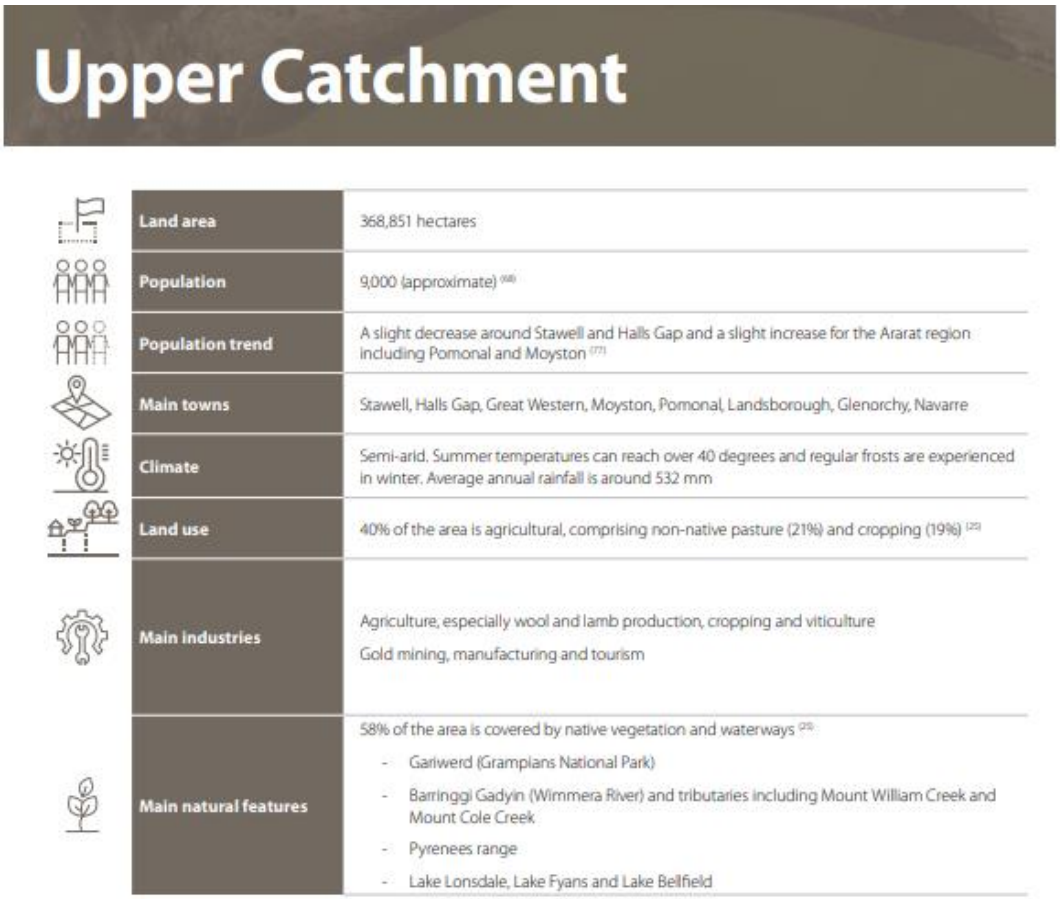
Teacher suggested solutions

Worksheet 1

Mapping the region

The Wimmera catchment boundary is located in western Victoria and covers an area of approximately 30,000km^2 or 10% of Victoria. The Wimmera extends from the Grampians National Park in the south to Lake Albacutya, near Rainbow in the north, and from the South Australian border in the west to past Stawell in the east. It includes the Wimmera River catchment and the eastern part of the Millicent Coast Basin. The Wimmera River is the largest Victorian river that does not flow to the sea, but instead flows into a series of terminal lakes. The largest of these terminal lakes are Lake Hindmarsh and Lake Albacutya.



Upper Catchment

Land area	368,851 hectares
Population	9,000 (approximate) [68]
Population trend	A slight decrease around Stawell and Halls Gap and a slight increase for the Ararat region including Pomonal and Moyston [77]
Main towns	Stawell, Halls Gap, Great Western, Moyston, Pomonal, Landsborough, Glenorchy, Navarre
Climate	Semi-arid. Summer temperatures can reach over 40 degrees and regular frosts are experienced in winter. Average annual rainfall is around 532 mm
Land use	40% of the area is agricultural, comprising non-native pasture (21%) and cropping (19%) [23]
Main industries	Agriculture, especially wool and lamb production, cropping and viticulture Gold mining, manufacturing and tourism
Main natural features	58% of the area is covered by native vegetation and waterways [25] - Gariwerd (Grampians National Park) - Barringgi Gadyin (Wimmera River) and tributaries including Mount William Creek and Mount Cole Creek - Pyrenees range - Lake Lonsdale, Lake Fyans and Lake Bellfield

Figure 1. Data on the Upper Catchment of the Wimmera region. Source: http://wcma.vic.gov.au/docs/default-source/corporatedocs/rcs/wimmera-regional-catchment-strategy-(rcs)-2021-27.pdf?sfvrsn=7dcb6e68_5
Please note: This is one of five available. Other information can be found in the source.

