



Government of Western Australia
Department of Water

A resource for secondary school
geography

*Protecting drinking water
in Western Australia*
Information for teachers

Looking after all our water needs

June 2011

Department of Water
168 St Georges Terrace
Perth Western Australia 6000
Telephone +61 8 6364 7600
Facsimile +61 8 6364 7601
www.water.wa.gov.au

National Relay Service 133 677

© Government of Western Australia

June 2011

This work is copyright. You may download, display, print and reproduce this material in unaltered form only (retaining this notice) for your personal, non-commercial use or use within your organisation. Apart from any use as permitted under the *Copyright Act 1968*, all other rights are reserved. Requests and inquiries concerning reproduction and rights should be addressed to the Department of Water.

ISBN 978-1-921907-67-8 (print)

ISBN 978-1-921907-68-5 (online)

Acknowledgements

The Department of Water would like to thank the following for their contribution to this publication: Kathryn Buehrig, Kellie Clark, Nigel Mantle & Trina O'Reilly (Department of Water), Norman J Snell (author) and staff from the Department of Education.

For more information about this report, contact the Water source protection branch on +61 8 6364 7600 or drinkingwater@water.wa.gov.au.

Disclaimer

This document has been published by the Department of Water. Any representation, statement, opinion or advice expressed or implied in this publication is made in good faith and on the basis that the Department of Water and its employees are not liable for any damage or loss whatsoever which may occur as a result of action taken or not taken, as the case may be in respect of any representation, statement, opinion or advice referred to herein. Professional advice should be obtained before applying the information contained in this document to particular circumstances.

This publication is available at our website <www.water.wa.gov.au> or for those with special needs it can be made available in alternative formats such as audio, large print, or Braille.

Protecting drinking water

A resource for secondary school geography

Protecting drinking water will help teach students about drinking water resources in Western Australia, with a focus on the state's south-west. It will help them learn about the current pressures on our precious and limited drinking water resources, such as a drying climate and land use development, and what we all need to do to ensure they are protected to provide safe, good-quality drinking water into the future.

Western Australia's drinking water comes from both surface and groundwater sources. The Department of Water protects and manages drinking water supplies using powers provided by legislation (*Metropolitan Water Supply, Sewerage and Drainage Act 1909* and *Country Areas Water Supply Act 1947*). Public drinking water source areas (PDWSAs) are proclaimed under either Act to ensure their protection.

Our goal is to ensure that the public has access to safe, good-quality drinking water now and in the future. To achieve this we:

- work with the community, local government and water service providers to identify, assess and protect PDWSAs by preparing drinking water source protection documents for new and existing water sources
- assign priority areas and protection zones in PDWSAs, to help determine appropriate land uses and activities that will preserve water quality
- have adopted the *Australian drinking water guidelines* - 'catchment to consumer', multiple barrier, risk-based framework
- prepare and implement policies and strategies with other state government agencies (e.g. Statement of planning policy no. 2.7: *Public drinking water source policy*)
- develop water quality protection notes, codes and guidelines on best environmental practice.

Want more information?

- Visit our website www.water.wa.gov.au to find out who the Department of Water is and what we do.
- Visit <http://drinkingwater.water.wa.gov.au> to find out more about our program to protect drinking water sources.
- Access this and other online education resources via www.water.wa.gov.au > Tools and data > Water education tools.
- For information about the *Australian drinking water guidelines*, visit www.water.wa.gov.au > Publications > Find a publication > Series browse > Water quality protection note > Water quality protection note no. 78: *The Australian drinking water guidelines*.
- For information about priority areas and protection zones and what land uses and activities are appropriate in them, read our Water quality protection note no. 25: *Land use compatibility in public drinking water source areas* accessed via the same link described above.

- For a list of different drinking water source protection plans available around the state visit www.water.wa.gov.au > Publications > Find a publication > Series browse > Water resource protection plans.
- We have different best management practice documents available on a range of different land uses to show land owners and operators how to protect water quality. Find these at www.water.wa.gov.au > Publications > Find a publication > Series browse > Water quality protection note.
- For a short video about drinking water supplies in Western Australia visit <http://www.youtube.com/watch?v=pGEHkR4Uw78> (uploaded by the Water Corporation, user name *Watercorpwa*). The full DVD is available by contacting the Water Corporation www.watercorporation.com.au.

Curriculum links

Protecting drinking water was developed by the Department of Water for secondary school students in Western Australia. It is based around three printed broadsheets which contain a range of stimulus materials focussing on the importance of surface water and groundwater resources for drinking water. The first broadsheet introduces the water cycle as it operates in the south-west of Western Australia. The second broadsheet compares the characteristics of two surface reservoirs found in the Collie River catchment and the third deals with the importance of underground water resources with a special focus on the Gnangara mound.

In addition to the broadsheets, there are a detailed series of student activities and information in the student workbook. These address the Curriculum framework outcomes of investigation, communication and participation, natural and social systems, place and space, and resources. Different aspects of these activities are suitable for use across years 8 to 12 and have a geographical emphasis. The complete package would be suitable to use as a middle school (Y8, Y9, Y10) environmental studies course of three to four weeks duration. Alternatively it would be a valuable reference for students studying Geography stage 1A and 1B (Environments at Risk and People and Places) and Geography stage 3A and 3B (Planning Cities and Climate Change).

The following table provides where each activity links to the Curriculum. (Please note that only the first sentence of each activity is provided to make this table easier to read).

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
Topic 1 – The water cycle				
<p>Activity 1</p> <ol style="list-style-type: none"> Complete the crossword. List three different ways in which relief is shown on the topographic map. Calculate the surface area in hectares of the Canning and the Wungong reservoirs. Calculate the average gradient of the Wungong Brook. Identify two different types of surface water features produced by people. Annual rainfall ... calculate the amount of water that will enter the Churchman Brook Reservoir each year. 			<ul style="list-style-type: none"> broad spatial patterns can be used for predictions and planning (Y10) geographic patterns (local, regional, global) are created by the interaction of processes changes in the use of the environment reflect people's changing values there are different perspectives on the conservation of significant natural and built features (Y9) 	
<p>Activity 2</p> <ol style="list-style-type: none"> Using the information provided ... describe the site and situation of the Canning catchment. With reference to topography, geology, 			<ul style="list-style-type: none"> broad spatial patterns can be used for predictions and planning (Y10) geographic patterns (local, regional, global) are created by the interaction of 	<ul style="list-style-type: none"> sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>climate, vegetation and cultural factors account for the location of the Canning dam.</p> <p>3. Explain why there is a decrease in rainfall as you move from west to east across the Canning catchment.</p> <p>4. Identify one significant change that has occurred in the Canning catchment.</p> <p>5. Compare and contrast drainage patterns and water features.</p> <p>6. Using ... compare and contrast the infiltration and groundwater deposits on the Darling Scarp and the Swan Coastal Plain.</p>			processes (Y9)	<p>resources (Y10)</p> <ul style="list-style-type: none"> resource management decisions influence the availability and sustainability of natural resources (Y9)
<p>Activity 3</p> <p>1. Use the outline map to show the location of the water and drainage features.</p> <p>2. Based on ... describe or define the water features.</p> <p>3. Using map evidence, identify and describe</p>	<p><i>Planning</i></p> <ul style="list-style-type: none"> how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> how to select, record and combine 	<ul style="list-style-type: none"> natural systems involve flows of energy there are interrelationships and flows between systems (Y8) human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> the characteristics of physical and built environments natural and human processes create spatial patterns/regions there is interdependence between people and places (Y8) 	

