ENVIRONMENTAL EDUCATION RESOURCE UNIT

Kura Kaitiaki
Water Conservation

For senior primary and intermediate classes

TEACHERS' RESOURCE

horizons
regional council

Acknowledgments

Kura Kaitiaki: Water Conservation was compiled by Helen Thomas (Environmental Educator, Horizons Regional Council) with the help of teaching resources from Greater Wellington Regional Council. Their support with the development of this resource and their willingness to share their own resources has been greatly appreciated. Special thanks to Henare Kani for his invaluable guidance and support.

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Foreword

Dear Teacher,

Welcome to Kura Kaitiaki; your water conservation resource for the Horizons Region.

We live in a Region shaped by many river systems. The Manawatū, Rangitikei and Whanganui are amongst the most iconic and, as these rivers weave through the landscape alongside numerous streams and lakes, it can be easy to think freshwater is an endless resource. However, as the demand for water increases so too does the need to be mindful of its use.

Often water is least available when we need it most and when it comes to conserving water small actions can make a big difference. Whether it's turning off the tap, reducing your shower time or monitoring water use on-farm or in a vegetable garden we all have a part to play in managing this precious resource. By gaining a better understanding of where our water comes from, its value and how it's used, we are better equipped to make informed decisions.

Much like the management of water, the development of this resource has been a collaborative effort. I'd like to thank all those who have contributed their time and expertise, including district councils across the Region and staff within Horizons. Thanks must also be given to you as a teacher. As you work to educate the next generation of water users, we hope you too will take the time to reflect on your water use at home and at school.

I am confident you will find our staff knowledgeable, helpful and easy to work with and I encourage you to get in touch should you require further assistance or advice. I wish you all the best as you embark on this journey into water conservation with your students.

Michael McCartney

Chief Executive

Horizons Regional Council

Contents

Friendly whio

Keep an eye out throughout the resource for our cartoon whio (blue duck). Whio are only found in New Zealand and are considered a taonga (treasured) species. They are a nationally vulnerable species facing a real risk of becoming extinct. Whio live in one of the most challenging environments in the world – a fast flowing river! They cannot live in just any old waterway though; they need fast-flowing, clean water with well planted banks and lots of underwater insects to eat.

These unique birds have some special features to help them survive in their natural environment, including: big, webbed feet for swimming in the rapids; a thick upper lip to allow them to scrape off insect larvae; and camouflaged to look just like a rock.

An introduction

Kura Kaitiaki promotes kaitiakitanga (guardianship) through water conservation. We are the honoured guardians of our precious treasures (wai) and divine law (water conservation).

Overall purpose

Kura Kaitiaki: Water Conservation is a resource which comprehensively explores the issues associated with using tap water. Its guided approach allows even inexperienced teachers of Environmental Education/Education for Sustainability to teach the concepts of water conservation and environmental action. The resource encourages students to understand where their tap water comes from and make informed decisions about how they use it.

How to use this resource

This resource covers the curriculum areas of Science, Social Science, Health and Technology. Mathematics and English objectives are also included in many activities. The resource can be taught throughout your timetable and over several subject areas.

If you are limited for time you can select activities. Ideally the resource should be taught in full for maximum comprehension of the concepts involved.

All internet links are interactive in the PDF document. Simply click on the link to open in your internet browser. All links were correct and working at time of publication.

Structure and content of the resource

The Kura Kaitiaki: Water Conservation resource is comprised of four sections:

Section One: Water as a resource

This section examines the students' knowledge and experiences with water. Students gain an understanding that water is a precious resource. Differences in water use around the world are also investigated.

Section Two: The water cycle

This section includes activities based around the natural water cycle and how water changes state and moves around the environment.

Section Three: How much water are we using?

Students measure how much water is used at school on a daily basis and explore how it is used.

Section Four: Making change

This section provides students with an opportunity to use their new knowledge and understanding to make informed decisions about how they use water. Students identify the priorities for change and organise action for the environment to reduce their use of tap water.

The New Zealand Curriculum (NZC)

Each activity in this resource has a curriculum link to at least one of the learning areas. Suggested success criteria are also given. Teachers can adjust these according to the needs and abilities of their students. As well as clear links to specific learning areas, the resource also incorporates the Values, Key Competencies and Principles from the current NZC. Particular emphasis is placed on the following values: ecological sustainability, innovation, curiosity, inquiry, equity, community and participation.

Timing for activities

Each activity is designed to take approximately 45 minutes, unless otherwise stated.

Level of activities

Although the resource is designed for year 5-8 students, it is aimed primarily at year 6-7 students. Every attempt has been made to cater for a range of abilities and levels within each activity. If using the activities with year 5 or year 8 students, you may need to adapt the learning intentions, success criteria and learning experiences to better suit your students' requirements.

Teaching and learning approach

Education for Sustainability (EfS)/Environmental Education

The resource aligns with current thinking and effective pedagogy for Education for Sustainability (EfS). Sustainability is a significant theme throughout the NZC interwoven throughout its Vision, Principles, Values, Key Competencies, and Learning Areas. The development of the NZC and its appreciation of sustainability was largely informed by the Guidelines for Environmental Education in New Zealand Schools (1999). The Guidelines continue to provide useful support for sustainability in teaching.

Kura Kaitiaki: Water Conservation is based on a framework for developing action competence produced through a Teaching and Learning Research Initiative project and used in the NZC. This framework suggests how students and teachers can develop action competence through working together. It describes six aspects that support action competence and that develop the key competencies of the NZC. They are: experience, reflection, knowledge, visions for a sustainable future, action-taking for responsibility, and connectedness.

For further information see:
http://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability
and
http://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability/Tools-and-resources/Guidelines-for-Environmental-Education-in-New-Zealand-Schools

Education for Sustainability concepts

Central concepts that students can develop understanding of through EfS include:

Sustainability - The ability of individuals, groups, and communities to meet their needs and aspirations without compromising the ability of future generations to meet theirs.

Equity - Respect for all life, social justice, intergenerational equity, finite resources.

Interdependence - Biodiversity, community, cultural diversity, democracy, globalisation.

Responsibility for action - Taking action, informed decision-making, citizenship, consumerism, enterprise, resilience, and regeneration.

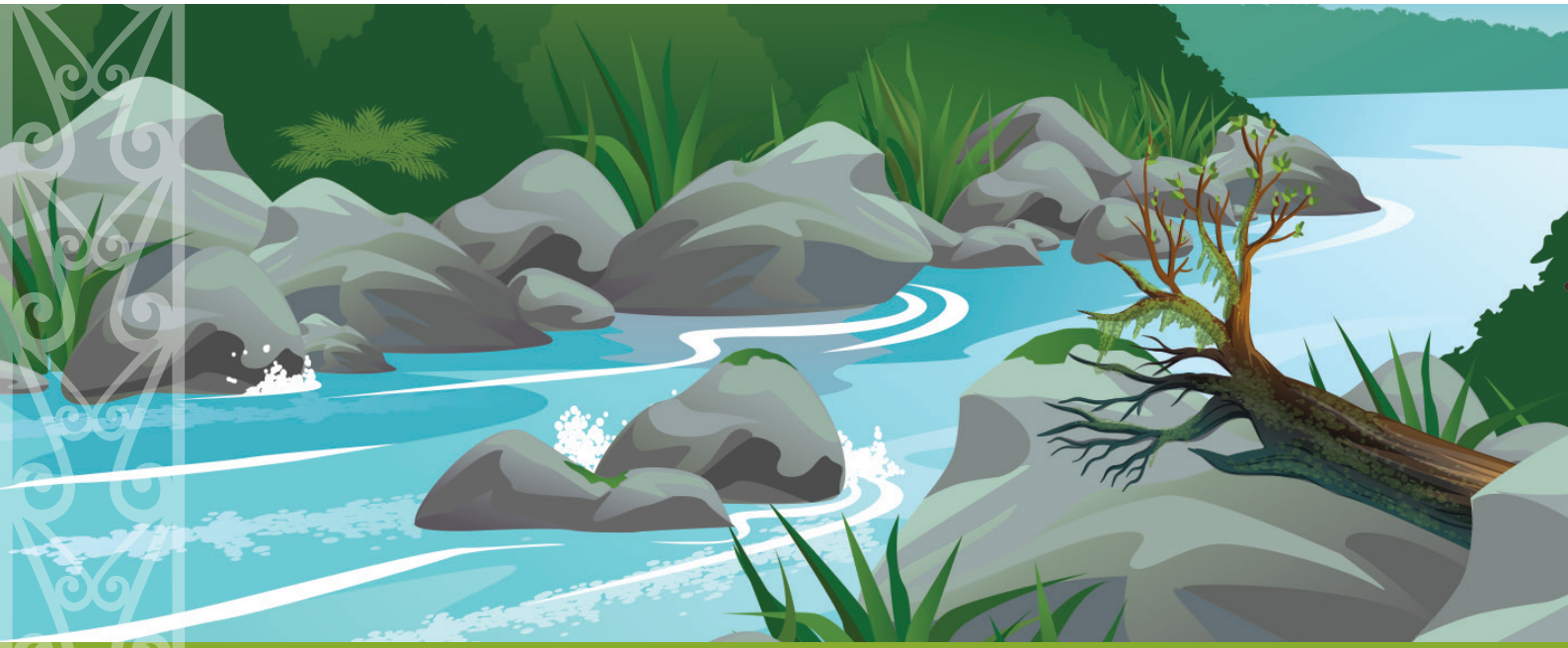
Curriculum links

	L3	L4
Science	**Planet Earth and Beyond** **Earth systems** Appreciate that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources. **Interacting systems** Investigate the water cycle and its effect on climate, landforms, and life.	**Planet Earth and Beyond** **Earth systems** Develop an understanding that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources. **Interacting systems** Investigate the water cycle and its effect on climate, landforms, and life.
	Nature of Science **Investigating in science** Build on prior experiences, working together to share and examine their own and others' knowledge. Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations. **Participating and contributing** Use their growing science knowledge when considering issues of concern to them. Explore various aspects of an issue and make decisions about possible actions.	
Social Sciences	**Social Studies** Understand how people view and use places differently. Understand how people make decisions about access to and use of resources.	**Social Studies** Understand that events have causes effects. Understand how producers and consumers exercise their rights and meet their responsibilities. Understand how people participate individually and collectively in response to community challenges.
Mathematics and Statistics	**Statistics** **Statistical investigation** Conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions; identifying patterns and trends in context, within and between data sets.	**Statistics** **Statistical investigation** Plan and conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships, and trends.
	Geometry and Measurement **Measurement** Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. **Shape** Represent objects with drawings and models.	**Geometry and Measurement** **Measurement** Use appropriate scales, devices, and metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time.
Health and Physical Education	**Personal Health and Physical Development** **Safety management** Identify risks and their causes and describe safe practices to manage these.	**Personal Health and Physical Development** **Safety management** Access and use information to make and action safe choices in a range of contexts.
	Healthy Communities and Environments **People and the environment** Plan and implement a programme to enhance an identified social or physical aspect of their classroom or school environment.	

	L3	L4
Technology	**Technological Practice** **Planning for practice** Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making. **Brief development** Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome. **Outcome development and evaluation** Investigate a context to develop ideas for potential outcomes. Evaluate these against the identified attributes to select and develop an outcome. Evaluate the outcome in terms of the need or opportunity.	**Technological Practice** **Planning for practice** Undertake planning that includes reviewing the effectiveness of past actions and resourcing, exploring implications for future actions and accessing of resources, and consideration of stakeholder feedback, to enable the development of an outcome. **Brief development** Justify the nature of an intended outcome in relation to the need or opportunity. Describe the key attributes identified in stakeholder feedback, which will inform the development of an outcome and its evaluation. **Outcome development and evaluation** Investigate a context to develop ideas for feasible outcomes. Undertake functional modelling that takes account of stakeholder feedback in order to select and develop the outcome that best addresses the key attributes. Incorporation stakeholder feedback, evaluate the outcome's fitness for purpose in terms of how well it addresses the need or opportunity.
	Nature of Technology **Characteristics of technology** Understand how society and environments impact on and are influenced by technology in historical and contemporary contexts and that technological knowledge is validated by successful function.	**Nature of Technology** **Characteristics of technology** Understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines.
English	**Listening, Reading, and Viewing** **Processes and strategies** Integrate sources of information, processes, and strategies with developing confidence to identify, and express ideas. **Ideas** Show a developing understanding of ideas within, across, and beyond texts.	**Listening, Reading, and Viewing** **Processes and strategies** Integrate sources of information, processes, and strategies confidently to identify, form, and express ideas. **Ideas** Show an increasing understanding of ideas within, across, and beyond texts.
	Speaking, Writing, and Presenting **Processes and strategies** Integrate sources of information, processes, and strategies with developing confidence to identify, and express ideas. **Ideas** Select, form, and communicate ideas on a range of topics.	**Speaking, Writing, and Presenting** **Processes and strategies** Integrate sources of information, processes, and strategies confidently to identify, form, and express ideas. **Ideas** Select, develop, and communicate ideas on a range of topics.

Water as a resource

SECTION 1



This section examines the students' knowledge and experiences with water. Students gain an understanding that water is a precious resource. Differences in water use around the world are also investigated.

Section 1: Water as a resource

PURPOSE

The purpose of this section is to help students to:

- Understand that water is a precious resource (taonga) that we all must look after for the future.
- Explore how they interact with water in their daily lives and learn how others use water.
- Be motivated to learn about water conservation and the global water situation.

Overarching concepts for Section 1:

- Fresh water is a limited resource.
- Water is important to everyone in lots of different ways.
- How we choose to use water has an effect on the world we live in.

Learning experiences	Learning intentions Students will:	Curriculum links	Content
1. A precious taonga	• Understand that fresh water is a precious natural resource.	**Science: Level 3 (and 4)** **Planet Earth and Beyond** *Earth systems* **Nature of Science** *Investigating in science* **English: Level 3 (and 4)** **Listening, Reading, and Viewing** *Processes and strategies* **Speaking, Writing, and Presenting** *Processes and strategies*	Photocards about the importance of waters as a taonga (a precious treasure).
2. Water in pictures	• Identify the different ways that people view and use water. • Recognise that water resources can be found in nature in a variety of forms.	**Social Sciences: Level 3** **Social Studies** **Science: Level 3 (and 4)** **Planet Earth and Beyond** *Earth systems* **Nature of Science** *Investigating in science* **English: Level 3 (and 4)** **Listening, Reading, and Viewing** *Processes and strategies* **Speaking, Writing, and Presenting** *Processes and strategies*	View a set of photos about water use and water in the environment. Discuss and group them.
3. Water in our lives	• Recognise that in different situations, people use and think about water differently. • Understand that as water consumers, we all have a responsibility to use water carefully.	**Social Sciences: Level 3** **Social Studies** **Social Sciences: Level 4** **Social Studies** **English: Level 3 (and 4)** **Listening, Reading, and Viewing** *Processes and strategies* *Ideas* **Speaking, Writing, and Presenting** *Processes and strategies* *Ideas*	Read a series of case studies about how children from other countries use water and compare to their own water use.
4. Water everywhere	• Recognise that there are limited resources of fresh water on Earth. • Understand that only a small proportion of fresh water on Earth is easily available for us to use.	**Science: Level 3 (and 4)** **Planet Earth and Beyond** *Earth systems* *Interacting systems* **Nature of Science** *Investigating in science* **Mathematics and Statistics: Level 3 (and 4)** **Geometry and Measurement** *Measurement*	Demonstration of fresh water as a proportion of water on Earth.

