fresh.

A SALINITY RESOURCE FOR WIMMERA SCHOOLS

FRESH & SALTY CREDITS

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This film is the work of artists Dave Jones, Mary French and Hannah French who worked with Wimmera Catchment Management Authority. It was created for Regional Arts Victoria's 'Fresh and Salty' project, which was supported by the Australian Government through the Regional Arts Fund, Helen MacPherson Smith Trust and VicHealth. Wimmera CMA would like to thank the Australian Government for its involvement in the project, as well as the Bureau of Rural Sciences.

Who is Wimmera Catchment Management Authority?

Wimmera Catchment Management Authority is responsible for creating a healthier and more sustainable environment. We work in partnership with the Wimmera community and a range of organisations and stakeholders to protect and enhance the condition of the region's natural resources.
Wimmera CMA recognises that the community is one of the most important assets in managing our environment. The CMA encourages the valued efforts of local groups, schools and individuals in looking after the Wimmera environment.

Wimmera Catchment Management Authority

WATERWATCH Wimmera
People Knowledge Catchments

Transience

Regional Arts Victoria

Australian Government
Regional Arts Fund

Australian Government
Department of Agriculture, Fisheries and Forestry
Bureau of Rural Sciences
Department of the Environment and Heritage

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The creators of

Artist Mary French and animator Dave Jones at the premiere of the 'Fresh & Salty film. (Photo: David Fletcher)

In 2007, Wimmera CMA commissioned three local artists to produce an animated educational resource about salinity in the Wimmera. The result was a seven-minute film entitled 'Fresh & Salty'. The water creatures, birds, fish, plants and landscapes in this film are typical of those found in the Wimmera. Extensive research was done before starting this project to ensure the story demonstrated local issues in the local environment as accurately as possible. Each creature and background was created as a three-dimensional latex model, photographed and then animated. The whole project took nine months.

Artists involved on this project were:

Dave Jones is an internationally-renowned animator and director based in Natimuk. Dave runs his own animation company 'Transience' and has produced video clips for Vanessa Amorosi, developed on-line games and won countless awards at national and international film festivals. In 2007 he was nominated for a prestigious Australian Film Institute award.

Mary French is a trained educator and community artist. Her skills extend across a wide range of creative areas, including papier-maché, sculpture, shadow puppetry and large format puppet constructions. She is a skilful painter and a magnificent creative facilitator.

Hannah French, Mary's daughter is a emerging young artist studying a university arts degree. Hannah has worked closely on many local community arts projects. She has also worked with Dave in the past on animations.

In addition to the 'Fresh & Salty' film and to further build on local water quality awareness, Wimmera CMA commissioned the artists to produce three television advertisements with the theme of 'Water…it's only part of the story'. Some of the characters produced for 'Fresh & Salty' also feature in the television advertisements. Refer to page 19 to view stills of the three TV ads which highlight the value and importance of Wimmera waterways. The advertisements captured the voices and values of local children and adults speaking about what they value in their local environment.

'Fresh & Salty' was created by the artists in partnership with Wimmera Catchment Management Authority, Regional Arts Victoria (RAV) and with funding support from the Bureau of Rural Sciences Community Salinity Monitoring Project.

A note for teachers

The purpose of this education kit is to guide teachers and their students through an informative and engaging journey into the world of salinity and its impacts on the Wimmera environment. This kit has been specifically designed for primary and secondary schools located in the Wimmera.

The education kit includes:
- The 'Fresh & Salty' DVD
- Background information about salinity in the Wimmera
- A series of lesson plans ideas and questions

This resource will be most effectively used if viewed in conjunction with the DVD attached. Many of the Waterwatch programs and activities described in this booklet contribute to achieving the dimensions and domains of VELS.

Salinity

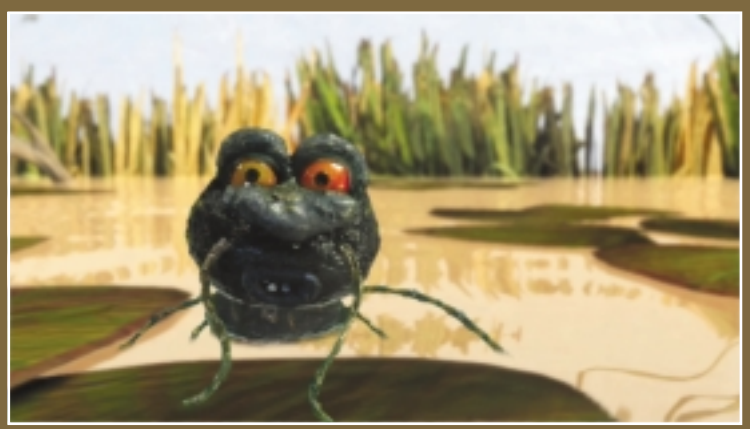
Increasing salinity on our land and in fresh waterways is one of the greatest environmental challenges facing the Wimmera and Murray Darling Basin. Salinity has been called the biggest environmental threat to Australia in the 21st Century. It is a serious issue affecting our waterways, soils, vegetation, landscapes and biodiversity. These impacts have led to significant decreases in fish and invertebrate populations, riparian vegetation and losses to recreational opportunities and land productivity. This has contributed to agricultural and economic loss and significant social change for local communities learning to live with increasing salinity.

While salt is naturally present in many of our landscapes, the way land is used and how much water is taken out of our waterways has caused an increase in salinity in our landscape. Salinity is a region-wide issue that the whole community needs to be aware of, so we can work together to find solutions for a healthier and more productive catchment.

Waterwatch

Wimmera CMA is committed to providing information and services to schools and the community through its Waterwatch and community education programs. The key aim of Wimmera Community Waterwatch is to increase awareness, understanding and ownership of local water quality, salinity and catchment issues. This is achieved through providing quality education activities and programs to schools (prep to 12) and involvement in major events such as World Wetlands Day, Wimmera Machinery Field Days and the Wimmera Kids Conference as well as initiating activities like Saltwatch Month, Wimmera Green Schools Week, National Water Week, field workshops and catchment tours.

