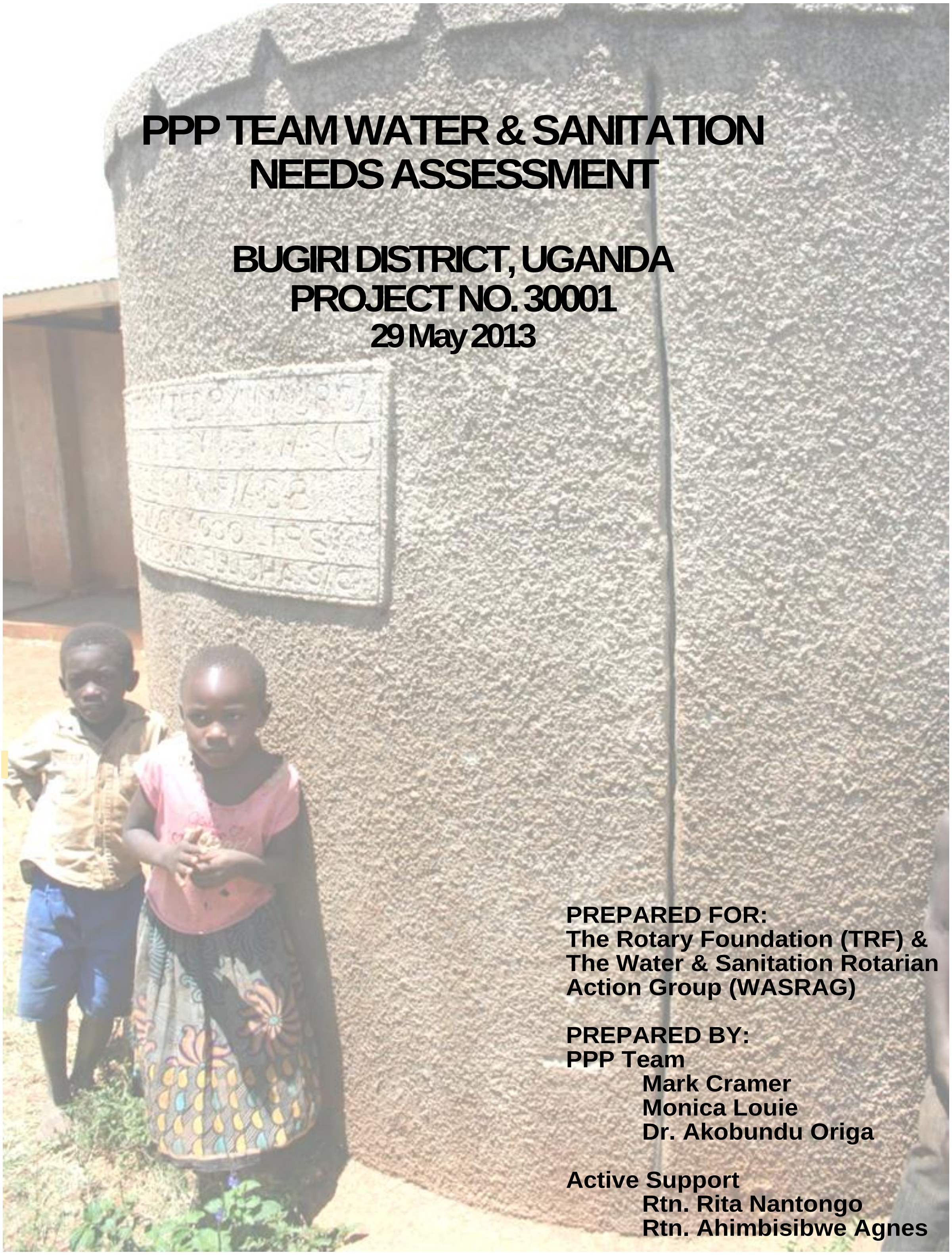

PPP TEAM WATER & SANITATION NEEDS ASSESSMENT

BUGIRI DISTRICT, UGANDA
PROJECT NO. 30001
29 May 2013

PREPARED FOR:
The Rotary Foundation (TRF) &
The Water & Sanitation Rotarian Action Group (WASRAG)

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EXECUTIVE SUMMARY

Located in eastern Africa, Uganda consists mainly of a plateau with a rim of mountains. Altitudes range from a low of 621m at Lake Albert to a high of 5,110m on Mount Stanley near the western border with the Democratic Republic of the Congo. The climate is tropical, but tapers off to semi-arid in the northeast.

Bugiri District is located in the southeastern part of Uganda. It has a total area of 5,701km^2 of which 1,493km^2 is land and the remaining 4,207km^2 is covered by water. The land is generally characterized by gentle undulating hills with few higher residual features. A somewhat higher relief across the district forms two main watersheds; a northern drainage and a southern drainage; the latter of which drains to Lake Victoria. Major swamps include Igogero, Kibimba and Dohwe and major hills are Irimbi, Bululu and Namakoko.

Bugiri district has a mean annual rainfall of 1,200 mm in the wetter south and 900 mm in the drier northwest. In general there are two peak rainfall seasons; April – June and August – November. The relatively succinct dry season occurs from December to March. Annual temperatures range from a low of 16.7°C to a high of 28.1°C.

Bugiri town is the largest commercial center in the district. This is also the locale of the district headquarters are and the district hospital. The town is 172km away from the Ugandan capital of Kampala. Bugiri District consists of one county, 16 sub-counties, 101 parishes, and 548 villages. The town of Bugiri is the only village considered to be “urban”; however, several other villages are considered rural growth centers namely Namayingo, Muterere, Nankoma, Busowa, and Buwuni.

Bugiri District lacks the water resources found in many of the other districts. Both groundwater and surface water sources are limited. Whereas Lake Victoria provides a very reliable water source, it primarily serves only those settlements located along its shores and will require treatment to provide a safe source of drinking water.

The Rotary Club of Ntinda identified six sub-counties that are in dire need of improvements to their water and sanitation facilities. These sub-counties include Budhaya, Bulesa, Bulidha, Buwunga, Muterere, and Nankoma. Average access to safe water sources across these six sub-counties is only 42 percent. Open defecation or the use of Kavera (plastic bags) approaches 28 percent. Only six percent have access to improved sanitation facilities with the remainder relying on the traditional pit privy.

To address these needs the Rotary Club of Ntinda requested a Program Planning and performance Evaluation (PPP) Team from WASRAG. The primary task of the PPP Team was to identify the water access points/sources, sanitation facilities, and hygiene practices utilized in the six identified sub-counties of Bugiri District. The goal of the PPP Team was to conceptualize projects that meet the desires of the communities and adheres to applicable government standards.

The PPP Team performed field work in Uganda March 04~15, 2013. The work consisted of two primary components. The first entailed conducting a door-to-door Household Survey with the assistance of an indigenous survey team to obtain statistical data on water and sanitation practices, as well as recent incidents of illness, satisfaction with current services, available avenues for financing, etc. The second component was to conduct a Water Point Survey

wherein Team members visited a number of sites where local residents collected water to obtain information on the general nature and condition of the available sources and to observe sanitary facilities utilized by the households in the area.

The PPP Team then proceeded to conceptualize projects to address the issues observed. Given the large geographical area and the diverse nature of plausible solutions to the water and sanitation needs the Team opted to provide a series of potential projects rather than just one project. The intent is to allow Rotary Clubs or other donor entities to select the project(s) that best adheres to their individual criteria. A list of the potential projects, the conceptual opinion of probable construction costs, and the potential impact on the communities is provided here in the table below:

TABLE ES.1
IDENTIFIED PROJECTS &
CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COSTS

UNIT COST (UGX)	DESCRIPTION	TOTAL COST (UGX)	TOTAL COST (USD)	POTENTIAL IMPACT
1	School Water & Sanitation	547,216,000	210,500	7,200 students
2	Protected Springs with Biosand Filters	344,516,000	132,500	1,050 households
3	Handpump Boreholes	522,216,000	200,900	500 households
4	Solar Pump Boreholes	627,216,000	241,200	500 households
5	Step 2 Chlorine Generators	632,216,000	243,200	5,000 households
6	Health Centre Compost Toilets & Food Plots	419,416,000	165,200	Undetermined
7	Traditional Pit Privy Upgrade	567,216,000	218,200	5,000 households
8	Lake Victoria WTP Phase 1	9,200,000,000	3,538,500	264,200 persons

Once a donor has selected a project and developed a partnering arrangement with the Rotary Club of Ntinda it will be necessary to conduct additional field work. This next phase of the work will include identification of the specific communities to be served, refinement of the scope of work, and development of a more accurate opinion of probable construction costs.

1.0 GENERAL OVERVIEW

As part of the Project Enhancement Process (PEP), Future Vision Plan, The Rotary Foundation (TRF) selected Uganda to be one of the nine Pilot Districts in which the Water and Sanitation Rotarian Action Group (WASRAG) will implement a WASH (Water, Sanitation and Hygiene) project.

The Rotary Club of Ntinda (District 9200) submitted “A Report of the Needs Identification Exercise in Bugiri District” in July of 2011. This was followed by a “Future Vision Plan PPP Team Request Form” in July of 2012. As a result, a Program Planning and Performance Evaluation (PPP) Team was recruited and assigned to the Bugiri Water Project (Project No. 30001).

The PPP Team was tasked with assessing the needs in the project area, prioritizing those needs, and developing appropriate solutions to address those needs. In essence, the PPP Team was to focus on six sub-counties within Bugiri District; specifically, Budhaya, Bulesa, Bulidha, Buwunga, Muterere, and Nankoma. Exhibits 1 and 2 present the general location of the project areas. During the fall of 2012 a Team Leader and two Team Members were selected for Project 30001. The PPP Team was notified of budget approval by TRF on February 05, 2013 to perform the required tasks.

The PPP Team gathered in Entebbe, Uganda the first weekend of March and travelled to Bugiri March 04, 2013. Field work was concluded on March 12, 2013. Prior to departure on the 13^{th} the PPP Team met with the staff of the Bugiri District Hospital and toured the facilities to become aware of issues related to regional health care. Although not officially a component of Project 30001 the needs at the hospital warrants consideration. Perhaps a Rotary Club or other organization will choose to partner with the Rotary Club of Ntinda to address the hospital’s sewerage issues. If there is interest, the PPP Team can provide a brief description of the observations made.

This report presents the PPP Team's Community Needs Assessment, base line analysis, community survey, and meetings with communities/stakeholders to identify needs and local ability to meet those needs. Taking these findings into consideration, the report provides potential solutions and appropriate technology to meet the identified needs, along with conceptual opinions of probable construction costs for the various projects. It is understood that this PPP Team's report will be reviewed by TRF and WASRAG and may lead to a Global Grant application when the report is jointly approved by them.

The primary purpose of this pilot project is to provide safe water, sanitation facilities and hygiene education. This will be the foundation for outcomes that will improve public health, community functioning, and quality of life. The primary task of the PPP Team is to identify the water access points/sources, sanitation facilities, and hygiene practices utilized in the sub-counties of Budhaya, Bulesa, Bulidha, Buwunga, Muterere, and Nankoma in Bugiri District. The Team will then discuss possible solutions for improving access to clean water and safe sanitation under the conditions found in these areas.

The goal of the PPP Team is to conceptualize a series of projects that meet the desires of the communities and adheres to applicable government standards.

