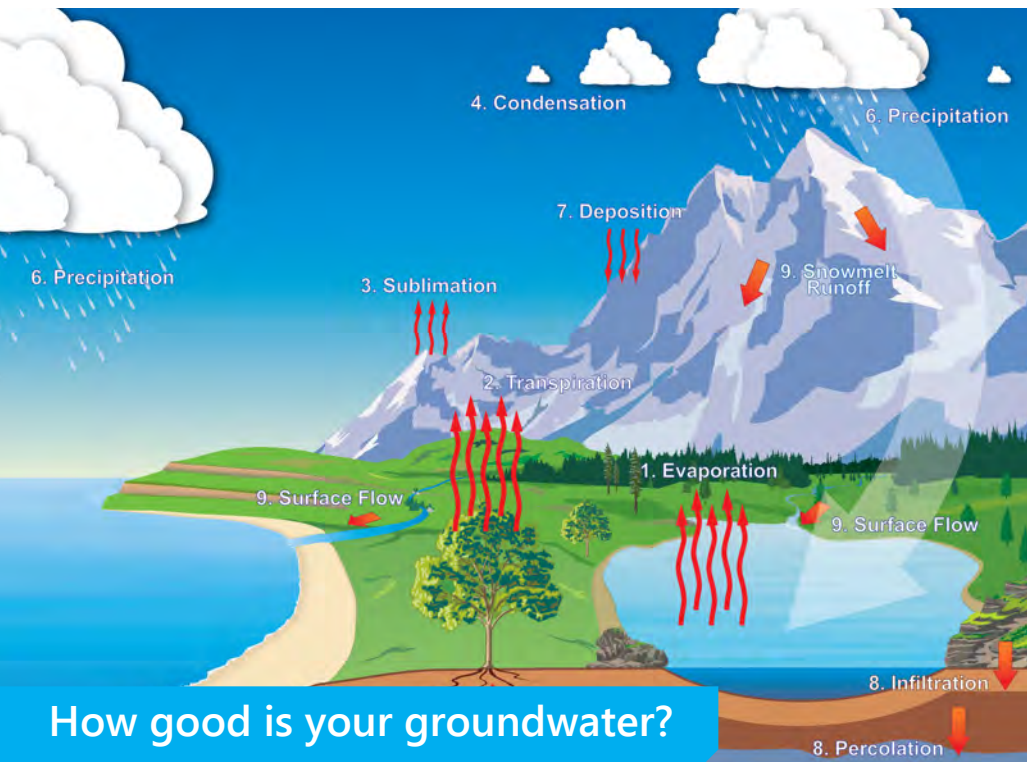


# Enviroteach

Environmental Education Resource for Teachers



How you can help

## From the Editor

### *Kia ora*

Groundwater is an extremely valuable resource for Southland. It forms an integral part of the hydrological cycle and has a significant influence on our rivers and streams. Many communities in Southland rely on groundwater for domestic, town, industrial and farm water supplies; but because it is usually 'out of sight', groundwater is also 'out of mind' for most people.

This issue of Enviroteach provides information to help teachers prepare lessons on groundwater, some classroom activities, practical guidelines to help schools protect groundwater from contamination, and some suggestions for a programme of inquiry, learning and action. The back page has a list of helpful websites, publications and activities.

I hope this resource inspires you to give groundwater a go!

Best wishes for Term 2.

