the Last Drop

Teacher Activity Book

CATCHMENT CONNECTIONS

NSW Environmental TRUST

City of Ryde

Last Drop Teacher Activities

This information pack is a set of practical activities and games which teach the core principles of the water cycle, water catchments, human impacts on catchments and the concept of the water footprint. Science experiments are ideal to help all types of learners understand complicated concepts from experience. We need to keep in mind all of the different learning styles (which can include verbal, visual and kinesthetic). Depending on the age group the experiments and games can be taught in simple or more complex ways.

1. Water Cycle

Cource: http://www.ucar.edu/learn/1_1_2_4t.htm

When introducing the term, Water Cycle, ask the students to draw a diagram of the water cycle. For younger children give them more assistance. For older children ask them to define every part of the water cycle on a blank sheet of paper. Collect and correct the answers. Keep them for your files and design your instruction based upon the students' needs.

Instruction

Explain the Water Cycle to the students while while referring to the Water Cycle diagram on an overhead projector or hand-out.

Materials

- Artist's clay or plastic mountain model
- Plastic shoe box with cover
- Petri dish
- Lamp
- Water
- Crushed ice

Procedure

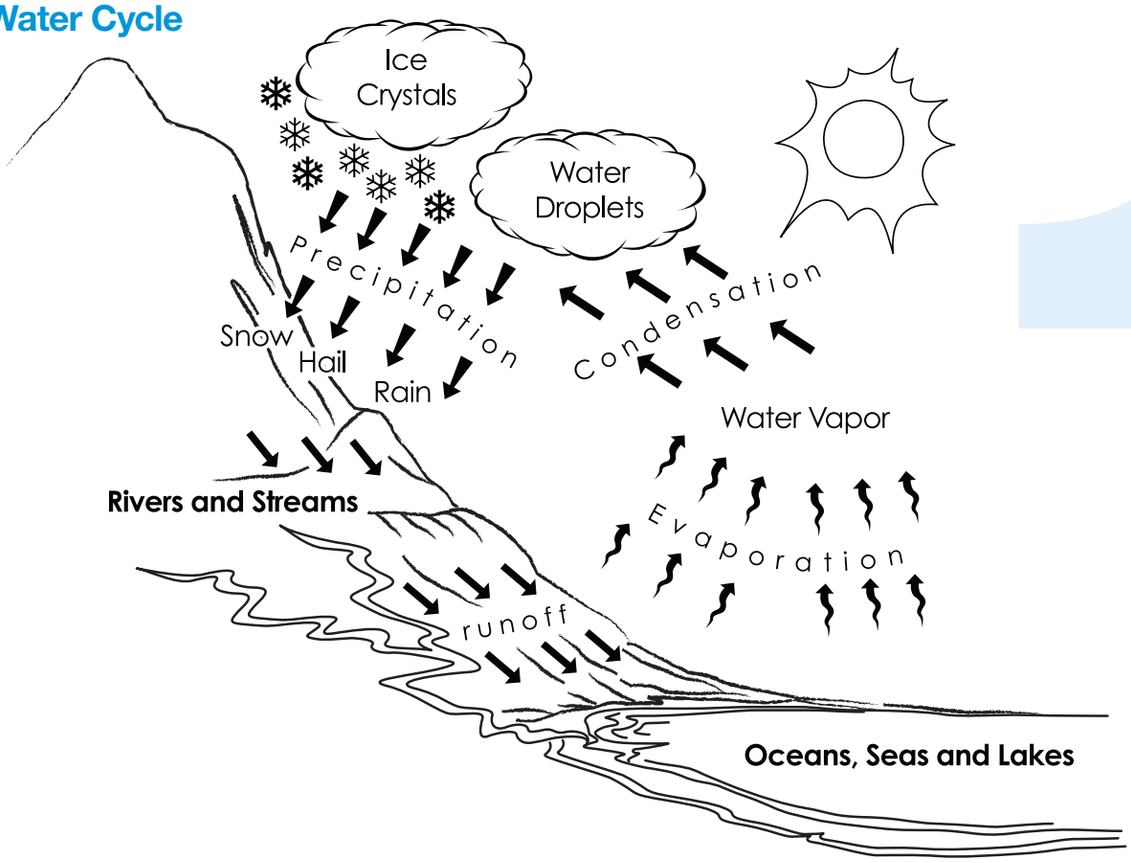
If you have a large aquarium, you can do this activity as a demonstration, allowing the students to study and observe the phenomena and develop their own ideas and conclusions for class discussion. With sufficient materials, you can also do it as a group project, with teams of three to five students responsible for setting up the model and drawing conclusions from their own work. The activity is described below as if it were a demonstration. As always, if done by students, it's important not to overly explain what is "supposed" to happen, but rather let them discover the model cycle for themselves.

