

Workshop 23 September
10 – 12 hrs and 15 – 17 hrs, Longliqi room

W3~4 The Waterharmonica

over 20 years experience with reuse of treated waste water through natural processes

Ruud Kamp

Floris Boogaard

"natural systems for wastewater reclamation"

"nature-based solutions for water pollution control"

"upgrading of well treated waste water in natural constructed wetlands"

"constructed treatment processes"

"natural reclamation systems"

"constructed surface flow wetlands treating effluent from wastewater treatment plants"

"wetland to accept tertiary treated wastewater"

"free water surface wetlands for tertiary wastewater treatment"

"nature-based solutions for water pollution control"

"reclaimed water potential for aquatic ecosystem restoration or recreation"

"constructed wetlands for secondary effluent treatment and water reuse"

"enhancement marshes"

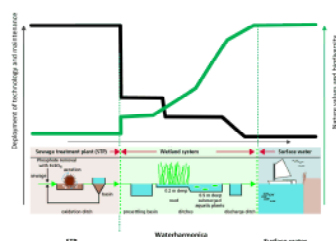
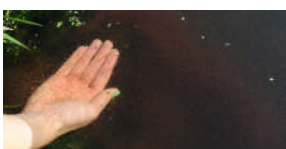
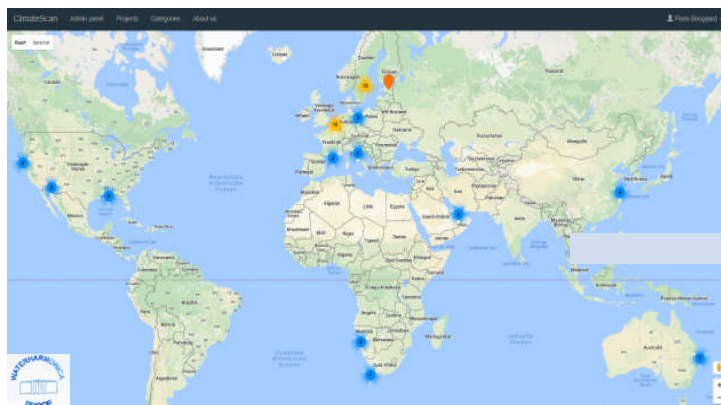
"constructed wetlands for improving wastewater quality"

"wetland treatment systems"

"effluent polishing in constructed wetlands"



www.climatecan.nl: Waterharmonica's biological link to change (well) treated waste water into usable surface water



Rekel/Water



"Waterharmonica: the natural link between tap water and surface water"

The Waterharmonica is a successful water innovation in The Netherlands, with 15 full scale applications for ecological upgrading of 1000 – 40.000 m³ treated waste water per day, with 5 more under design. The first ones were aimed on producing nutrient removal, buffering water and supply water for agriculture. Most of the recent Waterharmonica's ones are focusing on creating natural values, fish spawning and migration and on natural processes for water reuse as recreational waters

The Waterharmonica is a (natural) constructed wetland as well an *ecological engineering* solution for upgrading well treated waste water with relative low carbon loads. It is a special combination through of a customized selection of constructed natural processes for: biological filtration by Daphnia, phototrophic processes in algae mats on reed stems, oxygenation during day time by water plants, introducing food chains, ecotoxicological aspects, natural and recreational values, water buffering, nutrient removal, etc.

Waterharmonica's: till 2006



Tasks:

- ✓ Nutrient removal
- ✓ Disinfection
- ✓ Buffering water
- ✓ Supply water for agriculture and nature
- ✓ Supply of water for a leisure centre

No.	Name	Primary reasons/reasons for construction
1	Elburg	1976: to lower the nutrient level in STP effluent, taken out of operation. Has not been put back into operation because of the high natural value
2	Eversteek, Texel	1994: as a source of fresh water for agriculture on the island, disinfection because it crosses a residential area. Has been expanded and renovated in 2012 – 2013
3	Empuriabrava, Spain	1995: to supply water for a nature reserve to create local natural value
4	Klatenwater in Kaatzenheul	1997: to produce water with a low level of nutrients and pathogens for the fishing
5	Tilburg Noord	1997: to buffer effluent during rainwater discharge so as not to exceed the maximum permissible effluent rate because of the limited capacity of the stream de Zandek, ecological at basic discharge
6	Land van Cuijk	1995: to supply water for agriculture and to reduce discharge to natural waters
7	Sint Maartensdijk	2000: to reduce nutrients and obtain insight in the functioning of the helophyte filter, recreation
8	Waterpark Groote Beeren	2001: river restoration Groote Beeren, to promote wet habitats

Waterharmonica's: 2006-2016

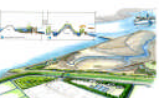


Tasks:

- ✓ Buffering water
 - ✓ River restoration
 - ✓ Surface water quality
 - ✓ Fish spawning
 - ✓ Making "natural habitats"
 - ✓ Recreation
- Customers relations:
"making friends"

No.	Name	Primary reasons/reasons for construction
9	Aquafin Grou	2006: to develop nature and a spawning pond, demonstration project and Urban Water Cycle Project
10	Ootmarsum	2010: "ecologisation" of the effluent for discharge into a small stream and Urban Water Cycle Project
11	Sint Oedenrode	2011: ecological corridor, "natural water", incorporated in a trail, first sanctuary with waterhouse
12	Krabbeldijk	2012: regional buffering water, recreational green buffer zone, ecologisation, improvement of water quality and Dutch WFD subsidy
13	Scoorndijk	2012: water buffer, recreation, to develop natural habitats, spawning pond/fish migration and Dutch WFD subsidy
14	Tilburg Maarsseburg	2012: to buffer "effluent", stormwater overflow, improving natural values, recreation, to prevent overflow
15	Vollenhove	2013: "making friends"
16	Eversteek, Texel	2013: extension existing Waterharmonica, more capacity and lower loading
17	Blaas-Houtakker	2013: "ecologisation" of the effluent for discharge into a small stream, landscaping
18	Dinxperlo	2014: Water garden and green zone. First Waterharmonica after a flood plan

Waterharmonica's: 2016 and beyond



Trends:

- Sand filtration of effluent STP
- Really needed when Waterharmonica?
- Beneficial to make water for providing high-quality water for use in cities or nature

No.	Name	Primary reasons/reasons for construction
19	Berkenwoude	2016: to remove nutrients, to make "living" water, buffering
20	Ameland	2017: Making water for fish, combination with fish migration
21	Terschelling	2017: Making water for fish, combination with fish migration
22	Groote Lucht	2018: Upgrading effluent to water for recreation
23	???	?



Groote Lucht



NoorderRuimte

More info? www.rekel.nl/water - www.waterharmonica.nl - www.stowa.nl - www.climatecan.nl