



**Water
Utility
Operator**

GAMES BOOKLET
Play & Learn

The three water networks used in Malta



As a water utility operator I am responsible for the proper functioning of three different networks. These are complex systems combining extended pipelines, treatment and storage units. **Learn more about the water networks in Malta by filling in the blanks.**

aquifers • bacteria • built • dams • desalinated • flooding • groundwater • new
• reverse • percolation • refined • salt • sea • sewage • soil

The freshwater supply system: Freshwater in Malta is produced from two main sources: groundwater and **r e v e r s e** osmosis (RO). RO plants remove _____ from _____ water and then the _____ water is mixed with _____. This mixing gives a blend that is suitable for drinking. Finally, the water is disinfected to remove any potentially remaining harmful _____ and it is then distributed to us through the supply network.

The sewage system: After its various uses in our houses, schools, offices and shops, the dirty water is led through another network to the _____ treatment plant, where it is treated and then discharged into the sea. If further _____ the resulting _____ water can be used for agriculture or landscape irrigation, or for recharging the underground _____.

The rainwater drainage system: Rain that is not absorbed by the _____ is drained into a network consisting of grids, pipes, open channels and small valley _____ and is finally discharged into the sea. It is important that this network is properly designed and maintained to avoid flooding and achieve maximum _____ into the soil. The risk of _____ is higher in low-lying areas, in particular dry valleys which have been _____ up.



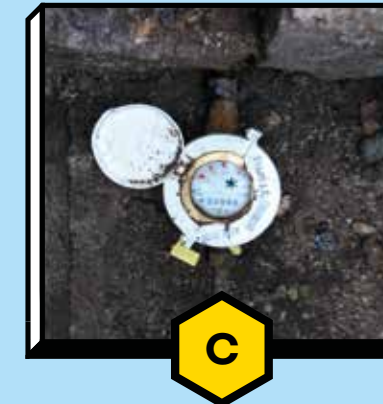
The three different water systems for freshwater, sewage and rainwater add up to many kilometers of pipelines! This means a lot of work for me!

What kind of water works are these?

As a water utility operator it is my duty to regularly check all kinds of water-works. Can you recognise them?
Do the matching.

1. Drain manhole cover (used to access the underground network)
2. Water meters (that measure consumption)
3. Elevated freshwater reservoir (to ease distribution)
4. Rainwater gutter (for watering urban green spaces)
5. Drains (that channel rainwater into the drainage system)
6. Pipes (found inside the Reverse Osmosis plant)
7. Settling tank (found in a sewage treatment plant)
8. Small valley dam (helps to retain storm water)

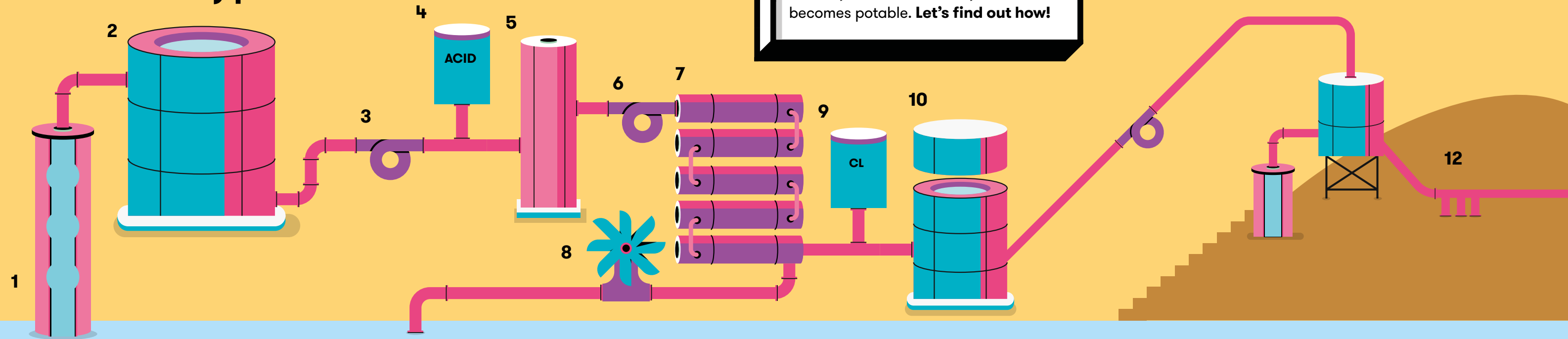
Answers: 1 E, 2..., 3..., 4..., 5..., 6..., 7..., 8...



