



2022

Kaleya Feasibility Study – Borehole Drilling Summary Report

Project №. AQ22-003

10 April 2022



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1 INTRODUCTION AND BACKGROUND

Aquaquest Limited (Aquaquest) was retained by Kaleya Smallholders Company Limited (KASCOL) to provide independent supervision during the drilling and construction of exploration boreholes at the KASCOL Estate in Mazabuka District, Southern Province. The drilling program is part of a feasibility study for a proposed expansion of the Sub-surface Drip Irrigation system, which has also been carried out by Aquaquest (AQ22-003: Feasibility Study Report).

The aim of the exploratory drilling campaign is to assess the existing groundwater potential and to evaluate the option of using production boreholes to supplement the existing surface water supply to meet the Estate's irrigation demands.

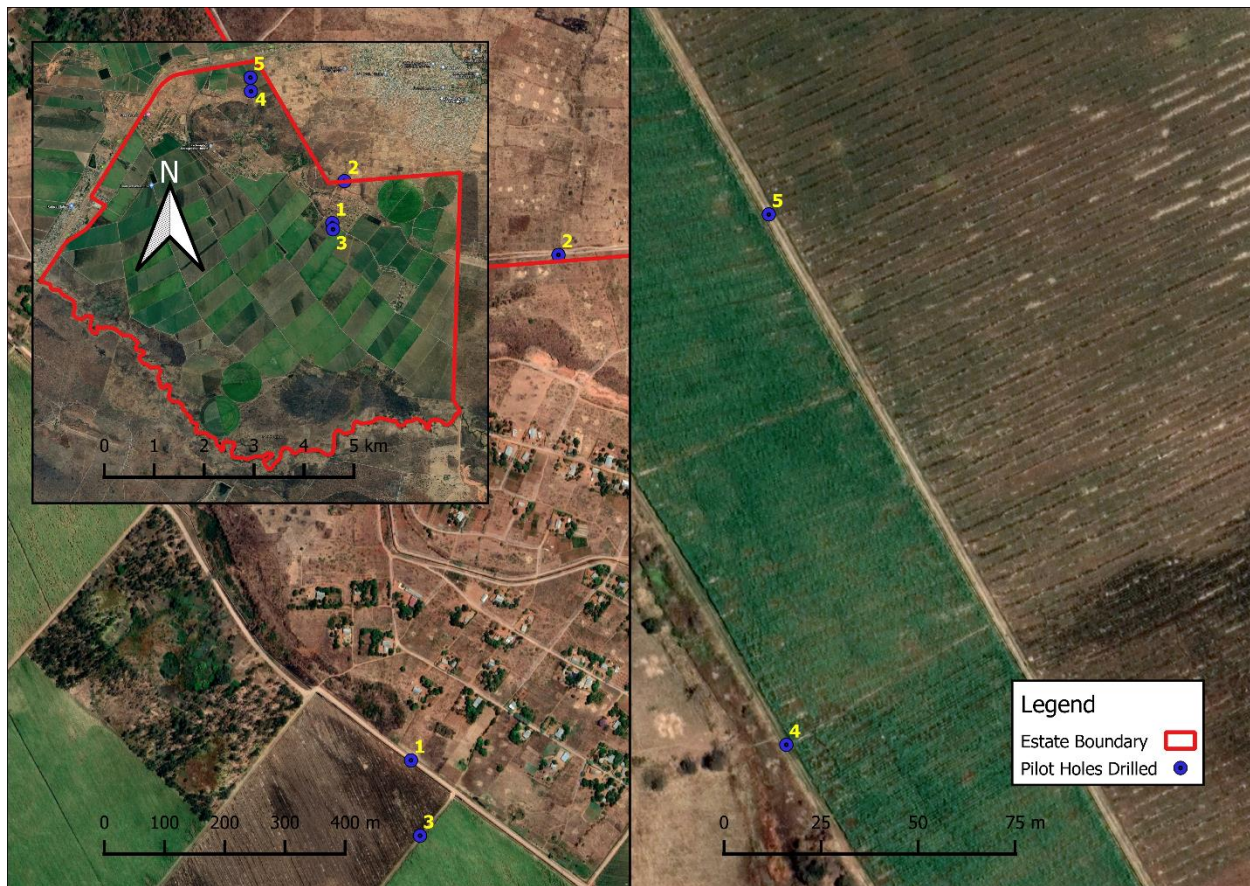


Figure 1. Location of Drilled Pilot Holes

The drilling program follows a geophysical survey conducted by Aquaquest in January 2022 (AQ22-003: Groundwater Assessment and Geophysical Survey). Following the completion of the geophysical survey, the collected electrical resistivity data was analyzed to select the best possible sites for exploration drilling. Other factors considered for the site

selection include geology, hydrogeology and topography. The location of the five recommended sites for pilot drilling are shown in Figure 1.

The current report includes the results and findings of the exploratory drilling campaign, which was carried out in two stages. First, 5 pilot holes were drilled between 23 and 27 February 2022, at the sites based on the recommendations from the geophysical survey. The activities and results of the pilot drilling are described in Chapter 2.

