GOVERNMENT OF WESTERN AUSTRALIA

Western Australian Planning Commission

WHITEMAN PARK

Children's Gnangara GROUND WATER Festival 2023

Groundwater Guru

2023 Teacher Resources

Book 3

- GROUNDWATER
- SOIL
- WETLANDS
- GROUNDWATER AND THE DREAMTIME
- SALINITY
- GROUNDWATER POLLUTION
- WASTEWATER
- WATER FOR OUR FUTURE

WHITEMAN PARK

CONSERVATION • RECREATION • EDUCATION

Welcome

Firstly, we would like to officially welcome you and your class to the 2023 Children's Gnangara Groundwater Festival.

As a unique and inspiring education event, we want the Festival to be a fun and educational day of activities for your students. To maximise your students learning in the lead up to the Festival and help you with activities to use in the classroom, we have developed this education resource, the Groundwater Guru.

While you can certainly treat the Festival as a "stand-alone" experience for your class, it can also be the focal point for a variety of related lessons and classroom activities, before and/or after the event. The Guru will provide you with comprehensive background information on groundwater, especially relating to the topics of:

- what the water cycle is,
- soils and how they affect groundwater,
- Noongar culture and the Dreamtime,
- salinity and groundwater pollution,
- water conservation.

All activities are linked to the curriculum.

We look forward to seeing you all at the Festival!

Acknowledgements

Whiteman Park simply wouldn't be able to offer this unique event without the support of our long-term major sponsor, the Department of Water and Environmental Regulation.

The provision of environmental specialists and educators from a large number of government and private stakeholders to help present the workshops and activities to classes is also critical to the event's success.

Government of **Western Australia**

Department of **Water and Environmental Regulation**

About our sponsor

The Department of Water and Environmental Regulation supports Western Australia's community, economy and environment by managing and regulating the state's environment and water resources.

We plan and manage the availability and quality of water throughout WA to support the state's growth and development.

As a part of our role we investigate the state's water resources to understand how water interacts with the environment. We use this information to decide how much water can be used and what is can be used for. The department also works to protect waterways and water-dependant environments.

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ssshhh... ANSWERS ARE ON PAGE 21

NOTE TO TEACHERS

There is a global recognition amongst environmental and political leaders of the need to educate young people about the importance of groundwater and how groundwater connects to all other resources.

For your students to make the most of their attendance at the Children's Gnangara Groundwater Festival it is important for them to develop an understanding of the concept of groundwater and how precious a resource it is.

This resource book has been designed for all year levels attending the Festival, from years 4 to 6. Some activities may not be appropriate for the year level that you are teaching, so please adjust activities accordingly.

The activities given for each section are intended to develop your students understanding of the topic.

A great way to make the most of this topic is to start a Groundwater Activity Book (GAB) for the students to record all their learning throughout the topic.

The first activity that is recommended is a KWL chart.

Activity

Activity Sheet

Did you know?

A sprinkler left running too long can waste more than 1000 litres of water every hour.

The Western Australian Government's 2019 *Waterwise Perth Action Plan* aims for a 10% reduction in groundwater use by 2030.

Most shower heads use an average of 12 litres of water per minute. So a 10 minute shower would use 120 litres! A 4 minute shower will use just 48 litres in comparison.

Earth's atmosphere contains approximately 13,000 km3 of water.

"When the **well is dry**, we know the **worth of water**."
BENJAMIN FRANKLIN

Education about water – the **world's most precious** resource – is of **global concern**.

What is salinity?

Salinity is a huge environmental threat that has become a serious problem in many parts of Australia, including Queensland, Victoria, South Australia and Western Australia. It affects everything from agriculture and land to water quality and infrastructure. Salinity is caused when the concentration of salt that is naturally stored in all landscapes and soils becomes too high.

Salt is found in all soils, either having been being carried inland from the ocean by wind or rain, developed naturally in deep sediments and rock minerals or accumulated in clay sub-soils over time. This salt does not become problematic if it remains deep in the soil, but there have been many changes made to the Australian landscape that have brought this salt closer to the surface where it causes major problems, upsetting the natural balance.

Clearing native vegetation has a direct effect on where salinity occurs, so protecting what remains is a vital part of managing the salinity problem!

Unsuitable land management activities and changes to the landscape and soils since European settlement have brought about the salinity crisis. The clearing of native vegetation and replacing it with crops and pastures that have much shallower roots has intensified the problem. Native Australian vegetation is salt-tolerant and has evolved over time to grow in the harsh Australian conditions. They have a deep root system which feed the plants water from well below the salty-soil line, unlike the European crops and pasture with their shallow roots that allows the groundwater table to rise into the salty soils.

