Research Report

Sustainable WASH Systems Learning Partnership

AFAR ASSET MANAGEMENT SYSTEM UPTAKE AND USE

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John Butterworth, and Anna Libey
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USAID FROM THE AMERICAN PEOPLE

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AFAR ASSET MANAGEMENT SYSTEM UPTAKE AND USE

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Front cover: ARWIEB staff practice asset data collection during user training in Afar. Credit: Bret McSpadden, IRC WASH

About the Sustainable WASH Systems Learning Partnership: The Sustainable WASH Systems Learning Partnership is a global United States Agency for International Development (USAID) cooperative agreement with the University of Colorado Boulder (UCB) to identify locally driven solutions to the challenge of developing robust local systems capable of sustaining water, sanitation, and hygiene (WASH) service delivery. The consortium of partners—Environmental Incentives, IRC, LINC, Oxford University, Tetra Tech, WaterSHED, Whave, and UCB—are demonstrating, learning about, and sharing evidence on systems-based approaches for improving the sustainability of WASH services in four countries.

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Acronyms

AMS	Asset Management System
ARWIEB	Afar Regional Water, Irrigation, and Energy Bureau
EFY	Ethiopian Financial Year
GSM	Global System for Mobile Communication
GTP	Growth & Transformation Plan
Lowland WASH	USAID Lowland Wash Activity
NGO	Non-Governmental Organization
NWI	National WASH Inventory
O&M	Operations & Maintenance
SWS	USAID Sustainable WASH Systems Learning Partnership
USAID	United States Agency for International Development
WASHCO	Water, Sanitation, and Hygiene Community Organization
WWO	Woreda Water Office
ZFP	Zonal Focal Person

Executive Summary

This paper explores monitoring and asset management practices in the Afar Region of Ethiopia. The context of water supply monitoring prior to USAID support is documented, and activities undertaken to strengthen asset management under the Sustainable WASH Systems Learning Partnership and USAID Lowland WASH Activity are detailed. Initial learning on uptake and use of the Afar Asset Management System (AMS), particularly regarding how the system is used and the extent to which the insights are informing regional processes and decisions, are reported and discussed. The learning paper concludes with recommendations for priority actions for the partnership to address to increase uptake and use and sustain monitoring and asset management in Afar.

In 2016, USAID commissioned a scoping report on water, sanitation, and hygiene (WASH) monitoring and data use in the Afar Region. The scoping process identified the extent to which WASH infrastructure remained underdeveloped and highlighted challenges in sector coordination, especially with respect to planning and reporting processes. The scoping concluded the region's lack of a decision-support system to manage operations and maintenance (O&M) activities was a major limiting factor.

Since 2017, the USAID Lowland WASH Activity, with support from the USAID Sustainable WASH Systems Learning Partnership, has worked with the Afar Regional Water, Irrigation, and Energy Bureau to establish a comprehensive asset management system for water services in the region. Initial support activities included a system design process, the collection of asset data from water supply infrastructure, and installation of remote sensors at more than 150 motorized boreholes.

This partnership piloted the first iteration of the Afar AMS across three rural *woredas* (districts) in 2018. Following a collaborative review, it incorporated lessons from the pilot into the tool and system processes and initiated a rollout at the regional level in mid-2019. Operationalizing the tool involved a series of training workshops for regional and woreda staff involved in the coordination and implementation of scheme monitoring and maintenance activities. An embedded project focal point provided permanent support through delivery of on-the-job training, guidance, and technical support for users, as well as recording experiences and identifying technical and operational issues and opportunities.

Following the first steps to operationalize the AMS, this paper provides a moment for reflection on initial operational successes and challenges. This is achieved through evaluating the extent to which staff of the Afar Regional Water Bureau has adopted and used the primary functions of the system. The paper analyzes data from the system on individual user actions to build a picture of the current rate of adoption and the extent to which system functions are used. A series of key informant interviews and discussion groups with technical, management, and regional leadership staff complement this information.

The findings show that increasingly the intended beneficiaries of the system at regional and woreda levels are updating the Afar AMS with functionality and maintenance issue information. A number of new water supply schemes have been added into the system, the regional leadership has introduced an updating mechanism to systematically update scheme functionality status, and maintenance processes are

beginning to be tracked. The system also benefits from widespread recognition among a larger group of regional staff, and regional leadership has shown commitment to operationalizing the asset management approach.

However, uptake has been less than expected and the intended user group of the system, the O&M team, has had little engagement with the system and does not seem motivated to incorporate it into its routine processes. The ongoing presence of the embedded focal person is the main factor in advancing the system's use, many of the initial successes remain in nascent stages, and the number of individual system actions is still small. Additionally, the system still does not align well with regional processes, and much work is needed to update the data collection form to meet the region's data and reporting needs. As familiarity and use of the system grows, especially at the management level, the authors expect to see increased institutionalization and insights from the system used to inform regional processes and decisions. But to date, SWS has completed all data analysis to support planning (included in this paper) with limited uptake by the future owners of these tools.

Originally authored in February 2020, this learning paper was intended as a mid-implementation reflection to understand the success of initial steps to operationalize the Afar AMS and outline recommendations for technical and operational modifications to help ensure continued and greater uptake and use of the system. SWS shared the paper in advance of a key project inflection point, and it informed a debate on the direction of USAID support for monitoring in Afar, Ethiopia.

Areas identified as priorities for future work include completing the development of the Afar AMS and improving the link between data made available through the system and regional maintenance activities. Implementing partners should prepare to support annual planning processes to use the data as evidence to support maintenance and repair planning as well as for evaluating proposed woreda annual plans. Attention is required to improve the design of the data collection process, improve the design of the dashboard analysis, and extend the inventory to include all motorized schemes.

Introduction to USAID Sustainable WASH Systems and Lowland WASH Activity

The Sustainable WASH Systems Learning Partnership (SWS) is a global USAID cooperative agreement identifying locally driven solutions to the challenge of developing robust local systems capable of sustaining water, sanitation, and hygiene (WASH) service delivery. Led globally by the University of Colorado Boulder, it emphasizes partnership and learning for catalytic change in the water and sanitation sector. Coordinating with and facilitating interactions among partners in four priority countries (Ethiopia, Kenya, Uganda, and Cambodia), the project works to meet the rapidly increasing needs of USAID's partner countries for sustainable WASH activities. SWS partners are addressing rural water supply (and small town sanitation) in different parts of Ethiopia.

The USAID Lowland WASH Activity (Lowland WASH) delivers technical assistance, develops small-scale infrastructure, and builds the capacity of regional governments and stakeholders in the Somali; Afar; and Southern Nations, Nationalities, and Peoples Regions. Lowland WASH aims to increase access to improved drinking water supply sources on a sustainable basis; increase adoption of key hygiene behavior; increase access to improved, sustainable sanitation; improve efficiency and sustainability of food production from irrigated and rain-fed agricultural systems; and improve water governance and data management. Starting in January 2017, SWS and Lowland WASH developed a strategic partnership, involving the International Rescue Committee and CARE as implementing NGO partners. This partnership continued until the Lowland WASH Activity closed out in February 2021.

The SWS and Lowland WASH partnership provides an opportunity for synergies between the systems strengthening and learning activities within SWS, with a focus on improved monitoring and maintenance, and the implementation of a package of new construction, rehabilitation, and improved maintenance for rural water supply schemes through Lowland WASH.

Along with the Afar Regional Water, Irrigation and Energy Bureau (ARWIEB), the partnership is strengthening government-led monitoring systems to improve data management, updating, and use of evidence to better inform regional processes and decisions. In doing so, the partnership aims to better understand the regional information requirements for improving and sustaining service delivery and the extent to which monitoring is an effective entry point to advocate for and support investment in the provision of maintenance services. Together, the partnership has worked to strengthen regional water supply monitoring and asset management through building and operationalizing the Afar Asset Management System (AMS).

What is Asset Management?

"Maintaining a desired level of service for what you want your assets to provide at the lowest life cycle cost." (USEPA CUPPS)

What are the benefits?

- Prolong asset life through better maintenance, repair, and rehabilitation decisions
- Set tariffs based on sound financial planning
- Meet service expectations and regulatory requirements

Adapted from "Asset Management: A Best Practices Guide," USEPA CUPPS Program

Context of Data Availability Prior to Afar Asset Management System

In early 2016, in advance of the SWS program, IRC prepared a scoping report on WASH monitoring and data use in Afar and Somali regions for USAID. The scoping involved a short visit to each region to assess the capacities, processes, and systems for WASH monitoring and use of data in the two regions. It made recommendations to support further activities within the context of the USAID Lowland WASH Activity and the One WASH National Program, Ethiopia's WASH-sector-wide approach that brings together ministries, development partners, academia, and civil society organizations to a common goal of one plan, one budget, and one report.

For Afar, the scoping found that WASH infrastructure remains underdeveloped. Most improved drinking water supply sources are based on deep wells, so the costs of development are high. High salinity and natural fluoride contamination present further challenges to safe water supply. Health institutions typically had sanitation facilities but lacked water supply. Schools often lacked latrines as well as water supply. And when schools had latrines, they served both boys and girls and usually lacked handwashing facilities.

The scoping identified major limitations in existing planning and reporting processes. Woreda water offices (WWOs) based quarterly and annual planning on limited data, and reporting tended to focus only on the construction of new facilities. The scoping exercise also found the data available for water sector reporting inadequate. Personal memory on the number of schemes and water points and estimates for the indicators, such as the number of non-functional schemes, served as the only data for performance indicator estimates. WWOs typically kept data in Microsoft Word files and/or on a chart on the office wall.

