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IWMI International Water Management Institute

CGIAR Research Program on Water, Land and Ecosystems

GEUS GEOLOGICAL SURVEY OF DENMARK AND GREENLAND

water & sanitation
Department: Water and Sanitation
REPUBLIC OF SOUTH AFRICA

CAPRICORN DISTRICT MUNICIPALITY

EKOSOURCE

Training Manual

on Field Data Collection for water resources management

Enhancing Sustainable Groundwater Use in South Africa (ESGUSA)

Contents

Citizen Science Training Instructions for Field Data Collection

1. Background

Groundwater and surface water are of vital importance for peoples' wellbeing and livelihoods, as it is often the main source for domestic, industry and agricultural water supply. The conjunctive management of these two resources is particularly important in semi-arid to arid regions, where surface water is scarce or seasonal and in rural areas with dispersed populations. Many water resources in rural areas are under pressure from increasing demand and declining yields due to population growth. It is against this background that the ESGUSA (Enhancing Sustainable Groundwater Use in South Africa) project has developed this field data collection manual to assist and teach Citizen Scientists (CS) on the collection and sharing of field data. The data collected are used for improving the hydrogeological understanding of the catchment and for supporting effective water resources management. The project is mainly focusing on the Hout River Catchment in Limpopo Province, South Africa, but the manual can be used in other monitoring activities as well.

2. Objective

The objective of the training manual is to support high quality field data collection on groundwater, surface water and rainfall by CS volunteers for improved water management.

3. Instruments for monitoring

The following instruments are used to take field data measurements for management of water resources:

1) Groundwater level meter (dip meter)
2) Manual rain gauge
3) Measuring tape
4) River staff gauge
5) Cell phone
6) Cell phone app

4. Installation of rain gauges

A rain gauge (see Figure 1) is an instrument used for measuring rainfall falling in an area. The rain gauge can be manual, where readings are recorded by an observer or can be automatic where readings are taken by an automatic recorder without an observer. In this project, we are using the manual rain gauge. Rain gauges should be installed in representative villages.

Figure 1. Manual rain gauge

The research team and volunteers are requested to identify areas for rainfall monitoring. These proposed sites are inspected for technical suitability of installation. The site conditions to be satisfied to allow scientific monitoring of rainfall are:

- The observed site should be open space without obstructions from trees, fences, walls, etc.
- The distance between the rain gauge and the nearest object should be more than twice the height of the object, or more than 20 m
- The ground surface should be generally flat, and the gauge should not be located on a hill
- In hilly areas, where flat ground cannot be obtained, the rain gauge should be located where the wind is not strong

5. Physical measurement of parameters

5.1. Groundwater level measurement

Groundwater level is the depth of the groundwater table from the ground surface. This distance is measured by an instrument known as a dip meter or a water level meter, shown in Figure 2. A water level meter consists of a probe fixed at one end of a tape measure graduated into meters and centimetres. As the probe is lowered into the borehole slowly, a signal in the form of a red light and/or a beep sound is

activated as the probe gets in contact with water. As soon as the signal is activated, the lowering of the probe is stopped and the length of the measuring tape lowered into the borehole is read from the top of the borehole casing. This length gives the depth of the groundwater table below the top of the casing. The depth of groundwater level below the ground surface is then calculated by subtracting the borehole casing height (B in Figure 2 from the distance of groundwater level from the top of the casing (A in Figure 2). In the field, A and B are measured, while the depth of groundwater from ground surface (C in Figure 2) is calculated automatically by the app, and should not be done by the volunteer.

