



**Sensor Messaging for Real-Time Monitoring and
Maintenance Response**

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1. About us

- REST was established in 1978, in response to the need of Tigrian refugees
- REST registered as a NGO in 1991,
- we collaborate and work closely with communities and local government
- Today , we are one of the prominent local NGO focuses in relief, rehabilitation and development programs
- We work in all Woredas of Tigray
- We have nine departments and special programs, out of which **Rural water supply Department** is the focus of c:w
- At grass root level we have coordination offices

2. History of Partnership

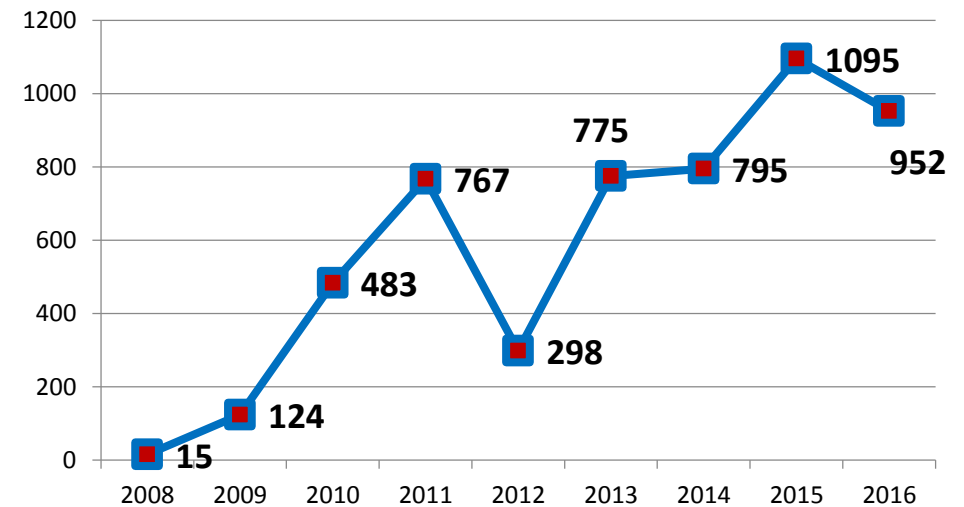
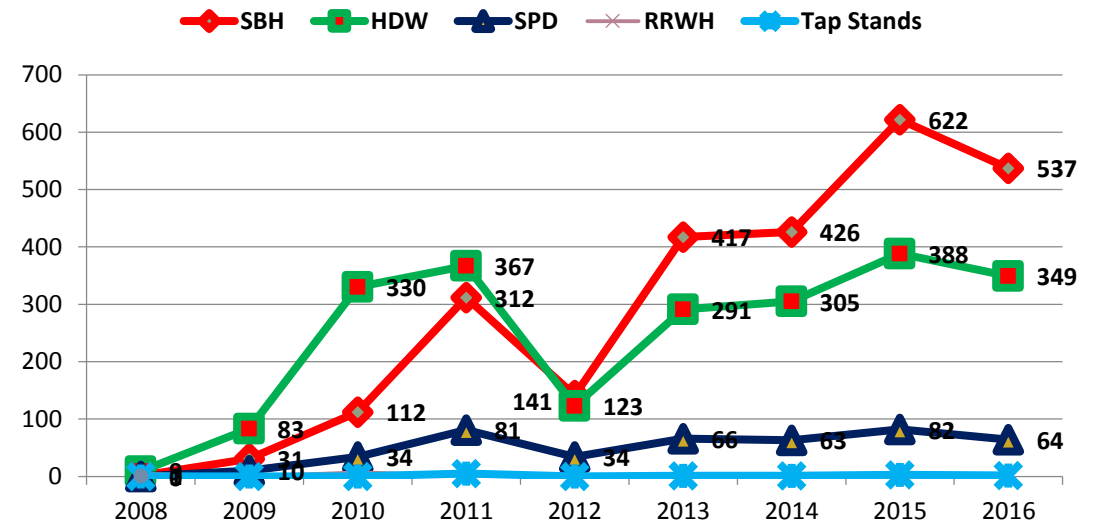


- charity: water has partnered with us since 2008
- Focused in Water Access & sustainability (90% of RWS Schemes)
 - Drilled well*
 - Hand dug well*
 - Spring Development*
 - Roof Rain water harvesting*
 - Piped water system*
- New well 90.5% & rehabilitation 9.5%
- Constructed in community, Health center and Schools
 - Community 95,2%, Health 0.32%& School 4.48%*
- Maintenance and Repair
 - Service 1000+ Wells across the Regions*

	SBH	HDW	SPD	RRWH	Pipe system	Total
2008	1	9		5		15
2009	31	83	10			124
2010	112	330	34	7		483
2011	312	367	81	2	5	767
2012	141	123	34			298
2013	417	291	66		1	775
2014	426	305	63			795
2015*	622	388	82		3	1095
2016**	537	349	64		2	952
Total	2599	2245	434	14	12	5304