Salinity and groundwater

Australia is a naturally salty continent and the salt that is found in soils has been carried across the Australian landscape over thousands of years by winds and rain, accumulating in the soil structure. This amassing of salt is expressed in many lakes and rivers in Western Australia which are naturally salty. As long as the salt stays deep in the soil it poses no problems, but changes have occurred on our land that are bringing the salt closer to the surface where it can cause major problems.

Looking back at the water cycle, we know that when rain falls, the water moves towards a catchment area and can either run off the surface of the land, be used by trees and plants, evaporate back into the atmosphere or soak into the ground to recharge groundwater systems.

Dryland salinity occurs when salt stored deep in the soil is brought close to the surface by rising groundwater levels. As this water nears the surface, the water starts to evaporate and the salinity levels in the ground increases to a point where plants can no longer survive.

When the water table rises, it also dissolves the salt that is naturally found in the soil causing the groundwater to become salty, resulting in the contamination of the land as well as local surface water. This saline groundwater can make its way into streams and drains where it will affect wetlands, river life and drinking water. In towns, the build-up of salt on the surface can damage roads, buildings, rail embankments and other infrastructure. It can be a very expensive problem!

The effect of salinity

Dryland salinity can have a devastating effect on the environment and is widespread throughout Australia. It is generally concentrated around agricultural areas where the native vegetation has been cleared for crops. Salinity can cause vegetation and crops to die, pollute rivers and dams which can harm water supplies for drinking and irrigation and can also affect our natural ecosystems, river systems and groundwater.

Salinity and its related problems have the potential to affect all Australians, whether they live in the country or in the city.

Salt is visible in some places as white salt scars on the surface of the land, particularly around rivers, streams and wetlands. In other areas the salt cannot be seen as it sits just beneath the surface of the soil.

Salinity and Western Australia

Western Australia has the largest area of dryland salinity in Australia and it is one of the biggest environmental threats that we face. Areas in the south west region of Western Australia have been identified as being high risk in developing salinity, since 18 million hectares out of 25 million hectares has been cleared of its native vegetation. Currently, over one million hectares is salt-affected.

Salinity is expected to continue to expand in WA for another 50 years or more, possibly affecting five million hectares. Other high risk areas include the eastern wheatbelt, eastern sections of the northern wheatbelt and coastal areas around Bunbury and Donnybrook.

Almost every stream and river in south west WA is affected to some extent by salinity. It is estimated that 850 endemic flora and fauna species were at threat of extinction as a result of dryland salinity.

70% of **Australia's dryland salinity** affected areas are **here in WA**.

97.5% of the world's **total water supplies** are made up of **saltwater** – just 2.5% is freshwater!

Solving the salanity problem

A big effort would be required to reverse or reduce the salinity problem in Western Australia: over 80% of the Wheatbelt would need to be replanted with deep-rooted species. Even then, it would take decades for the water table to restabilise and farming would no longer be possible in the region. But there are still lots of things that can be done at a local level to combat salinity issues.

More than half of all farms in Western Australia show signs of salinity.

In WA, the Department of Water and Environmental Regulation is tasked with managing and protecting key water sources. After years of research, a range of resources have been prepared to assist landholders and communities where salinity is a problem in these areas.

So what can be done?

- Some unaffected areas can be protected.
- Smaller areas can be restored through planting deep rooted native plants.
- Salt tolerant plants are suitable for planting in some areas.
- Wetlands can be protected from salt water flow by diverting the salty water.
- New uses can be found for salt affected land.
- Educating communities about salinity and how to manage the problem.

