Drains To Harbour

Teaching and Learning Activities

For Years 3-8

(Levels 2-4 of the NZ Curriculum)

whitebait Connection
Xstream about freshwater life

Mountains To Sea
Conservation Trust
Nga Maunga ki te Moana

Whangarei District Council

Introduction to DTH Additional Teaching Activities

These additional teaching activities are designed to support learning throughout the Drains to Harbour programme.
The learning activities support the key concepts for the programme and have been designed for students to extend their knowledge around fresh water, stormwater, aquatic animals and pollution.

How do we use these resources for the Drains to Harbour programme?

Activities are organised into subject areas. Teachers and students can choose to use one some, or all of the activities depending on their needs and interests.

The teaching activities included in this document complement the Drains to Harbour programme. A glossary is included as an appendix, for easy reference.

What levels are the activities suitable for?

All activities are suitable for Levels 2-4 (Years 3-8). They can be easily adapted by teachers for use at other levels.

Contents

Section One: The water cycle

In this section, find out about:

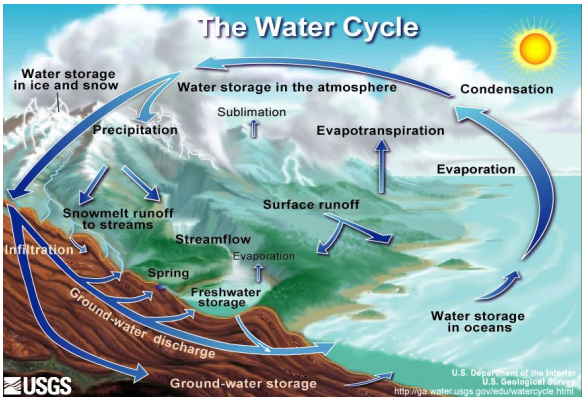


Image by USGS: (public domain).

- The water cycle and how water moves around the planet
- The stages of the water cycle: evaporation, precipitation and condensation.

Activity 1.1

Water Recycling In The Water Cycle

Curriculum Links	Key concepts	Resources needed
Science (Levels 2- 4) Planet Earth and Beyond; *Earth systems,* *Interacting systems* Material world	• How water moves in the water cycle • Stages in the cycle: evaporation, precipitation, condensation.	**Equipment (per individual)**: • A4 or A3 paper • Extra paper/ cardboard/ material scraps for added features • Scissors • Glue or sellotape • Ruler • Pencil • Markers/ felt tips
Learning Outcomes **Students should be able to :** • Explain the stages of the water cycle.		

Background Information

All of the water found on Earth is recycled through the water cycle. This process involves water moving from the earth into the atmosphere and back to the earth again. Water falls from the clouds as rain, hail and snow (called *precipitation*). The water collects into streams,

rivers and lakes, eventually flowing back to the sea as *run-off*. Water then *evaporates* from the sea, lakes, rivers, and plants and rises into the atmosphere where it *condenses* to form clouds.

Water can be a liquid (water), solid (ice) or a gas (water vapour) and can go back and forth from one form to another.

Evaporation: The sun evaporates water from the oceans into water vapour. This invisible vapour rises into the atmosphere where the air is cooler.

Condensation: The water vapour condenses into clouds as it reaches cooler air.

Precipitation: Water drops form in clouds, and the drops then fall to earth as rain, (precipitation). In cold climates, precipitation builds up as hail or snow.

Run off: Rainfall on land flows downhill as runoff, adding water to lakes, rivers and the ocean.

Learning Experience suggestions

Create a Water Cycle Triorama

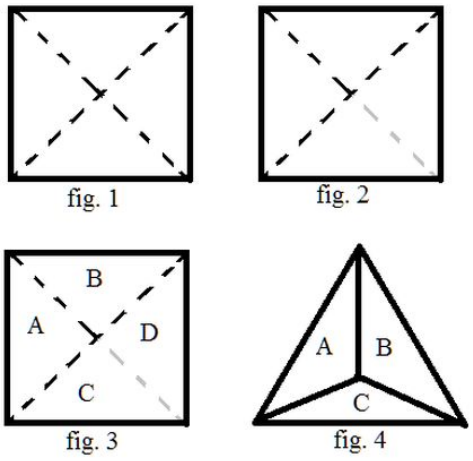


Image 11 - Diagram for creating a paper triorama from https://joulesportfolio.weebly.com/triorama.html

1. Follow the above diagram to create a paper triorama. *Further instructions on this link: https://www.lakeshorelearning.com/assets/media/images/free_resources/teachers_corner/projects/trioramaDramaTemplate.pdf*

2. Firstly, cut your piece of paper so that it is a symmetrical square. Then fold the paper diagonally each way. *See Figure 1.*

3. Cut along one half of the diagonal lines to create a slit. *See Figure 2: cut the faint line only.*

4. Slide one diagonal half over the other half and glue them together. *See Figure 3; slide C over D.*

5. On the three sides and the base of the triorama, illustrate each feature of the water cycle. *See Figure 4.* Also include one moving part or pop up on your triorama using paper, cardboard or material scraps.

The main four water cycle features illustrated should have headings. These are: evaporation, condensation, precipitation and run-off.

Extension: Label and include: transpiration, infiltration, groundwater storage and collection.

Activity 1.2

Observe the Water Cycle in a Jar

Curriculum Links	Key concepts	Resources needed
Science *Planet Earth and Beyond* Interacting systems *Material world* Properties and changes of matter Chemistry and society	• Water recycling • Steps in the water cycle	**Equipment**: • A large clear glass jar with a lid • A handful of small stones/ gravel • Two scoops of sand • ¼ jar of soil • A plastic bottle cap • Tap water • Plant seedlings
Learning Intentions *Students are learning to:* • see the water cycle concept of water recycling in action. • recognise the different water cycle stages involved during the experiment.		

Learning Experience suggestions

1. Using a large jar with a wide top, layer small stones in the bottom and then cover the stones with sand.
2. Fill the jar with soil until it is a third to a half full.
3. Place the seedlings in the soil making sure the roots are covered.
4. Fill the small bottle cap with water and place it next to the plants.
5. Tighten the lid on the jar or cover with plastic wrap. Place the jar in the sun for three days.
6. Record what happens each day inside the jar: is the water level the same inside the bottle cap? Can you see any condensation forming on the jar? If so, where?
7. After three days, use all of your observations to make a conclusion of what took place inside the jar. Describe the water cycle in your explanation and how it affects living things.

Section 2: Stormwater

In this section, find out about:

- Stormwater and what it is
- Where stormwater goes
- Features of a stormwater system
- What can end up in the stormwater system

Activity 2.1

Stormwater: Just Rain Going Down The Drain?

Curriculum Links	Key concepts	Resources needed
Science *Nature of Science:* Communicating in Science *Planet Earth and Beyond* Earth systems, Interacting systems	• Stormwater is created by rainwater that flows across outside surfaces and straight into stormwater drains and gutters in the street.	• Stormwater images (page 5 or Google Slideshow DTH Stormwater images)
Learning Intention *Students are learning to:* • Identify stormwater features		

Background Information

Stormwater is created by rainwater that flows across outside surfaces and straight into stormwater drains and gutters in the street. Water enters stormwater drains and flows directly out into the nearest stream, river or coastal waterway, without being treated. As stormwater travels over the land, it can pick up chemicals and materials that are not naturally found in our waterways. Some of these pollutants are toxic and dangerous, even in small amounts. Others, such as nutrients, are not poisonous but may be produced in such great quantities that natural systems can't cope with them.

