Managing Coastal Aquifers (MCA) Project

Community based water resources monitoring guide

Benefits of community based monitoring

A key element for sustainable water management is efficient monitoring, although this is particularly difficult and expensive in remote areas with limited options and monitoring points. Community based monitoring, which links water and social sciences, helps to address the issue of limited capacity in collecting and sharing data on water resources. It is an approach in which professional scientists, communities, and volunteers collaborate in the research design, data collection and interpretation process. Besides providing a cost-effective method for collecting datasets over a range of spatio-temporal scales, it allows community volunteers to contribute local information and insight that can be easily overlooked by external researchers, and for participants to learn through their engagement in data acquisition.

Community based monitoring can also be conducted with local schoolteachers and students. This has the advantage of contributing to teaching science and water management to local students through practical applications. It also ensures quality of data collection and motivation for participation in the monitoring programs.

- Build capacity and resources to collect, communicate, and comprehend information on the status of community water resources.
- Experienced network of volunteers in community decision making.
- Trained first responders to water stressed situations.
- Follow-up data analysis and communication.
- Data quality control.

Community based monitoring kit

Pelican case containing kit

Measuring tape

Sampling bottle and bottle dropper

Electrical conductivity meter

Smartphone

KoBo Toolbox app

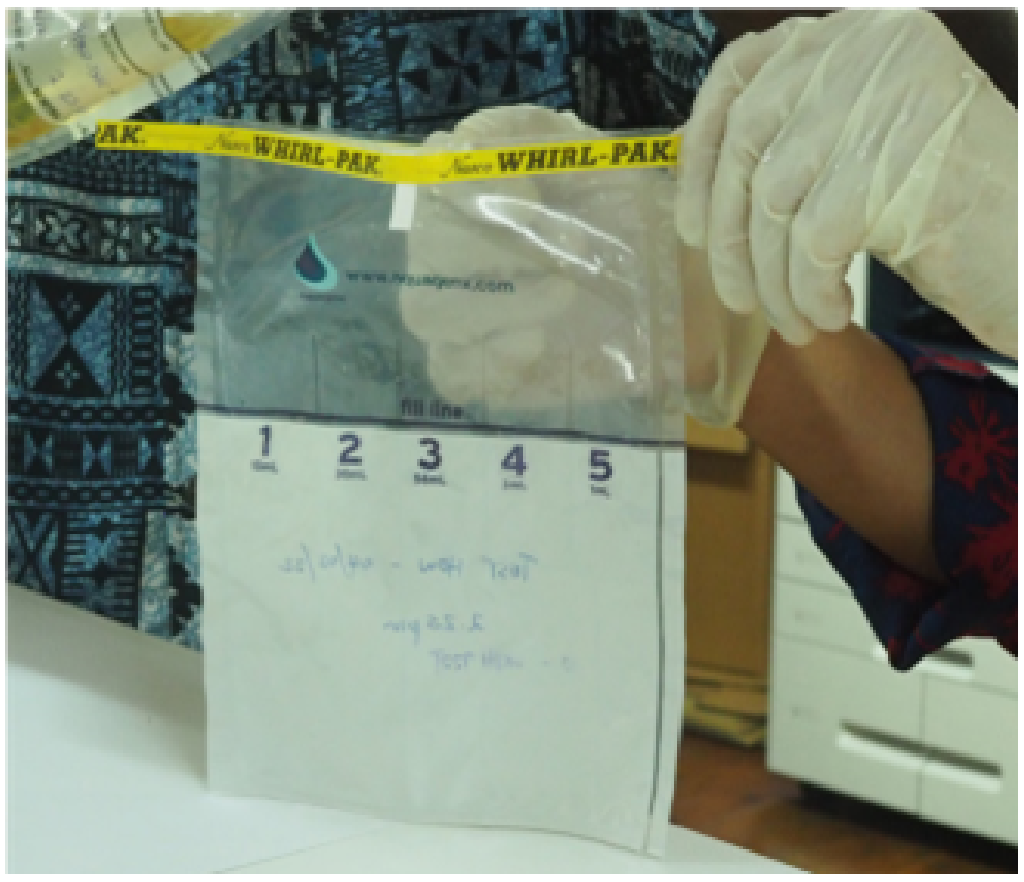
Water quality testing kit

Aquagenx CBT EC+TC MPN Kit

Stand up bag

Glucose reagent

Compartment bag



Well survey

A well survey is conducted to record the dimensions and characteristics of wells, the depth to the water table and the salinity of groundwater. The equipment required is a measuring tape and the salinity meter. It is advisable to also have a general observation of the well inspecting the condition of the well casing, the presence or absence of a well cover, and potential contamination sources in the vicinity.

