



Water... WOW!

STAGE 3 EDUCATION

Module 2: Virtual Water

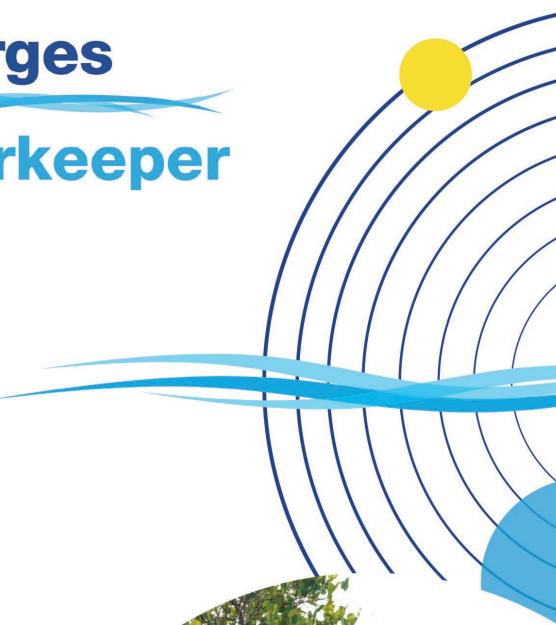
Water is essential for people not only for direct use, but also to produce our food and most other goods that we use every day.

Virtual water is the amount of water used in the growth and/or production of goods.

In this module, students will:

- explore how water contributes to the production of food and other goods that we use every day
- calculate how much virtual water is used in the production of a simple meal
- list the areas where water is used to sustain our everyday living
- discover why useable fresh water is a limited resource
- identify ways to conserve water

www.georgesriver.org.au



Module 2: Virtual Water



Teacher Background

Water for Farming and Industry (GE3-2: Explains interactions and connections between people, places and environments)

In *Module 1: Water for Life*, students learned that in our households we directly use lots of water from the environment each day! We indirectly use much, much more!

During 2016-17, the amount of water from the Australian environment consumed for human uses was over 16,500,000,000,000 litres (sixteen and a half trillion litres, which is a lot!). Most was consumed for agriculture (~63%), followed by: industry (~16%); households (~11%); and, water supply, sewerage and drainage (~9%). So, the household use that was the focus of the first module only accounts for about one tenth of our water use: students will learn more about how water is delivered to and from homes in *Module 5: Water for Living Cities*. Agriculture requires almost six times as much water as household uses and includes irrigation of crops and supplying drinking water to livestock. Industrial uses of water include being an ingredient in manufacturing, washing, dilution and cooling.

Water is also vital for transport. Over a billion tonnes of goods are transported on ships into or out of Australia each year.

Virtual Water (ST3-5LW-T: Explains how food and fibre are produced sustainably in managed environments for health and nutrition)

As mentioned above, water is essential for people not only for direct use, but also for agriculture to produce our food and many other products. Virtual water is the amount of water used in producing particular foods or other commodities. The volumes provided are estimates, as precise volumes for each item will depend upon things such as the size of that item, types of machinery used in production and the climate where the item was produced. The water is said to be virtual, because the item does not actually contain the stated volume of water, rather it is the amount of water that was used through the various stages of production. The concept of virtual water is useful when thinking about how everything people use is dependent upon water and the large volumes of water needed to produce different goods.

For example: concrete is a mix of cement, sand and water. Timber (i.e. harvested trees) required water to grow. Paper is also produced from trees and water is used in the pulping of paper. Metal production requires water for washing and cooling. Plastic production requires drilling for oil, which uses a lot of water, with more water used in the production process. Glass production requires furnaces, which are cooled using water.

So, How Much Water is Available to Support Our Activities on Earth

We need lots of water to produce those things that we eat and use every day. Most of the water we use needs to be fresh water, as we can't drink saltwater, can't water crops with saltwater and using saltwater in metal machinery will cause it to seize up through rapid rusting. Students may know that the Earth is covered mainly by water, but they may not realise that only a small amount is fresh and available for most human uses.

Although about 70% of the Earth's surface is water, this resource is one of the main limiting factors for supporting human activities. This is because we are very dependent upon extractable freshwater, but only a tiny percentage of the water on Earth is fresh and available. Most (~97%) of the water on Earth is held in the oceans and is too salty for our needs. Much of the freshwater is either frozen or underground. The remaining amount is the water available to support our needs, and this works out to be about 0.003% of the total water on Earth.

Sequence for Module 2 : Virtual Water

| | |
|--------------------------------|---|
| Syllabus Outcomes | <p>GE3-2 Explains interactions and connections between people, places and environments.</p> <p>ST3-5LW-T Explains how food and fibre are produced sustainably in managed environments for health and nutrition.</p> <p>MA3-2WM Selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations.</p> <p>MA3-11MG Selects and uses the appropriate unit to estimate, measure and calculate volumes and capacities, and converts between units of capacity.</p> |
| Learning Intentions | <p>For students to:</p> <ul style="list-style-type: none"> ◆ explore how water contributes to the production of food and other items that we use every day ◆ calculate how much virtual water is used in the production of a simple meal ◆ list the areas where water is used to sustain our everyday living ◆ explain why water is a limited resource ◆ identify & list ways they can contribute to conserving water |
| Teaching & Learning Activities | <p><u>Inquiry Question:</u> <i>Is there enough water in the world to sustain all the uses by people?</i></p> <ul style="list-style-type: none"> ◆ Introduce the concept of virtual water. What is virtual water? A lot of water is used daily within our homes, but water is also used in the production of food (agriculture) and other products (industry). We refer to this water as virtual because we don't see it. View video to discover how <u>food production</u> is placing a strain on our water supplies. GE3-2, ST3-5LW-T ◆ Can the amount of virtual water in your lunch be calculated? Using this water footprint <u>list</u> (or do a web search for 'virtual water' for other similar lists) students calculate the water footprint of their lunch. Is the amount of virtual water in their lunch more or less than the two litres of water that they directly consume for drinking each day? How does the amount of virtual water in one meal compare to the 200 - 300 litres of water they directly use in their household each day? Use these questions to prompt student discussions. MA3-2WM, MA3-11MG ◆ Introduce the 'Playground fact' that explores the amount of virtual water used for bottled water. Conduct a survey to investigate the number of people who purchase bottled water rather than drink tap water. Conduct a debate on bottled water versus tap water (students can search for information on the web to develop their arguments). ◆ Where else do we use virtual water in our lives? Students attempt to <u>calculate their water usage</u> by using a water footprint calculator. Extension activity: From your footprint calculator results, convert gallons to litres. MA3-11MG ◆ After calculating their water footprint, students calculate the average water usage for the |

