

# The Water Puzzle Correction

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TO REVIEW AFTER

**Erreur ! Signet non défini.**

## 1. Workshop planning

15-20 min:

### Welcome

- round of the table: How did you hear about Eau'dyssee, what do you do, what do you expect of today's session? (note down who does what and their level of knowledge on the topic + interest for the session)
- presentation of the workshop and the association Eau'Dyssee.

The association aims at educating people on water challenges. It creates educative workshops for different audiences (schools, professionals, councils, individuals, etc.). Those workshops can have different forms: exhibitions, games, videos, blog posts, etc. They are created by volunteers and based on verified sources. The association runs several workshops including the Water Puzzle.

The workshop was created in 2021 in France by Laurie Caillouet and Sébastien Legrand, both hydrologists. The goal of the workshop is to make participants realise that the water going through their tap travelled a long way before arriving there, and is limited.

The workshop is for 3 hours and will be split into 5 parts. In each part, we will use cards. Collectively you will read those cards and use causal links to place them on the board. It is made to be collaborative, so listen to each other and let everyone participate. *As a facilitator, make sure all the participants feel included and speak during the 3 hours.*

### Present how to use Mural (share screen)

Game 1 ~ 30 minutes

Game 2 + start of game 3 (human activities sorting) ~30 min (15 min if no green cards)

Game 3 (Impacts) ~ 30min

Game 4 ~ 30min

Debate & Discussion ~30/40 min

### Example of timing:

9-9h15: Welcome and Intro

9h15-9h20: Mural

9h20-9h50: Game 1

9h50-10h05: Game 2

10h05-10h20: Start of game 3 (human activities)

10h20-10h50: Game 3 impacts

10h50-11h15: Game 4 climate change

11h15-11h25: Footprint

11h25-11h55: Debrief

11h55-12: Final words

## 2. Game 1: The natural water cycle

Present the logic of game 1:

**Game 1 focuses on building the natural water cycle. The basis of the game is drawn. There are blue cards for water stocks, which represent where water is stored on Earth.**

### Step 1

You distribute the « stocks » blue cards to participants. They all read the cards one by one (need to listen to each other). Once they all read the cards, they place them on the drawing. If face to face, they can place each card after being read.

Explain the following points:

- Non-renewable aquifer: Groundwater or underground water is the water beneath the earth's surface that occurs in pore spaces and fractures of rock formations called aquifers: It is non-renewable when water table with a low annual renewal rate but a high storage capacity. So it is not that it does not renew, the issue is that the renewal of the consumed water is much longer than the lifespan of human society. This makes those water tables non-renewable. It is as if they are cut from the natural water cycle.
- Permafrost: Frozen soil (mix of mud and ice). They contain a high quantity of methane (greenhouse gas) and old dead animal bodies and virus. Their melting is and will have a catastrophic impact on climate change and human health.

