Student name: _____

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 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 question:

How do natural processes and human activities influence water 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.

Pre-visit lesson one: Background information

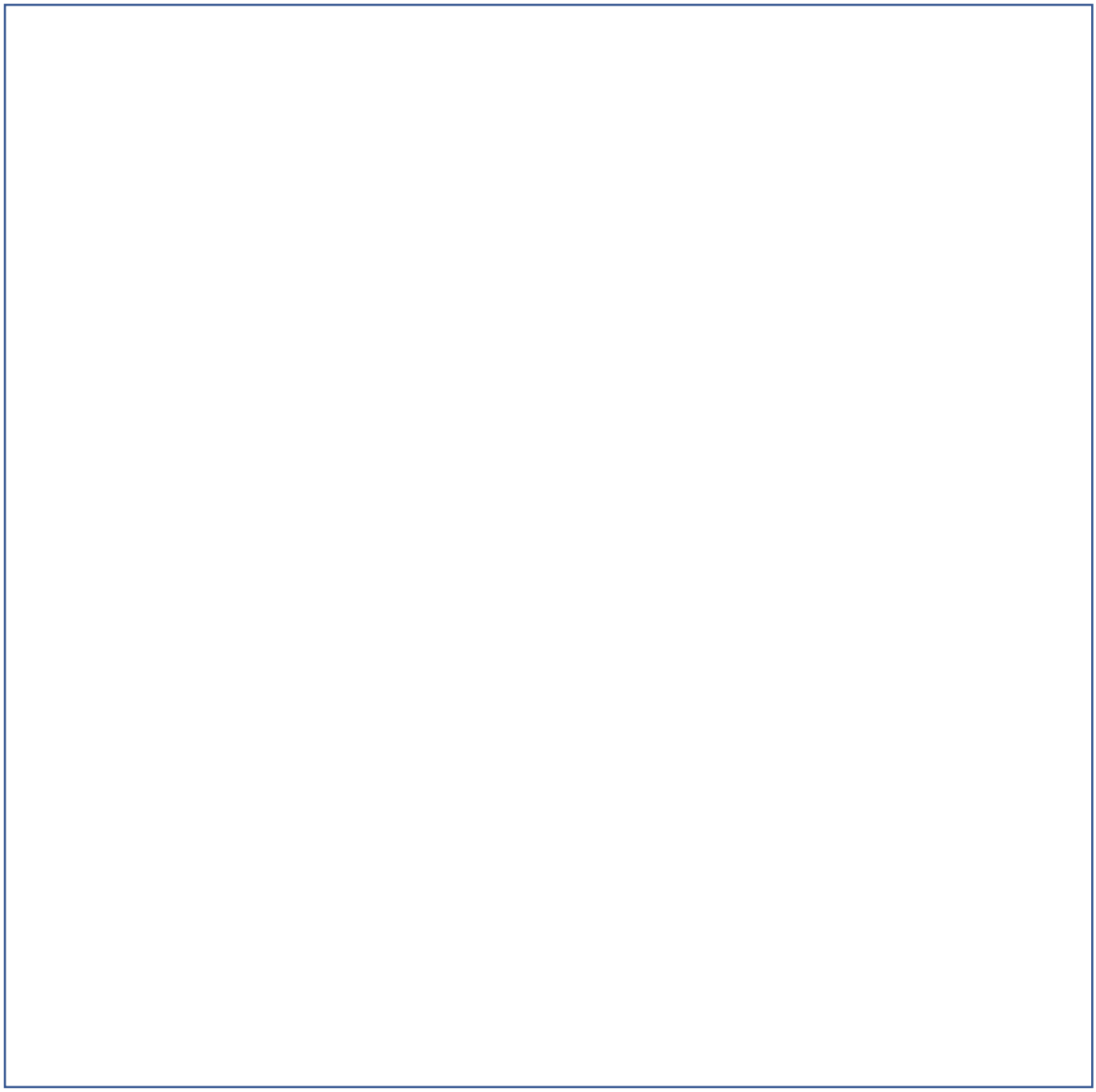
SIX Maps has been developed by the NSW Department of Land and Property. It provides access to cadastral (land and property boundaries) and topographic (hills and valleys) information, satellite data and aerial photography. Use SIX Maps to complete the following:

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

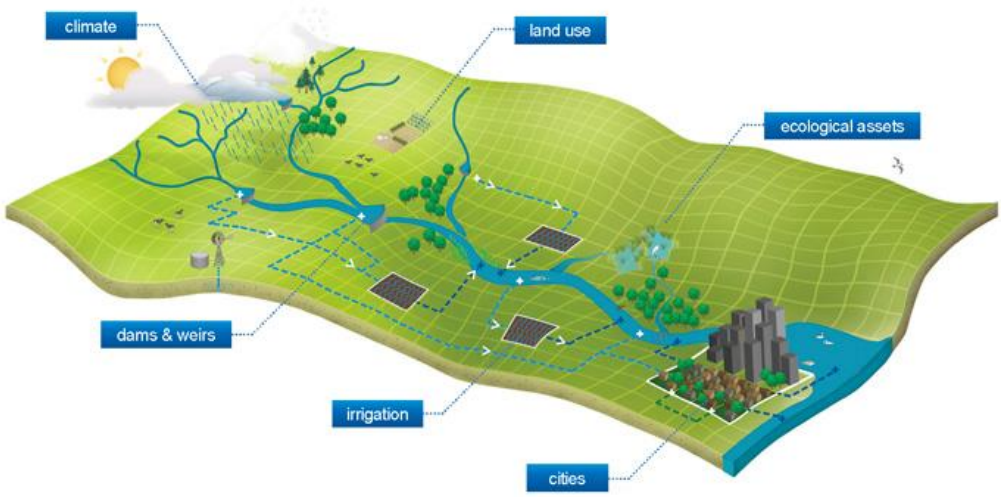
Pre-visit lesson two: The water cycle

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.)

Why is water important to the Sydney region?

Explain why the Hawkesbury-Nepean River is important to Sydney.

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 question. Your inquiry question is written on page 1.
Example: What are some human impacts on the Hawkesbury-Nepean River system?

Geographical question 1:

Geographical question 2:

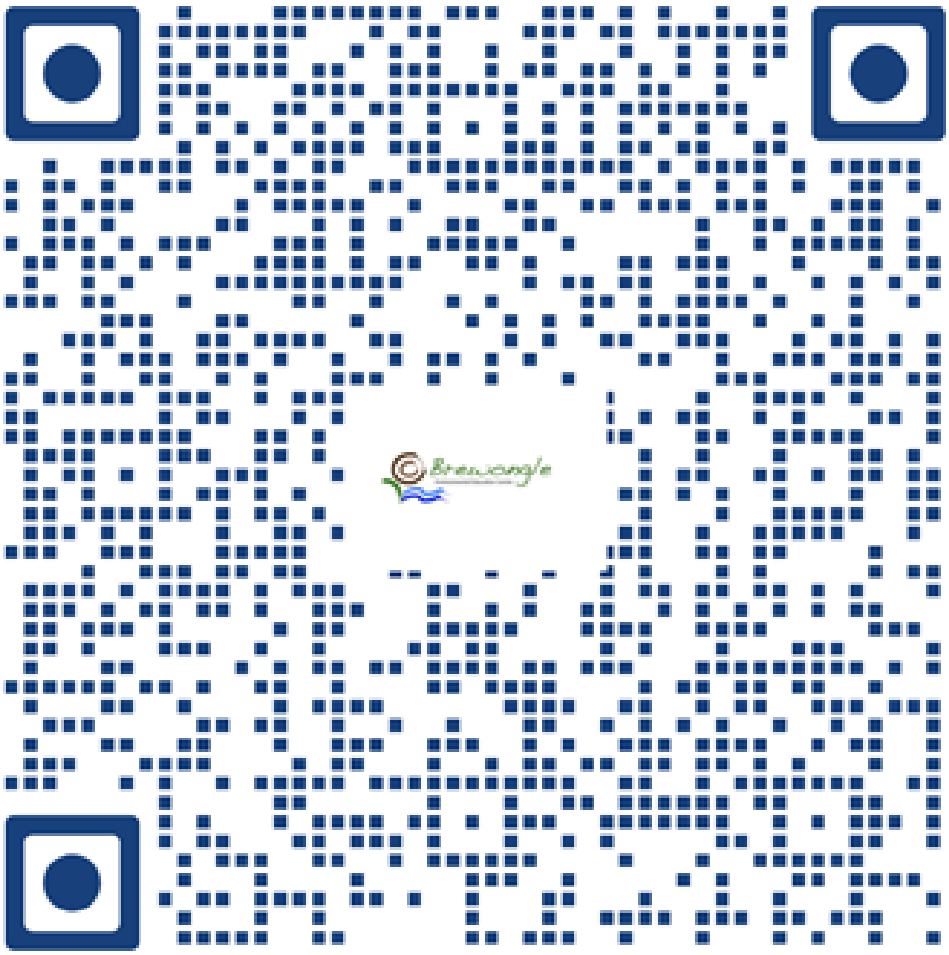
Geographical question 3:

