Siting for one Production Borehole in Mayuge District

Inception Report for one Production Borehole in Mayuge District

February 2024

Project 202401

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1 INTRODUCTION

1.1 Background

WE Consult was awarded a contract by Habitat for Humanity Uganda (HFHU) for siting and drilling supervision of one production borehole in Bukabooli sub county, Mayuge district. The consultant work involves three distinct phases; an inception phase comprising a desk study and field reconnaissance; field geophysical measurements; data analysis and reporting. This report is part of data analysis and reporting covering the inception phase.

WE Consult carried out a reconnaissance visit for the six communities in the project area.

The objective of the reconnaissance visit was to determine the general occurrence and quality of the water, find out the locations of the preferred sites, existing water sources, geomorphology, lineaments and determine the particular method of investigation to be used.

Additionally, existing data and information about the area has been gathered as part of the desk study. This combined with field reconnaissance form the inception report.

2 METHODOLOGY

2.1 Reconnaissance visit

The reconnaissance visit was carried out on 7th February 2024 by Edward Ndagije, a hydrogeologist from WE Consult, with a team from HFHU led by Daphne Mandhawun and Joshua Namuyondho. Six target areas (Figure 1) were visited; coordinates picked and the field geomorphology studied. Table 1 indicates the names of the preferred sites.

Table 1 Location of the preferred sites

Village	Parish	Sub county	UTM X	UTM Y
Makoma	Bugumya	Bukabooli	568527	36646
Bugumya	Bugumya	Bukabooli	566703	39328
Kirongo A	Bugumya	Bukabooli	562840	37812
Kaliro	Bugumya	Bukabooli	569293	40517
Mayirinya A	Mairinya	Bukabooli	576827	42979
Lwandera	Mairinya	Bukabooli	573428	41910

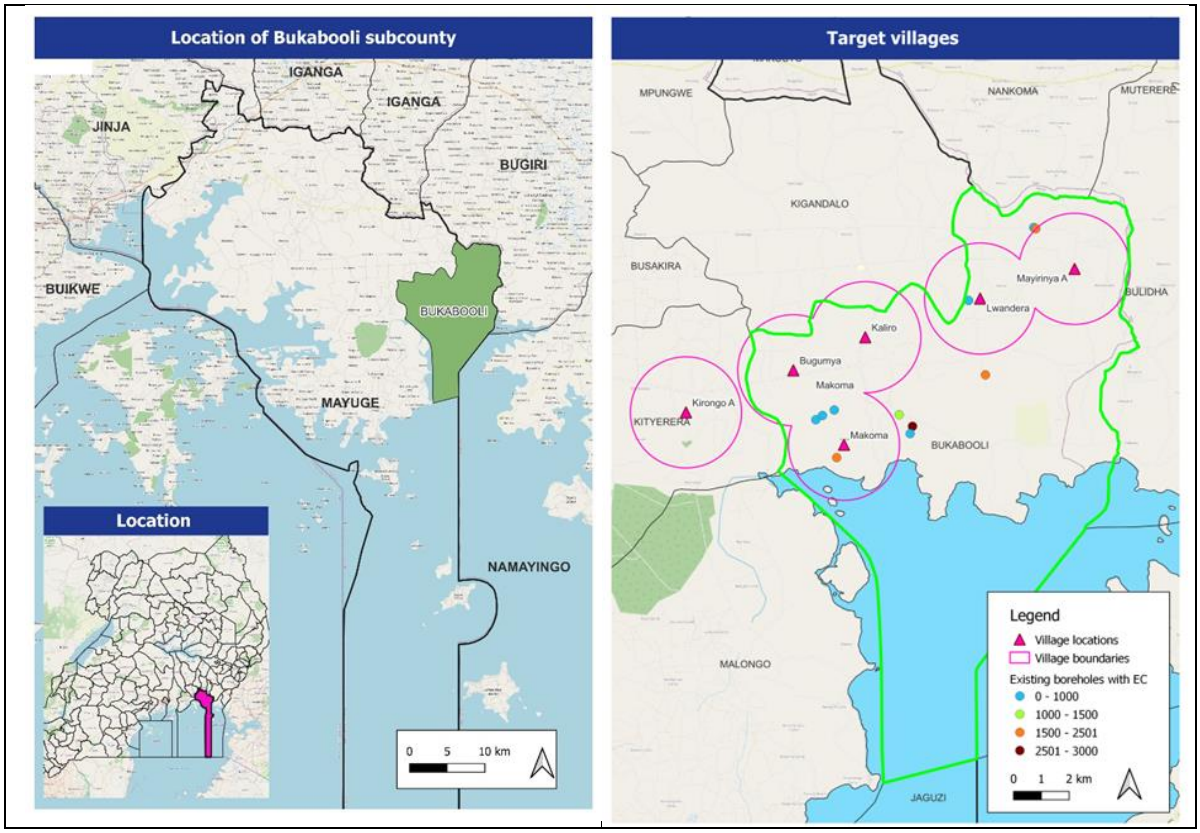

Figure 1 Location of Bukabooli subcounty (Project area)

