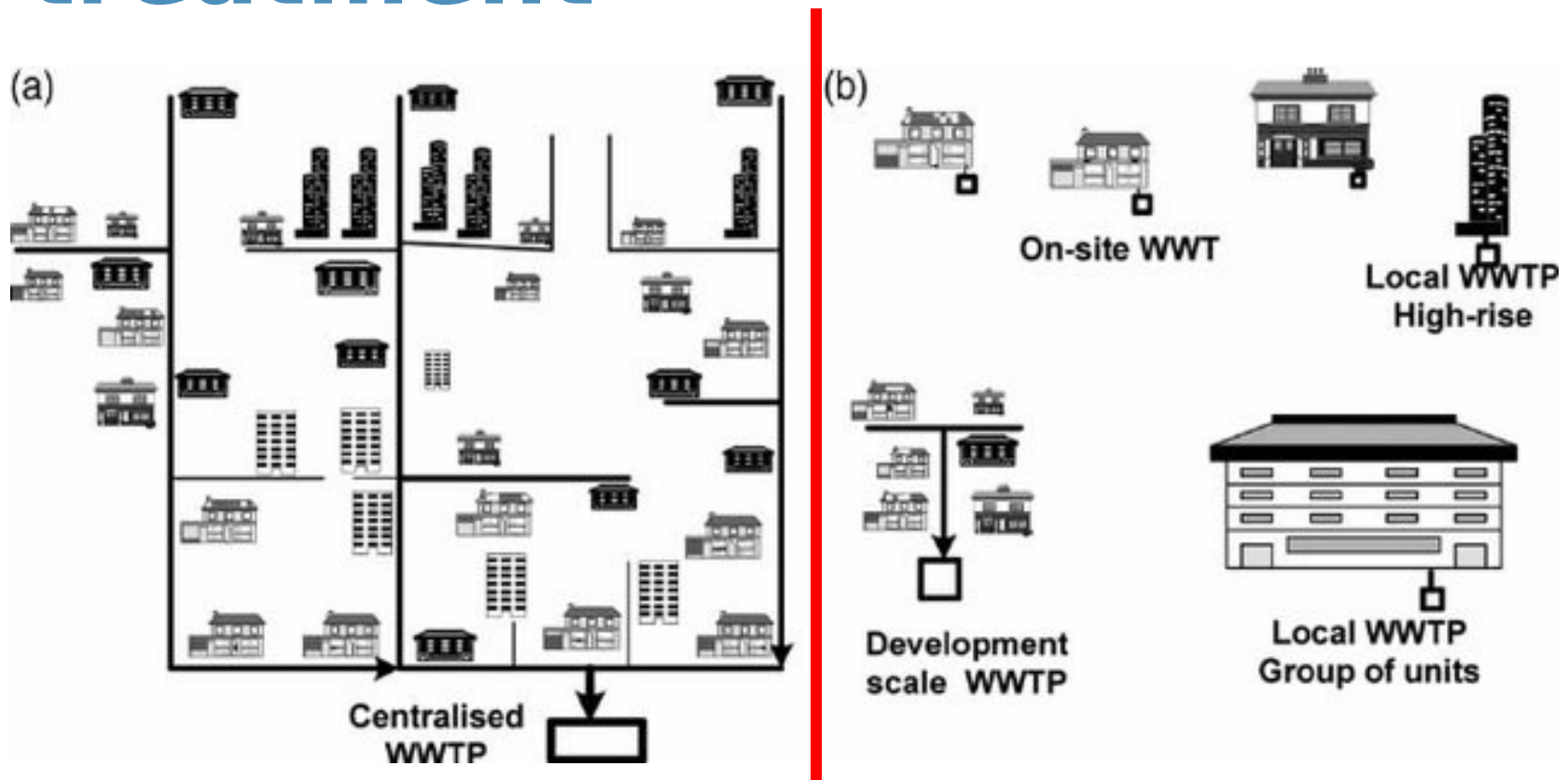


Decentralised water and waste treatment in view of resource recovery: The I-QUA & WAVE projects