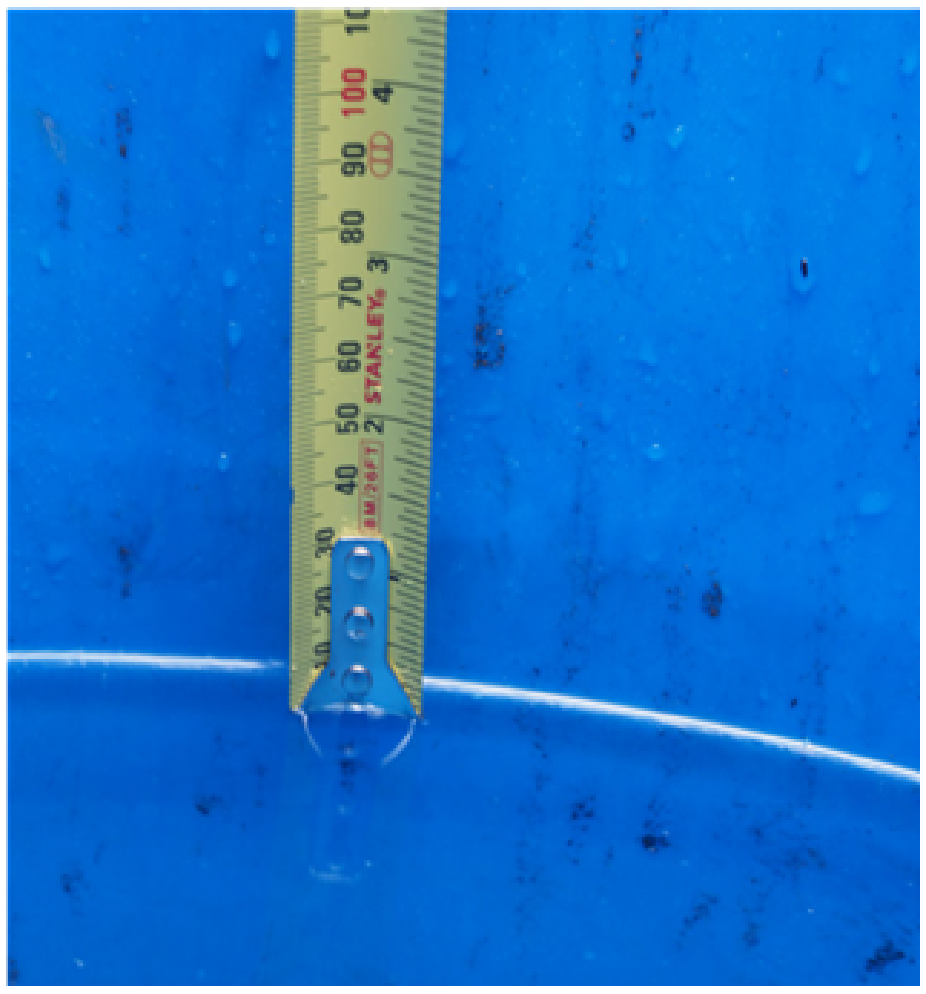
1. Well diameter

2. Casing height

Measure the height from the ground to the top of the well.

3. Groundwater level

Measure the height from the water level to the top of the well.



4. Total well depth

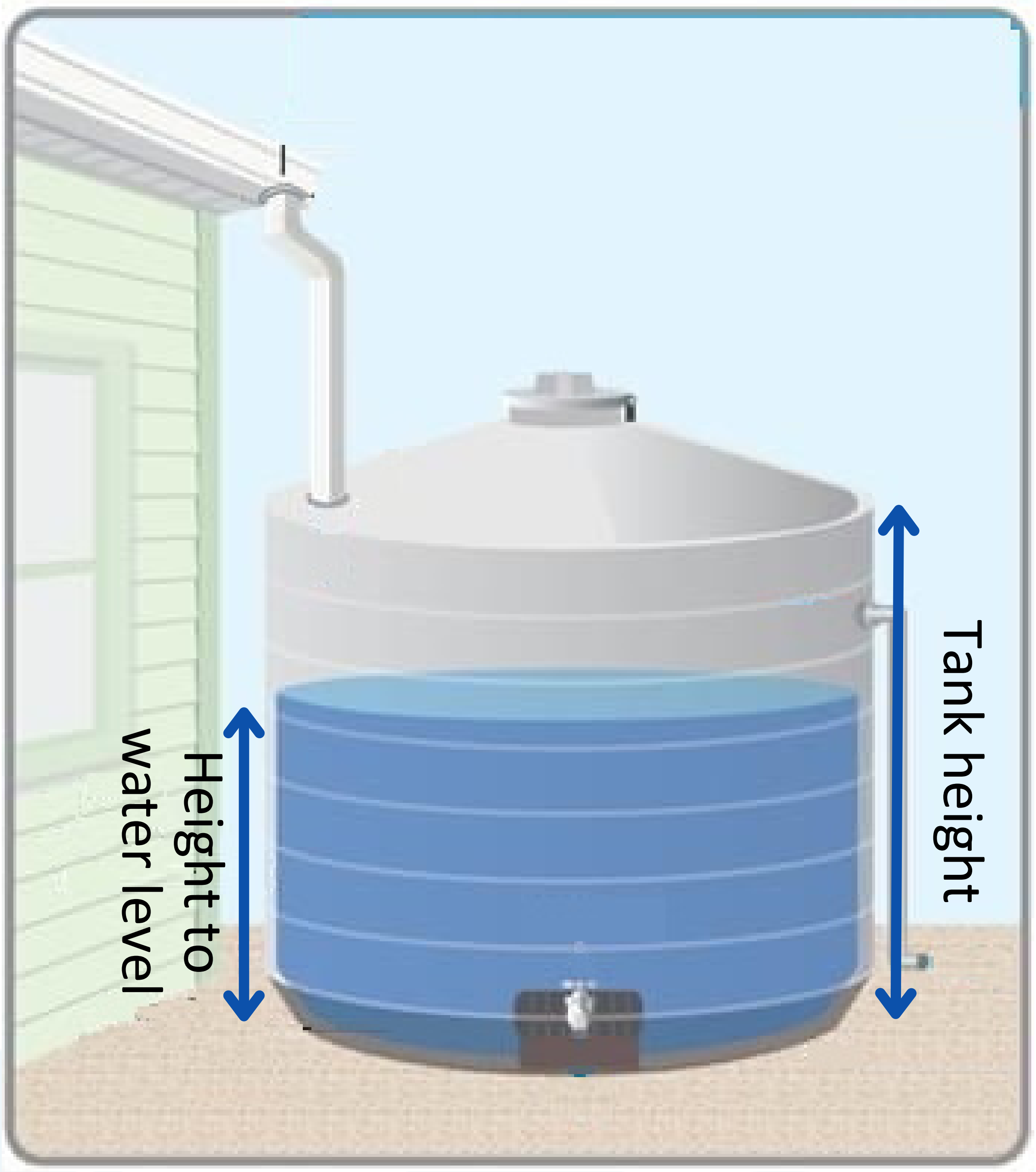
Measure the height from the bottom of the well to the top of the well casing.

5. Groundwater salinity

Switch the device on and drop the probe down the well until it is fully submerged. Read the electrical conductivity (EC) either in µS/cm or mS/cm.

Rainwater tank/cistern survey

This survey is conducted to record the dimensions and characteristics of rainwater tanks and cisterns and to assess the volume of available water in relation to current usage and demand. The equipment required is a measuring tape.