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Task 1

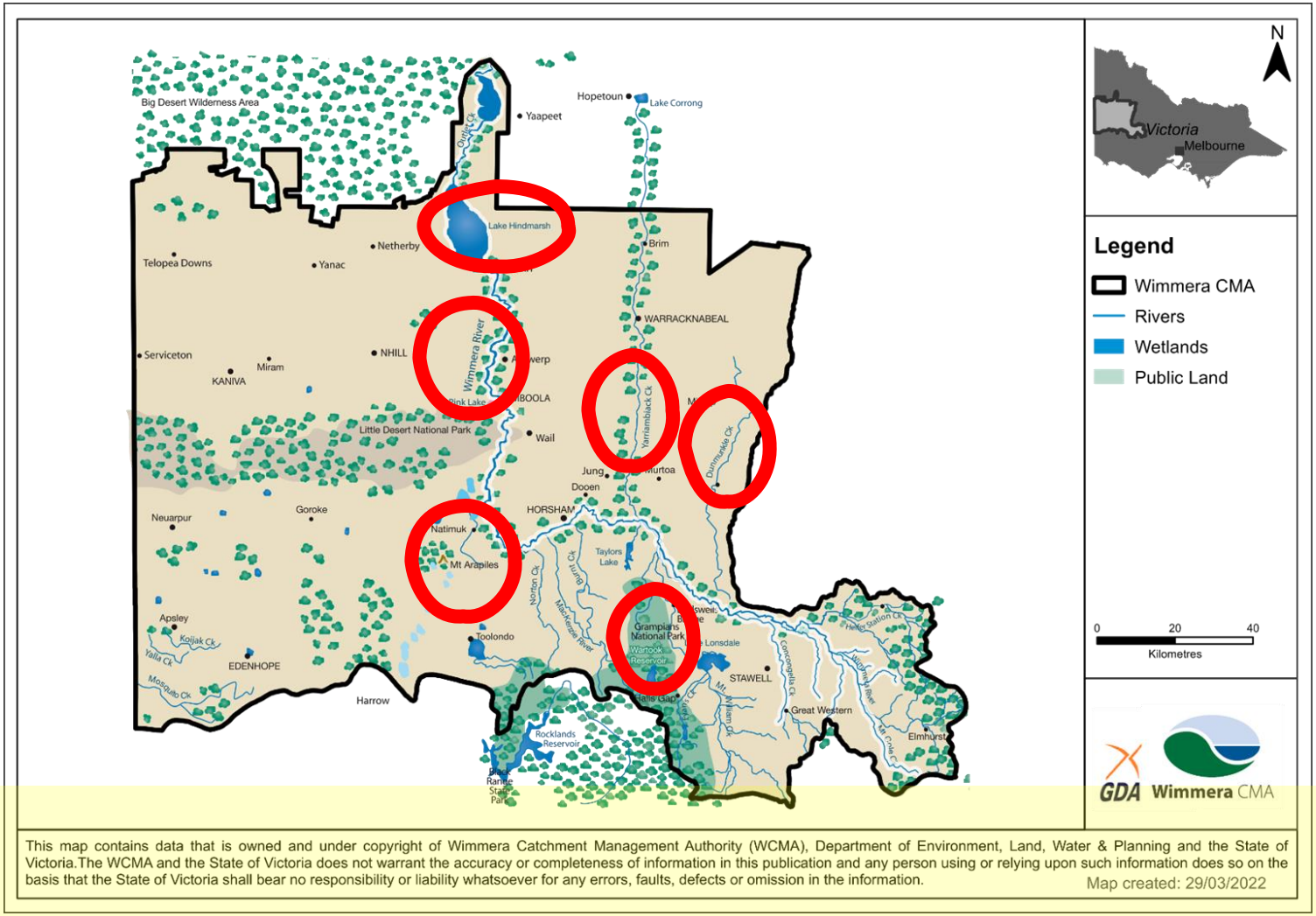
1. Open Google Earth: https://earth.google.com/web/
2. Using the search bar, locate the 'Wimmera River'.
3. By dragging the screen, follow the river in one direction and list the natural and human characteristics of the river region.

