Recycling Water – Teacher Resource

Intended Use of Resources

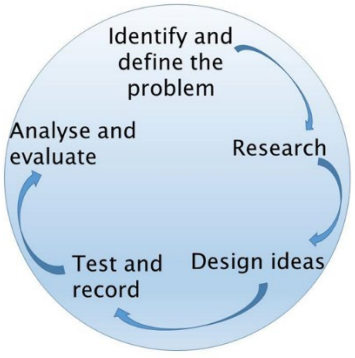
This project has been designed so that teachers from different STEM areas can pick and choose sections relevant to their subject area to work on. All activities in this package do not need to be completed to get value from the package – each activity can be completed as a stand-alone or can be approached, as a team, as a larger project. The package has potential to be extended into a much longer project to include curriculum points from different STEM subjects.

There are three **student workbooks - Open, Guided and Scaffolded,** that go along side this resource; all have the same suggestions for activities, however they have been written and edited to provide differentiated learning options to support good teaching practice**.** Teachers may pick and choose which versions they give which students, and may wish to edit them further to address their learning needs. Due to the differentiation of the workbooks, the **Open** activities will enable more syllabus links to be addressed, which is why each activity has its own syllabus links key. However, if you wish to give a truly open ended investigation then you could just give the students the challenge and background information section of the Student Workbook.

The Woodside Australia STEM Project aims to be accessible and supportive for teachers and students, please contact us if you have questions, require assistance or would like to arrange an incursion or a professional development workshop - www.wasp.edu.au

The Student Challenge

The school uses thousands of litres of water a year for flushing toilets, washing hands, watering the lawn etc. This is not very sustainable or environmentally friendly. The school has asked the students to think of ways to use water more sustainably and hopefully save money as well as water. Your job is to research water saving methods and come up with some recommendations. It is important that these recommendations are backed up with calculations and data.



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Background Information

Due to a changing climate, Perth's water sources have changed with time. Since the 1970s rainfall has reduced by nearly 20%, according to the Water Corporation, which means less water is flowing into dams. This has caused the Water Corporation to look for new sources of water.

In Perth 48% of water comes from desalination, 40% is from groundwater and 10% from surface water (Water Corporation). The Water Corporation is aiming to reduce the amount of groundwater and surface water used by encouraging households and businesses to use less water and make greater use of recycled water.

There are two main methods of recycling water, they are capturing rainwater and storing it in tanks for future use and re-using water that has been used for washing etc (grey water). Water collected this way can be used for watering gardens, flushing toilets and washing clothes without further treatment.

Activities

This booklet contains extra information on each activity, including syllabus links the overall activity objective, suggestions for recommended equipment or alternative ways to run investigations as well as useful resources and website links*. The syllabus links have been colour coded. These links to the Australian Curriculum are also relevant to the Western Australian Syllabus. – Please see the colour key below:

Covered in Scaffolded, Guided and Open Student Booklet
Covered in Guided and Open Student Booklet
Covered in Open Student Booklet
Italics – WA syllabus for DT and D and T

**Please note that the websites listed in activities were accessed in January 2019 – these addresses may change slightly, we would be grateful if you could let us know if these sites are no longer accessible.*

List of Activities

An initiative supported by Woodside and ESWA

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Background Research

Objective

Students will gain an understanding of the two main ways of recycling water – using rainwater and greywater. They will find out the difference between the two methods and learn some key vocabulary.

Students should find that water which has been used for washing can be re-used for flushing the toilet and in the washing machine but cannot be reused for drinking. Whereas some rainwater, if stored correctly, can be used for drinking and washing. People can save on water by firstly using rainwater to wash and then recycling this water for use in the toilet or watering the garden.

	Australian Syllabus Links
Science	ACSSU116 Some of the Earth's resources are renewable but others are non-renewable ACSSU117 Water is an important resource that cycles through the environment
Technologies	ACTDEK029 Investigate the ways in which products, services and environments evolve locally, regionally and globally and how completing factors including social, ethical and sustainability considerations are prioritised in the development of technologies and designed solutions for preferred futures.

Useful websites:

- The Water Corporation has some interesting statistics, facts and information regarding water usage and ways to reduce water use: https://www.watercorporation.com.au/water-supply/our-water-sources?pid=res-wss-np-spw https://www.watercorporation.com.au/-/media/files/residential/about-us/planning-for-the-future/water-forever-50-year-plan.pdf (page 40 -43)
- This website is a great introduction to greywater and covers the pros and cons of using greywater: https://www.choice.com.au/home-improvement/water/saving-water/articles/guide-to-greywater-systems
- This page discusses the positives and negatives of collecting rainwater: https://www.choice.com.au/home-improvement/water/saving-water/buying-guides/rainwater-tanks
- The Australian Government has useful information on water saving through reuse http://yourhome.gov.au/water/wastewater-reuse

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Washing Away the Water

Objective

Students will determine how much water is used, on average, during hand washing and relate this to water saving.

The main aim of this investigation is for students to be able to gain a visual idea of how much water they use each day just for washing their hands and consider how much this water equates to for the whole school. This activity should get them thinking about ways to save water and uses for the grey water.

In this activity students practice finding the mean, median and range and discussing what their water use looks like in comparison to the whole class results.

	Australian Syllabus Links
Science	ACSSU116 Some of the Earth's resources are renewable but others are non-renewable ACSSU117 Water is an important resource that cycles through the environment
Mathematics	ACMSP169 Identify and investigate issues involving numerical data collected from primary and secondary sources ACMSP171 Calculate the mean, median, mode and range for sets of data. Interpret these statistics in the context of data. ACMSP172 Describe and interpret data displays using median, mean and range.

