicator	Requirements	Payment per quarter (USD)
Waterpoint reliability and sanitary inspections	**Reliability**: All breakdowns must be recorded, and the waterpoint should be functional at least 96 percent of school days (or total days for health facilities) per quarter. **Sanitary Inspections**: Inspections are required every three months for piped systems and every six months for handpumps. The latest inspection should yield a low-risk score (0-2 hazards) for which the service provider is accountable. Inspection results must be reported to district government and management of school and healthcare facilities.	USD 50
Water safety assessment and reporting	**Chemical Testing**: Within the contract period, waterpoints must be assessed for chemical quality change (electrical conductivity, arsenic, fluoride and manganese). Results must be reported to district government and management of school and healthcare facilities. **Faecal Contamination Assessment**: Handpumps require biannual *E. coli* testing, while piped systems require quarterly testing. Results must be reported to district government and management of school and healthcare facilities within three days.	USD 25
Water safety management	**Faecal Contamination Management**: If *E. coli* is detected, corrective actions must occur within 7 days, followed by a reassessment at least three days later to confirm absence of *E. coli*. Managed actions ensure ongoing *E. coli* free status, qualifying the waterpoint for safety compliance payments.	USD 25

4.5 Results-based contract delivery

The results-based payment process

Results-based contracts differ from conventional disbursements in two important ways. The first is that payments are per outcome instead of per input or activity. The second is that payments are released only after outcome results are confirmed. Initial costs must be borne by the implementer.

Results-based funding is released through the following steps:

1. **Service delivery**: Contracted service provider performs maintenance and water safety activities to generate the desired outcomes.
2. **Results reporting**: The service provider reports results data in standardised formats.
3. **Verification**: Results are scrutinised through third-party data validation and verification processes.
4. **Disbursement**: Payments are calculated according to results and funds are released to the Service Provider.

Data verification

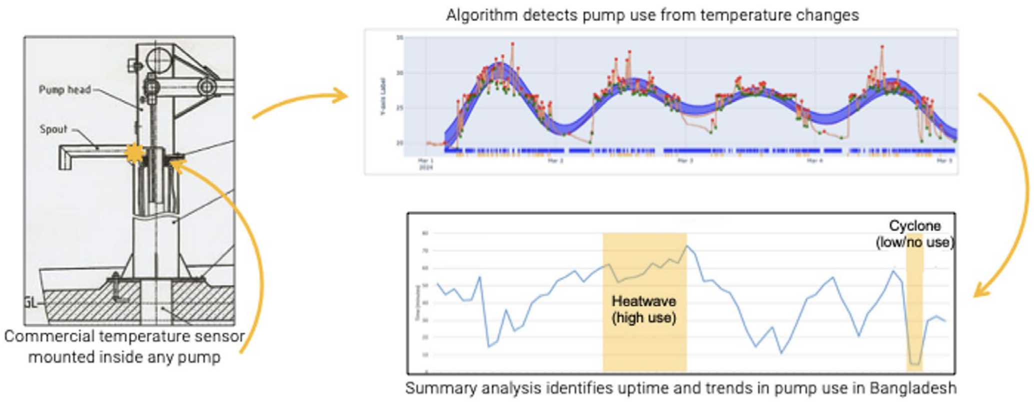
Results-based payments rely on high quality data. Real-time automated data is an ideal but often impractical standard for every location and context. Triangulation across various types of digital and manual data systems is a more practical approach that makes it difficult for reported performance to be falsified. Uptime applies a three-step data integrity process in its results-based contracts:

1. **Validation** – routine comparison of new data against historical records to identify errors and outliers.
2. **Verification** – annual review of supporting documentation on a sample of sites to evaluate data quality and accuracy.
3. **Visits** – annual in-person visits to a geographically representative sample of sites to confirm realities on the ground and identify wider issues not captured by other reporting (e.g. safeguarding, user satisfaction).

These processes can integrate with automated data as available but are also responsive to different contexts and data types. The tiered approach, to be applied in the Mumbwa pilot, allows for existing data systems to integrate with results-based contracts while enabling progressive improvement in data quality over time.