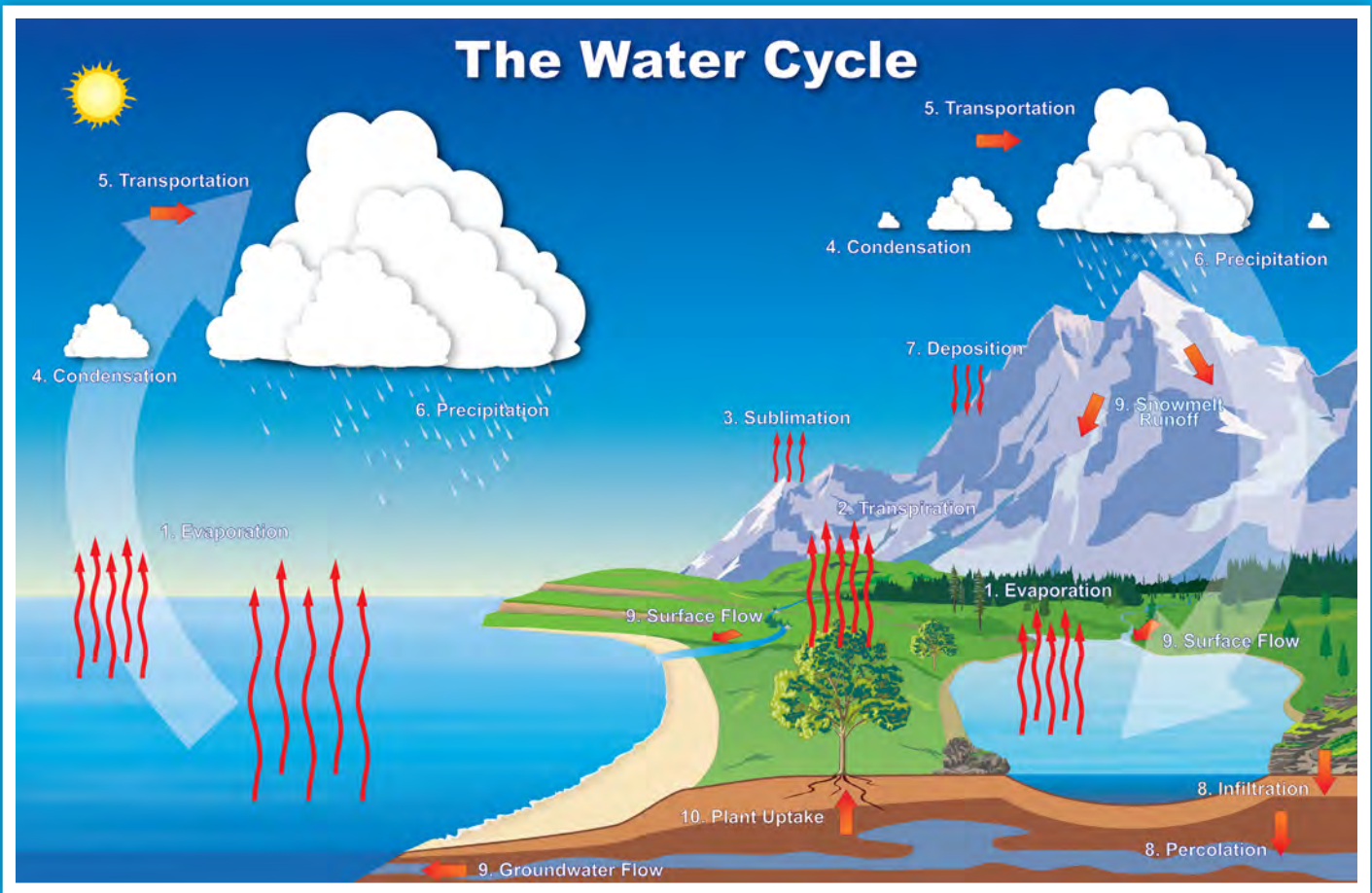
*Pat Hoffmann*  
Environmental Education Officer



## Inside this issue

- 2 What's in groundwater?
- 3 How good is our groundwater?
- 4-5 Action learning
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- 7 Classroom activities
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# What is groundwater?



The water cycle describes the continuous movement of water above, on, and below the surface of the Earth. Surface water includes rivers, streams, lakes and wetlands, while groundwater is water held under the ground in gravels, sand or cracks in rock. Permeable zones under the ground where groundwater accumulates are known as aquifers.

Most of the freshwater in New Zealand is actually under the ground. The water that moves into and under the ground may be stored for many years before being released at the surface (e.g. as springs or wells).

Much of the water in a river is made up of discharging groundwater. Rivers interact with groundwater in two ways:

- Rivers gain water from groundwater that flows in through the riverbed
- Rivers lose water as it flows out of the riverbed to groundwater

Groundwater also provides a vital role supporting wetlands and stream flows.