Subsequently, based on the results and observations from the first stage pilot drilling, the 2 highest yielding pilot holes were further developed into production boreholes between 23 March and 1 April 2022. The production borehole development is described in Chapter 3.

In Chapter 4, the main conclusions from the drilling campaign are presented, while recommendations have been provided on expected sustainable yields, borehole testing and potential further borehole development.

2 PILOT HOLE DRILLING

Five pilot holes were drilled between 23 and 27 February 2022 to confirm water availability and assess the potential yield of each selected site. The initial pilot drilling is essential for exploration purposes and allows for the development of the highest yielding sites into production boreholes. In addition, after comparing the results of the pilot drilling with the data collected during the geophysical survey, additional sites may be selected for further drilling, while survey targets can be identified for possible future geophysical investigations.

2.1 DRILLING METHOD

The drilling was conducted by Sri Lakshmi Boreholes Limited (SL Boreholes), a drilling company based in Lusaka and Mazabuka districts, which was contracted independently by the Client.

The method of drilling employed was rotary air percussion utilizing a 6" down-the-hole hammer (DTH), powered by a 300 psi (20-21 bars) air compressor. The drilling equipment and air compressor were both mounted on the same truck.

The DTH percussion tool, shown schematically in Figure 2, is the preferred means for the penetration of medium-hard to very hard rock formations, which were expected based on the observed geological formations at the Estate, as well as the geophysical measurements.

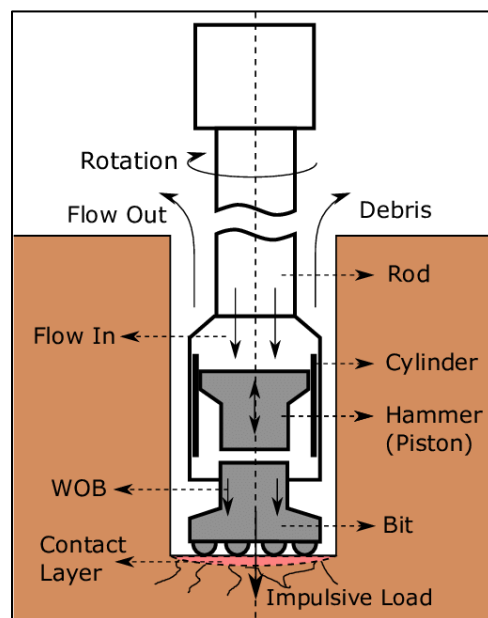


Figure 2. Schematic drawing of a DTH hammer; WOB = weight of bit, flow-in and flow-out refers to the drilling and lifting process with compressed air (researchgate.net)

All drilling works were monitored by the Aquaquest supervisor, who was present on site throughout the process. The Supervisor was responsible for recording all information, including drill bit size, water strikes (depths and estimated yields), and the geological log of lithologies encountered during the drilling process.

Drilling details are summarized in Table 1. The five selected sites were drilled to a depth of 80m each, in order of ranking, derived from the geophysical survey report. Drilling was done with a 6" (152mm) bit and a 6.5" (165mm) hammer. At PH03, reaming with a 9" hammer and installation of temporary casing was required to a depth of 13m bgl, due to the presence of collapsible top formations.

Table 1: Drilling details

Pilot Hole No.	Profile / VES Site No.	Coordinates Arc 1950 Zone 35 S		Drill Dates	Drilled Depth (m)	6.5" Temp. Casing	8" Temp. Casing	Drill bits		
		UTMX	UTMY					6"	6.5"	9"
PH 01	P10S68 / VES12	577933	8242883	23/2/22	80	-	7m	-	0-80m	-
PH 02	P14S92 / VES05	578178	8243722	24/2/22	80	-	-	-	0-80m	-
PH 03	P07S51 / VES11	577948	8242758	25/2/22	80	14m	-	18-80m	0-18m	0-13
PH 04	P12S78 / VES01	576302	8245522	26/2/22	80	-	-	-	0-80m	-
PH 05	P13S87 / VES20	576293	8245795	27/2/22	80	-	-	-	0-80m	-

2.2 DRILLING RESULTS – YIELD

During the drilling process, after striking water, yield measurements were taken every four meters using a 90-degree V-notch weir (Figure 3).



Figure 3. Taking yield readings on a 90-degree V-notch

All water strikes were recorded and assessed in terms of yield and aquifer formation. After the completion of drilling, the static water level in the hole was recorded. In PH01, PH03 and PH04, blown yields around 5-6 l/s were obtained, while in PH02, a yield of 1 l/s was

measured. PH2 was marked by the lowest yield (0.2 l/s). Water strikes, air-blown yields and static water level are shown in Table 2, for each of the 5 pilot holes.