Will you help me out?

Be vigilant for leaks, broken pipes and grids, etc. in your school, home and neighborhood. Inform your teachers or your family and report problems to the Water Services Corporation!
www.wsc.com.mt

Discover the desalination (Reverse Osmosis) plant



What happens inside a Reverse Osmosis (RO) plant? Salty and brackish water is treated, salts are removed, and water becomes potable. **Let's find out how!**

Add the missing key-words in each of the 12 steps of the process.

acid • beach • chlorine • desalinated • filter • groundwater • membranes
• lime • network • pressure • pump • sea • tank

1. The RO plant's input water comes from _____ wells.
2. In this buffer-____ the salt water is collected before its treatment begins.
3. This boost-_____ is necessary to keep the water flowing.
4. _____ is added before the salt water enters the membranes, so that the membranes can work properly.
5. This cartridge _____ helps to keep out any unwanted particles suspended in the water.
6. Another boost-pump pushes the water through the membranes under high _____.
7. Due to high pressure seawater goes through the _____, with salt remaining behind.
8. Due to the energy recovery turbine, part of the energy that was consumed earlier is reclaimed. The salty brackish water is then rejected back into the _____.
9. In the post-treatment phase _____ is added for disinfection and _____ is added to improve the taste.
10. The _____ water is collected and then pumped to an uphill area.
11. The desalinated water is mixed with _____ from a borehole.
12. The final water flows down to the users through the distribution _____.

True or False? Check T or F respectively.

1. There are three RO plants in the Maltese Islands, two in Malta and one in Gozo.
2. Many hotels in Malta have their own RO plants in place.
3. Groundwater in the Maltese Islands is enough to cover the needs, even without the RO plants.

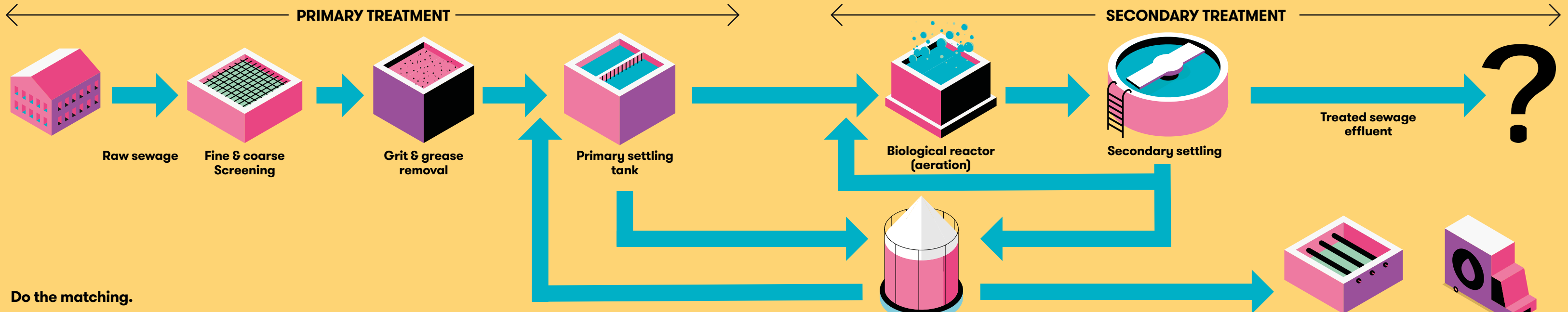
True	False
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Although RO plants require energy to run, technology advances have significantly reduced the energy needed for their operation. All energy use contributes to climate change due to CO₂ emissions; hence it is of utmost importance that we increase the use of renewable energy sources which do not cause emissions.