Contact Wimmera CMA for information on how your school can become involved in community monitoring and managing salinity in the Wimmera by phoning (03) 5382 1544.



Catchments and water quality

Catchments are areas of land bounded by sloping natural features such as hills or mountains. These sloping natural features of the landscape direct all water entering the catchment down towards a low point a lake, dam or the ocean. Catchments connect our land resources to our water resources through the movement of water, both under the ground and over the surface, as run-off. To understand and manage salinity, along with many other water quality issues, it is important to consider it from a catchment perspective.

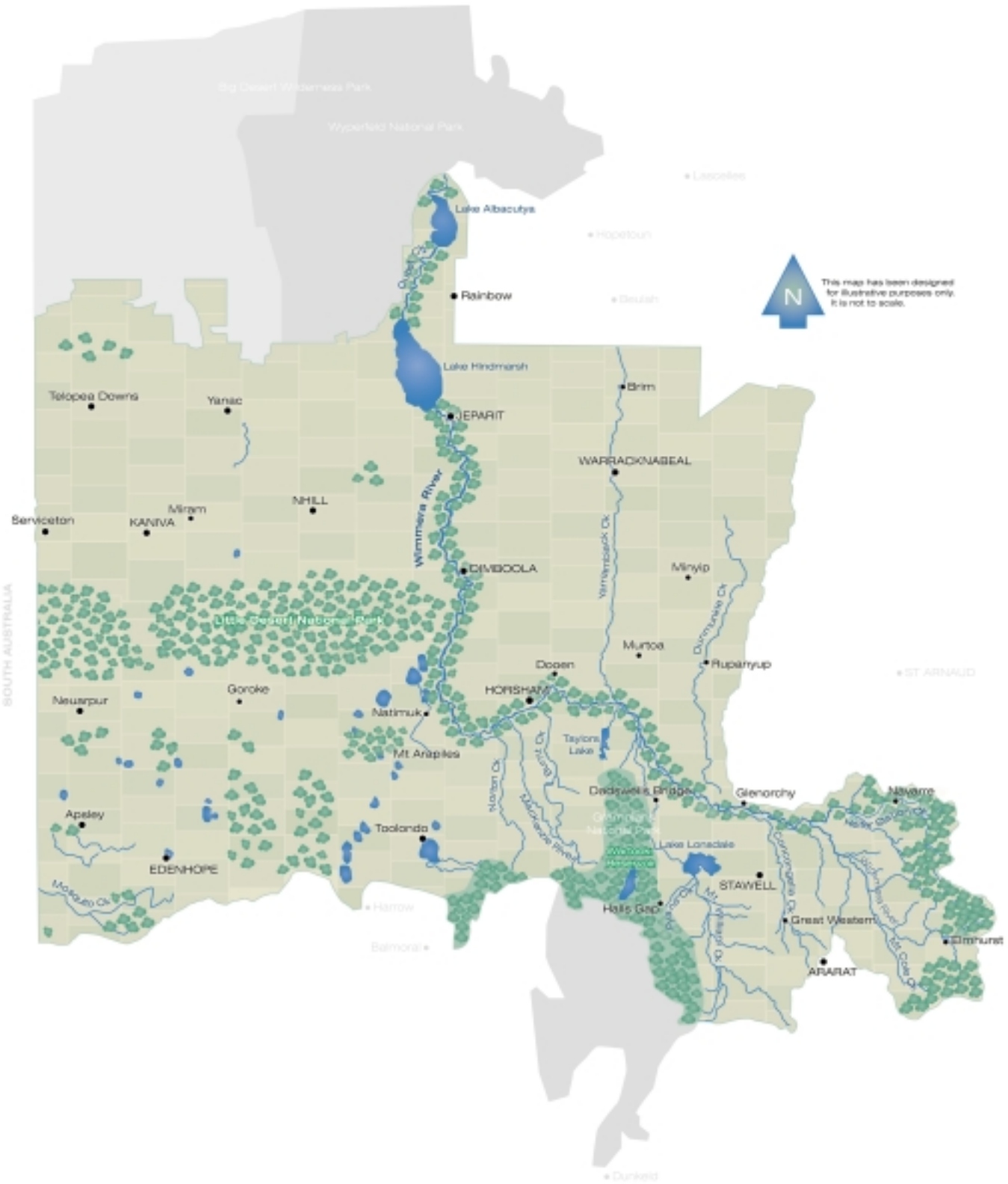
Wimmera River

The Wimmera River catchment in central-western Victoria is an area of 23,500 square kilometres, covering 10.3 per cent of Victoria and forming the south-west part of the Murray Darling Basin. The Wimmera River is Victoria's longest landlocked waterway, which means it doesn't flow into the sea.

The Wimmera River begins its life as a series of small tributaries, or creeks, beginning at Mt Buangor State Park. It receives water from the Pyrenees and Grampians ranges. The river passes through Elmhurst, Glenorchy, Horsham and Quantong, where it swings to the north and continues through Dimboola and Jeparit to Lake Hindmarsh, Victoria's largest freshwater lake. During very wet years Lake Hindmarsh overflows into Lake Albacutya. These lakes are known as the terminal lakes of the river and are recognised as wetlands of international significance.

The region has many natural features including open forests, semi-arid landscapes, the Wimmera River, wetlands and intermittent streams that only flow in winter. Rainfall varies from up to 1000mm in the Grampians to less than 300mm in the northern plains. The Wimmera River social, cultural, environmental and indigenous importance to the region. The river also supplies water for stock, domestic and irrigation purposes.

The Wimmera River is classified as a 'stressed' river system. This is due to decreased 'in flows' from rain and stormwater over the past 10 years and the amount of water taken out for stock, domestic, urban and irrigation demands. The river now receives between 11-14% of its average medium spring flows in the section of the river past Horsham. Increasing salinity and decrease in water quality and natural flows are significant challenges facing the Wimmera in trying to sustain this important and unique natural resource.