Figure 2. Dip meter (groundwater level meter)

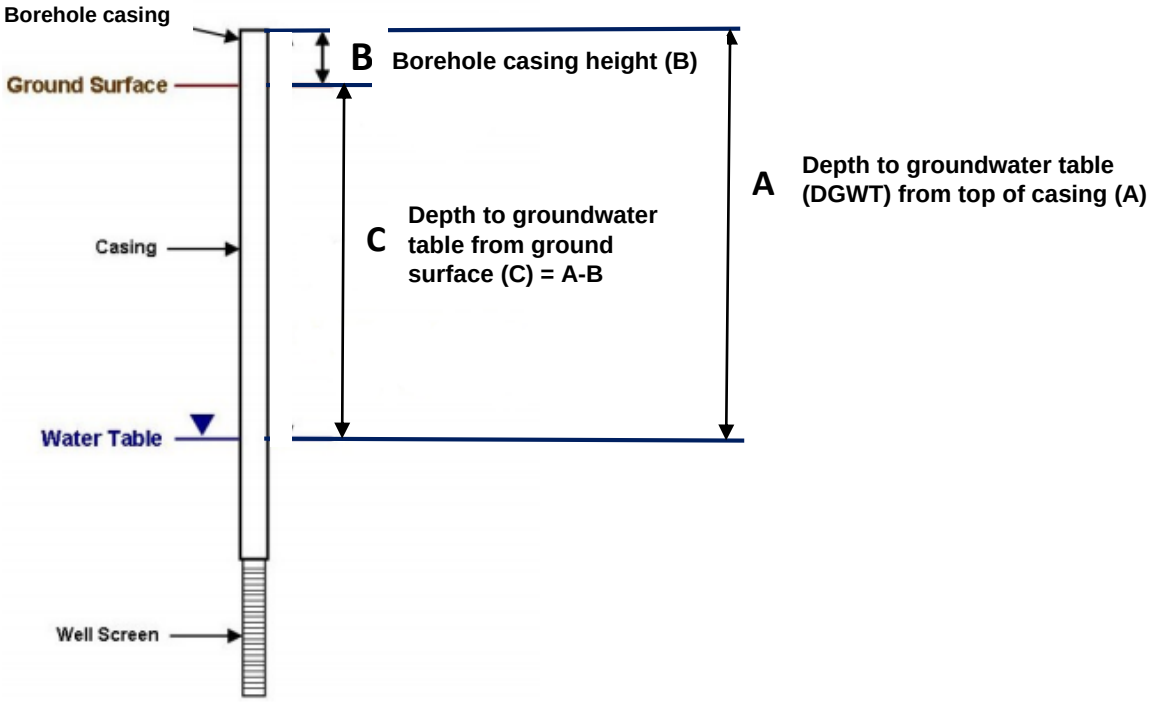


Figure 3. Borehole casing height and depth of groundwater

The groundwater level data collection is done every two weeks, and follows this procedure:

1) Note the time and date of measurement
2) Turn the switch on the water level meter on
3) Using the tape measure (Figure 4) Take the height measurement of the top of the borehole casing above the ground, with a precision of centimeters

Figure 4. Tape measure

4) Insert the water level probe into the borehole/piezometer and unwind the tape from the holder to lower the probe into the borehole
5) When the probe first touches the water surface in the well, a light glows to bright white next to the on-off switch on the side of the dip meter holder
6) Make sure the recording is done when the probe just touches the water surface and the light goes on. Do not further inject the probe
7) At this exact level, read the depth to groundwater level from the top of the borehole casing by using the measuring tape to obtain the exact reading in meters and centimeters (xx.xx m) between the graduated meter markings
8) Pull up the probe back up until the light glows dull and shake the probe to remove the water from the probe tip, and the probe light should be completely off by then. Repeat two times the water level measurement to check the first water level reading (notice the change in the light intensity)
9) When the measurement has been checked through the third reading, retrieve the probe from the borehole by winding the probe cable back on the holder
10) Clean the probe and place the water level meter into the carry bag.