How is wastewater treated?

What are the processes in a wastewater treatment plant? Let's find out! The diagram below represents the main processes inside such a plant.



Do the matching.

1. Input sewage
2. Screening
3. Grit & grease removal tank
4. Primary settling tank
5. Biological reactor
6. Secondary settling tank
7. Sludge digester

- A. Any sand and small stones are removed by flotation.
- B. Air is pumped and the bacteria 'eat' the organic substances.
- C. Raw sewage enters the plant.
- D. Large solid debris e.g. rags, wood, sticks are removed.
- E. Any remaining solids settle down as sludge.
- F. Sludge from all tanks becomes dry, odourless and biogas is produced.
- G. The heavy particles (colloids) that float slowly settle at the bottom as sludge.

Answers: 1..., 2..., 3A, 4..., 5..., 6..., 7...

Choose the right answer.

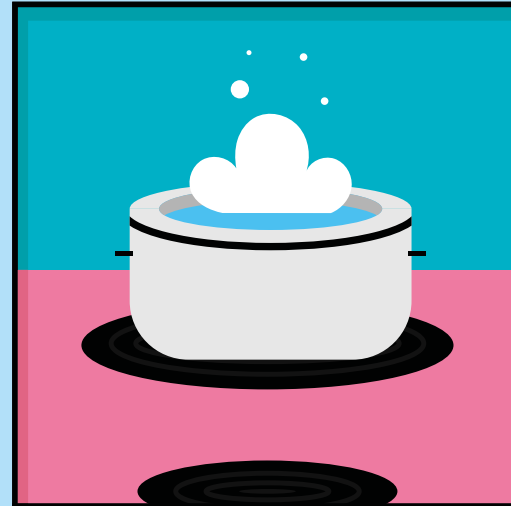
1. The percentage of sewage water treated in Malta is:
a. 80% b. 90% c. 100%
2. The solid grit removed goes to:
a. a landfill b. a crop land c. the sea
3. The dried odourless sludge can then be used as:
a. a fertilizer b. a fuel c. both as fuel and fertilizer
4. In Malta due to a refined treatment process, it is now possible to use all the reclaimed water for irrigation. This water is called:
a. New water b. Old water c. Fresh water

What can we use new water for?

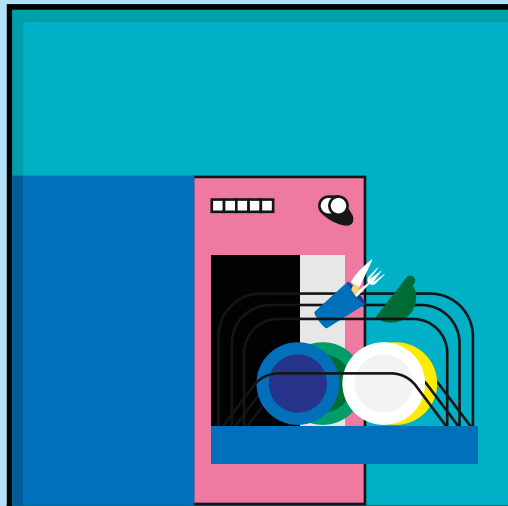
How can we use the reclaimed New Water? Write YES or NO under the following images.