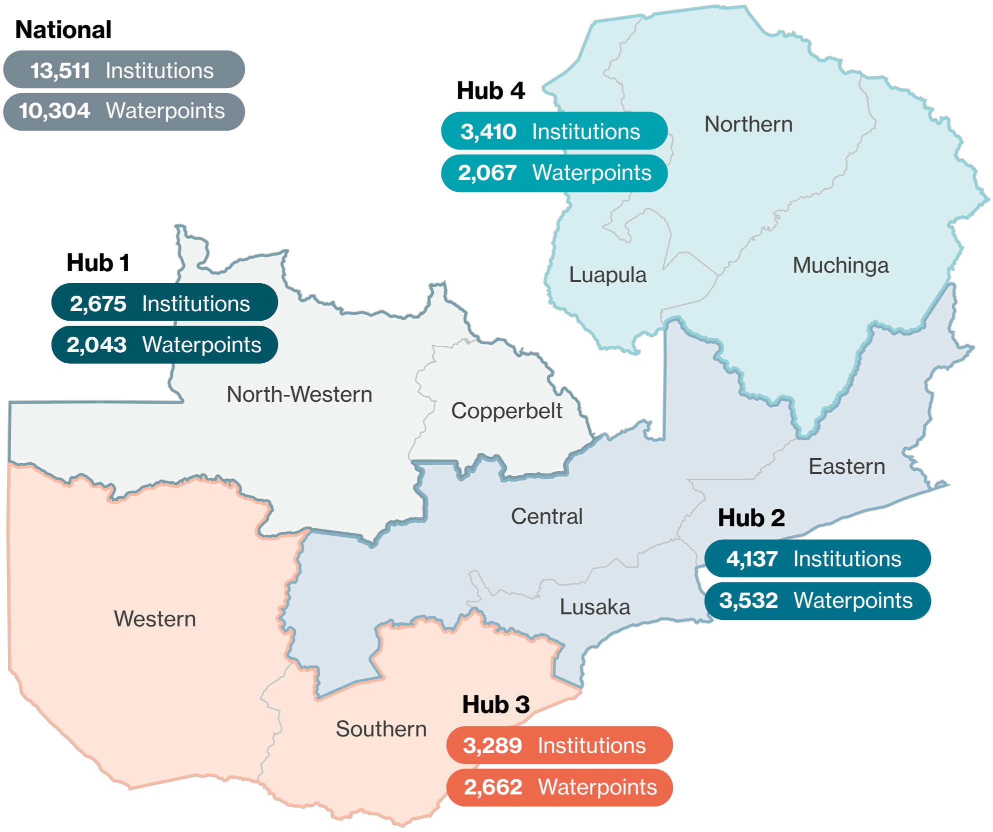
Handpump Sensors

Handpump usage can be estimated using temperature sensors mounted inside the pump. These sensors detect temperature changes as pumping draws up groundwater that is cooler than ambient temperature. Data recorded every 5 minutes provide robust estimates of functionality and usage. A water quality protocol and regular testing indicates no water quality risks from the sensors. Sensors do not transmit data but can store data for up to one year. Once retrieved, data provide a signal for pump use and daily temperature ranges. Automated analysis interprets the duration of pump use each day. Summary analysis across sites can verify uptime and average daily use.



5. Scaling up to national level

The vision is to expand the SafeManzi model for safe and reliable water services for schools and healthcare facilities from the pilot phase in Mumbwa district to a national scale, aligning with the government's commitment to achieving SDG 6.1. Across the country, there are 10,731 schools, including 9,441 primary and 1,290 secondary schools, serving approximately 4.3 million students. Data from the Ministry of Education shows that 48 percent of these schools rely on handpumps on boreholes or wells, 29 percent have boreholes with submersible pumps or piped connections, 19 percent use protected or unprotected wells, and 4 percent lack any water source. Additionally, there are 2,780 healthcare facilities, although comprehensive data on their water supply infrastructure is unavailable.



• **Figure 5**: Proposed service hubs for national scale-up.

- **Table 5: Summary statistics for the four proposed service hubs**

Service hubs	Hub 1	Hub 2	Hub 3	Hub 4	National
Provinces	Copperbelt and North Western provinces	Central, Lusaka and Eastern	Western and Southern	Luapula, Northern and Muchinga	
No. of provinces	2	3	2	3	10
Commerical utilities	Kafubu, Mulonga and Nkana, and North Western Water and Sanitation Companies	Lukanga, Lusaka and Eastern Water and Sanitation Companies	Western and Southern Water and Sanitation Companies	Luapula and Chambeshi Water and Sanitation Companies	
No of utilities	4	3	2	2	11
No. of districts	21	32	31	32	116
No. of schools[1]	2,101	3,384	2,601	2,645	10,731
No. of healthcare facilities[2]	574	753	688	765	2,780
No. of institutions	**2,675**	**4,137**	**3,289**	**3,410**	**13,511**
No. of handpumps	982	2,202	1,922	1,558	6,664
No. of motorised boreholes/ piped connections	1,061	1,330	740	509	3,641
No. of waterpoints	**2,043**	**3,532**	**2,662**	**2,067**	**10,304**
No. of students	929,656	1,515,268	869,199	991,103	4,305,226
Population[3]	4,027,567	7,787,235	3,745,248	4,050,719	19,610,769

1 MoE (2022). Education Statistics Bulletin 2020. Lusaka, Zambia: Directorate of Planning and Information, Ministry of Education.

