Name:…….. **Class:** ……..

Earth's natural systems

Checking the pulse of the Hawkesbury River

Geographical questions:

1. How have natural processes, cycles and circulations shaped the Hawkesbury River and its surrounding land?
2. How have human activities influenced the natural processes, cycles and circulations that have shaped the Hawkesbury River and its surrounding land?

Outcomes

GE-11-01 examines places, environments and natural and human phenomena, for their characteristics, spatial patterns, interactions and changes over time
GE-11-02 explains geographical processes and influences, at a range of scales, that form and transform places and environments
GE-11-05 analyses and synthesises relevant geographical information from a variety of sources
GE-11-07 applies geographical inquiry skills and tools, including spatial technologies, fieldwork, and ethical practices, to investigate places and environments
GE-11-08 applies mathematical ideas and techniques to analyse geographical data
GE-11-09 communicates and applies geographical understanding, using geographical knowledge, concepts, terms and tools, in appropriate forms.

Geographical tools

- Analyse and interpret various maps
- Use spatial information to determine connections, impacts and change over time
- Use fieldwork instruments to identify, collect and record geographical data and information
- Synthesise and interpret fieldwork data.

Pre-excursion activities

Access the Earth's natural systems website https://brewongle-e.schools.nsw.gov.au/student-learning/secondary/stage-6/checking-the-pulse-of-the-hawkesbury-river.html to complete the pre-excursion questions and lessons.

Health and safety

As you are working out in the field you need to be aware that:

- Ground materials can be slippery
- Edges of the river can be quite deep and muddy
- Some animals can deliver painful or venomous bites.

While kayaking

- PFD supplied by Brewongle EEC must be worn at all times while in the water
- Enclosed shoes must be worn in the water and kayaks
- You will need to bring a change of clothes, footwear, hat, towel, water bottle and sunscreen
- You must behave appropriately at all times and follow safety instructions.

Context

Use the context page of the Brewongle Stage 6 Geography Earth's Natural Systems website and your own research to complete the following questions. https://sites.google.com/education.nsw.gov.au/earths-natural-systems/pre-visit/context

1. What is a catchment?

   ……

   ……

2. Describe the Hawkesbury Nepean Catchment.

   Location: ……

   Size: ……

   Natural habitats: ……

   ……

3. Explain why maintaining the health of the Hawkesbury-Nepean River is so important. (Consider it's environmental, social and economic significance.)

   ……

   ……

   ……

   ……

   ……

   ……

   ……

   ……

4. Read the document titled *Natural Resource Management Issues in the Hawkesbury Nepean Catchment*. Consider how you and/or your school might be contributing to the following issues and provide examples in the lines provided. The first example has been completed for you.

   a) Issues affecting river health:

   E.g. We consume the drinking water that is extracted from the Hawkesbury-Nepean Catchment.

   ……

   b) Issues affecting biodiversity:

   ……

   ……

   c) Issues effecting soil and land:

   ……

   ……

   d) Issues associated with climate change:

   ……

   …… …..

Pre-visit lessons

There are FIVE additional pre-visit lessons that have also been designed to support this excursion and the topic Earth's natural systems. These lessons further investigate the natural processes, cycles and circulations that have shaped the Hawkesbury River and its surrounding land as well as the human activities that have influenced these natural processes, cycles and circulations. These lessons can be accessed using the following link. https://sites.google.com/education.nsw.gov.au/earths-natural-systems/pre-visit

Activity 1:

Riverbank erosion risk assessment

Learning intention:
Understand the importance of riparian zones to the health of waterways.

Success criteria:

