GOVERNMENT OF WESTERN AUSTRALIA

WAPC
Western Australian Planning Commission

WHITEMAN PARK

Children's Gnangara GROUND WATER Festival 2025

Groundwater Guru

Classroom Resources

Book 1

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

WHITEMAN PARK
CONSERVATION • RECREATION • EDUCATION

Whiteman Park acknowledges the Wadjuk Noongar people as the Traditional Custodians of the land on which we work, learn and play and acknowledge the significance of *Korndiny Karla Boodja* (Bennett Brook) at the heart of Whiteman Park.

Noongar is the official language of the Aboriginal people of the South-West of Western Australia. Traditionally an oral language, Noongar is made up of fourteen different dialects, resulting in variable spellings. Whiteman Park acknowledges the variations in pronunciation and spelling of Noongar words and refers to South West Land and Sea Council for consistency, except when referring specifically to an external organisation that utilises alternative spelling.

Acknowledgements

These resources were developed by Whiteman Park's education team for general classroom use associated with the Children's Gnangara Groundwater Festival. Teachers may duplicate these resources for education purposes only.

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ssshhh... ANSWERS ARE ON PAGE 30

The Children's Groundwater Festival story

The Children's Groundwater Festival began in Nebraska, USA in 1989 as an extension of the mission of The Groundwater Foundation (USA), which is to create a factually informed and motivated citizenry caring about and for its groundwater.

The Festival has since become an international model with the concept being adapted and replicated throughout the world. Festivals have been held in nearly 40 US states, Mexico, Canada and India.

It is our own unique adaptation of this festival that we bring to Western Australian students, with 2025 marking the 23rd year of the Children's Groundwater Festival at Whiteman Park.

Since 2002, over 20,000 students from 114 schools have been inspired to care for, conserve and protect the water that nourishes them by attending our Festival. The feedback received from teachers, students, presenters and Festival stakeholders has always been overwhelmingly positive!

Festival objectives

The aim of the Festival is to inspire students to learn more about conserving water and the environment that surrounds them through fun, interactive workshops.

Children who attend the Festival will be educated about water and how it is stored within natural systems, as groundwater or as surface water, and instructed on the important role water plays within natural and man-made ecosystems. The concept of sustainability and how sustainability relates to water use and water conservation will also be conveyed.

Students will develop a greater knowledge and understanding of:

- what groundwater is and how it differs from surface water
- the water cycle
- the interdependence of plants, trees, wildlife, soil and water
- the effect that human action has on the environment and the need for responsible action
- the value of water in our day-to-day living
- sustainability in relation to water supply, use and conservation.

The Festival is a great opportunity to help educate children who are old enough to be able to understand groundwater and environmental concepts, whilst still young enough to form their own value systems – and hence learn to protect our most precious resource. They also hold the key to encouraging parents and family members to change their water use habits too.

Class of 2025

Congratulations on your class's successful registration to attend the 2025 Children's Gnangara Groundwater Festival and welcome to the first issue of the Groundwater Guru!

As a unique and inspiring education event, we want the Festival to be a fun and educational experience for your students – and that extends beyond just the excursion day. These classroom resources have been developed to help maximise learning opportunities both in the lead up to the Festival, and after it.

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 about groundwater across four themed booklets, addressing:

- what groundwater is and where it fits in the water cycle
- soils and how they affect groundwater
- wetlands and groundwater in Noongar culture
- salinity and groundwater pollution
- wastewater and water conservation for the future.

Best of all , each of the activities provided are linked to the WA Curriculum.

We look forward to seeing you all at the Festival in November!

A word of thanks

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.

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.

Government of **Western Australia**
Department of **Water and Environmental Regulation**

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.

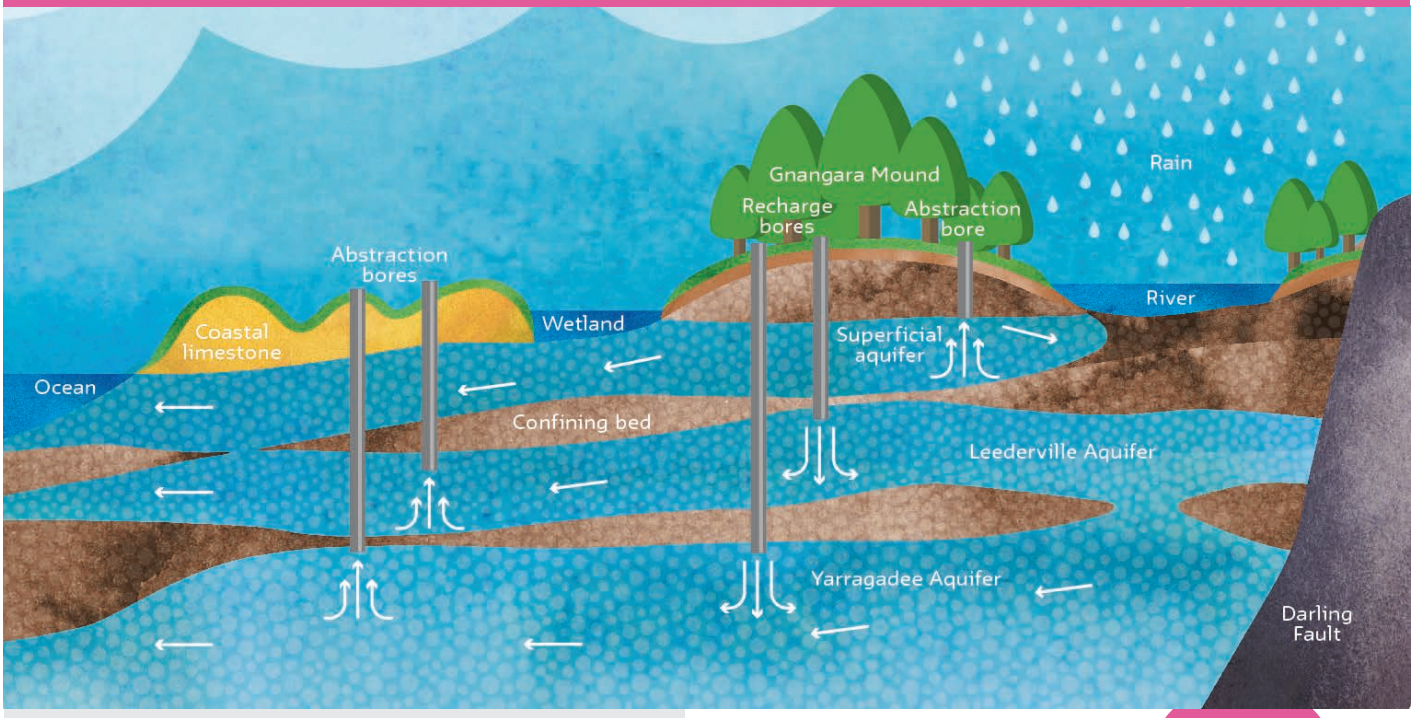
Most shower heads use an average of 12 litres of water per minute. So a 10 minute shower would use 120 litres! A 4 minute shower will use just 48 litres in comparison.

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**.

Groundwater



Source: Water Corporation, 2016

What is groundwater?

All the water that occurs below the land surface is groundwater.