2 GRZ (2022) Ministry of Health data on health care facilities (unpublished).

3 Zambia Statistics Agency (2022). 2022 Census of Population and Housing – Preliminary report. Republic of Zambia

The national model will replicate the structure of the Mumbwa pilot with modifications in management and operations to support scalability and engage a broader range of stakeholders. Four service hubs are proposed (Figure 5), each comprising two to three adjacent provinces that can be managed by a single service provider. Table 5 shows the number of institutions, waterpoints and population for each of these four hubs with an estimated total of 6,512 handpumps and 3,934 piped schemes, covering 10,304 institutions, excluding those using protected or unprotected wells or without any source. These institutions could be added into the service programme as new infrastructure is developed. For healthcare facilities, projections use the distribution of handpumps and piped systems in schools within each hub to estimate the numbers of different water supply infrastructure.

Similar to the pilot phase, activities related to repair and maintenance and water safety assessment will be conducted at the district level by the Area Pump Menders and Environmental Health Technicians, respectively, with water samples sent to Ministry of Health District (H1) labs for microbial testing and to the Food and Drugs Control lab in Lusaka for chemical testing. Whilst District (H1) lab capacities vary, a standardised approach is assumed, where each district will have a laboratory technician appointed by the service provider and the necessary equipment for *E. coli* testing. Each service hub will also appoint a Water Quality Coordinator to oversee water safety activities and a Provincial Coordinator to engage with stakeholders across the provinces within the hub.

Due to limited data on the current condition of water infrastructure, required rehabilitation, transport logistics, and district lab capacities, estimating reliable one-time set-up costs for national scale-up is challenging. Future work will co-design a costing methodology with relevant stakeholders based on empirical data to determine national one-off and recurring costs.

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6. Discussion

Five policy questions will require early discussion if there is a national ambition to deliver safe drinking water to all public institutions by 2030. First, how can the government plan funding commitments for both capital and operational costs for public institutions to ensure sustainability of results in the long term? Second, how can development partners coordinate complementary programmes to create efficiencies and support sustainability in outcomes? Third, can results-based funding support the desired transition to piped systems? Fourth, what are suitable public management arrangements to procure, contract and manage professional service providers in a national programme? Fifth, how can data validation and verification processes necessary for results-based contracts align and support existing government systems and regulatory objectives?

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Government funding for SafeManzi will be critical for scale and sustainability. Existing grants largely focus on building new infrastructure with insufficient attention to ensuring public funds maintain high quality services. The school grants illustrate a recognition of the challenge but an approach that is not delivering the desired results. It results in a classic principal-agent problem with an information asymmetry without an effective feedback loop between government funds and measured outcomes. Results-based contract are explicitly designed to address these challenges. Zambia has experience of implementing results-based contracts for road infrastructure programmes and lessons can be learnt on what funding modalities may be appropriate.

Equally, global development partners, such as the World Bank, the European Union and bilateral donors, have growing knowledge and interest in outcome-based funding or payment for results programming. Uptime has provided technical assistance in a number of the World Bank programmes and the University of Oxford has conducted extensive research on affordability, contract design and public health questions. Public facilities will always require a long term public subsidy to ensure the merit goods of high quality education and health benefit society and contribute to equitable growth.

This raises the significant financial question of Zambia's transition to piped water services as directed by the President. Currently, half of the public facilities use handpumps as the main drinking water source. The potential national scale up of SafeManzi will depend on alternative policy scenarios and financial strategies to progressively invest more in more piped systems whilst maintaining services from the majority of handpumps.

Finally, Zambia benefits from an active and dynamic NGO and private sector which has worked on rural drinking water systems over many decades. The design of a national scale up will require careful attention to procurement and contracting processes to ensure the government has an effective institutional structure and competent technical assistance for a national results-based contract. Two key considerations will be a rigorous data integrity system to validate data and verify outcomes for payments and the accompanying financial instrument to issue timely payments. Critical to these issues is to design a long term government results-based modality that is robust to the variation in development partner spending and priorities.

7. Conclusion

No country in Africa has managed to reliably deliver safe drinking water services in all public schools and healthcare facilities. Yet, the health of the current generation and the prosperity of future generations depend on high quality services being delivered effectively and efficiently. SafeManzi offers a new model inspired by the President's directive to achieve these goals. Government leadership will be the determinant of the scale and level of success. Results-based contracts provide a tested approach to effectively manage public funds transparently and accountably. If planning for a national scale up starts early with support from development partners, it is feasible that Zambia could be the African exception, and the first country to achieve safe drinking water in rural schools and healthcare facilities by 2030.