To keep streams healthy, stormwater that leaves our home, roads or school should only contain clean rainwater with no pollutants such as litter, lawn clippings, cigarette butts, car washing detergent, animal waste, sediment or chemicals.

Learning Experience suggestions

- Introduce the concept of stormwater and together with students discuss the meaning of ‘stormwater’.
- Share the Stormwater images on page 5 or Google Slides version: DTH Stormwater images . These images can act as discussion starters for talking about what stormwater is, where it goes and what can happen to it.
  What do the stormwater images have in common? What can we find out about stormwater from looking at the pictures? Use the images to think about where stormwater enters the system and where it goes.

Student activity sheet 2.1: DTH Stormwater Images

Activity 2.2

Rainwater Becomes Runoff

Curriculum Links	Key concepts	Resources needed
Science *Nature of Science:* Investigating in Science *Planet Earth and Beyond:* *Earth systems,* Interacting systems	• What is run-off • Run- off can pick up pollutants and deliver them to streams • A permeable surface is one that water can seep through • Water cannot flow through impermeable surfaces	**Permeable and impermeable surfaces** https://docs.google.com/presentation/d/19UW0SQ0UncJlXeJwCjrQHkUUw_zb-bkJj41gwVuZ2HY/edit?usp=sharing
Learning Intention *Students are learning to :* • Identify the differences between impermeable and permeable surfaces		

Background Information

Introduction

As rainwater flows along surfaces, it can pick up different substances that travel along in the water. These types of **runoff** can be pollutants, which will harm the natural environment. The type of surface that rainwater flows along will have an impact on the amount of runoff that is created, as well as the speed that the runoff travels. Soft surfaces in the natural environment will help to create less runoff and slow down its flow. This will reduce the amount of pollutant runoff that can be carried along in rainwater as well.

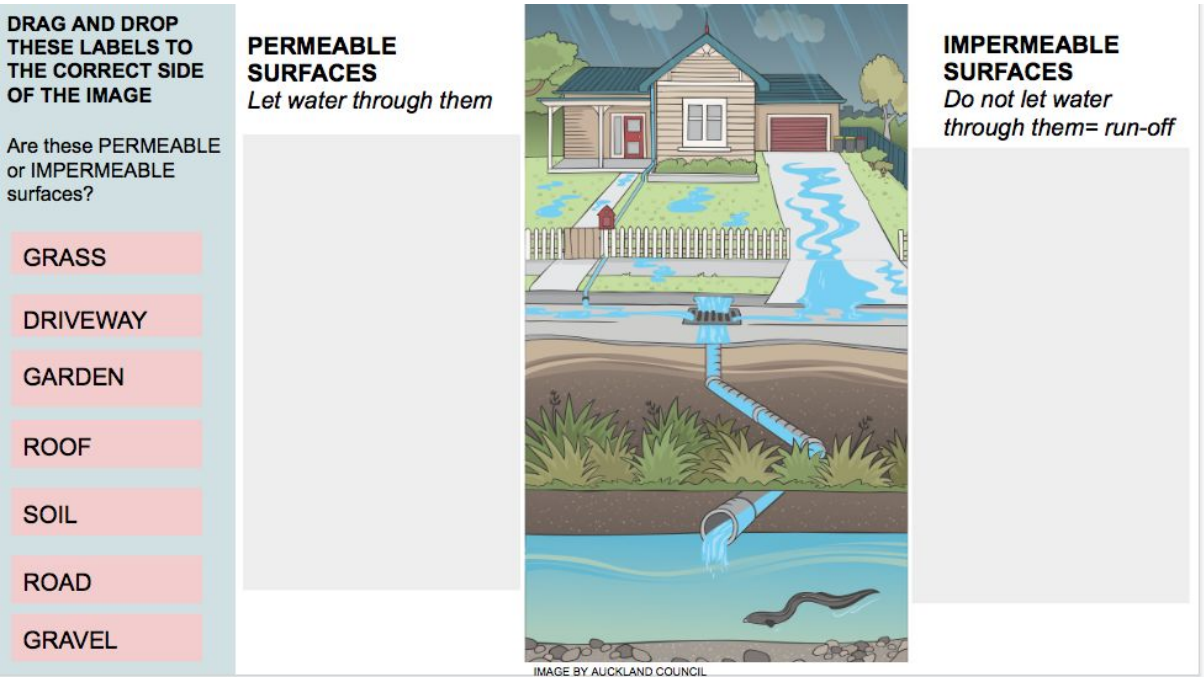
Introduction to permeable and impermeable surfaces

Stormwater is water that runs off hard, sealed **impermeable** surfaces, such as roofs, roads and driveways, car parks and footpaths. It flows untreated via gutters and drains in a network of underground pipes and open waterways, and finally ends up in streams, rivers and lakes.

When rain falls onto lawns and gardens, some of it soaks into the soil. This is because these surfaces are **permeable**, meaning water can soak through them and enter the groundwater below. This reduces the amount of water entering stormwater drains.

Learning Experience suggestions

Student Activity 2.3: Can you **label** the permeable and impermeable surfaces in the below picture?



Digital online activity: Drag and drop: Permeable vs impermeable surfaces (pictured above).
https://docs.google.com/presentation/d/19UW0SQ0UncJlXeJwCjrQHkUUw_zb-bkJj41gwVuZ2HY/edit?usp=sharing
(This file is set to view only: Make a copy and then drag and drop/ share with students)

Activity 2.3

Go for a Gutter Sweep!

Curriculum Links	Key concepts	Resources needed
Science *Planet Earth and Beyond* Interacting systems *Material world* Properties and changes of matter Chemistry and society	• pollutants observed in stormwater drains • awareness of the quality of stormwater in their local area	**Equipment (per group):** • Tape measure • Cones / chairs or something to mark off an area with • Outdoor broom • Rake • Spade • Dustpan • Gloves • Plastic bags x 6 • Clipboard • Pen and paper for recording data
Learning intentions *Students are learning to :* • Identify, record and appropriately discard of any pollutants observed in stormwater drains • Develop an awareness of the quality of stormwater in their local area		

Background information

Introduction to a gutter sweep

A gutter sweep involves each group choosing a different section of the school. The drain in this section is swept along a 50 metre section and the contents found in the sweep are analysed and recorded before being discarded appropriately.

A ‘sweep zone’ is the area of gutter that you will survey.

Learning Experience suggestions

1. Measure a 50 metre length of stormwater gutter and mark your sweep zone using cones or chairs.

2. Sweep and/or rake the gutter, verge and footpath in your sweep zone. Use spades and dustpans to collect the sweepings.

3. Carefully sort the sweepings into three different categories, (using gloves):
   - Organic material (leaves, grass & twigs)

- Rubbish / Litter
- Soil / Sediment (gravel, sand etc.)

4. Count up or weigh and record how much of each type of litter was found. This can be done by placing the sorted sweepings into separate bags. Count the total number of bags and the number of bags in each category and record this.

