

Ecological Retention-Soil-Filter

STOWA symposium 'Micro's verwijderen met natuurlijke nazuiveringssystemen'

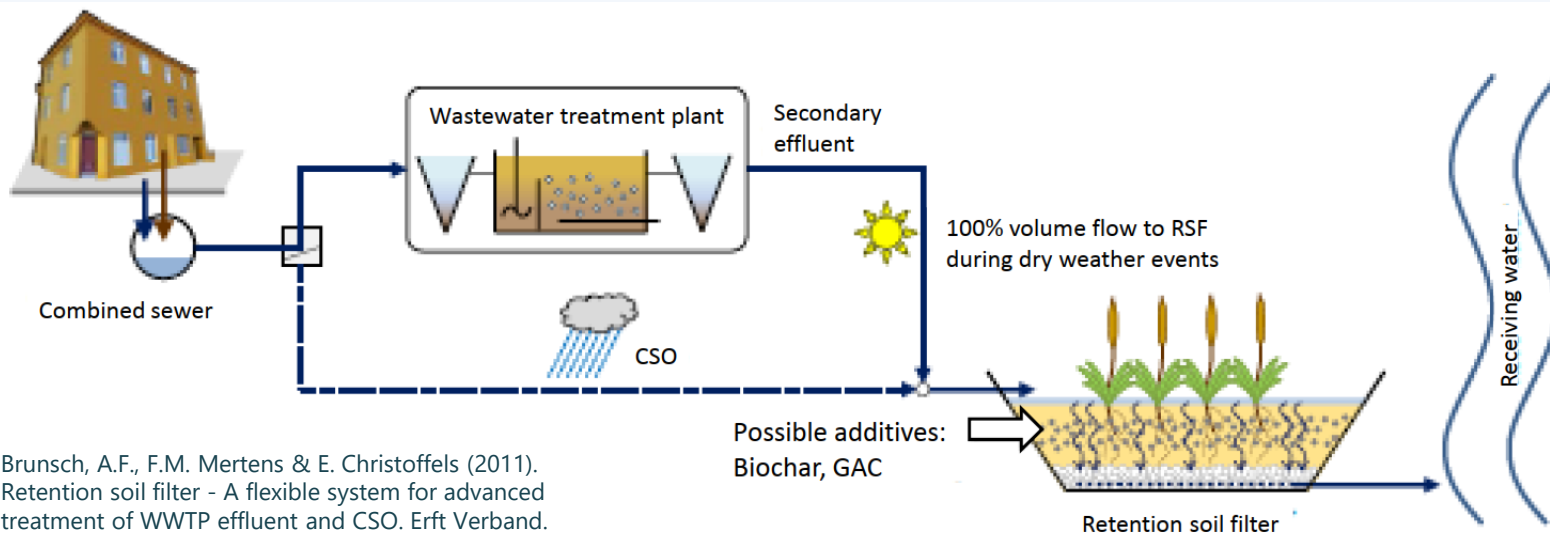
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- Demo installation in Rheinbach
- Micropollutant removal
- Benefits of the Retention-Soil Filter

Background retention soil filter

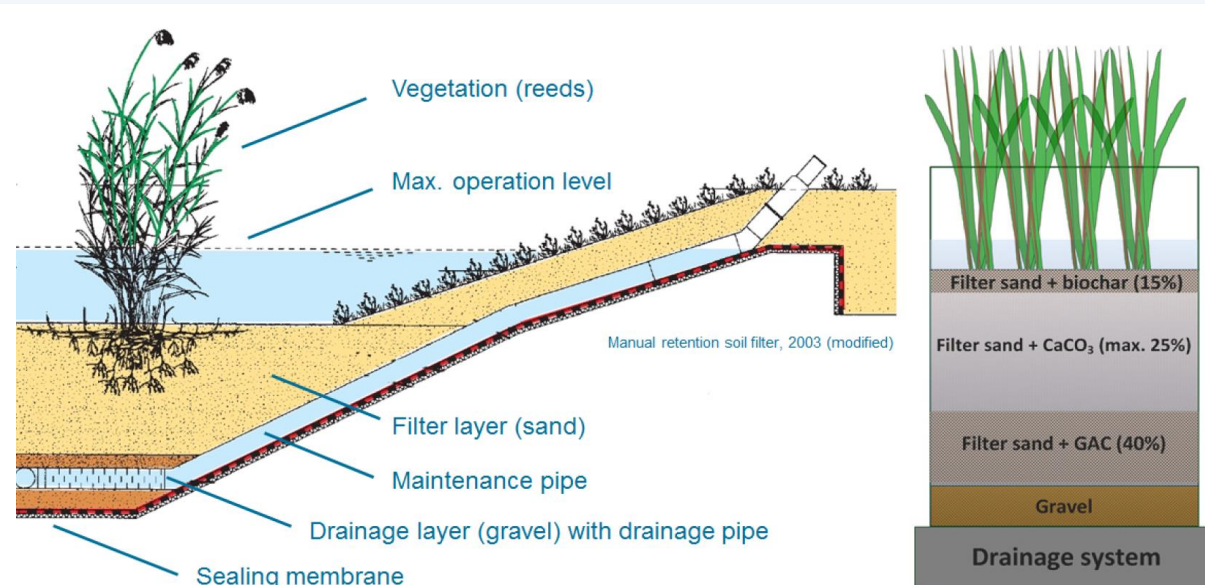
- Proven technology; successfully implemented for >30 y in Germany
- Wetland system for storage of combined sewer overflow and treatment of bypass water



