waterwise Queensland

Department of Environment and Resource Management

Explaining our catchment

year 7 Geography

For the draft Australian Curriculum

Water: Learn it for life!

Toward Q Tomorrow's Queensland

Queensland Government

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Department of Environment and Resource Management

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Explaining our catchment

Introduction

Conceptual diagrams are science communication tools that aim to communicate complex ideas about systems and processes in a simple, visual way. They are particularly useful in representing complex ideas about catchment processes—as shown in this conceptual diagram of Maroochy River.

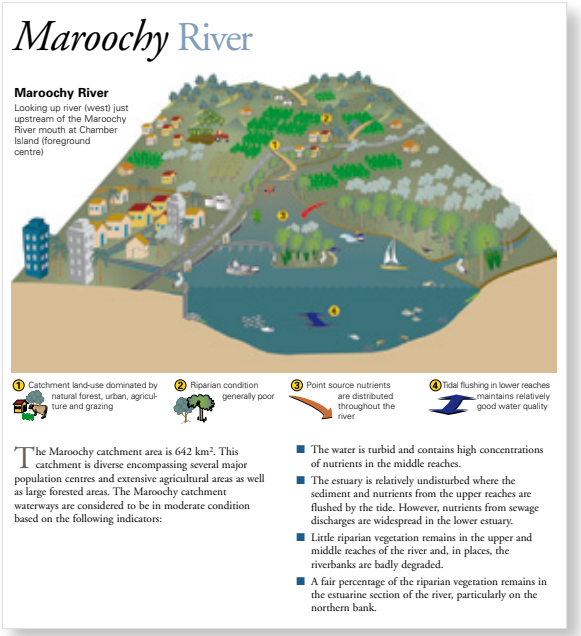
These tools can enhance students' understanding across a range of learning areas, particularly geography and science by:

- organising content meaningfully
- visually representing elements of and relationships between features
- facilitating understanding by presenting associations and relationships between elements in the diagram
- serving as mnemonic devices for learning
- activating prior knowledge with a visual metaphor.

In this lesson sequence you will use conceptual diagrams to identify features and relationships between features in the local waterway. Your students will create a conceptual diagram by hand, using a hypothetical waterway from 'The story of a river'. They will then create a digital conceptual diagram online using data collected from their local waterway—visually representing the significant land uses, features, processes, issues and relationships in their catchment.

In waterway studies, conceptual diagrams provide diagrammatic representations of ecosystems in which key features and major impacts can be illustrated. A conceptual diagram should be self-contained; that is, the reader should be able to comprehend all relevant information by looking at the diagram and legend. The legend should clearly explain all abbreviations and technical terminology in the diagram itself.

Conceptual diagrams are visual representations of abstract concepts that use natural or artificial items to organise content meaningfully.



This diagram has been reproduced with permission from Healthy Waterways ‹www.healthywaterways.org›.

Activity structure

The activity can be conducted within the context of a study of local water issues in either geography or science, or across both subject areas. It is assumed that students have explored the characteristics and land uses of catchments in previous lessons.

You can include or exclude lessons depending on the time and resources you have available. The table below outlines the lessons in this unit.

Lesson overview

Phase	Hours	Activity
Engage	1	Students follow the fictional 'Story of a river' from the source to the sea and identify the effects of different land uses along the way.
Explore		Students analyse the story to identify the significant features of this fictional waterway.
Explore	1	Students create a hard copy conceptual diagram of that waterway.
Explain		Teachers and students use the conceptual diagram to highlight and explain the natural and human processes, and impacts in the catchment.
Explore	1–2	Students view their local catchment from its source to its end using online spatial technologies. They identify the main land uses across the catchment and then collect water quality data across part of their waterway.
Explain	2–3	Students analyse their findings from the field to determine the features of the waterway that most affect its health.
Explore		Students then create a digital conceptual diagram to represent their findings.
Elaborate	1	Students create a report card for the catchment or waterway and share this with the class via a blog, website, flyer or some other visual medium. They use the Healthy Waterways report cards as a guide.
Evaluate		Students review the strengths and limitations of their conceptual diagram and the process used to create the conceptual diagram.

Australian Curriculum links for this unit

There are many, valid connections between this activity and the Australian Curriculum subjects of science and geography—particularly in Years 5 to 7. The activity could be undertaken as part of a larger unit of work that introduces concepts relating to water and water management. It could be conducted through either or both subject areas, depending on the needs of your work program.

The activity uses an inquiry approach promoted by the Australian Curriculum. Students are asked to consider a research topic that allows them to develop key questions and collect relevant data to address the issue.

There is also scope for students to communicate their findings in a variety of ways. Students will create a waterway report card as part of the exercise and the conceptual diagrams could be used as part of a report, flyer, information brochure or poster on the waterway.

Encourage your students to take some action to address any issues that were identified in their waterway as promoted by the Sustainability cross-curriculum priority in the Australian Curriculum. Local councils and catchment groups are a great starting point to connect your students to their local waterway; they could even form their own catchment group and begin improving the waterway.

Australian Curriculum: Geography

This activity fits neatly within Year 7 Unit 1 Environmental Resources. The following content descriptors are met while undertaking this activity.

» Geographical Knowledge and Understanding

- Environmental resources (including renewable and non-renewable and continuous resources) have different characteristics that affect their use and significance.
- Water is a resource that links places together as it moves through the water cycle.
- The distribution, availability and uses of fresh water vary throughout the world.
- Water is a difficult resource to manage because it moves through the environment, is an essential but shared resource, has competing uses, and is highly variable over space and time.

» Geographical Inquiry and Skills

- Observing and questioning
- Planning, collecting and evaluating
- Processing, analysing, interpreting and concluding
- Communicating
- Reflecting and responding

Australian Curriculum: Science

The Australian Curriculum: Science has many opportunities, particularly in year 7, to take advantage of the skills in this activity. Content descriptors are covered in: Science Understanding in the Earth and space sciences sub-strand, Science as a Human Endeavour through the Use and influence of science sub-strand, and Science Inquiry Skills generally.

Information for teachers

» Conceptual diagrams

Healthy Waterways has a very useful suite of catchment-based conceptual diagrams for South East Queensland in the Resources section of its website ‹www.healthywaterways.org›. Search for online examples that suit your local context.

» Land use impacts on waterways

Additional information about water movement through catchments and the impact that different land uses have on the health of a river can be found in the following fact sheets:

1. **Catchments and water quality**
   This fact sheet explains how many of the land uses mentioned in the ‘Story of a river’ impact on the quality of run-off in a catchment. Go to ‹www.derm.qld.gov.au/factsheets/pdf/catchments/c2.pdf›.
2. **The water cycle**
   This fact sheet explains water cycle processes and the role of groundwater in the water cycle. Go to ‹www.derm.qld.gov.au/factsheets/pdf/water/w49.pdf ›.
3. **Raindrops to tap water—How rainfall contributes to our water supply**
   This fact sheet provides additional information about run-off and groundwater supplies in aquifers. Go to ‹www.derm.qld.gov.au/factsheets/pdf/water/w155.pdf ›.

Teaching and learning sequence

This sequence of lessons is about using an online conceptual diagram creator to explain catchment processes. It is suited to middle years students.

»Lesson 1: Story of a river

Lesson overview

In this lesson, students review their ideas about the characteristics and land uses of catchments. The lesson focuses on the interconnections within a catchment and the effects that a variety of land uses have on the quality of water in a waterway. It identifies the types of substances found in rivers prior to treatment in a water treatment plant.