Natural Characteristics	Human Characteristics
Mountains/ Hills	*Towns*
Lakes/ Swamps	*Farms*
Desert	*Roads*

Task 2

Apply BOLTSS to the map provided of the Wimmera Catchment area

1. Rule a border around the map.
2. Rule an arrow which indicates the direction of north on the map.
3. Mark on the location of the following characteristics on you map and create a legend:
   - Mt Arapiles
   - Wimmera River
   - Yarriambiack and Dunmunkle Creeks
   - Lake Hindmarsh
   - Grampians ranges
4. Write a suitable descriptive title for your map.
5. Using the scale, estimate the length of the Wimmera River.
6. Using a highlighter, highlight where the map was sourced from.



Title: Wimmera catchment region

Estimated length of Wimmera River: 278 kms

Task 3

Using the tracing paper provided by your teacher, use the map from Task 2 as a base map.

1. Lay the tracing paper over the map in Task 2.
2. Trace the border from the base map onto your tracing paper (so you know where they line up)
3. Give your tracing paper layer the title 'Towns in the region'
4. Refer to: https://wcma.vic.gov.au/about-us/Region
5. Mark all the towns present in the catchment area on your tracing paper layer.
6. Ensure you create a suitable legend for this layer of the map.

Describe the pattern of towns and natural waterways in the Wimmera catchment region.
Students may have varied answers. Students should consider that towns tend to be located close to natural waterways.

Worksheet 2

The history of the Wimmera

Task 1

Access: https://aiatsis.gov.au/explore/map-indigenous-australia and by zooming and moving the map with your mouse, locate the Wimmera Catchment region.

Figure 1. Location of the Wimmera Catchment region.

Using the First Nations Language Group Map:

1. Identify the language groups in this area
2. Complete the following table:

Language Group	Area covered	Other information
Wergaia	*Nhill, Warracknabeal*	*Traded with southern groups*
Jardwadjali	*Horsham*	
Djadjawurung	*Donald*	
Djabwuurung	*Stawell, Halls Gap*	*Traded with Wergaia*

Task 2

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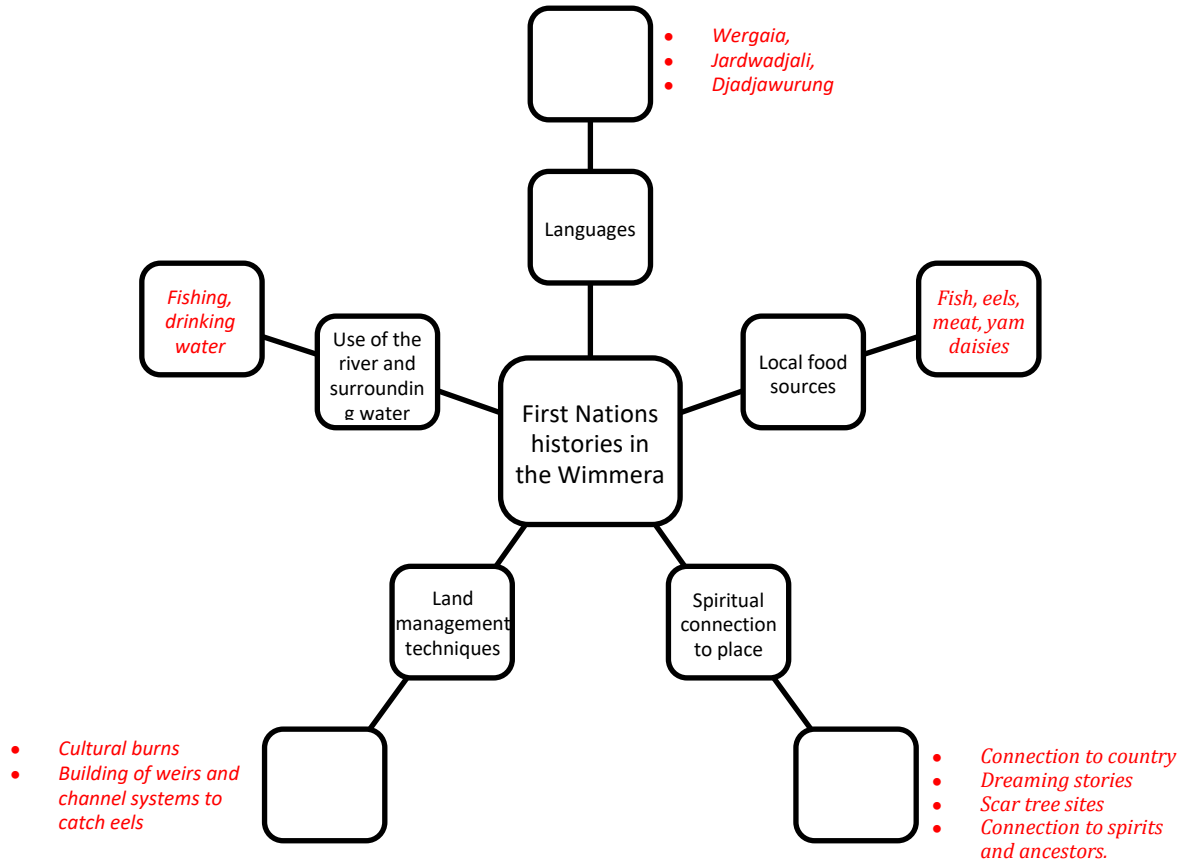
Using your map from Worksheet 1, attach another tracing paper overlay. Locate the First Nations Language Groups highlighted above (remember BOLTSS).