1. Discuss the water cycle with students. Show the graphic of the water cycle and explain the various parts.
2. Using the clay, shape a mountain.
3. Place the mountain on one side of the shoe box with the sloped side facing the interior of the box where the "ocean" will be.
4. Pour water into the "ocean" basin until about one-fourth of the mountain slope is covered.
5. Replace the lid of the shoe box.
6. Place a petri dish on top of the shoe box over the mountain.
7. Place crushed ice into the petri dish.
8. Position the lamp over the ocean. Turn on the lamp. CAUTION: THE LAMP WILL GET HOT. DO NOT TOUCH THE BULB OR SHADE.
9. Have students observe the container carefully and note any changes that they see. It might help to add a little smoke to the aquarium to help them see the circulation. (A few matches lit, then blown out and quickly dropped into the box will work).

Observations and Questions

ObservationQuestion	Answer
1. Which part of the activity simulated evaporation?	Evaporation was simulated as the 'ocean' was heated by the lamp.
2. Which part simulated condensation?	Condensation occurred as the water vapor from the ocean cooled on the lid of the shoe box near the petri dish of ice.
3. Which part simulated precipitation?	The drops of water falling from the lid of the shoe box simulated precipitation.
4. What is the energy source and what does it represent?	The energy source was the lamp, which represented the sun.
5. What elements of the water cycle are not represented?	Transpiration, infiltration, sublimation, and percolation were not represented.
6. How could we demonstrate transpiration in this activity?	We could demonstrate transpiration by adding live plants to the shoe box.
7. Would condensation occur in the box without the ice? Why or why not?	Condensation might occur over the mountains but not as quickly. The ice provided a greater temperature difference, forcing the vapor to condense.
8. After observing this activity, explain why water is considered a renewable resource.	Water is continually recycled through the various parts of the water cycle.
9. The system you observed/constructed is a model of the way the actual water cycle works. Why might scientists use a model like this in their research into the water cycle in the real world? Can you think of any reason that using such a model would be a problem?	

The Water Cycle



2. Transpiration: How much water does a tree transpire in one day?

Source: http://www.ucar.edu/learn/1_1_2_4t.htm

In this activity, students will make a small terrarium that will allow them to observe and measure the water given off through transpiration.

Background

Trees absorb water primarily through their roots. They evaporate water through openings in their leaves in a process called transpiration. As with human respiration, trees tend to transpire more with increased temperatures, sunlight intensity, water supply, and size. When it gets too hot, though, transpiration will shut down.

Many factors influence transpiration rates, including leaf shape, size, pores (stomata), and waxiness of the leaf surfaces. Where a particular tree species grows often depends upon how it has adapted its transpiration rate to a particular climate. Conifer needles are more efficient at retaining moisture than broadleaf trees because they have stiff, waxy leaves (needles) with small stomata that are recessed in the leaf surface. Because they are efficient in retaining water, conifers are found in drier and colder climates where water supplies are limited.

Plants transpire vast quantities of water - only one percent of all water a plant absorbs is used in photosynthesis; the rest is lost through transpiration. In one growing season, one corn plant transpires over 200 litres.

Transpiration, along with evaporation of moisture on land, provides almost two-thirds of the atmospheric moisture that falls as precipitation on land surfaces. The remaining one-third comes from the evaporation of the vast oceans.

In this activity, students will make a small terrarium that will allow them to observe and measure the water given off through transpiration.

Materials For Each Team of Students

- Transparent plastic cup to be used as the top of the terrarium
- Deli container or additional plastic cup for the bottom of the terrarium
- Square piece of cardboard between the two cups
- Small cutting of a house plant
- Petroleum jelly
- Lamp or source of sunlight
- Water
- Scissors

Procedure

1. Using the scissors, make a small hole (just big enough for the plant stem) in the center of the piece of cardboard.
2. Pull the plant stem through the hole and seal around the hole with petroleum jelly.
3. Fill the bottom cup with water and place the stem with the cardboard collar into the cup. Cover with the clear plastic cup.
4. Put the small terrarium in the sun or under a lamp.
5. In fifteen minutes, you should begin to see droplets of water on the sides of the clear inverted cup. More moisture will accumulate with time.
6. If possible, leave the terrarium cups set up in the classroom for several days and measure the amount of water transpired.
7. Ask students to calculate the water loss per square centimetre of leaf area.

Observations and Questions

1. Where does the moisture come from that accumulates along the sides of the top cup?
2. How do you know the water is coming from the plant and not just evaporating from the water in the cup?
3. Challenge students to imagine that their small plant was a large tree with a thousand times as many leaves. Ask them to assume that this tree transpires just like their plant and calculate how much water it would transpire.
4. Now ask them to imagine a small forest with 1000 such trees. How much water would transpire?
5. Ask if they think this much water going into the air in that area might affect the climate at all. Why or why not?

3. The Catchment

Source: amlrboccweb.pdf (application/pdf Object)

Introduce a catchment as an area of land where rainwater collects as it falls from the sky, then runs off trees and the surrounding land. Gravity makes water flow along a one-way path from high to low land, through the catchment and into a creek or river, and sometimes into a reservoir or dam and then into the sea.