Once students have completed the activity they will analyse the river outlined in the story to uncover its dominant positive and negative features.

Time allocation

Approximately one hour

Lesson objectives

In this lesson students should:

- explore the links between lifestyle, land use and water contamination
- identify the contaminants that have to be removed from water to make it drinkable
- analyse the waterway in the story to identify the positive and negative features that most influence the health of the waterway.

Equipment

For the class:

- one large clear glass or plastic container, or a small fish tank, filled with water (10–20 litre capacity)
- catchment story labels (Resource 1)
- a copy of 'The story of a river' (Resource 1)
- 12 small plastic containers such as film canisters

Preparation

Prepare 12 containers with substances listed in Resource 1. Photocopy the labels and cut and tape a label to each container.

Fill the container with the appropriate amount and type of substance listed in the table in Resource 1.

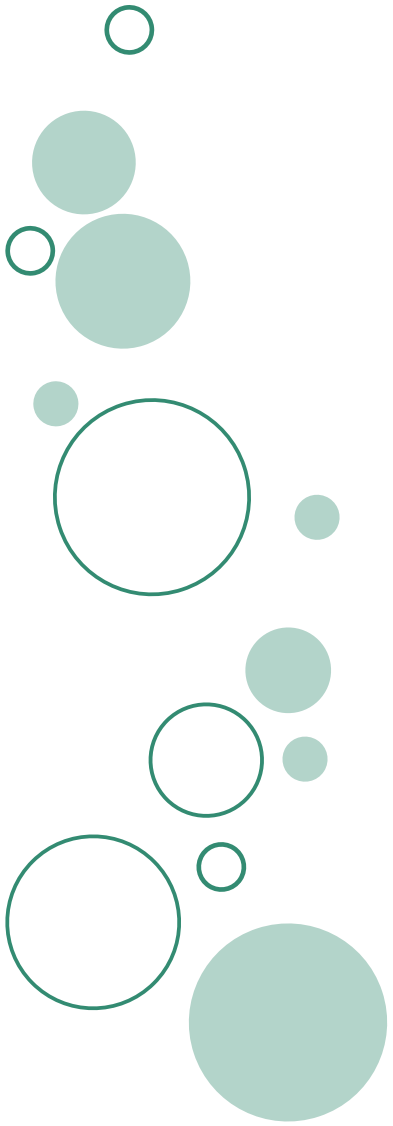
The story could be copied onto card and laminated for reuse.

Lesson steps

1. Place a clear jar, such as a punch bowl or small fish tank containing four to five litres of water, centrally in the room; explain it represents the river water. The effect is improved if the clear container is placed near a window so students can look through it.
2. Distribute the containers among the group. Remind students not to open the containers until their feature or land use emerges in the story; then they are to empty their container into the clear bowl of water—'the river'.
3. Read the story in Resource 1 in a dramatic way, stopping at the end of each section when a feature or land use is mentioned. Students come forward and empty their container into the bowl. Each land use is written in bold in the story. Students could take turns in reading a paragraph of the story.
4. Ask students to compare their river catchment to the catchment described in the story, and decide which land uses in the story are found in their catchment.
5. Ask students to suggest where a water storage dam for the town in the story would most likely be located. (On the outskirts of the town, end of paragraph 7.)
6. Ask students to list in their notebook, the types of substances that would go into the water before it reaches the dam. Reread the story until it reaches the outskirts of the town at the end of paragraph 9 (fertiliser, manure, salt, soil, vegetation, sewage, fishing line, oil, rubbish). You could use this activity as a listening game where students compete to record all the substances in the water.

7. Ask students to think about the land uses that drain into their local water supply to determine the types of substances in the water before it is treated at the water treatment plant. Have them record their ideas in their notebooks.
8. Have students draw a three-column table in one page of their notebooks. Label the first column 'Plus', the second column 'Minus' and the third column 'Interesting' (PMI).
9. Ask students to work individually for no more than two minutes to record aspects of the waterway that (a) positively influence the health of the water in the first column (Plus) and (b) the aspects that negatively influence the health of the water in the second column (Minus) of their table. Tell them to record any features of the waterway that do not obviously fit into the above categories as 'Interesting'.
10. Get students to leave their notebook at their desk and move to another notebook. Give students one minute to add to the notes of a classmate, before rotating the class again. Students again have one minute to review and add to the ideas in their classmates' notebooks. Give students one more minute to refine their own notes with the ideas they have seen in their classmates' notebooks.
11. Select three or four students to share findings from their own notebook with the rest of the class.

This activity is also available on the Department of Environment and Resource Management internet site in the Resource Bank. Go to ‹www.derm.qld.gov.au/waterwise/resources/index.html› and search for 'The story of a river' to access this stand-alone version of the activity.



»Lesson 2: Introduction to conceptual diagrams

Lesson overview

In the previous lesson, students explored the positive and negative impacts that different land uses or features have on the health of the river. In this lesson, students will create a conceptual diagram using the scenario from the previous lesson, the 'Story of a river'. Students will create a hard-copy conceptual diagram using the resources provided.

A conceptual diagram should act as a 'snapshot' of the catchment. A conceptual diagram is not a tool that quantifies the health of the waterway but one that highlights the features of the waterway that most influence its health. With this in mind, students analyse the positive and negative features of their waterway to identify those that play a more significant role in regulating its health.

Time allocation

Approximately one hour

Lesson objectives

In this lesson students will:

- interpret the meaning of diagrams and pictures
- translate from one form to another
- display visual elements of their conceptual diagram
- interrelate ideas or issues
- analyse their conceptual diagram.

Equipment

For each group

- a copy of the A3 background image of waterway (Resource 2)
- one set of symbols (Resource 3)
- Blu-tack to hold symbols on background image

Preparation

For each group, collate a conceptual diagram pack.

Choose one of the three potential background images provided in Resource 2 and enlarge to A3 size. Cut out one set of symbols provided in Resource 3 for each group. If possible, laminate the background images and symbols so they can be reused.

Lesson steps

1. As a class, review your findings from the PMI activity in the previous lesson. Ask one or two students to share their findings from their analysis. Remember to emphasise features that affect the health of the waterway in a positive or negative way.

   Stress that students will use the positive and negative aspects of the waterway detailed in 'The story of a river' when they create their first conceptual diagram. They will illustrate the main land uses that affect the waterway as well as any impacts of these on the health of the waterway.

2. Display some examples of conceptual diagrams to your students. Highlight key features of a conceptual diagram such as a background diagram representing the area being studied, icons representing different land uses and activities, coloured arrows for processes and a detailed legend clearly explaining all symbols.

3. Divide students into pairs or small groups of three and give each group a conceptual diagram pack containing the required resources.

4. Have students create their conceptual diagram by sticking the most appropriate symbols to the background image. Ask them to consult their PMI analysis from the previous lesson to ensure they include the most relevant features of the waterway in their conceptual diagram.

   Explain that there may be some additional symbols so they will need to carefully select those symbols that are relevant to the story. Emphasise that this diagram is not a map; it is not to scale; and the placement of features on the conceptual diagram merely represent the land use, natural processes or impacts evident in the catchment. They should not try to create a map for accurate navigation.

5. When their conceptual diagram is complete, ask each group member to spend two minutes, individually, recording the four features of the waterway that they believe most affect its overall health. Students should record their findings in their notebooks.

6. Have each student spend 30 seconds explaining his or her ideas to their group—i.e. their four options and why they chose each option. Encourage other group members to ask questions about the choices as they are shared.

