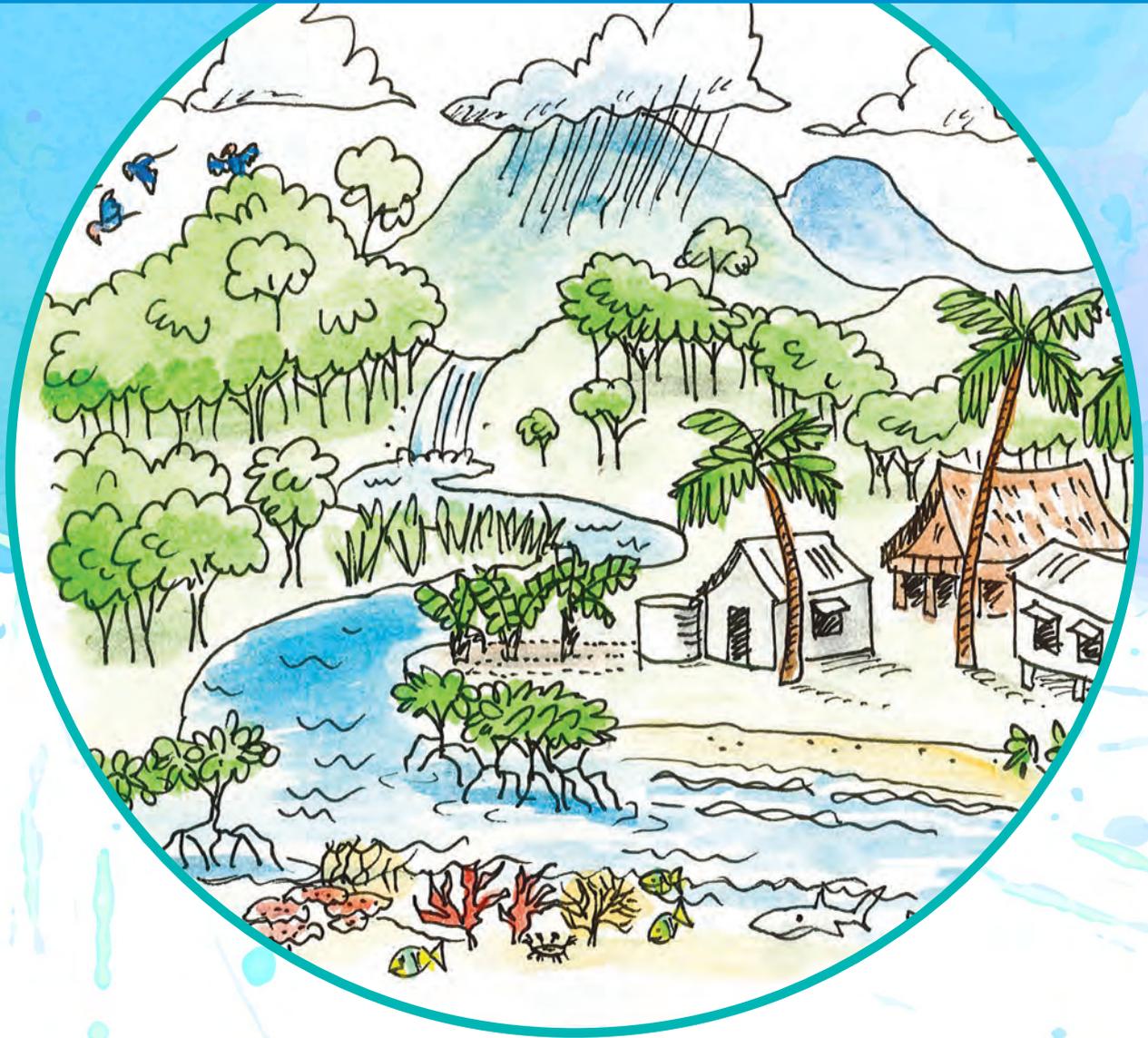


Water Safety and Security

Making and keeping our drinking water safe



A TOOLKIT FOR TEACHERS



LIVE&LEARN
Environmental Education



Water For
Women



Written by Live & Learn Environmental Education through the Resilient WASH in the Islands Region and Autonomous Region of Bougainville project in Papua New Guinea, supported by the Australian government and implemented by Plan International Australia and Live & Learn Environmental Education.

Written by: Michelle Abel and Mathew Johnston

Design and layout: Wilani van Wyk-Smit

Illustration and Editing: Nick Mattiske

Editing Assistance: Bart Smith

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Live & Learn Environmental Education

Ross House, Level 4, 247-251 Flinders Lane, Melbourne, Victoria 3000 Australia

Email: enquiries@livelearn.org

www.livelearn.org

Additional material on climate change adaptation was sourced from:

Learning about Climate Change – A Visual Guide – Secretariat of the Pacific Community (SPC) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2014

Adapting to Climate Change – a publication developed through input from a workshop that was held from September 6–11, 2010 in Pohnpei, Federated States of Micronesia

This manual is a revision of a 2008 toolkit prepared by Live & Learn Environmental Education Vanuatu for the World Health Organisation and South Pacific Applied Geosciences Commission as part of the Safety Plan Project.

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Introduction

This toolkit is designed to be used by teachers and other educators to teach children about the importance of safe drinking water, and to make connections between the environment, water availability, water storage and hygiene, and water borne diseases. It is designed to strengthen school curriculum themes and create student awareness, as well as effect behaviour change. The activities are aimed at students between grades 5 and 7, and can be used to support topics in basic science, mathematics, geography, and health and hygiene.

The activities within the modules will assist teachers and students to:

- Gain a deeper understanding of where water comes from
- Understand and make connections between the environment and water contamination
- Gain a deeper understanding of the impact of climate change on water availability
- Gain a deeper understanding of the importance of safe drinking water
- Understand and make connections between water contamination and water management
- Gain the practical experience and knowledge of doing a water safety audit
- Develop problem solving skills
- Develop thinking and reasoning skills
- Develop record keeping and analytical skills
- Take responsibility for their own family water hygiene
- Develop a plan for safe water in school

This resource contains three modules:

- 1 Where does our drinking water come from?
- 2 Looking after our water catchment
- 3 Keeping our drinking water clean

Each module contains background information for the teacher and one or more activities for students to complete. The activities are designed to allow students to learn through practical experiences, including discovering problems, thinking about solutions and taking some actions to solve problems that they discover.

The activities contain a **materials** and **what to do** section, which helps the teacher present the activity by following simple steps, and then provides easy-to-follow directions for running a class discussion after the activity is complete.

MODULE 1

Where Does Our Drinking Water Come From?

Learning Outcomes:

-○ Students understand why we need water
-○ Students understand the water cycle
-○ Students understand and can identify characteristics of a water catchment
-○ Students can identify the sources of drinking water in their community
-○ Students can explain how their water source system in their community works

Introduction to share with students

Why do we need water?

Living things cannot survive without water. Water is a necessity for life. An average person needs 4 litres of clean water every day to survive – this is not surprising given that 70% of our bodies are actually made up of water!

Being such a necessity, a lack of safe drinking water or contaminated (dirty) drinking water pose a threat to many living organisms and especially humans.

Humans can survive for several weeks without food, but for only a few days without water. A constant supply is needed to replace the fluids lost through normal daily activities, such as breathing, sweating and urinating. Water of sufficient quality to serve as drinking water is called potable water whether it is used as such or not. Water that is not harmful for human beings is sometimes called safe – water that is not contaminated to the extent of being unhealthy.

Water can carry disease

A big problem facing people is that although we all need water, unclean water can contain germs or microorganisms (bacteria too small to see with the naked eye) that cause disease. These nasty little organisms can make you very sick, and in some cases lead to death. They are especially dangerous for small children or the elderly. Water that looks clean is not necessarily safe for humans to drink. Contaminated drinking water is sometimes hard to see because the germs, bacteria and toxic chemicals that cause diseases cannot be seen with the naked eye. You could fit more than a million disease-causing germs in one single drop of water! So, you cannot assume that water is safe just because it is not dirty or does not have a bad smell.

If drinking water comes from a polluted source and is untreated it may contain germs and bacteria that can cause the spread of water-related diseases such as diarrhoea, dysentery, typhoid, cholera, polio and Hepatitis A. Contamination can occur when human and animal faeces which contain coliform bacteria enter the water source. Coliform bacteria lives in the intestines of both animals and humans, and is not harmful itself, but its presence in the water supply indicates that there may also be disease-causing bacteria from the faeces.

The World Health Organization estimates that more than 50% of all sickness and disease in the world is a result of poor quality water and sanitation. 1.6 million people, mostly children, die from diarrhea every year in developing countries. This is equal to five times the whole population of Vanuatu! This means over 4,000 people die every day from diseases carried by dirty water. It is therefore extremely important to understand how water can be protected from contamination and to test drinking water for disease causing germs.