Brunsch, A.F., F.M. Mertens & E. Christoffels (2011). Retention soil filter - A flexible system for advanced treatment of WWTP effluent and CSO. Erft Verband.

Background RSF-Eco+

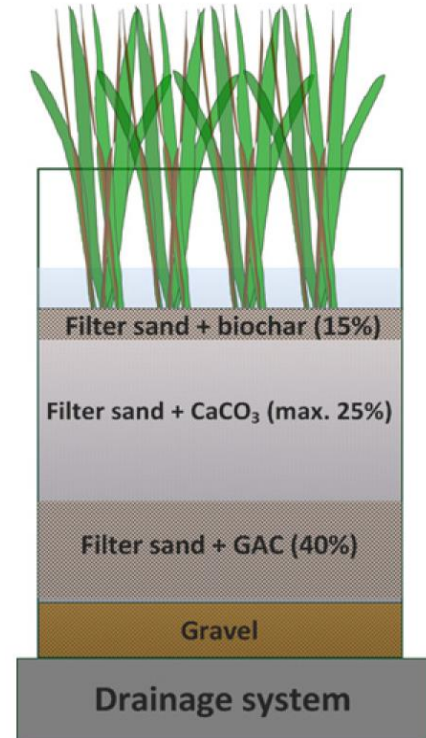
- STOWA proposal 2020: Feasibility of **Ecological** Retention Soil Filter
 - W+B
 - Atd GmbH
 - WUR
 - RWTH Aachen University
 - Erft Verband
- Addition of adsorbents
 - Play mayor role before biomass matures



Figuur 2 Schematische weergave van het retention soil filter [1] en van toevoegingen aan het substraat [1]

Concept RSF-Eco+: additional substrate layers

- Filter sand + biochar (15%)
 - Filter for TSS and substrate for vegetation (biological MP removal)
 - Plants provide nutrients and O_2 for microorganisms that degrade MPs
 - Biobased char for (cheaper) adsorption before maturation of biomass
- Filter sand + $CaCO_3$ (max 25%)
 - Stabilization of pH during nitrification; prevents release of heavy metals
- Filter sand + (sustainable) GAC (40%)
 - Adsorption of micropollutants
 - Well mixed but easy separation of GAC and sand
- Gravel
 - Prevents clogging



Retention-Soil Filter Rheinbach

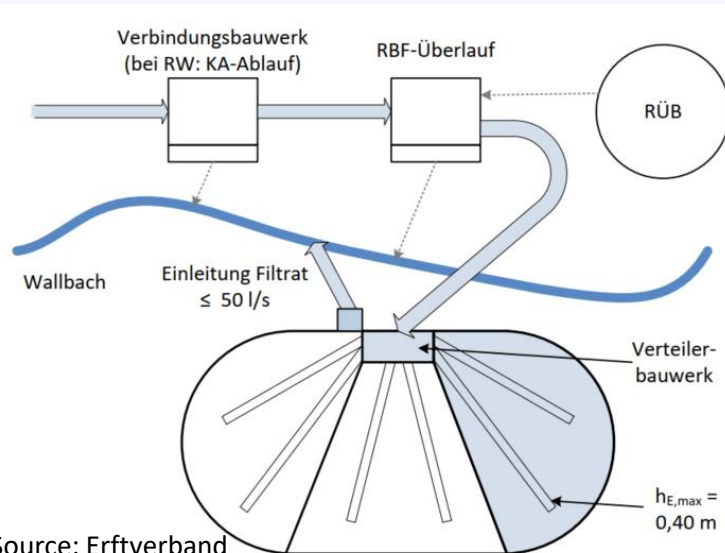
- 3 pilot installations (1,5 m²)
 - One of the filters using extra adsorbent layers (similar proposed RSF-Eco+)
 - **MP removal 89%; no breakthrough after 3 y**

