

## Flooding in the Hawkesbury-Nepean Valley

A new Secondary Geography resource, using a case study to teach 'Water in the World'

Source: <https://www.ses.nsw.gov.au/for-schools/secondary/water-in-the-world/>

Image: Shutterstock

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Western Sydney University has developed an innovative, high-quality, teacher-adaptable resource which is freely available to all, online, through the NSW SES website. The resource was developed on behalf of NSW SES in collaboration with Infrastructure NSW and ESRI. It aligns to the Australian Curriculum: Geography and the NSW Geography Syllabus K–10 (2015) to teach the topic in Stage 4 "Water in the World".

Teachers, students and residents in the Hawkesbury-Nepean Valley flood zone will benefit from this resource, as well as the broader community, and anyone who has an interest in flood patterns and also wants to discover about natural hazard risk or what they can do to prepare in the event of a flood. Teachers of geography who would like to adopt a skills-based or problem-based approach to teaching "Water in the World" are also beneficiaries, as well as those who would like to adapt the skills lessons to suit their own local environment.

### The link

To find the resource, go to the NSWSES website and look under the "For Schools" link, and you will find "Water in the World" in the "Secondary" section. There are six sub headings with a unit of work, teacher resources, primary sources, useful links and interactive materials.

<https://www.ses.nsw.gov.au/for-schools/secondary/water-in-the-world/>

### About the resource

This resource has been designed to develop student knowledge of flooding within the unique context of the Hawkesbury-Nepean Valley, by;

- considering the history of flooding
- presenting research on flood patterns
- using data and projections developed as part of the Flood Study 2017 'Hawkesbury-Nepean Valley Flood Risk Management Strategy' (2017)
- using scenarios to work through real-world problems relating to flood risk
- using cross-curriculum content particularly Science, English, Maths and History to explore flooding in the Hawkesbury-Nepean Valley
- delivering a model for high-quality fieldwork experiences
- developing geographical skills
- using an inquiry-based approach

# RESOURCE: WATER IN THE WORLD

- using a problem-based approach to dealing with the complex issues around flood risk, risk management, preparation and resilience within flood prone communities.

## Sample skills lesson

**Geographical Skills**

**Overview**

**Focus:**

These resources focus on developing students' competence and capability in applying geographical tools and skills. These tools include mapping, direction, scale, climate graphing and interpreting data. Geographical concepts such as scale, place, environment, change and interconnection are addressed. Students are given practical examples that relate to the Case Study of the Hawkesbury-Nepean Valley.

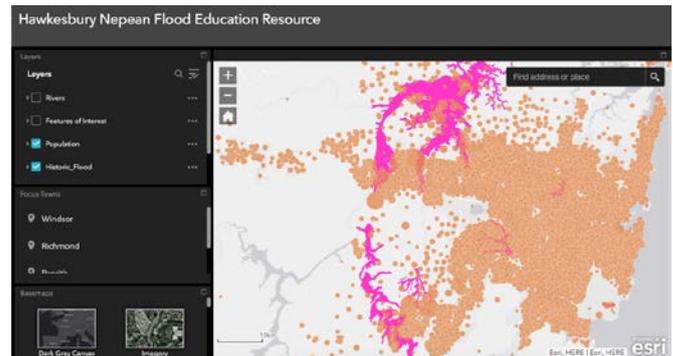
**Inquiry Questions:**

- How can I evaluate information sources for their reliability and usefulness?
- How can I represent data in a range of appropriate forms, with and without the use of digital and spatial technologies?
- How can I represent the spatial distribution of different types of geographical phenomena by constructing maps at different scales that conform to cartographic conventions, using spatial technologies as

**Teacher Resources**

- Geographical Skills All Tasks
- Skill 1 Location & Direction
- Skill 2 Interpreting Maps & Scale
- Skill 3 Climate & Weather

## ERSI – Hawkesbury-Nepean Flood Education Resource – interactive layers



Source: <https://hnvalley.maps.arcgis.com/apps/webappviewer/index.html?id=03d9a837718941ee950da668888ed607>