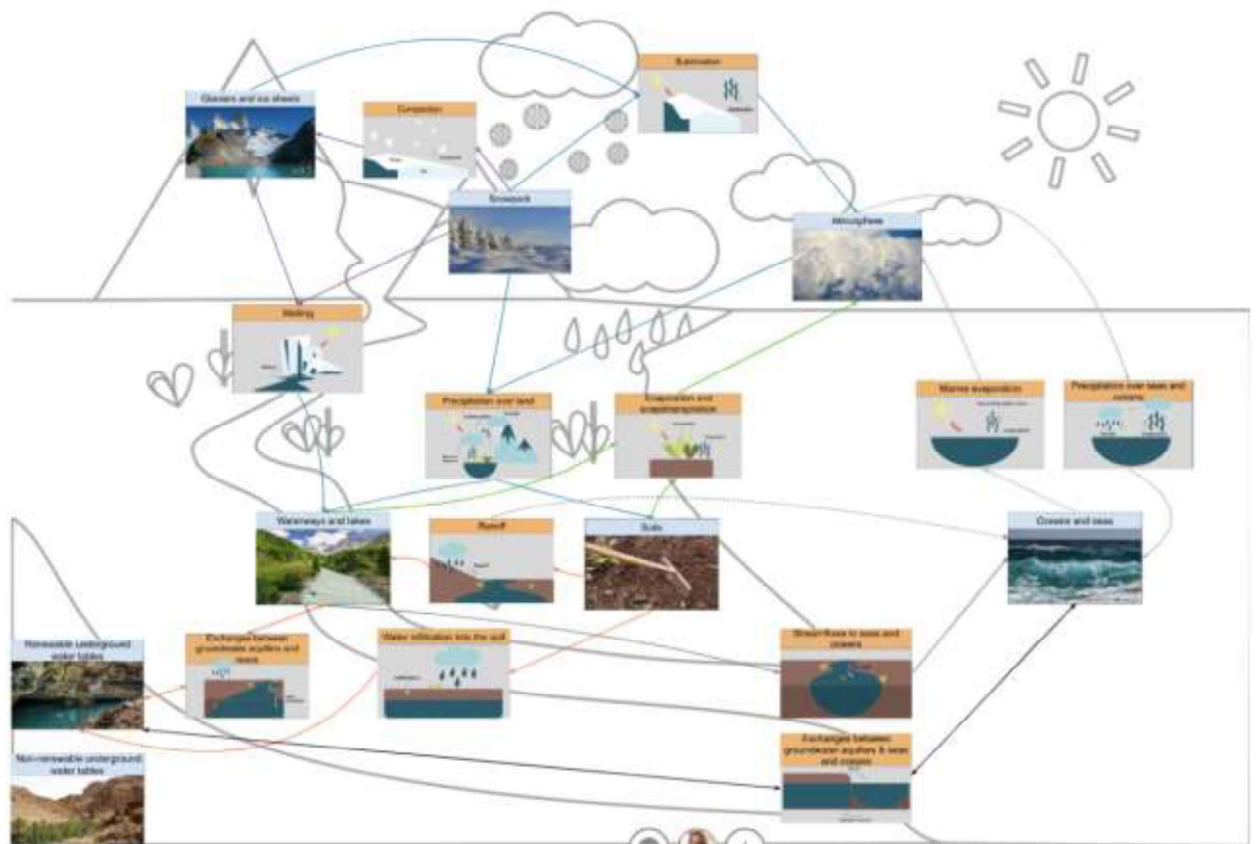
### Step 2

Same process as step 1, you distribute the cards, and participants read them one by one and place them at the end. They need to place one flux card between two stock cards. Each orange card represents the process linking the two stocks: how water is flowing between stocks.

There can be 3 blue cards linked to one orange card.

### Key messages

**Water is available in large quantity on Earth, but only a tiny portion of it is available for human use. Humans mostly rely on less than 1% of available water on Earth. And some of this water is coming from non renewable stocks. A stock is non renewable if the withdrawal rate is higher than the regeneration rate of the stock (take more water than putting back in).**



Correction

Cards	IN	OUT
Atmosphere	Marine Evaporation Terrestrial evaporation Evapotranspiration Sublimation	Precipitations over seas and oceans Precipitations over land
Snow pack	Precipitations over land	Melting Compaction Sublimation
Glaciers and ice sheets	Compaction	Melting Sublimation
Oceans and seas	Exchanges between groundwater aquifer & seas and oceans Waterways inflows to seas and oceans Precipitations over seas	Exchanges between groundwater aquifer & seas and oceans Waterways inflows to seas and oceans Marine Evaporation

Waterways and lakes	Melting Precipitations over land Runoff Exchanges between groundwater aquifer and rivers	Exchanges between groundwater aquifer and rivers Waterways inflows to seas and oceans
Underground water tables	Water infiltration into the soil Exchanges between groundwater aquifer and rivers Exchanges between groundwater aquifer & seas and oceans	Exchanges between groundwater aquifer & seas and oceans Exchanges between groundwater aquifer and rivers
Soil	Precipitations over land	Terrestrial evaporation Evapotranspiration Runoff Water infiltration into the soil
Non-renewable underground water tables	None	None

### 3. Game 2: The anthropogenic water cycle, from withdrawal to the use of water.

Present the logic of game 2: **Game 2 focuses on building the Human made water cycle. The goal is to understand where human society extracts water and the steps before water goes back into the environment.**

#### Step 1

Ask someone to read “Captured natural stocks” card. Place it under game 1 and ask participants to connect the correct stocks cards to this card (Red arrows).

#### Step 2

Distribute the red cards to the participants. Let them read them one by one. In the end, ask them if they can explain what **Consumed water** means.

**Consumed water:** During its use, part of the water is consumed or absorbed. This water is not directly restored back to the natural environment.

For example, it can be absorbed by plants or the soil, or evaporated into the atmosphere. It is not possible to know when or if this water will be available again to be reused. We consider that this water is not restituted because we cannot say where and when this water will be available again to be used in the area where it was withdrawn. It is removed from its original source and ecosystems. This water goes back into the large water cycle, but under another form (water

vapor for example) or somewhere else (another basin or country) and for an indefinite time (can take years). We modify the water repartition.