Exhibit 1.1:
Bugiri District

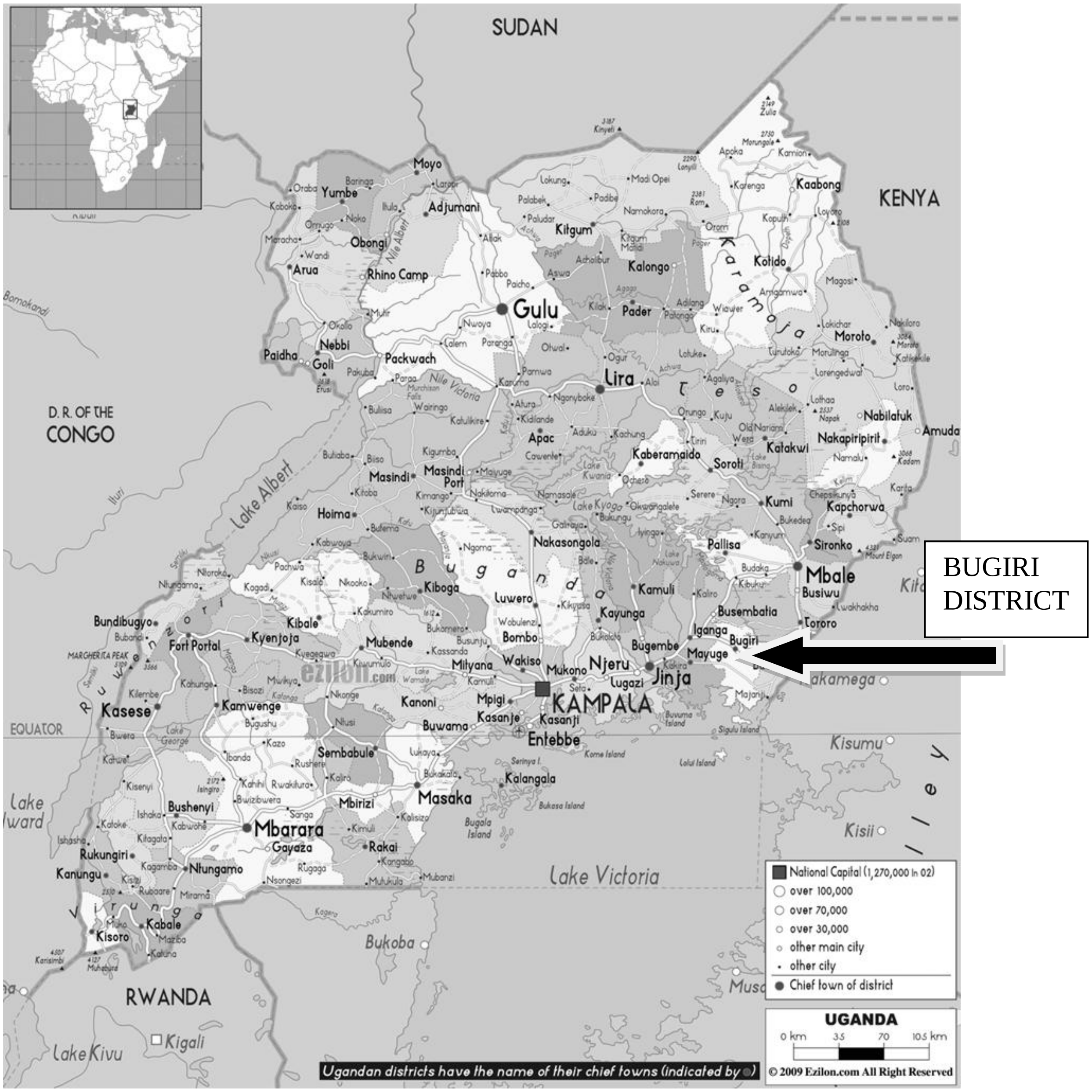
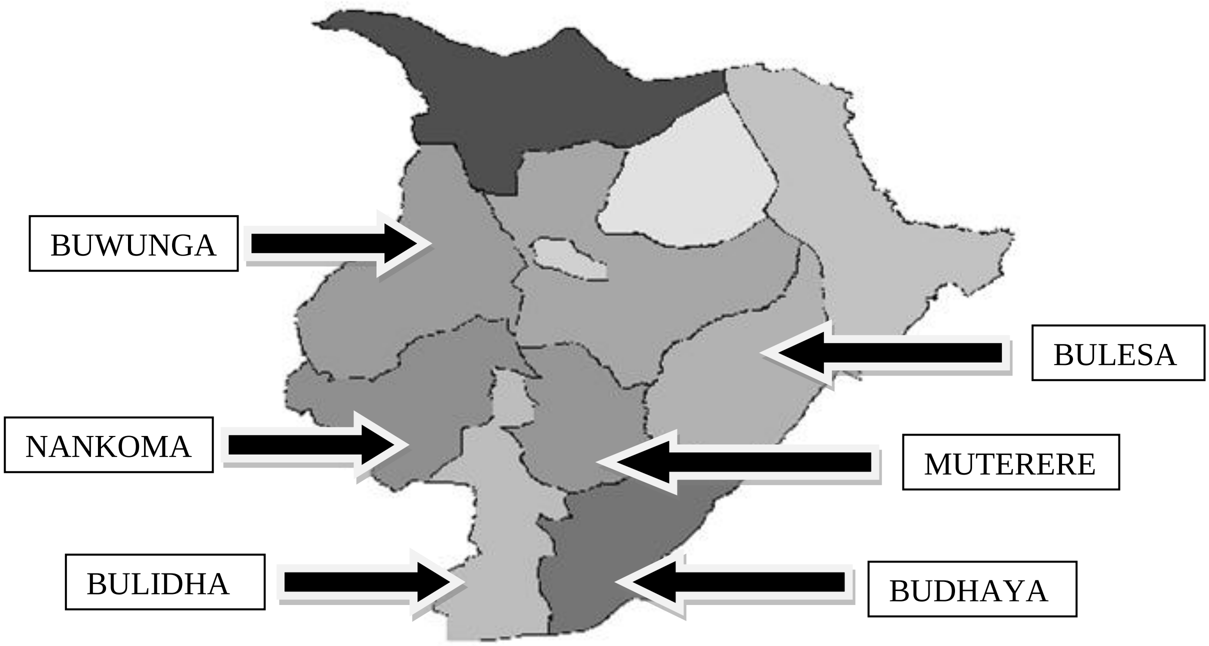


Exhibit 2.1:
Bugiri Sub-Counties



1.1 Country Background

1.1.1 Uganda

Located in eastern Africa, Uganda has a total area of approximately 236,000km^2 consisting mainly of a plateau with a rim of mountains. Altitudes range from a low of 621m at Lake Albert to a high of 5,110m on Mount Stanley near the western border with the Democratic Republic of the Congo.

The climate is tropical, but does taper off to semi-arid in the northeast. Annual rainfall ranges from 2,000mm over Lake Victoria to less than 700mm in the northeast. In the south along the lake shore there are two distinct rainy seasons. The rainy seasons are less pronounced in the northern portions of the country. Average temperatures vary little, ranging in Kampala from 28°C in January to 25°C in July.

Around 36,000km^2 is occupied by lakes; the largest is Lake Victoria which forms a large portion of the southern border. The lakes are predominantly freshwater lakes; however, the crater lakes of the Rift Valley are alkaline and have higher salinity.

Most of the land area is rural with around 43 percent arable and 28 percent forested. Agriculture is the primary sector of the national economy at over 77 percent of the population, followed by the sales and service industry at 8 percent.

1.1.2 Bugiri District

Located in the southeastern part of Uganda, Bugiri District has a total area of 5,701km^2 of which 1,493km^2 is land and the remaining 4,207km^2 is covered by water. The district is bordered by Tororo District to the northeast, Iganga District to the west, Mayuge District to the southwest, and Busia District to the east. Bugiri District also borders Kenya in the southeast and borders Tanzania in the waters of Lake Victoria to the south.

Bugiri town is the largest commercial center in the district. This is also the locale of the district headquarters and the district hospital. The town is 172km away from the Ugandan capital of Kampala.

The land is generally characterized by gentle undulating hills with few higher residual features. A somewhat higher relief across the district forms two main watersheds; a northern drainage and a southern drainage; the latter of which drains to Lake Victoria. M ajor swamps include Igogero, Kibimba and Dohwe and major hills are Irimbi, Bululu and Namakoko.

Bugiri district has a mean annual rainfall of 1,200mm in the wetter south and 900mm in the drier northwest. In general there are two peak rainfall seasons; April to June and August to November. The relatively succinct dry season occurs from December to March. Annual temperatures range from a low of 16.7°C to a high of 28.1°C. The average wind speed is 4.4km/hr, mainly blowing towards the north during March.

Soils found in this district are primarily loams and sandy loams. Soils texture is generally fine, which makes it vulnerable to erosion. Most soils are acidic. The most prevalent soil types include:

- Yellow-red sandy, clay loams soils varying from dark grey to dark which are slightly acidic and mainly derived from granite, gneissic and sedimentary rocks. They occur on gently undulating - hilly topography;
- Brown-yellow clay loams with laterite horizon dark brown to dark grayish brown, which are slightly acidic. These occur on flat ridge tops or undulating topography; and
- Light - grey-white mottled loamy soils with ground, structure-less loamy sands. They are acidic and mainly found on the lower and bottom slopes.

Bugiri District lacks the water resources found in many of the other districts. Both groundwater and surface water sources are limited. Whereas Lake Victoria provides a very reliable water source, it primarily serves only those settlements located along its shores and requires treatment to provide a safe source of drinking water. The Ministry of Water and Environment (MWE) has developed plans for a water system to serve several sub-counties in Bugiri and Busia Districts and is currently seeking funds for implementation.

Bugiri District consists of one county, 16 sub-counties, 101 parishes (LCIIs), and 548 villages (LCIs). The town of Bugiri is the only village considered to be "urban"; however, several other villages are considered rural growth centers namely Namayingo, Muterere, Nankoma, Busowa, and Buwuni.

General information extracted from the District Development Plan, 2010/11-2014/15, May 2011 (hereinafter DDP), provides an overall perspective of socio-economic conditions in the district. The following tables are derived from that source.

TABLE 1.1 SOURCE OF LIVELIHOOD		
Description	**Rural**	**Urban**
Subsistence farming	65,665	749
Employment income	3,375	1,235
Business enterprise	3,132	933
Cottage industry	489	26
Property income	509	84
Family support	4,141	929
Others	1,374	108

TABLE 1.2 ROOFING MATERIALS		
Description	**Rural**	**Urban**
Iron sheets	24,239	3,487
Other permanent materials	385	31
Thatch	53,801	535
Other	260	11

Approximately 66 percent of the total population has houses with roof material made up of thatch and these are mainly found in the rural areas. Around 34 percent have iron sheet roofed houses. Most of the houses have rammed earth floors. A few have cement screed and a very few have concrete floors. Walls are typically coated earth brick with relatively few structures consisting of sheet metal or concrete masonry units.

TABLE 1.3 FUEL FOR COOKING		
Description	**Rural**	**Urban**
Electricity/Gas	215	41
Paraffin	742	100
Charcoal	5,615	2,920
Fire wood	71,792	968
others	321	35

TABLE 1.4 FUEL FOR LIGHTING		
Description	**Rural**	**Urban**
Electricity/Gas	293	897
Paraffin (lantern)	4,814	1,196
Paraffin (tadoba)	71,240	1,897
Candle wax	874	56
Fire wood	1,382	10

TABLE 1.5 SOURCE OF DRINKING WATER		
Description	**Rural**	**Urban**
Tap/Piped water	324	1,162
Borehole	22,289	926
Protected well/spring	5,667	1,270
Gravity flow scheme	826	30
Open water sources	48,706	368
Others	873	308

The biggest percentage of the population draw water from open water sources. There are a few boreholes , a small number of protected wells, and a very small number of taps on piped systems.

TABLE 1.6 TYPE OF SANITATION FACILITY		
Description	**Rural**	**Urban**
Covered pit latrine	37,474	2,710
VIP	1,625	499
Uncovered pit latrine	15,741	641
Flush Toilet	830	110
Bush	22,	82
others	249	22

1.2 Project Purpose And Goal

The primary purpose of this pilot project is to provide clean water, safe sanitation facilities, and hygiene education. This will be the foundation for outcomes that will improve public health, community functionality, and quality of life.

The primary task of the PPP Team is to identify the water access points/sources, sanitation facilities, and hygiene practices utilized in the sub-counties of Budhaya, Bulesa, Bulidha, Buwunga, Muterere, and Nankoma in Bugiri District. The Team will discuss possible solutions for improving access to clean water and safe sanitation taking into consideration the circumstances of each of the sub-counties. The goal of the PPP Team is conceptualize a series of projects that meet the desires of the communities and adheres to applicable government standards.

1.2.1 Stakeholder Descriptions

The primary stakeholders are:

- Households/residents
- Community leaders
- Health Centres
- Primary & Secondary Schools

The secondary stakeholders are:

- District Government
    - District Water Office
    - District Education Department
    - District Planner
    - District Hospital
- National Government
    - Ministry of Water & Environment
- Rotary
    - Water and Sanitation Rotary Action Group (WASRAG)
    - The Rotary Foundation (TRF)
    - Rotary Club of Ntinda (District 9200, Club No. 29204)
- Local Non-Governmental Organizations (NGO)
    - Red Cross of Uganda
    - Uganda Muslim Rural Development Association (UMURDA)
    - World Vision
    - GOAL
    - Centre for Affordable Water and Sanitation Technology

1.3 Team Composition

The PPP Team consisted of three members. The Team Leader, Mark Cramer, PE, has over 30 years of water and wastewater experience and is President of Cramer Engineering, Inc., Chair of the Iowa Water For People Committee, and Secretary of the Board of Robin's Song. Robin's Song is a faith-based non-profit which trains indigenous teams in Africa to construct boreholes using hand auger drilling equipment (currently operating in Mozambique and Malawi).

