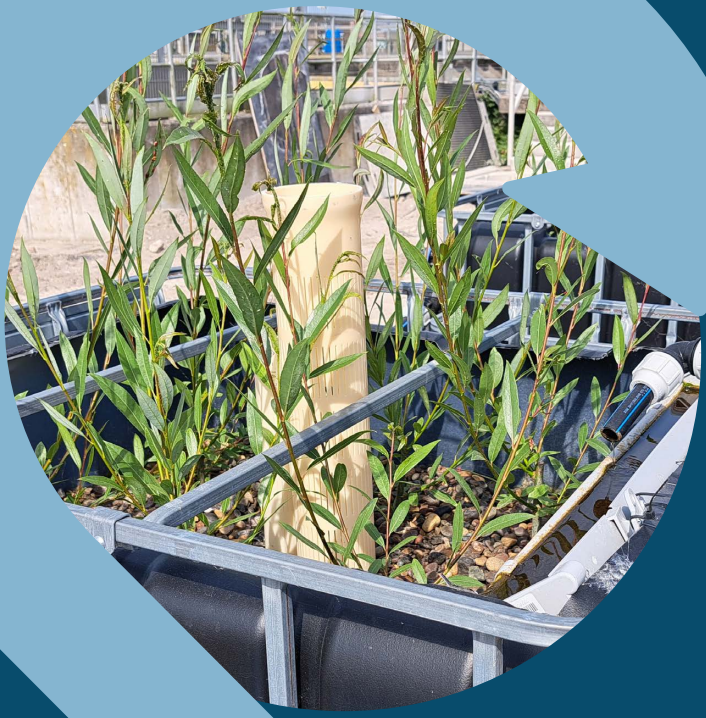

Plastic, Packaging

Strategies to solve the problem of hardly recyclable Packaging Materials

Bio-Waste

Extracting valuable compounds from different Bio-waste streams

Water

Water Symbiosis Strategies in Industry, Agriculture, and Urban contexts

CIRCSYST Circular Systemic Solutions

PLASTIC • PACKAGING • BIO-WASTE • WATER

Demonstrator 3

Smart wastewater solutions for water scarcity and floods

FLANDERS, BELGIUM, CCRI REGION

CIRCSYST

Circular Cities & Regions Initiative

UK Research and Innovation

Funded by the European Union

Start 2024

36 mo

€ 10.24 M

32 partners

9 pilots /
8 regions

About CircSyst

Resource extraction is responsible for nearly half of global greenhouse gas emissions and the vast majority of biodiversity loss. With 90% of world economy still linear, plastics, water and bio waste are treated as single use commodities rather than valuable resources. The CircSyst project addresses this challenge by developing Circular Systemic Solutions (CSS) that drive sustainable, circular economic models.

Over 36 months, 32 partners led by AIJU will run nine large-scale pilot systems spread across eight European regions, targeting three priority value chains from the EU Circular Economy Action Plan: water management, bio-waste valorisation, and plastics & packaging. The pilots exchange by-products and know-how so that, for example, a plastic fraction recovered in Greece can feed a recycling line in Spain. In this way, CircSyst forms an industrial-symbiosis network that supports the EU's Circular Cities and Regions Initiative (CCRI) and provides replicable and scalable solutions.

Demonstrator 3: Improved Treatment of Reverse Osmosis Concentrates in Constructed Wetlands and Smart Buffering

Water scarcity is a growing challenge in Flanders' coastal region, where water demand nearly doubles in summer and pressure on the small dune aquifer is high. Since 2002, drinking water provider Aquaduin upgrades treated municipal wastewater using ultrafiltration and reverse osmosis (RO) and infiltrates the treated water into the coastal dunes through **managed aquifer recharge**. A concentrate stream is produced as a byproduct of the reverse osmosis, containing elevated pollutant levels. In 2021, Aquaduin implemented a novel willow-planted **constructed wetland to treat this concentrate**.

CircSyst investigates how this wetland can be improved using biobased substrates to enhance removal processes:

1. **Nitrogen removal** using carbon-rich materials such as woodchips for denitrification.
2. **Phosphorus removal** using calcium-rich substrates like seashells.
3. **Micropollutant removal** (e.g., pharmaceuticals) using adsorptive materials such as biochar.

The project will also assess the integration of a **direct nanofiltration pilot** to increase the water recovery from the wetland effluent.

A second focus is the optimization of the interaction between wastewater treatment and drinking water production to maximize water recovery throughout the year. This integration is hampered by the strong variability in wastewater production (e.g., low flow during dry summer nights and high flows during rain events). To mitigate these stresses, different options of **smart buffering** in pumping stations and treatment plant influent are evaluated based on detailed hydraulic modelling.

Who is involved?

Aquafin provides treated effluent and contributes expertise in wastewater infrastructure and hydraulic modelling to assess buffering potential.

Aquaduin supplies the RO concentrate, hosts the pilot wetlands, and integrates outcomes into its drinking water production system.

VITO designs the pilot wetland and conducts experimental research, data analysis, and interpretation to guide optimisation.

CIRCSYST
Circular Systemic Solutions

Indirect potable reuse

Membrane filtration – direct nano filtration

Constructed wetlands for concentrate treatment

Smart water buffering system in sewer system

PARTNERS

vito

Aquafin

aquaduin

www.circsyst.eu

CircSyst @CircsystCSS

The CircSyst project is funded by the European Union in the framework of Horizon Europe Research and Innovation Programme under Grant Agreement N. 101135505

CIRCSYST | Circular Cities & Regions Initiative

UK Research and Innovation

Funded by the European Union