Further, WWOs had no information or decision-support system in place to manage operation and maintenance (O&M) activities. Woredas addressed simple requests, with difficult problems passed up to the region. Sometimes the office recorded requests, but no system existed to collect information such as the time taken to fix a problem, or the type of parts or components needed within the system. Due to limited resources and transport, WWOs did not regularly visit schemes and operated under the assumption that systems remained functional unless reported as otherwise. WWOs conducted water quality tests on newly constructed schemes but otherwise only conducted tests when contamination was suspected, or waterborne diseases detected in the community. The WWOs had no systematic water quality surveillance in place with regular testing.

The National WASH Inventory (NWI) data collected in 2010 remained an important source of data for basic coverage calculations and regional planning. However, the data had limitations and inaccuracies. Many of the coordinate locations for schemes collected by handheld GPS proved inaccurate, as were the government-published coverage calculations based on that data.

Afar Region: Key Water Supply Indicators

- Urban water supply coverage: 83 percent (Growth and Transformation Plan I [GTP I]), 39 percent (GTPII)*
- Rural water supply access: 60 percent (GTP I), 34 percent (GTP II)*
- Health institutions: all hospitals have water facilities; 36 percent of health centers and 6 percent of health posts have water facilities
- Schools: water available at primary (43 percent), secondary (57 percent), kindergarten (93 percent)

Sources: ARWIEB 11-Month Report. 2008 (Ethiopian Fiscal Year). Presentation for annual national Hygiene and Environmental Health review meeting. Bureau of Education baseline data.

*Note that service levels are defined differently under GTP I and GTP II. In the water supply sub-sector, the main objective of GTP I (2011–2014) was to provide safe water supply of 15 liters per capita (l/p/c) within a distance up to 1.5 km for rural population and 20 l/p/c within a distance of 500 m for urban population. The more ambitious targets of GTP 2 (2015–2020) aim to provide minimum service level of 25 l/c/d within a distance of 1 km for rural and between 40–100 l/c/d, depending on the town or city size, within a distance of 250 m for urban population.

Monitoring and Asset Management in Afar, 2016-2019

The goals of Lowland WASH and SWS in Afar Region included:

1. Establishing full inventories of all water supply schemes in Afar Region
2. Establishing mechanisms to maintain regular and reliable flows of water supply information
3. Introducing remote sensors to provide insight on borehole use
4. Operationalizing customized asset management tools that provide decision-makers and planners in-depth and highly useful information
5. Building the skills and capacity for the region to independently manage the new tools and processes

Based on the scoping report, as well as Lowland WASH's inability to obtain data during borehole rehabilitations (forcing boreholes to be completely disassembled), Lowland WASH proposed building a regional AMS. SWS's monitoring efforts in partner woredas included developing monitoring surveys and beginning data collection in these areas. However, the nature of government in Ethiopia limited full use of the data at the woreda level, so higher-level engagement appeared to be a better option. Building on these synergies, the implementing partners began establishing a more comprehensive AMS designed around

mWater Data Types for Asset Management

Water System: A collection of components in a distributed scheme.

Water Installation: An individual component such as a generator, borehole, or reservoir.

these objectives to improve water service delivery in Afar. This included developing and operationalizing an information management system for water supply assets, installing remote monitoring sensors that report on daily use of mechanized boreholes, building teams at regional and woreda levels to operate and manage the system, and improving the use of evidence in decision-making for conducting repairs and rehabilitations. Following improved asset management, the region could, therefore, use the data in the AMS to plan for long-term goals and access finance more readily to meet them.

Lowland WASH, in partnership with mWater and with support from SWS, developed the Afar AMS for the ARWIEB. Building on knowledge from the Somali Functionality Inventory, which UNICEF conducted in 2016–2017 using Akvo Flow, the partnership selected mWater as a superior alternative for data collection in Afar. Prior to the AMS development, Lowland WASH, SWS, and CARE collaborated in their data collection efforts and collected asset inventory data on all schemes in Mille Woreda (SWS), in Zone 5 (CARE), and on selected motorized schemes from across all zones during sensor installations (Lowland WASH). All data collection efforts used similar data points or indicators. A map of all individual assets for which data have been collected is included in Figure 1.

Following these efforts, the partnership decided to further engage mWater to customize a regional data collection and visualization platform for the entire region intended to capture all improved water schemes' data, with a focus on motorized schemes. Development of the system, which is comprised of a mobile app for data collection and a portal for data management and visualizations, took place during the end of 2017 and beginning of 2018. The partnership piloted it with the regional O&M team and three woredas in Q2 2018. This system brought together both survey data and sensor data components for the first time using data that SWS, Lowland WASH, and CARE had recently collected, as well as sensor data. Data made available through a mobile app and a dashboard included:

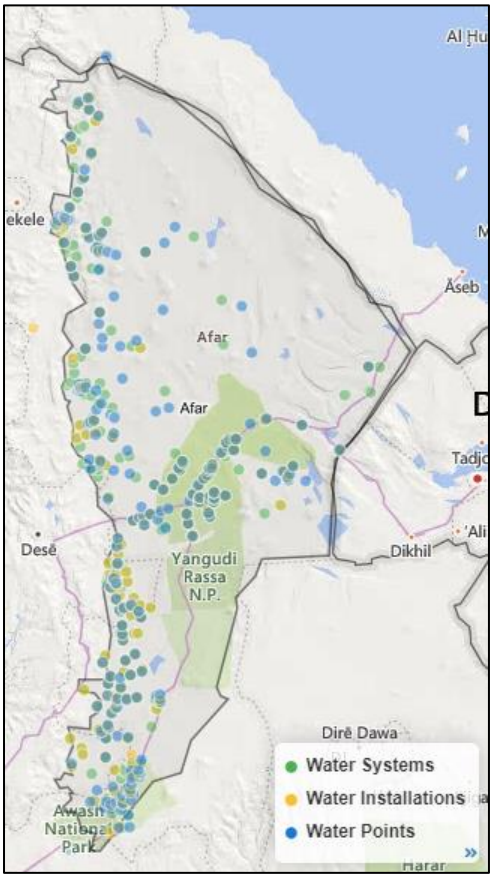

Figure 1: Map of all items in the AMS

- Water supply facilities: general details (name, year of construction, number of tap stands and connections, and present functionality status); water source (type, depth, construction, materials, sealing, water level, flow rate); details about the pump and power source (type, generator model, switchboard, solar installations); water reservoir (location, type, capacity); distribution network (type, length, and state of lines); water treatment (plant or chlorination details); and water quality test results.
- Management: general (current management status, female representation in the WASH Committee [WASHCO], finances held by the WASHCO);

users (number of households served, distance, estimations for livestock use, water trucking); tariffs (type of tariff system, amount), and time taken by users to access.

Overall, design, development, and rollout of the AMS has focused on supporting the maintenance process led by the regional O&M team. At the most basic level, the AMS supports the documentation of asset inventory data and the management and tracking of maintenance activities. The partnership held a training workshop in June 2018 to introduce the newly developed AMS to the region and begin onboarding staff from the regional O&M team and three selected woredas for the pilot phase. During the pilot, the partnership expected woredas to collect any missing data for the baseline inventory and add regular updates about scheme functionality and maintenance issues to the system. The partnership put the regional O&M team in charge of adding to and maintaining the inventory with updates from maintenance-related site visits, integrating the AMS processes within existing regional processes, and using the system insights to inform its maintenance activities. The partnership also expected users to collect and provide feedback on the system to improve the design and operational approach.

Reviewing the system metadata showed that only a small number of the expected actions had been reported into the system. The partnership organized a learning workshop in February 2019 to engage the regional and woreda stakeholders and plan a path forward. Following that workshop, a working group composed of staff from SWS and Lowland WASH, along with the implementing partners' embedded focal person, began developing and implementing an operationalization strategy focusing on understanding regional processes and how the AMS fits into and supports these processes, and retraining regional staff. At this time, SWS shifted its monitoring focus from Mille Woreda to the Afar Region to better support uptake and use of the AMS.

Following the learning and strategy design phase of the operationalization plan, mWater conducted an advanced training on backend system functionality for the working group and the regional IT department in July, with the regional O&M staff in August, and finally with regional management staff in November 2019. Throughout this period, it made refinements to the AMS dashboards and completed testing of the surveys with feedback given to mWater on items that the team could not fix alone.

Figure 2 shows the planned system use case outlined throughout 2019 and presented to ARWIEB staff during the management training. The Afar AMS tool is in the center with input from the O&M and planning departments, as well as direct input from remote sensors installed on motorized boreholes. A greater number of departments should receive data, information, and insights from the system, and the IT department should provide support for the inputs and tool.