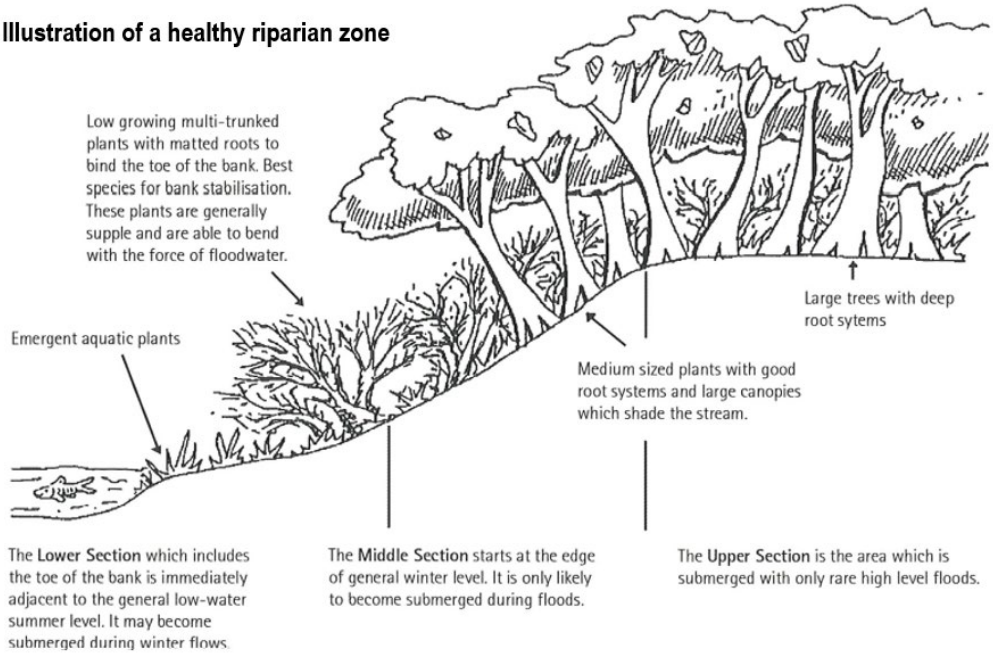
- Recognise the features of a riverbank that make it more susceptible to erosion
- Complete an erosion risk assessment checklist for two different sites along the Hawkesbury River
- Explain the importance of riverbank vegetation to the health of the Hawkesbury River

Riverbanks and riparian zones link terrestrial and aquatic habitats and play a key role in determining the health of a waterway.

Healthy riverbanks and riparian zones:

- filter sediments and nutrients entering our waterways
- stabilise the soil, reducing erosion
- provide vital habitat for various species, supporting biodiversity
- help regulate water temperature and influence local climates.

Illustration of a healthy riparian zone



Source: https://cdn.environment.sa.gov.au/greenadelaide/images/Riparian-habitat-assessment.pdf

Undertaking a riverbank erosion risk assessment can help locals, governments and organisations identify areas at risk and manage those areas accordingly to reduce damaging the health of the river.

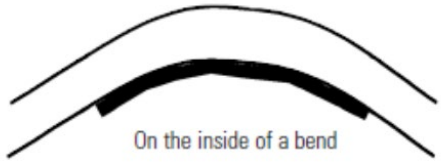
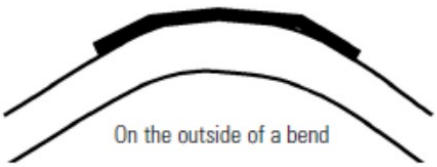
Using the following riverbank erosion risk checklist, you are going to assess the risk of erosion at TWO different sites along the Hawkesbury River while paddling in kayaks.

Photograph - Study site 1

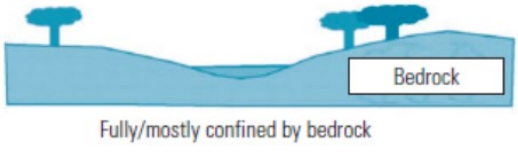
Photograph - Study site 2

This checklist has been adapted from 'Guidelines for monitoring riverbank health in the Hawkesbury Nepean' (2002), NSW Department of Land and Water.

1. Riverbank site location

	Site 1	Site 2
Is your riverbank site located mainly:  On the inside of a bend	Score: 0	Score: 0
 On a straight reach of the river	1	1
 On the outside of a bend	3	3
Your score		

2. River landform description

Is the river or stream at your site best described as:	Site 1	Site 2
 Fully/mostly confined by bedrock	Score: -2	Score: -2
 Partly confined by bedrock	-1	-1
 Unconfined (floodplain present) with no obvious levee banks	2	2
 Unconfined (floodplain present) with obvious raised levee banks	3	3
Your score		

3. Bank shape

Which of the following best describes the overall shape of your riverbank at the site? (choose only one).	Site 1	Site 2
 Gently sloping = 0	Score:	Score:
 Convex = 1		
 Concave = 2	(See images)	(See images)
 Stepped = 2		
 Near vertical = 3		
 Undercut = 3		
Your score		

4. Bank sediment types

How would you describe the general nature of your riverbank? **(Choose 1)**	Site 1	Site 2
	Score:	Score:
• Bedrock (the sides of the river or stream channel are lined with solid bedrock)	-3	-3
• Boulders or cobbles (rock material greater than 60mm in diameter)	-1	-1
• Bedrock at the base (toe) of the bank but other material above	0	0
• Gravelly (bank material diameter between 2 – 60mm)	1	1
• Clayey	2	2
• Sandy	4	4
Your score		