7. Based on their group's discussion, students record the four features that influence the waterway's health most significantly. There should be positive and negative features highlighted here.

»Lessons 3 & 4: Data collection

Lesson overview

In the previous lesson, students designed a hard copy version of the 'story of a river'. In this lesson students will analyse fieldwork data to create a conceptual diagram of the local catchment. Ideally, students spend time in the field collecting data and observing natural and human processes at work. Alternatively, students could undertake a virtual study of their waterway using an online mapping tool.

Consider the data you would like your students to collect while in the field. Three options are outlined in this lesson:

- Option 1: Investigating catchment land uses with a virtual field trip
- Option 2: Completing a 'Waterways health check'
- Option 3: Collecting water quality data.

Classes can complete a virtual field trip of the local catchment with a data projector and computer or an interactive whiteboard. The other two options involve actual data collection. Your choice will depend on how much time you have to collect data and what resources you have available to collect water quality data.

Time allocation

Approximately one to two hours

Lesson objectives

In this lesson students will:

- interpret the meaning of satellite images, aerial images and maps
- record their field data appropriately
- perceive patterns
- observe their waterway systematically
- collect data.

Equipment

- data projector and computer or interactive whiteboard for virtual field trip (Option 1)
- one copy of the 'Waterways health check' for each group (Option 2)
- data loggers or other water quality monitoring equipment if undertaking this quantitative data collection (Option 3)

Preparation

Preparation will depend on the data collection option you undertake.

Option 1: Arrange for a computer with internet access and a data projector for a demonstration. Even if you are able to access a computer lab or bank of laptop computers, a data projector is still a useful tool for you to demonstrate and discuss concepts before students engage themselves.

Option 2: Prepare water quality 'testing kits' for each student group comprising a 'Waterways health check' sheet, a dip net, and a small and a large container. The 'Waterways health check' sheets could be laminated.

Option 3: The preparation for this option will depend on which indicators you wish to measure and what equipment you are using. Read the information sheets listed in step 3 and also become familiar with your equipment before you collect data in the field.

Lesson steps

1. To begin, take your students on a 'virtual field trip' to examine some of the main features of your local waterway.

   With a computer and a data projector or interactive whiteboard, go to ‹www.google.com.au/maps› or another website that displays aerial imagery of your area to view the waterway from above. Your local council may have online access to this data. Start at the upper reaches of your waterway and follow the flow of water. As you move through the waterway, highlight the different ways the land around the waterway is used and discuss the effects of each land use on water quality. Look for clues about the health of the waterway such as:

   - a change in water colour
   - land use around the waterway which affects run-off into the waterway; for example a golf course or industrial area
   - increasing or decreasing urbanisation around the waterway
   - quantity and quality of riparian vegetation in rural and urban areas
   - overly modified riparian zones such as paving or concreting
   - fishing, shipping or other uses of the waterway itself.

The riparian zone is the area along the edges of a waterway. It is the zone of interaction between a waterway and the land.

   You could use any one of a range of online mapping tools to create a map or tour of your local waterway with specific places, pictures and even videos included. For more information on how to do this, consult the resources shown on this website: ‹www.contoureducation.com/resources›.

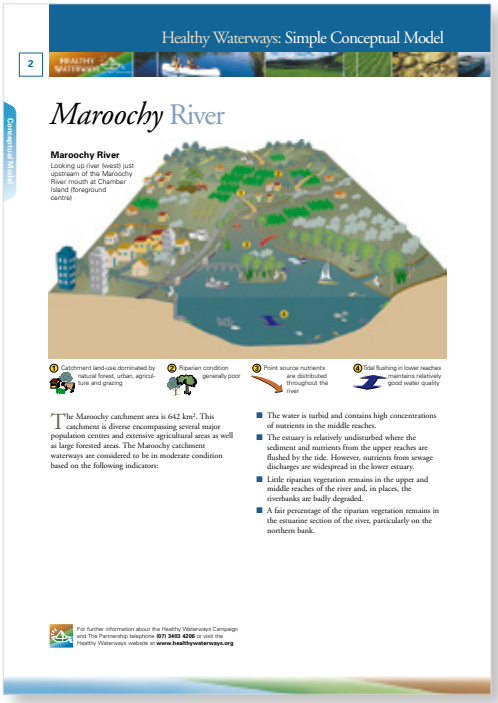
   Students record the main land uses along their waterway and the effects that each land use has on the health of the waterway. Remember that some land uses will affect your waterway negatively while some will affect your waterway positively and you should emphasise this fact to your students.

2. If you would like to include some data collection in your analysis of the waterway, but you do not have access to water quality monitoring equipment, you could use the 'Waterways health check'. The 'Waterways health check' provides simple, qualitative data to assess the health of your waterway. It can be downloaded from ‹www.waterwatch.org.au›. Select the 'Monitoring water quality' tab and find the link to 'Waterways health check: rating your local waterway'.

Example of a virtual field trip in the Lockyer Valley, Queensland via Google Maps.

3. If you can conduct more rigorous fieldwork and data collection, a number of online resources have been compiled below to help you get started. There are also a number of commercial data loggers that allow you to easily monitor various aspects of the health of your waterway. You could also try to borrow water quality testing kits from your local council or local waterway community or management group.

   - **Ecosystem Health Monitoring Program** ‹www.healthywaterways.org/EcosystemHealthMonitoringProgram/ProgramComponents.aspx›
   - **Healthy Waterways waterway monitoring tools** ‹www.healthywaterways.org/HealthyWaterways/Resources/Education/Waterwaymonitoringtools.aspx›


Healthy Waterways: Simple Conceptual Model

2

Maroochy River

Maroochy River

Looking up river (west) just upstream of the Maroochy River mouth at Chamber Island (foreground centre)

The Maroochy catchment area is 642 km². This catchment is diverse encompassing several major population centres and extensive agricultural areas as well as large forested areas. The Maroochy catchment waterways are considered to be in moderate condition based on the following indicators:

- The water is turbid and contains high concentrations of nutrients in the middle reaches.
- The estuary is relatively undisturbed where the sediment and nutrients from the upper reaches are flushed by the tide. However, nutrients from sewage discharges are widespread in the lower estuary.
- Little riparian vegetation remains in the upper and middle reaches of the river and, in places, the riverbanks are badly degraded.
- A fair percentage of the riparian vegetation remains in the estuarine section of the river, particularly on the northern bank.

» Lessons 5–7: Digital conceptual diagram

Lesson overview

In the previous lesson, students gathered data and ideas about their local waterway—either virtually or by fieldwork. In this lesson, students will create a digital conceptual diagram of their waterway to emphasise the different features and processes of their catchment that affect water health. The conceptual diagram is produced with an online tool designed by the University of Maryland's Centre for Environmental Science Integration and Application Network.

Time allocation

Approximately two to three hours

Lesson objectives

In this lesson students will:

- interpret the meaning of diagrams and pictures
- translate information from one form to another—from field data to a conceptual diagram
- display visual elements of their conceptual diagram
- interrelate ideas or issues
- analyse their conceptual diagram.

