# DELFT MEASURES RAIN



THIS IS THE INSTRUCTION MANUAL OF:







Welcome to the research team of the WaterLab! From now on you will be one of our researchers and you can contribute to, and help brainstorm, about research into water.

Water is incredibly important in our daily lives. We drink it, clean with it, swim in it and cook with it. At the same time, water can cause problems: heavy rain, floods or pollution. At the WaterLab we focus on these problems. Where are they located? What do we need more information about?

With a variety of projects we tackle issues regarding water quality, management and safety. As a WaterLab researcher, you will work together with companies, scientists, fellow researchers and other institutions. Together with you we will work on greater water awareness and a healthy and safe future for water in the Netherlands.

#### DELFT MEASURES RAIN

KNMI has an average of 1 rain gauge per 100 square kilometers throughout the Netherlands, a total of more than 300 rain gauges across the country. Apps, such as 'Buienradar', use rain measurements from radars that can measure rainfall per square kilometer. However, because radar measures rain indirectly, it is often inaccurate.

During the Delft Measures Regen project, we are aiming to increase the number of rain gauges, in order to every square kilometer in Delft. We strive for 1 measurement per day for 2 months. Awesome that you are participating too! This manual describes how to make a rain gauge yourself and how you can measure with it. Making the rain gauge takes about half an hour, but the cement has to dry for a day, so make sure you start on time.

Tip: In addition to this manual, we have also sent you a booklet with many more fun assignments and measurements. So if you want to know more about research and the weather, have a look in there!

# INHOUDSOPGAVE

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### WHAT YOU WILL NEED

To begin, collect the following materials. We will need these items build the rain gauge. Some of these materials can be found in the supplied measuring kit.

- 1. An empty 1,5L bottle from the brand Gwoon (such as Gwoon Sinas or Cola). These can be bought at the Coop close to the Science Centre.
  - Swon sylveon islande co
- 2. The ruler from the Waterlab Logbook (included)
- 3. Double-sided tape (included)
- 4. Scissors
- 5. A Stanley knife
- 6. A black, permanent marker
- 7. A nail (included)
- 8. A hammer
- 9. Cement (455g, included)
- 10. A 50ml tube (included)
- 11. Water (100ml)
- 12. A measuring cup or other bowl with a pouring spout to mix the cement in
- 13. Masking tape

# PART 1: MAKING A RAIN GAUGE STEP 1

- Remove the label from the Gwoon bottle.
- Use the painter's tape to make a nice horizontal band with the top of the tape, in order to mark the bottle exactly where the top part of the bottle is the thickest (see picture).



- Cut the bottle along the top of the tape, first making a cut with the stanley knife, and then continue with the scissors.
- Do make sure to cut it straight!



- Mix the supplied amount of cement with exactly 100ml of water. Use the supplied conical flask to measure the water.





- Stir until the cement is completely smooth. It should feel like wet sand.

Tip: Use a measuring cup with a spout to mix the cement. This will make it easy to pour out once ready!

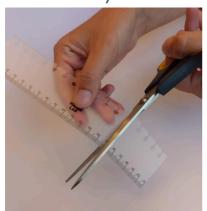
Tip: Clean the materials quickly after use, because it is fast-drying (within 5 minutes) cement!

- Use the top of the bottle you cut of earlier as a funnel and pour the full amount of cement into the bottle. Try not to get splashes against the side of the bottle.
- When all of the cement is in the bottle, gently move the bottle back and forth (do not tilt the bottle) until the cement is level.
- Clean the top of the bottle and other used materials immediately. If there are splashes on the inside of the bottle, wipe them off with a cloth.
- Leave the cement in the bottle to dry (15 min)





- When the cement is dry, you can continue with this step
- A ruler is included in the supplied Waterlab logbook. Remove it from the logbook and cut it so that you have the piece from 0 to 15 cm.





#### STEP 6

- Use a cloth to degrease the side of the bottle.
- Stick the double-sided tape on the degreased bottle: two pieces about 10cm apart (vertically, see pictures on the next page).

Tip: Make sure the tape is in the middle of the ruler, otherwise you may not be able to see the numbers and dashes.

- Stick the ruler on the bottle. It is really important that you make sure that the 0 cm line of the ruler is at exactly the same height as the top of the cement.





#### STEP 8

- Use the hammer and nail to make a hole in the bottle cap. Pay attention that you use a suitable surface for hammering.
- Screw the cap back on the bottle
- Turn the top of the bottle upside down on the bottom of the bottle

Finished! Wait 24 hours before you start measuring, in order for the cement to properly dry.