1:1 A precious taonga – teacher notes

Curriculum links

Science: Level 3 (and 4)

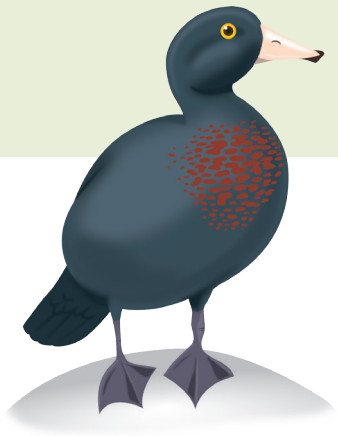
Planet Earth and Beyond
Earth systems
Appreciate that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources.

Nature of Science
Investigating in science
Build on prior experiences, working together to share and examine their own and others' knowledge.

English: Level 3 (and 4)

Listening, Reading, and Viewing
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Speaking, Writing, and Presenting
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.



Background knowledge

Water is a limited resource that we often take for granted here in New Zealand. Even though we have a relatively plentiful supply of water, it is often not used as wisely as it should be. The photocards aim to express the importance of water in our lives and the value of water to us all.

Water is a renewable resource. It replenishes with rainfall and is changed by the processes it goes through in the water cycle. Competition for the water available to us increases as time goes on.

In a Māori world view, the Earth is a living entity. Papatūānuku (the Earth mother) is both our ancestor and our provider. People are descended from her through the atua. The atua are part of, as well as guardians (kaitiaki) for, the environment and, as descendants of the atua, people are part of the environment. Water being part of that environment, we are water and water is us (this is also true in a scientific world view where humans are 70% water).

Tangaroa

Tangaroa is one of the descendants of Papatūānuku (the Earth mother) and Ranginui (the sky father). Tangaroa is the atua of the sea, rivers, lakes and all life within them. Water is Tangaroa's domain.

Mauri

As part of this living system, water has its own mauri (energy or life-force). Some students may have witnessed this energy in a fast flowing river or in the tranquil beauty of a deep pool.

Taonga

A taonga is a heartfelt treasure of immense value. There are times when a taonga can be an item, for example, something handed down through generations (taonga tuku iho), but a taonga can also be an idea or sometimes a person. A taonga is viewed and valued by others in a special way. If we respect and value water, and feel our connection with it as a part of the environment, then we must be responsible to care for it. We need to look after Earth's resources in a sustainable way to ensure her gifts remain for future generations. We need to think of water (and Earth's other gifts) as taonga.

1:1 A precious taonga – learning experience

Learning experience

- Share the learning intention and success criteria.
- Ask the students if they understand what is meant by a 'taonga'. Explain that a taonga is a 'heartfelt treasure of immeasurable value'. Water is very important and has many functions in our environment. Explain that water is seen by Māori as a taonga that must be looked after and respected.
- Use the photocards and go through each using the teacher notes on the reverse side. Ask students to record their ideas about the photocards as they are displayed. This could be done using a **KWL chart:**
  K = what you already **know** about water?
  W = what you **want** to know?
  L = what did you **learn**?
- Allow time for discussion and questions focussing on the students' own ideas about water.
- Share ideas about why water is a precious taonga/ natural resource. This could be a discussion or students could produce a piece of artwork to reflect their thoughts and feelings. As an extension, students could create their own presentations about water. Encourage students to explore and discuss their ideas in a way that works for them and for you.

Reflection questions

- Why is fresh water important to people?
  We need to drink water to survive.
- What do you think it might mean to say that water has 'mauri'?
  (see teacher notes)
- Why should we use fresh water wisely?
  It is necessary to have a continuous supply for our survival.

Vocabulary

- taonga
- Tangaroa
- Papatūānuku
- mauri
- immeasurable

Learning intentions

Students will:

Understand that water is a precious natural resource.

Success criteria

Students can:

Express their understanding of why water is a precious resource.

Resources

1:1 Photocards:
A precious taonga

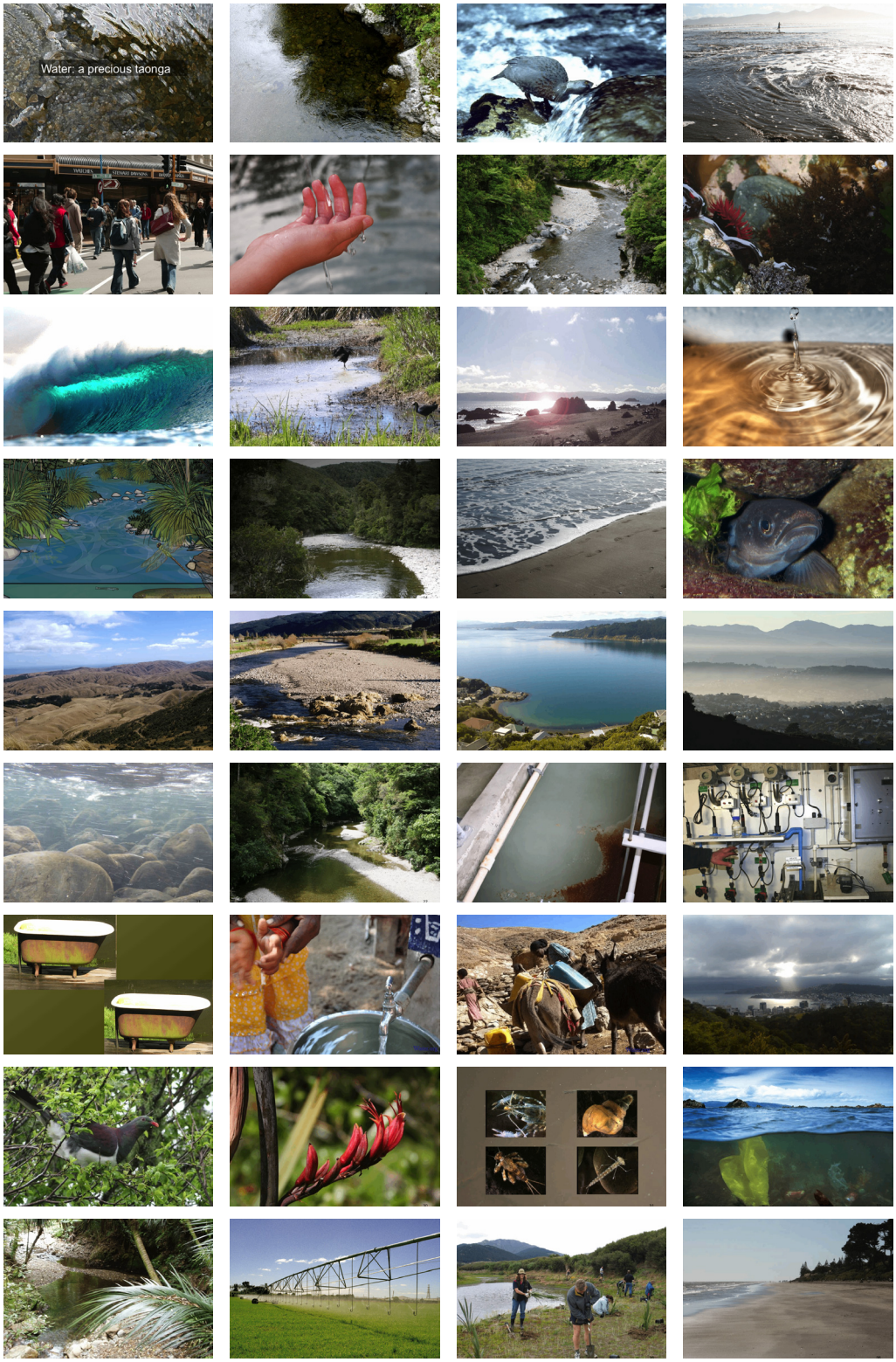
Set of 36

Education for Sustainability concepts

Interdependence/ Whanaungatanga:
Everything and everyone in our world is connected.

Responsibility for action/Kaitiakitanga:
If we want to use taonga, we must look after that taonga.

1:1 A precious taonga – photocards outline



1:2 Water in pictures – teacher notes

Background knowledge

These pictures depict water in the natural environment and people's interaction with water. We all interact with water daily, in a variety of ways. This activity aims to enable students to reflect on their own experiences with water and to share them with others.

Description of the water in pictures photocards

Photo No.	Description	Possible grouping*
1	Snow	1
2	Cow drinking	4
3	Swamp forest	1
4	Waterfall	1
5	Waterskiing	2
6	Drinking fountain	4
7	Mist	1
8	Bottled water	4
9	Water droplet/rain	1
10	Rainwater tank	4
11	Water slide	2
12	Girl in pool	2
13	Bucket fountain	2
14	Kayaks on a river	2
15	Fishing	2
16	Dishwasher	3
17	Washing machine	3
18	Toilet	3
19	Sprinkler in garden	3
20	Cleaning teeth	3
21	Washing hands	3
22	Water trough	5
23	Longfin eel	5
24	Dam	1

*These possible groups are a guide only and are not intended to be the only way to group the photocards. Encourage your students to have their own grouping and to be able to justify their choices.

Photos may be sorted into groups which may include some of the following categories:

1. Water in nature/water as a natural resource
2. Water for recreation
3. Water uses in the home e.g. cleaning, washing
4. Water for drinking
5. Water for plants and animals

Curriculum links

Social Sciences: Level 3

Social Studies

Understand how people view and use places differently.

Science: Level 3 (and 4)

Planet Earth and Beyond

Earth systems

Appreciate that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources.

Nature of Science

Investigating in science

Build on prior experiences, working together to share and examine their own and others' knowledge.

English: Level 3 (and 4)

Listening, Reading, and Viewing

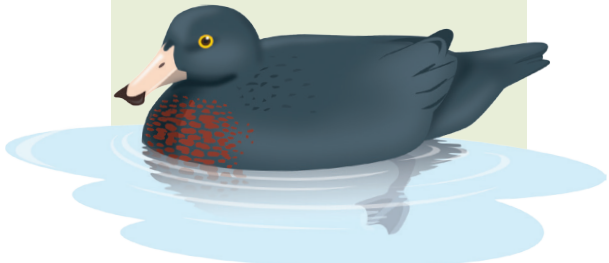
Processes and strategies

Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Speaking, Writing, and Presenting

Investigating in science

Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.



1:2 Water in pictures – photocards outline


1. Snow


2. Cow drinking


3. Swamp forest


4. Waterfall


5. Waterskiing


6. Drinking fountain


7. Mist


8. Bottled water


9. Water droplet/rain

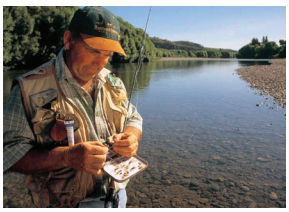

10. Rainwater tank


11. Water slide


12. Girl in pool


13. Bucket fountain


14. Kayaks on a river


15. Fishing


16. Dishwasher


17. Washing machine


18. Toilet

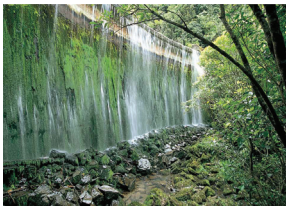

19. Sprinkler in garden


20. Cleaning teeth


21. Washing hands


22. Water trough


23. Longfin eel


24. Dam

1:2 Water in pictures – learning experience

Learning experience

This activity can be done as a whole class or in groups:

- Distribute photocards to students. Students without photocards can be the group leaders. Discuss the learning intentions and suggest that the grouping should include both water in nature and the ways that people use water.
- Group leaders can invent a title for a category after looking at the photocards. When each group leader has a different category title, each card can be discussed one by one, and grouped (together as a class) into categories.
- Students with a photocard can come to the front of the classroom. They can share which category they believe their card belongs to and give reasons. The rest of the class can agree or give alternatives.
- Display cards along with category titles.
- Discuss how students have seen people/animals use water in the photos. Students can then share their own experiences of water use and compare them to the people depicted in the photocards.
- As a class, use the previous discussions to create some generalised statements about how people use water, acknowledging how water is important to different people in different ways. Record ideas.
- Start a list of questions students have about what they have seen in the photos. These questions could lead to an inquiry if you prefer this approach.

Alternatively, you could allow small groups to sort cards themselves and assign categories, while the others work on an alternate task.

Reflection questions

- What ideas about water were there in the photos that you had not thought about before?
  Answers will vary.
- What things did other people notice that didn't initially stand out for you? Why do you think this is?
  Answers will vary.
- How do you use water differently to your classmates?
  Answers will vary.

Vocabulary

Start a vocabulary list of interesting words and concepts that come up during the discussion.

Learning intentions

Students will:
Identify the different ways that people view and use water.

Recognise that water resources can be found in nature in a variety of forms.

Success criteria

Students can:
Describe and categorise how people are using water in the photos.

Describe water resources in nature.

Resources

1:2 Photocards: Water in pictures.

Set of 24

Education for Sustainability concepts

Responsibility for action/ Kaitiakitanga:
If we want to use taonga, we must look after that taonga.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

1:3 Water in our lives – teacher notes

Curriculum links

Social Sciences: Level 3

Social Studies
Understand how people make decisions about access to and use of resources.

Social Science: Level 4

Social Studies
Understand how producers and consumers exercise their rights and meet their responsibilities.

English: Level 3 (and 4)

Listening, Reading, and Viewing
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas
Show a developing understanding of ideas within, across, and beyond texts.

Speaking, Writing, and Presenting
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas
Select, form, and communicate ideas on a range of topics.

Background knowledge

The global situation
Over the last 300 years, the world's population has increased by seven times, but the amount of water we use has increased 35 times[1]. We use fresh water for more things than ever before. This has meant that fresh water supplies are becoming depleted in many parts of the world.

One in every 10 people and one third of all schools in the world lack access to clean, safe water[2]. Often there is adequate rainfall or other water sources to provide water for the people of these countries, but they lack the infrastructure to get the water to the people.

This activity may take longer than 45 minutes depending on how you choose to run it, and how indepth the students get. It can also lead to an inquiry if you prefer this approach.

Fast facts[3]

- 50L: Recommended minimum amount of water per person per day to meet basic water needs.
- 95L: Half the world's population uses this much per person per day.
- 200L plus: People in industrialised countries (like New Zealand) use more than 200L per person per day.
- 10L: People in water-stressed countries use less than this per person per day.

[1] http://telstar.ote.cmu.edu/environ/m3/s4/cycleHydro.shtml
[2] http://water.org/learn-about-the-water-crisis/facts/
[3] http://watermatters.worldvision.org.nz/sections/watermatters/quest2.aspx

1:3 Water in our lives – learning experience

Country	Average water used per person per day	Case study synopsis
Ethiopia **1:3c**	15L /day[3]	Ayana lives in southern Ethiopia. There is no water supply for her family so they source their water from wells and ponds.
Israel **1:3d**	135L/day[4]	Ori lives in Jerusalem, Israel. He is very careful with water and uses it wisely.
Australia **1:3b**	285L/day[5]	Oliver lives in Brisbane, Australia. He and his family have ongoing water restrictions which mean they must be careful with their water.