5.2. Rainfall measurement

The standard procedure prescribed for collection and recording of rainfall data is every morning at 8:00 AM, unless there is a large storm and the rain gauge fills up within 24 hours. When this happens, the rainfall can be collected and recorded before 8:00 AM. Hence, volunteers should record the amount of rainfall received every day at 8:00 AM. If no rain has fallen, zero rainfall is recorded. The steps followed in the collection of rainfall are the following:

1) Note the date and time of measurement
2) Take the reading of the rainfall from the rain gauge graduated markings in millimeters (mm). It is important to ensure the rain gauge is level when taking the reading
3) If the water level in the rain gauge is between graduated markings, an estimate is made of the value between the lower and upper graduated mark
4) After reading the water level in the rain gauge, record this value in the Citizen Science phone app, together with date and time, location, and weather conditions
5) Record the location of the rain gauge observed
6) If there is or has been an extreme event, the number of fillings of the rain gauge within the 24 hours, and the last reading are added up to arrive at the rainfall received on that day

All readings are then entered into the CS phone app in the correct format, see Section 6. Volunteers are advised to keep an A5 book and record all readings obtained in it.

5.3. River flow measurement

The river flow monitoring can be spilt into two options: 1. No staff gauge exists in the river channel, i.e., only river flow or no river flow is recorded or 2. River staff gauge (see Figure 5) exists, and then reading of the gauge is recorded in the A5 book and into the CS phone app.