Retention-Soil Filter Rheinbach (with GAC)

- Filtration Area: 5.000 m²
- 3 segments each 1.670 m²
- Distribution of dry weather flow through concrete channels
- 2 concrete channels per segment

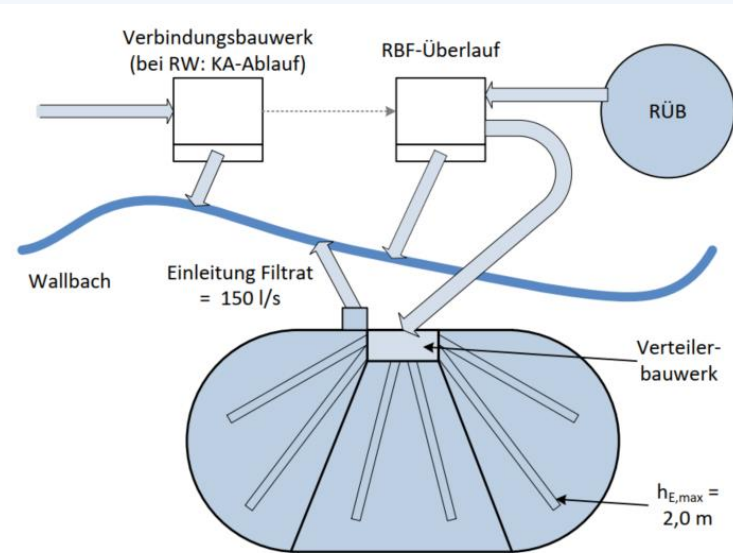
Integration of the Retention Soil Filter at WWTP Rheinbach

Dry Weather
(Treatment of WWTP effluent)



Source: Erftverband

Rainy Weather
(Treatment of Combined Sewer Overflow)