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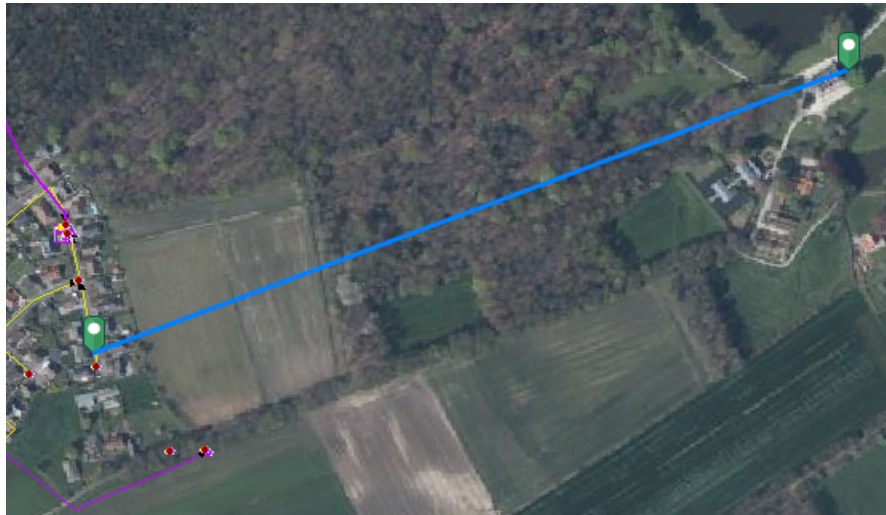
(De)centralised water treatment



Sharma, A. K., Tjandraatmadja, G., Cook, S., & Gardner, T. (2013). Decentralised systems—definition and drivers in the current context. *Water Science and Technology*, 67(9), 2091-2101.