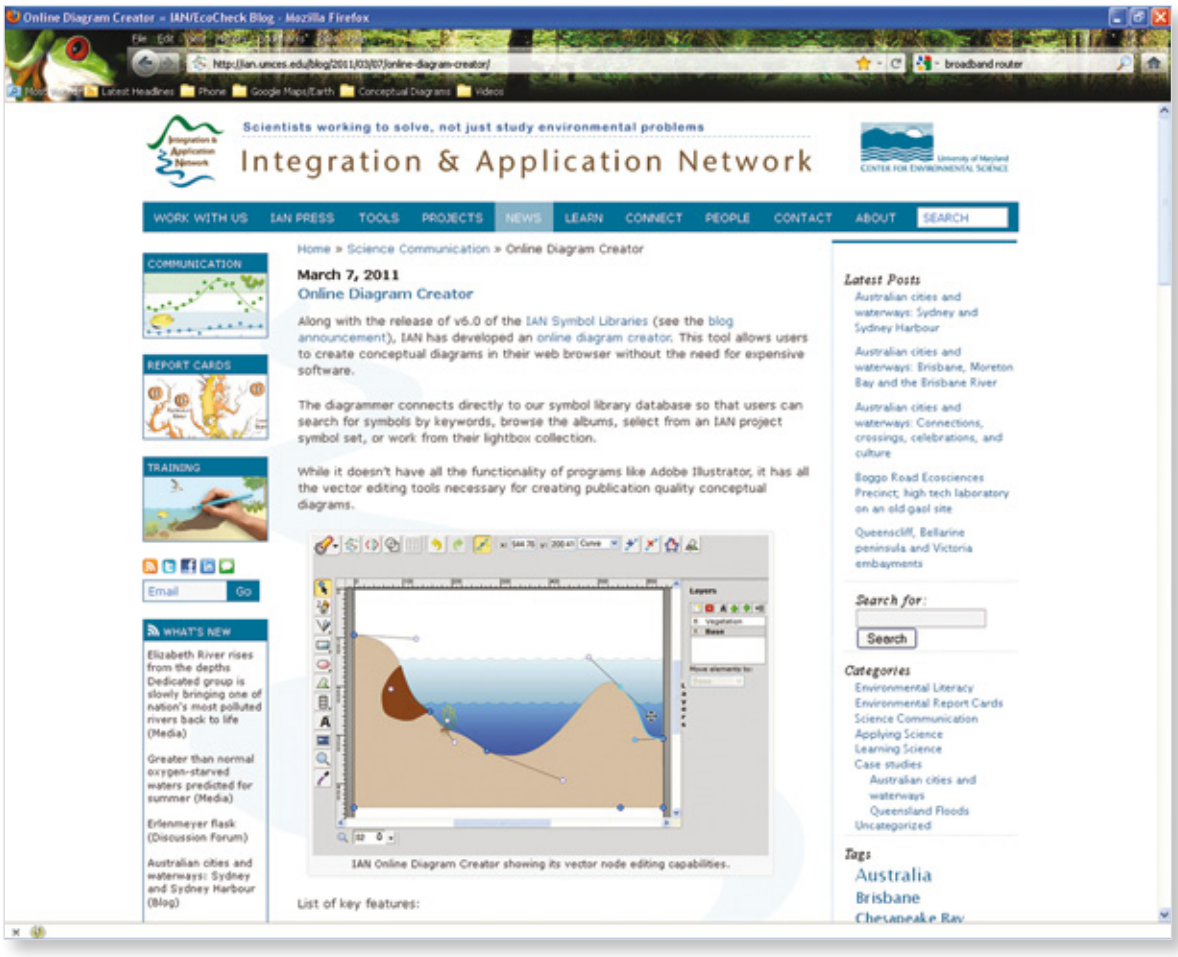
Equipment

- data projector and computer or interactive whiteboard for demonstration
- computer lab for students with no more than two students per computer

Preparation

Internet Explorer browser is incompatible with the online conceptual diagram creator software. Use an alternative web browser such as Mozilla Firefox or Google Chrome, both of which are freely available online. It is important that you confirm whether you can access the online conceptual diagram creator before you begin your lesson.

Prior to using the online conceptual diagram creator, students need to register their details with the site. Students go to ‹www.ian.umces.edu›, select 'tools' then 'image library' to complete the free registration process before this lesson. Alternatively, you could set up one registration for the entire class and share those log-in details with all students.



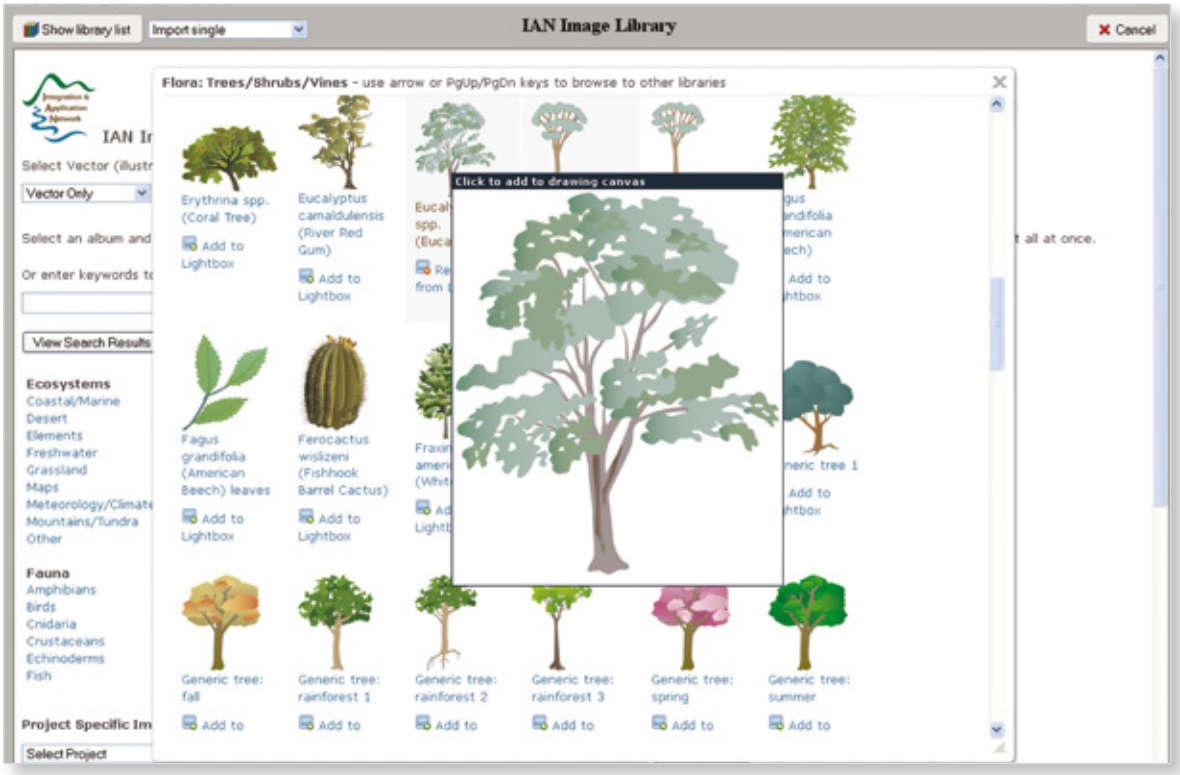
Lesson steps

1. Using the data projector, go to ‹www.ian.umces.edu›, select ‘tools’ then ‘online diagram creator’ and demonstrate the main features of the software. Search the internet for the terms ‘march 2011 online diagram creator ian’ to find a blog post, dated 07 March 2011, about the online diagram creator that also contains a useful video introducing and demonstrating the main features of the tool.

   Ensure you demonstrate the following features for your students:

   - main menu
   - drawing and shape tools
   - colour and palette tools
   - IAN image library.