* = under implementation

** = under implementation and on process of Agreement



Implementation Summery

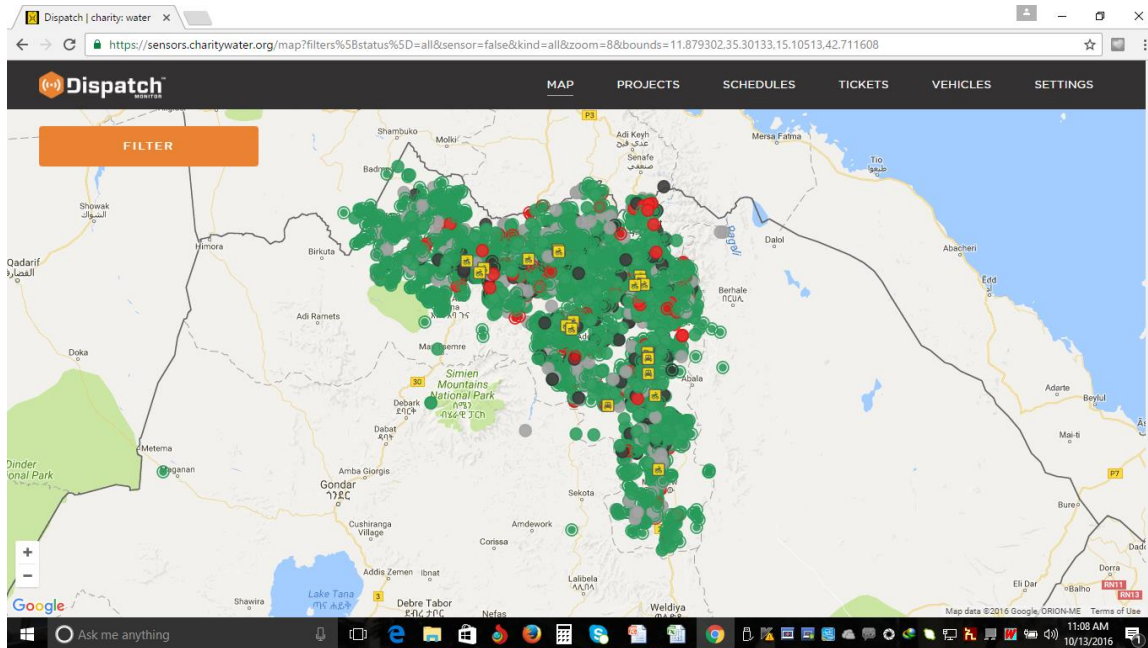


- Feasibility study & Site Selection
- Community Buy-in (Community to sign agreement with us) & establishment of WASHCOs at every water points
- Mobilization & construction of selected technologies
- signage installation, Fencing, door, padlock & chain, providing of tools and fast moving spare parts that last for one year
- Providing Training & Opening of bank account
- Handover of completed WP to WASHCO, Community and Tabia and wereda water office
- Conduct CLTSH and SLTSH
- Post Implementation Monitoring

3. Wahis mai Maintenance program

- **Program targets** - more than **93% of projects** are functional at any given time and broken water points are repaired at least within **30 days**
- The program is designing to achieve the over all program goal, to keep continuous water flowing in all water schemes (to ensure sustainability) we consider the following five parameters –
 1. Skill knowledge capacity development
 2. User contribution (community)
 3. Availability of spare parts
 4. Repair work beyond the capacity of woreda
 5. Monitoring

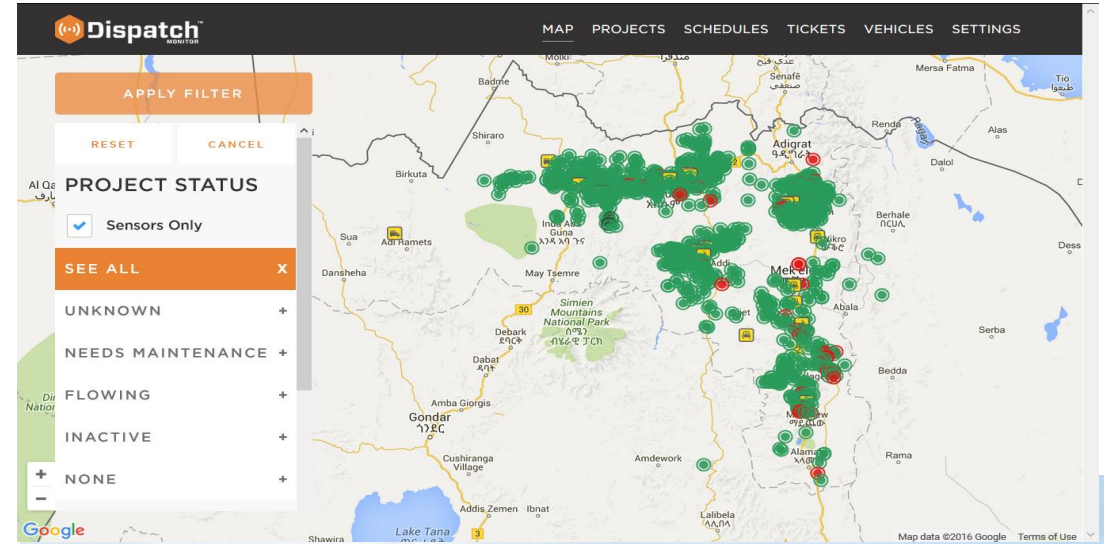
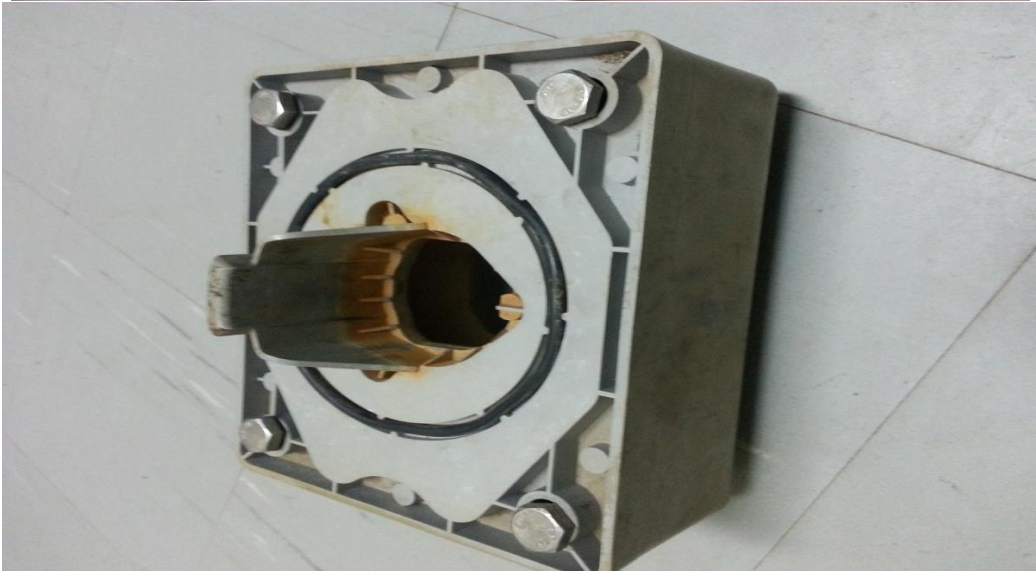
4. Wahis mai Program Scope



- Current reach of the Wahis mai maintenance program covers 30 Woredas and 4,704 water schemes
- The program follows cluster based approach, we have 5 clusters
- In each cluster we have
 - 3 technicians (Total 15 technicians)
 - 3 motorbikes (Total 15 motorbikes)
 - 1 vehicle (Total 4 vehicles)
 - Staffs equipped with Android tablets, manual GPS, necessary tools,
 - In head office we have four staffs



5. How We Do It



Obtaining Information

- Information about the problem encountered in a water scheme that affects the functionality obtained through –
 1. Free call 8701(Short code dial up)
 2. Direct call to Wahis mai technician Mobile Phone
 3. During Wahis mai technicians field visit through Akvo
 4. Directly from dispatch monitoring (installed sensors).