## The Bathtub Effect

The unique geomorphic features of the Hawkesbury-Nepean Valley make it particularly vulnerable to dangerous, fast rising floods. In the event of an East Coast Low weather system, where extensive rain is dumped on the Sydney region, the cumulation of water into the Hawkesbury-Nepean Valley can be large. The location of this system at the base of the Blue Mountains causing run off, as well as the five tributaries (Warragamba, Nepean, Hawkesbury, Grose Rivers South Creek) flowing into the Valley result in high volume water flows with significant pressure. Further, the narrowing of the Sackville Gorge towards the north of the catchment causes downstream flowing water to build up at this narrow point rapidly and to flow backwards. This is called the 'Bathtub Effect'. The Sackville Gorge acts a drain or 'plug hole' that results in a very slow release of the floodwaters as well as deep water backflow. Further, deep floodwaters can be affected by wind, creating waves, eddying currents, wind chop and other damaging water phenomena. The appearance of 'flood islands' during flood events also cause concern, as these islands may not be as safe as they appear. Flood islands can be cut off from evacuation routes and eventually consumed. In summary, the potential for danger in such a system is considerable, and the lack of recent flood activity may have resulted in increased complacency in the local population, and long drought periods increase the risk, as ground saturation levels are low, and water does not absorb readily.

The resource features an animation video that explains the bathtub effect, entitled "What makes flooding in the Hawkesbury-Nepean Valley so dangerous?". Teachers may choose to start with this clip as a stimulus for inquiry, or to use this clip to check student understanding after they investigate the Valley using maps, historical accounts and data from the Bureau of

## The Hawkesbury-Nepean Valley

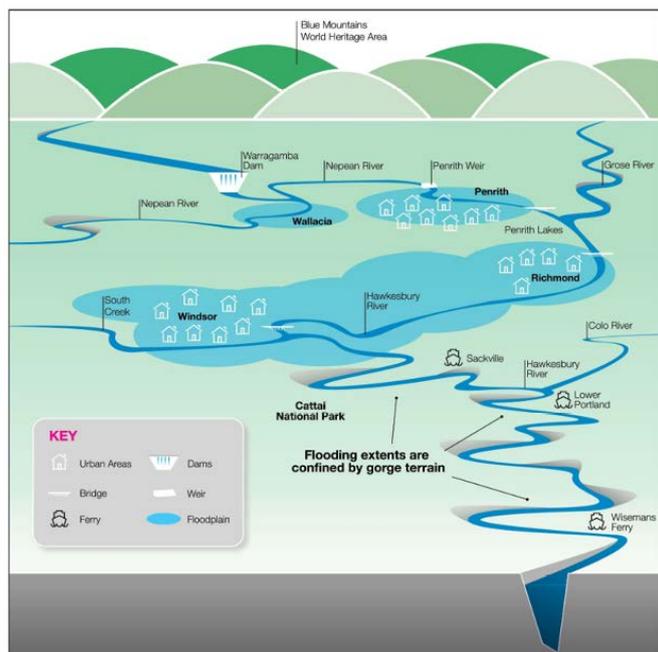
The Hawkesbury-Nepean Valley is the longest coastal catchment in Australia, with a river system of more than 470 kilometres stretching from Goulburn to Broken Bay. It provides more than 90% of Sydney's drinking water supply and is over 22,000km<sup>2</sup>. The Hawkesbury-Nepean Valley has formed over millennia through regular flooding, and also has tidal influence up to 145Km upstream. The largest flood recorded was in 1867 and reached a maximum level of 19.7 metres in Windsor. There were multiple fatalities during this flood and significant shock to community relating to the severity and destructive nature of this particular flood. The most recent major flood was in 1990, however there have been regular destructive flood events in the years prior to this. Aboriginal accounts of flooding in the region pre-colonisation exist and early British explorers saw evidence of flooding on the Hawkesbury river in the form of flood debris high in trees.