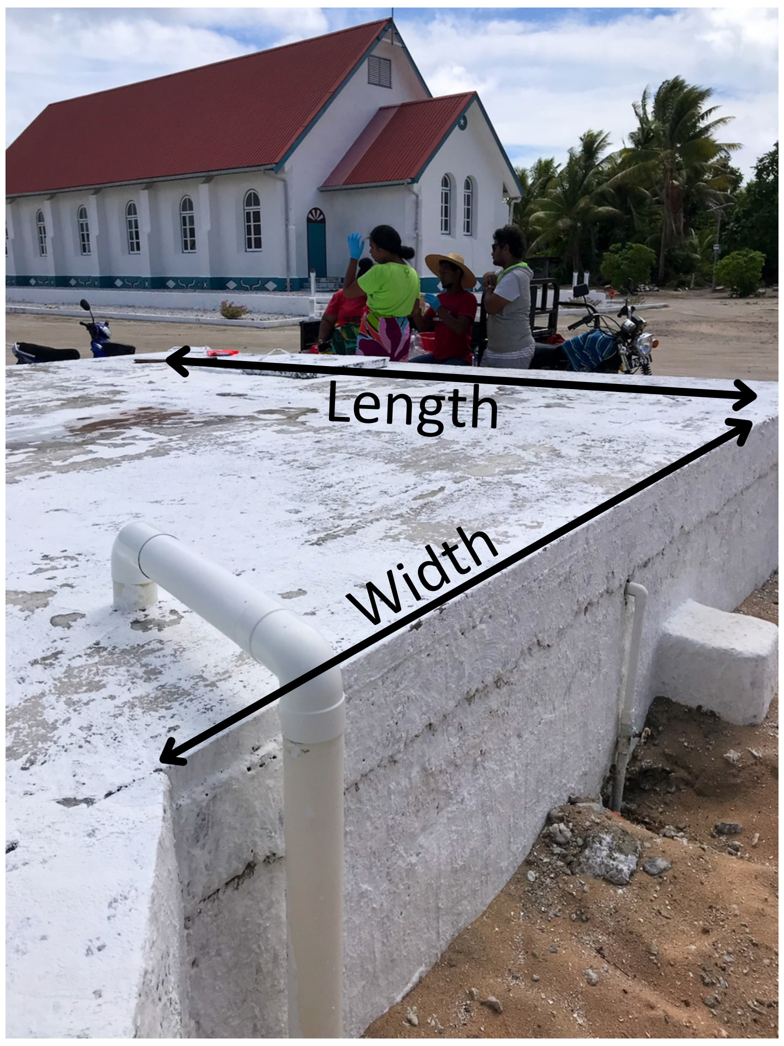


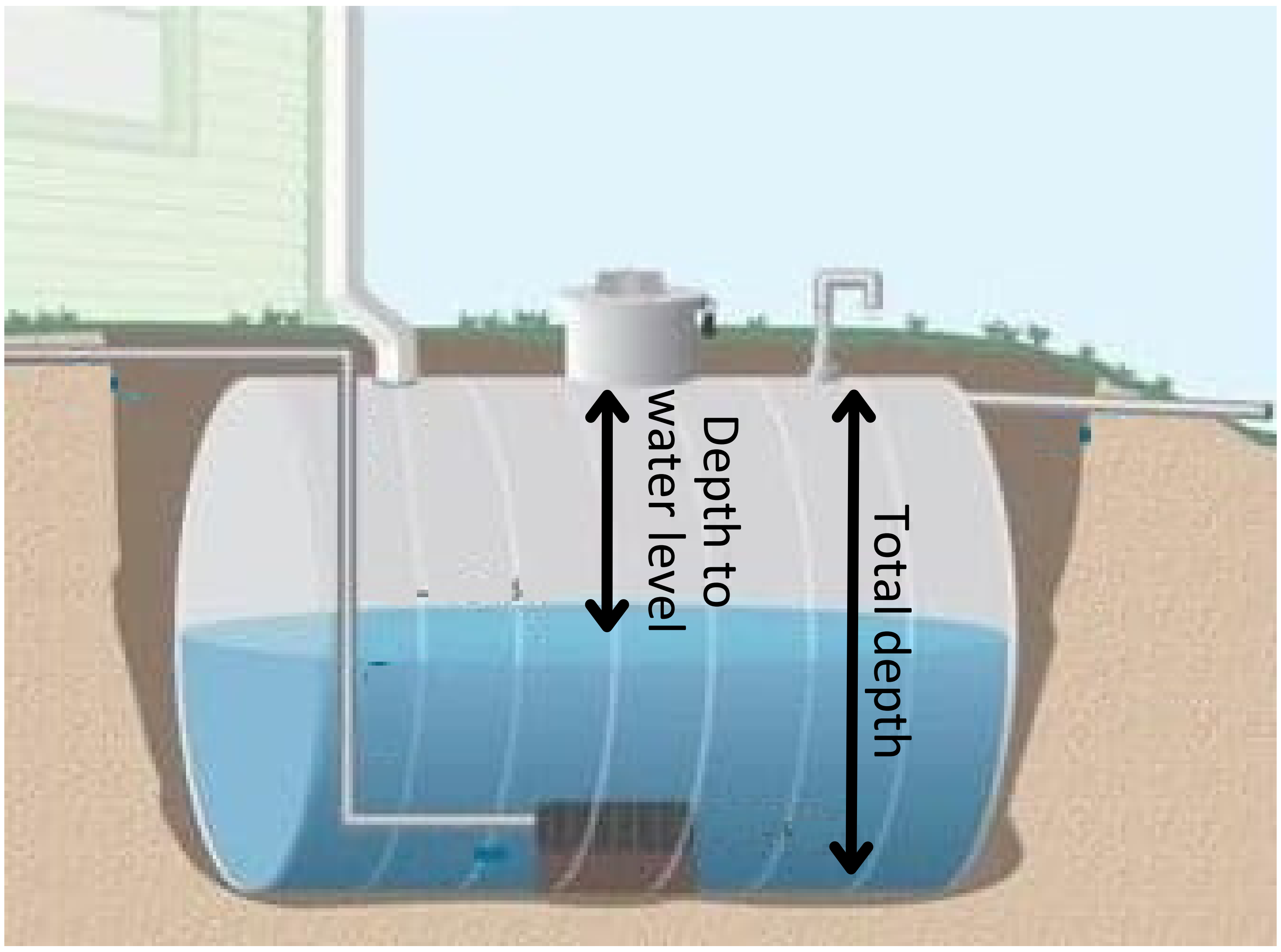
Estimating height to water level in raintanks

- For plastic/poly tanks, tap the sides a few times at different heights.
- A higher pitch thud with resonance would indicate that the tank is empty at that level.
- A lower pitch thud with no resonance would indicate that the tank at that level is full.
- Mark the level where the low pitch sound turns to a high pitch sound.
- Measure the height up to that level.

Surveying cisterns and rectangular rainwater tanks

- Measure the cistern's length, width and total depth.
- Measure the depth to water level.





