



## Assessment – Post-Trip Report

<b>Executive Summary</b>	
<b>Community:</b>	Kibuon
<b>Country:</b>	Kenya
<b>Chapter:</b>	Harvard SEAS Chapter
<b>Submittal Date:</b>	8/20/2019
<b>Authors:</b>	Billy Koech, Tatheer Adnan, Marwah Sabrah, Nicole Trenchard, Gavin Rees, Nisheet Reddy EIT, Christopher Lombardo
<b>REIC and other mentors:</b>	Christopher Lombardo (REIC, Faculty Advisor), Nisheet Reddy EIT (Travel Mentor), Avery Meyer EIT (Mentor)
<b>Scope of Work for the project (50 words)</b>	The Kibuon community consists of about 1600 members. Due to the lack of a nearby clean water source, community members in Kibuon travel long distances to collect water from nearby springs. This spring water is unclean and often leads to sickness in the community. The project aims to construct a water provision system, such as a well, within the community in order to address the need for safe and accessible water.
<b>Scope of Work for the trip (100 words)</b>	In the assessment trip: 1) The project team members met with the Community Based Organization to discuss the Project Partnership Agreement with the residents and the 5% community contribution, 2) Project alternatives were looked into and the corresponding data collected and some potential solutions were discussed with the Community Based Organization (CBO) and the residents 3) Demographic and geographic survey data was collected and the project site topography investigated to allow for the analysis and design of the project later and 4) material costs were investigated in local hardware stores.
<b>Proposed Next Step (100 words)</b>	The Harvard SEAS chapter will begin the alternative analysis process while maintaining communication with the community to get input on the alternative solutions. The team has tentatively slated the first project implementation for May 2020. The current proposed alternatives include variations on distribution and types of wells.
<b>Describe Recent Contact with Community, NGO, and in country partners. (100 words)</b>	The Chapter's primary contact is Paul Olando— the team's in country contact who also play the role of a community guide and translator having previously worked with other EWB chapters in the nearby communities of Lela and Bondo - and Julius Amara, the projects coordinator of the Kibuon CBO. The chapter regularly communicates with Paul and Julius via WhatsApp, email and scheduled calls every two weeks over Skype. Lastly, the chapter has been in contact with a local well drilling company called WECCO (Wuoth Ogik Education and Charitable Community Organization) that has worked on projects in the neighboring communities.
<b>Describe the Chapters current fundraising goals and milestones. (100 words)</b>	In the past academic year, the team has networked extensively with the Harvard John A. Paulson School of Engineering and Applied Sciences, the Phillips Brooks House Center for Public Service and Engaged Scholarship, and the David Rockefeller Center for Latin American Studies. The chapter aims to receive funding from these programs, continue applying to grants, and continue contacting potential new funding sources. The goal is to raise a total of \$44K to cover the hydrogeological study and implementation trip.
<b>IS THE PROGRAM STILL ON TRACK TO MEET THE EWB PROJECT EXPECTATIONS?</b>	YES

**Privacy:** EWB-USA may release this report in its entirety to other EWB-USA chapters or interested parties. Once the report is approved any member in Volunteer Village will be able to find and view the plan. Please do not include personal or sensitive information.

Project Timeline			
Major Milestone	Previous Date	Current Date	Description
<b>Program Adoption Date</b>	12/31/18		
<b>Previous Project in Program Date Constructed</b>	NA		
<b>Project Approval Date</b>	3/28/19		
<b>Completed Assessment Trip</b>	6/11/19		Trip conducted to sign partnership agreement and to start data collection for a water provision system
<b>Planned Implementation Trip</b>	Not Previously Planned	6/15/20	Trip to drill a borehole
<b>Planned M&amp;E Trip</b>	Not Previously Planned	1/6/21	Trip to monitor the system performance and conduct minor repairs.

## Table of Contents

Table of Contents.....	3
Table of Figures .....	5
1.0 Project Description.....	6
1.1 Project Background and History.....	6
1.2 Project Context.....	6
1.3 Project Goals/Objective.....	6
1.4 Scope of Work .....	8
1.5 Potential Solutions Considered .....	8
1.6 Project Team .....	8
1.7 Community Partners.....	9
1.8 Similar Projects .....	10
2. Assessment Results and Data Collected.....	12
2.1 Partnership Formation.....	12
2.1.1 Community Members.....	12
2.1.2 CBO Leaders.....	13
2.1.3 Local Government.....	14
2.1.4 Contractors .....	16
2.1.5 Suppliers.....	16
2.2 Project Feasibility .....	16
2.3 Data Collection .....	18
2.3.1 Surveys.....	18
2.3.2 Detailed Technical Data .....	22
2.3.3 Changes from Planned Activities .....	27
2.3.4 Outstanding Data needs.....	28
2.4 Climate Change Data Collection.....	29
2.5 Go/No Go Decision.....	30
2.5.1 Community/NGO Capacity.....	30
2.5.2 Technical Feasibility.....	31
2.5.3 Chapter Safety.....	32
2.5.4 Project Impact.....	32
2.5.5 Summary .....	33
2.6 Conclusions.....	33
3. Baseline Monitoring Data Collection.....	35
3.1 Water Source Development (HOME) PMEL Summary and Notes .....	35
3.1.1 Performance and Quality.....	35
3.1.2 Maintenance and Functionality .....	37
3.1.3 Community Capacity .....	37

3.2	Revisions to Beneficiary Analysis.....	38
4.	Next Steps.....	39
4.1	Borehole.....	39
4.2	Rainwater Catchment System.....	39
4.3	Spring Box.....	39
4.4	Criteria that will be used to determine the best solution.....	39
5.	List of Attachments.....	41
5.1	Drawing Package.....	41
5.1.1	Maps of Kibuon .....	41
5.2	Data from this Assessment trip.....	47
5.2.1	Water Quality Data.....	47
5.2.2	Potential Well Site Assessment .....	47
5.2.3	Household Survey Data Analysis .....	57
5.3	Photographs .....	64
5.3.1	6/2/19 .....	64
5.3.2	6/3/19 .....	66
5.3.3	6/4/19 .....	68
5.3.4	6/6/19 .....	71
5.3.5	6/8/19 .....	72
5.3.6	6/11/19 .....	72
5.3.7	Lela Hand Pump Assessment.....	74
5.3.8	Bondo Well & Solar Pump Assessment .....	75
5.3.9	Dispensary Surveys .....	76
5.4	Community Phone Book.....	80
5.5	Supplier and Contractor Reports .....	85
5.6	Community Partnership Agreement .....	87
5.7	Monitoring Data Forms.....	92
5.8	Lessons Learned .....	97
5.9	Survey Questionnaires.....	98
5.9.1	Household Survey Introduction Script and Questionnaire .....	98
5.9.2	Dispensary Survey .....	105
5.10	Meeting Minutes.....	107
5.10.1	First Meeting with the Kibuon Projects Committee (CBO) .....	107
5.10.2	First Meeting with the Community.....	111
5.10.3	Meeting with WECCO .....	114
5.10.4	Focus Group Meeting with the Women of Kibuon .....	117

## Table of Figures

Table 1.1: Members of the Kibuon Project Committee.....	10
Figure 2.1: Travel times to nearest wells .....	12
Figure 2.2: Structure of county governments in Kenya .....	14
Figure 2.3: Primary Water Source for Kibuon Residents .....	20
Figure 2.4: Reported Issues with Current Water Supplies in Kibuon.....	20
Figure 2.5: Frequency of symptoms as reported by community members .....	21
Figure 2.6: Map of Kibuon, Kenya divided into its four subcommunities. Homesteads, latrines, existing water collection locations, potential well sites, and other points of interest have been marked on the map. ....	23
Figure 2.7: Map of existing water collection points in Kibuon. ....	24
Figure 2.8: Proposed well sites in Kibuon with latrine locations provided as a reference.....	25
Figure 2.9: Coarse-grained soil classification as per Unified Soil Classification System (USCS).....	26
Figure 2.10: Fine-grained soil classification as per Unified Soil Classification System (USCS) .....	26
Figure 5.1: Full map of Kibuon, Kenya.....	42
Figure 5.2: Map of Kibuon A - Nyamilu.....	43
Figure 5.3: Map of Kibuon B - Sindianya .....	44
Figure 5.4: Map of Kibuon C - Ombo Lwanda .....	45
Figure 5.5: Map of Kibuon D - Wii Yao.....	46
Table 5.6: Calculated Averages from Household Surveys .....	57
Figure 5.7: First View of Community from Kibuon Hill .....	64
Figure 5.8: Kuria Tank Stand .....	65
Figure 5.9: Electric Pump & Well .....	65
Figure 5.10: Private Electric Pump Installed by WECCO .....	65
Figure 5.11: CBO Meeting Photo .....	66
Figure 5.12: Springs seen on 6/3 .....	67
Figure 5.13: Images from Perimeter Walk/Spring Walk.....	71
Figure 5.14: Water Treatment Methods available at Grocery Store in Migori .....	72
Figure 5.15: Women's Meeting .....	72
Figure 5.16: Bondo Well Assessment .....	72
Figure 5.17: Bondo Hand Pump Assessment .....	73
Figure 5.18: Municipal Tank & Pump .....	73
Figure 5.19: Ndonyo Water Project Contact Info, a Prospective EWB Partner Community .....	74
Figure 5.20: Data from Lela Dispensary indicating health and health care statistics that are gathered and reported monthly to Migori District. This information will allow the team to investigate community health trends in Kibuon so as to ensure the project adequately serves the health needs of the community. ....	77
Figure 5.21: Images of the damaged rainwater catchment system at the Lela Dispensary that serves as the only consistent water source for the clinic. ....	78
Figure 5.22: Images of the health data recording charts at the Bondo Dispensary.....	79
Figure 5.23: Nurse Reno Rachuono shows team member Marwah Sabra information logged at the Bondo Dispensary. ....	79

## 1.0 Project Description

### 1.1 Project Background and History

The Harvard SEAS EWB Chapter began its partnership with the Kibuon community in January 2019 when it adopted the Kibuon Program. The CBO, the Kibuon Projects Committee, initiated the Kibuon Water Project and a partnership with EWB to improve access to clean water for local residents. The Kibuon Projects Committee was founded in January 2016 amongst members with familial relations. It was then reformed in 2017 by holding nominations for members from different regions of the community to increase representation and inclusivity; this new model matched that of CBOs in nearby communities that had also partnered with different EWB chapters.

The Harvard Chapter completed its first assessment trip during the summer of 2019. During the assessment trip, the chapter had an opportunity to meet with community leadership and learn about the local political structure within Kibuon, conduct 40 household surveys to understand water usage patterns and issues, create a geographic map reflecting the demographics of the community, and interview medical professionals at local dispensaries to understand the primary health concerns of the community. Throughout the assessment process, the chapter collaborated closely with community leadership - Julius Amara and Paul Olang'o, who will continue to serve as liaisons with the community as the chapter enters the alternative analysis phase of the project.

### 1.2 Project Context

The project is based in Kibuon, Kenya, a community of around 1600 people located 8-10km outside Migori town in Migori County, Kenya. The CBO (Kibuon Water Council) divided the community into four regions (A, B, C, D), B and C being the largest geographically, while A and D are the smallest. Roughly speaking, these form four quadrants aligned along a central valley running the length of the community (see Figure 2.6 for more details). While the boundaries of these subregions were decided by the CBO for travel team's sake, the regions do exist as subcommunities within the larger Kibuon community, the boundaries of which were also decided by the CBO.

The community's infrastructure consists mostly of dirt roads, the largest of which run along the outside of the community, with the largest buildings being eight churches (Kibuon is majority Christian). None of the nearby schools are actually in the community, but two are located along these exterior roads and service the community. Slightly outside the border, there is also a health clinic which serves the area, however it is not well funded because the Migori County government is currently in debt.

The community currently gets a significant amount of their water from a set of "springs" located along the central valley of the community, accessible only by foot and donkey. These springs replenish slowly, leading to waits at the springs during the dry season, during which time some of the springs sometimes dry up. When this occurs, residents of Kibuon sometimes travel to nearby EWB constructed wells in Bondo and Lela, or pay local men with motorcycles to make the trip for them at a high cost, though this is not affordable for many households in Kibuon. While the water from the wells in Bondo and Lela is clean, the water at the springs in Kibuon contains high levels of E. Coli. as per the travel team's testing (Appendix 5.2.1).

### 1.3 Project Goals/Objective

The current sources of water in the Kibuon community are springs and shallow hand dug wells which are unclean and insufficient, leading high cost for acquiring water and occurrences of symptoms such as diarrhea, fever, convulsions and coughing which could be attributed to water borne illnesses; Community members spend a lot of time travelling to collect this water, and the water supply is severely limited. This project aims to provide cleaner, stable, and more accessible water for members of the

community which would reduce the occurrences of such illnesses and reduce the amount of time spent collecting water, hence allowing time for other activities, particularly education for children who spend time collecting water. Concrete objectives are stated below:

Determine the feasibility of the Kibuon Water Project:

1. Interview local village members to gauge their interest in the water project and the greatest sources of need in the community. Use hydrologic or rainfall data to gauge the potential for water collection and if the project will address these needs.
2. Determine the social, logistical, and technical work the project will require, as well as the community's capacity to contribute 5% of the project costs.
3. Determine the number of village members that will be using the water project

Discuss the Project Partnership Agreement with the community:

1. Assess fundraising practices. Attend Water Council meetings to observe how money is being collected, who is contributing, and how much they are contributing. Ask council members about other fundraising means they have planned. Determine how much money has already been raised.
2. Answer any questions that the community has regarding the project.
3. Establish communication and project workflow expectations through meetings with key stakeholders like the community members, Kibuon Projects Committee (CBO), and suppliers and contractors.

Assess project alternatives:

1. Consider the best method for water collection. Use observation, hydrologic surveys and seasonal rainfall data to compare the feasibility of different types of wells. Find potential locations for each.
2. Discuss alternatives with community, mentioning the pros and cons of each, and listen to the various opinions such as those of the community as a whole, and those of particular groups such as women, workers at the clinic, teachers and school kids.

Collect sufficient data to support project analysis and design.

1. Interview various households to analyze the demographics of the community. Produce a site layout using GPS apps or handheld devices. Sketch property lines and important landmarks in the community
2. Conduct technical measurements and analysis to begin preliminary design for the new water project. This includes coordinates, relative elevations, hydrogeological surveys, potential well recharge rate, seasonal variations, and expected demand.
3. Scope local area for material suppliers and labor for completion of the project.

Work with the community to select a group that will maintain and operate the water project:

1. Hold weekly meetings with this group and the general community to discuss visions for the project. Obtain contact information to enable continued communication.
2. Begin an operation and maintenance fund for the water collection system. Work with the stakeholders to discuss potential maintenance necessities and cost, as well as appropriate compensation for a designated community operator.

## 1.4 Scope of Work

The community is requesting assistance in the form of assessment, engineering design expertise, and project funding from EWB. Based on this assessment trip, the community's preferred solution to be pursued seems to be the construction of a groundwater well. Now that the initial data collection has been completed, the team plans to maintain communication with the community partners in order to collect any remaining pieces of data. The team is also planning on evaluating the potential well sites from the assessment trip to determine the optimum locations for well installation and then fundraising for and conducting hydrogeological studies on the chosen locations. The data from the hydrogeological study will be analyzed and compared against other potential solutions (see section 1.5 below) and the results presented in the Alternative Analysis report in the form of sketches, cost estimates (construction and maintenance), community inputs and number of phases expected for completion. Approval of the alternative analysis will be following by implementation and maintenance trips.

## 1.5 Potential Solutions Considered

Before the trip, the team came up with two potential useful solutions to solve the need for clean drinking water in Kibuon- rainwater catchment and boreholes. During the trip the team observed that the former would not meet the needs of the community therefore they did not focus on data pertaining to it. Boreholes on the other hand a, rainwater catchment and boreholes. During the trip the team observed that the former would not meet the needs of the community therefore they did not focus on data pertaining to it. Boreholes on the other hand are still being considered because they have been successful in nearby communities and given the travel team's assessments of local material and contractor capabilities, they are theoretically feasible. Furthermore, the chapter has the necessary skills and experience to design and implement these methods.

**Borehole:** Since the water table is high and stable enough to make drilling feasible, assuming no large difference from the communities nearby, another option is to install a borehole or set of boreholes. During the women's meeting, eight potential borehole locations were brainstormed (two in each subregion) that would reduce the time to a well from any point in the community to under 30 minutes. These sites were then assessed by the travel team and multiple were feasible for a potential borehole – provided a hydrogeological survey is favorable, as well as land rights. The borehole would be drilled by a contractor that the project team would hire on the ground. The project team would order a pump, from one of the local businesses the travel team met with that sold them, and the project team would likely install it depending on the well driller's services. The team will likely need to use photovoltaic power system due to a lack of grid-tied electricity in Kibuon. The borehole and pump should be maintained by the community members as parts are available locally and skilled workers are available.

## 1.6 Project Team

The chapter's project team is comprised of 20 Harvard Undergraduates, with Dr. Chris Lombardo serving as the faculty advisor and the REIC. Billy Koech and Tatheer Adnan are the project leads. The team works closely with professional mentors, Avery Meyers from WSP USA and Nisheet Reddy from GEI Consultants Inc.

**REIC and Faculty Advisor:** Dr. Chris Lombardo will be serving as the REIC, faculty advisor for student chapter, a travel mentor, and a health and safety officer. Dr. Lombardo is an Associate Director of Undergraduate Studies in the Harvard School of Engineering of Applied Sciences and Lecturer in Electrical Engineering. He received BS degrees in Electrical Engineering and Physics from the University of Maryland at College Park and his MS and PhD in Electrical Engineering from The University of Texas at Austin. He has been actively involved in EWB-USA since 2004 in several chapters throughout the United States. During this time, he has worked on projects in Ecuador, Mexico, Cameroon, Panama, Peru,

Dominican Republic, Tanzania and now Kenya. Additionally, he has served in several regional and national leadership positions within EWB-USA, including organizing the Design Global, Engineer Local course hosted with ASCE/EWB-USA Global Engineering Conference, serving as the chair of the Faculty Leadership Committee, and is a member of the EWB-USA Board of Directors. He has experience advising EWB projects for over 10 years therefore his involvement will be key in ensuring quality.

**Avery Meyer, EIT:** Avery is a structural engineer at WSP USA and a member of the Boston Professional Chapter. He was previously involved in a joint program with the Boston Professional chapter. Avery intends to continue to act as a mentor for the Harvard chapter. This project is within his capacity to support since Avery was able to support the Harvard SEAS chapter's last project in Tanzania while remaining active in the Boston Professional chapter. As the "International Development Lead" Avery will be helping select the culturally appropriate methods and will be working in the location of the project with the expertise to make sure the technology and construction practices are feasible.

**Nisheet Reddy, EIT:** Nisheet is a structural engineer at GEI Consultants Inc., and also the Vice President of the Boston Professional Chapter. Previously, he was a co-Mentor for a joint project in Tanzania between the MIT Student Chapter and the Boston Professional Chapter. As a mentor, he worked alongside students and co-mentors to design a catchment and tank system.

**Project Leads:** Billy Koech, a fourth-year student at Harvard University studying electrical engineering, and Tatheer Adnan, also a fourth-year student at Harvard University studying Bioengineering, are project leads for the Kibuon team. As the project leads, they take on the primary management role for the students and would be the primary contact between the REIC, faculty advisor, students, community and Program Engineer. Billy Koech also takes on the role of translator as he is a native Swahili speaker (one of the languages spoken in Kibuon).

**Chapter Presidents:** Nicole Trenchard, a fourth-year student at Harvard University studying mechanical engineering, and Eva Cai, a third-year student at Harvard University studying Bioengineering, serve as the chapter presidents. A strong chapter is well-organized, has clearly defined leadership roles, and prioritizes long-term planning to ensure sustainability. As Chapter Presidents, Nicole and Eva set chapter objectives and goals for the year, manage chapter activities, facilitate chapter meetings, maintain communication with EWB-USA HQ as well as the State Representative by reporting on chapter activities, changes and progress, disseminate information from EWB-USA to chapter members and ensure EWB-USA is represented professionally in conduct, communication, and at events.

**Students:** There are currently 20 students working on the project.

## 1.7 Community Partners

The current community partners are the Kibuon Projects Committee otherwise referred to herein as the Community Based Organisation (CBO), the in-country partner Paul Olang'o, the local drilling and community development organization Wuoth Ogik Education and Charitable Community Organization (WECCO), and some local government members. Of these partners the Harvard SEAS chapter has formally signed an agreement with 2 of them – the CBO and the in-country partner. WECCO will sign a partnership with the chapter should the chapter decide to drill a well with them; as for the local government members, they have expressed interest in signing a memorandum of understanding for the purpose of securing project funding but the chapter is still in the process of pursuing this. More details on partnership formation can be found in section 2.1 (Partnership formation)

The Kibuon Projects Committee is a group of 17 communally nominated members that locally represent the members of the community. As community partners they play the role of overseeing the community fundraising activities, on the ground project support and post implementation maintenance. They are also the highest deciding authority in conjunction with the Harvard SEAS chapter on matters regarding the project. The table below shows the members of the committee, their role in the committee and the region they represent.

Table 1.1: Members of the Kibuon Project Committee

Region A (Nyamilu)	Region B (Sindianya)	Region C (Ombolwanda)	Region D (Wiyao)
Meresa Odira (member)	Joshua Odoyo (member)	Vincent Aooko: (assist. chair)	Richard Okelo (member)
Eunice Awino (secretary)	Joel Agalo (member)	Benta Akelo (member)	
Julius Amara (coordinator)	Samuel Oguang (member)	Mercy Auma (chairlady)	
Joshua Ater (member)	Dickson Oler (member)	John Otieno (member)	
Daniel Omore (member)	Jane Atieno Ajuang (treasurer)		
Wycliffe Otieno (member and village elder)	Alice Akoth (member)		

Paul Olang'o as the in-country partners assists in logistical planning for chapter's trips to the community as well as on the ground support. He, along with his father Charles Olang'o, also acts as the travel team's translator, van driver and host during project trips. His past experiences working with the Oregon State University Chapter and the Princeton Professional Chapter enable him to also contribute to the project planning process. His contributions are discussed further in section 2.1.1 (Community members)

WECCO is a local company that consists of drilling professionals who have experience conducting hydrogeological studies and drilling wells in the neighboring communities of Migori county. Their community education initiatives set them apart from typical drillers because they not only drill wells but also focus on teaching communities how to maintain them.

The community members with the help of the Harvard SEAS chapter is seeking to strengthen the partnership with the local government. The current main contact in the local government is the Minister of Water and Energy for Migori county – Hon. Rebecca Ghati Maroa. Besides the main contact, Kibuon also has a representative in the county assembly by the name Hon. Aran Aran Patrick. As a community partner his role is to use his geopolitical influence to assist in organizing community fundraisers, and to help push funding requests in the local government.

## 1.8 Similar Projects

**Lela, Kenya:** The Oregon State University Chapter (OSU) constructed rainwater catchment and well-drilling projects in Lela, Kenya, a community with a population of approximately 2000 people, until 2015. Following a short hiatus due to university travel restrictions, the project was resumed by the San Francisco Professional Chapter (SF). Due to the community's desire for clean water, the OSU Chapter originally considered rainwater catchment, well-drilling, and surface water collection. However, after testing local water sources in the community, the project team determined that they were not viable due to contamination. The team chose to drill wells with a hand pump, noting the community's specific request, and implement rainwater catchment systems as a supplementary source of water. The chapter aimed to provide 15 liters per person per day of drinking water for community members, 3 liters per person per day of drinking water for school children and have no more than 500 users per well - all guidelines that the project team are considering incorporating into our implementation design.

The SF Professional Chapter has continued the work begun by OSU. The team traveled to Kenya in February 2019 and found that the Lela community had been very responsible and proactive with the maintenance of the wells built by OSU. All three wells were in good working condition, and the fees were being collected for each location. Moreover, the filtration systems at each site were also being

maintained. Based on the conclusions drawn from the assessment trip, the team plans on implementing three wells with mechanical pumps in the community.

Our team was able to have a conversation with Judy Jiang, who joined OSU's Lela Project in 2013, conducted a monitoring trip, and served the chapter as both a project and PMEL lead. She provided specific advice regarding the design of household surveys, which entailed a random sampling and asking to view the household latrine and handwashing facilities, which were both incorporated into our methodology. Furthermore, her insistence to identify and remain in contact with key leaders and utilizing local translator from the community is something our chapter plans on abiding to.

**Bondo, Kenya:** The Hope College Chapter coordinated the installation of two wells and a rainwater catchment system in a rural area called Bondo just outside Migori in southwest Kenya. The chapter has been in a partnership with the community for more than three years now, and has learned considerably from the challenges they faced. For instance, during the second trip of the chapter to the community they found that the design of the rainwater catchment system they intended on building would require significant adaptation, especially since some supplies needed were not easily accessible at single hardware store in Bondo. Given their experiences, the chapter recommends patience and adaptability as the necessary attitude for a successful implementation trip.

**Komosoko and Muchebe, Kenya:** Komosoko and Muchebe are communities located in the Migori district, with a population of approximately 2000 people each. Both relied primarily on rivers, infected with disease causing bacteria, as their primary source of water. The Princeton University Chapter partnered first with the Muchebe Primary School Management Committee, and then with the village of Komosoko. In 2014, the Muchebe community and Princeton team expanded an existing rainwater catchment system from a capacity of 20,000 liters to 67,500 liters, and the following year they partnered again to implement a second, 60,000L rainwater catchment system. The chapter is continuing to work in the Kuria West district and specializes in building wells and rainwater catchment systems. In a conversation with the Princeton University Chapter, the Harvard SEAS team found that the decision between building boreholes and rainwater catchment system depends primarily on the cost and wants of the community. However, the Princeton University Chapter expressed having trouble with information about the water table due to misalignment between the hydrogeological survey and the results from drilling.

## 2. Assessment Results and Data Collected

### 2.1 Partnership Formation

#### 2.1.1 Community Members

##### 2.1.1.1 Kibuon Community Introduction

The Harvard SEAS Chapter Team created a resource for organizing community member information that can be found as Appendix 5.4 in the Post-Trip Report. This documents the name, role in community and contact info of each community contact for the Kibuon Project along with a photo for identification. This resource is used to organize information as well as to prep future travel members so that they know who is who before they arrive in community.

The team held two community meetings with the residents of Kibuon, the first on June 3rd and the second on June 10th. The first meeting was heavily attended by men (17 of them), women (36 of them) and children in close proportions. The second one was heavily attended by women.

The team used the first meeting to introduce the mission of EWB-USA to the community as well as explain EWB USA's partnership model. The meeting was led by the project lead, Billy Koech, in Swahili together with the CBO's coordinator Julius Amara, who helped with translation to Luo. The team learnt that of the community's needs, water takes highest priority then followed by healthcare and electricity. Inadequacy of water impacts mostly children and women who have to wake up early in the morning at 6am to collect water; the children also have to leave school an hour before the ending time in order to collect water. Most attendees also reported experiencing symptoms such as diarrhea from drinking water from the "springs".

The team inquired about the community's use of wells in the neighboring communities of Bondo and Lela to which they reported mostly getting water from Lela because it has three wells (versus one in Bondo) and having good interactions with those communities. They also expressed strong desire to have similar clean and reliable water sources as Bondo and Lela. The cost of water from the wells in the neighboring communities is 5KSH per jerrycan for non-registered members and 20KSH per month for registered members. When asked why none of the Kibuon members were registered with the Lela or Bondo CBOs, they cited not knowing the cost of registering or the process for doing it and extremely discouraging travel times to those wells. The following values were given for the time it takes Kibuon residents to collect water from their respective regions by foot.

*Figure 2.1: Travel times to nearest wells*

Region	Time to Lela Well in hours (one way)	Time to Bondo Well in hours (one way)
A	1.5	0.5
B	2	1
C	not reported	not reported
D	1	not reported

In the first meeting the team also learned that 70-80% of the community members are farmers, and the rest are either business owners, or public servants such as teachers and dispensary specialists. In the 2nd meeting, the team reported to the community their findings from the assessment trip, reiterated the expectations of the 5 year partnership (one of which was the 5% community contribution) and stated the plans for the next steps. The minutes from the meeting can be found in Appendix 0.

#### 2.1.1.2 In-Country Partners

The project team was thoroughly supported by members of Kibuon and neighboring community Lela during the 2019 Summer Assessment Trip. Primary community contacts included Paul Olang'o and his father Charles Olang'o, who are members of the neighboring Lela Community that has worked with Oregon State University and San Francisco Professional Chapters. Charles and Paul were also involved in the EWB-USA project done in Bondo (another neighboring community) by Hope College. Both the Lela and Bondo Projects were water supply projects that included hand-pumped wells, and as such both Charles and Paul were very familiar not only with EWB-USA project processes but also in assisting EWB teams in collecting the data necessary to complete a water supply project. Charles hosted the travel team in his compound, serves on the Kibuon Projects Committee (as a sort of advisor member given he is a resident of neighboring Lela), and during the trip was involved as a survey translator (primarily for infrastructure surveys). Charles' son, Paul, also served as a community partner in the role of a daily mentor, community guide and translator. Paul was active in nightly team meetings, giving advice on how to proceed and helping the team to interpret daily events, and served as primary translator during most meetings. He is extremely passionate about Engineers Without Borders projects and was a phenomenal resource for the team. In addition to his contributions to the project, he helped with logistics for the trip by picking the travel team up in Nairobi in a rented van, driving the group the ~390 km to Kibuon, hosting the team in his own house within his father's compound, and ensuring that the team had enough time each day to eat, rest and plan.

#### 2.1.1.3 Translators

The team's translation was primarily done by Paul Olang'o, who is fluent in English, Swahili and Luo. The team's community surveys were also aided by Julius Amara, Joshua Ater, Richard Okelo, and Samuel Oguang, all of whom are village elders and some of which are faith leaders. There was some concern that having community leaders as translators may influence individual responses to questions, but the team did not observe any particularly problematic behavior, nor did they see results that were significantly different from the trends observed by Paul's team. The women's meeting was translated by Reno Rachuonyo who is a nurse at the Bondo Dispensary and kindly attended the gathering instead of attending church on Saturday (she is a member of the Seventh Day Adventist Church, which has a significant but minority population in the area). Deborah Nandwa was also in attendance as a volunteer translator, though her English fluency would have made hosting the meeting challenging.

#### 2.1.1.4 Miscellaneous

The team also encountered many community members that will be helpful for any future implementation trips, as many were fluent in English and/or were members of relevant skilled fields. During surveys the group also met many secondary and a few university students who were home over break, which will be important to think through when scheduling the next trip. If the team were able to engage these students, they could serve as excellent translators and could contribute to the sustainability of the project.

### 2.1.2 CBO Leaders

The Harvard SEAS EWB team was impressed by the Kibuon Project Committee's structure and proactivity both during the trip and in the months beforehand. The committee was founded in 2016 to write the ICP community program application from village elders in the region. This committee was formed with the intent of joining four small sub-villages with similar water concerns to address the region's needs. This new community was named Kibuon, and consists of four quadrants: Sindianya, Wii Yao, Ombo Lwanda and Nyamilu. The committee kept meeting notes for the times they gathered to brainstorm for the partnership application (which was primarily penned by Paul Olang'o with the support of a volunteer from Hope College) and then again when the committee renewed efforts after

the partnership formation with the Harvard College Chapter in 2019. The committee has always expressed interest in a borehole project, and while the team arrived on the trip prepared to assess for a variety of project scopes, after speaking with the water committee (and later validating with data/opinions collected during surveys) that the likely outcome of this trip would be the conclusion that Kibuon was in need of a well.

While the team was in Kibuon they met with the CBO on two formal occasions: once in the beginning of the trip and once on the last day before departure. During these meetings the chairwoman (Mercy Auma welcomed the team and CBO Coordinator and local pastor Julius Amara served as MC and primary translator. Committee members consisted of a seemingly proportionate number of elders from each quadrant of Kibuon and consisted of both men and women. All members appeared engaged at meetings, and many passionate statements were made about excitement regarding project next steps. The committee understood the responsibility of the 5% community contribution and had already begun collecting it from members by the time the Harvard EWB team arrived in country. On multiple occasions it was mentioned by Mercy and Julius that Kibuon hoped for 4+ wells, and while the team explained that the well location and number would depend on the hydro-geologic study, they remained adamant that they wanted a large quantity of wells to provide water for the community.

In addition to formal meetings with the Water Committee, leaders on the committee organized a series of luncheons for the Harvard SEAS Chapter team. These took place at the homes of village elders and community leaders that lived in the region that was being surveyed by the team on that particular day and consisted of generous spreads of delicious Kenyan food.