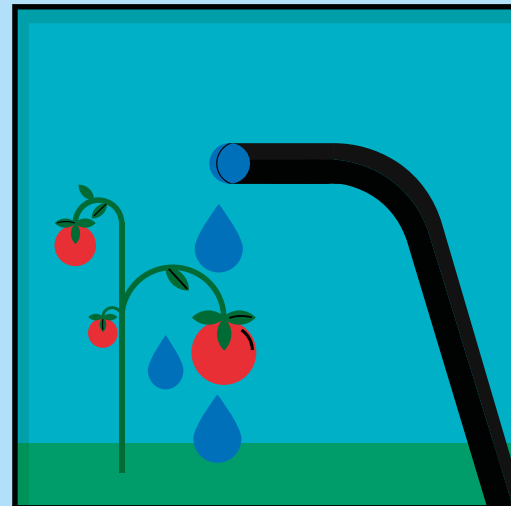
1. Watering a lemon tree?.....



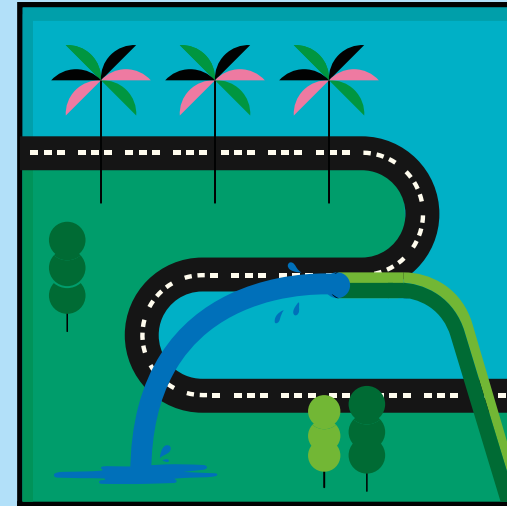
2. Cooking?.....



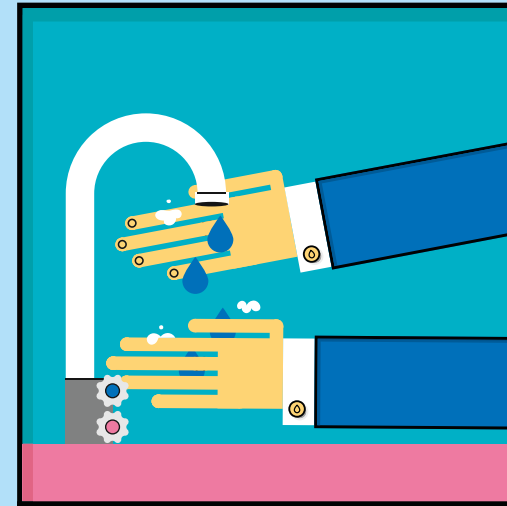
3. In the dishwasher?.....



4. Watering tomatoes?.....



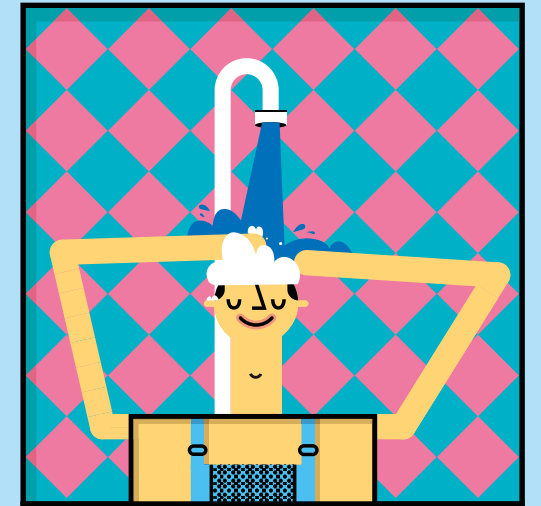
5. Watering urban green spaces?.....



7. Washing hands?.....



6. Drinking?.....



8. Showering?.....

Your opinion matters! Check Yes or No and justify your choice.