Dr. Akobundu Origa has over 30 years in the medical profession and currently holds offices as the Permanent Secretary Ministry of Rural Development, Cooperative and Poverty Reduction and Chair Abia State Chapter Health Reform Foundation of Nigeria

Monica Louie, EIT, is an Engineer 1 with Parsons Transportation Group and has experience on similar projects in Kenya and Cambodia through Engineers Without Borders.

The Team assembled in Entebbe on March 02 and 03, 2013 and met with members of the Rotary Club of Ntinda on the afternoon of March 03. On March 04, 2013 the Team traveled to Kampala where they met with the Rotary Governor Elect and other key members of District 9211. Later that same day the Team traveled on to the town of Bugiri in Bugiri District.

A stakeholder's workshop was conducted on the morning of March 05, 2013. It was attended by District Water Office staff, community leaders from the sub-counties, and representatives from NGOs working in the area. The purpose was to exchange information regarding development activities in the targeted sub-counties, as well as challenges and needs with respect to further development. In the afternoon a training session was held for the personnel recruited to conduct the household survey. On March 06, 2013 the household survey training continued, along with a field exercise in a hamlet of Nankoma Sub-County in the afternoon.

Field work took place March 06 through 12, 2013 consisting of both the household surveys and water point surveys. Sample forms of the household survey and water point survey may be found in Appendices A and B, respectively. At the request of the District Hospital, the Team met with hospital staff the morning and early afternoon of March 13, 2013. The visit included a tour of the hospital's restrooms, water system, and sewer system. The Team departed for Jinja around mid-afternoon.

On March 14, 2013 the PPP Team travelled to Kampala to meet with the Eng. Okello Geatano, MWE, to discuss national initiatives in the rural areas and the planned water system for Wakawaka, as well as other relevant topics such as design standards and development plans.

A debriefing at the Rotary Club of Ntinda monthly meeting was conducted on March 15, 2013. In the afternoon the Team wrapped up with a coordination meeting and travelled to Entebbe for departure.

2.0 PRELIMINARY ASSESSMENT

2.1 Community Profile

The project area consists of a widely disbursed number of sites that included rural villages and semi-urban communities with an array of existing water sources. Consequently, it was necessary to take a different approach to information gathering than may be found at some of the other PEP pilot project locations. Essentially the field work had two components; a water point survey conducted by the engineers on the Team and a household survey conducted by the community development based personnel. Information gathered was then used to populate the WASRAG/UNC tool. The following sections discuss each of these survey tools.

2.1.1 Household Survey

A household survey was conducted door-to-door for a sample of 400 households across the project area. The survey included eight sections as follows:

- SECTION 1: General Information
- SECTION 2: Status Respondent
- SECTION 3: Access To Safe Water
- SECTION 4: Sanitation Status
  - Section 4.1: Toilet
  - Section 4.2: Sanitation for Girls
  - Section 4.3: Garbage/Solid Waste Management
  - Section 4.4: Drainage
- SECTION 5: Financial Services
- SECTION 6: Information and Community Strategy
- SECTION 7: Savings and Entrepreneurship Skills Development
- SECTION 8: Potential for Development

Appendix A provides the consolidated responses to the survey whereas Table 2.1 below shows the top responses to a few key questions related to water and sanitation.

TABLE 2.1 HOUSEHOLD SURVEY RESPONSES			
No.	**Question**	**Response**	**Percent**
4	How many people in the household?	1-5 6-10	47 45
9	What is your main source of water?	Well Spring Swamp Borehole	27 13 23 30
10	Comments on sources of water	Congested Contaminated Distance/Smell Distance/Congested	48 12 15 12
11	How do you grade the quality of the water you use?	Poor Good	49 51
13	How do you store drinking water?	Pot Jerry Can	97 2
14	How much water does the household use per day?	3-4 Jerry Cans 5-10 Jerry Cans 10+ Jerry Cans	39 41 18
19	Is this amount of water enough for the household?	No	72
20	If no to Q19, why?	Very Far Congested	42 50
21	How much time is required to walk to nearest water source?	11-20 minutes 31-60 minutes >60 minutes	12 52 28
22	How would you want to be helped with regard to water problems?	Boreholes Protected Springs	50 24
23	How do you dispose of human waste?	Toilet Kavera (plastic bag)	55 18
31	If given a opportunity to construct a new toilet which type would you prefer?	VIP Flush Toilet Traditional Pit Latrine	94 3 3
32	Have any member of the household suffered from any water borne disease in the last 3 months?	Yes No	67 33
33	If yes to Q32, which one was it?	Diarrhea Cholera Typhoid N/A	41 3 28 28
34	If yes to Q32, what do you think was the cause?	Water Not Boiled Contaminated Source Not Boiled/Contaminated Other N/A	5 33 17 14 25
35	Can girls and women in household use sanitary towels for monthly periods?	Yes No	22 78
36	If yes to Q35, how much money is spent per month?	None 1,500-3,000 UGX	60 32
37	If no to Q35, what are the coping mechanisms?	Cloth Toilet Tissue Withdraw From Community	81 6 8
38	How many days of school do girls miss each month?	3-4 days 1 week N/A	78 15 6
39	How does this affect performance in school?	Poor Performance High Drop Out Rates N/A	49 41 9

2.1.2 Water Point Survey

A water point survey was conducted at a variety of water sources located in the project area. A table identifying the status of existing water sources as of February 2013 was obtained from the District Water Office at the onset of the PPP project. Based on this listing the 146 sites visited represent approximately 31 percent of the sources used for drinking in the project area.

At each water point a handheld GPS unit (Garmin eTrex® 10) was utilized to collect coordinates, photographs were collected of the source and surrounding area, and a local village leader or inhabitant was interviewed to assess the general conditions of the source. The survey also gathered information on sanitation and hygiene practices by the households that utilized that water source. Finally, the interviewee was asked about the number of people employed in trades other than subsistence farming. The survey included four primary sections as follows:

- SECTION 1: General Information
- SECTION 2: Water Supply
- SECTION 3: Sanitation and Hygiene
- SECTION 4: Available Labor Forces

It should be noted that some of the question are intended to provide a general indication of conditions and are not expected to yield hard data. For example, when questioned about the number of households that use a particular source it is not expected that the interviewee will know that number; however, an answer of 200 versus 1,000 households gives the interviewer a good idea of how heavily that source is used.

It should also be noted that the questionnaire evolved over the course of the project to provide information more relevant to local physical and social conditions in the project area. Consequently, some statistics may be based on only a portion of the total number of sites visited.

The results of the water point survey can be found in Appendix B, along with maps showing the locations. Table 2.2 below provides a summary of key facts collected for each of the sub-counties included in the project.

TABLE 2.2
WATER POINT SURVEY RESULTS

Description	Response	Budhaya	Bulesa	Bulidha	Buwunga	Muterere	Nankoma
Does this water source meet the Government's goal of <250 users	Yes No	4 19	0 17	3 21	1 20	0 21	3 17
Does this source meet the Government's criteria of <500 m to the farthest household	Yes No	10 13	2 15	8 12	3 17	7 14	5 14
Average distance to farthest household	km	1.9	1.8	1.6	1.8	1.4	1.5
Water Source/ Technology Used							
Developed Spring		2	1	1	3	7	2
Borehole/ Enclosed Well		14	12	10	9	7	8

Rainwater Catchment		3	1	7	2	3	2
Open Lined Well		0	1	1	1	0	2
Unimproved Source		4	6	10	6	7	6
Piped System		0	0	1	0	0	7
Average wait during dry season	hr	4.5	3.0	17.5	1.6	2.8	2.3
Predominant Sanitation Method Used							
Traditional Pit Latrine		13	15	12	16	15	17
Improved Pit Latrine		4	1	5	1	2	2
Ventilated Improved Pit Latrine		2	2	4	4	3	3
Kavera (plastic bag)		3	0	0	0	1	0
Evidence of Handwashing							
>80%		4	6	0	4	3	9
50%~79%		2	1	3	8	6	5
<50%		3	9	1	4	9	3
None		9	1	13	7	2	4
Non-Farm Workers							
Teachers		33	79	67	179	24	52
Police		3	6	3	12	0	18
Business/Craftsmen		0	200	0	0	0	180
Mechanics		1	8	0	3	0	3
Doctors		0	0	0	2	0	0
Nurses		2	8	0	0	3	0
Others (skilled & professional)		5	3	0	5	1	18

2.1.3 Community Assessment Tool

The household surveys and water point surveys, as well as internet searches and the technical reports provided by the government, were used to populate the Rotary Community Assessment Tool. This tool was used to develop a Community Profile that indicates, in general terms, the communities' strengths and weakness with the ultimate goal of providing recommendations for suitable water development solutions.

The tool was useful in assisting the Team in developing the Community Profiles, but not as useful for identifying potential projects. In the case of the former, the Community Assessment Tool provides a relatively objective means for assigning a "Level" from 1 through 5 for each of eight categories; Service, Environmental, Social-Cultural, Institutional, Human Resource, Technical, Energy, and Financial. From these Levels the user can develop recommendations for development projects that have the highest potential for success based on the community's capabilities.

The Community Assessment Tool's project recommendation component appears to be more suited to communities or regions where a single water system can be constructed with a distribution network out to the populace. In the Bugiri sub-counties included in the project area most communities are very small and widely disbursed; the exceptions being the rural growth centers of Muterere, Nankoma, and Wakawaka. The use of the solutions tool component is further discussed in Section 2.2 below.

Grid based electrical power is nearly non-existent. A single overhead primary line was observed in a few sporadic locations; which then influences available development options. Wakawaka is a community with available power and it has an existing water system. Nankoma also has an existing water system that appears to be operating reasonably well;

however, power is provided by a diesel generator that is operated only when filling the elevated tank.

Due to the nature of the project area spreadsheets were developed for each of the six sub-counties individually. In addition, spreadsheets were populated for the rural growth centers of Nankoma and Wakawaka. The resultant Community Profiles are identical for the rural area evaluations with minor differences for the Nankoma and Wakawaka evaluations. The profiles are presented in the tables below:

TABLE 2.3
RURAL SUB-COUNTY COMMUNITY PROFILE

Category	Level	Assessment
Service	1	Very Poor
Environmental	3	The community has a source of fresh water which is suspected of pollution.
Social-Cultural	5	A stable, equitable community with strong leadership and the involvement of woman in that leadership structure
Institutional	4	Institutions are stable and mostly effective, there is access to higher levels (secondary and/or technical) of education in the community
Human Resource	1	Basic (illiterate) labor force
Technical	1	This is no evidence of a supply chain for materials or the ability to provide basic maintenance and complete operational tasks.
Energy	1	No access to power
Financial	2	There is some level of stable economic activity in the community that is not hindered by a lack of financial management ability. Household income allows for minor flexibility in spending beyond very basic needs.

TABLE 2.4 NANKOMA TOWN COMMUNITY PROFILE		
Category	**Level**	**Assessment**
Service	2	Poor
Environmental	5	The community has a reliable source of fresh water that is deliberately kept clean from solid waste, industrial waste, and sewage.
Social-Cultural	5	A stable, equitable community with strong leadership and the involvement of woman in that leadership structure
Institutional	4	Institutions are stable and mostly effective, there is access to higher levels (secondary and/or technical) of education in the community
Human Resource	3	Unskilled and some skilled labor force
Technical	3	There is evidence of a supply chain for some technical materials and some basic maintenance and operational tasks are reliably performed
Energy	4	Intermittent grid power, continuous off-grid power
Financial	3	The community has some private sector participation and the ability to manage economic programs. Household income is such that reasonable water, sanitation, health, and energy needs can be met.

TABLE 2.5 WAKAWAKA TOWN COMMUNITY PROFILE		
Category	**Level**	**Assessment**
Service	1	Very Poor
Environmental	3	The community has a source of fresh water which is suspected of pollution.
Social-Cultural	5	A stable, equitable community with strong leadership and the involvement of woman in that leadership structure
Institutional	4	Institutions are stable and mostly effective, there is access to higher levels (secondary and/or technical) of education in the community
Human Resource	2	Unskilled labor force
Technical	3	There is evidence of a supply chain for some technical materials and some basic maintenance and operational tasks are reliably performed

Energy	4	Intermittent grid power, continuous off-grid power
Financial	3	The community has some private sector participation and the ability to manage economic programs. Household income is such that reasonable water, sanitation, health, and energy needs can be met.

2.2 Solution Assessments

The Community Assessment Tool has a component which compares the technology evaluations to the community assessment. In the future PPP Teams may be able to use this "Matching Assessment" to identify water development technologies that show the greatest potential for a successful and sustainable implementation. The model provides color coding for each technology in an extensive list of possible solutions, plus additional solutions that can be added by the user. The color coding is as follows:

- Green – Suitable technology for the community;
- Yellow – May be applicable, but must consider the categories that are of concern; or
- Red – Not Recommended.

