

## Water in the World

### Case Study: Hawkesbury-Nepean Valley

**Focus:** This unit of work develops students to become active and informed citizens about the Hawkesbury-Nepean Valley. Students examine water as a resource in the Hawkesbury-Nepean Valley and the factors influencing its flows and availability across the catchment and floodplain.

Students will investigate the nature of water scarcity and abundance and assess ways of overcoming these specific to the Hawkesbury-Nepean Valley. Students discuss variations in people's perceptions about the value of water and the need for sustainable water management. Students also investigate processes that continue to shape the catchment using the context of flooding as a hydrologic hazard.

#### **Inquiry Questions:**

- Why does the spatial distribution of water resources vary globally and within countries, including the Hawkesbury-Nepean Valley in Australia?
- How do natural and human processes influence the distribution and availability of water as a resource in the Hawkesbury-Nepean Valley?
- What effect does the uneven distribution of natural water resources have on people, places and environments across the Hawkesbury-Nepean Valley?
- What approaches can be used to sustainably manage water resources and flood events across the Hawkesbury-Nepean Valley floodplain?



*Nepean River near Penrith; Carroll, K., Western Sydney University, 2019*

**Context for the Unit:** The Hawkesbury-Nepean Catchment in New South Wales is 22,000 square kilometres, stretching from Brooklyn and Wisemans' Ferry in the north, to Lithgow in the west, to Goulburn in the south. The Hawkesbury-Nepean Valley sits within this larger catchment. It is a very flood-prone valley, known for wide, deep, rapid-rising floods. Several factors influence the flow and availability of water across the catchment and floodplain and its topography and land-use continue to be shaped by a variety of processes. The last significant flood event in the Hawkesbury-Nepean Valley occurred in 1992. Therefore, community awareness and preparedness for the next flood event is low.

In this unit of work, students will investigate the spatial dimensions, environmental features and interconnected nature of the Hawkesbury-Nepean Valley. This will help students understand factors and processes affecting scarcity and abundance of water, community perceptions about the value of water as well as flood events and possible strategies for a sustainable future of the area.

The purpose of the unit is for students to understand the water cycle, different uses and perceptions of water and how flooding is a natural hazard. By examining the Hawkesbury-Nepean as a case study, students can assess and determine the most appropriate ways of mitigating and managing a flood hazard in the catchment.

Students will investigate these issues by developing an awareness campaign/tool and flood action plan suitable for implementation at a personal, school, or community scale. By the end of the unit students will be able to use geographical terminology, tools and communication methods to demonstrate an understanding about the flood risk occurring throughout the floodplain and reflect on the appropriateness of their flood action plan.

**This unit of work specifically addressed Australian Curriculum Content and NSW Geography Outcomes.**

- **GE4-1:** locates and describes the diverse features and characteristics of a range of places and environments
- **GE4-2:** describes processes and influences that form and transform places and environments
- **GE4-3:** explains how interactions and connections between people, places and environments result in change
- **GE4-5:** discusses management of places and environments for their sustainability
- **GE4-7:** acquires and processes geographical information by selecting and using geographical tools for inquiry
- **GE4-8:** communicates geographical information using a variety of strategies

The following **Life Skills outcomes** have been integrated into this unit:

- **GELS-1:** recognises features and characteristics of places and environments
- **GELS-2:** demonstrates an understanding that places and environments change
- **GELS-3:** explores interactions and connections between people, places and environments
- **GELS-5:** explores management of places and environments
- **GELS-7:** collects and uses geographical information for inquiry
- **GELS-8:** communicates geographical information