Activities

- Show the Catchment Connections Project area map (covers over 2,000 hectares across the Terrys Creek, Mars Creek, Shrimptons Creek and Buffalo Creek catchments, which are all tributaries of the Lane Cove River) and ask students to identify the catchment in which the school is located and the associated waterway.
- Show the Eastwood Canal art Mural
- Mind map class ideas about catchments.
- Do the attached Catchment Questions
- Do the attached Catchment Survey
- Develop student answers about catchments.

Questions

1. What is a catchment?
2. Who lives in a catchment?
3. What are the people in the catchment doing?
4. Can you give an example of another kind of catchment?
5. Which parts of the catchment do you think would be clean and healthy?
6. Which parts of the catchment may be unhealthy or polluted?
7. What kinds of pollution might you find in the catchment?
8. Where would you like to live in this catchment? Why?
9. What are people doing to help the catchment?
10. What are people doing that may harm the catchment?
11. Can you group the helpful and harmful things that people do according to a particular characteristic?
12. What is not found in a catchment?
13. What do you think a perfect catchment would look like?

Make a catchment model: Provide students with the opportunity to build their own catchment model. A good activity would allow students to experiment by pouring water on their catchment and observing the flow of water from the high areas to the lower places.

Activities

- **Milk carton catchments:** Students fill milk cartons (cut in half lengthways) and fill them with soil to make mini catchments. Instructions below.
- **Giant class room model:** Make a giant catchment using a tarp or sheet of plastic draped over tables and chairs. Arrange the tarp so that a valley and river channel is formed in the middle and place a large bucket or container at the bottom to represent the sea. Add props to your catchment and then use a watering can to simulate rainfall. Observe the path that water takes as it flows from the hill to the sea.
- **Outdoor catchments:** Make a catchment by piling up sand in a sand pit. Cover the sand with a tarp and observe the flow of water from the hills to the sea.
- **Silt city:** Investigate the different amounts of stormwater run-off in the city compared with the country. Instructions below.

Catchment Questions

1. What is the name of the catchment you live in?
2. What is the biggest creek or river in your catchment?
3. What is the smallest river or creek in your catchment?
4. Name some animals you might find in your local catchment:
5. Name two types of pollution that might harm these animals.

What is a catchment?

A catchment is made up of connected creeks and rivers and the land that surrounds them. Rain landing in one catchment cannot end up in the creek of another catchment. Why?

Making Catchments

Raindrops land on the ground and are soaked up by the soil. However in heavy rain, some water will run down slopes and wash soil away. In this experiment you will make different catchments to see how running water causes soil erosion.

Materials

- 2 milk or fruit cartons (2 litre size)
- scissors
- soil
- mulch material (leaves, bark, sawdust, twigs, grass clippings etc)
- margarine containers
- watering can or “clouds”

What to do

Step 1: With the pouring side face up, prepare the cartons by cutting out the section marked in the diagram.

Step 2: Fill the cartons with soil

Step 3: Place a layer of mulch material over the soil in one of the cartons

Step 4: Incline the two cartons to represent a slope. Place the margarine container at the base.

Results: Now you have two different catchments.

Sprinkle the same amount of water over each catchment and measure the time it takes for the water to flow into the container at the base.

Measure the amount of water in the containers.

	Catchment A	Catcment B
Water at start		
Water at finsh		
Time taken		

Which catchment is more likely to have soil erosion problems?

Source: 'Our Land: Landcare activities for Upper Primary. National Soil Conservation Program 1989'

Silt City

Silt City explores the concept of how changes in land use in a catchment will create changes in the local and regional waterway environment.

By creating a Silt City model, students will see for themselves that;

- Comparatively more water runs off a city catchment
- Water runs off city catchments much more quickly - this can cause erosion and flooding,
- Less water soaks into a city catchment - leading to changes in groundwater levels and soil in the catchment, and
- How models can be used to investigate and solve problems.

Materials

- 1 metre square piece of black plastic stapled onto a piece of cardboard (to represent the city),
- 1 metre square piece of carpet (to represent the country),
- Four 500ml beakers,
- Blocks of wood or bricks (to prop up the carpet and plastic up and create a slope).
- A stop watch,
- Old stockings, and
- A small quantity of vegetable dye

Why don't you create a hypothesis about the differences between an urban and country catchment.

Set up this model and see if you were right.

Making the model

Set up your Silt City models in a classroom, a lab or outside in a space where the model catchments can be left to drip overnight.

Step 1: Prop up the carpet square and the plastic square at an angle using bricks or blocks. Ensure that there is a dip along the length of the squares, so water will run into two measuring beakers, collecting at the bottom.

Step 2: Sprinkle vegetable dye on the 'uphill' areas of the plastic and carpet squares. The dye will represent soil, or even pollutants present in the catchment. The dye will help you determine how quickly such a substance can make it through the catchment and into your waterway.