Unfortunately at this time the model has non-scientifically derived ratings for each technology under the various categories and merely data input to test functionality. The results for the six rural communities and two rural growth centers are not provided in this report due to concerns that it may confuse the casual reader. However, it would be beneficial to update the models developed for Uganda once the scientifically derived assessment data is input into the tool as planned.

At this time, recommendations must be based on engineering judgment as in years past. However, the Team does have the benefit of the Community Profiles to provide a reasonably objective view of the communities' strengths and weaknesses. On this basis, and in consideration of the data generated through the water point survey and household survey, several parameters can be identified to guide the selection of potential solutions. These parameters/observations include, but are not limited to, the following:

- The prevalent issue is the congestion and/or distance to safe water points; therefore, increasing the number of water points should be a top priority;
- The villages have a high degree of organization through committees or local government available to manage the water points;
- There appears to be some, although limited, financial capacity for monthly household payments to cover operations and maintenance (O&M) of water points;
- Levels of education are generally low with 37 percent reported as having no education and only 7 percent reporting levels above primary school;
- The available labor force is generally unskilled; therefore, low tech solutions should be implemented or moderately higher tech solutions that can be maintained by travelling maintenance crews, sometimes known as "circuit riders". Nankoma and Wakawaka are exceptions where water distribution system operators are available;
- Due to the large percentage of Muslims in the region personal hygiene has greater importance than many developing areas;

- With the exception of schools, traditional pit latrines are prevalent; thus, incremental improvement to sanitation could be more easily implemented;
- Most, if not all, schools have ventilated improved pit latrines (VIP); however, many units require replacement and virtually all schools have student: stance ratios that are twice the national standard;
- Many schools have rainwater catchment tanks; however, large areas of roof area are available for additional catchment tanks. In addition, many tanks are non-functional and all fail during the dry season; and
- Most schools promote hand washing, but the proximity to water sources precludes the use of available hand washing stations.

Additional observations that warrant consideration include:

- Only one village was observed thoroughly washing their water vessels prior to filling; thus, the potential for recontamination is significant at most locations;
- Villagers are generally willing to pay for water service; however, the cost of service must be considered. A typical borehole collects UGX 1000/household/month, but water systems (without treatment) cost around UGX 500/household/day;
- The MWE has existing plans for expansion of the water system in Wakawaka; including a preliminary opinion of probable construction costs.
- The MWE has conceptualized plans for conversion of hand pumps on boreholes to solar powered pumps to increase yields and transmit flow to standpipes in closer proximity to the users;
- The use of composting toilets is considered culturally unacceptable at this time; and
- There is a general understanding of the connection between the frequency of illnesses and the availability of clean water, safe sanitation, and proper hygiene.

Taking the above discussion into consideration a number of potential solutions are discussed in the following sections.

3.0 COMMUNITY FINDINGS - WATER

3.1 Water Demand

The 2002 Census states that average household size is 4.8 persons in Eastern Uganda. The household surveys indicate that this may be low for the project area. As shown in Table 2.1 above, 47 percent indicated a household size of 1-5 and 45 percent indicated a household size of 6-10. For the purpose of this report 5.5 persons per household will be considered the average household size.

The household surveys also indicated that 39 percent of respondents collect 3-4 jerry cans/day and 41 percent indicated 5-10 jerry cans/day. Assuming an average of 4.5 jerry cans/day and a jerry can contains 20L, then the average household use is around 16 lpcd.

The World Health Organization (WHO) rates a level of water service of 5 lpcd to be “No Access” and the level of health concern to be “Very High” since it is not possible to practice proper hygiene unless accomplished at the source. For “Basis Access” the WHO recommends 20 lpcd assuming laundry and bathing are carried out at the source. The level of health concern is still rated as “High”. The survey indicates the level of service in the project area is a little below

Basic Access. To push the level of service to WHOs next increment of 50 lpcd is not very practical for most of the villages at this time since it would require community taps or a maximum distance from household to source of 100 m. The MWE Water Supply Design Manual (hereinafter SDM) stated design criteria calls for 20 lpcd for members of rural households and 5 lpcd for students; which is in line with the WHO standard for basic access.

The PPP Team project approach is to incrementally improve access to safe water and improved sanitation. The intent of the projects discussed herein is to increase per capita consumption only slightly; from 16 lpcd to 20 lpcd. To accomplish this goal it will be necessary to increase the number of water points producing clean water, reduce the distance traveled from the households to the water points, and decrease the congestion at those water points. In essence, the identified projects are intended to meet the following objectives, based on WHO and SDM recommendations:

- Provide 20 lpcd of water for the purposes of drinking, cooking, personal hygiene and 5 L/student/day at the schools
    - Assume laundry and bathing will take place a the water source
    - Water will be available during all seasons/months
- Distance traveled to a water source by any household is less than 500 meters
- Maximum number of people obtaining their water from any single source is;
    - Borehole – 300 people
    - Protected Spring – 250 people
    - Pipe Stand – 150 people
    - Shallow Well – 200 people
- Flow rate of at least 7.5 lpm at each collection point
- Safe water quality for the intended purpose

3.2 Existing Water Systems

This section will describe the existing water systems for the six sub-counties in the project area. The PPP Team met with the District Water Officer in Bugiri to solicit information on existing water sources. The water sources identified included protected springs, boreholes, shallow lined wells, gravity fed systems (GFS), and rainwater catchment tanks. The government conducts surveys on an annual basis to determine the availability of water to the populace. The government records keep track of retrofitted and improved systems throughout the years, but do not include information on unprotected sources that may be in use. Also lacking was information on the piped systems in Nankoma and Wakawaka. A summary of the available water sources is provided in Table 3.1 below:

TABLE 3.1 WATER STATUS IN SUB COUNTIES AS OF FEBRUARY 2013								
Sub County	**Population**	**TECHNOLOGY TYPES**						**Coverage per Sub County**
		Boreholes	**Shallow Wells**	**Protected Springs**	**GFS Taps**	**Rainwater harvesting**	**Total Functional Sources**	
Budhaya	29,900	26	1	14	0	7	48	**36%**
Bulesa	38,100	42	10	16	0	0	68	**49%**
Bulidha	25,900	7	18	8	0	104	137	**35%**
Buwunga	44,200	40	4	13	0	4	61	**36%**
Muterere	28,200	26	2	25	0	12	65	**48%**
Nankoma	40,700	35	10	31	0	1	77	**48%**
Total	**207,000**	**176**	**45**	**107**	**0**	**128**	**456**	**42%**

Notes: 1. Gravity Fed Systems (GFS) does not include the piped systems of Nankoma and Wakawaka.
2. Rainwater catchments not included in coverage calculation due to intermittent reliability.

3.2.1 Protected Springs

An often used source of water is the unprotected springs found throughout the project area. Figure 3.1 shows a typical example of such a source. The proximity of these sources or the congestion found at the improved sources typically drives people to utilize these contaminated waters for domestic purposes.

Figure 3.1 Unprotected Spring

In some cases it may be possible to develop a protected spring at these locations and thereby improve the water quality to a more acceptable level.

According to the SDM a developed spring should have a subsurface concrete chamber that is installed far enough back into the hillside to be able to tap into the aquifer even when the groundwater table is low. The aquifer at this point should also have some reasonable thickness of impervious or semi-impervious materials above the aquifer to prevent contamination from surface water.

Developing a protected spring in the project area typically consists of excavating an area where water consistently reaches the surface. A concrete wall and pad are constructed with gravel filling a large area on the upgradient side of the wall to provide a subsurface reservoir for the water. The gravel is capped over with a clayey soil to limit infiltration from the surface. A discharge pipe or pipes protrude through the wall to provide for filling the collection vessels on the downstream side and have a perforated end that extends into the gravel on the upstream side. An example of a protected spring is found in Figure 3.2.

In spite of the measures taken to prevent contamination of the water through structural means it is imperative that steps be taken to protect the water shed as well. Agricultural use of chemicals should be restricted and the presence of pit privies or other sources of pollution upgradient of the water point prohibited.

Figure 3.2 Protected Spring

3.2.2 Lined Well

Like springs, wells can be found as merely hand dug pits excavated to reach the water table or as a lined well. The former is invariably contaminated. While the lined well has some modicum of protection by the well lining and extension of that protection above ground level to prevent the entry of runoff, these wells are typically contaminated above government accepted levels. Dust and debris can readily enter the well at the surface and fact that the vessel used to draw the water is handled and often set down on the pad adjacent to the well there is ample opportunity for contaminants to come in contact with the drinking water.

Figure 3.3 Unlined Well

Figure 3.4 Lined Well With Handpump

As an incremental improvement in source protection some shallow wells have been retrofitted to better prevent the entry of contaminants. In essence the well is relined with reinforced concrete pipe (RCP) and the surface is developed in a manner that is identical to the wellhead protection on a borehole, i.e. concrete pedestal, pad, and drainage trough with a Mark III handpump installed.

While this greatly improves the water quality, as compared to shallow wells that are open at the surface, shallow groundwater is typically more vulnerable to contamination than the deeper aquifers.

Figure 3.5 Open Lined Well With Windlass

3.2.3 Borehole

The form of water service most requested by the populace is the boreholes. In most cases these water points provide water quality within government standards and continue to function throughout the dry season. Typical construction in this region consists of a borehole around 75m deep. The casing and screen is generally polyvinyl chloride (PVC) and the pump column galvanized iron (GI). Locally available GI pipe is of questionable quality, so it has been reported that the pump columns must often be replaced after only two years of use. Stainless steel (SS) is available, but at a substantially higher cost.

Figure 3.6 Borehole With Fence

On the surface a pump pedestal and pad of concrete is constructed, along with a trough to drain excess water away from the pump column. The most prevalent pump used is the Mark III and sources for the pump and parts can be found in-country. A pump currently being introduced by UMURDA is the Canzee pump; however, none were observed in the field by the PPP Team. There may be other pumps introduced by other NGOs as well that were not encountered by the Team.

Figure 3.7 Typical Borehole

In most cases the only protection afforded the borehole is in the proximity restrictions to potential pollutant sources. In some cases the wellhead may also be enclosed by a wooden fence to stave off damage by livestock which is typically unrestrained. Examples of a typical borehole and one protected by a fence are shown in Figures 3.6 and 3.7.

During spot checks by the PPP Team and the annual government sampling boreholes were typically found to have met government water quality standards. The main exception is boreholes near Lake Victoria. The aquifer in that region is reported to be high in iron, thus, giving the water a brackish taste and is said to stain laundry.

Another exception is a borehole in Irimbi, Muterere Sub-County (Water Point Survey No. MU55A). This borehole was reported to discharge yellow water that has an odor and turns green when boiled. The water is used for non-potable purposes only and the villagers travel a kilometer further to Ngunga to obtain water for drinking and cooking.

3.2.4 Piped System

Two piped systems were observed in the subject sub-counties; one in the village of Nankoma in Nankoma Sub-County and the other in Wakawaka in Bulidha Sub-County. In Nankoma village, the water source is a 52 m borehole with a GRUNDFOS SP8A-37 pump that is powered by a diesel generator. The water is pumped to the system and a 60,000L tank daily. Water is distributed to consumers via 67 house connections, two kiosks with enclosed vendor booths, and ten standpipes. All delivery points are metered and water is sold for UGX 100/jerry can to fund system O&M. There is no disinfection provided.

Figure 3.9 Nankoma Village Borehole

Figure 3.8 Nankoma Village Water Tank

Figure 3.10 Wakawaka Standpipe

The Wakawaka system is similar; however, the source is Lake Victoria. The pump is reported to be solar powered; therefore, the system may be non-functioning during extended periods of cloudy weather and the tank cannot be refilled. There are no house connections and all water is delivered via five metered standpipes. Water is sold by attendants at a rate of UGX 100/jerry can.

As with the Nankoma system, the water is not disinfected; however, since it is lake water it is more likely to fail government water quality standards.

3.2.5 Rainwater Catchments

Rainwater catchment tanks are predominantly found at the public schools and regional Health Centres. These consisted of both plastic or ferrocement tanks with a small portion of the available roof area guttered. Many of the systems observed were non-functional; often as a result of needed gutter repairs, but nearly as frequently as a result of damage to the plastic tanks. It was reported that some of the schools where the neighboring households were denied access the tank damage was a result of vandalism.

Figure 3.11 Rainwater Catchment - Plastic

Some of the systems have a "first flush" device to divert the dirt and debris that is washed from the roofs at the start of a rainstorm. Many of the systems have a means for securing the outlet from unauthorized use.