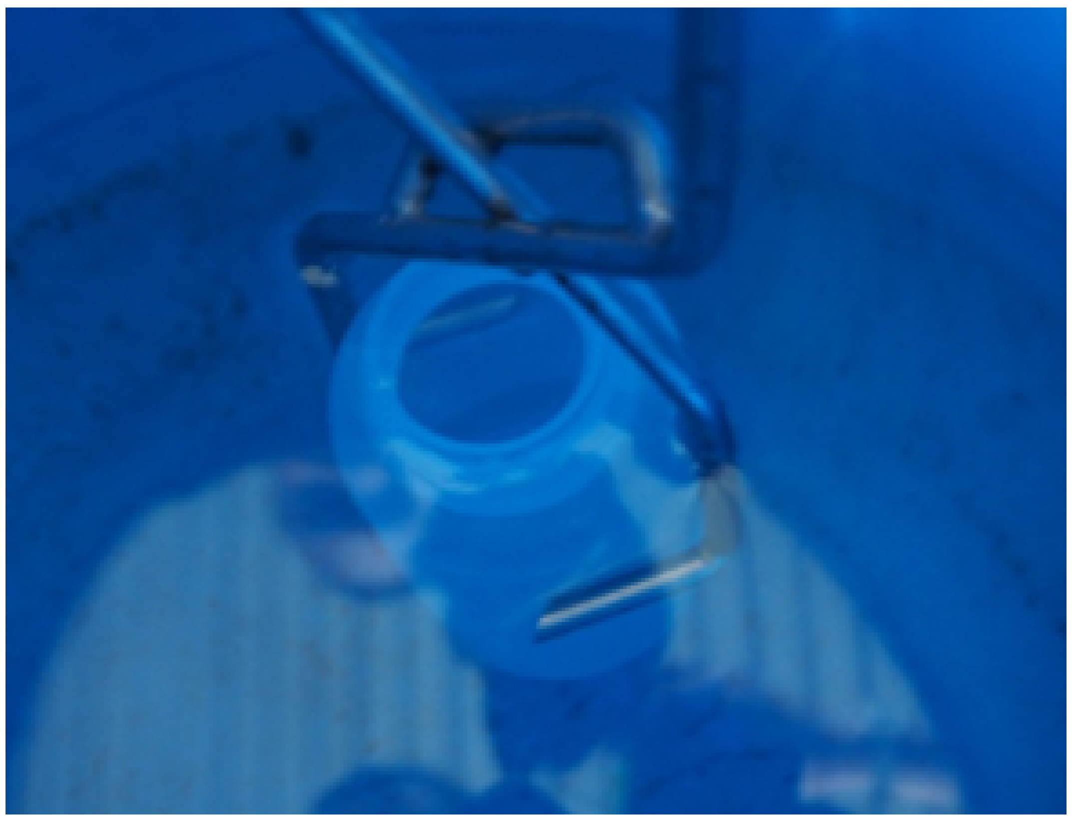
Water quality sampling and bacteriological analysis

Water-borne diseases can be caused by a multitude of pathogens, with the majority having a fecal origin. Testing for every potential pathogen in drinking water is not a practical approach. Therefore, it is preferred to measure fecal indicators instead. It is commonly accepted that Escherichia coli (E. coli) is currently the most reliable indicator of fecal contamination in drinking water.

A bacteriological analysis of water sources (wells, rainwater tanks, and cisterns) is conducted to determine their safety for human consumption. The method described below tests the Most Probable Number of E.coli and Total Coliforms in water.

- Wear hand gloves (if available).
- Label stand up bag with site details and sampling date and time.
- Tear open water stand up bag (avoid touching the inside of the bag).

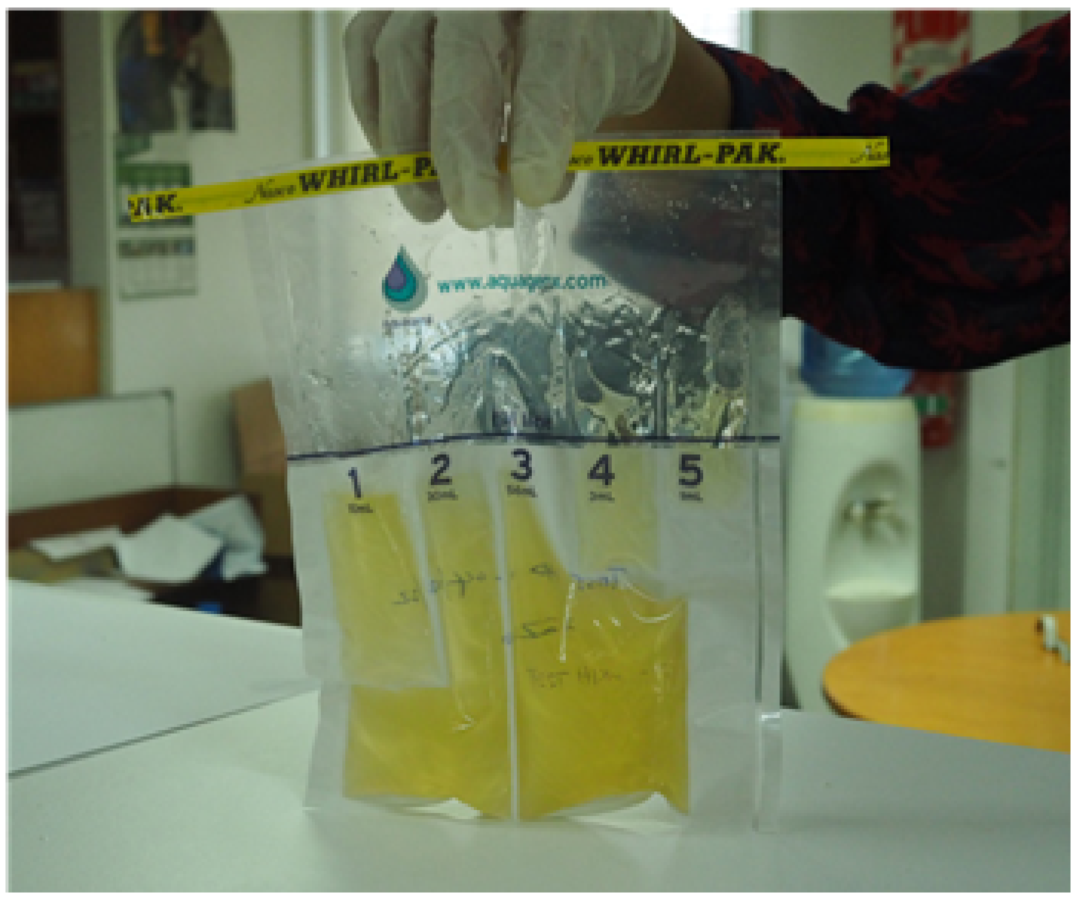
- If sampling from a well or cistern, use a sampling container to collect a sample.
- If sampling from a rain tank, collect sample from the tap (after letting the water run for a 2-3 seconds).