2.1.1 Existing water sources

Fourteen water sources were visited during the reconnaissance visit. One well had EC above 2500 µScm (as per the US EAS 12: 2014) as summarized in Table 2.

Table 2 Existing water sources

No	Name	Type	UTM X	UTM Y	EC (µS/cm)	PH	Comment
1	Mayirinya	Shallow well	575359	44467	530	6.3	Functional
2	Mayirinya	Borehole	575431	44422	1773	6.6	Functional
3	Rwandara	Shallow well	573013	41842	837	6.3	Near the swamp
4	Bugumya	Borehole	56649	39761	613	7	3.6 m3/hr
5	Budumba	Borehole	566826	38745	N/A	N/A	Abandoned because of a salty taste (Non-Functional)
6	Kirongo B	Borehole	567512	37548	629	6.9	Sitted by WE Consult (2019)
7	Kirongo B	Shallow well	567752	37700	86	7.1	Functional
8	Kirongo B	Borehole	568177	37897	613	6.3	Functional
9	Makoma	Shallow well	568785	36691	N/A	N/A	Fesh water but not functional
10	Makoma	Borehole	568265	36184	1674	7.3	Functional (Tastes salty)
11	Bujoto	Borehole	570993	37312	2830	7.3	Abandoned piped water system because of salinity
12	Bujoto	Borehole	570908	37047	414	7.3	Sitted by WE Consult (2016)
13	Namulube	Borehole	570513	37730	1063	7.7	Functional
14	Namulwana B	Borehole	573617	39162	2470	7.3	Functional

2.1.2 Water quality

The EC from recorded from the boreholes visited in the target areas was recorded and it is presented in Table 4. Additional results from boreholes sited by WE Consult in 2016 are also presented in Table 5.

Table 3 EC and PH for boreholes visited

No	Name	Type	EC(µS/cm)	PH
1	Mayirinya	Shallow well	530	6.3
2	Mayirinya	Borehole	1773	6.6
3	Rwandara	Shallow well	837	6.3
4	Bugumya	Borehole	613	7
5	Budumba	Borehole	N/A	N/A
6	Kirongo B	Borehole	629	6.9
7	Kirongo B	Shallow well	86	7.1
8	Kirongo B	Borehole	613	6.3
9	Makoma	Shallow well	N/A	N/A
10	Makoma	Borehole	1674	7.3
11	Bujoto	Borehole	2830	7.3
12	Bujoto	Borehole	414	7.3
13	Namulube	Borehole	1063	7.7
14	Namulwana B	Borehole	2470	7.3

2.2 Desk study

The aim of the desk study is to get a better understanding of the hydrogeology of the area. This includes analysis of existing geophysical and borehole data, geology, lineament analysis, water quality, topography among others. The sections below show the preliminary studies carried out;

2.2.1 Consultant's former works in the Mayuge district

In 2016, WE Consult carried out a geophysical and hydrogeological site investigations and construction supervision of 8 large diameter wells in Mayuge district. Two of the boreholes sited were in Bukabooli sub county. Borehole 8 and 9 were drilled in Bukabooli subcounty with yields of 5.1 m^3/hr and 34.4 m^3/hr respectively. These boreholes are located in the same geologic setting with the target villages. The main water strikes were between 36 – 41 m.

Table 4: Details for boreholes drilled in 2016

Prefix	DWD No.	Drilled depth (m)	DTBR (mbgl)	MWSL (mbgl)	WSL 1 (mbgl)	WSL 2	WSL 3 (mbgl)	Q Airlift (m^3/hr)	Q Dev (m^3/hr)	Q Test-con (m^3/hr)	Duration in hrs.	SWL (mbgl)	Status
1	60509	119.4	41.50	36.00	36.00	40.00	-	0.9	0.9	0.9	3	13.20	S
2	60515	141.2	23.00	19.00	19.00	46.00	76.00	4.3	4.3	3.8	72	4.82	S
3	60517	87.0	27.80	22.00	9.00	11.00	13.00	7.0	7.0	6.2	72	4.58	S
4	60522	115.0	19.80	-	-	-	-	0.0	0.0	-	-	-	D
5	60531	87.3	9.10	11.00	86.20	9.00	11.00	22.3	0.0	-	-	-	TF
6	60533	50.5	9.20	-	-	-	-	0.0	0.0	-	-	-	D
7	60535	73.4	36.60	14.00	73.40	11.00	14.00	30.0	30.6	6.0	27	10.20	S
8	60592	130.9	40.1	39	18	39	49	5.1	5.1	3.8	72	6.56	S
9	60594	78.5	30.2	36/41	25	36/41	51	34.4	34.4	35	72	2.80	S