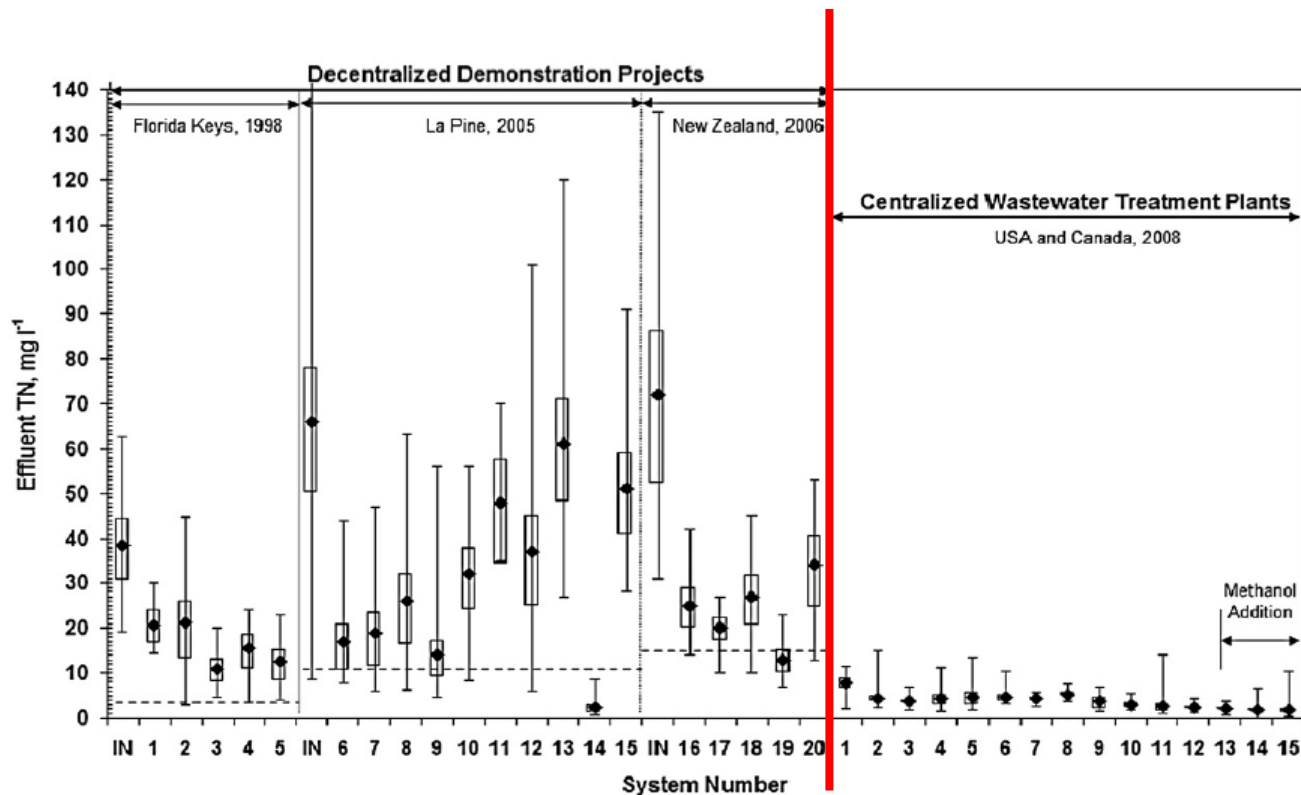
(De)centralised water treatment

- Reduced cost for infrastructure
 - E.g. case in Flanders: pressure sewer over +/- 900 m (height difference of 3,5 m): +/- 800 euro/m = 750 000 euro!



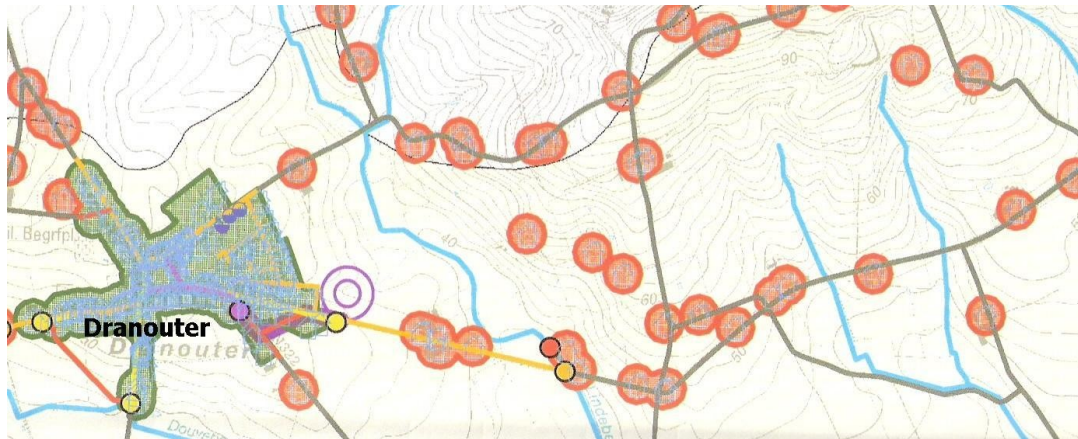
(De)centralised water treatment

- Reduced treatment efficiency



Decentralised water treatment

- Belgian/Flemish situation: zoning plan
 - Some rural areas: high amount of decentralised treatment



Decentralised water treatment

- E.g. Catering businesses
 - A: with treatment
 - B&C: no treatment
- Limits:
 - BOD < 25 mgO₂/l,
 - SS < 60 mg/l

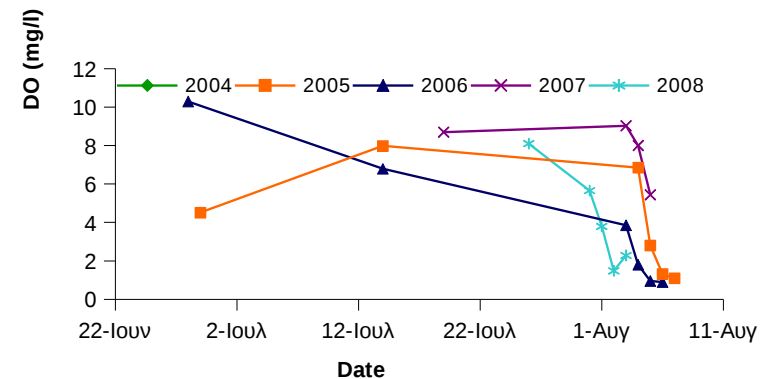
Table 3. Average and standard deviation of different water quality parameters measured at the discharge point of catering businesses A, B and C.