Flooding events, whilst destructive, have also made this land ideal for agriculture, as the soil is enriched with silt and many areas are low and flat which make it useful for farming. Early British accounts of this region describe in detail agricultural practices, use of the river system, the impact of flooding and the dependency of the Sydney Colony on the Hawkesbury-Nepean Valley for produce. In recent decades, however, changing land use patterns have resulted in a rise in population density with large numbers of houses and businesses being built in these areas. At present there are up to 134,000 people residing in the floodplain who may require evacuation (Resilient Valley, Resilient Communities Hawkesbury-Nepean Valley Flood Risk Management Strategy 2017).

# RESOURCE: WATER IN THE WORLD

Meteorology website (which can be found under “Useful Links”). Link to the clip: <https://www.youtube.com/watch?v=28SN9KixO2I&feature=youtu.be>

## The Bathtub Effect



View the bathtub effect video here <https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/>

## The brief

The brief was ambitious; the resource aims to deal with ‘difficult’ and ‘complex’ geographical problems that are authentic and require critical thinking and problem solving skills to resolve. Social research conducted by INSW and NSWSES suggests that **70%** of Hawkesbury-Nepean Valley residents are UNaware of their flood risk (2004), and that a large percentage of young people would engage in potentially risky behaviour in the face of flooding. Recent data from the Townsville flooding (2019) shows that only 50% of the population responded when instructed by SES to evacuate.

## The process

GTA NSW was a valued participant on the Schools Advisory Committee which monitored the project and advised on methodology and best practice. A writing team was assembled by Expressions of Interest from Government, Catholic and Independent sectors, including Professional Teacher’s Associations WESSTA and GTANSW, as well as expert academics with specialised knowledge of flooding and the Hawkesbury-Nepean Valley. There were multiple drafts and input from a range of experts.

A research and teaching pilot were also conducted in Term 3, and this project engaged 8 schools from within and outside of the Hawkesbury-Nepean Valley.

Pilot schools and teachers delivered the teaching and learning packages and commented upon their progress. Student understanding, perception of flooding and natural disaster awareness and preparedness were tested pre and post-teaching, as well as teacher attitudes toward the resources and best practice for delivery. This methodology proved to be highly useful in refining and directing the resource development process and has resulted in some world-class teaching and learning materials, as well as sound pedagogy through Inquiry Based Learning and Problem Based Learning approaches. Preliminary findings of the research are due to be published shortly.

## What is in the resource?

The resource is broken into six key areas:

- Flooding in the Hawkesbury-Nepean Valley – which examines historical floods, the bathtub effect, the water cycle and the unique features of the Hawkesbury-Nepean Valley. This section also contains a unit of work that teachers may choose to use or adapt, as well as multiple useful links to other sites and agencies, including maps designed by ESRI specifically to support this resource.
- Geographical Skills Lessons – feedback from teachers reported that students may not necessarily possess strong geographical skills coming into Stage 4, so these lessons can be used as stand-alone lessons to develop geographical skills, or as part of the case study. This section has had very positive responses from preliminary viewings of the resource.
- Fieldwork – a suggested fieldwork trip which incorporates geographical inquiry skills, as well as a model for undertaking quality fieldwork which can be adapted to suit any context.
- Stories of Resilience – this section provides a series of scenarios which offer opportunities for students to consider and debate the best solution for a real world problems, especially around sensible decision making in the event of a flood. This section is highly innovative, and the approach gives teachers and students the chance to consider the complexity of geographical issues, such as land use, natural hazards and risk management in multiple dimensions.
- Cross-curriculum content – *Water in the World* resources have been mapped to the Science syllabus, Mathematics syllabus, English Syllabus and also History syllabus for Stage 4.
- Gallery – the resource gallery contains a library of primary source material, images, graphics and photos, which can be downloaded and form the basis of lessons.