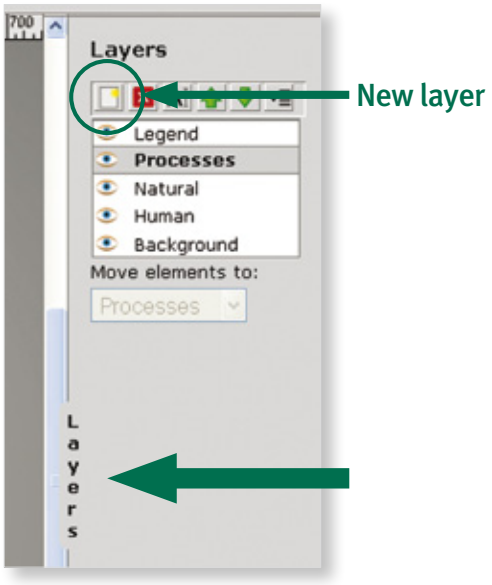
2. Click on the IAN button (see example) to access the IAN Image Library. Once you enter your registration details you will be taken to the library’s homepage. Here you can select from a range of symbols and backgrounds which have been separated into categories. Select a background image and ask your students to do the same on their computer. Once you click on an image it will be loaded onto your diagram as the top-most layer.

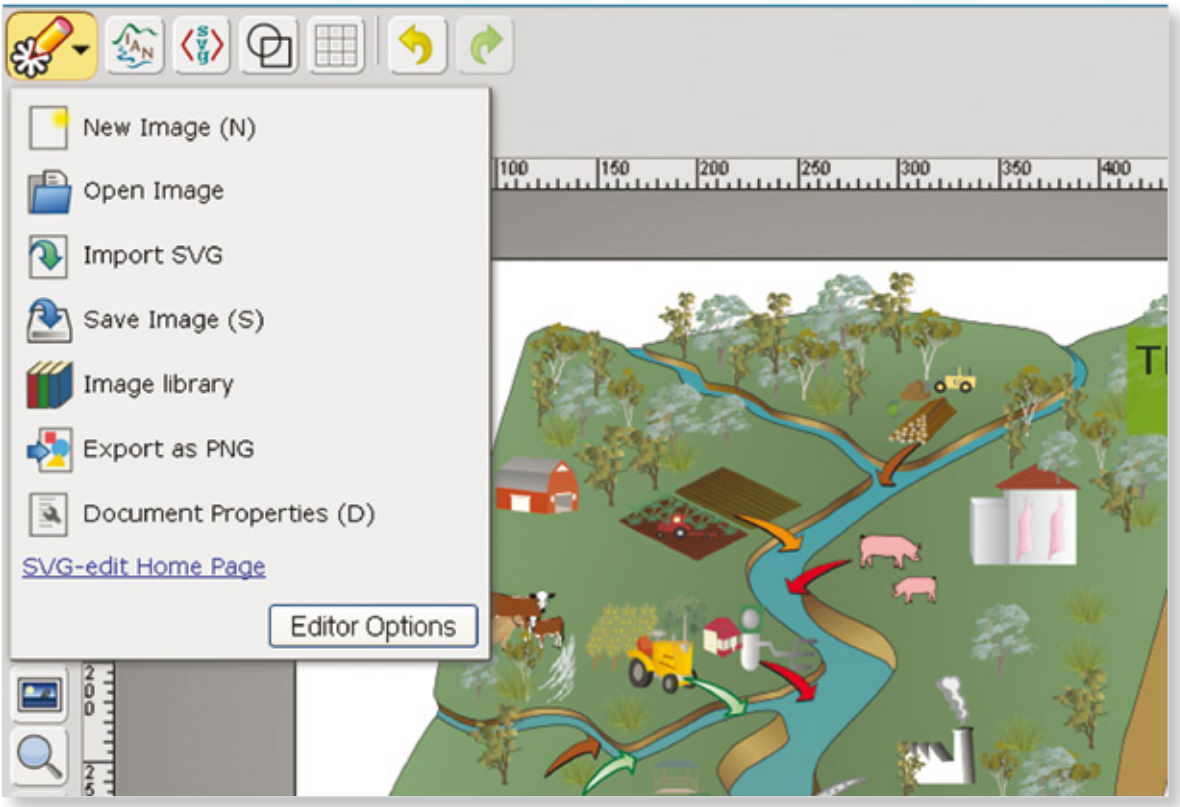


3. Select the first symbol to include in your conceptual diagram. To demonstrate how to use the symbol selector, start by searching for the word 'eucalyptus'. Go to the 'Flora: Trees/Shrubs/Vines' category and select the 'Eucalyptus spp (Eucalypt) 1' symbol. Clicking on the symbol will add it to your conceptual diagram on top of the other layers or symbols in the diagram.

   Demonstrate how to:

   - flip, rotate and resize the symbol by dragging the small blue handles that appear while it is selected. Use the Shift key to maintain aspect ratio when you resize, as this will stop your symbols distorting
   - use the duplicate element and delete element tools
   - change the order of layers so that smaller symbols are not lost behind larger symbols
   - watch the video referred to in step 1 for tips on how to arrange your symbols in categories. It is useful to set up layers called Background, Natural, Human, Processes and Legend before you introduce any symbols, as in the screenshot below
   - add relevant symbols to each layer you created—Natural, Human, Processes.





4. Demonstrate how to insert text using the text tool. Show your students how to:
   - enter text
   - change the size of text
   - change the font type.
5. Ask students to create their own digital conceptual diagram. Instruct them to continue to add symbols to their conceptual diagram to create a representation of their waterway. Students choose symbols that represent the main natural and human features in their waterway as well as any impacts these features have on the health of the water.
6. Tell students to click on the 'Export as PNG' button in the main menu—see example—to export their conceptual diagram as an image. They will be asked to nominate a location to save the image. The image can now be used in reports, presentations or other digital formats.
7. If students want to save their work at the end of one lesson to work on it later, they will need to follow these steps:
   a. Click the menu button, as above, and select 'Save Image (S)'.
   b. Save the work in a convenient location.
   c. To continue working on the project, go back to the online conceptual diagram creator and—from the menu—select 'Open Image'.
   d. Find the file saved earlier and select it. The conceptual diagram will be loaded into the online tool with the layers intact.
   e. Ungroup items to edit existing text and symbols. To do this, click anywhere on the image to bring up the blue handles around the image.
   f. Click the 'Break link' button (see example) to be able to modify individual elements of the image.

»Lesson 8: Waterway report card

Lesson overview

In the previous lesson, students created a conceptual diagram of their waterway or catchment. In this lesson, students create a report card for their catchment using the Healthy Waterways report cards as a guide. Based on the waterway features that they have identified as most significant, students will make two to three recommendations regarding things that could be done to improve the health of their waterway. Students will then evaluate the process they used to create their conceptual diagram.

Time allocation

Approximately one hour

Lesson objectives

In this lesson students will:

- translate information from one form (conceptual understanding) to another (waterway report card)
- synthesise information to provide an overview of the health of their waterway
- use vocabulary appropriate to the students' presentation medium
- arrange, display and present their information using a visual medium
- interrelate ideas, themes and issues related to their waterway
- use correct spelling, punctuation and grammar in their final presentation
- reach a conclusion about the final score of their catchment.

Equipment

For each student

- a copy of Resource 5

Preparation

Go to the Healthy Waterways conceptual models page by searching the internet for 'healthy waterways conceptual diagrams'. Copy some of these pdf documents to show to your students in step 2.