Map of the Wimmera River.

A whole host of plants and animals make this river their home...
living on the banks of the river, the surface of the water or, of course, underneath.

did you know?

- There are 21 fish species found in the Wimmera River. Five of these are native.
- There are about 3000 wetlands in the Wimmera. This accounts for 25% of Victoria's individual wetlands.
- The Wimmera River has a number of tributaries and distributaries - tributaries bring water into the waterway and distributaries distribute it out, especially in times of flood.

Importance of rivers... 'centres of life and health'

The Wimmera River and its environments are important places for many plants and animals in the region.

It's a source of water, food and shelter for animals such as frogs, water birds, aquatic invertebrates, reptiles, fish species, mammals and birds.

All of these species need good quality water and a suitable habitat to survive.

Along rivers, vegetation provides an important habitat for many creatures. Established trees provide food by depositing organic material into the water, giving shade and shelter for water birds, insects and reptiles as they go about their daily lives, eating... and being eaten.

River and waterway places are critical for supplying water for stock and domestic supply. People also rely on these waterways for recreation, fishing and social activities.

Despite the serious issue of salinity, the Wimmera River remains an incredibly important part of the landscape and Wimmera life.

It is OUR river! We all need to learn about it and do our bit to keep it healthy for the communities that depend on its catchment for their future.

Activity 1: VELS level 3-6

Understanding catchments

Aim:

To help students investigate the Wimmera and local catchments.

Materials Required:

A map of the school ground showing the layout of buildings, playgrounds and streets.

Procedure

Talk about what a catchment is. Students go into the school ground and prepare a catchment map based on the visible surface features they note as they move around the school. A completed map should show the main water routes (beginning at the school roof downpipes) and feeder routes such as gutters. The directions of movement should also be shown. Note: The map does not need to be to scale. Options include:

- Students work together on smaller catchments within the school limits, or in their street or garden at home.
- Students could construct a three-dimensional map, using matchboxes for various parts of the school and coloured wool to indicate the flow of water to indicate the water cycle of their catchments.

Following up

i. Discuss: what is a catchment?

ii. Our school is in the _____ creek/river catchment. Trace the path of a drop of water falling on the school roof until it leaves the school ground.

iii. Where does water end up after it has left the school grounds?

iv. If you were to build a dam in the school grounds, where would it be best located?

v. Using a topographic map of your local area, determine the catchment boundary of your local creek or river.

vi. Where does your drinking water come from? Where does your wastewater go to? Interview people who can help you answer these questions.

vii. The nearest waterway to our school is _____ i.e. (name of wetland, lake, creek, river/bore).

viii. Discuss the different ways the land in the catchment is used. Land use activities that happen in my catchment are _____.

Activity 2: VELS level 2-6

The catchment story

Characters:	Ingredients: *to be assigned a film canister containing:*
Farming country	Rock salt (representing fertilizer)
Piggery	Mud (representing manure)
Grazing lands	Table salt (representing salinity)
Herd of cattle	Soils/gravel (representing erosion)
Hobby farms	Cordial (representing sewage runoff)
Water skiing	Cooking oil (to represent boat petrol/oil)
Park	Rubbish (soft drink tops, lolly and lunch wrappers)
Subdivision	Sand/gravel
Garden	Diluted food dye (representing fertilizers)
Roads	Cooking oil (to represent petrol/ car oil)
Factory	Dishwashing detergent
Fishing	Bits of cut up fishing line

you may need a clear plastic bowl, spoon to stir and a net to remove waste

Directions

- Label and fill each film canister with ingredients as outlined above (make enough canisters for each student. There can be more than one student with the same character/canister).
- Assign each student a film canister.
- Students stand/sit in a circle and place a large clear container/fish tank (preferably see-through) in centre of circle.
- Read 'The catchment story' and when each student hears the name of their character in the story, they must empty the contents of their film canister into the container in the centre.
- The mixture will obviously look disgusting by the end of the story!

Pre-story

A catchment includes a river and all of creeks, streams and other smaller wetlands and waterways which run into it. When it rains, water drains naturally to the lowest point on the land, forming small creeks that feed into larger streams and rivers as they run downhill. Natural features such as ridges, hills or mountains form the boundaries of a catchment. Refer to map of the Wimmera catchment (see page 6) and ask students to follow the path of the Wimmera River and note how the river runs north to the terminal lakes of Lake Hindmarsh and Lake Albacutya.

Wimmera: story of a river

Our river begins way up in the mountains and flows down around hills, through farms and towns including Horsham, Quantong and Dimboola on its long journey to Lake Hindmarsh and Lake Albacutya.

Everybody has an affect on the river along the way. We will follow some clean droplets of water which just fell from the sky and entered our river at the very top of the catchment and track their progress all the way along the river until they reach Lake Hindmarsh. The Wimmera River is unique because most rivers flow to the sea – but not the Wimmera River.

1 Water falls as rain on the hills and slopes of the Pyrenees and Grampians ranges. The water gathers momentum as it descends the slopes. The river starts its journey towards Lake Hindmarsh through *farming* country, where recently, some crops were fertilized. After the crops were fertilized, it rained, and the run-off into the river bought some fertilizer with it.

2 The neighbouring farm is a *piggery*. Some of the manure from the pig pens wash into a drainage pipe which empties into the river.

3 On the other side of the river are *grazing lands*. There are very few trees remaining on this property. In some of the lower lying parts of the farm, the water table has risen, bringing salt to the surface and making the land unusable. It also means the run-off from the land is salty and this threatens the plants and animals living in the river.

4 A grazing *herd of cattle* feed on vegetation (that's the grass and shrubs) on the banks of the river. This removes much needed plants to keep the river bank stabilised and in place. When heavy rains arrive the banks collapse into the river.

5 Slowly, the river starts to wind its way through the outskirts of one of the major towns that it passes through. There are a number of *hobby farms* on the edge of town. The houses here are not connected to the sewerage system and have their own septic tanks. Occasionally these tanks overflow and untreated sewerage seeps directly into the river.