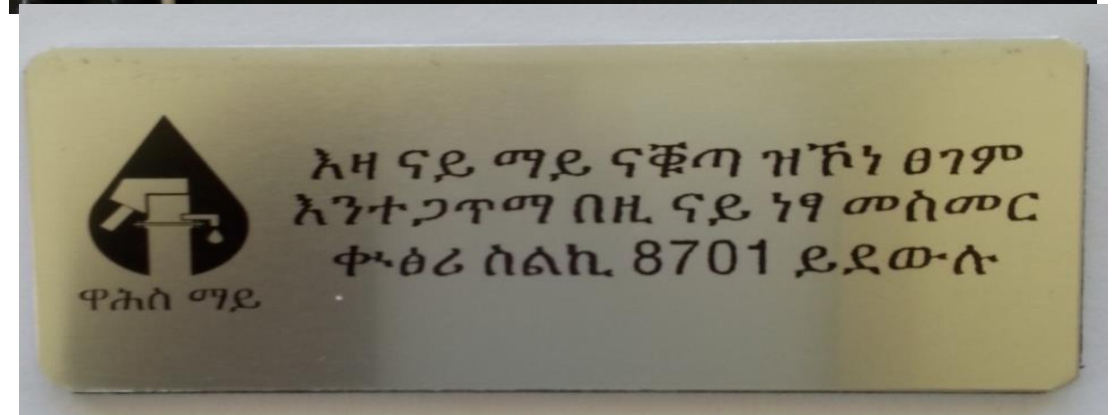
AkvoFLOW

- **Used to capture functionality , maintenance data and critical indicators**
- **Helped us choose sites to stop at along the way**
- **Content of surveys**
 - **Site Visit** –filled out at EVERY WM staff visit
 - **Rapid Assessment** –to assess WASHCO strength
 - **WP ID & Sensor Install** – used to record the latitude & longitude of each pump during installation
 - **Call In** – take this survey whenever you receive a call outside of WM site visit
 - **Implementation New Site Registration** –
 - **Site information Update** -



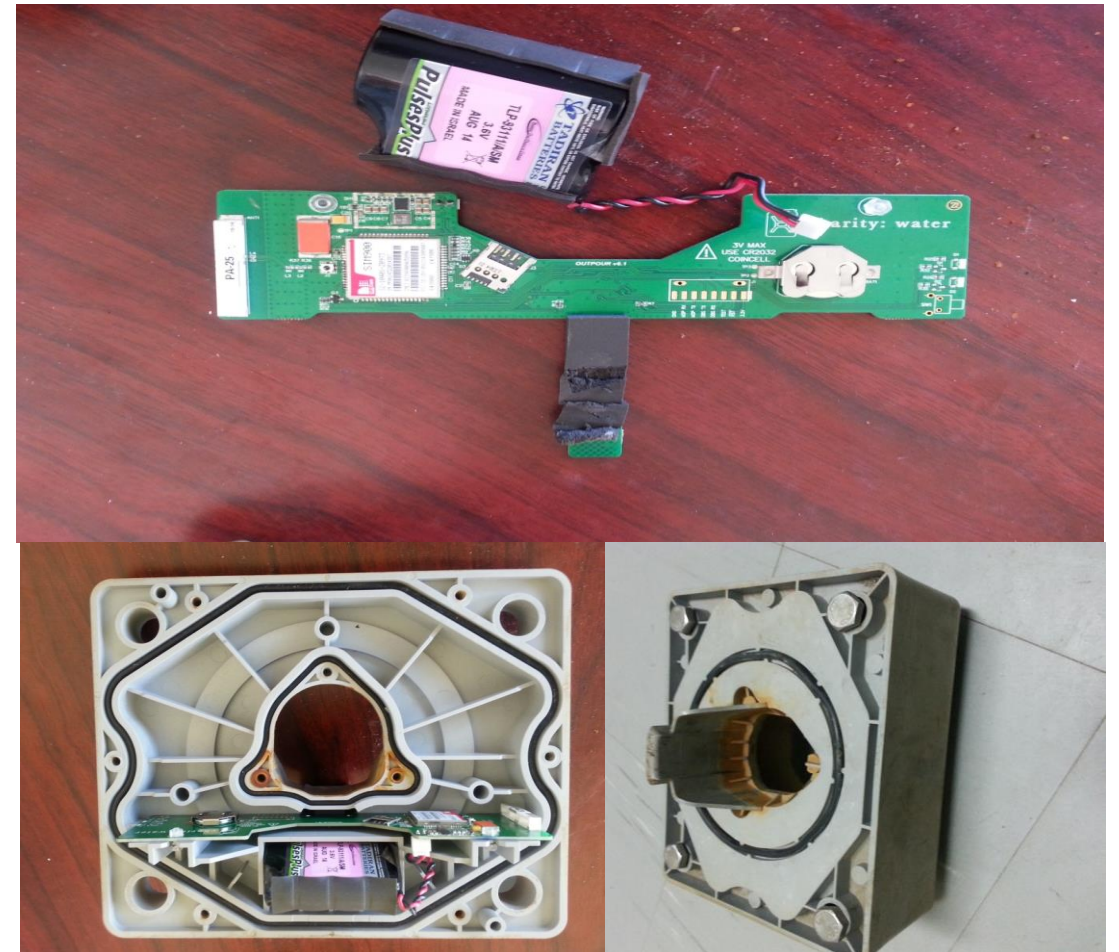
Short Code Dial (8701)

- Sticker tagging of short code number was done in all water schemes
- This free call is very important especially in areas having weak GSM coverage
- The call are received directly through person during working hour and answering machine out of working hour (30 minute recording capacity)
- The person that received the call make communication with technicians about the problem.
- The technicians in turn communicates to Tabia water technicians and WASHCOs to fix the problem.
- Call log system integrated with our PBX system to up grade the recording time



Water pour sensing Device (Sensor)

- has a GSM transmitter securely fitted inside the device
- The transmitter automatically send data on hand pump usage
- The transmitter is small and designed to fit with hand pump usage and have long lasting battery to power it to send data on hand pump usage
- The device constructed from strong material and designed to fit in between head and stand.