5. Riverbank vegetation – erosion protection

Amount of riverbank vegetation: **(Circle a score for <u>each</u> bullet point)**	Site 1	Site 2
	Score:	Score:
• Reeds, sedges and rushes present along more than half of the length of the riverbank **at the site and in and/or just above the water shallows**:	Yes = -1, No = 1	Yes = -1, No = 1
• More than half of **the base (toe)** of the riverbank contains trees and/or shrubs, ferns and grasses:	Yes = -2, No = 1	Yes = -2, No = 1
• More than half of **the slope of the riverbank** is covered with trees and/or shrubs, ferns and grasses.	Yes = -1, No = 1	Yes = -1, No = 1
• More than half of the top of the bank is covered with trees and/or shrubs.	Yes = -1, No = 1	Yes = -1, No = 1
Your score		

Site 1 results:

Generate your final erosion risk score

Question number	Score	Question number	Score	Question number	Score
Q1 Site location		Q3 Bank shape		Q5 Riverbank vegetation	
Q2 Landform description		Q4 Bank sediment type		**Total Score**	

Assign an erosion risk class (circle your result)

Erosion Risk Class	Description of Risk
☐ Total score = -10 to -1 Erosion risk – Class 1	**Low erosion risk** – bank naturally not prone to serious erosion
☐ Total score = 0 to 8 Erosion risk – Class 2	**Medium erosion risk** – bank has the capacity for serious erosion unless managed
☐ Total score = 9 to 17 Erosion risk – Class 3	**High erosion risk** – bank is highly susceptible to erosion even under natural conditions. It requires careful management to help reduce erosion.

Site 2 results:

Generate your final erosion risk score

Question number	Score	Question number	Score	Question number	Score
Q1 Site location		Q3 Bank shape		Q5 Riverbank vegetation	
Q2 Landform description		Q4 Bank sediment type		**Total Score**	

Assign an erosion risk class (circle your result)

Erosion Risk Class	Description of Risk
☐ Total score = -10 to -1 Erosion risk – Class 1	**Low erosion risk** – bank naturally not prone to serious erosion
☐ Total score = 0 to 8 Erosion risk – Class 2	**Medium erosion risk** – bank has the capacity for serious erosion unless managed
☐ Total score = 9 to 17 Erosion risk – Class 3	**High erosion risk** – bank is highly susceptible to erosion even under natural conditions. It requires careful management to help reduce erosion.

Activity 1

Discussion question

1. Explain the importance of riverbank vegetation to the health of the Hawkesbury River.

……

……

……

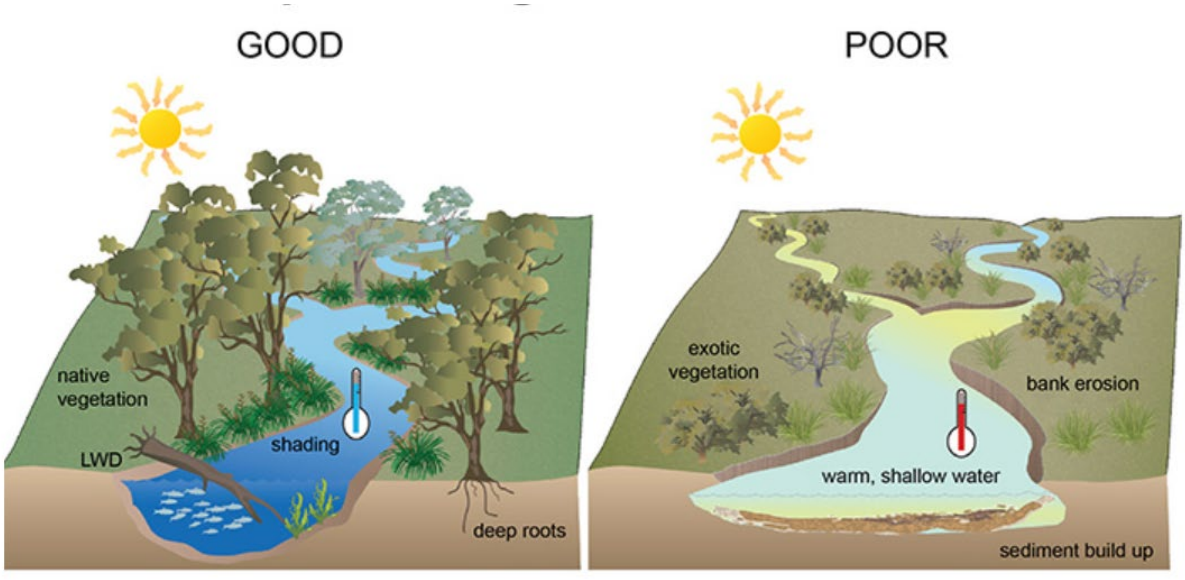
……

……

……

……

……



Good vegetation will contract and deepen the channel
Deep roots help maintain bank structure and stability, and reduce erosion
Large woody debris (LWD) provides habitat