Figure 3.12 Rainwater Catchment - Ferrocement

One catchment system at a private household was observed by the Team. It was a SS tank system constructed by GOAL as part of a project to assist disabled people in Muterere Sub-County. Beyond this "system", an occasional small plastic tank may be observed at a residence with a short section of metal corrugated roofing to direct the runoff toward the tank inlet. Note that the predominance of thatched roofing precludes the widespread use of catchment tanks at the household level.

3.3 Current Water Related Issues

3.3.1 Water Quantity and Quality

According to a report titled "Groundwater Quality: Uganda", British Geological Survey (BGS), 2001, groundwater provides 80 percent of potable water in rural Uganda. In general the groundwater in the project area is of acceptable quality and appears to have consistent yields. High incidents of fluoride tend to be found in the Crater Lake region and Rwenzori Mountains in Western Uganda and to the northeast in the Sukulu Hills.

Nitrate concentrations in groundwater are highly variable and problematic in some areas such as the Aroca Basin. Highest nitrate concentrations tend to occur near urban areas due to discharges from latrines and markets. To date, chemical usage in agriculture is fairly limited. As its use increases, water drawn from the shallower aquifers should be monitored for the potential for nitrates and other agricultural related chemicals.

To date, the only incidents of high arsenic have occurred in the Aroca region, and then they were below WHO guideline values. The BGS suggests testing take place in the Rift area, but there does not appear to be any direct references to the project area.

The only constituents of concern in Bugiri District are iron and manganese. These are a common problem in Ugandan groundwater and frequently exceed the WHO standard of 0.3 mg/L. Iron is believed to be an issue in the area adjacent to Lake Victoria. Groundwater quality testing was conducted by BEC Engineers as part of the feasibility study and design for the system proposed for southern Bugiri and Busia Districts. In addition to low yields in the area, iron concentrations were reported to range from 0.1~0.73 mg/L rendering the groundwater unpalatable and unsuitable for washing white laundry.

As previously discussed, one borehole visited in the Muterere area had water unfit for consumption; however, this appeared to be an isolated phenomena and the source of the contamination was not identified.

Surface water is predominantly found in wetlands and marshes. Springs may be intercepted and developed and, if the watershed can be protected, may yield potable water that meets WHO limits. In the south plans are available for drawing water from Lake Victoria; which includes treatment works to bring the water up to acceptable standards. A large number of households rely on surface water sources or shallow wells dug out in the nearby swamps. This water invariably has coliforms counts of “too numerous to count” (TNTC). Also see Figure 3.14.

A study by the MWE provided a series of maps showing occurrence and usage. The maps may be found in Appendix C.

The availability of water is also dependent on a few localized factors.

Time of Year – As previously discussed, there are two dry seasons in Bugiri District. The assessment trip was conducted in March, the end of the winter dry season. Several water sources were heavily stressed by usage and the water source was dry or had low yields. Most boreholes remained viable throughout the dry season; however, some were impacted by assumedly a low water table.

Figure 3.13 Congestion at Boreholes

There was heavy rain on occasion during the assessment and several additional water sources were being used, but only for a short period immediately following the rain; perhaps for a day. Note that the rains were insufficient to have a significant impact on the water catchment systems and none were observed to contain water at the time of the Team visits.

Regional Geology – The Muterere region is very rocky and has made it difficult to drill in certain villages. A predominance of boulder fields or bedrock were observed in various portions of the other sub-counties.

Congestion – The typical waiting period reported to the PPP Team varied from one to eight hours during the dry season; averaging approximately 3 hours. Some water points were dry and/or non-functional at the time of the field investigation. This time is in addition to time related to the distance traveled to collect the water.

3.3.2 PPP Team Water Quality Testing

Figure 3.14 Contaminated Drinking Water Source

Water quality testing was conducted at several of the water points to gather information on total Coliforms and Escherichia coli (*e. coli*), iron, hardness, pH, chlorine, and temperature. For each water source, a 10ml sample was collected and poured directly into a container of Easy Gel Coliscan Medium. This test samples 1-5ml and is ideal for testing in the field since the sample can be held under warm conditions (32-37^{o}C) and incubation temperature is not critical. Each bottle was labeled with the GPS coordinates collected by the handheld units and recorded in the survey forms. The plates were stored at 37^{0}C for 24 hours prior to conducting a coliforms count.

Exhibit 3.1 E.Coli Sample with No Colonies

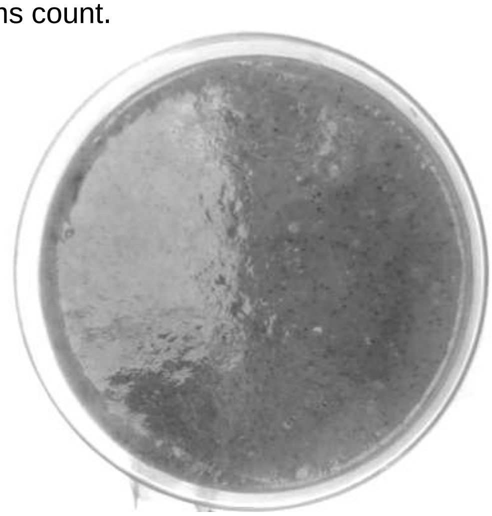


Exhibit 3.2 E.Coli Sample Too Numerous to Count

After completing the sampling for the coliforms test, a 30ml sample was collected and Insta-Test strips for iron, pH, and hardness were dipped into the water for five seconds and held horizontally. The same procedure was followed for chlorine. These are colorimetric tests that entail comparing the test strip to a color chart. After observing the color the strips are taped to the water point survey sheet as part of the permanent record.

Iron – This constituent is naturally occurring and often found in groundwater. Though it is not a major health concern, the WHO recommended level is <0.3mg/l. Iron-bearing groundwater is often noticeably orange in color, causing discoloration of laundry, and has an unpleasant taste, which is apparent in drinking and food preparation.

Iron can also have an impact on GI pipe; causing an acceleration of pipe corrosion.

pH – This is a measure of the acidity or alkalinity of the water. The pH for drinking water generally lies between 6.5 and 8.0. Water at 25°C (80°F) with a pH less than 7.0 is considered acidic, while a pH greater than 7.0 is considered basic (alkaline). When a pH level is 7.0, it is considered neutral.

The pH of the water in a stream, river, lake or underground flow will vary depending on a number of conditions: the source of the water; the type of soil, bedrock and vegetation through which it travels; the types of contaminants the water encounters in its path; and even the amount of mixing and aeration due to turbulence in its flow. The effects of a specific type of water pollution on living plants and animals can vary greatly.

The life expectancy of GI pipe can be influenced by both the pH of the water carried by the piping and the pH of soils surrounding the pipe.

Hardness – The concentrations of metal ions (generally calcium and magnesium carbonates) in the water determine its hardness. Increased levels of hardness impact the user's ability to remove soap during washing and laundry. Hardness can also cause a buildup on the inside of pipes.

Both pH and hardness can influence the efficiency of filtering systems in water treatment.

Chlorine – A strong oxidizer, chlorine does not exist in nature. It is a chemical that is commonly added to drinking water to kill most pathogens. The term "free chlorine" refers to chlorine that has not yet reacted with contaminants. Once it combines with other substances it is termed "combined chlorine" and the sum of free and combined chlorine is "total chlorine".

Tests for total and free chlorine were primarily conducted for "completeness" since it was not anticipated that chlorine would be found at any of the sources except the piped systems. During the interviews in Nankoma village and Wakawaka it was reported that no chlorine was being added at the piped systems either.

Other Contaminants – In some regions of the world, and even within Uganda, additional tests are conducted to determine the presence or absence of other constituents that may impact health. Most of these tests require access to a laboratory or special preservation techniques or additional equipment that is difficult to attain in a field kit form. As discussed previously, the BGS did not identify any particular contaminants of concern in the project area.

Typically, at the completion of water project a full screening of a water sample from the source is conducted by a laboratory to ensure that there are no unanticipated contaminants present. In addition, it would be advisable to run a full screen on the source water for any planned surface water system to aid in the design of the treatment processes.

Note that even when the water source is demonstrated to be free of pathogens the water may be contaminated by the vessel it is transported in or stored in at the home. Typically household cleaning of jerry cans consists of merely rinsing out the vessel prior to filling or none at all. Villagers were observed thoroughly cleaning the jerry cans prior to use at only one site.

During future field work, it is suggested that the participants conduct water quality testing at the source and on jerry cans or other storage vessels located at the homes of those same villagers.

This information could be used as the basis for implementing Point of Use (POU) treatment schemes.

Results – Tests were conducted on over 20 samples early in the field work portion of the project. In addition, one control sample was tested for coliforms using bottled water. As expected, the control sample showed no blue dots, thus indicating no *e. coli* present. Every other test showed the presence of coliforms, except for the samples collected at the Nankoma Village water system. Boreholes typically showed some coliforms, but usually just within or slightly over the WHO recommended limit of seven bacterial colonies. The results at all other sources were TNTC.

Upon the completion of the water collection and sampling, all petri dishes and containers were chlorinated prior to disposal to remove any traces of bacteria.

As anticipated, iron tests were frequently high; however, complaints regarding taste or problems with laundry were limited.

The pH was slightly acidic for the samples collected, but not outside of the WHO recommended limits. Similarly, hardness was within the limits of human consumption.

3.3.3 Water Treatment

No water treatment technologies were observed at any of the water sources. Drinking unsafe water can cause health problems in communities.

3. 3.4 Other Activity Uses

Several water sources were noted as being used for brick making only or for laundry and bathing. This cannot be confirmed as children were observed collecting water from these water sources and carried away in jerry cans.

3.3.5 Geographic Distribution of Water Points and Systems

The water points are very widely disbursed. Exhibit 3.1 below provides a map of the water sources included in the Water Point Survey as part of the PPP project:

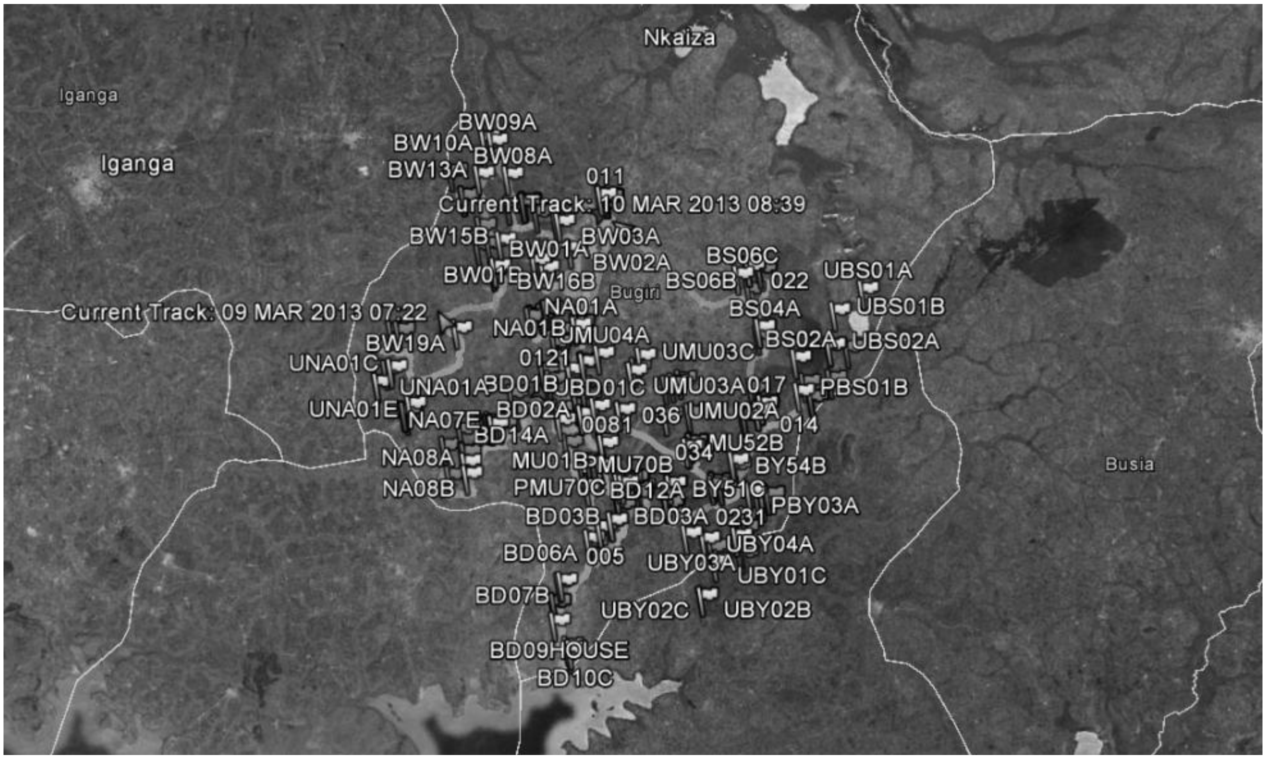


Exhibit 3.3 Mapping of Water Points

3.3.6 Satisfaction with Services

As part of the household surveys and water point surveys interviewees were questioned concerning their satisfaction with current water service and the most prevalent areas of concern. The following key points represent the most pressing issues related to satisfaction with services:

- Water quality is frequently cited as poor.
  - Many sites were unprotected springs or other access points to swamps
  - On occasion the taste of the water was described as poor
- The distance traveled to obtain water is often cited as a major issue.
  - Note that average distance to the farthest household is around 1.8 km, whereas the government standard is 0.5 km
- The time required to collect water is a frequent complaint.
  - Congestion at available water points, particularly boreholes, can require waits of one to eight hours or more, with an average of three hours in queue

3.3.7 System Operations

Most systems entailed drawing water by hand or through the use of hand pumps; consequently, system operation is straight-forward. Water collection is most often the responsibility of the children and women. Some pumps took longer or required more effort due to poor maintenance of the pump or the age of the unit.