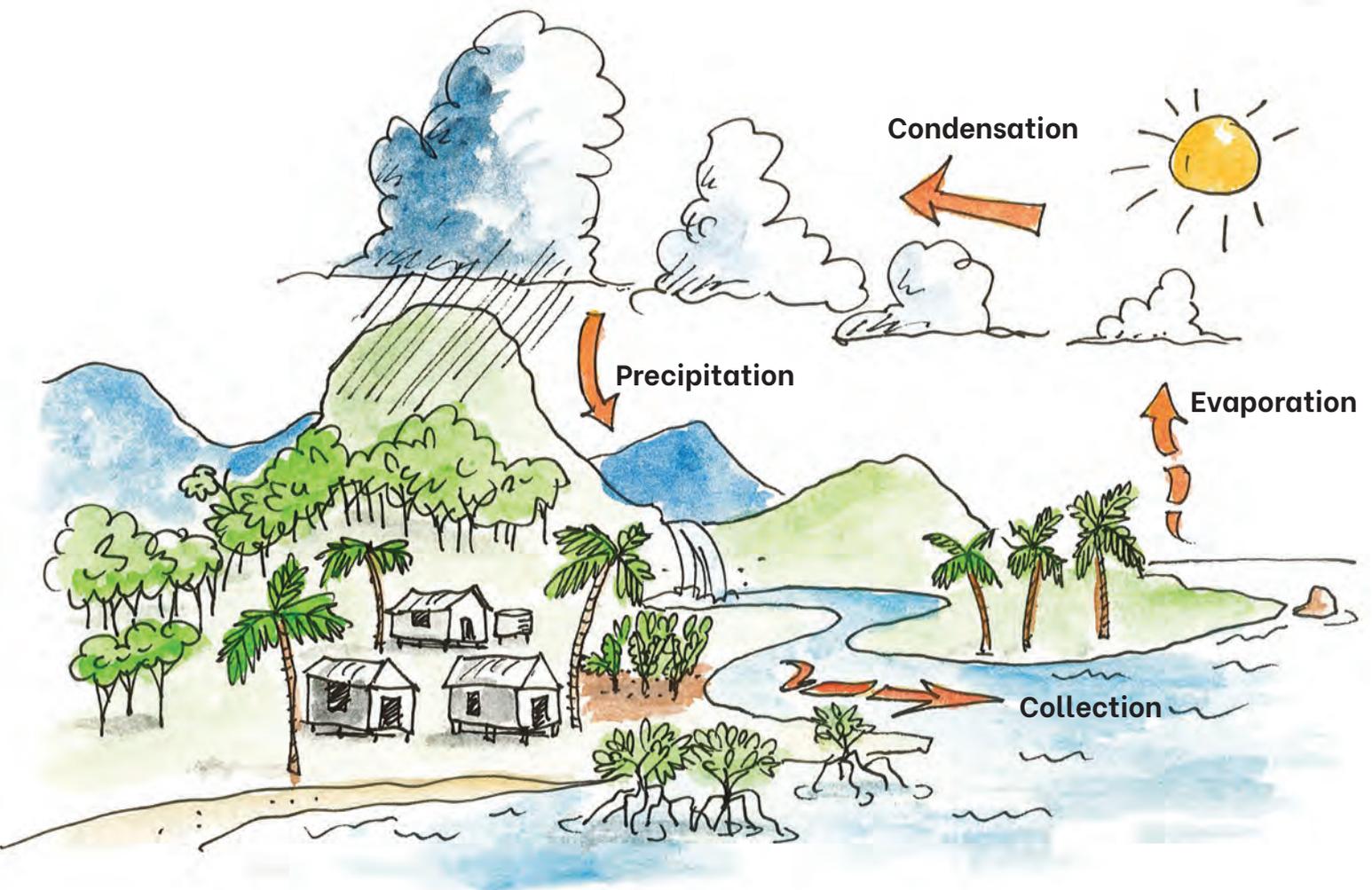
We are going to do some activities over the next few weeks to help us learn about where our water comes from, and how we can look after our water so that it is clean and keeps us healthy – because water is life!

Activity 1.1

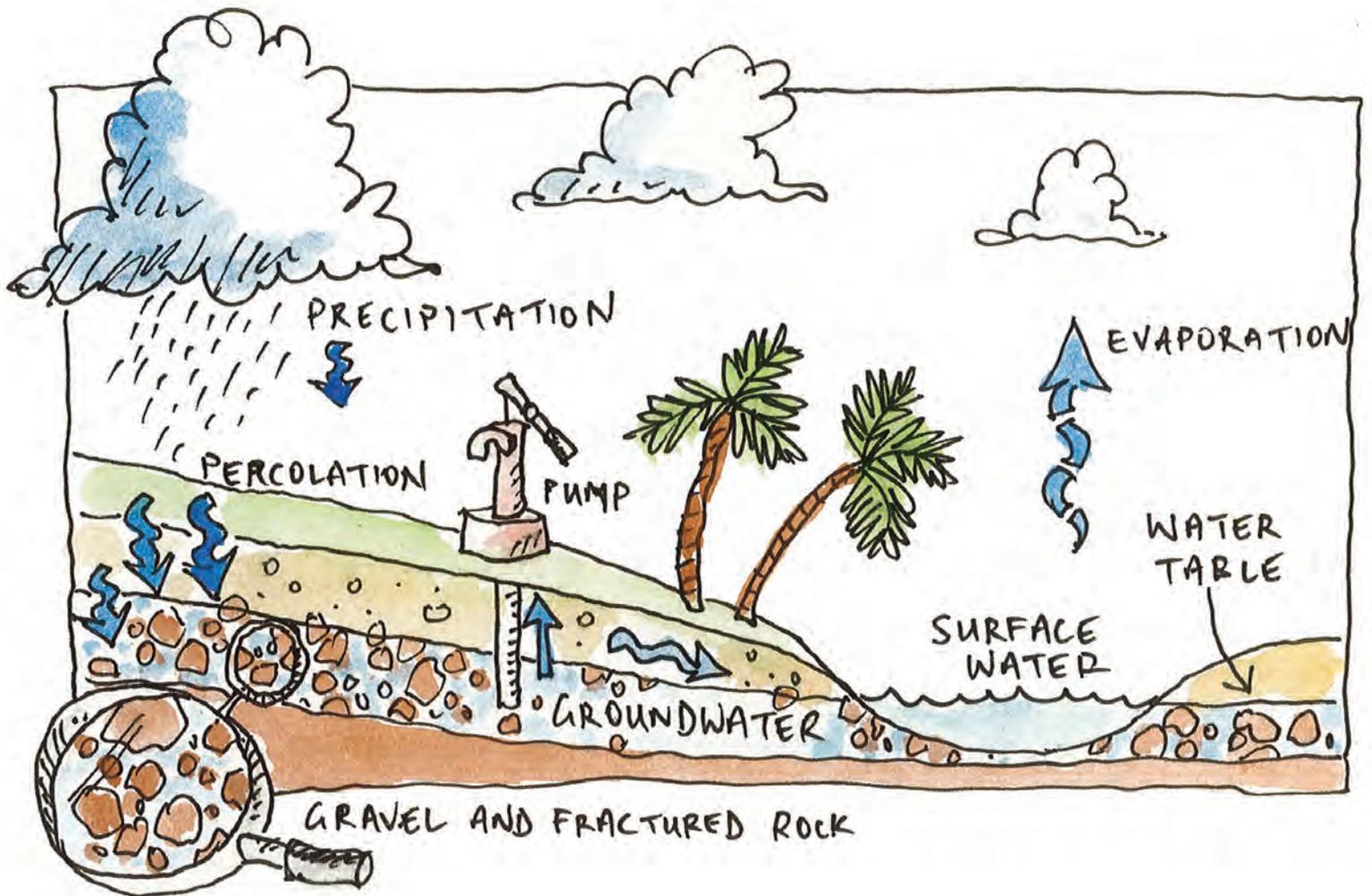
The Water Cycle

Materials

- Cups or bottles of drinking water (get the students to use their own drinking water they bring to school, if the school doesn't have a safe source of drinking water yet)
- Share the two pictures of the water cycle with the students – either by photocopying the pictures or drawing them on the blackboard or a large piece of paper.



WATER CYCLE – Rivers & Ocean



WATER CYCLE – Wells & Pumps

What to do:

DO: Get every student to take a sip of drinking water from a cup or bottle.

EXPLAIN: Did you know that the water you've just swallowed is the same water that dinosaurs, the Pharaohs of Egypt, Moses, or the first humans drank? That's because Earth always **recycles** water, and has been doing this for millions of years.