Mixing GAC, Carbonate and Sand



Installation of filter material

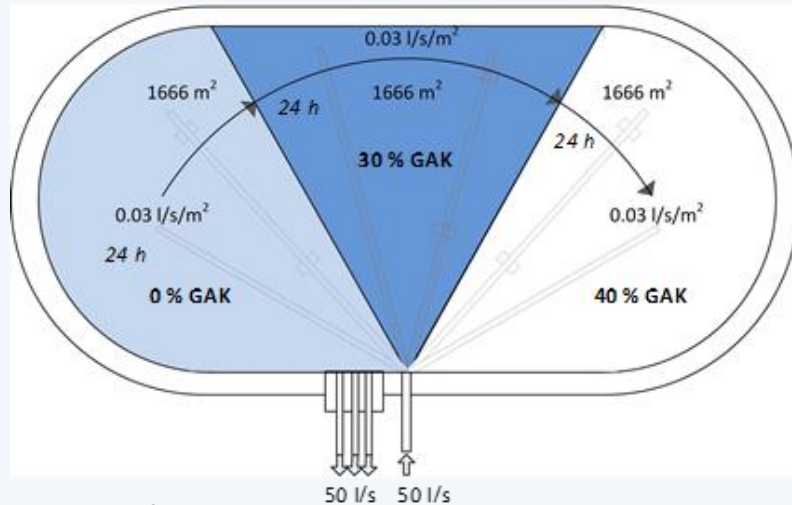


Planting the reed and RSF in operation



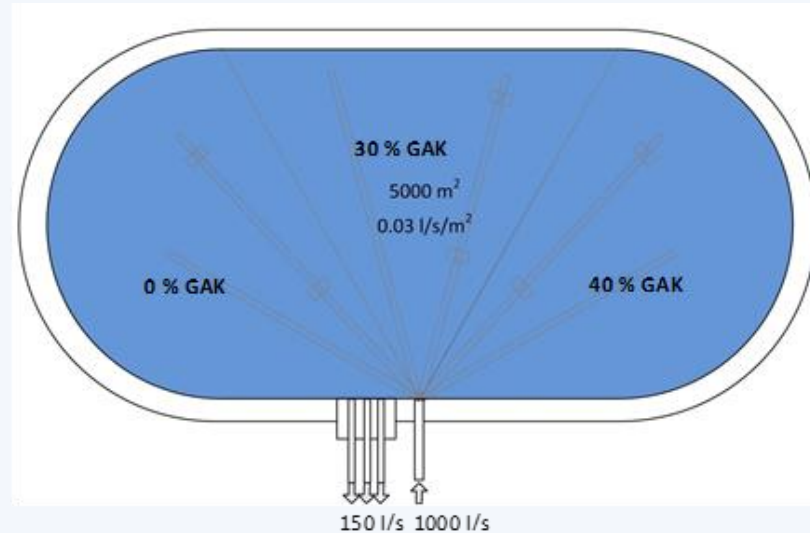
Operation in different modes

Dry Weather
(Treatment of WWTP effluent)

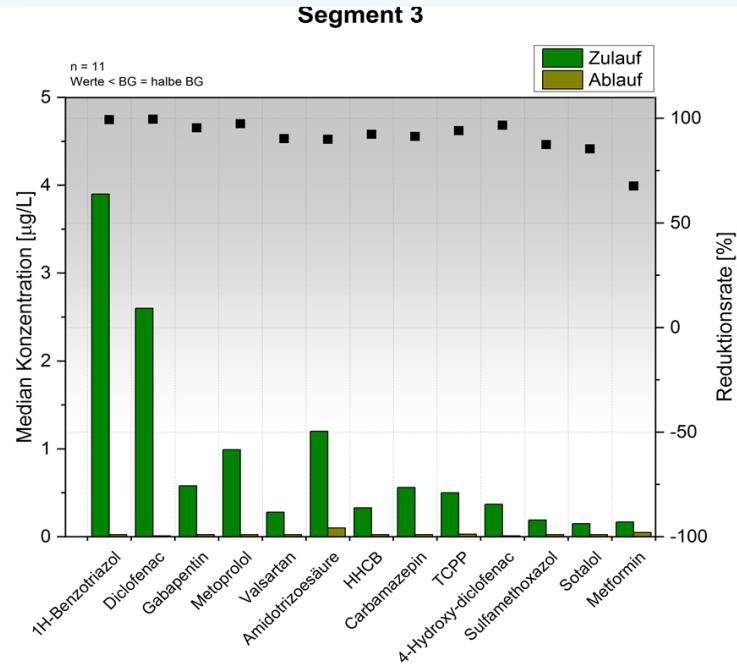
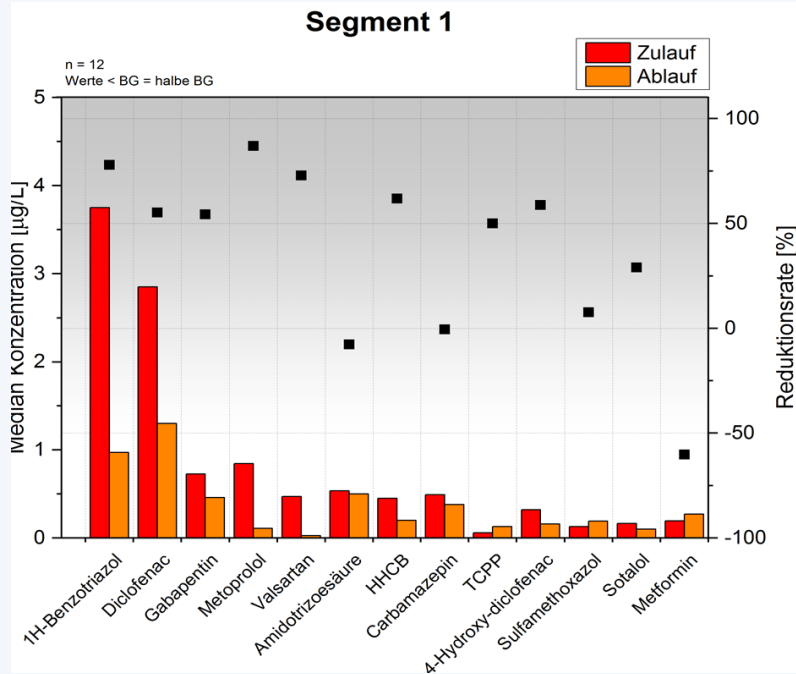


Source: Erftverband

Rainy Weather
(Treatment of Combined Sewer Overflow)