## Did you know?

The time it takes for water to travel through the entire water cycle is called the 'residence time'. Water cycling through the atmosphere can take almost 1½ weeks; water cycling through a wetland can take between one and 10 years and water cycling through the ground as groundwater can take as little as two weeks, but as long 25,000 years! In Southland the average time is 30 – 40 years.

The temperature of spring water ranges from its freezing point to boiling point. For example, at Hot Water Beach on the Coromandel Peninsula, hot water wells up under the beach sands and at low tide bathers can dig a hole and enjoy a natural hot pool!



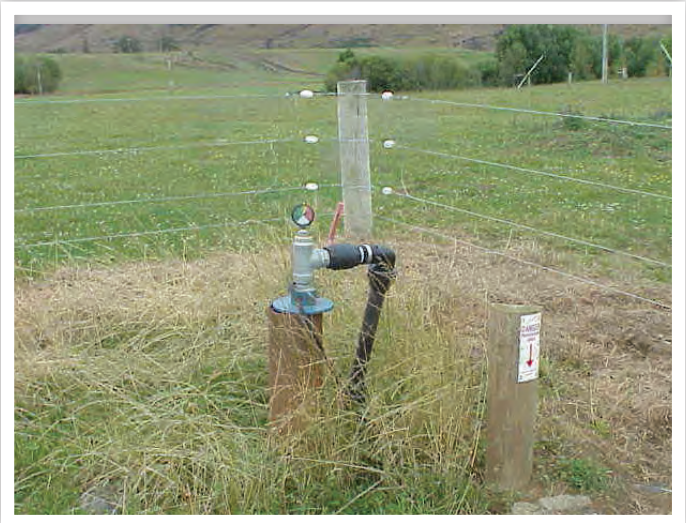
# How good is our groundwater?

**G**roundwater is an extremely valuable resource for Southland. Many communities use it for domestic drinking water, water for livestock, irrigation and other farm uses, as well as industrial and mining uses. We can access groundwater by drilling bores and wells.

Groundwater quality is influenced by the surrounding geology as well as human activities. Factors that influence the suitability of groundwater for drinking include:

- Micro-organisms such as bacteria, viruses and protozoa
- Nitrogen in the form of nitrate
- Chemical contaminants

Environment Southland has been monitoring groundwater quality regularly since 2000 to get a region-wide picture of water quality. Groundwater quality for drinking water is moderate to good throughout most of Southland with the majority of samples meeting the national standards for drinking water. Individual landowners are responsible for checking their own bores to ensure their water is suitable for drinking.



Groundwater is accessed by drilling bores for stock (above) and wells for domestic purposes (below).

## How well is your well?

### ***In Southland 2012–2013...***

- 10% of bores sampled for nitrates failed to meet the national drinking water standard.
- 50% of bores sampled for nitrate indicated a significant impact from land use activities.
- 27% of bores sampled for microbial contamination failed to meet the drinking water standard, indicating the presence of bacteria that can cause illness in people and animals.



Land use activities that have the potential to impact on groundwater quality are described as either 'point' or 'non-point' source discharges.

- Point source discharges are from specific sources such as pipes and drains, and are concentrated at a given point – septic tanks, offal holes, silage pits, landfills and leaking effluent ponds.
- Non-point source discharges relate to the infiltration of water over a widespread area and are often associated with agricultural or horticultural land use. Contaminants applied to land, including animal wastes and fertilisers, can leach through the soil and into the groundwater.



Effluent from a failed septic tank seeps through a culvert.

A banner image showing people in high-visibility vests working in a field, with the text 'Action Learning' overlaid in large white letters.

# Action Learning

Action learning is a teaching practice that employs individuals taking action and reflecting on the resulting changes. You can use this for a school or project. Here are some suggestions for a programme:

- Keep records of drinking water quality (e.g. from water quality tests) and notice trends over time.
- Report what you have learnt.
- Keep records of any actions your school has taken to help protect groundwater quality.
- Reflect on your success.
- Review your environmental care code every few years.

A large curved arrow pointing to the right, divided into two colored sections: orange on top and green on bottom. The text 'Reflect on change' is in the orange section and 'Take action' is in the green section.

Reflect on change

Take action

- Identify actions that will bring about the changes you want.
- How will you know you have been successful? What changes will you measure?
- Decide who will do what, and when.
- Implement your plan.
- Develop an environmental care code to help your school take care of groundwater on an ongoing basis.
- Educate others.





