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TRANSFORMATION TOWARDS SUSTAINABLE
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# Monitoring and management of climate resilient water services in the Afar and Somali regions of Ethiopia

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*This paper summarises two regional initiatives in the arid and drought-prone Afar and Somali regions of Ethiopia that seek to strengthen the monitoring of water services and contribute to improvements in management and service delivery. The Somali Functionality Inventory (SFI) was developed as an emergency intervention geared towards guiding borehole rehabilitation efforts during the 2016/17 drought, and now provides the foundation for on-going monitoring of all motorised boreholes in the region. The SFI enabled improvements in functionality during the drought to be measured. In Afar, a similar initiative has emerged with the additional deployment of remotely reporting sensor technology providing a mechanism for continuous monitoring of water supply schemes. Lessons from both on-going initiatives are identified, seeking to contribute to the development of monitoring systems and support the government's flagship Climate Resilient WASH initiative.*

## Water supply in Afar and Somali regions of Ethiopia

The Afar and Somali regions cover huge areas in the east of Ethiopia, from the borders with Eritrea in the north to Kenya in the south. The climate is arid and much of the population remain nomadic moving around in search of pasture and water for livestock, while small towns are growing rapidly in response to new economic activity. Everyone is vulnerable to the unpredictable climate with frequent droughts leading to migration, loss of livestock and economic hardship. Insecurity in neighbouring states, particularly Somalia, and internal conflicts along the Oromia/Somali border have added to the challenges of delivering water in this context. Many communities depend on emergency water trucking at enormous cost to government and development partners, and outbreaks of water related disease are common -there was a major outbreak of Acute Watery Diarrhoea in 2017.

The major improved water supply sources in these regions are groundwater boreholes – between 100 and 500 metres deep – accessing a range of aquifers. Water supply facilities typically include pump houses with generators, submersible pumps (either centrifugal or positive displacement pumps), pipelines, storage reservoirs and either simple (serving a few public tap stands) or more complex distribution systems (serving large numbers of household connections). Grid electricity is often unavailable, and while increasing, solar powered installations are relatively few, so most installations depend on diesel-powered generators with fuel being bought and transported by rural communities. Electro-mechanical failures are a key risk with pump, motor and generator systems and their correct use being a complex operation that demands skills that are in short supply. Relatively small errors in sizing and variations in operating times can hugely impact on pump life, and the life of diesel generators is significantly compromised if regular maintenance, such as oil and filter changes, is neglected. Basic corrective and preventative maintenance activities are most often not carried out by the poorly resourced and equipped voluntary committees (WASHCOs) or town water utilities that run schemes. These organizations largely depend on woreda and regional government to carry out maintenance. Proper asset management would seek to ensure that good maintenance regimes are followed, ensuring services and extending the life of infrastructure before rehabilitation is necessitated, but practices are far from optimum. The implementation of a good maintenance regime is essential to ensure that reliable

service delivery is achieved and that the need for major maintenance is avoided, or at least postponed. This is a fundamental aspect of good infrastructure asset management practice.

Climate Resilient WASH is a flagship initiative of the federal government, regional governments in the lowland emerging regions, and development partners, and a new part of the One WASH National Programme. It seeks to reduce dependence of communities on costly water trucking, through substantial investment in more resilient water supply schemes, typically deep boreholes supplying multi-village water supplies. New management models that bring professionalised operations to rural utilities are also being promoted (MoWIE, 2018).

Monitoring systems remain one of the weakest components of the country's water supply sector. A new national management information system has been long delayed, but is expected to rolled out in the near future together with a repeat National WASH Inventory since the last major national survey in 2010/11. However, these monitoring systems typically focus on a snapshot of a few Key Performance Indicators (KPIs) designed to track overall performance of the sector (such as the percentage of the population with access to improved water schemes or functionality of schemes), rather than being designed to provide data to support operations and asset management[1]. These two types of monitoring can be complimentary, and this paper focuses on the emergence of regional operational monitoring systems that mainly seek to improve local operations and asset management but which can also be used to support upwards reporting against sector KPIs. An underlying assumption in both the initiatives is that monitoring provides a good entry point to help drive improvements in asset management and strengthen the resilience of water supplies.