### 2.1.3 Local Government

The team met with local government representatives within the county government of Migori with the aim of pushing for governmental involvement through partnership formation with the local government. The County government of Migori has the structure depicted in the Figure 2.2. In addition, the Kibuon region has a chief and assistant chief who are closer to the citizens in terms of administrative hierarchy:

- Ndonyo Silfanus – Chief
- Milicent Tinga – Assistant chief

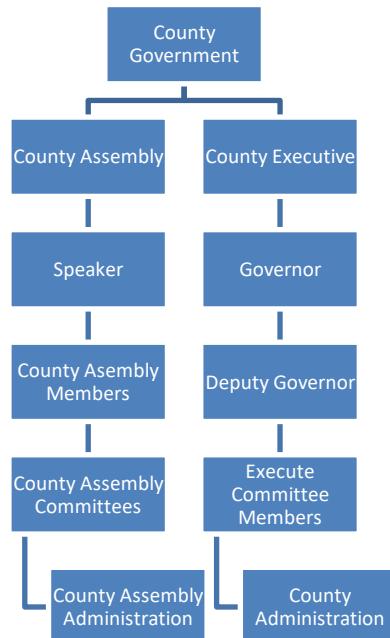


Figure 2.2: Structure of county governments in Kenya

The team held meetings with one official in the County Assembly (legislative arm of the county government) and three officials from the Ministry of Water and Energy who fall under the County Executive (executive arm of the county government). The details of the meetings are summarized in the subsections below, but the key takeaways are that the team is still pursuing a partnership between the county government and the CBO despite challenges that arise from poor governance.

#### 2.1.3.1 The Wasueta II Ward Representative's Office

The team visited the Wasueta II Ward Representative's Office where they met and conversed with the ward's representative/ Member of County Assembly (MCA) - Hon. Aran Aran Patrick. In the meeting were 7 other members of the office listed below:

- Jeniffer Awino - Office Secretary
- Phillip Obongo - Ward Manager
- Beatrice Akinyi - Office Caretaker
- Boaz Odogo - Ward Assistant
- James Sigambo - Chairman of water management with the ward
- Jacob Juma - Ward driver
- Edwin Odhiambo - General member and immediate member

The team learnt that Hon. Aran not only represents the Kibuon region where he is lives but also 55 others that combined make up the ward. They also learnt that governmental assistance can be requested through his office by having his office take a request from a region to the county government. At the county government requests are put into consideration for budgeting. But before approval, requests have to be verified by holding meetings with the local community members in order to fulfill a requirement called "public participation". According to the MCA this is multistep process that could take 2 to 3 years. Furthermore, he did not seem enthusiastic to engage in that process. However, he did show interest in organizing community fundraisers in the future for the purpose of helping the community meet the 5% requirement.

#### 2.1.3.2 Department of Water and Energy Offices

The team met with four representatives in Migori's Department of Water and Energy:

- Isaac Muthegi - Technical Manager of Migori county Water and Sanitation Company LTD
- Rhinox Odhiambo - Acting Director of Water and Energy
- Hon. Rebecca Ghati Maroa - Minister of Water and Energy
- Hon. Scholastica A. Obiero - CECM for Finance for Finance and Economic Planning

The department of water and energy has partnered with other NGOs in the past such as Kwash (an NGO that works on expansion of existing projects), Hydrating humanity (an NGO that drills boreholes in Kuria West) and Water Sector Trust Fund (an NGO that receives 10% governmental contribution on the total cost of their projects) suggesting the feasibility of a partnership with the CBO.

In these meetings the team came close to getting the local government to sign a partnership agreement with the CBO; the Minister of Water and Energy expressed a great deal of interest in establishing clear arrangements on how her office can contribute to the Kibuon project. However, her office needed clearance from the governor (who was away during the period of the trip) before beginning to write a memorandum of agreement therefore the team was unable to begin that process during the trip. This partnership is still being pursued for future trips.

Overall, the results were promising because the financial conversations in the department of water and energy transitioned quite fast as the project team was able to move from the director's office to the minister's office within less than an hour's notice. However, it is important to point out that the greatest challenge to the formation of such a partnership is the convoluted nature of the bureaucracy in the local government, the lack of transparency on governmental projects initiation procedures, and

the incompetence of some leaders with regards to representation of the needs of the community members.

#### 2.1.4 Contractors

Based on the community application and conversations with community leaders the Harvard EWB team was relatively confident that WECCO was a non-profit. However, when the team arrived and had a meeting with them, it became clear that WECCO is a for-profit drilling company that works in some cases with communities on water projects. The community seems to have selected them based on their involvement in other local EWB drilling. Based on the team's assessment, materials provided at the meeting (such as example hydrogeologic surveys and packets prepared for other clients) and visits to successful well-sites WECCO has drilled the company seems like a good choice.

As of the time of writing, the only contractor the project team has met with is WECCO – the travel team chose to prioritize different on the ground activities due to the ease of remotely contacting other contractors, as opposed to remotely conducting surveys or government meetings. The team intends to make contact with and, ideally, secure a quote from another driller to ensure that the community's selected contractor has quoted a reasonable value.

#### 2.1.5 Suppliers

The project team traveled to Migori town, which is approximately a 30 minute drive from Kibuon and is the largest town in the area. While there the team visited potential hardware stores for material availability. See Attachment 5.5 for a list of some of the materials that the team found. While there, the team met Benedict at Ritu Enterprises and found that he had worked with other EWB chapters to supply/construct project in the Migori County Area. He was an active Rotarian with the Migori Rotary Chapter and was part of a team that had received a global grant to construct rainwater catchment systems and latrines at 13 local primary schools. He will likely be a helpful resource as the team looks into material sourcing for the first implementation trip.

### 2.2 Project Feasibility

**Community Interest:** After having two community meetings, two CBO meetings, a women's meeting, and conducting household surveys, the project team has identified that the main problem faced by the community is the water problem. Community members' main request to the project team was a solution to the water problem. Most community members seemed to be interested in a borehole project similar to that implemented in the nearby community of Lela but were also open to other solutions as long as they provided a solution to the water problem.

**Community Based Organization:** The Kibuon water council was formed in 2016 to try to find a solution for the water problem. The first version of the council was composed mainly of members of the same family who gathered information about the water problem and the community, compiled it into an application, and submitted it to EWB-USA. After that, the committee disbanded for a period of time, but reformed once Kibuon's application was adopted by the Harvard SEAS chapter. The new water council had a more diverse group of members; all subregions of the community were represented on the council and the members were chosen by other community members. Each subregion nominated people to represent them on the council. These people are active members of the community and most of them are well known to community members through what they do; they are church pastors, village elders, community health workers, and concerned members of the community.

The CBO members have assigned roles within the council; chairlady, assistant chairperson, secretary, assistant secretary, treasurer, assistant treasurer, coordinator, and general members. The CBO holds meetings every Thursday that are open to community members to discuss the water problem and updates from our chapter about the water project. Additionally, during the project team's two weeks in

the community, the CBO provided support for the project team by providing us with a group of translators comprised of CBO members, as well as providing lunch in the community for the team every day.

From the data collected from the community and the project team's own observations in the field, the CBO seems to be highly organized and committed to the execution of the water project. Each member of the CBO has set responsibilities, the members were eager to offer support to the chapter and the CBO seems to be actively involved with community members. In conclusion, the CBO seems likely to offer the needed support to the water project and the Harvard SEAS chapter.

**Ability of community to support the cost of the project:** The CBO has come up with a fundraising plan to raise the 5%. They are following a model similar to that of the neighboring community of Lela. They have set up a registration system for whichever water system the travel team chooses to install: willing households will pay 500 KSH (5USD) to register and when the system is installed, they will pay a monthly fee of 20KSH (0.20USD) instead of paying per jerrycan of water. If not registered, community members will pay 5KSH (0.05USD) per jerrycan of water. From the population survey and the house map that the project team created; we estimate the number of households in the community to be 221 households. If project has a cost of around 20,000USD then with the CBO mandated registration fee, they will need 200 households to register to raise the 5% contribution which is a participation rate of about 90%. This raises a slight concern about the ability of the community to raise the 5% for the first system implemented, and a concern about the funding source for future systems proposed during the 5-year partnership. However, when these concerns were discussed with the CBO, they proposed holding a fundraiser for the community and they seemed confident that people will donate to the project.

**Possible locations for a borehole:** During the women's meeting, possible well locations were determined with the help of the community. These well locations were examined; we visited the locations, collected soil samples, and examined the possibility of using solar panels by using a sun surveyor Android app. The details of site assessments are outlined below in more detail in section 2.3.2.5. Some of the locations surveyed seem suitable for a borehole and a solar powered pump, the only data needed to finalize a location is the hydrogeological study. The hydrogeological study will be performed on the top two candidate locations that have been identified.

Some of the locations identified are located on privately owned lands, which might cause an issue. However, this concern was brought up at multiple community meetings and CBO meetings, and community members have expressed a willingness to sign over land rights to the plot of land which houses the borehole. Additionally, the names of the landowners of the possible identified locations have been collected and they will be contacted before any work or construction is done on their property.

**Ability of system to support the population of the community:** From the population survey, the project team found that the population of the community is larger than originally thought and any system that will be constructed needs to be able to support the larger number of people and their water needs. More information will be provided about the possible amount of water that the borehole, which is one possible solution, will produce after the hydrogeological survey is performed.

**Existing water sources:** Water samples were collected from water sources that are frequently used by the community. The project team identified these water sources through household surveys. These water samples were tested using a portable water testing kit and the results will be discussed in more detail in section 2.3.2.4 of the report. From initial findings, it seems that the water does not meet the health requirements for drinking. This could hinder the possibility of a spring box project to harvest water from the natural springs that were tested.

## 2.3 Data Collection

### 2.3.1 Surveys

#### 2.3.1.1 Household Surveys

Over 40 household surveys were conducted in the community, at least 10 coming from each subregion of the community, striving for socially, geographically, and economically diverse and representative compounds. While each compound might contain multiple homes, they would generally descend from a single grandfather and possibly more than one wife – the survey teams would explain that the questions referred to the entire compound, not just a single house or family within it. A rough rule of 1 house skip 5 was used to ensure geographic diversity, and the survey teams collaborated with the census team in an attempt to find a representative set of households. Each surveyed household was approached, unannounced, during the day at a time when our community contacts thought that people would be home (we avoided market times and Sunday morning, for example). Some houses were empty when the survey teams first arrived, but the survey teams would return and normally be successful. If residents were home, the survey team's translator would greet the family, ask if they would participate in the survey, and then enter a home in the compound and talk to a member of the family (normally an adult, though with a few exceptions).

After entering the home, the survey team would first explain the purpose and process of the survey to the residents using a standard script (Appendix 5.9). Once the respondents agreed to proceed with the survey, the team would proceed to ask them the questions in the household survey sheet (Appendix 5.9). To make sure this process went speedily, each survey team contained a translator and at least two members of the travel team – one to ask the questions and interact with the respondents, the other to take notes, verify that nothing was missed, and interject additional clarifying questions if they thought any were necessary. Surveys would generally take around 30-45 minutes depending on the translator and the answers to the questions.

The household survey questions focused around demographics, health, water usage, the project, and other questions intended to help understand the households means and occupation. Examples of data gathered were daily water usage, water collection method, known issues with the water, population figures, schools attended by any children, diarrhea frequency, and whether they knew the project team was coming.

The household survey data provides a solid foundation for understanding Kibuon and its needs, as well as baseline statistics that the team can later reassess in a post-implementation trip to measure the effect of a project. Key among these statistics are water usage, water collection methods, and time to collect water – using these we can then determine optimal locations to construct water sources, as well as forecast the time saved during water collection. Further we can roughly forecast the water demands of such a system and design it to meet them as best as possible.

Throughout the interviews, the travel team found certain questions difficult to translate. A quick review of these questions are:

- Demographics
  - Asking how many people physically lived in the household was often confused with how many people were in the family. Asking where children went to school revealed this.
  - Numeracy was a challenge for some people owing to low literacy levels or old age, thus some were unable to give precise numbers for demographic age groups.
- Water Usage
  - Asking for amounts in jerrycans proved much easier than asking for amounts in liters.

- Asking how much time was spent collecting water often led to per-trip estimates of time spent, not total time spent throughout a day.
- Would often not respond whether children helped collect water unless asked specifically.
- Water Issues
  - Respondents would often have to be prompted to talk about waterborne illnesses, otherwise they would not mention them when asked what the issues with the water were.
- Health Issues
  - Translating “convulsions” as a symptom was a challenge because the Swahili equivalent is closely related to epilepsy.

#### 2.3.1.2 Health Survey

A component of the household surveys were questions designed to assess the hygienic practices and habits, frequency of symptoms, and health education and awareness of community members. Health habits were initially targeted through questions asking about frequency and times of handwashing, but the team found that these questions were both cumbersome to translate and had potential to offend those being interviewed. Because there was common knowledge that handwashing and water sanitation was important for health, the team was concerned that they would be offending individuals by implying the team didn't think they followed basic hygiene practices or inviting an opportunity for inaccurate data reporting if the questions made interviewees uncomfortable. The occurrences of symptoms including malaria, diarrhea, cough, fever, convulsions, difficulty breathing, and blood stool were used as an indication of common health problems within the community. Moreover, community members were encouraged to report symptoms that were not provided within the pre-determined options, and several households reported “other” symptoms such as rashes and mucosal buildup. Lastly, the surveys determined the sources of health education and information within the community. The results from the health indicators can be seen in section 2.3.1.4.

#### 2.3.1.3 Dispensary Survey

While in Kibuon, team members visited the two dispensaries that serve as primary health-care options for community members. Neither are formally in Kibuon, but they are both within a 45 minute walking distance for nearly every home in the Kibuon. While there, team members asked questions from the healthcare questionnaire found in Appendix 5.9.2. At the Lela Dispensary Harvard EWB members were unable to get through the entire survey due to time constraints and understaffing, but the Bondo Dispensary nurse had less demand and was willing to spend over an hour answering questions for the team. This information was gathered with an interest in characterizing the health outcomes of community members before and after project completion with a focus on waterborne illnesses. This assessment trip data will serve as a baseline against which the team will compare data taken in years following implementation.

The team also gathered photos of the data logs kept by the dispensary staff. These logs are sent to the county and then national government, so this standard data will allow the Harvard EWB Chapter to compare health outcomes at the Lela and Bondo dispensaries to those found in other regions of the country. Those images can be found in the photo log in Appendix 0.

#### 2.3.1.4 Summary of Survey Trends

Through the household surveys the project team assessed which sources of water were being used most by community members. The two sources reported most frequently were springs and rainwater catchment as shown in Figure 2.3:

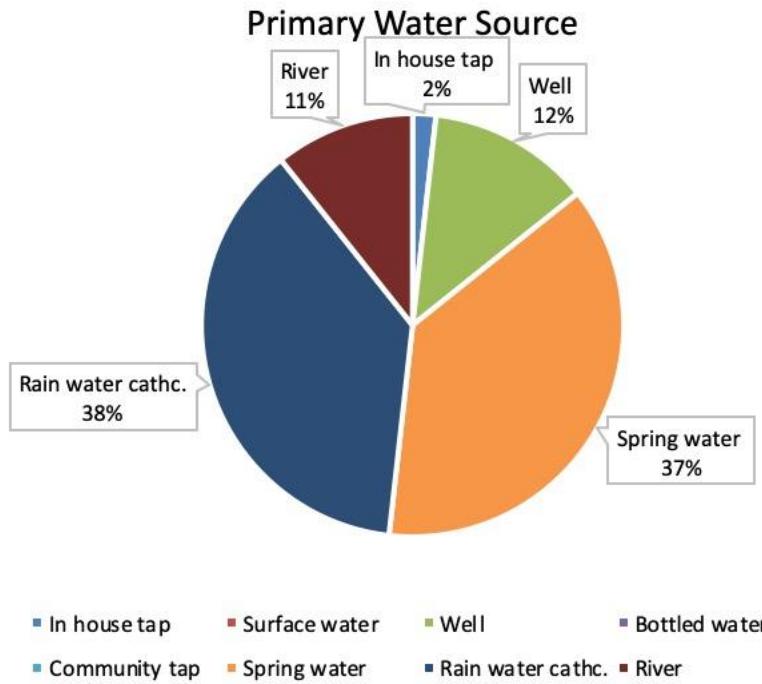


Figure 2.3: Primary Water Source for Kibuon Residents

Community members were also asked to report issues they had with the current water supply, including distribution and collection methods. The issues reported most frequently were water quality and shortage of supply as shown in Figure 2.4. Interviewees were encouraged to report issues outside of the options provided on the survey, and some reported longlines and cost as affecting their problem with the current water supply.

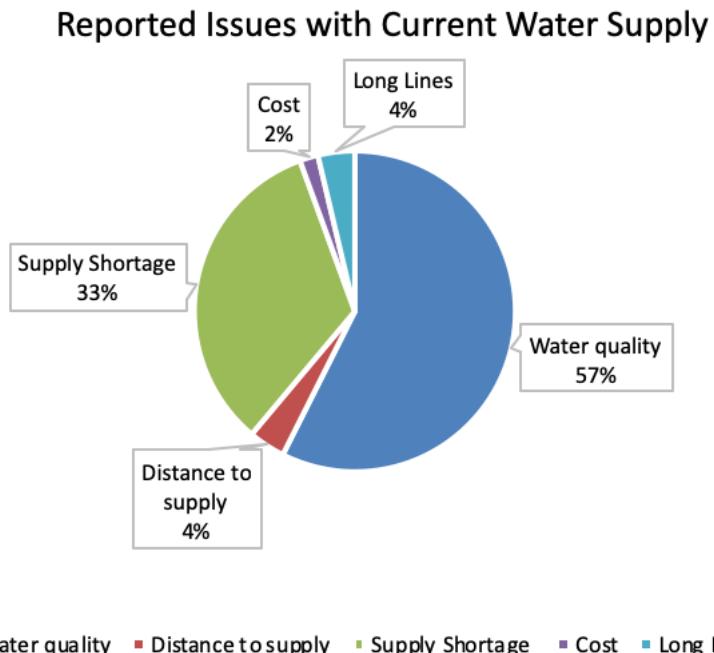


Figure 2.4: Reported Issues with Current Water Supplies in Kibuon

The dispensary surveys helped elucidate the multi-tier healthcare structure found within the community. The system is comprised of community health members, clinics and dispensaries, county and sub county hospitals, and teaching, referral hospitals. Community health workers are mostly volunteers, who receive 200KSH stipend/ month for their services. They are responsible for visiting each household at least once a month, collecting and providing health information to households, and writing transfer letters and referrals. The second tier of the system is comprised of clinics and dispensaries. While clinics are private, dispensaries are part of the public system and provide care free of charge. Nurses are the only medical professionals found within the clinic and dispensary system, there are no doctors available. Doctors primarily staff county and subcounty hospitals, which provide more advanced, specialized treatments and care teams.

Dispensary programs provide pharmaceuticals, neonatal care, family planning counseling, and healthcare outreach and educational services. Under the Linda Mama program pregnant women can undergo free delivery at any hospital, and care for newborns under the age of 1 free of cost. Moreover, the dispensary provides a complementary “Mother and Child Health Booklet” which details good healthy practices for new mothers. Under family planning and counseling, the dispensary hosts frequent talks with community members about child spacing, contraceptives, and reproductive needs. Counseling is provided in addition to biweekly health talks where community health volunteers (CHVs) and nurses inform community members about different health issues and topics.

The community health surveys revealed that the symptoms community members reported most frequently were coughing, malaria, and fevers. Diarrhea was reported as an infrequent condition, with many members communicating that the chemical treatments they applied to the water source helped avoid gastrointestinal infections. This data is shown below in Figure 2.5.

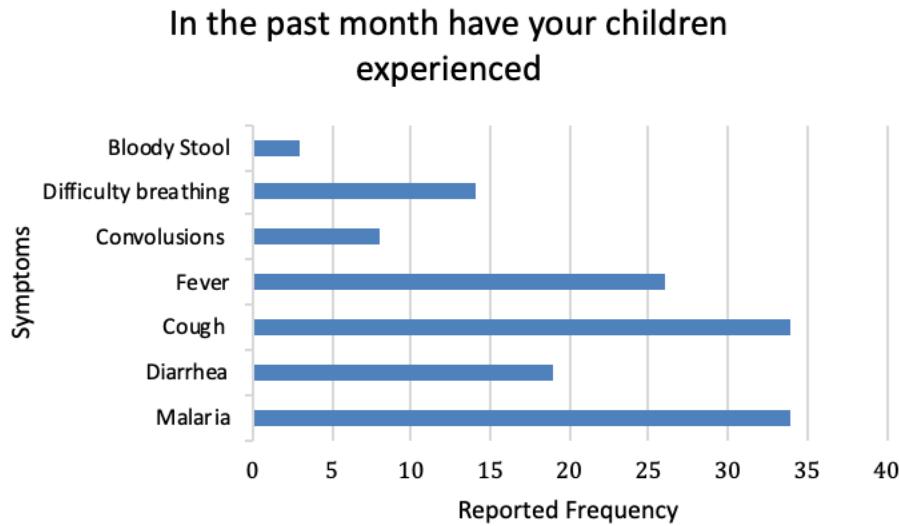


Figure 2.5: Frequency of symptoms as reported by community members

## 2.3.2 Detailed Technical Data

### 2.3.2.1 General Data Collected

Data	Method	Purpose
Total population	Population survey	Establish water demand
GPS locations of public buildings/property throughout community	Community tour with CBO leadership	Find potential location(s) for water project
Water usage by household	Household surveys	Establish water demand
Currently used water sources	Household surveys	Use as baseline data
Water quality of current water sources	Water Quality test strips	Use as baseline data
GPS locations of latrines and households	Population survey	Find potential location(s) for water project
Health issues faced by community	Household surveys + health clinic surveys	Use as baseline data
Videos of all the compounds (including descriptions of guttering and building materials)	Population survey	Additional data if needed
Solar path data	Smartphone solar pathfinder applications	Find potential location(s) for water project
Soil profile	Sedimentation test	Find potential location(s) for water project

### 2.3.2.2 Population Survey Data

A survey team composed of two travel team members and at least one translator went to every household in Kibuon (verified by satellite imagery and members of the CBO) – there they asked for the number of full-time residents, broken down into number of children and number of adults. They then placed GPS markers for the household and the household's latrine, including the demographic data gathered in the description of the household GPS marker. Each pin was also given a standard name indicating the subregion and number of the house (based on order the population survey team visited them). For example, A1 would be the first house visited in subregion A, B2 would be the second house in B visited by the team, etc.

A short Python script loads the KML map file generated by Google Earth and extracts all 221 household pins (based on folder file structure of map), prints the list of all names of the pins to check that they are household survey pins, then extracts the full time residents number based on a regular expression applied to the pin descriptions. As the regular expression requires a certain format, the script checks that the descriptions follow the format and flags them if they do not. These flagged descriptions were parsed by hand.:

The script calculated a population of 1515 and flagged 11 nonstandard descriptions. The nonstandard pins were then examined by hand and calculated as having a total population of 43, yielding a total population of 1558 full time residents, almost twice the initial estimate.

### 2.3.2.3 Geospatial Data Collected

To create a map of Kibuon, the project team collected GPS coordinates from each homestead, latrine, existing water collections point, proposed well location, and other points of interest. This data is shown in Figure 2.6. The four subcommunities (Kibuon A, B, C, and D) are bounded in different colors while homesteads are shown as green pins, latrines are shown in red pins, existing water collection

sites are shown in blue pins, potential well sites are shown in yellow pins, and other pints of interest are shown in purple pins. Subcommunity maps are shown in Appendix 5.1.1.

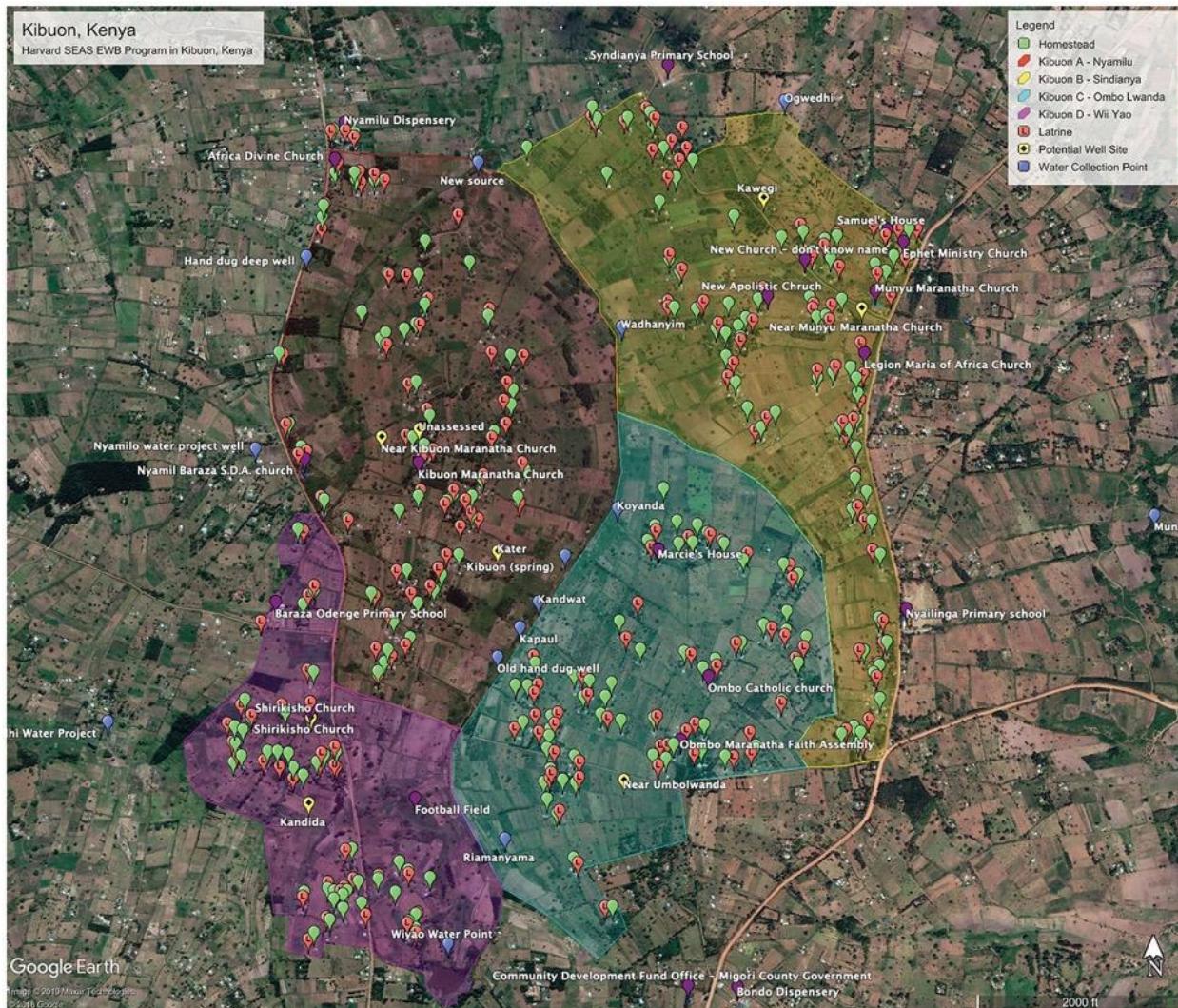


Figure 2.6: Map of Kibuon, Kenya divided into its four subcommunities. Homesteads, latrines, existing water collection locations, potential well sites, and other points of interest have been marked on the map.

In addition to collecting GPS coordinates to create a map of Kibuon, videos of all the compounds in the community were taken with narrations describing the existing guttering system, type of latrine and building materials. Latrines were classified as either Pit or VIP (Ventilated Improved Pit latrine). Most of the homesteads were made up of improved mud with thatched roof, although the project team did observe a few compounds made of brick masonry and/or concrete.

#### 2.3.2.4 Water Quality Data

Water samples were taken from 13 water collection sites within Kibuon and nearby communities. The water samples were tested for: pH, TDS, hardness, alkalinity, nitrate, nitrite, phosphorus, ammonia, bivalent metals, total coliform, and *e. coli*. All water collection sites met the applicable Kenyan<sup>1</sup> or WHO standards with the exception of total coliform and *e.coli*. The bivalent metals test

<sup>1</sup> [https://wasreb.go.ke/downloads/Water\\_Quality\\_&\\_Effluent\\_Monitoring\\_Guidelines.pdf](https://wasreb.go.ke/downloads/Water_Quality_&_Effluent_Monitoring_Guidelines.pdf)

failed at two water collection points, but it should be noted that the bivalent metals test does not determine the amount of each specific chemical species found in the sample. These results would need to be further analyzed to determine the specific amount of each bivalent metal species that is present in each sample. The tabular data for all water quality tests can be located in Appendix 5.2.1 while a map of the water collection points closest to Kibuon is shown in Figure 2.7 below.

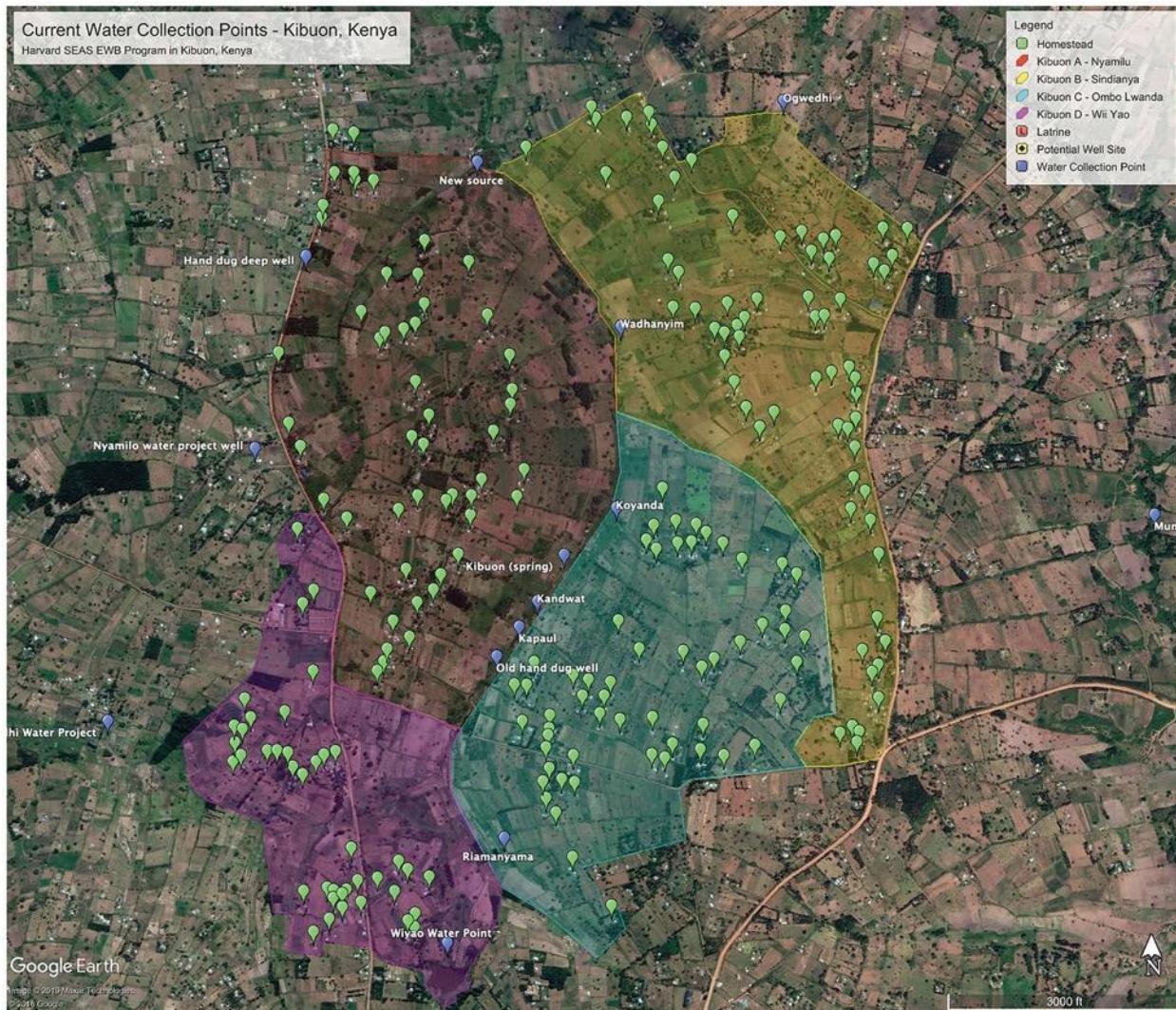


Figure 2.7: Map of existing water collection points in Kibuon.

#### 2.3.2.5 Data Collected for Drilling a Borehole

Seven potential sites were evaluated for drilling a well. At each of these sites, GPS coordinates were recorded, a solar pathfinder survey was conducted, and the soil type 2 feet from the surface was evaluated. Solar surveys were conducted with either EpiSun Tools<sup>2</sup> or Sun Surveyor<sup>3</sup> which are Android apps. Assessment data can be found in Appendix Error! Reference source not found.. The seven potential well sites are shown in Figure 2.8.