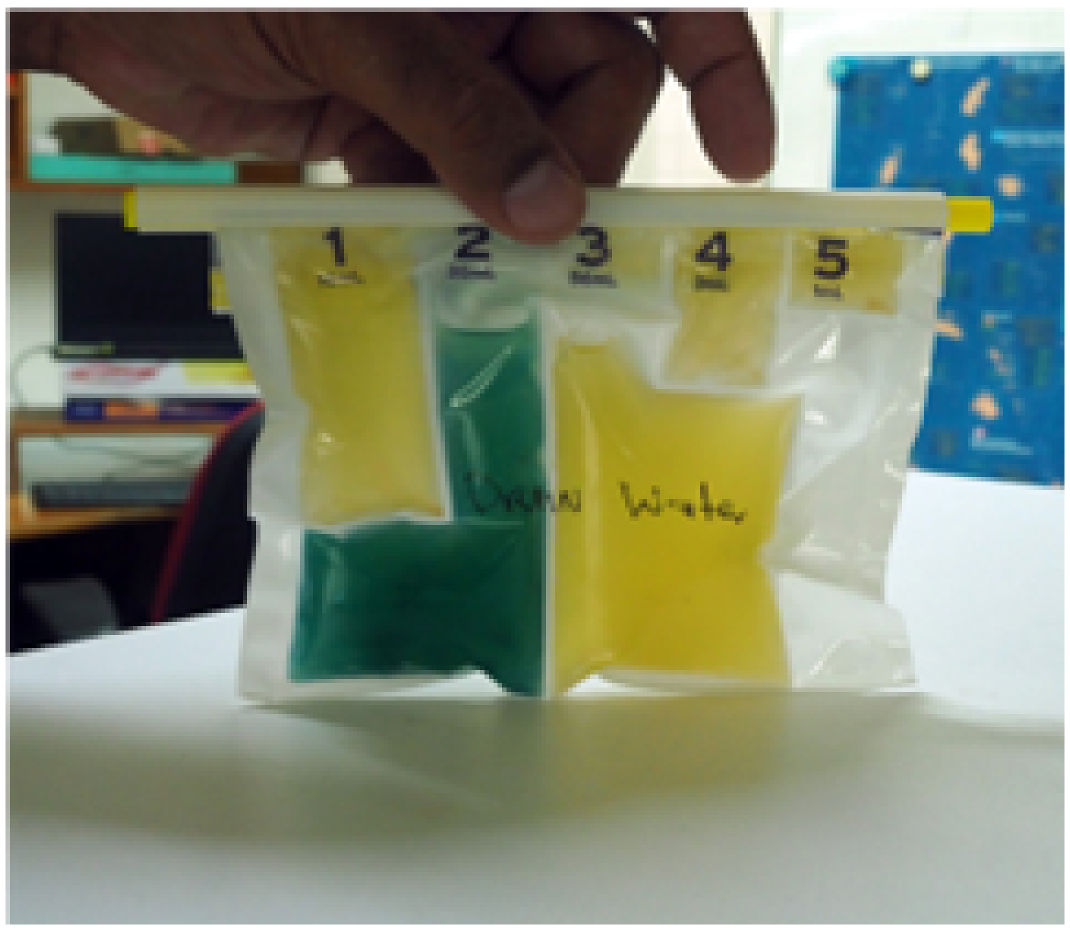
- Transfer the water sample to a stand up bag and fill up to the marked level.

- Add reagent and shake until it dissolves completely.

- Pour sample carefully into the compartment bags by filling each individual compartment up to the marked line.

- Store inside incubator at 25-30 °C for 40-48 hours.
- Read and record the Most Probable Number (MPN/100 mL) of E.coli according to the Table below.

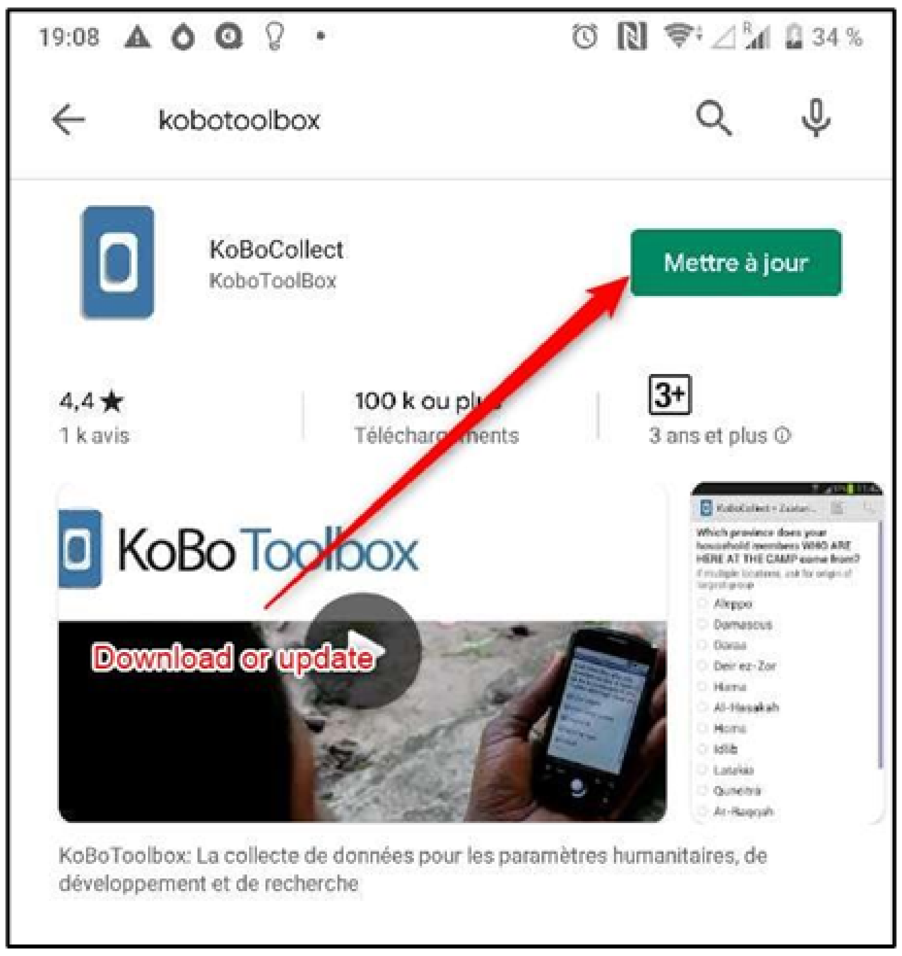



Example of low risk tap water sample (left) and intermediate risk drain water sample (right).