All the water in the world moves between lakes, rivers, oceans, the atmosphere and the land in an ongoing cycle called the water cycle. As it goes through this continuous system, it can be a liquid (water), a gas (vapour) or a solid (ice).



EXPLAIN: Show the students the two pictures of the Water Cycle and explain the following parts of the cycle:

Evaporation

Energy from the sun heats up the surface of the Earth, causing the temperature of the water in our rivers, lakes and oceans to rise. When this happens, some of the water “evaporates” into the air, turning into a gas called vapour. Plants and trees also lose water to the atmosphere through their leaves. This process is known as transpiration.

Condensation

As water vapour rises up high into the sky, it cools and turns back into a liquid, forming clouds. This process is called condensation. Currents high up in the air move these clouds around the world. Can you see any clouds high in the sky above your school today?

Water Cycle

Precipitation

When too much water has condensed, the water droplets in the clouds become too big and heavy for the air to hold them. And so, they fall back down to Earth as rain or, in cold countries, as snow, hail or sleet, a process known as precipitation. At your school you most likely only experience the water falling from the clouds as rain.

Collection

The fallen precipitation is then collected in bodies of water – such as springs, wells, bores (which is called groundwater), rivers, lakes and oceans – from where it will eventually evaporate back into the air, beginning the water cycle all over again.

So now you understand the water cycle, let's talk about a water catchment.

Activity 1.2

What is a Water Catchment?

Materials:

- Picture of an example water catchment – either photocopy the picture in this manual, or draw it on the blackboard or a big piece of paper
- Some water in a jug or bucket



A WATER CATCHMENT

What to do:

EXPLAIN: Where we collect water from depends on where the water first falls on the land.

- Some rain will fall directly into lakes, rivers or the sea, from where it will evaporate and begin the cycle all over again.
- If the water falls on trees and plants, it may evaporate from leaves back into the air, or trickle down to the ground. Some of this water may then be taken up by the plant roots in the earth.

A catchment is an area where water is collected by the land, such as the area around a river or lake.

DO: Get two or three students to stand up the front of the class and cup their hands together. Pour some water into their cupped hands (either do this over a bucket or basin, or you might want to do this activity outside!). Get the students to notice the water they can hold in their cupped hands, the water that spills over the side and the water that drips into the bucket or onto the ground below.

EXPLAIN: Imagine cupping your hands in a downpour of rain and collecting water in them. Your hands have become a catchment! The outside edge of a catchment is always the highest point. Gravity causes all rain and run-off in the catchment to run downhill where it naturally collects in creeks, rivers, lakes or oceans.

Rain falling outside the edge of one catchment (*demonstrated by the water poured into the hands of the students standing next to each other*) is falling on a different catchment and will flow into other creeks and rivers. Some water also seeps below ground (*demonstrated by the water dripping into the container or onto the ground under the students' hands*) where it is stored in the soil or in the space between rocks. This is called groundwater.

A catchment is an area or basin of land formed by the ridges, hills or mountains from which all the surface water runoff drains to the lowest point of land. The lowest point could be a dam, a section of river or the river mouth or ocean.

As water moves down the catchment, creeks form that feed into larger streams and rivers as they run downhill. Catchments are separated by ridge lines called watersheds. Catchments vary in size, and larger ones are made up of many smaller "sub-catchments". For example, if your school has a hill or mountain behind it the rain that falls on the hill will flow into gullies and streams and into a big river. This is a large catchment. Your school may have roofing iron on a building with guttering to a water tank. This is a sub-catchment within the larger catchment.



Living together in a water catchment

EXPLAIN:

- The water quality in the streams and rivers in a catchment depends on the type of land and how the land is used in a catchment, and how much rainfall you get. Catchments are constantly changing systems. Many of these changes occur naturally as a result of weathering or changing climate or by fires or floods. Within catchment areas close to rivers and oceans there are often people living, gardening, farming, or doing other work because of access to water and good soil.
- Water is generally clean in the upper areas of a catchment (for example, in the hills or mountains) but by the time it reaches the middle and lower catchments it has usually been affected by human activities. Activities taking place upstream can heavily affect those living downstream. These activities include:
 - Farming
 - Mining
 - Aquaculture (fish farming)
 - Changing flow of rivers
 - Forestry
 - Recreation
 - Building towns and factories next to the river
 - Tourism
- How people use land and water within a catchment affects both the environment and how other people downstream can use water. Communities that respect and understand the need to protect and conserve water will better be able to maintain this essential resource for future generations.



Activity 1.3

Mapping your catchment

Why carry out catchment mapping?

Human development around catchments affects the local environment and also the lives of people living in the catchment. This exercise helps students understand the complex nature of the catchment they live in. Taking the class for a walk around the area surrounding the school to identify different aspects of the catchment is a useful way to learn about the inter-relatedness of the local catchment, and drawing attention to the human impact on the area.

Materials:

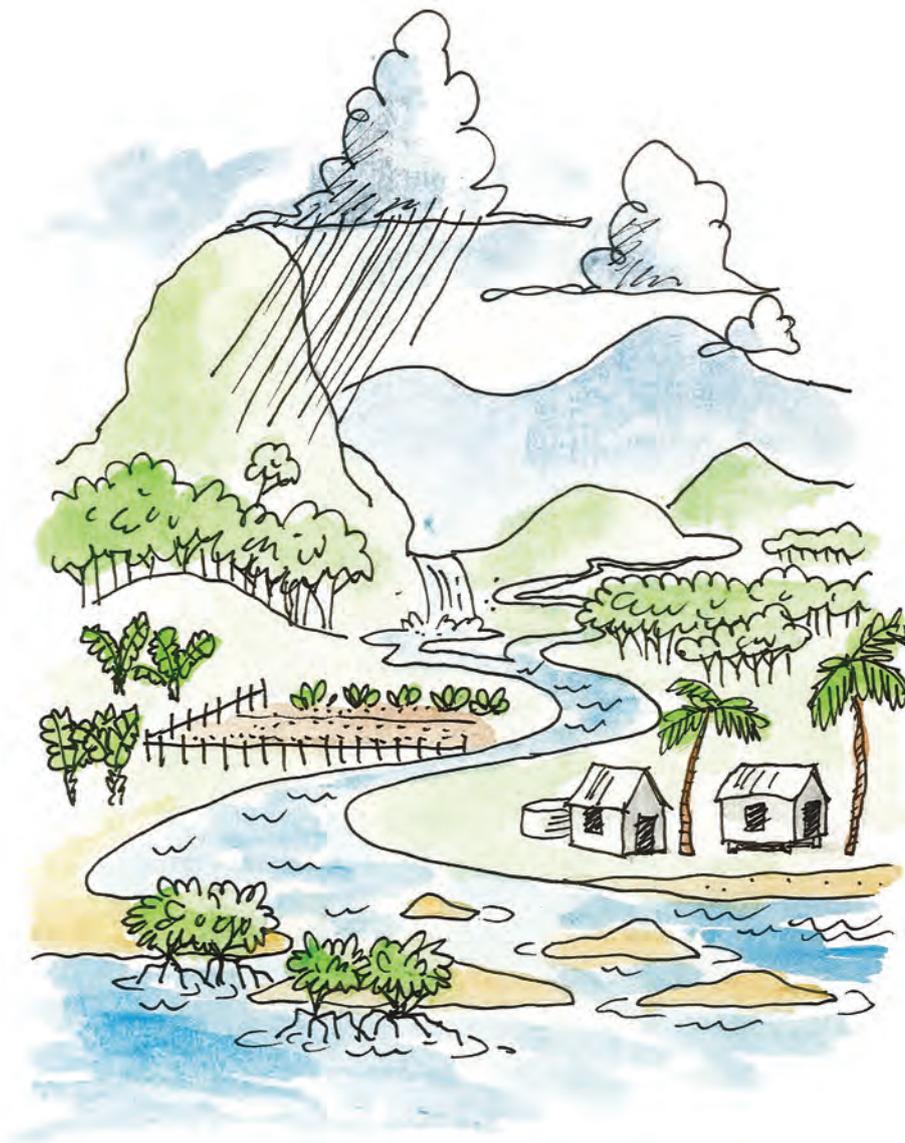
Paper for students to write notes on and for drawing maps. If no paper is available then maps can be drawn on the blackboard, or outside with sticks in sand or dirt in a clear area near the school.

What to do:

- WALK:** Take a walk around your school area in groups and get the students to identify the following in the local area:

	River	Forest	Lake or ponds	Fishing areas	Hill, mountain or ridge	Gardens, cash crops	Industry	Beach or ocean
Yes								
No								

- DRAW:** Get the students in small groups to draw a map of their local catchment, based on the things they observed on the walk. Make sure to include trees, rivers, hills, mountains, lakes, oceans, farms, buildings and roads. Point out what things are human made and what is natural to the land.



