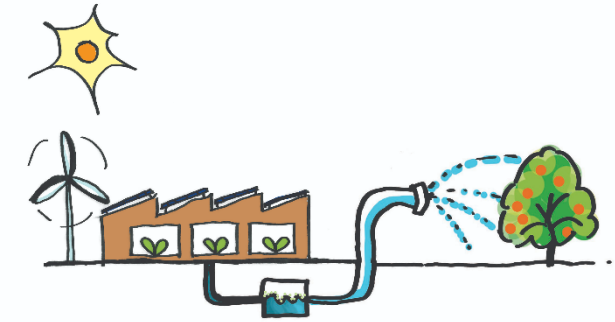
Nature based solutions for waste water re-use

in circular and climate resilient food systems

WAGENINGEN
UNIVERSITY & RESEARCH

Introduction

Food processing industries in the Netherlands are exploring how water use per unit of produced product can be reduced. Some consider whether residual water streams can be re-used within the factory or by neighbouring land owners such as farmers. Also, substances dissolved in the water can be re-used. In turn, the food industry can also use residual flows from other sectors.



Climate resilient water supply

Under average climatic conditions, freshwater supply for Dutch agriculture is excellent. However, in situations with a low river discharge and a high precipitation deficit, the freshwater supply cannot meet agricultural freshwater demand during the growing season. This is particularly true for the rain-fed agricultural areas in the southwestern part of the Netherlands that have no access to river water (**Figure 1***, square*). The competition for land is high in the Netherlands. As a result it becomes more difficult to realize intrinsic NBS solutions for the food processing industry that make use of constructed wetlands. A combined approach in which both waste water treatment technology is combined with NBS innovations make food production less dependent on conventional water resources and offer opportunities to make both delta nature and food production more climate resilient.

Combining spatial information

What are spatial explicit scenario's for the current and future water demand and water quality for nature, farming and industrial activities in a specified region and how does this fit to the reuse of NBS treated wastewater? **Figure 2** combines spatial information of the the Land Use Database of the Netherlands (LGN7) with spatial data from the European Pollutant Release & Transfer Register (E-PRTR), developed by the European Environmental Agency. The map is a section of the Southwestern part of the Netherlands.

Figure 1*, Freshwater supply areas in the Netherlands (Veraart et al, 2017). The white areas are dependent on precipitation and groundwater resources and/or artificial water supply (Zeeuws-Vlaanderen).*

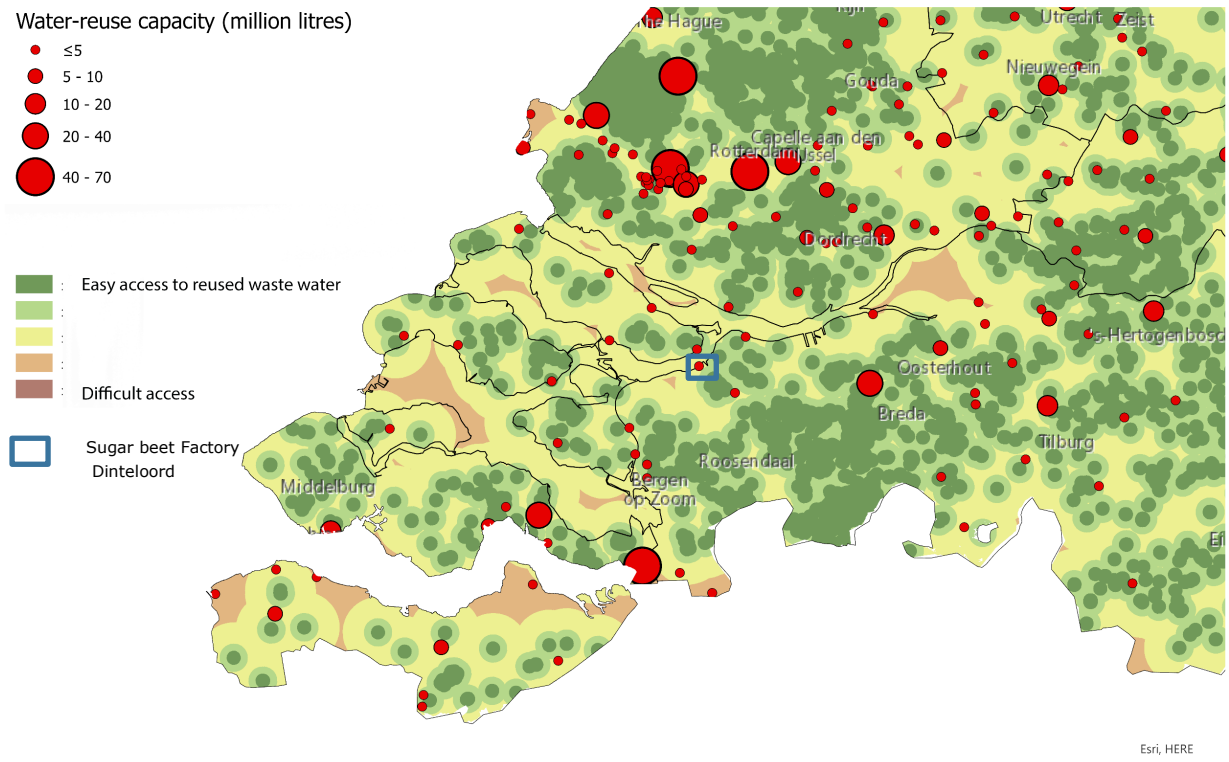


Figure 1, *Map of the Southern part of the Netherlands that combines spatial information about land use (LGN) and waste water resources from industries (Developed by Confidence Duku & Wilfred Appelman). First concept. The map is also available for the whole of the Netherlands.*

What is on the map?