Parameter	A (n = 5)	B (n = 7)	C (n = 3)
pH	7.9 ± 0.2	7.3 ± 0.3	7.7 ± 0.2
Temperature (°C)	27 ± 2.8	17 ± 3.7	18 ± 5.0
O ₂ (mg O ₂ /l)	0.3 ± 0.2	5.1 ± 1.7	4.5 ± 0.4
Conductivity (µS/cm)	1620 ± 109	2877 ± 1084	1681 ± 209
BOD (mg O ₂ /l)	76 ± 29	577 ± 174	803 ± 195
COD (mg O ₂ /l)	238 ± 53	1199 ± 249	1417 ± 283
SS (mg/l)	38 ± 1.7	244 ± 115	272 ± 0
Cl ⁻ (mg/l)	146 ± 19	604 ± 292	1052 ± 8
NH ₄ ⁺ (mg N/l)	32 ± 6.0	78 ± 26	55 ± 36
NO ₂ ⁻ (mg N/l)	0.02 ± 0.01	0.03 ± 0.02	0.01 ± 0.01
NO ₃ ⁻ (mg N/l)	0.3 ± 0.1	0.3 ± 0.1	0.3 ± 0.1
Ortho-PO ₄ ³⁻ (mg P/l)	8.4 ± 5.5	9.7 ± 2.2	5.9 ± 2.5

n: number of measurements.

Decentralised water treatment

- E.g. music festivals



Decentralised water treatment

- E.g. music festivals

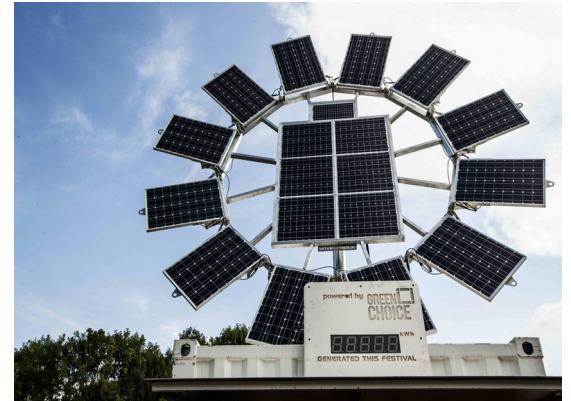
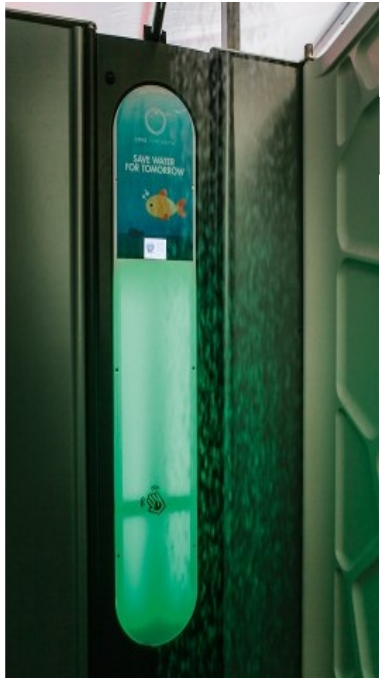


	TSS mg/l	COD mg O ₂ /l	Total N mg N/l	Total P mg P/l
Discharge limit	35	125	15	2
Untreated wastewater	83.7	202	9	1.3
Treated wastewater	5.33	23	8	1.6

Decentralised water treatment

- Tackling the challenges
 - I-Qua: decentralised water treatment demo project
 - WAVE: sustainable operation of music





IQUA

- 5 demo cases in Flanders (B) and The Netherlands:
 - Restaurant (B)
 - Goatfarm (B)
 - Mobile wetland (B)
 - Integrated treatment football infrastructure (NI)
 - Carwash (NI)



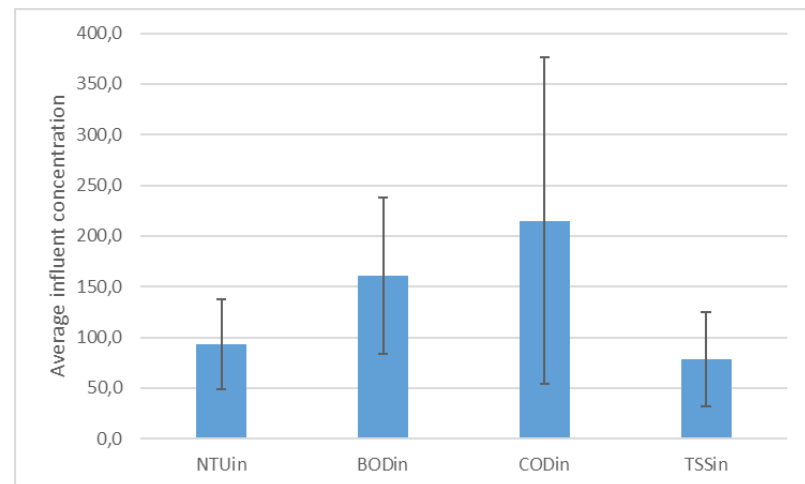
Mobile wetland

- 15 m³ mobile treatment system (vertical flow)
- Lava rock substrate



Mobile wetland

- Challenge tests
 - Flow
 - Q: 4 -> 8 -> 12 -> 16 m³/d
 - HRT: 3,8 -> 1,9 -> 1,3 -> 0,9 d
 - Winter period (+/- 10°C): no N/dN
 - Settled municipal waste water:

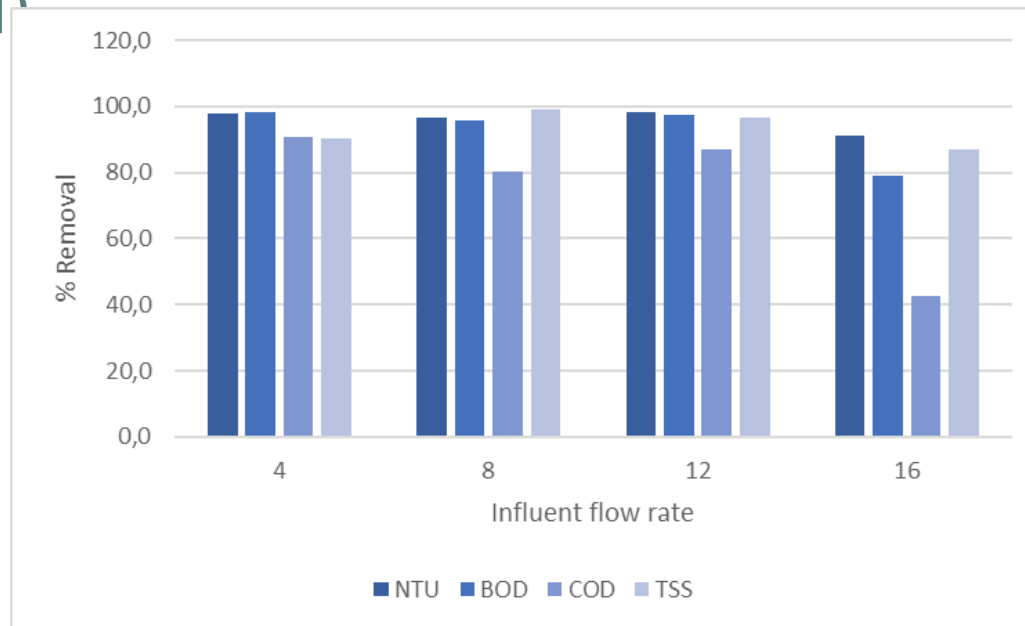


Mobile wetland

- Challenge tests

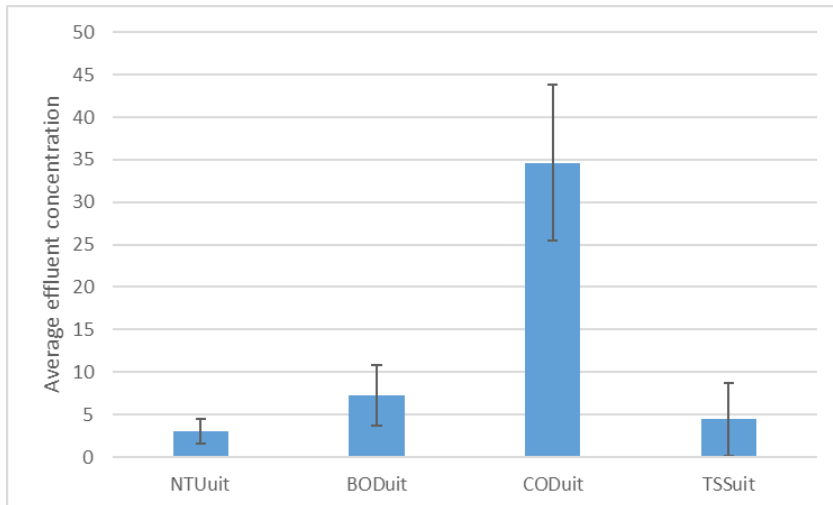
- COD/SS

- Good removal (> 80%, except COD at 16 m³/d)