An average family in New Zealand uses between 250-300L of water per person per day.[7]

Resources

1:3a Water use in different countries

1:3b Water use: Brisbane, Australia

1:3c Water use: Southern Ethiopia

1:3d Water use: Jerusalem, Israel

"Don't waste the water!" by Jill Macgregor

4 http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757
5 http://www.okwaterwise.ca/learn-go.html
6 https://www.scribd.com/document/98507670/Water-in-Australia
7 http://www.nrc.govt.nz/Environment/Water/Take-action/Saving-water/

1:3 Water in our lives – learning experience

Learning intentions

Students will:
Recognise that in different situations, people use and think about water differently.

Understand that as water consumers, we all have a responsibility to use water carefully.

Success criteria

Students can:
Compare their water use with people from other countries and give reasons for any differences.

Give reasons why we have a responsibility to use water wisely.

Education for Sustainability concepts

Interdependence/ Whanaungatanga:
Everything and everyone in our world is connected.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Equity:
Respect for all life, social justice, intergenerational equity, finite resources.

Learning experience

This activity is based on the English and Social Sciences curriculum. It could be completed during a reading session.

- Share the learning intentions and success criteria.
- View pictures, a slideshow, or stories about how children from elsewhere in the world use water.

E.g. http://environment.nationalgeographic.com/environment/photos/drinking-water/ or Jill Macgregor's story "Don't waste the water!"

- Explain that students will now read case studies of how other children around the world collect and use water.
- Hand out copies of the different case studies *(1:3b, 1:3c and 1:3d)* to the students.
- Ask the students, working in pairs or groups, to read the story they have been given and complete *1:3a: Water use in different countries.* Ask them to be prepared to summarise their case study for others.
- When they have completed 1:3a, invite individual students or pairs to join with others who read a different case study. Ask each person/group to summarise the case study they read for the other group and compare their answers for each question.
- Discuss their findings as a class.

As an extension, students could take on the role of the child in their case study and present a brief role play about water use in that country. Visit http://watermatters.worldvision.org.nz/ for more extension ideas.
Alternatively each case study can be done together as a class.

Reflection questions

- Of the three situations shown in these case studies, who had to be most careful with water? Why?
  Ayana in Ethiopia, because water was the hardest to come by. Answers will vary, the discussion is the important part.
- In each case, how much water do you think the family in the story use compared to your family?
  Answers will vary.
- Do you think that we use a lot of water compared to people in other countries?
  Reveal the statistics on water use in each country from teacher notes.

Vocabulary

- waterhole
- responsibility
- consumer
- showerhead
- efficient
- conserve

1:3a Water use in different countries

Questions	Country: Israel/Ethiopia/Australia (circle which case study you read)
1. How did they get the water they used?	
2. How did they use water in their homes?	
3. Explain how they use water in the same ways that you do in your own home.	
4. How do they save fresh water?	
5. Do they value water? Why/why not?	
6. Do you have a responsibility to use water wisely? Why/why not?	

1:3a Example responses

Questions	Israel	Ethiopia	Australia
1. How did they get the water they used?	From their taps. It is piped from Lake Kinneret.	From a waterhole, pond or well.	From their taps.
2. How did they use water in their homes?	Drinking, cooking washing hands: by pouring water over hands using a cup. Brushing teeth: using a cup to hold the water. Washing dishes: using a cloth to wipe the dishes before they wash them.	Drinking, cooking, washing dishes.	Drinking, cooking, washing dishes, washing clothes, showering, flushing the toilet.
3. Explain how they use water in the same ways that you do in your own home.	Answers will vary, but generally; drinking and cooking.	Also possibly washing dishes/showering.	
4. How do they save fresh water?	Showering: Water efficient shower head. They soap themselves while the water is off. They use water in a cup for brushing teeth and washing hands. They have tap aerators. No baths. Water garden with recycled water.	Cleaning themselves: instead of showering they wipe themselves with a cloth. Brushing teeth: They used a stick so that it didn't use water (not recommended for NZ students). They mixed water with milk for drinking to make it go further.	Showering: They had 4 minute showers with a timer. Water efficient appliances and shower head. Greywater recycling. Scraped plates and soaked pots before washing dishes. Use the half flush on the toilet. Fix leaks.
5. Do they value water? Why/why not?	Water is very precious to people in Israel. They have much less rain than NZ so they are very careful with water.	Very little water is used or wasted because it is so hard to get.	People in Australia are generally very careful with water because they have frequent droughts and restrictions.
6. Do you have a responsibility to use water wisely? Why/ why not?	Yes we do. Because water is a limited, valuable resource. It takes time, energy and money to bring water from water collection areas to our taps so we should use it carefully and thoughtfully. Answers will vary, encourage discussion.		

1:3b Water use 1

Brisbane, Australia; Oliver and his family

Getting their water

Oliver lives in Brisbane, Australia. There are taps in several rooms in Oliver's house and water is freely available to him when he needs it. He has water delivered to his house through a network of pipes. The water comes from several dams. It is treated and then pipes deliver the water to people in the city. Water is easy for Oliver to get, but he is very careful with it.

Water conservation

Oliver's family understand that water is not to be taken for granted because in the last few years there have been several droughts in Brisbane and water had to be carefully conserved. Everyone had to stop and think about how they used water. They have made many changes to their lifestyle to save water. After the last drought they bought a water efficient washing machine. They wait until the washing machine is full to do a load of washing so that water is used efficiently.

Saving water at home

The family time their showers with an egg timer. When Oliver gets in the shower he sets the timer for four minutes. When the timer goes off he gets out.

They have a water recycling system which collects the wastewater that is discharged from the laundry, bath, shower, and hand basins. This 'greywater' is treated and then used to flush the toilet and water the garden.

Their toilet has a dual flush system. Oliver uses the half flush button because it uses less water. When they are doing the dishes, the family scrape dirty plates and soak pots instead of rinsing them with water. They wait until the dishwasher is full before turning it on.

Water shortages

When the weather is dry, the water levels in the dams drop and the council informs the public how they can use water and how much they are allowed to use. Water use per person per day is measured and reported every day in the newspaper.

Because people in Brisbane never know when the next big downpour of rain will come, they are careful with water. By doing small things to save water, they work together and make sure there is enough water for everyone.

Brisbane, Australia - New Zealand

1:3c Water use 2

Southern Ethiopia; Ayana and her family

Water is difficult to come by in parts of Ethiopia for most of the year. In the dry season from October to February, there is very little rainfall. In small villages like the one that Ayana lives in there is no way of storing fresh water or treating it to keep it fresh.

Everyone in the community spends many hours a day getting the water they need for their daily lives.

Collecting water

Ayana and her mother start the day early and walk to the waterhole an hour and a half away. They carry the water back home using donkeys. They use the water they collect for washing and cooking. They go to the waterhole again in the afternoon, to collect more water. They must line up for water when they get to the well and people who live nearby get the first priority. This is where they collect water for their animals.

Sometimes Ayana and her mother take so long to get their water that she doesn't make it to school. When she is able to go to school, Ayana finds it difficult to keep up because she is away so much. Others in the class are in the same situation.

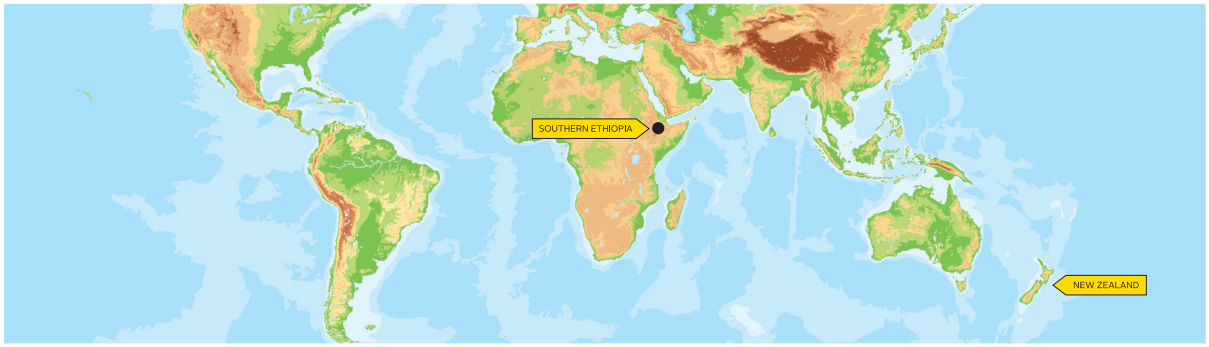
Using water at home

There are no showers where Ayana lives, so to clean herself she uses some water to wipe her body with a cloth. She brushes her teeth with a special stick and doesn't use water. Ayana is very careful with water and doesn't use much.

The water that she drinks must be boiled first otherwise it could make her sick. Ayana likes to add cow's milk to water and drink it. This makes the water go further. She cooks maize every day with her mother. It is difficult to grow any food because there is so little rain. So instead of growing food, they buy corn to eat.

Water shortages

In the dry season, water is even harder to find. There are deep wells, far away, for getting water when the ponds dry up. People bring the water up from the wells and fill troughs and buckets. It takes many people and a lot of effort. In the rainy season, water falls in ponds closer to their house and life is easier.



Southern Ethiopia - New Zealand

1:3d Water use 3

Jerusalem, Israel; Ori and his family

Ori lives in Jerusalem, Israel. Israel is a dry country, with very little rain and few water resources.

Getting their water

The water in homes in Jerusalem is piped from a great lake in the north called Lake Kinneret. It doesn't often rain in Israel, and there is no rain at all in the hottest months of the year. For this reason, Ori and his community respect and value the water that they are given and are very careful with water.

Using water at home

Ori's family have special attachments on their taps to add air to the water to make it go further. When they wash their dishes they spray each dish with water and then cover them with detergent. They then rinse the detergent off. This saves a lot of water.

Cleaning and bathing

Washing hands is done with a special cup which they use to pour water over their hands instead of using a tap. Using this method, very little water is wasted. Ori brushes his teeth with water from another cup. Ori's family have a small garden which is watered with the water they have recycled from their laundry waste water.

When Ori has a shower, he wets himself with water, turns the shower off, and then soaps himself. Then he turns the shower on again to rinse off the soap. His shower has a special water efficient showerhead which uses less water than a normal one. Ori never has a bath; in fact there is no bath in his house.

Drinking water

The water which comes from the tap is usually clean, but Ori's family buy bottled water to drink. The house has a water meter which is checked regularly. If the family use more water than they are allowed, they have to pay a lot of money. Everyone in the family does their part to save water.

Water shortages

When there is no rain people start to worry. Crops start to fail and the lake level drops. People start praying for rain. People in Jerusalem seldom waste water. Water is very precious to them.

Jerusalem, Israel - New Zealand

1:4 Water everywhere – teacher notes

Curriculum links

Science: Level 3 (and 4)

Planet Earth and Beyond

Earth systems

Appreciate that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources.

Interacting systems

Investigate the water cycle and its effect on climate, landforms, and life.

Nature of Science

Investigating in science

Build on prior experiences, working together to share and examine their own and others' knowledge.

Mathematics and Statistics: Level 3 (and 4)

Geometry and Measurement

Measurement

Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.

Background knowledge

Water resources on Earth

Water is everywhere in our world, but only a tiny proportion of this is fresh water that is suitable for drinking.

Of all the water on Earth, 97% is stored as salt water in the world's oceans. Salt water makes us sick if we drink it. Only 3% of the total water on Earth is fresh water. Unfortunately, not all fresh water is easy to access. The fresh water that comes to mind for most of us is surface water, such as lakes, rivers, and wetlands. But surface water makes up less than 1% of the fresh water on Earth. The majority of fresh water is in places that are very difficult to access, for example, underground (30%), in icecaps and glaciers (68%), or in water vapour (1%).

Fresh, available water is needed not just for humans but for all the plants and animals that live on Earth. One in 10 people in the world do not have access to fresh water and water doesn't fall or flow evenly across the whole world; think of rainforests vs deserts.

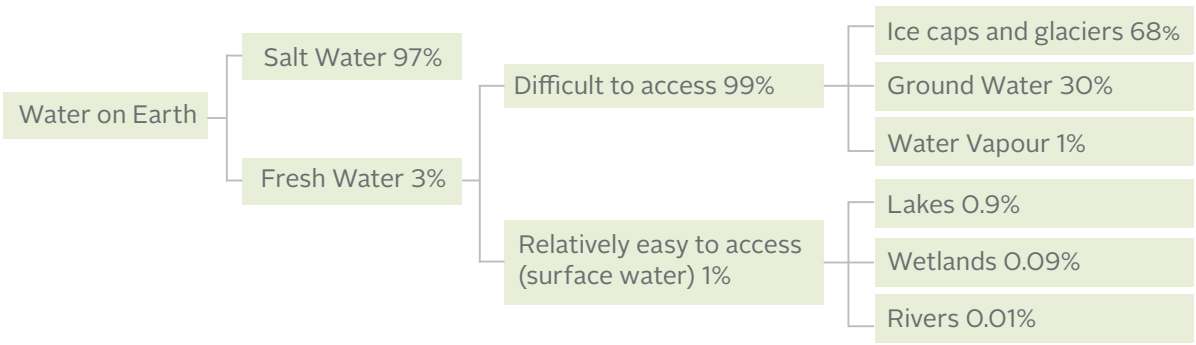
Why not use desalination to get fresh water from salt water?

Desalination (removing the salt from sea water for drinking) currently requires huge amounts of energy and is relatively more expensive than other systems. Intakes of water in the ocean often have negative effects on marine life. Desalination plants reduce important marine habitat for all kinds of animals.

The energy required to power a desalination plant also often causes greenhouse gas emissions and air pollution.

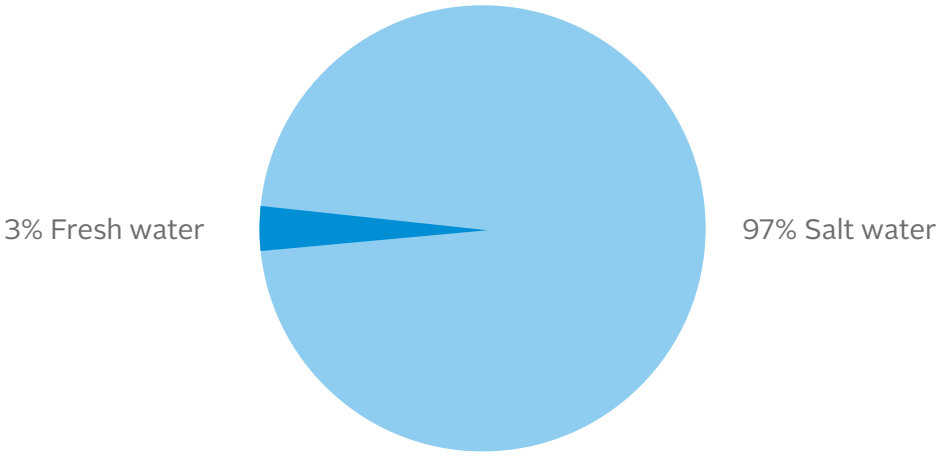
Salt is produced as a by-product of desalination and safe disposal of this is also a concern.