(more details in part 3)

If the water you use to wash the dishes or take your shower goes back into the river where it was taken, it is restituted (we control the place and the time). (In Sydney or other coastal cities, most of the used water comes from rivers feeding the Warragamba dam. Once used it is treated or not it will go directly into seas and oceans – it is not restituted to its original environment, we don't know if it will come back to the river again and when). Most of the water we use for agriculture is infiltrated into soil or plants, or evaporated so it is not restituted water.

The water available on Earth has been the same for millions of years, we can say that we drink the pee of dinosaurs! But depending on the climate, this water is stored in different reservoirs (warmer = more in the atmosphere, cooler – more in glaciers)

<https://www.cieau.com/le-metier-de-leau/ressource-en-eau-eau-potable-eaux-usees/qui-preleve-et-consomme-leau-en-france/>

Step 3

Place the red cards under the card “Captured natural stocks” and ask participants to find the correct order of steps and link the steps with arrows. It should form a line and there can be parallel steps (for example potabilization and treatment are not always a step).

### Key messages

Ask participants if they know where their water (on the tap) is coming from. (look for the answer before the workshop if you know your audience)

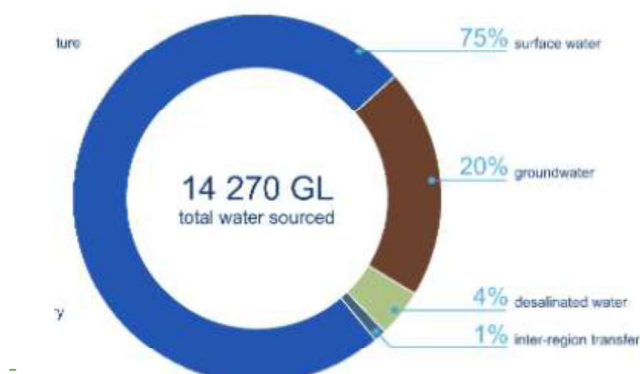
- In Sydney, 80% of the water comes from Warragamba Dam in the Blue Mountains
- Melbourne: 60% from Thomson Dam, rest from Murray and upper reservoir
- Brisbane: 51% from Wivenhoe dam
  - o The water for the city is treated by 3 water treatment plants; North Pine, Mt Crosby Eastbank and Mt Crosby Westbank before being distributed throughout the city and surroundings.
  - o Due to strong opposition recycled water is only used for Industrial purposes in South East Queensland. After the 2007 drought recycled water was heavily promoted. The Western Corridor Recycled Water Project (WCRWP) was developed during 2007-2010 at a cost of \$2.4 billion partially as a means to supplement drinking water supplies in Lake Wivenhoe, South East Queensland. This is the primary source of drinking water supply for Brisbane and much of the surrounding area.
  - o There are approximately 67 large surface water storages (over 10,000 megalitres) and 271 small surface water storages across Queensland.
- [Perth:](#)

- The percentage of each depends on seasonal factors; in 2018 it was around 43 per cent groundwater (Groundwater is drawn from the Yarragadee, Leederville and Mirrabooka aquifers, and is treated at six groundwater treatment plants. , 26 per cent surface water (8 dams) and 31 per cent desalinated water.
- In late 2017, the newest water source for the IWSS - the Groundwater Replenishment Scheme in Craigie - began recharging to aquifers. Groundwater Replenishment (GWR) is the process by which secondary treated wastewater undergoes advanced treatment to produce recycled water. The recycled water is recharged to an aquifer for later use as a drinking water source. BUt 2019- extracted 123 billions L - project can recharge 28 billion L/year...
- Northern territory:
  - In the Northern Territory (NT), 90% of the water supply comes from groundwater.
  - The most of Darwin’s drinking water comes from the Darwin River Dam. The rest comes from groundwater from the McMinns and Howard East borefields.

**AUSTRALIA:** In 2019-20 this division accounted for:

(<https://www.abs.gov.au/statistics/environment/environmental-management/water-account-australia/latest-release#physical-supply-and-use>)

- Total water use remained stable at 77,367 GL.
- Total water consumption fell to 11,231 GL.
- 94% of total self-extracted water use, or 63,658 GL, up 4% year on year. The vast majority of this water use (85%) is returned to the environment.
- Self-extracted water refers to water that is extracted directly from the environment. Possible sources include surface water (e.g. rivers and lakes), ground water, and desalinated sea water.



But careful, there is not only water coming out of the tap. Let’s see what we mean by that after.

Consumed water = water that is withdrawn from the environment but not put back at the same place or under the same form as it was withdrawn.