**Scope and sequence:** Program design and considerations: 10 weeks

**Weeks 1–2**

Inquiry Question(s)	Broad context, global scale	Outcomes and Concepts
<ul style="list-style-type: none"> <li>▪ Why does the spatial distribution of water resources vary globally and within countries, including the Hawkesbury-Nepean Catchment in Australia?</li> <li>▪ How do natural and human processes influence the distribution and availability of water as a resource in the Hawkesbury-Nepean catchment?</li> </ul>	<p><b>Water resources</b></p> <ul style="list-style-type: none"> <li>▪ Students investigate the characteristics and spatial distribution of global water resources</li> <li>▪ Classification of water resources</li> <li>▪ Examination of spatial distribution patterns of water resources</li> </ul> <p>Class brainstorm:</p> <ul style="list-style-type: none"> <li>▪ What is water?</li> <li>▪ Why is water so important?</li> <li>▪ What is an Aboriginal perspective of the value of water?</li> <li>▪ How do different people use and waste water?</li> <li>▪ Why is water important in Australia?</li> </ul> <p>Share the story – Tiddalick the Frog to provide an Indigenous perspective.</p> <p>See Indigenous Community Television ICTV  <a href="https://www.youtube.com/watch?v=eg8M9nSXY0U">https://www.youtube.com/watch?v=eg8M9nSXY0U</a></p> <p>Students use a global context to identify issues about water scarcity and resources  <a href="https://www.worldvision.org/clean-water-news-stories/global-watercrisis-facts">https://www.worldvision.org/clean-water-news-stories/global-watercrisis-facts</a>  <a href="https://www.globaleducation.edu.au/teaching-activity/water-for-life-f-2.html#activity1">https://www.globaleducation.edu.au/teaching-activity/water-for-life-f-2.html#activity1</a></p> <ul style="list-style-type: none"> <li>▪ 844 million people lack basic drinking water access, more than 1 of every 10 people on the planet.</li> <li>▪ Women and girls spend an estimated 200 million hours hauling water every day.</li> <li>▪ The average woman in rural Africa walks 6 kilometres every day to haul 18.1 kilograms of water.</li> <li>▪ Every day, more than 800 children under age 5 die from diarrhoea attributed to poor water and sanitation.</li> <li>▪ 2.3 billion people live without access to basic sanitation.</li> <li>▪ 892 million people practice open defecation.</li> <li>▪ 90 percent of all natural disasters are water-related.</li> </ul> <p>(<a href="https://www.worldvision.org/clean-water-news-stories/global-water-crisis-facts">https://www.worldvision.org/clean-water-news-stories/global-water-crisis-facts</a>)</p> <p>Students undertake in small groups or pairs a small-scale inquiry about the following aspects of NSW water resources</p> <ul style="list-style-type: none"> <li>▪ Environmental Water</li> <li>▪ Water Science and Data</li> <li>▪ Water Utilities</li> <li>▪ Basins and Catchments</li> <li>▪ Water Management and Legislation</li> </ul> <p>Students respond to:</p> <ul style="list-style-type: none"> <li>▪ How is the type of water resource managed?</li> <li>▪ By whom and how is this managed?</li> <li>▪ Why is it important water is managed for the future?</li> <li>▪ What are some of the risks for this resource for the future?</li> <li>▪ What are some of the strategies for the future to manage water in this context?</li> </ul>	<p>By the end of the <b>cycle</b> students are able to use at least two geographical tools to interpret and communicate an understanding about the nature and influences on the spatial distribution of water at a variety of scales.</p> <p>By the end of the <b>cycle</b>, students have confirmed their group, group name, and an idea about the type of awareness campaign/tool and flood action plan they would like to develop for implementation at a personal, school, community or catchment scale.</p> <p><b>Outcomes in focus:</b> GE4-8; GE4-7, GE4-3, GE4-2, GE4.1, GELS-1, GELS-3.</p> <p><b>Concepts in focus:</b> Place, Space, Environment, Scale</p>

Students review any current Water Restrictions from the Sydney Water site <http://www.sydneywater.com.au/SW/water-the-environment/what-we-re-doing/water-restrictions/index.htm>

Students consider the value of water from a range of perspectives:

- 13-14 year old teenager living in Sydney
- 13-14 year old teenager living in Dubbo
- Farmer in northern NSW

<https://www.dubbo.nsw.gov.au/our-region-and-environment/water-sewerage-and-drainage/water-restrictions>

<http://www.bom.gov.au/climate/drought/#tabs=Rainfall-tracker>

Students undertake the Sydney Water – Water Audit for their school and view the video clip

<http://www.sydneywater.com.au/SW/education/programs-resources/Highschool/water-audit/index.htm>

- Discuss the findings.

