



DRILLING AND TEST PUMPING OF ONE BOREHOLE IN KAYUNGA

Borehole Completion Report

December 2018

TGS 201840



TGS Water Ltd

Borehole Drilling, Water Supplies & Construction Management

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1 INTRODUCTION

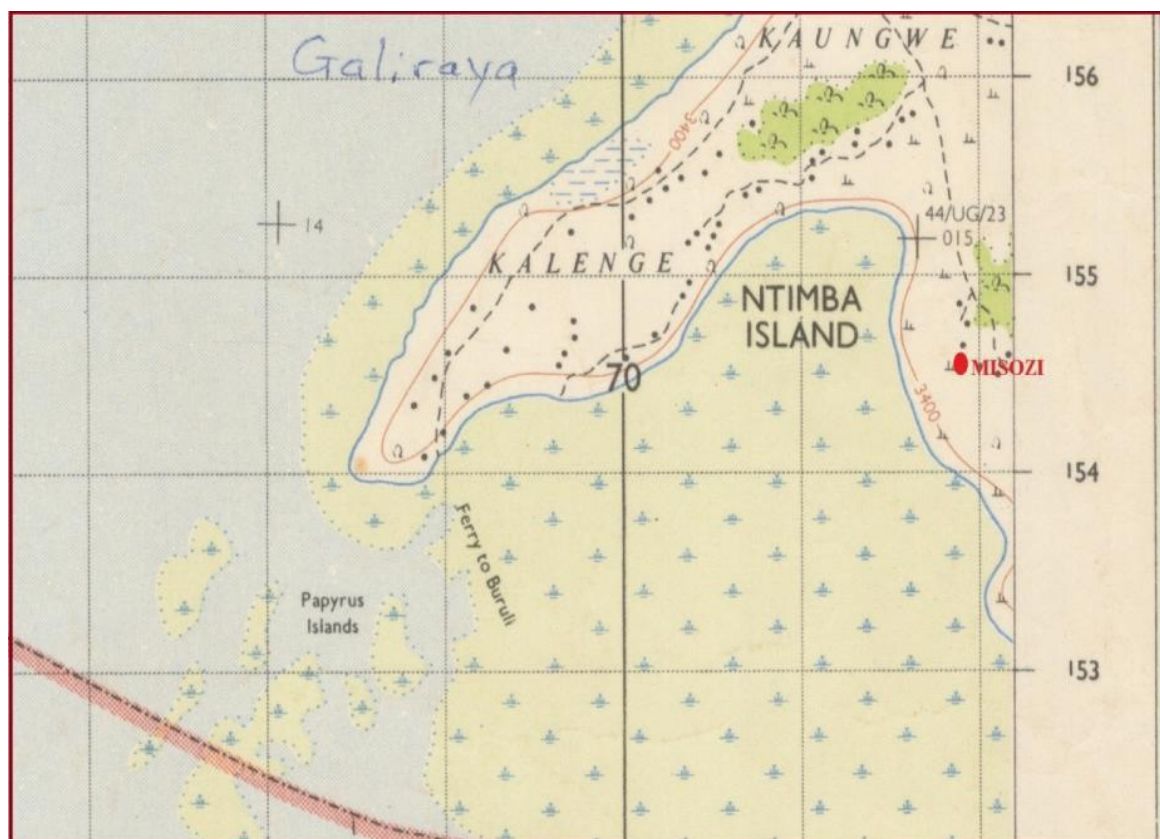
TGS Water Ltd was commissioned by the Ugandan Water Project (UWP) to carry out groundwater potential investigations, drilling and construction of one (01) borehole at Misozi village, Galiraya S/County of Kayunga District.

The water is intended to be used by vulnerable children and community living around Agnes Tambiti's home. (Lwamunda 2018)

In order to achieve the project target, UWP engaged Davis Lwamunda, a hydro-geologist to carry out a geophysical survey to identify a drill point within the client's land. The geo-physical survey was carried out to identify optimal locations for borehole drilling. The results of the geophysical survey were provided to TGS Water Ltd in a report that was written by Davis Lwamunda before the drilling team mobilised for the drilling programme. The location of the drill site is given in Figure 1.

This report presents the results of the drilling, test pumping, and water quality analyses.

Figure 1 Location map of Misozi Village borehole



(Lwamunda, 2018)

2 SUMMARY OF RESULTS

2.1 Logistics

TGS Water carried out the drilling, well design and development from 02/Dec/2018 to 05/Dec/2018, test pumping took place on 06th day of December 2018. The details of the borehole project time schedule are presented in Table 1.