Task 3

Complete the following mind map exploring First Nations histories in the region.



Websites to start your research:
Hindmarsh Shire Council: https://visithindmarsh.com.au/cultural-heritage
Barengi Gadjin Land Council: https://www.bglc.com.au/
Barengi Gadjin Aboriginal water project: https://www.water.vic.gov.au/aboriginal-values/the-aboriginal-water-program/barengi-gadjin-aboriginal-water-project-wimmera-river
ANTaR Victoria: https://antarvictoria.org.au/local-nations
Parks Victoria: https://www.parks.vic.gov.au/news/2020/06/11/00/11/cultural-sites-protected-along-the-wimmera-river
Traditional owner language map: https://aiatsis.gov.au/explore/map-indigenous-australia

Worksheet 3

Environmental Flows

Environmental water releases or environmental flows are designed to supply sufficient water back to river systems and wetlands based on scientific recommendations. Environmental water releases aim to improve conditions for aquatic, wetland, and riparian ecosystems. In the Wimmera's regulated rivers and creeks environmental flows assist in improving water quality and habitat for aquatic species as well as increasing the abundance and diversity of riparian and aquatic vegetation. Sometimes flows are deliberately stopped for a number of days in summer/autumn, which is called a 'cease to flow,' reflecting the typical conditions during those drier months.

Task 1

Access: https://www.vewh.vic.gov.au/water-for-the-environment/what-is-water-for-the-environment

Create a flow diagram or cartoon which explains what an environmental flow is and why it is important to people and place.

For example:
https://www.vewh.vic.gov.au/__data/assets/image/0004/343435/flows-diagram.png
https://www.youtube.com/watch?v=cbUrrYq9BmU

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Task 2

Access: https://www.vewh.vic.gov.au/water-for-the-environment/why-do-we-need-environmental-water

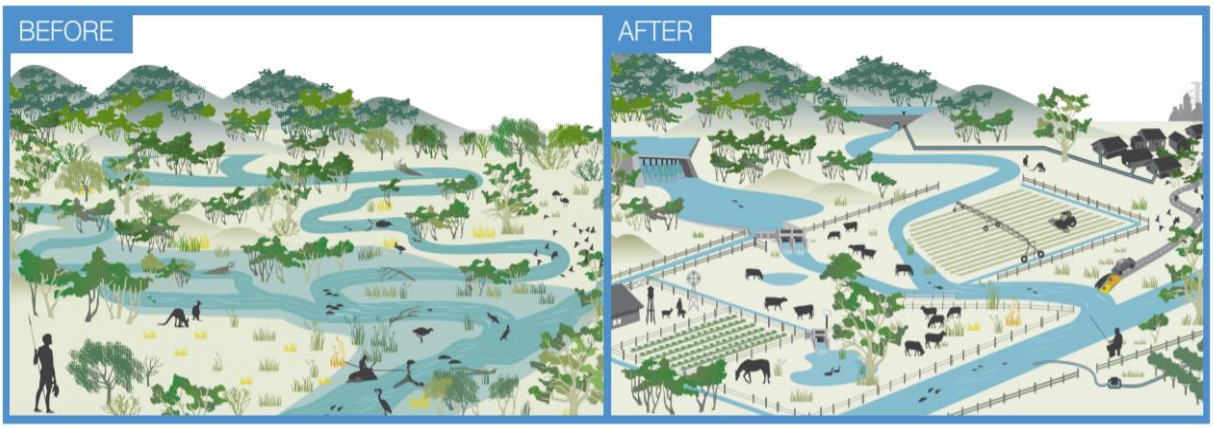

Figure 1. Impacts of human activities on water systems and flow.
Source:
https://www.vewh.vic.gov.au/__data/assets/pdf_file/0020/360245/VEWH0006_SWP_FS_2_Important_2015_v10.pdf

Explain what Figure 1 is showing us.
How human activities affect water sources.