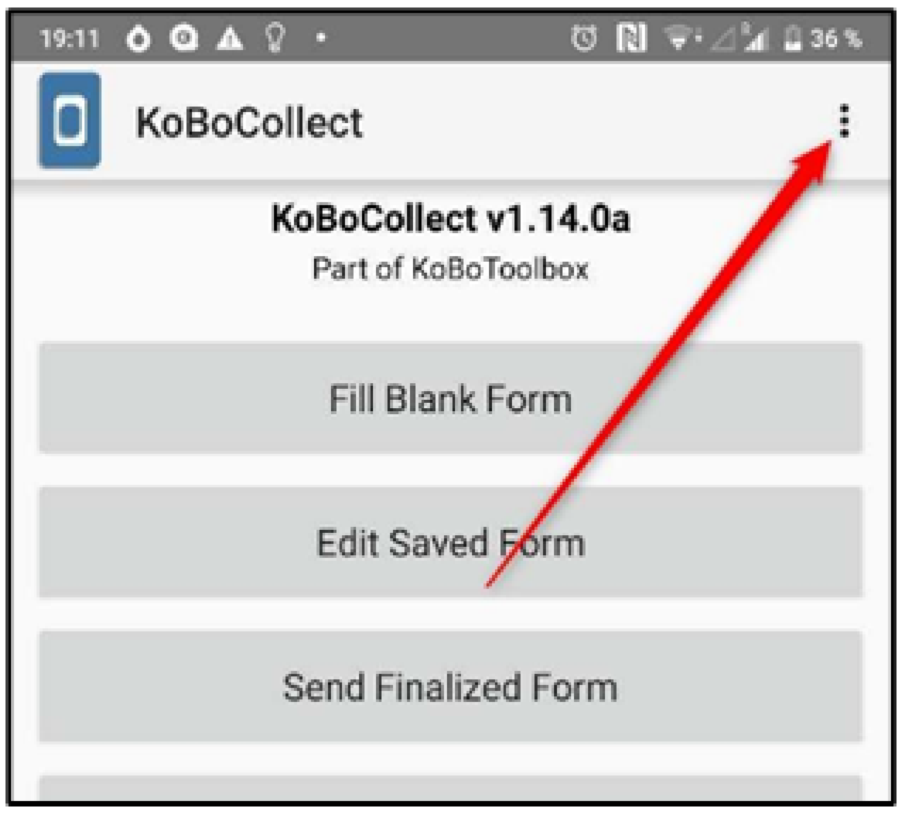
Row Number:	Compartment Number 1 10mL	2 30mL	3 56mL	4 3mL	5 1mL	MPN/100mL	Upper 95% Confidence Level/100mL	WHO Health Risk Category Based on MPN and Upper 95% Confidence Level
1						0.0	2.87	Low Risk/Safe
2						1.0	5.14	Intermediate Risk/ Probably Safe
3						1.0	4.74	
4						1.1	5.16	
5						1.2	5.64	
6						1.5	7.81	
7						2.0	6.32	
8						2.1	6.85	
9						2.1	6.64	
10						2.4	7.81	
11						2.4	8.12	
12						2.6	8.51	
13						3.2	8.38	
14						3.7	9.70	
15						3.1	11.36	Intermediate Risk/ Possibly Safe
16						3.2	11.82	
17						3.4	12.53	
18						3.9	10.43	
19						4.0	10.94	
20						4.7	22.75	
21						5.2	14.73	
22						5.4	12.93	
23						5.6	17.14	
24						5.8	16.87	
25						8.4	21.19	
26						9.1	37.04	
27						9.6	37.68	
28						13.6	83.06	High Risk/Possibly Unsafe
29						17.1	56.35	
30						32.6	145.55	High Risk/Probably Unsafe
31						48.3	351.91	
32						>100	9435.10	Unsafe

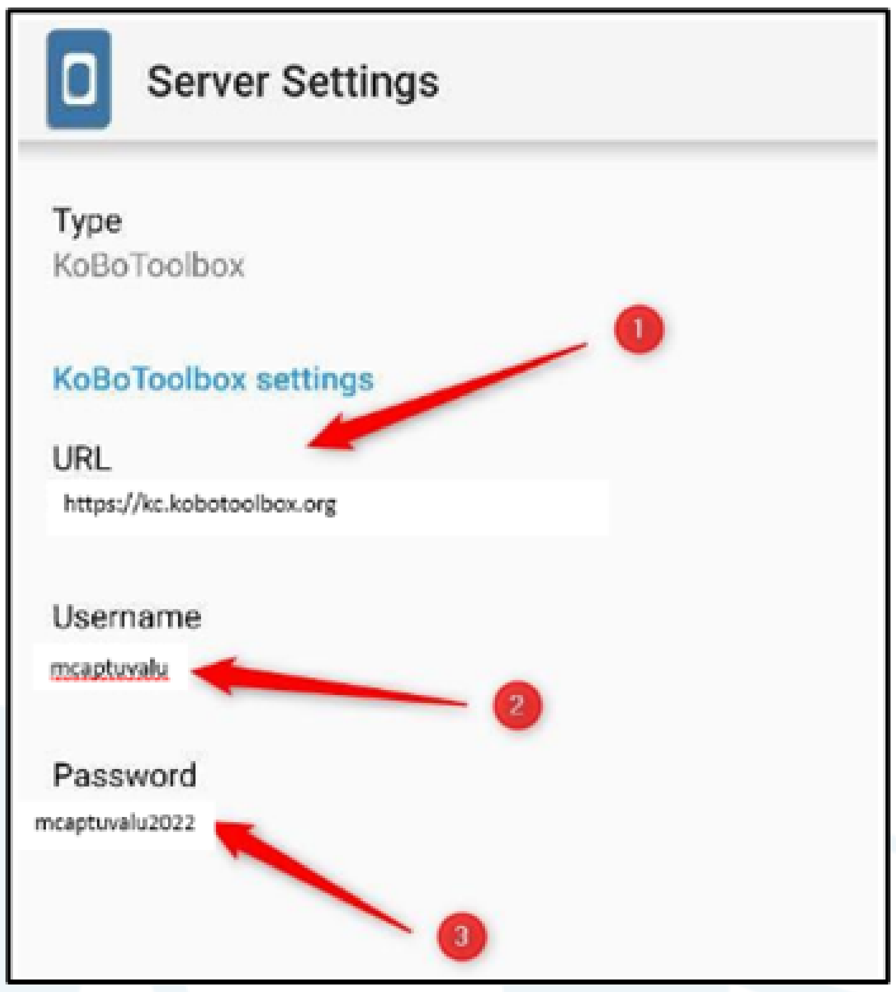
Appendix 1 - Working with KoBo Toolbox app