Removal of Micropollutants



Source: Erftverband

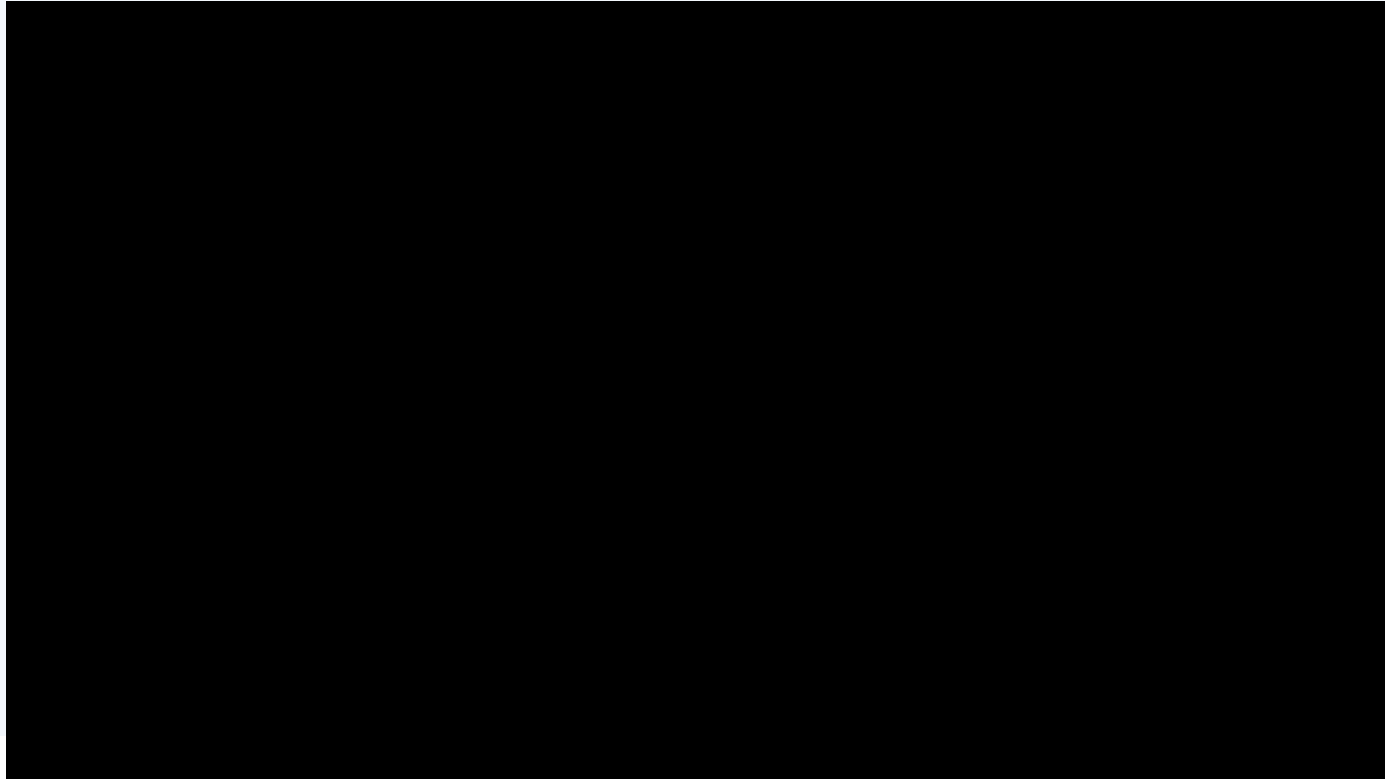
About the Retention-Soil Filter

- Combination of removal mechanisms increases range and capacity of removal
 - Take-up by plants
 - Degradation by microorganisms in/around roots, sand and GAC
 - Adsorption to organic material (biochar, GAC)
- Effective effluent polishing:
 - Additional N/P removal
 - MP removal >90%
 - Positive effects expected on ecotoxicity and pathogen removal assumed
 - Removal of Suspended Solids

About the Retention-Soil Filter

- Water buffering
- Plants provide habitat for insects/birds, prevent clogging and fit well in environment
- No transformation products or residues
- Low CO₂ footprint (40-70 g CO₂/m³)
 - Even lower if sustainable GAC is used
- Energy-use for RSF-Eco+ in NL ~107 MWh/y for 100.000 i.e.
 - Assumed height difference of 5 m
- Low operation costs
 - Mostly dependent on pumps; some maintenance and mowing

Construction of a retention soil filter in Aachen (Movie)





Questions?