Running Silt City

It is now time to set up two model catchments to explore the changes which take place in the water cycle when a city is built. The carpet catchment is more like a country catchment with plenty of plants (carpet) to slow the water - while the plastic catchment is impermeable and thus more like the city, with its' impermeable roads and rooftops.

Sprinkle both models with exactly the same amount of water (from two 500ml beakers), and record how long it takes for the water to move through each catchment and into the water collected at the downhill end of the model catchment. Predict which model will generate the most run-off. Predict which catchment will generate run-off most quickly?

Step 1: Appoint a time keeper, a measurer, and a recorder.

Step 2: Place two 500ml beakers 'downhill' so they can collect the run-off from each catchment.

Step 3: Use the other two 500ml beakers to gently sprinkle the 'uphill' end of each model (carpet and plastic) with 500ml of water.

Step 4: Measure the water collected in the downhill beakers after 30 seconds, 5 minutes and 1 hour.

Step 5: Allow your model catchments to drip overnight, and measure the level of water in the downhill beakers again in the morning.

Your Silt City Results

Water reaching the containers (in mL)

	Run-off Times	Plastic	Carpet
Comments			
30 seconds			
5 minutes			
1 hour			
Overnight			

Did you find that the fastest run-off response occurred in the permeable (country/carpet) catchment or the impermeable (city/plastic) catchment?

Did you find that in a 24 hour period, most run-off was produced by the permeable (country/carpet) catchment or the impermeable (city/plastic) catchment?

Discuss your results in your group. Were there any differences between catchments?

What were they?

Doing a Catchment Survey

Doing a survey of your local area is a great way to discover more about your catchment. You may just want to focus on a sub-catchment, such as the region that feeds your local creek or river. Print out the survey and take it with you next time you go for a walk or drive. You could even do this without leaving home if you like!

Your Catchment Survey

1. What is the nearest waterway to your house?
2. Where does that waterway end up?
3. What are the main land-uses in your catchment?
4. Trees that drop their leaves in autumn pollute our waterways and block stormwater drains.
5. Do you have any of these trees in your catchment? [0] [1-10] [10+]

   Parks and reserves often accumulate leaves, litter and dog poo. Leaves and dog poo will add nutrients to the water, while litter blocks drains, looks ugly and can hurt animals.
6. Do you have any parks and reserves in your catchment? Yes / No
7. If yes, can you see any dog poo, litter or piles of leaves? Yes / No

   Gardens that are heavily fertilised and watered pollute our waterways, adding nutrients and excess water as stormwater to the system.
8. Do you have houses and gardens in your catchment? [0] [1-10] [10+]

   Factories and businesses can release chemicals and other pollutants into our waterways if they are not managed properly.
9. Do you have factories or businesses in your catchment? [0] [1-10] [10+]

   Roads and carparks collect excess water which can contain car oil, petrol and rubber.
10. Do you have many car parks in your catchment? [0] [1-10] [10+]

    Run-off can wash petrol and detergents from service stations onto roads and into waterways.
11. How many service stations do you have in your catchment?
12. Sewage treatment plants can release treated sewage into waterways and out to sea. This wastewater can be high in nutrients.
13. Do you have any sewage treatment plants in your catchment? Yes / No

    Gross Pollutant Traps or trash racks collect large pieces of litter, leaves and branches, stopping them reaching the rest of the waterway and the ocean.
14. Do you have any trash racks in your catchment? Yes / No

    Wetlands help to clean water by letting soil and other pollutants sink to the bottom. Wetland plants can also aid in improving water quality.
15. Do you have any wetlands in your catchment? Yes / No
16. What pollutants are most likely to be created in your catchment?
17. Can you pin-point any pollution sources?
18. Have you noticed any pollution, or effects of pollution, in your local waterway?

4. Human Impacts On Catchments

Activities

- Catchment Capers: A role play activity investigating the impact of different people on the catchment
- Danny the Drip: Presented as a story this activity provides a dramatic visual simulation of the way pollution enters our waterways
- Make your own catchment

Questions

1. Can you develop a proposal that would help reduce pollution in the catchment?
2. What laws would you make to protect the health of the catchment?
3. Can you develop a set of instructions for somebody who is living in a catchment to help stop them polluting?

Catchment Capers

Background

Everyone lives in a catchment! Houses and schools are directly connected to waterways by the system of gutters and drains on roads. Any rubbish or pollution on roads, driveways and other hard surfaces can be washed into gutters, then down drains. These direct water into the nearest waterway which in turn runs into the main river or the sea. What we do at home or school impacts on waterways! Each land use in the catchment has the potential to affect water quality. Catchment Capers highlights the role different land uses play in affecting catchment health.

Look at a map of the Catchment Connection Project and see how large our catchment areas are. The catchment area includes all the small creeks and drains that feed into the main river. Find your location on the map.

Give each student (or pair of students) a role-play card. Younger children will need help reading and understanding their role.

