



Enabling aquifer storage and recovery (ASR) by high flowrate filtration for improved water management

Societal challenge

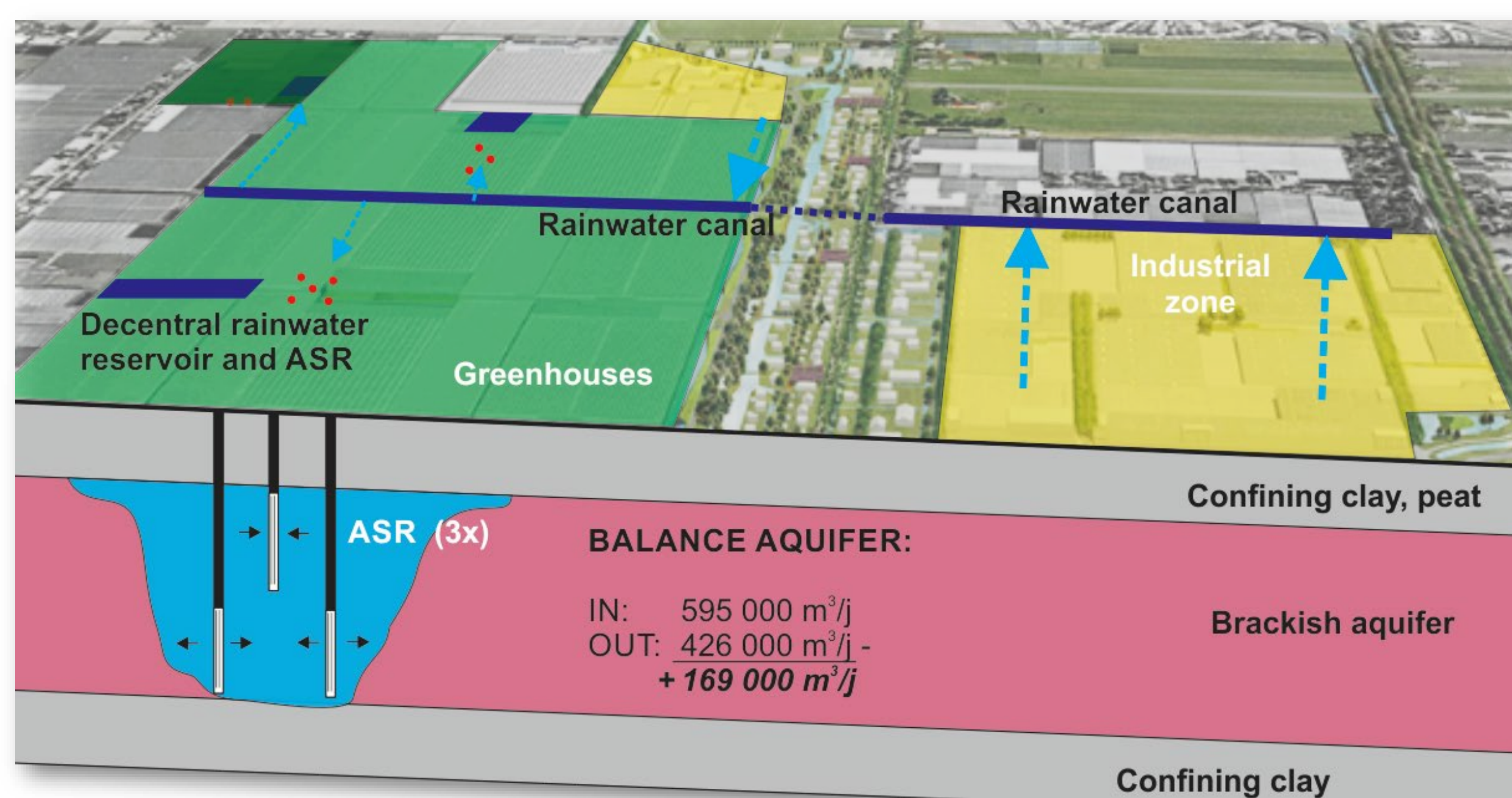
- Manage (extreme) rainfall and prevent pluvial flooding
- Water banking for use during later droughts

Engineered solution

- Aquifer storage and recovery of harvested urban rainwater

Benefits of the solution

- Local discharge, long-term water conservation
- Large capacity, limited spatial footprint, quality conservation



Case Glasparel, Waddinxveen, The Netherlands (use of rainwater ASR for horticulture and industry)