Lesson steps

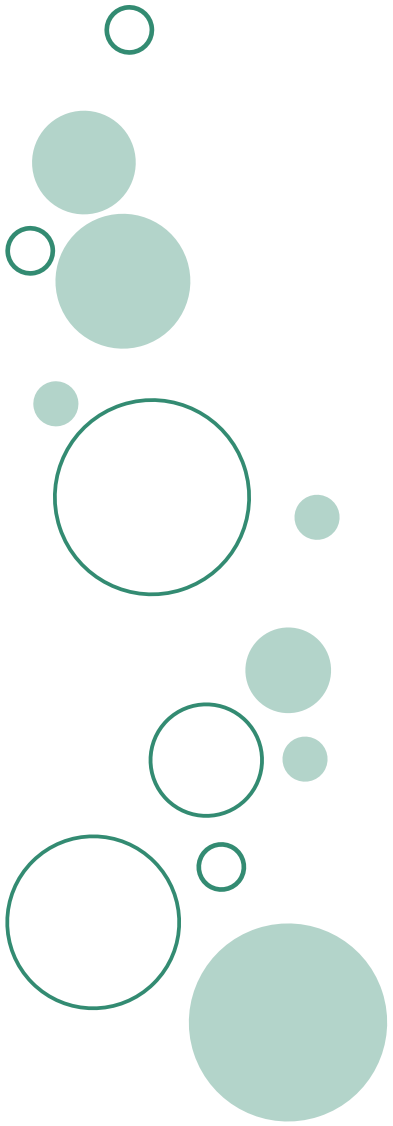
1. Decide how you would like your students to present their waterway report card as this will determine the exact formatting of their final product. They could create:
   - a hard-copy brochure, report or flyer
   - a blog post or website page
   - a poster
   - an oral presentation supported by presentation software such as PowerPoint.
2. Outline the required elements of the report card to your students. A report card should include:
   - an overview or short statement introducing the waterway (including its location, history, topography, etc.)
   - a summary of the top four features of the waterway that affect its overall health, perhaps as dot points
   - a conceptual diagram illustrating the more prominent features and relationships found within the waterway (lessons 6 and 7)
   - a legend and annotations as part of the conceptual diagram that illustrate how the waterway has been affected.

   Show your students some of the Healthy Waterways conceptual diagrams to help them visualise a finished, real-world example.
3. Use a commercial word processor or the free 'OpenOffice' to create a report card for your local waterway. The report card should contain:
   i. the conceptual diagram as the feature of the page
   ii. a legend that highlights each student's four most significant catchment features in terms of its health
   iii. a brief overview of the catchment or waterway to give the reader some relevant background knowledge. This might include information such as the general location, climate, human habitation, land use overview and history where appropriate.

4. Place numbers (1–4) onto the conceptual diagram indicating the four significant features of the waterway. In the overview of the waterway, indicate why each selection was chosen as a significant feature of the waterway.

5. Finally ask students to give their waterway a final grade (A → E) and then share their work.

6. At the completion of their task, ask students to spend a few minutes reflecting on the process they used to develop their conceptual diagram and the effectiveness of the diagram as a tool for communicating information. Students complete a SWOT analysis (Resource 5) to synthesise and record their thoughts. Explain what each element of the SWOT analysis means. Strengths and Weaknesses are generally internal, that is, related to the process and creator while Opportunities and Threats are external factors that helped or hindered the creation and the dissemination of the conceptual diagram.



Resource 1

The story of a river

»Catchment labels

Forest	Farming	Orchard	Grazing
Hobby farms	Spring	Fishing	Waterskiing
Picnic	Subdivision	Roads	Industry

»Substances

Land use	Substance	Quantity / Condition
Forest	Tea, mulch	½ container of tea and 1 teaspoon of mulch
Farming	Soil	1 teaspoon
Orchard	Baking powder	½ teaspoon
Grazing	Muddy water	½ container
Hobby farms	Yellow water and toilet paper	Full container water + small pieces of paper
Spring	Clear water and table salt	Full container of tap water and ½ teaspoon of salt
Fishing	Tangle of line	Piece of fishing line
Water skiing	Vegetable oil	½ teaspoon
Picnic	Styrofoam, plastic, pieces of balloons, etc.	Small pieces of paper, styrofoam, plastic, balloons cut up or broken up
Subdivision	Soil	1 teaspoon
Roads	Coffee grounds	½ teaspoon
Industry	Detergent	A couple of drops of detergent in a full container of water—shaken up

Note: All these substances are non-toxic and safe.

