



Practical investigation – Recycled Water flow diagram

Flow diagram

A flow diagram visually represents the steps and orders that must be made to complete a process. To improve students' Working Scientifically skills, flow charting skills are required for students to sequence steps in an explanation, correctly organise steps in a process, and obtain information from a flow diagram.

This activity aims to show students how to create a flow diagram and develop their flow-charting skills. They will also learn about how we treat our recycled water using different separation techniques. Rather than just describe the process in plain text, students can identify the steps by representing them visually.

The flow diagram cards include all the necessary process in recycled water treatment based on St Marys Advanced Recycling Plant. See how we treat recycled water to protect the environment.

Syllabus links

- **SC4-9WS** – presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations.
- **SC5-9WS** – presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations.



We monitor and manage recycled water at advanced water recycling plants like this one at St Marys.

Instructions

1. Print off the cards attached.
2. Cut out the arrows and key with dashed lines for your flow diagram.
3. Rearrange the order of the slides to create a flow diagram of how you think we filter water in advanced water treatment.
4. Cut out the items in the sorting game.
5. Place items where you think they are removed in water treatment.
6. Check your answers or visit [St Marys Advanced Water Recycling Plant](#) page.

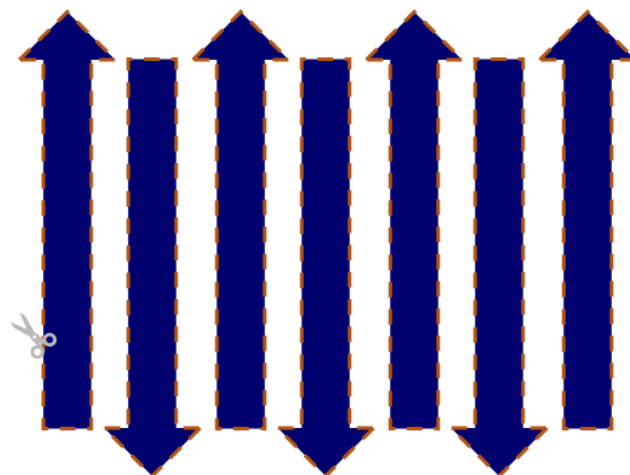
Flow diagram cards

St Marys Advanced Water Recycling Plant

Uses membrane technology to produce highly treated recycled water, which is discharged into the Hawkesbury-Nepean River.



Sydney
WATER



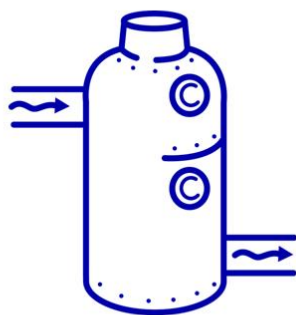
Recycled water

St Marys Advanced Water Recycling Plant receives about 60 million litres of tertiary treated effluent (recycled water) from: St Marys Water Recycling Plant, Penrith Water Recycling Plant and Quakers Hill Water Recycling Plant.



Decarbonators

We pass the water through decarbonators. We reduce the amount of dissolved carbon dioxide in the water that entered the water through high pressures in advanced treatment. We adjust the pH to ensure we meet environmental standards.



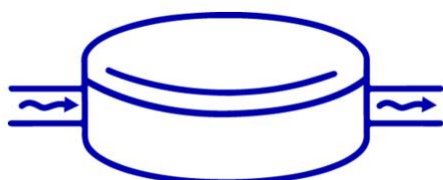
Highly treated recycled water

St Marys Advanced Water Recycling Plant purifies recycled water to such a high standard that it greatly reduces the volume of nutrients, including nitrogen and phosphorous. This purified water is discharged into the river from Penrith. This improves the water quality downstream of the Penrith Weir and helps reduce the growth of algae and water weeds.



