Water in the World:
Hawkesbury Nepean River

The Hawkesbury Nepean River has been a vital part of our landscape for many thousands of years. It played and continues to play a key role in the lives of Indigenous Dharug People living in the area. The River was also important to the early European settlers as well as many thousands of people today. This geographical inquiry will focus on the environmental and human processes that influence the availability and distribution of water, with a particular focus on the Hawkesbury River at Sackville North.

Inquiry aim:

To investigate the natural and human processes influencing the water quality and availability in the Hawkesbury River catchment at Sackville North.

Inquiry question:

How do natural and human processes influence water as a scarce resource in the Hawkesbury Nepean River?

Health and safety issues - As you are working out in the field you need to be aware that:

Ground material is often covered in moss and can be very slippery.
Vines and dense undergrowth can trip.
Fallen trees can be rotten and weak.
Some animals can deliver painful or venomous bites.
On slopes, rocks can be easily dislodged.

Success Criteria

You will be able to describe the unique features and characteristics of the Hawkesbury Nepean.
You will be able to describe some of the processes that have influenced the formation of the Hawkesbury Nepean.
You will be able to explain the interactions and connections between people and the Hawkesbury Nepean over time.
You will be able to discuss management of the Hawkesbury Nepean for sustainable futures.
You will be able to use a number of geographical tools to communicate your learning about the Hawkesbury Nepean River catchment.

Student name: _____

Pre-visit lesson one: Background information

SIX Maps has been developed by the NSW Department of Land and Property. It provides access to cadastral (land and property boundaries) and topographic (hills and valleys) information, satellite data and aerial photography. Use SIX Maps to complete the following:

1. On SIX Maps, type in Sackville North.
2. Click on Basemaps (top right of page) and drag the tab down until you can see the street and suburb names.
3. Zoom out and fly around until you find your local suburb.
4. Click on Basemaps and move the tab back up until you can see the satellite image.
5. Zoom out to a scale around 1:600 000 (you can see this in the bottom left of screen). Follow the Hawkesbury Nepean River upstream from the ocean to Warragamba Dam.
6. By holding a piece of string to your computer screen or using SIX Maps Distance tool (the one with the ruler icon) estimate the length of the Hawkesbury Nepean River: _____ km
7. Look at the satellite image of the Hawkesbury Nepean River. Identify 3 different broad land use patterns around the river and discuss how this would affect the Hawkesbury Nepean River.

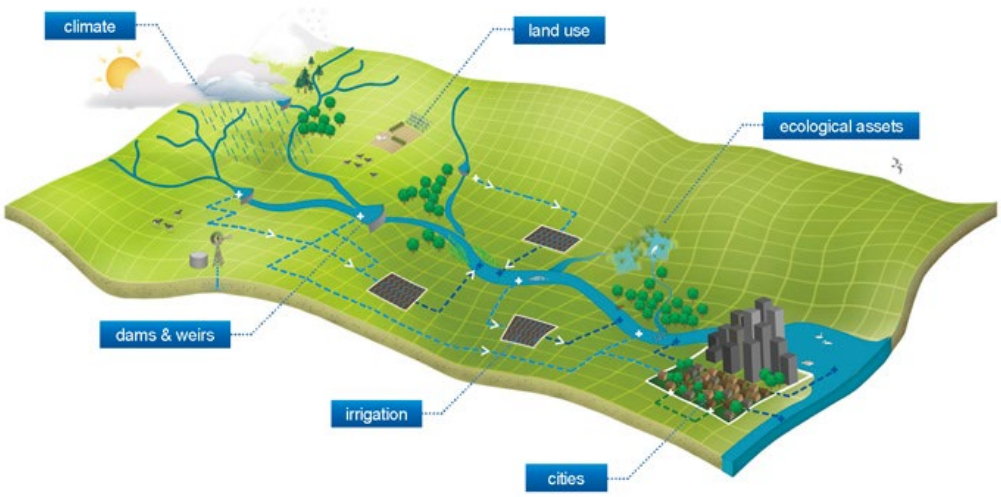
Land Use	Impact on the River

Pre-visit lesson two: The water cycle

Use the word bank below to draw and label the water cycle.