6 There are a number of people making use of the river around the bend. Tangle Bags is *fishing* on the banks. Unfortunately her line gets caught around a rock, she can't undo her snag and leaves the line in the water.

7 In the past when there was plenty of water, people would go *water skiing*. While skiing on Taylors Lake, Lorraine Leak realises that her boat needs a service. Before she has it fixed, it leaks engine oil directly into the waterway.

8 Another group of people are enjoying a picnic at a *park* overlooking the river. A gust of wind blows some of their rubbish off the table and down into the water.

9 The river now starts to meander through the suburban part of town. A new *subdivision* is being developed. Many of the trees have been removed and when it rains, the top layer of soil is eroded and contributes to the silting up of river.

10 Most houses in the developed parts of =town have a garden. To keep those nasty bugs away, *gardeners* use a range of pesticides. At the end of the day, when people are bucket watering their garden, the pesticides wash off the plants into stormwater drains and enter 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 carried into the stormwater drains and straight into the river.

12 There are still some factories along the river here. They use detergents to keep their production equipment clean. Sometimes the dirty water is hosed out of the *factory* into the gutter where it disappears into a stormwater drain. Once again, this water flows straight into the river. The detergents can cause algae to grow in the water. Once the algae begins to die, it uses up oxygen, which plants and animals in the river rely on.

13 With one final bend in the river, the river finally terminates at Lake Hindmarsh. But look at what flows out with it!

Points of Discussion

1. How did students feel about the change in the colour and look of the 'river'.
2. How would you feel about drinking or swimming in this water?
3. Do you think this is like the real situation - is this how pollution might occur in our river?
4. What other measures could be used to prevent or reduce water pollution?
5. Write your own story about the catchment in which you live, drawing on the different issues in your area.

Summary

Catchments and groundwater investigations

- Explore a catchment (Activity 1).
- Read and act out 'Story of our river' (Activity 2).
- Explore and discuss the concepts of groundwater and the water cycle (Activity 3).
- Explain and discuss what people do in one part of the catchment can affect the area downstream.
- Brainstorm the features of a healthy catchment (eg trees, clean water, no rubbish, variety of plants and animals).
- Discuss the causes and effects of waterway pollution (eg natural leaf litter, pest and weeds, human pollution).
- Brainstorm and discuss ways that your community, your school and each student can help reduce river pollution.
- Write a story about a droplet of water as it travels from the mountains to the terminal lakes.

They call it ‘Groundwater’

During and after rainfall, water in a catchment can either run-off the surface of the land, be used by trees and other plants, soak into the ground, or be lost by evaporation through the water cycle. Some water will move past the root zone of plants and enter the groundwater system. This is a natural process that leads to an increase or ‘recharge’ of groundwater. The upper surface of the groundwater is called the watertable.

Groundwater systems are found deep below the surface and refer to the underground section of a catchment. It includes places where water enters, is stored, transmitted and departs. The Wimmera has a diverse range of ground water flow systems. Each system has the potential to cause dryland salinity and add to the amount of salt in waterways.

One particular regional groundwater flow system is located in the Parilla Sands of the Wimmera, north of Horsham. About six million years ago, this part of the region was covered by an inland sea. About two million years ago, this massive sea retreated to where the ocean is now located off the South Australian border. Vast amounts of fine grained sand and deposits were left behind to form the Parilla sand region. In many places across the Wimmera this occurs naturally at places like Mitre Lake near Mount Arapiles. Where the groundwater surface has risen due to increased levels in groundwater recharge, the area of saline groundwater discharge increases and the lower landscape is affected. This is often clearing of native vegetation.

What happens when trees are removed?

Removal of deep-rooted native vegetation will increase the amount of water that moves past the root zone and into groundwater sources. Trees act like pumps, drawing water for growth up through their roots. When trees and vegetation are cleared, much of this water can slip down through the cracks and crevices into the water table, causing groundwater levels to rise.

When a saline water table rises to within one or two metres of the ground’s surface, water moves to the surface by capillary action, bringing salt with it.

When water evaporates, salt is left behind in the surface layers of the soil. As salinity levels increase, salt-sensitive plant species die, leaving the soil prone to erosion. Over time the soil becomes saline, decreasing the soil structure and limiting vegetation growth.

Rivers and streams represent the lowest points in the landscape. They are often affected by saline discharge from regional groundwater. An example of where this occurs in the Wimmera is saline groundwater flowing into the Wimmera River from Parilla sands, north of Horsham.

Deeper pools of the Wimmera River, which have traditionally been key breeding grounds for fish and other freshwater aquatic species, now contain salt and groundwater that contains no oxygen. This has impacted considerably on the ecological viability of the river.

Activity 3: VELS level 2-5

Mini water cycle

Aim:

To help students understand the process of the water cycle from rainfall to runoff.
To understand how groundwater is recharged.
To learn where water goes by creating a miniature water cycle.

You will need:

- Large glass jar/container with lid
- Bottle cap or similar to hold a small amount of water
- A collection of plants
- Soil
- Sand
- Small rocks/gravel.