Table 2. Drilled pilot holes and yield results

Pilot Hole No.	Drilled Depth (m)	Est. Airlift Yield (l/s)	SWL (mbgl)	Water Strikes		
				Main (mbgl)	1 st (mbgl)	2 nd (mbgl)
PH 01	80	4.6	1.55	77	20	58
PH 02	80	0.2	n/a	68	13	68
PH 03	80	5.6	0.18	25	25	28
PH 04	80	6.2	0.95	27	27	46
PH 05	80	1.0	1.50	25	4	25

2.3 DRILLING RESULTS – GEOLOGY AND HYDROGEOLOGY

During the drilling process, drill cutting samples were collected at 2-meter intervals. The drill cuttings were observed, analyzed and their geological characteristics recorded. Geological characteristics in relation to the ground water occurrence (hydrogeology) are very important to observe, as this will help in selection of potential sites for future drilling: by knowing the rock formations in which groundwater occurs and good yields are achieved, clear survey targets can be set for future surveys, while sites for additional drilling campaigns may either be selected or omitted based on known geological characteristics.



Figure 4. Drill cuttings for PH01, collected every 2 meters (0-2m at top right, 78-80m at bottom left).

In Figure 4, samples of drill cuttings collected and logged every 2 meters are shown for PH01. The same sampling procedure was applied for all other pilot holes. The general

stratigraphy of the formations underlying the KASCOL Estate consists of unconsolidated soils, colluvium and/or alluvial sediments at the top, followed by calcium-silicates and biotite schist beneath. The calcium-silicate rock has variations in its mineralogical composition: the carbonate-rich variety is found directly below the soils and unconsolidated top sediments, and is in turn underlain by the silicate-rich rock type, which transitions into the biotite schist. The calc-silicate rock is characterized by foliations, indicating that low-grade metamorphism took place in the region.

The calc-silicate formation is the major host rock for groundwater occurrence in this area, all major water strikes encountered during the drilling were in this geological unit. The presence of carbonate mineral in calcium-silicate formations is associated with the formation of karst features: these are secondary openings within the calcareous rock formation that have been caused by chemical weathering through dissolution of carbonate minerals. Limestones and dolomites are very vulnerable to this form of weathering. The presence of these relatively large openings allows for the storage and transmission of considerable volumes of groundwater within these rocks.

While some minor shallow water strikes were observed within the soils and alluvial sediments, these are most likely related to seepage of irrigation water from the surrounding fields. Water strikes in the biotite schist at depth are very limited and may be absent altogether.

3 PRODUCTION BOREHOLE DEVELOPMENT

3.1 REAMING OF PILOT HOLES

After completion of the pilot hole drilling, the two most productive pilot holes (PH03 and PH04), both with an air-blown yielding above 5 l/s, were selected for development into production boreholes.

The boreholes were reamed with 10.5" and 12" bits to allow for the installation of 8.5" permanent steel casing (see Figure 5). During the drilling, temporary casing was installed to prevent collapsing material from falling into the borehole. In total, 12.6 m of 13.5" casing was used on BH01 and 1.8m at BH02. Initially, the holes were to be reamed and cased to 80 meters below ground level (mbgl), but this was not attained at both sites. BH01 was installed with 8.5" casing to a final depth of 68 m bgl, while BH02 was installed to a final depth of 78.5 m bgl.



Figure 5. Drill bits, Temporary casing and rods used

BH01 was drilled at 9-inch diameter from 67 to 80 m. Drilling at 10 and 12-inch was not possible, as the hammers were getting stuck because of collapsing material. During the installation of the casing, the casing string could not go beyond a depth of 68 m bgl and a decision was made to conclude installation at that depth, as the open hole below was stable and could act as a sump. Summarized drilling and installation details for both production holes are included in Table 3.

Table 3. Drilling and installation details of BH01 and BH02

Borehole / Pilot Hole No.	Profile / VES Site No.	Drill Dates	Drilled Depth (m)	Drill bits			13.5" Temp. Casing	8.5" Perm. Casing	Slotted screens
				9"	10.5"	12"	m bgl	m bgl	m bgl
BH 01/PH03	P07S51 / VES11	21/03 – 26/03/22	80	67-80	-	0-67	12.6	68	14-26, 32-44, 50-62
BH 02/PH04	P12S78 / VES01	27/03 - 01/04/22	78.5	-	33 - 78.5	0-33	1.8	78.5	24.5-36.5, 42.5-54.5, 60.5-70.5

3.2 INSTALLATION

The 2 boreholes were installed with 8.5" steel casing to a final depth of 68 and 78.5 m bgl, respectively. To enable the flow of water from the aquifer zones into the borehole, the steel casing was perforated in a uniform manner with 4-5mm slots for the screen section (see Figure 6).



Figure 6. Casing and gravel in the two boreholes

Due to the incomplete casing installation, the screened sections in BH01 were set at 14-26, 32-44 and 50-62 m bgl, which still corresponds relatively well with the main water strikes at 25-28 and 37 m bgl. In BH02, the screened sections are set at 24.5-36.5, 42.5-54.5 and 60.5-70.5 m bgl, which corresponds very well with the main water strikes at 27, 46 and 68 m bgl.