Precipitation	Surface runoff	Groundwater	Lake	River
Ocean	Evaporation	Condensation	Transpiration	Clouds
Runoff	Atmosphere	Infiltration	Plants	Lithosphere

Pre-visit lesson three: River catchments



What is a river catchment? (Provide 3 local Sydney examples.)

What is water scarcity? Do you think it is connected to water quality? Why?

Why is water important to the Sydney Region?

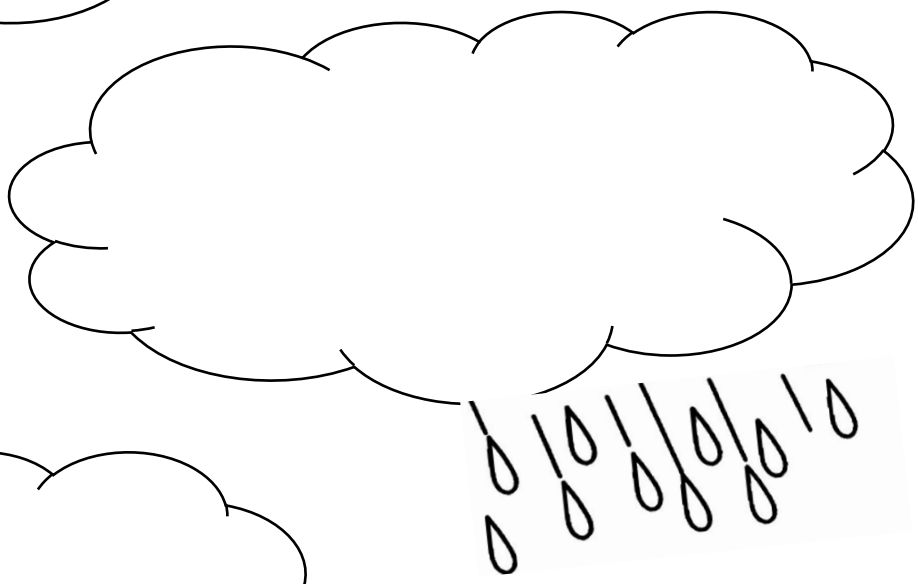
Is the Hawkesbury River important to Sydney? How?

Pre-visit lesson four: Geographical questions

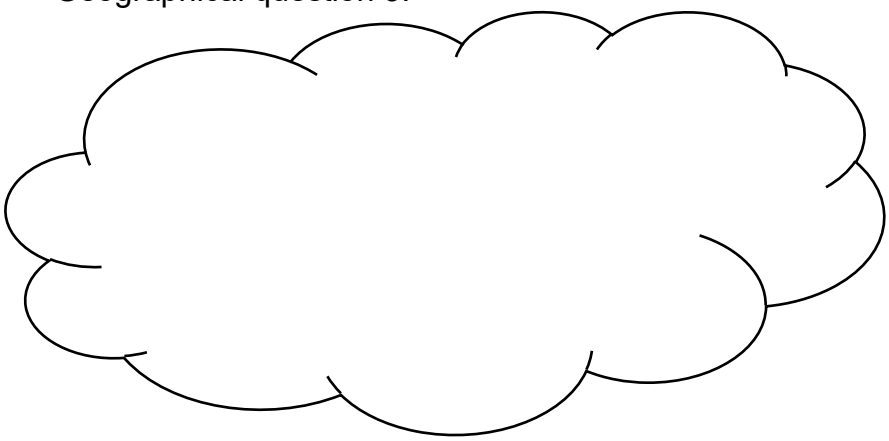
Brainstorm: What are some geographical questions you might ask for this Inquiry?
Geographical questions are questions which help you identify the information you need to answer the inquiry questions. Your inquiry questions are written on page 1.
Example: What are some human impacts on the Hawkesbury Nepean River system?

Geographical question 1:

Geographical question 2:



Geographical question 3:



Can you think of any additional questions that might add depth to your inquiry?

Pre-visit lesson five: Planning your inquiry

Brainstorm what you might need to answer your inquiry questions – draw a mind map and for each question include resources, geographical tools and recording methods. (Hint: scientific instrumentation, statistics and graphs, spatial tech such as GPS, Google Earth etc. Visual tools such as drawing and photography, tables, media, writing, etc.)

What do you already know? Scan the QR code and answer the quiz questions.