## Somali Functionality Inventory

### Initiative and objectives

The Somali Functionality Inventory (SFI) was initiated by UNICEF as part of the response to the 2016/17 drought impacting the region. The concept was developed closely with the regional and national WASH clusters and built on previous monitoring efforts to support the drought response, with modifications due to the evolving nature of the drought response. Rehabilitation of boreholes became a new focus in the 2016/17 humanitarian response in addition to water trucking and emergency sanitation and hygiene interventions.

There was also interest to work more closely with government (the Somali Regional Water Bureau or RWB) and develop a monitoring system that would outlast the emergency. Phase 1 to develop and support the SFI ran from January to June 2017 (Pearce, 2017; Pearce *et al*., 2017) with IRC[2] and Akvo (www.akvo.org) providing technical assistance to the RWB via UNICEF. The objective was to ensure that up-to-date information was available on the functionality of the main water supply schemes in the region and to support the planning and direction of the emergency response with a focus on borehole rehabilitation and maintenance interventions, and to help monitor the outcomes of those interventions.

### Progress and achievements

By February 2017, the SFI had established an inventory of most motorised boreholes in Somali region with data collected rapidly by 11 government teams deployed to the regions 11 zones and supported by logistics and Information Management Officers from UNICEF. All data was collected on smartphones running Akvo's Flow app. Tailored forms collected data on background to the scheme, technical details, functionality status, current use and experiences from a sample of users at the scheme. Initial data collection in three priority zones (Jarar, Dollo and Qohray) took only 10 days with data collected from all regions within 3 weeks and covering 280 boreholes. A second round of data collection and data validation workshops in March 2017 added 70 further boreholes, with subsequent updates adding 14 more by August 2017. Non-functionality rates of these three groups of boreholes were 24.3, 32.9 and 28.6% respectively.

A more detailed asset form was developed with the support of the USAID Lowland WASH Activity and used by Mobile Maintenance Teams (MMTs) leveraging their presence at sites and their additional detailed knowledge of borehole installations. They also reported on the rehabilitation or maintenance performed. The database at the end of 2017 included records from 94 sites visited by MMTs.

A simple, practical and low-cost updating mechanism of borehole status was designed based on telephone calls from Zonal Focal Points to Woreda Water Officers who are generally able to report on the functionality status of boreholes in their woredas. After piloting this procedure was rolled out across all zones at a total updating cost of 2000 Birr (about 8 USD) per month and the RWB committed to budgeting for the call and data costs.

At the end of 2017, the SFI included data on a total of 364 boreholes considered to include all water supply schemes that were 'in service' although there are other boreholes that were drilled for test purposes, have not been equipped or are for agricultural use, and new boreholes are being drilled all the time.

Partial integration in RWB processes was achieved but most data use was directly by UNICEF. Between February and August 2017, non-functionality rates were reduced overall from 24.3% to 19.8% (see Figure 1). During the same period, 37 boreholes changed status from non-functional to functional while 14 changed status from functional to non-functional. The 4.5 percentage point reduction in non-functionality was achieved in the context of relatively high additional investments and deployed capacities as part of the emergency response. At the same time this was during a period of severe drought and high pressure on water points since other more seasonal water sources were unavailable.

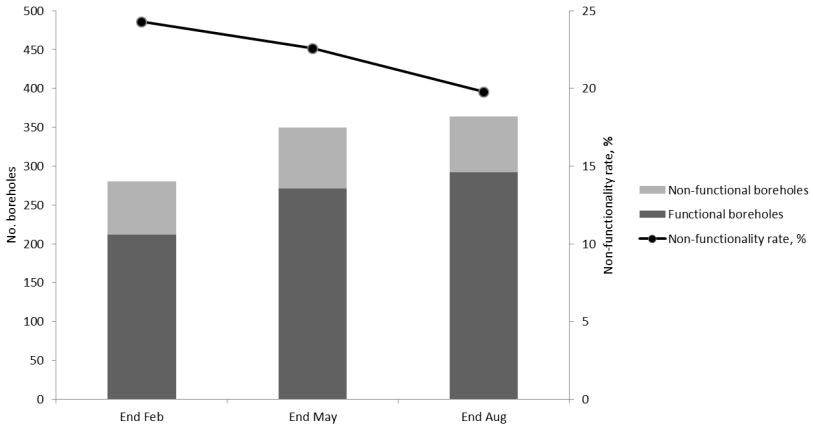


**Figure 1. Boreholes included in SFI and trend in non-functionality rate**

Source: IRC WASH

## Lessons learned and planned further development

Lessons learned have been used to design a second phase of support to the SFI that started in January 2018. This seeks to further institutionalise the management of the system while promoting wider use of the data. It also includes trialing the use of remote sensors to support updating, based upon experiences from Afar (see below). Because of lower ongoing costs of the service, it is also intended that data will be migrated from Akvo Flow to the mWater platform.