DISCUSS:

- How are the things you identified connected? Do rivers run into the ocean? Do houses exist close to rivers or wetlands?
- Looking at your map, how can things that are human built affect the natural characteristics?
- How is the catchment used by people in your area? Tick the boxes below. (You may select more than one.)

Drinking Water	<input type="checkbox"/>	Washing clothes	<input type="checkbox"/>	Water for animals	<input type="checkbox"/>
Fishing	<input type="checkbox"/>	Toilet use	<input type="checkbox"/>	Wood from trees	<input type="checkbox"/>
Dumping rubbish	<input type="checkbox"/>	Watering gardens	<input type="checkbox"/>	Food from forest	<input type="checkbox"/>
Small business	<input type="checkbox"/>	Building roads	<input type="checkbox"/>	Other	<input type="checkbox"/>

- How do you think use of the land by humans could affect the catchment?

MODULE 2

Looking After Our Water Catchment

Learning Outcomes:

-● Students understand how much water is used in their homes and at school
-● Students understand how human actions within the catchment impact our water sources
-● Students understand the impact of climate change, and some simple adaption strategies

Activity 2.1

How do we use water?

Materials:

- Paper for students to write notes on
- Blackboard to write up table for students to copy in their calculations

What to do:

ASK: How much water do you think your family uses every day? How much water do we use in our school every day? Let's look at the common ways a family uses water in their household and work out how much that family uses in a week. Then we will look at how we use water in our school.

ACTIVITY: Get the students to work in groups to complete the following tables – one for home and one for school.

This work involves some counting and multiplication tasks, so you will need to explain to the students how to work these out if they are unsure.

For younger children you can give them numbers you have calculated yourself, and demonstrate how much water this is by showing them a bucket or bottle filled with water and getting them to imagine how many bottles or buckets are needed every day to reach the total amount of water needed in a family or in the school.



How much water does your family use every day?	Number of times per day this is done in your family	Total litres of water used by family in a day for this activity	Total litres of water used by a family in a week (multiply the number in the daily column by 7)
Cooking a meal uses around 10 litres of water			
Washing dishes in a sink uses about 9 litres of water <i>(if dishes are washed under a running tap much more water is used)</i>			
Washing clothes by hand uses 60 litres of water and a washing machine uses around 155 litres <i>(if clothes are washed under a running tap much more water is used)</i>			
Bucket shower uses 12-30 litres			
Flushing a toilet uses 11 litres			
Washing hands after going to the toilet uses about 1 litre of water <i>(if you use a tap, less if you use a basin)</i>			
Washing hands before cooking food uses 1 litre of water <i>(if you use a tap, less if you use a basin)</i>			
Every person in a family should drink 2 litres of water each every day			

How much water does your school use every day?	Estimated number of times per day this is done in your school	Estimated total litres of water used by your school in a day for this activity	Estimated total litres of water used by your school in a week (multiply the number in the daily column by 7)
Flushing a toilet uses 11 litres (if your school has dry pit or composting toilets leave this line blank)			
Washing hands after going to the toilet uses about 1 litre of water			
Washing hands before cooking food uses 1 litre of water (if you use a tap, less if you use a basin)			
Group handwashing activities uses about 20 litres of water			
Cleaning of toilet blocks uses about 20 litres of water			
Every student and teacher should drink at least 1 litre of water at school during the day			



DISCUSS: After the students have some idea of the amount of water a family or the school needs to have every day, get them to discuss whether there is always enough water at home or at school, and what they do when there isn't enough water. Is it common for there to be water shortages in your community?

Activity 2.2

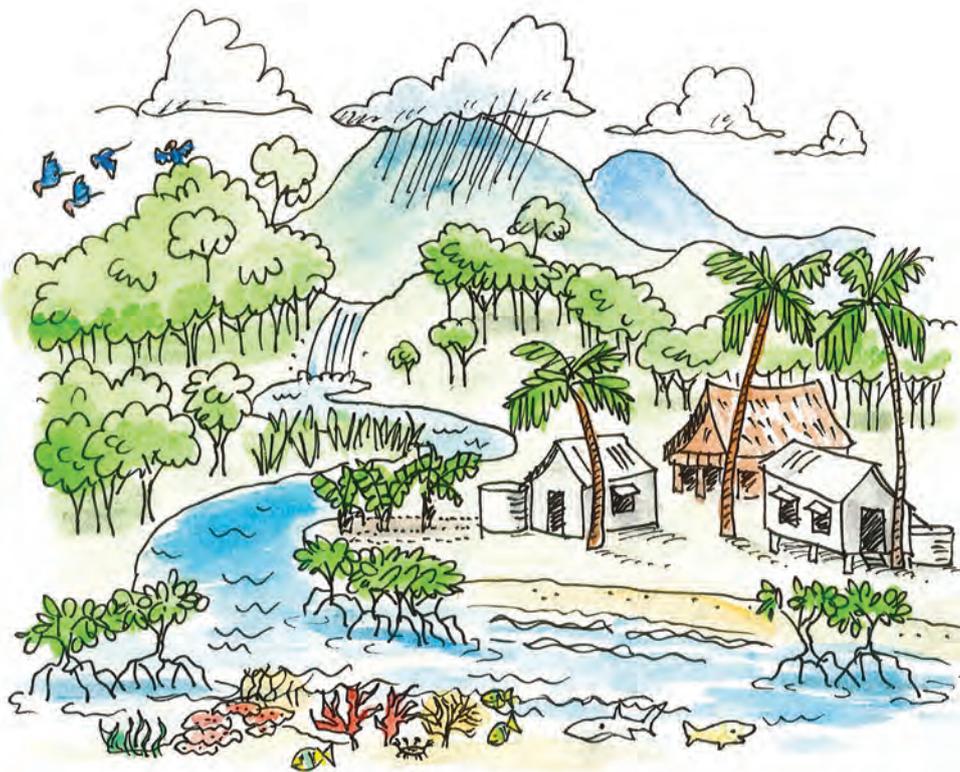
What things can damage our water catchment?

Materials:

- Two pictures from the manual of healthy and unhealthy catchments – either individual copies for the students, or redraw them on the blackboard or large pieces of paper
- Notepaper for students to use
- A copy of each table for the group work (write it out by hand)
- Drawing paper and coloured pencils or paints for the optional poster activity (if available)

What to do:

- **SHOW:** Show the students the picture of the healthy catchment. Ask them to describe what they can see. Then show them the picture of the unhealthy catchment. Ask them to describe what they can see. (They should note things like amount of trees, erosion, pollution in the river and health of the reef.)



A HEALTHY WATER CATCHMENT



AN UNHEALTHY WATER CATCHMENT

EXPLAIN: There are four areas that can threaten the health of a water catchment, and result in less water for the community, or polluted water. These four things are:

1. Threatened forests, vegetation and agriculture
2. Threatened freshwater resources
3. Threatened coastline/mangroves/seagrass beds
4. Threatened people/children

The threats to our water catchment can be from human activities and natural events.

GROUPWORK: Get the children to stand in an open space. Read through each of the threats in the tables below and get the children to move to the left side of the room if they think it is as a result of human activity, and move to the right side of the room if they think the threat is the result of natural activity. If they think it could be both, then stand in the middle of the room.

Threatened forests, native vegetation and agriculture	Human activity	Natural event
Clearing of too much forest for firewood, selling to logging companies, or other development		
Unmanaged or bad agricultural practices – (e.g., no composting of taro patches, monocropping, removal of native vegetation)		
Overrun with invasive species that threaten native plants and animals; invasive plant species don't hold soil well		
Prolonged, severe droughts – when there is no rainfall		
Other?		

Threatened freshwater resources	Human activity	Natural event
Using chemicals without proper care that spill into the ground and pollute the water		
People collecting too much freshwater from wells so they are not able to refill		
Pit toilets or septic tanks too close to rivers or creeks used for drinking water, and water gets polluted		
Drainage or run-off from doing laundry, having a shower, washing a car or other activity runs into rivers or creeks and the water gets polluted		
Saltwater contamination (king tide) of drinking supplies and gardens		
Other?		

Threatened coastline/mangroves/seagrass Beds	Human activity	Natural event
Clearing of native vegetation (mangroves/trees/shrubs/reeds) along the shore		
Coastal erosion by storms or king tide		
Dredging of sand – loss of seagrass		
Overharvesting of species that live in these areas (too many people taking very large fish/shellfish that can supply the reef with more offspring, or taking very small fish/shellfish that were not able to reproduce)		
Environmentally damaging types of coastal development (e.g. seawalls)		
Other?		