Mobile wetland

- Challenge tests
 - COD/SS
 - Average removal (all HRT)



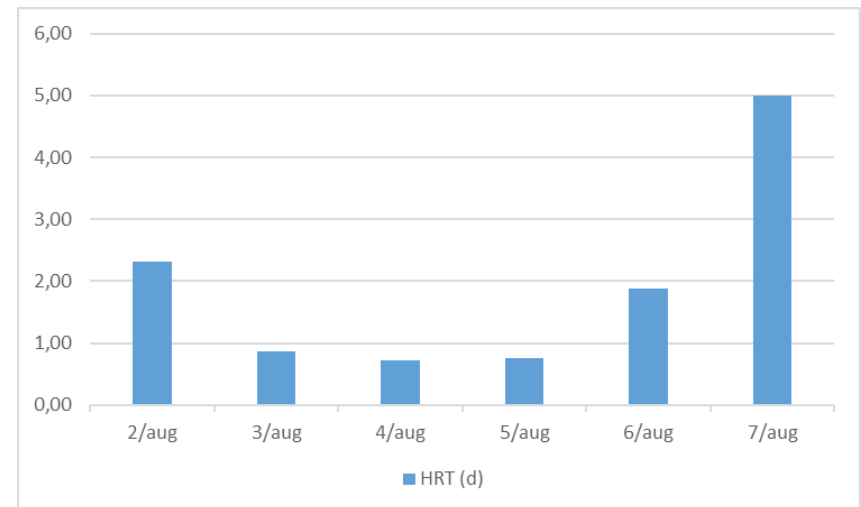
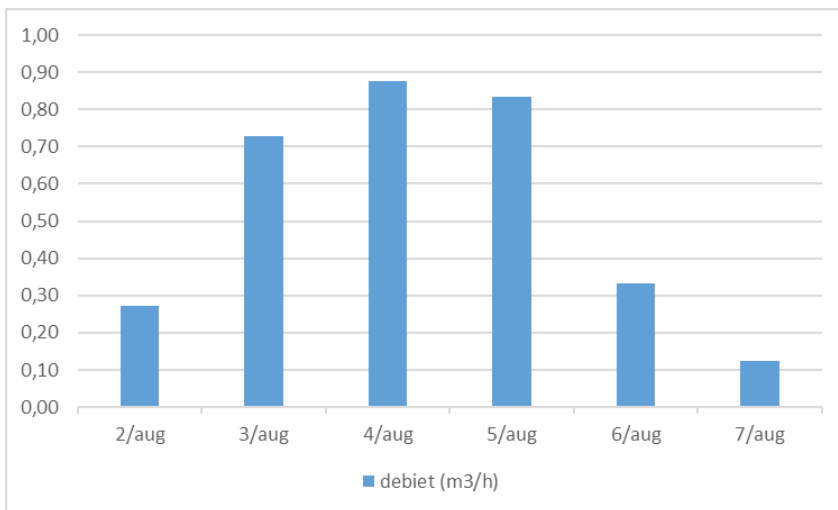
Parameter	Influent	Effluent	% Removal
NTU	93,1	3	96,7
BOD (mg/l)	160,8	7,2	95,5
COD (mg/l)	215,1	34,6	83,9
TSS (mg/l)	78,4	4,5	94,3

Limit:
BOD < 25 mg/l;
SS < 60 mg/l



Mobile wetland

- Actual performance
 - Grey water
 - Flow rate and HRT
 - 76 m³ in total (<-> 44 m³ in 2017)

