

Teacher Strategies for ESRI Maps

Focus: This teacher resource provides a range of inquiry strategies to use with the ESRI maps to develop students' geographical thinking about the Hawkesbury-Nepean Valley. It considers the main rivers and tributaries that create the bathtub effect and provides students with opportunities to gather geographical data about the valley, the floodplain, and potential and historic flood levels. This allows students to apply geographical concepts about interconnection, scale, direction, topography and environmental change. These tasks are intended to be inquiry based, geographical challenges for students to work collaboratively in groups to solve and apply their geographical skills.

ESRI has created 12 static maps of the Hawkesbury-Nepean Valley, specifically for this resource. These maps are available on the NSW SES website.

ESRI has also created a dynamic online mapping resource for use with this resource. To access this free online GIS tool please use the links available on the NSW SES website.

Inquiry Questions:

- What is a catchment?
- What is a valley?
- What are the main rivers and tributaries that flow across the Hawkesbury-Nepean Valley?
- What types of vegetation, landforms and water bodies exist in the Hawkesbury-Nepean Valley?
- How can we interpret topographic maps?
- Where are places and spaces within the Hawkesbury-Nepean Valley?
- What is scale and how do we use scale when reading maps?
- How can we use direction, location and position to understand the Hawkesbury-Nepean Valley?
- How have historic floods effected the Hawkesbury-Nepean Valley?
- How does the population density and distribution affect land use and future management of the Hawkesbury-Nepean Valley?

Map 1 Overview

- In groups identify the rivers and main tributaries of the Hawkesbury-Nepean Valley Catchment.
- Using a piece of string and the linear scale measure the distance of these rivers shown on this map.
 - Nepean River
 - Hawkesbury River
 - Warragamba River
 - Colo River
 - Coxs River
 - How does scale on a map help you to understand distance?
 - What are some of the limitations of using this map to estimate river distance/lengths?

Geographical Challenge

Identify which direction the water from these rivers and tributaries flows within the Hawkesbury-Nepean Catchment and what geographical data suggests this.

Map 2 Vegetation

- In groups describe the types of vegetation that you can detect in the Hawkesbury-Nepean Valley and how you can identify this.
- What type of map is this?
- Explain how you can tell the height, slope and gradient of the land in the Hawkesbury-Nepean Valley using this map.

Map 3 Water Infrastructure

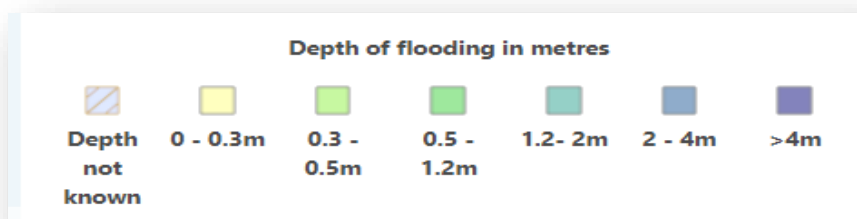
- In groups identify these features of water infrastructure:
 - Warragamba Dam
 - Victoria Bridge
 - Yarramundi Bridge
 - North Richmond Bridge

Geographical Challenge

Predict what would happen to these bridges in the event of a flood in the Hawkesbury-Nepean Valley.

Research the heights of these bridges and the normal river heights at these points and complete the table below showing the levels these bridges would become inundated by reviewing the predicted depth of different floods within the Hawkesbury-Nepean Valley.

- Use the following information from the Australian Bureau of Meteorology to interpret actual current river height data.
http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDN60143.html
- Use the map tool from NSW SES site to investigate flood depths for different locations for different flood events.
<https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/>
- Teaching Tip: use the legend of the NSW SES map below to identify the depth of flooding in metres.



Bridge/	Current bridge height in metres.	Normal river height in metres.	Predicted depth of flooding for high likelihood (98% chance of happening once in an 80-year life time) in metres.	Predicted depth of flooding for medium likelihood (55% chance of happening once in an 80-year life time) in metres.	Predicted depth of flooding for low likelihood (15% chance of happening once in an 80-year life time) in metres.