Useful websites:

- This BBC bitesize link is a good revision tool for averages and comparing data. https://www.bbc.com/bitesize/guides/znhsgk7/revision/1

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Grey Watering the Garden

Objective

Students will use grey water to investigate what affect it has on plant growth and discuss the viability of using grey water to water the school playing fields and garden. This investigation focuses on the scientific method, with students making predictions about the outcome of the investigation. Grey water is commonly used for watering plants and gardens as although it contains cleaning products, they are usually so dilute they do not impact growth. Students may want to investigate at what concentration cleaning products have a negative on the growth of plants.

Students will see from this investigation that grey water is reusable and they will consider how they could reduce their water use by re-using water.

	Australian Syllabus Links
Science	ACSSU116 Some of the Earth's resources are renewable but others are non-renewable ACSSU117 Water is an important resource that cycles through the environment ACSIS124 Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge ACSIS125 Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed. ACSIS130 Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.
Technologies	Competing factors, including social, ethical and sustainability considerations, in the development of technologies.
Mathematics	ACMSP169 Identify and investigate issues involving numerical data collected from primary and secondary sources

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Finding Your Daily Average Use of Water

Objective

Students calculate their daily use of water and compare with the class. Students discover that there is a lot of hidden water use in their daily lives.

This activity gives students an opportunity to compare the difference between mean, mode and median and discuss variation in range of data.

Student also use an online calculator tool to calculate the hidden water usage which they will not have thought about, such as water used in food and clothing production. They will probably find that the largest volume of water use is through food production and that the less meat they eat the less water they use – they can link this to food chains and the pyramids of biomass.

Students will generally be very surprised at how much hidden water they are using and will realise that it would be very difficult to replenish the amount of water using a rain tank.

We recommend using https://www.watercalculator.org/ for calculations but note the water calculator gives an answer in gallons/day not litres, a gallon is around 3.7 L.

	Australian Syllabus Links
Science	ACSSU116 Some of the Earth's resources are renewable but others are non-renewable ACSSU117 Water is an important resource that cycles through the environment ACSSU112 Interactions between organisms can be described in terms of food chains and webs; human activity can affect these interactions.
Technologies	Competing factors, including social, ethical and sustainability considerations, in the development of technologies.
Mathematics	ACMSP169 Identify and investigate issues involving numerical data collected from primary and secondary sources ACMSP171 Calculate the mean, median, mode and range for sets of data. Interpret these statistics in the context of data. ACMSP172 Describe and interpret data displays using median, mean and range.

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Useful websites and resources:

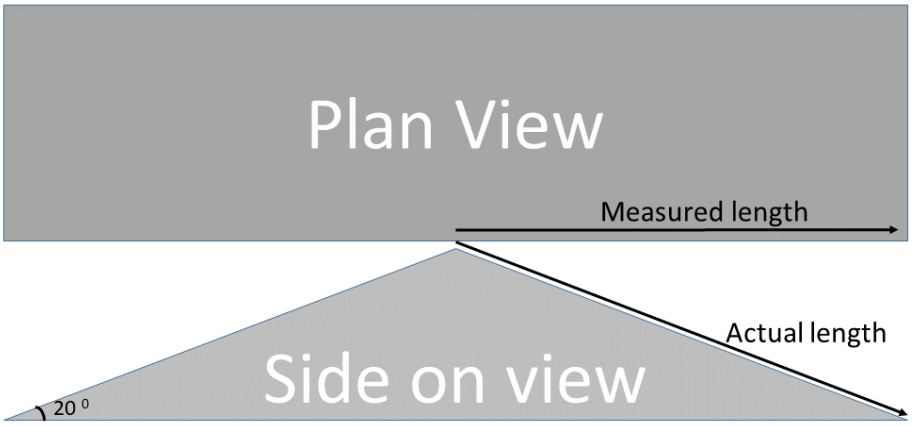
- BBC Bitesize Food chains and food webs – this can be used to discuss how much water is needed to support each trophic level and compare it to energy: https://www.bbc.com/bitesize/guides/zq4wjxs/revision/2
- This short video is very useful for explaining why there is such a high amount of "hidden/virtual" water in our daily lives: https://www.youtube.com/timedtext_video?ref=player&v=b1f-G6v3voA

Planning for Rain

Objective

Students will determine how much water can be stored from rain each month by determining the surface area of the school roofs.

This activity includes students downloading the plan view of the school from Google Maps, or another source, and using this to determine the surface area of the roof. Unless they consider the angle they will only get a rough estimation of the area of the roof and this will be slightly lower than what the actual surface area is. (The actual length is greater than the measured length when using a plan view).



Students can use the Bureau of Meteorology rainfall measurements to determine roughly how much water they would collect each month and discuss if that will be enough to replenish the school's water supply.

	Australian Syllabus Links
Science	ACSSU116 Some of the Earth's resources are renewable but others are non-renewable ACSSU117 Water is an important resource that cycles through the environment
Mathematics	ACMMG159 Establish the formulas for areas of rectangles, triangles and parallelograms, and use these in problem solving. ACMNA173 Recognise and solve problems involving simple ratios

Calculating the Cost

Objective

Students will use calculations to determine the best water storage tanks to purchase for the school.

Students will use their calculations and knowledge to discuss the pros and cons of different water storage devices. They will consider that the cheapest option is not always the best, as underground water storage takes up no space, in comparison to above ground storage. Students might also consider that although they have the capacity to store lots of water, they may not get that much rain. This allows them to discuss if grey water tanks should be used instead of rain water tanks or as well as.

	Australian Syllabus Links
Subject area	**Australian syllabus links**
Science	ACSSU116 Some of the Earth's resources are renewable but others are non-renewable ACSSU117 Water is an important resource that cycles through the environment
Mathematics	Investigate and calculate "best buys", with and without digital technologies.