Useful salinity information websites

CSIRO Salinity Factsheet
www.watersciencelab.com.au

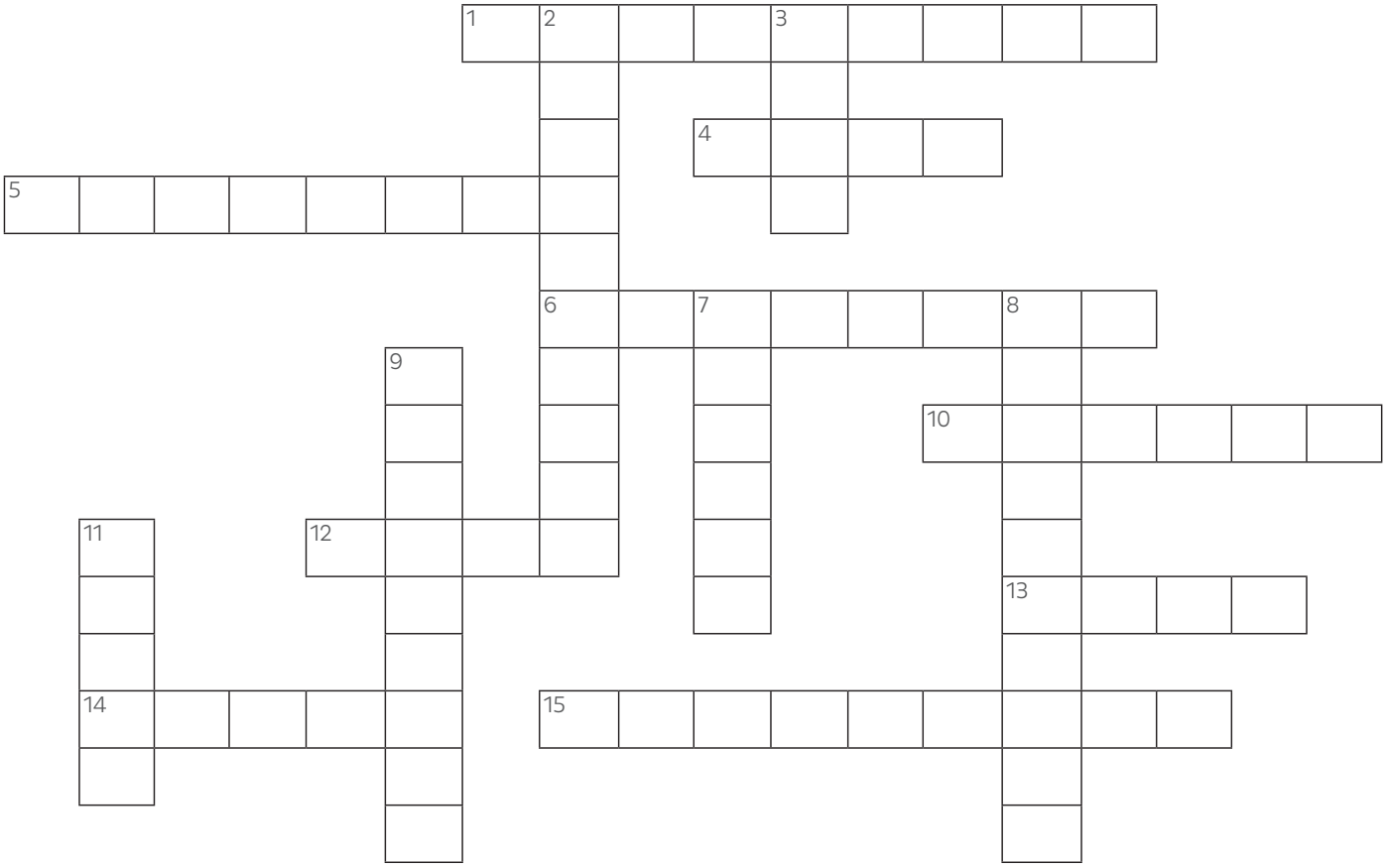
Department of Agriculture and Food: Interactive groundwater and salinity map
www.agric.wa.gov.au

Department of Environment and Energy
www.environment.gov.au

Department of Water and Environmental Regulation
www.dwer.wa.gov.au

University of Western Australia
www.uwa.edu.au

Salinity Crossword



Across

1 Perth's main waterway, a place for black birds

4 Salt in a landscape can sometimes cause a _ _ _ _ where no plants will grow, and you can see the salt area on the ground.

5 As part of the watercycle, when rain occurs, groundwater levels increase, or are 'topped up'. This is known as groundwater _ _ _ _ _ _ _ _

6 Unconfined aquifers allow the water to rise, collecting salt. What is the other main type of aquifer?

10 When the water table rises, it collects the salt in soil, which causes the groundwater to become _ _ _ _ _ _.

12 Groundwater can sometimes be seen at the surface as a river, _ _ _ _ or waterhole.

13 How does salt get washed into waterways?

14 The water_ _ _ _ _ is the name of the top level of groundwater in an unconfined aquifer.

15 If only 3% of all water on Earth is freshwater, 97% of our water is...

Down

2 The name of the process that water takes between ocean, the atmosphere and land.

3 This impermeable (liquids can't pass through it) soil-type can confine an aquifer.

7 What type of plants are best to help keep salinity under control?

8 When surface water from the ocean, lakes, or on the ground turns into a vapour and rises into the atmosphere, it _ _ _ _ _ _ _ _ _ _

9 What is a high-risk region in Western Australia for developing salinity issues? (Its north-east of the metropolitan area of Perth and grows much of our crops)

11 Native vegetation has deep _ _ _ _ _ that keeps the water table low and out of highly saline top soil.

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Activity Ideas

ACTIVITY 1:
SALINITY ROLE PLAY

As a class, watch the CSIROpedia's '*Soil Salinity in Australia*' video.

Link: **https://csiropedia.csiro.au/soil-salinity-australia-2001/**

Then, in groups write a role play to determine how the salinity crisis may affect different sectors of the community. Roles to consider include: farmers, shop owners, families, plants, native animals and local government.

Each person in the group will play the role of someone affected by salinity and present their point of view on the topic.