Discuss: Which item and/or group of litter is most common? Why do you think this is?

5. Discard of the sweepings responsibly; can some of the litter be mulched, composted or recycled?

Investigate the potential for reducing, reusing and recycling the litter category items from your gutter sweep. Sort items into reduce/ reuse/ recycle groups. (Use signs, boxes or hoops).

6. After analysing and interpreting your gutter sweep data, develop some solutions that can be introduced at school to prevent all of the different forms of pollution from entering the stormwater system.

7. Communicate these findings to the school community through an assembly presentation, video, signage placed around the school grounds or include it in the school newsletter.

Gutter sweep: Extending learning

- Select one of the unusual items found during your Gutter Sweep and write a story to describe how it arrived in the gutter and the next part of its journey. The story may be a recount, adventure, mystery, science fiction or comic strip. Interesting item ideas include a party popper, letter, reading glasses, tennis ball, false teeth, lipstick, shoe, key, child's toy or a wallet.

- Invite parents and local residents to try a Gutter Sweep in their area too. Instructions for how to conduct it can be written up and placed in letterboxes in your local area.

Section 3: Catchments

In this section, find out about:

- What is a catchment is
- How water moves in a catchment

Image (left) adapted from Catchment features from Bedford County Conservation.

Activity 3.1

We All Live In A Catchment

Curriculum Links	Key concepts	Resources needed
Science Planet Earth and Beyond; Earth systems; Interacting systems	• A catchment is an area of land that is bordered by hills and drains to one common river and to the sea.	• Mapping software such as Google Maps • What is a catchment slideshow 1. What is a Watershed?
Learning Outcomes *Students should be able to:* • Understand what a catchment is • Locate their own catchment area and identify the main rivers and mountains • Identify the main land uses in their catchment.		

Background Information

As it rains, water flows over the land as runoff and collects in channels such as streams and rivers that empty into a body of water such as a lake or the ocean. A catchment is an area of land that catches rainwater and drains it to the lowest point. Higher land areas such as hills and mountains separate catchments from each other. A birds eye view of a catchment can look like a tree with smaller channels flowing into larger ones. The smaller creeks are similar

to twigs and small branches and these flow into the streams, like the main branches of a tree. Streams then empty into large rivers, which are similar to the tree trunk.

Suggested Learning Experience

- Show students an example of a catchment on your local council GIS or mapping software. The borders of the catchment are the surrounding hills, so a contour view is useful.
- View the catchment slideshow to learn more about the structure of a catchment/ watershed. 1. What is a Watershed?
- Use the *student activity sheet 3.1 Our catchment* to encourage students to explore their own catchment in a digital context.

Image by Whitebait Connection

Student activity sheet 3.1 Our catchment

Google Docs version: DTH Student activity sheet 3.1 Our Catchment
(Make a copy to edit).

Students can use Google Maps to locate your school and the surrounding streets in your area.

Research and answer the below questions:

1. What is the name of our local catchment area?

2. What is the name of our main river/s that flow to the sea?

3. What are the main mountains/ hills that rainwater runs off to form our streams and rivers?

4. Locate the closest waterway to your school and estimate how far it is from your school to the river.

5. List the main land uses in your catchment area, between your school and the waterway. (Housing, transport, business, industry, farming, recreation etc...).

6. How could these land uses affect the catchment; specifically the health of the waterways in your catchment area?

Activity 3.2

Where Does Water Flow in a Catchment?

Curriculum Links	Key concepts	Resources needed
Science *Planet Earth and Beyond;* *Interacting systems* *Material world;* *Properties and changes of matter;* *Chemistry and society*	• The structure of a catchment • How water flows in a catchment	**Equipment**: • Sheets of white A3 or larger paper (one per student or group) • Shallow pan or tray • Water-based felt colour markers • Spray bottle of water Slideshow: 2. Building our own Watershed Activity
Learning Outcomes *Students are learning to:* • Predict and observe where water flows within a catchment • Understand how a whole catchment can be impacted by pollutants used in one area		

Suggested Learning Experience

1. View the slideshow 2. Building our own Watershed Activity to learn about how to do the activity and show students what is involved.
2. Crumple a large piece of paper in pairs and then smooth it out, leaving some bumps in the paper still as ridges.

3. Trace the lines with different coloured markers. Each colour can represent a different pollutant such as fertiliser, sediment and cow manure.

4. Place the paper on a tray and shape it to look like a catchment with mountains and valleys.

5. Spray the paper with water to represent rain and watch the colours run down the ‘hills’ into ‘rivers’ and then out to the ‘ocean’.

Discuss:

- What happened at the highest and lowest points of the catchment?
- What happened to the pollutants as it rained? Did they mix together? Would anything that happens at the top of the catchment affect what was happening at the bottom of the catchment?

Section 4: Pollution and issues for stormwater

In this section, find out about:

- Pollution and its effects on stormwater

Activity 4.1:

How to Reduce Water Pollution

Curriculum Links	Key concepts	Resources needed
Science (Levels 2-4) *Nature of Science:* *Communicating in Science* *Planet Earth and Beyond* Interacting systems *Material world* Properties and changes of matter Chemistry and society	• Stormwater pollution and effects • Actions we can take to solve pollution problems	**Equipment**: • *Student activity sheet 4.11 Sources of pollution* (page 23) • *Student activity sheet 4.12: Matching pollution effects and actions (pages 25-27).*
Learning Outcomes *Students are learning to:* • investigate the impact of stormwater pollution on a waterway • recognise solutions to the problem of stormwater pollution • understand the importance of keeping our waterways clean		

Background information about pollution

Introduction to pollution prevention

Stormwater pollution can come from many different sources. Pollutants that are left on driveways or in gutters are washed into the stormwater system and then waterways.

Detergents are often very alkaline (high pH). Detergents can contain the nutrient phosphate which can greatly increase plant growth and cause algal blooms in waterways. Aquatic animals can have their protective body coating stripped off, or even die from the changes in pH and nutrient load to the water. Instead of washing cars and other vehicles on a paved surface, they should be washed on the grass using phosphate-free detergent.

Oil can end up in the waterways from leaking out of cars and washing into stormwater drains, or directly leaking from or spilling out of boats into the water. Oil can coat and smother any aquatic plants and animals, making it difficult for them to breathe and survive. Dispose of oil very carefully and deal with oil leaks.

Animal waste can enter a waterway from pet owners not picking up their animal's waste so that it washes into a stormwater drain or a waterway during rain. Livestock such as cows and sheep can excrete straight into a waterway if they have access to one. Animal waste can reduce water clarity and bacteria in the waste can increase nutrient levels in the water, killing sensitive aquatic animals and increasing algal blooms. Bacteria can make streams unsafe for people to swim in or collect food or drink.

Large amounts of **leaves, sediment and garden debris** can block up stormwater drains and cause flooding. Sediment in the water can reduce the clarity and increase the water temperature. This makes it difficult for plants to photosynthesise and aquatic creatures can find it hard to breathe, especially if their gills are clogged with sediment. Barriers can be installed between paved or concrete areas and the garden to prevent the spreading of soil, gravel, flowers, leaves, fruits and berries into stormwater drains. Instead of hosing down driveways, it is better to sweep them. This will save water and prevent contaminated run-off from flowing into the street stormwater drains.