2.2.2 Water quality

The EC from recorded from the boreholes sited by WE Consult in 2016 are presented in Table 5.

Table 5 Results from water certificates for 2016 drilled boreholes

S/N	Parameters	Units	BH1	BH2	BH3	BH7	BH8	BH9
Sampling date: 2017			30th / 04	16th / 05	19th / 05	06th/ 06	11th / 09	14th / 09
1	pH	-	7.29	7.24	7.28	7.26	6.73	6.52
2	EC	µS/cm	320	356	350	324	336	384
3	Colour	PtCo	2	2	2	2	2	384
4	Turbidity	NTU	2	2	2	2	2	384
5	TDS	mg/l	260	247	246	266	248	2

S/N	Parameters	Units	BH1	BH2	BH3	BH7	BH8	BH9
Sampling date: 2017			30th / 04	16th / 05	19th / 05	06th/ 06	11th / 09	14th / 09
6	TSS	mg/l	0	0	0	0	1	0.013
7	Alkalinity	mg/l	120	110	120	130	120	259
8	Hardness:	mg/l	56	52	54	50	66	44
9	Calcium	mg/l	32	30	30	30	40	22
10	Magnesium	mg/l	24	22	24	20	26	130
11	Bi-Carbonate	mg/l	120	110	120	130	120	130
12	Chloride	mg/l	10	15	20	15	25	20
13	Fluoride	mg/l	0.06	0.03	0.05	0.03	0.06	0.05
14	Iron: total	mg/l	0.015	0.012	0.018	0.019	0.038	66
15	Sulphate	mg/l	15	18	16	16	18	18
16	Nitrate	mg/l	0	0	0	0	0	0

Borehole 8 and borehole 9 were drilled in Bukabooli subcounty, the EC values were 336 µS/cm and 384 µS/cm. Among the visited one shallow at Kirongo B had EC value lower than these two boreholes.

2.2.3 Geology and success rates

The subcounty is covered by three geological formations as shown in Figure 2. Cherty quartzite, shale, black shale and BIF and the Kibuyeporhyritic granite have 100% success rate. Mayuge granite covers the largest part of the subcounty and has a success rate of 86%.

Table 6 Success rates and geology

Lithology	Min of DTB	Average of DTB	Max of DTB	Count of yield	Min of yield	Average of yield	Max of yield	Count of Depth	Min of Depth	Average of Depth	Max of Depth	Count of Successful2	Sum of Successful2	Success Rate
Cherty quartzite, shale, black shale and BIF	38.0	38.0	38.0	2	0.6	0.6	0.6	2	73.5	73.5	73.5	2	2	100
Kibuye porphyritic granite	15.0	20.8	27.7	12	0.4	1.5	3.6	12	45.7	55.6	64.4	12	12	100
Mayuge granite, locally porphyritic	18.6	28.8	40.0	14	0.2	1.4	4.0	14	27.0	52.6	70.1	14	12	86