## Correction

### Add screenshot of Mural correction

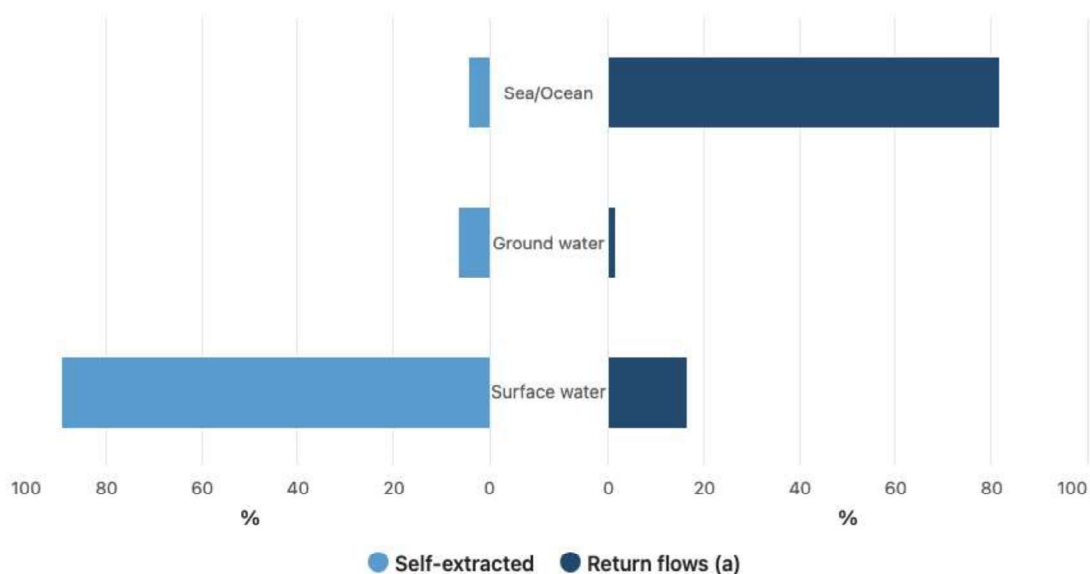
4 arrows connect to « Captured natural stocks”: Renewable underground water tables, Non-renewable underground water tables, Lakes and waterways, Oceans and seas. We can also draw an arrow from “Extraction” to “Non restored withdrawn water” and one from “Non restored withdrawn water” to the drawing of game 1.

Not all the water we use is treated or purified. BUT in Australia we use purified water for our toilets, washing clothes and showers. Do we need to do so? About 90% Sydney sewage after only primary treatment, is still discharged to ocean by 4 km deep ocean outfall pipes at North Head, Malabar and Bondi. [In 2019-20, the Water Supply, Sewerage and Drainage Services industry](#): Released 1,720 GL of water to the environment, Representing 83% of total wastewater collected.

The return flows to the environment went to the following destinations:

- Surface water: 287 GL or 17% of the total.
- Groundwater: 26 GL or 2% of the total.
- Sea/Ocean: 1,408 GL or 82% of the total.

### Water Supply, Sewerage and Drainage Services Industry - Source of Water and Discharge Destination



(a) Return flows represents the flows of water from industries and households to the environment

<https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines>

In the world however, Some 2.2 billion people do not have safely managed\* drinking water services, 4.2 billion people do not have safely managed sanitation services, and 3 billion lack basic\*\* handwashing facilities. . It is estimated that 1 in 10 people (785 million) still lack basic services, including the 144 million who drink untreated surface water. The report also says that

2.1 billion people have gained access to basic sanitation services since 2000 but in many parts of the world the wastes produced are not safely managed. (need systemic solution)

[https://www.who.int/news/item/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who#:~:text=Some%202.2%20billion%20people%20around,lack%20basic\\*\\*%20handwashing%20ofacilities.](https://www.who.int/news/item/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who#:~:text=Some%202.2%20billion%20people%20around,lack%20basic**%20handwashing%20ofacilities.)

500 enfants meurent chaque jour dans les pays d'Afrique subsaharienne à cause d'eau salubre et d'un assainissement insuffisant. En Afrique subsaharienne, 70% des habitants ne sont reliés à aucun réseau, ce qui veut dire que tous les rejets vont dans la nature, entraînant une pollution immédiate et sur le long terme des milieux naturels.

Cards	IN	OUT
Extraction	Captured natural stocks	Uses Water purification
Water purification	Extraction	Uses
Uses	Water purification Extraction	Treatment Restitution to the natural environment Non restored withdrawn water
Treatment	Uses	Non restored withdrawn water Restitution to the natural environment
Restitution to the natural environment	Uses Treatment	Captured natural stocks
Non restored withdrawn water	Uses	

## 2. The human made water cycle