Water from rainfall and rivers seeps underground, filling the gaps in the nooks, crannies, cracks and spaces between rocks and soil particles.

Think about when you pour milk over your cereal: the milk doesn't sit on top of the cereal or create a pool at the bottom of the bowl (unless you use lots and lots!), it flows in and around the cereal, filling in all the gaps. Groundwater acts the same way, filling all those gaps.

The rock and sediment that holds groundwater – like the cereal in our example above – is called an **aquifer**. Groundwater can be found in a confined, unconfined or semi-confined aquifer.

Groundwater is also vital for our natural environment.

Up to **half** of all the water used in Perth comes from **groundwater supplies**.

Fresh surface water is scarce, this makes **groundwater a major source of water** for Perth.

Hydrogeology is the study of the **distribution and movement of groundwater** in the soil and rocks of the Earth's crust.

Groundwater levels in Perth were the **lowest ever** on record in **March 2016.**

Where does groundwater come from?

Groundwater is part of the **water cycle**, a continuous process of water moving through the environment.

During the water cycle, water evaporates from the sea, lakes, rivers and any other sources of surface water, turns into a gas (like when water from a boiling kettle turns into steam) and is called water vapour. When water evaporates from plants we call that process **transpiration**, and when it evaporates off YOU, we call it... *perspiration*!

The water vapour is part of the air and as it rises and cools, it can change back into its liquid form to create clouds. This process is called **condensation**. Clouds are moved around the Earth by winds, and under the right conditions, rain (or **precipitation**) will occur.

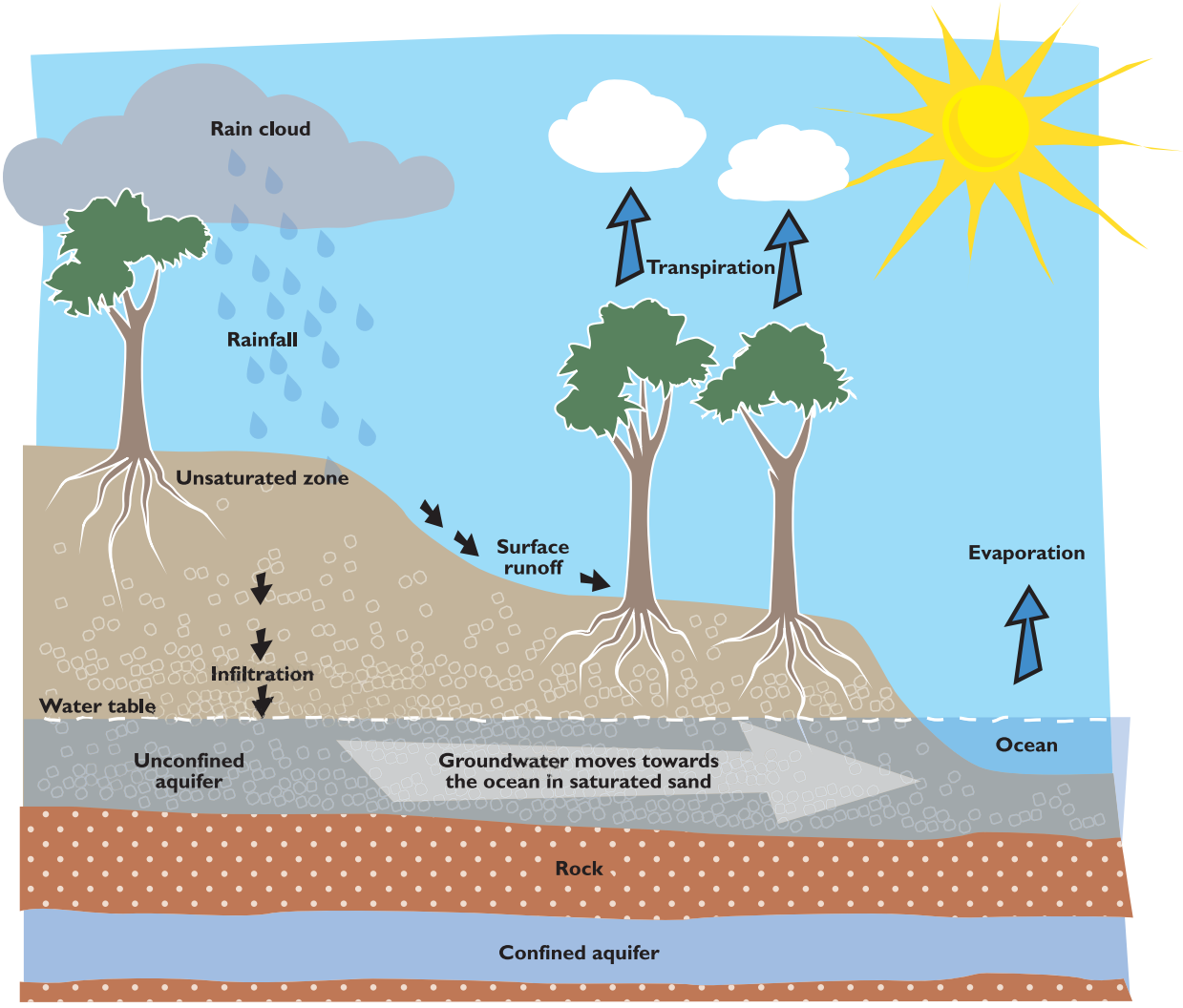
Groundwater is made up from rain which soaks through the soil then rocks into aquifers, or the saturated zone. This process is called **percolation** and recharges the groundwater.

Aquifers are an important part of the water cycle, because they store water. **Unconfined aquifers** (or **superficial aquifers**) can be **recharged** by rainwater. They are usually close to the surface and sometimes appear as wetlands or lakes. The top of these aquifers is called the **water table**. Below this layer lies **semi-confined aquifers** which are covered by rock or sediment, through which water barely passes. The deepest aquifers are **confined aquifers**. This means they are sealed between two layers of **impermeable** rock and rainwater cannot refill them.

Groundwater doesn't just stay underground though. Eventually, as groundwater moves very slowly (often just a few to tens of metres each year!), it is discharged through lakes, rivers or the ocean where the water cycle continues.

Not all rain ends up as groundwater either. Plants take up much of our rain before it enters our aquifers, while if the ground is very dry and hard, the rain will not soak into the soil at all.

The Water Cycle



Perth groundwater and the Gnangara Mound

There are four main aquifers in Perth's groundwater system, that are mostly made from limestone. The two major unconfined aquifers are the Gnangara Mound, to the north of the Swan River, and the Jandakot mound to the south.

The Gnangara Mound is the shallowest aquifer in the Gnangara groundwater system. It stretches between Gingin to the north and the Swan River to the south. The mound is so-called as the water table literally forms a 'mound' shape.