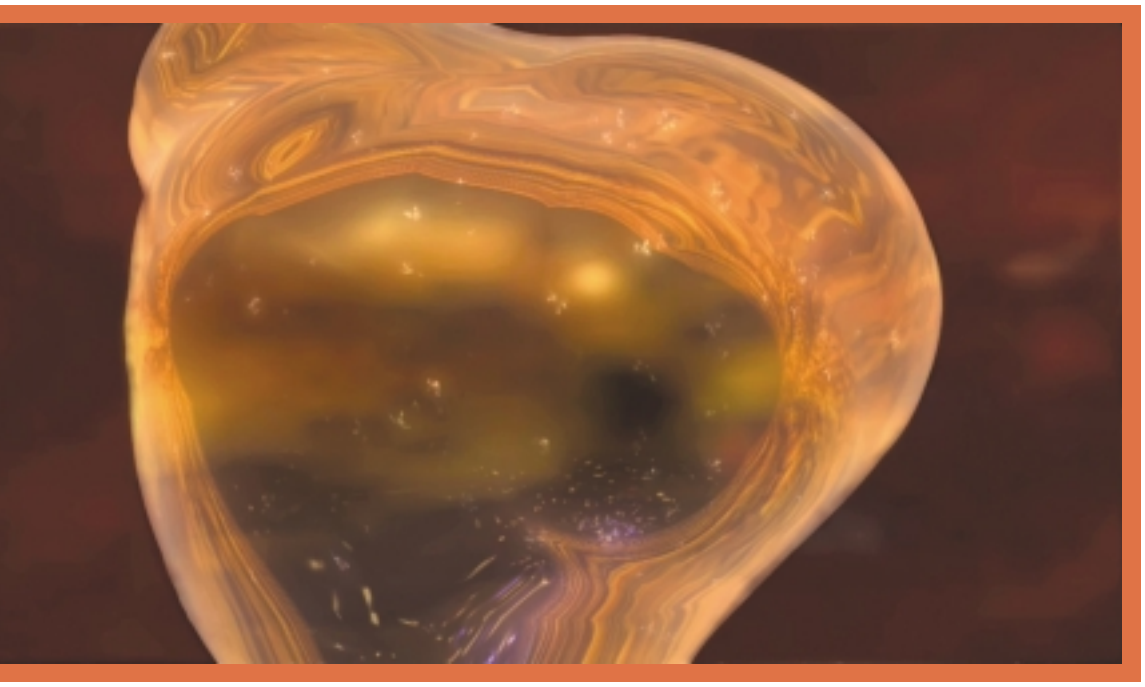
Directions:

1. Add a layer of gravel, followed by a layer of sand, and then soil. Build up one end of the model with a sloping edge, to mimic a small hill (see image above).
2. Place your plants in the soil.
3. Add a small dish (bottle lid), complete with water, at the opposite end of the sloping rise.
4. Place the lid on your large glass jar or container.
5. Over 1-2 weeks, observe how water moves through the environment. Look at the different stages of transpiration, evaporation, condensation, precipitation and run off.
6. Record your observations every second day.

Exploring salinity

Salt is a natural part of our landscape originating in our soils and groundwater. When salinity is moving through the soil to the surface and into waterways, it becomes a serious issue for long-term sustainability of our natural rivers, creeks, lakes and soils.

There are two types of salinity found in our landscape. Primary Salinity (or natural salinity) which occurred before European settlement. Secondary Salinity is the salinity which has become apparent since settlement.



Droplet of water with salt.

Salinity is the presence of soluble salts in soils and waterways. Salinity is used to describe the presence of higher than normal levels of salts such as sodium chloride, magnesium and calcium sulphates and bicarbonates in soil and water.

It usually results from water tables rising too close to the groundwater surface. Soil salinity refers to the concentration of soluble salts in the soil, and the salinity of water refers to the concentration of salts in solution.

Salinity includes the following forms:

Dryland salinity
Caused by saline, seeps into the soil scalding the land surface on non-irrigated lands, which in turn affects plant growth and degrades soil structure.

Irrigation salinity
Occurs on certain irrigated lands resulting from the overuse of water causing rising water tables.

Where does the salt come from?
Salts are a natural component of all landscapes.

They result from the weathering of rocks and other sediments and are moved by water. Salts in the landscape originate from a number of sources:

Rain
Rainfall carries salt from the atmosphere and it builds over thousands of years. Salt from the sea is carried inland by strong winds, and falls in rain. The concentration of salts in rainfall is very low, but higher as you move nearer the coast.

Rocks
Salts are present in rocks and are released by weathering and erosion. Many rock types including marine sediments, granites and rhyolites contain high levels of sodium and potassium, which may be moved by water or wind after weathering.

Retreating seas
Many millions of years ago the Wimmera and Mallee were covered by an inland sea. When the sea retreated about 10 million years ago, the sediment left behind contained large quantities of salt.
Salt accumulates in groundwater by water soaking through sediments and rocks that were formed as part of the inland sea environment. Many soils in the lower Wimmera have been formed from these materials.

Measuring salinity
There are different ways of measuring the amount of salinity in water. One method for testing the concentration of salt ions dissolved in water (salinity) is achieved by measuring the water's electrical conductivity (EC). The standard unit for measuring EC is microsiemens per centimetre (µS/cm). The higher the reading, the higher concentration of salt ions in the water.
The acceptable range of salinity levels in Wimmera waterways is between 350 and 2200 µS/cm/EC. However, parts of the Wimmera River have salinity readings from 3000 up to 80,000EC. In some areas of the lower Wimmera River, salinity has been recorded at levels of 170,000EC - more than twice the amount of sea water!
Putting this into perspective – the limit for drinking water is 800EC, barley crops tolerances peak at 8000EC, fish become stressed and stop breeding at 10,000EC, sheep will not drink water with salinity higher than 15,000EC, yabbies die at salinity levels of 41,700EC, salt water in the Pacific Ocean is 58,300EC.

salt salt salt

Activity 4: VELS level 3-6

A taste of salt

In this experiment prepare four solutions, of different salinity levels, for comparison.

Aim:

Students learn the technique for measuring salinity and gain an appreciation of different concentration levels by tasting the solutions. This activity can be done in small groups or as a whole class demonstration.

Equipment Required:

- Salinity meter
- Table salt
- Distilled water or rainwater
- Four (4) small clean containers (plastic cups)
- Teaspoons

Summary

Salinity Impacts

- Discuss the associated health problems for both humans and stock consuming too much salt.
- Explore how salt affect plants. Set up the bean seed experiment.
- After watching Fresh & Salty, write an historical recount about why we have salinity in the Wimmera.
- Using illustrations, drawing, models and even sandpit sculpture, explain the history of salinity in the Wimmera.
- Taste and measure the salinity of two water samples from Activity 4.
- Discuss as a group the sources of salinity.
- Learn how salinity is measured. Measure the salinity of water samples collected from local waterways, dams and bores.
- Use salinity meters from monitoring kits available from your local Waterwatch Coordinator (Activity 3 & 4.)