Water quality – Pond water bug study

Biological indicators of water pollution

- Circle the sensitivity rating if the animal is found
- Count the number of animals for abundance.

Macroinvertebrate common name & sensitivity	Sensitivity rating	Abundance
Very sensitive		
Tadpoles	10	
Stonefly nymph	10	
Mayfly nymph	9	
Sensitive		
Caddisfly larva	8	
Riffle Beetle or larva	7	
Water mite	6	
Tolerant		
Beetles larva	5	
Dragonfly nymph	4	
Water strider	4	
Whirligig beetle	4	
Damselfly nymph	3	
Midge or fly larva	3	
Freshwater shrimp	3	
Water scorpion/ Needle bug	3	
Very tolerant		
Diving beetle	2	
Worms	2	
Water treader (v.small)	2	
Water boatman	2	
Back swimmer	2	
Bloodworm	1	
Leech	1	
Freshwater snails	1	
Total		

WATER QUALITY RATING TOTAL
Using Sensitivity Rating Total
45 + Excellent
30 - 44 Good
20 - 29 Fair
<20 Poor

Sensitivity ratings refer to:

_____
_____
_____
_____
_____

Water quality is linked to the concept of scarcity because:

_____
_____
_____
_____
_____
_

Is abundance or diversity of water bugs preferable? Why?

_____
_____
_____
_____
_____

Water quality – Hawkesbury River

Dharug Aboriginal name for the river _____

Site Location _____

Date of tests _____

Physical parameters

Parameter	Result		Unit	Healthy range
River width			m	na
Tide	Ebb (Flowing to low.)	Flood (Flowing to high.)		na
Water Temperature			^{O}C	12-18 ^{O}C
Turbidity			NTU	<10 NTUs

Chemical parameters

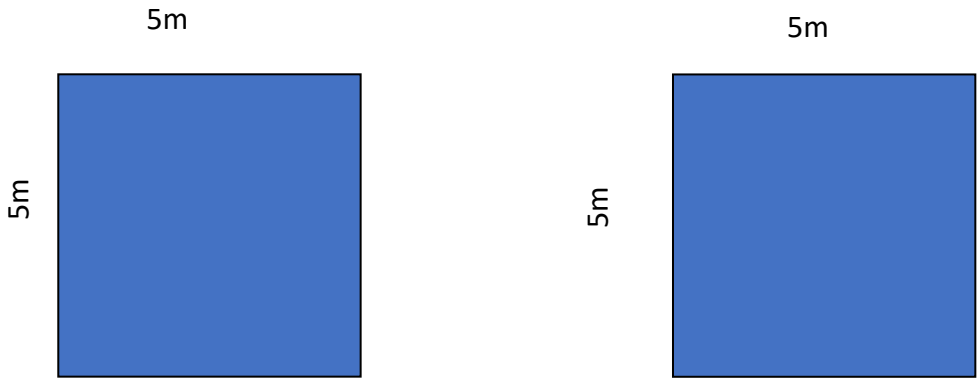
Parameter	Result	Unit	Healthy range
Salinity		ppm	<250ppm
pH (acidity)		pH	6-8
Oxygen		mg/L	8-10mg/L

Link the parameters tested to these natural and human impacts:

Natural Influences	Parameter	Human Influences
• Storm events • Rock formations • Geomorphology - the study of landforms & the processes that make them such as weather, erosion, deposition.		• Speed boats - especially wake boats with increased ballast • Clearing of the banks – erosion of the river banks → widening and shallowing • Damming upstream
• Tide and rainfall • Geology – rock types in the catchment • Water table.		• Fertilisers • Treated sewage • Washing powder / detergent • Water table changes due to clearing or irrigation.
• Storms • Algae • Climate		• Boating • Clearing in the catchment • Carp – introduced species, bottom feeders.
• Seasons • Climate • Sunlight • Turbidity - Turb↑ = ↑sunlight.		• Clearing in catchment → increased turbidity → temp↑ • Roads & rooves – albedo (dark surfaces absorb heat, light ones reflect it) dark surfaces→ increase in water temperature
• Tide and rainfall • Geology – rock types in the catchment • Water table.		• Treated sewage • Washing powder / detergent • Water table changes due to clearing or irrigation.
• Tide and rainfall • Geology – rock types in the catchment • Water table • Eutrophication: ↑ algae due to high nutrient levels→ lack of sunlight getting into water → reduced dissolved oxygen levels.		• Fertilisers • Treated sewage • Washing powder / detergent • Water table changes due to clearing or irrigation.