<sup>2</sup> <https://apkpure.com/episuntools/com.profactum.epitools>

<sup>3</sup> <https://www.sunsurveyor.com/>

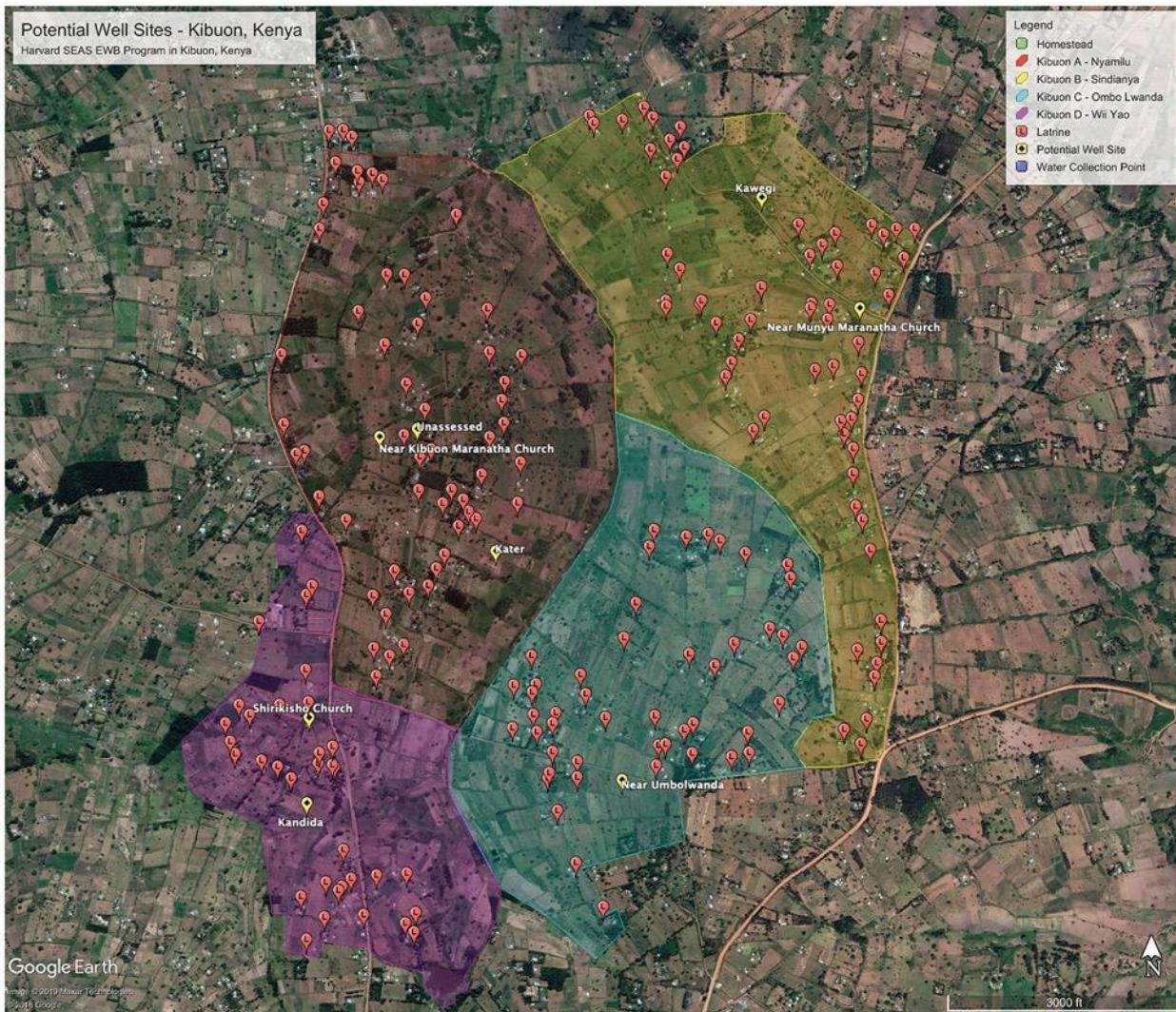


Figure 2.8: Proposed well sites in Kibuon with latrine locations provided as a reference.

Soil samples were taken at all the seven potential sites for drilling a well. Since this was a preliminary evaluation of the conditions, a hand shovel was used to dig the soil. In all seven sites, we encountered rock around two feet from the ground surface. From the project team's observations, and from the project team's communications with the members of WECCO, the team understands that the subsurface conditions within the community are typically rocky. The soil samples were classified according to the Unified Soil Classification System (USCS). The following methods were used to do this.

**Visual-Manual Observation:** The soil sample readings were taken within five minutes of its removal from the subsurface. Descriptions include the percentages of sand, gravel and fine components, color and the presence of organics.

**Settlement in water:** To measure the percentages of fine (silt, clay) and coarse (gravel, sand) material, a 330mL empty plastic water bottle was filled with roughly equal proportions of the soil sample and water. This sample was left undisturbed for 24 hours, and the ratio of coarse to fine grain particles was calculated based on the heights of the two layers into which the soil settled: the coarse grained particles at the bottom and the fine grained particles at the top. Since the area of cross section of the water bottle is roughly constant, this ratio represents the percentage volume of the components in the soil sample.

The soil classification of each sample can be found in Appendix 5.2.2. The USCS soil classification charts are shown in Figures Figure 2.9 and Figure 2.10 below.

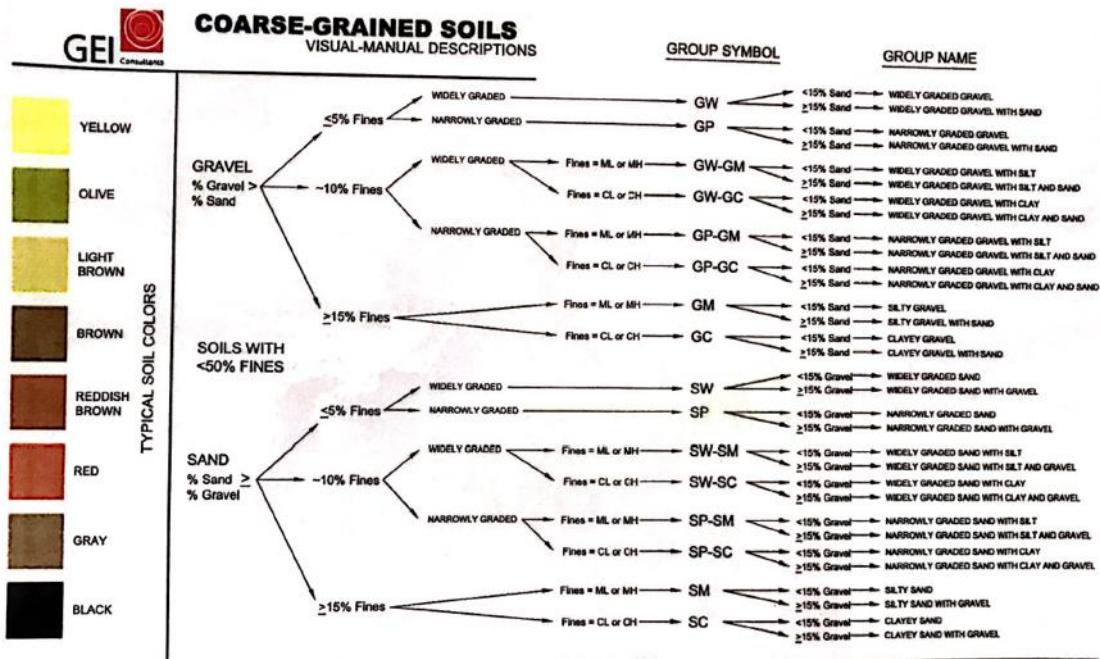


Figure 2.9: Coarse-grained soil classification as per Unified Soil Classification System (USCS)

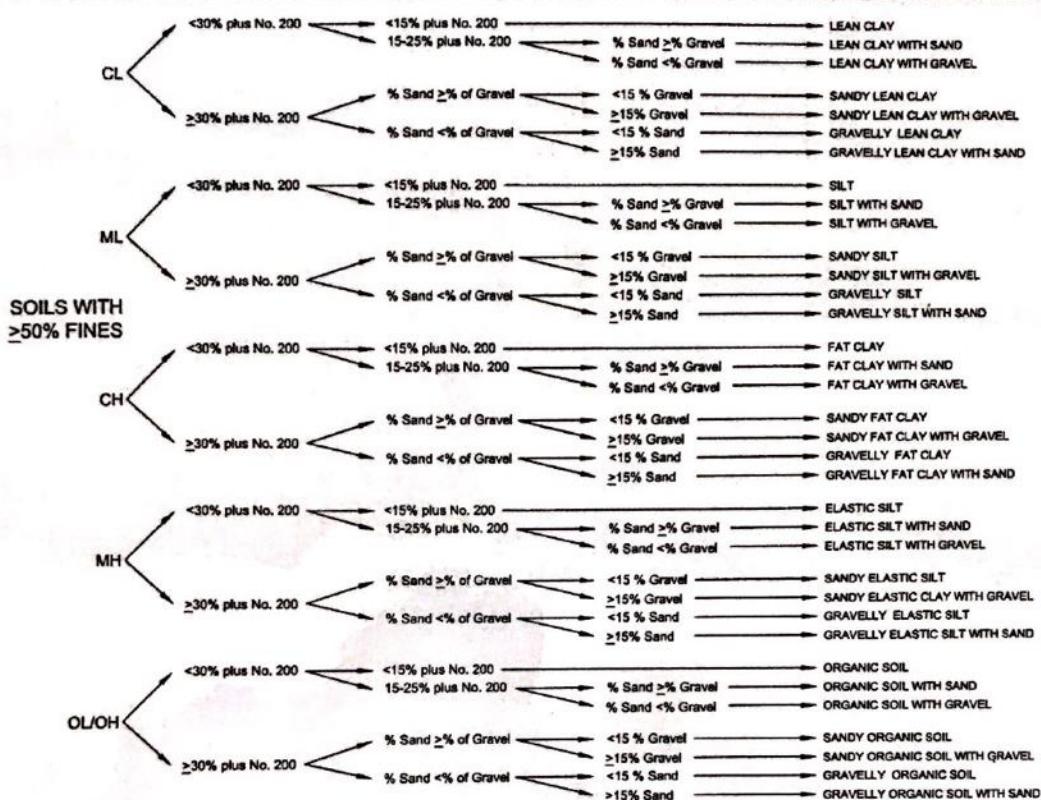


Figure 2.10: Fine-grained soil classification as per Unified Soil Classification System (USCS)

### 2.3.3 Changes from Planned Activities

#### 2.3.3.1 Original Schedule

Start (Day)	End (Day)	Task	Description	Duration (days)
1	1	Meet with NGO contact (Otieno Owino from WECCO) and community representative (Paulo Olango)	Ask preliminary questions	1
1	1	Meet with community leadership	Discuss project and trip schedule	1
2	2	First meeting with Kibuon Water Council (CBO)	Discuss fundraising progress and methods	1
2	2	Hold community meeting	Introduce team, explain purpose for trip, address questions, comments, and concerns	1
2	3	Tour Kibuon	Record GPS coordinates of important locations (water sources, public buildings, school, health clinic, etc.)	2
3	11	Household surveys	Interview 20-30 households in total, aim for 2-3 per day (ask about water usage, health issues, education)	9
3	3	Water quality testing	Test water quality of current water sources	1
3	5	Gather building dimensions	Of public buildings that could potentially be used for rainwater catchment	3
3	5	Soil analysis at building locations	Test soil type and load bearing pressure	3
5	5	Meeting with county government (if possible)	Discuss local politics and how they may affect projects	1
5	5	Visit local health clinic	Collect health data	2
6	7	Hydrogeological survey	Work with hydrogeologist to find optimal pump location within or near Kibuon	2
7	7	Meeting with WECCO	Discuss borehole construction	
8	8	Second community meeting	Address any new questions, comment and concerns	1
8	8	Women's Meeting (if possible)	Hear concerns and priorities of women in the community	1
9	10	Search for potential suppliers	Visit nearest commercial center and create directory of vendors and items sold	2
11	11	Final meetings with community leadership and Water Council	Discuss next steps and get partnership agreement signed	1-2
12	13	Finish any incomplete tasks		2

#### 2.3.3.2 Changes to Schedule

- The travel team was initially planning on arriving to Nairobi on day 1 (5/30/19) and beginning the drive to Kibuon in the morning of day 2 (5/31/19). However, one travel team member's flight was delayed until the night of day 2, so the team decided to drive to Kibuon on day 3 (6/1/19) instead. The travel team spent day 2 in Nairobi, so most of the original schedule was shifted down.
- The NGO's van broke down twice in Nairobi, on day 1 and day 2, so the NGO took it to be repaired both times in the morning of day 2 and day 3.

- The travel team briefly met with WECCO during dinner on day 3 and had the official meeting on day 4 (6/2/19) instead of on day 7 as originally planned. The travel team visited WECCO's electric pump and tank at a location site nearby.
- The travel team met with the CBO and held the community meeting on the same day, day 5 (6/3/19), which was done later than expected from the schedule. The travel team also visited and mapped nearby springs.
- The travel team mapped the perimeter of Kibuon on day 6 (6/4/19) and began building assessments and household surveys. They also revised the household surveys based on their first few experiences.
- The travel team began mapping all the households and latrines on day 7 (6/5/19), and continued household surveys.
- The travel team met with more county officials than expected. On day 8 (6/6/19), the travel team met with the Technical Manager of Migori County Water and Sanitation LTD, the Acting Director of Water and Energy, and the Minister of Water and Energy.
- The travel team began water testing and conducted dispensary surveys on day 9 (6/7/19), as well as continued mapping and surveying all households.
- The travel team held the community women's meeting on day 10 (6/8/19), which was on time for the shifted schedule.
- The travel team visited potential well sites and collected soil samples, met with the MCA (Member of County Assembly, similar to a Ward Representative), and continued mapping and surveying on day 11 (6/9/19).
- The travel team held the second community meeting on day 12 (6/10/19), which was also on track based on the shifted schedule.
- The travel team visited Lela's wells, finished mapping, surveyed primary schools, and visited the electric pump, concrete tank, and water kiosk in Bondo on day 13 (6/11/19). These visits were not included in the original schedule but were prioritized after learning about them and the communities they serve. The team had originally allocated one day for a hydrogeological survey, but instead used that time to complete the above activities since a more thorough analysis of the potential well location sites was needed before choosing locations for the hydrogeological survey.

### 2.3.4 Outstanding Data needs

#### 2.3.4.1 Fundraising plan

This projected total cost of the project raises concern over the ability of the community to raise the 5% community contribution since 90% of the households will need to be registered in order to meet the minimum cost. These concerns were discussed by the CBO who then proposed holding a fundraiser locally referred to as a "harambee". Data is still needed on the estimated revenue from the harambee and the expected frequency of holding such fundraisers.

#### 2.3.4.2 Hydrogeological study

Based on the project team's interactions with the community, it is our understanding that the preferred alternative to address the water needs is a borehole. So, several potential sites were evaluated to drill a well. However, a hydrogeological survey needs to be conducted to understand the ground water distribution near these potential sites and determine if it is feasible to dig a well.

The project team had two meetings with WECCO, a for-profit drilling company with prior experience in community related water projects. Their standard operating procedure involves using a water level detector to test the depth of water and sending data collected during the survey to their office in Kisumu where tests are conducted to estimate the quantity and quality of water available at any given location. Their estimation of the typical depth of water in the surrounding regions is between 100 and 160 meters. Their typical water detection survey takes around three days and around one week to generate a detailed hydrogeological survey report.

#### 2.3.4.3 Another well contractor

From a cost standpoint, the project team would like to reach out to at least one other drilling company in the region. The project team understands from communications with WECCO that the soil strata in the community is typically rocky, which might influence the number of days to drill. The main criteria to choose a particular drilling company would be their proposed costs, previous experience drilling around the community, and the availability of required drill rig and tools.

#### 2.3.4.4 High Resolution Water Quality Test

The authority in jurisdiction for the supply of water to the community needs to approve the water standards before a borehole is dug at any location. The process involved in doing that is yet to be determined by the team. However, the team understands that if WECCO is hired as the drilling contractor, they will collect the water sample from the potential well location and send it to the government laboratory to conduct required tests to describe the quality of water.

### 2.4 Climate Change Data Collection

**NOTE:** This climate change data was difficult to collect, as the questions were not easy to translate into Swahili and contained some technical concepts that were not familiar to community members. This difficulty may or may not have impacted the accuracy of the data collected. The team also found that farmers were most reliably informed regarding weather patterns and changes in typical climate patterns.

The project team collected the climate change data needed through household surveys. At the end of each household survey members of the project team posed the following questions:

1. Has it gotten hotter or cooler in the last ten years?
2. Has there been a change in your drinking water supply in the last ten years? If so how?
3. Have rainfall patterns changed in the last ten years? If so how?
4. Has the change in rain affected how you grow crops? If so how?
5. Has drought impacted your community in the last ten years? If so how?
6. Has a major storm(s) impacted your community in the last ten years? If so how?

In the pre-trip plan, the project team had additional climate change questions. However, the questions were compound questions phrased in a complex way. This made it difficult for the translators to phrase the questions in Swahili in a simple way that was easy for community members to understand and answer. The additional questions were also technical in nature, so the travel team decided that they were not suitable for general members of the community to answer since it was unlikely that they would have accurate or informed answers to the questions.

Additionally, the basic climate change questions were also very difficult to communicate to members of the community. The difficulty was mainly due to two reasons:

1. The full meaning of some of the questions got lost in translation from English to Swahili to Luo
2. The interviewees did not understand that the questions were concerned with trends that occur over a long period of time. Instead, they gave answers that describe more recent short time changes (i.e. over the past couple of months).

Therefore, it was difficult to deduce whether the answers we received were an accurate representation of overall trends that have occurred over the past ten years.

**Summary of results:**

- It has gotten hotter in the last ten years
- There has been a change to the community's drinking water supply; some of the springs that were used as water sources have dried up in the last ten years.
- Rainfall patterns have been changing. Rainfall has become more irregular and there has been less rainfall during the wet season, and the dry season is getting longer.
- People have not changed their crop growing habits. They plant the crops at the same time which results in them losing some of the harvest due to seeds drying up because of the delayed rain.
- It seems like there was a drought in 2010 that lasted for 6-7 months. However, when asked the question about the drought, most people confused it with the dry season and gave us answers pertaining to this year's dry season, which is not a drought.
- There have been major storms in the past ten years whose main effect was the destruction of some community members' harvests.

In summary, the community reported hotter climate, less rainfall, and more varying rainfall patterns. The main impact on the community has been the reduced crop yield, and the destruction of some community members' harvests.

## **2.5 Go/No Go Decision**

### **2.5.1 Community/NGO Capacity**

1. Will the NGO and community be able to support the project enough for it to be successful?

It seems likely that the in-country partner, NGO and the community will be able to support the project enough for it to be successful. In the first CBO meeting, the CBO and in-country partner were able to outline a plan for raising the 5% contribution. The CBO members, which are well-known throughout the community, have been collecting a set fee from households to become registered members of the well, and plan to charge a smaller monthly access fee for the maintenance of the well. At the point of travel, the CBO had already registered 40 people who made either partial or full payments totaling to 5000KSH, which indicates community willingness to contribute. The community is also planning on hosting a community fundraiser "Harambe," which the religious leaders in the CBO have successfully done in the past to raise funds for church projects. Furthermore, during the household surveys, the travel team saw CBO members collecting additional registration fees from households who felt even more enthusiastic after seeing the travel team was present in the community. Accordingly, the community has shown commitment to a fundraising plan and demonstrated its feasibility.

2. Was the community application fully honest about the water problems they are facing and their ability to support the project?

There were no major differences between the community application and the travel team's findings during the trip regarding the water challenges they face. As stated in the application, there are very few water sources in the community, most are unclean and cause sickness such as malaria and diarrhea, and often times community members walk long distances to collect water. It is clear there is a shortage of clean water, and the impacts of this shortage were shared in detail with the travel team during the women's meeting with the community.

3. Will the project be sustainable, and will the community be able to maintain it after the partnership is finished?

The CBO plans on collecting a monthly maintenance fee from the registered community members to sustain the well and perform any maintenance or repairs. The religious leaders in the community, some

of which are CBO members, have been able to sustain their churches by also raising money from the community for infrastructure. While the travel team is unaware of whether the community has technicians for maintenance, it seems the community would be able to acquire some.

4. Is the NGO trustworthy?

The NGO was heavily involved with the travel team and the community throughout the entire trip, and demonstrated a commitment to clear, honest, and consistent communication between the travel team and all other parties. The NGO was eager to facilitate the communication of all questions and concerns between the travel team and CBO, particularly when translating or providing extra clarification during meetings. The NGO has been involved with Kibuon for over a year and was also involved in the EWB projects in the nearby communities Lela and Bondo.

5. Is the community leadership involved in the project?

Community leadership is heavily involved in the project. As the CBO is comprised of 17 community leaders who were elected by the community members of Kibuon as their representatives. The CBO accompanied the travel team on many of the assessment tasks such as GPS mapping, household surveys, and site assessments, in order to answer all questions and concerns the travel team had. The CBO has also been proactive about communicating with the rest of the community about the status of the project and their next steps.

6. Is there a change in project scope that makes it impossible for the chapter to fund the project?

Although there is room for the project scope to expand in the future, the travel team's current expectations for the project are within the chapter's budget.

## 2.5.2 Technical Feasibility

1. Is the proposed project technically possible with the resources available?

The proposed project for a groundwater well seems technically feasible given the drilling contractors the travel team spoke to, the hardware stores they visited, and the 7 well location sites they assessed. One drilling contractor gave specific quotes on both the hydrogeological survey and drilling costs, was able to make guarantees for certain drilling issues that may arise and seemed experienced in drilling around the community. There are numerous hardware stores in the nearby city of Migori that have the necessary materials as well as transportation for tanks. Many of the well location sites are in places reasonably accessible by the community (particularly since they were recommended by the women of the community), are on community-owned land and have adequate sun exposure should solar panels ever be installed. A groundwater well could reasonably address the community's water concerns; nonetheless, the community is open to different solutions as well.

2. Are the necessary materials and skilled labor accessible?

While the local community does not have all the necessary materials, they are all available in the nearby city of Migori, approximately a 30 minute drive from Kibuon. Migori has a number of reasonably priced hardware stores and the travel team saw and heard of many skilled laborers. However, the travel team is unsure of whether skilled laborers are available in the community and whether they are affordable.

3. Will the government allow the chapter to go through with this project?

The travel team met with multiple government officials, including the Technical Manager of Migori County Water and Sanitation LTD, the Acting Director of Water and Energy, the Minister of Water and Energy, and the Wasueta II Ward Member of County Assembly(MCA) to discuss the project and any regulations the chapter should be aware of and found that there does not seem to be any legal difficulties to continue the project. Rather, the office of Acting Director of Water and Energy can issue

a letter of no objection that could expedite the drilling permit application process. The government did not interfere with the other similar EWB projects completed by other chapters in the neighboring communities of Lela and Bondo.

4. By the end of the assessment trip, has the chapter collected enough data to make informed design decisions when back at Harvard?

The travel team collected an abundance of data including statistics and qualitative information from the detailed household surveys, full community GPS map, numerous community meetings and the women's meeting, site visits and soil samples, and various visits and surveys at local schools and dispensaries. The data collected appears adequate to make an informed decision after returning from the trip.

5. Does the chapter have the infrastructural and technical knowledge to construct this system?

While the hydrogeological survey and borehole drilling would be done by a drilling company, the chapter has done borehole projects in the past and has the infrastructural and technical knowledge to construct the remainder of the system.

6. Is the groundwater in Kibuon of sufficient quality?

While there are successful groundwater wells in the nearby communities Lela and Bondo, the travel team cannot conclude whether the groundwater in Kibuon is of sufficient quality without a hydrogeological test and further studies. The travel team did see a few wells in Kibuon that seemed to produce water, however they also saw hand dug wells that had either never reached water or no longer produce water.

7. Are there any environmental threats, such as regular natural disasters that would jeopardize the integrity of the well?

There are no apparent environmental threats that would jeopardize the integrity of the well.

### 2.5.3 Chapter Safety

1. Will participating in this project cause any health or safety risks to the team?

As long as the appropriate vaccinations and medications are taken, participating in this project does not pose any apparent health or safety risk to the team. The Kibuon community is in a rural location, so should any political instability arise, it would most likely be in larger cities and the travel team members would be safe. However, the travel team did not find any reason for concern about violence or unsafety.

### 2.5.4 Project Impact

1. Will this project truly have the impact predicted?

For the water to equally serve all parts of the community, the borehole needs to be dug in a central common public location. From the community, CBO, and women's meetings, the travel team was able to narrow down 7 potential borehole locations that community members expressed satisfaction with. All Kibuon community members are also eligible to pay the one-time registration fee and the monthly maintenance fee to get access to a specified amount of water from the well every day. Depending on which borehole location is chosen, the water may be farther from some residents of Kibuon than others; therefore, the community and the travel team are considering the possibility of increasing the water access points with tap stands or some sort of distribution system. Furthermore, looking farther ahead, it may be beneficial to drill additional boreholes in future phases of the project to disperse the water access points and decrease the water collection time for more residents. It is difficult to assess before

conducting the hydrogeological survey whether the borehole would provide enough water for the community, however with the survey data on the community's daily water usage and information about Lela's wells, the chapter may be able to make some estimates. The travel team is unaware of whether there will be any arrangements for households that cannot afford the registration or monthly fees, and they need to communicate with the CBO and NGO again regarding any plans for that.

2. Is this a project that the community members seem to want?

The community members have demonstrated great commitment to this project. There was a very high turn-out at the community meetings and community members were eager to share their ideas and hopes for the project. While the travel team has offered a borehole as one potential solution and the community is in support of that, the community is also open to other solutions if they may be better.

3. Is the NGO truly representing the best interests of the people?

The NGO is representing the best interests of the people and has been involved with not just Kibuon, but also the neighboring communities Lela and Bondo in which EWB has worked before as well. The community is familiar with the NGO representative and they communicate with each other well.

4. Is there another organization which is implementing or planning a similar project currently which the group previously had no knowledge of?

The travel team did not find that there are any other organizations currently implementing a similar project in Kibuon.

#### 2.5.5 Summary

Based on these criteria, the chapter can confidently decide that this project is appropriate and within the scope of the chapter, and to proceed with the project in a partnership with Kibuon.

### 2.6 Conclusions

The project team considers the trip a success. Although unexpected changes in plans posed some challenges, they also allowed for new opportunities including the chance to initiate partnerships with the local government by meeting with officials in the department of water and energy. One component from the trip that made a significant impact on the team's experience was the presence of the in-country partner Paul Olang'o who was not only familiar with how EWB-USA works from his substantial involvement with other chapters, but also fulfilled the roles of host, translator, guide and meeting facilitator.

Through the team's numerous forms of data collection, including community meetings, women's meeting, various surveys, site visits, etc., the team was able to better quantify and understand the common challenges faced during water collection for the community. These different data points emphasize the pressing need for a partnership with the community and allow the team to better create indicators that can track the future progress and impact of the project.

After evaluating the go/no go criteria the team has decided to proceed with the project for the reason that all the minimum requirements were either sufficiently met or exceeded. The team is beginning to plan for the assurance of feasibility, desirability and sustainability of the project. One factor from the list of go/no go decisions that the team plans to follow up on is the fundraising plan for the CBO in order to ensure that the 5% minimum requirement is met.

The administration of 40 household surveys, about 10 from each of the four regions, enabled the team to get a general sense of the household water needs and demand. The randomized and geographically widespread selection of the samples combined with the high number of samples per region will enable the team to extrapolate trends of the entire community.

Of all the pieces of data collected, the hardest to collect was the climate change data. The chapter recommends that EWB-USA iterates over the questions to decrease their technical nature. The team has included suggestions on changes section 2.4 that could be made in order to make these questions easier to ask and easier to infer information from.

When asked about their preferences, the general consensus was that the community members and the CBO would prefer the construction of wells as the solution to their water needs. Given this input and the widespread implementation of wells in the neighboring regions by other EWB chapters, the team collected data on seven potential well locations and plans to pursue well drilling as one of the alternatives in the alternative analysis phase.

### 3. Baseline Monitoring Data Collection

#### 3.1 Water Source Development (HOME) PMEL Summary and Notes

Given that the team has just completed its assessment trip the chapter is still in the pre-project stage which means that some of the indicator questions are not applicable due to the fact that the team is yet to construct a water provision system. The responses to these non-applicable indicators are preceded by a statement explaining the reason for the non-applicability. The filled-out field data sheet that corresponds to the indicators below can be found in Appendix 5.7

##### 3.1.1 Performance and Quality

**Community Satisfaction:** Not applicable due to pre-project conditions. There is no uniform water provision system for the community- most get water from springs, others from rainwater catchment, and others from wells in the neighboring communities of Bondo and Lela. See Figure 2.3 for percentage distribution of water source usage in the community. Of the 40 surveyed houses only one house confirmed that they were satisfied with their own privately owned well bringing the overall satisfaction percentage to 2.5%. However due to the chapter's pre-project conditions and as per the data sheet instructions, this value was reported as 0%.

**Existing Conditions:** No conditions were reported because no system currently exists to meet the water needs of the majority of the Kibuon community members.

**Local Standard:** Not applicable due to pre-project conditions. However, the project team secured information on how drillers can acquire permits from the regulatory body known as the Water Resource Management Authority (WRMA) and how the chapter can acquire drilling permits from the environmental conservation and regulatory body known as the National Environment Management Authority (NEMA). The groundwater resource management standards can be found in the Water Resources Management Rules document and the Water Act, 2016 document of the Kenya Gazette.

**Women Involvement:** Involvement of women was at the core of deciding the seven potential locations for drilling wells because women in the Kibuon society collect water at frequencies higher than that of any other demographic. The CBO also has women representatives (6 out of the 17) who participated in the meetings between the CBO and the Harvard SEAS Chapter, the community meetings and the Women's meetings; the chair of the committee, Mercy Auma, is also a woman.

**Water Quality – Joint Monitoring Programme (JMP) community rainy:** Based on the 40 household surveys, the team determined that the level of access is 19.47 liters per person per day (Lppd) with their current water sources which places their access within the ballpark value for Basic access (20Lppd). However, it is important to note that a significant portion of the population is below this average because some households have as many as 30 people.

**Water Quality – JMP community dry:** Some households store water in their homes in preparation for the dry season; others hire motorcyclists to collect water for them at a fee. Regardless, most households reported decrease in water availability in the dry season, thus that can be extrapolated to a value below 15 Lppd. This places the communities access level at Emergency access (15 Lppd) during the dry season.

**Water Quantity – On day tested:** Not applicable due to absence of an existing system (pre-project conditions). As per the data sheet instructions this value was reported as 0.

**Water Quantity – Dry Season:** Not applicable due to absence of an existing system (pre-project conditions). As per the data sheet instructions this value was reported as 0.

**Water Quantity – Rainy Season:** Not applicable due to absence of an existing system (pre-project conditions). As per the data sheet instructions this value was reported as 0.

**Water Consumption – Community:** Not applicable. The team found that community members get water from different sources – not a single system. Some water sources, specifically the ones in the valley (such as Koyanda and Wadh Anyim), got higher number of visitors than others.

**Water Quality:** The spring water sources failed the test for appearance and quality; most sources had seemingly brown water- see appendix 5.2.3.6 (photographs). Chemical and biological test results can be found in appendix 5.2.1.

**Water Storage Safety:** The average frequency for water collection is 9.8 times per week suggesting that households collect water at least once every day. Almost all the households surveyed owned jerrycans (with small openings) that they used to collect and transport water and consequently store until depletion. In some rare cases members used buckets. The jerrycans had narrow mouths thus reducing risk of contamination. Additionally, all the surveyed households reported cleaning their jerrycans before collecting water. Therefore, it is estimated that over 76% of the users practice safe water storage.

**Water Transportation Safety:** All the surveyed households reported cleaning their jerrycans before collecting water for transportation. The narrow-mouthed containers decreased the risk of contamination making the estimate for users who practice safe water transportation be over 76%.

**Water Supplies near facilities:** The nearest improved water sources are located in the neighboring communities of Lela and Bondo; 3 wells in Lela and 1 in Bondo . However, the travel distance to these wells for most community members is more than 1 km and some residents would hire motorcyclists to collect water for them at an average frequency of 10 times per week.

**Water JMP Level of Service:** Most residents get water from unprotected springs and sometimes hand dug wells. This places the community's water resource in the Unimproved category of the WHO/UNICEF JMP Standard. Some residents get water from the Bondo and Lela wells but the travel time exceeds the 30 minutes threshold therefore placing these resources in the Limited category of the WHO/UNICEF JMP Standard.

**Water Collection Distance:** In the dry season 83.9% of the sampled households reported spending more than 30 minutes traveling to collect water. In the wet season 25.7% reported spending more than 30 minutes. Given that the average number of people per household is 9.225 and that there are 221 households, the following values were calculated as per the data sheet instructions:

$$\text{Dry season} = 83.9\% * 221 \text{ (households)} * 9.225 \text{ (people per household)} = 1710 \text{ people}$$

$$\text{Wet season} = 25.7\% * 221 \text{ (households)} * 9.225 \text{ (people per household)} = 523 \text{ people}$$

The dry season value, 1710 people, exceeds the total number of people (1600) in the community therefore suggesting all water users spend more than 30 minutes acquiring water from the sources. The PMEL object does not distinguish between seasons therefore the value reported is the average of 1710 and 523.

**Theft protection:** Due to pre-project conditions the team was unable to inspect the non-existent system for theft vulnerabilities. However, the CBO outlined a revenue plan that should cover the maintenance costs which will include theft protection features such as a fences and lockable enclosures for solar panels, pumps and control boxes.

### 3.1.2 Maintenance and Functionality

**Functionality On Day Observed:** This indicator is not applicable because an improved water source does not exist and therefore cannot be evaluated for functionality.