Typically pump repairs take place only after the pump has ceased to operate. Repair of protected springs or generals grounds keeping at undeveloped sites only occurs when the system has completely failed.

The piped systems in Nankoma Village and Wakawaka have paid staff to maintain and operate the systems.

3.3.8 System Management

The protected springs and undeveloped sources are basically unmanaged. Boreholes typically have a water user committee that manages the facility. The role of the water user committee varies among the sites and can include collecting fees on a monthly basis or as required to purchase replacement parts. In some cases the committee may be responsible for unlocking the pump for use to control the hours of operation or possibly to collect a fee on a per container basis.

There are only two piped systems that have formal management through a water Board. As stated, both the Nankoma and Wakawaka systems utilize paid staff to maintain the system and collect fees for it use. Both systems must monitor and repair pipes and distribution points on a regular basis.

The Nankoma system has an electric pump and a diesel generator set to power it that requires a greater level of maintenance, thus, more sophisticated management. The Wakawaka system has a solar pump which then requires a greater level of management than most systems; however, the facility does not have the added engine maintenance of the diesel generator nor the logistics of obtaining fuel.

3.3.9 Tariff/Financial Management

Nankoma Village has the most sophisticated system with multiple distribution points that are all metered. There are 67 house connections that are billed monthly based on usage at UGX 66/20L. In turn, households are allowed to sell water at UGX 100/20L to generate a small profit. There are two kiosks and ten standpipes that are metered and manned. The primary difference is the kiosks have a small building to shelter the person collecting for the service. Both have limited hours of operation and the water is sold for UGX 100/20L. Discussions are underway concerning the possibility of privatizing the two kiosks.

Wakawaka is a little less sophisticated. This system has five metered and manned standpipes. Like Nankoma, the standpipes have limited operating hours and the water is sold for UGX 100/20L.

In the majority of the other communities funds are only collected when the pump breaks down. Often this is a standard UGX 1000/household or in other cases an equal share of the cost for repair. This is seen as an inefficient way to keep a water point operational. It has been noted that it can take a few days to a few weeks, perhaps even longer, to collect the necessary money to purchase a part. After the money is collected then they have to hire a mechanic to come and install the part, and parts are not always readily available.

A few committees collect funds on a monthly basis. The most typical fee collected is UGX

1000/household/month; however, in some cases the fee is on a per household member basis or in others the cost per household may be higher or lower. One community was reported to have raised its own money to install a shallow well and based on this success are now organizing the community to collect additional funds for a second shallow well.

A growing trend among NGOs is to use a new development model whereby the committee is required to organize and contribute financially as a prerequisite to obtaining assistance. This includes contributing to both the capital expense and the long term maintenance of the system. As an example, the Red Cross has been constructing a number of boreholes and other interventions in Bulidha Sub-County. As a prerequisite to attaining their assistance the community must be organized to collect around UGX 200,000 as a contribution toward the initial construction and they must set up a bank account and commence monthly fee collection for the ongoing O&M costs. Typically, the Red Cross uses the initial "seed money" to open a bank account on behalf the villagers or contribute it to a grassroots organization within the village that provides small loans for micro-businesses.

3.4 Identified Problems

A number of problems have been discussed in the preceding sections. This discussion has included the primary areas of concern; however, there are additional issues which may hinder the ability of the governmental or non-governmental entities to successfully implement viable solutions.

3.4.1 Primary Areas Of Concern

The following list is a compilation of the main issues that are faced by the people in the project areas:

- Distance traveled from households to water sources
- Congestion at the water sources resulting in long waits to fill vessels
- Many of the sources currently in use are undeveloped springs, swamps, or unlined wells and are highly contaminated
- Many of the developed water sources exceed WHO standards for bacterial colonies
- There is a high potential for recontamination of household water transport and storage vessels
- Lack of available water at schools and below water quantity standards at households results in reduced personal hygiene

3.4.2 Potential Hindrances to Project Implementation

There are a number of tangible and intangible issues that interfere with project implementation in the region. These potential challenges that must be addressed, or at least considered, when implementing recommended projects. Identified ancillary problems include, but are not limited to, the following:

- Electrical grid power is rarely available
    - Solutions for most villages must rely on hand power, renewable energy, or generator sets

- Roads do not extend to many of the villages and access to some water points is by walking only
- There is a continuing attitude that the government, or “others” should provide water to the community at no cost to the inhabitants
- There is a widespread attitude that the entity that constructed the water source should also provide for maintaining the equipment.
    - Note that there is increasing self-reliance among a number of villages that collect funds for system repairs or, in a few isolated cases, collect fees monthly to fund future O&M
- In most cases skilled labor is unavailable; low tech solutions are required and/or the ability to periodically retain trained individuals for system maintenance
- Grassroots committees exist, but may require additional training in the proper management of the water resource
- Most villagers are aware of WASH issues; however, further sensitization is needed to reinforce those lessons

3.5 Identified Solutions

A variety of potential solutions may be applied to the problems cited above. The following subsections provide the solutions that may be considered in this report. This is by no means expected to be an all inclusive list, but, merely a manageable identification of ideas that may be implemented individually or in combination to address the issues found in a very diverse set of field conditions. Note that the conceptual opinions of probable construction costs are very rough in nature; collected from a variety of sources and very vague as to what is actually included in the work. The cost figures provided are to provide the reader with an “order of magnitude” idea of what can be accomplished and should not be used for budgeting purposes.

The proposed solutions identified here are based on the concept of incrementally improving the health and living conditions of the inhabitants of the six sub-counties. For many of the following potential projects they may be viewed as the “next step” and not as an end to further work in the area.

3.5.1 Rainwater Catchments

The predominance of thatched roofing on residences precludes the use of catchments on most of the homes. If a project is implemented that targets only the houses with metal roofs then the beneficiaries would be the wealthier members of the community a the exclusion of the poorest.

The use of rainwater catchments tanks as conceptualized herein is for the schools only. A majority of the schools have at least one catchment tank; however, in many cases the tank and gutter need to be replaced. In addition, all of schools visited by the PPP Team that had catchment tanks only utilized a small fraction of the available roof area.

A potential project would entail maximizing the use of available roof area at schools by installing additional rainwater catchment tanks and gutters. Note that the water should be made available to neighboring households as well. Some schools have experienced vandalism as a result of excluding persons from outside of the school. The cost of the rain gutter is approximately UGX 7,500/m and the price of ferrocement tanks according to a local NGO run UGX 950,000 for a 6,000 L tank, UGX 1.5 million for a 10,000L tank, and UGX 2.6 million for a 20,000 L tank. As an alternative, a 10,000 L plastic tank can be utilized for an installed price of UGX 6.5 million (USD 2,500). For rough project estimation purposes rainwater catchment projects will be shown as 20,000 L ferrocement tanks with 30m of gutter at a conceptual cost of UGX 6.75 million (USD 2,570).

Note that even with the increased storage and rainwater collection area the tanks may still run dry during extended periods of little or no rain. A secondary source within reasonable walking distance should be provided, if possible.

3.5.2 Protected Springs

This potential project entails developing springs currently in use by villagers. It is common practice to utilize resources that are in closest proximity and the least congested; thus, a large number of persons may be assisted by the improvement of the water point(s) in closest proximity. In addition, these sources may serve as a backup to other facilities, such as boreholes, when such units are taken offline for maintenance. The cost of protecting a spring is generally in the area of UGX 3.0 million (USD 1,160).

Given the protected springs may not fully comply with WHO standards for bacterial colonies a project to develop springs should have a POU treatment component.

3.5.3 Lined Wells

Lined wells are found in various forms throughout the project area; however, the only ones to be considered for projects herein are those that are enclosed at the surface and a handpump is installed to draw the water. A typical retrofit with concrete pipe for a well lining and the construction of a concrete pedestal, pad, and runoff trough will cost roughly UGX 6.0 million (USD 2,290).

3.5.4 Boreholes

The predominant request among interviewees is for an increase in the number of boreholes. With the exception of the groundwater near Lake Victoria and one well in Muterere, boreholes have been shown to provide a consistent source of clean water. A borehole with a handpump can cost UGX 28 million (USD 10,800) with a stainless steel pump shaft and dependent upon the depth of the bore.

Projects involving the construction of boreholes should be accomplished in concert with the District Water Office. The government's standard process for borehole implementation includes the following steps:

- Find a reliable drilling company;
- Commission a hydrogeological survey (a);
- Determine community location preferences (b);
- Decide on location considering (a) and (b);
- Hire a third-party to complete an EIS;

- Obtain necessary government permits;
- Clear roads within the community for drilling rig access;
- Drill borehole;
- Evaluation of borehole performance (production, quality, etc.); and
- Install pump (if evaluation result is positive).

3.5.5 Solar Boreholes

The MWE scheme to install solar pumps on boreholes is expected to double well yield and provide collection points in closer proximity to end users. The African Development Bank (ADB) introduced a conceptual plan that includes fencing, lights, and other deterrents to theft at a cost of approximately UGX 120 million/borehole (USD 46,300). The government version developed by the Japan International Cooperation Agency (JICA) relies on an alarm system and the ability of neighboring household to protect the equipment at a cost of around UGX 70 million (USD 27,000).

The conceptual design proposed here is in between. Whereas it does not include the fence and lights proposed by ADB it does include the installation of barbed wire on the tank/panel tower and access for O&M is through a locked hatch. Note that any deterrents can be readily circumvented by a determined thief. The construction of solar boreholes should only be implemented in the vicinity of housing clusters where multiple villagers may be able to respond if the alarm is tripped. To cover the costs of additional security features a 10 percent factor is being added to the JICA version of the solar borehole system.

The conceptual opinion of probable construction costs, including a second elevated tank and standpipe located 2km from the borehole, is expected to be around UGX 77 million (USD 29,700).

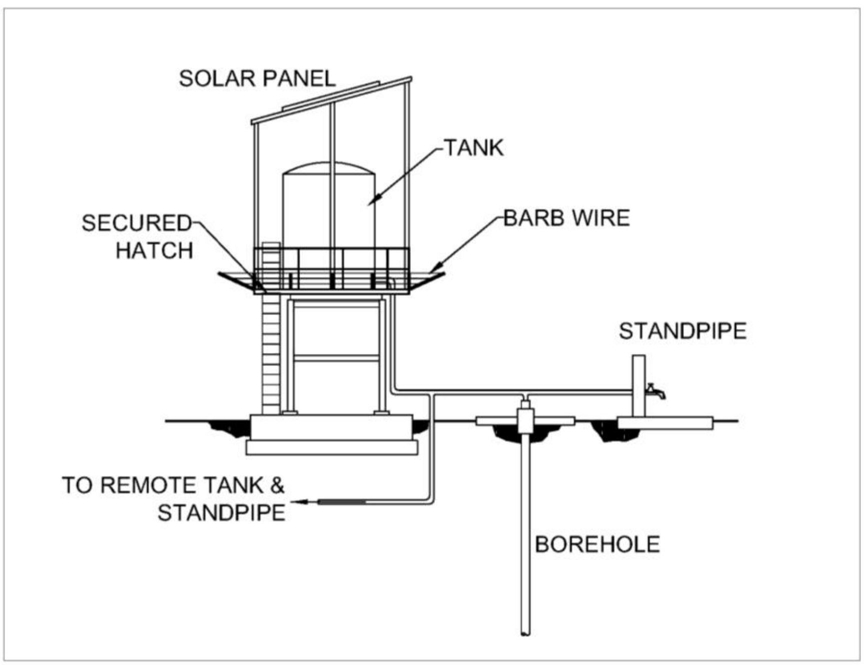


Exhibit 3.4 Government Conceptual Design

3.5.6 Water Treatment Plant (WTP) and Distribution System

The MWE currently has a plan for constructing a system that draws water from Lake Victoria, provides treatment, and distributes the water to five sub-counties located along the lake (includes Bulidha in Bugiri District). The system is designed to serve a projected population of 264,228 in 2023 at a demand of 4,424m^3/d. The treatment works will consist of an alum house, filters, flocculators, clarifiers, chlorine house, contact tank and clear water well, backwash system, and an office block with residence for operators.