Some **fertilisers, pesticides and herbicides** contain chemicals that can be toxic to aquatic life if they enter the waterways after rain. Nitrogen and phosphorus contained in these chemicals can cause algal blooms. Some algal blooms generate toxins that are a health risk to humans and livestock. Instead of using chemical fertilisers, compost, bokashi or worm wee are great natural fertilisers. Consider planting native grass and plant species which require less fertiliser and pesticides.

Paint or **litter** can easily end up in stormwater drains. Animals and plants can suffocate if they are caught in either of these items. Paint can coat the surface of aquatic life and make it difficult for plants to get sunlight. Litter is often mistaken as food by aquatic animals and they can become very sick or die by ingesting different types of litter.

Ensure that your school has a strong litter control program in place. All school staff including grounds people, cleaners and other contractors must be made aware that paint, litter and wastewater must not be disposed of in a stormwater drain.

Suggested Learning Experience

1. Use the images from *Student activity sheet 4.11 Sources of pollution* (page 26) to start a discussion on types of pollution that can reach streams.
2. Research stormwater pollutants and the effect they have on the health of a waterway. See:
    - Science Learning Hub https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution
    - KCC information about pollution https://kcc.org.nz/not-so-fresh-water/
    - New Zealand's fresh water at a glance poster (MfE) Download [209.3 KB]
3. Cut out each square in the *Student activity sheet 4.12: Matching pollution effects and actions (student copy).* Distribute to students in groups.
4. In groups, students can match each pollutant with the effect it has on a waterway and then find the correct action that people can take to stop each pollutant from harming the waterways.
5. Compare answers to the correct version (teacher copy).
6. Discuss what pollution is and what we can do to avoid it. Background information is included on pages 24- 25.

Student activity sheet 4.11: Sources of pollution

Image 11 - Stormwater pipe

Image 12- Mining

Image 13 - Oil spill

Image 14 - Detergent down stormwater drain

Image 15 - Fertiliser spread

Image 16: Cow waste in waterway

Image 17 - Roadside litter

Image 18- Erosion

Image 19- Rubber from tyres

Image 20 - Dog waste on street

Image 11: Stormwater discharge, Image by Gerick Bergsma 2008 | Marine Photobank https://creativecommons.org/licenses/by/2.0/
Image 12: Open cast mining, Kalgoorlie_open_cast_mine.jpg, Australia Attribution 2.5 Generic
Image 13: Spilt oil in Sundarban, 2014 by Kallol Mustafa Attribution-Share Alike 4.0 International
Image 14: Free for commercial use, DMCA, pxfuel
Image 15: Spreading lime on a Devon field, by Mark Robinson, Attribution 2.0 Generic
Image 16: Cows fording the stream by Andrew Bowden; https://creativecommons.org/licenses/by-sa/2.0/
Image 17; https://www.piqsels.com/en/public-domain-photo-olhqm CC0, public domain, royalty free
Image 18: Eroding riverbank by P Glenwright; Attribution-Share Alike 2.0 Generic
Image 19: Royalty free image, Free for commercial use, DMCA, pxfuel
Image 20: Dog Pool Lane by Elliot Brown; https://creativecommons.org/licenses/by/2.0/

Student activity sheet 4.12: Matching pollution effects and actions

These statements are all mixed up. Match the pollutants to their effects and appropriate actions to take.

Student Copy

Pollutant type	Effect on waterway	Action to take
Animal wastes	• Can clog the gills of fish and bugs. Plant and animal life can be coated and smothered. • Can cloud the water, blocking sunlight. • Some types can be toxic and make water unsafe for people and animals.	• Keep this out of gutters, drains or waterways! • To dispose of it, pour small amounts into kitty litter or shredded paper to absorb and dry, then throw it into the rubbish. • Take leftovers to local paint shops, as some collect it back and recycle or dispose of it safely.
Engine oil	• Releases and heavy metals into the water. • Wildlife can mistake it for food.	• Plant more native trees near the waterway. The roots will hold the riverbank in place so nothing washes into the waterway. • Sweep dirt back into the garden and not onto the road. • Cover dirt on trailers with a tarpaulin.
Rubber from worn tyres	• Contains phosphate, a nutrient which can cause algal blooms. • Strips the protective coating from the skin of frogs and fish.	• Only use small amounts of this that are biodegradable. • Better still, grow organic produce where no sprays are used. • Compost and mulch can be used instead.
Plastic wrap	• Bacteria in animal waste can make it unsafe for people to swim or take water for drinking from waterways. • Increased nutrient levels in the water can kill animals and increase algal blooms in waterways.	• Check often that cars and boats aren't leaking oil, which can wash into waterways. • Don't pour any type of oil down the drain. • Dispose of oil safely by taking it to a depot. • Report any oil spills noticed in a public space to the Council immediately.
Detergent	• This producer causes big changes in oxygen levels in the water so it is difficult for fish to survive.	• Drive safely to avoid skidding. • Replace old, worn tyres. • Don't leave strips of shredded tyres on the road.

	• It can be toxic and also can smell really bad so waterways are unsafe for swimming.	
Pesticides	• Animals can mistake it for food and get very sick. • They can get trapped in it and suffocate. • Clogs up the waterway.	• Avoid using plastic by using reusable options instead. • Always put rubbish in the bin. • Paper, plastic, cans and bottles can be recycled. Organise regular clean up days in your area.
Soil erosion (sediment)	• Animals and plants can die from the harsh chemicals. • It can be unsafe for humans to swim in the waterway.	• Decrease the nutrients that are entering the waterway. • Plant more trees to absorb more of the runoff.
Fertiliser	• This can cause high numbers of plants and algae to start growing in the waterway.	• Fence off waterways so livestock can't access the water. • Pick up and safely dispose of pet waste. • Don't hose off animal enclosures near roads or paved surfaces.
Paint	• Use up oxygen as it decomposes. • Increase the nutrient levels in water causing algal blooms.	• Make sure this doesn't go down the stormwater drain where it will block up waterways. • Compost and mulch all green waste from gardens.
Algae	• Dirt and debris wash into the waterway, decreasing light in the water. • This increases the water temperature and makes it difficult for water plants to survive as they can't photosynthesise.	• Don't apply it on wet or windy days. • Use solid types that won't disperse so quickly. • Find alternatives that are biodegradable.
Lawn clippings and garden waste	• Forms a colourful but toxic film over the top of the water, making it hard for animals and plants to breathe in the waterway. • A waterway can be unsafe for people to swim in or take drinking water from it.	• Use low / no phosphate types. • Don't wash cars or machinery on driveways or roads where the runoff can enter the storm water system. • Instead wash on the grass where it can be absorbed.