Water quality – Impact of vegetation & topography on water quality

In this activity you will be using **two adjacent 5m x 5m quadrats.** One of these quadrats is in a vegetated (bush) area and the other in a cleared non vegetated area. <u>You will be repeating the same tests on each quadrat.</u>



Parameter	Instructions	Bush	Class Average	Cleared	Class Average
Soil compaction	Using the wire compaction tool, carefully press the end into the soil until it becomes too difficult to insert further. Look at and record the depth using the markings on the wire.	cm	cm	cm	cm
Tree abundance	Count the number of trees, which are taller than 5 metres in each quadrat.				
Ground cover	Inside each quadrat, estimate the percentage of ground that is covered by plants.	%cover	%cover	%cover	%cover
Canopy cover	Using the boards with canopy cover charts and mirrors, estimate the average percentage canopy cover in each quadrat.	%cover	%cover	%cover	%cover

1. Explain how tree canopy cover, ground cover and root systems reduce the amount of stormwater runoff entering the river.

Canopy cover

Ground cover

Root systems

2. **As a class, walk to a steep section of a walking track.** Looking around, explain why there is more erosion on the steeper track.

Stormwater Mitigation Walk

3. List 3 methods of stormwater mitigation used at Brewongle.

1. 2. 3.

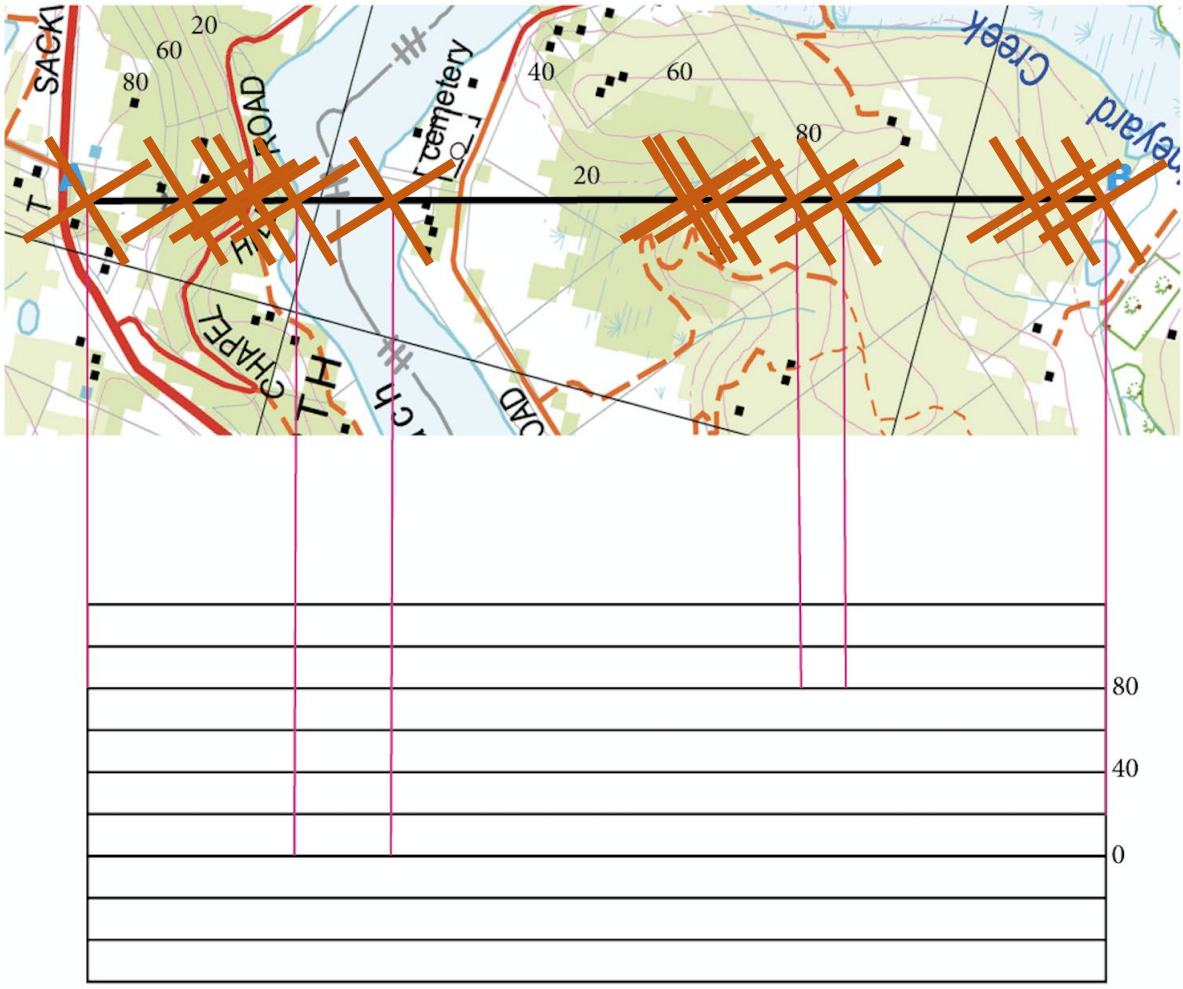
4. How does stormwater mitigation (slowing water down as it runs downhill) prevent erosion?