Activity Outline

Cat owner: Car driver: Car washer: Dog owner: Gardener with exotic trees: Gardener using fertiliser: Apple grower: Picnic people: Gardener dumping weeds: Builder: Factory owner

Go around the class and have each student read (or help them read) their role. Ask each student or pair of students, to find pictures from a magazine or draw a picture of the impacts their role can cause. Computer clipart could also be used (a good clipart site is http://dgl.microsoft.com). Alternatively, this could be done ahead of time.

Seat the students around the 'river' (a tarp, piece of cardboard or poster paper can be used for this) and explain that they are the catchment area for this river.

Comment on how clean the river looks and that when it is clean, it is a good home for animals and a healthy place to play.

Emphasise that some things get into the river by going 'into the gutter and down the drain', repeat this phrase as often as possible until the students join in. Discuss how that role would affect the water, then place the picture/s into the river. As more pictures accumulate, comment on how the water is looking, e.g. who would want to swim in /drink that water? Would it be a good home for animals?

When everyone has had a turn, discuss the problems of a polluted river: not fit for swimming or fishing; poor habitat for aquatic life; could be smelly or could look bad. BUT for every pollution problem, there is a solution!

Go around again and for each problem, brainstorm solutions. Hints are given on the next page. As a solution is found, pull the related pollutant pictures out of the river, so that at the end, the river is clean.

Sum up by asking class what they and their family can do to help the river. If they can give some relevant answers, the exercise has worked!

Pollution solution hints

Cat owner: Keep cats indoors all the time or at least from dusk-dawn; build an enclosed cat playground; have a collar with at least 2 bells.

Car driver: Fix oil leaks; avoid leaving rubber on the road by not braking suddenly or doing donuts'; avoid driving on sensitive areas such as riverbanks; find alternatives to car travel, e.g. walking, cycling and car pooling.

Car washer: Wash the car on the lawn so that water and detergents get used by the garden rather than go down the drain; use a car wash (most water is recycled).

Dog owner: Keep dog on lead in bushland/waterway areas; always pick up dog poo and dispose of it in a bin.

Gardener with exotic trees: Plant local native plants instead of exotics (avoids potential weed problems too!); collect fallen leaves and add them to compost heap or garden beds.

Gardener using fertiliser: Only use minimal amount; never use garden chemicals when rain is forecast; recycle kitchen and garden scraps into compost as an alternative to fertilisers; use native plants that are adapted to local conditions and require fewer chemicals.

Apple grower: Never use chemicals when rain is forecast and always follow instructions; use drip irrigation instead of sprinklers to lower water use; use organic methods of pest control.

Picnic people: Always put rubbish in bin or take away if no bin is provided; a lot of rubbish can be recycled or reused; never throw fruit away as it can spread germs or weeds.

Gardener dumping weeds Never dump weeds in or near bushland or waterways - dispose of in bins; some weeds can be destroyed by deep burial or composting.

Builder Cover sand and gravel heaps with plastic sheets to prevent it washing away; put a barrier between the building site and the gutters/drains.

Factory Owner: Don't dump any chemicals in drains.

Danny the Drip

Background: Danny the Drip is an active visual exercise emphasising the variety of pollutants that can enter waterways and how they accumulate. It shows the progressive deterioration of a river as it makes its way from the hills, through the catchment and out towards the sea.

a) distribute the names of the pollutants (and their imitations for the purpose of the exercise) to students - some doubling up is okay.

b) Ask students to bring in a small amount of their sample pollutant in a suitable spill-proof container.

You will need

A large clear container (e.g. flat tray, washing tub or small aquarium).

An open space, preferably outside or in a wet area.

Some envelopes and small containers (eg. Film canisters or small vegemite jars).

You can supply the 'pollutants' yourself, or:

Pollutants Imitation

1. Plant food - Dynamic lifter
2. Poo - Coffee beans
3. Algae - Chopped lettuce
4. Dead animals - Plastic toy animals
5. Soil - Soil
6. Salt - Salt
7. Acid -Water/ green cordial
8. Nasty chemicals - Mustard or tomato sauce
9. Fishing line - Fishing line
10. Rubbish - Small items of litter
11. Lawn clippings - Grass
12. Leaves - Non-native leaves
13. Oil - Cooking oil
14. Cement - Flour/ baking soda
15. Sticks - Twigs
16. Gravel - Gravel or pebbles
17. Sand - Sand
18. Petrol - Brown vinegar
19. Rubber - Chopped rubber bands
20. Cigarette butts - Butts or cotton bud tips
21. Detergent - Detergent
22. Toxic chemicals - Coloured cordial

The story

Half fill the container with water. Read the story (below) and when prompted, have students add pollutants into the water. At the end of the story, all the pollutants will have accumulated into a mess, demonstrating that different types of pollution can add up to cause significant problems in waterways.