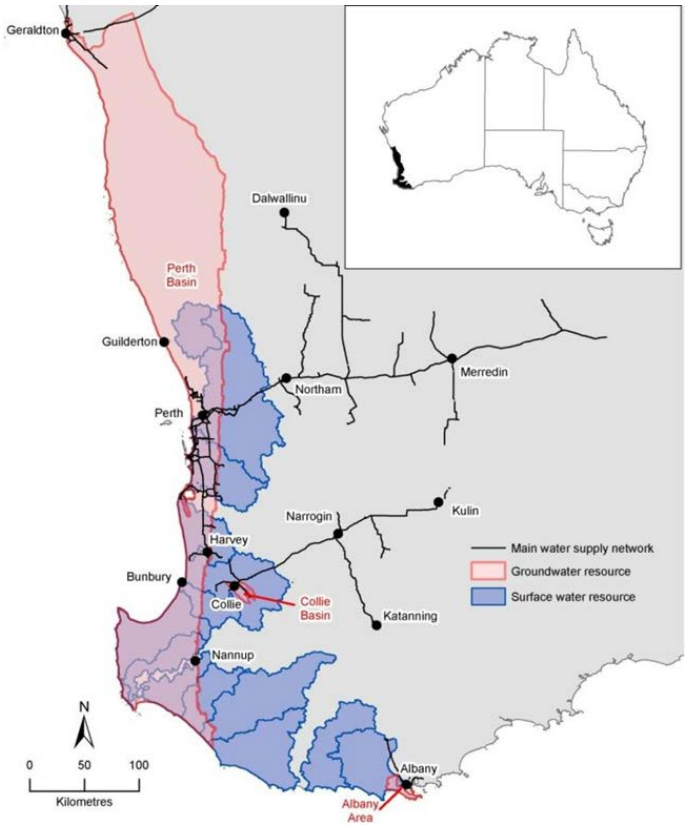
It sits on top of a series of other confined and unconfined aquifers. The Gnangara groundwater system includes the Superficial, Mirrabooka, Leederville and Yarragadee aquifers, and supplies a lot of Perth's drinking water.

The semi-confined Leederville aquifer stretches from the Moore River in the North to Fremantle in the south, and the deep, 'confined' Yarragadee aquifer is *so large* that it stretches from Geraldton to Albany. Water in these aquifers moves very slowly and some of our groundwater has been down there for over 40,000 years!

Water from these aquifers is used to:

- supply up to 40% of Perth's drinking water
- keep our parks, sports ovals, school ovals, and household gardens alive
- grow plants (horticulture) and food for us to eat (agriculture).

It is the Department of Water and Environmental Regulation's responsibility to look after our groundwater resources. They monitor groundwater recharge and manage how much is taken out of our aquifers to ensure we have good quality groundwater and a healthy environment into the future. Everyone can help by reducing their water use though!



Maps courtesy of Water Corporation

Groundwater in a confined aquifer is often under pressure so when the aquifer is penetrated by a well, **the water is forced up!**

Groundwater at Whiteman Park

Whiteman Park has a very special job – to protect the groundwater underneath it from pollution. The Park sits over the southern tip of the Gnangara Mound and you can see the surface expression of this groundwater in each of the Park's wetlands, dams and water holes, across winter and into early summer.

The melaleuca damplands and banksia woodlands in the Park are all groundwater dependent ecosystems. This means the plants and many of our fauna species rely on groundwater (whether through their roots or at surface level in the form of the Park's many wetlands) for survival.

Wetland and groundwater levels in the Park and across the Gnangara Mound have been under strain in recent years due to a combination of the drying climate (less rainfall) limiting **recharge** of the mound and increasing use for irrigation and public water supply.

To see the groundwater level for yourself, visit the Village Lake at Whiteman Park (between the Village Junction Station and Shelter B), as the lake surface shows the level of the Gnangara Mound.

One Duck Lagoon on the Bennett Brook Railway bushland loop and dams throughout the Park are other places to see the surface expression of groundwater.

Useful websites for groundwater information

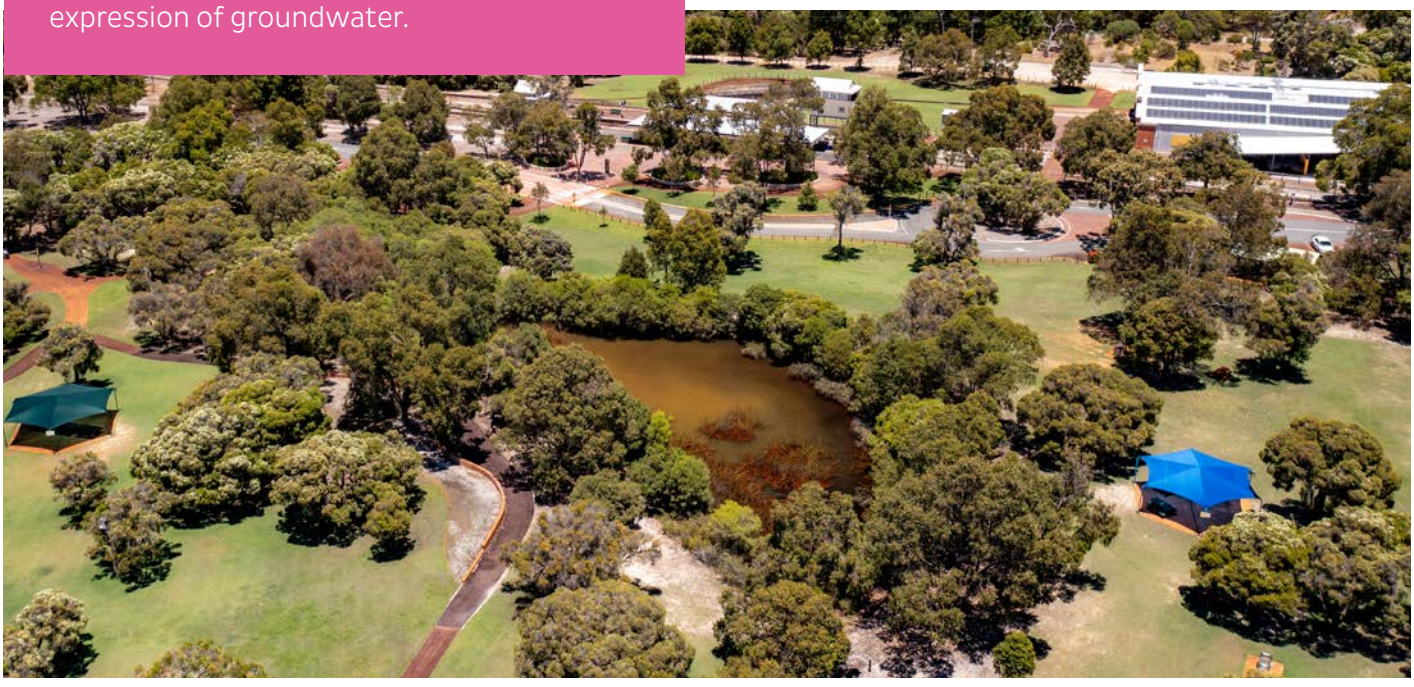
CSIRO
The water underground: the future of water in Perth
csiro.au

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

Environment & Society Portal
Perth: Water Beneath the City
environmentandsociety.org

United States Geological Survey
www.usgs.gov

Water Corporation
www.watercorporation.com.au



Watch the Gnangara Mound water levels rise and fall at the Village Lake.