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 geographical 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

Learning intention: Understand how to assess water quality using biological indicators of health.

Success criteria:

- Safely collect water bugs using a dipnet
- Identify water bugs using a water bug identification chart
- Draw conclusions about the health of the Brewongle ponds based on fieldwork evidence
- Explain why diversity of water bugs is more preferable than abundance in a water body

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 Sensitivity Rating		

WATER QUALITY RATING TOTAL
(Circle your result.)

45 + Excellent
30 - 44 Good
20 - 29 Fair
<20 Poor

What do the water bug sensitivity ratings refer to?

_____

_____

_____

_____

Is abundance or diversity of water bugs preferable in a water body? Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Water quality – Hawkesbury-Nepean River

Learning intention: Understand catchment functioning and the natural and human influences on water quality.

Success criteria:

- Use fieldwork equipment to conduct water quality tests
- Collect accurate data
- Analyse and interpret test results using environmental health guidelines
- Draw conclusions about the health of the Hawkesbury-Nepean River based on fieldwork evidence
- Identify the natural and human factors that effect the physical and chemical parameters

Dharug name for the river _____

Site Location _____

Date of tests _____

Physical parameters

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

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.

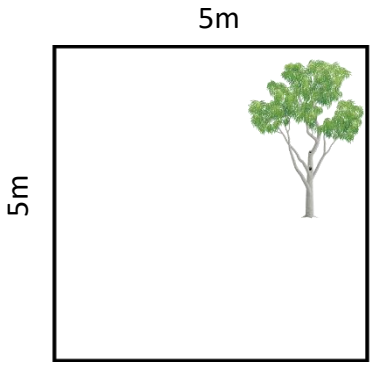
Water quality – Impact of vegetation on water quality

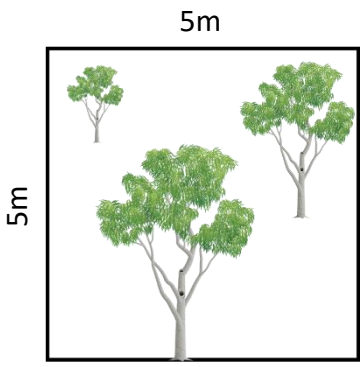
Learning intention:
Understand the importance of terrestrial vegetation to the health of waterways.

Success criteria:

- Use fieldwork equipment to conduct soil and vegetation tests
- Collect accurate data
- Explain the importance of terrestrial vegetation to the health of the Hawkesbury-Nepean River

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. You will be repeating the same tests on each quadrat.