Without vegetation, the channel will become wider and shallower
Absence or loss of vegetation increases channel instability and erosion
An absence of LWD reduces habitat

Source: https://water.dpie.nsw.gov.au/science-data-and-modelling/surface-water/monitoring-changes/nsw-river-condition-index

Activity 2:

Water quality assessment

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 River based on fieldwork evidence
- Identify the natural and human factors effecting the health of the Hawkesbury River

The Hawkesbury River is part of a larger system known as the Hawkesbury-Nepean Catchment. It is one of the largest coastal basins in NSW, covering about 21,400 square kilometres.

Human activities that occur in the catchment such as land clearing, development, sewage disposal, agriculture and industrial waste disposal all have an impact on the river's health. In future, the river will face additional pressure due to population growth and land use changes.

Because of it's social, environmental and economic significance, it is crucial to undertake regular water quality testing of the Hawkesbury River. This will ensure that water quality is managed and maintained, and that that future communities in this area will continue to benefit from the services provided by this ecosystem.

Water quality assessment field data			
Location:			
Sample collection time:		Sample collection date:	
Weather conditions (previous 24 hours):		Weather conditions (previous 48 – 120 hours):	
Date of last rain:		Rainfall (mm):	
Tide: ebb tide (running to low) OR flood tide (flowing to high)			
River width:			

On water tests				
	Site 1	**Site 2**	**Site 3**	**Average**
Surface temperature				
Secchi depth (Turbidity)				
River depth				

Physio-chemical water quality parameters			
Parameter and units of measure	**ANZECC trigger values for ecosystem protection**	**Result**	**Discussion/possible causes of these results**
Temperature °C	N/A		
pH (Potential of Hydrogen)	6.5 – 7.5		
DO (Dissolved Oxygen) mg/L	>5		
DO (Dissolved Oxygen) % saturation	85 - 110		
Electrical Conductivity uS/cm (Micro-siemens per cm)	200 - 300		
Turbidity Ntu (Nephelometric Turbidity Units)	<50		
PO_4 (Phosphates) mg/L	0.02		
NOx (Nitrates) mg/L	0.04		

Water quality assessment results analysis

Parameter	Natural causes	Human causes
Temperature	• Seasons • Climate • Sunlight/shade provided by trees and plants • Turbidity: high levels of turbidity increase water temp	• Increases in turbidity due to human activities such as land clearing • Roads and rooves: dark surfaces increase heat • Human induced climate change
PH	• Rainfall is slightly acidic • Geology: rock types in the catchment. E.g. sandstone • Photosynthesis and decomposition can influence carbon dioxide levels which can change PH • Soil runoff	• Fertilisers • Treated sewage • Washing powder and detergents • Higher than natural levels of acidic rain due to carbon emissions • Mining, industrial and agricultural runoff
Dissolved oxygen	• Temperature – cold water can hold more D.O. than warm water • Photosynthesis releases oxygen into the water • Eutrophication: increases in algae causes a lack of sunlight to enter the water which reduces oxygen	• Decomposition of organic waste requires oxygen. Waste entering the water as a result of human activities (e.g. fertilisers, runoff from farms and urban areas, sewage and land clearing) can reduce oxygen levels
Electrical conductivity Dissolved charged ions. E.g. calcium, potassium, chloride, sulphate and nitrate.	• Tide • Rainfall • Geology: rock types in the catchment. E.g. sandstone. • Water table	• Sewage including treated sewage • Washing powder and detergents • Water table changes due to land clearing and irrigation
Turbidity Refers to clarity or cloudiness of water. Caused by large numbers of individual suspended particles.	• Storms, rainfall and runoff • Algae • Fires leading to exposure of soils	• Boating • Clearing in the catchment • Urbanisation leading to more runoff • Introduced species such as carp. These fish are bottom feeders • Fires leading to exposure of soils
Phosphates and nitrates	• Phosphorous rich bedrock • Animal waste • Decomposing plant matter	• Human and animal waste • Faulty sewage systems • Fertiliser • Washing powder and detergents • Urban and industrial runoff