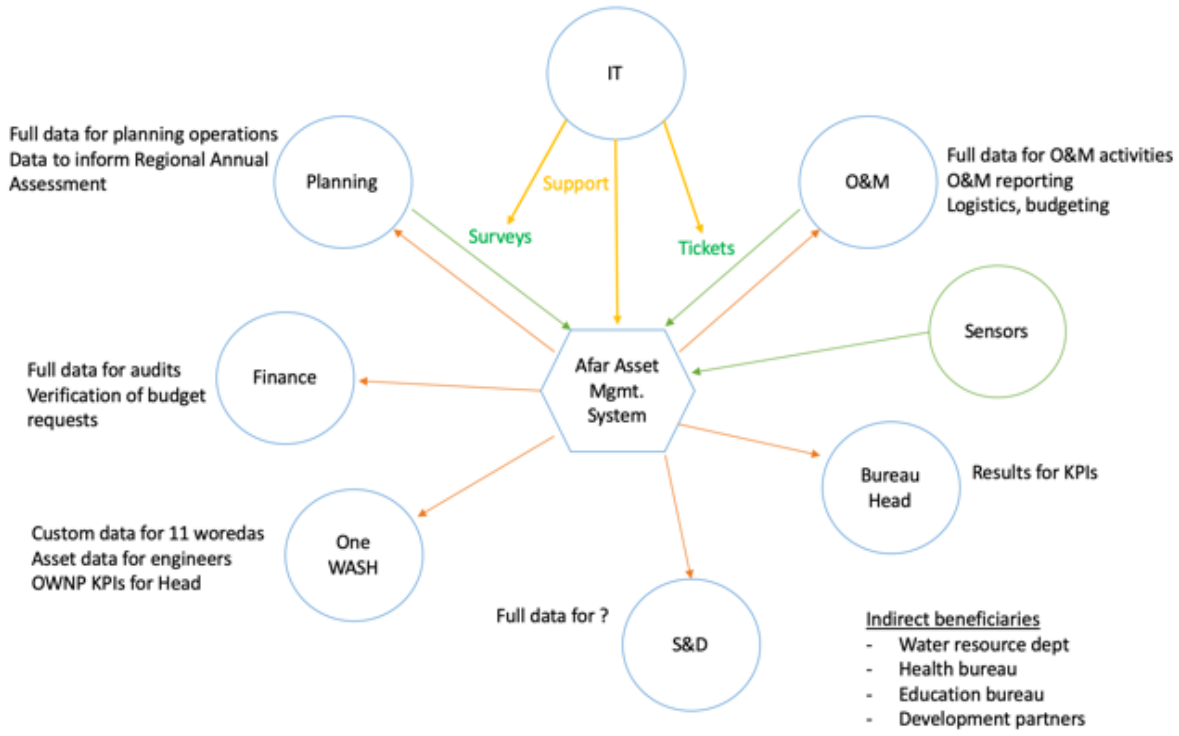

Figure 2. AMS user groups and key data inputs and outputs

Despite the best efforts of the working group and embedded focal person, use of the AMS remained low until the management training in November 2019. Following the November training, the senior management team, led by the deputy director, pushed lower-level management members, particularly the O&M head and the directorate head, to use the system.

The regional leadership also implemented a new Zonal Focal Person (ZFP) structure, with five ZFPs responsible for leading the data updating of the AMS. The individuals all currently worked at the regional water bureau and were selected from different ARWIEB departments to help expand understanding of the AMS across regional teams (due to disappointment with the O&M team's lack of use). Their task included monthly reporting of the functionality status of schemes from across the five zones (one zone per ZFP). The O&M team also continued to be encouraged to use the system to manage maintenance tasks within the AMS, add water systems, and add to and update system data during maintenance visits.

Following these changes, for the first time, usage of the AMS increased driven by direction from leadership, the ZFP's engagement, and support from the embedded focal person. A visual timeline of all activities is included in Figure 3. This timeline shows the extent to which the AMS developed through a process of evolution. The activity faced barriers around implementing sustainable service delivery, and the approach evolved to meet the requirements. The downside of this approach included long gaps in between implementation and continued development of the system.

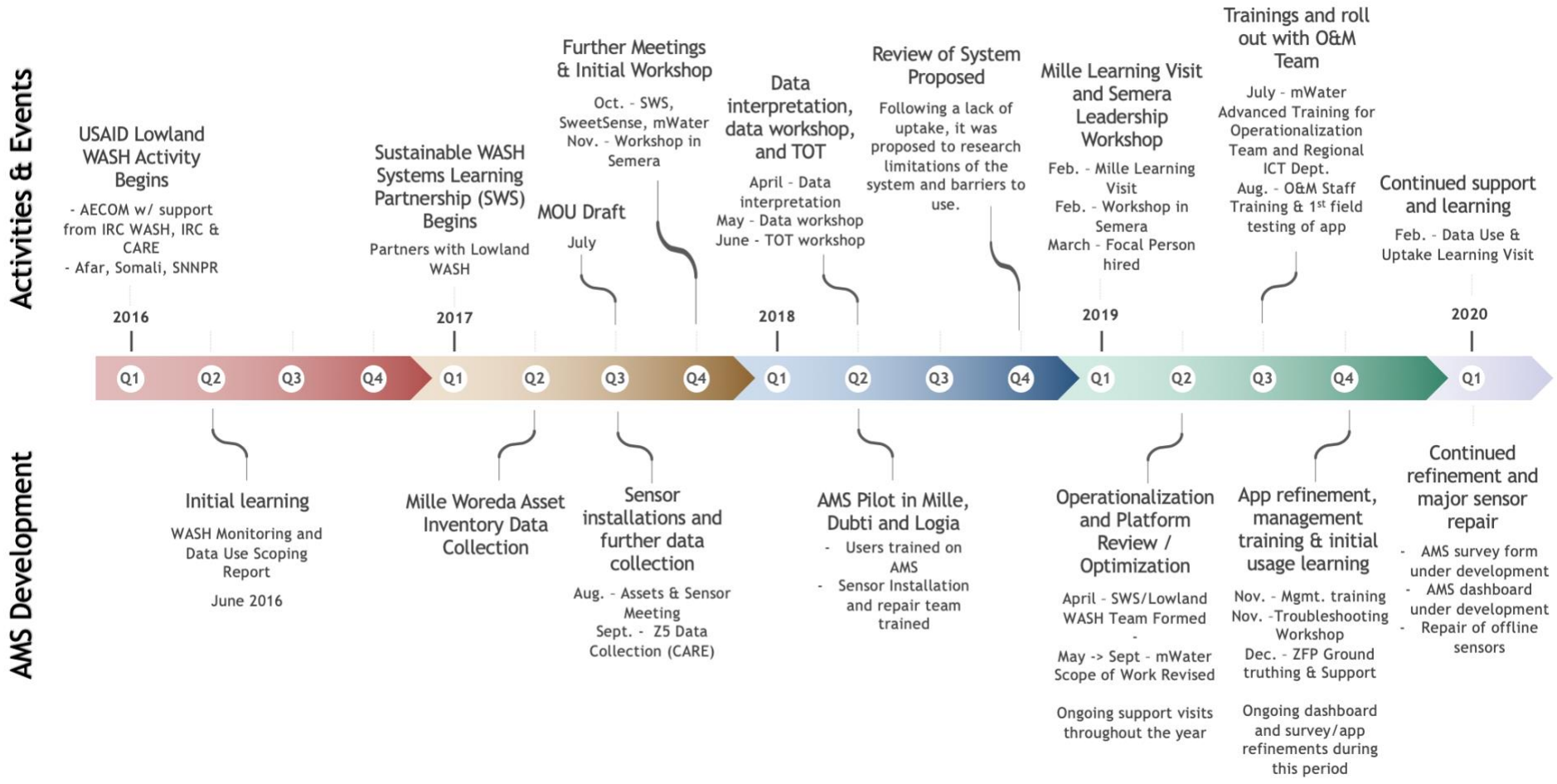

Figure 3. Timeline of events and implementation activities

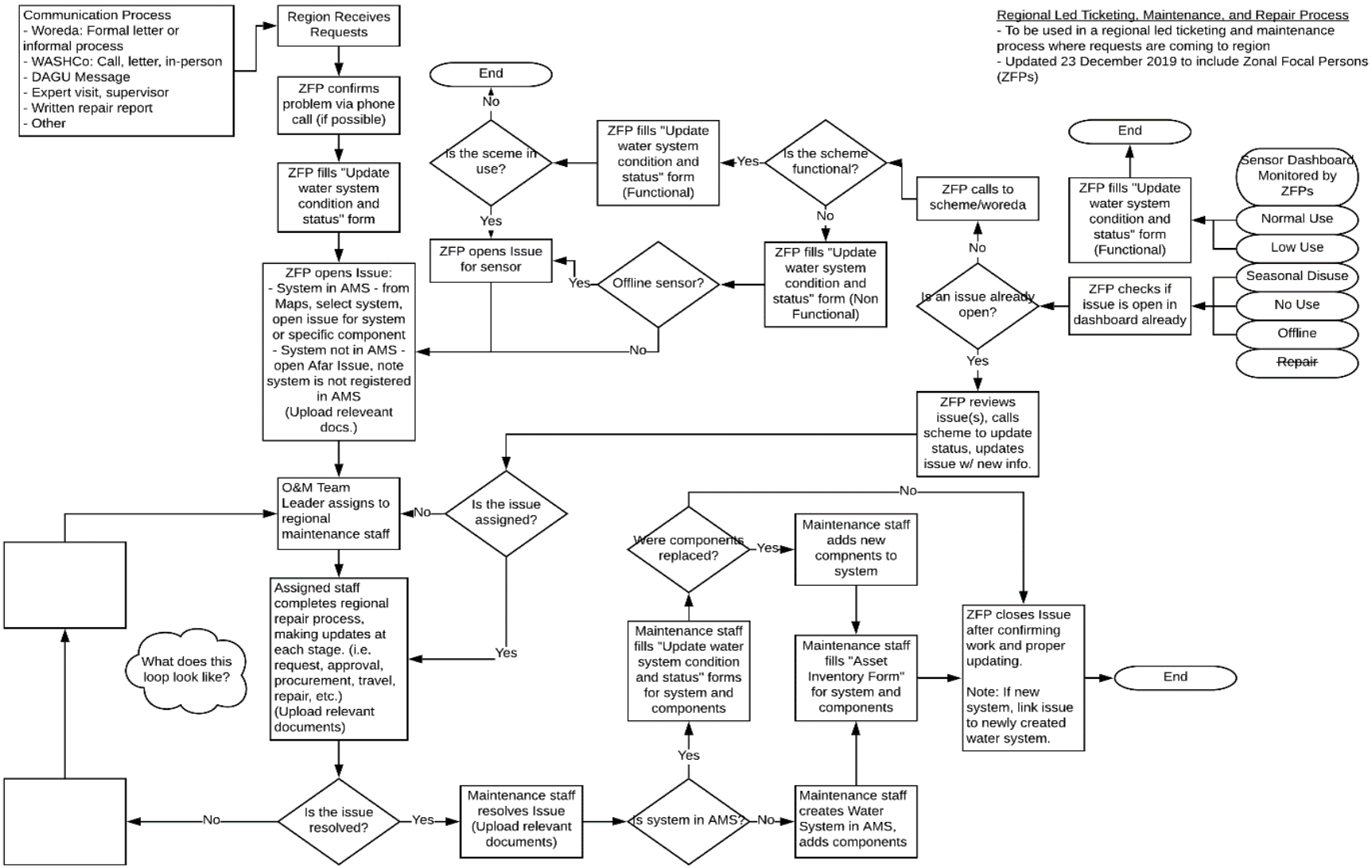

Figure 4. Zonal Focal Person process diagram

Processes and Decisions the AMS Data is Intended to Inform

Users enter data about water schemes and assets in the system through a form from a site visit or existing sources such as drilling logs. These data can be accessed at the scheme level by viewing survey responses in the mobile app, but they are also visualized in aggregate in an mWater dashboard to understand the type of assets, their make and model, or age, for example.