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>the different ways in which people have changed the water and drainage features in the southern Perth region.</p>	<p>information from a range of appropriate sources</p> <ul style="list-style-type: none"> • how to make connections with information, linking key ideas through using data analysis tools (Y10) <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) <p><i>Applying and communicating</i></p> <ul style="list-style-type: none"> • that viewpoints change over time • how to account for changing patterns (Y10) 		<ul style="list-style-type: none"> • geographic patterns (local, regional, global) are created by the interaction of processes • changes in the use of the environment reflect people's changing values (Y9) 	
<p>Activity 4</p> <ol style="list-style-type: none"> 1. Using the outline map of the Perth region, plot the features. 2. Mark in the approximate locations of the Swan Coastal Plain, the 	<p><i>Planning</i></p> <ul style="list-style-type: none"> • how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) 		<ul style="list-style-type: none"> • the characteristics of physical and built environments (Y8) • geographic patterns (local, regional, global) are created by the interaction of 	<ul style="list-style-type: none"> • sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future,

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>Darling Scarp and the Great Western Plateau, and explain ...</p> <p>3. Explain how the location and distribution of water resources would affect the land use or urban planning of the Perth region.</p> <p>4. Using the ... mark on the urban settlements of Mundijong, Byford Wattleup and Forrestdale.</p>	<p><i>Conducting</i></p> <ul style="list-style-type: none"> • how to select, record and combine information from a range of appropriate sources • how to make connections with information, linking key ideas through using data analysis tools (Y10) <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) <p><i>Applying and communicating</i></p> <ul style="list-style-type: none"> • that viewpoints change over time how to account for changing patterns (Y10) 		<p>processes (Y9)</p> <ul style="list-style-type: none"> • broad spatial patterns can be used for predictions and planning (Y10) 	<p>and the availability of resources (Y10)</p> <ul style="list-style-type: none"> • resource management decisions influence the availability and sustainability of natural resources (Y9)
<p>Activity 5</p> <p>1. Using ... write a detailed description of the weather and ocean</p>	<p><i>Planning</i></p> <ul style="list-style-type: none"> • how to analyse issues, clarify specific purposes and construct 	<ul style="list-style-type: none"> • natural systems involve flows of energy • there are interrelationships and flows between systems 	<ul style="list-style-type: none"> • the characteristics of physical and built environments • natural and human processes create 	<ul style="list-style-type: none"> • sustainable development is when resource use maintains a balance between the resource needs and

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>characteristics associated with the frontal system.</p> <p>2. Describe and explain the seasonal pattern of rainfall.</p> <p>3. Explain how this information is important to understanding the location and distribution of water resources.</p> <p>4. Using the ... describe and account for the changes in the amount of rainfall experienced.</p> <p>5. How would this variation in rainfall affect the location of the surface water catchments?</p> <p>6. Research the hailstorm that hit Perth in March 2010 and describe its impact on the city.</p> <p>7. How useful are violent summer storms in providing additional drinking water supplies?</p> <p>8. Based on ... suggest a settlement in the south-west that would provide the best location for future population.</p>	<p>a search plan for investigation (ICT) (Y10)</p> <p><i>Conducting</i></p> <ul style="list-style-type: none"> • how to select, record and combine information from a range of appropriate sources • how to make connections with information, linking key ideas through using data analysis tools (Y10) <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) <p><i>Applying and communicating</i></p> <ul style="list-style-type: none"> • that viewpoints change over time • how to account for changing patterns (Y10) 	<p>(Y8)</p> <ul style="list-style-type: none"> • human activity impacts on the interrelationships in natural systems (Y9) 	<p>spatial patterns/regions (Y8)</p> <ul style="list-style-type: none"> • geographic patterns (local, regional, global) are created by the interaction of processes (Y9) • broad spatial patterns can be used for predictions and planning • natural and human factors contribute to environmental problems and planning solutions • people's views on the significance of places change over time and are shaped by their circumstances (Y10) 	<p>wants of the population now and in the future, and the availability of resources (Y10)</p> <ul style="list-style-type: none"> • resource management decisions influence the availability and sustainability of natural resources (Y9)

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>Activity 6</p> <ol style="list-style-type: none"> 1. Study the map ... and write a paragraph describing the change to variations in evapotranspiration rates. 2. Compare the annual evapotranspiration with the annual rainfall. 3. Write a paragraph describing the surface runoff or drainage pattern in the south west of Western Australia. 4. Based on the annual rainfall in the south west and the location and extent of the rivers, identify examples of rivers which are most and least likely to carry large volumes of water. 5. Rank the different rivers numbered on the drainage map from those best able to supply drinking water to the least able. 6. Investigate the top three rivers in your ranking 	<p><i>Planning</i></p> <ul style="list-style-type: none"> • how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> • how to select, record and combine information from a range of appropriate sources • how to make connections with information, linking key ideas through using data analysis tools (Y10) <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) <p><i>Applying and communicating</i></p> <ul style="list-style-type: none"> • that viewpoints change 	<ul style="list-style-type: none"> • natural systems involve flows of energy • there are interrelationships and flows between systems (Y8) • human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> • broad spatial patterns can be used for predictions and planning • natural and human factors contribute to environmental problems and planning solutions • people's views on the significance of places change over time and are shaped by their circumstances • sustainable solutions involve a balance between ecological, social, economic and political factors (Y10) 	<ul style="list-style-type: none"> • sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of resources (Y10) • resource management decisions influence the availability and sustainability of natural resources (Y9)

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
and see if they are the sites for dams and reservoirs.	over time <ul style="list-style-type: none"> • how to account for changing patterns (Y10) 			
Topic 2 – Water catchments: an investigation				
Activity 1 1. Study ... to produce a detailed annotated (labels and notes) sketch map of the Collie catchment. 2. Reproduce the final sketch map on an A3 sheet of paper in a frame measuring approximately 30 by 30 cm. 3. Include a scale, title, legend and labels around the margin of the map.		<ul style="list-style-type: none"> • natural systems involve flows of energy • there are interrelationships and flows between systems (Y8) • human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> • broad spatial patterns can be used for predictions and planning • natural and human factors contribute to environmental problems and planning solutions • people's views on the significance of places change over time and are shaped by their circumstances • sustainable solutions involve a balance between ecological, social, economic and political factors (Y10) 	<ul style="list-style-type: none"> • sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of resources (Y10) • resource management decisions influence the availability and sustainability of natural resources (Y9)
Activity 2 1. Describe the site of the Harris and Wellington reservoirs. 2. Describe the location or situation of the Harris and Wellington	<i>Planning</i> <ul style="list-style-type: none"> • how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) 			

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
reservoirs.	<p><i>Conducting</i></p> <ul style="list-style-type: none"> • how to select, record and combine information from a range of appropriate sources • how to make connections with information, linking key ideas through using data analysis tools (Y10) 			
<p>Activity 3</p> <ol style="list-style-type: none"> 1. Use the contour map provided below to show the shape and area of the Harris Reservoir. 2. Study the contour patterns and suggest reasons why this site was considered to be suitable for the construction of a dam and reservoir. 3. Identify and briefly describe three factors that you think would be important when choosing a site suitable for the construction of a dam to supply drinking water. 	<p><i>Planning</i></p> <ul style="list-style-type: none"> • how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> • how to select, record and combine information from a range of appropriate sources • how to make connections with information, linking key ideas through using data analysis tools (Y10) 	<ul style="list-style-type: none"> • natural systems involve flows of energy • there are interrelationships and flows between systems (Y8) • human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> • broad spatial patterns can be used for predictions and planning • natural and human factors contribute to environmental problems and planning solutions • people's views on the significance of places change over time and are shaped by their circumstances • sustainable solutions involve a balance between ecological, social, economic and political factors (Y10) 	<ul style="list-style-type: none"> • sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of resources (Y10) • resource management decisions influence the availability and sustainability of natural resources (Y9)