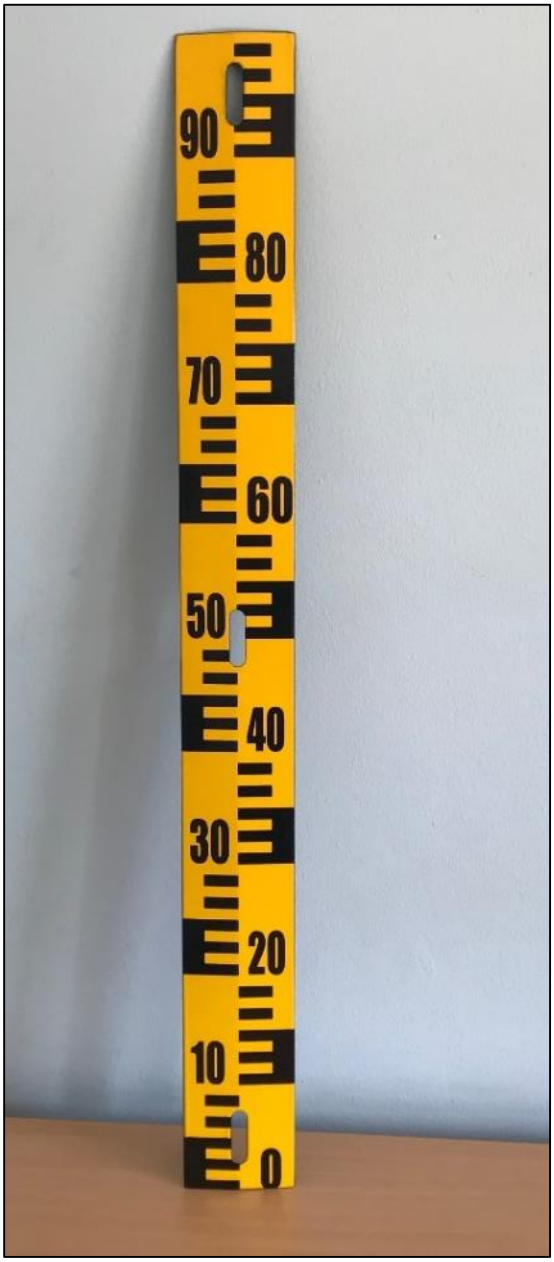


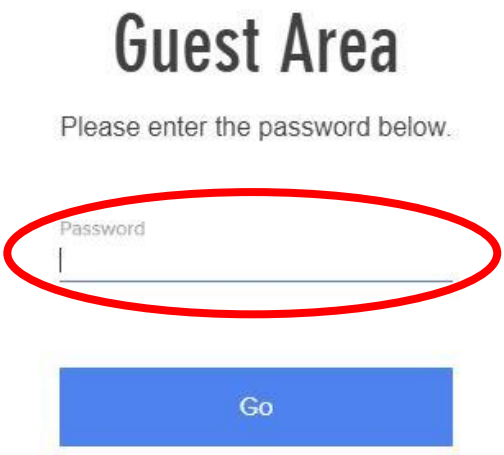
Figure 5. 1m staff gauge

6. Steps on how to use the Citizen Science App

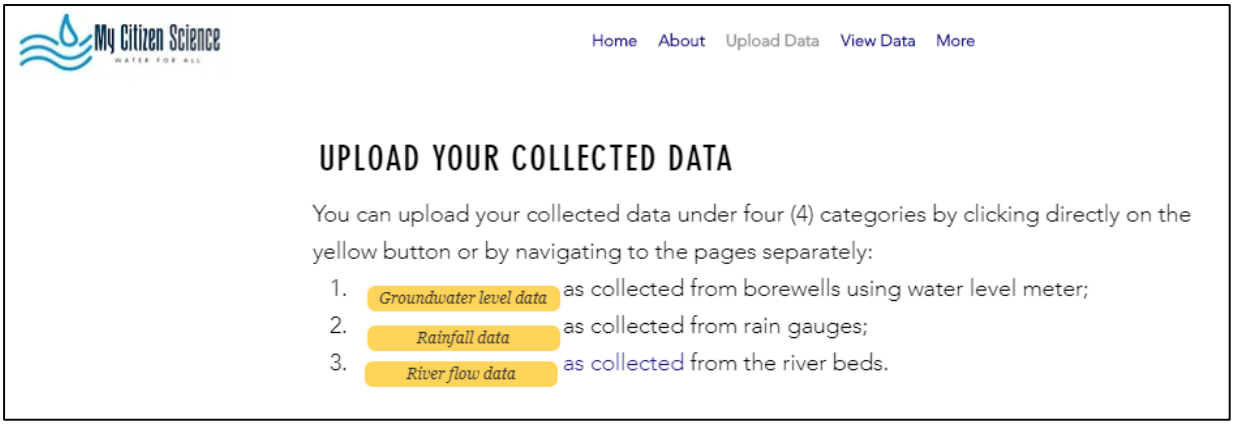
1) Login to : https://www.citizenscientists.biz/

2) Click on “upload data”

3) Enter the password “**letmein**” to be logged into the app



4) The app will give you an option of uploading ***Groundwater level data***, ***Rainfall data*** and ***River flow data*** as shown in the image below.