To support the maintenance process, observations and follow up on the daily sensor status changes or maintenance requests trigger the opening of a maintenance ticket describing the issue. This can then be assigned to a technician who can update the ticket throughout the maintenance process and resolve the ticket when repairs are completed. A more senior staff member closes the ticket when repairs are verified. A structure illustrating this process is shown above in Figure 4. This is the second iteration of the process following the implementation of the ZFP structure.

With greater system uptake and use, the partnership envisions the O&M team woud be better able to communicate its progress and limitations in maintaining water systems. Maintenance tickets could be used to count maintenance activities, to calculate and communicate response times, and to potentially estimate financing gaps. Managers could use asset data to prepare the purchases of spare parts.

Beyond the O&M team, all stakeholders, including regional leadership, discuss and encourage the idea that the AMS data can support higher level decision-making and planning. However, to date, there are not clear use cases or engagement on meeting this objective, something that needs to be explored further.

Data in the AMS

As outlined in the previous section, SWS, Lowland WASH, and CARE undertook initial data collection prior to full regional AMS development, which consolidated data into one inventory. They developed data collection parameters jointly, largely based off Ethiopia's NWI data collection form; however, in collaboration with the ARWIEB and the partnership technical team, they made several changes throughout the process. Once mWater began its customization, it consolidated multiple forms into one form, and imported the data from different data collections to the deployed asset inventory form. This allowed all prior data to be accessed in the customized mobile app and dashboard.

The AMS presently contains comprehensive asset data for 305 water systems, including a range of technical information about individual assets, their type, location, and condition. This includes aspects of the source type, construction, scheme functionality, water meters, water levels and flow rates, pumping, power sources, generators and solar installations, switchboards, reservoirs, water quality, water treatment, scheme management, uses and beneficiaries, average time taken to collect water, water trucking, livestock access, and tariffs collected. Maintenance activities are tracked and the use status of up to 173 motorized boreholes outfitted with sensors are currently updated daily. A full list of previous data collections can be found in Annex 3. Currently, the fourth iteration of the combined form is used (Asset Inventory Form [Afar v4]). mWater's original data import had numerous issues and necessitated another import in Q4 2019. The data collection form continues to undergo testing and revision, with a

new form released during 2020 that updates existing questions, streamlines the data collection process, and adds additional requested data points, mainly related to technical well data such as pump height or casing diameter. See Annex 4 for a list of all parameters currently collected in the AMS.

Exploring Afar AMS Metadata and Sensor Data to Understand System Use

This section explores what can be seen in the Afar AMS metadata and presents quantitative data on system engagement through adding sites, creating "issues," and functionality status and condition updates. Through unique user data, who is engaging with the Afar AMS and what actions these individuals undertake in the system can be understood. The section also presents sensor data and its implications. Together, these insights are triangulated against, and complimented by, interviews with user groups in the next chapter. The partnership downloaded data from mWater, analyzed and graphed it in Excel, and followed up via interviews with the embedded focal person and regional users. This initial exploration further informed custom dashboards to be built in mWater for the projects' final learning.

Adding New Systems

To enable the Afar AMS to become increasingly relevant for the ARWIEB, staff needs to add existing water systems not yet included in the inventory and new water systems when they enter service. Therefore, a critical function of the Afar AMS is the capacity to add new sites. Figure 5 shows the number of water schemes added throughout the entire timeline of Afar AMS development. At the time of the ARWIEB O&M team training in Awash, August 2019, the inventory consisted of 282 water systems, all of which had been added by SWS, CARE, and Lowland WASH. These are a mix of scheme types, with approximately 220 motorized schemes, out of an expected total of around 300 motorized schemes. The total number of schemes in the region is unknown, and parsing out motorized schemes in any data set is not always clear. Between September 2019 and mid-February 2020, the embedded focal person added six water systems, and woreda and regional staff added the remaining 17, for a total of 23.

The partnership introduced remote sensors to facilitate communicating information on borehole runtime. It intended the AMS to incorporate data reported from the sensors, and between September 2017 and January 2019, Lowland WASH installed remote sensors at 179 motorized schemes, with support from woreda staff.

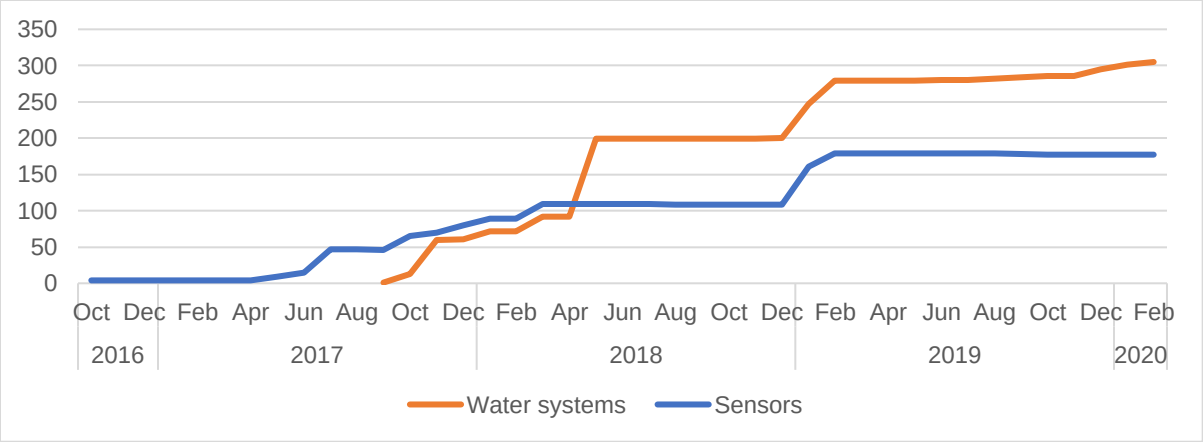

Figure 5. Water systems and daily sensor reports added to the AMS

O&M Tracking

A critical function of the Afar AMS involves using the mobile app to register "issues": problems arising in water supply delivery. When a problem is identified, AMS users can log into the mobile app and follow a process to log the issue, which includes identifying the water system, identifying the type of problem (e.g., problem in system, no water), specifying the problem (e.g., with generator, pipelines etc.), and taking a photo. When the issue is submitted, the O&M team head can review and assign responsibility for repair to O&M staff within the AMS. The issue and the repair are tracked in the system and then closed when the scheme is back to providing service. This process has four stages: Open, Update, Resolve, and Close. The full process diagram for Afar AMS issues function is included above in Figure 4.

Historically, the ARWIEB O&M team has not tracked O&M activities systematically, and the team does not have a list of past activities. Information for quarterly and annual reporting processes is limited to the O&M team head asking team members about past activities and then documenting these remembrances in reports. The issues function of AMS should improve this function by tracking O&M activities and availing results, including lists of schemes repaired and awaiting maintenance. Unfortunately, the issues process and other data captured in the system did not well inform existing reporting processes, and major modifications to align with reporting are needed or changes to the regional reporting process explored.

SWS and Lowland WASH put the issues function into operational practice following the O&M team training on the Afar AMS in Awash on August 26–27, 2019. Since then, the partnership's working group has supported various user groups across the region to adopt the practice. This includes support to users from the O&M team and Mille Woreda during field visits and ongoing support from the embedded focal person. In October 2019, the partnership formed the ZFP structure and assigned individuals from the O&M team, Water Resource Management Department, and the Energy Department with roles and responsibilities for reporting monthly functionality status updates and opening and closing of maintenance issues. To help track the uptake of the issues function, the partnership initiated a separate tracking mechanism to evaluate the progress of system uptake and use on the part of the O&M team. This mechanism tracked where the embedded focal point captured all repair and maintenance support

requests submitted to the O&M team and all support activities the team undertook. Figure 6 shows both the O&M requests and activities that the embedded focal person tracked and the issues opened in the AMS between September 2019 and mid-February 2020. The data show parallels between the data sets and suggests that many of the support requests submitted to the O&M team are included as issues in the AMS. When the time comes for annual reporting, some information on O&M activities will be available.