The red dots are sources of waste water originating from, amongst others, food & Beverage and municipal waste water treatment (derived from E-PTR data from 2019). The green areas have relatively easy access to waste water from food processing industries using the relative distance between water supply and agricultural water demand (horticulture) as a rough proxy.

The objective is to define multiple spatial knowledge rules in 2021 instead of one proxy in dialogue with stakeholders. Indeed, by using multiple criteria the suitable areas for NBS combined with waste water treatment will becomes much smaller, however more realistic. An agricultural water demand map is currently being developed based on the potential transpiration, actual transpiration and irrigation based on the current climate for the period 2009-2018 with outcomes for 10 day periods for 250x250 meter grids with support of the Netherlands Hydrological Instrument (NHI).

Practical examples

Purified effluent water from the sugar beet factory Cosun in Dinteloord (Figure 1) is used as irrigation water for nearby greenhouse horticulture. The treatment is done by Reversed Osmosis (STOWA Deltafact, 2020). Sugar beets consist of >70% water and are processed in autumn and winter. Greenhouse horticulture need irrigation water in spring/summer. Since 2016 the purified waste water is stored within the aquifer (NBS solution) during winter and the water can be recovered in spring and summer by ASR technology (Zuurbier et al. 2014). Before 2016 the water was discharged into the Mark-Dintel, an old coastal creek that is now a freshwater stream. Breda, situated along this river, is developing spatial plans to realize a climate resilient peri-urban catchment in cooperation with local food processing industry, farmers and owners of natural areas.

NBS solutions are also sometimes considered but not implemented. For example, the Heineken brewery considered biological waste water treatment (Helophyte filter). However, it was decided to postpone the project, because it appeared difficult to guarantee the desired discharge water quality towards the authorities (Groene Cirkels).

Stakeholder engagement

Due to the COVID crisis, the first external workshop has unfortunately been postponed to the beginning of 2021. Exploratory contacts have been made with stakeholders such as water board Scheldestromen, Rijkswaterstaat, Shell, Witteveen & Bos, the municipality of Breda and STOWA.

Next year (2021)

We will continue develop the Technology Portfolio of Nature Based Solutions for climate resilient agro- and food industries. This portofolio consists of a list of 21 waste water treatment and storage technologies.

We will start with participatory spatial scenario development to explore combinations of nature based solutions with technologies from the portefolio.

Cited literature

Stowa (2020), Deltafact: Hergebruik van afvalwater. Retrieved from: https://www.stowa.nl/deltafacts/zoetwatervoorziening/droogte/hergebruik-van-effluent.

Veraart, J. A., R. van Duinen, and J. Vreke. 2017. Evaluation of Socio-Economic Factors that Determine Adoption of Climate Compatible Freshwater Supply Measures at Farm Level: a Case Study in the Southwest Netherlands. Water Resour Manag 31: 587-608

Zuurbier KG, Kooiman J, Groen M, Maas B, Stuyfzand PJ (2014a) Enabling Successful Aquifer Storage and Recovery of Freshwater Using Horizontal Directional Drilled Wells in Coastal Aquifers Journal of Hydrological Engineering 10 doi:10.1061/(ASCE)HE.1943-5584.0000990 , B4014003.

Credentials (pictures and figures)

The picture in the header (page 1) shows the COSUN factory in Dinteloord by night (Maurice Veraart, 2016). Picture left: a Greenhouse in West-Brabant The graphic (page 1) was designed by Xiaolu Hu, Landscape architecture researcher from Wageningen Environmental Research

Nature based Solutions for climate resilient and Circular food Systems

This case study is part of NBS for climate resilient and circular food systems. This project aims to improve our understanding about nature-based solutions (NBS) in the context of food systems at risks due to climate change. Visit our project website for more information.

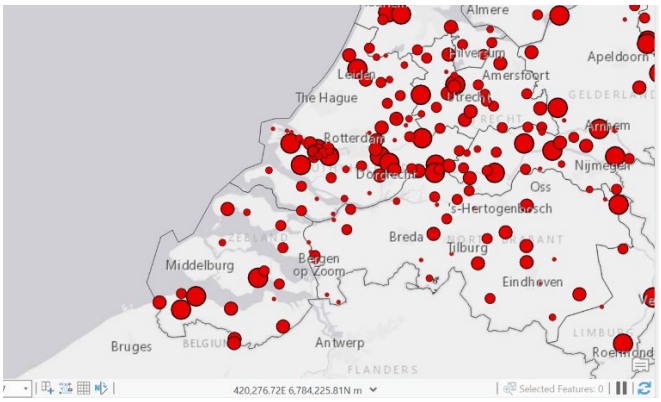


Figure 3, *Map of the Southern part of the Netherlands that shows the E-PTR data of Phosphorus loads from both food industry and municipal waste water treatment plants. Not only the water but also the dissolved substances could be reused.*

Authors:
Jeroen Veraart
Confidence Duku
Nienke Nuesink
Wageningen Environmental Research
Contact: Jeroen.veraart@wur.nl

Wilfred Appelman
Irma Steensma-Rijkse
Raymond Creusen
Wageningen Food & Biobased Research
Contact: wilfred.appelman@wur.nl

Deliverable funded by the WUR programmes Food Security and Valuing Water (KB-35-007-002) and Circular and Climate Neutral' (KB-34-007-010). Supported by Dutch ministry of Agriculture-Nature and Food Quality (LNV).