# Learning

Inquiry learning strategies with an emphasis on students  
You can use the action learning cycle to plan any topic, issue  
of inquiry, learning and action focusing on groundwater.

## START HERE

Identify  
the current  
situation

- Does your school or community have a groundwater well or bore? If not, where does your drinking water come from? *See page 8 for help on how to find out.*
- When last was your drinking water tested? What were the results?
- Identify activities in and around your school that might impact on groundwater quality. *See page 6.*
- Contact Public Health South or Environment Southland to find out more.

Explore  
alternatives

- Which do you think is better: bore water, rain water, treated / municipal water or bottled spring water? Why?
- Are you satisfied with the quality of your drinking water? If not, what changes would you like to see?
- Identify ways in which your school and community can help to protect groundwater. *See page 6.*
- Identify your priorities for change.

# How can you help?

## Chemicals

Schools use a range of products to keep the school clean and hygienic. Some detergents contain ingredients that are known to be harmful to water quality and aquatic life. Agrichemicals such as fertilisers and pesticides have the potential to contaminate land and water through spray drift, being washed into stormwater or waterways, or leaching through the soil to groundwater.

- Try making your own cleaning products (e.g. vinegar and bicarbonate of soda) and test them to see how well they work. For inspiration, watch the 6-minute video clip *Stories from Otepoti* available from <http://vimeo.com/15548358>
- Learn about natural alternatives for feeding plants and try making your own (e.g. compost, worm juice, comfrey or seaweed tea)
- Experiment with some natural approaches to controlling pest insects in your school garden

## Waste

Litter can pollute waterways and leach toxic chemicals into soil and groundwater as it breaks down.

- Reduce the amount of rubbish going to landfill by reducing, reusing, recycling and refusing.
- Pick up litter in your neighbourhood and school grounds.

## Stormwater

Stormwater is the rainwater that runs off hard surfaces such as school roofs, driveways, footpaths and playgrounds. Stormwater pipes collect rainwater and carry it untreated to the nearest waterway. This may be a stream, lake, estuary, beach or harbour; or, it might be an underground aquifer that acts as someone else's drinking water supply.

- Obtain a map of your school. Walk the school grounds with your class and identify all the stormwater drains. Identify any contaminants on the school grounds that could end up in the stormwater system.
- Ask Environment Southland or your local council to help you work out where the stormwater drains discharge water to. It might be the nearest river!
- Discuss with your class what should and should not go down a stormwater drain.

## Septic tanks

Septic tanks need to be used correctly to ensure they work properly. If your school is on a septic system, have a conversation with the students about what kinds of things should and shouldn't be flushed down the toilet or poured down the drain.



*Instead of using fertilisers on their vegetables, Gore Main School keeps worm farms and collects "worm juice" to use on their gardens.*



*To reduce the amount of waste going to landfill, Lochiel School uses separate bins for food scraps, recyclable waste and rubbish.*



*Teachers from Southland's EnviroSchools marked spray-painted fish on stormwater drains as a reminder that contaminants washed down our drains end up in the waterway, where they can adversely affect fish and other stream life.*

# Classroom activities

## Aquifer in a cup

**Objective:** Learn groundwater concepts by building a model aquifer (groundwater, surface water, water table, saturation zone, recharge, infiltration)

### Equipment

- 2 clear plastic cups
- Sand, gravel or aquarium rock
- Water

### Instructions

1. Start by filling a clear plastic cup with sand or gravel. *This represents the soil and rocks in the ground.*
2. Add water until the cup is half full. Where did the water go? *The water filled in the spaces between the particles of sand or gravel. This represents groundwater.*
3. Continue to fill the cup with water until it covers the sand or gravel. *Water stored above ground is called surface water. This includes rivers, lakes and oceans.*
4. Fill a second cup with sand or gravel and add water. This time, stop before the water is above the surface. Look closely at the line created by the water. *This line is called the water table. The area below the water table is called the saturation zone. The unsaturated zone is the area above the water table.*
5. Now add more water, pretend the water is rain from a storm cloud. Watch the water table. *Your groundwater supply has just been recharged. This is what happens when it rains or snows and water infiltrates or sinks into the ground.*

**Source:** [www.groundwater.org](http://www.groundwater.org)

## Clean water challenge

**Objective:** Use the equipment to attempt to clean the sample water. Share ideas and discuss what might work. Experiment! Compare the outcomes.