This is the story of a drop of water called Danny NB: the words in bold are the cue for adding the pollutants into the 'catchment'. Use the italicised questions to prompt discussion about catchment friendly alternatives.

Danny the Drip's journey begins high up in the hills where the rain first falls onto the slopes and runs off the hills into creeks and rivers. Danny falls from the sky into one of the rivers and here begins his long and exciting journey to the sea.

As Danny the Drip travels down the river, he passes though farms and towns and sees many things that make him very sad and sick. Danny is angry because these things are polluting the water and making it a yucky, smelly place for him to live. But Danny knows that it's actually easy for people to look after the river and to prevent polluting it.

As Danny the Drip moves down through the hills he enters some farming country. Here Danny meets Farmer Joe who is growing some wheat crops for our bread. Farmer Joe has recently fertilised his crops to make them grow. After fertilising there was a downpour of rain and the extra plant food was washed into the river. **plant food**

Next door to Farmer Joe is Farmer Mary, and she keeps lots of cows. Farmer Mary's cows are allowed to drink from the river and eat the river plants. While they are eating and drinking, the cows poo straight into the river. The poo smells horrible and makes the water dangerous to drink for people and animals. **Poo** The cow poo also acts as a fertiliser for the water plants and makes them grow more quickly. One kind of water plant, grows out of control because of all the poo. Poor Danny the Drip, his water is now yucky, smelly and full of slimy algae. **algae**

Should farmer Joe throw lots of fertiliser on the wheat or should he only put on what is needed?

How can Farmer Mary stop it? Leave the cows to drink near the river, or put up a fence and keep them out?

What should Mr Potts do to fix this problem? Keep cutting down trees or plant native trees and shrubs?What is the difference between a native and an introduced tree? Can you name any native trees, bushes or shrubs?

When Mr Potts bought his farm, he decided to cut down all the trees to make way for his sheep. With all the trees gone, the birds and the native animals like possums and parrots lost their homes. Even the sheep would like lots of trees for shade in summer and shelter for their little lambs from cold and rain in winter. Without plants to hold the riverbanks together, the soil comes loose. When it rains, the riverbanks collapse into the water dumping lots of into the river. **soil**

How can Danny see where he's going if his river is full of mud? Without trees, the soil and the river gets very. Many of the plants and animals don't drink salty water and lots of them die. **salty**

Poor Danny the Drip is very unhappy now his home is getting more polluted as he makes his journey to the sea.

How can we stop the soil and water getting saltier?

Keep chopping down trees or by planting native trees and shrubs?

What should be done with the acid waste? Let it drain into the river or take it to a chemical dump?

What should these people do to stop nasty chemicals getting washed into the river? Overload the garden with chemical sprays or use small amounts of spray or even have organic gardens?

What should the fisherman have done with his fishing line? Leave it there or untangle it?

After a long and winding journey through the hills, Danny the Drip finally reaches the edge of a town. Here, there are a number of small hobby farms, where people grow vegetables, fruit

and grapevines. To keep the weeds and insects away from their crops, many people spray chemicals, called pesticides onto their plants. **acids chemicals**

When the sprinklers come on to water the plants, the get washed into the gutters, down the stormwater drains and into the river, poisoning many of the plants and animals that live there.

As he continues his journey to the sea, Danny the Drip passes some people making use of the river. A man is fishing on the banks. Unfortunately his gets caught around a rock and is left in the water. "OH NO!!" thinks Danny the Drip"what would happen if a fish or a bird got caught up in that fishing line?" **fishing line**

Around the next bend, Danny the Drip sees a group of people enjoying a picnic on the edge of the river. A gust of wind blows some of the off the table and down into the river. **Rubbish** Danny the Drip is really sad now; he can't believe how careless some people can be.

At the park Danny the Drip sees a gardener cutting . Danny also sees an old exotic tree dropping all its autumn into the gutter. **Lawns leaves** If the leaves and lawn clippings are left to rot on the ground, they will make their way into the gutters, down the stormwater drains and into the river. Then they'll use up all the oxygen and Danny's plant and animal friends would suffocate and die.

As he passes into the town, Danny the Drip spots an old school bus taking kids home. The bus driver has not serviced the bus for a long time and its engine is leaking straight onto the road. "Oh dear!" Thinks Danny the Drip "that oil will be washed into the gutters, down the stormwater drains and into the river. oil

The ducks and other birds are not going to like this yucky, sticky oil polluting their homes and making their feathers stick together."

A man is doing some work on a path leading from his house to the river and he needs to clean the cement mixer. If he washes it onto the path, it will flow into the gutters, down the stormwater drains and into the river where it will pollute the water with nasty cement mix. **cement**

What should the people have done with their rubbish? Leave it lying around or put it in a bin or recycle or compost it?

What should the gardener do with the lawn clippings? Put them in a compost heap or dump them in the river?

What should the gardener do? Leave them there to rot or rake them up and add them to her compost?

What should the bus driver do when he gets back to the depot? Get the oil leak fixed or let it keep dripping?