Table 1 - Time schedule of project activities

Date	Activity	Staff involved
30 th Nov 2018 to 01 st Dec 2018	Mobilizing	Okello Emmanuel, Ongom Martin, Byamukama Simon, Odur Simon and Support Staff
02 nd to 05 th Dec 2018	Drilling, design, installation and development of the borehole	Okello Emmanuel, Ongom Martin, Byamukama Simon, Odur Simon and Support Staff
06 th Dec 2018	Test pumping	Okello Emmanuel and Ongom Martin
11 th Dec 2018	Quality Control and Technical Management	Paul Kato

Air rotary drilling method was used to drill the borehole. Drilling in the overburden and the transition zones were done by use of drag bits to the hard rock, and a DTH hammer through the hard rock to the final depth. Table 2 shows a summary of the equipment deployed for drilling.

Table 2 - Summary of drilling equipment deployed

Equipment	Brand and type	Specification
Drilling Unit	PAT 401 NEW	3m long mast
Compressors	ELGI Model DS 900-200	14 bar
Accessories		10", 8" and 6.5" drag bits, 6 7/8", 5" and 4" DTH hammer and 6" button bit reamer, Drill rods (2.5" OD, 2m length)

2.2 Results of the drilling program

One drilling attempt was made at the recommended drill point and the driller's yield was 1500 litres per hour. A summary of the drilling results is presented in Table 3. Detailed information on the well logs is given in Annex 1.

Table 3: Summary of the boreholes drilled

DWD No.	Source name	UTM (X)	UTM (Y)	Depth Drilled (m)	Flow (m ³ /hr)	Status	MWS (m bgl)	WSL 1 (m bgl)	WSL 2 (m bgl)
55244	Misozi	471945	154395	58.85	1.50	S	36	36	42

WSL: Water strike level, mbgl: meters below ground level, S: Successful borehole, U: Unsuccessful borehole, m³/hr: cubic metres per hour

2.3 Results of the test pumping program

The main objective of test pumping was to determine the safe yield and optimum installation depth of the pump. Therefore, for every successfully drilled borehole, it is important to carry out test pumping. The borehole has been subjected to a constant rate test of 3hours' Grundfos SQ-5-60 pump was used for the test.

Table 4: Test pumping results summary

DWD No.	Source name	Test pumping schedule		PID (m)	Q _{test} (m/hr)	SWL (m bgl)	DWL (m bgl)	Duration of the test		Recovery (min)	Recommended PID
		start	End					(min)			
55244	Misozi	06/12/2018	06/12/2018	29.00	0.90	4.75	20.68	180	40		21

SWL: Static Water Level, mbgl: meters below ground level, S: Successful borehole, U: Unsuccessful borehole, PID: Pump installation depth

The borehole was subjected/ pumped for 3hrs at 0.90 m³/hr constant rate (CR) test and the water level was drawn to 20.68 mbgl. It showed a recovery of 90% in 40mins. The detailed test pumping data is presented in Annex 2.

2.4 Water quality analysis

At the end of test-pumping, one water sample was collected and later taken to the regional water quality laboratory of the Ministry of Water and Environment of Uganda, in Lira.

The parameters analysed from the water sample are presented in Annex 3. The results of the water quality analysis will be forwarded as soon as they are received from the lab.

2.5 Site Clearance.

After the drilling and test pumping program, the site was cleared.

3 CONCLUSION AND RECOMMENDATIONS

3.1 Conclusions

- The project was delivered with 100% success rate, where one (01) drilling attempt was made to obtain one successful borehole.
- The results of test pumping indicate that the borehole meets the minimum requirements ($Q_{\text{sustainable}} = 0.5\text{m}^3/\text{hr}$) for installation of a hand pump.
- The water is fit for human consumption as the results of water quality analysis indicate that the water meets the national standards for portable water.

3.2 Recommendations

- We recommend that the community set up a water resource committee to take care of the borehole.
- We recommend that the client establishes a training for community members on how to use and maintain the boreholes to ensure their sustainability.

Annex 1: Borehole log

Borehole completion data

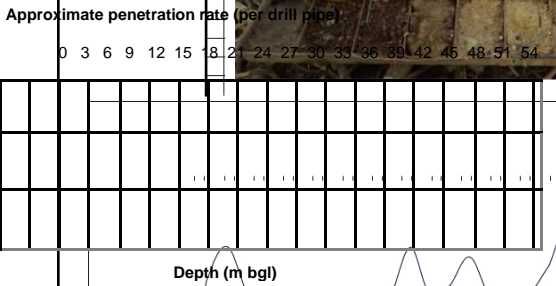
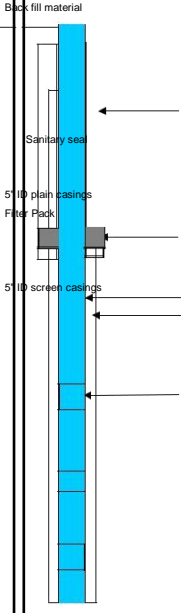
Drilling Contract No.: 201840