### **Hawkesbury-Nepean Catchment – Case Study**

Students learn about the scope, scale, location and topography of this catchment:

*Located in NSW..., the Hawkesbury-Nepean catchment is one of the largest coastal basins in NSW. With an area of 21,400 square kilometres, over 70 per cent of the catchment consists of mountainous terrain, with about 10 per cent of flat terrain.*

*The south terrain, around 10 per cent of the total catchment, comprises undulating plateau type country. The maximum elevation is about 1,290 metres.*

<https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/hawkesbury-nepean>

Students undertake using visuals, maps, ESRI data and information the following investigation and complete the scaffold

Sites for investigation:

<https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/hawkesbury-nepean>

<https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/>

<http://www.infrastructure.nsw.gov.au/expert-advice/hawkesbury-nepean-flood-risk-management-strategy/>

Tributaries and rivers of the catchment	Location, size and topographic features of the catchment	Main water storage	Key water management issues	Water users	Major environmental hazard

Students use the following Geographical Tools to investigate water resources.

- **Maps** (choropleth, synoptic charts),
- **Spatial technologies** (satellite images),

- **Graphs and Statistics** (multiple tables and graphs presented on a geographical theme),
- **Visual representations** (annotated diagrams, photographs, aerial photographs)

**Consolidation activity 1:**

Students individually communicate a response to both inquiry questions. This can be digitalised or on paper to form an individual journal of learning. The response can be in the form of an annotated diagram or map, flow diagram etc., it does not have to be in written prose form. Responses to the second inquiry question will be built upon in the next cycle.

**Consolidation activity 2:**

Students to confirm their group members, group name and draft ideas for their awareness campaign.