Threatened people/children	Human activity	Natural event
Homes and community infrastructure and services are located in flood zones.		
No sustainable, local source of drinking water (bottled water is not sustainable)		
Damaged food crops, lack of food variety, dependency on imported foods		
Increased illness from dirty water (during drought and also during flooding)		
Physical stress and dehydration from extreme heat and drought		
Other?		

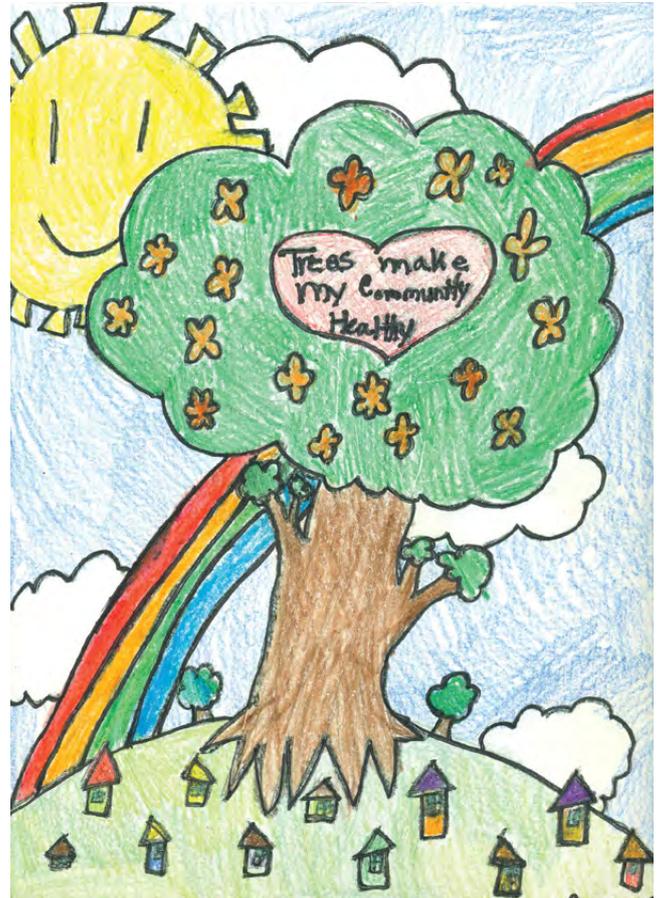
DISCUSS: When this activity is completed with the students discuss how many threats to the water catchment are from human activity and how many are from natural events (most are from human activity). Discuss what humans can do to reduce the threats. Write a list of these activities (suggestions include):

Water catchment care and water saving strategies

1. Establish community rules to protect upland native trees and plants, and select zones that cannot be cleared and burned.
2. Keep natural trees and plants on high slopes and mountains above the community to protect reservoirs and freshwater areas – ensure areas that catch rain (where the clouds form on higher mountains, for example) are free from pollution.
3. Apply wise farming practices that do not clear too much land and erode the soil.
4. Install household or community water catchments and tanks to save rainwater for times of limited rain or drought.
5. Fix leaky pipes to existing water tanks so that available rainwater is being captured for use.

ADDITIONAL ACTIVITY: Get the students to draw or paint posters to share some of these messages about protecting the water catchment and wise use of water.

The examples below are from other schools.¹



¹ Sources of poster examples:

<https://www.rowlandwater.com/ivy-dong-page/>

<https://vicwater.org.au/events-awards/national-water-week>

<https://californiareleaf.org/arbor-week/2014-ca-arbor-week-winners/>

Activity 2.3

How does climate change affect our water catchment?

Materials:

- Four pictures from this activity – either individual copies for the students, or redraw them on the blackboard or large pieces of paper
- Notepaper for students to use

What to do:

EXPLAIN: Climate change and water

Earth has its own control system. The oceans, the land, the air, the plants and animals, and the energy from the sun all affect each other to make everything work in harmony. Nothing changes in one place without changing something in another place. The overall effect gives us our global climate.

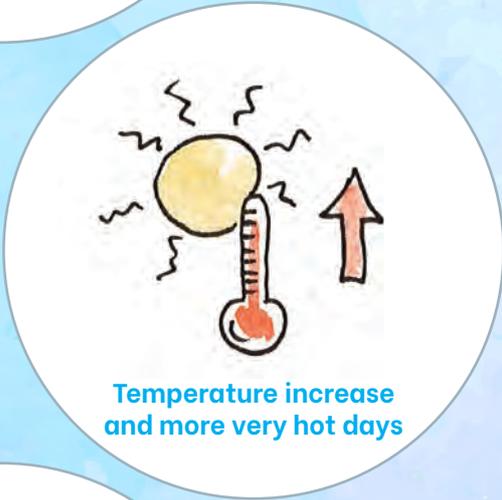
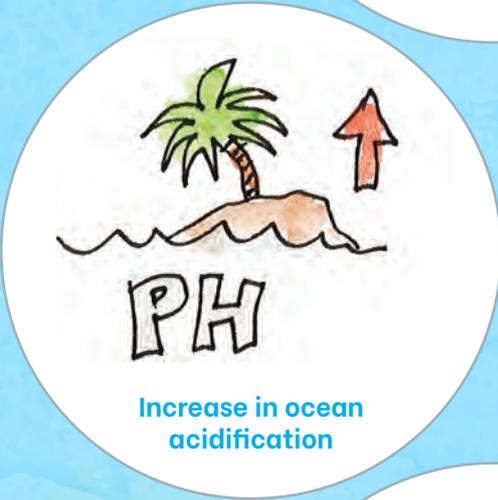
- Climate:** The average pattern of weather conditions over a long period of time. Climate isn't weather – weather changes daily.
- Global warming:** The increase in Earth's average temperature over a long period of time.
- Carbon dioxide:** A gas released by the burning of coal, natural gas, oil and wood that traps heat in the atmosphere.
- Fossil fuels:** Coal, oil and natural gas, which come from the breakdown of ancient plants and animals in the ground.

The Earth is now warming at a much faster rate due to human causes. Things that are increasing the warmth of the Earth include:

- Generating electricity through burning fossil fuels
- Driving cars and trucks that use petrol or diesel
- Flying planes that use aviation fuel
- Running factories on electricity
- Logging forests
- Forest fires

These activities release carbon dioxide into the air, which act like a blanket in the sky, trapping in the warmth of the sun's rays. When the air around the Earth gets warmer the global climate starts to change. A warmer global climate includes more unpredictable and unreliable weather patterns, and more extreme weather, such as stronger storms.

CLIMATE CHANGE AND WATER



How does a changing climate affect our water supply?

We are going to learn about two ways that the changing climate affects our water supply:

1. Sea level rise
2. Rainfall

1 SEA LEVEL RISE



- 1 Potential for storm surges, flooding, erosion
- 2 Potential for droughts or floods and landslides
- 3 Potential for stress on plants and crops
- 4 Potential for coral bleaching

EXPLAIN: There are two reasons why sea levels are rising.

The first is easy to think about. At the north and south poles of the Earth most of the land and sea is covered with ice. A warming climate makes the air at the north and south poles warm enough to melt some of the ice. When this ice melts more water goes into the world's oceans.

Understanding the second way sea level rises needs you to use your imagination a bit more. The top parts of the ocean, down to about 700 meters, have absorbed most of the extra heat in the air generated through climate change.

Warm water takes up more space than cool water. To understand this properly you need to know about how molecules dance around – but for now just think about how when you put your hand in a container of very hot water you dance around a lot, and when you put your hand in a container of very cold water it can make your hand feel slow and heavy. In the ocean hot water molecules dance around and take up more space, and cold water molecules huddle together more closely.

So warm water takes up more space, which means the sea level rises higher onto your local beach. Sea level rise can cause stronger storm surges, flooding of areas close to the sea, and saltwater moving inland and contaminating underground drinking supplies.

2 RAINFALL

Changes in weather patterns can mean less dry season rainfall and more wet season rainfall. This can also mean more extreme rainfall days, hot days and stronger cyclones. Droughts and floods are more likely to occur.

If not enough rain falls and there is drought:

- 🔹 springs may dry up
- 🔹 wells may be empty
- 🔹 rainwater tanks may not fill up quickly enough
- 🔹 rivers or creeks may dry up, or get so small and full of mud they can't be used for drinking water

If too much rain falls:

- 🔹 landslides may occur and contaminate or block water supplies
- 🔹 wells and rivers may be flooded, so the water is dirty
- 🔹 pit toilets may get flooded and contaminate drinking water supplies
- 🔹 flood waters may contribute to increase in diseases

High rainfall effects



Low rainfall effects



DO: Ask students in pairs to look at the two pictures of the high and low rainfall effects and ask them to describe what they see. Have students make a list of the effects they see in the pictures.

DISCUSS: Ask students to imagine what problems are most likely to affect their school and the surrounding communities due to having too much rain or not enough rain.