Now that the rain gauge is finished, we just have to put it in the right place. The measurement can be disturbed by all kinds of factors. Ideally, observe the following rules when measuring:

- Buildings, fences and trees can have a major influence on the rain measurement. Make sure that the distance between a high object and the rain gauge is twice as high as the height of the object (see picture).



- Place the rain gauge about 1 meter from the ground on a stand (e.g. the garden table)
- Choose a location where the meter is not easily pushed over by people, vehicles or pets.

This will not be feasible in most gardens, try to apply the rules as best as you can. For example, you can put the rain gauge as far away from large objects as is possible in your garden.

### STEP 2: HOW TO MEASURE

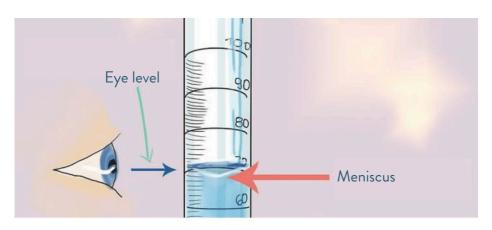
This part of the manual explains how to read your homemade rain gauge properly. Follow this guide the first few times you measure, in order to measure accurately. After a while, you will probably know the steps by heart and you will not need to use this manual anymore. Try to ensure that you measure at the same time, sometime between 8 a.m. and 10 a.m. This way we are sure that the rain is measured for the whole day (24 hours) and that all participants measure at about the same time. This is important because in this way we can achieve good data to compare.

Tip: Set an alarm to go off daily on your phone at your fixed time to go out and measure.

Install the Enketo app before reading the rain gauge for the first time. You can report your rain measurement every day via the app.

You will receive precise details on how to install and use the Enketo app by email.

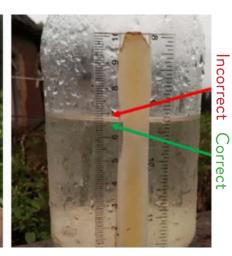
- Go to the rain gauge with your phone at the time you have decided upon.
- Read the rain gauge, how many millimeters has it rained?
- Make sure you read at the bottom of the meniscus (see image below)



#### MOST COMMON MISTAKES

- If you consider the water level as a line, make sure you are measuring at the bottom of the meniscus (below the surface). In the pictures below, the measurement on the left is 30 mm and not 32 mm. In the right picture it is 67 mm and not 68 or 69 mm.

Correct Incorrect



 Record your measurements in millimeters and not in centimeters.

- Take a photo of the water level in the rain gauge.
- Make sure you keep your phone straight so that the photo is really parallel to the waterline.
- Make sure your camera is as high as the waterline.







Incorrect

Correct

Correct

- Submit your measurement and photo via the Enketo app.
- Don't forget to add comments about the weather. On the next page there are some suggestions.
- Discard the water from the rain gauge. This way you measure the rainfall separately for each day.

### COMMENTS ABOUT THE WEATHER

#### Describe the clouds

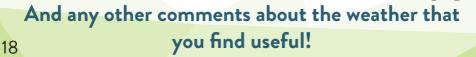
- It is a cloudy day
- There are clouds here and there
- There are no clouds at all today

#### Describe the wind

- There is no wind, wind force = 0
- You can read the wind direction on a plume of smoke, wind force = 1
- If you can feel the wind on your face, wind force = 2
- Twigs and twigs in the tree are constantly moving, wind force = 3
- Clothes flapping and paper blowing away, wind force = 4
- Branches and twigs move and bend in the wind, wind force = 5
- Large branches move and bend, wind force = 6

#### Describe the rain

- Was there heavy rainfall during the day or not?
- Was it a long or short shower?
- Were there several showers or just one?









#### UPDATES? YES PLEASE!

Of course it is fun and interesting to follow the developments of your research. If there are important updates, we will inform you as much as possible via e-mail, so that you don't miss anything. You can always find information about the project on the project page on our website. If you have questions that are not answered on the website, you can contact the WaterLab team at: waterlab-sc@tudelft.nl.

New updates and developments, and also announcements for new projects can be found on <u>Facebook</u>, <u>Twitter</u>, <u>Instagram</u> and <u>LinkedIn</u>. Do you want to participate in a new project? Then you can register via the <u>WaterLab website</u>.





DELET MEASURES RAIN IS A COLLABORATION BETWEEN:





**Gemeente Delft** 

SmartPhones 4 Water



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