



ACTIVITY NOTES

SUSTAINABLE ARCHITECTURE - TERRA WATER



14 to 16 years old



15 - 20 minutes

Includes:

Teacher Notes

Student Worksheet



EXPO
CITY
DUBAI



TEACHER NOTES



LESSON SUMMARY

In this activity, students understand the process of water treatment and how buildings can be designed to become net-zero for water. Students understand how different categories of waste water are treated differently and some difficulties in reaching net-zero.



EXPO CITY DUBAI CONNECTION

Terra is committed to achieving net zero water consumption. This is both to reduce pressure on already vulnerable fresh water stocks as well as the dependency on desalination. To do this has two goals:

- To achieve net-zero water use
- To consume 40% less water than the regional average

These are ambitious goals. While the pavilion is located in an arid landscape with little water, it requires a lot of water to run. At the Terra Pavilion, water is involved in everything from cooling the building to preparing food, and watering the gardens - not to mention supplying enough drinking and bathroom water everyone who visits each day.

Terra's aim was to make sure that as little of this water as possible comes from Dubai's main drinking water supplies, and therefore water is captured, cleaned and recycled all over the Pavilion. Depending on where the water comes from and how it is used, its quality varies, so Terra has a number of different systems for cleaning and reusing water.



LEARNING OBJECTIVES

- Understand how innovative architecture can lead to the development of net-zero water buildings which generate, manage and recycle their own water
- Understand how different categories of water are treated differently
- Describe some difficulties for a building in Dubai to achieve net-zero water consumption



MATERIALS/ RESOURCES REQUIRED

- Student Slides

ACTIVITY OVERVIEW

The student slides outline how potable, greywater and blackwater are treated at Terra.

Potable Water:

Although almost all water generated from collection of condensate or groundwater turns into drinking water, some of this water may also be used to make up water which has been lost from the greywater system. Treatment includes sterilisation to kill microbes in the water.

Greywater System:

The greywater system diagram shows how water can be continually recycled again and again through an on-site cleaning and sterilisation process. Although greywater is not classified as drinkable, the treatment process makes the water very clean.

Blackwater System:

The blackwater system shows how toilet water can be continually recycled again and again. The filtration process involves passing water through the reed beds which surround the pavilion. The roots of the reeds are able to filter water while microbes in the soil can even digest soap particles. The majority of treated blackwater is used for irrigation.



Questions:

1. Give an example of:

- a. Potable water – *rain water, condensation from windows*
- b. Greywater – *dirty water from a hand sink or shower*
- c. Blackwater – *dirty water from a toilet*

2. Why is it important for blackwater to be kept separate from potable water?

Blackwater may contain harmful microbes which could make potable water unsafe to drink

3. What difficulties do you think the Terra pavilion faces in its goal of generating all its own water?

The arid climate of Dubai reduces the amount of available rainwater and groundwater. Technology for capturing humidity from the air is still developing, but is not currently sufficient.

4. Terra uses reed beds as part of the blackwater filtration systems.

Suggest why this is better than mechanical or chemical methods of filtration.

Other methods require high amounts of energy to treat water. This energy typically comes from fossil fuels which contribute to carbon emissions. Reed beds also have no moving parts and require very little maintenance.

5. The use of greywater in handwashing and blackwater in flushing toilets can be described as 'closed loop systems' – what do you think this means?

These are closed loop systems because the same water continuously loops through a cycle of use, treatment and re-use. The same water can be used again and again, indefinitely.



DID YOU KNOW?

Mangroves are the only tree which can live in salt water and naturally desalinate water to make fresh water for the tree to use. They are also useful for protecting coastlines, absorbing CO₂ from the atmosphere and filtering waste water. Students could be given an activity to find out more, or simply read the following news articles.

[Why the UAE's mangroves are so important — and how to save them \(thenationalnews.com\)](https://www.thenationalnews.com/uae/2019/09/11/why-the-uae-s-mangroves-are-so-important-and-how-to-save-them/)

[Device inspired by mangroves could help clear up flood water | Science | The Guardian](https://www.theguardian.com/science/2019/09/11/device-inspired-by-mangroves-could-help-clear-up-flood-water)