Links at a glance – Groundwater Classroom Activities

ACTIVITIES	5 Es					Delivery			Science							Science Inquiry Skills			HASS		HASS Skills	English				Cross Curriculum Priorities	General capabilities
									Chemical			Earth and Space	Use and Influence		Nature and Development	Questioning and Predicting			Geography		Questioning and Researching	Expressing and developing ideas	Literacy			Sustainability	
	Engage	Explore	Explain	Elaborate	Evaluate	Individual	Small groups	Whole class	ACSSU074	ACSSU077	ACSSU095	ACSSU075	ACSHE062	ACSHE083	ACSHE098	ACSIS064	ACSIS231	ACSIS232	ACHASSK090	ACHASSK112	WAHASS26	ACELA1498	ACELY1694	ACELY1704	ACELY1714		
Activity 1: **KWL Chart**	●					●													Y4		Y4					●	●
Activity 2: **What is Groundwater?**		●				●		●	Y4	Y5			Y4	Y5	Y6	Y4			Y4	Y5						●	●
Activity 3: **Water Cycle**			●				●	●		Y5	Y6		Y4		Y6	Y4	Y5	Y6	Y4							●	●
Activity 4: **Journey of a Water Drop**				●		●				Y5	Y6	Y4			Y6								Y4	Y5	Y6	●	●
Activity 5: **Groundwater Word Sleuth**					●	●			Y4										Y4			Y4				●	●

ACTIVITY 1

KWL Chart

TEACHER INFO

This activity will require students to list their prior knowledge of water and groundwater and write down what they already know about the topic. Students will also list what they would like to learn through learning about the topic of groundwater and at the end will reflect upon what they have learnt.

WHAT TO DO

On a piece of paper or a special Groundwater activity book (GAB) have the students draw up a KWL chart (know, want to know, learnt).

Students will fill in the first column (Know) with all the information that they already know about Groundwater before studying the topic further.

The second column (Want to know) will be filled in with all the information that they would like to learn about from studying groundwater at school and attending the Children's Gnangara Groundwater Festival at Whiteman Park.

Leave the last column blank (Learnt) and fill this in after the Festival. This will be for the students to list what they have learnt about groundwater and to reflect on the topic.

Keep the GABs handy for use in future activities across the Guru resources.

ACTIVITY 2

What is Groundwater?

TEACHER INFO

This activity is to begin students becoming familiar with what groundwater is.

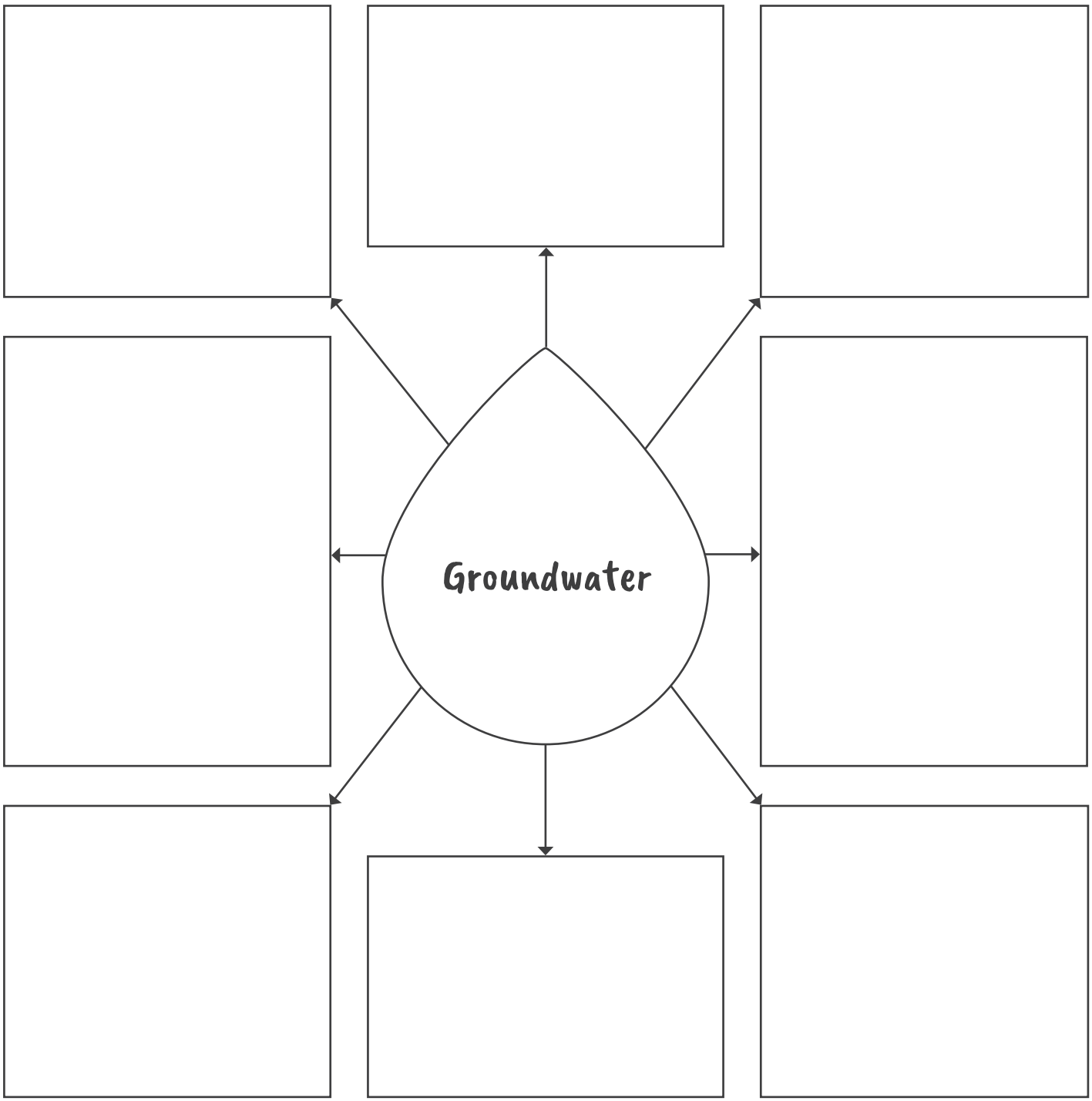
PROCEDURE

1. Begin by reading the groundwater content in the Groundwater Guru to your students. As a class, explore the words highlighted in bold (hint: there is a glossary at the back of the booklet) to find out what they mean.
2. Ask students to create a research map with groundwater at the centre, using the My Groundwater Research Map worksheet on the next page.
3. As a class find out information about groundwater. Here are some good places to begin:
   - Groundwater
     https://watercorporation.com.au/Our-water/Groundwater
     Water Corporation
   - Groundwater Facts
     University of New South Wales
   - Groundwater handout
     Region of Waterloo
   - It's Called Groundwater
     https://youtu.be/VtIY4FYWJV8
     Government of British Columbia
   - Our Groundwater Connection
     https://youtu.be/gxENTkMmyEE
     Anoka Conservation District
   - What is Groundwater?
     https://youtu.be/zyHtkDCwQUw
     MooMooMath and Science
   - What is Groundwater?
     https://youtu.be/oNWAerr_xEE
     KQED Quest
   - What is Groundwater?
     https://groundwater.org/what-is-groundwater
     The Groundwater Foundation
   - What is groundwater? And how do we track it from space?
     https://climatekids.nasa.gov/groundwater
     NASA Climate Kids
   - World Water Day: Everything you need to know about groundwater
     https://youtu.be/fqWmweBsDnA
     GNS Science, New Zealand
4. Have your students fill their My Groundwater Research Map worksheet with the facts they have found out, then share these facts as a class.