ACTIVITY 2:
SEED GROWTH

For a classroom experiment, plant some seeds in two different containers and water one with fresh water and the other with salty water each day. Over two weeks, record the growth rates of the two seeds and discuss the results.

Note: easy sprouting seeds such as wheat are ideal for this experiment.

ACTIVITY 3:
SALINITY REMEDIES

As a class, research which Government agencies are working towards remedies for salinity. Discuss the different solutions that are being trialled.

- Does the class think that there is one solution better than another?
- Or would a mix of all remedies be the best solution?

One of the recommendations to counteract and/or prevent a salinity problem, is to plant indigenous (local) trees. Research local community and Landcare agencies that conduct community planting sessions, then use the information that they provide to create posters advertising any upcoming tree planting sessions (note: you may need to contact them for permission to use their name/information).

Activity Ideas

ACTIVITY 4:
SALTY SOLUTIONS

AIM

This experiment tests to see how much salt is needed to add to tap water to make it taste like salty seawater.

MATERIALS REQUIRED:

- 4 plastic cups – to mix salt in labelled cup 1, cup 2,cup 3 and cup 4
- A plastic cup for each student in the group
- Salt – about 50g for the class
- A pop stick for stirring for each cup
- Teaspoons

SAFETY NOTE

Make sure all containers are clean as children will taste the water. Make sure that students have their own individual cup to taste the water and do not share.

PROCEDURE

1. In groups, write a prediction of how many teaspoons will need to be added to a glass of normal water before it tastes like seawater.
2. Set up four (4) cups of water, along with a tasting glass for each person in your group. Label each cup: cup 1, cup 2, cup 3, cup 4.
3. In each cup, add the salt as outlined in the table below. Copy the table below into your workbook.

Cup number	Amount of salt added	Taste
1	No salt	
2	3 grains	
3	¼ teaspoon	
4	1 big teaspoon	

4. Transfer a little liquid from each cup, one at a time into your cup for tasting. Record what you taste in your workbook. Make sure you rinse the cup after each taste with tap water.

CONCLUSION

As a group, answer the following questions based on the experiment.

- Which cup started to taste a little bit salty?
- Which cup tasted like the salty seawater?
- Did you need a lot of salt or just a little to create a salty seawater taste?

Polluting our groundwater

We used to think that the ground had some kind of purifying property – that pollutants could be poured on the ground and disappear out of sight. Well they do disappear out of sight in some instances, but they don't disappear – pollutants lie beneath the surface and can cause major health and environmental problems.

It has only been in recent history that pollution has become a problem. This is because of how long pollutants can remain in soils in the subsurface. Many pollutants do not break down and can build up in large proportions over time.

Pollutants like nutrients, bacteria, pesticides, herbicides, petrol, oil, heavy metals and chemicals can work their way down into the groundwater by filtering through the soil. Movement of groundwater and dispersion within an aquifer can spread pollutants through a larger area, and means that some pollutants might intersect with groundwater bores, be transported back into surface water areas and can also feed into wetlands and rivers affecting the ecosystems in these areas.

Alternatively, if water levels rise beneath the soil surfaces, pollutants trapped within the soil can mix with water and cause problems for plants and animals in the affected area and humans relying on the groundwater for domestic consumption.

Groundwater can become polluted from many different sources such as suburban run off from backyards, fertilisers from farms or suburban areas and dumping grounds from factories.

Sources of groundwater pollution

Groundwater pollution occurs when waste products or other substances change the chemical or biological characteristics of the water and degrade water quality so that animals, plants or human uses of water are affected (WRC, 1998).

There are many different things that can contaminate groundwater, all of which can be categorised into five different types of contaminants:

- Synthetic – man-made chemicals that are not found in nature;
- Hydrocarbons – petrols and oils etc;
- Inorganic – salts and minerals, fertilisers and pesticides, some of which can occur naturally;
- Pathogens – bacteria and micro-organisms that may cause sickness; and
- Radio nuclides – radioactive material (some of which may occur naturally).

There are many sources of groundwater pollutants, some of which will be discharged directly into groundwater (point source pollution) and some of which indirectly contributes to the pollution of groundwater sources (non-point source pollution). These sources can be grouped into three different categories:

- Those intended for release - i.e., septic tanks, injection wells etc.;
- Those intended for storage which have leaked - i.e., landfill, storage tanks etc.; and
- Unintentional release of pollutants by chemical spill, disasters, etc.

Pollutants may include plant nutrients, bacteria, viruses, pesticides, herbicides, hydrocarbons (including petrol and oil), heavy metals and other toxic chemicals.

The 'Boot River' activity shows students the impact we have on the environment.

Does land use lead to groundwater contamination?

