5 How Clean is Our Local Stream?

Aim: To find out how clean our local stream is by monitoring the water quality.

Select from these ideas

- How clean is the water? What does clean mean? Some sources of pollution are easily seen, such as rubbish dumping, while others are less visible, such as bacteria.
- In the previous activities some of the 'pollutants' we added didn't seem to change the water at all, but we knew that the pollutant had been added. How do we know if a waterway is polluted?
- Think of a local waterway.
- How do we know that the water is clean or dirty?
- What could we look at to check on the quality?
- What would we do if we find that the water quality is good? Bad?
- What do we think our local stream/river water quality will be like? **How will we find out?** Take student responses and record them as a brainstorm or a graffiti chart. Save it to compare with the next activities. Use the students ideas to create the basis of your stream visit activities. Using the journal article *Testing the North River* 1996 part 2 number 3, gives students ideas about how they can **find out** about how clean their local stream is.

Environmental Education *in* the Environment

These activities are designed to give an overall picture of water quality. Although single activities will give you an indication, it is the accumulation of the results of **all** the activities and investigations that have occurred throughout this unit that will give you a more accurate picture of the water quality of a stream.

ACTIVITY 1 - Pre Field Trip Discussions

1. The Physical Factors

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Clarity

Refer to Photocopy Master 15

- Gather water samples from different places around the school in clear glass jars. Try to get a variety of sources e.g. from the tap, a puddle, the swimming pool.
- Discuss the differences in quality and why these differences might occur.
- Discuss the clarity tube and its purpose (refer to Photocopy Master 15 for instructions).
- Have students think about what things might alter the clarity of a waterway. *Erosion, stock in a stream, fertiliser runoff increases plant and algae growth, stormwater runoff, discharges from industry.*

pH

Refer to Photocopy Master 16

- Sometimes pollutants enter waterways and they cannot be seen immediately. Measuring the pH (acidity or alkalinity) of the water can be one way of detecting differences. Discuss what pH is and discuss examples, e.g. citrus fruit is acidic around about 3 or 4, bottled water is around 7, neutral. Fertiliser has a pH of around 6.
- Discuss what might cause differences in pH. *Acid spilling into a waterway such as an accidental spill of trade waste. Acidic water can kill fish living in a waterway and make the water very toxic. Alkaline readings can be caused by excessive lime fertiliser or detergents in the water. This can cause too much plant growth in the waterway and block it or use up valuable oxygen in the water.*
- Look again at the water samples and decide what sort of pH you would expect them to have. Follow the instructions in Photocopy Master 16 and test 2 water samples. Discuss the results.

Temperature

Refer to Photocopy Master 17

- Discuss why the temperature of a stream would matter and who it would matter to. *Macroinvertebrates like cold fast running water with plenty of oxygen in it. Still water tends to have less oxygen and heats up faster. Macroinvertebrates are at the beginning of the food chain for other aquatic life.*
- Discuss things that people can do to either make a stream cooler or warmer. *Damming a river will make the downstream flow slower and potentially increase the temperature. Using water to cool machinery and returning the water slightly warmer. Planting trees will provide more shade, cooling water down.*
- Guess the temperature of different water sources around the school. Practice reading a thermometer and taking the temperature of water, Photocopy Master 17.

2. Water Flow

- Find out if the water from a local river or stream is used by people and what it is used for. Some examples are the Waikato River is used to supply water for people in Hamilton. People in Hamilton use between 47, 000 to 80, 000 cubic metres of water per day, depending on the season. Discuss what a cubic metre is. Do some conversions of cubic metres to litres (1 cubic metre = 1,000 litres). Comparisons: a milk tanker with truck and trailer carries 25, 000 cubic metres, the Olympic swimming pool built for Sydney has a capacity of 2,000 cubic metres (50m x 20m x 2m deep), a standard hot water cylinder in a home holds 180 litres of water.
- Discuss who and what is affected by a change in the flow of a river. *Regional Councils measure the flow of a river to determine if there is sufficient water for people who want to 'take' water and also to understand how flows change in floods.*
- Look at Photocopy Masters 18a & b, the field sheet for the flow activities, and practice relevant skills such as measuring the depth of water and converting the measurement to metres. Put 'mock' figures into the calculation and discuss the results and how to convert the figures.
- There are two sections to this to get a measure of cubic metres per second of water flow. Part 1 is the **velocity** of the water and Part 2 is the **area** of the stream.

Part 1 To calculate the stream velocity:

1. Time an orange floating down 10 metres of a stream.
2. Add together all the orange float times. Divide it by the number of repetitions, i.e. find the average time.
3. Divide this time by the distance that the orange travelled (hopefully 10 metres).

Refer to Photocopy Master 18a

Velocity = Time/Distance
= metres/second (Using 10 metres makes the maths easy!)

Part 2 To calculate the stream area:

1. Add together all the depth measurements (make sure that these are in metres, if the depth has been recorded in centimetres convert to metres, e.g. 41cm = 0.41m). Divide them by the number of measurements made to give you an average depth in METRES.
2. Multiply the average depth by the width of the stream to get square metres (m^2).

Refer to Photocopy Master 18b

Area = stream width x average depth
= ____ m x ____ m
= ____ m^2

(take 10 depth measurements across the stream and average)

- To calculate the **overall flow of the stream:**

1. Multiply the velocity (from Part 1, Photocopy Master 17a) with the area (from Part 2, Photocopy Master 17b).
2. Your answer is cubic metres per second. To convert to litres multiply this by 1000.