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>Activity 4</p> <ol style="list-style-type: none"> Using ... describe the characteristics of the different water types indicated by the letters A, B, C and D. Based on the information provided on the Harris and Wellington reservoirs, suggest which water type(s) each reservoir corresponds to. 	<p><i>Planning</i></p> <ul style="list-style-type: none"> how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> how to select, record and combine information from a range of appropriate sources how to make connections with information, linking key ideas through using data analysis tools (Y10) 	<ul style="list-style-type: none"> natural systems involve flows of energy there are interrelationships and flows between systems (Y8) human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> broad spatial patterns can be used for predictions and planning natural and human factors contribute to environmental problems and planning solutions people's views on the significance of places change over time and are shaped by their circumstances sustainable solutions involve a balance between ecological, social, economic and political factors (Y10) 	<ul style="list-style-type: none"> sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of resources (Y10) resource management decisions influence the availability and sustainability of natural resources (Y9)
<p>Activity 5</p> <ol style="list-style-type: none"> Draw up the table ... and then summarise the characteristics listed for the Harris and the Wellington reservoirs and catchments. Evaluate each catchment as a source of suitable drinking water. Suggest and discuss at 	<p><i>Planning</i></p> <ul style="list-style-type: none"> how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> how to select, record and combine information from a 			

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>least four important strategies that could be put in place to protect water catchments and the water supplies they contain.</p>	<p>range of appropriate sources</p> <ul style="list-style-type: none"> • how to make connections with information, linking key ideas through using data analysis tools (Y10) <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) 			
<p>Activity 6</p> <p>Choose one of the sub-catchments supplying water to the Wellington Reservoir for the site of a new dam.</p>	<p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) 			
<p>Completing the investigation</p> <p><i>Issues and solutions in maintaining and developing safe, good quality drinking-water supplies ...</i></p>	<p><i>Applying and communicating</i></p> <ul style="list-style-type: none"> • that viewpoints change over time • how to account for changing patterns (Y10) 			

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
Topic 3 – Groundwater: the Gngangara mound				
<p>Activity 1</p> <p>Write a detailed description of the Gngangara groundwater mound. Include maps and diagrams to assist in providing a complete description.</p>		<ul style="list-style-type: none"> • natural systems involve flows of energy • there are interrelationships and flows between systems (Y8) • human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> • broad spatial patterns can be used for predictions and planning (Y10) • geographic patterns (local, regional, global) are created by the interaction of processes (Y9) 	
<p>Activity 2</p> <p>Draw an outline map of the Gngangara groundwater mound region using the land use map on side one of the broadsheet.</p>		<ul style="list-style-type: none"> • natural systems involve flows of energy • there are interrelationships and flows between systems (Y8) • human activity impacts on the interrelationships in natural systems (Y9) 	<ul style="list-style-type: none"> • broad spatial patterns can be used for predictions and planning (Y10) • geographic patterns (local, regional, global) are created by the interaction of processes • changes in the use of the environment reflect people's changing values • there are different perspectives on the conservation of significant natural and built features (Y9) 	

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>Activity 3</p> <p>Using the groundwater systems model found on side two of the broadsheet, write a detailed explanation of the ways in which the groundwater supplies in the Gngara mound can be managed sustainably.</p>		<ul style="list-style-type: none"> natural systems involve flows of energy there are interrelationships and flows between systems (Y8) 	<ul style="list-style-type: none"> broad spatial patterns can be used for predictions and planning (Y10) geographic patterns (local, regional, global) are created by the interaction of processes (Y9) 	<ul style="list-style-type: none"> sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of resources (Y10) resource management decisions influence the availability and sustainability of natural resources (Y9)
<p>Activity 4</p> <p>You have been asked to prepare a Q and A (questions and answers) brochure on the recycling of wastewater to address Perth's future water needs.</p>	<p><i>Planning</i></p> <ul style="list-style-type: none"> how to analyse issues, clarify specific purposes and construct a search plan for investigation (ICT) to formulate questions appropriate to each part of their research (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> how to select, record and combine information from a range of appropriate sources how to make 			

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
	<p>connections with information, linking key ideas through using data analysis tools (Y10)</p> <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> ways to use critical literacy skills to interpret and evaluate source material to identify and account for trends and patterns from evidence (Y10) 			
<p>Activity 5</p> <p>Using the information provided on the different water sources and their associated costs, evaluate the advantages and disadvantages of these in meeting Perth's current and future water needs.</p>		<ul style="list-style-type: none"> natural systems involve flows of energy there are interrelationships and flows between systems (Y8) human activity impacts on the interrelationships in natural systems (Y9) 		<ul style="list-style-type: none"> sustainable development is when resource use maintains a balance between the resource needs and wants of the population now and in the future, and the availability of resources (Y10) resource management decisions influence the availability and sustainability of natural resources (Y9)
<p>Activity 6</p> <p>Develop a poster to be put in shopping centres within the Perth metropolitan area,</p>	<p><i>Planning</i></p> <ul style="list-style-type: none"> how to analyse issues, clarify specific purposes and construct 	<ul style="list-style-type: none"> human activity impacts on the interrelationships in natural systems (Y9) there are local, regional 		<ul style="list-style-type: none"> sustainable development is when resource use maintains a balance between the resource needs and

Topic and activity	Investigation, communication and participation	Natural and social systems	Place and space	Resources
<p>informing people of the importance of protecting and sustainably managing the groundwater resources found in the Gnamptara and Jandakot mounds.</p>	<p>a search plan for investigation (ICT)</p> <ul style="list-style-type: none"> • to formulate questions appropriate to each part of their research (Y10) <p><i>Conducting</i></p> <ul style="list-style-type: none"> • how to select, record and combine information from a range of appropriate sources • how to make connections with information, linking key ideas through using data analysis tools (Y10) <p><i>Processing and translating</i></p> <ul style="list-style-type: none"> • ways to use critical literacy skills to interpret and evaluate source material • to identify and account for trends and patterns from evidence (Y10) 	<p>and global challenges to sustainability (Y10)</p>		<p>wants of the population now and in the future, and the availability of resources (Y10)</p>

- List three different ways in which relief is shown on the topographic map.

Contours, spot heights, shading (contour shadows).

- Calculate the surface area in hectares of the Canning and the Wungong reservoirs.

NOTE: There are 100 ha to 1 km².

Canning = about 750 ha.

Wungong = about 650 ha.

- Calculate the average gradient of the Wungong Brook from GR 211261 to GR 160319.

NOTE: Find the height at the start and finish points and calculate the difference. Find the distance in metres along the brook. Divide the difference in height into the distance to find the gradient and express this as a ratio of 1 in x.

Distance is approximately 8 km; height difference is 50 m = 8000/50

= 1 in 160 gradient.

- Identify two different types of surface water features produced by people (cultural water features) and provide map evidence to support your conclusion.

Tailing dams, water reservoirs and dams.

- Annual rainfall across the Churchman Brook drinking water catchment is approximately 900 mm per year. Assuming 10 per cent of this runs off while the rest evaporates, is used by plants or infiltrates into the ground; calculate the amount of water that will enter the Churchman Brook reservoir each year. To do this activity, complete the following steps:

- Use the scale shown on the *Southern Perth water resources* map to find the area of the catchment in hectares. This can also be done by plotting the catchment on the *Southern Perth topographic map*.
- As there are 1 000 L of water to 1 m³, a total of 10 000 000 L will fall on each hectare of land.
- Runoff of 10 per cent will produce 1 000 000 L/ha.
- Provide your answer in kilolitres (1 kL is 1 000 L).