Weeks 3–4

Inquiry Question(s)	Catchment context, local scale	Outcomes and Concepts
<ul style="list-style-type: none"> <li>How do natural and human processes influence the distribution and availability of water as a resource in the Hawkesbury-Nepean Catchment?</li> </ul>	<p><b>The water cycle</b></p> <p>Students investigate how the operation of the water cycle connects people and places, for example in the Hawkesbury-Nepean Catchment: (ACHGK038)</p> <ul style="list-style-type: none"> <li>identification of water cycle processes</li> <li>explanation of water flows within the Hawkesbury-Nepean Catchment</li> <li>examination of factors influencing water flows (such as the bathtub effect) and the availability of water resources in different places eg latitude, altitude, topography, location, climate change</li> </ul> <p>Students investigate the following water cycle from Sydney Water:  <a href="https://www.sydneywater.com.au/SW/education/drinking-water/Natural-water-cycle/index.htm">https://www.sydneywater.com.au/SW/education/drinking-water/Natural-water-cycle/index.htm</a></p> <p>Geographical Tools for the cycle:</p> <ul style="list-style-type: none"> <li>Maps (choropleth, synoptic charts),</li> <li>Spatial technologies (satellite images),</li> <li>Graphs and Statistics (multiple tables and graphs presented on a geographical theme),</li> <li>Visual representations (annotated diagrams, photographs, aerial photographs)</li> </ul> <p>Students conduct a scientific experiment to identify the following properties of water:</p> <ul style="list-style-type: none"> <li>Molecules and atomic structure of H<sub>2</sub>O</li> <li>Water as a solvent</li> <li>Water carries chemicals, minerals and nutrients</li> </ul> <p>Students consider in groups “Making a Cloud” by Sydney Water to understand principles of evaporation, condensation and precipitation.  <a href="https://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdk5/~edisp/dd_099223.pdf">https://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdk5/~edisp/dd_099223.pdf</a></p> <p>Students consider the source of their drinking water in Sydney, Blue Mountains, Hawkesbury, Penrith and Blacktown:  <a href="https://www.sydneywater.com.au/sw/water-the-environment/how-we-manage-sydney-s-water/water-network/index.htm">https://www.sydneywater.com.au/sw/water-the-environment/how-we-manage-sydney-s-water/water-network/index.htm</a></p> <p>Class discussion about the following aspects sustainable water management:</p> <ul style="list-style-type: none"> <li>description of the nature, extent and causes of water scarcity and abundance for greater Sydney</li> <li>assessment of strategies used to overcome water scarcity and abundance including the role of governments, non-government organisations, individuals and communities in sustainable water management</li> </ul> <p><a href="https://www.waternsw.com.au/supply/drought-information/greater-sydney/greater-sydney-catchment">https://www.waternsw.com.au/supply/drought-information/greater-sydney/greater-sydney-catchment</a>  <a href="https://www.waternsw.com.au/data/assets/pdf_file/0003/548058/wsp_metro_surface_water_background.pdf">https://www.waternsw.com.au/data/assets/pdf_file/0003/548058/wsp_metro_surface_water_background.pdf</a>  <a href="https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/About-us/Metropolitan-Water/2017-Metropolitan-Water-Plan.pdf">https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/About-us/Metropolitan-Water/2017-Metropolitan-Water-Plan.pdf</a>  <a href="http://www.infrastructure.nsw.gov.au/media/1534/insw_hnvflooding_strategy1_v2.pdf">http://www.infrastructure.nsw.gov.au/media/1534/insw_hnvflooding_strategy1_v2.pdf</a></p>	<p>By the end of the <b>cycle</b> students are able to use at least two geographical tools to interpret and communicate an understanding about the nature and influences on the spatial distribution of water at a local scale.</p> <p>By the end of the <b>cycle</b>, students have confirmed and planned for the awareness campaign/tool and action plan they would like to develop for implementation at a personal, school, community or Catchment scale</p> <p><b>Outcomes in focus:</b> GE4-8; GE4-7, GE4-3, GE4-2, GESL-7, GELS-8</p> <p><b>Concepts in focus:</b> Place, Space, Environment, Interconnection, Scale</p>

	<p>Consider the following management plans for sustainable water usage, storage and security for the greater Sydney region.</p> <ul style="list-style-type: none"><li>▪ How important is Warragamba Dam for water security in Sydney?</li><li>▪ What steps can you as an individual take to manage your personal water usage?</li></ul> <p><a href="https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/About-us/Metropolitan-Water/2017-Metropolitan-Water-Plan.pdf?la=en">https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/About-us/Metropolitan-Water/2017-Metropolitan-Water-Plan.pdf?la=en</a> <a href="https://www.choice.com.au/home-improvements/water/saving-water/articles/water-saving-home-guide">https://www.choice.com.au/home-improvements/water/saving-water/articles/water-saving-home-guide</a></p> <p><b>Consolidation activity:</b> In their learning journal students build on their response to the second inquiry question from the previous cycle. It is recommended to use a different colour or find some other way of showing the response for this cycles' entry. The response can be in the form of an annotated diagram or map, flow diagram etc. It does not have to be in written prose form.</p>	
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Weeks 5–6