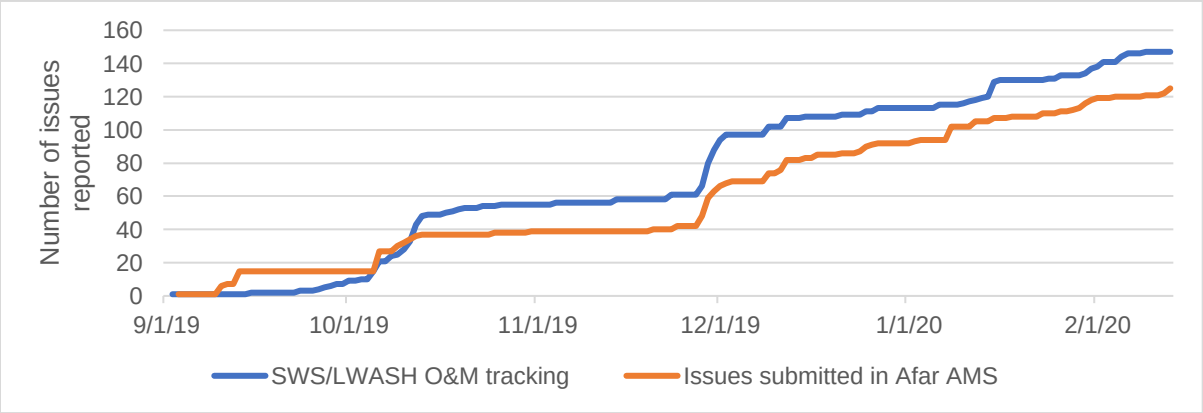

Figure 6. O&M Issues tracked and reported in the AMS

Who has been opening these issues in Afar AMS can be explored using the metadata. Figure 7 shows, overall, that implementing partners have submitted the majority of issues. However, that number is decreasing each month as other Afar AMS users become more actively engaged. The number of issues that ZFPs submit has been consistent since the formation of the group and the partnership entrusted it with AMS responsibilities. The number of issues that O&M staff — who are the intended primary users of the Afar AMS due to its maintenance role and active engagement in maintenance — is considerably lower than expected. This is in spite of the August training that occurred before the partnership put in place the ZFP structure and tasked it with opening issues. Although the ARWIEB leadership group continues to submit a low number of issues, that is to be expected, since the leadership had not been trained on opening issues and its anticipated use is focused on the data and insights generated from the system rather than participating in data entry and submitting issues. Mille Woreda has continued to submit issues each month.

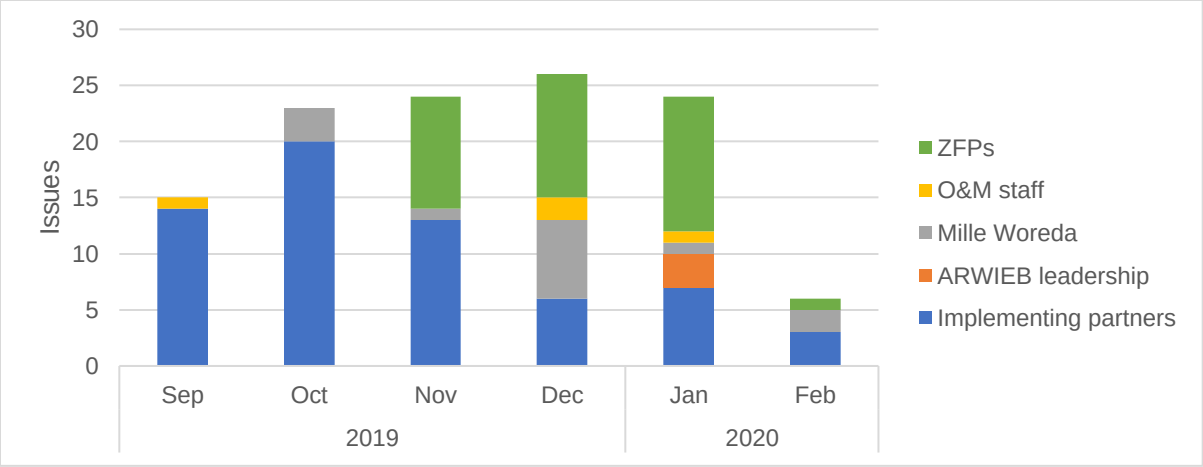

Figure 7. Issues submitted by AMS user groups

While data show issues are consistently submitted, they also show less is done to update, resolve, and close issues. As can be seen in Figure 8, since September 2019, a total of 125 issues have been opened, 19 have been updated, and 12 have been resolved and closed. The same data, shown on a cumulative graph (Figure 9), demonstrate the significant disparity between issues that have been opened and issues that have been updated, resolved, and closed. In discussion with the O&M team, the partnership determined that many of the issues opened have in fact been repaired, but this is not captured in the AMS since O&M staff undertaking the repairs are not consistently logging the updates in AMS.

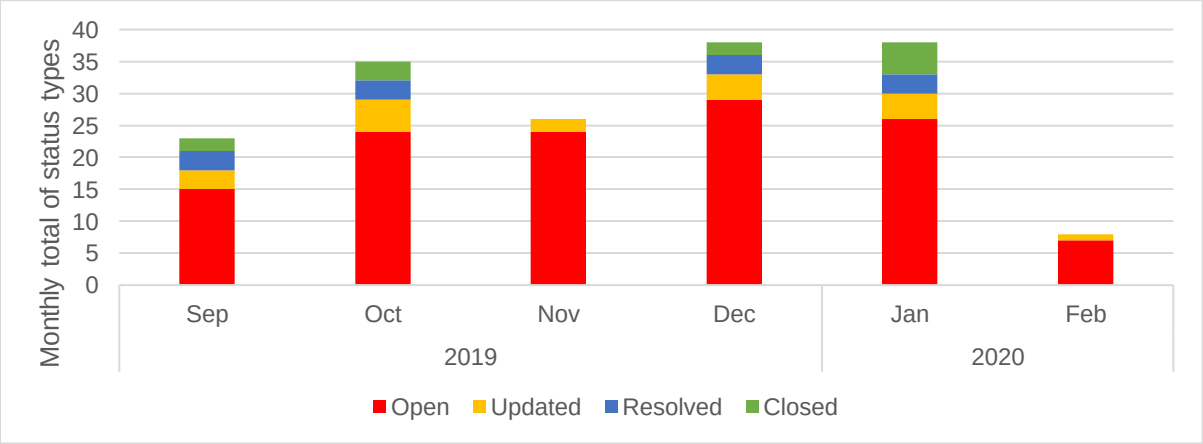

Figure 8. Tracking monthly issues in the AMS

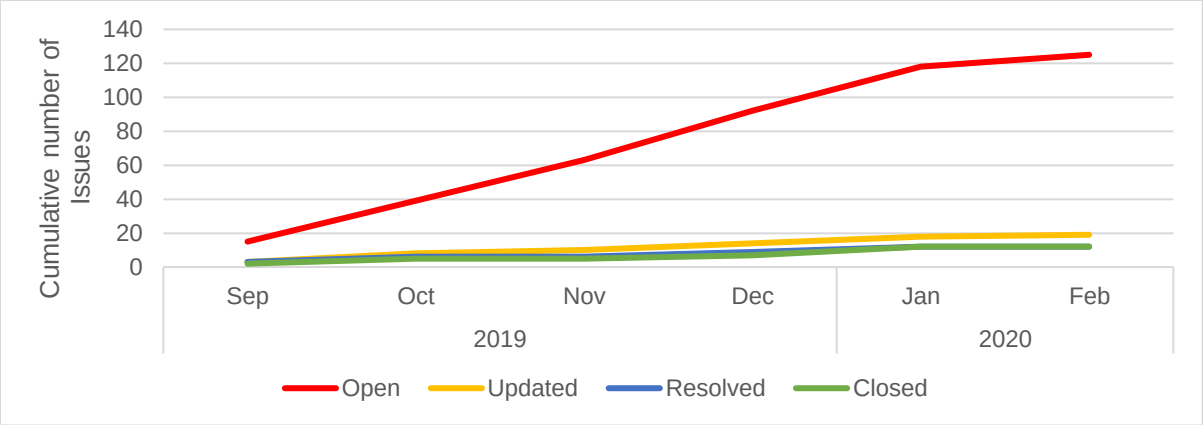

Figure 9. Cumulative issues processed in the AMS

Functionality Status Updates

Another critical function of the Afar AMS is to ensure the latest and most reliable data on scheme functionality is available. This is done though systematically updating the functionality and condition of assets. The process involves using the mobile app to identify the system and the asset for which the update relates, describing the current condition of the asset, and submitting the update. Moderators approve updates before they are finalized in the database. This is currently a manual process that has the potential to be automated based on sensor status changes. The metadata on functionality status and condition updates showed the uptake of this function to be low until the ZFP structure was put in place related to the Afar AMS in November 2019. Prior to the ZFPs, very few monthly updates took place, and implementing partners made most of these (Figure 10). It should be noted that many of the ZFP's updates basically transferred sensor "normal use" status to the AMS as "functional," and automating this may lessen the burden on ZFPs but also would likely lessen the number of updates needed. In this use of sensor data, sensors did not appear to be reliable at identifying a non-functional scheme, making it difficult to follow up "no use" sensor status. Few issues have been opened using sensor data as explored in the (forthcoming) paper "Near Real-Time Borehole Functionality Monitoring for Strengthening Water Supply Asset Management."

