



WHITEMAN PARK
Children's Gnangara
**GROUND
WATER**
Festival 2023

Groundwater
Guru
2023 Teacher Resources
Book 2

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 Gngangara 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 it can be used for. The department also works to protect waterways and water-dependant environments.

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ssshhh... ANSWERS ARE ON PAGE 15

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 a wetland?

A wetland is an area where water covers the soil, this may be dry for part of the year or continuously. Wetlands can be found in many different locations such as along the coast, in the mountains and in dry inland areas. Wetlands can be known by many different names, including swamps, marshes, billabongs, lakes, lagoons, saltmarshes or mudflats. A wetland can be naturally occurring or artificially constructed.



Groundwater and wetlands

Groundwater supports wetland ecosystems, both directly and indirectly, while wetlands act to receive, store, filter and release groundwater as it travels through them. Groundwater-fed wetlands occur where the ground surface is at or below the groundwater table. Shallow sub-surface groundwater is also a primary water source for many wetlands. Horse Swamp, in Whiteman Park (pictured above) is an example of a groundwater-fed wetland, while much of Bennett Brook (pictured left) relies on shallow sub-surface groundwater.

Most wetlands in WA are seasonally wet. Those that receive water from groundwater tend to stay wet longer throughout the year, but when groundwater levels drop through overuse or climate change, wetlands can suffer and deteriorate. This is a concern as wetlands are an important way to maintain the quality of the water in our lakes and rivers, while also supporting a wide range of animals and plants.



Why are wetlands important?

Wetlands are home to an ecosystem of plants and animals which all depend on each other for food and shelter and breeding areas. Wetlands provide homes for a range of animals such as frogs, fish and invertebrates. Wetlands form important habitat and havens for land animals as well, offering both shelter in surrounding vegetation and much-needed water. Nearly 20 per cent of Australian bird species depend on wetlands for their survival, along with a variety of plant life.

Wetlands are often described as 'nature's kidneys', as they act as a filter, recycling valuable nutrients, trapping sediment and preventing pollution and waste products from reaching the rivers and oceans. They also help maintain the level of the water table.

Not only are wetlands significantly important to the environment, they also play a substantial role in Aboriginal Dreamtime stories and Aboriginal culture.

Protection of wetlands

The important role that wetlands play in the environment can often be underappreciated. Too often, rubbish, pollution and disturbance can affect the delicate ecosystem that lives within and around a wetland area. Education about the importance of wetlands is essential for the community to understand the significant role that they play.

To assist in the conservation and protection of many significant wetlands, the Australian Government released '*The Environment Protection and Biodiversity Conservation Act 1999*'.

The main objectives of this legislation is to provide protection to the environment - especially in areas of national environmental significance - by conserving biodiversity and protecting and managing areas of natural and cultural significance.

The care for wetlands is normally undertaken by the state government, local natural resource management groups, catchment management authorities or other non-government organisations.





World Wetlands Day

On February 2, 1971, the Convention of Wetlands of International Importance was signed in Ramsar, Iran. This agreement is also known as the Ramsar Convention. Since the signing of this agreement, World Wetlands Day is celebrated on February 2 every year. The convention was devised to halt the worldwide loss of wetlands and Australia plays an important role. Many of the Australian wetlands are on the list of the Ramsar sites to be protected and managed.

Wetlands create a **vital link** between **land and water**.

Useful websites to find out about wetlands

Department of Agriculture: Wetlands brochure

www.agriculture.gov.au

Department of Climate Change, Energy, the Environment and Water

www.dcceew.gov.au/water/wetlands

Department of Environment and Energy

www.environment.gov.au

DWER YouTube:

“Perth’s community and wetlands rely on groundwater”

youtu.be/WtnAneK9n6k



Activity Ideas

ACTIVITY 1: **DISCOVERING WETLANDS**

Write the definition of a wetland on the board and discuss and the importance of wetlands in the natural environment.

ACTIVITY 2: **GROUP ACTIVITY**

Split your students into groups, with one student as a scribe. Read out a series of different questions/statements for the group to respond to, an example list is provided below. As each student has a response the scribe will write down their response.

After the last question/statement, get your students to decide within their groups, what they think is their best response for each question and share that with the class. Write down the responses on the board and the students can copy these into their GABs.

Example questions:

Why are wetlands important?

What depends on a wetland?