DWD ref. no.	DWD 55244	MISOZI		Company reference number: 55244	
Final Depth (m)	58.85	District	KAYUNGA	Altitude	1032.00 m amsl
Airlift yield (m ³ /hr)	1.50	Sub-County	GALIRAYA	GPS E	154395
SWL (m bgl)		Parish	NTIMBA	GPS N	471945
Date started	12-02-18	Date completed	12-05-18	Drilling Unit	401 new
					ves 4

Drill pipe	Depth (m bgl)	Penetration rate (min/m)	Geology	Type	Size and color and other details	Design	Details / Remarks
1	1.87	5			Yellowbrown laterite		
1	2.37	2			yellow brown laterite		
2	4.37	11		loam	yellow brown laterite		
3	6.85	6			Rad brown laterite		
4	8.85	4			Yellow brown sticky clay		
5	10.85	2			Yellow brown sticky clay		
6	12.85	3			Yellow brown sticky clay		
7	14.85	3			Yellow brown sticky clay		
8	16.85	4			Yellow brown sticky clay		
9	18.85	6		Clay	Yellow brown sticky clay		
10	20.85	6			Yellow brown sticky clay		
11	22.85	11			Yellow brown sticky clay		
12	24.85	6			Yellow brown sticky clay		
13	26.85	7			Yellow brown sticky clay		
14	28.85	10			Yellow brown sticky clay		
15	30.85	6			Light brown sandy weathered rock		
16	32.85	5			Light brown sandy weathered rock		
17	34.85	6			Light brown sandy weathered rock	F 34.00	200
18	36.85	9		Weathered rock	Light brown sandy weathered rock		
19	38.85	13			Light brown sandy weathered rock		
20	40.85	4			Light brown sandy weathered rock		
21	42.85	6			sandy weathered rock		
22	44.85	7			sandy weathered rock		
23	46.85	9			ite - medium grained granite	F 46.00	400
24	48.85	26			ite - medium grained granite		
25	50.85	45		Fresh b	ly medium grained granite	F 50.00	400
26	52.85	36			ly medium grained granite		
27	54.85	50			ly medium grained granite		
28	56.85	58			Medium gray medium grained granite		
29	58.85	67			Medium gray medium grained granite	F 58.00	300



Total airlift yield: 1.50
Main water strike: 38.00



material	unit	Qty est.	Qty act.	remarks
cement	50 kg bags	1.00	1.00	
filter pack	50 kg bags	27.00	30.00	
gravel pack	liters	460.00	460.00	
backfill	liters	530.00	530	
screen	lengths (nrs)	3.00	3.0	
screen total length	meters	8.79	8.79	
screen	broken pieces		-	
casing	lengths (nrs)	17.00	17.0	
casing total length	meters	49.71	49.81	
casing	broken pieces		-	
bottom plugs	material	cement	Cement	
seal material	Cement	Cement	Cement	
development	hours		2.5	Water Cleared

INSTALLATION DATA

Drilling	Depth		BHD	Drilling method
		28.85	58.85	
			175	Air

Equipment	Length	Depth		ID	OD	Diameter and type
		2.9	0.00	38.34	127	139.7
1		38.34	41.27	127	139.7	5" ID screen casings
1		41.27	44.20	127	139.7	5" ID Plain casings
1		44.20	47.13	127	139.7	5" ID screen casings
1		47.13	52.99	127	139.7	5" ID Plain casings
1		52.99	55.92	127	139.7	5" ID screen casings
1		55.92	58.85	127	139.7	5" ID Plain casings

Annular space	Depth		Volume (l)	Fill type
		16.00	530	Inert backfill
		16.00	176	Cement grout
	18.00	62.87	460	Filter Pack

GENERAL REMARKS:

The borehole was drilled to a depth of 58.85m with registered water strike levels at 36m, 42m having yields of 1000/hr and 400 l/hr respectively during drilling.

Design; The borehole was installed to 56.20 m with 5" ID Plain and screen casings from top bottom.

Drilling Method; The borehole was drilled with air rotary using 10 drag bit and 6.875" button bit/ DTH hammer up to 58.85m .

Development; The borehole was developed for 2.5 hrs with a clear discharge of 1500 l/hr

Challenges; Low penetration rates and highly collapsing sticky clays.