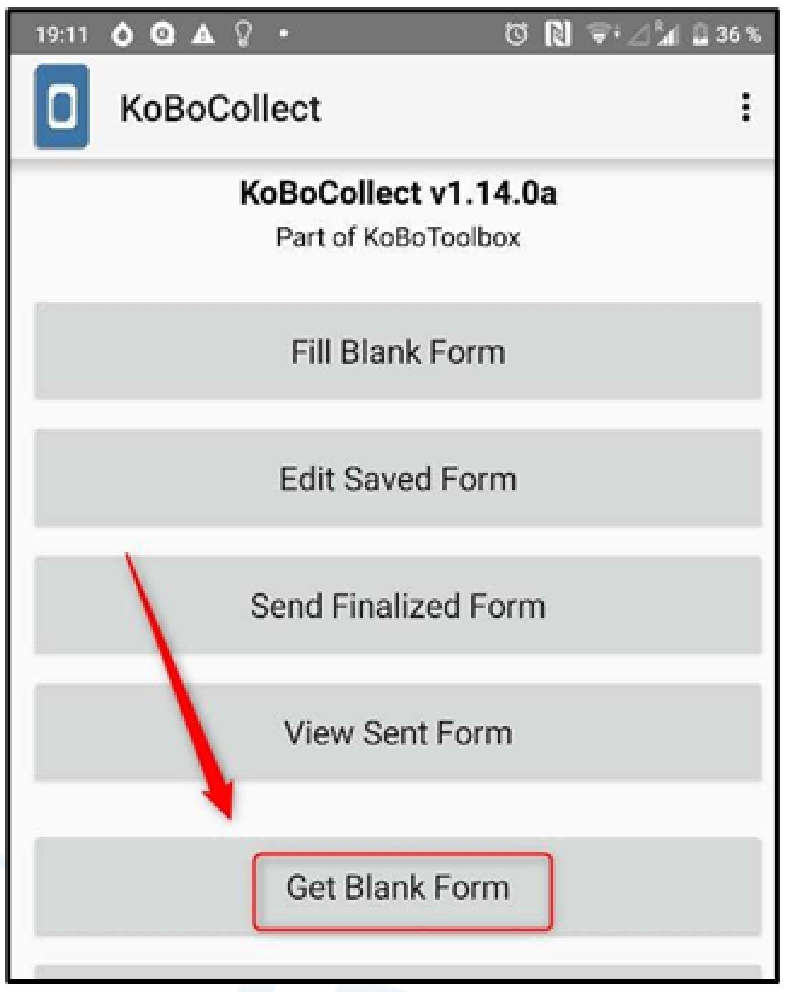
- Install and run KoBo Toolbox app on Android device



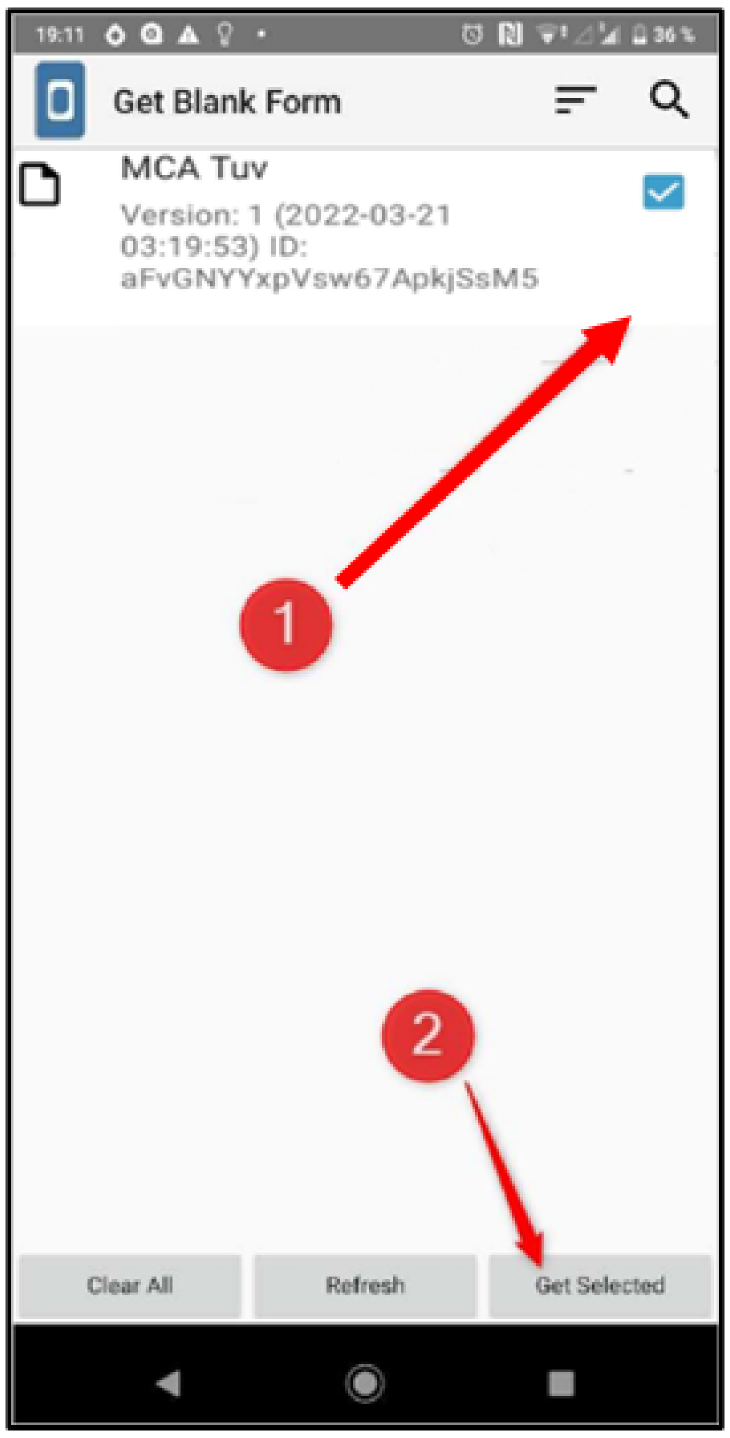
- Click on the three dots on the upper right menu.
- Click on General Settings.
- Set server URL: https://kc.kobotoolbox.org
- Set your username: mcaptuvalu
- Set your password: mcaptuvalu2022
- Click on "Get Blank Form" to download a new form or an updated version of existing form.