What could live in a wetland?

What would happen if there were no wetlands?

ACTIVITY 3: **AN AUSTRALIAN WETLAND**

Ask your students to choose an Australian wetland to conduct a research project on. This could be a local wetland, near your school, or a significant national wetland. Things for them to consider include:

- The importance of the wetland in the environment
- Animal and plant life found in the ecosystem
- What type of wetland it is
- Threats to the wetland
- Who manages the wetland
- Are there any community awareness/education programs or projects for their chosen wetland?
- What connections are there to groundwater, rivers or lakes

Get your students to present the information they gathered on their chosen wetland.

Students can present their project to the class as an individual or group oral presentation.

Or get your students to create a poster on their selected wetland, identifying any risks to the wetland and communicating any conservation/education messages they uncovered.



Activity Ideas

ACTIVITY 4: IDENTIFYING WETLANDS

As a class, identify five different wetlands in your local area and write these on the board. Get your students to classify what type of wetland it is from the research that they have done.

ACTIVITY 5: WETLAND WORDS

Ask students to research and define the different types of wetlands found in Australia. Select 2-3 from each category and get your students to write these down in their GABs.

Marine and coastal wetlands

Coral Reefs
Beaches
Lagoons
Mangrove Wetlands
Saltmarshes
Mudflats

Estuaries

Estuaries
Mudflats or tidal flats
Mangrove forests
Saltmarshes

Alpine wetlands

Bogs
Alpine lakes and tarns

Inland wetlands associated with rivers

Floodplains
Rivers
Billabongs
Swamps
Marshes
Lakes

Arid wetlands

Salt lakes
Mound springs
Ephemeral (or temporary lakes),
streams and waterholes

Using these descriptions, choose adjectives to create a crossword or word search for another student to solve.

ACTIVITY 6: GROUNDWATER POSTER

As a class, watch the Department of Water and Environmental Regulation's video titled, '*Perth's community and wetlands rely on groundwater*'.

Link: <https://youtu.be/WtnAneK9n6k>

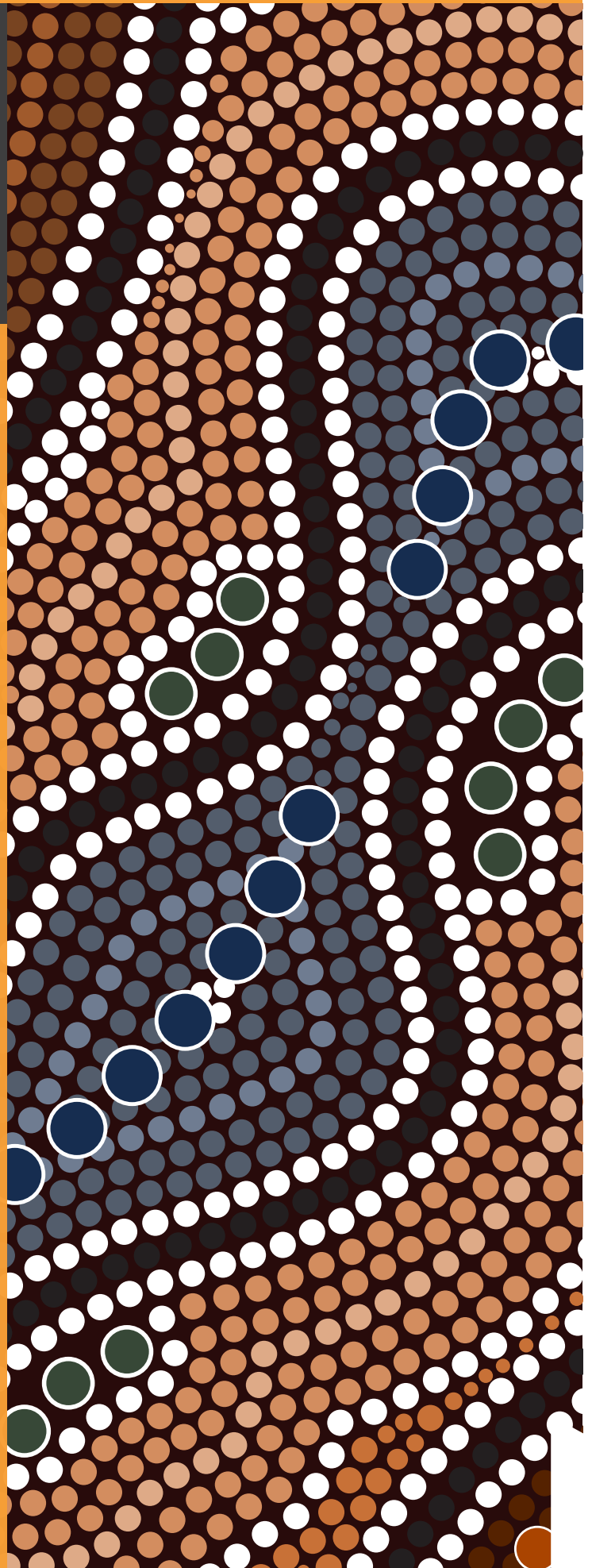
After watching, discuss what they learn from the video as a class, then ask students to create a poster to promote awareness of the importance of wetlands and preserving groundwater.