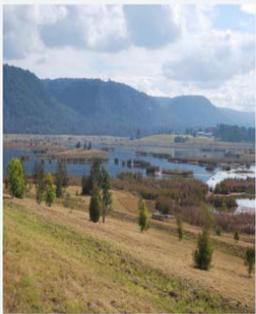
# RESOURCE: WATER IN THE WORLD

## Skills Lesson

**Water in the World**  
Flooding in the Hawkesbury-Nepean Valley  
Stage 4, Geography Resources



**Observe:**  
As you travel across the floodplain what do you see?



Here we are looking back towards Blue Mountains.  
The Blue Mountains to the west limits the Nepean River, which is below the escarpment. The river has changed course over many thousands of years across this area. As it slows and meanders after coming out of the mountains it has deposited millions of tonnes of sand and gravel over the low area between the mountains and the higher ground to the east.

**Describe the floodplain.**

View of floodplain from Castlereagh Rd, 2019, Carroll, K., Western Sydney University

**Make notes/draw the topography (in 2D form showing the estimate of the height, elevation of the land).**

Sample abstract from fieldwork

## How to use the resource

All of the resources are free to download in either PDF or Word format. Teachers can take and adapt any resource to suit their situation or geographical context. For instance, there has been considerable interest in this resource from schools in Maitland area, and other regions vulnerable to flood across Australia. Other teachers have noted that students are making connections to both Bush Fires (Stage 3) and other Natural Hazards (Stage 4) broadly moving towards a resilient and more prepared community. The unit of work is detailed and can be adjusted to suit a range of student abilities. The sources and lesson ideas contained in the resource can either accompany the Unit of Work or provide a basis for teachers to develop their own lesson ideas. Teachers who have not been trained in geography may find this resource of particular interest.

## Georgie the Geographer



## Georgie the Geographer

Georgie the Geographer is an innovative device featured in the resource. Georgie is an avatar of a young person, interested in geography. This character has been used to animate and teach content in a rich and visually interesting manner, and also to present complex ideas simply. The artist, Alex Wegner, has used a vibrant visual recorder style to represent Georgie, and the character engages directly with a young audience. Teachers can use the clips as a stimulus for discussion or inquiry learning. The clips currently in the resource are:

- The Water Cycle
- Weather and Rainfall

## Acknowledgment of GTA NSW

Western Sydney University would like to gratefully acknowledge the work of GTA NSW in supporting the development and publication of this important resource. President Lorraine Chaffer was part of the Schools Advisory Committee and a critical friend of the project, also promoting the resource through updates to GTANSW Members. Susan Caldis contributed to the writing and maintained ongoing support from the 2019 conference onwards. GTANSW members also piloted the resource and participated in professional learning events relating to the resource. In 2020 there will be additional events and publication, including conferences and PL, so watch out for updates! Teachers are encouraged to share and give feedback about the resource and how it is being used in classrooms. Please contact the Centre for Educational Research team at Western Sydney University through Dr Kay Carroll, the project lead.

## References

Aboriginal account of flooding pre-colonisation: King, P.G. *Historical Records of New South Wales*, Volume 6 p.61, Governor Phillip Gidley King to Earl Camden, 7 April 1806.

Account of flood debris in early colony: Hunter, J. *An Historical Journal of Events at Sydney and at Sea 1787–1792*, 1793.

Early agriculture in Hawkesbury-Nepean: Atkinson, J. *An account of the state of agriculture and grazing in NSW*, London, 1826, p.7.

Infrastructure NSW, Links to key documents:  
[https://www.hawkesbury.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0018/93051/Infrastructure-NSW-Resilient-Valley,-Resilient-Communities-2017-January.pdf](https://www.hawkesbury.nsw.gov.au/__data/assets/pdf_file/0018/93051/Infrastructure-NSW-Resilient-Valley,-Resilient-Communities-2017-January.pdf)  
<https://floodata.ses.nsw.gov.au/flood-projects/hawkesbury-nepean-valley-regional-flood-study>  
[http://www.infrastructure.nsw.gov.au/media/2162/ec\\_insw\\_hawkesbury-nepean\\_fss-document\\_web.pdf](http://www.infrastructure.nsw.gov.au/media/2162/ec_insw_hawkesbury-nepean_fss-document_web.pdf)