After the installation of the casing lines, inert gravel pack of 5-10mm was placed in the annular space between casing and borehole (see Figure 6). The gravel acts as a filter to avoid sediment inflow into the borehole.

Details of the borehole drilling results, geological logs, water strikes, installation details, and screen locations are shown in the logs in Annex II.

3.3 BOREHOLE DEVELOPMENT / FLUSHING

The flushing of the boreholes was done right after gravel-pack installation. Borehole development by air-lifting clears the borehole of unwanted fine sediment that makes the water turbid and could block the screen section of the casing. The development further assists the gravel pack to settle properly in a uniform manner down the hole, without bridges and gaps.

Flushing was done for an hour for both boreholes: the water was clear towards the end of the flushing and flow measurements were taken using a V-notch, providing an estimate of the borehole yields, as shown in Table 4. Upon completion, BH01 provided a very good air-blown yield of 14 l/s, while BH-2 was marked by a fair air-blown yield of 9 l/s. Upon completion, the boreholes were capped and sealed, as shown in Figure 7.

Table 4. Yield of the two boreholes

Borehole /Pilot Hole No.	Profile Site No.	Arc 1950 Zone 35 S		Drill Dates	Drilled Depth (m)	Est. Airlift Yield (l/s)	SWL (mbgl)	Water Strikes		
		UTM E	UTM (N)					Main (mbgl)	1 st (mbgl)	2 nd (mbgl)
BH 01 /PH03	P07S51	577948	8242758	25/2/22	80	14	0.2	25	25	28
BH 02 /PH04	P12S78	576302	8245522	26/2/22	80	9	1.55	27	27	46



Figure 7. The two Boreholes sealed after completion of works

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The drilling program was completed successfully, as the targets that were set out were largely attained. Of the five pilot holes drilled to a depth of 80m bgl at the selected target sites from the geophysical survey, two had a yield of more than 5 l/s, while a 3rd hole had a yield of 4.6 l/s.

The two highest yielding sites (PH03 and PH04) were reamed using large diameter bits of 10.5" and 12" to allow for the installation of 8.5" permanent steel casing. Due to collapsing, only 68 m of casings and screens could be installed for BH01 (PH03), with screens set at 14-26, 32-44 and 50-62 m bgl, which still corresponds relatively well with the main water strikes at 25-28 and 37 m bgl.

BH02 (PH04) was installed to 78.5 m bgl, which is close to the total drilled depth of 80m. Screened sections in BH02 are set at 24.5-36.5, 42.5-54.5 and 60.5-70.5 m bgl, which corresponds very well with the main water strikes at 27, 46 and 68 m bgl.

During air-lift development, the yield of BH01 was 14 l/s (50 m³/hr), while the yield of BH02 was 9 l/s (32 m³/hr). However, it must be noted that the actual potential and sustainable yields of the boreholes can only be determined during test pumping. Which has not been conducted.

From the drilling results, it can be concluded that underground water has the potential to supplement the existing surface water supply, and that boreholes with yields in the range of 9-17 l/s (0-60 m³/hr) are considered to be feasible at Kaley Estate.

4.2 RECOMMENDATIONS

Before starting any additional works, pumping tests on the two completed boreholes should be conducted to give a full picture of the available groundwater potential and the sustainable yield. The need for an appropriate test pumping exercise should be emphasized for BH01, which is situated in an area that may receive water directly from the flood irrigated fields. Furthermore, a pumping test at BH02 is expected to provide a good indication of the volume of water that can be supplied by the underlying carbonate rock.

More geophysical surveys would have to be conducted to identify additional borehole locations for a full-scale drilling programme, targeting 25 boreholes in the range of 10-15 l/s.

Furthermore, it is recommended to:

- Conduct a 6-hour step-drawdown test of 4 steps (1.5 hours per step), followed by a 24-hour pumping test to assess the response of the water level to the applied pumping rate(s), and to determine the maximum safe yield of the borehole. It is recommended to test the boreholes at a maximum yield of approximately 10 l/s or 36 m³/hr for BH02 and 15 l/s or 50 m³/hr at BH01.

The highest possible discharge to be applied during the constant discharge test is derived from the results of the step-drawdown test. If needed, based on the results of the step-drawdown test, a valve should be used to reduce the pumping rate during the constant discharge test to a sustainable level.

- Ideally, the water level during pumping should not drop below a depth of 25 and 27 m bgl for BH01 and BH02 respectively, to avoid drawdown into the aquifer, possible depletion, sand intake, and reduced yield;
- Test pumping should be supervised by a competent hydrogeologist, who should also be responsible for the analysis of the test pumping results.
- The pump should be installed at a depth of 47 m bgl in BH01 and at 57 m bgl in BH02, inside the corresponding blank casing section. Generally, it is recommended to install the permanent pump between two screened sections and to keep the maximum drawdown above the main water strike level. However, for the purposes of a pumping test, the pump can be temporarily installed at a lower depth. The pump should never be installed within a screened zone, as this may result in enhanced sediment intake and damage to the pump;
- From the test pumping results, determine sustainable boreholes yields, suitable pump type and capacity and recommended pump depth.
- After the selection and during the installation of a permanent pump, install a 1-inch guide pipe in the borehole to allow correct and unimpeded measurement of the water level;
- Install a soft starter for the pump to reduce initial power loading and to reduce electricity costs;
- With groundwater availability being an important input considered during the future development of the farm, it is important to closely monitor both groundwater levels and abstraction rates, to ensure that water levels are not drawn down too rapidly as a result of unsustainable pumping rates;
- Chlorinate the boreholes and collect water samples for water quality analysis before using the borehole water for human consumption;
- Ensure that the boreholes are registered with the Water Resources management Authority.