Pollution of groundwater resources has become a major problem today. The pollution of air, water and land has an effect on the pollution and contamination of groundwater. The solid, liquid and gaseous waste that is generated, if not treated properly, results in pollution of the environment. This affects groundwater too. For example, when air is polluted, rainfall will settle many pollutants on the ground, which can then seep into and contaminate the groundwater resources.

Catchments can transport non-point source pollutants. Non-point source pollution is associated with rainfall runoff moving over and through the ground, carrying natural and human-made pollutants into water sources. Pollutants accumulate in catchments as a results of various human driven and natural events. Below are some examples of land use and their potential problems:

LAND USE	ACTIVITIES	POLLUTION PROBLEMS
Agriculture	Tillage, cultivation, pest control, fertilisation and animal waste	Sediment, nitrate, ammonia phosphate, pesticides and bacteria
Construction	Land clearing and grading	Sediment
Forestry	Timber harvesting, road construction, fire control and weed control	Sediment, pesticides
Land Disposal	Septic systems	Bacteria, nitrate, phosphate
Surface mining	Dirt, gravel, mineral excavation	Sediment, heavy metals, acid drainage and nutrients
Urban Storm Runoff	Car maintenance, lawn and garden care and painting	Oil, gas, antifreeze, nutrients, pesticides and paints

The plastic problem

Groundwater isn't the only water source we rely on that is experiencing pollution issues. While groundwater feeds our lakes and wetlands, rivers feed into our oceans and more and more pollutants are ending up in these waters. Plastics are just one of the pollutants that are being found in more and more waterways. While you might not think that the empty plastic water bottle floating downstream is that big a problem, its once the plastic starts to break down that things get serious.

Plastic has become an integral part of our human lives with consumption continually increasing over the past 50 years. Plastic is a lightweight, versatile and strong material that is also relatively inexpensive to produce, making it a seemingly ideal resource for many different purposes. But plastic also creates a big issue given much of it is designed to only be used once. In Australia alone, over 3.5 million tonnes of plastics was consumed in 2016/17, yet less than 300,000 tonnes was recycled, despite the fact that plastics recycling is well established in Australia and accessible to all households. This means that much of the plastic we use is not making it through the recycling process. So where is it ending up? While much of it is going to landfill, it is also finding its way into our waterways and oceans.

Plastic micro pollution

Plastic is the most common type of debris found in the ocean and is a major environmental problem worldwide. Millions of tons of plastics are making their way into the oceans and waterways each year from coastal areas. Plastic pollution can come in all shapes and sizes from the large pieces that we can see floating on top of the water or sitting on the bottom, to small and microscopic pieces from broken up plastics or synthetic fibres. These small microscopic pieces are called microplastics.

Plastics bottles and packaging eventually break down in the elements (sunlight, wind and waves etc) into smaller pieces while floating plastic bags can resemble jellyfish, both of which are being mistaken for food getting eaten by aquatic animals.

What can you do to prevent groundwater pollution?

A large portion of water that is supplied to Perth comes from groundwater supplies and it is important to make sure that our vital groundwater supplies are kept clean. Everybody can play their part in this by following these rules:

- Use phosphate-free fertilisers on the garden and use the directed amount that is written on the pack.
- Disposing of paints, oils and chemicals correctly and not pouring them down the drain. Call local council for disposal advice if required.
- Recycle paper, can, bottles, plastic and compost food scraps. This reduces the amount of rubbish making its way into tips and landfills. Recycle, reuse and reduce.
- Check driveway for any oil spills and leaks from the car that may be washed into drains after any rainfall.

Useful websites regarding pollution

Cool Australia
www.coolaustralia.org

Department of Water and Environmental Regulation
www.dwer.wa.gov.au

The Groundwater Foundation, USA
www.groundwater.org

Water Corporation (teaching resources)
www.watercorporation.com.au

Defining Pollution

1. NNCONMITAATIO ☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Definition: .....

2. CHAALETE ☐☐☐☐☐☐☐☐

Definition: .....

3. LLTIPOUON ☐☐☐☐☐☐☐☐☐

Definition: .....

4. IENLR ☐☐☐☐☐

Definition: .....

5. EEVRONNMNTI ☐☐☐☐☐☐☐☐☐☐

Definition: .....

6. BRRIEA ☐☐☐☐☐☐

Definition: .....

7. FNDLLALI ☐☐☐☐☐☐☐☐

Definition: .....

8. CNTMNTAIEON ☐☐☐☐☐☐☐☐☐☐

Definition: .....

9. SAWTE ☐☐☐☐☐

Definition: .....

10. HAARZUSDO ☐☐☐☐☐☐☐☐☐

Definition: .....