### Equipment

- A bucket of dirty water from a pond, or create your own dirty water by adding debris (soil, leaves, grass etc.)
- Plastic cups
- Paper towels
- Cotton balls / discs
- Coffee filter paper
- Sponges
- Pieces of fabric
- Sand and gravel
- Rubber bands

### Instructions

1. Get students to work in teams of 2–4.
2. Provide each team with a set of equipment and a sample of dirty water.
3. Tell students that their objective is to use the materials provided to “clean” the water. Recommend that they discuss ideas and agree on a plan before they begin using the supplies. Encourage them to try different ideas.
4. After students have tried different approaches, ask them to report back on what they did, what worked well and what didn’t work so well.

### Things to discuss

- Sometimes there are pollutants in groundwater that we cannot smell or see.
- If you use a bore, you should have the water tested at least once a year to ensure that it is safe to drink.
- It is easier to keep water clean than to clean it up.

To extend this activity, add additional materials that will either help or hinder the cleaning process, e.g. salt, empty milk jugs, screen, cheese cloth, string, wire, scissors, activated charcoal, denture-cleaning tablet, clay, soap, baking soda, flour, sugar, magnifying glass, plastic cling wrap, aluminium foil, duct tape, food colouring.

**Source:** [www.groundwater.org](http://www.groundwater.org)



# Helpful resources...

## Websites

### Environment Southland

- [www.es.govt.nz/environment/water/groundwater](http://www.es.govt.nz/environment/water/groundwater)

### UK Groundwater Forum

- [www.groundwateruk.org/what-is-groundwater](http://www.groundwateruk.org/what-is-groundwater)
- [www.groundwater.org/kids/getinvolved/protect](http://www.groundwater.org/kids/getinvolved/protect)
- [www.groundwateruk.org/tips-on-how-you-can-help-protect-groundwater](http://www.groundwateruk.org/tips-on-how-you-can-help-protect-groundwater)

### Ministry for the Environment

- [www.mfe.govt.nz](http://www.mfe.govt.nz)

## Where does your drinking water come from?

To find out, go to the Drinking Water for New Zealand website and type in the name of your school or community. This website will also give you information about how well your water supply complies with the National Drinking Water Standards.

[www.drinkingwater.esr.cri.nz](http://www.drinkingwater.esr.cri.nz)

## Activities, puzzles & games

### How to make an edible aquifer

- [www.groundwater.org](http://www.groundwater.org)

### Crosswords, word searches, a maze and colouring sheet

- [www.groundwater.org](http://www.groundwater.org)

### Free App – groundwater awareness trivia game

- [www.groundwater.org](http://www.groundwater.org)

## Publications

### Environment Southland

- *How well is your well? A guide to protecting the quality and reliability of your groundwater supply.*

[www.es.govt.nz](http://www.es.govt.nz)

### Ministry of Health

- *Secure groundwater bores and wells for safe household water.*

[www.healthed.govt.nz](http://www.healthed.govt.nz)

### Ministry of Education

- *Environmental Best Practice Guidelines for Schools.* There are a number of everyday school activities that have the potential to adversely affect the environment. It's important that schools identify these activities and work out the best way to manage them. This publication provides simple, common-sense guidelines for environmental management at schools.

[www.minedu.govt.nz](http://www.minedu.govt.nz)

### Health Ed

- *Household water supplies.* Detailed information about the supply of safe drinking-water to households other than those connected to town water supplies. Includes water sources, water systems, water testing and water treatment and disinfection.

[www.healthed.govt.nz](http://www.healthed.govt.nz)

### The New Zealand Hydrological Society

Series of three posters and a teachers' kit:

- The Water Cycle
- Where is Our Water
- Who Needs Water

There is also teacher resource to accompany the posters which includes teachers' notes explaining the concepts illustrated in the posters and learning activities for pupils.

[www.h2know.org.nz](http://www.h2know.org.nz)