Salinity measurement instructions

1. Label the containers 1 – 4 and half fill them with water.
2. Follow the instructions below to measure the salinity level of the water in each container.
3. Add salt, ¼ of a teaspoon at a time, to container 1 and measure the salinity level using the EC meter (it should be less than 800 µs/cm). Record your results.
4. Add salt to container 2, (again adding ¼ of a teaspoon at a time), until it measures approximately 1500 µs/cm. Record how much salt was added.
5. Repeat Step 3 for container 3 until it measures approximately 7000 µs/cm.
6. Repeat Step 3 for container 4 until it measures >10000 µs/cm.
7. Taste each solution and record your response.

How saline is that water? Measuring salt

1. Remove cap and rinse end of probe in the water to be tested.
2. Switch unit on (on/off button).
3. Dip the end of the probe into the water to be tested. Gently swirl the probe, until the numbers stop changing on the screen.
4. Multiply your reading by 1000 (eg. 1.73 x 1000 = 1730 µs/cm).
5. Record your result.
6. Rinse the end of the probe with tap water and turn off.

Container Amount of Salt (tsp)	Salinity Level (µs/cm)	Taste

Follow-up activities

Ask students to create a Procedural Writing Text to recount the experiment. Provide students with a copy of the Water Quality tolerances (page 14) and ask them to create an illustrated fact sheet.

The extent of the problem

Increasing salinity is one of the most significant environmental problems facing the Wimmera. While salt is naturally present in many of our landscapes, the way land is used and changes to ground and surface water movement have caused an increase in the amount of salinity in our land and waterways.

In the Wimmera, dryland salinity affects more than 22,000 hectares of the catchment. On average, 110,000 tonnes of salt is transferred into the Wimmera River system each year - the equivalent of 4400 semi-trailer loads! Increased salinity in the landscape effects not only the local environment, rivers and landscapes, but also impacts on our local communities, both economically and socially.

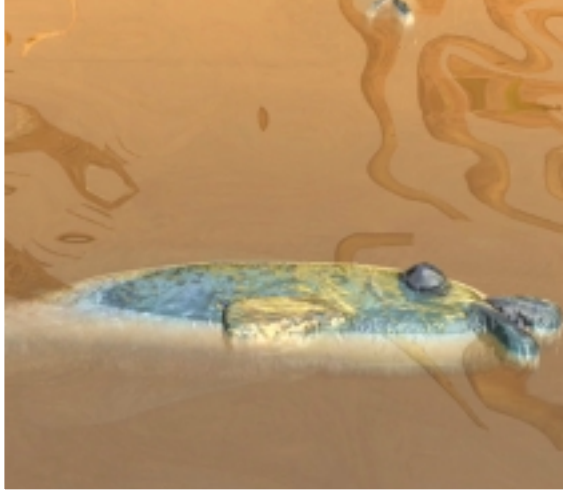
For animals and small invertebrates that rely on freshwater for survival, high levels of salinity can cause major problems, including stress, changes to the freshwater community, loss of diversity due to increased sediment and chemical pollution of rivers and dams. Salinity also reduces the growth of many aquatic plants, affects primary production and reduces important habitats for small creatures. It also reduces riparian habitats and increases the potential for bank erosion.

Rising water tables deposit salinity to the soil surface and create many problems in our waterways. High levels of soluble salts in the landscape can result in less productive farmlands, destroy riparian environments and reduce habitats for wildlife.

When salinity affects the water collected in dams, or held in reserves, rivers and wetlands, it can have a high economic and social cost. If this happens, there is increased cost of treating water for drinking, and reduced level of the suitability/availability of water for irrigation, stock and domestic water supply. There is less option for use of available water for industry and business.

Rising salty water tables can also damage public infrastructure, roads, fences, railways, buildings plus damage water-using household equipment, i.e. pumps and water heating equipment.

Productive land losses have caused significant social and economic hardship. This can occur in irrigated or dryland farming regions. Increased salinity in our waterways may also have an effect on the choice of recreational activities available to residents and visitors.



Salinity tolerances

Plant salinity tolerances (EC - µS/cm)

These tolerance levels are indications only. Plants may survive using water outside these ranges.

Violets, loquat, violets	500
Grain Sorghum	700
White Clover	800
Rice	1,000
Maize / Corn	1,100
Aster, begonia, fuchsia, rose, azalea, camellia, gladiolus, ,dahlia, poinsettia, walnut, blackberry, french beans, parsnip	1200
Lucerne, Soybeans	1,300
Field peas and beans, strawberry Clover	1,400
Broad beans, flax, bougainvillea, hibiscus, carnation, almond, grapefruit, plum, raspberry celery, radish, mulberry	1,700
Bluegrass, fescue,	2,000
chrysanthemum, oleander, pomegranate, cauliflower, gherkin	2,300
Phalaris	2,800
Artichoke	3,000
Oats	3,300
Asparagus, cabbage, beetroot, spinach	3,500
Wheat	4,000
Canola	4,300
Sorghum	4,700
Cotton	5,100
Barley	5,300
Sugar beet	6,200
Saltbush	8,000

Salinity tolerances for stock (EC - µS/cm)

Acceptable level for adult poultry	4,700
Maximum limit for adult poultry	5,800
Acceptable level for adult pigs	6,600
Acceptable level for adult cattle	7,800
Maximum limit for adult pigs	9,400
Limit for Horses and lactating ewes	10,000
Acceptable level for adult sheep	15,600
Maximum limit for adult cattle	16,500
Maximum limit for adult sheep	20,000

Salinity tolerances for freshwater plants, fish and macro-invertebrates (EC - µS/cm)

Impact on macro-invertebrates	1,500
Impact on germination of freshwater aquatic plants	1,500
Freshwater fish eggs and juveniles are less tolerant	2,000
Reduction in emergence of macro-invertebrates	3,000
Reduction in macro-invertebrate diversity	3,000
Adult freshwater fish tolerance	4,600
Upper limit for mature freshwater aquatic plants	6,200
Significant reduction in macro-invertebrates(water bugs)	15,000
Maximum limit for Yabbies*	41,700

Activity 5: VELS level 2-6

The effect of salinity on seed germination

Aim:

Investigate the effect of salinity on seed germination.
Understand how salinity can affect cropping and agriculture in the Wimmera.