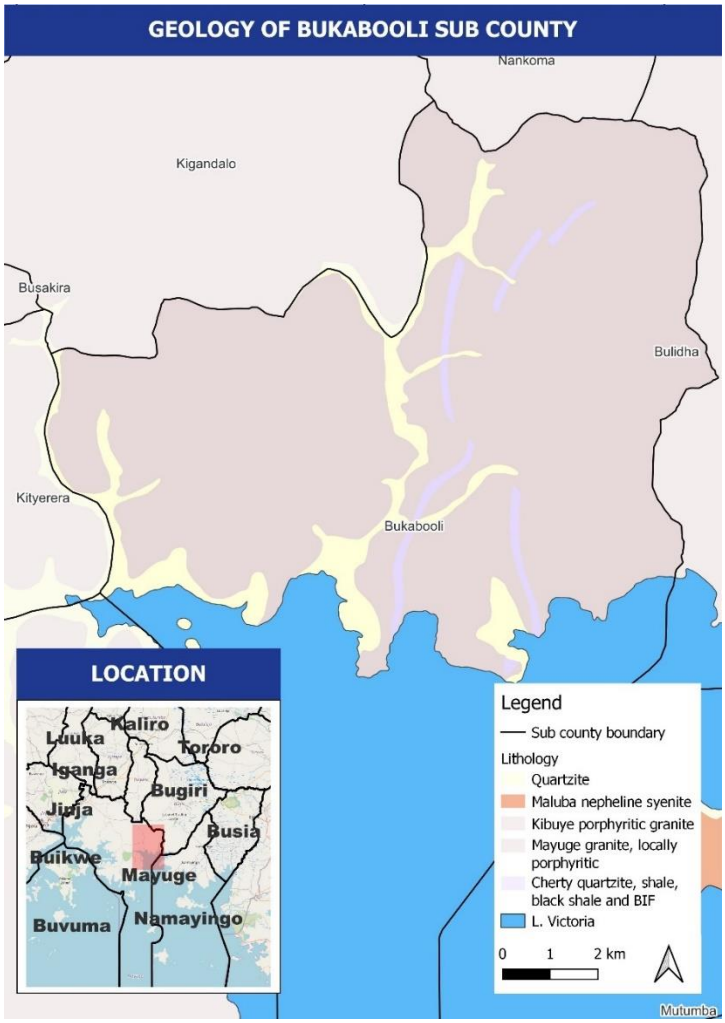

Figure 2 Geology of Bukabooli subcounty

2.3 Siting Phase

2.3.1 Geophysical survey

One siting team will be deployed, headed by a hydrogeologist who will be assisted by a geophysical field assistant. Four to five casual laborers will be recruited from the project area to support the hydrogeologist with the physical work (hammering electrodes, carrying equipment, vegetation clearing etc.). The hydrogeologist will be supervised by the senior hydrogeologist through telephone calls with discussions at the end of each day will keep the senior hydrogeologist informed of the progress and will enable him to take appropriate and prompt action when required.

Detailed geophysical measurements will be carried out by means of an SAS 1000 Terrameter. Measurements will be carried out at the sites agreed upon by the client and will comprise resistivity profiles and Vertical Electrical Soundings (VES) at promising anomalies of the profiles. The profiles will be carried out perpendicular to anticipated lineaments as identified during the desk study.

Vertical Electrical Soundings (VESes) will be carried out at anomalous zones as identified through the profiling exercise.

Calibration profiles and soundings will be carried out on boreholes with high EC and boreholes with low EC measurements to know if the relationship between the geoelectric layers and the EC measured during the reconnaissance visit.

2.3.2 Geophysical data analysis

The results of the desk study and the geophysical survey will be evaluated as a total in order to select the specific drilling locations. The Vertical Electrical Soundings will be interpreted with a specialized program (WINSEV). Combined with data from existing boreholes in the area, this will aid to determine the character, relations, distribution, and geological buildup of formations/ rock masses at each site. Additionally, the depth to bedrock and recommended drilling depth will be determined.

The investigated sites are evaluated in order to select the most promising sites for a high yielding borehole. This evaluation is primarily done based on a scoring system. This classifies the sites in a technical and quantitative way, based on shape and location of anomaly and Vertical Electrical Sounding, topographical and geological setting and hydrogeological experience of the consultant. Furthermore, the sites are compared with geophysical data of boreholes in the area, to assess how much the newly surveyed sites resemble the calibration measurements.

The final recommendations will be based on the scoring, comparison with existing borehole data and the experience of the senior hydrogeologist.

2.4 Reporting

The detailed siting report will contain the review of previous studies, analyses of all existing borehole data, all siting results, including calibration data of existing boreholes, detailed location maps (of the surveyed sites and recommended sites), recommendations for the sites to be drilled, the recommended drilling methods, equipment and details and their applicability.

3 DISCUSSIONS AND RECOMMENDATIONS

Basing on the information gathered in the field, boreholes visited, PH and EC measurements, the siting will be carried out in Makoma and Bugumya villages.

It was observed boreholes next to the swamps had Lower EC and boreholes at higher altitudes had higher EC measurements. Siting will be carried out next to the swamps or rivers.

4 PROJECT TIMELINE

Table 7 Timeline to be followed

Activity (work)	07-Feb	08-Feb	09-Feb	10-Feb	11-Feb	12-Feb	13-Feb	14-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb	20-Feb	21-Feb	22-Feb	23-Feb	24-Feb
Reconnaissance																		
Inception report																		
Inception Report feedback																		
Desk study																		
Geophysical measure-ments																		
Data Analysis & Reporting																		
Report review by client																		
Final Report																		