Where should he put the waste water?

Wash it onto the path or dispose of it safely?

The roads are full of traffic. **Petrol** drips out of cars and if they brake in a hurry, they leave from their tyres on the road.

Danny sees one woman in a car who has just finished smoking a cigarette. **Cigarette butt** The woman flicks her out of the window and onto the road If left on the road, the cigarette butts will wash into the gutters, down the stormwater drains and into the river. Danny will have to swim around in the dirty, smelly cigarette butts, petrol and rubber because every time it rains these pollutants are carried down the gutter into the stormwater drains and straight into the river which flows to the local beach.

As Danny moves towards the sea he notices someone washing their car on the driveway. **Detergent** The car washing is running into the gutters, down the stormwater drains and into the river.

Is this OK or should she do something else with her butts?

What could motorists do to stop the damage they do to the river?

Should the car be washed in the driveway or on the lawn?

Where should the dirty washing water go?

Danny the Drip notices that one of the factories near the river has a pipe coming from it that leads straight into the river. When he takes a closer look he sees that there are all sorts of coming out of the pipe. "This is just terrible," thinks Danny the Drip "don't people realise what they are doing to my home?" The detergent has lots of fertiliser in it that helps make more slimy algae grow. "OOOH! Oh No!" thinks Danny the Drip "My poor animal friends are not going to like all this algae in the water the algae uses up oxygen and they won't be able to breathe."

toxic chemicals

What could the factories do with their chemicals to stop damaging the river? Could they use less or alternative chemicals or dispose of their waste in a better way?

With one final bend in the river Danny the Drip finally arrives at the sea BUT LOOK AT THE WATER that flows into the sea with him - it is full of yucky, smelly, slimy and poisonous pollution. The pollution can hurt the animals and plants in the river and also hurts the animal and plants that live in the sea.

Make your own Catchment

Burying rubbish may remove it from sight, but pollution can still leak from it into the catchment by flowing through the ground. To see how burying rubbish can pollute the water, you'll need:

- a 2-litre PET bottle
- a knife
- a coffee filter bag
- sand
- paint
- a paper towel
- water

Cut the 2-litre PET bottle in half. Pour about ¼ litre of water into the bottom half of the bottle to represent a clean reservoir. Turn the top half of the bottle upside down and place it in the bottom half, with the coffee filter bag sitting inside.

Next, put about two handfuls of sand in the filter. Squirt some paint on the paper towel -- this will be your rubbish. Put the rubbish on the sand, then bury it using more sand.

Finally, make it 'rain' by pouring water over the sand. Watch what happens to the water in the bottom of the bottle. You probably wouldn't want to drink water that looks like that!

Can you think of ways to clean the water to make it drinkable? How could you avoid pollution seeping through the ground or flowing along streams into a reservoir in the first place? Which is easiest?

5. Your Water Footprint

Source berc.berkeley.edu/system/files/WaterMod2L1.doc

Objective

Students will understand of the concept of a water footprint, be able to identify the relative amount of water used by everyday human activities and distinguish between direct and indirect use of water. Students should be able to suggest simple conservation strategies that can be implemented in everyday life.

Lesson

As You Enter Ask

Can anybody name some ways that we use water at home?

Introduction to Lesson

(Teacher presentation-limit to 5-10 min. Indicate what is large and small-group instruction)

Large Group

People use water in lots of different ways. At home people use water every day for many basic tasks like cooking, cleaning, watering their lawn etc. Outside of the home amazing amounts of water are used to keep our society running. Water is used for things like farming (watering crops), industry (manufacturing goods) and power plants (cooling).

Certain uses of water consume more or less water than others. Since the amount of water we have depends on where we can get it and how much of it we treat (Remember the water cycle we learned about last week?) it's important that we conserve as much as possible. Today we're going to learn about how much water is used by different things we do and some ways that we can decrease the amount of water we use.

Small Group:

How much water do you think is used when you flush the toilet? (~15 litres - maybe bring in a gallon milk jug so they can visualize how much)

How about when you take a shower? (~15 Litres per minute - so 10 min shower = 151 litres!) Now think about how many times a day you do these things. These types of activities are called "direct uses" of water because you yourself are taking the water and using it.

Now think about the products you use every day.

How much water do you think it takes to make a t-shirt? (~2,650 litres ~1,900 litres for ¼ lb beef)

These things are called "indirect uses" of water. Even though you don't see the water that went into making them, you are still using the water by using the product.

So, you can see how even in your own home you use lots of water every day. In fact, the average Australian uses 250 litres of water every day! You could fill an entire swimming pool with the water you use in less than a year!

The amount of water used directly and indirectly by a person or activity is called their "water footprint". Even though much more water is used by things like farming and industry than by individual people, we don't have direct control over these things so it is difficult for us to change them. But, we can make a big difference by working on understanding and reducing our personal water footprints. Next we're going to each calculate our water footprints and talk about what we can do to make them smaller.