ACTIVITY 2
WORKSHEET

My Groundwater Research Map

Fill in each box with the facts you have learned about groundwater from your research. You can use illustrations as well.



ACTIVITY 3

Water Cycle

TEACHER INFO

This activity will help introduce your students to the different stages of the water cycle. In this activity, students will create a mini water cycle, either individually, or as a whole-class, which they will observe and then record their findings in their GABs.

INTRODUCTION

Before beginning the experiment, it is important that the stages and the terminology are explained to the students so that they are aware of what they are observing:

- Evaporation – Water from a body of water or from the soil is warmed by the sun and changes from a liquid into a gas form (water vapour).
- Condensation – The water vapour rises up into the sky. When the water vapour rises higher into the sky, it begins to cool down and then changes back into a liquid as small droplets, which may stick together to form clouds.
- Precipitation – The clouds become heavy with water and the water droplets held in the clouds begin to fall to the earth as rain, sleet, snow or hail.
- The water that falls from precipitation may fall into rivers, streams, lakes, seep into soil to replenish groundwater or enter the roots of plants. When the sun warms it up again, the cycle repeats.

MATERIALS REQUIRED

- Big glass jar with a screw top lid
- Soil
- Sand
- Plants
- Bottle cap
- Pebbles and small rocks

PROCEDURE

1. Take the top off the jar and add the small rocks and pebbles to the bottom. Add the sand and then the soil to fill the jar half way.
2. Plant the plants around the edges of the jar.
3. Fill the bottle cap with water and place it in the middle of the jar.
4. Put the lid on the jar and put it in a sunny location.
5. Observe what happens in the jar and get your students to write down their observations in their GABs.

ACTIVITY 4

Journey of a Water Drop

TEACHER INFO

Students will use the stages of the water cycle to write a narrative on a water drop. This will help them develop the concept of the different stages of the cycle and also develop an understanding of where water is used and needed.

Step 1

As a class, brainstorm the different places that water can go, for example: tap, sink pipes, septic tanks, ocean, rain water tank etc. Ask your students to copy the brainstorm ideas into their GAB.

Step 2

The students will use the water cycle stages and the different places that water travels to write a narrative in their GAB. Ask the students to pick any part of the water cycle to start their story and write about the journey of a single water drop. They could start in a rainwater tank, the classroom sink or in the ocean. They must write in detail about the journey the water drop will go through as it travels through the water cycle.

ACTIVITY 5
WORKSHEET

Groundwater Word Sleuth

CAN YOU FIND THE FOLLOWING WORDS?

The words all relate to groundwater and the water cycle.
Words can be backwards and diagonal.
Letters may be used more than once.

B	R	P	I	C	M	T	J	S	A	L	I	N	I	T	Y	G
R	O	S	F	A	P	C	L	K	F	U	K	T	Z	C	R	P
A	D	W	A	T	E	R	C	Y	C	L	E	R	J	O	A	E
I	G	B	H	C	K	Q	S	T	S	X	E	A	U	N	W	R
N	I	S	T	H	I	J	A	D	U	G	W	N	V	F	A	M
F	U	A	R	M	H	N	N	Z	R	A	D	S	P	I	T	E
A	Q	T	A	E	R	I	D	A	F	W	G	P	L	N	E	A
L	W	M	N	N	Z	J	H	N	A	J	F	I	A	E	R	B
L	I	O	S	T	K	C	I	T	C	O	M	R	N	D	T	L
A	H	S	P	O	E	L	E	R	E	G	O	E	T	L	A	E
Q	K	P	I	R	A	R	P	S	I	L	T	D	S	K	B	G
U	D	H	R	S	E	I	M	P	E	R	M	E	A	B	L	E
I	Q	E	E	P	D	R	I	N	K	A	I	S	L	M	E	R
F	V	R	N	D	E	N	I	F	N	O	C	N	U	W	O	N
E	W	E	T	L	A	N	D	C	E	Y	B	E	K	C	Z	A
R	O	C	B	O	R	E	Z	E	V	A	P	O	R	A	T	E

aquifer
atmosphere
bore
catchment
confined
drink
evaporate
groundwater
impermeable
permeable
plants
rainfall
recharge
rock
sand
salinity
silt
soil
surface
transpire
unconfined
water cycle
watertable
wetland

EXTENSION QUESTION

Use a dictionary to look up all the words above and write down their meaning and how they relate to groundwater.

ACTIVITY 5
WORKSHEET

Groundwater Word Sleuth

CAN YOU FIND THE FOLLOWING WORDS?

The words all relate to groundwater and the water cycle.
Words can be backwards and diagonal.
Letters may be used more than once.

B	S	A	N	D	L	P	E	G	R	A	H	C	E	R	W	E	R	A	R
E	N	V	I	R	O	N	M	E	N	T	Q	L	E	V	A	R	G	T	K
P	E	R	M	E	A	B	L	E	Y	E	U	T	O	K	T	S	O	M	I
A	D	W	K	H	M	C	A	T	C	H	M	E	N	T	E	Z	C	O	M
S	R	F	S	O	G	H	N	A	T	D	Y	U	J	Y	R	Y	G	S	P
I	J	E	T	C	A	O	F	O	N	V	T	D	R	E	T	M	F	P	E
L	R	V	R	E	Q	R	A	V	I	P	I	P	R	C	A	L	S	H	R
T	I	A	A	H	U	W	E	T	L	A	N	D	E	O	B	U	T	E	M
C	G	P	N	S	I	D	R	Q	F	W	I	R	M	N	L	B	Y	R	E
S	N	O	S	G	F	K	A	X	U	M	L	H	O	F	E	O	L	E	A
T	A	R	P	E	E	C	I	T	J	I	A	Q	U	I	F	R	G	M	B
N	N	A	I	G	R	O	N	S	M	V	S	Y	N	N	H	E	S	Y	L
E	G	T	R	F	Y	R	F	W	P	O	R	O	D	E	P	J	T	O	E
I	A	E	A	J	C	W	A	D	R	I	N	K	I	D	X	I	K	B	N
R	R	Z	T	D	E	T	L	B	U	Y	L	A	P	L	A	N	T	S	A
T	A	E	I	B	C	G	L	C	K	W	A	T	E	R	C	Y	C	L	E
U	N	C	O	N	F	I	N	E	D	E	N	V	I	R	V	B	R	N	P
N	D	A	N	H	C	T	N	R	E	T	A	W	D	N	U	O	R	G	O

aquifer
atmosphere
bore
catchment
confined
drink
environment
evaporate
Gnangara
gravel
groundwater
hydrology
impermeable
mound
nutrients
permeable
plants
rainfall
recharge
rock
salinity
sand
silt
soil
surface
transpiration
unconfined
water cycle
watertable
wetland

EXTENSION QUESTION

Use a dictionary to look up all the words above and write down their meaning and how they relate to groundwater.