DRILLING COMPANY	TGS
DRILLER	Ongom Martin
CONSULTANT	Davis Lwamunda
SUPERVISOR	Okello Emma

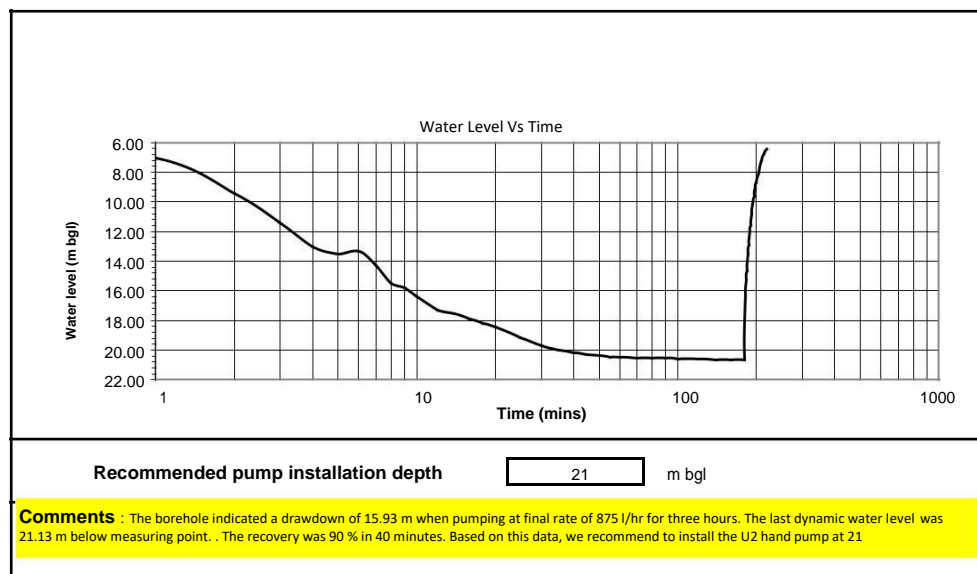
BHD, ID, OD, size are diameters in mm, depths in meters

Annex 2: Test pumping results

Pumping test data		Misozi		Drilling Contract No. 201840	
Borehole No.	DWD	55184	Altitude	1032	m amsl
Company ref no.		55184	GPS east	154395	
Final Depth (m)		30.76	GPS north	471945	
Date:	06-12-18		Drillers yield	1.50	m3/hr
Time Started	12:40		Time Finished	15:40	
Tested yield	0.90	m3/hr	Duration test	180.00	min
Water sample	yes	yes/no	Duration recovery	40.00	min
S.W.L at start test	4.75	m bgl	DWL end of test	20.68	m bgl
WSL1		m bgl	Drawdown	15.93	m
WSL2		m bgl	Recovery	90	%
WSL3		m bgl	Main water strike		m bgl
WSL4		m bgl	Depth of pump	29.00	m bgl
WSL5		m bgl	Measuring Point	0.45	m agl
Measured by :	Ongom Martin		Supervisor:	Okello Emmanuel	
Company :	TGS		Client :	RRD	
Contract No.:	201840		Contract Name:	Drilling and Test Pumping 1 borehole in Kayunga	

DRAWDOWN			
Time, t (mins)	Water Level (m bgl)	Drawdown (m)	Discharge, Q (l/h)
0	4.53	0.22	
1	7.05	2.30	1600
2	9.41	4.66	
3	11.40	6.65	1150
4	13.02	8.27	
5	13.52	8.77	
6	13.32	8.57	
7	14.29	9.54	
8	15.50	10.75	
9	15.80	11.05	1000
10	16.40	11.65	
12	17.27	12.52	
14	17.55	12.80	
16	17.89	13.14	
18	18.17	13.42	
20	18.46	13.71	916
25	19.14	14.39	
30	19.71	14.96	
35	20.00	15.25	
40	20.15	15.40	
45	20.31	15.56	
50	20.38	15.63	
55	20.45	15.70	
60	20.47	15.72	897
70	20.53	15.78	
80	20.55	15.80	
90	20.56	15.81	
100	20.57	15.82	
120	20.61	15.86	
140	20.63	15.88	
160	20.64	15.89	875
180	20.68	15.93	

RECOVERY			
Time, t (min)	Time (min)	Water Level (m)	Residual Drawdown (m)
0	180	20.68	15.93
1	181	18.15	13.40
2	182	16.40	11.65
3	183	15.27	10.52
4	184	14.65	9.90
5	185	14.05	9.30
6	186	13.49	8.74
7	187	12.93	8.18
8	188	12.50	7.75
9	189	11.97	7.22
10	190	11.60	6.85
12	192	10.80	6.05
14	194	10.17	5.42
16	196	9.60	4.85
18	198	9.09	4.34
20	200	8.69	3.94
25	205	8.05	3.30
30	210	7.23	2.48
35	215	6.76	2.01
40	220	6.42	1.67
45	225		
50	230		
55	235		
60	240		
70	250		
80	260		
90	270		



Annex 3: Water quality analysis