Photo © Katrina Charles, November 2024

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9. Appendix: Breakdown of cost estimations for pilot phase in Mumbwa district

9.1 Service hub

One-off set-up costs

1. Office set-up			
Item	**No. of items**	**Unit cost (ZMW)**	**Total (ZMW)**
Laptop and IT	4	24,000	96,000
Office Furniture – Table and Chair	4	10,000	40,000
District sub-total			**136,000**

2. Baseline surveys, trainings and inception workshop		
Item	**No. of items**	**Unit cost per item (ZMW)**
Baseline Survey and technical assessment	1	375,000
Inception workshops at district level	1	61,400
Training of APMs in Water Network Maintenance	1	35,000
Training of EHTs in Water Quality Testing	1	27,500
Training of district staff in data management	1	25,000
District sub-total		**523,900**

Annual recurring costs

1. Staff salaries						
Position	**Staff per district**	**Full time equivalent**	**Item unit cost (ZMW)**	**Cost frequency category**	**Frequency**	**Total (ZMW)**
Executive Director	1	0.05	64,134	Monthly	12	38,480
Program Manager	1	0.05	46,493	Monthly	12	27,896
Accountant	1	0.05	32,674	Monthly	12	19,604
Data Manager	1	0.1	16,401	Monthly	12	19,681
Technical Officer	1	0.1	14,177	Monthly	12	17,012
Project Manager	1	1	32,674	Monthly	9	294,066
District sub-total						**416,740**
Position	**Staff per district**	**Full time equivalent**	**Item unit cost (ZMW)**	**Cost frequency category**	**Frequency**	**Total (ZMW)**
Laboratory Officer (existing)	1	0.25	400	Daily	144	14,400
WASH Coordinator	1	0.25	200	Daily	60	3,000
DWASHE Committee	20	1	200	Quarterly	12	48,000
District Health Office	2	1	200	Quarterly	12	4,800
District sub-total						**70,200**

2. Review meetings			
Item	**Cost per event (ZMW)**	**No. of events per year**	**Cost per year (ZMW)**
Liaison with Utility Companies	5,500	2	11,000
Workshops, review meetings etc.	21,500	2	43,000
District sub-total			**54,000**

9.2 Maintenance services

One off set-up costs

1. Rehabilitation of existing infrastructure		
Item	**Percentage of waterpoints needing rehabilitation (in Mumbwa)**	**Average cost (ZMW)**
Handpumps (Low costs)	52.6 %	1,239
Handpump (Moderate costs)	6.9 %	16,760
Handpump (High costs)	40.5 %	26,631
Handpump sub-total (n=116)		**1,461,318**
Piped schemes (Minor rehab)	48.8 %	4,823
Piped schemes (Moderate rehab)	23.3 %	18,314
Piped schemes (Major rehab)	27.9 %	35,225
Piped schemes sub-total (n=43)		**707,132**
TOTAL (n=159)		**2,168,450**

2. Toolkits		
Item	**No. of items**	**Total (ZMW)**
Pump testing Equipment	1	19,000
Tool kits	1	12,500
District sub-total		**31,500**

Annual recurring costs

1. Repair and maintenance			
Item	**No. of waterpoints**	**Average allocation per waterpoint per year (ZMW)**	**Total per year (ZMW)**
Handpumps	116	5000	580,000
Piped schemes	43	7000	301,000
District sub-total (n=159)			**881,000**

2. Transport and allowance	
Lumpsum for district	**30,000**

9.3 Water safety

One of set-up costs

1. District laboratory set-up		
Item	**Description**	**Total cost (ZMW)**
Equipment for district lab	The Aquasafe® WSL50 Premium portalab; Refrigerator; Incubation container for compartment bag tests; sterile bottles	258,000
Tools for sampling	Cooler box 12L; Metal tongs; Lighter	5,200
District sub-total		**263,200**

2. Chemical tests			
Item	**No. of samples (incl. 10 % duplicates + 10 % field blanks)**	**Cost per sample (ZMW)**	**Total cost (ZMW)**
Chemical analysis (As, F, Mn)		500	95,500
Chemical analysis (Pb) – 10 % of waterpoints	19	200	3,800
District sub-total (159 waterpoints)			**99,300**
Sample transportation (chemical tests)	From Mumbwa to Lusaka (5 trips with 30-50 samples per trip)		750

Annual recurring costs

1. Consumables		
Item	**Description**	**Total cost (ZMW)**
Reagents/ solutions	pH buffer solution; electrode cleaning and storage, conductivity standard; distilled water	5,462
Consumables (for *E. coli* sampling and testing)	CBT EC+TC MPN Kit (50 pack); chromogenic coliform agar; garbage bags; gloves; hand sanitisers; methanol; methylated spirit; cotton wool	81,195
District sub-total		**86,657**
2. Transport and allowance		
Routine sample collection, revisits and sanitary inspection	Lumpsum for EHT allowance and fuel for motorbike	50,000

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