Catchment is about 22.5 km² or 2 250 ha. 2 250 000 000 L will enter the Churchman Brook reservoir per year or 2 250 000 kL.

Activity 2

- Using the information provided for the Canning dam as well as the map found on side 1 of the *Water cycle broadsheet*, write a detailed description of the *site* and *situation* of the Canning catchment. Include details of natural and cultural features.

Site includes reference to relief, landforms, heights, natural vegetation. Situation refers to location using grid references, latitude and longitude, directions to and from other significant map features. Answers can contain a variety of different features.

2. With reference to topography, geology, climate, vegetation and cultural factors, account for the location of the Canning dam.

Canning dam is located in a region of deep narrow valleys on the western edge of the Darling plateau/ranges. These provide good sites for the construction of dams to create reservoirs. The forested areas provide good catchments as they ensure the quality of the water is maintained. Being higher than the city of Perth, they can use gravity to move the water to the metropolitan area. The lack of urban development in the catchments also helps protect the quality of the water.

3. Explain why there is a decrease in rainfall as you move from west to east across the Canning catchment.

The Darling Scarp creates orographic effect with uplift of rain bearing winds producing heavier rain on the escarpment. As the air passes inland, the amount of moisture is less and rainfall declines.

4. Identify one significant change that has occurred in the Canning catchment after the dam construction and briefly discuss how it impacts on the catchment and Perth's drinking water resources.

Since the 1970s, rainfall in the Canning catchment has decreased by around 20 per cent, resulting in a 60 per cent decline in stream flow. Many dams in the south-west no longer fill with winter rains and Perth water supplies are increasingly being sourced from groundwater and other sources.

5. Compare and contrast the drainage patterns and water features shown to the east and west of the South Western Highway on the topographic map. Include the names and locations of different features as well as a description of their general distribution patterns.

To the west of the South West Highway, the soils are sandy and few large rivers cross the sandy plain. Some important features on the plain include Thompsons, Yangebup and Forrestdale lakes. Higher land to the east of the highway has a great number of surface drainage features such as rivers, streams and brooks. These include Churchman Brook, Wungong Brook and Canning River.

6. Using the *Groundwater – infiltration* diagram on side 2 of the broadsheet as well as the *Southern Perth topographic map*, compare and contrast the infiltration and groundwater resources on the Darling Scarp and the Swan Coastal Plain. Explain why there is greater infiltration on the plain compared to the scarp.

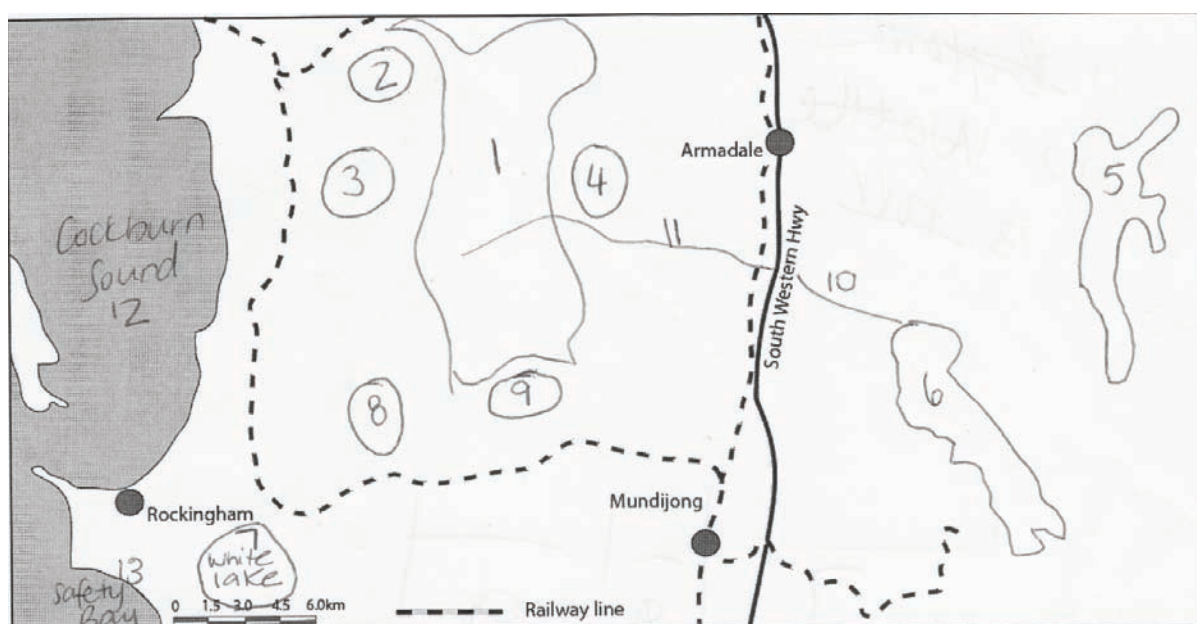
Swamps and lakes indicate a shallow watertable on the coastal plain. The sandy soils encourage greater infiltration and reduced surface flows. Jandakot groundwater mound illustrates this subsurface water resource. Areas of rocky outcrops and clay soils in the Darling Range reduce the amount of infiltration and encourage surface runoff.

Activity 3

1. Use the following outline map and the *Southern Perth topographic map* on side 1 of the *Water cycle broadsheet* to show the location of the water and drainage features listed below:

- Jandakot Underground Water Pollution Control Area (UWPCA)
See no. 1 on Outline map below
- Yangebup, Thompsons and Forrestdale lakes
See no. 2, 3 and 4 respectively
- Canning and Wungong reservoirs
See no. 5 and 6 respectively
- White Lake
See no. 7
- Bollard Bulrush Swamp
See no. 8
- Big Bulrush Swamp
See no. 9
- Wungong Brook
See no. 10
- Birriga drain
See no. 11
- Cockburn Sound
See no. 12
- Safety Bay
See no. 13

Outline map



2. Based on information contained in the topographic map legend found on side 1 of the *Water cycle broadsheet* as well as your own research, describe or define the following water features:
- reservoir
Body of water contained upstream of a dam wall
 - dam
Barrier constructed across a valley to contain or trap water
 - intermittent swamp, lake or stream
Seasonal body of water – dries up during seasonal dry period
 - perennial swamp, lake or stream
Permanent body of surface water
 - inundation
Subjected to flooding
 - spring
Groundwater seeping or flowing to the surface at a specific location
 - catchment
Area of land that supplies water to a stream or a network of streams
 - tributary
Smaller stream entering a larger one
 - drain
Channel constructed to remove or modify the movement of surface water.
3. Using map evidence, identify and describe the different ways in which people have changed the water and drainage features in the southern Perth region. Some of these can be identified by referring to the map, others you may need to infer.