WHITEMAN PARK Children's Gnangara GROUND WATER Festival

Activity Ideas

ACTIVITY 5:
12 STEPS TO POLLUTION PREVENTION

As a class, read through the *12 Simple Ways to Reduce Groundwater Pollution* and brainstorm ways you could put these into practice. You could:

- Create a poster to demonstrate how pollution can be reduced within your local community.
- Do a web search to find information on water treatment processes. Discuss the different solutions that are being used and/or trialled.
- Discuss the different land uses in your local area and the pollutants associated with each. Mix substitute pollutants (eg. vegetable oil, jelly crystals, gravox, etc.) with water to simulate pollution. Talk about the quality of water and whether or not it would be suitable for plant, animal and/or human consumption.

12 Simple Ways to Reduce Groundwater Pollution

1. Correctly dispose of hazardous household products.
2. Use non-toxic household products wherever possible.
3. Recycle and dispose of all rubbish properly.
4. Conserve water.
5. Use natural fertilisers.
6. Avoid over-watering lawns and gardens.
7. Decrease impervious surfaces around your home.
8. Maintain septic systems properly.
9. Recycle used motor oil.
10. Help mum & dad wash the car with earth-friendly products over the lawn (so it gets a good drink at the same time!).
11. Help identify, report and stop polluters and litterers.
12. Use native plants in your garden – they need less fertiliser and water!

Activity Ideas

ACTIVITY 6:
HOW FERTILISERS TRAVEL THROUGH SOILS

AIM

Students will be able to see that fertilisers and other pollutants aren't necessarily all filtered out by soils, and may end up in our groundwater.

INTRODUCTION

Explain that new farming methods, which include using pesticides (bug and weed killer), and fertilisers (plant nutrients) have helped farmers keep up with the growing population. These chemicals help increase the amount of food grown by farmers. These pesticides and fertilisers also have nitrogen-containing substances called nitrates which can seep down through the soil as they are carried in water that soaks into the ground.

MATERIALS REQUIRED

- 3 Paper cups
- Top soil (the surface layer of soil from your garden)
- Green food colouring
- Water

PROCEDURE

1. Put three holes in the bottom of a cup and fill it ¾ full of top soil.
2. Explain to the students that the blue food colouring symbolises fertilisers. In another cup, mix a few drops in with the water (enough that you can see the colour, but not too dark!).
3. Hold the soil-filled cup over an empty cup to catch the water that will seep through.
4. Poor the coloured water into the soil-filled cup and instruct the students to observe the colour of the water that seeps out of the soil.

CONCLUSION

Discuss with the students the following questions based on the results of the experiment.

- Was there evidence of the blue food colouring in the water?
- Did the soil remove all the fertilisers (food colouring) or is it still greenish in colour?
- What do you think would happen if there were a high concentration of manure or chemical fertiliser above a groundwater source?

Activity Ideas

ACTIVITY 7:
NO WATER OFF A DUCK'S BACK

AIM

In this activity, students will try several ways to clean up an oil spill, similar to the methods used by real-life clean-up crews. It is good to know just how hard it is to clean up an oil spill, and hence its likely effect on the environment.

BACKGROUND

Contaminated and polluted water has a major effect on the animals and plants that live in the water sources. A common pollutant that is found in rivers and estuaries amongst many others is oil. Oil has a major effect on many waterbirds, especially ducks. When ducks come in contact with oil floating on top of the water it has a major effect on the feathers of these animals. The feathers become matted, which affects the duck's ability to insulate and keep themselves warm. This could lead to them dying from the cold. Another risk is that the ducks could suffer from stomach ulcers if they swallow any of the oil when they try to clean off their feathers.

BEFORE YOU START

- As a class, research how oil can find its ways into water sources and list the reasons.
- Investigate how oil covered birds are treated to remove the oil from their feathers. What is used to save the birds that have been exposed to excess oil?
- Complete the activity below trying different methods in cleaning up an oil spill. These methods are similar to what crews use in cleaning up major oil spills.

MATERIALS REQUIRED

- One large bowl with a lid
- Measuring cup
- Water
- Cooking oil
- Variations or dishwashing detergents
- Paper towel or cloth
- Sponges
- String

PROCEDURE

1. Fill up the bowl of water halfway.
2. Pour a ¼ cup of oil into the water.
3. Cover the bowl with the lid and gently shake the water. Did the oil and the water mix?

Activity Ideas

4. Using these different methods try and remove the oil from the water:
    - Try using the cloth or paper towel try cleaning up the oil from the water.
    - Use the string to make a border around the oil. Drag the oil to one side of the bowl.
    - Will the sponge soak up the oil?
    - See if the detergent can clean up the oil.
5. In your workbook, rate the effectiveness of each method with a score between 1 – 10, with '1' being the least effective and '10' the most.

Source: **http://water.epa.gov**

ACTIVITY 8:
BECOME AN ACTIVE ENVIRONMENTAL CITIZEN!

Discuss with students about how they can have an impact in changing environmental issues with their consumer choices and actions. Discuss with the students that their voice on the issue and choices of things that they buy show that they are concerned with this environmental issue and are making choices to make a difference.