**Functionality:** This indicator is not applicable because an improved water source does not exist and therefore cannot be evaluated for functionality. As for the water from springs and hand dug wells, most households reported that it did not meet their needs unless filtered and or treated. Thus, the value reported for this indicator is 1%-25% (percentage of time that the system is working as intended).

**Community Identified Need:** An improved water source does not exist in Kibuon therefore the needs of the community members have not been met.

**Functionality Non-Performance Reason:** Not applicable due to pre-project conditions; an improved water source does not exist in Kibuon.

**Maintenance Completed:** It is inferred that the CBO will be capable of conducting maintenance activities given their commitment to the project and their current fundraising plans for future maintenance.

**Maintenance Non-Performance Reasons:** Not applicable due to pre-project conditions; an improved water source does not exist in Kibuon.

### 3.1.3 Community Capacity

**CBO Best Practices:** Kibuon's CBO was founded prior to the May 2019 assessment trip. The members were assisted through translation and guiding the team in the community. The CBO also serves as the maintenance body.

#### CBO Structure:

- Equitable cost sharing – All users of the system are required to pay the same registration fee. They will also pay equal amounts for monthly fees once a system is installed.
- Good record keeping - The treasurer of the CBO keeps a ledger with records on amount of money raised and expenditure.
- Fair elections – The CBO does not hold elections; instead members of the community collectively nominate their representatives. Although this is not as ideal as elections, the chapter reserves judgement because the CBO is still young and might undergo iterations to improve on its structure. For example, in 2017 the CBO was reformed to increase inclusivity and representation.
- Developing and maintain the respect of the community – while on the assessment tip, the project team observed good relations between the community and the CBO as the CBO assisted in translation and conducting household surveys.
- Conduct regular meetings – The CBO meets once every week on Thursday.
- Women as representatives in the CBO – 6 out of 17 of the CBO members are women.
- Balanced membership (non-nepotistic participation) – The CBO consists of members from each of the 4 regions that make up Kibuon. As it stands, there are no close familial ties amongst the members.
- Women in Leadership roles – The top three positions in the CBO hierarchy are all held by women:
  - Chair- Mercy Auma
  - Secretary - Eunice Awino
  - Treasurer - Jane Atieno Ajuang

Best practices **not** followed:

- Adequate funding for operation and maintenance – The team still need data from the CBO on the remaining amount of the 5% community contribution see section 2.3.4 (Outstanding Data needs)
- Frequent elections – the CBO does not hold frequent elections.
- Inclusive membership – The CBO members hold their positions until individuals decide to step down.

**CBO Fund Adequate:** The CBO currently has KSH 5000 in its bank account. When they start charging monthly fees the gross revenue per month will be KSH 4420 assuming all households register and pay the monthly fee.

**CBO Fund:** The CBO has an account with Equity Bank whose office are located about 8km away in Migori town.

**CBO Revenue Source:** Each household is expected to pay a one-time registration fee of 500KSH. In addition to that, it is likely that the CBO will adopt a model similar to that of the neighboring communities where each registered household is pays a monthly fee and non-registered members pay a per-jerrycan fee. The CBO also plan to hold community fundraisers, "harambees" in order to generate additional revenue.

**CBO Revenue Frequency:** One-time registration fee plus a monthly fee for registered members and a per use fee for non-registered members

**CBO Revenue Structure:** One-time registration fee plus tariff collection on a regular basis for registered members and a per use fee for non-registered members

**CBO Fund Amount:** 5000KSH (50 USD)

## 3.2 Revisions to Beneficiary Analysis

**Direct Beneficiaries:** The beneficiaries of this water supply system will be 221 households- a total of 1600 people- provided a well is within 30 minutes of each household.

**Duplicate Beneficiaries:** No duplicate beneficiaries. This will be the first project in Kibuon.

## 4. Next Steps

The next step is to find a solution suitable for the community's water needs. Below is a brief description of the options that will be considered by the chapter in the alternative analysis.

### 4.1 Borehole

This solution is the preferred one by the community; in their original application and during community meetings they requested the construction of a borehole. Before implementing this solution, a hydrogeological survey still needs to be conducted to determine whether a borehole is even possible in the locations chosen during the assessment trip. Borehole projects in nearby communities have positive reviews from the residents of Kibuon and if a similar project can be implemented in Kibuon, it has a good chance of being a stable water source. Advantages of a borehole include the ability to provide a clean water supply that will be enough for the community especially if using an electric pump which has higher flow rates, and this solution does not depend on variable weather data. However, a borehole could prove to be an expensive option since professional drillers need to be hired and in the long run maintenance might also be a financial issue. Additionally, there is no electricity in the community which limits the pump options to a solar powered pump, or a hand pump which has a much lower flow rate.

### 4.2 Rainwater Catchment System

This solution provides a less expensive alternative to a borehole, while also providing a clean water supply. To install a rainwater catchment system, rainfall data needs to be obtained as the project team currently do not have any rainfall data suitable for assessing this option; rainfall data could possibly be obtained from the weather station in Migori county. There is also a lack of public buildings in the community that have a central location and are good to use; the only existing public buildings are churches and one school, but the school is on the edge of the community. Churches could possibly be used but the project team would need to consider the social consequences of picking one church over another. The population of the community is also larger than expected so we would need to construct a comprehensive system that can collect enough water to support the large population of the community all year round, even in the dry seasons.

### 4.3 Spring Box

There are several springs being used by members of the community, but from the household surveys it seems like most of these springs are seasonal, so if a spring box is to be implemented the project team would need to plan construction in the dry season so that only reliable springs are used. While in the field, we conducted water testing using water testing strips, and the results of the tests, which are discussed in more details in section 2.3.2.4 and appendix 5.2.1, do not indicate that the water is suitable for drinking, thus a spring box might not be a viable option. To use this option a water test conducted by a professional lab will be needed.

### 4.4 Criteria that will be used to determine the best solution

1. Cost
2. Constructability
3. Ease of maintenance
4. Durability
5. Complexity of design
6. Human interaction
7. Water quality
8. Water availability
9. Availability of technical data



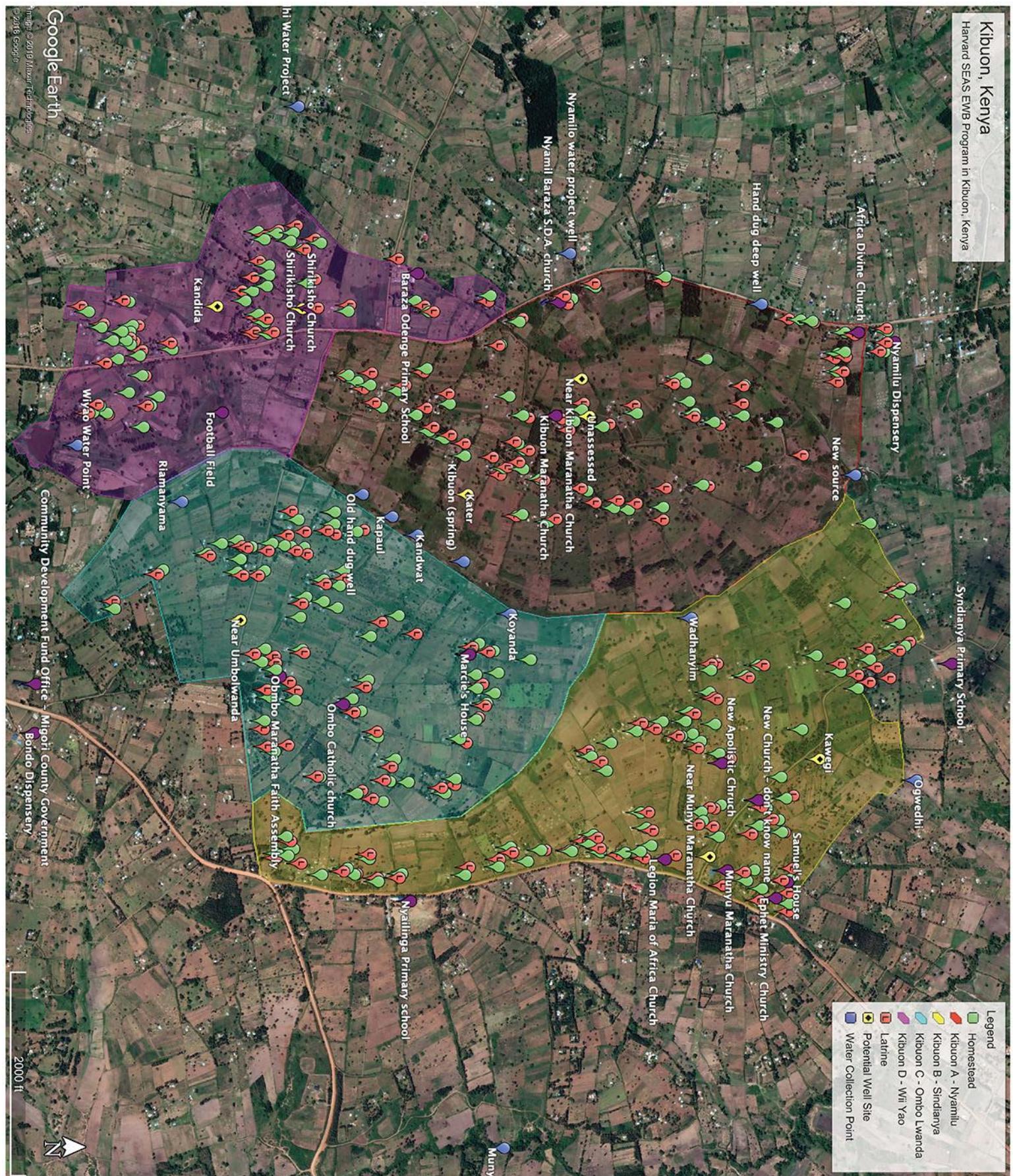
## 5. List of Attachments

### 5.1 Drawing Package

#### 5.1.1 Maps of Kibuon

Maps of Kibuon are on the following five pages.

Kibuon, Kenya



*Figure 5.1: Full map of Kibuon, Kenya*

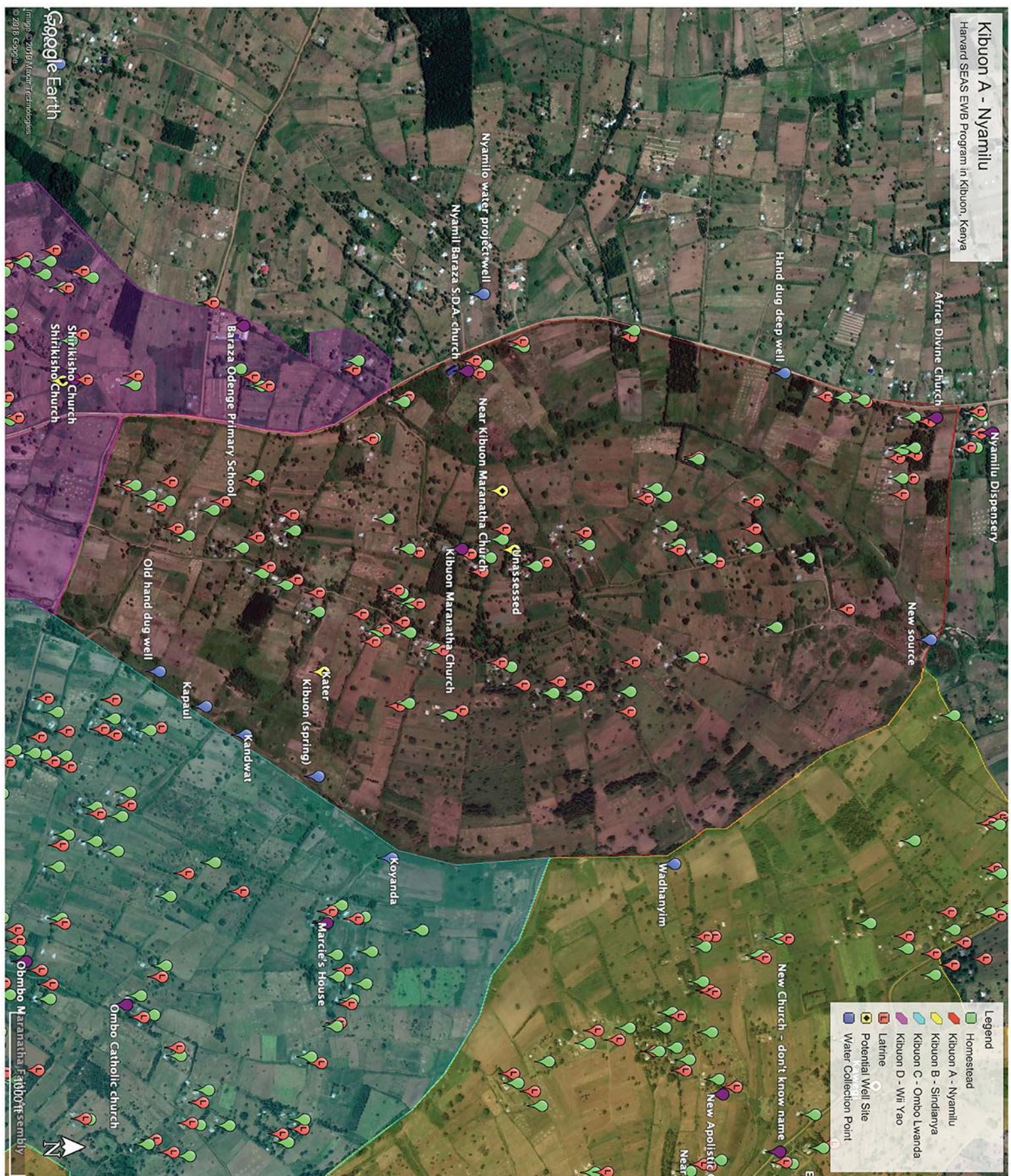


Figure 5.2: Map of Kibuon A - Nyamili

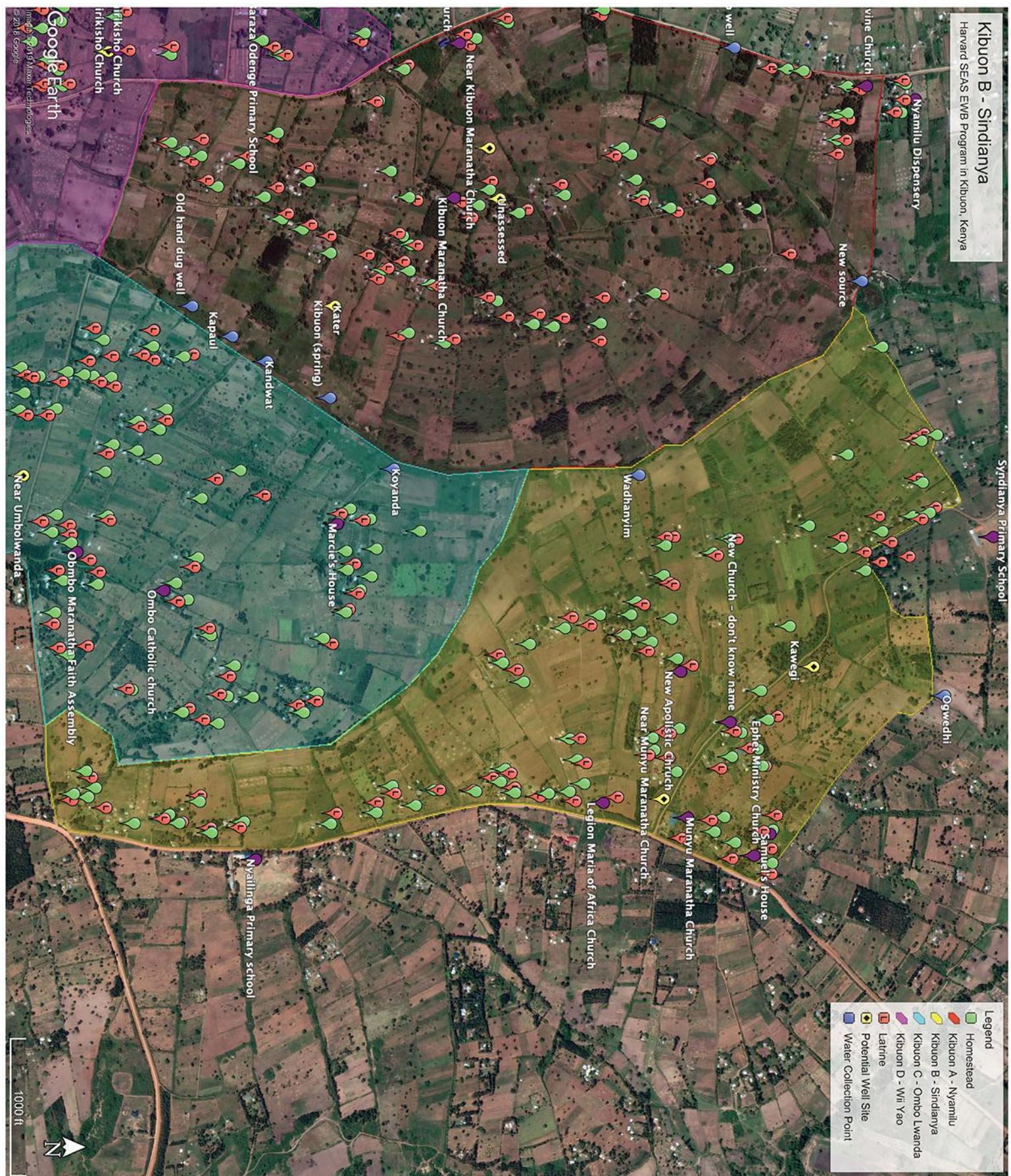


Figure 5.3: Map of Kibuon B - Sindianya

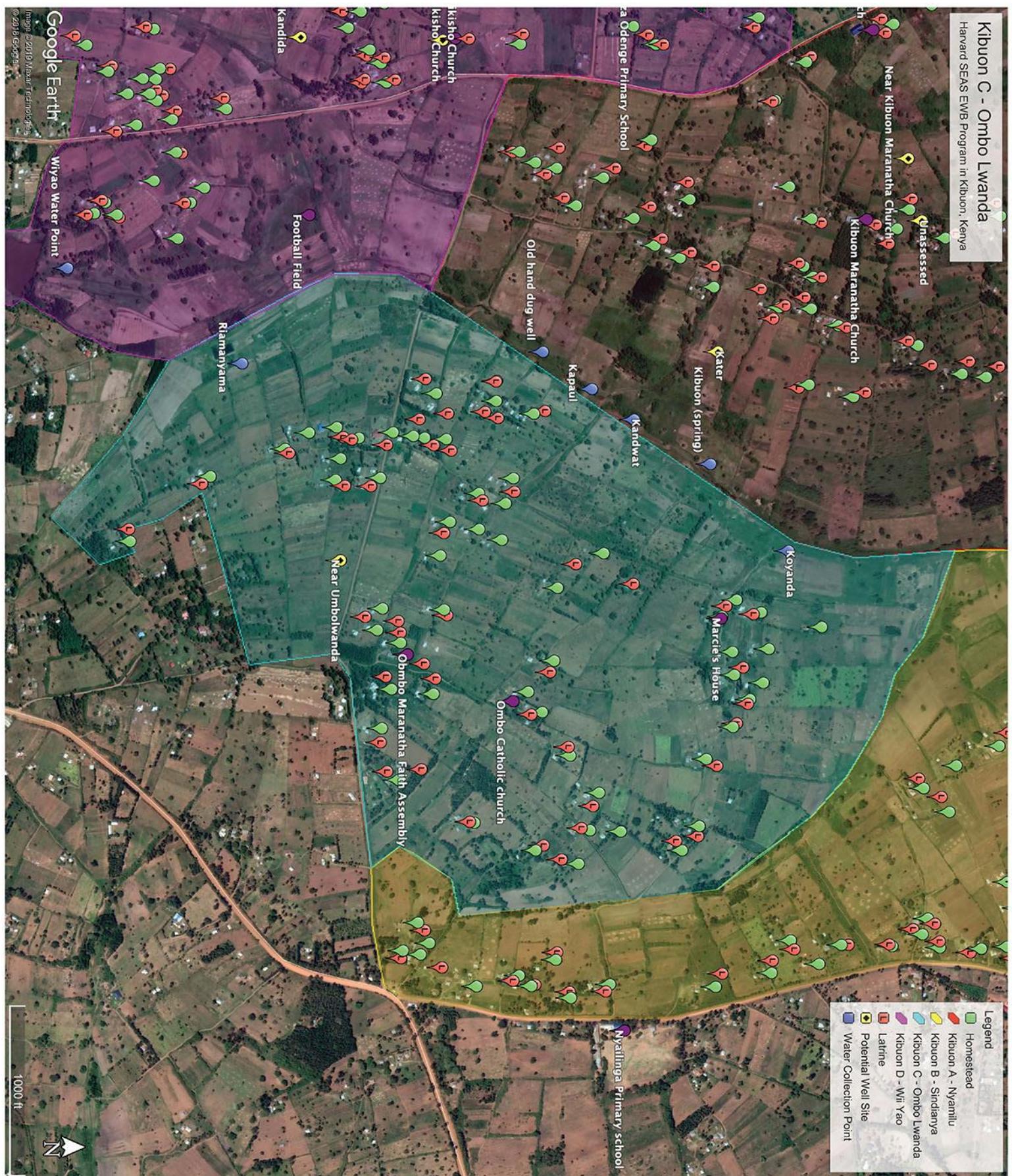


Figure 5.4: Map of Kibuon C - Ombo Lwanda

Kibuon D - Wii Yao  
Harvard SEAS EWB Program in Kibuon, Kenya

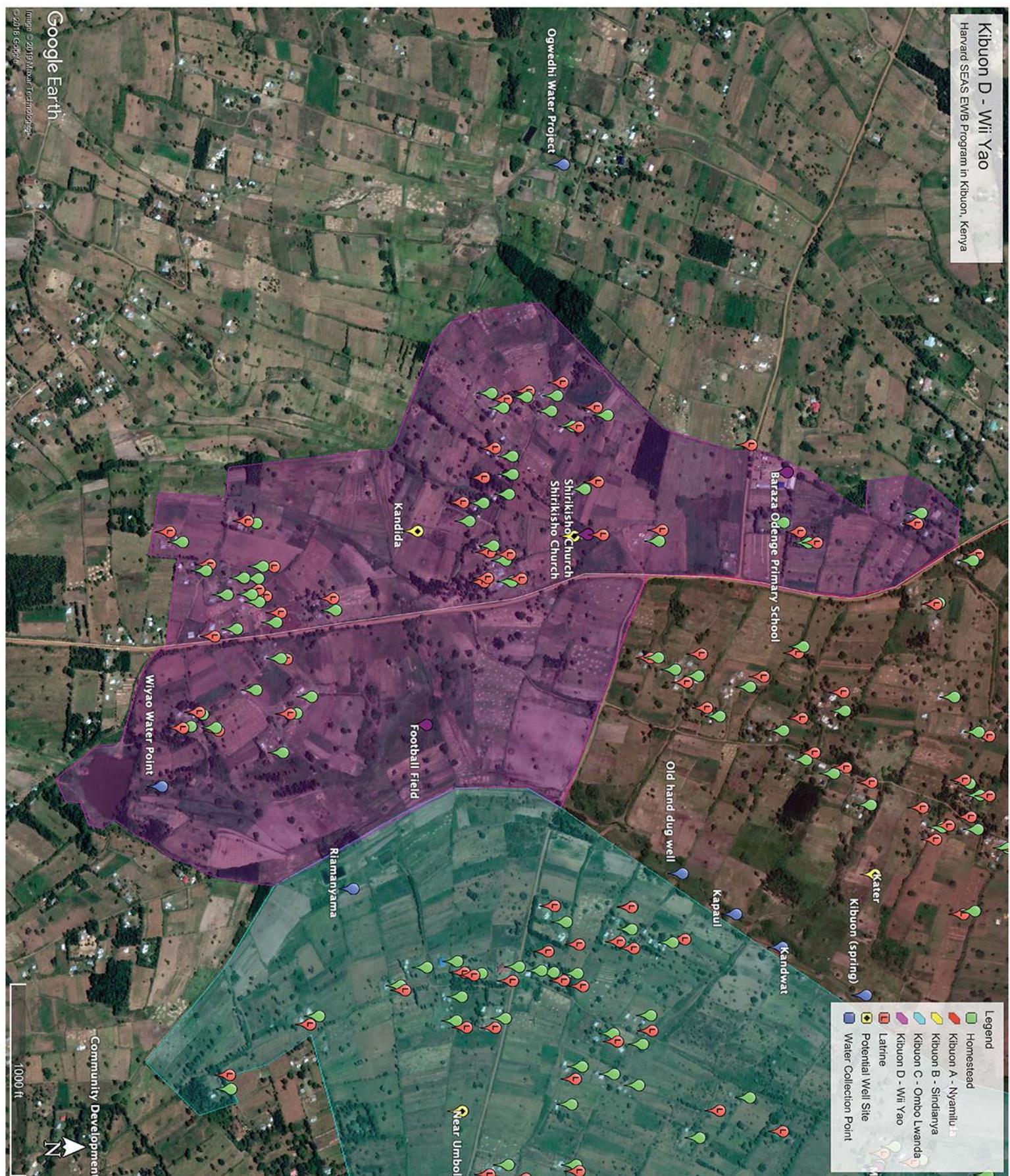


Figure 5.5: Map of Kibuon D - Wii Yao

## 5.2 Data from this Assessment trip

### 5.2.1 Water Quality Data

	pH	TDS (ppm)	Hardness (ppm)	Alkalinity (ppm)	Nitrate (ppm)	Nitrite (ppm)	Phosphate (ppm)	Ammonia (ppm)	Metals, bivalent (ppb)	Total Coliform (CFU)	e.coli (CFU)
Kenyan Standard <sup>4</sup>	6.8 - 8.5	1500	500	No standard	10	3*	No standard	0.5	Cu: 100 Co: No standard Zn: 5000 Cd: 5 Ni: 70* Hg: 1	0	0
Wadhanyim	7.2	66	20	180	0	0	5	0.5	< 10	TMTC	16 15 15
Ogwedhi	7.2	113	250	180	< 0.5	0.15	5	0	< 10	TMTC	> 20 11
Hand Dug Deep Well	6.8	81	120	120	0	0	5	0.5	< 10	TMTC	1 1 2
Koyanda	6.2	40	50	40	2	0.15	15	0.5	< 10	TMTC	44 40 31
Kibuon	6.8	61	120	80	0	0	15	1.0	< 10	TMTC	30 > 30 > 30
Kondwat	6.8	108	250	180	0	0	5	0	< 10	TMTC	8 12 18
Kapaul	6.8	58	120	40	0	0	5-15	0.5	< 10	TMTC	8 12 11
Riamanya ma	6.2	42	50	40	0.5	0	15	0	< 10	TMTC	25 29 23
Wiyao	6.8	76	120	80	0	0	5	3-6	< 10	TMTC	1 4 5
MCA Taps	8.4	148	425	240	0	0	5	0.5	50-100	2 3 1	0 0 0
Bondo A – Hope College EWB	6.8	171	425	240	0	0	5	0	< 10	N/A	N/A
Lela B – OSU/SF Prof EWB	6.8	128	250	240	0	0	30	0	100	N/A	N/A
Bondo Kiosk	8.4	133	250	240	0.5	0	5	0.5	100	N/A	N/A

### 5.2.2 Potential Well Site Assessment

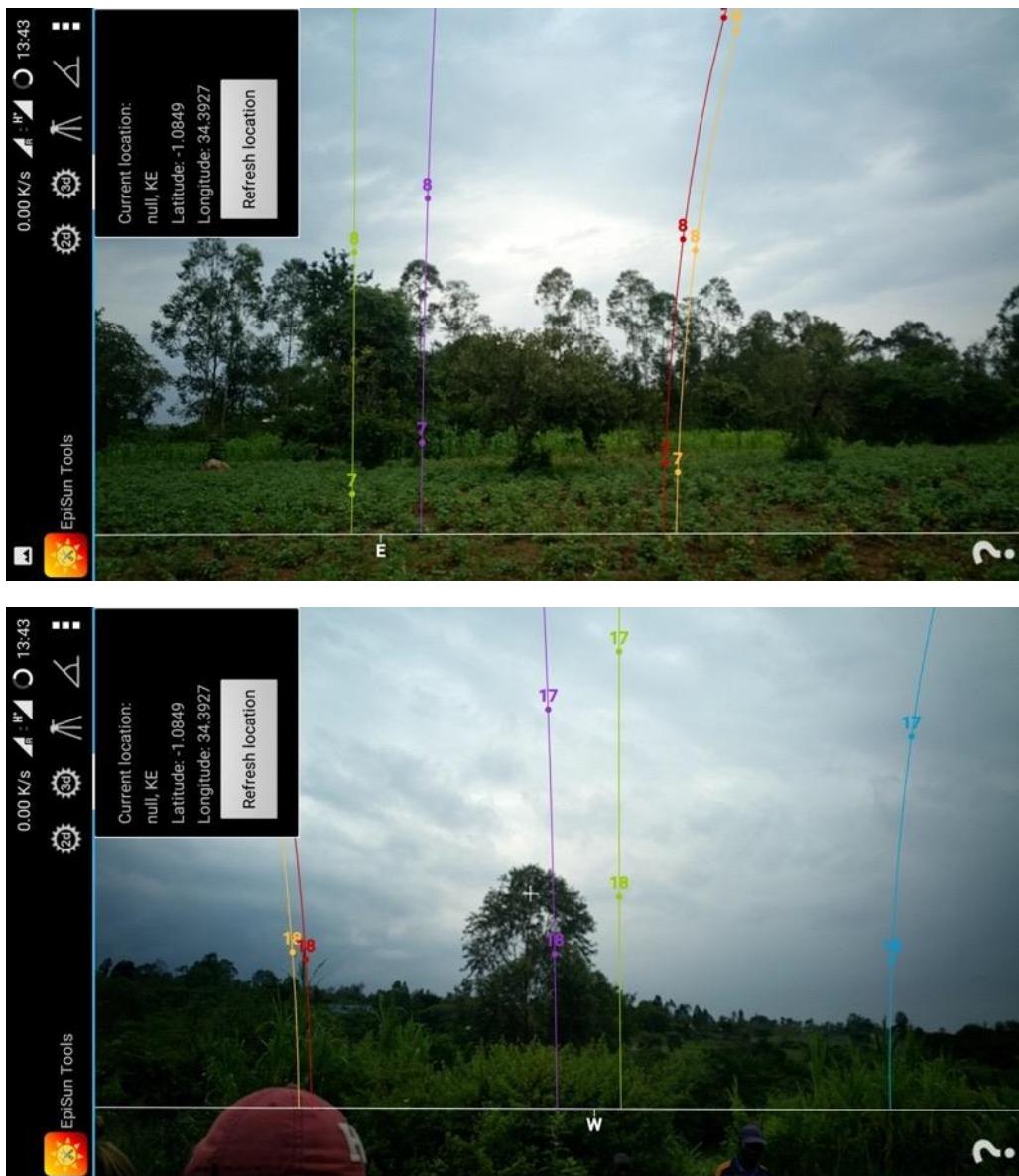
The map of all potential well sites is shown in Figure 2.8. Below the site assessment data will be presented for each of the seven assessed well sites. Images from EpiSun Tools have the following sun

<sup>4</sup> Guidelines On Drinking Water Quality And Effluent Monitoring, Kenya Water Services Regulatory Board, [https://wasreb.go.ke/downloads/Water\\_Quality\\_&\\_Effluent\\_Monitoring\\_Guidelines.pdf](https://wasreb.go.ke/downloads/Water_Quality_&_Effluent_Monitoring_Guidelines.pdf). If a Kenyan standard could not be found, the entry is marked with \* and the WHO standard was used

traces: winter = blue, spring = green, summer = yellow, autumn = violet, current day (June 9-10, 2019) = red.