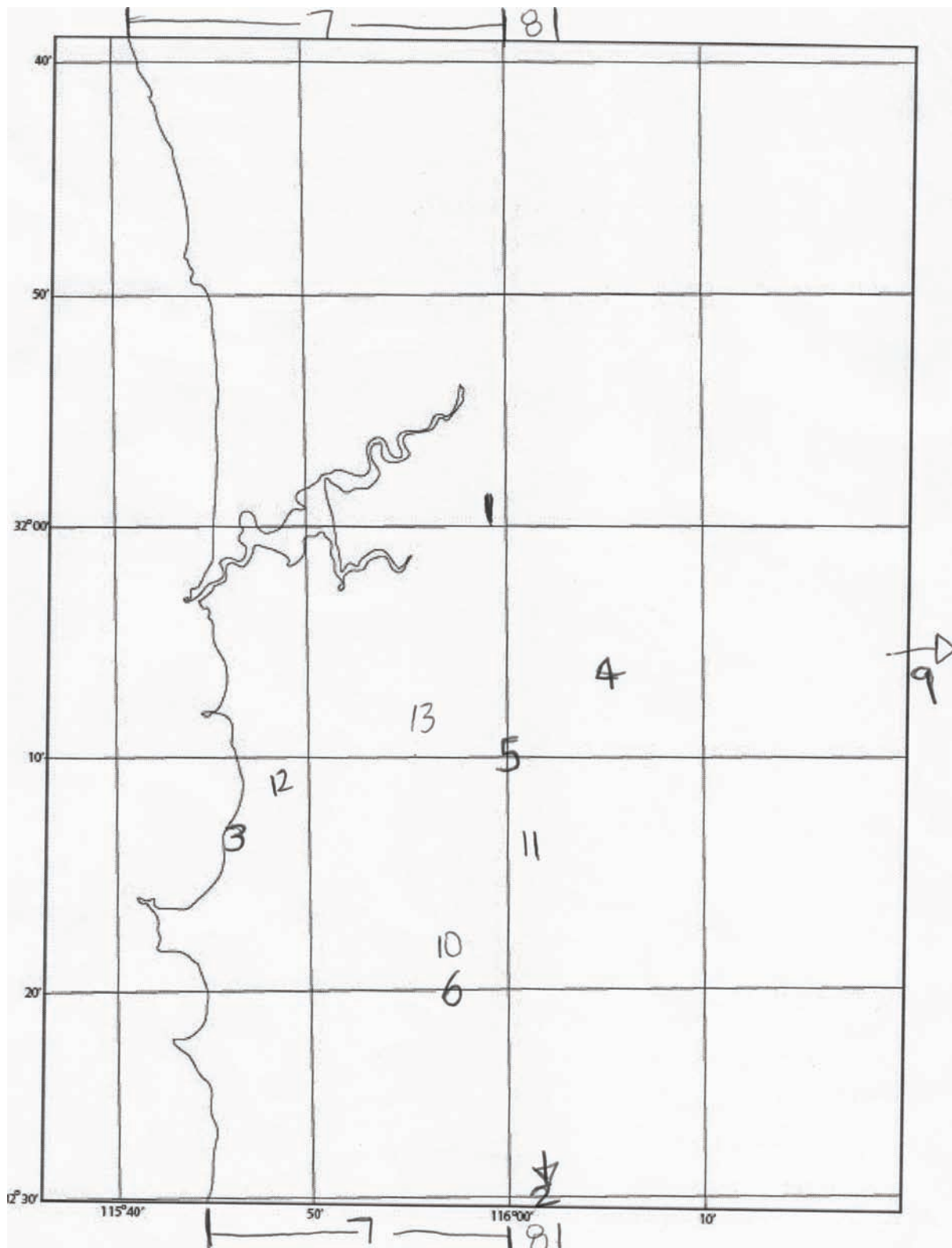
Changes to the natural water cycle in the region by referring to the map include: the construction of dams, development of drainage channels, tailing dams (contain contaminated water which is allowed to evaporate from these sites). Changes to the natural water cycle which need to be determined by inferring from the map include: clearing of vegetation, construction of concreted and paved impervious urban surfaces resulting in change of stormwater systems and the tapping of groundwater supplies. Examples and direct reference to map information should be included in the answer.

Activity 4

1. Using the outline map of the Perth region provided below, plot the following features according to their latitude and longitude:
- Perth airport weather station (side 2 of the *Water cycle broadsheet*)
See no. 1 on Perth region outline map below (31° 56' S 115° 59' E)
 - Karnet weather station (side 2 of the *Water cycle broadsheet*)
See no. 2 (32° 26' S 116° 04' E)

- Perth Desalination Plant 32° 12' S 115° 46' E
See no. 3
 - Canning dam 32° 06'S 116° 05'E
See no. 4
 - Wungong Dam 32° 10'S 116° 00'E
See no. 5
 - Serpentine Dam 32° 20'S 115° 57'E.
See no. 6
2. Mark in the approximate locations of the Swan Coastal Plain, the Darling Scarp and the Great Western Plateau. Explain how the topography of the region influences the location and types of water resources found here.
- Swan Coastal Plan – see no. 7*
- Darling Scarp – see no. 8*
- Great Western Plateau – see no. 9*
3. Explain how the location and distribution of water resources would affect the land use or urban planning of the Perth region. Consider the possible impacts of land use on water quality.
- Land-use planning needs to consider the location of public drinking water source areas to take into account the possible contaminating effects of urban and industrial land uses. The development of policies to protect catchments from a range of land uses is needed to ensure that the quality of surface and groundwater drinking water supplies is not compromised.*
4. Using the *Southern Perth topographic map* found on side 1 of the *Water cycle broadsheet* mark on the urban settlements of Mundijong, Byford, Wattleup and Forrestdale on the Perth region outline map provided below. You will need to use the latitude and longitude on both maps to accurately complete this exercise. Describe the *site* and *situation* of two of these settlements.
- Site includes reference to relief, landforms, heights, natural vegetation. Situation refers to location using grid references, latitude and longitude, directions to and from other significant map features. Answers can contain a variety of different features.*
- Mundijong – see no. 10*
- Byford – see no. 11*
- Wattleup – see no. 12*
- Forrestdale – see no. 13*

Perth region outline map



Activity 5

Frontal uplift

1. Using the information contained on the weather map *Indian Ocean – evaporation and advection* write a detailed description of the weather and ocean characteristics associated with the frontal system. Include information on air pressure, wind direction, air masses and ocean temperatures.

Note the location of the front, its direction of travel and the air pressure associated with it. Identify the two air masses that meet along the front – tropical and polar maritime. Identify the wind direction before the front crosses the coast and after.

2. Describe and explain the seasonal pattern of rainfall shown by the *Mediterranean climate - graphs*. Include information about the amount of rainfall occurring at different times of the year and its relationship with the seasons as illustrated by the changes in temperature.

Students should describe the winter rainfall and the summer dry season, and how this coincides with temperature variations i.e. warm, dry summer and cool, wet winter. Students can also highlight the difference between the amounts of rainfall at both locations. Note that actual amounts of rainfall and temperatures should be included in the answer as supporting evidence.

3. Explain how this information is important to understanding the location and distribution of water resources in the south-west.

Surface water sources occur where there is greatest rainfall. Rainfall can recharge groundwater aquifers in other areas during winter. Winter rainfall is important to meet the needs of the community during the dry summer, when there is little or no rainfall. Also note that rainfall is greater in amount towards the south-west corner of the region and this has consequences for Perth and other places towards the northern part, such as distance and cost to transport water to consumers.

Orographic uplift

4. Using the information provided by the *Mediterranean climate - graphs* and the *Annual rainfall - precipitation* map, describe and account for the changes in the amount of rainfall experienced when moving from west to east across the south-west of Western Australia.

As you move east and north, rainfall decreases. The isohyets also run parallel to the coast so distance from the sea is a significant factor associated with rainfall distribution. Note that locations and actual amounts of rainfall should be included in the answer as supporting evidence.

5. How would this variation in rainfall affect the location of surface drinking-water catchments in the south-west?

The greater amount of surface water further south will influence the location of dams and reservoirs that will be needed to be built to supply Perth with drinking water.

Convectional uplift

6. Research the hailstorm that hit Perth in March 2010 and describe its impact on the city.

Students should Google 'Perth hailstorm' to find information on the impact on people, properties and the environment. Consider possible health, financial, environmental and social impacts.