Information for the diagram below has been adapted from: http://ga.water.usgs.gov/edu/Earthwherewater.html

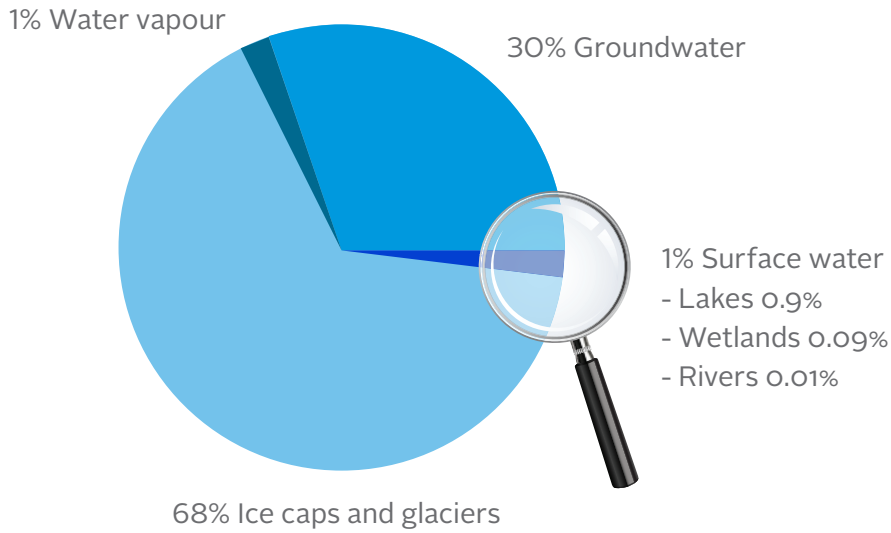


1:4a Water on Earth

Proportion of fresh water on Earth



The fresh water on Earth



1:4 Water everywhere – learning experience

Learning intentions

Students will:
Recognise that there are limited resources of fresh water on Earth. Understand that only a small proportion of fresh water on Earth is easily available for us to use.

Success criteria

Students can:
Describe the proportions of the different types of water on Earth.

Display the proportions of fresh water that are on Earth and describe which are easily available for drinking.

Resources

1:4a Water on Earth
A bucket or 10L container
A small cup (approx 200mls)
1 teaspoon (5mL)

Education for Sustainability concepts

Responsibility for action/ Kaitiakitanga:
If we want to use taonga, we must look after taonga.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Learning experience

- Introduce the learning intentions and success criteria.
- Show students a globe of the Earth. Ask students how much of the planet is covered by water. Explain that water covers approximately 70-75% of our planet.
- Ask students how much fresh water there is compared to salt water on Earth. Encourage discussion. Reveal that 97% of the water on Earth is salt water and only around 3% is fresh water.
- Work as a class to make a list of the places on Earth where fresh water is found (rivers, lakes, wetlands, snow, ice, glaciers, groundwater, rain etc).
- Working in small groups, students could order these places from the one that holds the most fresh water to the one that holds the least.
- Explain to the students that not all of this fresh water is readily available for drinking. As a class, brainstorm the sources of water that are readily available for drinking (surface water in rivers, lakes and wetlands). Discuss the sources that are not readily available for drinking, for example, salty water (the sea) or water that is difficult to access (snow, ice, glacier water, underground water). Carry out the following demonstration to indicate the true proportions of drinkable water.

The learning experience continues on the next page.

Demonstration: Water proportions on Earth

	Questions	Description
1	Fill a bucket with water.	This is all the water on Earth (including water in the air as rain or mist).
2	Ask a volunteer to take a small cup of water from the bucket. Set the bucket aside.	The water in the cup represents all the fresh water on Earth. The water left in the bucket represents the salt water that is in the oceans.
3	Ask a volunteer to take a teaspoon of water from the cup. Set the cup aside.	The water left in the cup represents fresh water that is difficult to get at (e.g. underground water or water frozen in glaciers/ice caps). The water in the teaspoon represents the remaining surface water and other fresh water.
4	Examine the water in the teaspoon.	Water left on the teaspoon represents fresh water that is easier to get at – water found in lakes, rivers, streams, rain.

Learning experience continued

- Explain that the amount of water used in the activity must be multiplied many millions of times to get the actual amounts involved.
- Hand out copies of 1:4a to share in small groups. Discuss the proportions of fresh water in different places on Earth.
- Explain that the surface water is the rivers, lakes, wetlands, streams, and rain and that this water is the only water that is relatively easy for us to access and use.
- Ask what this available fresh water is used for? Discuss. Refer to the previous learning experience (1:3 Water in our lives). We use water for making things, growing food, cleaning, washing, and drinking etc. As well as for people, this fresh water must also meet the needs of all plants and animals on Earth.

As an extension, students could represent the information in 1:4a: Water on Earth in a different format, for example, as pictograms or bar graphs.

Reflection questions

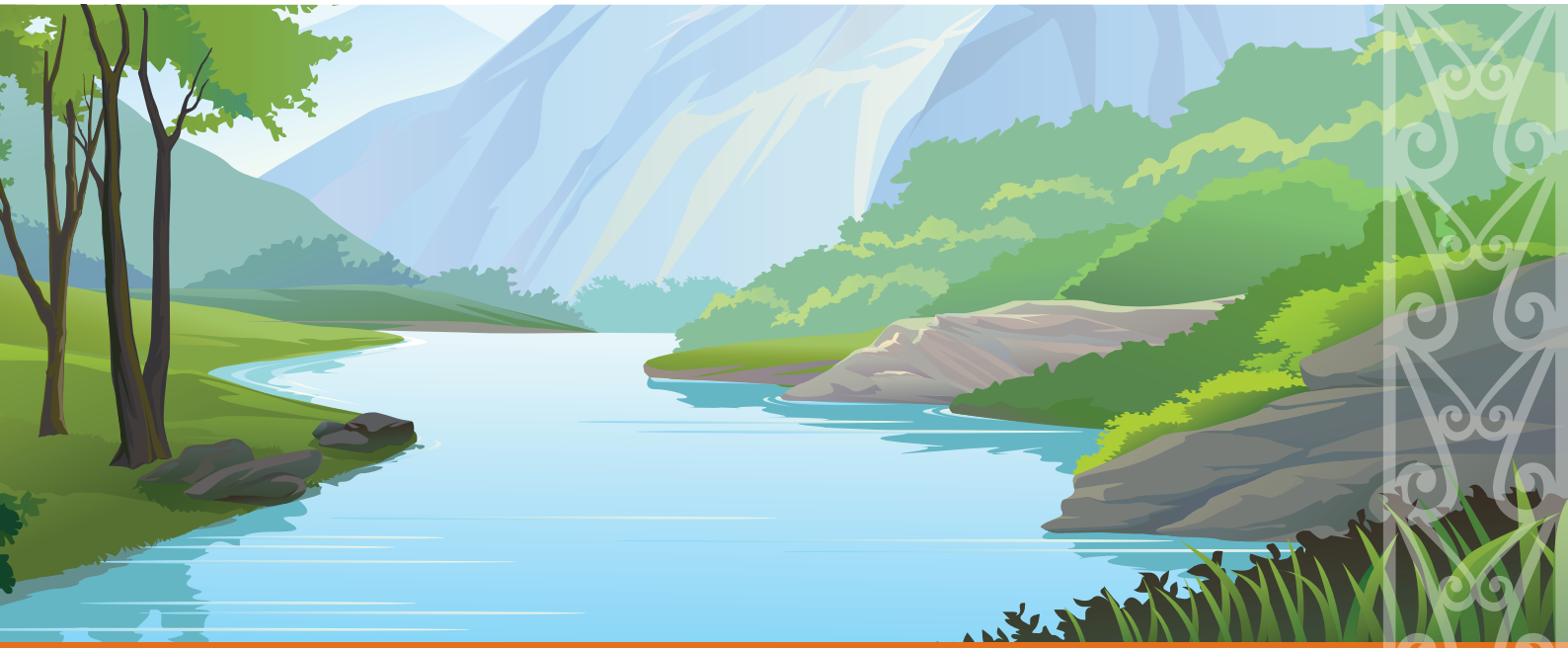
- Do you think that we have an unlimited supply of fresh water?
  Answers will vary. Encourage discussion, but explain that there is a limited amount of fresh water to meet the needs of all life on Earth; plants, animals, and humans.

Vocabulary

- proportions
- access/accessible
- inaccessible
- surface water
- ground water

The water cycle

SECTION 2



This section includes activities based around the natural water cycle and how water changes state and moves around the environment.

Section 2: The water cycle

PURPOSE

The purpose of this section is to help students to:

- Understand how water changes state (solid – liquid – gas).
- Understand that water moves around the planet in a cycle.
- Explore how water moves differently around a natural catchment compared to an urban catchment.

Overarching concepts for Section 2:

- Water naturally moves around the planet in a cycle, changing state as it goes.
- Our changes to the natural landscape affect how water moves around a catchment.

Learning experiences	Learning intentions Students will:	Curriculum links	Content
1. The natural water cycle	• Understand that water moves around the planet in a cycle. • Investigate water movement in a terrarium and relate this to water movement in the environment.	**Science: Level 3 (and 4)** **Planet Earth and Beyond** *Interacting systems* **Nature of Science** *Investigating in science*	Students set up a terrarium experiment to see the water cycle in action. They observe water changing state from liquid to gas and back again.
2. Changes in the movement of water	• Investigate how urban landscapes can alter the pathways of water. • Recognise that water behaves differently on permeable and impermeable surfaces.	**Science: Level 3 (and 4)** **Planet Earth and Beyond** *Interacting systems* **Nature of Science** *Investigating in science* *Participating and contributing*	Students examine water movement in natural and urban catchments. They investigate how water interacts with both impermeable and permeable surfaces.

2:1 The natural water cycle – teacher notes

Background knowledge

Water changing state
Water is the only substance on Earth that is found naturally as a solid (e.g. ice, snow, hail), liquid (e.g. water, rain), and a gas (e.g. water vapour, steam, fog, mist).

The natural water cycle
Water moves around the planet in a repeating cycle, changing state between a liquid, a gas, and a solid.

In the water cycle, the sun heats up liquid water on the Earth and causes it to become water vapour (a process called evaporation). The water vapour then rises in the air and, when it hits cold air higher up, it condenses into clouds (a process called condensation). When the clouds become too heavy, it falls to the Earth as rain/hail/snow (a process called precipitation).

Water movement in the water cycle
When water reaches the Earth as precipitation it can:

1. Evaporate directly from the ground/ocean/a water body.

2. Run-off to collect in water systems such as wetlands, lakes, creeks, streams, rivers or estuaries (making its way through these systems to the ocean where, over time, it will evaporate as the sun heats it).

3. Soak into the ground. From there it can follow a number of pathways. It can:

– be taken up by plants and trees through their roots, which eventually release it out into the atmosphere as water vapour (a process called transpiration).
– filter through the ground into a groundwater system.
– filter down into giant, underground, rock 'sponges' called aquifers. Water from aquifers re-enters water systems through springs or seepage into the ocean or by filtering back into waterways.

Water can also become solid ice or glaciers or end up in a thermal boiling pool. The options are almost endless!

The cycle continues as water evaporates and then precipitates back to Earth.

Curriculum links

Science: Level 3 (and 4)

Planet Earth and Beyond
Interacting systems
Investigate the water cycle and its effect on climate, landforms, and life.

Nature of Science
Investigating in science
Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.

2:1 The natural water cycle – learning experience

Learning intentions

Students will:
Understand that water moves around the planet in a cycle.

Investigate water movement in a terrarium and relate this to water movement in the environment.

Success criteria

Students can:
Explain how water moves in the water cycle.
Describe the movement of water in a terrarium and relate this to water movement in the environment.

Resources

Clear container e.g. jar/vase
Plastic wrap
Soil
Spray bottle/watering can
Several small plants
Rubber band
Poster: The Water Cycle

Education for Sustainability concepts

Interdependence/ Whanaungatanga:
Everything and everyone in our world is connected.

Learning experience

- Share learning intentions and success criteria.
- With the students, make a terrarium using listed resources. Explain that you will use the terrarium to show how water changes state and moves in the water cycle *(students could construct a terrarium as a homework activity if preferred).*
- Place soil in a vase or large jar. Plant several seedlings in the soil and water generously so that soil is wet to touch. Place plastic wrap on top of the vase/container and secure with a rubber band to prevent any moisture escaping.
- Set aside the terrarium while you discuss students' predictions. Ask students what they understand by 'the water cycle'. Explain that water moves in a cycle around the Earth, changing state as it goes. Ask what students understand by 'changing state' *(see teacher notes).*
- Display the poster 'The Water Cycle'. Discuss the stages of the water cycle on the poster; evaporation, precipitation, transpiration, condensation. Explain each process. Ask if students can find evidence of any of these stages of the water cycle in the terrarium.

  Students should be able to see evaporation as water vapour in or on the side of the container and condensation hanging as water droplets on plastic wrap after about 20 minutes. Precipitation is sometimes visible as water droplets very slowly making their way down the side of the container, or on leaves. After a few hours there should be large water droplets hanging from the plastic wrap and 'precipitation' will be more frequent and easier to observe.
- A few days later, if we take off the plastic wrap and feel the soil would it still be wet?

  Yes it would, because water in the terrarium is moving around in a cycle; changing state, but not escaping, as it does on Earth.
- Ask students to draw a diagram of the terrarium, labelling the states of water that they can see and where the processes of condensation, evaporation, precipitation and transpiration are occurring. Record observations over several days.

The learning experience continues on the next page.

Learning experience continued

- For an interactive and simple review of the water cycle and the associated vocabulary see: http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html
- For an animation about the water cycle, transpiration and run-off see: http://www.youtube.com/*watch?v=LBtOZAo2sr4*

As an extension, read Connected, Part 2, 2002: An interview with a glass of water. Find words to describe water as a solid, a liquid and a gas in the article.

Reflection questions

- Where do the processes of precipitation, evaporation, transpiration and condensation happen outside the terrarium?
  See teacher notes for examples. Encourage discussion.

Vocabulary

- state
- terrarium
- condensation
- evaporation
- precipitation
- transpiration

Example of a terranium

2:2 Changes in the movement of water
– teacher notes

Curriculum links

Science: Level 3 (and 4)

Planet Earth and Beyond
Interacting systems
Investigate the water cycle and its effect on climate, landforms, and life.

Nature of Science
Investigating in science
Build on prior experiences, working together to share and examine their own and others' knowledge.

Participating and contributing
Use their growing science knowledge when considering issues of concern to them.
Explore various aspects of an issue and make decisions about possible actions.

Answers to 2:2a

1. a) precipitation
   b) transpiration
   c) infiltration
   d) run-off
   e) infiltration
2. Answers will vary. More run-off, less transpiration, less infiltration, less water to groundwater.
3. Answers will vary. More impermeable surfaces, less trees, less permeable surfaces.