Activity 2.4

Things we can do to protect our water supply in a changing climate

Materials:

- Notepaper for students to use

What to do:

EXPLAIN: We can do many things to protect our water supply in a changing climate. Following are some of these things. (You may think of more.)

Problem	Adaptation Solution
Springs dry up, wells are empty	<ul style="list-style-type: none">• Put rainwater guttering on all permanent buildings and install extra water tanks to catch rain during more frequent storms.
Landslides during heavy rain that contaminate water supplies	<ul style="list-style-type: none">• Keep forests (don't cut them down!) as trees hold soil tightly together, and love eating carbon dioxide in the air.• Plant trees in areas where there has been logging, or where erosion is a problem
Flooded toilets contaminating water sources	<ul style="list-style-type: none">• Build all toilets 2 metres above ground water level, and at least 30 metres away from all water sources.• Relocate all septic tanks to higher ground if necessary.
Floodwaters causing diseases	<ul style="list-style-type: none">• Make sure the school and community areas have good drainage so that rainwater can move away quickly.• Plant trees, shrubs and gardens that absorb water quickly and hold soil together.
Short-term water shortages during cyclones and storms	<ul style="list-style-type: none">• Make sure the school is ready to be a local evacuation centre for emergencies, with a safe space on higher ground that has emergency supplies

DO: Ask the students to pick one of the following activities to complete:

Write a short story...

Write a short story about an animal in the forest or fish in the sea and what changes they notice when their environment is affected by logging, flooding or warmer oceans, or similar. Describe how the changes affect them and how they might feel.

OR

Write a letter...

Write a letter to the prime minister or other leader about climate change and what effects it may have on the water supply in your local school and community. You don't have to post the letter, but you should think about the problems that they should know about, how that makes you feel, and how the government might be able to help with adaptation solutions.

OR

Draw a picture or diagram...

Draw a picture or diagram of adaptation solutions your school or community can do right now to protect the water catchment and water supply in your community.

OR

Make a map...

Make a map of your school/village/town/city and place points on the map and label where effects of climate change might affect the water catchment or access to safe drinking water, and what adaptation solutions you think could be helpful.



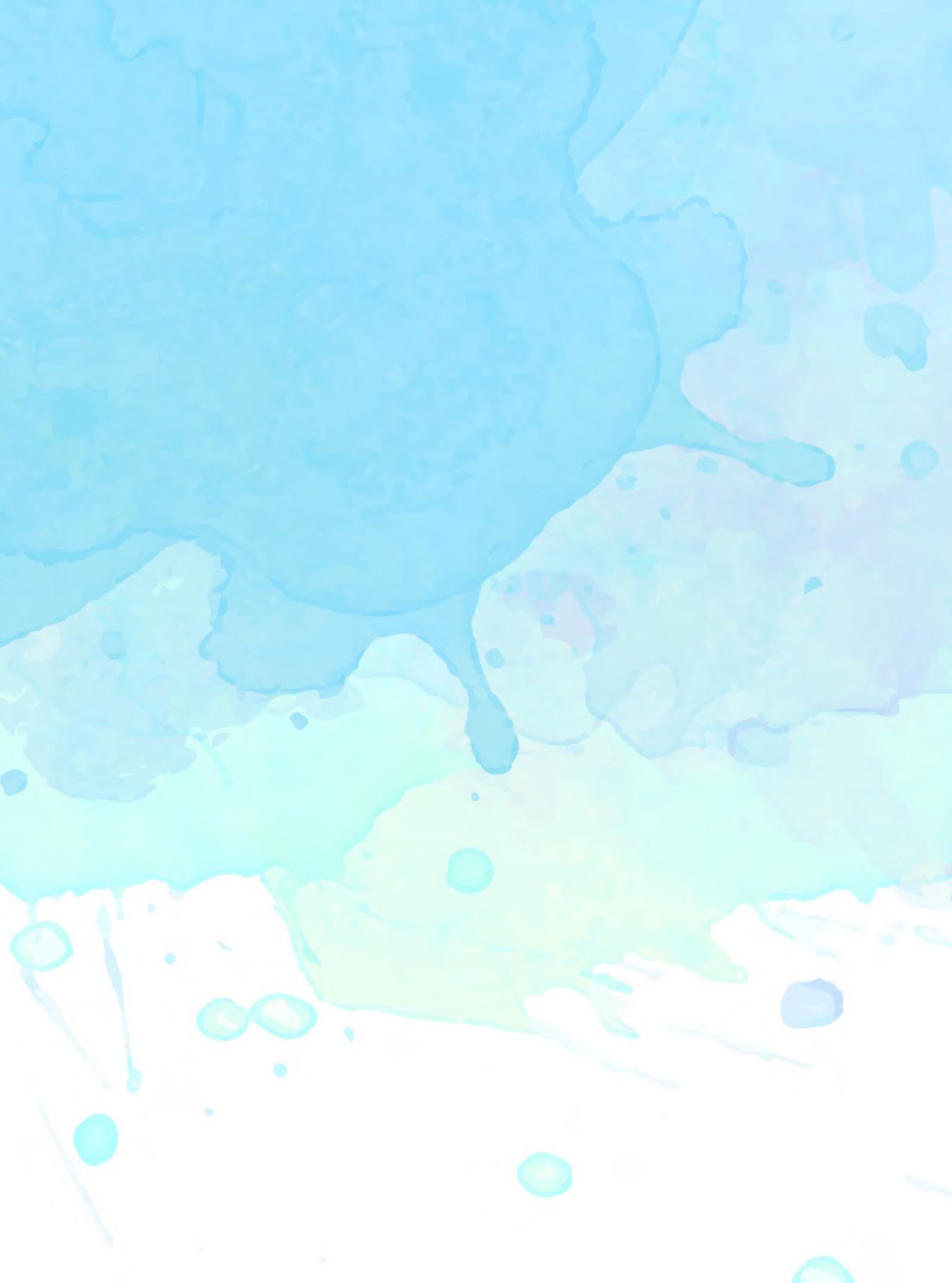
FACTSHEET: **Trees are Cool**

Trees are our allies in the fight against climate change. Trees do wonderful things for our environment:

- Trees absorb and store carbon dioxide, and produce oxygen.
- They reduce the salinity (saltiness) of the soil.
- They clean the air by absorbing pollutants.
- They cool the air by releasing water through their leaves, a process called evapotranspiration.
- They cool the ground through their shade.
- They provide homes for birds, animals and even other plants.
- Their roots hold the soil together, preventing erosion.
- They suck up water when it rains, preventing flash floods.
- They even help with mental health, by providing beautiful views to enjoy.

We need to plant as many trees as we can!





MODULE 3

Keeping Our Drinking Water Clean

Learning Outcomes:

-⦿ Students understand the different sources of drinking water
-⦿ Students can talk about water contamination and the diseases that can be carried in water
-⦿ Students understand how to prevent simple risks to drinking water
-⦿ Students are able to conduct a water safety audit and make suggestions to improve water safety

Activity 3.1

Sources of drinking water – rivers and streams

Materials:

- Notepaper for students to record observations or draw pictures or maps

What to do:

EXPLAIN: Usually there are four main sources of drinking water:



Rivers and streams

Our rivers and streams can originate from springs (water coming out of the ground), or from rainwater runoff from the mountains and hills draining to the lowest point of the land.



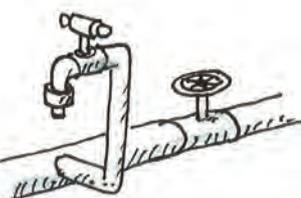
Bores and ground wells

Bores and ground wells are holes drilled or dug down to natural stores of water under the ground (groundwater).



Rainwater

Rainwater is water that has fallen as rain. It can be collected from a corrugated iron roof or another structure and stored in a container like a drum or rainwater tank.



Piped water

Piped water can come from springs, rivers, underground wells, tanks or dams. With a bore, a hole is drilled down into water stored under the ground and the water is pumped out into tanks. Pipes then go from these tanks to schools and houses in the community. If the river is the source of piped water, it can be pumped or gravity fed into storage tanks and then fed into a system of pipes to the community.

DO: Field trip for students to observe water source – preferably a river or stream. The purpose of this activity is to observe, and then discuss the activities taking place along the river or stream edge, and to make connections between these activities and the pollution of the river or stream.

What to do

1. Walk along the edge of a river or stream.
2. Get the students to observe and record how the people are using the river or stream. In their notes they should include the following:
 - o How many houses and gardens are near the edge of the water?
 - o How close are the nearest houses (in meters)?
 - o What kinds of toilets are people using and how far from the river or creek are they located?
 - o Is there any rubbish that has been dumped into the river or creek, or on the banks?