**Table 1. Comparison between monitoring initiatives in Afar and Somali regions**

| Aspect | Afar | Somali |
|---|---|---|
| Initiation | Project-led initiative from two USAID projects collaborating with the AWRB (regional government) | Part of the emergency response, led by UNICEF and engaging regional government and the WASH cluster. |
| Organisations directly involved to date | AWRB, USAID Lowland WASH Activity/AECOM, USAID Sustainable WASH Systems Learning Partnership/IRC, CARE, SweetSense, mWater | RWB, UNICEF, IRC, Akvo, USAID Lowland WASH |
| Initial data collection | Over multiple phases working towards gradual coverage of region | Rapid by 11 government teams covering each of 11 zones |
| Scale | 194 schemes by end 2017, mainly focused on motorised boreholes, but including all schemes in Mile woreda and zone 5 | 364 motorised boreholes including most of the main domestic water supply schemes in the region. |

| | | |
|---|---|---|
| Updating | Sensors provide continuous data from 90 schemes, no updating yet of other data | Monthly, by telephone to woredas water offices. |
| Data platform | Data collected using mWater app with related visualisations | Data collected using Akvo Flow app with customised visualisation developed by Akvo. |
| Data use | Not yet documented | UNICEF have been key user to coordinate rehabilitation, with some use by RWB for planning. |
| Next steps | Further extension of inventory and remotely reporting sensor installation; improvement of dashboards; development of dispatch functions to support rehabilitation and maintenance; pilots of improved asset management practices | Further capacity building support to RWB focused on updating and use, piloting utility of remotely reporting sensors for strategic boreholes. |

## Afar

### Initiative and objectives

A similar initiative to the SFI has developed in Afar under the leadership of the USAID Lowland WASH Activity and the Afar Water Resources Bureau (AWRB). In early 2017, the Lowland team with the support of IRC and drawing upon lessons learned from the SFI, undertook an asset inventory and Life Cycle Cost Analysis in Mile woreda[3], Afar. This was part of the activities of the USAID Sustainable WASH Systems Learning Partnership which is working in Mile to strengthen local systems to improve rural water service sustainability. At the same time, the USAID Lowland WASH team was introducing remotely reporting (cellular and satellite networks) sensor technology for monitoring motorised boreholes to the region working with its partner SweetSense (www.sweetsensors.com), and the first major batch of sensors were installed in Mile in parallel to the asset inventory.

A workshop convened by the USAID Lowland WASH Activity in November 2017 brought together key actors in the region such as the AWRB and UNICEF and the skills of additional experts such as mWater. Based on the Mile asset inventory pilot and the ongoing deployment of sensors, a partnership was developed to work towards an asset inventory of all motorised boreholes and potentially all improved water sources in the region. In late 2017, CARE (with DFID support) led the process for the entire inventory for zone 5 using the same indicators and surveys as deployed in Mile and at other sites where sensors were installed.

The goal, based on the November 2017 workshop, is a regional wide system for monitoring Afar's key domestic water supplies (covering at least all motorised boreholes) with sensors ensuring continuous updating and improved data leading to improved asset management processes.

**Photograph 1. Data collection training for the SFI in Somali region**

**Photograph 2. Solar panel and transmission unit for borehole sensor in Afar**

### Progress and achievements

By the end of 2017, the Afar database included almost 200 records from 31 water supply schemes in Mille (all schemes in the district), 50 additional motorised boreholes across multiple zones where sensors were installed, and 113 schemes in Zone 5 (all schemes in the zone).

