

How to monitor groundwater on your farm

Key messages

- Groundwater quality monitoring is used to understand if nitrogen has leached through the soil profile to groundwater.
- Monitoring involves measuring groundwater levels and collecting a groundwater sample.
- A groundwater sample can be collected using a syringe attached to a tube, or a water pump.
- Groundwater monitoring helps you understand groundwater flow direction and whether nitrogen is being lost to groundwater.

Introduction

Groundwater is defined as water held underground in the pores of the soil or in rock fractures. Groundwater monitoring is often done using a groundwater monitoring bore, also known as a piezometer, installed in strategic locations on your farm. Groundwater monitoring can also use existing wells or dams/pits that intercept shallow groundwater. Refer to “**6. How to construct piezometers for monitoring groundwater on your farm**” and “**7. How to install piezometers on your farm**” for further information on the construction and installation of piezometers. This fact sheet describes the monitoring in shallow piezometers, bores or pits with a maximum depth of 2.5-3.0 m.

Groundwater monitoring involves the regular measurement of groundwater levels (to determine groundwater flow direction) and groundwater sampling (to determine the presence of nitrogen). Regular groundwater monitoring helps you assess whether nitrogen is present in groundwater and how it changes over time in different parts of the farm. These variations can occur in response to seasonal effects, fertiliser application, soil types, etc.

If nitrogen is found in groundwater samples, understanding the flow direction enables you to identify where the leached nitrogen is moving from and to and where management actions (like [agronomic management](#) or [treatment systems](#)) might be needed.

Is monitoring groundwater expensive?

Measuring the groundwater level is easy and cheap, as only a tape measure is needed. Groundwater sampling can be performed at minimal cost with a syringe attached to a 6 mm vinyl tube using a stopcock valve (\approx \$10) or a hand pump (\approx \$30). A more costly but quicker method is with a battery-

operated water pump (\approx \$450, including a 12 V battery and a garden hose).

What do I need to monitor groundwater?

To measure groundwater level:

- tape measure

To sample water with a syringe and vinyl tube:

- powderless gloves
- 60 mL luer lock syringe
- 6 mm vinyl tube
- 2-way stopcock valve
- weight or sinker
- deionised water
- clean wide-mouth container

To sample with a pump, you will need:

- powderless gloves
- hand pump or
- battery-operated pump with a 12 V battery
- garden hose
- clean wide-mouth container
- deionised water
- bucket

How do I monitor groundwater?

The first thing to do is measure the height of the groundwater level.

Measuring groundwater level:

1. Uncap the piezometer.
2. Measure the groundwater depth from the top of the PVC pipe (e.g., casing) to the top of the water within the pipe using the tape measure (Figure 1).
3. Use Table 1 to record the groundwater depth.



Figure 1: Put the tape measure into the piezometer until it touches the water. Record the height from the water to the top of the PVC pipe.

Purging the piezometer:

Before collecting a groundwater sample, the piezometer must be purged to ensure that the sample collected is of fresh groundwater in the aquifer (not stagnant water that has been sitting in the piezometer). It is recommended to purge three times the volume of water contained in the piezometer, and this process can be performed quickly with a water pump. Use Table 2 to calculate the volume of water that needs to be purged in a 50 mm diameter piezometer. However, a piezometer may run dry before completing the three-volume purging. If it runs dry, collect the sample as soon as the piezometer refills with water.

Collecting a groundwater sample with a syringe:

1. Wear powderless gloves.

2. Connect the weight or sinker to the bottom of the vinyl tubing, the vinyl tubing to the stopcock valve and the stopcock valve to the 60 mL luer lock syringe (Figure 2).
3. Insert the vinyl tube into the piezometer, ensuring that it does not hit the bottom, and stir up any fine sediments that may be sitting there.
4. Keep the stopcock valve open (parallel to the syringe) and suck the water up with the syringe.
5. Close the stopcock valve (perpendicular to the syringe).
6. Disconnect the syringe from the locked stopcock valve.



Figure 2: A tube attached to a syringe can be used to collect a groundwater sample.

Collecting a groundwater sample with a water pump:

1. Connect the garden hose to the water pump.
2. Insert the pump into the piezometer, ensuring it does not hit the bottom, stirring up any fine sediments (Figure 3).
3. Connect the pump to the 12 V battery (if using a battery-operated pump) or operate the manual pump.
4. Collect the pumped water into a wide-mouth container (Figure 4).

NOTE: During a sampling event, prevent cross-contamination by wearing gloves, not smoking, not sampling near car fumes, and not touching the ends of the syringes, filters and pump. Ensure the syringe,

the pump and the hose/tube are rinsed thoroughly. It is recommended to rinse the syringe with the water to be sampled or deionised water. Also, pour deionised water into a bucket to rinse the water pump internally and externally and prevent cross-contamination with the following samples.

This factsheet provides an overview of processing a sample. For accurate results, it is important to follow all the steps for sample collection, processing, transport and quality control outlined in the [Queensland Government's Monitoring and Sampling Manual 2018](#).



Figure 3: A water pump inserted into the piezometer can be a quick and easy way to purge the piezometer and collect a groundwater sample.

Measuring nitrogen in a groundwater sample:

If the groundwater sample is tested with nitrate strips, eject some drops of water from the syringe on the nitrate strips or immerse the nitrate strip in the water sample for a few seconds if sampling was performed with a water pump. Refer to **“4. How to use nitrate strips to test water quality on your farm”** for further information.

If a groundwater sample is collected for laboratory analysis, filter it into a 200 mL sampling bottle. Refer to **“5. How to process a water sample for laboratory analysis”** for further information.

Use Table 3 to record the sampling information, including notes about recent rainfall, fertiliser application or management practices.



Figure 4: Fill the sample bottle with the water being pumped out of a piezometer or well.

Table 1

Monitoring point name	Date and time	Groundwater level (m) from the top of the piezometer casing	Notes