Teacher copy: 4.12: Matching pollution effects and actions

Answers- these are arranged in correct columns- (student copy pages 24-25 is mixed up)

Pollutant type	Effect on waterway	Action to take
Animal wastes	• Bacteria in animal waste can make it unsafe for people to swim or take water for drinking from waterways. • Increased nutrient levels in the water can kill animals and increase algal blooms in waterways.	• Fence off waterways so livestock can't access the water. • Pick up and safely dispose of pet waste. • Don't hose off animal enclosures near roads or paved surfaces.
Engine oil	• Forms a colourful but toxic film over the top of the water, making it hard for animals and plants to breathe in the waterway. • A waterway can be unsafe for people to swim in or take drinking water from it.	• Check often that cars and boats aren't leaking oil, which can wash into waterways. • Don't pour any type of oil down the drain. • Dispose of oil safely by taking it to a depot. • Report any oil spills noticed in a public space to the Council immediately.
Rubber from worn tyres	• Releases chemicals and heavy metals into the water. • Wildlife can mistake it for food.	• Replace old, worn tyres. • Drive safely to avoid skidding. • Don't leave strips of shredded tyres on the road.
Plastic wrap	• Animals can mistake it for food and get very sick. • They can get trapped in it and suffocate. • Clogs up the waterway.	• Avoid using plastic and use reusable options instead. • Always put rubbish in the bin. • Paper, plastic, cans and bottles can be recycled. • Organise regular clean up days in your area.
Detergent	• Contains phosphate, a nutrient which can cause algal blooms. • Strips the protective coating from the skin of frogs and fish.	• Use low/ no phosphate types. • Don't wash cars or machinery on driveways or roads where the run-off can enter the storm water system. • Instead wash on the grass where it can be absorbed.

Pesticides from orchards	• Animals and plants can die from the harsh chemicals. • It can be unsafe for humans to swim in the waterway.	• Only use small amounts of this that are biodegradable. • Better still, grow organic produce where no sprays are used. • Compost and mulch can be used instead.
Fertiliser from farms	• This can cause high numbers of plants and algae to start growing in the waterway.	• Don't apply it on wet or windy days. • Use solid types that won't disperse so quickly. • Find alternatives that are biodegradable.
Soil erosion (sediment)	• Dirt and debris wash into the waterway, decreasing light in the water. • This increases the water temperature and makes it difficult for water plants to survive as they can't photosynthesise. • Can clog the gills of fish and bugs.	• Plant more native trees near the waterway. The roots will hold the riverbank in place so nothing washes into the waterway. • Sweep dirt back into the garden and not onto the road. • Cover dirt on trailers with a tarpaulin.
Paint	• Can clog the gills of fish and bugs. Plant and animal life can be coated and smothered. • Can cloud the water, blocking sunlight. • Some types can be toxic and make water unsafe for people and animals.	• Keep this out of gutters, drains or waterways! • To dispose of it, pour small amounts into kitty litter or shredded paper to absorb and dry, then throw it into the rubbish. • Take leftovers to local paint shops, as some collect it back and recycle or dispose of it safely.
Algae	• This producer causes big changes in oxygen levels in the water so it is difficult for fish to survive. • It can be toxic and also can smell really bad so waterways are unsafe for swimming.	• Decrease the nutrients that are entering the waterway. • Plant more trees to absorb more of the run-off.
Lawn clippings and garden waste	• Use up oxygen as they decompose. • Increase the nutrient levels in water causing algal blooms.	• Make sure this doesn't go down the stormwater drain where it will block up waterways. • Compost and mulch all green waste from gardens.

Section 5: Traditional And Sustainable Waste Management

In this section, we will learn about:

- Māori traditional waste management
- Mauri, tikanga and kaitiakitanga

Activity 5.1:

Cultural values of water for Māori

Curriculum Links	Key concepts	Resources needed
Social Science (levels 2-4) *Social studies* **Science** *Nature of Science: Communicating in Science*	• Mauri, tikanga and kaitiakitanga • Cultural values about water	**Equipment**: • *Student activity sheet 5.11 Types of water from a traditional Māori view*
Learning Outcomes *Students are learning to:* • describe the cultural values of water for Māori • live the concept of *kaitiakitanga* and take personal and social responsibility for the natural environment		

Background information

Introduction to Māori cultural views of water

In Māori culture, people are seen as strongly connected to all living and non-living things within the environment. This creates awareness around protecting the natural world, as we are all reliant on it for our health and survival. The impacts of pollution on our freshwater sources and how this influences people's health is of great concern to Māori, as water lies at the heart of the traditional Māori worldview.

Many Māori place a great significance on the state of the *mauri* or life force within all natural things, including water. If the quality of water is harmed, then the *mauri* of the water will be low and it is recommended that people don't use the water, especially not for drinking or collecting food from.

For the *mauri* of all living things to be protected, people can practice *kaitiakitanga*, where they are the guardians, or *kaitiaki,* of an area and can sustainably manage the natural and

physical resources in an environment. Solutions for how to maintain the *mauri* of the water involve creating new ways for how stormwater, wastewater and the sludge remains from wastewater should be re-entering the ecosystem.

What is a Sustainable Urban Water Cycle?

The urban water cycle can be viewed from a traditional Māori viewpoint, where rain is seen to be water in its most purest form, which changes as the water becomes runoff on land and collects pollutants. The water must be cleansed of pollutants by passing through vegetation and the earth before entering the sea and then evaporating back into the atmosphere.

Suggested Learning Experience

- Discuss the different values and perspectives of class members about water and our connections to water as people.
- Share knowledge from students and community from a traditional Māori viewpoint, talking about the types of water and kaitiakitanga.
- Explain the meaning of mauri. Can How can the mauri of polluted water be restored? What is water called once the mauri has been restored?
- Students can try to match the types of water with their definitions on *Student activity sheet 5.11 Types of water from a traditional Māori view (page 36)*
- In groups students can discuss: What is the quality and name of rainwater before it falls to earth? What can rainwater be used for once it has touched the earth? What is polluted rainwater called?
- Ask a cultural advisor or whanau of school for extra information about tikanga and local understandings of water and te ao Māori.
- Learn more about Māori cultural views of water at Science Learning Hub: https://www.sciencelearn.org.nz/resources/2511-toku-awa-koiora-question-bank

Student activity sheet 5.11

Types of water from a traditional Māori view

Student copy

- Cut out the types of water from a traditional Māori view and the definitions below. They are all mixed up. Organise them so the definitions match the types. Then arrange the types of water into a water cycle.
- See page 38 for an idea of what this might look like.

Type of water	Definition
Waikino	Saltwater, found in the ocean, harbours, estuaries and tidal rivers.
Wai Māori	The water of life. The purest of water found in rainwater and springs. Waiora can restore the mauri.
Waimate	Freshwater, (water without salt) that can be used by people for daily activities.
Waiora	Bad water. Water that is dangerous e.g rapids, flooding or waterfalls, or water that has become physically or spiritually polluted but may be restored.
Waitai	Dead/ polluted water. Water that has lost its mauri and can cause sickness in humans or human food.

Answer to 5.11: Teacher copy

Waikino	Bad water. Water that is dangerous e.g rapids, flooding or waterfalls, or water that has become physically or spiritually polluted but may be restored.
WaiMāori	Freshwater, (water without salt) that can be used by people for daily activities.
Waimate	Dead/ polluted water. Water that has lost its mauri and can cause sickness in humans or human food.
Waiora	The water of life. The purest of water found in rainwater and springs. Waiora can restore the mauri.
Waitai	Saltwater, found in the ocean, harbours, estuaries and tidal rivers.

Image 21 - Traditional Māori view of water cycle by The Ministry for the Environment, New Zealand.

Section 6: Healthy habitats and stream animals

In this section, we will learn about:

- What makes a freshwater habitat healthy
- Freshwater macroinvertebrates

Image above: Koura by Whitebait Connection

Activity 6.1:

What Makes a Freshwater Site Healthy?