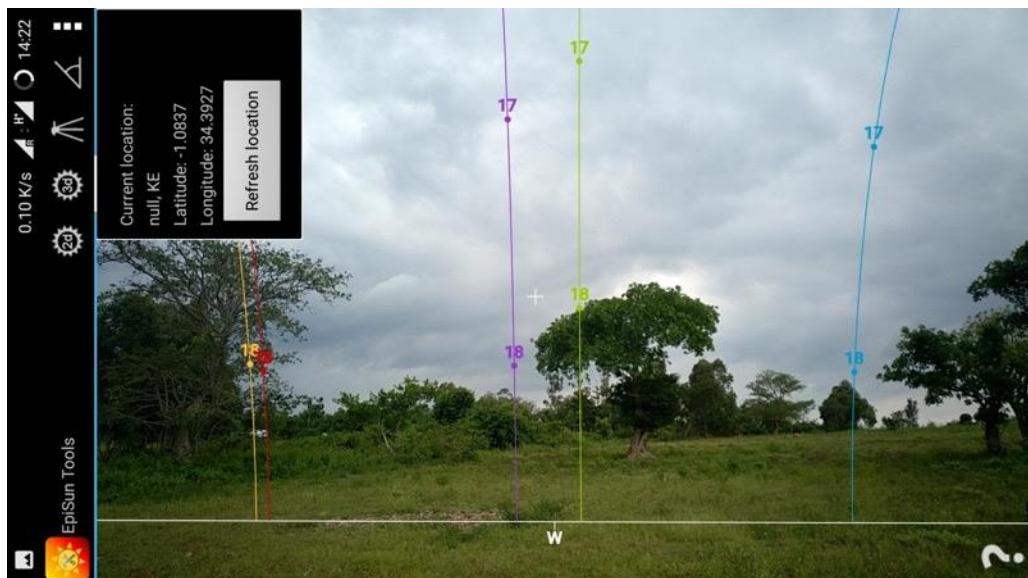
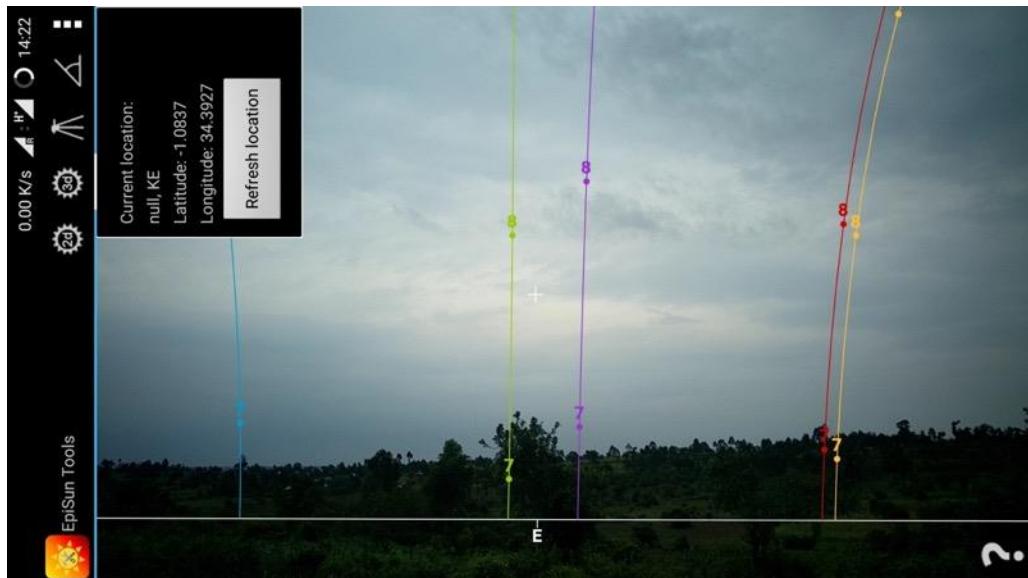
### 5.2.2.1 Near Kibuon Maranatha Church

<b>Sector</b>	Kibuon A – Nyamilu
<b>GPS Coordinates</b>	-1.083961, 34.391740
<b>Soil Type</b>	Silty Gravel with Sand (GM): Coarse grained soil, Brown, ~40% gravel, ~20% sand, ~40% fines
<b>Electric Utility</b>	N/A
<b>Solar Survey</b>	Very few shading issues at dawn or dusk throughout the year
<b>Accessibility</b>	~135 meters to the nearest house and >100 meters to the nearest latrine. This site is behind James Ogweno's cultivated land and seems to be a fallow area at the time of inspection. Drill rig needs to pass over cultivated lands to reach the site and no nearby road access.



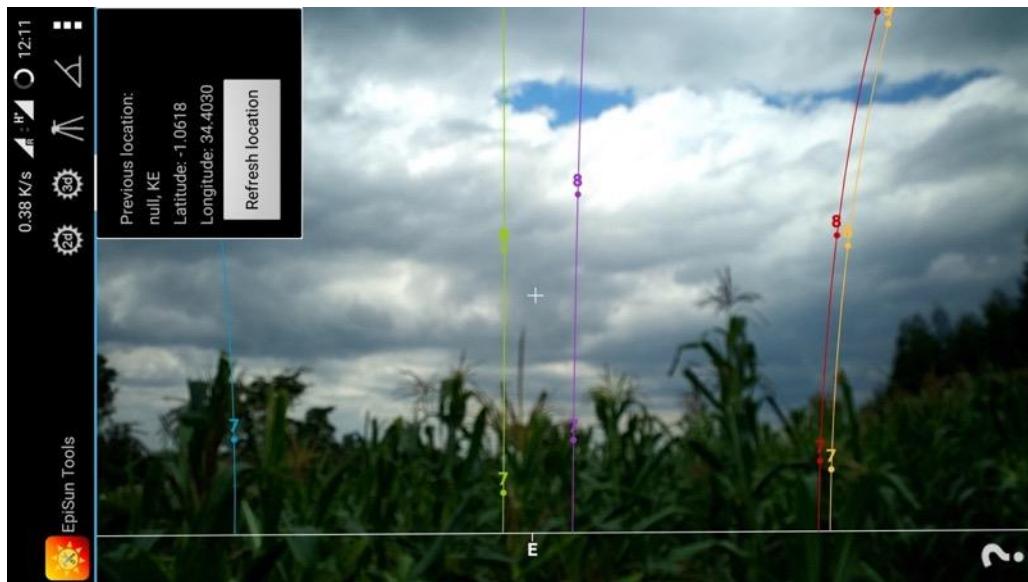
### 5.2.2.2 Kater

<b>Sector</b>	Kibuon A – Nyamilu
<b>GPS Coordinates</b>	-1.086971, 34.394797
<b>Soil Type</b>	Silty Gravel with Sand (GM): Coarse grained soil, ~%35 gravel, ~%25 sand, ~% 40 fines
<b>Electric Utility</b>	N/A
<b>Solar Survey</b>	Very few shading issues at dawn throughout the year. In the summer this site will experience shading beginning around 17:00.
<b>Accessibility</b>	No latrines or homes within 100m.



### 5.2.2.3 Near Munyu Maranatha Church

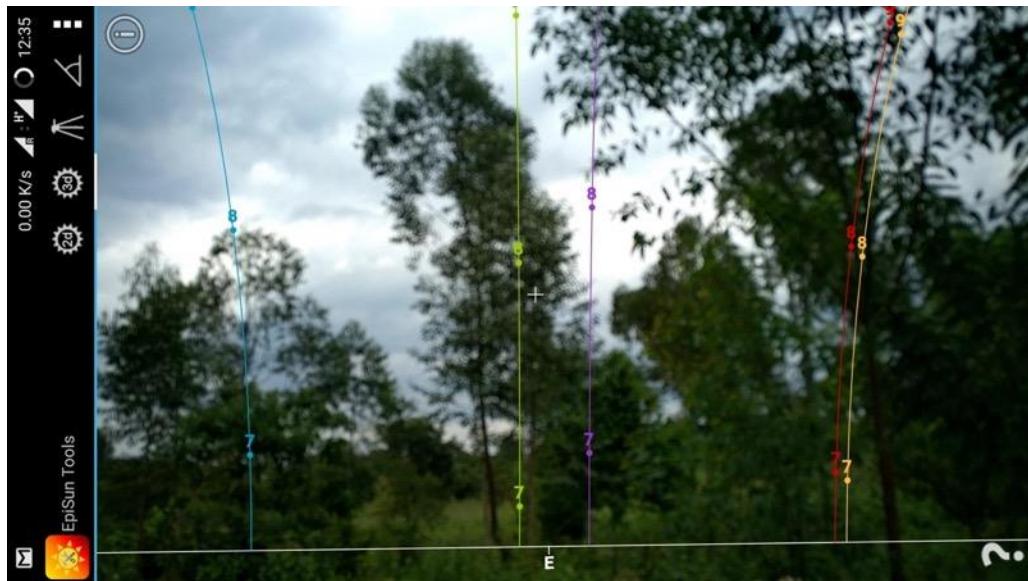
<b>Sector</b>	Kibuon B – Nyamilu
<b>GPS Coordinates</b>	-1.080579, 34.404386
<b>Soil Type</b>	Silty Gravel with Sand (GM): Fine grained soil, Brown, ~55% fines, ~35% gravel, ~15% sand, organic matter present
<b>Electric Utility</b>	There is an electric utility pole at a heading of 28° and distance of 29m.
<b>Solar Survey</b>	Very few shading issues at dawn throughout the year. In the summer this site will experience shading beginning around 14:30.
<b>Accessibility</b>	Good access for a drill rig due to the presence of a wide road running past Maranatha Church. The site is ~30 meters from the main road and the nearest latrine is ~80 meters away.





#### 5.2.2.4 Kawegi

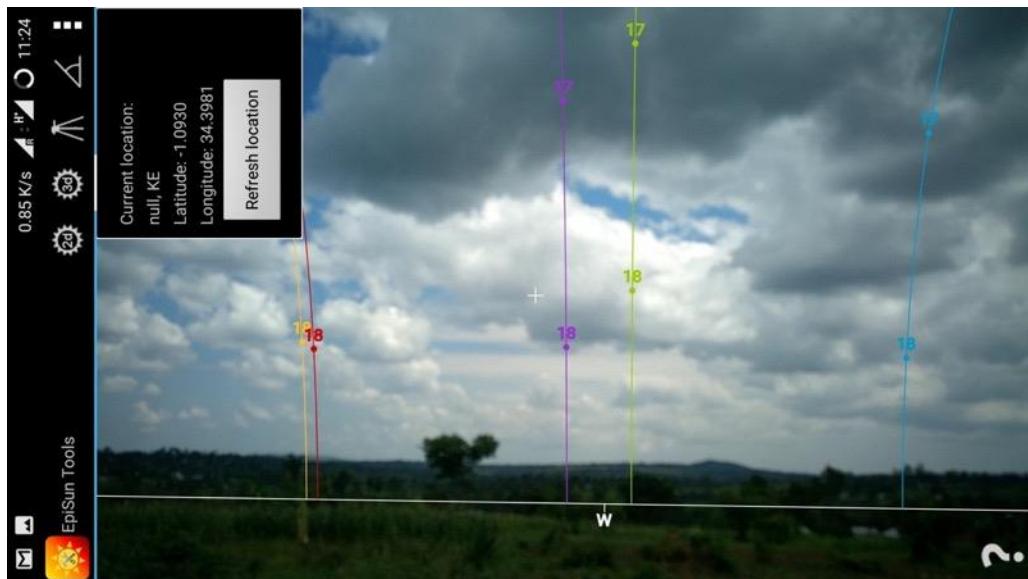
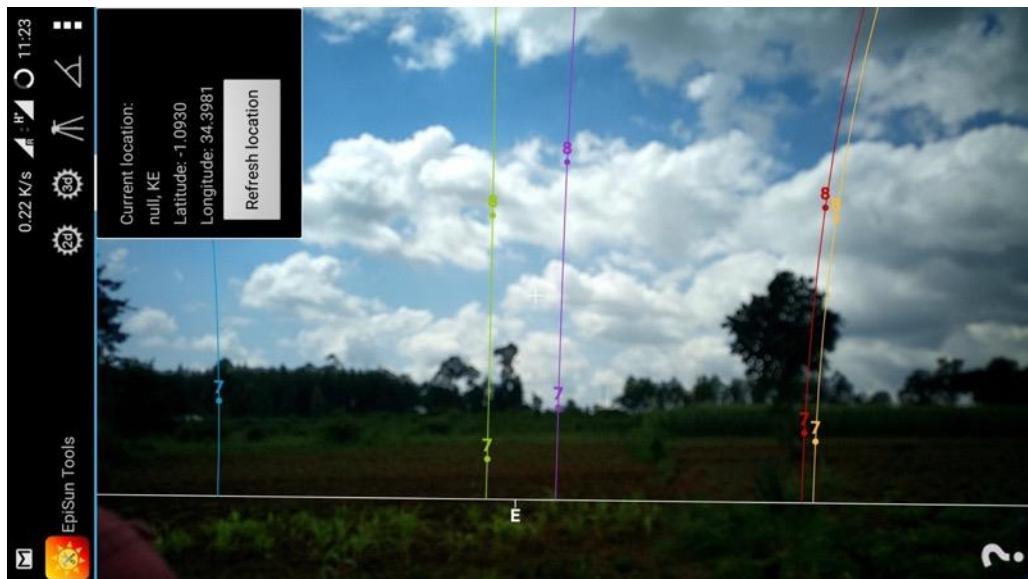
<b>Sector</b>	Kibuon B – Nyamilu
<b>GPS Coordinates</b>	-1.077636, 34.401824
<b>Soil Type</b>	Silty Gravel with Sand (GM): Coarse grained soil, ~45% fines, ~35% gravel, ~20% sand
<b>Electric Utility</b>	There is an electric utility pole at a heading of 236° and distance of 18m.
<b>Solar Survey</b>	There are significant shading issues in the morning ending around 8:00 or 9:00 in the winter and spring. These shading issues continue until 10:00 in the summer. In the winter there are shading issues from 12:00–14:00. In the evening there are relatively few shading issues throughout the year which begin around 17:00.
<b>Accessibility</b>	Good road access, but uneven terrain with some trees and boulders. Currently cultivated. Home nearby but no marked latrines within 100m.





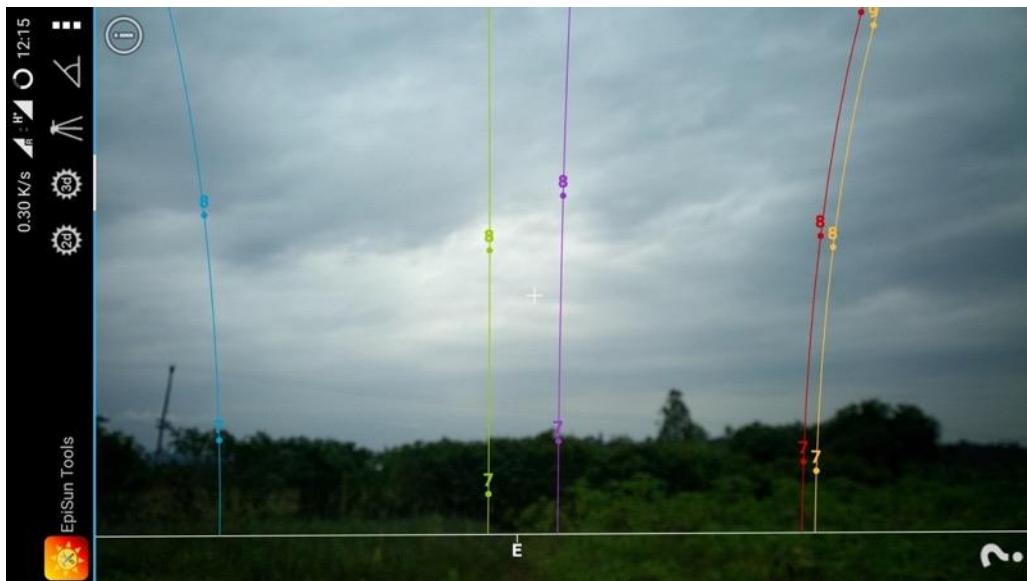
#### 5.2.2.5 Near Ombo Lwanda

<b>Sector</b>	Kibuon C – Ombo Lwanda
<b>GPS Coordinates</b>	-1.092940, 34.398123
<b>Soil Type</b>	Gravelly Silt with Sand (ML): Fine grained soil, Brown, ~50% fines, ~35% gravel, ~15% sand
<b>Electric Utility</b>	N/A
<b>Solar Survey</b>	There are no significant shading issues throughout the year. In the summer there may be some shading until 8:00.
<b>Accessibility</b>	Access to wide road next to property with no major obstructions. Property currently cultivated. No latrines or houses within 100m.



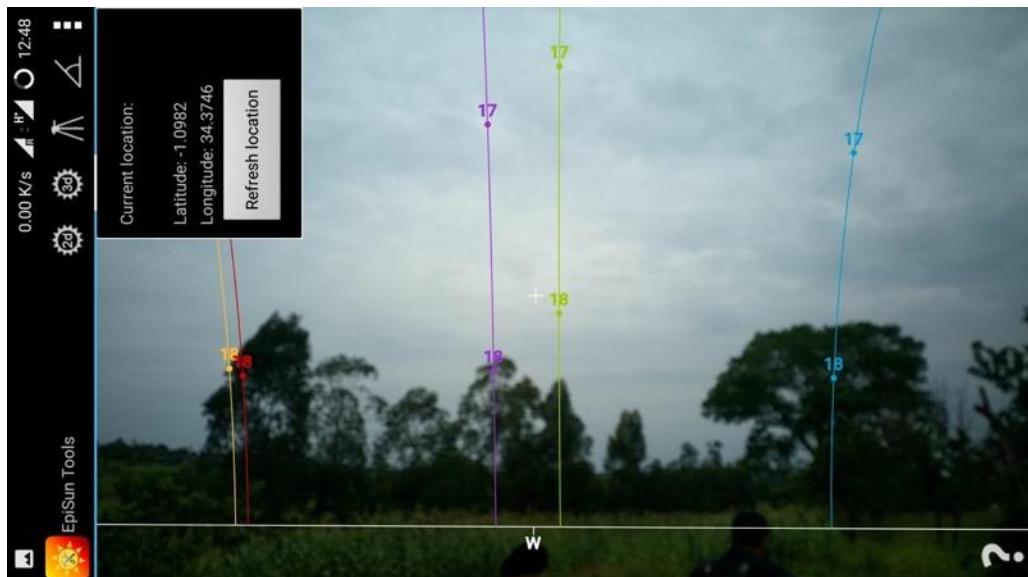
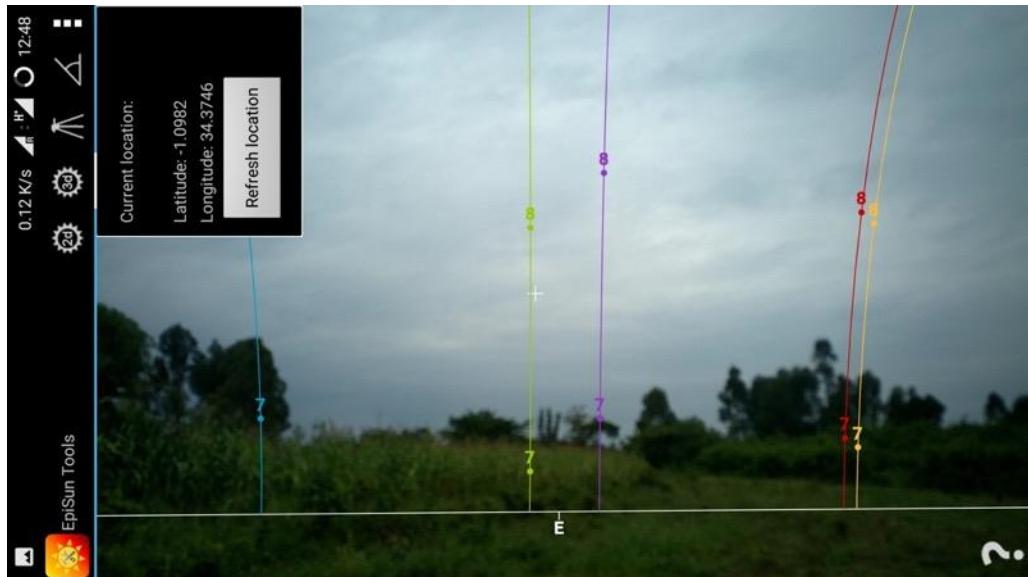
#### 5.2.2.6 Near Shirikisho Chruch

<b>Sector</b>	Kibuon D – Wii Yao
<b>GPS Coordinates</b>	-1.091338, 34.389900
<b>Soil Type</b>	Silty Gravel with Sand (GM): Coarse grained soil, ~45% gravel, ~20% sand, ~35% fines
<b>Electric Utility</b>	N/A
<b>Solar Survey</b>	There are no significant shading issues in the morning throughout the year. In the evening, shading begins at 17:00 or before throughout the year.
<b>Accessibility</b>	Easy access for drill rig. Potential well site is located in between cultivated lands and ~100 meters from Shrikisho church.



#### 5.2.2.7 Kandida

<b>Sector</b>	Kibuon D – Wii Yao
<b>GPS Coordinates</b>	-1.093592, 34.389825
<b>Soil Type</b>	Silty Gravel with Sand (GM): Coarse grained soil, Light Brown, ~40% gravel, ~40% fines, ~20% sand
<b>Electric Utility</b>	N/A
<b>Solar Survey</b>	There are no significant shading issues throughout the year. In the summer there may be some shading until 8:00.
<b>Accessibility</b>	Good access for a drill rig. Nearest latrine is roughly 300 meters away from this location. This site would not require anyone to give up their cultivated land.



## 5.2.3 Household Survey Data Analysis

### 5.2.3.1 Data Information

All of the following data was obtained through the self-reported household surveys conducted by travel team members. All percentages and data points are based on these sample sizes:

- Total Kibuon: 40 households surveyed
- Region A: 10 households surveyed
- Region B: 10 households surveyed
- Region C: 14 households surveyed
- Region D: 6 households surveyed

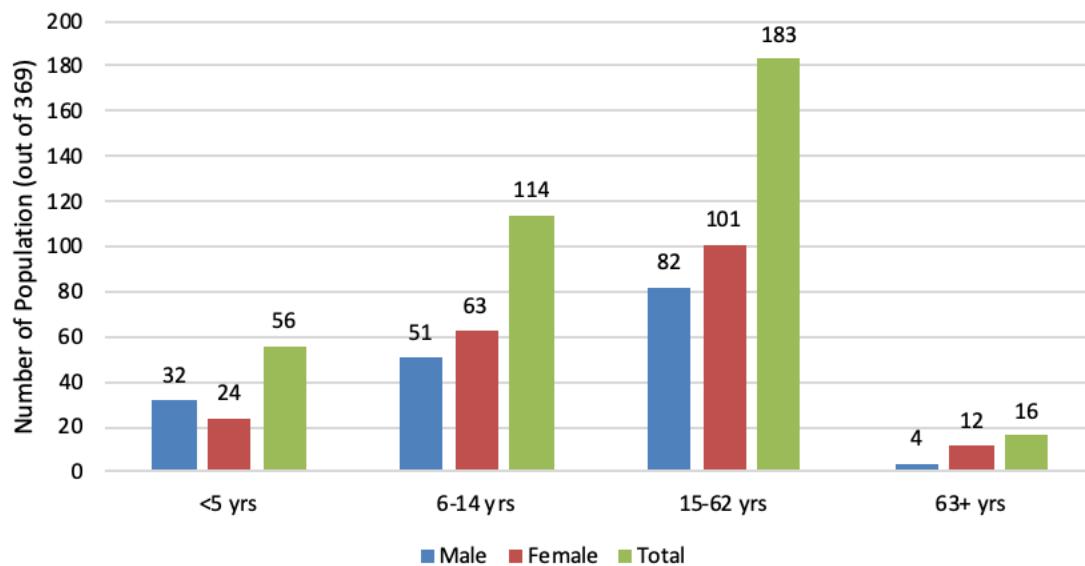
These sample sizes also very roughly approximate the relative sizes and populations of each region.

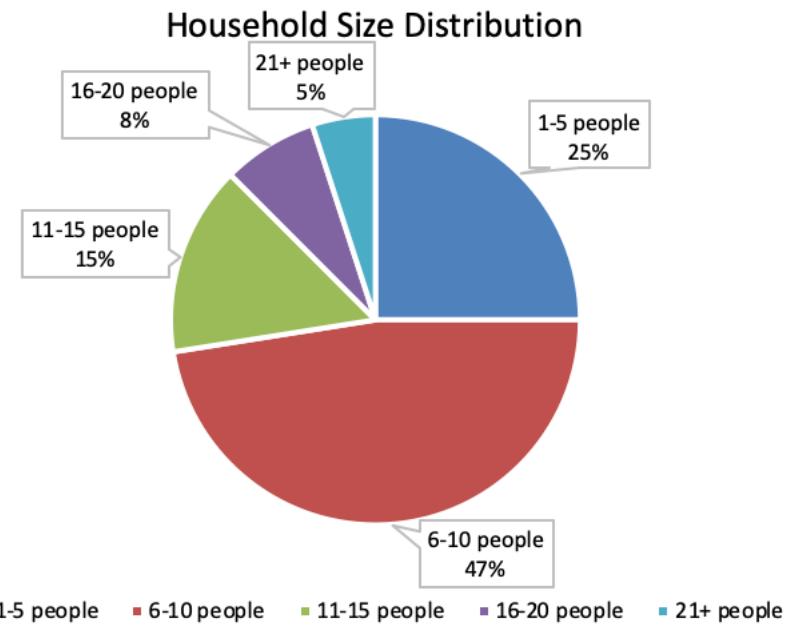
*Table 5.6: Calculated Averages from Household Surveys*

Data	Value
Average household size	9 people
Households with at least one child in school	36 out of 40 households
Households that hire motorcycles to collect water	22 out of 40 households
Average frequency of hiring motorcycles	10 times per week
Average number of jerrycans per trip	5 jerrycans each trip
Average total water usage per household	180 liters per day
Average drinking water usage per household	27 liters per day
Average reported fair price for one jerrycan of water	5.36KSH (0.05USD) 75% of respondents reported 5KSH 95% of respondents reported 3-10KSH 1 reported 15KSH, 1 reported 0KSH
Average time spent getting to school	25 minutes each way

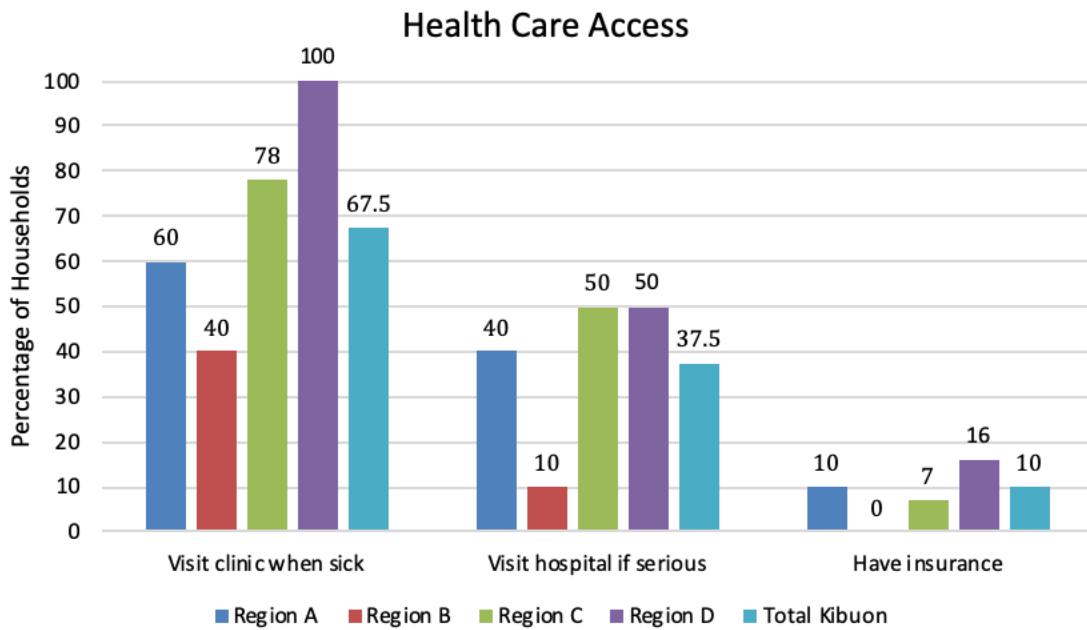
### 5.2.3.2 Population Data

**Population Distribution (out of 369 people)**



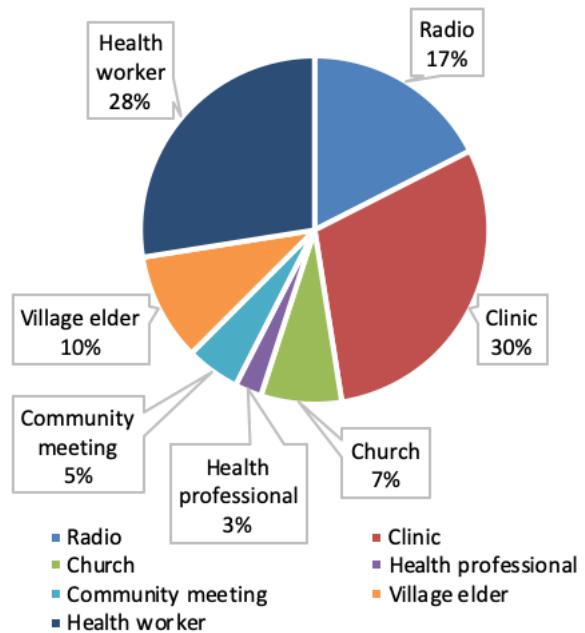


#### 5.2.3.3 Health Data

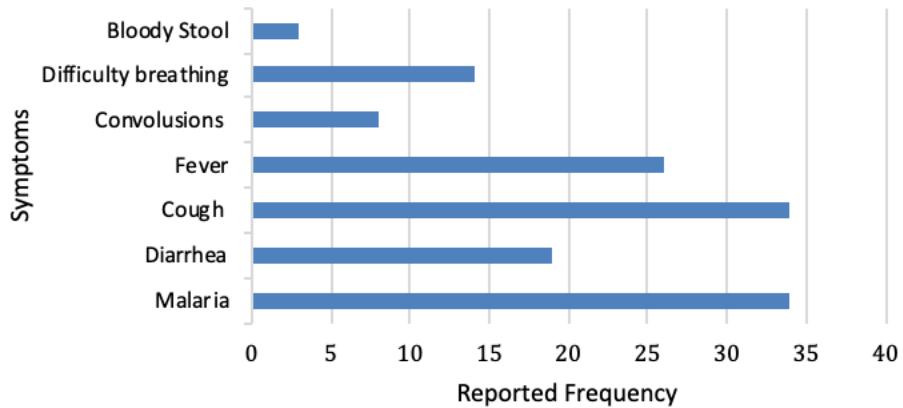


## Where do you get your health information?

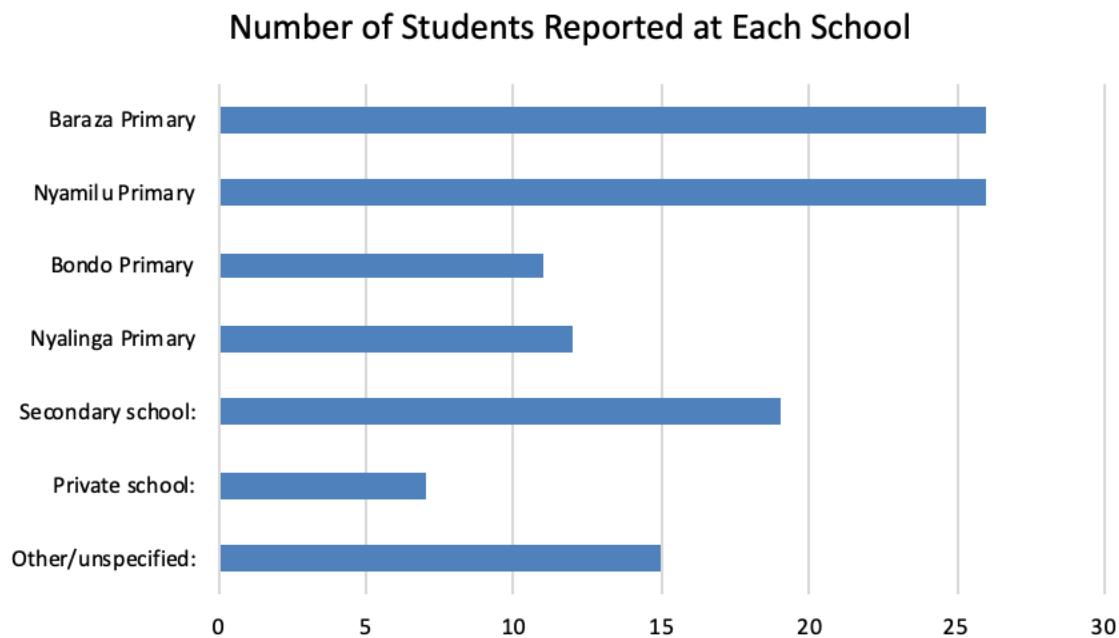
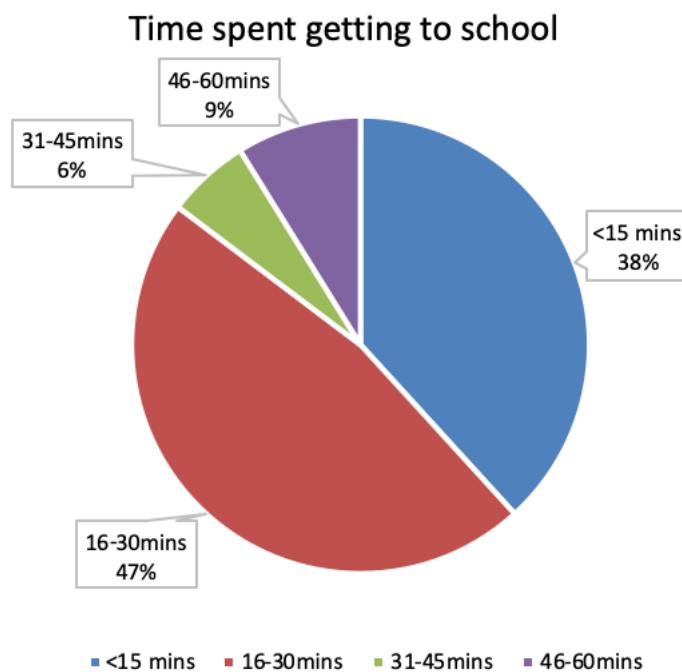
(note: some households reported more than one, or omitted response)