	Student observations
How many houses are less than 30m from water's edge? How many metres between the house and the water for the closest houses?	
What kinds of toilets are used? How many metres between the toilets and the water?	
How is the river or creek used? Laundry? Swimming? Bathing? Fishing?	
Can you see rubbish dumped on the side or in the river or creek?	
What improvements could be made?	

DISCUSS: Making meaning of the field trip

- In the classroom discuss how these houses could be polluting the river or creek.
- Ask the students to draw the river or creek and label the places where it is used for washing, swimming, gardening, rubbish dumping, etc.
- Ask the students to work in small groups and instruct each group to write down actions that need to be taken (what can the people in these houses do to change things?). When each group has finished, ask one student from each group to share some ideas with the rest of the class.
- As a group discuss what we can do as a school/class/individual. Part of this plan may be public awareness about the river or creek and how it becomes polluted.
- Ask a local elder, councillor, chief, MP or other community leader to come to your class or write them a letter and show him/her your findings. Ask how he/she can help.



Activity 3.2

Sources of drinking water – understanding groundwater

The purpose of this activity is to understand what groundwater is and how it moves and to make the connections between groundwater and contaminated drinking water.

Materials

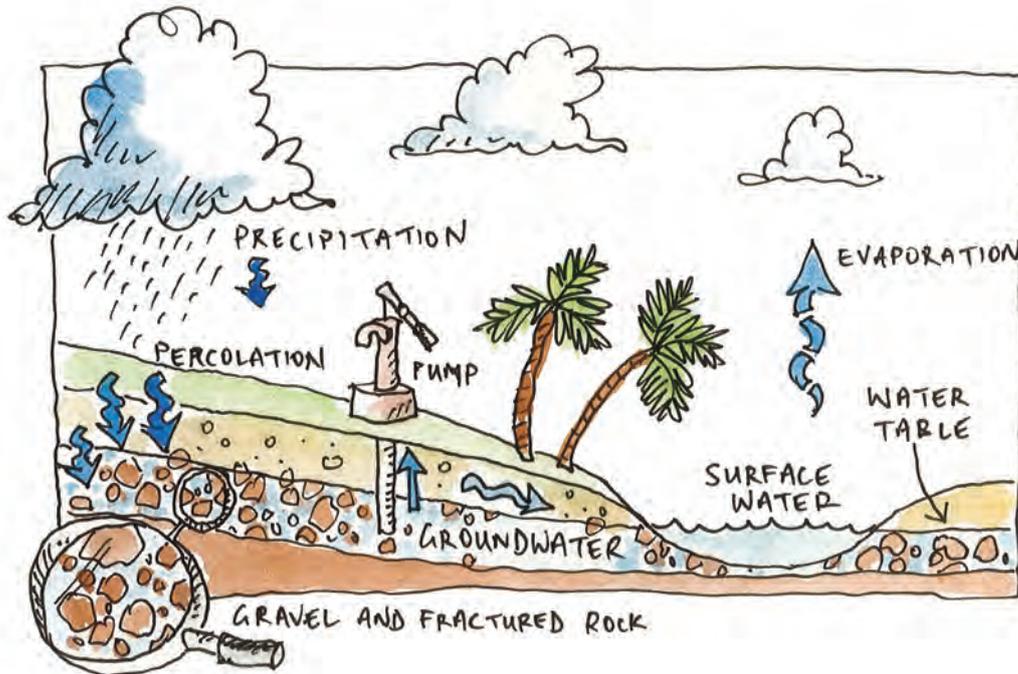
- A container such as a cake tin
- Clean sand
- Bright coloured cordial (red) or water with dye

What to do

1. Get a student to fill the container with sand and pat it down firmly.
2. Get the students to pour some red cordial or strong dyed water into the sand on one side of the container.
3. Sprinkle the sand with water until it is saturated but not too wet.
4. Get another student to tip up the side of the container where the cordial or dyed water was added and hold the container at an angle for 2-3 minutes.
5. After 2-3 minutes rest the container back down flat. Using a spoon or stick, dig the sand out of the end of the pan opposite to where you poured the cordial and observe what is underneath.



- EXPLAIN:** Show the students the picture about groundwater (either share copies or draw on the blackboard or paper).



Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in these cracks and spaces, and moves slowly through soil, sand and rocks called aquifers. How does the water get under the ground? It comes from the rain that falls onto forests and the land and seeps down into the cracks beneath the surface of the earth.

Groundwater can come to the surface at a natural spring, or into lakes and streams. We can also use the groundwater when we dig a well or drill a borehole.

How far down is the groundwater? This depends on many things, like how sandy or rocky the ground is where you live, and how much rain falls each year. We call the top boundary of the groundwater the water table. The water table is where we measure how far down the groundwater is.

Shallow wells may go dry if the water table falls below the bottom of the well. The water table near a river is usually high, so if you dig a well the water is usually not too far down. If the soil is very sandy or loose it can be very easy for the groundwater to be polluted.

Groundwater can be polluted by buried rubbish, septic tanks, dry pit toilets, and from overuse of fertilizers and pesticides. If the groundwater becomes polluted, it is not safe to drink it.

It is very easy to contaminate groundwater, but there are also easy ways to keep groundwater safe from contamination:

1. Toilets (dry pit and septic) need to be more than 30 metres away from all water sources.
2. Toilets should be built downhill from place where groundwater is collected, to avoid sewerage water running down into the groundwater and contaminating it.
3. Wells should be kept covered when not in use, to keep out animals and their faeces.
4. Keeping vegetation away from the sides of the well also helps to prevent animals hiding close to it.
5. Water should be collected with clean containers such as buckets.

Activity 3.3

Sources of drinking water – rainwater

The purpose of this activity is to understand what rainwater is and to make the connection between rainwater storage and contaminated drinking water.

Materials

- Picture from the manual – either individual copies for the students, or redraw it on the blackboard or large piece of paper
- One plastic bottle or water container with a lid – very clean
- Water to fill the containers
- One plastic bowl or bucket with no lid – with visible dirt in it or on the outside
- Notepaper for students to use

What to do

- **EXPLAIN:** Most of the water that we use has at one stage fallen as rain, as part of the water cycle. But when we use the term **rainwater**, we mean water that has fallen as rain and has been collected from a corrugated iron roof or another structure and stored in a container such as a rainwater tank, for drinking or washing.



DO: Get the students to look at the picture of the roof and water tank. They need to identify three different ways that the water in the tank could become dirty.

EXPLAIN: Most people think that rainwater is always safe to drink. Mostly this is true – if the air where you live is clean then the rainwater will also be clean. But to make sure that the water is safe you should do the following things:

1. Roofs and their gutters need to be kept clean (this also prevents rust).
2. Branches from overhanging trees should be cut to prevent leaves dropping into the gutters.
3. Make sure tank openings are screened so that birds, rats and lizards, which have access to the roofs and gutters, don't contaminate the water with their droppings or even get inside the tank.
4. Having a screen on the water inlet on every tank stops mosquitos from breeding in the collected water.

DO: Put the two containers in front of the students. Fill both containers with water from a known safe source (school water tap, school water tank, etc.). Get the students to answer the following questions:

- True or False?* The water in both containers is from a safe source, so both are safe to drink.
- True or False?* The water in the clean container with a lid is the safest.
- True or False?* The water in both containers will not be safe if we touch it with a dirty cup, ladle or dirty hands.

(Answers: False, True, True)

EXPLAIN: Putting a lid or cap on water storage containers helps keep water free from contamination from dust or insects. When we use water containers, we should always make sure our hands have been washed with soap and water.



Activity 3.4

Understanding hazards for safe drinking water

This section will allow students to understand the complexity of issues that are related to water supply throughout many areas and make sure they're using the right way of collecting different types of water.

The following section outlines different types of water sources that might be used in your school's area.

Emphasise the examples that are most relevant to your school and use the discussion prompts to have a group discussion on each type of water source. Then students can answer questions at the end.

Materials

- Factsheet from the manual – either individual copies for the students, or redraw it on the blackboard or large piece of paper

What to do

- **EXPLAIN:** Review the factsheet “Keeping our Drinking Water Safe” with the students. This can be done as a whole class, or in small groups.

Once the students are clear on the information about water sources, how they can become contaminated, and how they can be made safe, get the students to answer the following questions:

- **DISCUSS:**
 - What are the main types of water supply in your school and community?
 - Are there differences between your home and school water supplies?
 - What are the biggest problems that might occur with your water supply?
 - What steps can you take to make sure your water supplies at school and home are safe?

