AquaNES

Demonstrating Synergies in Combined Natural and Engineered Processes for Water Treatment Systems

Constructed wetlands in cNES flowsheets – what for and how to design

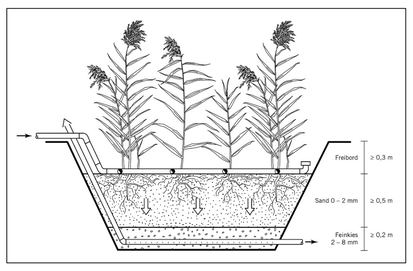
Figure 1: Raw Wastewater Filtration.

Primary treatment

Pre-treatment

- Screens, sand and grease traps are possible (not necessary) pre-treatment options.
- Phosphorus precipitation.

Secondary treatment



- Bioreactor,
- 2nd stage vertical flow wetland,
- UV disinfection.

Challenge/ Purpose

Integrated sludge treatment (TSS, COD NH_4).

Dimensioning of the wetland according to DWA–A 262 (2017).

- Hydraulic and COD areal loading rates,
- Water distribuition.

Advantage

- Very low operational costs, substitution of further sludge treatment.
- State of the art for primary treatment in remote areas.

Challenge/ Purpose

Biological treatment step of domestic and municipal wastewater (BOD, COD, NO_3).

Dimensioning of the wetland according to DWA-A 262 (2017).

- Hydraulic and COD areal loading rates,
- Water distribution.

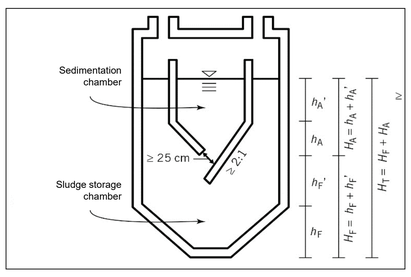
Advantage

- Very good adaption to varying hydraulic and pollutant loads.
- Ecological habitat.

Figure 2: Vertical flow (VF) wetland.

Secondary treatment

Primary treatment



- Imhoff tank,
- Settling pond,
- Anaerobic or aerobic biological primary treatment.

Tertiary treatment

UV disinfection

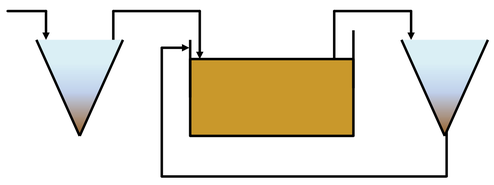
- Because of the very low turbidity of the filtrate UV can be applied for disinfection.

Horizontal subsurface flow (HSSF) wetland

- For further denitrification and removal of pathogens.

Secondary treatment

Secondary WWTP



Reactive filter (media)

Granulated activated carbon (GAC) layer

- For further removal of micropollutants.

Industrial by-products

- Ferric hydroxides, ferric sulfates, calcium carbonate.

Challenge/ Purpose

Downstream purification stage (TP, TN, micropollutants, pathogens).

Dimensioning of the wetland according to DWA-A 262 (2017); DWA-A 178 (2018, draft).

- Hydraulic, COD and TSS areal loading rates,
- Water distribution.

Advantage

Ozone treatment + Constructed wetlands

- Reduction of biodegradable transformation products,
- Higher disinfection safety.

Water reuse.

Figure 3: Tertiary treatment for water reuse. 20,000 m² vertical flow wetland.

Tertiary treatment

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