A total of 90 sensors have been deployed, supplied by SweetSense and providing the capability to measure when the pump is in use by measuring the electrical power supplied to the pump. These sensors - based on the availability of mobile network coverage in a given area - use either satellite (currently using the Iridium satellite communications network) or cellular GSM communications to relay data which is then made available through an online dashboard. The sensors were installed by woredas and regional government staff with the support of SweetSense and the USAID Lowland WASH team, and after training the region now has the capacity to manage sensor installation and replacement. While the data is available to the region on a dedicated dashboard, use has not yet been systematically promoted or documented. While the satellite sensors are operating well, since December 2017 the sensors relying on GSM communications have not been reporting due to government security restrictions shutting down access to mobile data outside of Addis Ababa. This is a major challenge with the ongoing data costs of the satellite communications amounting to around 20 USD per month per site compared with around 2 USD for the GSM version[4].

Typically some important information such as data on water levels or yields is missing for these schemes. The USAID Lowland WASH team have supported the use of advanced measurement techniques to fill some of these gaps. Ultrasonic flow meters are being used to estimate the pumped yields of sources that often lack meters, well water levels are also assessed by ultrasonic measurements, and simple water quality tests using portable probes to measure fluoride and other parameters, and the compartment bag test to estimate *E. coli* contamination have added water quality data to the database.

### Lessons learned and planned further development

In Afar, the partnership between at least 3 different projects and the agreed use of common indicators, surveys and the same data collection platform (mWater) has enabled cost effective data collection across a large number of sites. The initiative has the potential to ultimately include all improved sources or at least all motorised schemes.

Pilots of improved asset management processes are planned in Mile - one of 20 worerdas identified by the Federal Ministry of Water Irrigation and Electricity for post-construction unit pilots – and in Serdo where USAID Lowland WASH Activity is developing new water supplies based on desalination of hot waters and a rural utility is planned. These will build on training of key staff in asset management which has got underway. Multi-village water supply schemes, many developed with the support of UNICEF, are also expected to benefit from improved monitoring.

An improved dashboard is planned to help promote use of data led by the AWRB, including the provision of dispatch functions for use by the AWRB in scheduling rehabilitation and maintenance.

During the course of 2018 it is also expected that SweetSense will be able to deploy sensors communicating through a new low cost satellite network provider at costs similar to using GSM.

## Overall conclusions and recommendations

While both the emergency-led initiative in Somali and a project-led initiative in Afar have led to the development of partnerships and rapid development of new monitoring systems in these regions, the utilisation of data from systems and the improvement of operations and maintenance of boreholes and related water supply schemes is now the major focus of both efforts.

In Somali region the SFI provided the ability to demonstrate a 4.5 percentage point reduction in non-functionality during a major drought as a result of rehabilitation and maintenance efforts as part of the humanitarian response. With very limited data on the potential to reduce non-functionality rates in this context, this is considered a useful data point to support future efforts.

It is important to recognise the limitations in establishing monitoring systems where the public finance is not yet in place to act on the data or sustain the data management systems. Advocacy around proper financing of asset management and monitoring is planned, and this should span both humanitarian and development focused-actors and initiatives.

More detailed regionally focused inventories can provide much of the data required for reporting against national sector KPIs and provide a cost-effective means to collect this data through the gradual improvement

of systems geared towards operations and asset management. The SFI and Afar datasets will provide substantial data on the location of schemes when the second National WASH Inventory is conducted.

With detailed data collected on about 450 motorised boreholes and related schemes across these two regions, and some other schemes, these inventories also provide an important resource for planning Climate Resilient WASH as well as a potential mechanism to support management of new investment in these areas.

To date the sharing of lessons shared between Afar and Somali regions has been ad-hoc but there is potential for improved learning through facilitation of organised reflection engaging key organisations across these regions and sharing lessons more widely throughout Ethiopia.

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## Notes

[1] Asset management is "An integrated approach involving planning, finance, engineering and operations to effectively manage existing and new infrastructure to maximize benefits, reduce risks and provide satisfactory levels of service to community users in a socially, environmentally, and economically sustainable manner."

[2] Where this paper refers to IRC it is intended to mean the think-and-do tank headquartered in the Netherlands and with an office in Ethiopia (www.ircwash.org) and not the International Rescue Committee which is also a major WASH actor in Ethiopia.

[3] A *woreda* is the equivalent of a district.

[4] During the course of 2018 there is an expectation that moving to the SWARM communication network will reduce satellite data costs to around the same as current GSM costs i.e. 2 USD/ month per sensor.

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