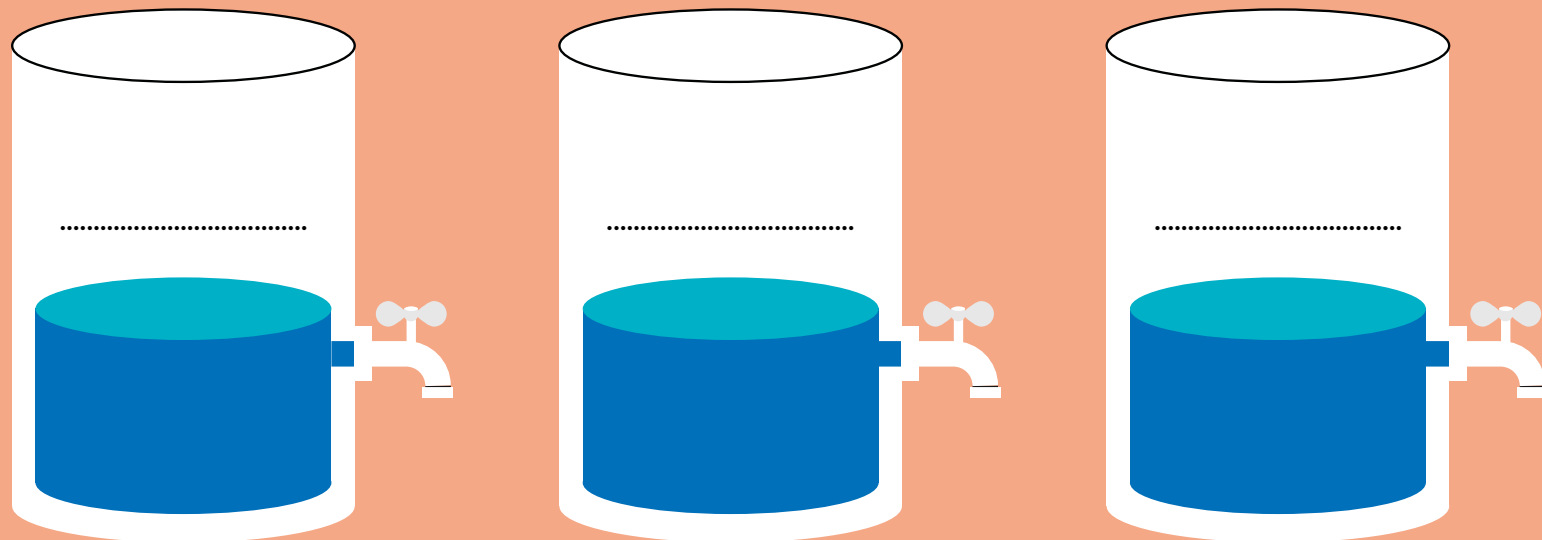
Would you agree to use the reclaimed New Water to...	Yes	No	Why? (explain your choice in a few words)
... water your school's garden?			
... water the grass in a roundabout?			
... water for agriculture?			

Rainwater harvesting vs greywater systems

In dry areas, especially small islands, people have been collecting rainwater for thousands of years. It is a practice that collects and stores water to cover household needs during the dry summer months. After supply networks ensured access to water in all households, people gradually stopped collecting rainwater. Nowadays however, climate variability has increased water scarcity, making rain harvesting practices popular once again. Both traditional and modern applications are installed in all types of buildings.

‘Grey’ water is the water that drains from sinks, showers, bathtubs and washing machines (in contrast flushed toilet water is often termed as ‘black’). Greywater contains mostly soap, shampoo and detergents and is therefore relatively easy to treat in order to be reused. Although treated greywater is not appropriate for drinking or showering, it can be used for other purposes that do not require top quality water.

After constructing the rain harvesting and greywater models at the Ghajin Centre, **write three things rainwater harvesting systems and greywater systems have in common:**



Do the following matching exercise.

Rainwater harvesting systems

Greywater systems

Both systems

1. Collect, treat and use the wastewater from sinks, bathtubs, and washing machines.
2. Collect, treat and use precipitation water.
3. Reduce the water bills.
4. Their input water depends on the weather.
5. They can reduce the risk of flooding if constructed on a large scale.
6. Their output water can be used for watering the garden (flowers and trees) but only through drip irrigation (to avoid contact).
7. Their output water can be used for watering the garden (flowers, trees and vegetables).
8. Their output water can be used for toilet flushing.