Student Practice/Engagement

(Activity, reading, small group discussion, etc. - probably bulk of lesson. Include guiding ideas/questions for individual teachers to connect activity to objective)

Small Group

Calculation of individual water footprint for each student followed by discussion of simple household conservation strategies:

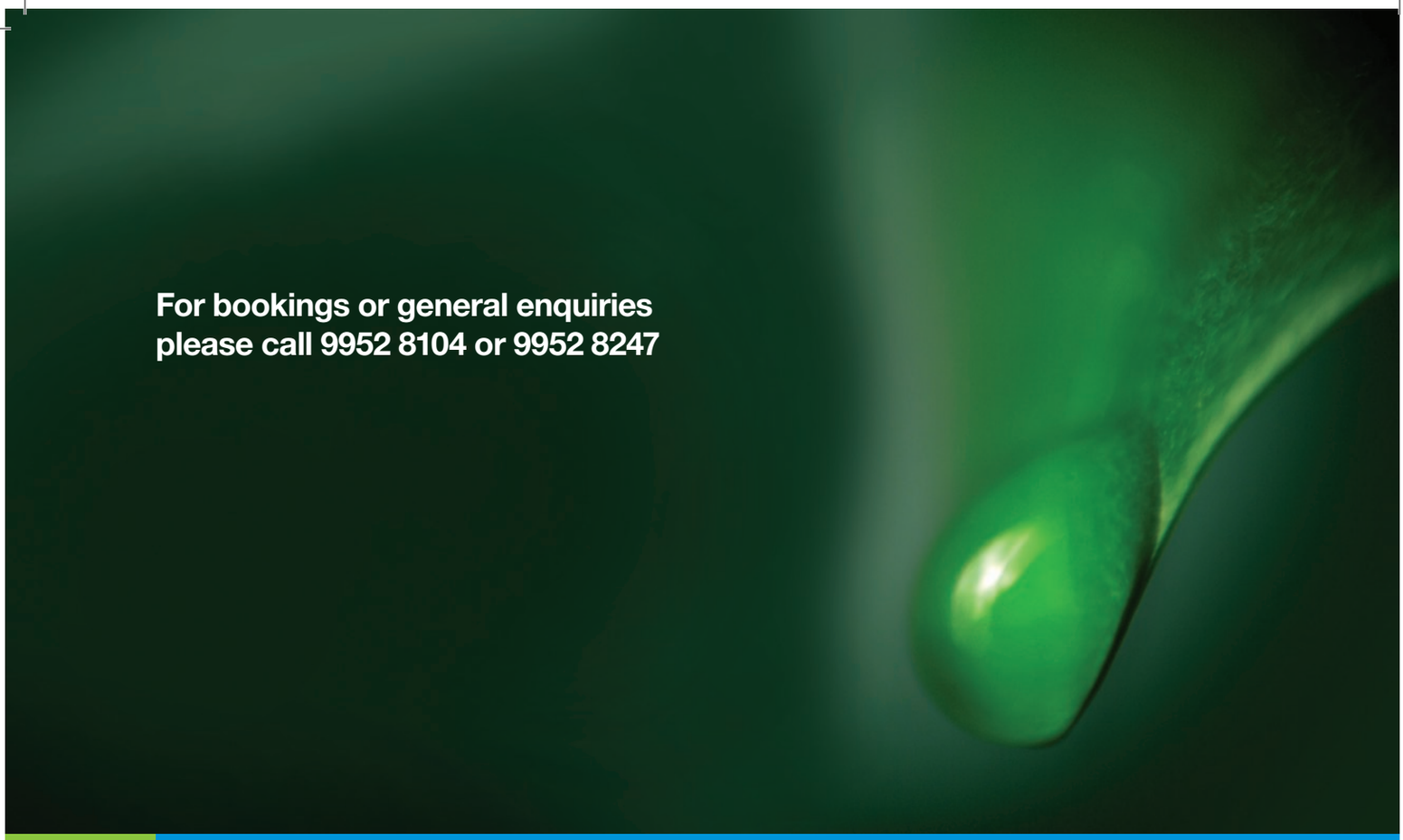
- shorter showers
- low flow showerheads, toilets, dishwashers, etc.
- avoiding bottled water
- reuse and recycling
- energy conservation

Large Group (time permitting)

"Price is Right" type game: Each mentor's group is given a whiteboard. Several human activities (TBD) and products are written on cards and drawn from a hat. Each group then has to guess the amount of water used per day/year/ etc or used to produce one unit of that product (e.g. t-shirt, bottled water, piece of paper, etc.). by that activity and write it on the board. (Alternative: could draw two activities and ask them to guess which one uses more/less water) After each round offer short discussion of activities mentioned and possible conservation strategies

Conclusion/Wrap Up

Bring students back to lesson objective. Ask to write "what did you learn" sentence. Could be done in small or large group.



For bookings or general enquiries please call 9952 8104 or 9952 8247

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