Background knowledge

Pathways of water
In a natural catchment covered with trees and vegetation, water will fall onto trees, plants or soil and be absorbed by them. Large amounts of water will seep into the ground in a natural environment (a process called infiltration), and be absorbed by plants. The majority of water in a natural, vegetated catchment passes through the groundwater system.

Impermeable surfaces
Impermeable surfaces will not let water through them. Many surfaces in urban environments are impermeable e.g. concrete, buildings and roads.

Permeable surfaces
Soil, bush, and grassed surfaces are permeable, letting water through them so that it can enter groundwater and aquifers.

Run-off
Run-off can be defined as rain that is not absorbed by the ground. Run-off flows overland into our rivers, streams and beaches.

Water movement in a natural and an urban catchment
In the poster "Water in Natural/Urban Catchments" an equal amount of rain falls in both the urban and natural catchments. The sizes of the arrows are based on proportions of each of the processes.

In the urban catchment, there are a lot of impermeable surfaces, so rain is mostly directed into the stormwater system or flows overland as run-off *(red arrows).*

In the natural catchment, much of the rain is taken up by vegetation and released into the atmosphere by transpiration *(pink arrows).* The remainder runs off into streams and rivers or filters into aquifers and groundwater through infiltration *(purple arrows).*

Is more run-off a problem in urban catchments?
Large amounts of run-off can cause flooding and erosion. Less infiltration can cause a depletion of groundwater supplies. Run-off flows down our driveways, footpaths, roads, and carparks into drains, taking debris and chemicals into drains, streams and rivers, and out to sea.

2:2 Changes in the movement of water
– learning experience

Learning experience

- Share the learning intentions and success criteria.
- Revise the concepts and vocabulary introduced in the previous activity. Discuss the concept of a catchment.
- Ask students what would happen to rain if the catchment in the poster 'The Water Cycle' was covered with houses and concrete.
  Rain would not soak into the ground. Encourage discussion.
- Introduce the word 'impermeable' and discuss the difference between permeable and impermeable surfaces *(see teacher notes).*
- Take a container of water onto a permeable surface (e.g. grass) and an impermeable surface (e.g. courts) in your school grounds. Tip water onto each surface and observe results. Discuss why water behaves differently on these two surfaces.
- Ask students to look at the two versions of water movement in a catchment shown on the poster 'Water Movement in Natural/Urban Catchments'. Explain what run-off and infiltration are *(see teacher notes).*
- In pairs, ask them to describe the differences they see between the two sides of the poster.
  One has lots of permeable surfaces (natural catchment), the other has lots of buildings/impermeable surfaces (urban catchment).
- Explain that the different arrows show the different pathways water can take when it rains. Encourage the students to notice that there is the same amount of rain falling on both catchments.
- Ask students where does the largest amount of water go in the natural catchment?
  Transpiration from plants (pink arrows).
- Where are the pink (transpiration) arrows in the urban catchment? These arrows are very small; Why is this?
  There are not many trees, therefore not much transpiration. Encourage discussion.
- Point out the aquifer in the natural catchment in the poster and explain how the water in a natural catchment filters down into the groundwater or aquifers *(see teacher notes)* and then out to sea.

The learning experience continues on the next page.

Learning intentions

Students will:
Investigate how urban landscapes can alter the pathways of water.

Recognise that water behaves differently on permeable and impermeable surfaces.

Success criteria

Students can:
Identify differences in the movement of water in urban catchments compared to natural catchments and give reasons for the differences.

Describe how water behaves on impermeable and permeable surfaces.

Resources

Poster: The Water Cycle

Poster: Water Movement in Natural/Urban Catchments

2:2a Water movement

Container of water

Learning experience continued

- Why do you think the red run-off arrows are so much larger in the urban catchment?
  Encourage discussion. There are a lot more hard (impermeable) surfaces in an urban catchment than a natural catchment. The water can't soak into the ground as much and a lot more of it runs off. To avoid flooding, we use stormwater drains to collect the water and direct it through underground pipes straight into streams and rivers.
- Ask the students to complete 2:2a. Discuss their answers *(see teacher notes).*

As an extension, find examples of impermeable surfaces in your school and observe water falling on them and how it is directed into drains. Students could also create a map of their school highlighting permeable and impermeable surfaces, stormwater drains, plants for transpiration, roofs and drainpipes etc.

Reflection questions

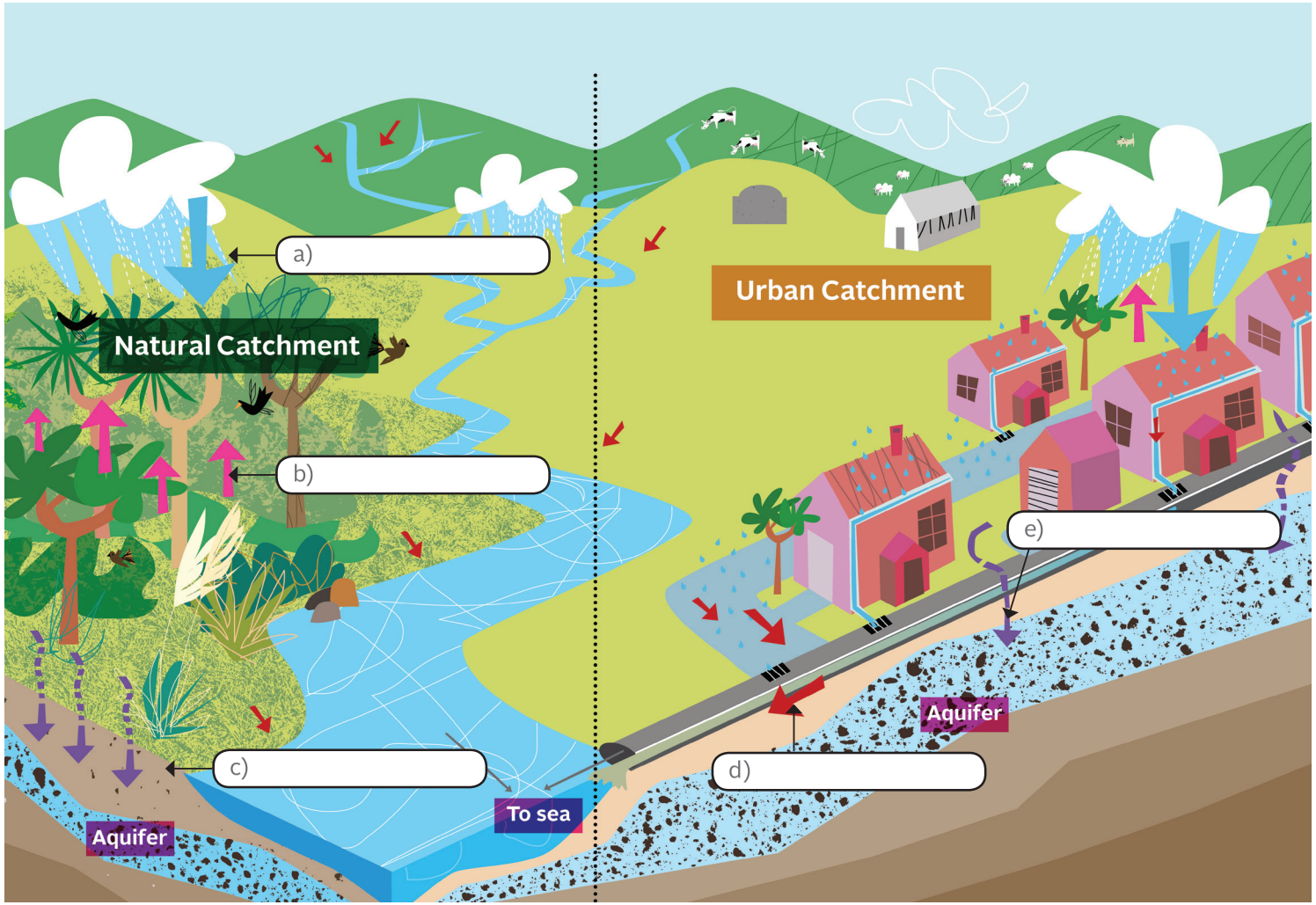
- Why is so much run-off a problem in the urban catchment?
  Answers will vary, it is important to encourage discussion. Large amounts of run-off in urban catchments can be a problem because water collects pollutants from impermeable surfaces, such as roads and roofs, and transfers them directly to streams rather than filtering them out as they pass through the ground. Excess run-off also reduces the flow of water to groundwater.
- How could we minimise problems with run-off in urban landscapes?
  Answers will vary. Limit the amount of impermeable surfaces and use permeable surfaces wherever possible.

Vocabulary

- catchment
- urban
- run-off
- infiltration
- permeable
- impermeable

2:2a Water movement

1. Place the following words in the appropriate boxes to describe the processes shown: **run-off, transpiration, infiltration, precipitation** (one appears twice).



2. How does water move differently in an urban catchment?

3. What causes these differences?

How much water are we using?

SECTION 3

Students measure how much water is used at school on a daily basis and explore how it is used.

SECTION 3

Section 3: How much water are we using?

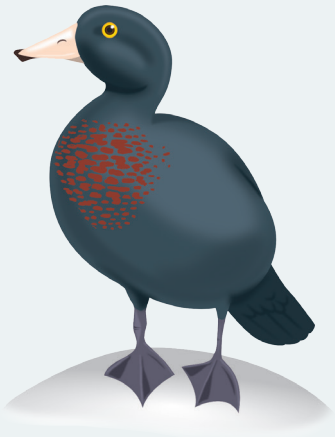
PURPOSE

The purpose of this section is to help students to:

- Understand how much water they use every day.
- Measure water use in their school.
- Use graphs and data to obtain information about water use.

Overarching concepts for Section 3:

- Water is used in many different ways at school and at home.
- We can all use less water by using it more efficiently.



Learning experience	Learning intentions Students will:	Curriculum links	Content
1. Household water use in New Zealand	• Compare water use in New Zealand with water use in other countries. • Examine patterns or trends about household water use.	**Mathematics and Statistics: Level 3 (and 4)** **Statistics** *Statistical investigation* **English: Level 3 (and 4)** **Listening, Reading, and Viewing** *Processes and strategies* *Ideas* **Science: Level 3 (and 4)** **Nature of Science** *Investigating in science* *Participating and contributing* **Social Science: Level 3** **Social Studies**	Students compare household water use in New Zealand to use in other countries.
2. Using water at school	• Investigate the water outlets/uses in their school environment. • Represent water outlets with symbols on a map.	**Science: Level 3 and 4** **Nature of Science** *Investigating in science* **Mathematics and Statistics: Level 3** **Geometry and Measurement** *Shape* **English: Level 4** **Speaking, Writing, and Presenting** *Ideas*	Students record where the water outlets are located in their school.
3. Measuring water use: Water meter	• Investigate how much water is used at school using a water meter on their school's water supply pipe.	**Mathematics and Statistics: Level 3 (and 4)** **Statistics** *Statistical investigation* **Geometry and Measurement** *Measurement* **Science: Level 3 (and 4)** **Nature of Science** *Investigating in science* *Participating and contributing* **Social Sciences: Level 3** **Social Studies**	Students learn how to read a water meter and examine the results of the readings to find an average amount of water used per school day.
4. Measuring water use: Water survey	• Investigate how much water they use at school in a day.	**Mathematics and Statistics: Level 3 (and 4)** **Statistics** *Statistical investigation* **Geometry and Measurement** *Measurement* **Science: Level 3 (and 4)** **Nature of Science** *Investigating in science* **Social Sciences: Level 3** **Social Studies** **Technology: Level 3 (and 4)** **Nature of Technology** *Characteristics of technology*	Students record their daily water use on tally chart. Results are then combined to find how water is used during a school day.
5. Our water future	• Reflect on how much water is used at school. • Recognise that their water use will have an effect on the future environment and community.	**Science: Level 3 (and 4)** **Nature of Science** *Investigating in science* *Participating and contributing* **Social Sciences: Level 4** **Social Studies** **English: Level 3 (and 4)** **Listening, Reading, and Viewing** *Processes and strategies* *Ideas* **Speaking, Writing, and Presenting** *Processes and strategies* *Ideas*	Students reflect on how much water is used at school each day. They examine how their water use could influence future water issues.

3:1 Household water use – teacher notes

Background knowledge

Most people in New Zealand rely on a town supply for their water. It takes time, effort, money and resources to deliver water to these households.

Water withdrawal

Almost 110,000 km^3 of rain falls over planet Earth each year. This is equal to about 1800 times the volume of Lake Taupo. About 2/3 of this amount evaporates or is transpired through plants and other organisms. The remaining 1/3 of water provides surface water and groundwater[6]. Some of this surface water is withdrawn for human use (water withdrawal). We use this water for our industries, agriculture and for household use. Keep in mind though that rain doesn't fall evenly across the world.

New Zealand's household water use

New Zealand's domestic (household) water use is high in proportion to our industrial and agricultural use when compared to other countries. Our household water use makes up approximately 22% of our country's total water use, compared to an average of 10% worldwide. However, in our cities, domestic water use is a much higher percentage. In some cities, household water use can be as high as 60% of the total water use.

Do New Zealanders use a lot of water?

New Zealanders do use a relatively large amount of water when compared to people in most other countries.

The United Nations says that people need a minimum of 50L per person per day to survive, however some countries use far less than this[7].

An average New Zealand family uses between 250-300L of water per person per day[8]. Having enough water for everyone in New Zealand in the future will rely on more water efficient appliances and water conservation and fair distribution between households, industry, agriculture, and the environment.

[8] http://www.fao.org/nr/water/aquastat/water_use/index.stm
[9] http://www.newint.org/issue354/facts.htm
[10] http://www.nrc.govt.nz/Environment/Water/Take-action/Saving-water/

Curriculum links

Mathematics and Statistics: Level 3 (and 4)

Statistics

Statistical investigation

Conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions; identifying patterns and trends in context, within and between data sets.

English: Level 3 (and 4)

Listening, Reading, and Viewing

Processes and strategies

Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas

Show a developing understanding of ideas within, across, and beyond texts.

Science: Level 3 (and 4)

Nature of Science

Investigating in science

Build on prior experiences, working together to share and examine their own and others' knowledge.

Participating and contributing

Use their growing science knowledge when considering issues of concern to them.

Social Sciences: Level 3

Social Studies

Understand how people view and use places differently.

Background knowledge continued

Summer vs winter water use
Our water use increases over summer, with watering gardens, filling swimming pools, and greater demand for water to drink and wash with. Unfortunately, water is less plentiful in summer as there is less rainfall. In winter there is more rain but demand is lower. Water providers must plan for seasonal variations in water availability and use.

What do we mean by "industry"?
Industry refers to all the businesses and factories that convert raw materials into goods or that provide useful services needed by society.

What do we mean by "agriculture"?
Agriculture refers to the occupation of farming, forestry, and fishing. Agriculture supplies raw materials for industry as well as directly to consumers.

What do we mean by "household/domestic"?
In this resource "household" and "domestic" are used interchangeably. It refers to activities relating to a family or home. Household/domestic use would refer to how a person or a family uses something and is seperate from industry and agriculture.