5 REFERENCES

1. Song, Xianfeng & Kane, Alexandre & Aamo, Ole & Detournay, Emmanuel. (2019).
A dynamic model of the drilling action of percussive tools.

ANNEX I - PILOT HOLES

- PH01
- PH02
- PH03
- PH04
- PH05



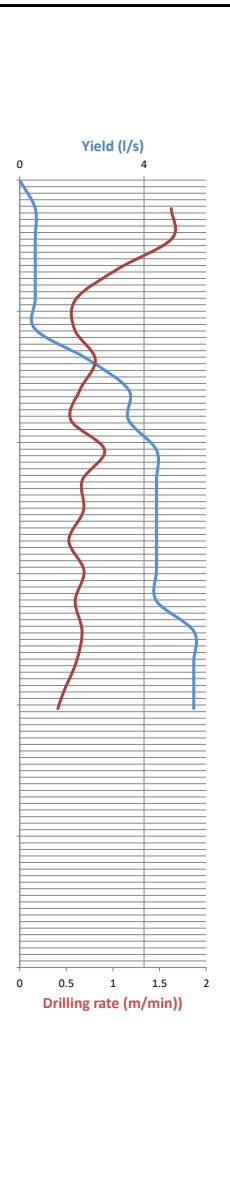
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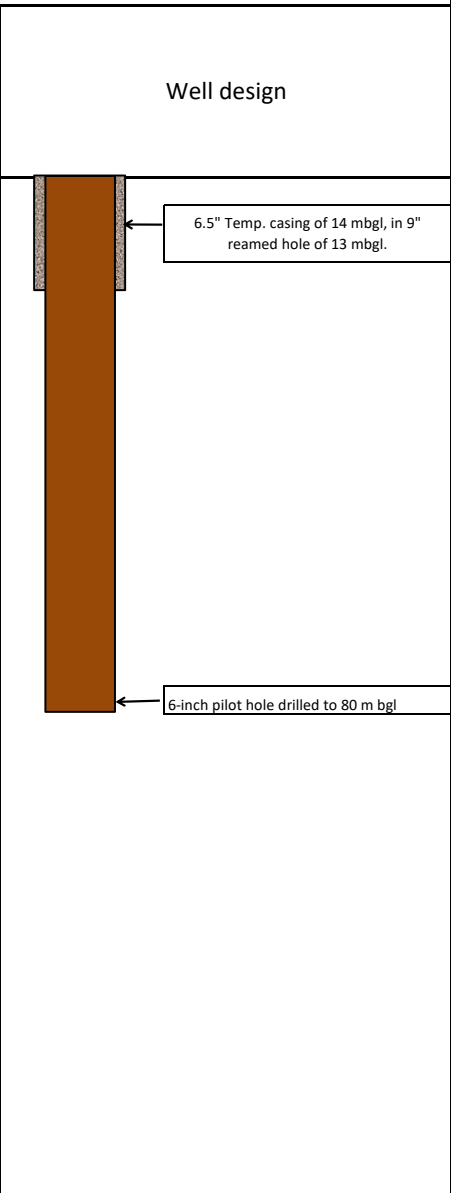
Borehole completion report (PH03)

AQ Project nr. : AQ22-003	Project Name : Kaleyia Feasibility Study		Profile and site no: P7S51
PH ID / BH ID : PH03	Province : Southern Province	UTM X : 577948	Drilling company : SL Boreholes
Date started : 25/02/2022	District : Mazabuka	UTM Y : 8242758	Driller : Ramreddy.K
Date completed : 26/02/2022	Location : Kaleyia	Altitude : m amsl	Drilling method : DTH
Drilled depth : 80 m bgl	Static water level : 0.18 m bgl	Casing material : n/a	Client Name: KASCOL
Est. airlift yield : 5.6 l/s	Main water strike : 28 m bgl	Depth of casing : m bgl	Aquaquest Supervisor: NS