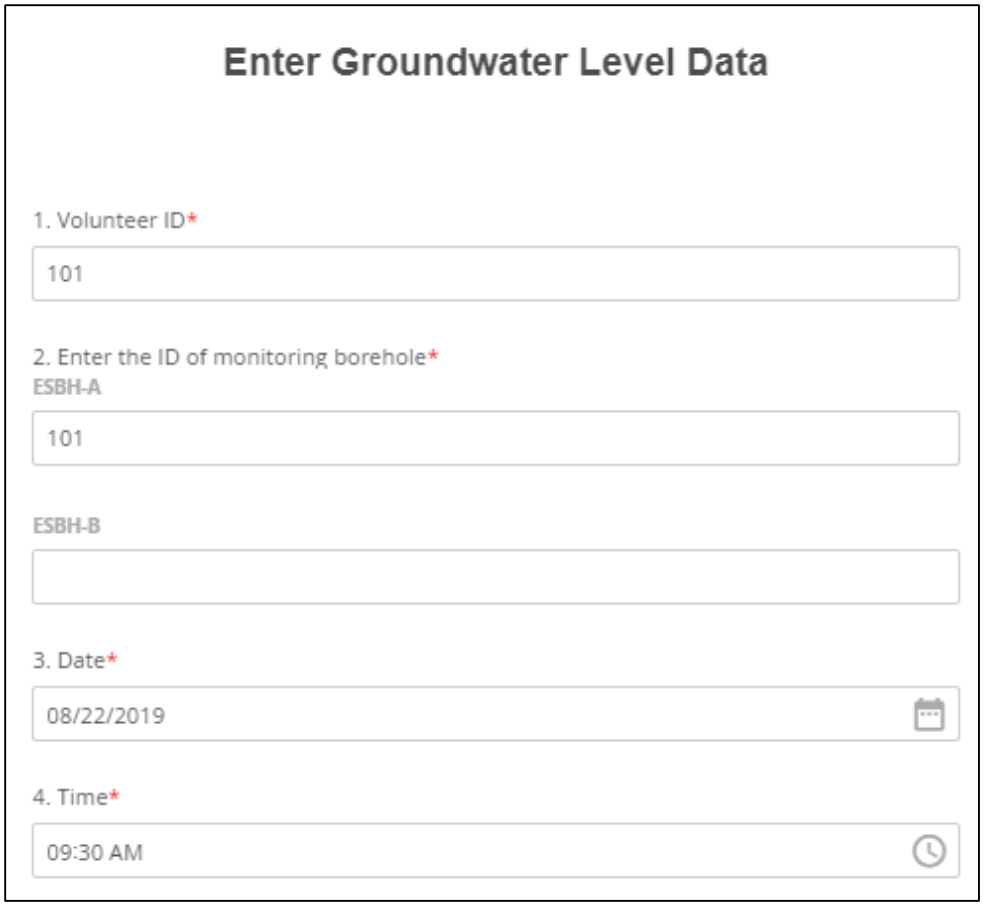


7. Recording monitored parameters in the Citizen Science App

7.1. Groundwater level measurements

1) Click on the button with "*Groundwater level data*"

2) A monitoring form will appear as shown below. The * (red star) means that a value in the correct format should be recorded in the row for the form to be submitted, otherwise an error will be activated and form will not be submitted.



3) Measure A and B as shown in Figure 3 using the groundwater level meter in Figure 2.

5. Ground Water Level Data from Borehole

Enter water meter reading from the top of borehole in meters (A)*
Enter the value as you see on the water meter from the edge of borehole

4

.*
Centimeter(cm)

57

6. Enter the height of borehole from ground in meters (B)*

0

.*
Centimeter(cm)

50

7. General Observations

Describe the weather conditions on the day of sampling*
(E.g. sunny/ cloudy/ raining, very hot/ cold/ breezy, you can write the temperature of the day, etc.)

Cloudy

8. Describe the water as observed inside the borehole during sampling

Smelly

Upload pictures of field/ sampling that you have taken*

1562076975924.jpg (26.3 KB) ×

Choose files or drag here

SUBMIT FORM

4) In Row 1, fill your volunteer identification number (ID) as given in your volunteer contract

5) In Row 2, fill in the borehole identification number (ID) (this number is written on the borehole casing or on a metal peg next to the borehole) and the same for “B” if you have more then one borehole

6) In Row 3, click the box on the right to select the date of measurement

7) In Row 4, click on the circle to the right to select the time of taking the groundwater level measurement

8) In Row 5, enter the measurement of the depth to the groundwater level from the top of the borehole casing using the dip meter provided (A) (Figure 2 and Figure 3. Record the number in meters with centimeter precision (as an example: 4.57 m)

9) In Row 6, enter the height of the borehole casing (B), measured from the ground surface to the top edge of the casing (Figure 3 and Figure 6). Record the number in meters with centimeter precision (as an example: 0.50 m)

10) In Row 7, enter the weather conditions at the time of taking the water level measurement, e.g., hot and sunny or raining. If you know the temperature at that time of the day, you can also write it in this row

11) In Row 8, note the water quality from the borehole if water is taken out of the borehole for further testing. The description should be on color of the water, clarity or murkiness or presence of suspended particles in the water or if the water has an odor. If no water is taken from the borehole for further testing, then this row can be left blank