The opinion of probable construction costs is UGX 11 billion (USD 4.2 million) for the complete system. A scaled down version, termed Phase 1, includes the WTP and a greatly reduced area of piped distribution is anticipated to be around UGX 9.2 billion (USD 3.6 million). Phase 1 will extend the distribution system to two parishes to serve a projected population of 27,540.

3.5.7 Biosand Filter

Household size biosand filters can be used to provide treatment at the POU for water collected from contaminated sources such as springs and swamps. They may also be considered to treat water that becomes contaminated when it is transported to the home in an unclean vessel.

The website for the Centre for Affordable Water and Sanitation Technology (CAWST) provides a good overview of biosand filter technology. In essence, a biosand filter (BSF) is an adaptation of the traditional slow sand filter, which has been used for community drinking water treatment for 200 years. The BSF is smaller (about 1m tall, 0.3m wide on each side) and adapted so that it does not flow continuously, making it suitable for use in people's homes. The filter container can be made of concrete or plastic. It is filled with layers of specially selected and prepared sand and gravel. The sand filters pathogens and suspended solids from contaminated drinking water. A biological community of bacteria and other micro-organisms grows in the top 2cm of sand. This is called the biolayer. The micro-organisms in the biolayer eat many of the pathogens in the water, improving the water treatment.

No power is needed to operate the unit; water is just poured into the upper reservoir and flows by gravity to a storage container placed at the outlet end. On the negative side, only 12-18L/hr can be treated with one of these units. Note that water must be maintained over the biolayer to keep the desired microorganisms healthy. If allowed to dry the only treatment is the large particles that can be filtered out by the sand.

Based on laboratory and field study, BSF have been shown to remove the following:

- Up to 100 percent of helminthes (worms)
- Up to 100 percent of protozoa
- Up to 98.5 percent of bacteria
- 70-99 percent of viruses

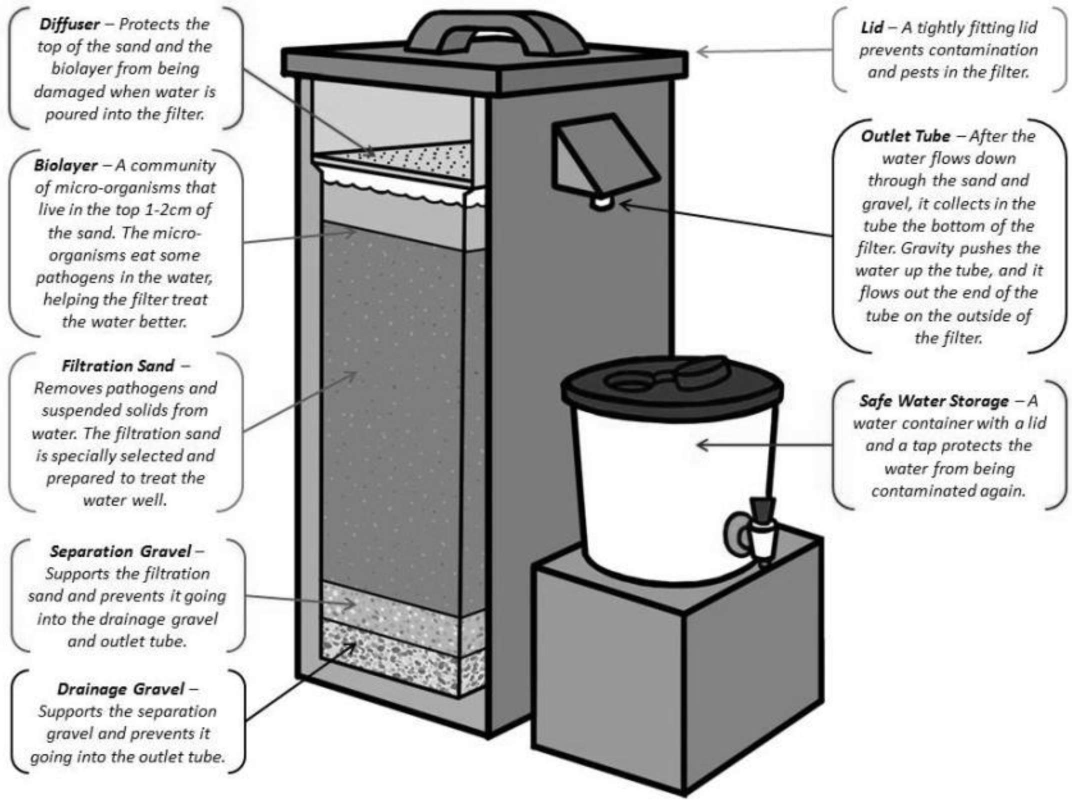


Exhibit 3.5 Biosand Filter
Source: CAWST website, 2013

Based on a 2010 project in Kenya, the cost per unit for a plastic BFS is around UGX 26,000 (USD 10) including delivery and installation. At an assumed treatment rate of 15L/hr an average household of six persons can treat enough water for the family each day with one unit.

3.5.8 Chlorine Generators

Figure 3.15 Khlor Gen Chlorine Generator Kit

The Community Assessment Tool identifies the WATAsol as a potential POU device to generate chlorine. Given the cost of this device it would be most applicable to a village wide system or a micro-business that provides chlorinated water to others within the village. The unit basically has two electrodes that are placed in a container of water. Salt is added and an electric current runs between the electrodes. Sodium hypochlorite is formed through electrolysis of the salt water. The WATA kit costs EUR

200 (USD 260), but does not include a power source.

The Hays Pure Water For All Foundation has a similar device that can be obtained in a kit that includes a 6v battery and small solar panel to recharge it. This kit, called the Khlor Gen System sells for UGX 1.5 million (USD 567).

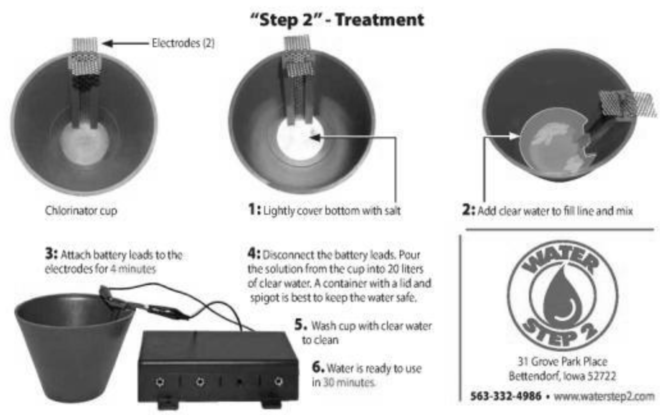


Figure 3.16 Step @ Chlorine Generator Kit

For the household or family compound level it may be possible to use a small chlorine generator developed by the University of Iowa referred to as the "Step 2". This unit operates on D-size batteries or other sources of approximately 6v DC. A kit is available from Water Step 2, including the first set of batteries and a battery holder, for USD 20 plus shipping. Recently an upgraded version became available that has a circuit board that will turn the unit off after a set period of time and allows you to leave the batteries in the holder. This upgraded unit sells for UGX 78,000 (USD 30).

3.5.9 Ceramic Pots and Candles

These devices are essentially filters with extremely small pore sizes. The pots can be set on top of the storage vessel or mounted above it. The user fills the pot with contaminated water and it is allowed to drip through over the course of the day. The candle is a small tubular device. The candle can be mounted inside of a vessel and operated in a similar manner as the ceramic pot with the water dripping through to a storage vessel or it can be used like a straw and water drawn through the device under a vacuum.

Figure 3.17 Ceramic Pot

It may be possible to create a business to manufacture ceramic pots in Bugiri or one of the other more urban centers. If produced locally, the filter cost may be available in the UGX 20,000 ~ 80,000 range (USD 7.50 ~ 30.00). However, a single pot capacity is only 20L/d, so one unit may be required for each family member. There is also an increased likelihood that untreated water will be used for drinking since the filtered water may not be available on demand.

A 10-inch ceramic candle that will produce 52L/d may be purchased from a US sporting goods supplier for around UGX 57,000 (USD 22), but if installed as a drip system it will also be necessary to purchase vessels with the appropriate sized fittings to accommodate the candle.

3.6 Summary

Given the wide range of conditions in the project area it only follows that a variety of solutions must be made available to address the issues. In the recommendations section a list of potential projects is provided. It is anticipated that prospective partnering Rotary Clubs or other donors will select a project(s) that meets their organization's criteria or they feel can garner the support of their membership.

Individual projects may or may not completely satisfy the needs of a specific sub-county, but may be viewed as the first phase of a longer term project.

Known regionally as "sensitization" or the "software" component, all projects should include budgeting for training. This training may be designed to either reinforce lessons learned through WASH and other past programs or introduce new concepts. In the case of some of the more technical solutions, a select group may be trained to construct a specific device or to construct and maintain a system.

4.0 COMMUNITY FINDINGS - SANITATION

4.1 Current Conditions

4.1.1 Sanitation

According to the DDP 48 percent of the populace uses a covered pit latrine, 20 percent use an uncovered pit latrine, and only 3 percent have access to a VIP. The DDP reports that 28 percent still use the bush. Per the household survey this last category includes a large percentage that use a Kavera and around 12 percent actually go in a field or river.

Of the pit latrines, field observation indicates these are nearly universally of the traditional pit privy (TPP) type with an earthen floor over a wooden support structure. The condition of the

Figure 4.1 Traditional Pit Privy

Figure 4.2 Traditional Pit Privy Interior

enclosure varies significantly from one community to another. Typically, the walls are constructed of a plastered mud brick and the roof, if present, is thatched material. The use of a concrete squat plate to transform the TPP to an improved pit privy (IPP) was not

Figure 4.4 School VIP - Full & Out of Service

Figure 4.3 School VIP - New Construction

encountered in the field with any regularity.

On very rare occasions VIP toilets were observed at private residences; however, these improvements were primary seen at the schools. The condition of such units varied considerably, ranging from newly constructed to several that were no longer usable or nearly

filled/dilapidated. At all schools visited by the PPP Team the ratio of students to stance was nearly double the government standard of 40: 1. On the positive side, the schools observed have separate toilets for girls and boys and typically have stalls for disabled children with handrails and in a few cases a wheelchair ramp. With the exception of a couple of schools that severely lacked available stances, the schools generally had separate facilities for students and teachers.

4.1.2 Hygiene

The link between hygiene and health appears to be commonly understood. The lack of available clean water in reasonable proximity does deter regular handwashing; however, the cited incidence of handwashing is significantly higher than most developing areas. The reason for this higher rate of handwashing is the Muslim influence. Countrywide Muslims comprise 40 percent of the population; however, the percentage is higher in Eastern Uganda, including Bugiri District. For religious reasons Muslims place greater attention to cleanliness than may be found in many other groups.

Figure 4.5 Hand Washing Station

In the schools the availability of a handwashing stand is widespread. One school actually had a small catchment collecting rainwater from the latrine roof and a hose bibb piped into one of the girl's stalls to provide a means for menstruating girls to maintain cleanliness. However, almost all of the handwashing stations were dry. The distance to a water source precludes the ability of the schools to keep the stations full except during the rainy season when the available rainwater catchment tanks serve as the source.

4.2 Satisfaction With Service

Overwhelmingly people would like to have VIP toilets at their homes. In the household survey a full 94 percent expressed a preference for the VIP and only 3 percent each for flush toilets or TPP.

Although not a survey question, several persons in leadership roles were asked about the acceptability of compost toilets; locally referred to as ECOSAN toilets, named for its manufacturer in South Africa. The response was universally that the use of human excreta for fertilizer would not be accepted by the populace.

4.3 Identified Problems

Several problems in areas of sanitation and hygiene may be identified from discussions with people in the villages and compilation of survey data:

- Approximately 30 percent of households do not have access to any type of toilet
- Only 3 percent of households have access to VIP toilets
- The schools have an average student to stance ratio of 79: 1
- Many schools have handwashing stations, but the units are dry due to the distance to the water source
- The use of composting toilets is not considered to be culturally acceptable

4.4 Identified Solutions

Continuing with the theme of incremental improvements to the current status quo, the PPP Team has identified a limited number of solutions that may be considered for projects in this report.