Technical challenge

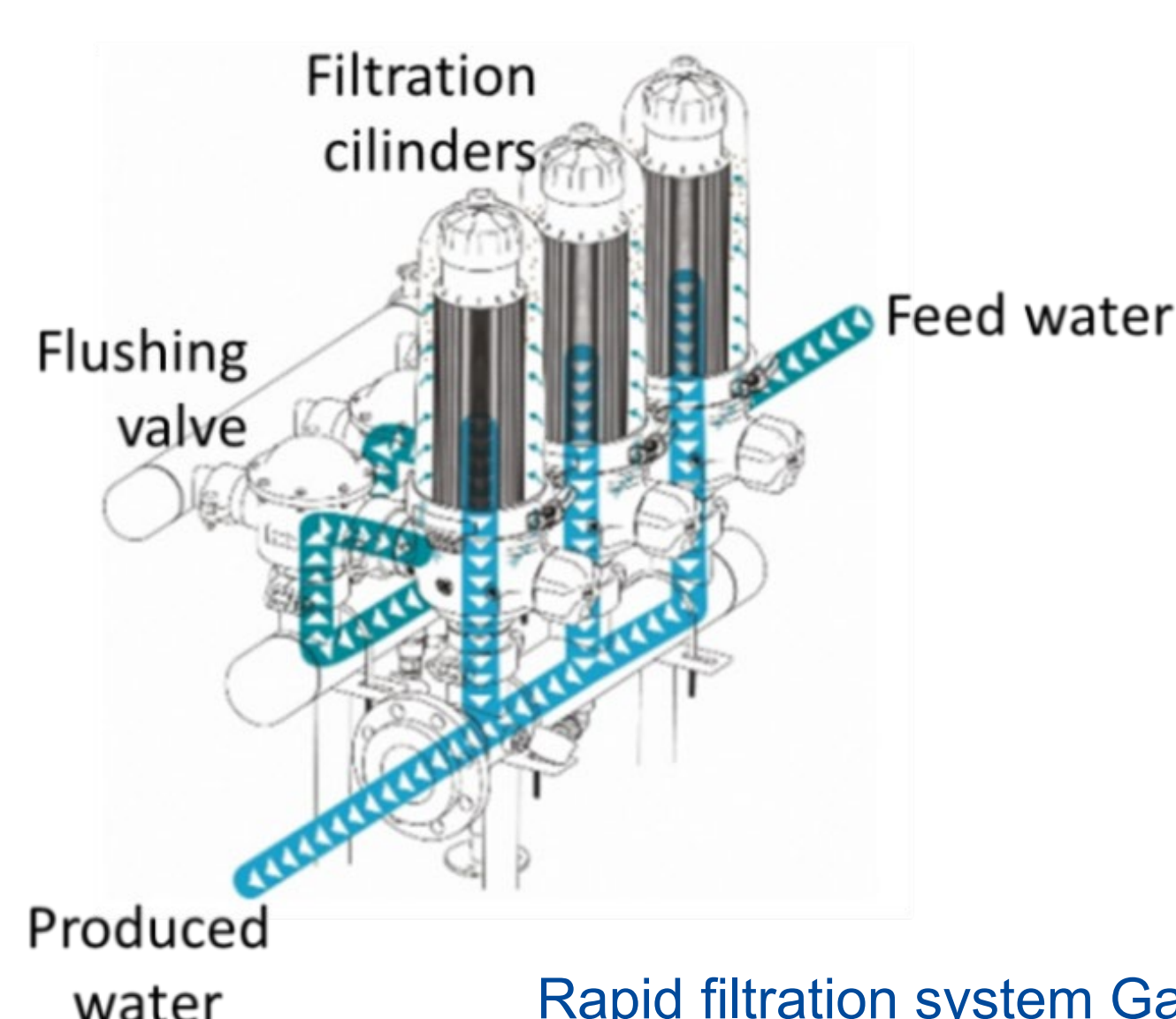
- Rapid rainwater treatment to prevent clogging
- Optimal design and operation to prevent overflows and oversizing

Strict limits for infiltration water quality during ASR to prevent well clogging

Prevention of well clogging (general)	
Suspended solids	< 0.1 mg/L
Turbidity	< 1 NTU
Dissolved Organic Carbon (DOC)	< 2 mg/L
Iron	< 0.01 mg/L
Assimilable Organic Carbon (AOC)	< 10 µg acetate-C/L
Modified Fouling Index (MFI*)	< 3-5 s/L ²

Methodology

- Evaluation of pre-treatment systems available
- Extensive field test of rapid and compact filtration system and disinfection fed by stormwater with a high clogging potential
- Design and control program (SWALLOW)