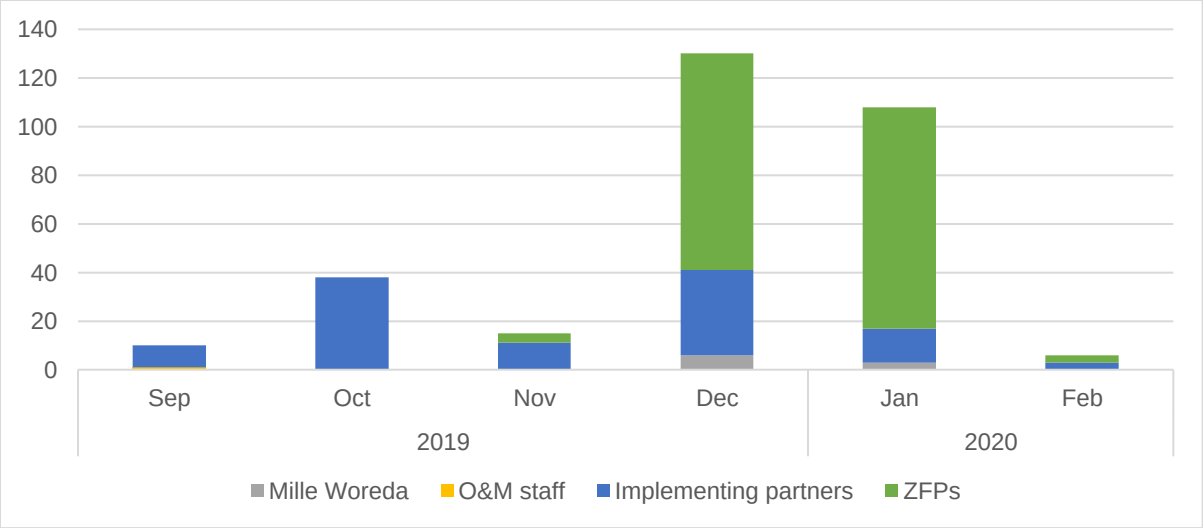

Figure 10. Functionality and condition status updates per user group

Extent to Which the Data is Understood and Utilized

Creating and Managing Maintenance Issues

As noted in interviews (see Annex 2 for a full list), the Mille Woreda staff view the Afar AMS as a tool to improve advocacy and communication with the regional O&M team. Mille Woreda engineers submit issues so the O&M team is alerted and can see problems arising in the woreda. The woreda staff see an advantage of opening these issues to get the attention of the O&M team.

The woreda believes its use of the AMS is working to gain greater attention from the region. Communication between the offices has improved, and the region is becoming more responsive to the problems arising in the woreda. Recent examples are the Mille–Saraytu water system (AMS scheme ID:15337487) where the region supported the generator and riser pipe replacement, the Mille–Gelaha water system (AMS scheme ID: 19848415) where the region supported the switchboard replacement, and the Amultabo Hp water system (AMS scheme ID:15337418) where the region supported the repair of the solar pump. While the normal process of sending a formal request letter is still followed, the AMS data are now available to support the request, and the embedded focal person is present at both levels to monitor such requests. Mille Woreda staff occasionally record maintenance issues resolved locally (not requiring regional support) in the AMS, as seen in Figure 11.

Figure 11. A local technician in Mille Woreda submitted this photo to the AMS showing a pipeline under repair. Photo credit: IRC WASH

Mille Woreda staff also estimated the response time has improved, which it believes is partially due to the ability to send pictures and a description of the problem in the issue form. The woreda also feels there is regional trust in the system and the data submitted, but that the region is not well engaged in undertaking actions within or using the system. For example, when the region provides rehabilitation support, it is the woreda that uses the Afar AMS to update, resolve, and close the issues that the staff itself opened.

A large part of the information captured during the interviews related to woreda level use. This is largely because uptake and use in Mille Woreda is greater than at the regional level. While SWS conducted regional-level interviews with O&M staff, ZFPs, and a group of regional management and leadership staff, they provided more limited information relating to the system due to generally low use.

ZFPs did confirm they are engaging with the issues process in the AMS. During the ZFP calls to scheme operators and woredas, they identify problems and are able to log these into the AMS via the issues function. However, in discussions with the SWS/Lowland WASH embedded focal person, this requires a lot of encouragement, follow up, and reminders. ZFPs confirmed that they did not view this task as part of their job description, and they did not receive support such as phone credits or other incentives to encourage them to complete their newly assigned tasks.

The O&M team head confirmed an overall increase in the number of problems reported to the region. This noticeable uptick in recent support requests appears to be related to data coming in from usual calls about breakdowns in addition to the new method of ZFPs identifying breakdowns. The O&M team head also noted that more information is available about the problems that can potentially be helpful in preparing for repairs, but challenges remained related to managing the maintenance process. For the AMS to be effective, all issues need to be logged and prioritized (which is currently not a feature), and all staff need to work together to manage the process. Until this happens, it is easier to continue with the

existing, ad-hoc process, which includes many paper-based components that cannot be replaced due to government requirements in processing finance or supplies.

Updating Functionality Status and Condition of Assets

ZFPs perceive their primary role as updating scheme functionality status and condition on a monthly basis. They do not directly access the AMS to retrieve data but receive weekly updates from the SWS/Lowland WASH focal point with the sensor expert status results for all the schemes in their zone that have sensors. Using sensor data is a focus of the responsibilities of ZFPs. Sensor data are used for understanding functionality of schemes to be used in creating issues and monthly status updating. If a scheme in their zone has a "normal use" sensor, the ZFP will update the status to "functional." When a scheme reports "no use," the ZFP calls the woreda or scheme operator to understand what is happening. ZFPs are sometimes unable to talk with scheme operators to confirm or receive information about functionality status. Sometimes they cannot reach them or sometimes no cell number is included in the AMS. Additionally, ZFPs have not been given telephone credit and therefore have limited ability to make all necessary phone calls. Currently it seems that only schemes with sensors are updated and those without sensors are not a part of the updating process, despite a monthly checklist of schemes in each zone provided to the respective ZFPs.

The latest status will always be updated, so a functional scheme will be updated every month. When non-functional, it is often difficult to glean sufficient information to include for reporting into the Afar AMS because of the unreliability of calls to operators or caretakers. The main benefit of the sensors is that the ZFP does not currently need to call the woreda or caretaker to determine the functional status when sensors report "normal use."

ZFPs experience challenges with contradictions between sensor reports and the real functional status, where many of the schemes reported as "offline" or "no use" are actually functioning normally. ZFPs are concerned about the high number of offline sensors and the number of incorrect "no use" reports. The ZFPs estimate 50 percent of "no use" and "offline" reports are genuinely broken pumps, but the other half are either functional pumps that may not be used frequently (such as backup boreholes) or the "no use" status is caused by pump caretakers, woreda, or regional technicians disconnecting the clamp that attaches the sensor to the pump's power cable or other sensor problems such as chewed wires, poor network, or other mechanical issues. During the ZFP focus group discussion, the ZFPs expressed concern about the reliability of sensor data. SWS hypothesizes better training and awareness raising on sensors will decrease the number of clamp detachments and thus improve the reliability of, and trust in, the sensors. Additionally, sensors need regular maintenance, so following up on "offline" and "no use" sensors regularly to replace batteries, maintain wires, or replace sensors will help improve the number of online sensors.

The accuracy of and response to sensor status are explored further in the companion monitoring learning paper, "Near Real-Time Borehole Functionality Monitoring for Strengthening Water Supply Asset Management."

Using Data from Afar AMS

According to ZFPs, whenever rainwater is available, scheme operators are not concerned about the maintenance of schemes. When rainwater availability declines and the community returns to groundwater pumping, any scheme functionality problems that occur take longer to reach the region, which then takes longer to respond because of a sudden influx of problems. Regular scheme functionality updating processes, such as monthly calls to operators, have been introduced as part of the Afar AMS to improve the timeliness of information about schemes even if the updated data are not used. ZFPs believe this has the potential to affect the functionality of schemes and overall service provision in Afar. ZFPs perceived an increase in the quantity and speed of information flow on scheme breakdowns and believe this has resulted in faster awareness of problems and will potentially result in faster water service repairs.

The O&M team head made clear that knowing about broken schemes was never a problem of the O&M team, rather the backlog of support requests cannot be met due to technical, financial, and capacity constraints. The introduction of AMS has meant the region receives more information about breakdowns, but having information about more broken schemes does not mean more schemes get repaired. Although using data from the AMS to make a data-driven argument for increased finance has been communicated throughout all trainings, as well as the goal of simplifying and improving maintenance management, the O&M team head clearly said that he sees the system as an additional task for an already overburdened and under-equipped team.

The limitations for the O&M team undertaking more repairs include logistics, transport, spare parts, and expertise, but the challenges are mostly financial. According to O&M team head, the budget for maintenance decreases each year and most funds now come from UNICEF, and these are also declining. The O&M team is largely working through finance available at the woredas: if a woreda can cover the expenses of the repair, including transport and per diems for the O&M team engineers, the head will instruct staff to undertake repairs.

According to the O&M team head, aside from learning about more breakdowns and support requests, the O&M team is not using the Afar AMS. Insight from the AMS does not support prioritizing breakdowns, managing material support, or any other function of the team. Similarly, although the system became operational in August 2019, data have not been used yet to inform planning or reporting processes. Furthermore, O&M team staff is apparently not yet using the inventory data in the field. This is particularly disappointing, because the partnership previously understood that the O&M team had a keen interest in accessing comprehensive data on schemes, such as pump depth, while in the field. The full list of scheme data in the AMS is available in Annex 4.

Beyond using the AMS to improve communication with the region through the "issues" function, Mille Woreda uses the system to understand location of schemes and the distance from the WWO for calculating fuel required for maintenance activities. The WWO is also looking at sensor data to understand the volume of water pumped at each site and inform its support to WASHCOs. Using flow data, the woreda has seen that solar schemes are often left turned on without supervision and has been

able to address this problem of wastage and overuse. It also has been able to track if the WASHCO is collecting proper tariffs or not based on sensor-measured pump run time.

AMS metadata tracking of individual user logins and activities shows very limited regional staff access of the dashboard component of the AMS. The embedded focal point has also raised awareness that so far there has been limited interest in the AMS outputs for use in decision-making. The Water Resources Department is interested in the yield data, and the Planning Department is interested in the usage data, but again, further understanding and design is needed to realize these ideas. The system may also need to be further customized to include valuable data points that are not currently captured.