Background:

This experiment is best run over a period of two weeks to give the seeds adequate time to germinate.

Materials Required:

- Bean seeds or barley seeds
- 4-6 water samples with varying levels of salt, one being tap water and another distilled water
- Salinity meter
- Extra distilled water to rinse meter between samples
- Labels for four dishes
- Cotton wool
- Cling wrap
- Dish for growing seeds

Procedure:

1. Place cotton wool on the bottom of each growing dish. Label each dish to correspond with one of the water samples.
2. Spread bean seeds (not too thickly) across the cotton wool on each of the dishes.
3. Add sufficient sample water to the appropriate dish. You should only moisten the seeds. Excess water is not necessary.
4. Cover each dish with cling wrap to prevent it drying out. Place the dishes on a bench in a safe place with access to sunlight.
5. Check the dishes every two days and add sample water as necessary to keep the seed moist. Count the number of germinated seeds, and the height of plant growth.
6. As the beans begin to germinate, remove the cling wrap from the dishes.
7. Continue checking and recording over a period of two weeks.
8. Record your results in a table similar to the table on the right. You may also wish to take regular photographic evidence over the two weeks.

Water sample EC level	Date	Number of germinated seeds	Average height of germinated seeds
Sample 1 Distilled Water			
Sample 2 Tap Water			
Sample 3			
Sample 4			
Sample 5			

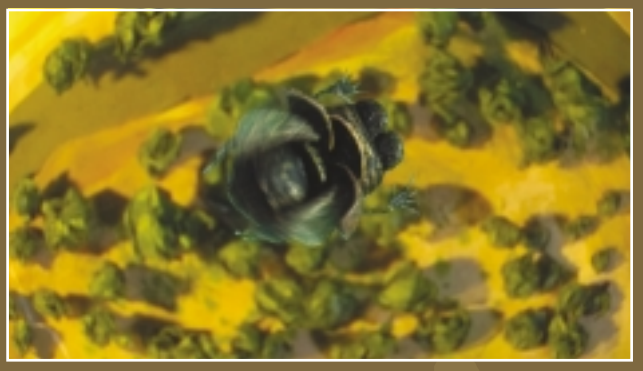
Studying the data:

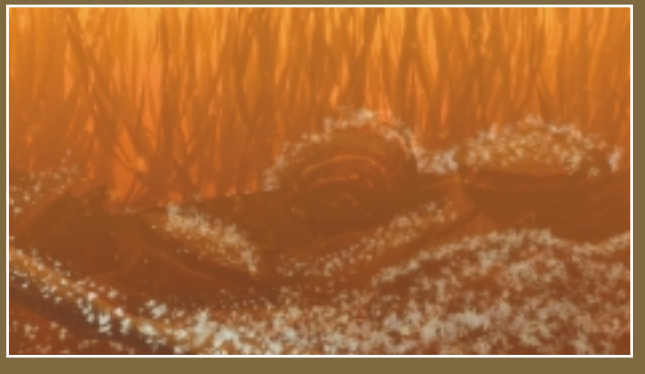
1. Draw a bar graph of results, comparing the germination and growth rates for each of the samples.
2. What effect does salt appear to have on seed germination?
3. What are the implications for farmers in salt-affected areas?
4. How might native plants, animals and ecosystems be affected by salinity?

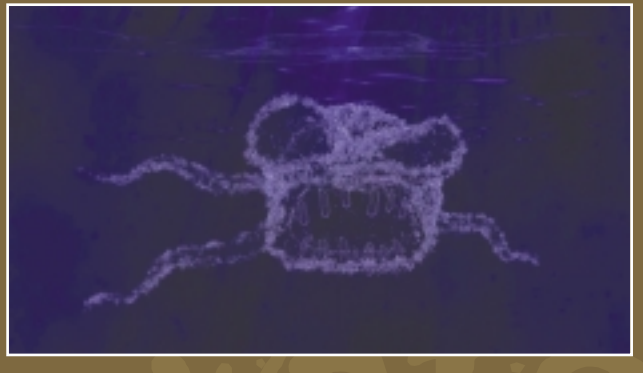
Activity 6:

Fresh & Salty storyboard

Teachers to colour photo copy this page for students to rearrange in order after viewing the DVD.







Salty solutions

A catchment approach

Salinity is a problem the whole community needs to own and work together to solve. Sometimes the cause and effect of salinity can be seen and solved within a single area. But most of the time the effects and causes of salinity cross property boundaries and catchments. Everyone in a catchment is affected by the way land, rivers and waterways are managed. Therefore effective salinity management requires a whole-of-catchment approach. By learning and understanding more about salinity we can produce real and long-lasting benefits for all.

Testing for salinity

Wimmera schools, community groups, landholders and individuals are involved in Community Waterwatch networks across the Wimmera region. Community testing of water quality parameters and salinity in a systematic regular manner is an important way that salinity data is captured to map salinity changes in our waterways.

Students across the Wimmera can become a part of community monitoring networks, learning to test salinity and water quality parameters across the region.

Waterwatch provides all training, equipment and support free for schools and teachers. Data collected contributes to managing salinity issues in our environment.

Hands-on monitoring activities provide students with real-life learning opportunities and community action.

Choose a waterway close to your school and set up a monitoring site to study. Take ownership of this area, learning about the waterway environment.
Monitor the water quality and salinity on a regular basis, learn to interpret and graph your data.

Ask students to bring in samples collected from local water sources - dams, tanks, bores, creeks and rivers. Label the sample clearly with location name and collection date and time.