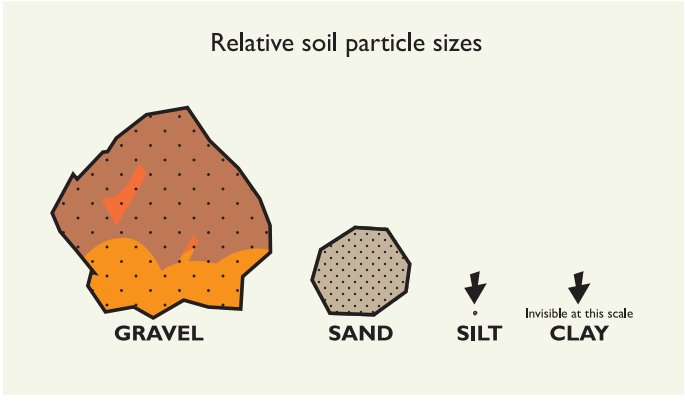
Soil

What is soil?

Soil is made up of a mixture of bits of broken-down rock, minerals and a variety of living and dead life forms. Soil is full of rich nutrients and water that is needed for plants and, ultimately, animals to survive.

Soil texture

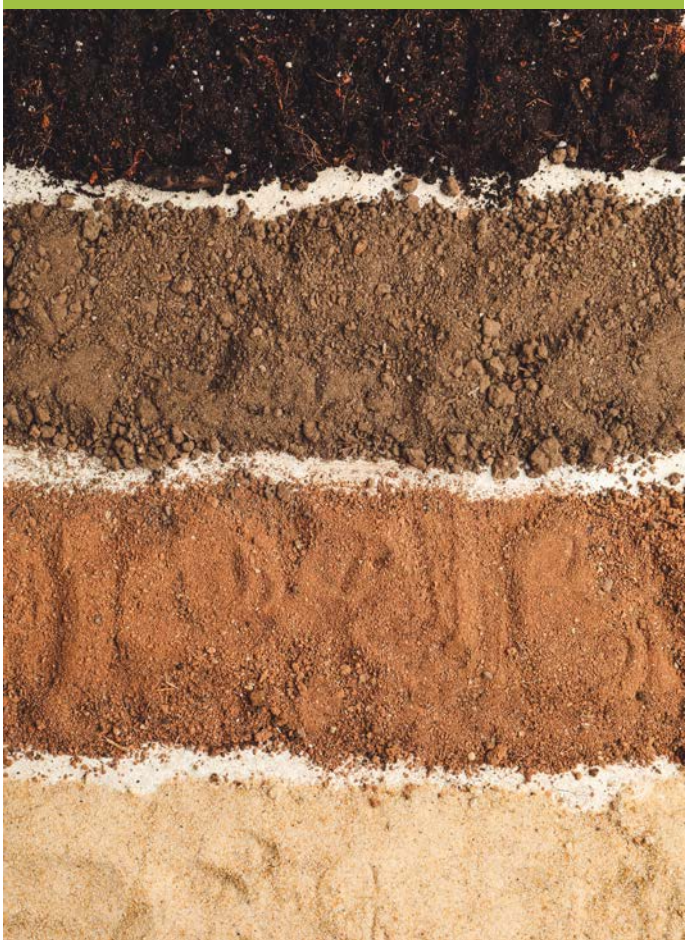
Soil texture is the way that a soil feels and the amount of sand, clay and rock that is present in the soil. Pick up some soil and rub it between your fingers. You will feel the different grain and particles within the soil. This is the soil texture.



Soil is classified depending on its **particle** size, as shown in the illustration above. In gravelly soil, more than half the grains are pieces or rock that are larger than 4.5mm. If the grains are smaller, we call it sand. If the particles are so small that they are difficult to see, we call it silt. Clay is made of the tiniest rock particles.

Did you know?

Many soils have a mix of different textures. Soils that have a greater range of different particles will be less porous as the smaller sized particles will fill in the gaps.



Porosity and permeability

How much and how fast water soaks down into an aquifer all depends on the porosity and permeability of the soil.

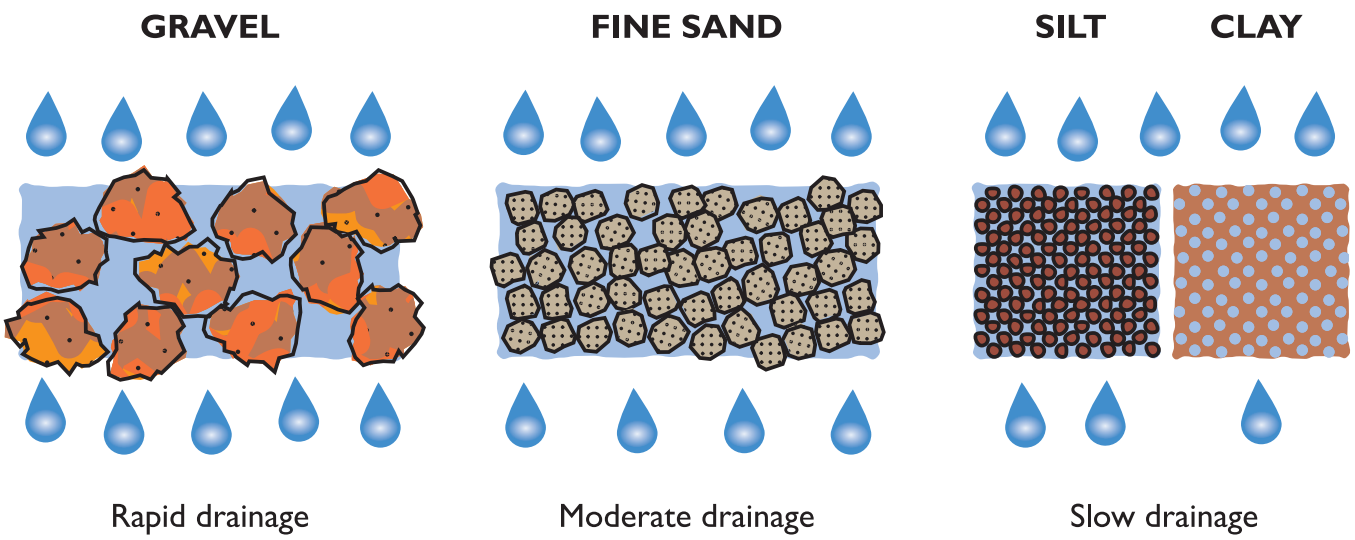
The **porosity** of a soil is the amount of space (pores) in a rock or soil that can store water. Soils that contain small particles pack together closely and tightly, leaving many small spaces or 'pores' between each particle. Larger soil particles are not packed together as closely therefore less space is created, but the 'pores' are much larger.

The **permeability** of a soil is how easily water can move through it. Soil permeability is affected by the size and shape of the soil particles. If a soil has particles which are fine and tightly packed, such as clay, it will take longer to allow water to move through it. A soil with large, loose particles will be more permeable and allow water to move through it more freely.