List 2 reasons that environmental flows are important for natural systems.
Improve river health and provide refuges for water species during droughts.

What are the effects of deepening and widening existing river channels?
Greater volume of water can flow through the channel and less flooding.

List 2 reasons why environmental flows are necessary for all users.
Maintain health of the river by mimicking natural flows and ensure wetlands get water.

Task 3

Watch: Mallee the Mighty Mussel - YouTube
1. Why are mussel numbers declining in the Wimmera River?
Increased sediment and less flushing of the river.

2. What do mussel numbers indicate about the river's health?
Increased mussel numbers indicate good river health.

3. How might environmental flows help species such as the mussel?
Increase water quality by removing waste products.

Task 4

Brainstorm the following question:

Do wetlands always have to be wet?

Access: https://www.vewh.vic.gov.au/water-for-the-environment/environmental-benefits#:~:text=Why%20wetlands%20sometimes%20need%20to%20dry

Answer the question above.

No, it is sometimes better that wetlands have dry and wet phases.

Task 5

Watch: https://www.youtube.com/watch?v=WFBYeIgrkP8&t=2s

Fill in the following table exploring the different reasons that environmental flows are important in the Wimmera river.

Environmental importance	Economic importance	Social and recreational importance	Cultural importance
Help fish and other water creatures or native wildlife to breed and survive. Sustain the natural vegetation of the area.	*Bring visitors to the area who spend money at local shops.*	*Sports especially fishing, connect people and places.*	*History of an area. Learning place for students and adults. Sustaining the spiritual connection to the land for First Nations Peoples.*

Worksheet 4

Significance of water

Using an image search, collect 8 images of the uses of water within the Wimmera Catchment. For each image, outline how it shows water usage and importance. Suggest what would happen if water supply was reduced.

Photo	Uses of water	Impacts of water scarcity
	Recreational fishing	Lower fish stocks Access for boats reduced

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Worksheet 5

Floods and droughts in the area

Task 1

Research measures which have been put in place to control and maintain water supply during times of drought in the Wimmera region.

Websites to get you started:

1. Case study: Building a strong Wimmera River: https://www.vewh.vic.gov.au/news-and-publications/stories/case-study-building-a-strong-wimmera-river
2. ABC News: https://www.abc.net.au/news/2008-09-12/drought-takes-heavy-toll-on-wimmera-river/508542
3. Threats to river health: https://environmentvictoria.org.au/our-campaigns/healthy-rivers/about-healthy-rivers-2/threats-river-health/
4. Horsham council: https://www.hrcc.vic.gov.au/Emergency-Management/Flood

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Task 2

Refer to the photos and images you collected in Worksheet 4. For each image consider how a flooding event would impact that use of the river and how it could be managed.

Photo	Impacts of flooding	Flood management, ideas or strategies
	Dangerous for people to access river Unpredictable conditions Fish stocks impacted by faster river flows	Increase signage about wearing a life jacket and fishing with at least 2 other people. Carrying a rope and planning an escape route.

Task 3

Research a flooding event that has occurred within the Wimmera Catchment region. For the event selected fill in the table below.

Example of flooding events:
2010 Flood: https://www.abc.net.au/local/photos/2010/09/06/3003413.htm
2011 Flood: https://www.abc.net.au/news/rural/2011-01-25/floodwater-welcome-here/6191252
2011 Flood: https://www.abc.net.au/local/photos/2011/01/12/3111331.htm
Flood history: https://www.floodvictoria.vic.gov.au/learn-about-flooding/flood-history/1971-to-2000-floods
2016 Floods: https://www.manningrivertimes.com.au/story/4171399/wimmera-floods-seen-from-the-air-photos/

Flooding location	*Wimmera River, Horsham*
Date that flood occurred	*January 2011*
Area flooded	*Low lying areas across Horsham area.*
Cause of the flood (e.g. excessive rainfall, seasonal, human-induced)	*Excessive overnight rain across the river catchment.*
Recovery or management of the flooded area	*Clean up and repairs to areas impacted.*