Topics for discussion:

- Do you feel that you have any ability to change this environmental issue or other issues that are similar?
- What do you think should be done on the issue of microplastics in water?
- With the environmental issue of plastics and microplastics in water, what can you actively do to help stop the plastic pollution?

ACTIVITY 9:
CHOICES, CHOICES

The power of our choices makes a difference. Discuss with student the power of their choices and how they can with contribute positively or negatively. Ask the student to start thinking about things that they can change and choices that they can make to avoid plastic pollution, for example – bringing a waste-free lunch to school, making their own body scrubs with natural ingredients, investing in a filter for the washing machine, looking at clothing labels and avoiding synthetic materials where possible.

Ask your students to choose two of their suggestions and to actively spend a week making these choices. At the end of the week they need to write a recount in their GAB about how the process was and if they felt they were making a difference. Ask the students to include:

- what did they do differently?
- was it hard to follow their choices?
- would they be able to continue this long term?

Activity Ideas

EXTENSION ACTIVTY:
DESIGN AN ENVIRONMENTALLY FRIENDLY BALLOON

Only new ideas will stop the problem with plastic polluting our waterways. Already there are clever people around the world coming up with innovative solutions to our various plastic pollution problems, such as the the *Great Bubble Barrier* and Boyan Slat's *The Ocean Cleanup*. What ideas can YOU come up with?

Begin by researching these ideas as a class. You'll find some helpful information on the Stop! Micro Waste website and by watching Behind the News' "Ocean Rubbish Clean Up" story.

One of the sources of micro plastics in water are birthday balloons. When balloons burst, they become very dangerous for wildlife, who can become entangled in plastic ribbons, or swallow the balloons, thinking they are food. Breaking your class up into groups, get them to use the design steps listed below to invent an alternative to balloons for children's parties. They have to make sure it is:

- colourful
- fun
- made from a material that will naturally break down (ie., is biodegradable) in the near future.

Design steps:

1. Research the problem
2. Brainstorm ideas
3. Build a prototype
4. Test the prototype
5. Make any changes necessary

Groundwater Glossary

Aquifer	Geological formations such as those composed of sand, sandstone and limestone which contain useable quantities of groundwater are called aquifers.
Catchment area	A drainage area, usually with higher areas feeding water into lower areas and rivers.
Confined aquifer	An aquifer where the water is confined under pressure between relatively impermeable layers. Sometimes called artesian aquifers.
Contaminants	Something that renders another thing impure and/or unusable.
Dispersion	When something is scattered, diffused or spread out amongst another.
Dryland salinity	The movement of salt to the surface of the land.
Ecosystem	The interaction of organisms and their environment and how they relate to one another.
Evaporate	When surface water turns into vapour.
Fauna	The animals of an area.
Flora	The plants of an area.
Impermeable	A substance that liquids (and gases) are unable to pass through.
Infiltrate	To filter through or 'permeate'.
Permeable	A substance that liquids (and gases) can penetrate and move through.
Permeability	How well a substance allows water to move through it.
Pollutants	A substance that pollutes another object, resulting in that object being harmful or unsuitable for its usual purpose.
Pollution	The act of polluting, or the result of pollutants .
Porosity	How much water a substance can hold in its pores.
Recharge	The water that passes through the ground to replenish an aquifer.
Superficial aquifer	See 'unconfined aquifer'.
Subsurface	Below the surface, in this instance, below ground level.
Surface water	Water that flows or is held in the streams, rivers, lakes and wetlands of a landscape.
The Dreaming	The time before Creation in Aboriginal Noongar culture. Also known as Nyitting in Noongar.
The Dreamtime	The Dreaming, has different meanings for different Aboriginal groups across Australia. In our local Noongar country, the Nyitting relates to the Waugal, a mythical serpent who created the rivers and the land formations of the south-west Western Australia. Dreamtime stories are Creation stories.
Transpiration	When water is taken up by plants, it is released through the leaves as vapour, the process is called 'transpiration'.
Unconfined aquifer	The aquifer closest to the ground surface is called the shallow, or unconfined aquifer. Its upper surface is the water table.
Water cycle	The continuous cycle of water between the ocean, atmosphere and land.
Water table	The level at which groundwater sits in an unconfined aquifer. Swamps and lakes in low-lying areas are often the surface expression of groundwater.