The transmitter offers three key benefits



1. Measurement of hand pump usage and associated volumetric water use to monitor service delivery
2. Remote surveillance of maintenance service delivery and down-time to guide performance-based contracts;
3. promote sector accountability.

Expectations -

- Reduced hand pump down time
- Increase functionality
- Increase revenue collection

Installation of Sensor

- Installation is simple, enabling it to be retrofitted in to existing pumps
- **Body Trace GSM Device** – used to test the network strengths. It is very important to know before install which sites are under the GSM coverage, and which are not.
- to install the sensor, simply removed the cover and handle. Then, carefully removed the first rod and insert the rope in the second rod and slowly lower the rod until the rod weight rest on the footvalve
- Remove the pump head, insert the sensor on the top of stand as shown in picture and
- Lastly, re-install all parts carefully



Test sensor Installation



- The water meter sensing was tested (2 times) before huge installation.
- These trials demonstrated -
 - On pre and post installation discharge test
 - To demonstrated proof of concept, transmit ability, following calibration to produce an estimation of the volume of water produced by the pump
 - on perception of the users.

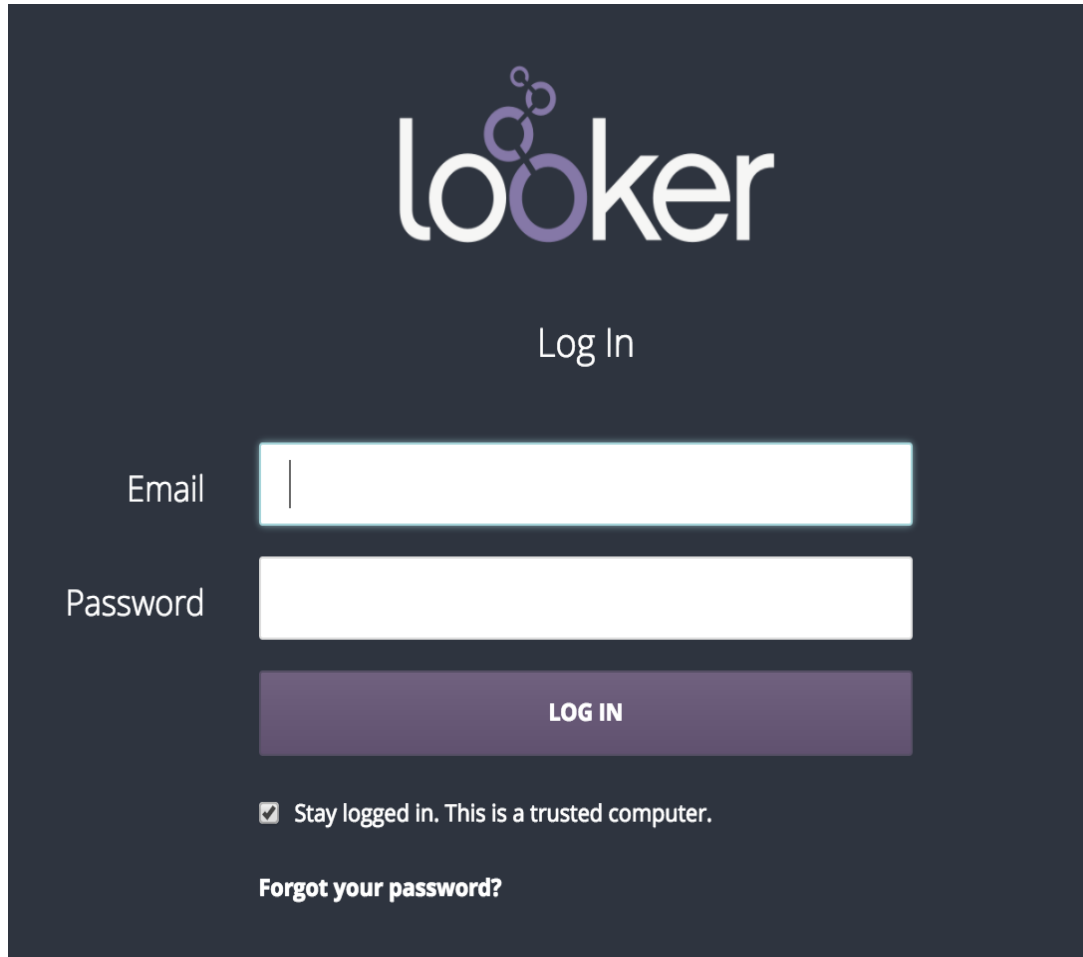
2650 sensor installation (Full running)



- The first batch was planned to install 1000 sensors. This was starting from Nov/2015 and Wahis Mai installed 989 sensors up to Dec/2015.
- The second batch planned to install 2000 sensors. This was started in June/2016 and installed 1650 and will be completed on October 30/2016 .
- Improvement are doing progressively over time and know most of the sensors transmitting and currently we know water schemes operational or not.
- About the volumetric estimation, we are doing further to bring accurate estimation.