7. How useful are violent summer storms in providing additional drinking-water supplies for the Perth region?

Research on the contribution of these storms should show they are of short duration, may produce heavy localised falls, with significant runoff onto roads and into stormwater drains. The infiltration into groundwater is often not significant, due to the rapid runoff. Their contribution to water reservoirs is limited and the higher evaporation rates in summer reduce their medium term effectiveness.

8. Based on all of the information about water provided on side 2 of the *Water cycle broadsheet*, suggest a settlement in the south-west that would provide the best location for future population growth. Give reasons for your selection.

A range of locations could be chosen with Bunbury, Busselton and Albany being good examples. These locations have greater rainfall than Perth or locations further north to support a growing population. Students should make use of all information on the broadsheet and use a number of specific details from these sources to produce an acceptable answer.

Activity 6

1. Study the map of annual evapotranspiration on side 2 of the *Water cycle broadsheet* and write a paragraph describing the change to variations in evapotranspiration rates within the south-west of Western Australia. Include data and references to actual locations. Suggest reasons for the different rates shown on the map.

Students will need to describe the basic trend that evapotranspiration potential reduces as you move away from Perth towards the south-west. Specific values in mm/year and actual south-west locations should be used (for example, Perth, Albany etc). Students will need to suggest the reasons behind the trend, and justify their response.

2. Compare the annual evapotranspiration with the annual rainfall. Explain how these two factors affect the operation of the water cycle in the south-west of Western Australia.

Students will need to describe similarities between evaporation potential and precipitation. Specific values in mm/year and actual locations may be used. The basic trend is that as precipitation increases, evapotranspiration decreases. This is linked to climate (temperature) and geographical features (such as distance to the coast and landforms). Students should describe this in the context of the whole water cycle.

3. Write a paragraph describing the surface runoff or drainage pattern in the south-west of Western Australia.

Students will need to describe the basic trend that drainage in the south-west is towards the coast in waterways. They will also need to describe the plateau's uncoordinated drainage and refer to the salinity, and that these areas do not drain towards the coast. They should use actual locations and river names to illustrate their response.

4. Based on the annual rainfall in the south-west and the location and extent of the rivers, identify examples of rivers which are most and least likely to carry large volumes of water. Give reasons for your choices.

Students should look at the rainfall chart and determine that rivers in high rainfall zones would have higher likelihood of carrying larger volumes of water. Students should also consider the catchment size. High volume rivers would include Warren, Frankland, Collie, Murray, and Swan (noting that the Avon and Canning contribute to the Swan). Lower volumes are likely to be those north of Perth – Greenough and Moore, and those in south-east of the study area – Denmark and Palingup. Precipitation levels and location names should be used. Students should be able to justify their responses. (Proactive students can research their answer using flow data from www.water.wa.gov.au > tools and data.)

5. Rank the different rivers numbered on the drainage map from those best able to supply drinking water to those least able, considering quantity of water. Explain how you decided on your ranking. Identify other information that you would need in order to make a complete assessment of the suitability of the different rivers in the south-west as potential drinking water sources.

Considering quantity only, students should choose the rivers they established in question 5 (above) that are likely to carry the highest volume of water, and justify their responses, considering rainfall and catchment size. Other information required to make a complete assessment of suitability for drinking water would include water quality data, constant or variable flow, proximity to populations requiring the water, current levels of development in the catchments (contamination risks).

6. Investigate the top three rivers in your ranking and see if they are sites of existing dams and reservoirs.

Students will need to research their top three rivers using information from the workbook, broadsheet and they can also access the internet. Department of Water (www.water.wa.gov.au) and the Water Corporation (www.watercorporation.com.au) contain relevant information.

Topic 2 - Water catchments: an investigation

Reference: *Water catchments broadsheet.*

Activity 1

1. Study the different information sources found on the broadsheet to produce a detailed, annotated (labels and notes) sketch map of the Collie catchment showing the following features:

Measure the map and draw a rectangle to the same proportions on an A3 sheet of paper. Divide it in quarters to help position the features that you need to put on the sketch map.

- main rivers, tributaries and water reservoirs
Draw these as blue lines on the map.
 - areas of forest
Include only forest areas and not cleared or semi-cleared areas.
 - areas of high salinity
Show these areas by labels or by a dotted line around the affected areas.
 - areas of higher and lower rainfall
Give some examples of rainfall totals for different parts of the map.
 - areas of significant mining and farming
Use colours to show these areas.
 - relief characteristics and significant landform areas.
Use labels to identify and describe the different landforms.
2. Reproduce the final sketch map on an A3 sheet of paper in a frame measuring approximately 30 by 30 cm.
 3. Include a scale, title, legend and labels around the margin of the map.

Activity 2

1. Describe the *site* of the Harris and the Wellington reservoirs making special reference to:
 - elevation or height
Use contours to estimate the height of the reservoir water levels.
 - landforms
Identify the main location from the contours. These will be valleys, hills and summits. Include the names of different landforms if shown on the map.
 - area or size
Calculate the surface area of the reservoirs.
 - shape
Describe the shape using terms such as linear, radial, dendritic, branched, elongated, etc.

2. Describe the location or *situation* of the Harris and Wellington reservoirs making special reference to:
 - geographic location within the south-west
Use latitude and longitude and grid references.
 - surrounding or adjacent areas and features
Identify nearby distinctive landforms.
 - distances, directions and position
Use the map scale and compass directions to show the location and relationship to other map features.

Activity 3

1. Use the contour map provided below to show the shape and area of the Harris reservoir. Note that the contour interval is 50 m and shading may be used to show the areas of the map with similar heights.

Students will need to look at the height and shape of the dam and then select the contours that match its shape, see contour map below.

2. Study the contour patterns and suggest reasons why this site was considered to be suitable for the construction of a dam.

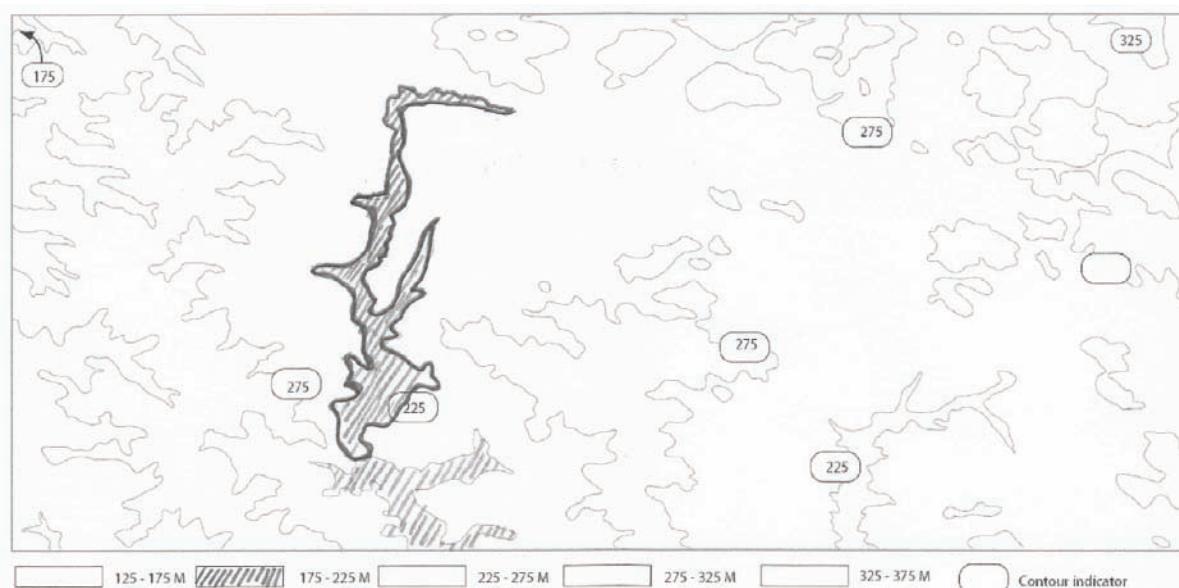
The location is a narrow valley which when dammed, would provide a reservoir of some size. It is cheaper to dam a narrow valley rather than a wide one.