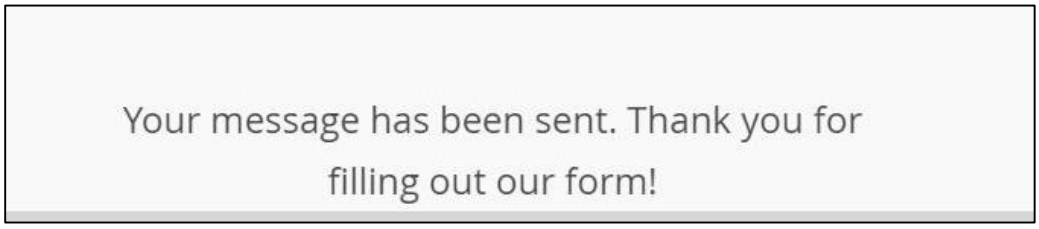
12) An image of the borehole being monitored can be saved and be submitted with the form

13) Record the location (coordinates) of the borehole observed

Figure 6. Height of borehole casing

14) Then click "*SUBMIT FORM*" to submit your observed and recorded data to an online platform. This online sharing platform can be accessed by the research team, citizen science team and anyone who has rights to access the data

15) You will then receive a message confirming the successful submission of your form as shown below

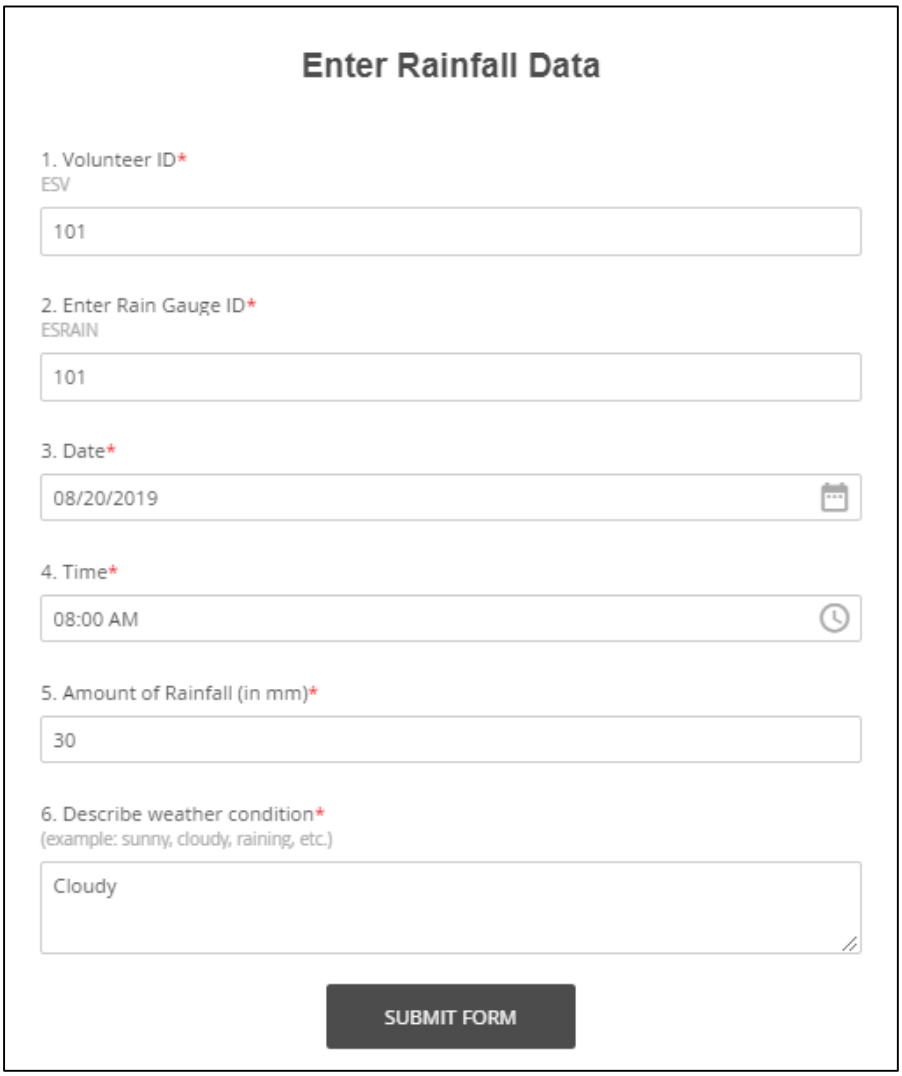


16) After receiving this message, you may now proceed to the next monitoring borehole or site to measure the next variable applicable on that day. At the next site, if you are measuring groundwater level again, follow again the steps from 1 – 9.

7.2. Rainfall measurement

1) Click on the button with "*Rainfall data*"