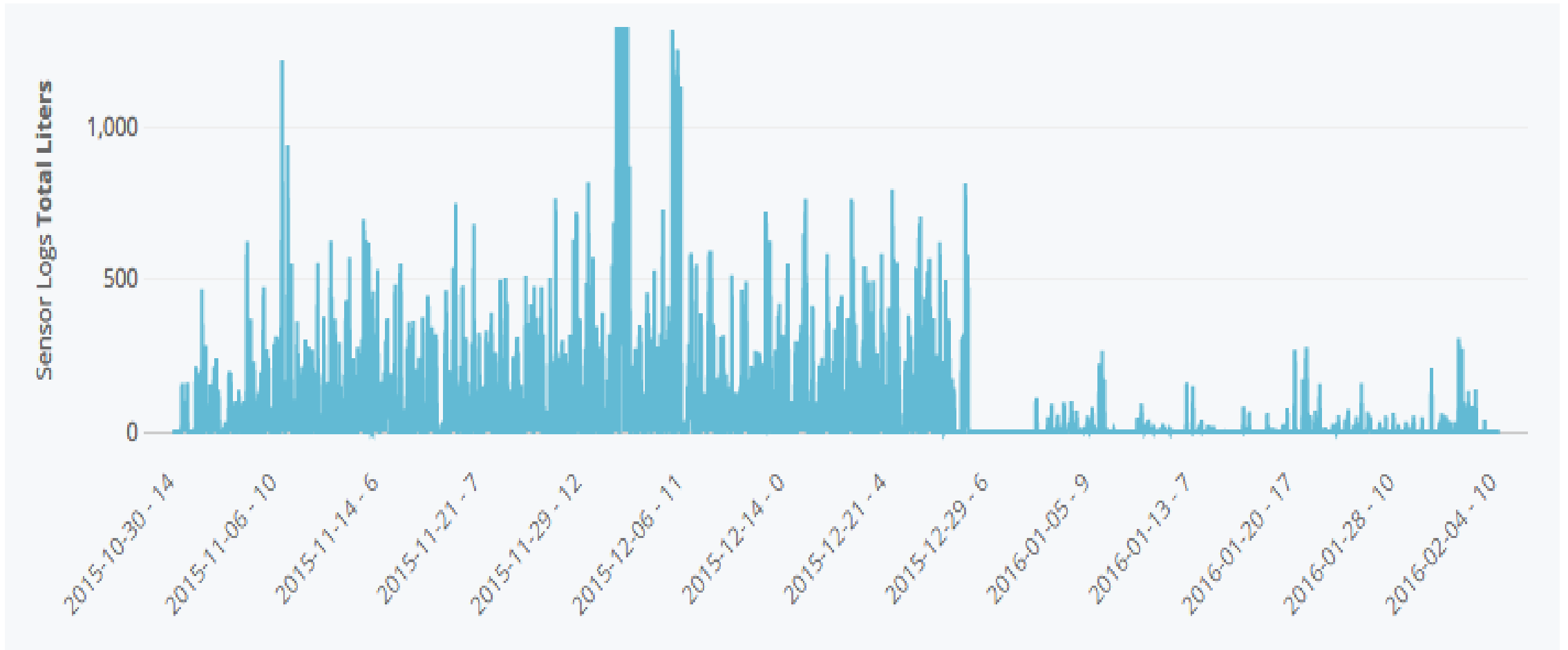
View data in looker

<https://charitywater.looker.com/dashboards/75>

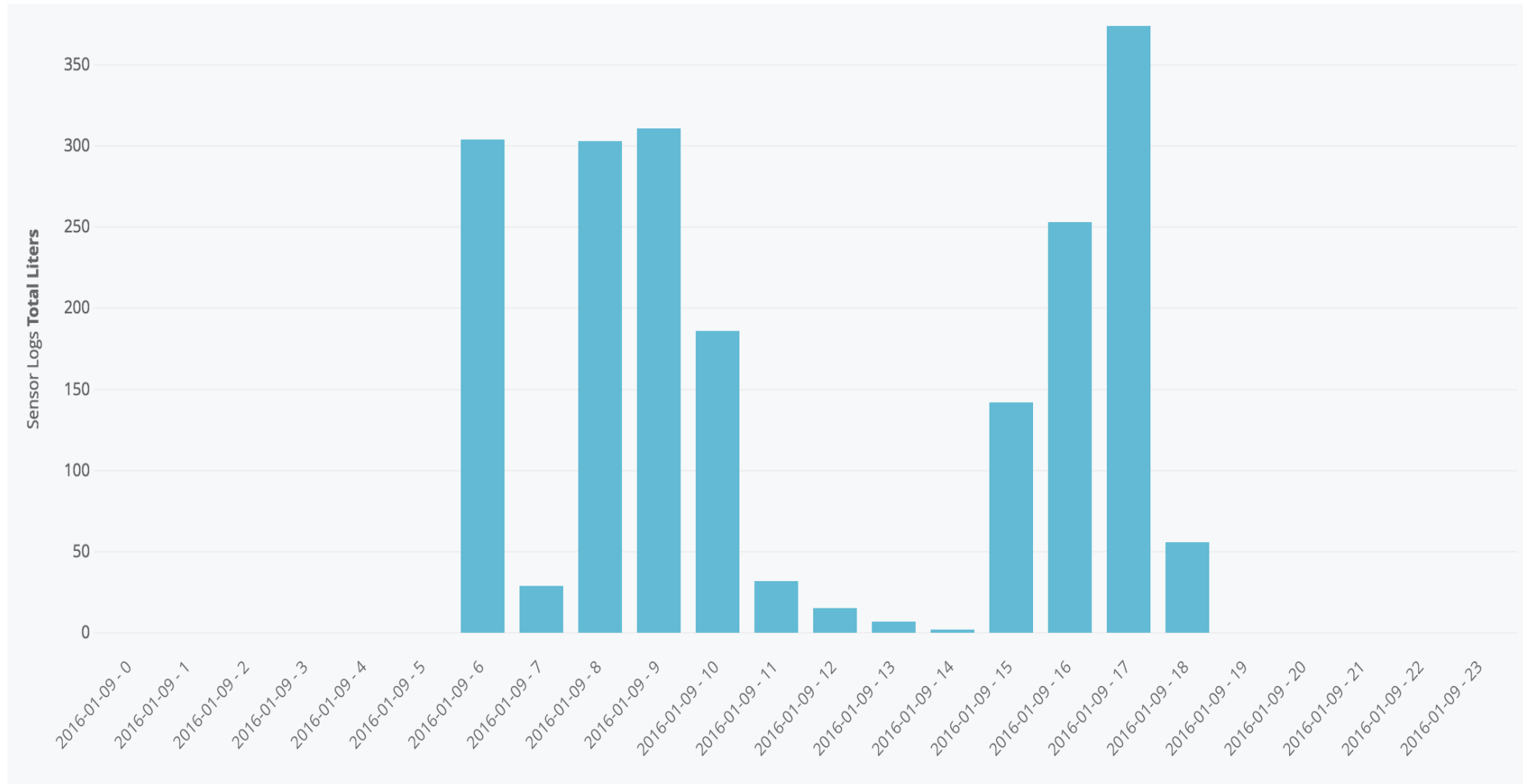
A screenshot of the Looker login interface. The background is dark grey. At the top center is the 'looker' logo in white, with a purple cog icon above the 'o'. Below the logo is the text 'Log In'. There are two white input fields: one for 'Email' and one for 'Password'. Below the password field is a purple button with the text 'LOG IN' in white. At the bottom left, there is a checkbox with the text 'Stay logged in. This is a trusted computer.' and a link that says 'Forgot your password?'.