Water is life

For over 55,000 years Aboriginal people survived in the dry and arid countryside of Australia thanks to their vast knowledge of the land and understanding of groundwater systems. Australia is one of the driest continents in the world and knowledge of where to access water and how to sustain it for their survival was imperative. Understanding the land, flora and fauna was the key to determining if water was located nearby.

The Aboriginal people respected the watercourses and viewed them as a sacred source of life. They preserved and sustained their water supplies for thousands of years and did not dirty or pollute them. Water sources were important as water was not only necessary for their survival but also integral to their way of life. The cultural belief system of the Aboriginal people stems from 'The Dreaming', in which they believe that the Earth's landscapes and all the features contained within it, including groundwater, were created and formed by the Dreaming and Dreamtime beings.

The Noongar people reside across the South-West of Western Australia, including the Swan Coastal Plain, where Whiteman Park and the Gngangara Water Mound sit. The Swan Coastal Plain was traditionally abundant with water supplies, unlike other dry, desert-like locations within Australia. The Noongar people used these water sources (including wetlands, rivers and lakes) for hunting, gathering and trading.



The Wagyl

The Wagyl, (which can also commonly be spelt Waugal, Wogarl, Waagle or Waugul) is associated with fresh water and water bodies. The Wagyl is the Noongar people's major Dreamtime spirit and is central to the Noongar beliefs, laws and customs. It is a spirit that symbolises creation and is the creator of waterways, landforms and wetlands including those around Perth and the South West of Western Australia.

The Wagyl travels above and below the ground, creating springs, wetlands and water sources and resides deep beneath the earth in underground springs. The Wagyl is the giver of life and maintains all fresh water sources, appointing the Noongar people as guardians and custodians of the land. It is believed that the major rivers, smaller creeks, springs and lakes which drain into the Swan Coastal Plain were created by the Wagyl.

'As the Wagyl slithered over the land, his tracks shaped the sand dunes, his body scoured out the course of the rivers; where he occasionally stopped for a rest, and created bays and lakes. Piles of rocks are said to be his droppings, and such sites are considered sacred. As he moved, his scales scraped off and became the forests and woodlands of the region.'

(An introduction to Noongar History and Culture www.noongarculture.org.au)

The cultural impact of groundwater health

It is believed by many Noongar people that the deterioration of groundwater levels over the years is due to the decline in the wellbeing and health of the Wagyl. The Noongar people believe that if the Wagyl dies or leaves the water, then the water sources will dry up.

With Perth's population now at 2.1 million people, the Gnangara Mound is supplying water to support households, agriculture, recreation grounds and industry. It also continues to support many ecosystems and environmental features such as wetlands, waterways and other water sources. Much of the flora and fauna of these areas depend on the health and availability of groundwater.

The Gnangara Mound is a valuable resource to both Indigenous and non-Indigenous communities. We need to understand the importance of sustaining this resource not just for water accessibility but also for the cultural impact and importance that it has for the Aboriginal people.

Useful websites to learn more about groundwater and the Dreamtime

Western Australian Museum
museum.wa.gov.au/explore/wetlands/

South West Land and Sea Council
www.noongarculture.org.au/spirituality/

Water Corporation: Walk with the Waugal
www.watercorporation.com.au



Noongar Meanings

Link the Noongar word with its English meaning. Then sketch something to represent it.