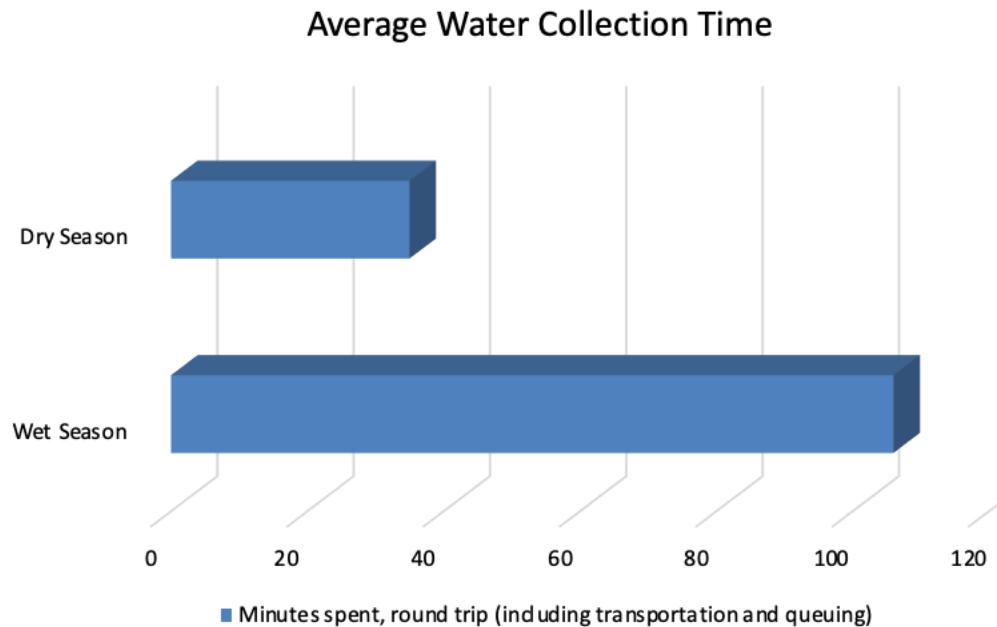
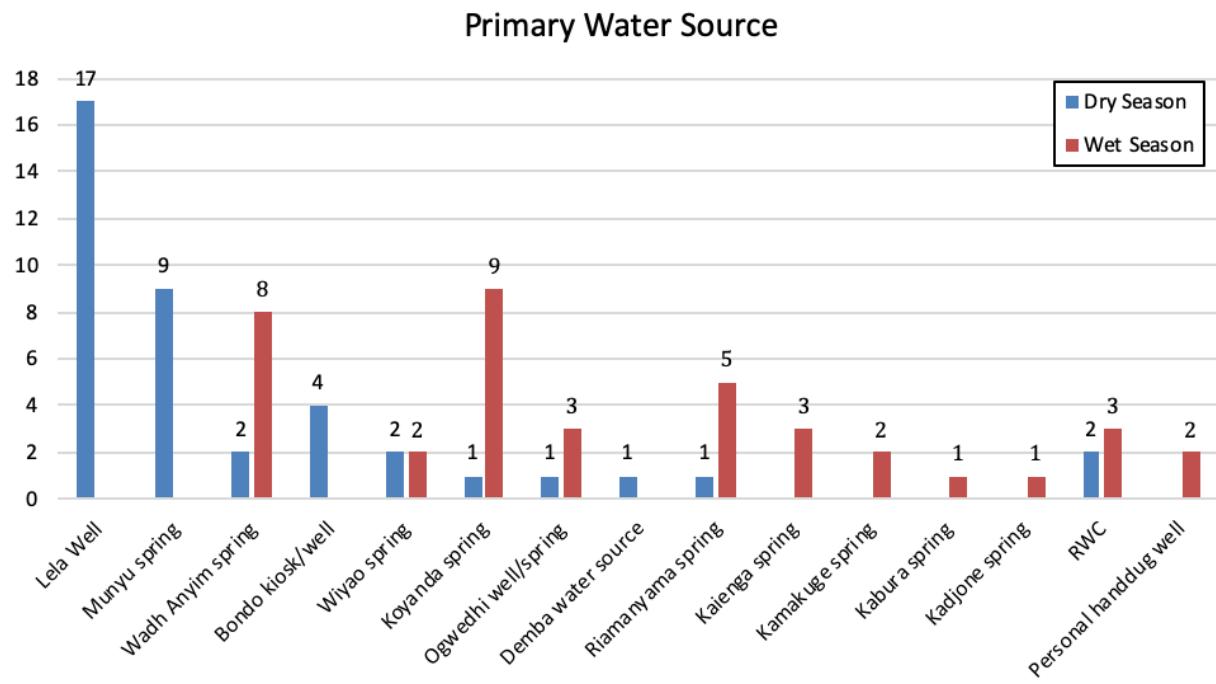
## In the past month have your children experienced



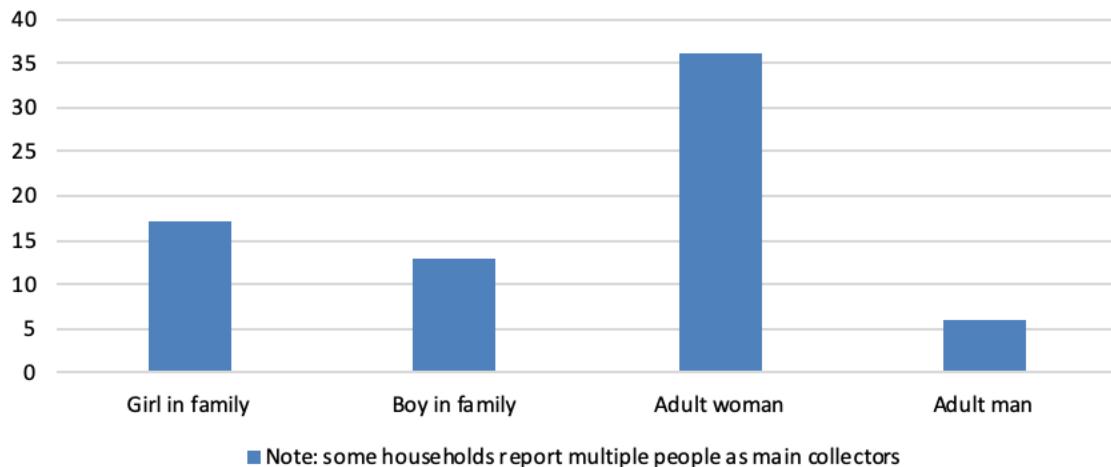
#### 5.2.3.4 Education Data



#### 5.2.3.5 Water Collection Data

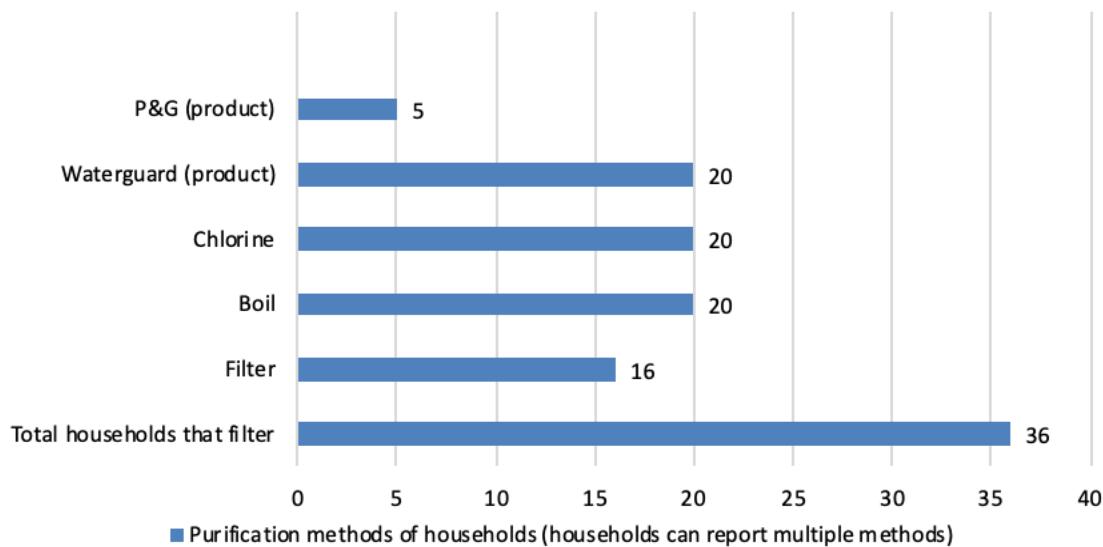


### Who Collects Water Most Often for the Household?

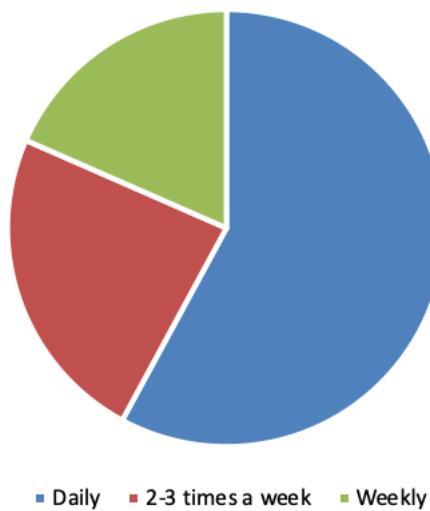


#### 5.2.3.6 Water Purification Data

### Household Purification Methods

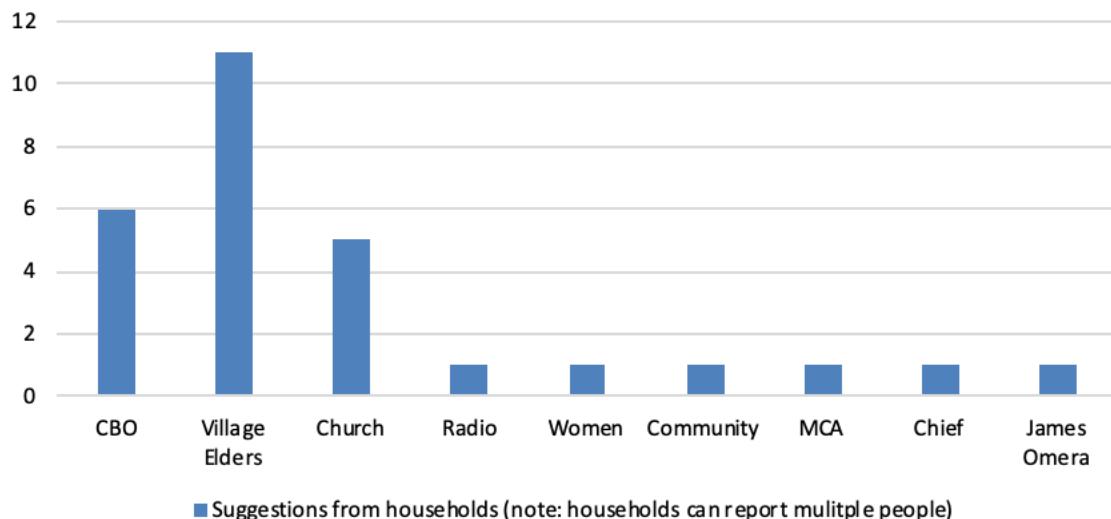


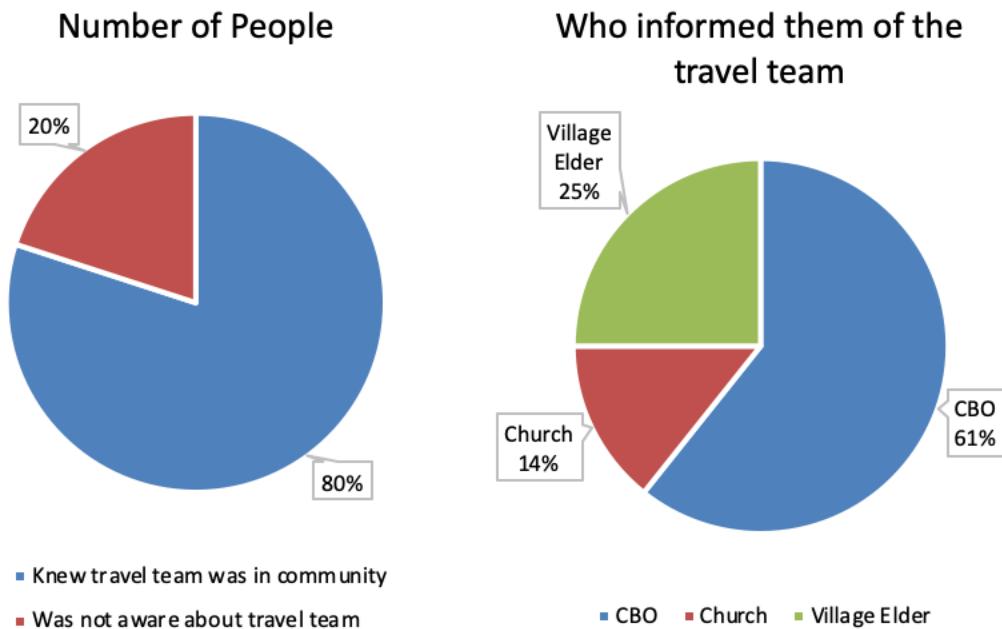
### How Frequently Households Clean their Water Containers



#### 5.2.3.7 Community Leader Data

##### Suggestions from households (note: households can report multiple people)





## 5.3 Photographs

### 5.3.1 6/2/19



Figure 5.7: First View of Community from Kibuon Hill



Figure 5.8: Kuria Tank Stand



Figure 5.9: Electric Pump & Well



Figure 5.10: Private Electric Pump Installed by WECCO

### 5.3.2 6/3/19



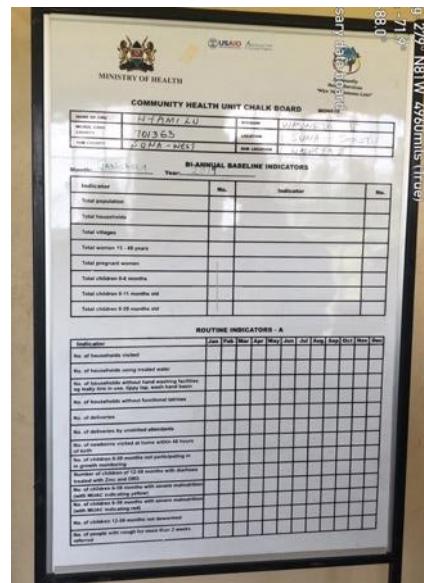
Figure 5.11: CBO Meeting Photo





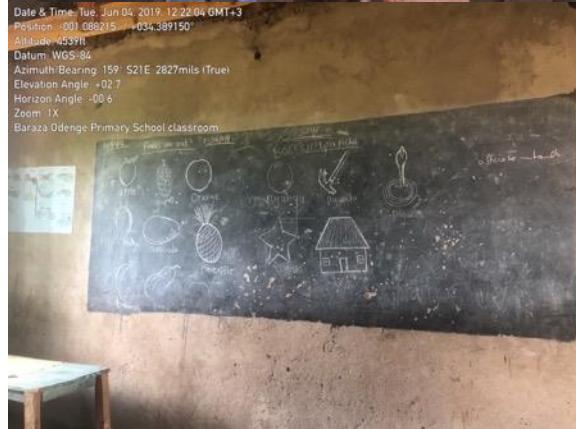
Figure 5.12: Springs seen on 6/3

5.3.3 6/4/19



Assessment – Post-Trip Report  
 Harvard SEAS Chapter  
 Kenya, Kibuon Water Project

Revised 02/2019



Assessment – Post-Trip Report  
 Harvard SEAS Chapter  
 Kenya, Kibuon Water Project

Revised 02/2019

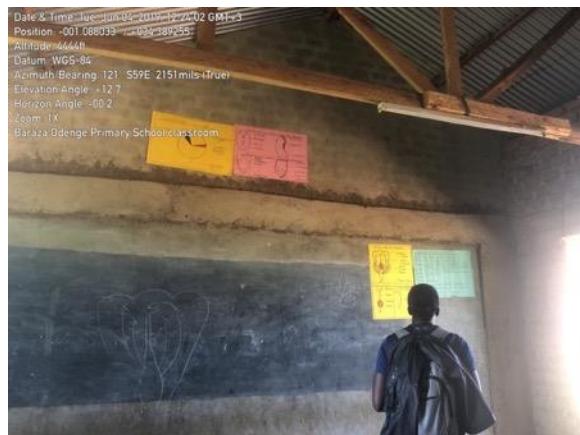
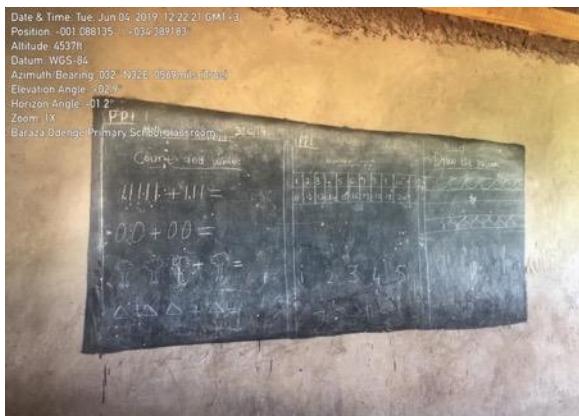




Figure 5.13: Images from Perimeter Walk/Spring Walk

#### 5.3.4 6/6/19



*Figure 5.14: Water Treatment Methods available at Grocery Store in Migori*

### 5.3.5 6/8/19



*Figure 5.15: Women's Meeting*

### 5.3.6 6/11/19



*Figure 5.16: Bondo Well Assessment*



Figure 5.17: Bondo Hand Pump Assessment



Figure 5.18: Municipal Tank & Pump



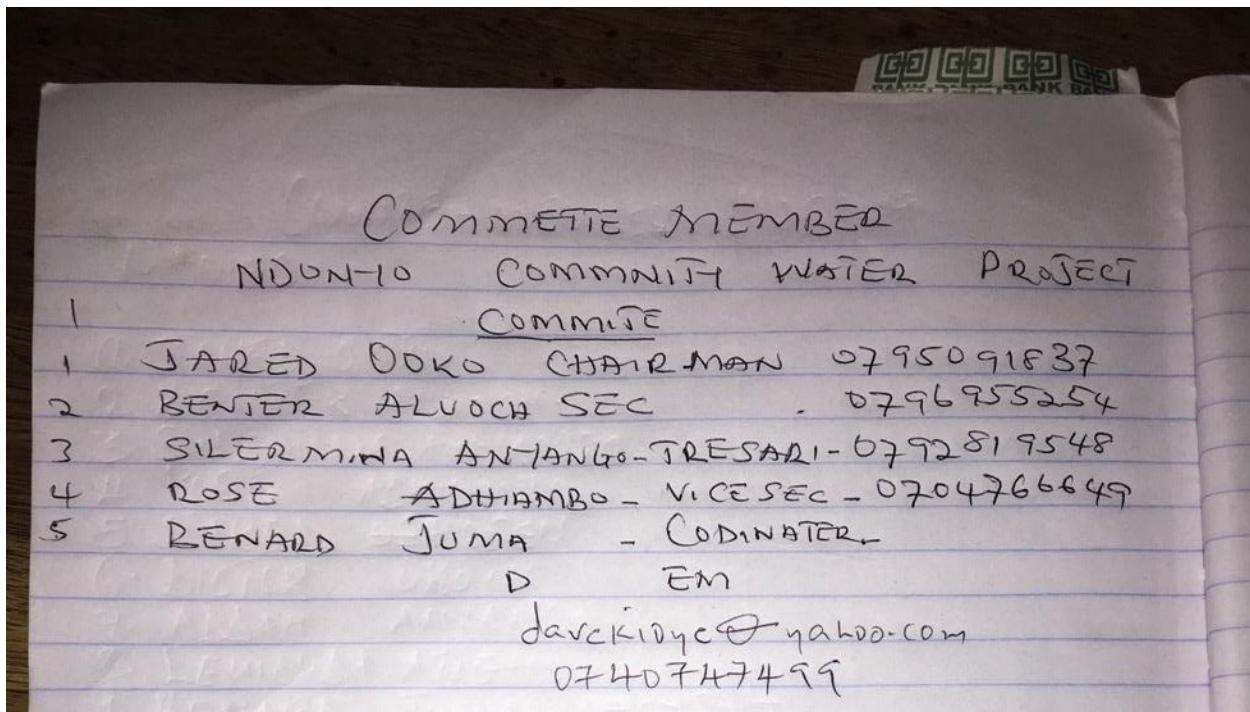
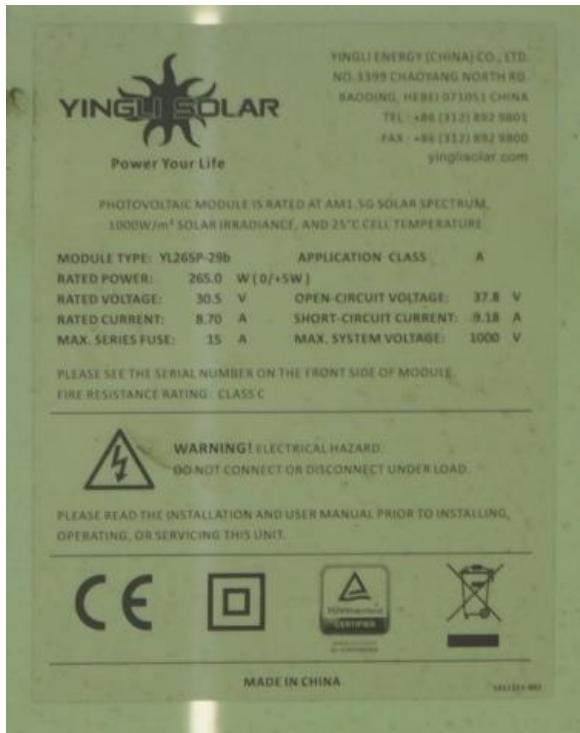


Figure 5.19: Ndonyo Water Project Contact Info, a Prospective EWB Partner Community

### 5.3.7 Lela Hand Pump Assessment



### 5.3.8 Bondo Well & Solar Pump Assessment



### 5.3.9 Dispensary Surveys

Bondo Dispensary Photo Log	
6-7-19	
Photo #	Date Type + Summary
4414	ANC chart 2019
4415	ANC Performance 2016 - 2017
4416	Antenatal Antenatal Clinic Data 2018 + 2019 ↳ HIV, syphilis, # clients, pregnant
4417	ANC chart 2018
4418	Posters + charts + office/room "
4419	Reno's / her Nurse's Office "
4420	Posters + charts + office/room "
4421	Medicine Room w/ Drugs "
4422	"
4423	"
4424	"
4425	"
4426	"
4427	"
0071	HTS Performance 2018
0074	Medical Room w/ bed
0081	Dispensing Interior
0082	Immunizations 2019
0083	Sura West Antigen Performance (June/July/August 2018)
0084	Immunizations 2016 - 2017
0085	PNC Progress Chart 2018
4413	Bondo Water Catchment + Tank
0088	Candid w/ Reno
4420	Group picture with Reno





Figure 5.20: Data from Lela Dispensary indicating health and health care statistics that are gathered and reported monthly to Migori District. This information will allow the team to investigate community health trends in Kibuon so as to ensure the project adequately serves the health needs of the community.



*Figure 5.21: Images of the damaged rainwater catchment system at the Lela Dispensary that serves as the only consistent water source for the clinic.*

NAME	AGE	NDC DISPENSARY		IMMUNIZATIONS		PERIODIC EXAMS		TESTS		THERAPY	
		STAN	WEEK	STAN	WEEK	STAN	WEEK	STAN	WEEK	STAN	WEEK
ROSA MARIA 1	15	14	15	09	18						
ELIAS ARNONE 1	0	0	0	0	0						
ROSA MARIA DOSE	8	9	7	09	12						
DPV1>ITR	23	21	17	24	11						
DPV1>ITR	0	0	0	0	0						
DPV2>ITR	17	17	17	21	25						
DPV2>ITR	0	0	0	0	0						
DPV3>ITR	24	12	17	17	14						
DPV3>ITR	0	0	0	0	0						
IPV	24	12	14	17	14						
DPV1<MR	22	21	17	24	11						
DPV1>MR	0	0	0	0	0						
DPV2<MR	17	17	17	21	25						
DPV2>MR	0	0	0	0	0						
DPV3<MR	23	21	17	17	21						
DPV3>MR	0	0	0	0	0						
PCV10<ITR	23	21	17	24	11						
PCV10>ITR	0	0	0	0	0						
PCV10<MR	17	17	17	21	25						
PCV10>MR	0	0	0	0	0						
PCV10<ITR	24	12	14	17	14						
PCV10>ITR	0	0	0	0	0						
PCV10<MR	23	21	17	24	11						
PCV10>MR	0	0	0	0	0						
PCV10<ITR	17	17	17	21	25						
PCV10>ITR	0	0	0	0	0						
PCV10<MR	24	12	14	17	14						
PCV10>MR	0	0	0	0	0						
ROSA 1	22	22	17	29	11						
ROSA 2	17	17	17	21	25						
VITA AT GROWTHS	15	17	21	20							
MRI 1< ITA	23	17	22	10	18						
MRI > ITA	03	0	0	0	0						
FIG. AT ITA	23	17	22	10	18						
VITA AT ITA	17	8	17	11	13						
VITA AT ITA	16	5	10	05	13						
MRI 2-18-2TR	13	14	7	09	11						
MRI 2-18-2TR	04	4	8	01	01						
ANNUAL EXAM											
ELIAS ARNONE 2											
VITA 2-5-18											
VITA 2-5-18	19	21	25	09	10						
VITA 2-5-18	08	0	0	0	0						
VITA 2-5-18	10	0	0	10	0						

SUNA WEST SELECTED ANTIGEN PERFORMANCE FOR JUNE, JULY & AUGUST 2018										
	Target June to Aug	Achieved P1	Coverage (%)	Achieved P3	Achieved MR	DO P1 - MR	P1 - MR DOB	Category		
KIRIBATI	124	109	100	125	139	30	17.7	2		
SAN MARINOS	155	142	103	142	131	11	7.7	1		
PAKISTAN	80	82	78	91	90	-8	-9.7	3		
MALTA	60	59	100	60	52	18	25.7	2		
MARSHALL ISLANDS	33	100	144	72	79	25	25	2		
PALESTINE	49	348	74	52	52	-1	-1	1		
TOGO	24	21	105	18	18	3	14.2	2		
MANAMA	24	17	207	58	62	-9	-16.4	1		
PAKISTAN	78	78	100	79	56	32	-1	-3.2	1	
MONROVIA	71	63	9.9	48	82	22	28.2	2		
PAKISTAN	201	204	90.7	28	62	-45	-165.7	1		
PAKISTAN	114	110	98.1	100	257	-4	-265.7	3		
PAKISTAN	38	26	123	24	117	-1	-0.9	1		
PAKISTAN	30	30	100	24	117	-12	-46.1	1		
PAKISTAN	9	10	106	7	7	-4	-11.1	1		
SUNA WEST MISCELLANEOUS	-	-	-	-	-	-	-	20	2	
SUNA WEST MISSING	-	-	-	-	-	-	-	-	-	
<b>TOTAL</b>	<b>1206</b>	<b>1414</b>	<b>117</b>	<b>1252</b>	<b>1338</b>	<b>79</b>	<b>5.5%</b>	<b>1</b>		



Figure 5.22: Images of the health data recording charts at the Bondo Dispensary.



Figure 5.23: Nurse Reno Rachuono shows team member Marwah Sabra information logged at the Bondo Dispensary.

## 5.4 Community Phone Book

Photo	Name	Title/Role	Notes
	Paul Olang'o	Community contact, team member, logistics coordinator, van driver	Fluent in English, Swahili, Luo. Served as survey translator. Charles' son. Has experience working with other EWB chapters (Hope, OSU, SF Pro).
	Julius Amara	Pastor, unofficial CBO head, survey translator	Fluent in English, Swahili, Luo. Served as survey translator.
	Charles Olang'o	Community contact, informal translator for pop. data	Hosted team at his house, has experience with other EWB chapters (Hope, OSU, SF Pro).
	Keni Otieno	WECCO Driller/Team Member	Martin's Son

	Martin Otieno	WECCO Director	Keni's Father
	Hezron Oyanda	WECCO Secretary	
	Richard Okelo	CBO member, Village Elder for Kibuon D/Wiao	
	Vincent Aooko	Assistant Water Chair	

	Maresa Odira	CBO member	
	Benta Akelo	CBO member	
	Eunice Awino	CBO member Secretary Baby's name is Nicole	
	Joshua Ater	CBO Member, Bishop	

	Wycliffe Otieno	Village Elder for Kibuon A (Nyamilu)	
	Joel Agalo	CBO Member	
	Mercy Auma	Chairwoman of CBO, Community Health Worker	
	Deborah Nandwa	Translator for start of women's meeting.	

	Reno Rachuono	Bondo Dispensary Nurse, all-star translator	Very fluent in English, Swahili, Luo
	Samuel Oguang	Translator at 2 <sup>nd</sup> CBO Meeting, Bishop	
	Judith Amara	Julius' Wife	

## 5.5 Supplier and Contractor Reports

Item	Store Location	Unit(s)	Price (KSH)	Note
PVC Downspout	Kion Hardware	#	???	
Gutter Brackets	Kion Hardware	#	???	
3" pipe	Kion Hardware	13ft long sections	???	
4" pipe	Klon Hardware	20ft long sectios	???	
Gutter	Kion Hardware	16ft long sections	???	
Metro PVC Primer & Glue	Kion Hardware	Container of # oz	???	Not in stock/store
10,000L Poa Tank	Kion Hardware	Tank	78,000	
10,000L KenTank	Kion Hardware	Tank	76,000	
Simba Cement	Kion Hardware	## lb bag	700	
DumuBlue Cement	Kion Hardware	## lb bag	600	
Sand	Kion Hardware	medium load (10 tons)	18,000 to deliver (price unclear)	
Gravel/Aggregate	Kion Hardware	medium load (10 tons)	20,000	
#10 Rebar	Kion Hardware	40 foot section	660	
#8 Rebar	Kion Hardware	40 foot section	500	
Concrete Mixer + Operator	Kion Hardware	day		
CMU 6"X 9"	Kion Hardware	brick	70	
CMU 9"X 9"	Kion Hardware	brick	80	
Wire Mesh Light Gague	Kion Hardware	sheet (4' X 8')	500	
Wire Mesh Medium Gague	Kion Hardware	sheet (4' X 8')	700	
Wire Mesh Heavy Gague	Kion Hardware	sheet (4' X 8')	1200	
Spade	Kion Hardware	unit	500	
Drillbits	Kion Hardware	unit		Not in stock/store
1 1/4" Metal Pipe	Kion Hardware	13ft or 14ft long sections	450	
<hr/>				
10,000L KenTank	Ritu Enterprises	tank	73,000	
5,000L KenTank	Ritu Enterprises	tank	32,000	
2,000L KenTank	Ritu Enterprises	tank	13,500	
10,000L TopTank	Ritu Enterprises	tank	73,000 ± 1,000	
5,000L TopTank	Ritu Enterprises	tank	32,000 ± 1,000	
2,000L TopTank	Ritu Enterprises	tank	13,500 ± 1,000	
Metal Reducer	Ritu Enterprises	unit	???	
PVC Downspout	Ritu Enterprises	unit	???	
Cement Mixer & Operator	Ritu Enterprises	day	7,000	
Binding Wire	Ritu Enterprises	roll (25 kilos)	3,200	
Binding Wire	Ritu Enterprises	length (1 kilo)	150	

Consumer Meter	Ritu Enterprises	unit	3,500	
Master Meter	Ritu Enterprises	unit	???	

## 5.6 Community Partnership Agreement



### Community Agreement – Project Partnership

This contract is between the Harvard School of Engineering and Applied Sciences chapter of Engineers Without Borders, USA, Kibuon Community-Based Organization (CBO) and the in-country partner for the purpose of setting guidelines for the Kibuon Water Project. The roles and responsibilities listed below must be included in the standard EWB-USA Project Partnership Agreement. Additional roles and responsibilities identified by any party to the agreement may be added at the discretion of all parties to the agreement. This document must be signed by all parties in order to move on to the design development of the Kibuon Water Project.

EWB-USA is a volunteer-based organization without a pre-approved budget. Implementation of all projects is contingent upon all parties meeting the commitments outlined below, funds being raised and a stable security situation which allows travel to the site by our members. This agreement is not legally binding, but is intended to clarify expectations, roles and responsibilities of all parties to the subject project.

The residents of Kibuon and members of the CBO agree to the following:

- To communicate directly with the Harvard SEAS chapter of EWB-USA on a regular basis, as determined by the needs of the project.
- To inform the Harvard SEAS chapter of EWB-USA of any changes to the security/safety situation.
- To allow the Harvard SEAS chapter of EWB-USA to communicate directly with all interested community groups in order to get all pertinent input to the development of the Kibuon Water Project.
- To organize and involve community members in all aspects of the project.
- To identify community contacts to accompany the Harvard SEAS chapter of EWB-USA team during site visits.
- To ensure that Kibuon Water Project represents community-wide priorities and that all community members will have the opportunity to benefit from the project per the terms of use established by the community.
- To contribute a minimum of 5% of the capital construction cost in cash before construction begins.
- To provide in-kind contributions to the project at no cost to the Harvard SEAS chapter of EWB-USA (examples are skilled and unskilled labor, borrowed equipment, local materials, etc.).
- To identify a formal system of responsibility for the operations and maintenance of Kibuon Water Project.
- To establish and administer the funding mechanism required to continually operate and maintain the Kibuon Water Project after construction is complete.