- Scroll through the list of WP IDs to see which ones have zero flow
- If you want to see more information on a single sensor, click on "View Sensor Data" under the WP ID.
- If you want to download the data to see the table in Excel for more analysis or for sharing with clusters or other government stakeholders, click on the Cog Icon on the top right corner of the table and select "Download Data...":
- A second window will appear to assist with the download. Select "All Results" to ensure all sensor data is included in the excel download:

The graph page convenient interface to see usage patterns and identified potential pump failure



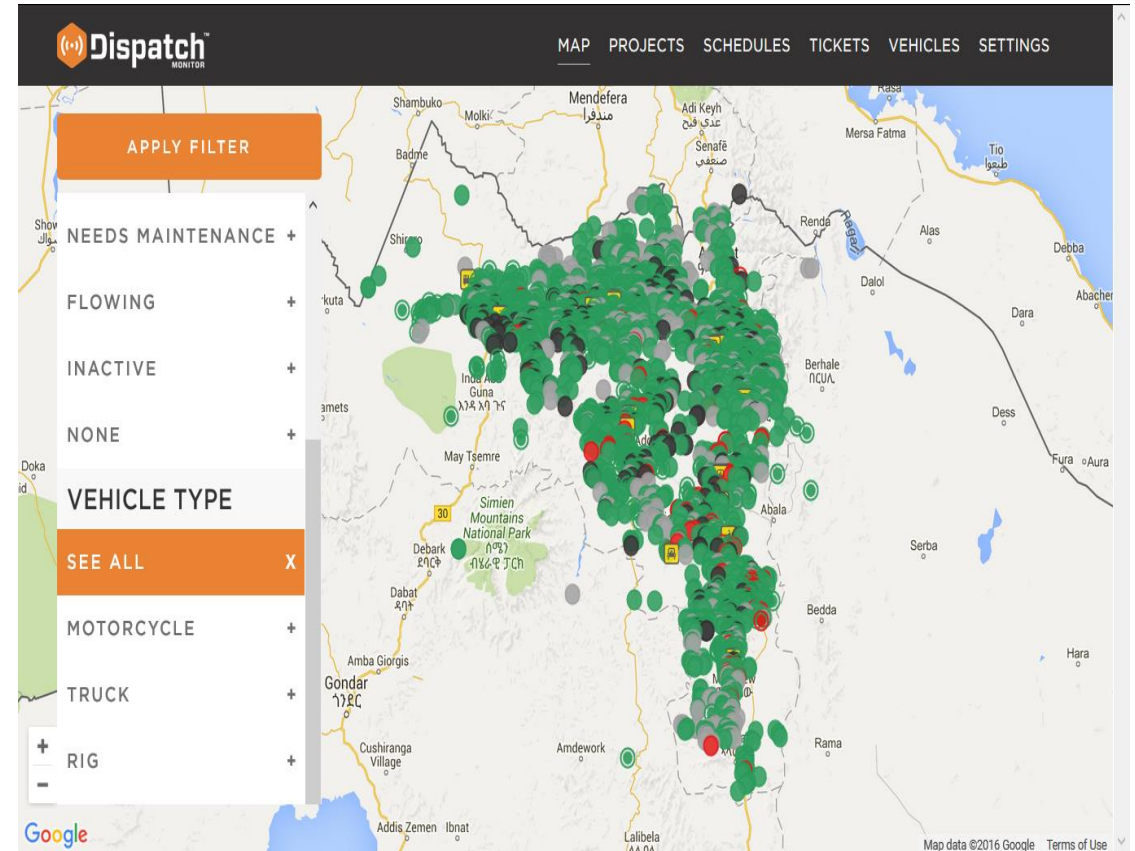
It is convenient to see hourly usage patten per scheme



Dispatch Monitor as a Tool

(Organize and presents data collected from sensors, call-in & AkvoFLOW)

- The data transmitted from the pumps (sensors) and AkvoFLOW are captured by **Dispatch Monitor** and organized and presented in Map or List Feature
- Dispatch Monitors dash board used to see –
 - The status of pump
 - Track Repairs & downtime,
 - Track Wahis mai Tasks,
 - Create weekly plans,
 - Monitor overall program.
 - Track vehicle movements