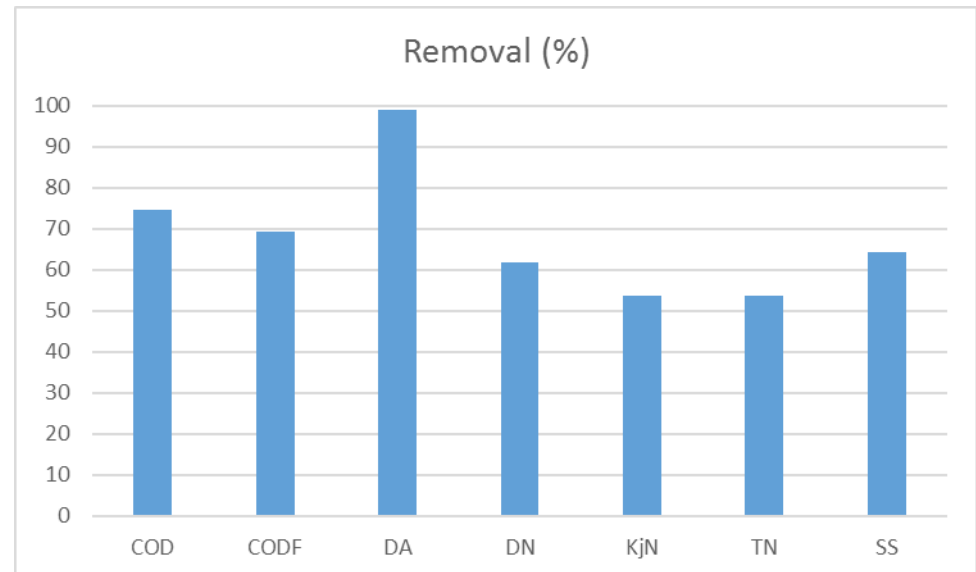




Mobile wetland

- Actual performance
 - Good removal of detergents (+/- 90%)
 - Fair removal of COD and SS (70%)
 - Nitrification:
 - NH_4^+ ↓ -> 55%
 - TN removal but no NO_3^- ↑
 - No P removal
- Similar operation
in 2017 and 2018

□ .



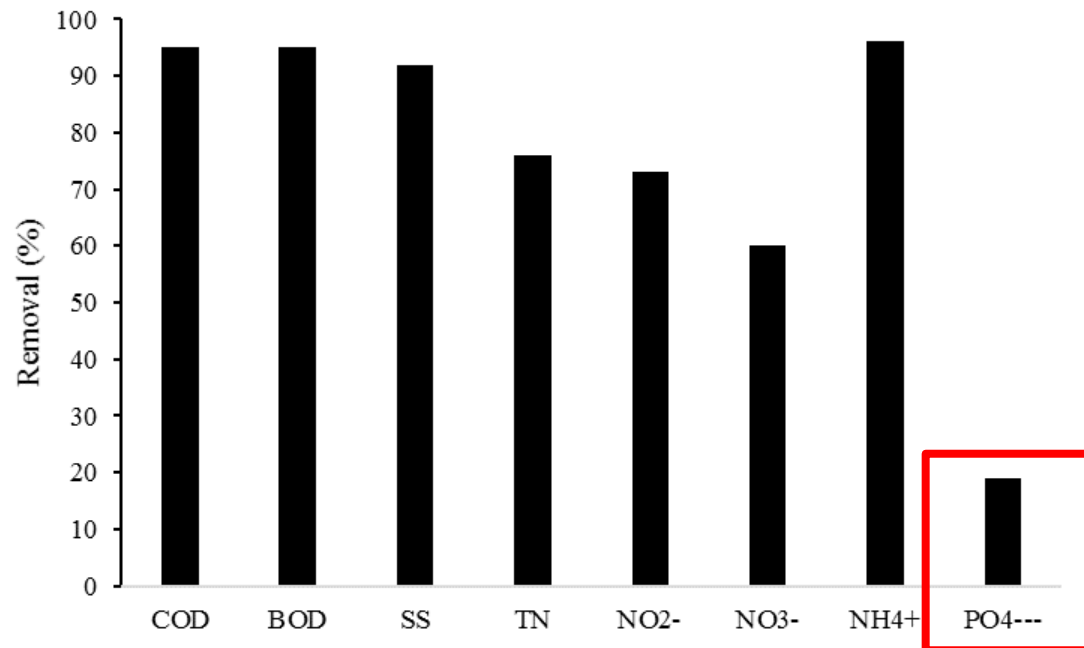
Goat farm

- Current situation
 - Constructed wetland (with recirculation for N/deN)