Pipe nr.	Depth (m bgl)	Time (minutes)	Penetration rate (m/min)	Yield (l/s)
0	0.0	0	0	0
1	4.3	2.67	1.63	0.5
2	8.9	2.82	1.63	0.5
3	13.5	4.37	1.05	0.5
4	18.1	7.63	0.6	0.5
5	22.7	7.83	0.59	0.5
6	27.3	5.67	0.81	2.2
7	31.9	7.10	0.65	3.5
8	36.5	8.40	0.55	3.5
9	41.1	5.05	0.91	4.4
10	45.7	6.85	0.67	4.4
11	50.3	6.72	0.68	4.4
12	54.9	8.73	0.53	4.4
13	59.5	6.67	0.69	4.4
14	64.1	7.73	0.6	4.4
15	68.7	6.88	0.67	5.6
16	73.3	7.55	0.61	5.6
17	77.9	9.73	0.47	5.6
18	80.5	6.35	0.41	5.6



Lithology		
Diagram	Description	Water strike (m bgl)
[Pattern]	Clay (0-4m)	4
[Pattern]	Alluvial sediment(4-12)	
[Pattern]	Calc-silicate (rich in silicate minerals, highly fractured)	25
[Pattern]		28
[Pattern]		37
[Pattern]		
[Pattern]	Biotite - Quartz Schist(66-80)	66



INSTALLATION DATA			TECHNICAL DATA		
Depth	BHD	Drilling method	Material	Unit	Remarks
80		DTH	cement	50 kg bags	
			gravel pack	20 kg bags	
			gravel pack	liters	
			backfill	liters	
			casings - plain	meters	
			casings - screens	meters	
			casings - excess	broken pieces	
			bottom plugs	materials	
			seal material		
			development	hrs	
GENERAL REMARKS:					
Pilot hole was drilled with 6.5" (165mm) bit to 80 m bgl.					
Water was encountered at 4m, 25m, 28m, 37m and 66 m bgl.					
Final yield was 5.6 l/s, which is good enough for development.					
Depth	Volume	Fill material type			



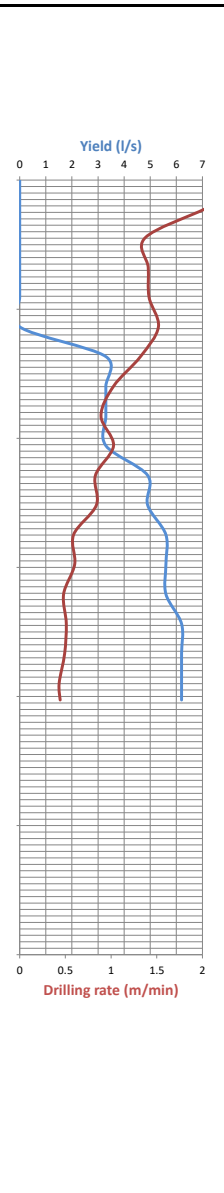
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Borehole completion report (PH04)

AQ Project nr. : AQ22-003	Project Name : Kaleyia Feasibility Study		Profile and site no: P12578
PH ID / BH ID : PH04	Province : Southern Province	UTM X : 576302	Drilling company : SL Boreholes
Date started : 26/02/2022	District : Mazabuka	UTM Y : 8245522	Driller : Ramreddy.K
Date completed : 26/02/2022	Location : Kaleyia	Altitude : 1062 m amsl	Drilling method : DTH
Drilled depth : 80 m bgl	Static water level : 0.95 m bgl	Casing material : n/a	Client Name: KASCOL
Est. airlift yield : 6.2 l/s	Main water strike : 27 m bgl	Depth of casing : m bgl	Aquaquest Supervisor: NS

Pipe nr.	Depth (m bgl)	Time (minutes)	Penetration rate (m/min)	Yield (l/s)
0	0.0	0	0	0
1	4.3	2.12	2.05	0
2	8.9	3.35	1.37	0
3	13.5	3.27	1.41	0
4	18.1	3.25	1.42	0
5	22.7	3.03	1.52	0
6	27.3	3.48	1.32	3.3
7	31.9	4.48	1.03	3.3
8	36.5	5.17	0.89	3.3
9	41.1	4.48	1.03	3.3
10	45.7	5.55	0.83	4.9
11	50.3	5.48	0.84	4.9
12	54.9	7.80	0.59	5.6
13	59.5	7.65	0.6	5.6
14	64.1	9.57	0.48	5.6
15	68.7	9.02	0.51	6.2
16	73.3	9.35	0.49	6.2
17	77.9	10.65	0.43	6.2
18	80.5	5.87	0.44	6.2



Lithology		
Diagram	Description	Water strike (m bgl)
[Pattern]	Clay (0-2m)	
[Pattern]	Calc -Silicate rock (very rich in calcite and highly weathered (2 - 30m)	
[Pattern]	Calc -Silicate rock (very rich in calcite, moderate to highly weathered (30 -55m)	27
[Pattern]	Calc -Silicate rock (very rich in calcite, moderately weathered (55 - 80m)	46
[Pattern]		52
[Pattern]		68

Well design
<p style="text-align: center;">6-inch pilot hole drilled to 100.1 m bgl</p>