2) A monitoring form will appear as shown below



3) In Row 1, fill your volunteer identification number (ID) as given in your volunteer contract

4)

5) In Row 2, enter the rain gauge identification number (ID), which is written on the rain gauge

6) In Row 3, click on the box on the right to select the date of measurement

7) In Row 4, click on the circle to the right to select the time of taking the rainfall measurement

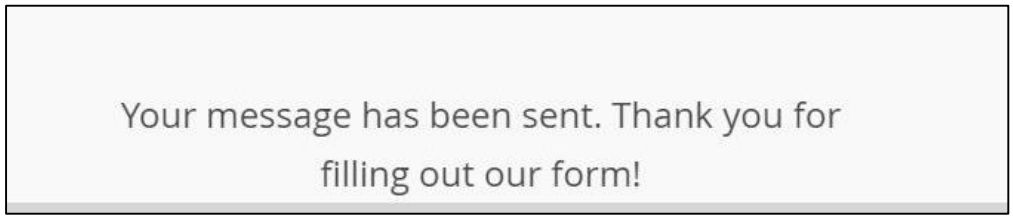
8) In Row 5, enter the rainfall measurement in mm as observed on the rain gauge

9) In Row 6, give a short description of the weather conditions observed on the day of the measurement

10) Record the location (coordinates) of the rain gauge

11) Then click "*SUBMIT FORM*" to submit your observed and recorded data to the online platform

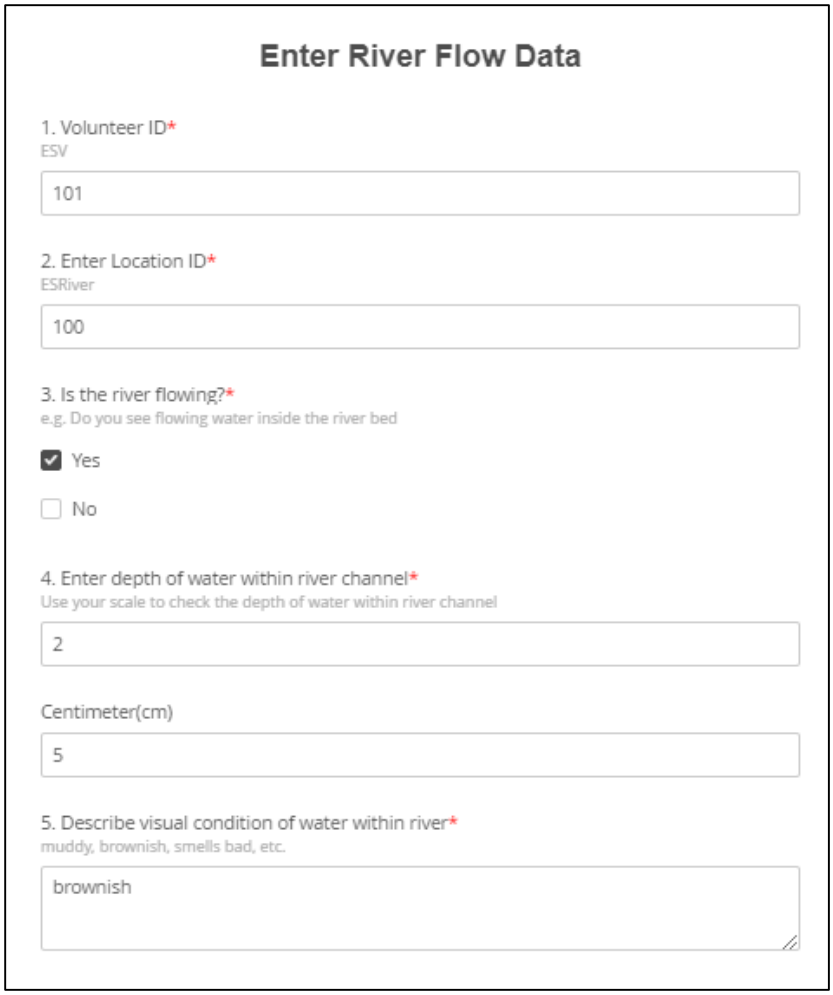
12) You will then receive a message confirming the successful submission of your form as shown below