Inquiry Question(s)	Catchment context, local and personal scale	Outcomes and Concepts
<ul style="list-style-type: none"> <li>What effect does the uneven distribution of natural water resources have on people, places and environments across the Hawkesbury-Nepean catchment?</li> <li>What approaches can be used to manage water resources and flood events across the Hawkesbury-Nepean Catchment?</li> </ul>	<p><b>The value of water</b></p> <p>Students investigate the economic, cultural, spiritual and aesthetic values of water for people, including Aboriginal and Torres Strait Islander peoples, for example: (ACHGK041)</p> <ul style="list-style-type: none"> <li>description of the ways water is used by people eg agricultural, commercial, industrial and recreational uses</li> <li>discussion of variations in people’s perceptions about the value of water eg economic versus aesthetic</li> </ul> <p>Identify the different Aboriginal tribal groups that inhabited the Hawkesbury-Nepean Catchment and valley.</p> <p>Discuss this Aboriginal name for the Hawkesbury River:</p> <p><b>Deerubbin</b> ‘wide, deep water’ from the Kuringai people –the traditional owners of the mouth of the Hawkesbury River.</p> <p>Students research a song-line or summary of the history of the river:  <a href="https://dictionaryofsydney.org/entry/hawkesbury_river">https://dictionaryofsydney.org/entry/hawkesbury_river</a></p> <p>Consider the Dharug Language and key terms  <a href="http://education.abc.net.au/home#!/media/152066/learning-dharug-aboriginal-language-of-sydney">http://education.abc.net.au/home#!/media/152066/learning-dharug-aboriginal-language-of-sydney</a></p> <p>Describe the plants and animals that live and thrive along the Hawkesbury-Nepean River  <a href="https://brewongleec.com/resources/stage-4-resources/">https://brewongleec.com/resources/stage-4-resources/</a></p> <p>Virtual or Physical site study-Devil’s Rock  <a href="https://youtu.be/iV2ZB4bTguA">https://youtu.be/iV2ZB4bTguA</a></p> <ul style="list-style-type: none"> <li>What makes this site important for Dharug peoples?</li> <li>What evidence is there of Aboriginal influence on the landscape?</li> <li>What is the value of land for Indigenous peoples?</li> <li>How can we tell people about this significance?</li> </ul> <p>Case Study: Aboriginal Women’s Heritage: Nepean  <a href="https://www.environment.nsw.gov.au/research-and-publications/publications-search/aboriginal-womens-heritage-nepean">https://www.environment.nsw.gov.au/research-and-publications/publications-search/aboriginal-womens-heritage-nepean</a></p> <p><i>The seven Aboriginal women in Aboriginal Women’s Heritage: Nepean, tell their own life stories. They tell about the changes they have seen over the years. They recall stories about the chores they had to do when they were young and what they liked and disliked about those chores. Things like fetching the household water from the river by bucket as there was no water to their houses in the early days; collecting and boiling water for bathing; collecting wood to boil the copper for the family’s washing and collecting wood for the fires were part of the day to day work.</i></p> <p><i>They tell of the daily routines, like milking cows and getting meals for their younger brothers and sisters while their parents were out working. The women tell how the family would use an ice chest to keep their food chilled and fresh. Stories about fruit picking, fishing and trapping rabbits. They tell about growing their own fruit and vegetables and eating whatever they grew or caught to supplement the family’s diet.</i></p> <p><i>One of the women talks about the Stolen Generations and how she was never to see her father again, how at the age of seven she was separated from her brothers and sisters. The women grew up in an era when they were not encouraged to talk about their Aboriginality.</i></p>	

	<p>In pairs choose one Aboriginal Woman's story to re-tell to modern Indigenous and Non-Indigenous peoples. Create a short story or speech about this woman's experiences and memories of country. Include key details about the experience, the influence of the landscape, society's views and opportunities for connection with country.</p> <p>Geographical Tools for the cycle:</p> <ul style="list-style-type: none"><li>▪ <b>Maps</b> (choropleth, synoptic charts)</li><li>▪ <b>Spatial technologies</b> (satellite images)</li><li>▪ <b>Graphs and Statistics</b> (multiple tables and graphs presented on a geographical theme)</li><li>▪ <b>Visual representations</b> (annotated diagrams, photographs, aerial photographs)</li></ul>	
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Weeks 7–8

