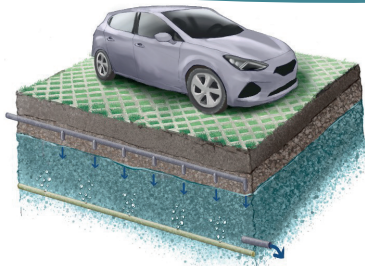


Belgium – RIETLAND – Phytoparking treating pre-treated wastewater



Jaurrieta, Lide; «Illustrations of nature-based solutions for urban water management», <https://doi.org/10.34810/data1745>, CORA. Repositori de Dades de Recerca, V1



DESCRIPTION

Pilot 3 is a **Phytoparking** located in Ypres, Belgium, that treats wastewater of 105 PE in a septic tank followed by Phytoparking at an off-grid campsite. The Phytoparking is an **aerated hybrid wetland** that is covered with crushed gravel and grass tiles to support vehicles and other heavy objects. Rietland designed a system that treats black and grey water separately on 32m² and 44m², for **reuse for toilet flushing and agriculture**. The two systems are in **compliance with the Flemish government's** discharge limits (graph 1). The Phytoparking can handle load variations, making it appropriate for a campsite with high and low seasons (graph 2).

Additionally, **co-benefit** analysis shows that water can be **reused**, there are **no oil spills leaking** through Phytoparking, and **energy** consumption is **low**.



DESIGN AND TECHNICAL DETAILS

Build up: The Phytoparking consists of a 1.3m deep liner basin that is filled with expanded clay granulates (1m). There is no contact between groundwater and wastewater. On top of the substrate, a pressure-distributing layer and grass tiles are placed to support vehicles and other heavy objects.

Type of influent: Grey & Black domestic wastewater

Design Phytoparking

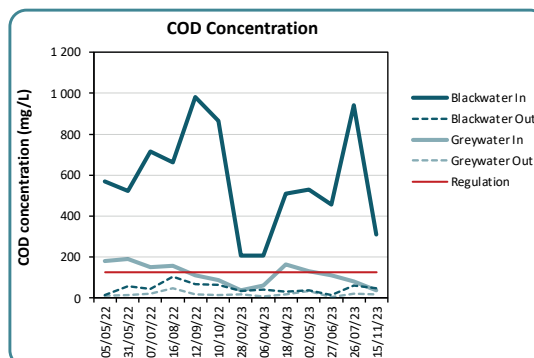
- Forced Bed Aerated – intermittent aeration
- Hybrid wetland of 44m² (grey) & 32m² (black) treats wastewater of 105 PE.
- Substrate = Expanded Clay Aggregates
- The treated grey water is reused for toilet flushing

Micropollutants: Due to the alternation between oxygen-rich and oxygen-poor conditions, a rich mosaic of bacterial life is created. This also efficiently removes pathogens and substances that are difficult to degrade, such as pharmaceuticals & insect repellents.



TREATMENT PERFORMANCES

- **Conventional Pollutants:** High removal > 90% of TSS, BOD, TP and NH₄ for grey and black water, High removal for TN (*G:71.2%/B:71.0). High removal COD for black water (91.6%), and moderate for grey water (G:83.3%) graph 1.
- **Organic Micropollutants:** Grey: 8 substances found out of 25 (influent). Black: 21 substances found out of 44 (influent). Removal >80% for Valsartan, Rosuvastatin, Propranolol, Losartan, Gabapentin, diclofenac and DEET; Irbesartan 33%
- **Pathogens:** High removal e-coli (G: log 4.8/B: log 4.0). Moderate removal for Total coliform (G: log 3.6/B: log 2.4) and Somatic coliphages (G: log 1.4/B: log 1.3).
- **Environmental impact:** Risk reduction of metals between influent and effluent is variable according to sampling dates and for different chemicals.