Community Agreement – Project Partnership

Revised 02/2019

Harvard College EWB-USA Chapter

Kenya, Kibuon

- To be available to assist with additional technical data collection not completed by the Harvard SEAS chapter of EWB-USA on site assessment trips.
- To allow photos or video taken by the Harvard SEAS to be used in EWB-USA HQ's marketing materials to share the story of the organization's work with wider audiences.

The in-country partner agrees to the following:

- To avail to the Harvard SEAS chapter a quote of the cost of the services they can offer prior to providing any service.
- To inform the Harvard SEAS chapter of EWB-USA of any changes to the security/safety situation.
- To visit Kibuon often, and as needed, for project progress.
- To build the capacity of the Kibuon CBO to establish continuing support of the system, as needed.
- To provide project-specific training for the Kibuon CBO, as needed.
- To identify contributions that the in-country partner can make to the project (examples include funding, resource procurement, heavy equipment, etc.)
- To assist in ongoing monitoring and evaluation of the Kibuon Water Project.
- To be available to assist with additional technical data collection not completed by the Harvard SEAS chapter of EWB-USA.
- To allow photos or video taken by the Harvard SEAS to be used in EWB-USA HQ's marketing materials to share the story of the organization's work with wider audiences.

The Harvard SEAS chapter of EWB-USA agrees to the following:

- To work in partnership with the Kibuon CBO to design and develop the project, the Kibuon Water Project.
- To seek input from community members during the design phase
- To communicate with the Kibuon CBO and in-country partner throughout project design phases to provide status updates on project design development.
- To identify contributions that the Harvard SEAS chapter of EWB-USA can make to the project construction expenses (examples include fundraising, assistance with community grant applications, etc.).
- To inform the Kibuon CBO and in-country partner of any changes to the agreed upon details of site visits (examples include a change of dates, number of travelers, etc.).
- To collect technical data required to complete the project design.
- To provide project-specific education and training, including operations and maintenance training in English and Luo.
- To provide a manual to instruct the community on operations and maintenance of the Kibuon Water Project in English and Luo.
- To provide as-built drawings to the Kibuon CBO after project completion in English and Luo.

Community Agreement ~ Project Partnership

Revised 04/2017

Harvard College EWB USA Chapter

Kenya, Kibuon

- To acquire explicit permission before photographing or videotaping members of the Kibuon CBO and/or in-country partner and explain that photos and videos may be used for marketing materials to share the EWB-USA story with wider audiences.
- To ensure photographs and videos present subjects in a dignified and respectful manner and that images are honest representations of the situations and the facts.

In addition to the responsibilities listed above, indicate the responsible party for each of the following:

- Coordination of transportation for travel team members of the Harvard SEAS chapter of EWB-USA will be provided by the in-country partner and the CBO.
- Coordination of translation services for travel team members of the Harvard SEAS chapter of EWB-USA will be provided by the in-country partner and members of the community identified by the CBO and/or the in-country partner.
- Transportation of materials will be coordinated by the in-country partner.

On behalf of and acting with the authority of the residents of Kibuon, the in-country partner and the Harvard SEAS chapter of EWB-USA, the under-signed agree to abide by the above conditions.

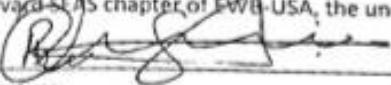
Community Agreement – Project Partnership

Revised 04/2017

Harvard College EWB-USA Chapter

Kenya, Kibuon

On behalf of, and acting with the authority of the residents of Kibuon, the in-country partner and the Harvard SEAS chapter of EWB-USA, the under-signed agree to abide by the above conditions.

  
Signature

12/6/19  
Date

BILLY KOECH

Printed Name

+1 617-710-6745

Contact Telephone Number (including country code)

Project Lead in the Harvard SEAS Chapter of EWB-USA

  
Signature

12/6/2019  
Date

Christopher Lombardo PhD

Printed Name

+1 443 454 3207

Contact Telephone Number (including country code)

REIC/Faculty Advisor in the Harvard SEAS Chapter of EWB-USA

  
Signature

12/6/2019  
Date

MERCY AUMA ODOON

Printed Name

0724 492570

Contact Telephone Number (including country code)

CHAIR LADY

Position in Community-Based Organization

Community Agreement – Project Partnership  
Harvard College FWB-USA Chapter  
Kenya, Kibuon

Revised 04/2017

Signature

Date

Printed Name

+254 710-565-797

Contact Telephone Number (including country code)

Position in Local Partner Organization

## 5.7 Monitoring Data Forms

**Project Category:** Water Source Development (Home)

**Project Name:** Kibuon Water Project

**Project Country:** Kenya

Link to Water Source Development (Home) Question Instructions

**Chapter:** Harvard SEAS Chapter

**Data Collector:** May 2019 Travel Team

**Date:** May 2019

Project Indicators Field Data Sheet		
<b>Performance and Quality</b>		
<b>Community Satisfaction</b>		
Q: What percent of those surveyed say they are satisfied with the current system?		Notes: Pre-project condition. There is no uniform water provision system for the community- some get water from springs, other from rainwater catchment, and others from wells.
A: <b>0%</b> % (based on survey of CBO or community representatives)		
<b>Existing Condition</b>		Notes:
Q: What is the current condition of the existing, modified, or new system?		No system except for springs and and some DIY rainwater catchment systems
A: <input type="checkbox"/> Great condition <input type="checkbox"/> Needs aesthetic maintenance <input type="checkbox"/> Needs maintenance <input type="checkbox"/> Major maintenance <input type="checkbox"/> Not in use due to poor condition <input checked="" type="checkbox"/> Does not currently exist		
<b>Local Standard</b>		Notes: Pre-project conditio- non existent system
Q: Does the system meet applicable local standards?		
A: <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> No Standard Identified		
<b>Women Involvement</b>		Notes: Women participated in CBO meetings and community meeting. The chapter also organized a focus group meeting with just the women
Q: Were women consulted in the planning process?		
A: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
<b>Water Quantity - JMP Community dry</b>		Notes: Most households reported decrease in water availability in the dry season thus that can be extrapolated to a value below 15 liters per person per day
Q:What level of water access does the project provide in dry season?		
A: <input type="checkbox"/> Does not meet minimum standards: <15 litres per person/ day <input checked="" type="checkbox"/> Emergency access: Minimum of 15 litres per person/ day <input type="checkbox"/> Basic access: Minimum of 20 litres per person/ day <input type="checkbox"/> Intermediate access: Minimum of 50 litres per person/ day <input type="checkbox"/> Optimal access: > 100 litres per person/ day		
<b>Water Quantity - JMP Community rainy</b>		Notes: Actual value is 19.47 lppd . This was calculated based on data on water usage from household surveys- However it is important to note that a significant portion of the population is below this average
Q:What level of water access does the project provide in rainy season?		
A: <input type="checkbox"/> Does not meet minimum standards: <15 litres per person/ day <input type="checkbox"/> Emergency access: Minimum of 15 litres per person/ day <input checked="" type="checkbox"/> Basic access: Minimum of 20 litres per person/ day <input type="checkbox"/> Intermediate access: Minimum of 50 litres per person/ day <input type="checkbox"/> Optimal access: > 100 litres per person/ day		
<b>Water Quantity - On day tested</b>		Notes: Pre-project condition
Q: What is the quantity (measured) of water from the source on the day of the visit? ( L/day)		
A: <b>0</b> (L/day)		

<b>Project Category:</b> Water Source Development (Home)	<b>Chapter:</b> Harvard SEAS Chapter
<b>Project Name:</b> Kibuon Water Project	<b>Data Collector:</b> May 2019 Travel Team
<b>Project Country:</b> Kenya	<b>Date:</b> June 2019
Link to Water Source Development (Home) Question Instructions	
<b>Water Quantity - Dry Season</b> Q: What is the quantity of water from the source (L/day) in the dry season?  A: <u>0</u> (L/day)	Notes:  pre-project condition
<b>Water Quantity - Rainy Season</b> Q: What is the quantity of water from the source (L/day) in the rainy season?  A: <u>0</u> (L/day)	Notes:  pre-project condition
<b>Water Consumption - Community</b> Q: What is the overall average people per day using the system?  A: <u>0</u> (people/day)	Notes: Pre-project condition. The team collected data on sources of water for the community and the number of number of households for each source. Attach graph.
<b>Water Quality</b> Q: What is the quality of the water?  A: <input type="checkbox"/> Good Quality (No water quality issues) <input checked="" type="checkbox"/> Exceeds Secondary (Fails test for appearance or taste) <input type="checkbox"/> Exceeds Primary (Does not meet potable water quality standards)	Notes:  Springs appeared brown and dirty - see photographs in appendix 5.3 of springs See water quality test results table in appendix 5.2.1
<b>Water Storage Safety</b> Q: Percentage of system users practicing safe water storage?  A: <input type="checkbox"/> 0% <input type="checkbox"/> 1– 25% <input type="checkbox"/> 26% - 50% <input type="checkbox"/> 51% - 75% <input checked="" type="checkbox"/> 76% - 100% <input type="checkbox"/> N/A for storage	Notes:  Most community members stored water in jerrycans for about a day because they used the same jerrycans for water collection.
<b>Water Transportation Safety</b> Q: Percentage of system users practicing safe water transportation?  A: <input type="checkbox"/> 0% <input type="checkbox"/> 1– 25% <input type="checkbox"/> 26% - 50% <input type="checkbox"/> 51% - 75% <input checked="" type="checkbox"/> 76% - 100% <input type="checkbox"/> N/A for transportation	Notes:  Most community members owned jerrycans (with small openings) that they used to collect and transport water. Some members used buckets.
<b>Water Supplies near facility</b> Q: What is the number of improved water sources within 1km of a public water access point (or public service range of your project.)?  A: <u>0</u> (Number)	Notes:  Some household reported getting water from the Lela and Bondo well, but none of the wells were within a kilometer of the community because most had to send motorcyclists to get water for them



<b>Project Category:</b> Water Source Development (Home)	<b>Chapter:</b> Harvard SEAS Chapter
<b>Project Name:</b> Kibuon Water Project	<b>Data Collector:</b> May 2019 Travel Team
<b>Project Country:</b> Kenya	<b>Date:</b> May 2019
Link to Water Source Development (Home) Question Instructions	
<b>Water JMP Level of Service</b> Q: Select which WHO/ UNICEF JMP Standard this project meets water access/ quality. A: <input type="checkbox"/> Safely Managed: Drinking water from an improved water source which is located on Premises, available when needed and free from faecal and priority chemical contamination. <input type="checkbox"/> Basic: Drinking water from an improved source, provided collection time is not more than 30 minutes for a roundtrip including queuing <input type="checkbox"/> Limited: Drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing <input checked="" type="checkbox"/> Unimproved: Drinking water from an unprotected dug well or unprotected spring <input type="checkbox"/> Surface Water: Drinking directly from a river, dam, lake, pond, stream, canal or irrigation canal	
<small>Notes:</small> Most residents collect water from unprotected springs. In the dry season some collect water from wells in Bondo and Lela but the travel time exceeds 30 mins.	
<b>Water Collection Distance</b> Q: What is the number of households collecting water from water source further than 30 minutes roundtrip including queuing as reported by water committee or appropriate source, times average household size? A: <u>1116</u> (number)	
<small>Notes:</small> In the dry season 83.9% of the sampled households reported spending more than 30 minutes traveling to collect water. In the wet season 25.7% reported spending more than 30 minutes.	
<b>Theft Protection</b> Q. Theft protection (is theft protection in place and working) A: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
<small>Notes:</small> Pre-project condition. The CBO outlined a revenue plan that should cover the maintenance costs which includes theft protection	
<b>Maintenance and Functionality</b> <b>Functionality On Day Observed</b> Q: Is the system functioning on day observed? A: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
<small>Notes:</small> Pre-project condition. Non existent system	
<b>Functionality</b> Q: % What percent of the time is the system working as intended? A: % of time that the project is working (time operating/ time designed to operate): <input type="checkbox"/> 0% <input checked="" type="checkbox"/> 1– 25% <input type="checkbox"/> 26% - 50% <input type="checkbox"/> 51% - 75% <input type="checkbox"/> 76% - 100%	
<small>Notes:</small> Pre-project condition. Non existent system	
<b>Community Identified Need</b> Q: Does the system meet the community identified need? A: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partial	
<small>Notes:</small> Pre-project condition. Non existent system	

<b>Project Category:</b> Water Source Development (Home)	<b>Chapter:</b> Harvard SEAS Chapter														
<b>Project Name:</b> Kibuon Water Project	<b>Data Collector:</b> May 2019 Travel Team														
<b>Project Country:</b> Kenya	<b>Date:</b> May 2019														
Link to Water Source Development (Home) Question Instructions															
<table border="1"> <thead> <tr> <th>Functionality Non Performance Reason</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: What is the reason the system is not performing as intended?</td> <td></td> </tr> <tr> <td>A:  <input type="checkbox"/> Initial need overstated or unreasonable or unattainable  <input type="checkbox"/> Limited maintenance/construction funds  <input type="checkbox"/> Technical design issue  <input type="checkbox"/> Not constructed per design  <input type="checkbox"/> Inappropriate, ineffective or no maintenance.  <input type="checkbox"/> Population growth, migration or other change in number of users.  <input type="checkbox"/> Cultural issue  <input type="checkbox"/> Change of community priorities  <input type="checkbox"/> Theft  <input type="checkbox"/> Community infighting  <input type="checkbox"/> Intercommunity conflict  <input type="checkbox"/> Technology not adopted, not preferred, or not embraced  <input type="checkbox"/> Unforeseen damage  <input type="checkbox"/> Other organization solved problem  <input checked="" type="checkbox"/> N/A system functioning as designed                 </td> <td>Pre-project condition Therefore this is not applicable.</td> </tr> </tbody> </table>		Functionality Non Performance Reason	Notes:	Q: What is the reason the system is not performing as intended?		A: <input type="checkbox"/> Initial need overstated or unreasonable or unattainable <input type="checkbox"/> Limited maintenance/construction funds <input type="checkbox"/> Technical design issue <input type="checkbox"/> Not constructed per design <input type="checkbox"/> Inappropriate, ineffective or no maintenance. <input type="checkbox"/> Population growth, migration or other change in number of users. <input type="checkbox"/> Cultural issue <input type="checkbox"/> Change of community priorities <input type="checkbox"/> Theft <input type="checkbox"/> Community infighting <input type="checkbox"/> Intercommunity conflict <input type="checkbox"/> Technology not adopted, not preferred, or not embraced <input type="checkbox"/> Unforeseen damage <input type="checkbox"/> Other organization solved problem <input checked="" type="checkbox"/> N/A system functioning as designed	Pre-project condition Therefore this is not applicable.								
Functionality Non Performance Reason	Notes:														
Q: What is the reason the system is not performing as intended?															
A: <input type="checkbox"/> Initial need overstated or unreasonable or unattainable <input type="checkbox"/> Limited maintenance/construction funds <input type="checkbox"/> Technical design issue <input type="checkbox"/> Not constructed per design <input type="checkbox"/> Inappropriate, ineffective or no maintenance. <input type="checkbox"/> Population growth, migration or other change in number of users. <input type="checkbox"/> Cultural issue <input type="checkbox"/> Change of community priorities <input type="checkbox"/> Theft <input type="checkbox"/> Community infighting <input type="checkbox"/> Intercommunity conflict <input type="checkbox"/> Technology not adopted, not preferred, or not embraced <input type="checkbox"/> Unforeseen damage <input type="checkbox"/> Other organization solved problem <input checked="" type="checkbox"/> N/A system functioning as designed	Pre-project condition Therefore this is not applicable.														
<table border="1"> <thead> <tr> <th>Maintenance Completed</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Is there evidence that maintenance is being completed on existing system?</td> <td></td> </tr> <tr> <td>A:  <input type="checkbox"/> Observed  <input checked="" type="checkbox"/> Inferred  <input type="checkbox"/> Reported  <input type="checkbox"/> None/Limited                 </td> <td>Pre-project condition Therefore this is not applicable. However the participatory nature of the CBO infers that they will be capable to follow up on maintenance</td> </tr> </tbody> </table>		Maintenance Completed	Notes:	Q: Is there evidence that maintenance is being completed on existing system?		A: <input type="checkbox"/> Observed <input checked="" type="checkbox"/> Inferred <input type="checkbox"/> Reported <input type="checkbox"/> None/Limited	Pre-project condition Therefore this is not applicable. However the participatory nature of the CBO infers that they will be capable to follow up on maintenance								
Maintenance Completed	Notes:														
Q: Is there evidence that maintenance is being completed on existing system?															
A: <input type="checkbox"/> Observed <input checked="" type="checkbox"/> Inferred <input type="checkbox"/> Reported <input type="checkbox"/> None/Limited	Pre-project condition Therefore this is not applicable. However the participatory nature of the CBO infers that they will be capable to follow up on maintenance														
<table border="1"> <thead> <tr> <th>Maintenance Non Performance Reasons</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: What is the reason for no maintenance or limited maintenance?</td> <td></td> </tr> <tr> <td>A:  <input type="checkbox"/> No responsible party  <input type="checkbox"/> Limited funding  <input type="checkbox"/> Lack of training  <input type="checkbox"/> Staff turnover  <input type="checkbox"/> Community dissatisfaction with project  <input type="checkbox"/> Lack of community support  <input type="checkbox"/> Community infighting or conflict  <input checked="" type="checkbox"/> N/A                 </td> <td>Pre-project condition Therefore this is not applicable.</td> </tr> </tbody> </table>		Maintenance Non Performance Reasons	Notes:	Q: What is the reason for no maintenance or limited maintenance?		A: <input type="checkbox"/> No responsible party <input type="checkbox"/> Limited funding <input type="checkbox"/> Lack of training <input type="checkbox"/> Staff turnover <input type="checkbox"/> Community dissatisfaction with project <input type="checkbox"/> Lack of community support <input type="checkbox"/> Community infighting or conflict <input checked="" type="checkbox"/> N/A	Pre-project condition Therefore this is not applicable.								
Maintenance Non Performance Reasons	Notes:														
Q: What is the reason for no maintenance or limited maintenance?															
A: <input type="checkbox"/> No responsible party <input type="checkbox"/> Limited funding <input type="checkbox"/> Lack of training <input type="checkbox"/> Staff turnover <input type="checkbox"/> Community dissatisfaction with project <input type="checkbox"/> Lack of community support <input type="checkbox"/> Community infighting or conflict <input checked="" type="checkbox"/> N/A	Pre-project condition Therefore this is not applicable.														
<table border="1"> <thead> <tr> <th>Community Capacity</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td> <table border="1"> <thead> <tr> <th>CBO Best Practices</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Does a maintenance body such as a CBO exist to provide long term operation and maintenance support?</td> <td>Kibuon has a CBO that existed prior to the assessment trip - established in 2015, reformed in 2017</td> </tr> <tr> <td>A:  <input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No                 </td> <td></td> </tr> </tbody> </table> </td> </tr> <tr> <td> <table border="1"> <thead> <tr> <th>CBO Structure</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Which best practices does the CBO/Maintenance body follow?</td> <td> <ul style="list-style-type: none"> <li>* Team still needs data on communities fundraising plan - "harambee"</li> <li>* Future users of the system are required to register. All users pay the same fee</li> <li>* The treasurer of the CBO keeps a booklet with records on amount of money raised and expenditure</li> <li>* Members of the community collectively nominate their representatives. The CBO is still young and might undergo iterations to improve inclusivity and fairness. This has already been observed from the 2017 reforms.</li> <li>* Observed good relations. CBO assisted in data collection and translation activities in households</li> <li>* CBO meets every Thursday</li> <li>* 6/17 CBO members are women.</li> <li>* Inclusivity. The CBO members are nominated, then the chair is voted into place by the CBO members.</li> <li>* Reformed in 2017 to increase representation and change the original nepotistic structure</li> <li>* Chair- Mercy Auma. Secretary - Eunice Awino, Treasurer - Jane Atieno Ajuang</li> </ul> </td> </tr> </tbody> </table> </td> </tr> </tbody> </table>		Community Capacity	Notes:	<table border="1"> <thead> <tr> <th>CBO Best Practices</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Does a maintenance body such as a CBO exist to provide long term operation and maintenance support?</td> <td>Kibuon has a CBO that existed prior to the assessment trip - established in 2015, reformed in 2017</td> </tr> <tr> <td>A:  <input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No                 </td> <td></td> </tr> </tbody> </table>	CBO Best Practices	Notes:	Q: Does a maintenance body such as a CBO exist to provide long term operation and maintenance support?	Kibuon has a CBO that existed prior to the assessment trip - established in 2015, reformed in 2017	A: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<table border="1"> <thead> <tr> <th>CBO Structure</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Which best practices does the CBO/Maintenance body follow?</td> <td> <ul style="list-style-type: none"> <li>* Team still needs data on communities fundraising plan - "harambee"</li> <li>* Future users of the system are required to register. All users pay the same fee</li> <li>* The treasurer of the CBO keeps a booklet with records on amount of money raised and expenditure</li> <li>* Members of the community collectively nominate their representatives. The CBO is still young and might undergo iterations to improve inclusivity and fairness. This has already been observed from the 2017 reforms.</li> <li>* Observed good relations. CBO assisted in data collection and translation activities in households</li> <li>* CBO meets every Thursday</li> <li>* 6/17 CBO members are women.</li> <li>* Inclusivity. The CBO members are nominated, then the chair is voted into place by the CBO members.</li> <li>* Reformed in 2017 to increase representation and change the original nepotistic structure</li> <li>* Chair- Mercy Auma. Secretary - Eunice Awino, Treasurer - Jane Atieno Ajuang</li> </ul> </td> </tr> </tbody> </table>	CBO Structure	Notes:	Q: Which best practices does the CBO/Maintenance body follow?	<ul style="list-style-type: none"> <li>* Team still needs data on communities fundraising plan - "harambee"</li> <li>* Future users of the system are required to register. All users pay the same fee</li> <li>* The treasurer of the CBO keeps a booklet with records on amount of money raised and expenditure</li> <li>* Members of the community collectively nominate their representatives. The CBO is still young and might undergo iterations to improve inclusivity and fairness. This has already been observed from the 2017 reforms.</li> <li>* Observed good relations. CBO assisted in data collection and translation activities in households</li> <li>* CBO meets every Thursday</li> <li>* 6/17 CBO members are women.</li> <li>* Inclusivity. The CBO members are nominated, then the chair is voted into place by the CBO members.</li> <li>* Reformed in 2017 to increase representation and change the original nepotistic structure</li> <li>* Chair- Mercy Auma. Secretary - Eunice Awino, Treasurer - Jane Atieno Ajuang</li> </ul>
Community Capacity	Notes:														
<table border="1"> <thead> <tr> <th>CBO Best Practices</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Does a maintenance body such as a CBO exist to provide long term operation and maintenance support?</td> <td>Kibuon has a CBO that existed prior to the assessment trip - established in 2015, reformed in 2017</td> </tr> <tr> <td>A:  <input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No                 </td> <td></td> </tr> </tbody> </table>	CBO Best Practices	Notes:	Q: Does a maintenance body such as a CBO exist to provide long term operation and maintenance support?	Kibuon has a CBO that existed prior to the assessment trip - established in 2015, reformed in 2017	A: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No										
CBO Best Practices	Notes:														
Q: Does a maintenance body such as a CBO exist to provide long term operation and maintenance support?	Kibuon has a CBO that existed prior to the assessment trip - established in 2015, reformed in 2017														
A: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No															
<table border="1"> <thead> <tr> <th>CBO Structure</th> <th>Notes:</th> </tr> </thead> <tbody> <tr> <td>Q: Which best practices does the CBO/Maintenance body follow?</td> <td> <ul style="list-style-type: none"> <li>* Team still needs data on communities fundraising plan - "harambee"</li> <li>* Future users of the system are required to register. All users pay the same fee</li> <li>* The treasurer of the CBO keeps a booklet with records on amount of money raised and expenditure</li> <li>* Members of the community collectively nominate their representatives. The CBO is still young and might undergo iterations to improve inclusivity and fairness. This has already been observed from the 2017 reforms.</li> <li>* Observed good relations. CBO assisted in data collection and translation activities in households</li> <li>* CBO meets every Thursday</li> <li>* 6/17 CBO members are women.</li> <li>* Inclusivity. The CBO members are nominated, then the chair is voted into place by the CBO members.</li> <li>* Reformed in 2017 to increase representation and change the original nepotistic structure</li> <li>* Chair- Mercy Auma. Secretary - Eunice Awino, Treasurer - Jane Atieno Ajuang</li> </ul> </td> </tr> </tbody> </table>	CBO Structure	Notes:	Q: Which best practices does the CBO/Maintenance body follow?	<ul style="list-style-type: none"> <li>* Team still needs data on communities fundraising plan - "harambee"</li> <li>* Future users of the system are required to register. All users pay the same fee</li> <li>* The treasurer of the CBO keeps a booklet with records on amount of money raised and expenditure</li> <li>* Members of the community collectively nominate their representatives. The CBO is still young and might undergo iterations to improve inclusivity and fairness. This has already been observed from the 2017 reforms.</li> <li>* Observed good relations. CBO assisted in data collection and translation activities in households</li> <li>* CBO meets every Thursday</li> <li>* 6/17 CBO members are women.</li> <li>* Inclusivity. The CBO members are nominated, then the chair is voted into place by the CBO members.</li> <li>* Reformed in 2017 to increase representation and change the original nepotistic structure</li> <li>* Chair- Mercy Auma. Secretary - Eunice Awino, Treasurer - Jane Atieno Ajuang</li> </ul>											
CBO Structure	Notes:														
Q: Which best practices does the CBO/Maintenance body follow?	<ul style="list-style-type: none"> <li>* Team still needs data on communities fundraising plan - "harambee"</li> <li>* Future users of the system are required to register. All users pay the same fee</li> <li>* The treasurer of the CBO keeps a booklet with records on amount of money raised and expenditure</li> <li>* Members of the community collectively nominate their representatives. The CBO is still young and might undergo iterations to improve inclusivity and fairness. This has already been observed from the 2017 reforms.</li> <li>* Observed good relations. CBO assisted in data collection and translation activities in households</li> <li>* CBO meets every Thursday</li> <li>* 6/17 CBO members are women.</li> <li>* Inclusivity. The CBO members are nominated, then the chair is voted into place by the CBO members.</li> <li>* Reformed in 2017 to increase representation and change the original nepotistic structure</li> <li>* Chair- Mercy Auma. Secretary - Eunice Awino, Treasurer - Jane Atieno Ajuang</li> </ul>														

<b>Project Category:</b> Water Source Development (Home)	<b>Chapter:</b> Harvard SEAS Chapter
<b>Project Name:</b> Kibuon Water Project	<b>Data Collector:</b> May 2019 Travel Team
<b>Project Country:</b> Kenya	<b>Date:</b> May 2019
Link to Water Source Development (Home) Question Instructions	
<b>CBO Fund Adequate</b> Q: Complete this statement: "The maintenance body/ CBO has enough balance in the institutional financial fund to:" A: <input type="checkbox"/> Fund full replacement of the system <input type="checkbox"/> Fund 3 months operation and maintenance activities only <input type="checkbox"/> Fund 3 months operational activities only <input checked="" type="checkbox"/> Limited funding (less than 3 months operation costs) <input type="checkbox"/> Opportunistic funding (money generated as needed for repairs) (the estimated cost of a single typical repair) <input type="checkbox"/> Limited opportunistic funding (some money but less than the estimated cost of a single typical repair can be generated as needed) <input type="checkbox"/> No balance	
	<u>Notes:</u>  CBO has raised KSH 5000 . The month revenue will be KSH 4420 if all household pay the monthly subscription fee after the system is functional.
<b>CBO Fund</b> Q: Does the maintenance body/ CBO save its money in an institutional financial (i.e. bank) fund? A: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	<u>Notes:</u>  The CBO has an account with Equity Bank whose office are located about 8km away in Migori town
<b>CBO Revenue Source</b> Q: What is the revenue source (who pays the fee)? A: <input type="checkbox"/> Users <input type="checkbox"/> Students/parents <input checked="" type="checkbox"/> Entire community <input type="checkbox"/> Partial community (more wealthy, business owners, farmers, etc.) <input type="checkbox"/> Sliding scale <input type="checkbox"/> Local government	
	<u>Notes:</u>  The registration fee is on a per-family basis. Registered families will also likely pay a monthly fee. Non-registered members will likely have to pay on a per-jerrycan basis. The CBO also plans to hold community fundraisers, "harambees", to generate more revenue. Harambees are voluntary
<b>CBO Revenue Frequency</b> Q: What is the revenue collection frequency? A: <input checked="" type="checkbox"/> Monthly <input checked="" type="checkbox"/> Per use (tap attendant, kiosk, etc.) <input type="checkbox"/> No fee <input type="checkbox"/> Annual fee <input type="checkbox"/> When needed <input type="checkbox"/> Initial connection <input type="checkbox"/> After sale of products (crop sales) <input type="checkbox"/> Seasonally	
	<u>Notes:</u>  The CBO is likely to implement a payment system similar to that of neighbouring communities of Bondo and Lela where families pay a one time registration fee and a monthly fee. Non registered members pay a per jerrycan fee.
<b>CBO Revenue Structure</b> Q: What is the structure of the revenue collection? A: <input type="checkbox"/> Pay metered amount <input checked="" type="checkbox"/> Per use (tap attendant, kiosk, etc.) <input checked="" type="checkbox"/> Tariff collection <input type="checkbox"/> No fee <input type="checkbox"/> School fee <input type="checkbox"/> Community solicitation/collection as required <input type="checkbox"/> Fee by select user type <input type="checkbox"/> Revenue from sales. <input type="checkbox"/> Initial Connection Fee <input type="checkbox"/> Sliding Scale	
	<u>Notes:</u>  same as the notes above
<b>CBO Fund Amount</b> Q: What is the amount in CBO institutional financial fund? A: <u>50</u> (USD)	
	<u>Notes:</u>  KSH 5000

## 5.8 Lessons Learned

What is something that you learned on this trip?	What category would you put your lesson in?
Have jumper cables in your team toolbox in case your van/car breaks down.	Travel
Do not go anywhere in Nairobi without your passport on your physical person.	Travel
Check for big national events happening during your stay. Our team was delayed by a roadblock set up for the president of Kenya's independence day speech.	Travel
Always carry your med kit with you when you leave for the day (or at least keep it in the car). Team cleaned up a woman with injuries from a motorcycle crash.	Travel
Discuss as a team instances in which you will/won't give medical aid to a community member. The team made two decisions to treat people before they went to a dispensary but was then approached by community members to behave like doctors (which the team did not do).	Community/NGO Relations
There are community health workers all across Kenya that work with local dispensaries to share health knowledge. While some regions are better staffed than others, theoretically every house is assigned to a community health worker that is tied to the national health program.	Other
Local dispensaries in Kenya now receive money from their districts instead of from the national government or state. This means that some dispensaries in less financially sound districts have unreliable/nonexistent budgets.	Other
Compile your team photo log and travel log nightly over/after dinner: it makes your post-trip work much easier!	Data Collection/Assessment
The difference between a well, spring, river, lake, etc. is not clear in all languages and can be lost in translation. Work with your translator to include information in surveys that helps a community member communicate what type of water source they are referring to.	Data Collection/Assessment
Ideal survey team breakdown: pairs surveying population and infrastructure, pairs + translators surveying families. Infrastructure survey pairs can work approximately 10 times faster than the community survey pairs.	Community/NGO Relations
Make a map using google maps or other similar apps. Helpful for storing population data, surveyed households (for future PMEL surveys/social visits), elevation, etc.	Data Collection/Assessment
Request community translators on first day of trip and invite them to come even if you already have other translators working with you. Consider asking around for local secondary school students (who will be taking their classes in English at school)	Community/NGO Relations
Seek out partnerships with local universities! They can complete their attachments (internships of sorts) to gain graduation credit and you can gain awesome civil students and team members.	Community/NGO Relations

## 5.9 Survey Questionnaires

### 5.9.1 Household Survey Introduction Script and Questionnaire

#### 5.9.1.1 Introduction

Hello and good morning/afternoon.

We are part of the Engineers Without Borders team. We want to learn about the water and health concerns in your town. We would like to ask you some questions. These questions are about your family's health, your drinking water, and your latrine. This will help us with our project.

You do not have to be a part of this survey if you do not want to. If you do want to be in it, you do not have to answer any question that you do not want to. Your answers will be kept private. We will not use your name or any personal information in our report.

Do you have any questions about our survey or project?

Would you like to be a part of our survey?

#### Swahili:

Shikamoo/ Hujambo/ Habari ya asubuhi/jioni.

Sisi in wahandisi na tunajitambulisha kama Engineers Without Borders. Tungependa kujua kama mko na wasiwasi wowote kuhusu hali ya afya na hali ya maji kati ka jamii hii. Tuko na maswali machache ambayo tungependa kuwauliza. Haya maswali yanahuus h ali ya afya ya familia yako, maji mnayoyanywa na hali ya vijumba vyao choo. Majibu ambayo tutatpat a yatatusaidia katika miradi yetu katika hii jamii.