3. Identify and briefly describe three factors that you think would be important when choosing a site suitable for the construction of a dam to supply drinking water.

HINT: visit <http://drinkingwater.water.wa.gov.au> for information, scroll down to find examples of drinking water source protection plans.

Factors could include suitable water quality, flooding of surrounding land uses, water availability, proximity to current settlements requiring drinking water, financial cost of taking, treating, transporting and distributing the water, suitability of site for dam construction.

Harris contour map



Activity 4

- Using the information shown on the *Water quality factors* diagram, found on side 2 of the broadsheet, describe the characteristics of the different water types indicated by the letters A, B, C and D.

This can be answered using the diagram and then writing a statement for each letter. For example, 'A' would be a high quality drinking water with low turbidity, low pathogens, low salinity and low nitrates.

- Based on the information provided on the Harris and Wellington reservoirs, suggest which water type(s) each reservoir corresponds to.

Harris has high quality drinking water – A. Wellington is not suitable for drinking water due to its salinity. As there is no pathogen readings supplied, students need to base their assessment on salinity, turbidity and nitrates. D would be the most appropriate choice.

Activity 5

- Draw up the table shown below and then summarise the characteristics listed for the Harris and the Wellington reservoirs and their catchments.

Characteristics	Harris Dam Catchment Area	Wellington Dam Catchment Area
Catchment size and location, water inflow and change over time.	<i>Harris has a smaller storage capacity.</i>	<i>Wellington has a larger capacity than Harris.</i>
	<i>Dams are located near populated areas requiring water (e.g. Collie). Both have experienced a reduction in flows due to our drying climate. Students should give evidence from the broadsheet and workbook.</i>	
Water quality characteristics and potential human health consequences.	<i>Harris has good quality drinking water. Students can give data and human health impacts from the broadsheet and workbook.</i>	<i>Wellington's water is too saline. Students can give data and human health impacts from the broadsheet and workbook.</i>
Water uses and importance.	<i>Harris is currently used for drinking water. Drinking water is the highest beneficial use of a reservoir.</i>	<i>Wellington's water is currently used for irrigation and recreation. Both are important uses for the community.</i>
People's activities and impacts within each catchment.	<i>Harris is protected by law as it is used for drinking water. It is mostly surrounded by state forest which protects the water quality.</i>	<i>Recreation and land uses impact on the water quality. Students should mention examples based on the workbook and broadsheet.</i>

- Evaluate each catchment as a source of suitable drinking water.

Harris reservoir is the most suitable. Wellington's salinity is unsuitable. Students should give other reasons based on their investigations.

3. Suggest and discuss at least four important strategies that could be put in place to protect water catchments and the quality of water supplies they contain.

HINT: visit www.water.wa.gov.au > Managing our water > Water quality > Water quality protection notes.

These strategies would include protecting the catchment from urban and rural development and maintaining the natural vegetation cover by protecting the area under legislation, ensuring appropriate land use planning, limiting forestry and mining activities, restricting public access to the reservoir and major waterways, and monitoring the quality of the water in the reservoir. Students may have other appropriate answers.

Activity 6

Choose one of the sub-catchments supplying water to the Wellington reservoir for the site of a new dam and complete the following (do not choose Harris or Mungalup dams, as they already supply drinking water):

The Bingham River would provide a good example for the questions below as it has many of the characteristics of a good catchment. Students should select a location for the dam where the valley is narrow and the contours would show a reservoir of a good size.

1. Draw a map to show the location of the dam and the probable extent of the reservoir.
HINT: Consider the contours and their shape as well as the location and number of streams that will provide inflow into the reservoir.
2. Explain why you chose the catchment.
3. Explain why you chose the site of the dam wall.
4. Identify factors or arguments against the construction of the new reservoir and discuss how these could be dealt with.

Completing the investigation

Now that you have finished the activities provided, it is time to complete the investigation on the topic: *Issues and solutions involved in maintaining and developing safe, good quality drinking-water supplies from surface water catchments.*

This investigation can be broken into sections which students should find for themselves using a concept map or a matrix. A suggested breakdown is as follows:

Explain the terms 'good quality drinking water supplies' and 'surface water catchments'.

Issues in developing a safe good quality drinking water supply.

Solutions to the development of a good quality drinking water supply.

Issues in maintaining a safe good quality drinking water supply.

Solutions to maintaining a safe good quality drinking water supply.

Conclusions and observations which should include comments on the importance of water catchment management.

Topic 3 - Groundwater: the Gngangara mound

Reference: *Groundwater broadsheet.*

Activity 1

Write a detailed description of the Gngangara groundwater mound including its:

- location, size and shape

Use the map scale and the grid on the land use map on side 1 of the Groundwater broadsheet to calculate the area and dimensions of the mound. Use the topographic and land use map to describe the location.

- relief, landform and important water features

Name the features such as the Swan River, the west coast and the lakes (e.g. Lake Joondalup, etc.).

- land use across the mound

Identify the different land uses (e.g. urban, horticulture, etc.), their location and extent.

- structure and geological characteristics

Use the groundwater mound block diagram on side 2 of the Groundwater broadsheet to describe the geology and structure of the mound.

- groundwater characteristics

This includes the different aquifers and the characteristics of the water provided in the description provided in this topic.

Include maps and diagrams to assist in providing a complete description.

Activity 2

Draw an outline map of the Gngangara groundwater mound region using the *Gngangara groundwater mound – land use map* on side 1 of the broadsheet. Based on the types of land uses shown on the map and information about groundwater pollution risks:

1. Classify the different areas on the blank map as high, medium or low pollution risk areas. Use colours and a key to identify the three areas.
2. Briefly explain why there are different degrees of groundwater pollution risks across the Gngangara mound.
3. Compare your map with the current distribution of bores that supply public drinking water. Evaluate the extent to which the location of the bores has been influenced by the differences in the levels of pollution risk shown by your map.
4. Identify some strategies that could be put in place to reduce the impact of the different land uses on the quality of the groundwater resource.

HINT: Research water quality protection notes covering various land uses. See www.water.wa.gov.au > Managing our water > Water quality.

This is a question which requires students to think about contamination and its effects on groundwater. They will produce different maps. The important thing is that they justify their responses and understand that land use planning over groundwater resources is very important.

Activity 3

Using the *Groundwater systems model* found on side 2 of the broadsheet, write a detailed explanation of the ways in which the groundwater supplies in the Gnamptara mound can be managed sustainably. Consider the following:

- the balance between extraction and replenishment rates
- factors affecting evapotranspiration
- factors affecting infiltration, inflows and groundwater outflows
- our drying climate.

In this question, students should demonstrate that they understand the links between climate and groundwater supplies and the need for sustainable management of the resource. Answer should show this understanding.

Activity 4

You have been asked to prepare a questions and answers brochure on the recycling of wastewater to address Perth's future water needs.

- Prepare five questions that would most likely be asked by the public about this water recycling initiative.
- Research and prepare a short paragraph answer for each of the questions that would provide the information to the public.
- Include at least two graphs and two diagrams in your brochure.