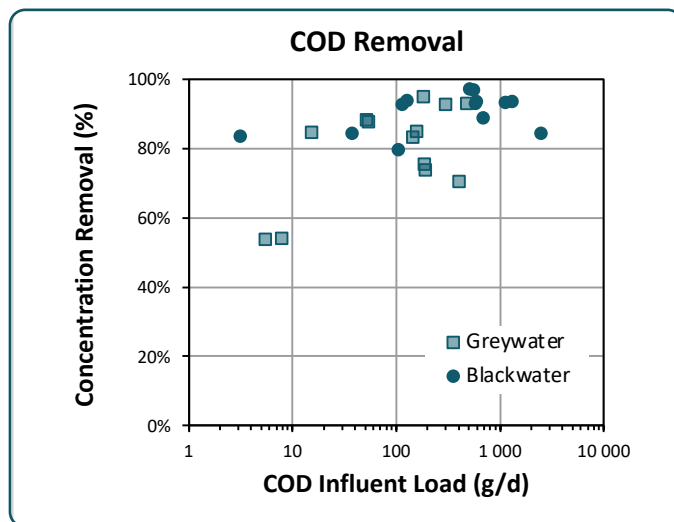


*G = Grey wastewater,
*B = Black wastewater

COD concentrations of black and grey wastewater influent and effluent over time. All effluent concentrations are below the purple line (Flemish limit for effluent:125mg/L).

VERSATILE SYSTEM

- **Robust System:** The Phytoparking is equipped with an intelligent controller that automatically adjusts the aeration to the amount of wastewater that is being treated. This further optimizes energy consumption and allows the Phytoparking to be used flexibly for varying loads and different types of wastewater. Graph 2 shows good COD removal at high loads – up to 2476 g/d – as well as at low loads in both grey and black water. The two influent concentrations of grey water showing only 55% removal were sampled during low season (low influent COD concentration of < 40 mg/L; Flemish effluent limit is 125mg/L). The Phytoparking is also very robust because there is seldom a malfunctioning, which means maintenance is limited.
- **Types of wastewater:** The Phytoparking can treat domestic wastewater and industrial wastewater such as from food and beverage industry, organic chemistry, soil remediation projects and wastewater flows from the agricultural sector.
- **Applications:** Residential areas, offices, hotels, campgrounds, hospitals, elderly homes, schools and businesses



Regardless the fluctuations in influent load of COD, the Phytoparking shows a good removal (range: 70% – 97%), not taking into account the two samples with influent concentrations (<40mg/L) during low season (Flemish limit for effluent:125mg/L).



REUSE LEGISLATION

WHO: The reclaimed water of the Phytoparking has no risk according to values for exposure by the WHO for **toilet flushing** and for irrigation of **lettuce for consumption** with grey water (tested for e-coli & Salmonella).

EU 2020/741: Monitoring over 2 consecutive years shows that effluent of the Phytoparking can be used for **agriculture** as reclaimed water quality class B.

EN16941-2: All treated grey and black water samples meet standards for NTU, pH & e-coli for **toilet flushing**, as well as the average values for Tot. Coliform. The reclaimed water of the Phytoparking does not meet the requirements for **water that is being sprayed**.



PROS AND COSTS

Advantages: Low operational costs, no skilled personal required, robust system, nice landscaping, does not add to urban heat island, does not require any space.

Costs:

- **OPEX low:** no sludge discharge, low energy consumption, only 1 annual maintenance
- **CAPEX moderate:** approximately €70.000 for 10 parking spaces that treat wastewater of 140 PE. The return on investment can be 5 years depending on the discharge levy.



CO-BENEFIT ANALYSIS

- **Water reuse:** 71% (389m³) of treated grey wastewater was reused for toilet flushing by 18071 camping guests.
- **Fluids leaking from vehicles:** A relatively large fraction of a potential oil spills is retained in the top layer. The large volume of the biofilter will assure dilution of the leakage so it will not impact the treatment performance. The micro-organisms can break down oil droplets.
- **Energy consumption:** 1224kWh (€355) was consumed to treat black and grey water from 18071 campsite guests during two camping seasons. The pump that facilitates the reuse of the reclaimed water requires 23% (276kWh) of the energy.