Answers to 3:1b

1. United Kingdom.
2. High, answers will vary but could include: We are not very careful with using water in our homes, we use a lot of water in the garden and bathroom compared to other countries.
3. 234L in winter.
   251L in summer.
4. In the bathroom – probably for showers and baths.
5. Answers will vary but could include: 'Unaccounted for' means other uses which don't fit into another category. This includes leaks in water pipes.
6. Answers will vary but could include: People need to water their gardens, fill pools, and wash more often in summer.
7. Answers will vary, but could include: Take shorter showers, less baths, flush toilet only when necessary etc.

3:1 Household water use – learning experience

Learning experience

- Share the learning intentions and success criteria.
- Explain that we will examine how an average New Zealander uses water at home and what proportion of New Zealand's total water is used in homes.
- Visit the concept of one litre of water. Show students examples of different quantities of water *(e.g. a standard bucket = around 10 litres).*
- Ask how much water (in litres) students think we use every day in our homes? Share ideas.
- Hand out 3:1a and 3:1b. Ask students to examine Graph 1 on 3:1a. Compare proportions of water used for farming/agriculture between countries. Discuss reasons for differences *(e.g. some countries are developing or industrialised)*. Discuss the meaning of terms used in the graphs *(see teacher notes).*
- Ask students what percentage of New Zealand's water use is used for households in NZ?
  Approximately 22%. Encourage discussion as to why we use as much as we do.
- Ask students to answer the questions on 3:1b.
- Discuss answers and reflect on findings.

As an extension, students can create other graphs of this data or investigate other data about water use.

Reflection questions

- How do you think your own water use changes between summer and winter?
  Answers will vary.
- Is water available in summer in as large amounts as it is in winter?
  No, less rainfall means there is less water available in summer. Encourage discussion about if we use water as wisely as we should in summer.

Vocabulary

- household/domestic
- proportion
- agriculture
- industry/industrial

Learning intentions

Students will:
Compare water use in New Zealand with water use in other countries. Examine patterns or trends about household water use.

Success criteria

Students can:
Answer questions about household water use in New Zealand from information in graphs. Describe patterns of water use in our homes.

Resources

3:1a Water use in New Zealand

3:1b Water use in New Zealand worksheet

Education for Sustainability concepts

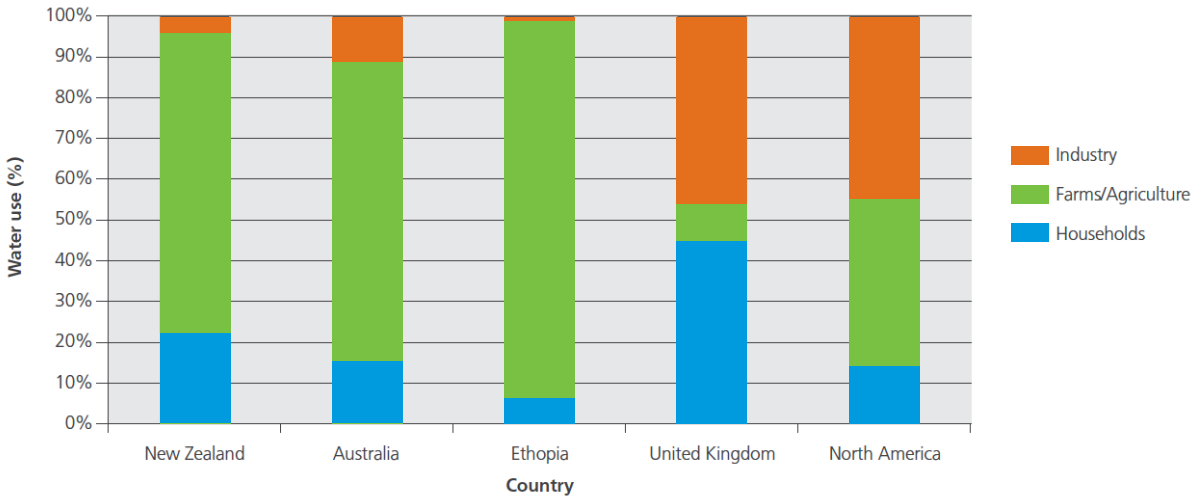
Equity:
Respect for all life, social justice, intergenerational equity, finite resources.

Responsibility for action/ Kaitiakitanga:
If we want to use taonga, we must look after the taonga.

3:1a Water use in New Zealand

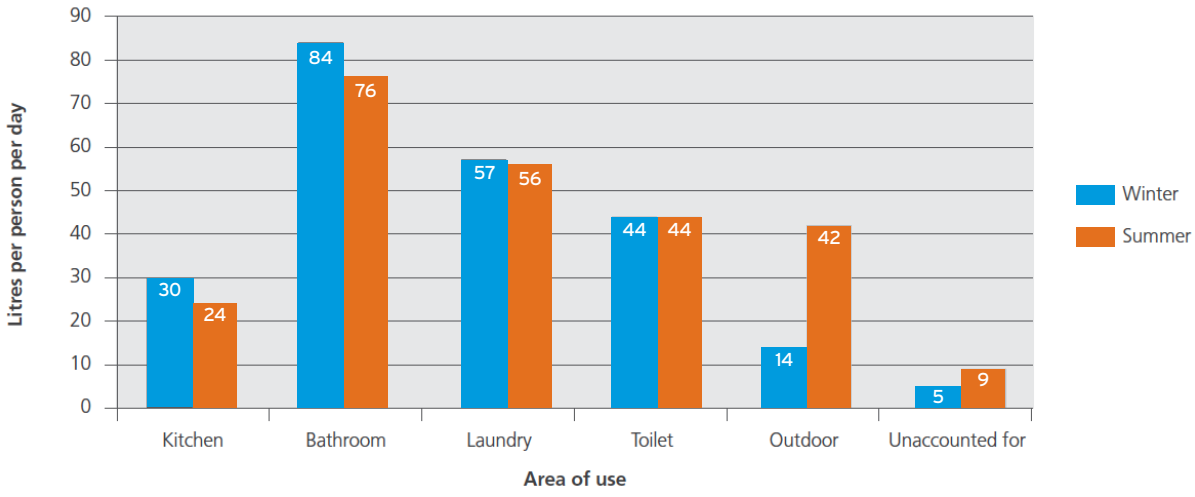
Graph 1:
World water use in households, farms and industry

(Data sourced for Graph 1 from http://www.fao.org/nr/water/aquastat/main/index.stm)



Graph 2:
Estimated household water use in New Zealand

(Data adapted for Graph 2 from BRANZ EC1356)



3:1b Water use in New Zealand worksheet

Answer the following questions using 3:1a:

1. Which country has the highest proportion of household water use?

2. Is New Zealand's household water use high or low compared with other countries? Why do you think this is?

3. How much water do we use at home on an average day?

In winter:

In summer:

4. What is most of the water in our homes used for?

5. What do you think 'unaccounted for' means? Why do we need this option?

6. Why is 'outdoor' water use so much greater in summer?

7. When you look at graph two, what ideas come to mind about reducing water use?

3:2 Using water at school – teacher notes

Background knowledge

Water is used by all schools and households in New Zealand. We are all responsible for using the large amount of water that our country uses.

Map of the school
Prior to the activity, photocopy a school map for each group. To allow enough room to record all water outlets, enlarge the map to an A3 size.

Water outlets in schools
Water outlets are objects or appliances which we obtain water from. Sometimes these are known as fixtures. Examples of water outlets include taps, drinking fountains, water tanks, toilets, urinals, and watering equipment. Students will become more aware of the uses of water in their school through this activity and may find other water outlets.

Water collection
In some schools there may be areas of water collection e.g. rainwater tanks or greywater recycling. Include these on your map as well and explore how they work. You could use a different identifier (such as colours or symbols) to indicate that these objects save or re-use water instead of using it up.

Timing and organisation
This activity involves students investigating water outlets around the school. Ideally, you would want to conduct the survey at a quiet time of the day when other classes are not using water outlets. If possible involve the caretaker, other school staff or parents in the investigations.

This activity may take longer than 45 minutes.

Disruption of other classes
Students need to be considerate of other classes. Discuss with your students how they could get the information they need with the minimum disturbance to other classrooms and teachers.

Groups for surveying
Ensure that there are both female and male members of each group so that they can accurately survey all toilets and bathrooms.

Curriculum links

Science: Level 3 (and 4)

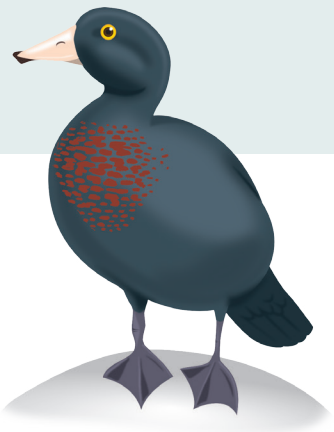
Nature of Science
Investigating in science
Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.

Mathematics and Statistics: Level 3

Geometry and Measurement
Shape
Represent objects with drawings and models.

English: Level 4

Speaking, Writing, and Presenting
Ideas
Select, form, and communicate ideas on a range of topics.



3:2 Using water at school – learning experience

Learning intentions

Students will:
Investigate the water outlets/uses in their school environment.

Represent water outlets with symbols on a map.

Success criteria

Students can:
Identify water outlets in their school environment.

Label water outlets on a school map using symbols.

Resources

Map of the school (A3)
Pens/pencils
Books/clipboard

Education for Sustainability concepts

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Responsibility for action/ Kaitiakitanga:
If we want to use taonga, we must look after the taonga.

Learning experience

- Share the learning intentions and success criteria.
- Revisit the graph of household water use around the world. Explain that you will be investigating where water is used in their school every day.
- Provide students with a map of the school. Discuss the water outlets/uses at the school. These may be taps, water tanks, drinking fountains, toilets etc.
- Explain that students are to draw symbols on the map for each type of water outlet/use. Discuss and decide on appropriate symbols for each outlet, making sure that each symbol is distinctive and easy to draw.
- Divide students into several groups. Assign each group of students to an area of the school to investigate. You may need to organise adult supervision at certain locations. Remind students to be considerate of other classes.
- When students have labelled the water outlets in the area of the school they investigated, they can come together to share results. Each student or pair should end up with a map detailing all water outlets in the school.
- After labelling maps, construct a table describing the outlets found. For example:

Type of water outlet	People who use it	Total no.	What this water is used for
Classroom taps	Students and staff		Washing hands, washing art equipment, filling up containers etc
Toilets			
Drinking fountains			
Etc			

- What other water uses/outlets are at home which are not used at school? (For example: washing machines, baths)

As an extension, students could find places in the school where there are leaks or where water is not being used efficiently.

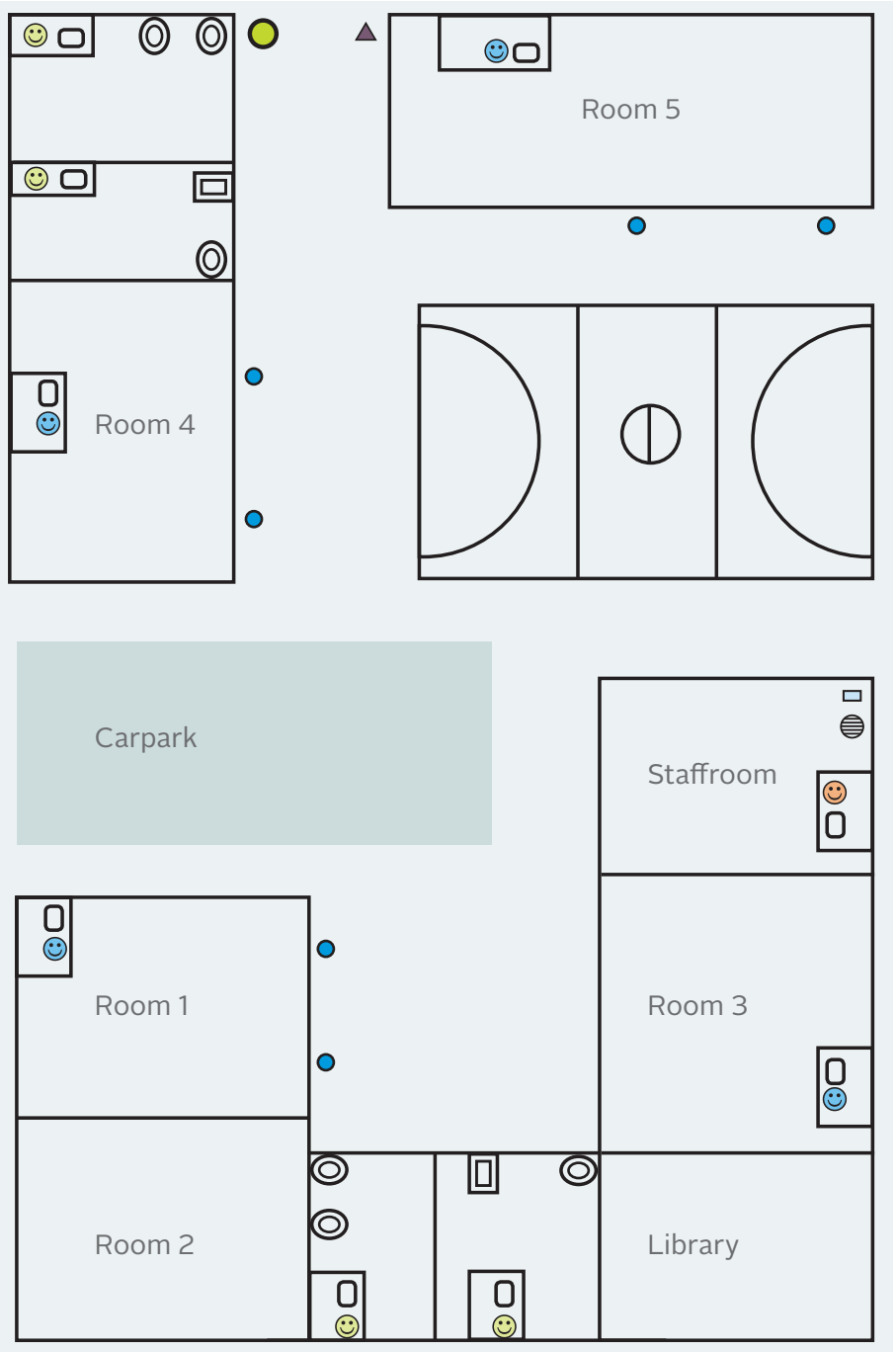
Reflection questions

- What are your thoughts about how we use water at school? *Answers will vary.*
- Could any of these water outlets/activities re-use greywater instead of using drinking-quality water? *Yes – toilets, hoses, urinals etc.*

Vocabulary

- outlet
- symbol
- greywater

Example of labelled school map



Key

- Classroom taps
- Bathroom taps
- Urinals
- Toilets
- Drinking fountains
- Staffroom taps
- Water cooler
- Hot water zip
- Rainwater tank
- Hose

3:3 Measuring water use – teacher notes

Curriculum links

Mathematics and Statistics: Level 3 (and 4)

Statistics
Statistical investigation
Conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions; identifying patterns and trends in context, within and between data sets.

Geometry and Measurement
Measurement
Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.

Science: Level 3 (and 4)

Nature of Science
Investigating in science
Build on prior experiences, working together to share and examine their own and others' knowledge.

Participating and contributing
Use their growing science knowledge when considering issues of concern to them.