INSTALLATION DATA			TECHNICAL DATA		
Depth	BHD	Drilling method	Material	Unit	Remarks
80		DTH	cement	50 kg bags	
			gravel pack	20 kg bags	
			gravel pack	liters	
			backfill	liters	
			casings - plain	meters	
			casings - screens	meters	
			casings - excess	broken pieces	
			bottom plugs	materials	
			seal material		
			development	hrs	
GENERAL REMARKS: The pilot hole was drilled at 165 mm (6.5-inch) diameter to a depth of 80 m bgl. Water was encountered between between 27, 46, 52 and 68m.					
Depth	Volume	Fill material type			



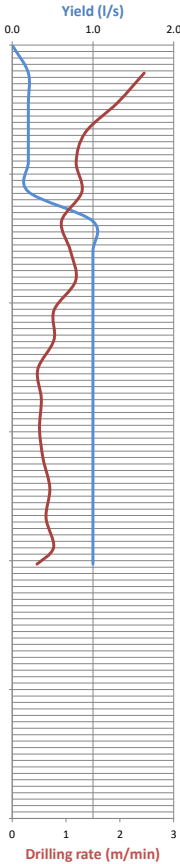
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Borehole completion report (PH05)

AQ Project nr. : AQ22-003	Project Name : Kaleyia Feasibility Study		Profile and site no: P13S87
PH ID / BH ID : PH05	Province : Southern Province	UTM X : 576293	Drilling company : SL Boreholes
Date started : 27/02/2022	District : Mazabuka	UTM Y : 8245795	Driller : Ramreddy.K
Date completed : 27/02/2022	Location : Kaleyia	Altitude : m amsl	Drilling method : DTH
Drilled depth : 80 m bgl	Static water level : 1.5 m bgl	Casing material : n/a	Client Name : KASCOL
Est. airlift yield : 1 l/s	Main water strike : 25 m bgl	Depth of casing : m bgl	Aquaquest Supervisor : NS

Pipe nr.	Depth (m bgl)	Time (minutes)	Penetration rate (m/min)	Yield (l/s)
0	0.0	0	0	0.0
1	4.3	1.77	2.45	0.2
2	8.9	2.35	1.96	0.2
3	13.5	3.38	1.36	0.2
4	18.1	3.87	1.19	0.2
5	22.7	3.55	1.3	0.2
6	27.3	5.02	0.92	1.0
7	31.9	4.25	1.08	1.0
8	36.5	3.90	1.18	1.0
9	41.1	5.92	0.78	1.0
10	45.7	5.93	0.78	1.0
11	50.3	9.68	0.48	1.0
12	54.9	8.50	0.54	1.0
13	59.5	9.07	0.51	1.0
14	64.1	8.03	0.57	1.0
15	68.7	6.58	0.7	1.0
16	73.3	7.32	0.63	1.0
17	77.9	5.98	0.77	1.0
18	80.5	5.65	0.46	1.0



Lithology		
Diagram	Description	Water strike (m bgl)
	Clay (0-2m)	
	Calc-Silicate (rich in calcite with trace amounts of silicate minerals (3 - 32m)	4
	Calc-Silicate (rich in calcite with significant amount of silicate minerals (32 - 52m)	25
	Biotite - Quartz Schist (52 - 80m)	

Well design	
	6.5-inch pilot hole drilled to 80 m bgl

INSTALLATION DATA			TECHNICAL DATA		
Depth	BHD	Drilling method	Material	Unit	Remarks
80	165mm	DTH	cement	50 kg bags	
			gravel pack	20 kg bags	
			gravel pack	liters	
			backfill	liters	
			casings - plain	meters	
			casings - screens	meters	
			casings - excess	broken pieces	
			bottom plugs	materials	
			seal material		
			development	hrs	
GENERAL REMARKS:					
The pilot hole was drilled at 165 mm (6.5-inch) diameter to a depth of 80 m bgl.					
Water was encountered between between 4 and 25 m bgl.					
Depth	Volume	Fill material type			