Database and User Interface

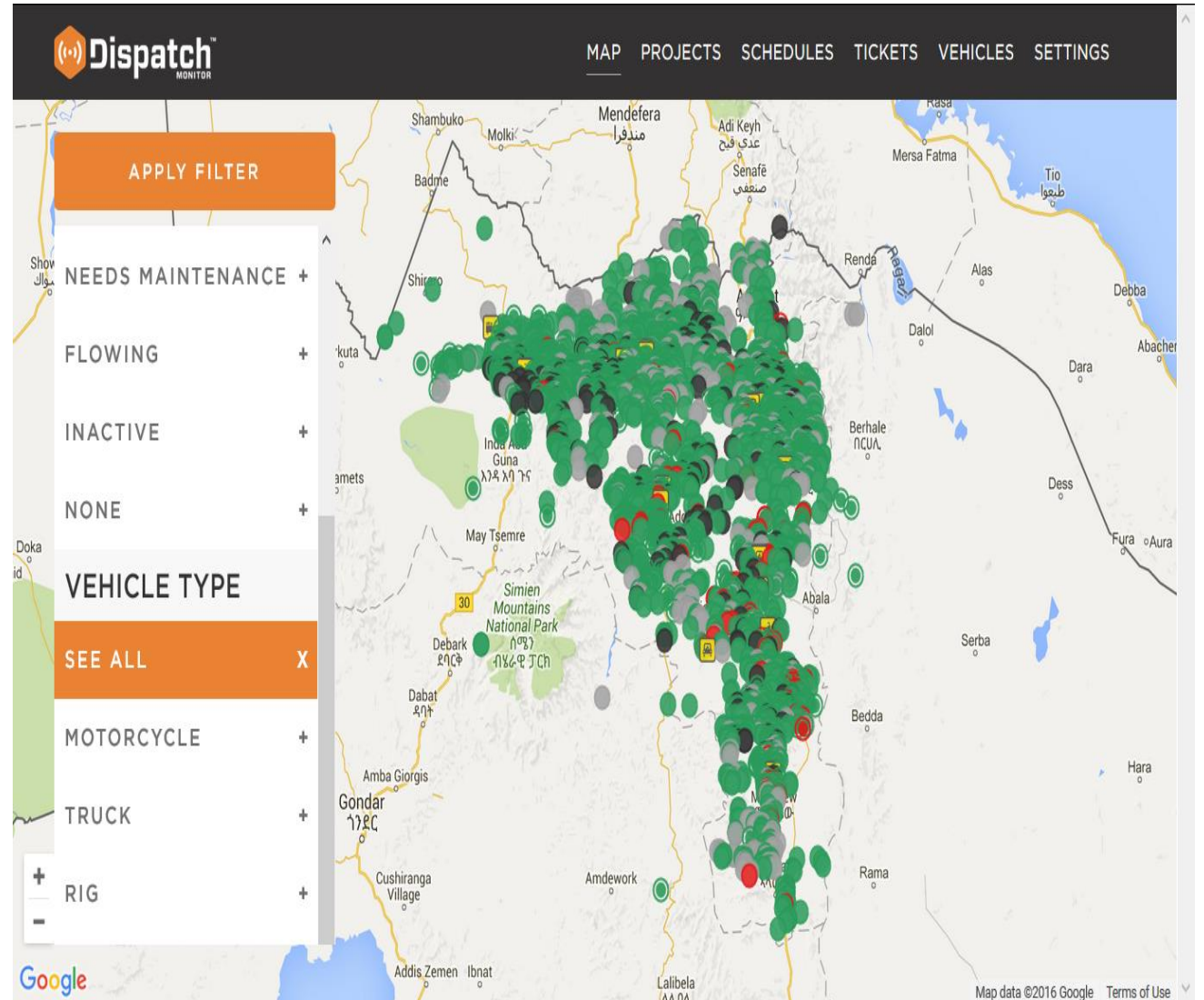
- Use the Tickets tab to find open assignment
- Filter sites by woreda or Tabia based on where your team will be working
- Filter by sensor or maintenance to see which tickets/ assignment are due to be completed
- Sort by “ reported on” date to find which maintenance have been unresolved the longest
- Write down the WP IDs for the sites you will visit in the coming scheduling period

The screenshot shows the Dispatch Monitor dashboard. At the top, there is a navigation bar with the following tabs: MAP, PROJECTS, SCHEDULES, TICKETS, VEHICLES, and SETTINGS. The main content area is titled "Dashboard" and features a dropdown menu currently set to "All Districts". Below this, there are two main panels: "OVERVIEW" and "KEY METRICS".

OVERVIEW	
✓ Flowing	2223
✗ Needs Maintenance	78
⊗ Inactive	200
⊕ Unknown	365

KEY METRICS	
👁 Visibility	87.3%
🔑 Flowing	88.9%

- Each pump location is represented by marker on the map with the status of pump –
- Full Operational(Flowing) (Green)
- Broken/need maintenance (red)
- Unknown (White/Grey)
- Inactive (Black)



Filter by Sensor – to see transmission status of sensor

The screenshot displays the Dispatch Monitor interface. At the top, the navigation menu includes MAP, PROJECTS, SCHEDULES, TICKETS, VEHICLES, and SETTINGS. The main map area shows a region in Ethiopia with several green circular markers representing sensors. A filter panel is open on the left, showing the 'PROJECT STATUS' section with 'Sensors Only' selected. A detailed view of a sensor is shown on the right, displaying the following information:

- Date: 2015-02-25
- Activity: Observation survey - Flowing
- Sensor Name: (partially obscured)
- Last Transmission: 2016-01-21 - 989 Liters
- Average Daily Liters: 527 Liters
- Install Date: 2015-11-05

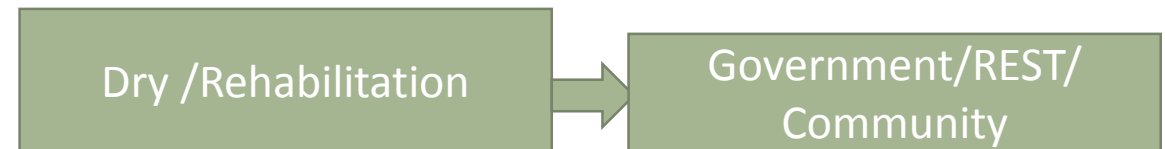
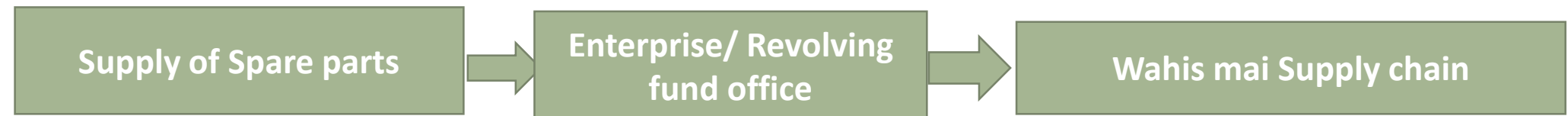
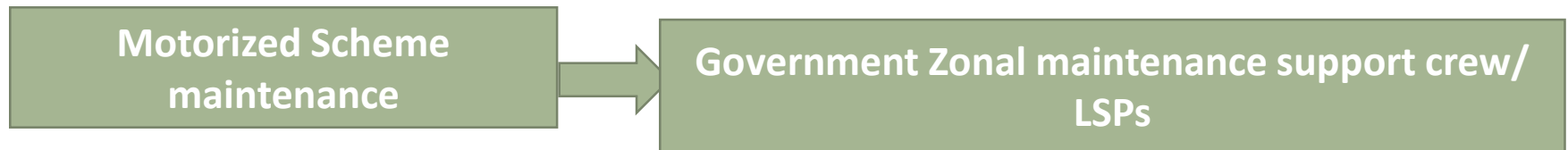
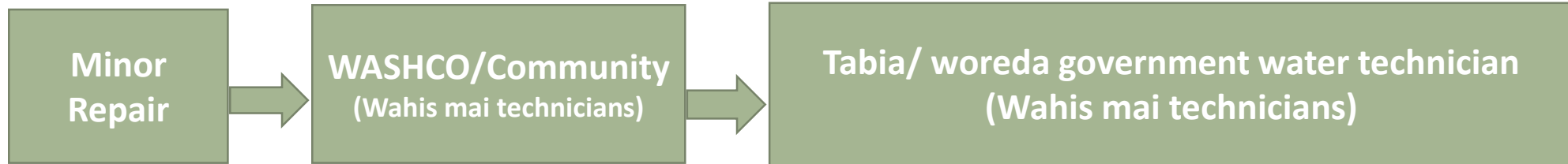
Buttons for 'EDIT' and 'DELETE' are visible at the bottom of the sensor details panel. The map background includes labels for locations like Badme, Shiraro, Birkuta, and Simien Mountains National Park.