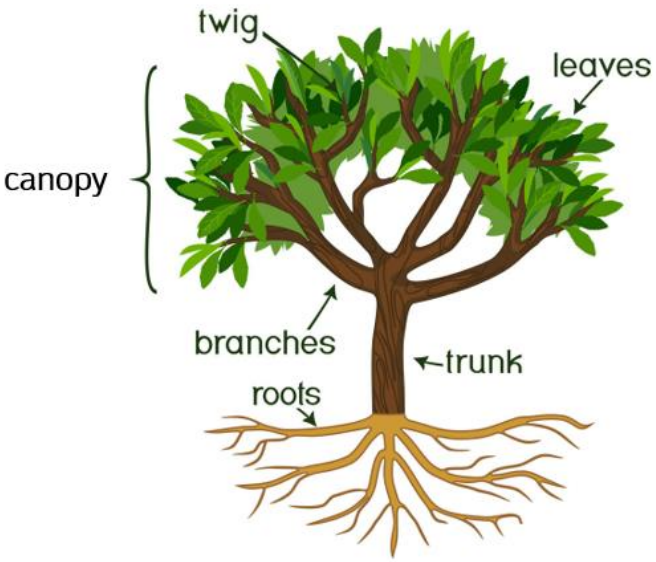
Parameter	Instructions	Cleared	Class average	Bush	Class average
Soil compaction	Using the wire compaction tool, carefully press the end into the soil until it becomes too difficult to insert further. Record the depth using the markings on the wire.	cm	cm	cm	cm
Tree/shrub abundance	Count the number of trees and shrubs 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 of 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



Water quality – Impact of topography on water quality

Learning intention:
Understand the impact of topography on water quality.

Success criteria:

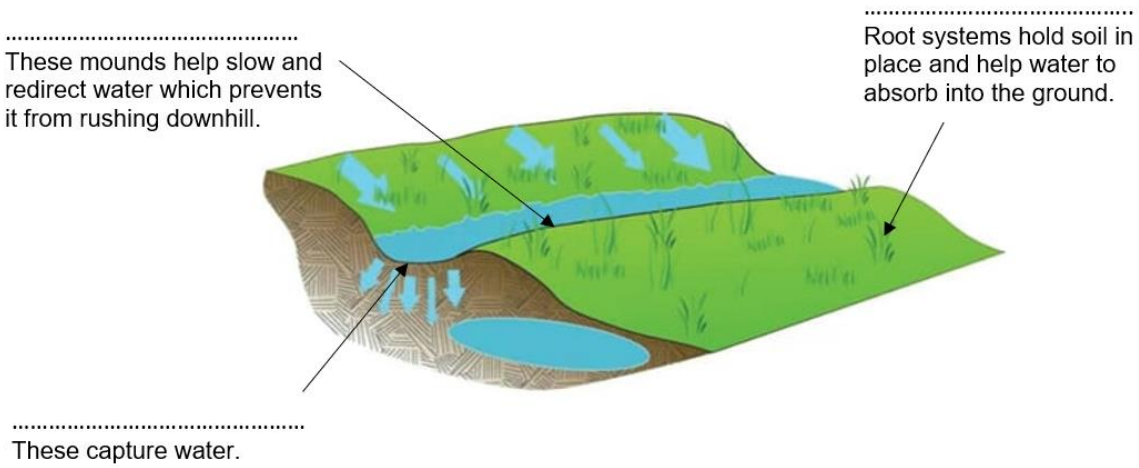
- Identify the features of the mitigation methods used to manage stormwater at Brewongle EEC
- Describe the importance of stormwater mitigation to managing water quality in the Hawkesbury River

Stormwater mitigation at Brewongle EEC

1.Using the words in the word bank, label the diagram of a swale below and complete the close passage.

Word bank:

	pollutants	swale trench	plants
mitigation	runoff	infiltration	swale berm



Storm water …….. protects water quality in the Hawkesbury-River by slowing down …… and promoting natural filtration. Water is slowed down and diverted using swales, trenches and stormwater drains. Plants, gardens and rock trenches increase ……... By reducing the amount of runoff entering the river, stormwater mitigation methods reduce the amount of ……. and sediments entering the water leading to a healthier river system.

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