Better aligning the AMS with existing processes and reporting within the region and vice versa and encouraging staff to use the system regularly may improve interest in the system. However, many existing processes cannot be replaced such as paper-based requests and approvals for finance. It has also been noted that the data are not that useful when they are incomplete and hard to update, so a concerted effort to complete the data set may allow users to more easily keep it updated. With better, more aligned data, demonstrating the usefulness in obtaining finance or improving planning may also help improve use.

Recommendations Arising During the Interviews

Interviewees raised a number of criticisms and concerns about the Afar AMS and the AMS approach during discussions with ARWIEB and Mille Woreda staff, as well as several recommendations for improvements. As discussed, ZFPs identified the fact that the AMS does not include information for all schemes, or even all motorized schemes, as a significant limiting factor for widespread adoption. ZFPs have also experienced technical issues with the functioning of the AMS mobile app where data have gone missing. This could be related to challenges with connections and data loss or could relate to user errors and the need for improved support and training. Mille Woreda also highlighted problems and confusion with regular changes to the mobile app, and recently it was unable to create issues. The staff subsequently identified a work-around but is frustrated that the mobile app has lost functional components.

Interviewees cited not enough resources to support the AMS as a familiar challenge. Mille Woreda does not have a vehicle or a budget required for transport and per diems related to AMS activities such as site creation. Sensor support is also not available. ZFPs have requested phone credits for calling pump operators, but they have not received any financial support or incentives. Mille Woreda also highlighted the challenges of providing mobile devices. ZFPs and Mille Woreda recommended further capacity building on sensor repair and the AMS dashboard.

The ZFP role brings additional and unwanted responsibilities. Some of the ZFPs have not been engaged and are resentful about the additional responsibilities and the lack of additional incentives provided, particularly those from outside the O&M team. Although different for each ZFP, depending on the number of schemes and “offline” or “no use” sensors in their respective zone, as well as network condition for calling caretakers, the time taken to complete ZFP responsibilities is estimated at three to four days per month. Office work is also not incentivized as staff push for work outside the office to

maximize per diems received. ZFPs stated that while the AMS is important, the ARWIEB gives it insufficient attention, and for the system to be sustained, it requires a full-time, dedicated staff. ZFPs also recommended community-level awareness creation on the sensors, particularly for caretakers and WASHCOs, for support with sensor maintenance and improved communication about issues arising.

Mille Woreda recommended simplifying the existing support request process, which is based on formal letters sent between the woreda and region, by including the full request and letters within the AMS. ZFPs recommended a change to the updating process where woredas are responsible for collecting information on all schemes, and that information be transferred to regional-level data collectors (preferably the O&M team and not ZFPs) during a monthly call. Much time could be saved if WWOs prepared the information on all schemes so the ZFPs would not need to call caretakers.

During discussion with the regional leadership, some department heads expressed demand for accessing the AMS data. Currently the Energy Department does not access the dashboard or make use of the data, but it has an interest in accessing custom analysis that can support its specific processes and decisions. The department's information needs relate largely to solar schemes. Overall, more attention, capacity building, and support needs to be given to displaying valuable data for the O&M team and other regional departments, and more needs to be done to support the individual teams and create information products tailored to their specific processes and decisions, particularly regular reporting requirements. Connecting with these departments earlier in the development process may have also improved uptake and use as more users may have been updating and using the data.

Mille Woreda also identified challenges with sustaining sensors. Its concern is that sensors are frequently offline, and that cables, clamps, and solar panels are not strong enough to withstand damage from weather and animals. ZFPs recommended a budget for sensor maintenance. In addition to maintenance of schemes, the O&M team is given the additional task of maintaining sensors. Sensor maintenance activities require a separate or additional budget for staff and a vehicle.

While the primary Afar AMS use case is within the O&M team, and despite the limited evidence of system use by that team, the team head did not have any recommendations for improvements to the system or operational approach. In discussion, the system is clearly still perceived as separate from the regional processes and not entirely helpful.

Discussion on the Learning Questions

To what extent has the ARWIEB adopted improved asset management using the AMS?

Considerable effort, particularly on the part of the SWS/Lowland WASH embedded focal person, ZFPs, and Mille Woreda, has been made to operationalize the Afar AMS. Over the past six months, the partnership can see significant system uptake for some core processes of the system, such as creating issues and updating scheme functionality status. The responsibilities for these functions have been assigned, and ARWIEB staff are well aware of the system, the data it contains, and its capabilities.

Less progress is being made in improving the inventory of water schemes. In previous discussions with the regional O&M team and others, the partnership understood that having access to comprehensive

data sets for all schemes was a high priority, as was improving the data already in the AMS for existing schemes. It is therefore worrying that so few schemes have been added or modified in the six months since the system was operationalized.

It is the O&M team that are in the field, visiting schemes, and in the position to add or modify scheme data. However, the O&M team, which the partnership assumed would be the primary AMS users, has not meaningfully engaged with the system. Data input and functions undertaken are overwhelmingly coming from ZFPs, Mille Woreda, and even more so from the embedded focal person. This is clear from the limited number of issues or status updates submitted from O&M team staff and is further demonstrated by issues tracking. While the ZFPs and Mille Woreda are opening issues, the O&M team are not updating or closing them, even when the scheme repairs are being made. The embedded focal person compensates for the lack of engagement to keep the system functional and updated as much as possible.

Understanding why the O&M team has not engaged with AMS needs to be the focus of future enquiry. Since the team has received multiple trainings and support, as well as mobile devices and computers on which to use the system, it likely has more to do with individuals seeing limited value in the AMS, and/or disinterested leadership of the O&M team.

What regional processes and decisions are informed by AMS?

The greatest missed opportunity is the amount of data presently in the Afar AMS that is not used to inform ARWIEB processes or decisions. Although the inventory does not cover all schemes, data for a wide range of indicators are available and accessible through a range of dashboards with custom analysis. Staff from various departments has been trained, and awareness of the system is widespread among technical staff and management. Despite this, the partnership has been unable to identify cases where data from the Afar AMS are used to inform processes such as quarterly reporting, or for decision-making such as prioritizing O&M activities, annual planning, or advocacy for greater allocation of resources toward scheme maintenance.

Building and operationalizing the Afar AMS, providing training and support, and making data accessible through analysis and presented on dashboards have not resulted in widespread use. More could be done to tailor the AMS data to fulfil specific administrative purposes within various ARWIEB departments. Also, it is still early in the rollout of the system, and the partnership expects to see increased usage of the data as regional staff become more familiar with and confident in using the system, and in using evidence more generally. That said, during all trainings and meetings, these issues have arisen, but engagement from the regional staff on supporting changes or better understanding of data needs has been non-existent. Finding ways to address these shortcomings in understanding is key to the success of the platform.

Beyond further development and modification, there is scope to engage more fully in sharing data and analysis from AMS with various regional departments. Specific insights could be developed and shared through weekly or monthly reports, for example with the Energy Department, which is responsible for management of solar schemes across the region.

To what extent is sensor data useful to the AMS and ARWIEB in support of asset management and maintenance?

It is far easier to update the status of a scheme in the AMS when the sensors report a status of "normal use" because "normal use" can be assumed to be functional, and the update can be performed without calling the borehole operators. However, when sensors detect "no use" or "offline," a call to the operator or woreda is required. Since these calls are often difficult to undertake due to challenges such as reliable cellular connectivity, insufficient telephone credit among ZFPs, or general unwillingness to go through the process, the data show a bias toward reporting updates for functional and sensor-equipped schemes.

ZFPs do not prioritize schemes that have changed functionality status. Instead they update the status of as many schemes as possible every month. Because a bias exists toward updating functional schemes, as discussed above, this means that most schemes are updated from functional one month to functional the next month. It might be easier to have automatic updating within the AMS, as per a previous recommendation, so that sensors reporting normal use are automatically updated to functional. Therefore, only schemes without sensors or those with sensors reporting "no use," "low use," or "offline," need to be called.

Presently there are around 300 motorized boreholes in Afar. At the time of writing in January 2021, 173 schemes have sensors, approximately 47 percent are online, and of these, approximately 60 percent are "normal use" — a total of 50 boreholes. Therefore, having sensors installed currently saves ZFPs from calling woredas or caretakers to collect monthly information on the status of those 50 schemes, but does not assist in the updating for the approximately 250 others.

Since sensor data are presently used only for updating scheme functionality status, low numbers of online sensors pose a challenge for the ongoing integration of sensors in Afar. The high numbers of offline sensors due to cellular data shutdowns and sensor failures highlight the need for a more sustainable mechanism to ensure sensors remain online and reporting. Periodic sensor repair interventions are difficult to coordinate and likely to be prohibitively expensive without external financial support.

If the sensors support only a fraction of the overall functionality updating effort, and do not bring measurable benefit elsewhere, it is difficult to develop a comprehensive argument for their ongoing support. A separate report is dedicated to exploring the implementation and the utility of the sensor monitoring network.

Is there additional or unexpected learning from data analysis and interviews?

Despite the challenges ZFPs face, having responsibilities for updating and engaging with the system embedded in different departments is useful because it has exposed teams and individuals beyond the O&M team to the system and the available data. The head of the Energy Department seconded this opinion during the ARWIEB management and leadership group interview.

Submitting issues into the AMS might help to communicate the problems earlier, but the formal process of sending stamped letters is the only route currently accepted to submit an O&M support request. If an issue is logged in the AMS, the formal process must still be followed, and if not, the issue will not be addressed. The benefit to adding an issue is therefore somewhat limited to improving communication and alerting the O&M team that a formal support request will soon be submitted. To better align the formal support request process with the AMS, the issue forms should include reporting on completion of O&M team office tasks, such as when financial paperwork is submitted or when spare parts are requested or received.