Water coming from rain harvesting, greywater recycling, desalination as well as from treating the wastewater is often called “non-conventional”.



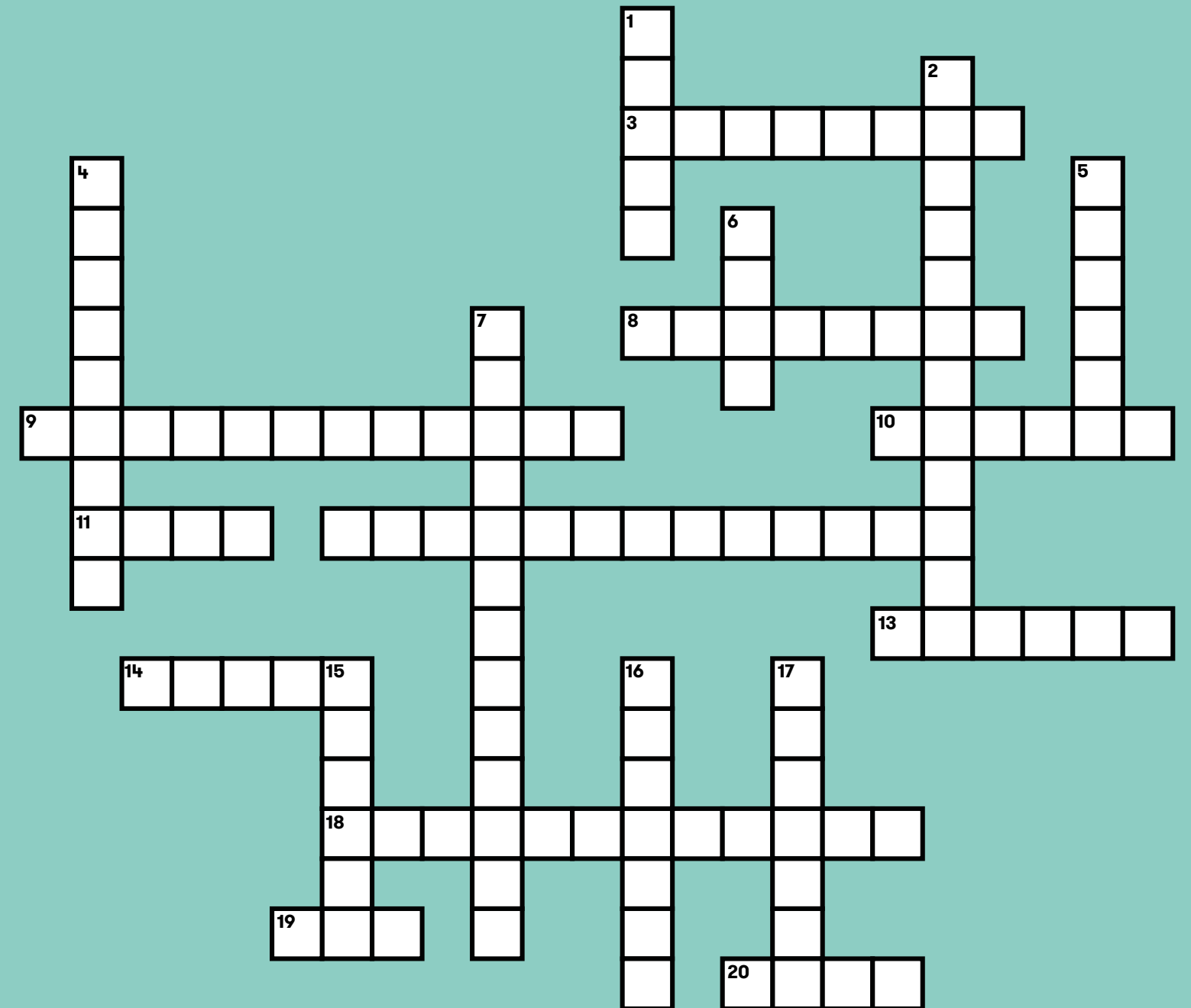
The water systems in a crossword!