Inquiry Question(s)	Catchment context, local and personal scale	Outcomes and Concepts																												
<ul style="list-style-type: none"> <li>What effect does the uneven distribution of natural water resources have on people, places and environments across the Hawkesbury-Nepean Catchment?</li> <li>What approaches can be used to manage water resources and flood events across the Hawkesbury-Nepean Catchment?</li> </ul>	<p><b>Natural hazard – Flood</b></p> <p>Students investigate the causes and impacts of and responses to a flood event (a hydrological hazard) in the Hawkesbury-Nepean Valley</p> <ul style="list-style-type: none"> <li>Prediction of the impact of climate change on the occurrence, frequency and extent of this type of hazard</li> <li>Discussion of management strategies to reduce the future impact of similar hazard events</li> </ul> <p>NSW State Emergency Service (SES) states;  <i>The Hawkesbury-Nepean Valley has some of the most dangerous floods in Australia. The last major flood was in 1990. Five of the biggest floods in the past 150 years have occurred since 1961. Most floods have occurred after a period of drought. It's important you understand your flood risk and learn how to prepare. Talk to your family and friends about your plans.</i></p> <p>Students view the bathtub effect video  <a href="https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/">https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/</a></p> <p>Discuss as a class the infographic and the reasons for flooding  <a href="http://www.infrastructure.nsw.gov.au/media/1525/hnvflooding_factsheet_feb2018.pdf">http://www.infrastructure.nsw.gov.au/media/1525/hnvflooding_factsheet_feb2018.pdf</a></p> <p>Students in pairs complete the following table using the map and table from the NSW SES site.</p> <p>Select a flood likelihood map –  <a href="https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/">https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/</a></p> <table border="1" data-bbox="424 1182 1169 1724"> <thead> <tr> <th>Place/ Suburb/ Location</th> <th>Depth in metres for low likelihood ( 15% chance of happening once in an 80 year life time)</th> <th>Depth in metres for medium likelihood (55% chance of happening once in an 80 year life time)</th> <th>Depth in metres for high likelihood 98% chance of happening once in an 80 year life time)</th> </tr> </thead> <tbody> <tr> <td>Bligh Park</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Pitt Town</td> <td></td> <td></td> <td></td> </tr> <tr> <td>McGraths Hill</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Cranebrook</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Emu Plains</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Windsor Downs</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Historical research about the 1867 Floods:              Using a range of data sources prepare a short video or google slide about the 1867 flood              Include in your historical case study:</p> <ul style="list-style-type: none"> <li>the height and extent of floodwaters</li> <li>the impact of the flood on people, property and economic activity</li> <li>the different perspectives</li> <li>the strategies used to assist people</li> </ul>	Place/ Suburb/ Location	Depth in metres for low likelihood ( 15% chance of happening once in an 80 year life time)	Depth in metres for medium likelihood (55% chance of happening once in an 80 year life time)	Depth in metres for high likelihood 98% chance of happening once in an 80 year life time)	Bligh Park				Pitt Town				McGraths Hill				Cranebrook				Emu Plains				Windsor Downs				<p>By the end of the <b>cycle</b> students are able to use at least two different geographical tools to the previous cycles (Weeks 1 – 4) to interpret and communicate an understanding about the effect of uneven water distribution, and sustainable water management approaches at a local scale.</p> <p>By the end of the <b>cycle</b>, students will have collaboratively finalised their awareness campaign/tool and action plan.</p> <p>By the end of the <b>cycle</b> students are able to:</p> <ul style="list-style-type: none"> <li>collaboratively present their groups' awareness campaign/tool and flood action plan for the chosen scale;</li> <li>individually engage in peer assessment activities for other flood action plans; and</li> <li>collaboratively write a self-reflection of their groups' flood action plan in response to feedback and feedforward from peer assessment</li> </ul> <p><b>Outcomes in focus:</b>              GE4-8; GE4-7; GE4-5; GE4-3; GE4-2; GE4-1, GELS-5, GELS-7, GELS-8</p> <p><b>Concepts in focus:</b> Place, Space, Environment, Interconnection, Sustainability, Scale</p>
Place/ Suburb/ Location	Depth in metres for low likelihood ( 15% chance of happening once in an 80 year life time)	Depth in metres for medium likelihood (55% chance of happening once in an 80 year life time)	Depth in metres for high likelihood 98% chance of happening once in an 80 year life time)																											
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Windsor Downs																														