Curriculum Links	Key concepts	Resources needed
Science *Nature of Science:* *Communicating in Science*	• Healthy habitats • Features of a healthy waterway	**Equipment (per group):** • Google Doc: What makes a stream healthy: https://docs.google.com/document/d/1e23af0hCwq0JQ0tKU0EAKFQfQ_kbNblAbwyX9u75lmM/edit?usp=sharing
Learning Outcomes *Students are learning to :* • Understand what a healthy freshwater habitat is like • Identify the features of a waterway • Understand the importance of healthy waterways for people, plants and wildlife		

Background information

Why do we need healthy freshwater habitats?
Healthy habitats are vital for all life. Freshwater habitats are prone to issues such as pollution, habitat destruction, sedimentation and pest plants and animals. Our native biodiversity depends on healthy habitats to survive.

What is a healthy freshwater habitat like?
A healthy freshwater habitat has plenty of vegetation around it, providing shade and protection from the heat of the sun. It has an absence of pests and clean, clear water without too much sediment or nutrients in it.

Suggested Learning Experience

1. Determine what a freshwater habitat is. List the different habitats that freshwater habitats could include and the different animals and plants that would be found living here. *(Describe what can be seen living in a stream, river, pond, lake and wetland).*

2. Identify the features of a waterway and discuss why these natural places are special and need to be taken care of. What is needed in a freshwater habitat for animals to survive?

(Consider rocks and plants as habitat or food for animals, the importance of water for plants to grow and land based animals to drink from and trees along the waterway providing shade and leaf litter as food for aquatic creatures).

3. In groups, students can create a chart or poster outlining what features are needed for a waterway to be healthy. Record ideas on a chart such as this Google Doc: What makes a stream healthy:
https://docs.google.com/document/d/1e23af0hCwq0JQ0tKU0EAKFQfQ_kbNblAbwyX9u75lmM/edit?usp=sharing

Example chart;

What Makes a Stream Healthy or Unhealthy?

Healthy?	Unhealthy?
e.g. ● lots of plants and animals around ● the water is flowing ● lots of frogs ● fresh water ● trees providing shade over the water	e.g. ● lots of litter ● not many plants there ● the water is still and smelly ● polluted water ● no trees nearby shading the water

4. Discuss:

- If you painted a healthy picture of a stream, what would you include?
- Would we find animals in a healthy stream? What types of animals?
- If you were an animal in a stream what would you need to live?

Activity 6.2:

Recognising Macroinvertebrates

Curriculum Links	Key concepts	Resources needed
Science *Living World: Evolution* *Nature of Science: Investigating in Science*	• ID of macroinvertebrates • Identify similarities and differences between macroinvertebrates • Grouping, classification and special features.	**Equipment (per group):** • *Student Activity Sheet 6.21: Macroinvertebrate Chart (pages 42-45)*
Learning Outcomes *Students are learning to:* • Understand that macroinvertebrates can be used as indicators to assess the health of a waterway • Identify specific features of macroinvertebrates • Group similar macroinvertebrates together based on their features		

Background information

What are macroinvertebrates?
A macroinvertebrate is an animal without a backbone which is large enough to see without a microscope.

Why monitor macroinvertebrates?
Monitoring the variety of biodiversity (variety of plants and animals) in a stream is a good way to determine if a waterway is healthy. Which macroinvertebrates are present can tell us a lot about the habitat and the health of the water.
Some animals are more sensitive to pollution and if they are present, they can be a good clue that the water is healthy. These are sometimes known as indicator species.

Suggested Learning Experience

1. View the Science Learning Hub video about Macroinvertebrate sampling: https://www.sciencelearn.org.nz/videos/1973-macroinvertebrate-sampling. Discuss what a macroinvertebrate is and why we study them.

2. *Share the Student Activity Sheet 6.21: Macroinvertebrate Chart (pages 42-45).* In groups, students can equally divide up the macroinvertebrate cards between them. They can discuss what they think is interesting about the creatures within their group. Observe the names of individual macroinvertebrates (water bugs). Discuss how different macroinvertebrates live in

different habitats, depending on their needs, sensitivities and tolerance levels. If desired, cut out all the segments and students can piece them together to give the correct bug with the descriptions and pictures.

3. Compare water bugs and talk about differences between them (i.e. are their legs different? are their body shapes different?). Which do they think would be sensitive bugs? Which do they believe would be less sensitive and more tolerant?

4. Discuss how the numbers by the names indicate their level of tolerance to pollution levels tells us how healthy or polluted the water is. Ask them if they know what the colours might mean, give them a minute to talk amongst themselves. Some are very tolerant to pollution (low sensitivity numbers) and some are very sensitive and intolerant to any pollution (high numbers). Bring up the Macroinvertebrate Chart onto the Smart Board and share the pollution sensitivity rating section. Explain those with green ratings are sensitive to pollution and if they are found in freshwater samples it means the water is fairly healthy and there are low levels of pollution. Conversely orange and red means that the bugs don't mind/ can tolerate living in unhealthy water.

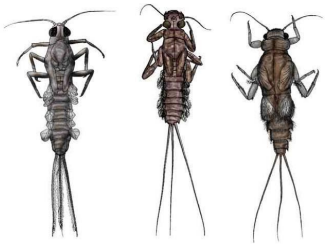
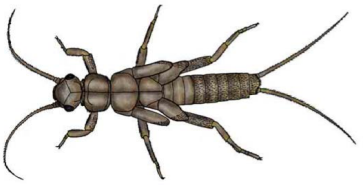
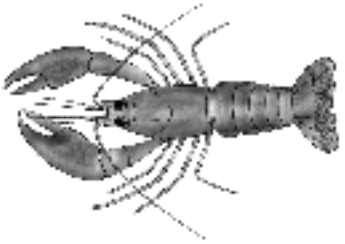
5. Students can discuss which features the different macroinvertebrates have. Together, with discussion, they can place their macroinvertebrates in groups according to their features. Which ones are similar and which are different?

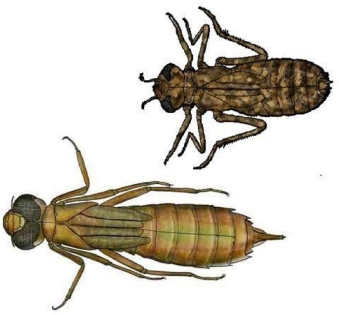
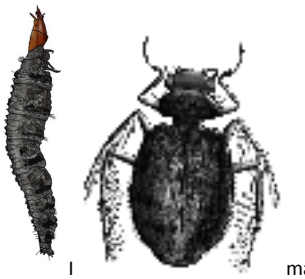
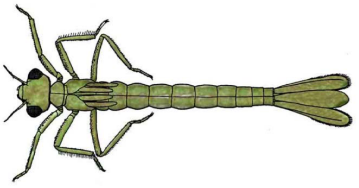
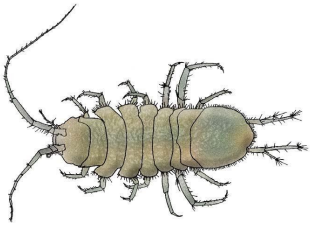
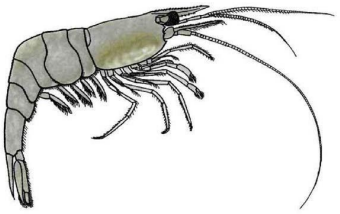
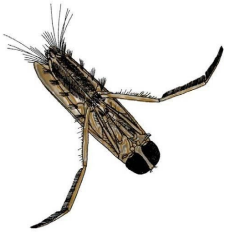
5. Groups can rotate so they can have a look at how other groups have each placed their macroinvertebrates.