Activity 2

Discussion questions

1. Did your water quality test results identify any areas of concern? If so, list these below.

……

……

……

2. Research the possible human and natural causes of these results.

……

……

……

……

……

……

……

……

……

……

……

Activity 3:

Vegetation classification

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

Success criteria:

- Use fieldwork equipment to measure and collect abiotic data
- Identify tree vegetation using a tree identification chart/booklet
- Use fieldwork data to identify the dominant vegetation type at Brewongle
- Explain the importance of terrestrial vegetation to the health of the Hawkesbury River

The terrestrial vegetation of the Hawkesbury-Nepean Catchment is remarkably diverse. As well as providing a habitat and food source for a large range of animals, terrestrial vegetation also plays an important role in the water cycle, which helps maintain the health of the river system.

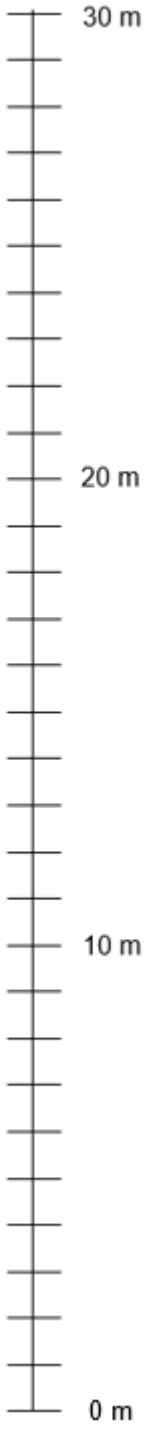
The diversity of the flora within the catchment is largely due to variations in soil moisture content. Geology, soil properties, climatic conditions such as rainfall and temperature, topography and the availability of sunlight can all influence soil moisture content.

Using the table below and the transect over the page, record the abiotic conditions as well as the tree species found at Brewongle. Using this information, classify the dominant vegetation type found at Brewongle.

Abiotic Components					
	Method	**Group 1**	**Group 2**	**Group 3**	**Mean result**
Slope	Use clinometer – blue colour. Measure in degrees				
Aspect	Use compass. Find north using the north pointer. Use north to work out which direction your slope is facing.				
Canopy cover	Use canopy mirror. Measure in percentage.				
Leaf litter	Place trowel into the centre of leaf litter. Take measurement from the centre of the trowel in centimetres.				
Soil type	Assess the soil type using the instructions in the laminated handout.				

Vegetation transect

Date: …….. **Time:** …….. **Conditions:** ……..……..



Key
Tree name and symbol
•
•
•
•

<table>
<tr><th colspan="2">Terrestrial vegetation types found in the H.N. Catchment</th></tr>
<tr><td><u>Warm Temperate Rainforest</u>
Features: Highly shaded and higher amounts of rainfall which leads to more soil moisture retention.
Dominant tree/plant species:
Sassafras (Doryphora sassafras)
Coachwood (Ceratopetalum apetalum)
Lilly Pilly (Acmena smithii).
The ground layer of these rainforests is often covered in ferns.</td><td><u>Wet Sclerophyll Forest</u>
Features: Occur in moister areas with rainfall amounts typically over 900mm per year.
Dominant tree/plant species:
Black Butt (Eucalyptus pilularis)
Sydney Blue Gum (Eucalyptus saligna)
Rose gum (Eucalyptus grandis)
Vines, creepers and ferns are common in the understory.</td></tr>
<tr><td><u>Sydney Montane Dry Sclerophyll Forest</u>
Features: Occur on quartz-rich sandstone soils. Generally receives more than 1000 mm of rainfall per year.
Dominant tree/plant species:
Blue Mountains Ash (Eucalyptus oreades)
Silvertop Ash (Eucalyptus sieberi)
Stringybark (Eucalyptus blaxlandii)
Sydney peppermint (Eucalyptus piperita)</td><td><u>Sydney Hinterland Dry Sclerophyll Forest</u>
Features: Occur on sandstone slopes and ridges. Generally receives less than 1000 mm of rainfall per year.
Dominant tree/plant species:
Grey myrtle (Backhousia myrtifolia)
Yellow bloodwood (Corymbia eximia)
Grey gum (Eucalyptus punctata)
Iron bark (Eucalyptus crebra)</td></tr>
<tr><td colspan="2">Terrestrial vegetation type found at Brewongle EEC:</td></tr>
</table>

Activity 3

Discussion question

1. Explain the importance of terrestrial vegetation to the health of the Hawkesbury River. In your response, you must refer to the role vegetation plays in the water cycle.

……

……

……

……

……

……