	<ul style="list-style-type: none"> <li>▪ the importance or current significance of this flood event to people and the community today.</li> </ul> <p><a href="https://www.abc.net.au/news/2017-06-22/eather-family-remember-the-great-hawkesbury-flood-of-1867/8641634">https://www.abc.net.au/news/2017-06-22/eather-family-remember-the-great-hawkesbury-flood-of-1867/8641634</a></p> <p><a href="https://trove.nla.gov.au/newspaper/article/13150632">https://trove.nla.gov.au/newspaper/article/13150632</a></p> <p><a href="https://www.researchgate.net/publication/317002314_The_June_1867_floods_in_NSW_causes_characteristics_impacts_and_lessons">https://www.researchgate.net/publication/317002314_The_June_1867_floods_in_NSW_causes_characteristics_impacts_and_lessons</a></p> <p><b>Preparing for a flood in the Hawkesbury-Nepean Valley</b>          Individually consider the following steps in preparing for a flood incident in the valley:</p> <ul style="list-style-type: none"> <li>▪ Locate your suburb and house using an ESRI map</li> <li>▪ Evaluate the level of risk (low, medium, high)</li> <li>▪ Identify a flood evacuation route and estimate how much time you would have to evacuate an area in the event of a flood hazard.</li> <li>▪ Create a household plan of who to tell, how to communicate and what you should bring with you.</li> <li>▪ Develop a home emergency kit for what you need to do and have available in the event of a flood incident</li> </ul> <p><a href="https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/">https://www.ses.nsw.gov.au/hawkesbury-nepean-floods/</a></p> <p><b>Going deeper 1.</b>          In groups find out another past flood incident (eg 1961, 1990, 1992)</p> <ul style="list-style-type: none"> <li>▪ Describe the extent of the flood, height above river levels and flood depth at different locations in the region.</li> <li>▪ Outline the causes of the flooding (East-Coast Low, precipitation, bath-tub effect, topography)</li> <li>▪ Explain the effects on the community (human, economic, social)</li> </ul> <p><b>Going deeper 2.</b>  <b>Consider the broad approaches we need to adopt in the face of increasing natural disasters like floods and bushfires.</b></p> <p><i>'By taking collective action now to reduce disaster risk, we can ensure Australia continues to sustainably enjoy the benefits of global change.'</i></p> <p><i>'Disaster resilience and risk reduction is a shared responsibility, but often not equally shared. While individuals and communities have their roles to play, they do not control many of the needed levers to reduce some disaster risks. Governments and industry in particular must take coordinated action to reduce disaster risks within their control to limit adverse impacts on communities.'</i></p> <p>National Disaster Risk Management Framework, Commonwealth of Australia, 2018</p>	
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**Consider the range of options for responding to flood risk in the Hawkesbury-Nepean Valley.**

- Consider the range of options on the different strategies and create a SWOT (Strengths, Weaknesses, Opportunities and Threats of each approach)
- Infrastructure options include new flood mitigation dams, river diversion channels, river dredging, local levees, and regional evacuation road upgrades.
- Non-infrastructure measures include land use planning and development controls, voluntary house purchase, flood mapping and forecasting, community awareness and floodplain governance.
- Use these sites for a range of perspectives and options for mitigation.