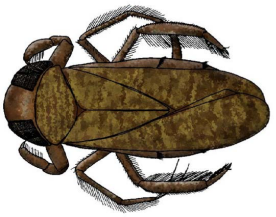
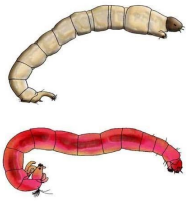
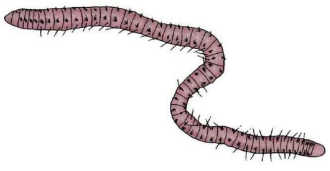
6. Back in their group, explain classification (how scientists group animals) and what they use to group these freshwater invertebrates. For an example of a classification key, see Landcare Research:
https://www.landcareresearch.co.nz/resources/identification/animals/freshwater-invertebrates/guide

7. In conclusion, why is knowing about sensitivity and groups of macroinvertebrates present in a stream important? (the species present give us an indication of how healthy the water is and what level of pollutants are there).

Student Activity Sheet 6.21: Macroinvertebrate Table

Name of macroinvertebrate Sensitivity score (out of ten) Green= sensitive, Orange= medium sensitivity and red= tolerant	**Description of macroinvertebrate**	**Picture**
Mayfly nymph 8 – 9 Flat mayfly: 8 Spiny gill & Swimming mayfly: 9	They have a flat body with three 'tail' gills. Some have feathery gills visible along the side of their body as well. They are herbivores and graze on dead plants and leaves. When an adult, they may live for a few days or sometimes only hours.	 Image 36
Caddisfly larvae 5 - 10 Free living & Woody-cased caddisfly: 5 Stony-cased caddisfly: 6 Smooth-cased caddisfly: 9 Spiral-cased caddisfly: 10	They mostly have a protective case that they build around their soft bodies. The case can be made out of leaves, sand, stones or sticks. They are herbivores, scraping algae from the surface of rocks, or some are carnivores, hunting for small invertebrates.	 Image 37
Stonefly larvae 5 – 10 Tail gill & Spotty stonefly: 5 *Stenoperla* stonefly: 10	They have a flat body with two tail gills. Most types have no side gills. They can crawl quickly in and out of water. They are herbivores and eat decaying plant material.	 Image 38
Freshwater mussel 6	They are bivalves so have two parts to their shell. They are filter feeders, sucking in water containing nutrients and cleaning the water in the process.	 Image 39
Freshwater Crayfish (Koura) 5	They are omnivores, eating both plants and animals. They have powerful, pointed pincers to grab their prey with.They have a hard shell (exoskeleton), which they shed while growing.	 Image 40

Dragonfly Larvae 6	They have chunky bodies with spider-like legs. The jaws are large and extend out from their head to catch their prey. The female adult will dive bomb the water dropping her eggs in. The larvae hatch, grow up and use long reeds to climb out of the water, moult and fly off as an adult dragonfly.	 Image 41
Beetle larvae/ adult 6	The adults have a hard exoskeleton; six legs and they store oxygen under their wings when diving under the water. The larvae are predators while the adults may be herbivores, predators or scavengers. They have chewing mouthparts to eat their prey with.	 I mage 42 Larvae Adult
Damselfly Larvae 5	They have slender bodies with three tail feathers at the end of its body. These are actually gills that help it to breathe. They are carnivores with very big jaws, just like the dragonfly.	 Image 44
Isopod 5	They are small crustaceans that look like slaters. They have a hard, segmented exoskeleton (external skeleton) with two pairs of antennae. Some eat dead or decaying plant and animal matter, others are grazers, a few are predators, and some are parasites.	 Image 45
Freshwater shrimp 5	These animals mainly eat decomposing vegetation, bacteria and algae. They eat by using the first two pairs of their legs to grab the food and put it into their mouth.	 Image 47
Backswimmer 5	They are carnivores that like to suck the body juices of other insects, tadpoles and small fish! They swim on their back, coming to the water surface to breathe.	 Image 48

Water boatman 5	They are omnivores, eating algae and other small invertebrates. They breathe underwater by carrying a bubble of air under their wings.	 Image 49
Mosquito larvae 3	They are detritivores in their larval stage and then don't eat as a pupa until they become an adult mosquito. They have a breathing tube attached to their tail that they can hold above the water and breathe through like a snorkel.	 Image 50
Rounded snail 3	They are herbivores with a long tongue that looks like a chainsaw. Their tongue rotates in their mouth very slowly and scrapes algae off rocks to eat.	 Image 51
Leech 3	They are carnivores, mainly feeding on the blood and juices of snails and other large aquatic animals. They have suckers at each end of their body to help them move and latch onto their prey.	 Image 52
Midge larvae 2	They are small worm-like larvae. They can turn bright red in low oxygen environments as they carry oxygen around in their body instead. They are omnivores, eating decaying plants and animal matter.	 Image 53
Segmented worm 1	These long, thin, segmented animals can turn bright red in low oxygen environments. Most feed on decomposing organic matter.	 Image 54

Images 36 to 54: Macroinvertebrate Chart retrieved from Government of South Australia resource: Critters Galore teacher resource pack - Natural Resources SA: www.naturalresources.sa.gov.au › files › education › waterwatch ›

Section 7: Water quality

- Water quality tests
- How water quality parameters affect stream life

Activity 7.1:

Water Quality Testing: Exploring The Health Of A Waterway

Curriculum Links	Key concepts	Resources needed
Science (Levels 2-4) *Nature of Science: Investigating in Science* *Material world; Properties and changes of matter, Chemistry and society*	• How to test water quality testing parameters • Why we test these	**Equipment (per group):** • *Student activity sheet 7.11, Water quality tests and parameters Google Docs editable version Student activity sheet 7.11 Water quality tests DTH*
Learning Outcomes *Students are learning to:* • Describe how each water quality parameter is measured and what it tells us about the water • Determine how each water quality parameter is impacted on by the environment and the effect this has on the health of the waterway		

Background information

Introduction to water quality parameters

1. **Clarity**

Clarity is how murky or clear the water is. Water clarity can be measured using a clarity tube to observe how clear the water appears. Lower clarity means the water is more murky and holds more sediment (dirt). A main cause of low water clarity is from erosion; where soil and plant matter gets washed into waterways. Low water clarity can increase the water temperature and can also block the gills of fish and water bugs and smother plants or creatures living on the bottom of waterways.

2. **Temperature**

The temperature of the water can affect the level of oxygen that can be dissolved in the water, with less oxygen available at higher water temperatures. High water temperatures also affect the metabolic rate of aquatic creatures and some may not be able to survive. The

water temperature can be measured with a thermometer and ideally a healthy waterway is between 10 and 25 degrees Celsius. (C) The water temperature can be affected by the amount of vegetation shading a waterway, the water clarity, depth and flow, the time of day and season and any runoff from roads or urban environments flowing into the water.