- | | |
|---------------|--------------|
| Boodja | waterhole |
| Ngulla Boodja | knowledge |
| Wadjellas | river |
| Kaartdjin | rainbow |
| beeliar | our land |
| boya | land |
| boroong | swamp/lake |
| ngamma | rain |
| pinjar | white people |
| walken | rock |



Activity Ideas

ACTIVITY 7: **THE WAGYL**

Research the water areas of Perth that the Wagyl created and locate them on a map of Australia, then get your students to draw an illustration of the Wagyl as it created one of the water locations that were identified.

ACTIVITY 8: **LOCAL WATER SOURCE CONNECTIONS**

As a class, look at your school's local area and research Aboriginal connections.

- Are there any water sources nearby?
- What connection did Noongar people have to these water sources?
- Are there any sites sacred to the Noongar people in your area?
- What do these sites represent to the Noongar people and their culture?

ACTIVITY 9: **ENVIRONMENT MANAGEMENT**

Research how Noongar people traditionally looked after the environment, including local water sources. How does this differ to how water sources are maintained and used today?

Create a poster promoting environmental management based on traditional Noongar customs.

ACTIVITY 10: **THE DREAMING**

Research the Dreaming and explain what this term means. How are these stories preserved and told to other generations?

ACTIVITY 11: **GROUNDWATER IN WHITEMAN PARK**

As a class, watch the two Walk with the Waugal videos from Water Corporation about Gngangara Mound and Bennett Brook.

Link: <https://youtu.be/7Q7fJ8inVz4>

Link: <https://youtu.be/rDpkqlolzBc>

As a class, discuss these questions from the Water Corporation:

- What do you think your role is in protecting a valuable water source like the Gngangara Mound?
- Why does Water Corporation, and why should we all, value Noongar knowledge of our water sources?
- Do you think we could drink water straight from the ground, as Aboriginal people did?

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

Wetlands References

About freshwater mussels. Mussel Watch WA. (accessed June 2016)

Australian Government Department of Environment and Energy website. environment.gov.au/

Australian Museum website. australian.museum/

Groundwater dependent ecosystems. Queensland Government website. wetlandinfo.des.qld.gov.au/wetlands/resources/training/15-gde-ecology/

Tiger snake. Perth Zoo. perthzoo.wa.gov.au/animal/tiger-snake

Turtle Oblonga Rescue & Rehabilitation Network Inc. www.turtleoblonganetwork.org.au/fact-sheets.html

Wetlands and Groundwater: It's all connected. Wisconsin Wetlands Association website. www.wisconsinwetlands.org/updates/wetlands-and-groundwater/

Wetlands. Groundwater Resource Hub website. groundwaterresourcehub.org/nature-and-groundwater/wetlands

'Wetland hydrology' in A guide to managing and restoring wetlands in Western Australia. 2012. Department of Environment and Conservation, WA.

Aboriginal Culture References

Aboriginal People built water tunnels. Judy Skatssoon. March 2006. www.abc.net.au

An Introduction to Noongar History and Culture www.noongarculture.org.au

Australian Indigenous culture and history. Australian Federal Government (January 2008) info.australia.gov.au/information-and-services/culture-and-arts/indigenous-culture-and-history

Connection to Country. 2012. South West Aboriginal Land and Sea Council. www.noongarculture.org.au

Culture and Maps: Spirituality. 2010. South West Aboriginal Land and Sea Council. www.noongarculture.org.au

Indigenous History of the Swan and Canning Rivers. Swan River Trust. www.noongarculture.org.au

Study of Groundwater-Related Aboriginal Cultural values on the Gnangara Mound Western Australia. Dr Edward McDonald, Bryn Coldrick & Linda Villiers. October 2005. Department of Environment.

Understanding Groundwater. 2001. Water and Rivers Commission, WA.

We used to get our water for free...: Identification and Protection for Aboriginal cultural values of the Pilbara Region. Hilary Rumley & Kim Barber. April 2004.

Whadjuk. 2012 South West Aboriginal Land and Sea Council. www.noongarculture.org.au

The Waugal. November 2010. State library of Western Australia. (accessed June 2014)

ANSWERS FOR TEACHERS

Noongar Meanings

Boodja (land)
Ngulla Boodja (our land)
Wadjellas (white people)
Kaartdjin (knowledge)
Beeliar (river)
boya (rock)
boroong (rain)
ngamma (waterhole)
pinjar (swamp/lake)
walken (rainbow)