Si lazima ushiriki katika huu utaifiti kama hutaki. Kama hutaki kushiriki, basi si lazima na hakuna haja ya kujibu maswahili ambayo hutaki kujibu. Majibu yako yatabaki kati yetu; hatutayapa kwa mtu yeote. Pia hatutatumia jina lako au ma elezo yoyote kukuhusu wewe binafsi katika ripoti yetu.

Uko na maswali yoyote kuhusu huu utaifiti na mradi wetu?

Ungepende kushiriki katika utaifiti wetu?

#### 5.9.1.2 Questionnaire

Note, the crossed out questions were not asked to save time (initial survey took over 1.5hrs) and the questions at the end were standard follow up questions that the project team added. Additional questions were added in a household specific manner at the surveyor's discretion.

**Kibuon Household Survey**

April 2019



Interviewer(s):

Household Code (GPS):

Date:

1. \*Number of household members by age & gender (put star near respondent)

Pregnant	5 & under		6-14		15-62		Over 62		Total		
	M	F	M	F	M	F	M	F	M	F	T

1a. If they have children, do they go to school?

yes       no       sometimes

1b. If yes, how long does it take for them to walk to school?

2. \*Where do you get your drinking water? (check all that apply)

	In house tap		Community tap
	Surface water		Spring water
	Well		Rain water
	Bottled water		Other:

2a. Do you get your drinking water from this source year round?

yes       no       don't know/not sure

2b. If no, what months or time of the year do you get your water from this source?

(Also if answer for 2a was no) Where else do you get your water?

3. \*How long does it take you to collect your household water and drinking water each day?

<30 minutes       30 min-1 hour       1-2 hours

2-3 hours       over 3 hours       not applicable

4. \*Are there any problems with your current water supply?

Water shortages       Water quality  
 Water supply is too far       Other \_\_\_\_\_



\*indicates a question should be prioritized

**Kibuon Household Survey**

April 2019

5. \*How many liters of water do you collect in a day for use inside the home? (Can we see your jerrycan?)

<5 liters       5-10 liters       10-15 liters  
 15-20 liters       over 20 liters       not applicable

6. \*Who collects the water most often?

Boy in household  
 Girl in the household  
 Adult woman in the household  
 Adult man in the household  
 Other \_\_\_\_\_

7. Do elderly people collect water (for themselves or for the household) from the main water source?

7a. How much water do they drink every day in liters?

8. \*Do you do anything to purify your water before you drink it?

yes       no       don't know/not sure

8a. \*If yes, what? What do you think of each of these methods?

Filter (ceramic, sand, etc) \_\_\_\_\_  
 Boil water \_\_\_\_\_  
 Chlorine/other chemical \_\_\_\_\_  
 Solar disinfection \_\_\_\_\_  
 Other \_\_\_\_\_

8b. Why do you use this method?

	Cost		Health/Safety
	Taste of water		Other:
	Ease of use		Don't know/Not Sure

9. Do you clean your water container?

yes       no



\*indicates a question should be prioritized

**Kibuon Household Survey**

April 2019

9a. How often do you clean your water container? (this could also be asked by which months or seasons they clean it in)

- weekly     monthly     every 2-3 months  
 every 3-4 months     less often

~~10.~~ Do you wash your hands daily?

- yes     no

~~11.~~ When do you wash your hands? (ask as an open ended question, check only what respondent identifies)

Before eating	Before feeding child
After eating	After cleaning house
After going to the latrine/after urinating or defecating	After working outside
After cleaning child's bottom after s/he defecates	When hands are dirty
Before preparing food	After you wake up
Before eating	Other

~~12.~~ Do you use soap when you wash your hands?

- yes     no     sometimes

~~13.~~ Why do you wash your hands? (ask as an open ended question, check only what respondent identifies)

- to be clean  
 to be safe/healthy/prevent disease  
 to smell good  
 told to do so  
 other \_\_\_\_\_

~~14.~~ When do your children wash their hands?

- Not applicable (children under 5, or no children)  
 don't know/not sure  
 when their hands are dirty



\*indicates a question should be prioritized

**Kibuon Household Survey**

April 2019

after going to latrine/urinating/defecating

before eating

after eating

15. \*Do you have a latrine at your house? (can I see it?)

yes     no     yes but not in use

15a. \*If yes, what type of latrine?

pit latrine

composting pit latrine

pour flush

flush

other \_\_\_\_\_

15b. \*If no, where do you usually go to the bathroom?

community latrine

neighbor's latrine

river/stream

bury it outside

in the bushes

don't know/not sure

other \_\_\_\_\_

16. Sometimes children get sick and need treatment. When this happens do you usually go to the clinic?

yes     no

16a. \*Where do you usually get your information about health?

	Radio		Clinic
	Church minister/priest		Health professional (doctor/nurse/midwife)
	Community meetings		Traditional healer



\*indicates a question should be prioritized

**Kibuon Household Survey**

April 2019

	Community leader		Family member/friend
	Community health worker		Other

17. \*In the past month have your children experienced any of the following?

	Difficulty breathing		Diarrhea
	Fever		Bloody Stool
	Convulsions		Cough
	Malaria		Other

18. \*In the past 2 weeks has your child had diarrhea?

yes     no     don't know/not sure

18a. \*If yes, how often have they had diarrhea? (ask as open ended question)

- Daily  
 12-14 times  
 8-11 times  
 4-7 times  
 1-3 times

(Gauge if next question is appropriate to ask)

19. In the past 2 weeks have you had diarrhea?

yes     no     don't know/not sure

19a. If yes, how often have you had diarrhea? (ask as open ended question)

- Daily  
 12-14 times  
 8-11 times  
 4-7 times  
 1-3 times

20. Has your household ever talked about having a different method of water collection and/or treatment?

yes     no     don't know/not sure



\*indicates a question should be prioritized

**Kibuon Household Survey**

April 2019

If yes, what type of system/treatment would you like to have?

---

21. \*Who do you think should be responsible for taking care of the system?

22. \*What do you think is a fair price for one jerrycan of clean water?

23. \*Has the local government ever asked you to contribute money toward a project?

yes       no       don't know/not sure

If yes, what type of project was it?

24. \*What is the best way to let people know about this project?

SURVEYOR NOTES/OBSERVATIONS:

25. How does the community resolve conflicts?

26. Is there anyone we should speak to before we leave?



\*indicates a question should be prioritized

## 5.9.2 Dispensary Survey

Kibuon Healthcare Survey [\[link\]](#)

[link]

April 2019 [\[link\]](#)



Clinic Name:

Clinic Location (GPS):

Date:

1. Who works at the clinic? (note the numbers)

Midwives  Doctor(s)  Nurse(s)  Health volunteers  
 Community health worker  Other \_\_\_\_\_

1a. What kind of training has the staff had? Where did it take place?

1b. What days and times is the clinic open each week?

2. How does the clinic receive funding?

3. Is there a health worker in the community? What kind (community health worker, doctor, nurse, midwife)?

yes  no  don't know/not sure

4. Are there traditional health care providers or healers in the community?

yes  no  don't know/not sure

4a. What are they called?

4b. What do they do?

5. Do people in the community pay for their own health care?

yes  no  don't know/not sure

5b. If yes, is there anything that is not covered by this payment?

6. How does the community keep track of illness, disease, services, and deaths?

Clinic

District or National Statistics

Community Leaders



**Kibuon Healthcare Survey**

?

April 2019

Other \_\_\_\_\_

7. What are the top three health concerns in the community? (If there is a more specific concern, list it in related category)

Diarrhea

Respiratory \_\_\_\_\_

HIV/AIDS

TB

Chronic Disease (e.g. heart disease, cancer) \_\_\_\_\_

Women's health \_\_\_\_\_

Injuries/Accidents \_\_\_\_\_

Child Health \_\_\_\_\_

Nutrition/Malnutrition \_\_\_\_\_

Other \_\_\_\_\_

8. Does the clinic have any programs which educate community members about healthcare? What are they?

9. Have any non-governmental organizations been in the community to promote health in the last 5 years?

yes       no       don't know/not sure

- 9a. If yes, what is the name of the organization?

\_\_\_\_\_

Are they still working here in the community?

yes       no       don't know/not sure

10. What does the clinic use as a source of water?

11. Do you have any statistics about how often people are ill from waterborne disease?

12. Are there any long-term health issues that people face because of the water quality?

13. Could we contact you with more questions? What is your contact information?



## 5.10 Meeting Minutes

### 5.10.1 First Meeting with the Kibuon Projects Committee (CBO)

Date: June 3, 2019

Start time: 10:45am

End time: 1:00pm

Attendees: EWB team (Marwah, Billy, Nicole, Nisheet, Chris, Jude, Gavin), Paul and Charles Olang, Mercy, Julius, Vincent, Eunice, Richard, Joel, Maresa, Benta

(37:30) Region where each person is from (see notes below for which region each letter signifies)

Region A (Nyamilu)	Region B (Sindianya)	Region C (Ombolwanda)	Region D (Wiyao)
Maresa Odira: member	Joshua Odoyo: member	Vincent Aooko: (assist. chair)	Richard Okelo: member
Eunice Awino: secretary	Joel Agalo: member	Benta Akelo: member	
Julius Amara: coordinator for A	Samuel Oguang: member	Mercy Auma: chairlady	
Joshua Ater: member	Dickson Oler: member	John Otieno: member	
Daniel Omore: member	Jane Atieno Ajuang: treasurer		
Wycliffe Otieno: member and village elder	Alice Akoth: member		

#### Phone numbers:

- Richard Okelo: 0715704830
- Vincent Aooko: 0715393068
- Mercy Auma: 0724490570
- Joshua Ater: 0701231118
- Samue Oguangl: 0723879412
- Wycliffe Otieno: 0711780819
- Julius Amara: 0721424351

#### Planned Questions:

- Chair - Mercy Ododa, Sec - Eunice Owino, Tres - Eunice Ochieng
- Intros
- When was it started? How was the first committee established? Who helped set it up? How were they involved in the community application?
  - (0:00) First assembled in 2016 from a family center to discuss community problems with regards to water
  - (1:00) Assembled and had a debate about the problems of the community. From that meeting, they appointed officials for the problems. First meeting had more people from the same family/connections. 2017 submitted application for water provision, then disbanded for a while until we adopted the project, so they reconvened and re-elected members (through debate, elected regional representatives)

- (4:40) February 2017 submitted application to EWB-USA. Had a meeting about the different water problems in the community and the different responses
- (6:20) All the members of CBO were raised in Kibuon and live in Kibuon. The CBO is registered with the government
- How are appointments/ elections done?
  - (6:40) Committee formed through nominations for positions. Brought together entire community and had people from diff regions of community to nominate people who they think are good representatives
- How often does the CBO meet?
  - (11:30) Meet every Thursday, but before we adopted the project they didn't meet that often. Have been meeting every Thursday since January 2019.
- What is the leadership structure?
  - (21:50) Chairlady, then assistant chairperson/deputy, then secretary, then assistant secretary, then treasurer, then assistant treasurer, then remaining committee members, then residents
  - (23:10) Committee has about 18 members. **There are 4 villages in Kibuon (Nyamila is A, Sindianya is B, Ombolwanda is C, Wiyao is D)**
    - **For surveys they recommend going in alphabetical order (A,B,C,D). A and B are the largest. Recommended doing 2 days per region.**
  - (29:00) There is just this one committee and they make all the decisions, there aren't subcommittees. Their main concern is water
- Any government connections/relationships? Do they know anyone in Government?
  - (25:40) Julius knows the MCA, have been in communication, and will have a call with him to decide when to meet. However, CBO has no formal connections with government
  - (9:30) CBO is registered with government. Every group must be registered with gov. Initial fee is ksh 1200, and then annual renewal is ksh 200
- DONT FORGET TO ASK ABOUT FUNDRAISING - ie. How is the 5% raised. They can also contribute through materials
  - (13:00) **They have been registering every household with a one-time ksh 500 fee. Around 40 people have registered (not paid fully yet). They currently have ksh 5000**
  - (14:40) **Maintenance fee of ksh 20 per month for registered members, which allows them to access water**
  - (16:10) **No additional fees for members, but jerrycan limit depends on how much water available from well. For nonregistered members, TBD but are thinking ksh 5 per jerrycan (same as price from town)**
  - (31:00) Fundraising plans have been the registration fee and the ksh 20 per month. Planning to host a fundraising event for the community (harambe)
- Are there benefits from registering now?
  - (32:45) The incentive to pay for registration right now (vs later) is the fact that we adopted the community now, so they have been reading our emails to the community
- How did they choose the water fees?
  - (46:50) They decided on the registration and monthly fees by meeting and discussing only amongst themselves (not with community)
- Are CBO meetings open to community members?
  - (18:30) CBO meetings are open to all community members, community is informed through churchs and village elders and word of mouth
  - (20:10) Kibuon has smaller villages that each have village elders

- How/where will they store the funds? Do they have an account?
  - (44:00) Storing their funds in Equity Bank, they have an office in Migori
- How are fees and records maintained?
  - (56:00) They have the secretary keep a record of who is paying fees
- How will they get the land for the well?
  - (44:40) They've discussed land donations, and they don't have it narrowed down to a single person but there have been many enthusiastic people to donate land. Incentive is just enthusiasm to have water.
- How are public meetings organized?
  - (48:40) **Organized public meetings by using the village elders to send information to various regions in Kibuon. They also use the churches because a majority of members go on Sundays, so they announce it then.**
  - (51:00) They've done 4 meetings in the past: 1 in Feb, 2 in March, and 1 in April (2019). Typically 40 or 50 people come.
- Do they have any recorded data on the community eg. census, past survey?
  - (52:40) Got 800 by having each village elder do an approximate guess on how many people live in their region.
  - (55:00) They can't make an estimate now, but they can go out to find out
  - (1:00:30) 800 is an approximation of both the people that live here and those who probably study or work outside of Kibuon now
- Do they have any technicians in the community who can perform maintenance?
  - (1:04:30) Yes, many people in the community, and Joshua and Joel have construction experience
  - (1:06:20) Also have electricians and plumbers, including someone named Kefa
  - (1:07:00) Any engineers or engineers with diplomas? Very unlikely, those with diplomas usually work outside of the community
  - (1:08:20) Few doctors and nurses also, they work outside of the community
  - (1:09:00) Any one with any medical experience? 13 community health volunteers (Mercy the chairlady is one of them)
- Who are the influential people in the community?
  - (57:20) **Influential people are politicians (MCA), religious leaders, provisional administrators (subchief representing Kibuon but lives in Bondo). They settle disputes in the subchief's office in Bondo**
  - (1:00:00) Richard is a member of the panel of the subchief
- Where do most people go for healthcare?
  - (1:10:00) People usually go to the dispensary in Bondo and in Nyamila (the only 2 in the community)
  - (1:11:00) Hospital in Migori county and Nyamaraga (level 3 subcounty hospital)
    - Migori is the larger one
- Has anyone in the committee been involved in the design of a water dist system?
  - (48:10) Only person who has been involved was Charles (with the projects in Lela)
- Have other organizations been involved? Find out if there are any existing water related contracts
  - (1:12:40) No other organizations
  - REA Electrification Program (gov program) is working on providing electricity
- Primary schools with electricity?

- (1:13:00) Baraza Oderge and Nyailing'a had electricity installed about 3 years ago
- (1:14:30) REA Electrification Program (government program) is distributing electricity to schools first and then to homes (see photo from photolog from 6/2/19 Marwah). REA did the electricity in Baraza and Nyailing'a
- (1:18:40) Not sure when it will reach houses but the plan is called "Vision 2030"
- Where are the public community buildings - schools, churches etc
  - (1:20:00) 8 churches and 1 primary school in Kibuon
  - (1:26:40) What are the denominations for the 8 churches? Just Christianity
- What are the different ethnic groups?
  - (1:27:40) Kisii and Luhya but they are unbiased
- (1:22:00 to 1:26:30) Discussing organizing many things:
  - Who can help us with the surveys in Luo?
  - Ask for help with organizing a women's meeting.
  - Organizing with village elders when we go to each region
- (1:28:30 to 1:54:00) Discussing many things
  - Talk about expectations
    - organize and involve community members in future construction activities
    - communication while abroad,
    - meetings amongst themselves
    - help with suppliers and contractors
    - help with collection of incomplete data while abroad
    - operation and maintenance. Help organize a formal system for this
    - establish/ maintain a fundraising system
    - allow us to use pictures in their reports
    - equal distribution of the project's benefits
  - What to expect from us:
    - design and development of project
    - seek CBO input in design phase
    - Be explicit about our skills – what we can do vs what we will need help with
    - inform CBO of any changes in agreed upon plan eg travel dates, site visits
    - Create O&M manuals (with drawings) and translate them to Swahili and Luo. (We will need help)
    - We will ask for permission before taking pictures - let you know how we use them

## 5.10.2 First Meeting with the Community

Date: June 3, 2019

Start time: 3:00pm

End time: 4:45pm

Attendees: EWB team (Marwah, Billy, Nicole, Nisheet, Chris, Jude, Gavin), Paul and Charles Olang, Julius, and the community (53 people – 36 women and 17 men – about 10 of them were the CBO members) (ages look mostly 25-80)

- What are the problems that the community is facing?
  - Water is top priority
  - Health care is second priority
    - Migori hospital is expensive
    - People have died due to long distance
    - Ambulance to Migori costs ksh 8000
    - Hire a vehicle to drive you to Migori is ksh 5000
  - Electricity is third priority
    - Current lamps they use emit a smoke that causes health issues
    - Asked how many experienced health effects of lamp: most people raised hand
- What is the impact of lack of water on education?
  - School ends at 4pm
  - Kids are sent at 3pm to collect water for school, and again at 4pm to collect water for home
  - Some kids wake up at 6am to collect water for home, and then go to school before 8am
  - Some kids in primary school drink any type of water, causing diseases (typhoid, dysentery)
- How long does it take to collect water/how far is it from the schools?
  - 4 schools: same listed in CBO meeting notes
  - Depending on the season it takes between 1-3 hours roundtrip
  - There are a couple of springs around here where they collect water-- this is their source of water a very high majority of the time
  - During the rainy season they collect water that forms in the valley, but that is a very short amount of the year
  - Rarely/never go to the river in Bondo
  - During the dry season, many villages go to the same springs that haven't dried up, which are:
    - Riamanyama
    - Wadh Anyim

How do you collect water?

- Ksh 5 per jerrycan if you go buy yourself
  - Ksh 20 per jerrycan if you send a motorcycle (max is 5 cans so ksh 100)
  - During dry season, over 90% of them said they send a motorcycle daily
- Uses for water?
    - Drinking
    - For animals (cows, sheep, lamb, etc)
  - Regions represented at meeting
    - This meeting is being held in A
    - There is a funeral in D which is why there are few people
    - From A is 21 people

- From C is 8 people
- From B is 14 people
- From D is 9 people
- Is it difficult for kids to go to secondary school?
  - It is difficult, main issue is poverty.
  - Day school secondary fee is ksh 20,000 per year for day school
  - Boarding school secondary fee is ksh 50,000 to 80,000 per year
  - 21 people raised their hands saying they have kids in secondary school
    - 11 people in day school
    - 14 people in boarding school
  - 8 people raised their hands saying they have kids in college
- Frequency and effect of flooding?
  - Every April/May it floods
  - Destroys crops near valley
  - Most houses are high so don't get flooded
- Who would they say are their community leaders/influential people they can look to for help and change?
  - Technically influential is the MCA but they don't really help
  - Religious leaders
  - Chief Ndonyo Silfanus lives in Gilbore
    - Assistant Chief Milicent Tinga
    - What makes them influential? They are government leaders/people in power
    - They listen but they don't really make change
  - The only time these leaders make change is during elections. Those people are MCA, women's representative, governor, and senator
- What is the relationship with Bondo and Lela and are they happy about their water systems?
  - Generally good interactions
  - Water from their wells is generally clean
  - Cost for water from Lela by sending motorcycle is ksh 100 for 5 cans
  - Otherwise it is ksh 5 per jerrycan
  - From A to Lela well it takes 1.5 hours each way (by foot)
  - From B to Lela well it takes 2 hours each way (B is the farthest region)
  - From D to Lela well it takes 1 hour each way (D is closest region)
  - Nearest well is Bondo (30mins from A and 60mins from B each way by foot) but they usually get it from Lela because Lela has 3 wells so they wait for less time (Lela has 30 mins wait time during dry season, but Bondo has 3 hours wait time because of long line)
- How many people are registered members of Lela? How much does the membership cost (both initial registration fee and monthly fee? How many jerrycans do they get)?
  - No one is a registered member because distance is extremely discouraging
  - **No one knows how much it costs to register to become a member, or the monthly fee**
- Careers
  - Farmers: 70-80% raised their hand
  - Businesses: 5-6 raised their hand

**Questions community asked:**

- If we are completely unable to provide water for ourselves, is EWB able to provide money for us to just purchase water?

- Response: EWB is a national organization that works with communities to create sustainable solutions, so the work we try to provide needs to be able to sustain itself independently from EWB aid
- It is a partnership and team effort, so there is a community contribution expected too of 5%
- Are you going to provide us with a well?
  - Response: This is an assessment trip so we are still collecting information about the community to see what the best option is, but the end goal is to provide them with water.

**Other notes:**

- Many CBO members were present during meeting which may affect community members' answers, especially about influential leadership
- Community members don't know the costs for Lela registration, and that it is almost 30 times cheaper per jerrycan (note that you can still send someone on your behalf to collect water if you are registered)
- Women's meeting is scheduled for: Saturday 2pm
- Next community meeting: Monday 3pm
- Female volunteers to translate for the meeting

### 5.10.3 Meeting with WECCO

Date: June 2, 2019

Time : 2-4pm

Attendees: Billy, Marwah, Nisheet, Gavin, Jude, Chris, Nicole with Martin (director of WECCO), Hezran (WECCO secretary), Ken (Martin's son), Julius (and Paul and Charles)

- What services do they offer?
  - Hydrological survey
  - Well drilling
  - Pump installation
  - Maintenance and repairs
  - Community training
  - Distribution systems
- Background on WECCO
  - WECCO = c (\* maybe Community Organization)
    - If there are students that go into secondary school or college and cannot afford it, they sponsor them with financial aid. They find these students based through talking, social settings, etc. Mostly try to sponsor orphans and those who are very needy. If they notice a bright student around, they sponsor them. No application.
  - Has 15 members
  - In Migori town
  - They've drilled in Rakwaro, Aruba, Tokana, Siaya (and more, check with Billy)
    - Manual pump is 25km in Rakwaro Girls Preparatory school
    - Electric pump in Florence (in Migori)
    - Electric pump in Chamkombe (3km from Migori)
    - Tank stand in Kadika
  - They've been drilling for 10 years
- How do you determine if the location for the well will actually provide water, and do you conduct hydrological surveys?
  - They use a device to conduct the hydrological study that measures the depth of the water table. The device also collects chemical data, device model: NIVA
  - Send the data to a government office in Kisumu that determines the quantity of water and quality.
  - 75,000 shillings to conduct the hydrological study (includes everything). They will send a more precise quote
  - 2-4 hours to conduct hydrological study, and 3 days to get data from Kisumu. You have the booklets of data in about a week. Working days are Mon-Fri and offices are closed during holidays
  - 100-160m average for well depth because Kibuon location is close to lake
  - After they collect the data, they provide it to us in booklets (3 copies). We can go to one of their offices to look at the data of other wells
- Do you have data on any of the wells already drilled? (how long they last, the amount of water it provides, if water depth differed from expectations from hydrological study)
  - They have records of all the wells and are willing to share them with us
  - None of their drilled wells have died yet
  - Sometimes the pump (which they've installed) breaks
- Drilling process and information
  - Drilling costs 10,000 shillings per meter (so 160m is 16k dollars)

- Must dig at least 1 or 2km away from other wells and 100m from latrines
- Drilling should not take more than 3 days if the area is just soil.
- If the region is swampy, they drill and use plastic casing, which will take longer than 3 days. Also if there are many boulders in the way, it also takes longer than 3 days.
- The soil around here is mostly rocky and takes about 2 days to drill. Average total depth is 160m. Sometimes it takes just 1 day from 8am-9pm
- The water table varies greatly through Kibuon, so sometimes the place they're told to drill isn't the best location
- If the results from the hydrological survey suggests that you should not drill a well in that location, they won't drill it. They usually follow the data that is in the hydrological survey.
- Can do our own hydrological survey, but must provide them with the data for them to drill there (because of government requirements)
- They use a machine to drill the well with 3 drill bits. Which they use depends on the data collected from the hydrological study
  - 3cm
  - 6cm
  - 10cm
- **Maintenance:** Usually do maintenance after 5-8 years because rocks and sediments block the path, so they open the well from the top and redrill the well all the way down and add gravel on the bottom
  - Costs 500,000 shillings
- Pump installation information
  - They also install pumps, although sometimes the pump breaks (but there is still water in the well)
  - Three types of pump depths:
    - Pumps up to 45m
    - Up to 100m
    - Up to 160m
  - Electric vs Manual
    - Electronic pump
      - Costs 200,000 or 350,000 or 600,000 (Martin recommends the 350, works fine)
        - Models of pumps are dipwell 1, dipwell 2, dipwell 3
        - They know stores where you can replace broken parts for the 350 pump
        - Warranty guarantee is 3 years (for 350 and 600 only)
      - Pumps into a tank when its not full
      - During the dry season, if the water in the well is low then it doesn't draw water. This is ideal
      - For maintenance of the electric pump, WECCO cannot do that. Community has to contact the manufacturer of the pump.
        - Offices for manufacturer are in Kisumu, Nairobi, Mombasa (Kisumu is closest to Kibuon)
        - Usually manufacturer takes a few weeks to make the repair
      - The casing for the electrical pump is included in the installation price
    - Manual hand pump
      - Costs between 120,000 to 180,000. Pumps differ by quality and durability (some of them are imported-- expensive is imported from India. Cheaper is in China)
        - The India brand is Afridev
        - 1 year guarantee for the manual pumps (all of the pumps)
      - The pump in Charles house is the Afridev 120,000 shillings, but a better quality is the 180,000

- dipwell 3 is 230, dipwell 2 is 180 (from India)
- If it pumped during the dry season and there is no water, the pump breaks
- The concrete base for a manual pump costs 10,000 shillings
- Pump warranty covers if the pump breaks or stops working. They will come to replace it. If community breaks it themselves, it is not covered. So if members try to use the pump during the dry season and break it themselves, it is not covered under warranty (but it is just a piece of rubber that breaks in that case--costs 5,000 shillings to replace rubber).
- They haven't made any solar pumps-- dangerous part is theft
- Do you do any distribution systems?
  - They can do installations of pipe systems to people's houses
  - They recommend using electrical pumps
  - If it is a very large region, they have multiple tanks that they pump into
  - Recommend water kiosks with a caretaker to ensure no one breaks anything or wastes water
  - In Siaya they have household members rotate for taking care of the well (must establish a committee to do this)
  - Ask them for a quote of a particular region and amount of water
- Do you offer any trainings to communities about well maintenance?
  - Yes, and the training is free
  - They train the entire community
  - They give them the run down of what to do to maintain the well
- We have the maintenance manual that Hope College made for Bondo

#### 5.10.4 Focus Group Meeting with the Women of Kibuon

##### **What challenges do you have with water? Is there anything you would like to share with us?**

- Fetch water from river, sometimes have to get up at 3am
- Sometimes there isn't even water when you get there and you have to wait for it to refill if you want water
- Walking to get water at night is dangerous and there are wild animals
- There is dirty water that can transmit diseases
- Have to collect water at different times, odd hours
- Have to take care of children and don't have time to sleep
- Have to keep kids out of school because they go collect water and get back after school starts (sometimes have to go with mothers to collect water very early in the morning)
- Hard to wake up early to fetch water
- Older woman got hurt when an animal startled her at night while carrying a jerrycan (hit her back and is still injured)
- Older women can't walk to get water, have to drink dirty water because of inaccessibility
- Animals also use the same water points that are for drinking/bathing
- Some water points are personal and people charge for water
- Marital strife because husbands think women are being unfaithful when they leave at strange hours to collect water
- Water collecting is women's work so they just have to deal with it

##### **Are there any women's issues you would like to talk about that are not specific to water?**

- Women are not given any priority in their households in this region
- Men do not help their partners with chores/women's work
  - Food
  - Water
  - Children
  - Firewood
  - Cleaning
  - Laundry
- Family planning: men don't allow women to use family planning so they have more children than they can support
- When they see the side effects of the birth control they want to stop using them<sup>5</sup>
  - Side Effects:
    - Injections every three months
    - Heavy/painful menses when they do come
- Teen pregnancy and young marriages
  - 14 year old brides, sometimes 12 years old
  - If they give birth/get pregnant then they either:
    - Get married and the cycle continues because the girl child cannot finish schooling and are unprepared to become a mother
    - Are supported (along with their child) by an already over-burdened mother
- Drug addicted men come home to women at night and abuse them
- Still expect to eat when they get back
- Bring home no income (spend it on drugs/alcohol)
- STI's and HIV are significant issues
- Cash crop in Kibuon is tobacco, but when men make a bit of money from it they get another wife
  - Give HIV à all wives

---

<sup>5</sup> My impression is that this woman was talking about women not liking birth control because of side effects, but this was not totally clear from the translation. -Nicole

- “inherit wives” = women whose husbands have died
- 14% HIV positive (from Reno)
- When you get married you are given a piece of land and the woman is expected to produce income from it. This is all that women have to provide for themselves.
  - This is all women have to buy:
    - Clothing
    - Food
    - Supplies for children
    - Feminine Hygiene supplies
    - School

**What are the men doing every day?**

- Most men leave in the morning, stroll around during the day, return @ night
- Polygamy is problematic for women
- Women have adolescent daughters and are left to be raised by women
- There are no boarding schools in the area, so what girls do/what happens to them on the way to school and back is a mystery to mothers
- Kids are assaulted on the way to school
- Girl children are more expensive than boy children so men leave their care to mothers
  - Menstruation products = expensive
- Orphans due to family deaths (sometimes HIV/AIDS)
- Grandchildren are sometimes left to grandparents who cannot provide for them due to age/economic limitations
- Gambling is a problem
  - Men get casual work but because they gamble none of the money makes it home
  - Gambling via phone (sportpesa) leads to spending of small amounts
- Widows are numerous
- Men do not show public affection to wives
- Women are expected to help with business but do not have the knowledge/capital to help the businesses
  - Interested in how we could help with the issue
  - Need skills to provide for themselves and families
- Girl children used to only be expected to get married from grade 4-8 to provide dowry for family (still hasn't gone away)
- Once you get pregnant you stop going to school and nobody brings you back
- Young couples have problems
  - Women are faithful to men but men aren't faithful to women
  - Causes conflict
  - Everybody might as well be unfaithful
  - Cellphones aren't answered by men when they're around their wife
- Luo culture: when an older female relative dies a young woman is selected to replace her
  - Take care of children, get married to widower
- Husband might have cattle but women are the ones taking care of them with feeding and watering

**Do you feel comfortable talking to your husbands about these issues? (murmuring/talking amongst group)**

- Not given opportunity to talk about it, speaking up is seen as disrespectful. Complaining makes everything worse.
- Bring in another wife if you complain you have too much work.

**How would more water access change things?**

- Wouldn't have to leave early/late to get water
- More clean water

**How would you solve the water issue?**

- WANT A DRILLED BOREHOLE
- Ideally would want water pumped to their house

**Where would the best place for a borehole be as the first step?**

- Places they prefer it to be drilled, but one wouldn't be enough for the entire community

**Where would the best place for a borehole be as the first step?**

- 4 villages/sub-villages that would each have ideally a few water points

**Where do many people from the community meet in Kibuon?**

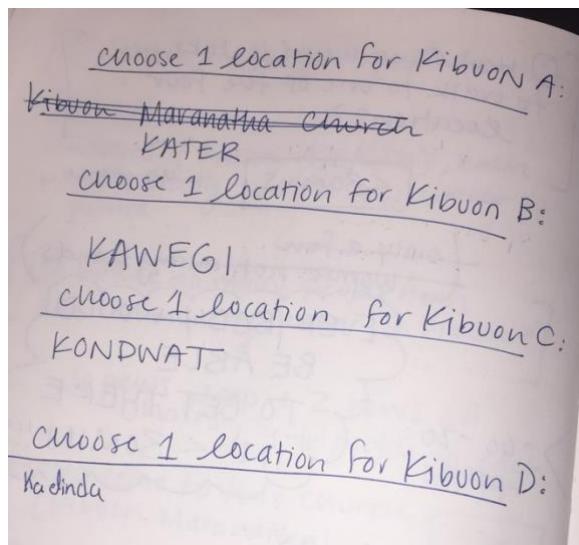
- Kibuon Maranatha (location of the meeting) ~24
- Munyu Chirch ~20
- Ombo Luanda ~6
- Sirikizo: ~9
- # of people who cannot get to any of these locations by walking: 0

Worried about water point drying up.

**EVERYBODY WOULD BE ABLE TO GET TO THESE LOCATIONS IN LESS THAN 30 MINUTES.**

**People:**

- Kibuon A: 25
- Kibuon B: 17
- Kibuon C: 7
- Kibuon D: 9



- 14% HIV infection rate  
- STI/HIV transmission