ANNEX II – DEVELOPED BOREHOLES

- Borehole 1

- Borehole 2



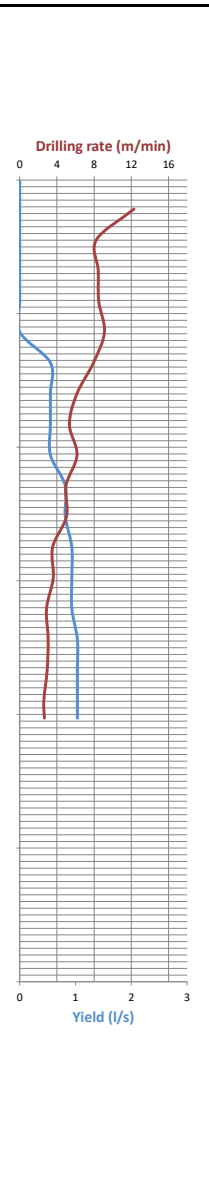
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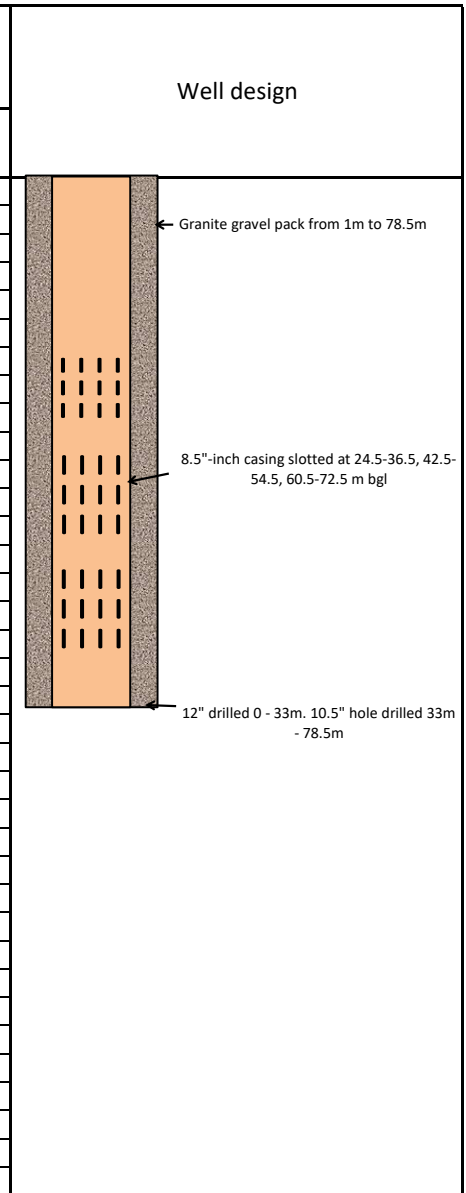
Borehole completion report

AQ Project nr. : AQ22-003	Project Name : Kaleyia Feasibility Study		Profile and site no: P12578
PH ID / BH ID : BH02	Province : Southern Province	UTM X : 576302	Drilling company : SL Boreholes
Date started : 27/03/2022	District : Mazabuka	UTM Y : 8245522	Driller : Ramreddy.K
Date completed : 01/04/2022	Location : Kaleyia	Altitude : 1062 m amsl	Drilling method : DTH
Drilled depth : 78.5 m bgl	Static water level : 1.55 m bgl	Casing material : Steel	Client Name : KASCOL
Est. airlift yield : 9 l/s	Main water strike : 27 m bgl	Depth of casing : 78.5 m bgl	Aquaquest Supervisor: NS

Pipe nr.	Depth (m bgl)	Time (minutes)	Penetration rate (m/min)	Yield (l/s)
0	0.0	0	0	0
1	4.3	2.12	2.05	0
2	8.9	3.35	1.37	0
3	13.5	3.27	1.41	0
4	18.1	3.25	1.42	0
5	22.7	3.03	1.52	0
6	27.3	3.48	1.32	3.3
7	31.9	4.48	1.03	3.3
8	36.5	5.17	0.89	3.3
9	41.1	4.48	1.03	3.3
10	45.7	5.55	0.83	4.9
11	50.3	5.48	0.84	4.9
12	54.9	7.80	0.59	5.6
13	59.5	7.65	0.6	5.6
14	64.1	9.57	0.48	5.6
15	68.7	9.02	0.51	6.2
16	73.3	9.35	0.49	6.2
17	77.9	10.65	0.43	6.2
18	80.5	5.87	0.44	6.2



Lithology		
Diagram	Description	Water strike (m bgl)
	Clay (0-2m)	
	Calc - Silicate rock (very rich in calcite and highly weathered (2 - 30m))	
	Calc - Silicate rock (very rich in calcite, moderate to highly weathered (30 - 55m))	27
	Calc - Silicate rock (very rich in calcite, moderately weathered (55 - 80m))	46
		52
		68



INSTALLATION DATA				TECHNICAL DATA		
Depth	BHD	Drilling method		Material	Unit	Remarks
0	78.5 m	10.5"	DTH	cement	1 x 50kg bag	Borehole sealed at 0-1m
				gravel pack	2.5 m3	Granite gravel pack (8-10mm) filled 1-78.5m
				gravel pack	2.5 m3	
				backfill		no backfill used
				casings - plain	42.5 m	
				casings - screens	36 m	4 - 5 mm slots on screen
				casings - excess	1.5 m	target of 80 m not reached
				bottom plugs	fabricated	casing closed by cutting and bending
				seal material		
				development	1 hr	1hr of flushing during which yield measurements were taken
GENERAL REMARKS:						
Penetration rates and preliminary yield measurements are for the pilot hole PH04, later developed to BH02.						
Reaming of the borehole was done with 12" from 0-33 mbgl, 33 - 78.5 mbgl was done with 10.5" bit.						
1.8 m of 13.5" temporary casing was used to secure the unstable top formation of the borehole.						
Around 2.5 m3 of gravel was used, Yield estimates were done during flushing of the borhole, final yield estimate was 9 l/s.						
The annular space was sealed with cement at 0-1 m and the top part of steel casing was sealed.						
Depth	Volume	Fill material type				
1	78.5	Granite				