Flow of stream = Velocity x Area
= _____ m/s x _____ m^2
= _____ m^3/s (to convert to litres x 1000)

Have students practice using these equations and discuss what information they will be finding out from doing this activity.

3. The Biological Factors - The Animals

Refer to Photocopy Masters 19 + 20

- Discuss what sorts of animals students might expect to find in a stream. *Fish, eels, insects, snails, worms, midge, sandfly and mosquito larvae, back swimmers, water boatmen, fresh water koura, mussels, leeches, macroinvertebrates – larvae and nymphs of adults such as mayflies, dragonflies, damselflies, stoneflies, dobsonflies.*
- The *Stream Community Picture Pack* (sent to all schools) is a valuable resource from Learning Media that will assist with this.
- Investigate the lifecycle of some of these animals and the places that they like to live.
- Refer to photocopy master 19 *Bug Identification Chart*. The numbers on the chart refer to the animals Pollution Tolerance Index or PTI. The smaller the number, the more tolerant the animal is of pollution. Animals such as the mayflies and stonefly nymphs score a 4 and are not tolerant to pollution.

- Talk about the part that they play in the overall food chain, as they are only living out part of their lifecycle in the water. For example, stream insects (and other aquatic invertebrates) feed from materials within the stream:
  - algae growing on rocks is munched by grazers **e.g. snails**
  - fragments of organic matter are netted by filterers **e.g. sandfly larva**
  - leaves and twigs that become trapped in the stream are eaten by browsers and shredders **e.g. mayfly**
  - Predators prowl trying to capitalise on the hard work of the grazers, filterers, shredders and browsers (i.e. eat them!) **e.g. the glamorous toebiter**.

The Stream Community has a food web card that is helpful for this.

- Play a game of Who am I? Students ask yes and no questions to another student to try and identify an animal, e.g. I have a PTI of 4, I like cold running water, I live part of my life in the water, the adult part out of the water, Who am I?
- Discuss how students will find and identify these animals by discussing Photocopy Master 20.

4. Habitat Assessment - Bug Food and Stick Races

- Discuss the environments that we like to live in and the habitats that help us to thrive. Ask the students to consider what kind of habitat they think stream animals need to thrive. *Cool, clear running water with a variety of places to live. The bottom of the stream needs to have rocks or cobbles for the water to bubble over and become aerated, and sides of the stream should be planted with trees to provide shade, food and filtered light.*
- Look at the photographs of streams included in this unit and gather your own photos. Decide which ones students think would be a 'good' habitat for animals.
- Design a water craft that will determine the stream rating as a suitable habitat for animals. Be prepared to test them at the stream. Remember to make them biodegradable in case they get away.
- Go over Photocopy Master 21 *Bug Food and Stick Races* and discuss the things students will need to be looking for in this activity.
- For a more precise assessment use Photocopy Master 22 *Habitat Assessment Sheet.* Each of the factors on the master are scored and then an overall rating of habitats for the stream is reached.

Refer to Photocopy Masters 21 + 22

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- Are students aware of the procedures required to carry out the stream activities?
- Do they have an expectation of what they might find and what this will tell them about the water quality in that stream?

Make sure you take only pictures and leave only footprints.

ACTIVITY 2 The Field Trip: Education *in* the environment

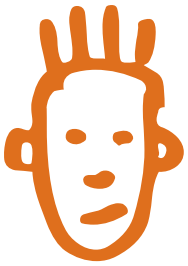
Choosing a suitable site for water activities is essential for an enjoyable day. Streams that are safe for students to enter and have places for the different activities to take place and are known to at least one member of the group are important factors to consider.

A pre-visit to the site is strongly recommended so that a Risk Analysis can be carried out. Check your school policy for acceptable adult student ratios around water and follow this policy. Students should be involved in planning a risk management procedure for the day.

Each activity requires adult supervision and should have been thoroughly explained and discussed with students before visiting the stream. Students should have a good understanding of what the activity measures, why they are doing it and how the activity is carried out.

Two parts to a field trip can be completed in one day. Students can also investigate how a local water user such as a water or wastewater treatment plant (as discussed in section 3) uses water. Contact your District or City Council to arrange a visit.

The success of the water activities is reliant on good adult supervisors who have been well briefed on the expectations of them for the day. Sending home a copy of the activity that they will be supervising several days before the trip allows time for any issues to be sorted out.



Kits of equipment are available for teachers who have attended training. Please contact the Programme Co-ordinator (Schools) on Environment Waikato's Freephone 0800 800 401.

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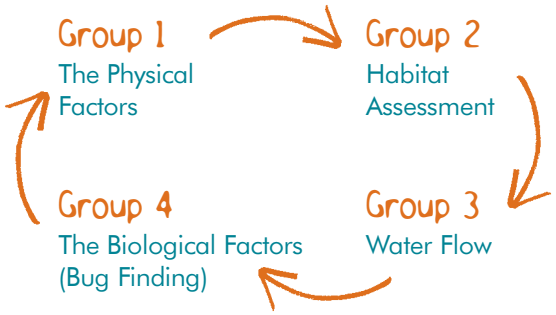
- Discuss with students what they expect to find, see and investigate.
- Focus on the stream and the things that they can see that will contribute to good water quality and poor water quality.
- A 'round robin' type arrangement of the water quality activities ensures that students get maximum hands-on experiences. Select suitable sites for each of the activities. For example:



- At the conclusion of the activities, discuss as a class what you found. What 'picture' is emerging about the stream?

Please ensure all equipment is returned clean and complete. Please report any damage, loss or difficulties on return of the equipment and make any necessary comments on the evaluation form. Thank you.