Social Sciences: Level 3

Social Studies
Understand how people view and use places differently.

Background knowledge

School water use
A school's water use will differ depending on which water fixtures you have and the size of your school roll. For example, a school with a swimming pool uses far more water than one without a pool, and the more students at your school, the more water you will use.

The water meter
A water meter is a device which measures the volume of total water used by a property. It measures water directly and accurately.

What is a cubic metre?
A cubic metre is a volume of water 1 metre x 1 metre x 1 metre. This volume is equal to 1000 litres (L). Large volumes of water are measured in cubic metres (m^3).

What does a water meter look like?
Your school water meter will usually be located somewhere near the front boundary of the school.

Your caretaker should be aware of the location of the water meter and what it looks like. You may need assistance to find it and understand the readings.

When should we read the meter?
You will need to read the meter at the same time every day to record your results. This will ensure consistency.

We suggest that you read the meter first thing in the morning and last thing before students go home.

The water bill
If your school has a water bill, look at a previous school water bill to obtain more data about your water use. A water bill displays the actual amount of the water used at your school during a certain time period. Readings to calculate the amount owing are taken from your school water meter, therefore past water bills will give you reliable information about the history of water use in your school.

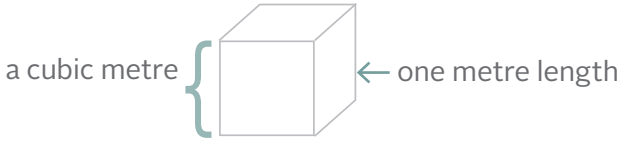
If your school doesn't receive a water bill or have a water meter already in place, you may be able to loan or buy one. You can temporarily install it for the duration of the investigation, or use it long term to track seasonal trends.

3:3 Measuring water use – learning experience

Learning experience

This activity should be completed in short intervals over several days.

- Share the learning intention and success criteria.
- Explain that you are going to read the school water meter to find out exactly how much water is used per day at the school.
- Introduce the idea of a cubic metre of water. To show what a cubic metre looks like, use a metre ruler, newspaper, and tape to construct lengths of rolled newspaper one metre long. Tape them together into a square or use more to make a cube. Explain that a cubic metre is 1m x 1 m x 1m *(see teacher notes)*. One cubic metre is equal to 1000L.



- Discuss when the water meter should be read to determine total water use in a school day. Agree on a procedure for obtaining the meter readings. Discuss why consistency of readings is important.
- Visit the water meter and record your measurements. Explain the units of measurement of water and relate these to everyday examples.
- Continue reading the meter over the next several days to get an average daily use.
- After reading the meter over several days take all of the results to find an average amount of water used per day.

As an extension, examine several school water bills and compare to your other results. Graphs of the results may allow more comparison.

Reflection questions

- What surprised you about the meter reading results?
  Answers will vary.
- Was there a difference between the afternoon reading on day one and the morning reading on day two? If so, give reasons for the difference.
  The difference will be the amount of water used after students leave school and at night. This will include water used in school cleaning and any leaks in school water pipes or taps.

Vocabulary

- water meter
- measurement
- reading
- estimate
- cubic metre

Learning intentions

Students will:
Investigate how much water is used at school using a water meter.

Success criteria

Students can:
Gather water use data from the school water meter.

Find the average amount of water used per day at school.

Resources

Metre rulers
Newspaper
Tape
Paper to record measurements
Clipboard
Pen/ pencil

Education for Sustainability concepts

Responsibility for action/Kaitiakitanga:
If we want to use taonga, we must look after that taonga.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

3:4 Water survey – teacher notes

Background knowledge

Accuracy of results
The table included is based on average water use for each outlet. Amounts have also been rounded for ease of calculation for the activity. Appliances can vary hugely depending on age and technology, for example, a dishwasher can use between 10L and 40L of water per cycle.

If you wish to measure water use more accurately, you can investigate your water outlets and appliances to get more exact figures for how much water they use. This could be done by measuring the actual amounts of water used or looking in associated manuals or records.

Measuring water use
Water is measured in cubic metres (m^3), litres (L), or millilitres (mL).

- 1000mL = 1L
- 1000L = $1m^3$

Water is used extensively every day in schools, by both staff and students. It is important to include staff use in your survey as well as students use.

Urinals and toilets
Toilets and urinals will make up a large proportion of the students' water use at school. Water use of toilets and urinals also varies, depending on age and condition.

Automatic flushing of urinals can waste a large amount of water; they are programmed to flush after a certain amount of time regardless of use. Urinals use between 3.8L (new) and 19L (20+ years old) per flush. Urinals which flush after each use are more water efficient than those which flush automatically. Half flush toilets use about 3L if they are new. Older toilets can use 11-13L for a full flush and usually don't have a half flush option.

Leaks
Dripping taps or leaking appliances waste a lot of water but are often fairly quick, cheap and easy to fix. You may want to teach students how to change a washer in a tap or discuss how you would manage finding a leak as part of the activity.

Swimming pools
Pools can use a very different amount from one day to the next. To find a rough estimate of water used by a pool per day, multiply the capacity (width x length x depth) by the number of times you fill the pool each year and then divide by 365 (days).

Curriculum links

Mathematics and Statistics: Level 3 (and 4)

Statistics
Statistical investigation
Conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions; identifying patterns and trends in context, within and between data sets.

Geometry and Measurement
Measurement
Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.

Science: Level 3 (and 4)

Nature of Science
Investigating in science
Build on prior experiences, working together to share and examine their own and others' knowledge.

Social Sciences: Level 3

Social Studies
Understand how people view and use places differently.

Technology: Level 3 (and 4)

Nature of Technology
Characteristics of technology
Understand how society and environments impact on and are influenced by technology in historical and contemporary contexts and that technological knowledge is validated by successful function.

3:4 Water survey – learning experience

Learning intentions

Students will:
Investigate how much water they use at school in an average day.

Success criteria

Students can:
Gather data about their water use for the day. Identify how they contribute to water use during a school day.

Resources

Tally chart
3:4a School daily water use

Education for Sustainability concepts

Responsibility for action/Kaitiakitanga:
If we want to use taonga, we must look after the taonga.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Learning experience

- If possible, the day before this activity, get students to use a tally chart similar to the one below to record how many times they use each water outlet in a day. Each time they use a water outlet they should record it on the chart.
- Share the learning intention and success criteria.
- Explain that the tally chart records how many times they use each water outlet each day. They will use it to work out how much water they use each day at school.
- Revisit the maps of the school the students created with water outlets on them. Examine all of the water outlets on the map. Ask students to estimate how much water they think would be used at the school each day considering all of these outlets.
- After the students have completed the tally charts for one day, combine results together to get the average number of times each water outlet is used. Use these averages to complete 3:4a.
- Adjust the use of 3:4a according to your students' abilities. Those who are struggling may only complete the student use section.
- Using 3:4a, find how much water is used at your school each day.

Reflection questions

- What surprised you about your survey results?
  Answers will vary.
- How do you personally contribute to using water at school?
  Answers will vary.

Vocabulary

- survey
- efficient
- average
- wastage

My tally chart of daily water use

	Tally of number of times used	Total times used
Drinking		
Drinking fountains		
Drink bottles		
Toilet		
Half flush		
Full flush		
Urinal		
Hygiene		
Washing hands		
Taps in classroom		
Other		

3:4a School daily water use

Water use	**Water used (L)** (averages only)		**No. of times used a day** (average)		**Total used** (per person)
Student Use					
Drinking					
Drinking fountains	0.5L (500ml)	x		=	
Drink bottles	0.5L (500ml)				
Toilet					
Half flush	3L	x		=	
Full flush	6L				
Urinal	10L per flush				
Hygiene and cleaning					
Washing hands	1L	x		=	
Taps in classrooms	10L per minute				
			Total water use per student		
			x number of students	=	
			Total water use: students		
Staff Use					
Staffroom					
Staffroom taps	10L per minute	x		=	
Drinking water	2L per person				
Hot water: kettle	2L per jug				
Dishes: in sink	6L				
Dishwasher	30L				
Staff toilets	6L				
			Total water use: staff		
Other					
		x		=	
			Total water used at school per day (total water use: students + total water use: staff + other)		

3:5 Our water future – teacher notes

Curriculum links

Science: Level 3 (and 4)
Nature of Science
Investigating in science
Build on prior experiences, working together to share and examine their own and others' knowledge.

Participating and contributing
Use their growing science knowledge when considering issues of concern to them.

Social Sciences: Level 4
Social Studies
Understand how people participate individually and collectively in response to community challenges.
Understand that events have causes and effects.

English: Level 3 (and 4)
Listening, Reading, and Viewing
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas
Show a developing understanding of ideas within, across, and beyond texts.

Speaking, Writing, and Presenting
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas
Select, form, and communicate ideas on a range of topics.

Background knowledge

The future of our water supply
Our current water supply is sometimes stretched, especially in summer, when demand for water increases and there is less rainfall. New water sources may be needed in the future unless water use per person can be reduced as population grows.

This activity encourages critical thinking to examine how students' actions and behaviours can influence the future environment.

Will conserving water really make a difference?
Conserving water will reduce our energy and resource use and decrease our waste. Every litre of tap water produced and distributed uses resources and energy.

If we reduce our water use by 15% then a new water source may not be necessary until far into the future.

What is wrong with creating new water sources?
When we interrupt natural water sources the natural pathways of water are changed forever. Animal habitat is lost and water movement within that catchment is irreversibly altered. This may have serious consequences for land and water around the affected area. The effects vary depending on the type of structure being built and how it is built. The clean water we need for drinking water is often found in the most pristine environments.

Won't we always need more water as the population grows?
We will eventually need more water as the population grows and demand increases. But water conservation and informed action can make a large difference to when new sources will be needed. If we can delay a new water source the local environment will benefit.

Answers for 3:5a

Part 1: *Answers will vary*
Part 2: *Example responses:*

Water conservation by everyone.

Less water used and wasted. More water re-used, rainwater collection, and water efficient equipment used. Less water is needed.

Another water source **would not** be needed in the near future.

Harsher water restrictions **would not** be necessary.

3:5 Our water future – learning experience

Learning experience

- Share the learning intentions and success criteria.
- Reflect on learning so far during this unit. Resources from Section 1 could be used as a prompt for discussion.
- Revisit the results from learning experiences 3:3 and 3:4 and discuss findings. Recap how water is used by students during a school day and how much is used.
- Work out the average amount of water used per person per day from meter readings and audit results. Record this amount used on 3:5a. Is the amount per person per day more or less than what the students expected? What is most of this water used for?
- Ask students if they think that reducing water use at school could have an effect on the environment. Encourage discussion. Explain that how we use water now and in the near future will affect our future water sources and supplies in the long term. Everyone in the community plays a part in protecting our water resources *(see teacher notes)*.
- How could the total water use of the school be reduced? What are they doing already to conserve water? Record ideas on 3:5a.
- Discuss the different futures described in 3:5a and the possible consequences of our actions. Ask students to add their ideas about reducing school water use to the column on the right of the table.
- Share ideas and answers. Discuss the current situation at school and whether students would like anything to change to improve the situation. Are there any underlying issues?

As an extension, visualise a desirable water future for your community. This could take the form of an illustration, story, or map.

Reflection questions

- How will we change our behaviour?
  Answers will vary.
- Which future from 3:5a would you want to happen?
  Water future 3 is most desirable.

Vocabulary

- conservation
- long-term
- community

Learning intentions

Students will:
Reflect on how much water is used at school.

Recognise that their water use will have an effect on the future environment and water supply.

Success criteria

Students can:
Describe how much water is used per person per day at school.

Explain how water use at school has an effect on the future water supply.

Resources

3:5a Water use: now and in the future

Education for Sustainability concepts

Equity:
Respect for all life, social justice, intergenerational equity, finite resources.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Responsibility for action/Kaitiakitanga:
If we want to use taonga, we must look after the taonga. Taking action, informed decision-making, citizenship, consumerism, enterprise, resilience and regeneration.

3:5a Water use: Now and in the future

Part 1: Water use: What is happening now?	
How many litres per person per day do we use at school? *(See 3:4a and the water meter measurements)* _____ *litres per person per day*	Can we reduce our water use? **Y / N** If yes, how could we reduce the amount of drinking-quality water that we use?
What are we already doing to save water? _____ _____ _____ _____	_____ _____ _____ _____ _____

Part 2: Water use: What will happen in the future?			
Complete the chart for water future 3			
	Water future 1 *Water use increases*	**Water future 2** *No change*	**Water future 3** *Water use decreases*
Water conservation	No water conservation.	Some water saving.	
Using water at school	Water use increases. More water is wasted. No water re-use or rainwater collection.	Water use stays the same. Some water re-use or rainwater collection.	
If every school and home did the same			
Water sources/ collection to supply water	Another source **would be** needed soon.	Another source **would be** needed in the near future.	
Water restrictions	Harsher water restrictions **would be** necessary.	Harsher water restrictions **may be** necessary.	

Making change

SECTION 4

This section provides students with an opportunity to use their new knowledge and understanding to make informed decisions about how they use water. Students identify the priorities for change and organise action for the environment to reduce their use of tap water.

Section 4: Making change

PURPOSE

The purpose of this section is to help students to:

- Understand how they can conserve water.
- Recognise how their actions contribute to a sustainable future.

Overarching concepts for Section 4:

- Everyone can use water more efficiently and help protect our natural environment.
- We need to make informed choices about how we use our tap water.

Learning experiences	Learning intentions Students will:	Curriculum links	Content
1. Which water action?	• Target an issue about water use in their school. • Decide on an environmental action to reduce their water use and address the issue.	**Science: Level 3 and 4** **Nature of Science** *Participating and contributing* **Technology: Level 3 (and 4)** **Technological Practice** *Planning for practice* *Brief development* **Social Sciences: Level 4** **Social Studies** **Health and Physical Education: Level 3** **Healthy Communities and Environments** *People and the environment*	Students examine possible actions to reduce their water use. They make an informed decision about how they could use water more efficiently and decide on an appropriate action.
2. Planning for action	• Organise, plan, and implement an action project to reduce their water use.	**Health and Physical Education: Level 3** **Healthy Communities and Environments** *People and the environment* **Health and Physical Education: Level 3 (and 4)** **Personal Health and Physical Development** *Safety management* **Technology: Level 3 (and 4)** **Technological Practice** *Planning for practice* *Brief development* **Science: Level 3 (and 4)** **Nature of Science** *Participating and contributing*	The action is planned. The students and teacher plan when, where and how the action will take place. Responsibilities are assigned and action is organised.
Take action for the environment			
3. How did it go?	• Reflect on their action project and evaluate how it went.	**Technology: Level 3 (and 4)** **Technological Practice** *Outcome development and evaluation* **English: Level 3 (and 4)** **Speaking, Writing, and Presenting** *Processes and strategies* *Ideas*	Students critically reflect on their action and describe how they will maintain their project. Students can reassess water use and monitor change, which may lead to further action.

4:1 Which water action? – teacher notes

Curriculum links

Science: Level 3 (and 4)
Nature of Science
Participating and contributing
Use their growing science knowledge when considering issues of concern to them. Explore various aspects of an issue and make decisions about possible actions.