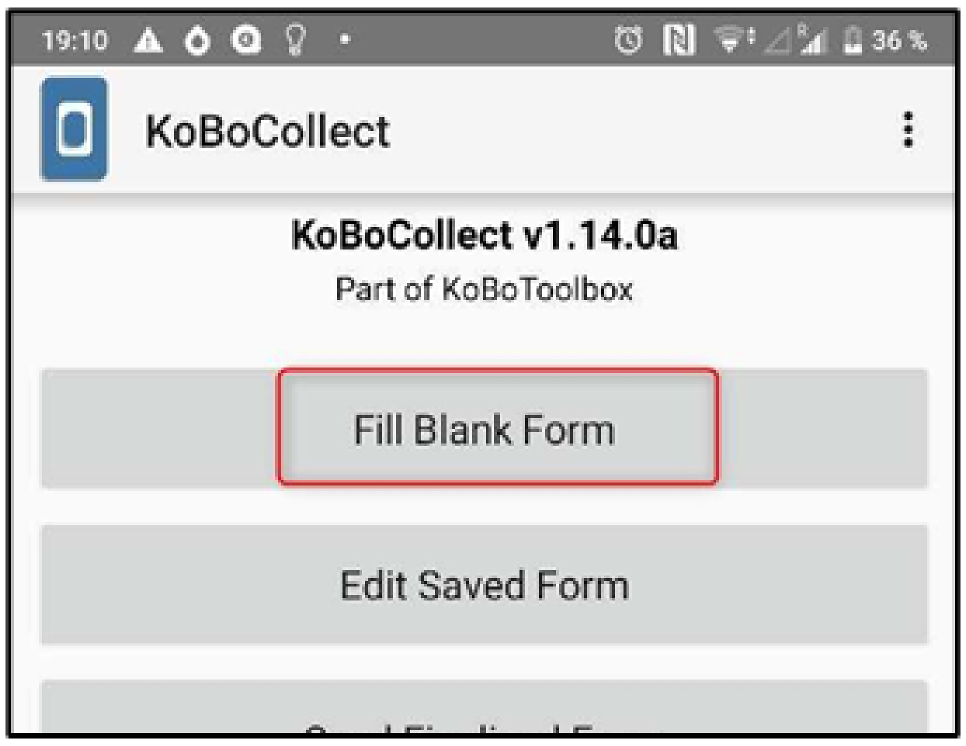


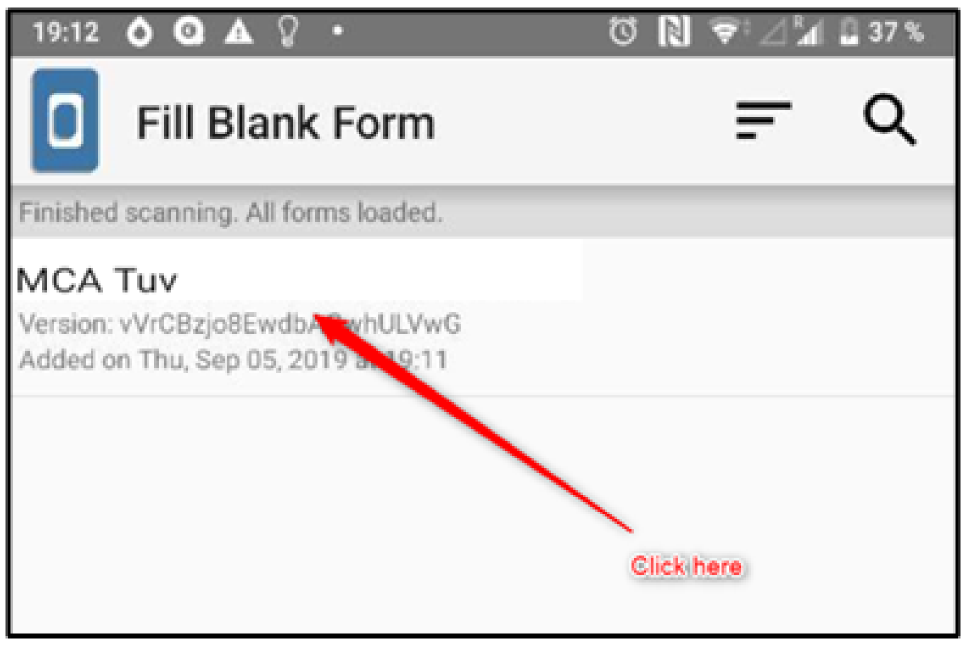




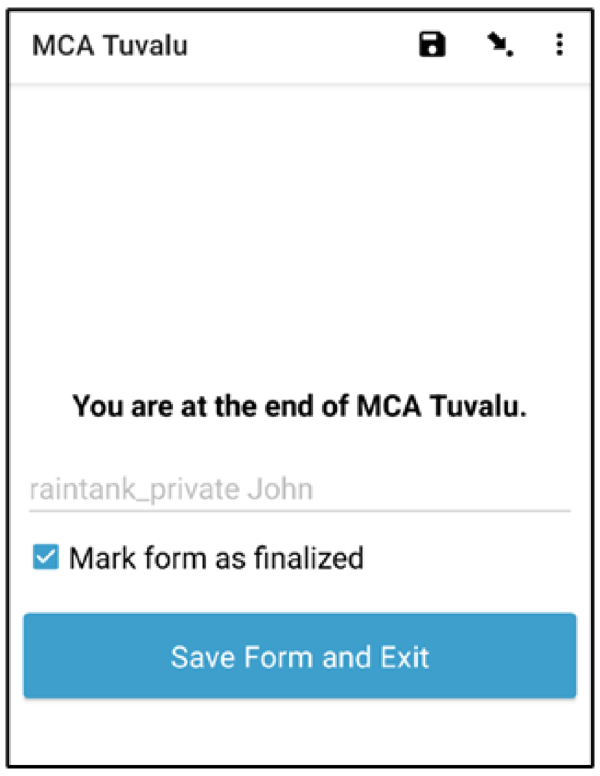
- Tick the box next to the new or updated form (MCA Tuvalu).
- Click on "Get Selected".
- When surveying an asset, click on "Fill Blank Form" and then click on the form name.







- When reaching the end of the form, mark it as finalized and save it. A name is automatically generated based on the owner and the type of asset, e.g. "Kaupule cistern_communal".
- If however a sample was collected for bacteriological analysis, the test result will have to be added to the form after 40-48 hours. In this case do not mark the form as finalized. Once the test result is obtained, click on "Edit Saved Form" to add the test result and then finalize the form.
- To submit a finalized form, internet connection is required. Click on "Send Finalized Form" and choose the form(s) you would like to submit.



Appendix 2 - Calibration of TPS WP-84

Temperature calibration

- Place the Temperature sensor into a beaker of room temperature water, alongside an accurate thermometer. Stir the sensor and the thermometer gently to ensure an even temperature throughout the beaker.
- Select Temp Calibration: Menu → Cal → Temp
- When the reading has stabilized, press the Up / Down keys to adjust the temperature.
- Press F1 to calibrate.

Conductivity calibration

- Rinse the Conductivity sensor in distilled water. Shake off as much water as possible. Blot the outside of the sensor dry. Do not blot the sensor plates. Ensure temperature has been calibrated.
- Zero Calibration: Leave the sensor dry and in the air. Select Conductivity Calibration.
- Menu → Cal → Cond
- When the reading has stabilized, press F1 to calibrate.
- Standard Calibration: Place the sensor into a sample of fresh conductivity standard (2.76 mS/cm) so that it is immersed at least above the vent hole.
- Select Conductivity Calibration: Menu → Cal → Cond
- When the reading has stabilized, press F1 to calibrate.