Across

- 3. A step in sewage treatment: organic matter is decomposed by bacteria.
- 8. In a RO plant seawater is forced to pass through it, withholding the salt.
- 9. Removing salt from seawater.
- 10. It restrains the suspended solids in a liquid.
- 11. Another word for reservoir.
- 12. Settling of solid particles at the bottom of a tank.
- 13. Land sealing increases the risk of ... (pl).
- 14. The water network is full of them.
- 18. The process of killing bacteria to make water safe to use.
- 19. ...water, results from a sewage plant and can be used in irrigation.
- 20. Another word for soap water from the sink.

Down

- 1. Another word for toilet water.
- 2. Harvested rainwater is a 'non-... water resource'.
- 4. 'New water' is rich in them.
- 5. Another word for municipal wastewater.
- 6. The machine that forces water to move.
- 7. Lowering the pH; a step in RO treatment.
- 15. The solid material left after sewage treatment.
- 16. This type of osmosis is used to desalinate water.
- 17. Another word for underground reservoir.



Water, energy, food & ecosystems: all essential and all linked!

How so? Let's start with water. We use water to grow our crops and to generate electricity. Power plants use water from nearby lakes, rivers and aquifers for cooling or processing purposes. At the same time, we need energy to pump and heat our water, produce food from our crops and transport it to our table. Ecosystems don't only supply the water we need, they are also where pollination takes place, resulting in the plants that we eat, or use as medicine. They too need enough water and protection to be able to function properly. In other words, there are interconnected water, energy, food and ecosystem requirements.

By 2050 we will be 9 billion people on our planet and we will have to produce enough food for all. That means we will need more water and energy. With a changing climate on top of everything else, we have to create partnerships between sectors, make trade-offs, promote stability and make clever decisions to address the so-called ... **(fill in the blank letters to find out)**.

E		ergy, food, ecosystems
and wat		r link in many
and comple		ways.
Deeply		nderstanding these links
mean		a new way of thinking.

Check your own nexus-thinking: **Choose symbols from the following nexus-diagram and write a phrase to connect them.**

Example: To produce a loaf of bread we need flour that comes from wheat. Wheat crops need land, sun, fertilizers and water to grow, as well as bees and wind to pollinate. To harvest and transport the wheat we need fuel for tractors, trucks and ships. To make flour from wheat we need energy and water. We also need energy and water to bake the flour and make bread.



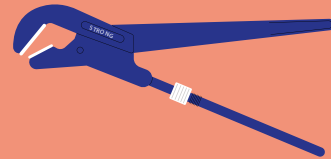
Write your phrase below.

What's in my toolbox?



A fully stocked toolbox is valuable to any technician working in a water utility plant. Tools are needed for installing new devices, fixing leaks, repairing damages, etc. How familiar are you with his tools? For each tool complete the phrase “It is a ... and it is used for ...”.

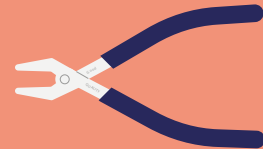
plumber's tape • fittings • gloves • hammer • spanner • pliers • pipe wrench • tape measure



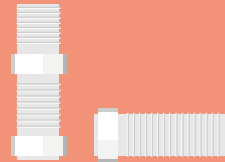
1.....



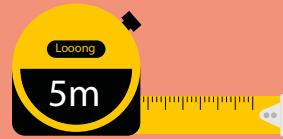
2.....



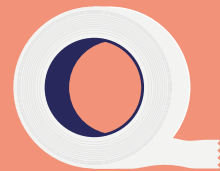
3.....



4.....



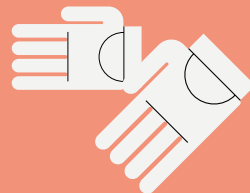
5.....