Technology: Level 3 (and 4)
Technological Practice
Planning for practice
Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making.

Brief development
Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome.

Social Sciences: Level 4
Social Studies
Understand how people participate individually and collectively in response to community challenges. Understand that events have causes and effects.

Health and Physical Education: Level 3
Healthy Communities and Environments
People and the environment
Plan and implement a programme to enhance an identified social or physical aspect of their classroom or school environment.

Background knowledge

What is taking action for the environment?
Taking action is making an informed decision to carry out a task that will contribute to a sustainable future. The information students have learned throughout this unit should allow them to make informed decisions about which water action is appropriate for them and will contribute to a sustainable water future. Examples of water actions are listed on 4:1a.

Planning for action
When planning to take action you will need to consider what students will learn as a result of the action, how they can be involved, and how manageable and achievable it is. Action should be a result of the learning and investigation during the whole unit. An action should ideally target either an issue which came up during your investigations or a long standing water issue in your school. Following the processes in this section will help to successfully plan for action.

Why can't the teacher choose the action?
The aim of environmental action is that the students are motivated to take action for their own reasons. Their environmental action will mirror their experiences and will be right for them. Innovative thinking should be encouraged. Well managed, student-centred actions can have a lasting, profound influence on students' lives.

What is action competence?
Action competence is the ability of students to take action on issues that concern them. It is learning about environmental issues so that students can plan and take action on those issues.

Why is taking action important?
Taking action is an essential part of Environmental Education. The action component is crucial, and will often lead towards the resolution of an issue or problem. You may choose to carry your action over to the next term or to enlist help from the community or another class in order to make it happen.

What are guiding questions?
Guiding questions keep your action relevant to your learning and goals. They define the requirements for action and ensure that your action is going to target the issues you have investigated during your unit.

4:1 Which water action? – learning experience

Learning experience

This activity may take several sessions to complete

- Share the learning intentions and success criteria.
- Revisit the desired water future from Section 3 and discuss how school water use could affect the future environment.
- Encourage students to set a water saving goal as a starting point. Have water bills and audit information available. Agree on a realistic, obtainable goal which addresses a water issue. Your goal may be to achieve a 10% reduction in water use in a year or it may be to increase the amount of water recycling or rainwater harvesting in your school.
- Discuss any issues about school water use (from your audit or other investigations) and the underlying problems behind these. Which issue is the most concerning? What is the cause of this issue?
- Ask students to brainstorm ideas about water actions which would help achieve the goal for their school and solve the issue.
- Show any relevant presentations and information listed on 4:1a to students. After viewing examples, discuss possible actions to address your school issue. Ensure your students know they don't need to be limited to the examples provided.
- Decide on your top three potential actions. Record them on 4:1b. Use your goal to establish some other guiding questions *(see teacher notes).* Complete the decision making grid together as a class. The decision making grid will help make choosing an action more straight forward.
- When you have decided on an action, complete 4:1c, either in groups or as a class. The questions on 4:1c will encourage students to make sure that the action chosen is appropriate for the issue involved and the goal they have established. The action should be guided by the teacher so that it is manageable and achievable.

Reflection questions

- How will this action help you reach your goal?
  Answers will vary.
- Can you achieve this action with the time and resources you have available?
  Answers will vary.
- How does this action contribute to a sustainable future?
  Answers will vary.

Vocabulary

- goal
- issue
- significantly

Learning intentions

Students will:
Target an issue about water use in their school.

Decide on an environmental action to reduce their water use and address the issue.

Success criteria

Students can:
Identify an issue about water use in the school to target.

Identify an environmental action that will reduce their water use and address the issue.

Resources

4:1a Examples of water actions

4:1b Decision making grid (enlarge to A3)

4:1c Our chosen action

Education for Sustainability concepts

Interdependence/ Whanaungatanga:
Everything and everyone in our world is connected.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

4:1a Example of water actions

		Issue	Potential solution	Description of solution
Water conservation	Changes to water use		**LC= low cost** **MC = medium cost** **HC = high cost**	
		A lack of awareness about the need to conserve water at school and in the community.	Education campaign at school about water conservation. **LC**	An awareness campaign motivating students and the community to use drinking water wisely; assembly presentations/posters/concerts/ newsletter items.
			Make a movie to tell people how they can conserve water. **LC**	Students could design and make a movie about water conservation at their school.
		Students consistently forget to conserve water at certain locations at the school.	Mural about water conservation. **LC**	Students design a mural about water conservation for areas where water is being wasted.
			Signs to remind students to conserve water. **MC**	Students design and produce signs to remind students to conserve water at key locations.
		Water is not being used wisely in homes.	Produce a brochure/ movie/show/ song about water conservation at home. **LC**	Research and design a targeted brochure to show examples of water conservation devices and actions for homes.
	Emergency water	No water stored at home or at school in case of an emergency.	Set up emergency supplies of water for school/home. **LC**	Research and plan an emergency supply of water for school/home. Encourage others to do the same by sharing your experiences.

		Issue	Potential solution	Description of solution
Water wastage	Inefficient water use	Hoses or inefficient sprinklers are used to water the garden and use a large proportion of our water.	Replace old watering system with a more water efficient watering system. **HC**	Investigate the alternatives for your garden irrigation and obtain funding to replace it.
		Drinking-quality water is being used to water the garden/flush toilets.	Install a rainwater tank or greywater recycling system. **HC**	Design a system to collect rainwater in a water tank to flush toilets or use greywater recycling to flush toilets/ water the garden.
		Taps are inefficient and waste water.	Investigate and install water saving devices for taps. **MC**	Install tap aerators/flow restrictors for taps to reduce flow.
		Toilets are inefficient (no dual flush).	Install dual flush, water efficient toilets. **HC**	Students investigate alternatives to their current toilets and urinals.
			Install water saving device in toilet. **LC**	Place 2L plastic bottle in each cistern to save water with each flush if dual flush too expensive.
		Urinals are wasting water (old inefficient system).	Install automated or waterless urinals. **HC**	Students investigate alternatives to their urinals.
		Water from drinking fountains is wasted.	Install more water efficient drinking fountains/modify drinking fountains. **HC - LC**	Students research and make changes to their water fountains to make them more water efficient.
			Recycle water from fountain which would otherwise be wasted. **MC**	Students design a system for recycling wastewater from drinking fountains onto gardens.
	Leaks	Leaks from taps or pipes.	Investigate and describe steps to fix a leak. **LC**	Research how to fix any leaks from taps or pipes in your school and then design a method to fix them.

Do not be limited by these ideas - be creative with your action.

4:1b Decision making grid

Possible Action			
Guiding questions			
Would this action reduce our water use significantly?			
Do we have the resources we need or can we get them easily?			
Will we learn about something new as a result of this action?			
Will the action involve our community?			
Total score Scoring out of 3: 3 = definitely 2 = maybe 1 = probably not			

Example of a decision making grid			
Guiding questions	Rainwater tank	Install aerated taps in our classrooms	Produce a movie about water conservation
Would this action reduce our water use significantly?	3	3	2
Can we achieve this action within the time we have?	1	3	1
Do we have the resources we need or can we get them easily?	1	1	1
Would we be excited about doing this action?	2	1	3
Will we learn about something new as a result of this action?	3	2	2
Will the action involve our community?	3	1	3
Will this action contribute to our school goal?	3	3	3
Total score	**16**	**14**	**15**

4:1c Our chosen action

Our school's water goal is:

How will this action help us reach our goal?

Our water action will be:

How much water will we save?

This action will help save water by:

We chose this action because:

What issue does this action help to solve?

4:2 Planning for action – teacher notes

Curriculum links

Health and Physical Education: Level 3
Healthy Communities and Environments
People and the environment
Plan and implement a programme to enhance an identified social or physical aspect of their classroom or school environment.

Health and Physical Education: Level 3 (and 4)
Personal Health and Physical Development
Safety management
Identify risks and their causes and describe safe practices to manage these.

Technology: Level 3 (and 4)
Technological Practice
Planning for practice
Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making.

Brief development
Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome.

Science: Level 3 (and 4)
Nature of Science
Participating and contributing
Use their growing science knowledge when considering issues of concern to them. Explore various aspects of an issue and make decisions about possible actions.

Background knowledge

How can the teacher help to enable students to complete the action?
Thinking ahead of students and removing potential obstacles will help the action to progress. This may include discussing the action project in advance with the principal, Board of Trustees or local businesses.

Environmental action ideally involves people outside your school. There will be many people who will be able to help you in councils, among parents and families, in not-for-profit groups, businesses, and other agencies.

Generally people are keen to help schools and are generous with their time. Initiatives which bring communities together are valuable in many ways and will enrich your school.

Should we complete more than one action?
This will depend on how much experience you and the students have with environmental action. The fewer projects you have, the higher the chance of success and the more likely the project is to create lasting change.

How do I find time to carry out this action?
You may find that you need to carry the action over into the following term or ask for some extra resources in order to achieve your action. Support from other staff and the principal is vital to the success and longevity of an action project.

Obtaining funding for action projects
Funding for water action projects is available from several different sources. You may also be able to fundraise or negotiate with local businesses to achieve your goals. This could also be a good opportunity for your students to explore various funding options.

Examples of funding available are:
WWF Environmental education fund
http://www.wwf.org.nz/what_we_do/education/funding_action_projects/

There are other funding opportunities available from councils, businesses and the Ministry for the Environment.

For other opportunities see: http://generosity.org.nz/

4:2 Planning for action – learning experience

Learning experience

This activity can be completed as a class or in groups

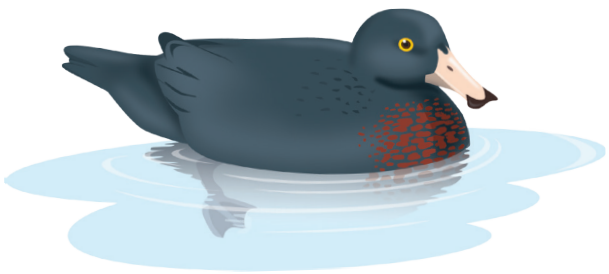
- Share the learning intention and success criteria.
- Discuss the action chosen in the previous activity. Ensure that the action is both achievable and realistic.
- Consider the resources required to complete the action. Brainstorm ideas and record.
- Ask students if they have ideas about who could assist with the project. They may have relatives or contacts who could lend a hand. Also consider businesses, councils, and other outside agencies.
- Name people who will need to be consulted before starting the action and discuss this process.
- Complete 4:2a together as a class.
- After completion, prioritise steps and assign responsibilities. Record these and agree on an appropriate timeframe.
- Agree on a collective plan of action.
- Constructing a timeline or a list of steps may help to keep you on track and organised.
- **Begin your action!**

Reflection questions

- What are the potential consequences of your action? *Answers will vary.*

Vocabulary

- resources
- completed
- responsible/responsibilities
- consequences
- agencies



Learning intentions

Students will:
Organise, plan, and implement an action project to reduce their water use.

Success criteria

Students can:
Complete an action plan for their project and implement the plan.

Resources

4:2a School water action plan

Education for Sustainability concepts

Interdependence/ Whanaungatanga:
Everything and everyone in our world is connected.

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Responsibility for action/Kaitiakitanga:
If we want to use taonga, we must look after the taonga. Taking action, informed decision-making, citizenship, consumerism, enterprise, resilience and regeneration.

4:2a School water action plan

When will it be completed?

What is the cost? **Where** will the money come from?

Where will this action happen?

Who will we need to talk to about this action?

ACTION

What resources and information do we need?

What needs to be done?

1.
2.
3.
4.
5.

Who is responsible?

1.
2.
3.
4.
5.

How will we let people know about our action?

4:3 How did it go? – teacher notes

Background knowledge

Why reflect and evaluate?
Reflective thought and critical evaluation allows students to think objectively and to stand back from their project and look at it from a different perspective. Reflection allows knowledge to be assimilated and adapted and encourages deep, critical thinking.

How will reflecting and evaluating help our action?
Reflecting will enable students to take more responsibility for the action and to think about improvements which could be made. Reflecting on action will increase their understanding of the action process and increase the likelihood of successful future environmental action. Reflecting on learning will also have implications on your teaching.

Planning for reflection
Ask questions during your action taking which prompt reflective thought. Questions which encourage students to examine their thoughts and feelings will allow more effective reflection and evaluation.

Share your experiences with the school and community
Inform others in your school of what your environmental action was and why you did it. Present a play at assembly, write a blog or web page or an article for the newsletter. The opportunities are endless. This may inspire other classes to be involved or participate in their own action for the environment.

Allowing time for celebration
Ensure that you celebrate your action with your students and applaud their successes. If others have been involved in your action, acknowledge their efforts as well.

Keep positive
Keep positive about the project and its successes. Students often really enjoy participating in action for the environment. Keep up momentum by frequently revisiting your action and maintaining it. If there have been mistakes, learn from them and look forward to your next project.

Curriculum links

Technology: Level 3 (and 4)
Technological Practice
Outcome development and evaluation
Investigate a context to develop ideas for potential outcomes. Trial and evaluate these against key attributes to select and develop an outcome to address the need or opportunity. Evaluate this outcome against the key attributes and how it addresses the need or opportunity.

English: Level 3 (and 4)
Speaking, Writing, and Presenting
Processes and strategies
Integrate sources of information, processes, and strategies with developing confidence to identify, form, and express ideas.

Ideas
Select, form, and communicate ideas on a range of topics.

4:3 How did it go? – learning experience

Learning intentions

Students will:
Reflect on their action project and evaluate how it went.

Success criteria

Students can:
Complete an evaluation of their action project.

Resources

4:2a School water action plan (completed)

Education for Sustainability concepts

Sustainability/Hauora:
The choices we make today affect choices we will be able to make in the future.

Responsibility for action/ Kaitiakitanga:
If we want to use taonga, we must look after the taonga. Taking action, informed decision-making, citizenship, consumerism, enterprise, resilience and regeneration.

Learning experience

- Share the learning intention and success criteria.
- Explain to students what evaluation means and why it is important *(see teacher notes).*
- Discuss how the process of taking action went. Ask students what difference the action has made.
- Was the action plan carried out as described on 4:2a? What changes were needed?
- Complete a bus stop activity or PMI chart using the following questions:

1. Did you achieve what you set out to achieve?
2. Did you enjoy the action project? Explain.
3. Did it solve the problem/issue? Why/Why not?
4. What did you learn from this action? What else would you like to learn?
5. Is the community involved? How could we encourage them to be involved?
6. Does your action require any maintenance? If so, what sort of maintenance is needed? Who is responsible and when will it be done?
7. If you did this action project again, what would you do differently? Why?
8. Will this action have an effect on the future environment?
9 How did you personally contribute to this action?
10. What would you like to see happen next?

- After completion, discuss the responses. Plan any maintenance needed.
- Ask students if they have any ideas about what the next steps are for the project. Refine ideas and share them with other interested people.

As an extension, re-survey your water use or water meter readings and compare to previous results. Has there been an improvement? Inform the school about the difference you have made.

Your students could also share their results and celebrate their successes with their local councils. Minimising water wastage at the school tap is a great opportunity to engage with your local councils and explore, from their point of view, why doing so is valuable and important.

Vocabulary

- achieve
- evaluation
- maintenance