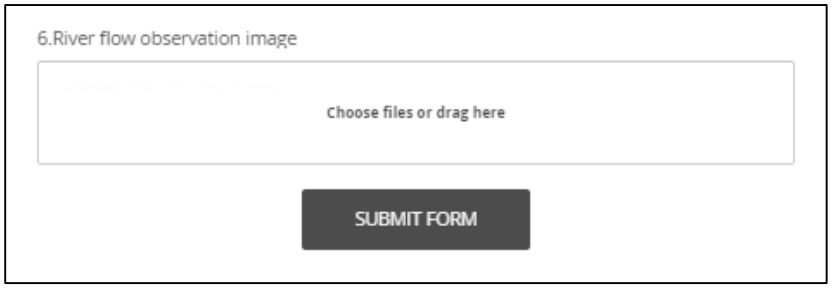


7.3. River flow measurement

1) Click on the button with "*River flow data*"

2) A monitoring form will appear as shown below





3) In Row 1, fill your volunteer identification number (ID) as given in your volunteer contract
4) In Row 2, enter the river section/staff gauge identification number (ID), which is given in Figure 5, section 5.3.

5) In Row 3, click on “Yes” if there is flow of water and “No” if there is no flow observed

6) In Row 4, enter the depth of water within the river channel. This is observed from the staff gauge (Figure 5). Record the number in meters with centimeter precision (as an example: 0.75 m). If there is not staff gauge at the location, leave this blank.

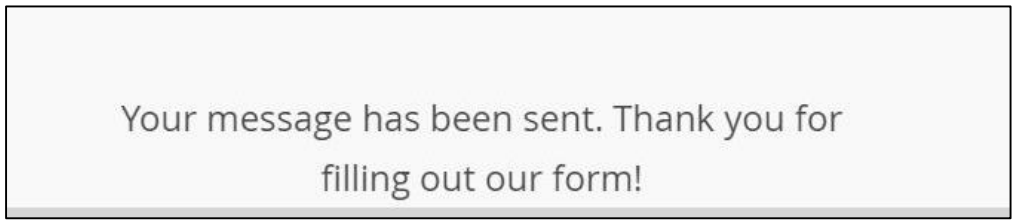
7) In Row 5, fill in the description of the water condition observed, e.g. clear, muddy, brownish (or other color), with debris, smells bad, etc.

8) In Row 6, insert an image of the river flow observed

9) Record the location (coordinates) of the river channel observed

10) Then click "*SUBMIT FORM*" to submit your observed and recorded data to the online platform

11) You will then receive a message confirming the successful submission of your form as shown below



In case of any technical difficulties or queries while filling in the form please contact: Resego Mokomela (063 602 1435)