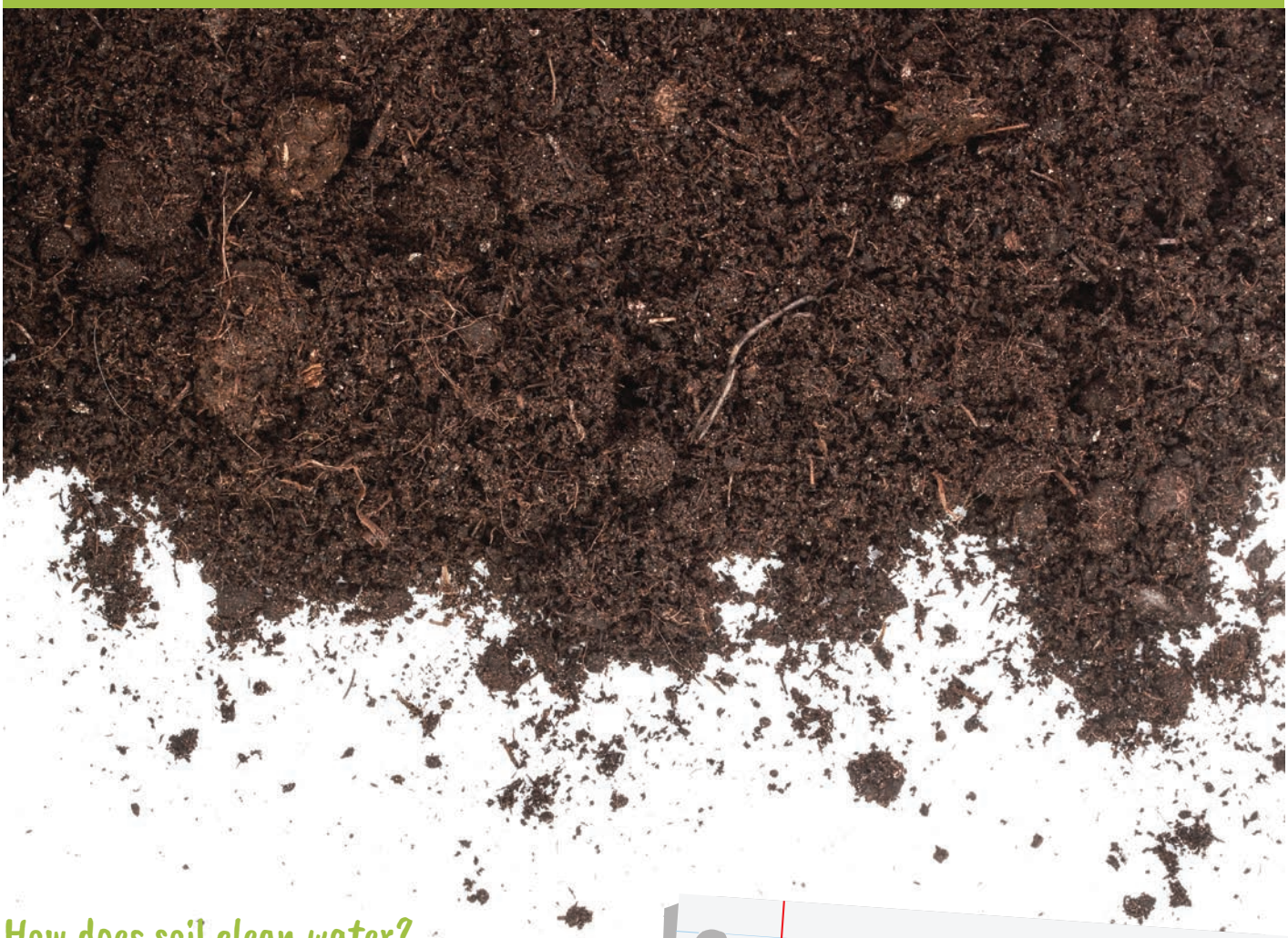
The permeability of soil and rocks determines how much and how fast water will flow into a groundwater aquifer. A confined aquifer is covered by a layer of impermeable rock or soil. Water cannot pass through this layer unless a bore is drilled through it. An **unconfined aquifer** has an **impermeable** layer at the bottom and a permeable layer at the top and is topped up by rainfall that filters through the **permeable** soil from the surface.

The Gnangara Mound is a large unconfined aquifer on the Swan Coastal Plain. Most of the soils within the mound are loose sandy soils and limestone, which is very porous (it has large holes). Because the soils on top are permeable, rainwater can soak into the aquifer easily. It can also store large quantities of water within the pores.

Permeability of different types of soils



It will take 2 minutes for water to travel 1 metre in gravel but it will take 200 years to travel the same distance in clay! What does that tell you about the texture of the two different soils?



How does soil clean water?

Healthy soil is the key to clean water. It works as a physical strainer, renovator, and recycler of all wastewater passing through it. Healthy soil gives us clean air, clean water and healthy **ecosystems** by performing several functions.

One of these functions is filtering potential pollutants out of the **infiltrating** water. The minerals and microbes in soil are responsible for filtering and cleaning both organic and inorganic materials that end up in it.

The pores between soil particles also help filter non-dissolvable pollutants out of **recharge** water. As pore size decreases more pollutants are trapped within the soil this allows cleaner water to continue to move through the soil.

Unfortunately this also works in reverse. When groundwater levels rise, pollutants (or salt) are brought back to the surface.

Useful websites to find out about soil

CSIRO Land and Water
www.csiro.au/en/research/natural-environment/land/Soil

Water Corporation
Garden designs for Perth and the South West: Soil advice
www.watercorporation.com.au

Soil Science Australia
www.soilscienceaustralia.org.au/training/soils-in-schools/

Links at a glance – Soil Classroom Activities

	5 Es					Delivery			Science					HASS	HASS Skills		Cross Curriculum Priorities	General capabilities
ACTIVITIES	Engage	Explore	Explain	Elaborate	Evaluate	Individual	Small groups	Whole class	Earth and Space	Use and Influence	Biology	Nature and Development		Geography	Questioning and Researching	Analysing	Sustainability	Literacy
									ACSSU075	ACSHE083	ACSSU094	ACSHE061	ACSHE098	ACJASSK090	ACHASSI073	WAHASS26		
Activity 6: **Think-Pair-Share**	●						●		Y4		Y6		Y6	Y4	Y4	Y4	●	●
Activity 7: **Movement of a Water Drop**		●						●	Y4			Y4	Y6				●	
Activity 8: **Porosity and Permeability**		●					●	●	Y4	Y5		Y4	Y6				●	
Activity 9: **Soils Word Jumble**					●	●											●	●

ACTIVITY 6

Think-Pair-Share

Teachers – on the board write three questions:

1. How does water get to the groundwater system?
2. What are the different particles that make up soil?
3. Do you think that soil can clean water?

Ask your students to pair up with another class member and share their thoughts on each question. Do they think the same things, or do they have different responses for each question?

The students should then write down their responses and the responses of their partners in their GABs*.

AFTER THE FESTIVAL

Ask your students to review their original thoughts and reflect on what they and their partner had written about each question.

How does this compare to what they now know about the groundwater?

ACTIVITY 7

Movement of a Water Drop

TEACHER INFO

This activity will aid students understanding of how water can filter from the surface to the ground. They will discover how different types of soil affect the movement of water. Students are required to act out the movement of water through the different types of soil – gravel, sand and clay.

BACKGROUND

As this is an activity that the students will act out, it is important to go through rules of behaving safely as there will be some examples where they will be in contact with each other.