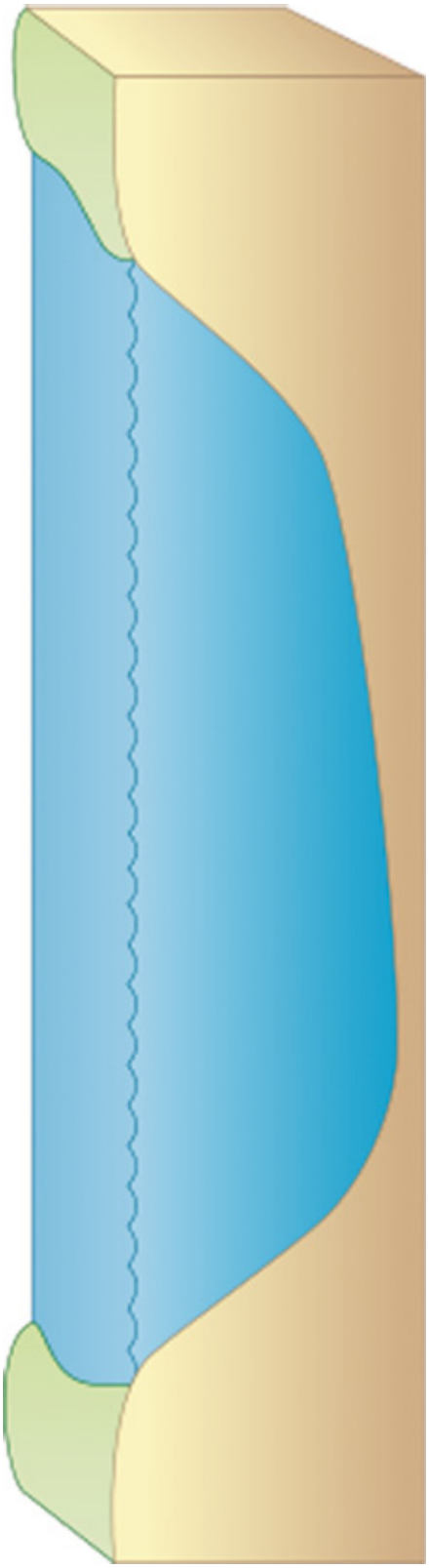
The story of a river

1. This is the story of the travels of a river through its catchment. It begins in the higher parts of the catchment where the rain runs off the slopes and begins its long journey to the sea. The river flows through a national park and then through a *forest*. The water gathers momentum as it descends the slopes. Even in these relatively undisturbed areas, the rain washes mulch and some soil into the river.
2. The river continues its journey towards the sea through *farming* country. Some farmers left their crop residues on the paddocks to protect their soil. But one farmer ploughed the fields and left them bare. Recent rains have carried soil from the bare paddocks into the river.
3. On a nearby *orchard*, the farmer wanted to encourage his crop to grow, so he put fertilisers in his soil. However, he applied more fertiliser than his crop could use. This farmer also wanted to protect his crop from weeds and bugs, so he sprayed the crop with pesticides. But again he used too much of the chemicals. When the rain comes, the extra fertiliser and pesticides on the farmer's paddock are washed into the river.
4. On the other side of the river are *grazing* lands. A herd of cattle graze on the vegetation on the banks and drink from the river. They disturb the soil on the river banks. When heavy rains arrive, the banks erode and collapse into the river.
5. Slowly the river starts to wind its way through the outskirts of a major town. Out here there are a number of *hobby farms*. The houses here are not connected to a sewerage system; they have their own septic tanks. If the septic tanks are not maintained, they can occasionally overflow and untreated sewage can seep directly into the river.
6. Just before the town a freshwater *spring* from an underground aquifer reaches the surface near the river and replenishes it. The spring water collects salts as it moves through underground layers of rock and soil and these, too, enter the river.
7. There are a number of people making use of the river around the bend. Someone is *fishing* on the banks. Unfortunately their line gets caught around a rock and is left in the water.
8. Other people are *waterskiing*. Their boat needs a service and its engine is leaking oil directly into the river.
9. Another group of people are enjoying a birthday *picnic* at a park overlooking the river. A gust of wind blows some of their rubbish off the table and into the water. They release some balloons and some of these balloons are also blown into the river.
10. The river now starts to meander through the suburban part of the town. A new *subdivision* is being developed. Many of the trees have been removed and the developers have built small fences to hold the soil on the building site when it rains. However, there is a big storm and run-off from the storm washes away the fences. The top layer of soil is eroded and washed downstream, contributing to silting up the river.
11. People who have spent the day at work are now starting to drive home. The *roads* are choked with traffic. Oil drips out of many of these cars and sometimes they brake in a hurry, leaving traces of rubber on the road. Every time it rains these pollutants are washed into the stormwater drains and straight into the river.
12. There is still some *industry* along the river here. Detergents are used to keep the production equipment clean. Sometimes, the dirty water is washed out of the factory into the gutter where it disappears into stormwater drains. Once again, this water flows straight into the river. If there are certain chemicals in the detergent it will cause increased algal growth in the river. When this algae dies and begins to rot, it uses up oxygen which animals in the water rely on. They may suffocate as a result.
13. With one final bend the river finally arrives at its mouth and flows out into the sea. But just look at what flows out with it!

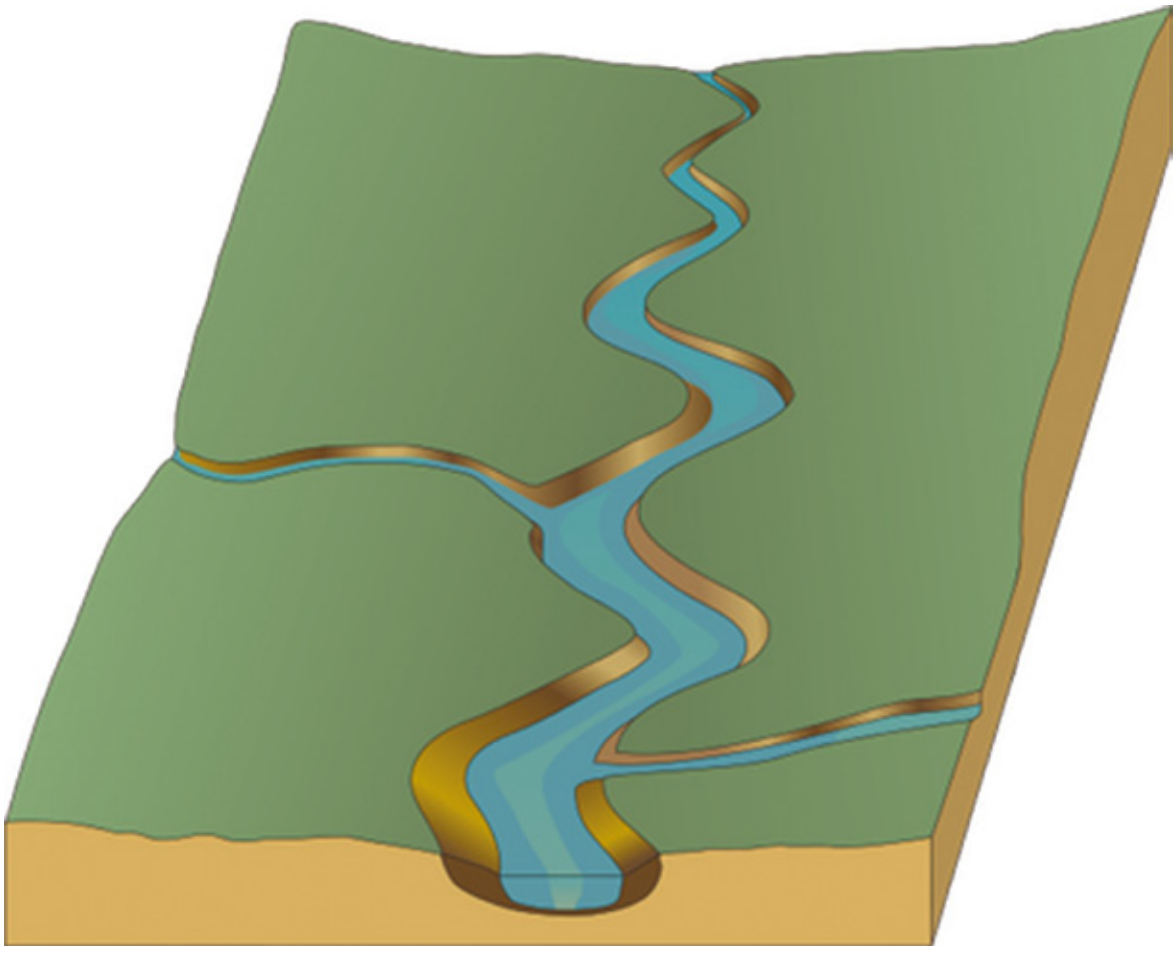
The story of a river is adapted from 'Who polluted the Potomac?', Alice Ferguson Foundation, USA.