FACTSHEET: Keeping our Drinking Water Safe

How does the water get there?	What might make the water unsafe?	How can we make it safe?
Rainwater tank		
Rain falling on roof, into gutters and then into pipes	Dirt on the roof, bird poo and leaves on the roof; dirty, uncovered water collection containers; dirty hands touching taps or water collection containers	<ul style="list-style-type: none"> • No leaking taps • Good pipes into the tank • Clean roof • Clean water intake screen • Tank is not cracked or leaking • Keeping water collection containers clean, and covered with lids • Washing hands with soap before collecting water
Shallow wells		
Groundwater fills the well	Lack of rainfall reducing groundwater levels, animal waste washed into the well, human waste from open defecation or toilets built too close to the well, dirty hands collecting water in dirty containers	<ul style="list-style-type: none"> • Regular cleaning of area around well • Regular maintenance of any pumps to make sure they are working well • Keeping water collection containers clean, and covered with lids • Washing hands with soap before collecting water
Water barrels		
Dam, spring, reservoir, pipeline, containers	Waste and germs from animals, animals getting in barrels, breakages in pipelines bringing in sediment, dirty hands collecting water in dirty containers	<ul style="list-style-type: none"> • Well-maintained pipes and taps • No cracks or holes in barrel, sealed from animals • Keeping water collection containers clean, and covered with lids • Washing hands with soap before collecting water
Surface water		
Rainfall cycle, rivers, streams, creeks	Animal waste in the water, sediment from erosion or land clearing, chemicals in water, humans bathing or going to the toilet in the water	<ul style="list-style-type: none"> • Access to water source is safe • Animals (pigs, chickens, etc.) are kept in pens so they can't get into the water • Keeping water collection containers clean, and covered with lids • Washing hands with soap before collecting water
Tap-stand		
Dam, spring, reservoir, pipeline	Contamination in pipeline to tap-stand, animal waste around tap-stand, dirty hands collecting water in dirty containers	<ul style="list-style-type: none"> • Secure, proper pipe and taps without leaks • Good drainage around tap-stand • Keeping water collection containers clean, and covered with lids • Washing hands with soap before collecting water

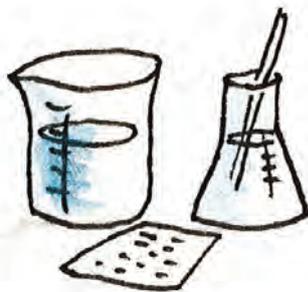


EXPLAIN: There are ways that we can treat our stored water in order to kill any bacteria and microorganisms that can cause disease:



Boil water with lots of bubbles for one minute, let it cool and put it in a clean container with a lid before you drink it.

Put clean-looking water into a clear plastic bottle, put the lid on and shake the bottle, then leave it in the sun for 6 hours (or 2 days if it is cloudy). The sun kills any bacteria in the water.



We can also add chemicals such as chlorine to water to purify it.

Activity 3.5

Conducting a water safety audit at school

This activity will allow students to observe, record and make connections between possible contaminated water at the school, and water safety management and practices.

Materials

- Water audit forms – enough for students to work in groups (if you can't get copies, then get the students to write down the water audit questions on paper)

What to do

EXPLAIN: Why carry out a water audit?

An audit is simply a series of questions and observations that we use to find out more about drinking water in the school, how it is used, and whether it is at risk of being contaminated.

We do a water audit to get a better understanding of what we need to do to make sure the school drinking water is clean and healthy.

We want to know the following things:

- *How is water being used?*
- *Where does the water come from?*
- *Is the water at risk of being contaminated by disease-causing germs?*

Take the class out to the school's drinking water source and go through the audit questions.

WATER AUDIT

Fill in the boxes below where they apply to your school

Water source (where do you get your drinking water from?)	What do you use it for?	Does it ever run out?	Do you think it is safe to drink? (explain)
Water tank			
Well			
River			
Other			

Rainwater Tanks

Condition of gutters and roofs (if present)	Please tick	How often are these things maintained/cleaned?	Please tick
Very good – very few leaves, no dirt or evidence of animals		Often (every 1-2 months)	
Good – few leaves, little dirt or evidence of animals		Occasionally (twice a year)	
Poor – many leaves, some dirt, evidence of animals		Rarely (once a year) or Never	

Is there an intake screen on the tank? Yes No

How often is it cleaned?

.....

.....

.....

.....

Is there any uncovered opening on the rainwater tank? Yes No

.....

.....

.....

.....

Well water

What kind of well do you have?

Drilled (bore) Dug Open Sealed

What types of toilets are “nearby” in the community (include neighbouring properties)	Approximate distance from well (meters)	Are these uphill, downhill or on flat ground?
Pit/VIP toilet		
Septic tank		
Area where people defecate (e.g. in the bush or river)		

River

1. How many meters is the school from the nearest creek or river?

2. How is the river used by people in the school? (You may tick more than one answer)

- | | | |
|---------------------------------------|---------------------------------------|---|
| <input type="radio"/> Drinking | <input type="radio"/> Washing clothes | <input type="radio"/> Cleaning dishes |
| <input type="radio"/> Fishing | <input type="radio"/> Washing cars | <input type="radio"/> Disposing of waste water |
| <input type="radio"/> Dumping rubbish | <input type="radio"/> Toilet | <input type="radio"/> Providing water for animals |

Pipes and taps

Do you have access to piped water via tap? Yes No

How many people share this tap?

Is the area around the tap-stand fenced? Yes No

Describe

.....

.....

.....

.....

Is there water on the ground near the tap-stand? Yes No

Describe

.....

.....

.....

.....

What types of toilets are nearby? (including in neighbours' properties)	Approximate distance from toilet to tap?	Are these toilets uphill, downhill or on flat ground?
Pit/VIP toilet		
Septic tank		
Area where people defecate (e.g. in a bush or river)		
Other (please explain)		

Activity 3.6

Understanding the water safety audit

Doing a water safety audit on the school's drinking water source is a good way to demonstrate to the students how they can make sure their drinking water at home is safe, and to help them come up with suggestions they can make to school leadership on improving the safety of drinking water at school.

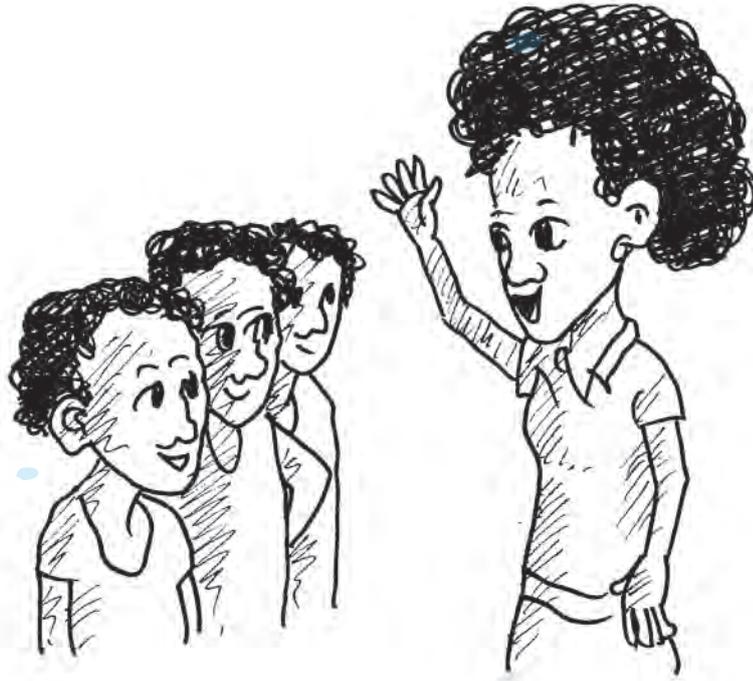
Materials

- Factsheet: Keeping our Drinking Water Safe
- Completed water audit information for the school
- Notepaper for students to write down their analysis and recommended actions

What to do

1. Have the class break into groups of 5 or 6.
2. Give each group a large piece of paper.
3. Have them draw the table below (*only draw tables for the water sources that are in your school*).
4. Get the students to use the information collected in the water audit and the information in the fact sheet to find any possible problems with the drinking water at the school.
5. After they have found possible problems get the students to write suggested actions they can take.

Rainwater tanks	
Why might it be unsafe? <i>Problems seen from the audit</i>	How can we make it safe? <i>Actions you recommend for the school</i>
Well water	
Why might it be unsafe? <i>Problems seen from the audit</i>	How can we make it safe? <i>Actions you recommend for the school</i>
Surface water	
Why might it be unsafe? <i>Problems seen from the audit</i>	How can we make it safe? <i>Actions you recommend for the school</i>
Tap-stand	
Why might it be unsafe? <i>Problems seen from the audit</i>	How can we make it safe? <i>Actions you recommend for the school</i>



ACTION: Organise a meeting with the school leaders responsible for water, sanitation and hygiene (WASH) in the school (this could be a WASH committee, a health committee or the school board of management). Get the students to make a presentation of their findings and recommended actions to improve the safety of the school drinking water.