Conclusions and Recommendations

Having access to regular and reliable insight on water supply is critical to support and sustain services. However, data alone do not influence decisions and actions. Meaningful improvements in water supply services require evidence to inform a range of processes and decisions, from planning rehabilitation and the extension of services to advocacy for increased investment for maintenance activities. Significant funding is going into developing systems, and, although challenging to get right, continued investment in improving, operationalizing, and institutionalizing monitoring approaches, in coordination with investment in maintenance systems, is a critical factor in sustaining services. However, a major limiting factor in updating and using the data is finance. Even with data, unless they can be used to gain additional finance, no significant improvement in maintenance should be expected. Overall, there is a difficult cyclical problem where data need to be collected to be useful, but until they are shown to be useful, interest in changing processes to better collect and use data in an overburdened and underfunded organization is as challenging as it is difficult, time-consuming, and not immediately useful in making things more efficient.

The Afar AMS is updated with regular information, increasingly by the intended beneficiaries of the system at regional and woreda levels, but the insights from the system are not yet used. Without significant external support, encouragement, and financing, there would likely be significantly less use, if any. The main strengths of the Afar AMS currently are widespread understanding of the system, leadership's commitment and buy-in, and progress in keeping the system updated with maintenance issues and the functionality status of schemes. Additionally, the team has continued to adapt and learn throughout the project how to better align the system to meet the needs of the ARWIEB.

Although the current results are limited, progress is being made, and the partnership expects to see a continued trend of greater uptake and use of the AMS in the coming months. To meet the goals, the partnership will need to see ongoing support from the region. Additionally, better understanding of regional processes, decision-making, and data needs are essential, as the partnership designed the system with the O&M team in mind, but system workflows do not follow the existing O&M team processes, and the available data have limited value outside the O&M team.

Priority focus areas for future work are completing the development of the AMS and improving the link between data made available through the system and regional maintenance activities. Implementing partners should plan to support ARWIEB's annual planning process to use existing data as evidence to

support maintenance and repair planning as well as for evaluating woreda plans, increasing engagement with senior management and regional leadership to showcase the AMS capacity, and building regional demand. Additionally, work is required to improve the design of the data collection process, improve the design of the dashboard analysis, and extend the inventory to include all motorized schemes. Beyond SWS, it is hoped another partner can continue to support the region in operationalizing and utilizing the AMS, as it is difficult to imagine the region will have the capacity or funding to sustain the system on its own.

Annex 1. Previous Learning Documentation

External/Published

WASH Monitoring and Data Use in Afar & Somali: Scoping Report

Monitoring and Management of Climate Resilient Water Services in the Afar and Somali Regions of Ethiopia

Real-Time Monitoring for Improved Water Services in the Ethiopian Lowlands

Pioneering a Systematic Approach to Better Operate and Maintain Rural Water Schemes in Ethiopia's Remote Afar Region

Quantifying Increased Ground Water Demand from Prolonged Drought in the East African Rift Valley

Annex 2. Interviews Conducted

AMS User Group	Individuals Interviewed
Leadership	Acting Head, and Energy Directorate Director WRM Directorate Director One WASH Coordinator Planning Directorate Director
ZFPs	One WASH Department and ZFP for zone 1 O&M team and ZFP for zone 2 Water Resource Department and ZFP for zone 3 Study & design team and ZFP for zone 4 Energy Department and ZFP for zone 5
O&M Team	O&M team head
Mille Woreda	Engineer and focal point for coordinating the AMS users in Mille Mille woreda water office staff

Annex 3. Prior Surveys

Survey	Date Created
Asset_Inventory_Mille_Mille_Woreda_Afar_Region	May-17
Afar Rural Water Supply Asset Inventory Borehole Logs and Equipping	Jun-17
Afar Rural Water Supply Asset Inventory Field Survey	Jun-17
WASHCO survey - Mille	Aug-17
Afar Rural Water Supply Asset Inventory	Sep-17
Afar Regional Asset Inventory - Water Quality Results	Oct-17
Afar Rural Water Supply Asset Inventory merged with Sweet Sense Inventory	Jan-18
Afar Rural Water Supply Asset Inventory - Zone 2	Feb-18
Water_Quality_Results_Zone2_Afar_Asset Inventory	Mar-18
Afar Water Asset Monitoring Form	Jun-18
Afar v2 Asset Inventory Form	Jun-18
Asset Inventory Form (Afar v4)	Jun-19

Annex 4. Data Points in the AMS: From Asset Inventory (v4), March 2020

Water System		**Installation Site**		**Water Point Site**
General		*Source*		*Tap Stand*
Zone		Type		Name
Woreda		Photo of source		Year constructed
Kebele		Water meter?		Functionality
Village		Working meter?		Picture
Context		Current meter reading w/ comment		No. of months non-functional (NF), partially functional
Contact info - 2 people		Current reading		Main cause of NF
Name		*Borehole/well*		Physical state
Position		Name		Water meter?
Telephone		Construction year		Working water meter?
Scheme details		Well depth		Meter reading
Name		Well diameter		Water quality test?
Year of construction		Is well unsanitary		Select unique code
Total number of sources		Unauthorized livestock entry?		
Type		Source of pollution w/in 10m		
Number of tap stands		Latrine w/in 30m		
Number of household connections		Location of latrine		
Number of institutional connections		Adequate drainage		
Functionality		Vulnerable to flooding		
Status		*Surface water*		
Photo of non-functionality		Construction year		

Water System		**Installation Site**		**Water Point Site**
Cause of non-functionality		Physical state		
Description of functionality		*Spring*		
Number of months non-functional		Construction year		
If functional, emerging problems		Physical state		
Description on emerging problems		*Sensor*		
Was the scheme out of service in the last month?		Is a sensor installed?		
Number of days out of service		Type		
Yield		Date of installation		
Average pump run time		Serial number		
Seasonally dry?		Telephone number		
		Picture		
		Notes		
		Water level and flow rate		
		Water level measurement done?		
		Date and time		
		Type of device used		
		Was measurement done before pumping		
		Static level before measurement		
		Reason for not doing before		
		How long was the pump running?		

Water System		Installation Site		Water Point Site
		Was level measured after pumping?		
		What is the measurement after pumping?		
		How long the pumped worked before measurement?		
		Reason for not doing after		
		Flow rate done?		
		How calculated?		
		What was the flow rate measurement?		
		Reason for not measuring flow rate		
		Pump		
		Year installed		
		Physical state		
		Current status		
		Current condition w/ comment		
		Describe the problem or repair needed		
		Type of lifting device		
		Type of hand pump		
		Power source		
		Generator		
		Year installed		
		Physical state		
		Generator brand		
		Generator model		

Water System		Installation Site		Water Point Site
		Generator serial number		
		Fuel		
		Is fuel kept in a safe location?		
		KVA		
		max Amps		
		Last service data		
		Alternator manufacturer		
		Alternator model		
		Alternator serial number		
		Picture		
		Generator house		
		Is there a generator house?		
		Does it lock and protect the equipment?		
		Solar installation		
		Year installed		
		Physical state		
		Who installed		
		Picture		
		Type voltage of submersible pump		
		D/C to A/C voltage inverter manufacturer		
		D/C to A/C voltage inverter model		
		D/C to A/C voltage inverter rate power (watts)		

Water System		Installation Site		Water Point Site
		D/C to A/C voltage inverter peak power		
		D/C to A/C voltage inverter: A/C current charging range		
		Pump controller manufacturer		
		Pump controller model		
		Pump controller serial number		
		Power (max) Kw		
		Pump controller input current (amps)		
		PV panels manufacturer brand		
		PV panels model number		
		PV panel type		
		PV panels size		
		PV panel wattage		
		Total number of PV panels		
		Are the PV panels in a fenced area?		
		Additional components		
		Switchboard		
		Switchboard manufacturer		
		Model		
		Power (KW) w/comment		
		Voltage w/ comment		
		Ampere w/ comment		
		Picture		
		Reservoir		

Water System		Installation Site		Water Point Site
		Picture		
		Type		
		Capacity w/ comment		
		Physical state		
		Distribution network		
		Year main line constructed		
		Physical state		
		Secondary distribution construction year		
		Physical state (secondary)		
		Water treatment		
		Water treatment plant?		
		What kind?		
		Physical state		
		Year constructed		
		Chlorination?		
		Chlorination practice		
		How often chlorination		
		Livestock water		
		Livestock facilities?		
		Physical state		
		Year constructed		
		Water quality test		
		Microbiological		
		Is the source selected for water quality?		

Water System		Installation Site		Water Point Site
		Date of sample		
		Unique code		
		Fluoride		
		Fluoride test?		
		Date		
		Result w/ comment		
		EC/TDS test		
		Is source selected?		
		Date		
		EC result w/ comment		
		TDS result w/ comment		
		Temperature		
		pH test		
		Is source selected?		
		Date		
		pH result w/ comment		
		Management		
		Management body		
		Current management status		
		Women representation		
		Money held by WASHCO		
		Users		
		Households in village/town		
		Households served		
		Households w/in 1km		

Water System		Installation Site		Water Point Site
		Livestock use		
		No. of camels/day		
		No. of cattle/day		
		No. of horses/donkeys/day		
		No. of goats/sheep/day		
		Water trucking?		
		Number of trucks/day		
		Tariffs		
		Tariff type		
		Amount		
		Livestock tariff?		
		Tariff/camel w/ comment		
		Tariff/cattle w/ comment		
		Tariff/horse/donkey w/ comment		
		Tariff/goat/sheep w/ comment		
		Institutional tariff?		
		Amount w/ comment		
		Number of institutions		
		Time		
		Maximum one direction time for regular user		