3. **Flow**

The water **flow (velocity)** measures the volume and speed of water movement in a waterway. It can be measured by timing how long a float takes to travel over a fixed distance marked off in the waterway. In tidal areas, the flow is affected by regular tidal cycles. In non-tidal areas, the flow can be affected by the physical structure of the waterway, as well as the amount of water in the catchment.

4. **pH**

The pH measures the acidity or alkalinity of water on a scale of 0 - 14. The pH of water can be tested using universal indicator paper testing strips that change colour depending on the acidity or alkalinity of the water.
Very acidic water would be 0 – 4 and highly alkaline water would be 11 – 14. Both extremes of the pH scale are very harmful to aquatic life and all fish would die. Most freshwater creatures prefer the pH to be between 6.5 – 9 with a healthy waterway having a neutral pH of 7. Factors that can disrupt the pH of a waterway are industrial runoff, fertiliser runoff and large amounts of soil erosion that contains acid sulphate.

5. **Nutrients (nitrate and phosphate)**

Nitrate is a nutrient essential to all life forms and occurs naturally in waterways. In water, nitrate levels can be measured as nitrogen. Factors which increase nitrate levels in waterways include; stormwater pollution, animal waste, sewage, decomposing plant matter and fertilisers.

Phosphate is a mineral nutrient that plants and algae need to grow. It is also found in detergents, fertiliser, sewage and animal waste.

We can’t see nitrate or phosphate in the waterways, but we can test for the presence of these nutrients using colorimetry testing. This involves adding a chemical to the water, where the water becomes coloured if either of these nutrients are present.

High levels of nitrate and phosphate in a waterway supply aquatic plants with too many nutrients which makes them grow very quickly. This process is called eutrophication and causes algal blooms to occur in a waterway which increases the dissolved oxygen levels and water temperature. Once these plants die, the oxygen in the water is used up and dissolved oxygen levels can become very low, harming or killing aquatic creatures.

More information on assessing the health of freshwater streams, rivers and lakes can be found here: Monitoring stream health

Student activity sheet 7.11: Water quality tests and parameters

Fill in the table, using the above information about water quality testing:

Water Quality Parameter	**What does it measure?**	**How can you measure it?**	**What influence does this have on the waterway?**
Flow (velocity)	*The volume and speed of water movement in a waterway.*	*By timing how long a float takes to travel over a fixed distance marked off in the waterway.*	*Low flows can lead to stagnant lifeless water.*
2			
3			
4			
5			

Google Docs editable version [Student activity sheet 7.11 Water quality tests DTH]

DTH Programme Glossary

Algal bloom	A rapid increase in the growth of algae in a waterway. This occurs when there are too many nutrients in the water.
Aquifer	An underground layer of permeable rock or sediment that is filled with groundwater. The water can be brought to the surface through natural springs or by pumping.
Biodiversity	The variety of life and living things.
Bio-indicator	An organism that gives us an idea of the health of an ecosystem.
Catchment	An area of land where all the water from rain that does not soak into the ground drains out through one point.
Condensation	The process in which water vapour (a gas) in the air turns into liquid water. Condensing water forms clouds in the sky. Water drops that form on the outside of a glass of icy water are condensed water.
Dam	A manmade area that collects freshwater.
Ecosystem	The relationship between plants and animals interacting with an environment.
Erosion	A process where unstable ground is moved by water, wind and ice. Excessive erosion can be caused by people changing the land, e.g deforestation.
Estuary	A small sheltered area of coast where the freshwater mixes with the salt water.
Evaporation	The process in which liquid water becomes water vapor (a gas). Water evaporates from the surfaces of oceans and lakes, from the surface of the land, and from snow melting and rises into the atmosphere.
Food chain	The transfer of energy from one organism to the other in the form of food. A food chain begins with plant-life, and ends with animal-life.
Food web	The interconnection of many food chains within an ecosystem.
Groundwater	The water that is located below the Earth's surface. Groundwater is replenished by rainwater that travels through the soil and collects in the spaces between the soil, sand and rocks, forming an aquifer.
Gutter	A ditch or channel that runs along the edge of the street/ curb in order to carry rainwater to a drain.

Habitat	A place or type of place which provides a home for living things. A healthy habitat has a greater diversity of plants and animals.
Harbour	A large sheltered area of coast.
Impermeable surface	A hard, sealed surface that water cannot pass through such as a rock, roof, road, driveway, car park or footpath.
Indigenous/ native	Types of life (species) found naturally in New Zealand.
Kaitiakitanga	The action and ethic of caretaking, protection and guardianship.
Lake	A natural area that collects freshwater.
Macroinvertebrate	Any type of creature without a backbone or internal skeleton that can be seen with the eye. The diversity and species of macroinvertebrates found in a stream is a good indicator of water quality.
Mauri	The life force within all natural things. Everything has its own mauri including streams, people, rocks, animals and forest.
Natural water cycle	The continuous movement of water on, above and below the surface of the Earth through the processes of evaporation, transpiration, condensation, precipitation, run-off, infiltration and collection.
Permeable surface	A soft surface that can absorb water or allow it to pass through, such as grass, soil, sand, turf and plants.
Photosynthesis	The process in which green plants use sunlight to make their own food.
Pollutant/ contaminant	A substance that is introduced into the environment that has a negative impact on living things.
Pollution	The process of making the environment unhealthy and harmful for living things.
Precipitation	The process in which water (in the form of rain, snow, sleet, or hail) falls from clouds in the sky.
Riparian	The strip of land next to streams, rivers, lakes and wetlands.
River	Larger waterway which flows all year round and moves down the catchment. Creeks and streams flow into rivers and rivers finish where they meet the harbour or sea.

Sedimentation	A process starting with erosion resulting in sediment from the land (e.g soil and dirt) entering waterways such as streams, rivers and harbours. This sediment builds up and forms areas of mud.
Stormwater	Rainwater that is surface runoff from the land. There can be many different pollutants carried along in the runoff. Stormwater is untreated and runs straight into drains that transport it to the nearest waterway to be released into.
Stormwater drain	Drains constructed to remove stormwater from surfaces. These drains are very common in developed areas as they allow water to drain quickly and prevent flooding.
Stormwater pipe	The pipes that carry stormwater from a stormwater drain to an outlet, where the stormwater is released into a waterway.
Stream/ creek	Small fresh waterway which flows at least part of the year and moves down the catchment.
Surface run-off	Rain, snow melt, or other water that flows over the land and collects in surface streams, rivers, lakes or the sea.
Transpiration	The process in which some water within plants evaporates into the atmosphere. Water is first absorbed by the plant's roots, then later exits by evaporating through pores in the plant.
Urban	Town or city areas, where there are lots of buildings, roads and houses.
Wastewater	Water containing waste from all sinks, toilets, laundries, kitchens and bathrooms, and from commercial/ industrial sources. Wastewater must be treated through septic tanks or a larger wastewater treatment plant to remove harmful bacteria, solids and other pollutants. These can be disposed of on land, and treated water can be discharged into rivers or out to sea.
Waterway	A river, stream or lake. A route for freshwater to flow through.