Figure 4.6 Concrete Squat Plate

4.4.1 Improved Pit Privies

This report only considers the concrete squat plate, with respect to IPPs. This will entail retrofitting the TPPs that are commonly found in the area. The concept here would be to create local startup businesses to manufacture the units. The cost per plate is anticipated to be in the neighborhood of UGX 65,000 (USD 25).

A concrete squat plate improves sanitation by providing a surface that can be more readily cleaned. It also improves safety in that traditional earth covered timber supports are vulnerable to attack by termites. The retrofitting of TPPs with concrete squat plates would be considered an incremental step in sanitation improvement with an eventual move toward a VIP or composting toilet.

4.4.2 Ventilated Improved Pit Privies

The VIP has a concrete floor to improve cleanliness and the pit is offset from the superstructure so that a ventilation pipe can be installed. This allows the methane gasses to be directed away from the user and discharged above the height of the structure. The schools typically have VIP toilets; however, current student: stance ratio is around 79: 1. The number of stances (individual stalls) should be doubled to bring the ratio to government goals of 40: 1. In addition, a number of facilities are near capacity or in need of major renovation. The cost of a two-stance VIP is 6.0 million (USD 2,300) while an eight-stance VIP is anticipated to be around UGX 17.0 million (USD 6,540).

4.4.3 Composting Toilet

A composting toilet is similar to a VIP in that it has the concrete squat plate and ventilation pipe; however, the superstructure is built up above ground level and sits on top of a vault. In addition, the squat plate is designed to allow urine to be separated from feces to improve the composting process by reducing the moisture content. The urine can be used on crops without further processing. The composting process typically takes around six month or more, so the toilets are generally constructed as two-stance units so that one unit may be closed off and composting whiles the other unit is being filled. Consequently, it is assumed that the costs associated with one of these units is double that of the VIP, or UGX 3.9 million (USD 1,444).

The composting toilet concept has been introduced to Uganda in the form of the ECOSAN toilet presented through the WASH program. As stated previously, the use of human wastes for agricultural purposes is not culturally accepted. The concept here would be to develop a series of demonstration projects. Perhaps the units would be located the Health Centre located in each Sub-County. This project should be tied into an agricultural demonstration plot to show the beneficial use of this waste.

4.5 Summary

As discussed, only a limited number of solutions are provided for sanitation. As with water, the solutions are provided as part of a list of potential projects that may be championed by various prospective partners. Furthermore, a sensitization component should be budgeted into each project.

5.0 RECOMMENDATIONS

The theme which has been put forth throughout this report is that the diverse conditions and wide geographical area included in the project area renders it impractical to promote a single solution. Consequently, a variety of projects are presented herein and it is anticipated that potential participants may pick and choose which projects or combination of projects they wish to take forward.

The projects identified here are not site specific, but merely based on the number of units that will provide a project that will require an investment of USD 100,000 to 250,000 and require approximately two years to implement. The specific sites for construction or installation of the units will be determined as the project progresses. The one exception is the government's Lake Victoria Water Treatment Project Phase 1.

While the PPP Team does not identify specific areas for the work, it is recommended that prioritization of project recipients be based upon an ascending order of existing water coverage within the six sub-counties under consideration. The order of need is as follows:

TABLE 5.1
PROJECT PRIORITIZATION BY SUB-COUNTY

Sub-County	Rank by Sub-County	Water Coverage by Sub-County
Bulidha	1	**35%**
Budhaya	2	**36%**
Buwunga	2	**36%**
Muterere	3	**48%**
Nankoma	3	**48%**
Bulesa	4	**49%**

The list below represents potential projects, in no particular order, that may be pursued by potential Rotary Clubs or other donor groups and NGOs. Note that the conceptual opinion of probable construction costs is to provide a general idea of funding requirements only. Once a project is selected it will be necessary to take further steps to identify the specific villages to be included, develop a detailed scope of work, develop a feasibility study if necessary, and develop a detailed opinion of probable costs.

5.1 School Water & Sanitation Project

The project entails improving water supply and sanitation facilities at ten public schools. Construct two ferrocement water catchment tanks, complete with 30m of gutter, and one 8-stance VIP at each school. Based on an average school size of 720 students as observed by the Team, the number of students impacted by this project will be 7200 students.

5.2 Protected Spring with Biosand Filters

Develop 25 protected springs. Generally this will entail development of unprotected springs or unlined wells, but may also require some source protection. Given that the springs and shallow wells are generally polluted or at risk, the project will also include the distribution of household biosand filters. Based on the government of 250 users per protected spring water source it is assumed that 42 households per source will require a biosand filter. The total project impact will be for 1,050 households.

5.3 Handpump Boreholes

The project will construct ten new boreholes. Based on the government standard of 300 users per borehole (50 households/borehole) the project has the potential to benefit 500 households.

5.4 Solar Pump Boreholes

Similar to the project above, this project entails the construction of five boreholes; however, the unit will be fitted with an electric pump powered by a solar panel. The system will include a tank and standpipe at the bore site and a remote tank and standpipe near another housing cluster approximately 2km away. The assumption is that such a system will be capable of serving twice the population of a standard borehole; therefore, the project would benefit around 500 households.

5.5 Step 2 Chlorine Generators

This project involves the mass distribution of the small Step 2 Chlorine Generators that run on D-size batteries. The project is envisioned to distribute units to approximately 5,000 households and provide training in its use.

5.6 Health Centre Compost Toilets

In an effort to promote a more positive attitude regarding the use of composting toilets this project would install eight units at each of the District Health Centres. The toilets would be open to the public to use. The compost material would be utilized on agricultural demonstration plots to show proper and safe use of human waste to improve crop yields. The number of facilities to receive these units would be six; it is unknown the number of persons that may be impacted until it can be determined how many people would be willing to use the facilities.

5.7 Traditional Pit Privy Upgrade

The project is intended to upgrade the commonly used TPPs to IPPs by providing concrete squat plates. The use of such plates should improve cleanliness by providing a washable surface and be more structurally sound than the current timber and dirt floors. The project is also intended to promote startup of a number of micro businesses across the area in the manufacture of the plates. The number of units included in this initial project is 5,000.

5.8 Lake Victoria WTP Phase 1

This project is the Phase 1 component of the project developed in the report entitled

"Consultancy Services for Feasibility Study and Detailed Engineering Design of Piped Water Supply and Sanitation Systems in Bugiri District" BEC Engineers. The most immediate beneficiaries in the project area are the households in the vicinity of Wakawaka, Bulidha Sub-County; however, the project extends over several sub-counties. Phase 1 will serve two parishes with a projected population of 27,540 and eventually serving a population of approximately 264,228 with the completion of Phase 5.

5.9 Sensitization

As previously mentioned, every project should have a sensitization component of some type included. In addition, there are a number of expenses beyond the physical construction. Given that the true scope of the projects is not yet defined, these indirect costs cannot be estimated with accuracy. For the purposes of this report, historical budget figures derived from a CAWST hospital project in Northern Uganda will be used as the basis for project indirect costs. The costs will be added as follows:

TABLE 5.2
APPROXIMATION OF INDIRECT PROJECT COSTS

PROJECT DELIVERABLES	UNIT	TOTAL QUANTITY	UNIT COST (UGX)	TOTAL COST (UGX)	TOTAL COST (USD)*
A. Baseline Survey					
Data Collection.	LS	1	13,000,000	13,000,000	5,000
Feasibility Study and Report production	LS	1	17,667,900	17,667,900	6,795
Baseline Survey Total					**11,795**
B. Health Education and Training					
Production of Public Relations Leaflets & Flyers	sets	1	2,000,000	2,000,000	769
Development of Training Manuals	Manual	1	5,000,000	5,000,000	1,923
Provide Working Tools to Village Health Workers	LS	1	2,500,000	2,500,000	962
Open Air Drive Shows in Villages	Shows	10	200,000	2,000,000	769
Health Education & Training Total					**4,423**
C. Community Organization and Participation					
Community Mobilization and Sensitization	meetings	15	90,000	1,350,000	519
Project Launch	events	3	2,300,000	6,900,000	2,654
Project handover of facilities	events	3	300,000	900,000	346
Community Organization/Participation Total					**3,519**
D. Community Capacity Building					
Train Local Artisan on Cost Effective Construction Approaches (40 people)	Training	1	1,000,000	1,000,000	385
Developing and Production of construction manual (once)	Piece	1	2,000,000	2,000,000	769
Networking and Collaboration (Stakeholder consultations)	Meetings	4	100,000	400,000	154
Training User Committees	Training	5	200,000	1,000,000	385
Training of Village Health Teams (1 day workshop)	workshop	1	900,000	900,000	346
Training in Group Enterpreneurship Skills.	Training	5	900,000	4,500,000	1,731

Community Capacity Building Total					**3,769**
E. Post-Construction Assistance					
Follow Up of Project Activities	years	1	1,000,000	1,000,000	385
Fuel for Vehicle and Motor Cycle	Month	24	480,000	11,520,000	4,431
Costs for Public Transport	Month	24	180,000	4,320,000	1,662
Post-Construction Assistance Total					**6,477**
F. Project Monitoring					
Design Monitoring and Evaluation Tools	LS	1	300,000	300,000	115
Establish Community Based Monitoring Systems	Training	4	1,500,000	6,000,000	2,308
Monitoring & Supervision Visits	visits	12	350,000	4,200,000	1,615
Review Meetings (1 per Quarter)	Meetings	12	100,000	1,200,000	462
Project Monitoring Total					**4,500**
G. Investment Cost					
Computer with Accessories	Set	1	2,300,000	2,300,000	885
Motor Cycle	Unit	2	16,500,000	33,000,000	12,692
Used Vehicle	Unit	1	35,000,000	35,000,000	13,462
Investment Cost Total			**]**		**13,577**
H. Project Evaluation					
Consultancy Fees	Day	10	750,000	7,500,000	2,885
Per Diems for Other Involved People	Day	10	300,000	3,000,000	1,154
Travel Costs for Consultants	Day	10	300,000	3,000,000	1,154
Project Audit	LS	3	1,500,000	4,500,000	1,731
Evaluation Total					**6,923**
I. Administration/Overhead					
Project Manager (1)(60% of time)	Month	24	1,425,000	34,200,000	13,154
Extension Staff (2)	Month	24	800,000	19,200,000	7,385
Project Contribution to Technical Engineer (30% of time)	Month	24	660,000	15,840,000	6,092
NSSF-10% of gross salary	Month	24	288,500	6,924,000	2,663
Workman's Comp. Provided on Total Monthly Salary at 0.3%	Month	24	299,520	7,188,480	2,765
Insurance for Vehicle and Motorcycle	Year	3	660,000	1,980,000	762
Service and Repair of Vehicle and Motorcycle	Month	12	200,000	2,400,000	923
Electricity/Security	Month	24	40,000	960,000	369
Communication/Internet	Month	24	50,000	1,200,000	462
Office Supplies	Month	24	70,000	1,680,000	646
Bank Charges of the Local Partner	Month	24	30,000	720,000	277
Maintenance of Office Equipment	Month	24	40,000	960,000	369
Unexpected Costs	years	3	2,000,000	6,000,000	2,308
Administration/Overhead Total					**38,174**
TOTALS					**93,158**

*Note: Conversion at UGX 2,600 = USD 1

5.10 Summary

The following table provides a summary list of the project identified for consideration in the project area and a conceptual opinion of probable construction costs. The intent is to provide a variety of projects that various Rotary Clubs may wish to pursue. The projects are presented in no particular order.

TABLE 5.3 IDENTIFIED PROJECTS & CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COSTS				
UNIT COST (UGX)	**DESCRIPTION**	**TOTAL COST (UGX)**	**TOTAL COST (USD)**	**POTENTIAL IMPACT**
1	School Water & Sanitation	547,216,000	210,500	7,200 students
2	Protected Springs with Biosand Filters	344,516,000	132,500	1,050 households
3	Handpump Boreholes	522,216,000	200,900	500 households
4	Solar Pump Boreholes	627,216,000	241,200	500 households
5	Step 2 Chlorine Generators	632,216,000	243,200	5,000 households
6	Health Centre Compost Toilets & Food Plots	419,416,000	165,200	Undetermined
7	Traditional Pit Privy Upgrade	567,216,000	218,200	5,000 households
8	Lake Victoria WTP Phase 1 All phases through Phase 5	9,200,000,000 29,585,000,000	3,538,500 11,378,800	27,540 persons 264,200 persons

Most of the projects could be implemented in any of the sub-counties. It is suggested that selection consider the prioritization shown in Table 5.1 so that those most in need are addressed first. The projects can also be mixed and matched to a large extent. Once a particular project(s) is identified it will be necessary to do additional field work refine the scope, geographical area, and funding requirement.