Resource 2

Conceptual diagram backgrounds



Conceptual diagram backgrounds



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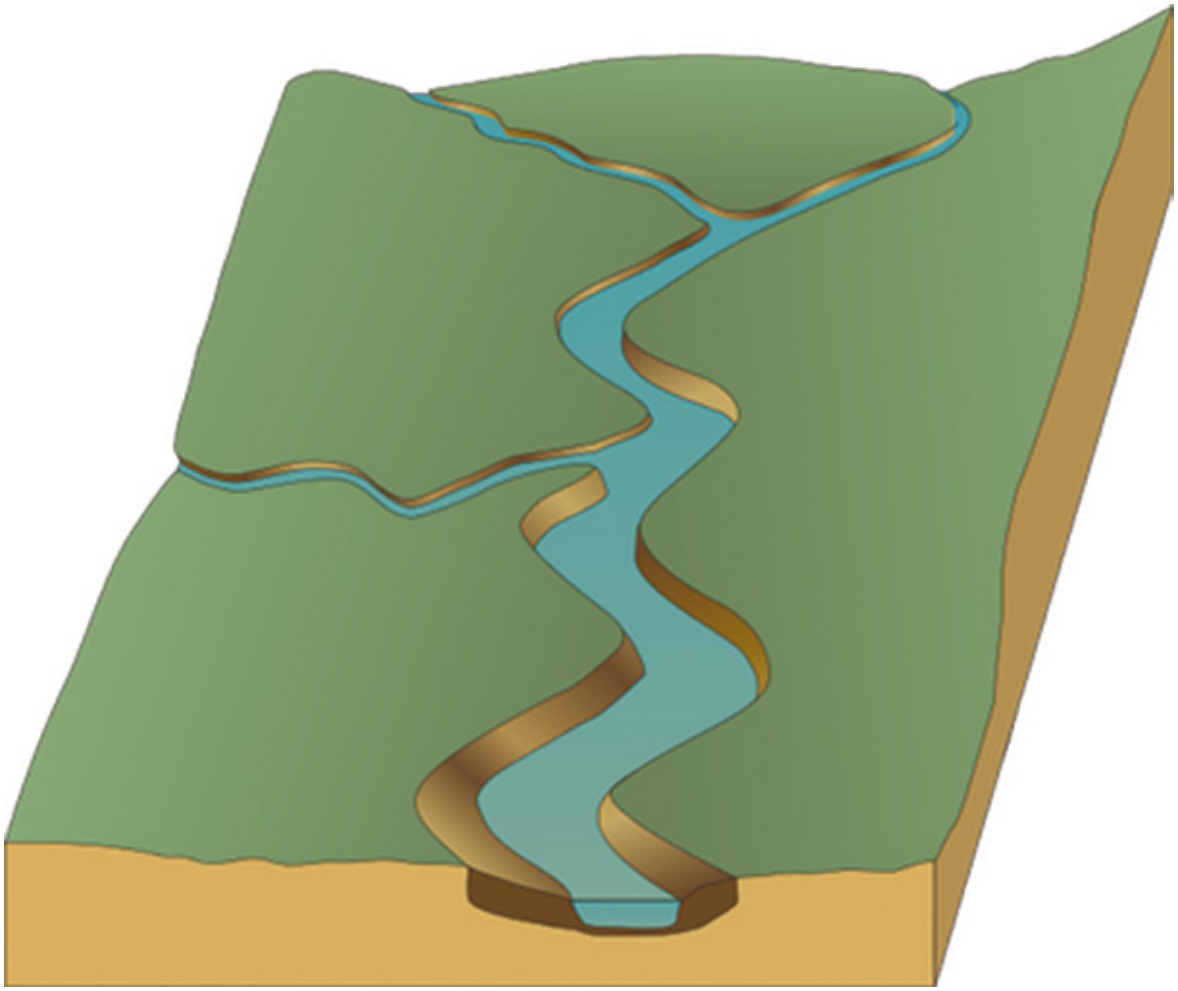

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Resource 3

Conceptual diagram cut-outs

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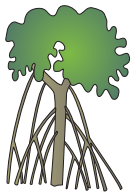
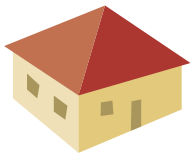
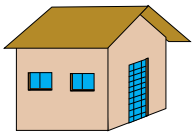
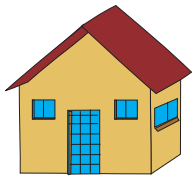
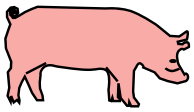
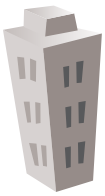
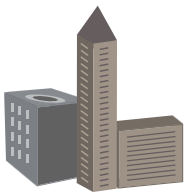
Conceptual diagram cut-outs





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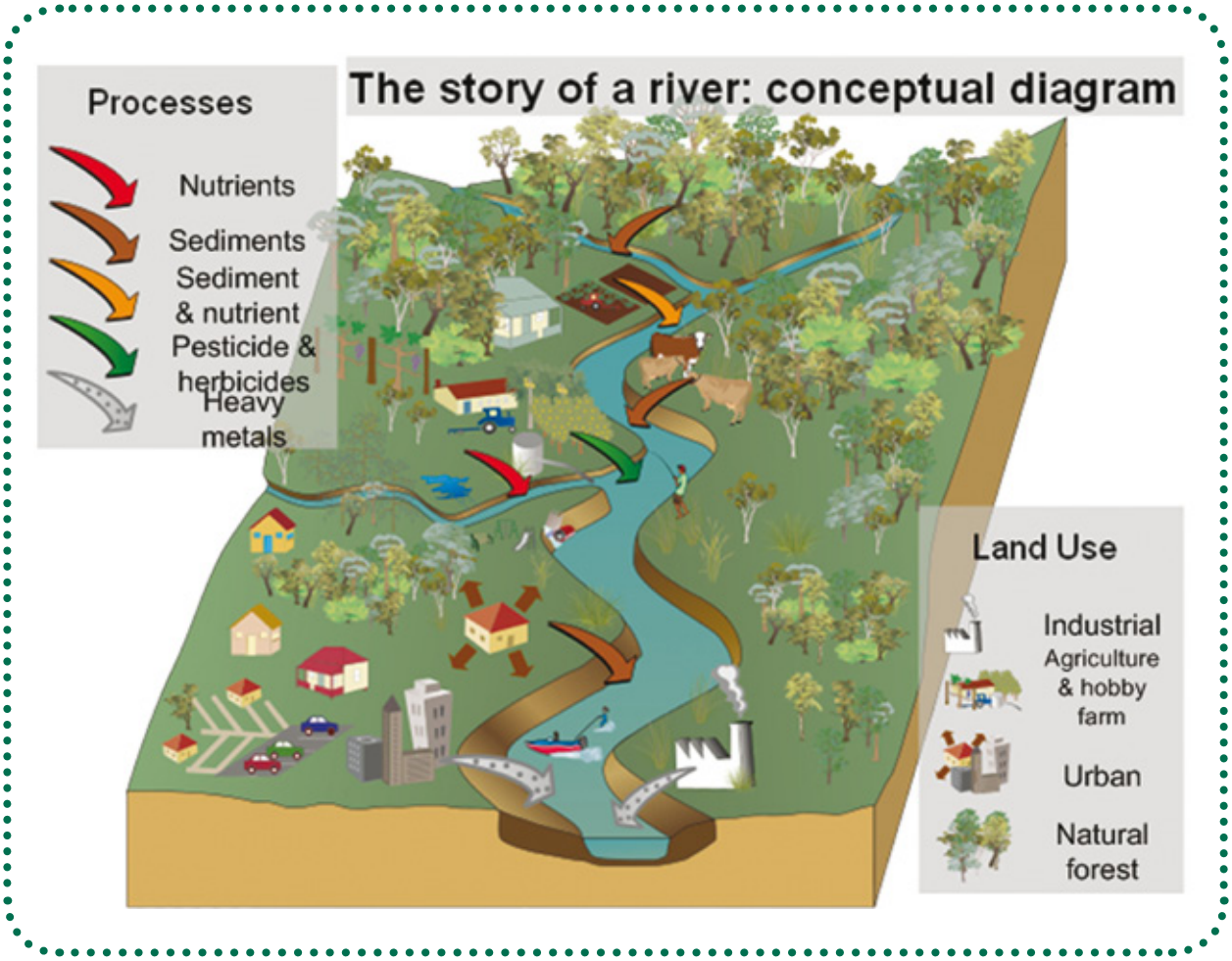
Resource 4

The story of a river example

Your students' hard copy conceptual diagram representing the story of a river should look something like the figure below. Note that simple symbols have been used and the legend explains all features on the diagram.



Student evaluation

1. Complete this SWOT analysis by entering the Strengths, Weaknesses, Opportunities and Threats, based on your conceptual diagram.

Strengths	Weaknesses
Opportunities	Threats

2. What would you do differently if you were asked to create a conceptual waterway diagram again?

- _____
- _____
- _____
- _____
- _____
- _____
- _____