

# Klaterwater as waterharmonica

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## Efteling

- Efteling without water?
- No boating reservoir, No Pirana, No Gondoletta
- Water is very important in the amusement park
- Irrigating of the lawns and flower beds



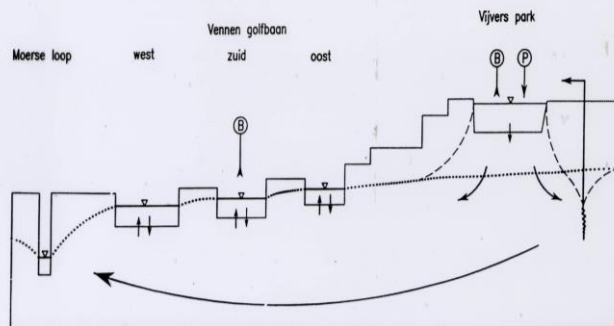
## Efteling (2)

- Use of water > 300.000 m<sup>3</sup>/year
- Source: groundwater



## Efteling (3)

Grondwatersysteem



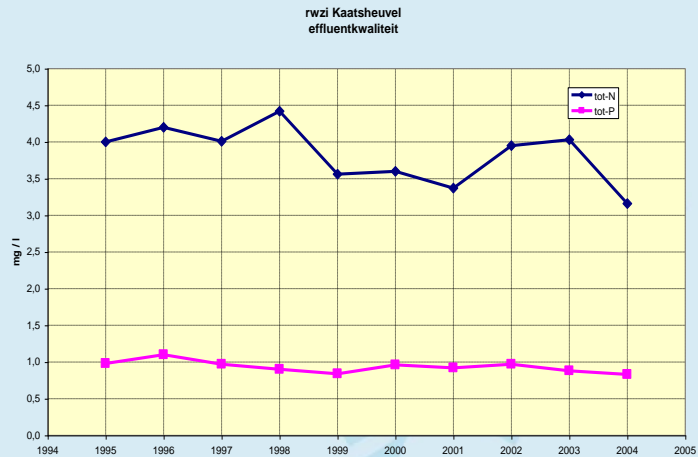
## Efteling (4)

- Water consumption (> 300.000 m<sup>3</sup>/jr)
- Source: groundwater
- 1994 Province started the fight against drought
- Alternative source
- 1997 Construction of the golfcourse:
  - Prohibited to use groundwater
  - Prohibited to use surfacewater

## Looking for alternatives

- Deliberation between waterboard, Province and Efteling
- Decision to treat effluent of the wwtp Kaatsheuvel in a reedbedfilter:
  - Natural charisma
  - Fits well in the environment

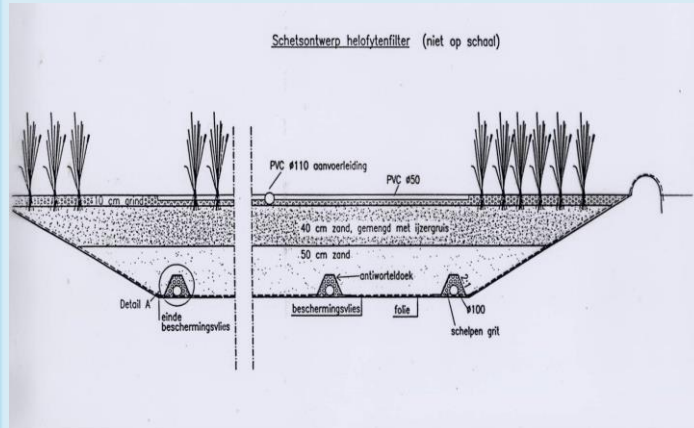
## Interlude: Effluentresults wwtp



## Investigation

- Feasibilitystudy
- Reedbed filter, vetrtrically passed
- Goal:
  - Total P: 0,2 mg/l
  - Therm.tol. E.coli < 20 c.f.u./ml
- Pilot 12 m2 on wwtp Kaatsheuvel

## Investigation (2)



## Investigation (3)

- Duration about 1 year
- Conclusion: goals achievable with a vertical reedbed
- Dimensions:
  - Surface load 148- 277 l/m<sup>2</sup>.d
  - Cycle: 1,5 h feed, 4,5 h rest