6.....



7.....



8.....

**Do you know other plumbing tools?
Draw them here, and write what they are used for.**

Answers

Page 2-3: The three water systems used in Malta

reverse osmosis, salt, desalinated, groundwater, bacteria, sewage, refined new water, aquifers, soil, dams, percolation, flooding, built.

Page 4-5: What is this waterwork?

1E, 2C, 3H, 4B, 5A, 6AG, 7D, 8F

Page 6-7: Discover the desalination plant

1 beach, 2 tank, 3 Pump, 4 acid, 5 filter, 6 pressure, 7 membranes, 8 sea, 9 chlorine, lime, 10 desalinated, 11 groundwater, 12 network.

True or False: 1T, 2T, 3F

Page 8-9: How is wastewater treated?

Matching: 1C, 2D, 3A, 4G, 5B, 6E, 7F

Multiple choice: 1c, 2a, 3c, 4a

Page 10-11: What can we use new water for?

YES: 1, 4, 5; NO: 2, 3, 6, 7, 8

Page 12-13: Rainwater harvesting vs greywater systems

Common Elements: pipes, tanks, filters, pumps, saving water, Rain: 2, 4, 5; Grey: 1, 6; Both 3, 7, 8

Page 14-15: The water systems in a crossword!

Across: 3 aeration, 8 membrane, 9 desalination, 10 filter, 11 tank, 12 sedimentation, 13 floods, 14 pipes, 18 disinfection, 19 new, 12 grey.

Down: 1 black, 2 conventional, 4 nutrients, 5 sewage, 6 pump, 7 acidification, 15 sludge, 16 reverse, 17 aquifer.

Page 18: What's in my toolbox?

1. Pipe wrench-to screw pipes 2. Spanner-to grasp and twist objects (fittings) 3. Pliers-to hold firmly or cut 4. Fittings-to connect pipes of different sizes or regulate water flow 5. Tape-to measure length 6. Teflon tape-to seal pipe threads 7. Hammer-to wedge, beat, stick or pin something 8. Gloves-to protect and give a good grip.

References

Nexus: www.iiea.com/environmentnexus

Photo credits

Page 4-5: © MIO-ECSDE/MEdIES

Graphic design

Caparo design crew

ISBN

978-99957-1-469-7

Citation

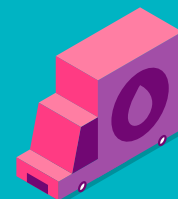
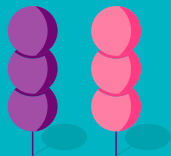
Main authors: Iro Alampej & Vicky Malotidi (MEdIES, MIO-ECSDE)

Scientific supervision: Prof. Michael Scoullas (UoA, MIO-ECSDE)

Editing: Anastasia Roniotes (MIO-ECSDE), Amanda Zahra (GHAJN, EWA)

Special thanks to David Sacco (Water Services Cooperation), Paul Micallef, Amanda Zahra and Natalino Spiteri (GHAJN, EWA) for their useful comments and Manuel Sapiano (EWA) for the continuous support.

This booklet is for students who visited the Għajn National Water Conservation and Awareness Centre, played and learned together with the water utility operator and are willing to support him in his duties to manage water properly! Are you one of them?



This brochure is to be used by the visitors of the 'Għajn' Water Conservation and Awareness Centre. It has been prepared by MIO-ECSD and the Energy and Water Agency of Malta, in the frame of the LIFE 16 IPE MT 008 Project.

Partners



GĦAJN
The National Water
Conservation Awareness Centre
ghajn@gov.mt



Energy and Water Agency
www.energywateragency.gov.mt
info-energywateragency@gov.mt



**Mediterranean Information Office
for Environment, Culture and
Sustainable Development**
www.mio-ecsde.org, info@mio-ecsde.org



**Mediterranean Education Initiative
for Environment and Sustainability**
www.medies.net
info@medies.net