PROCEDURE

1. Begin by reading your students the sections '*What is soil?*' and '*Soil texture*' from the Groundwater Guru. Explain that they are going to find out which soil water moves through the best.
2. Select three or four students to be the water molecules, the rest of the class will be the rock materials (either gravel, sand or clay).
3. Act out each scenario for water moving through gravel, sand and clay, as outlined below.
4. At the end of the three activities, go through the discussion points with your class.
    - Which rock material was the easiest for water to move through? Which was the hardest to move through?
    - How would different rock material affect the quality of our groundwater supplies?
5. Ask student to write a recount on the movement of a water drop in their GABs, including what they learnt about the different types of rock materials and how water moves between them.
6. Finish by reading the '*Porosity and permeability*' information to the class. You can use the illustration '*Permeability of different types of soil*' above the section '*How does soil clean water*' to help explain.

a) How water moves through gravel?

Ask the students that are assigned to be gravel to stand in a line a distance apart where they can stretch out their arms without touching any other students.

The students that are water molecules will then move through the gravel from one end of the line to the other.

Ask the students:

- How long did it take for the water molecules to pass through the gravel?
- Was it easy to get past the gravel?

ACTIVITY 7

b) How water moves through sand?

The students who were gravel now become sand. Ask the students to move closer together in the line and place their hands on their hips, so that their elbows touch the person standing next to them.

The water molecules will then move through the sand molecules like they did before with the gravel. This time the water molecules will experience some difficulty in moving through the line but they should still reach the other side.

Ask the students:

- How long did it take for the water molecules to pass through the sand?
- Was it harder to move through the sand then the gravel?

c) How water moves through clay?

The 'sand' students will now become clay. Ask the students to stand with their hands at their sides and move very close together. They should be standing so close together so that it will be difficult for the water molecules to pass through.

The students acting as the water molecules will then gently push their way through the clay and some may not be able to move through at all.

ACTIVITY 8

Porosity and Permeability

TEACHER INFO

Students will be able to visualise the difference in porosity and permeability with this activity.

TO TEST HOW POROSITY WORKS

Materials Required:

- A few glass jars, preferably with screw top lids
- Sand
- Gravel

Procedure

1. Begin by reading your students the section '*Porosity and permeability*' from the Groundwater Guru.
2. Fill one clear container with a sample of sand and another with gravel and observe the different 'pores', or spaces, in each sample.
3. Students should write down their observations in their GABs.
    - Which soil has the biggest pores?
    - Which soil do they think could store the most water?

TO TEST HOW PERMEABILITY WORKS

Materials Required

- the tops of three soft drink bottles
- a pair of pantyhose
- three containers for collecting water

Procedure

1. Put the pantyhose over the opening of the drink bottles and fill each bottle with sand, clay or gravel.
2. Place this over the container and slowly poor an equal amount of water into each bottle.
3. Observe and record which soil type allows water to travel through it the quickest, and hence, which is the most permeable.

EXTENSION ACTIVITY

1. Add dirt and/or food colouring to the water and pour it into the drink bottles again.
2. Observe and record how clean the water is that collects in each container.
3. Discuss what might have happened.
4. Read the class the section *'How does soil clean water?'*

ACTIVITY 9
WORKSHEET

Soils Word Jumble

Solve the following mixed up words, that all relate to Groundwater.

1. SSLIO

2. CHGRRAEE

3. GLAERV

4. SYSMTEEOC

5. WTRTAAEELB

6. PRBLMEAEE

7. WARUONTEGDR

8. FREUIAQ

9. IIRTLNFTEA

Jumble Answer:

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'.
Particle	A tiny piece
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.

WHITEMAN PARK
Children's Gnangara
GROUND WATER
Festival

Curriculum Links

The following Western Australian Curriculum and Australian Curriculum content descriptions apply to the activity ideas and activity sheets provided in these resources.

YEAR 4 LINKS	
SCIENCE	
Science Understanding	**Biological Sciences** Living things depend on each other and the environment to survive (ACSSU073)
	Chemical Sciences Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)
	Earth and Space Sciences Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)
Science as a Human Endeavour	**Nature and development of science** Science involves making predictions and describing patterns and relationships (ACSHE061)
	Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE062)
Science Inquiry Skills	**Questioning and predicting** With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS064)
HASS	
Geography	The importance of environments to animals and people, and different views on how they can be protected (ACHASSK088)
	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 colonisation (ACHASSK089)
	The natural resources (e.g. water, timber, minerals) provided by the environment and different views on how they can be used sustainably (ACHASSK090)
HASS Skills	
Questioning and Researching	Identify current understanding of a topic (e.g. brainstorm, KWL chart) (WAHASS26)
Evaluating	Draw conclusions and give explanations, based on the information and/or data displayed in texts, tables, graphs and maps (e.g. show similarities and differences) (WAHASS35)
Communicating and Reflecting	Reflect on learning, identify new understandings and act on findings in different ways (e.g. complete a KWL chart, propose action in response to new knowledge) (WAHASS39)
ENGLISH	
Literacy	Plan, draft and publish imaginative, informative and persuasive texts containing key information and supporting details for a widening range of audiences, demonstrating increasing control over text structures and language features (ACELY1694)

Groundwater Guru 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 (ACSSU043)
	Chemical Sciences Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077)
Science as a Human Endeavour	**Use and influence of science** Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083)
Science Inquiry Skills	**Questioning and predicting** With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS231)
HASS	
Geography	The way people alter the environmental characteristics of Australian places (e.g. vegetation clearance, fencing, urban development, drainage, irrigation, farming, forest plantations, mining) (ACHASSK112)
	Features of environments (e.g. climate, landforms, vegetation) influence human activities and the built features of places (ACHASSK113)
	The impact of bushfires or floods on environments and communities, and how people can respond (ACHASSK114)
ENGLISH	
Literacy	Plan, draft and publish imaginative, informative and persuasive print and multimodal texts, choosing text structures, language features, images and sound appropriate to purpose and audience (ACELY1704)

Groundwater Guru Curriculum Links

YEAR 6 LINKS	
SCIENCE	
Science Understanding	**Biological Sciences** The growth and survival of living things are affected by physical conditions of their environment (ACSSU094)
	Chemical Sciences Changes to materials can be reversible or irreversible (ACSSU095)
	Earth and Space Sciences Sudden geological changes and extreme weather events can affect Earth's surface (ACSSU096)
Science as a Human Endeavour	**Use and influence of science** Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)
	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 (ACSHE098)
Science Inquiry Skills	**Questioning and predicting** With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS232)
ENGLISH	
Literacy	Plan, draft and publish imaginative, informative and persuasive texts, choosing and experimenting with text structures, language features, images and digital resources appropriate to purpose and audience (ACELY1714)

ALL YEAR GROUPS	
CROSS-CURRICULUM PRIORITIES	
Sustainability	**Sustainability addresses the ongoing capacity of Earth to maintain all life.** Education for sustainability develops the knowledge, skills, values and world views necessary for people 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	

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ANSWERS FOR TEACHERS

Soils Word Jumble

1. soils
2. recharge
3. gravel
4. ecosystem
5. water table
6. permeable
7. groundwater
8. aquifer
9. infiltrate

Jumble Answer:
Save Water!