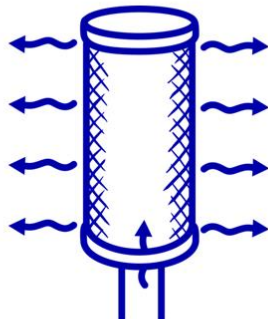
Recycled water balance tank

The highly treated water is temporarily stored in the clear water balance tank before being pumped to Penrith, where it's released into Boundary Creek



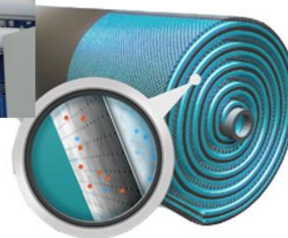
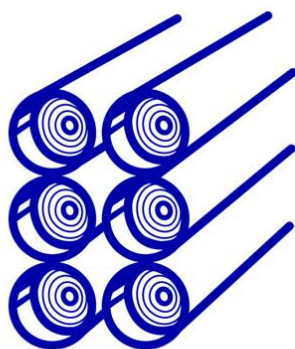
Fine mesh strainer

We filter out any aquatic weeds, algae or leaves that may be in the water.



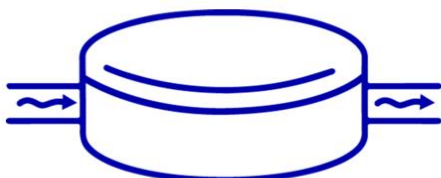
Reverse osmosis

We force the water at high pressure through reverse osmosis membranes. The membranes remove particles larger than 0.0005 μm producing clean water (permeate) and concentrate. Concentrate is sent to North Head Wastewater Treatment Plant.



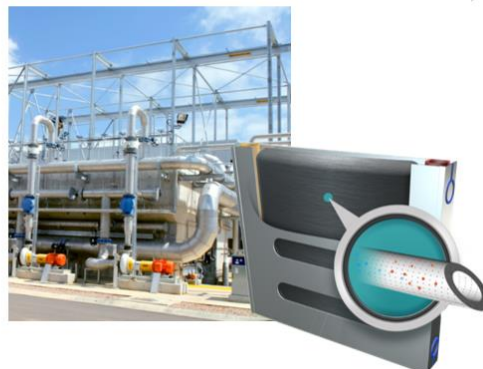
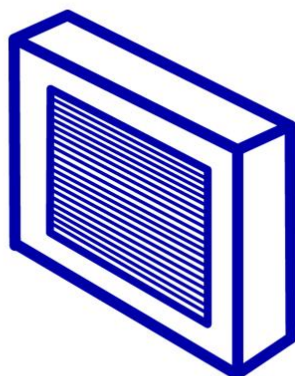
Feed water balance tank

We pump recycled water from St Marys, Penrith and Quakers Hill into the feed balance tank. The water mixes and we add chlorine and ammonia to disinfect the water and assure water quality before advanced treatment (membrane filtration).



Ultrafiltration

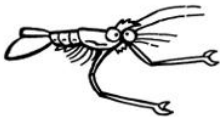
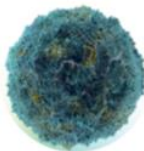
We pump the water into a tank filled with ultrafiltration membranes. A vacuum sucks the water through the semi-permeable and removes particles larger than $0.02\text{ }\mu\text{m}$. We clean membranes regularly and the cleaning waste is sent to St Marys Water Recycling Plant for treatment.



Sorting game

Cut out these items and place where you think they are removed in the flow diagram.

Note: Wastewater treatment disinfects (kills) pathogens, the harmless cell or cell fragments can be removed in using membrane technology.

 algae, sticks and leaves	 dissolved carbon dioxide	 salts and dissolved nutrients	 Red blood cells ($6 - 8\text{ }\mu\text{m}$)
 small invertebrates	 pollen grains ($15 - 200\text{ }\mu\text{m}$)	 Poliovirus ($\sim 0.03\text{ }\mu\text{m}$)	 Salmonella ($0.7 - 5\text{ }\mu\text{m}$)