5. How do vegetation and stormwater mitigation combine to manage water quality?

Test your knowledge! Scan the QR code and take the quiz!

Post-visit activity one: Topography of the Hawkesbury River

1. Complete the cross-section by drawing lines from the contour interval to the corresponding graph line. + marks the contour lines.
2. Use the **word bank** below to label the geomorphic features of the landscape into the cross-section



Which side of the river (the steep side or the flatter side) contributes most to water turbidity? Why?

_____

_____

_____

_____

_____

_____

_____

Word bank

Brewongle Ridge

Lagoon Cemetery

Floodplain Gully

Chapel Hill Road

Post-visit lesson two: Fieldwork summary

How does topography influence water quality?

Describe a human process that has changed the availability of usable water in the Hawkesbury River.

What role does vegetation play in the health of a river system?

Post-visit lesson three: Processing the data

Below is a list of geographical tools used to collate, review and evaluate data and information. Choose at least 5 of these tools to analyse and present your data in a Word document.

The information you create here will be used in your documentary assessment task.

▪ Using ICT software, use a **topographic map** or **satellite image** as a base map, locate the Hawkesbury River at Brewongle and identify surrounding natural and human features.
▪ Collate data from your in-depth study into a **table** to summarise your findings.
▪ Create **flowcharts** to demonstrate your understanding of the ways water quality influences people and places.
▪ Assemble and annotate **photographs** to provide a visual representation of the site. Analyse and label interconnections.
▪ Develop **consequences charts** to explain human impacts (positive and negative) on the Hawkesbury Nepean River. Show the impacts on Google Tour Builder. Use photos taken on the day to match parts of the tracks we walked.
▪ Use a **T-chart** to represent data on advantages and disadvantages of population increases in the Hawkesbury Nepean River Catchment.
▪ Create a **mind map** summarising how different groups of people (stakeholders) value the Hawkesbury Nepean River. Include Traditional Owners, National Parks rangers, local residents, local farmers, recreational users and any others you can think of.
▪ Construct a **flow chart** or **concept map** to explain the role of government and other major stakeholders in sustainably managing the Hawkesbury Nepean River catchment.
▪ Research floods of the Hawkesbury Nepean River and create a **poster** to educate local residents about flood mitigation.

Assessment task:
Communicating geographical information

Work in small groups to develop a 5 - 6 minute video documentary on the environmental and human processes that form and transform water availability for the Hawkesbury Nepean River, using Sackville North as a field study. Your documentary should include:

- A clear description of the landscape features around Brewongle
- An evaluation of positive and negative human impacts on the Hawkesbury Nepean River
- Appropriate maps, satellite images, graphs, statistics, flowcharts, labelled photographs, diagrams, illustrations/sketches and other labelled visual representations
- Information on the traditional use of Dyarubin by Dharug people
- A description of who is responsible for the river – people, government, developers, conservationists, recreationists and local residents
- An evaluation of the potential impact of flood on the local area
- A description and justification of a course of action to decrease the impact of changes to the natural environment around Brewongle EEC.