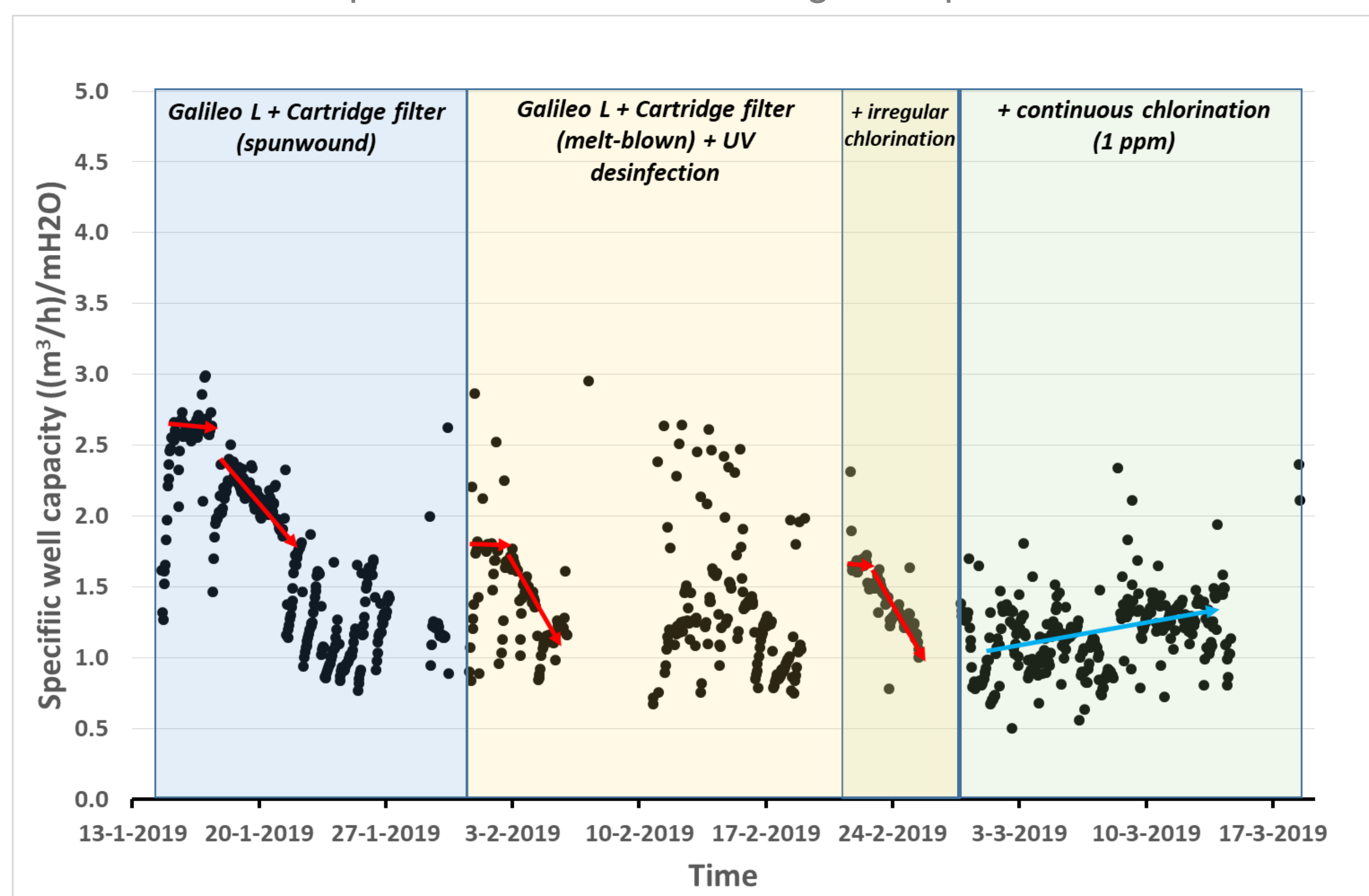
Rapid filtration system Galileo L



Performance of the rapid pre-treatment system

- The Galileo L with a 5 micron filter was able to lower turbidity, but it was insufficient to prevent clogging
- Removal of particles > 1 µm was enhanced by adding 1 micron (nominal) cartridge filters, but rapid clogging was still observed due to penetration of particles through the filters and biological growth
- Disinfecting the water using UV did not improve the pre-treatment, but adding a disinfectant (Na-hypochlorite) did and suggested prevention of well clogging by preventing biological growth