| | |
|-----------|---|
| | <p>class. Next, consider that Australia is the driest continent inhabited by humans on Earth, but also has one of the highest rates of water consumption per person (termed our ‘water footprint’).</p> <ul style="list-style-type: none"> ◆ Revisit the inquiry question and discuss just how much water is available in the world. How much of the Earth is covered in water? How much of the Earth’s water is fresh and accessible? View video Show Me the Water to discover the amount of available freshwater on Earth. MA3-11MG ◆ Given that there is a limit on the amount of freshwater, particularly in a dry continent such as Australia, ask students to consider whether they could identify & list ways they can contribute to conserving water. |
| Resources | <ul style="list-style-type: none"> > Is water stress causing a global food emergency? http://education.abc.net.au/home#!/media/85250/water-stress-affects-food-production > Virtual water list: https://www.cseindia.org/water-footprint--3880 > Virtual water: http://virtualwater.eu/ > Getting your facts straight about water use http://education.abc.net.au/home#!/media/1239330/getting-your-facts-straight-about-water-use > Water Footprint https://www.cseindia.org/water-footprint--3880 > Calculate your water footprint https://www.watercalculator.org/intro/ > Australia’s water footprint https://serc.carleton.edu/integrate/teaching_materials/food_supply/student_materials/1097) > Show me the water! http://education.abc.net.au/home#!/media/1995083/show-me-the-water- |
| Feedback | Your feedback is important to us. Please complete this quick online survey: http://bit.ly/ModulesFeedback |

Playground fact:

It takes five litres of water to produce one litre of bottled water (four litres required for construction of the plastic bottle, plus the one litre of drinking water). The most popular bottled water in Australia costs over \$2.50 per litre. Alternatively, for \$2.50 you could buy about 250 litres of tap water, which is a bit more than that needed to fill a standard bathtub.



See: https://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mtyx/~edisp/dd_161652.pdf

Biographies of authors

Dr David Reid

David is a scientist who studies waterways for his work at Georges Riverkeeper in southern Sydney. He grew up near Lake Macquarie and the beaches south of Newcastle, where he spent much time swimming, surfing, exploring the life in water and generally enjoying being close to water. After finishing school, he went to university and his studies eventually led to completion of a PhD on waterbugs and food webs in farmland streams. Gaining those qualifications has allowed him to do research and monitoring work in waterways around the world, including those in New South Wales, Victoria, South Australia, New Zealand and New York City (see https://www.researchgate.net/profile/David_Reid15). He still enjoys having fun in water too!

Antonina Fieni

Antonina loves rivers. She is often seen paddling up rivers and creeks looking for Eastern water dragons or sacred kingfishers. When not paddling, Antonina is teaching environmental science and geography at the Georges River Environmental Education Centre and at the Field Study Centre at Sydney Olympic Park. Her qualifications include a Bachelor of Education and a Graduate Diploma in Environment.

Acknowledgements

Georges Riverkeeper was established in 1979 and is a waterway management organisation located in southern Sydney that is dependent upon funding from member councils. Thank you for funding and other support to Bayside Council, Campbelltown City Council, City of Canterbury Bankstown, Fairfield City Council, Georges River Council, Liverpool City Council, Sutherland Shire Council and Wollondilly Shire Council. Any opinions expressed in these modules are those of the authors, not Georges Riverkeeper or member councils.

Thank you to Beth Salt and Nathan Varley for reviewing the modules and providing suggestions for improvements prior to their release. Thank you to Georges River Environmental Education Centre and local schools for helping with development of the modules, using the modules and providing feedback to improve the modules.

Thank you Creative Commons (<https://creativecommons.org/>), from which most images were sourced.

© Georges Riverkeeper

January 2020

Authorised and published by Georges Riverkeeper

PO Box 205

Hurstville BC NSW 1481

Australia

This document is available at www.georgesriver.org.au

While reasonable efforts have been made to ensure that the contents of this publication are factually correct, Georges Riverkeeper gives no warranty regarding its accuracy, completeness, currency or suitability for any particular purpose and to the extent permitted by law, does not accept any liability for loss or damages incurred as a result of reliance placed upon the content of this publication. This publication is provided on the basis that all persons accessing it undertake responsibility for assessing the relevance and accuracy of its content.

The "Water... WOW!" education modules should be attributed to Georges Riverkeeper.

The "Water... WOW!" education modules (excluding all trade marks and logos) is licensed under a Creative Commons Attribution 4.0 Australia licence. In essence, you are free to copy, distribute and adapt the work, as long as you attribute the work and abide by the other licence terms.

Go to <http://creativecommons.org/licenses/by/4.0/> to view a copy of this licence.



Georges Riverkeeper is an alliance of Councils
with collective responsibility for the Georges
River and its catchment.
www.georgesriver.org.au