Saltwatch

Get involved in Saltwatch during May each year. Saltwatch began in 1987 and is now Australia's longest-running community water monitoring program which helps communities better understand the salinity problems across Australia.

Saltwatch includes an annual snapshot of salinity held across Victoria, where school students, landholders and the wider community test salinity and water quality from samples collected at local water sources.

Testing samples with a salinity meter helps determine salinity levels across the region. Results are posted on the Saltwatch website. You can log onto www.saltwatch.org.au to access the snapshot results.

Phone Wimmera CMA on (03) 5382 1544 to get in touch with your local Wimmera Community Waterwatch Coordinator and find out how to get involved.

What can we do?

"There are a few things we can do to make sure the same thing doesn't happen here. Planting more trees is a great start... or even getting involved in keeping an eye on salinity at 'your place' with your local community Waterwatch group".

Schools can get involved in a range of salinity reducing activities, including:

- Testing for salinity as part of Wimmera community Waterwatch
- Saltwatch activities
- Tree planting along waterways
- Tree planting around your school yard and community
- Join large tree planting events

Tips on sampling

- Never sample alone - always sample with a buddy and an adult.
- Don't sample if you feel uncomfortable or consider yourself at risk.
- Use a clean container to collect your sample (thoroughly rinsed three times).
- Take samples approximately 20cm from the surface of the water and 20cm from the bottom if shallow.
- Wash your hands after collecting samples in the field and after testing before you eat (water samples may contain pollutants).

Planting trees

Planting more trees is one practical way your school can help reduce salinity. Trees and native vegetation act as pumps, using their roots to reach deep down into the soil and draw up water to keep groundwater levels low. Many trees and native vegetation have been cleared from the Wimmera landscape to make way for crops and pasture. Crops and pasture have shallow roots that are unable to reach the groundwater, causing it to rise toward the surface.

The value of trees in maintaining the soil/water balance in our river catchments is widely recognised. Across the Wimmera and Victoria, community groups, farmers, schools and government departments are working together to restore the water balance by being actively involved in revegetation programs.

Contact Wimmera CMA, Landcare and Greening Australia to find out where local tree planting events are held in your area... conserve, protect and get involved.

Tree planting activity

1. Consider planting indigenous (local) trees and shrub species, as they are better suited to the soil and climate of your area.
2. Contact your local Landcare or Greening Australia office to find out where trees could be planted to reduce salinity. Plan where you will plant by checking for service lines such as sewerage, gas and water. Also check for powerlines above for large growing trees.
3. Dig a hole for your plant two to three times the diameter and a little deeper than the size of the container the tree is in.
4. Remove all weeds – they may compete with the tree for water and nutrients.
5. Take the tree out of its container. Loosen soil at the base of the tree roots.
6. Place your tree in the hole and cover with soil.
7. Water your newly planted tree.

After you have planted your tree, it's important to keep looking after it to make sure it survives. You can do this by watering when the soil is dry, clearing any weeds from around the tree and providing mulch such as hardwood chips or straw.

Mulch helps retain soil moisture and control the growth of weeds. You might also consider placing a guard around your tree for extra protection.

Summary

Salty solutions for schools

- Discuss how your community can prevent rising water tables that bring salt to the surface.
- Discuss ways that salinity in our waterways and on the land can be managed to prevent or reduce impacts of salinity.
- Brainstorm ways your community could help prevent the affects of increasing salinity.
- Design a flyer or poster encouraging the community to reduce salinity.
- Register your school to become involved in the annual Salinity Snapshot during May each year.
- Become involved in monitoring salinity in a local waterway. Waterwatch provides all training, equipment and support for students to test waterways in the Wimmera. Join a growing network of Waterwatch monitoring schools.

Additional resources

Other resources available for schools from Wimmera Community Waterwatch include:

- Creeks and Pipes, an interactive salinity and catchment life-sized board game activity (based on snakes and ladders).
- Interactive Waterwatch trailer. Learn about the effects of salt on aquatic invertebrates that live in local waterways. Learn how to collect and identify these amazing critters that tell us about the condition of our waterways.
- Read Pete and Paul's Salty Adventure, a Wimmera CMA environmental big picture story book (already at schools) - Levels P-6

Phone Wimmera CMA's community Waterwatch team on (03) 5382 1544 to access these resources or speak to qualified Waterwatch staff who conduct sessions and programs in schools across the region.

Water…

it's only part of the story

A sample of Wimmera CMA's TV advertising campaign 'Water…it's only part of the story', complements the Fresh & Salty DVD .

The television ads continue the theme of Fresh & Salty with appearances from some of the Fresh & Salty characters plus a few new ones.

Using local children's and adult's voices, the advertisements bring to life what Wimmera people value about their local environment.

"The Wimmera River is a great place… great to see, great to fish. Gee whiz it's a great recreational place; it only wants a decent flow down it. Hopefully the wheel will turn and eventually it will come back… and hopefully I'll be here long enough to see it."

"The river is a major nourishing point. I feel like a bit of a gatekeeper or a guardian. There's also a sadness. It's the lowest I've ever seen it in my life. But whether the river's got water in it or whether it's empty or sad… it's still got a strong presence."

"Where we go there is nobody else… it's just quiet and peaceful, no hustle and bustle.. don't have to be anywhere… don't have to do anything…. you're laughing!"

The impact of salt on our land and waterways is one of the greatest environmental challenges facing the Wimmera and Murray Darling Basin in the 21st Century.

Salinity is a serious issue that affects our waterways, landscapes and biodiversity.

This Fresh & Salty educational package, which includes a short animated film and resources for classroom based activities, takes a fresh and innovative approach to teaching students about salinity.

Transfield

Regional Arts Victoria

Australian Government
Regional Arts Fund

Wimmera
Catchment Management
Authority

WATERWATCH
Wimmera
People Knowledge Catchments

Australian Government
Department of Agriculture, Fisheries and Forestry
Bureau of Rural Sciences
Department of the Environment and Heritage