HINT: Research the Water Corporation's website www.watercorporation.com.au

This question introduces the sometimes controversial topic of recycling wastewater. It also provides an opportunity for the students to apply inquiry skills via the use of focus questions.

Activity 5

Using the information provided on the different water sources and their associated supply costs, evaluate the advantages and disadvantages of each in meeting Perth's current and future water needs. Consider the following:

- the reasons why there is such a big difference in the costs associated with the different water sources
- the environmental impacts of using the different sources
- the capacity to sustainably meet the future water needs of the Perth region.

Write two paragraphs outlining the conclusions can you draw from the information provided by the graphed data.

Costs of supplying water from different sources are affected by factors such as distance to the resource, infrastructure cost, level of treatment required and energy costs (extraction, pumping, etc.). Environmental issues include the impact on natural ecosystems and the potential for health impacts on the human population. Sustainability issues include the size of the resource and its capacity to be replaced/replenished.

Activity 6

Develop a poster to be put in shopping centres within the Perth metropolitan area, informing people of the importance of protecting and sustainably managing the groundwater resources found in the Gnangara mound. The poster should be designed to illustrate the following:

- the different uses of the groundwater
- the risk of pollution from land uses
- the location and importance of the groundwater resource
- the ways that the groundwater can be sustainably managed
- the steps that can be taken to minimise the risk of contamination.

HINT: Visit <http://drinkingwater.water.wa.gov.au> for information.

This question brings together the different issues and characteristics of the Gnangara groundwater mound. It is a consciousness raising exercise and allows students to apply their knowledge in a visually creative context.

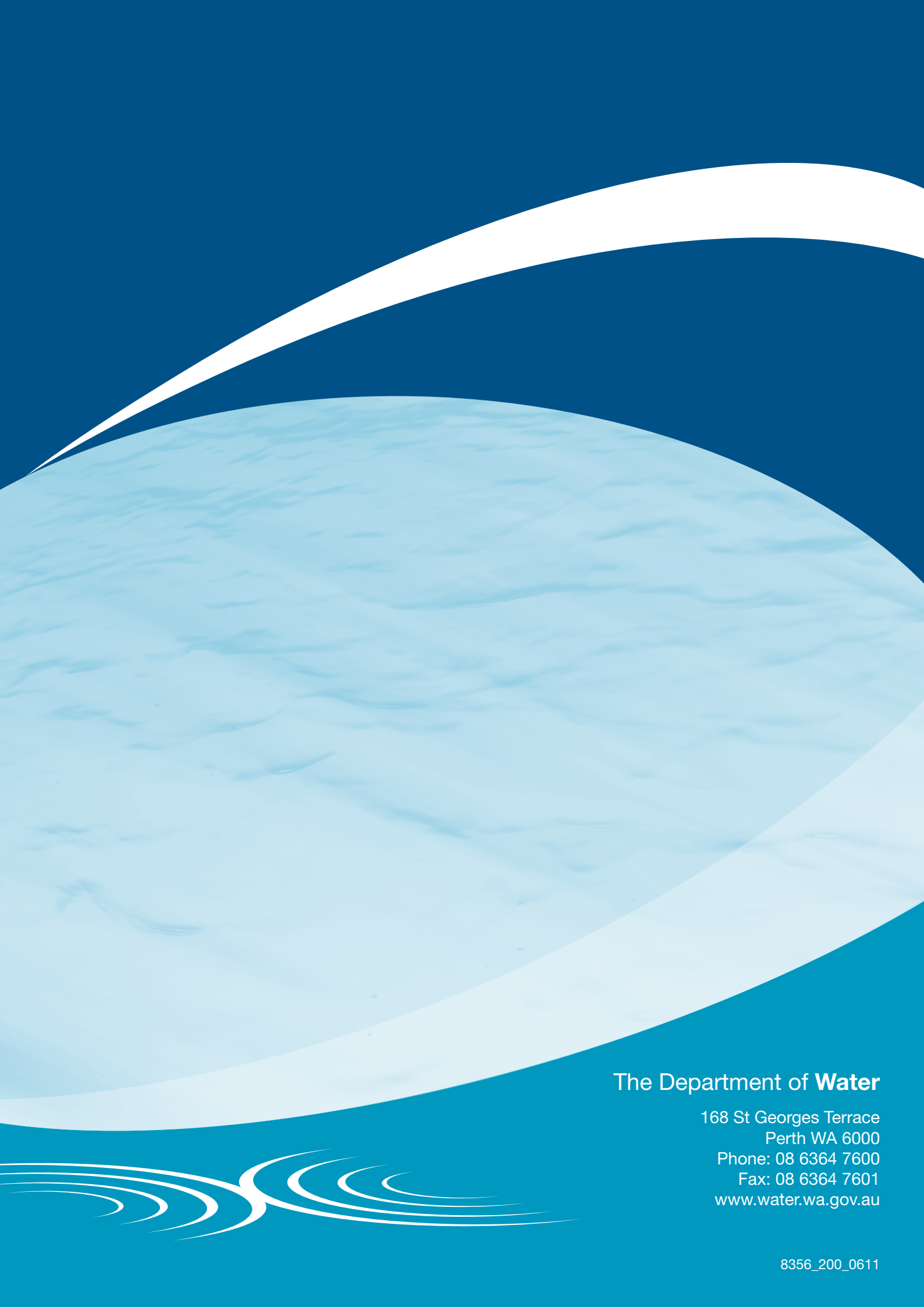
References

- Department of Water 2007, *Harris Dam Catchment Area drinking water source protection plan*, Department of Water, Perth, available
<<http://www.water.wa.gov.au/PublicationStore/first/76344.pdf>>
- Government of Western Australia 1909, *Metropolitan Water Supply Sewerage and Drainage Act* (WA), reprinted under the *Reprints Act 1984* (WA) as at 27 April 2008, available
<www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_588_homepage.html>.
- 1947, *Country Areas Water Supply Act*, reprinted under the *Reprints Act 1984* (WA) as at 14 April 2008, available
<www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_208_homepage.html>.
- National Health and Medical Research Council (NHMRC) & Natural Resource Management Ministerial Council (NRMMC) 2004a, National Water Quality Management Strategy: *Australian drinking water guidelines*, Australian Government, Canberra, available
<www.nhmrc.gov.au/publications/synopses/eh19syn.htm>.
- Water & Rivers Commission 2004, *A fresh future for water: salinity situation statement for the Collie River catchment: a summary*, Water & Rivers Commission, Perth, available
<<http://www.water.wa.gov.au/PublicationStore/first/13228.pdf>>
- Western Australian Planning Commission 2003, Statement of planning policy no.2.7: *Public drinking water source policy*, Government Gazette Western Australia, 10 June 2003, pp. 2077-82, Government of Western Australia, Perth, available
<<http://www.planning.wa.gov.au/Plans+and+policies/Publications/149.aspx>>
- World Health Organization 2004, *Guidelines for drinking-water quality – Volume 1 – Recommendations*, 3rd edn, World Health Organization, Geneva, available
<www.who.int/water_sanitation_health/dwq/gdwq3rev/en/index.html>.

Other contact details

Water Corporation
629 Newcastle Street
Leederville Western Australia 6007
Telephone +61 8 9420 2420
Facsimile +61 8 9423 7722
www.watercorporation.com.au

Department of Education
151 Royal Street
East Perth Western Australia 6004
Telephone +61 8 9264 4111
www.det.wa.edu.au



The Department of **Water**

168 St Georges Terrace
Perth WA 6000

Phone: 08 6364 7600

Fax: 08 6364 7601

www.water.wa.gov.au