6. Responsibility of maintenance:

Definition of terms

- **Minor Repair** - It is the restoration of a defective component to return the facility to acceptable working condition, **which does not require lifting of hand pump assembly**, is treat as **minor repair**. This type of repairing involves repair of handle, nut & bolts, rod, bearing, plunger, footvalve, U-seal, centralizer etc.
- **Major Repairs** - The repairing of hand pump which involves any **repair done to pipes, cylinder and concrete works** require more time , manpower or additional tools; this type of repairing cannot be made by WASHCOs and community and will be carried out by woreda mechanics/private sectors/ Wahis mai wherever available.
- **Dry Well** – aquifer is empty; there is no water on any rods /within cylinder or around the eye of spring.
- **Rehabilitation** – repair works that require more sophisticated equipment than is available to Wahis mai technicians (> 4000 birr). Are the correction of major defects and the replacement of equipment to enable the facility to function as originally intended?

Steps for Maintenance



- **Local Service Providers (LSPs)** – responsible not only for maintenance activities but also plumbing, supply of SPs and auditing of WASHCOs.
- **Government** - the government/ Wahis mai support is mandatory until ensuring the community can take up the responsibility to O&M managing. The government support includes - **capacity building, facilitate and coordinate LSPs, assists the RFO and Conduct continuous community mobilization and sensitization**
- **Wahis mai technicians** – has a direct maintenance support approach to achieve the proposed targets . Wahis mai involved –
 - Wahis May technician respond immediately, and talks to available WASHCO /Tabia and woreda government technicians and repair by coaching the available stakeholders
 - Assist to create stakeholder capability to repair and manage their schemes
 - Support back stop SPs by direct sell to WASHCO if not available in woreda RF shops

7. Results

Date ዕለት	Saving/ዕቅር			Outstanding ተራያያይ	Signature ፊርማ
	Deposit አታዊ	Withdrawal ወገእ	Interest ወለድ		
17-5-11	2119			2119	[Signature]
17-6-11	880			2499	[Signature]
17-11-11	150			3149	[Signature]
18-2-11		270	8182	3157182	[Signature]
17-2-11	924		9330	2887182	[Signature]
2-4-11	3410			3811182	[Signature]
22-5-11	1500			3855182	[Signature]
1-6-11	1390			228512	[Signature]
31-10-11	5050		12405	979512	[Signature]
12-12-11	3200			1010512	[Signature]
26-1-12	1534			1523512	[Signature]
1-2-12	1912			1535512	[Signature]
2-3-12	2230			1855912	[Signature]
8-4-12	4570			2009312	[Signature]
				203924	[Signature]
				223048	[Signature]
				2485495	[Signature]
				2970495	[Signature]

Branch: _____
 Sub Branch: _____
 Name: _____
 Address: _____
 Wereda: _____
 Kebele: _____
 Village: _____
 Nationality: _____
 Account No: _____
 Manager Signature: _____
 Seal (ምሥጫን)

- Visibility = 89%
- Functionality (with out dry & rehab) = 93.8%
- Transmission of sensor = 70% (the one which are not transmitting we think are in area of weak / no internet)
- Maintained in response of call-ins = 81 WP
- Maintained in response of sensors = 137 WP
- WASHCO deposit in bank account increased to more than 29,704 Birr

Repair Done



- Wahis mai technician repaired= **902**
 - With the presence of WASHCO = **377(72.8%)**
 - With the presence of Tabia tech =**107 (20.3%)**
 - With the presence of woreda tech= **9 (1%)**
- Out of which **65%** major repair & **35%** minor repair
- Government technicians repair= **107**
 - WASHCOs = **75 (69.8%)**
 - Tabia water technicians = **28 (26.4%)**
 - Woreda water technicians = **4 (4.2%)**

8. The Integration of Wahis mai program with government

[Re-engineering WRB maps.docx](#)

Government Context

- Provide rural safe water supply of about 25l/c/day with in the distance of 1km from water delivery point for 85% of rural population of which 20 % are provide with RPS.
- Decrease rural water supply schemes non-functionality rate from 15.5% to 7%
- Various proclamation, regulation, directives and guidelines that are very useful and create an opportunities to think about the Operation & Maintenance (O&M) issues
- We have an established RFO at regional and in all woreda centers to provide water supply technologies, chemicals and spare parts.
- Establishment of LSPs in all Woredas
- Well Establish water supply extension supporting system at kebele level
- institutionalized the O&M separately as one Core process (department) within the bureau and organized the water revolving fund office as an enterprise
- establishment of Tabia level WASHCO committee on process of implementation and scheme level WASHCO committee (6 members) established in all water scheme, out of which more than half members are female
- Establishment of Tabia level water WASHCO
- Establishment of 4 zonal maintenance crew to support the post maintenance works
- Encouraging of storing additional fast moving parts