Victoria Bridge					
Yarramundi Bridge					
North Richmond Bridge					

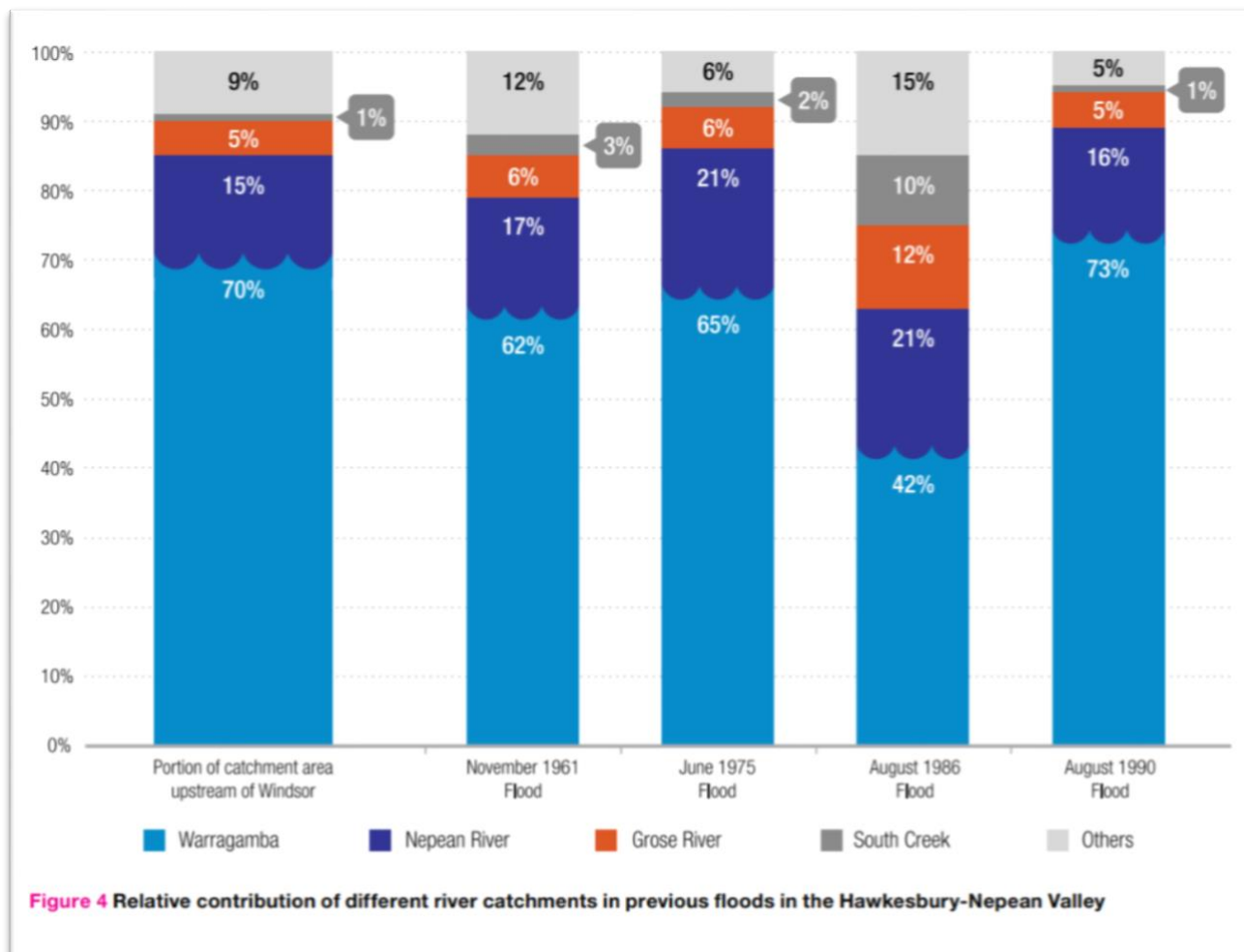
Map 4 Historic Flood

- In groups identify what locations have been affected in the Hawkesbury-Nepean Valley by historic floods.
- What do you notice about the locations of where historical flooding has clustered?
- As a group explain why you think historical flooding has affected these places and spaces.
- Consider the bathtub effect, flow of the rivers and main tributaries, the topography and historic and current data from Infrastructure NSW from the sites below:

<http://insw.com/media/1393/insw-factsheet-flooding-in-the-hawkesbury-nepean-valley.pdf>

http://www.infrastructure.nsw.gov.au/media/1534/insw_hnvfloodstrategy__1_v2.pdf

Teaching Tip: use Figure 4 of the Resilient Valley, Resilient Communities Hawkesbury-Nepean Valley Flood Risk Management Strategy (2017) published by Infrastructure NSW to help students understand the map and the contributions to historic flooding from different rivers and main tributaries. This is a useful cross curriculum content link with K-10 Mathematics Curriculum.



Maps 5, 6 & 7 Richmond; 8, 9, 10 Penrith; 11, 12, 12 Wallacia; 13, 14, 15 Windsor.

- In groups use maps showing the vegetation, historic flood data and population relating to Richmond, Penrith, Wallacia and Windsor to create a brief profile of the natural, historic and urban features of this area.

Geographic features	Richmond	Penrith	Wallacia	Windsor
Vegetation and landforms				

Historic flood data				
Urban density				

Using these maps and the data/profiles collected consider the following discussion geographical questions;

- What locations are more susceptible to flooding based on the topography and historic flood data?
- How might different suburbs such as Richmond, Penrith, Wallacia and Windsor be affected by a future flood event?
- What are some of the factors that communities in these areas should know about the potential for flood events?
- Why is it important to understand the geographic features of places?

Geographical Challenge

What recommendations would your group make to local councils, state government agencies and developers about future urban density and distribution in these areas based on this data?