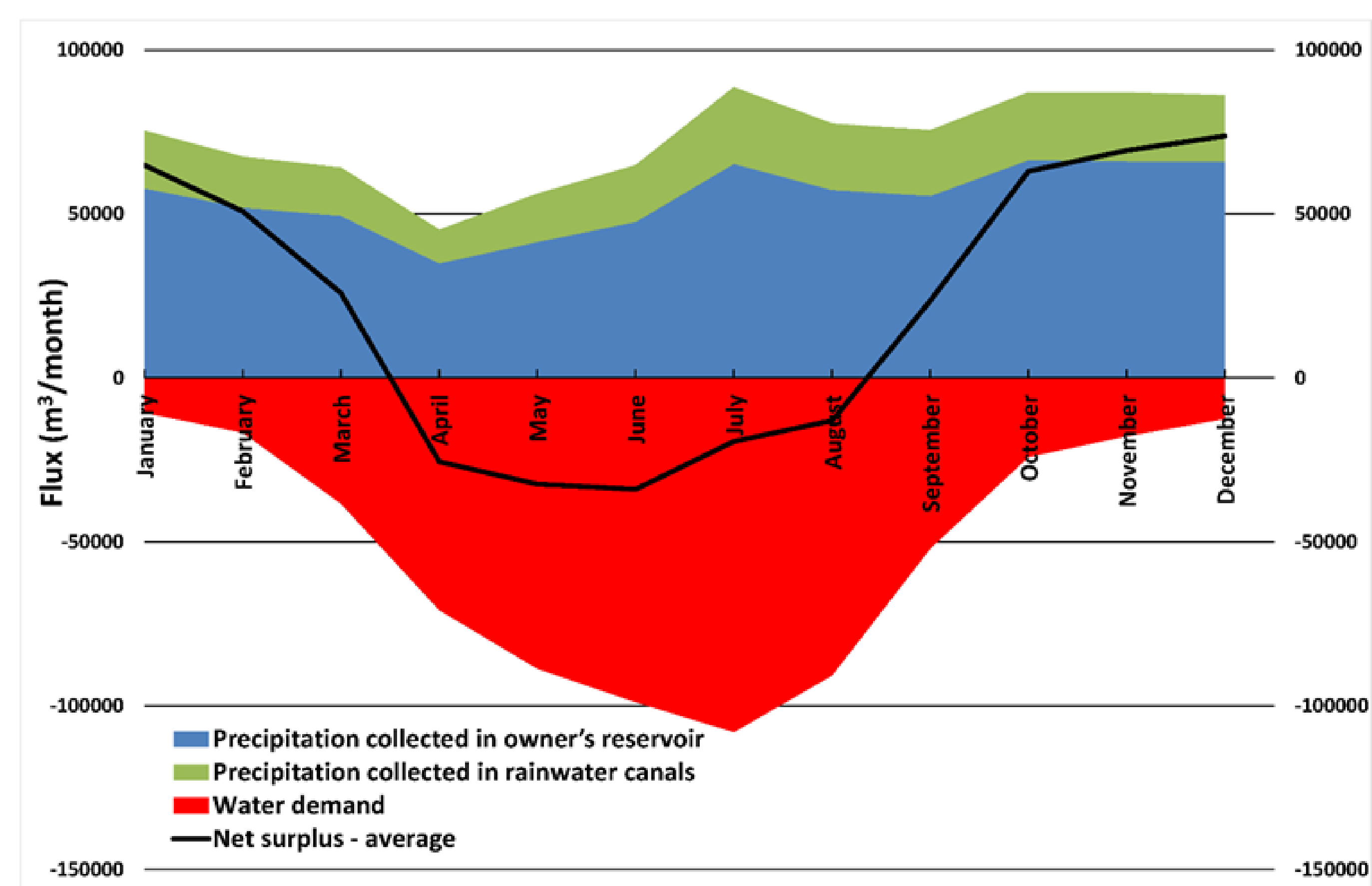
Rapid pre-treatment using compact rapid filtration is a challenge, removal of even the finest particle and reduction of growth potential are vital.



Specific capacity of the Freshmaker well in Ovezande during the pre-treatment tests in 2019

Design and operation tool

The water budget model fed by time series of rainfall and demand at the Glasparel site. It showed that pro-active management of storage basins of more than 300 m³/ha had a slight benefit to prevent overflow and shortage. More important however is the use of the tool for dimensioning the combination of retention and ASR wells.



Example of the output of the water budget model for Glasparel

Contact: Dr. Marcel Paalman (marcel.Paalman@kwrwater.nl)