<https://www.homeaffairs.gov.au/emergency/files/national-disaster-risk-reduction-framework.pdf>

<https://www.theage.com.au/national/victoria/millions-in-australia-s-east-face-natural-disaster-risk-20190101-p50p4x.html>

<http://www.infrastructure.nsw.gov.au/media/1963/assessing-the-options-feb-2019.pdf>

<https://www.planning.nsw.gov.au/-/media/Files/DPE/Discussion-papers/improving-flood-resilience-hawkesbury-nepean-discussion-paper-2019-10-15.pdf?la=en>

<http://www.infrastructure.nsw.gov.au/media/1723/warragamba-dam-raising.pdf>

<https://www.waternsw.com.au/projects/greater-sydney/warragamba-dam-raising>

<https://www.smh.com.au/environment/conservation/greens-franklin-campaign-warragamba-dam-wall-20181018-p50ae2.html>

[http://www.insw.com/media/1993/warragamba-dam-raising\\_feb-2019.pdf](http://www.insw.com/media/1993/warragamba-dam-raising_feb-2019.pdf)

[http://www.insw.com/media/2162/ec\\_insw\\_hawkesbury-nepean\\_fss-document\\_web.pdf](http://www.insw.com/media/2162/ec_insw_hawkesbury-nepean_fss-document_web.pdf)

Use the following Geographical tools to assist you

- **Maps** (choropleth, synoptic charts), Spatial technologies (satellite images)
- **Graphs and Statistics** (multiple tables and graphs presented on a geographical theme)
- **Visual representations** (annotated diagrams, photographs, aerial photographs)

Outline strategies that could help reduce or mitigate the impact of a flood.

<https://www.chiefscientist.qld.gov.au/publications/understanding-floods>

<https://flooddata.ses.nsw.gov.au/>

[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)

Strategy/ Technology	Evidence of impact in historic or predicted flood incidents	How could this reduce or mitigate flooding in the Hawkesbury-Nepean Valley?	How could this strategy be implemented and communicated?
<p>Examine how a flood can impact on individuals and communities.</p> <ul style="list-style-type: none"> <li>▪ Write a 1-2 page report that covers the human, social, economic and environmental impacts.</li> </ul> <p>Create a short video, google slide show or representation using a range of geographical data to communicate how to respond to a flood event in the Hawkesbury-Nepean Valley</p> <ul style="list-style-type: none"> <li>▪ Consider your audience eg the local community or school and</li> <li>▪ Find compelling and factual evidence that supports your recommendations and information.</li> </ul>			

## Weeks 9–10

Inquiry Question(s)	Catchment context, local and personal scale	Outcomes and Concepts
<ul style="list-style-type: none"> <li>▪ What effect does the uneven distribution of natural water resources have on people, places and environments across the Hawkesbury-Nepean catchment?</li> <li>▪ What approaches can be used to manage water resources and flood events across the Hawkesbury-Nepean Catchment?</li> </ul>	<p>Groups present their 5–7minute presentation of awareness campaigns and flood action plans. Designated group members complete the peer assessment as indicated.</p> <p>Groups can commence their collaborative self-reflection about their groups' awareness campaign/tool and flood action plan using the feedback and feedforward from the peer assessment</p> <p><b>Consolidation activity:</b>                      Students complete a self-reflection activity about the awareness campaign/tool and flood action plan in their learning journal.</p>	<p>By the end of the <b>cycle</b> students are able to collaboratively present their groups' awareness campaign/tool and flood action plan for the chosen scale; individually engage in peer assessment activities for other flood action plans; and collaboratively write a self-reflection of their groups' flood action plan in response to feedback and feedforward from peer assessment</p> <p>By the end of the <b>unit</b> students are able to use geographical terminology, tools and communication methods to: demonstrate an understanding about the flood-risk occurring throughout the Catchment; and reflect on the appropriateness of their flood action plan.</p> <p><b>Outcomes in focus:</b> GE4-8; GE4-5; GE4-2; GE4-1, GELS-6, GELS-8</p> <p><b>Concepts in focus:</b> Place, Space, Environment, Sustainability, Scale</p>