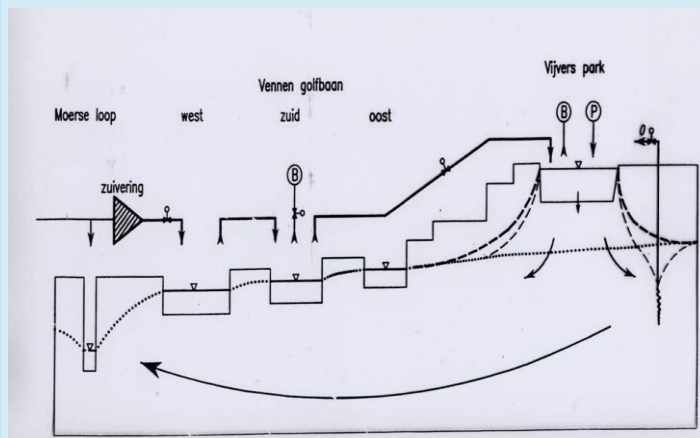
## Realization

- 1997 start up of the vertical reed bed filters
- 4 filters with a total surface of 6500 m<sup>2</sup>, fed alternating
- Supply by a pumping station and a pressure pipe (4 km)
- Flow: 40 or 75 m<sup>3</sup>/h



## Realization (2)

### Klaterwater !



## Results reedbedfilter

- Good in the beginning
- Less well than the results of the pilot (esp. the P-removal)
- Mainly caused by distribution problems
- Underestimation of the problem
- Summer 2000: algal bloom in Ven-W It looked like pea soup with (golf)balls !!

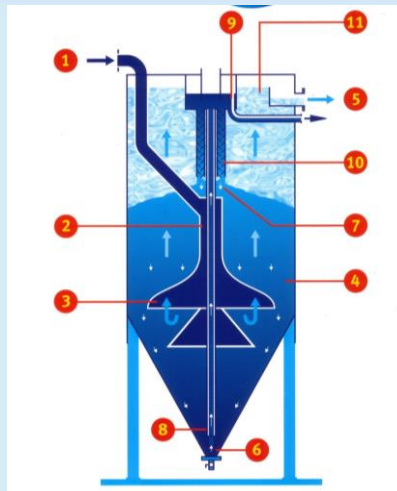
## And now ???? How to improve ??

- Together with the Efteling concluded that:
- Extra treatment of the WWTP-effluent was necessary
- Continuous sandfiltration ( $P = 1 \rightarrow P = 0,2$ )
- Active biological housekeeping in Ven-West

## Sandfiltration (dimensions)

- Continuous filter for P-removal
- Filterbed 1,8 m height
- Filtersurface 8 m<sup>2</sup>
- Filtrate flow 40-75 m<sup>3</sup>/h
- Waswaterflow 5 m<sup>3</sup>/h
- Dosing of FeCl<sub>3</sub> (flow prop.)
- Operation stopped in wintertime

## Sandfiltration





## Sandfiltration

**Opening**  
**jan. 2003 byr**  
**Pardoes en**  
**Droppie Water**



## Sandfilter (results 2011)

<i>Parameter</i>	<i>Eenheid</i>	<i>Toevoer zandfilter</i>	<i>Afvoer zandfilter</i>
CZV	mg/l	2,9	24
BZV	mg/l	1	1
N-Kjeldahl	mg/l	1,6	1,1
NH4-N	mg/l	0,1	0,1
NO3-N	mg/l	2,2	2,4
N-totaal	mg/l	3,9	3,5
Ortho-P	mg/l	0,62	0,03
Totaal-P	mg/l	0,74	0,11
Droogrest onop. best.	mg/l	3	2

- Treated 400.000 m3
- No use of groundwater
- Dosing: 5 g Fe/m3

## Project costs

- Total investment ca. € 1,5 million
  - Efteling € 0,5 million
  - WBD € 0,3 million
  - Subsidy (Interreg/GeBeVe)
- Efteling pays ± € 0,30 / m<sup>3</sup> tot the WBD

## Conclusion

- Klaterwater prosperous project in which treated effluent contributes in the battle against draught
- Project is an example of good cooperation!

- Any questions ????