Curriculum links

ALL YEAR GROUP LINKS

Cross Curriculum Priorities	
Sustainability – Allow students the opportunity to develop the knowledge, skills, values and world views necessary for them to act in ways that contribute to more sustainable patterns of living.	
General Capabilities	
Literacy	Numeracy
Critical and creative thinking	Ethical understanding
Personal and social capability	
General Capabilities	
Questioning and predicting	Planning and conducting
Processing and analysing data and information	Evaluating
Communicating	

YEAR 4 LINKS

Science
Science Understanding
Biological Sciences – Living things depend on each other and the environment to survive
Chemical Sciences – Natural and processed materials have a range of physical properties that can influence their use.
Earth and Space Sciences - Earth's surface changes over time as a result of natural processes and human activity.
Science as a Human Endeavour
Use and influence of science -Science knowledge helps people to understand the effect of their actions.
Nature and development of science - Science involves making predictions and describing patterns and relationships
HASS - Geography
The Earth's environment sustains all life
The importance of environments to animals and people, and different views on how they can be protected
Aboriginal and Torres Strait Islander Peoples' ways of living were adapted to available resources and their connection to Country/Place has influenced their views on the sustainable use of these resources, before and after colonization.
The natural resources (e.g. water, timber, minerals) provided by the environment and different views on how they can be used sustainably

CURRICULUM LINKS

YEAR 5 LINKS

Science
Science Understanding
Biological Sciences - Living things have structural features and adaptations that help them to survive in their environment.
Chemical Sciences – Solids, liquids and gases have different observable properties and behave in different ways.
Science as a Human Endeavour
Use and influence of science -Scientific knowledge is used to solve problems and inform personal and community decisions.
Nature and development of science - Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions.
HASS - Geography
Factors that shape the environmental aspects of a place
The way people alter the environmental characteristics of Australian places (e.g. vegetation clearance, fencing, urban development, drainage, irrigation, farming, forest plantations, mining)
Features of environments (e.g. climate, landforms, vegetation) influence human activities and the built features of places.
The impact of bushfires or floods on environments and communities, and how people can respond.

YEAR 6 LINKS

Science
Science Understanding
Biological Sciences - The growth and survival of living things are affected by physical conditions of their environment.
Chemical Sciences - Changes to materials can be reversible or irreversible.
Earth and Space Sciences - Sudden geological changes and extreme weather events can affect Earth's surface.
Science as a Human Endeavour
Use and influence of science - Scientific knowledge is used to solve problems and inform personal and community decisions.
Nature and development of science - Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions.

References

Salinity References

A new direction for salinity management in Western Australia: A consultative review. 2019. GHD on behalf of the Department of Primary Industries and Regional Development.

Department of Water and Environmental Regulation website.
www.water.wa.gov.au

Dryland Salinity. Department of Environment and Water, South Australia Government.
www.environment.sa.gov.au/topics/soil-and-land-management/soil-health-and-condition/land-salinity-monitoring

Dryland Salinity. National Committee on Water Engineering.
www.engineersaustralia.org.au/Communities-And-Groups/National-Committees-And-Panels/Water-Engineering

Groundwater Salinity. Department of Primary Industries VIC.
agriculture.vic.gov.au/farm-management/water/groundwater-salinity

National Action Plan for Salinity and Water Quality website. (accessed June 2014)

Salinity in Western Australia.
www.agric.wa.gov.au/soil-salinity/dryland-salinity-western-australia-0

Salinity: Our silent disaster. ABC Science.
www.abc.net.au/science/slab/salinity/default.htm

Salinity Overview Western Australia. Australian Natural Resources Atlas. (accessed June 2014)

Understanding Healthy Waterways how can we help keep our waterways healthy? Part 4: Salinity. Jill Reade. Waterwatch Australia

Western Australian Auditor General's Report: Management of Salinity. May 2018. Office of the Auditor General Western Australia.

Western Australian Soil Health Strategy, draft report. 2020. Department of Primary Industries and Regional Development, Perth.

Groundwater Pollution References

2016–17 Australian Plastics Recycling Survey: National Report. 2018. Envisage Works on behalf of the Department of Environment and Energy.

Darby Duck, the Aquatic Crusader – No water off a Duck's Back! United States Environmental Protection Agency.
www.epa.gov/nps/nonpoint-source-pollution-awareness-darby-duck-aquatic-crusader

Macquarie Concise Dictionary (4th Ed). 2008. Macquarie Dictionary at The University of Sydney, NSW.

USGS Water Science School website.
www.usgs.gov/special-topic/water-science-school

Water Facts WF8: What is Groundwater? December 1998. Water and Rivers Commission, WA.

When the Mermaids Cry: The Great Plastic Tide article. Claire Le Guern, March 2018. Coastal Care website.
http://plastic-pollution.org/

ANSWERS FOR TEACHERS

Salinity Crossword

1. Swan River
2. water cycle
3. rock
4. scar
5. recharge
6. confined
7. native
8. evaporates
9. wheatbelt
10. saline
11. roots
12. lake
13. rain
14. table
15. saltwater

Defining Pollution

1. contamination
2. leachate
3. pollution
4. liner
5. environment
6. barrier
7. landfill
8. containment
9. waste
10. hazardous