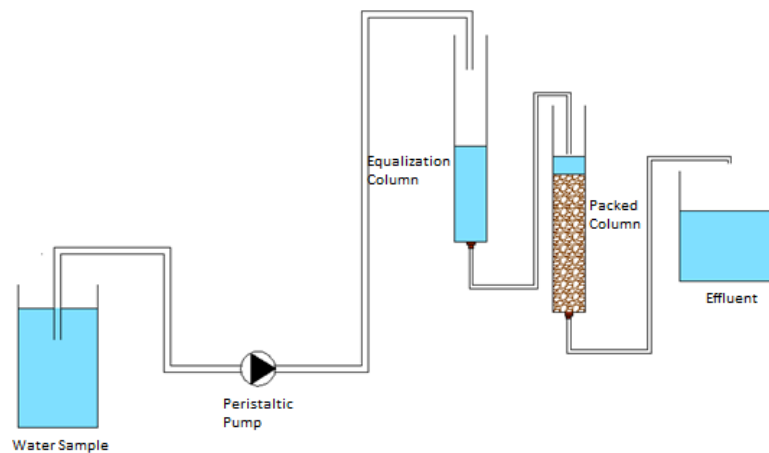
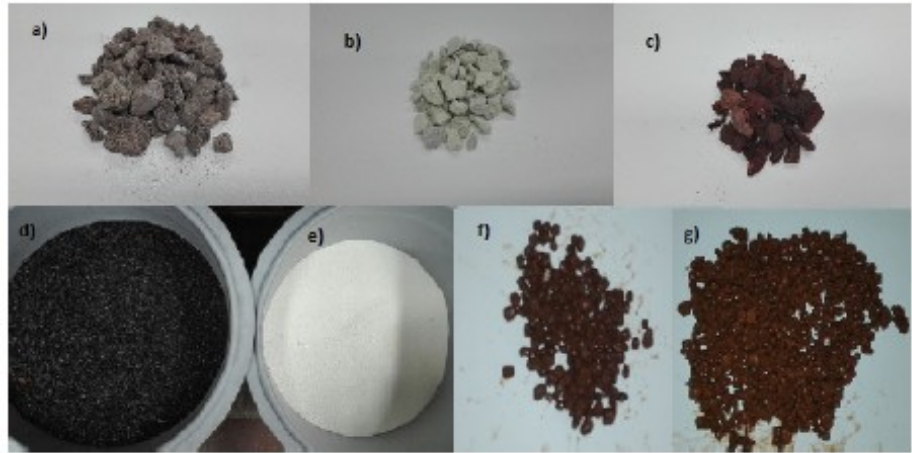
Goat farm

- Removal efficiency (%)
 - -> extra polishing step for P removal



Goat farm

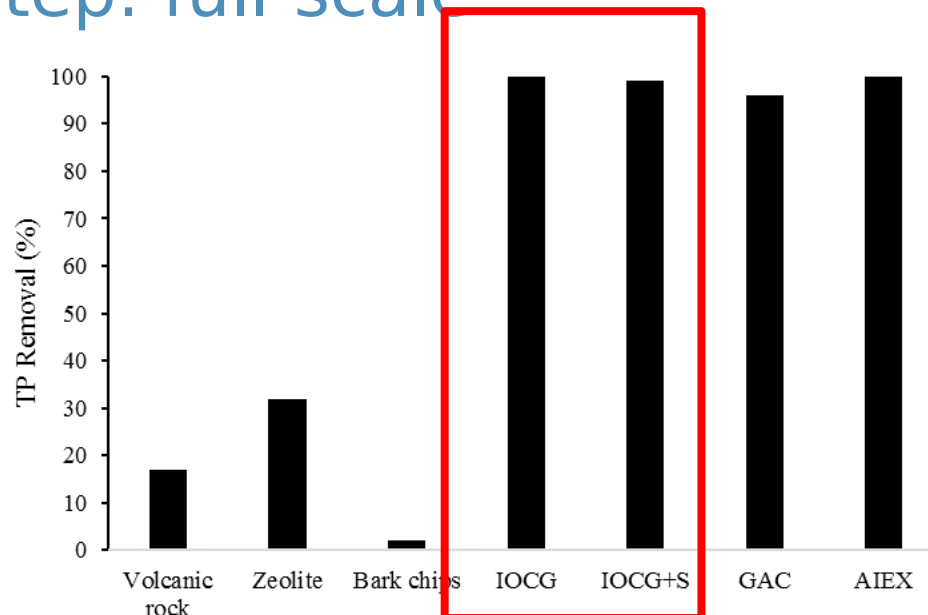
- Extra polishing step
 - Granular filtration



- a) Lava rock
- b) Zeolite
- c) Wood chips
- d) Activated Carbon
- e) ALEX Resin
- f) IOCG+S
- g) IOCG.

Goat farm

- Extra polishing step
 - IOCG: very good TP removal (and some extra N removal)
 - Next step: full-scale



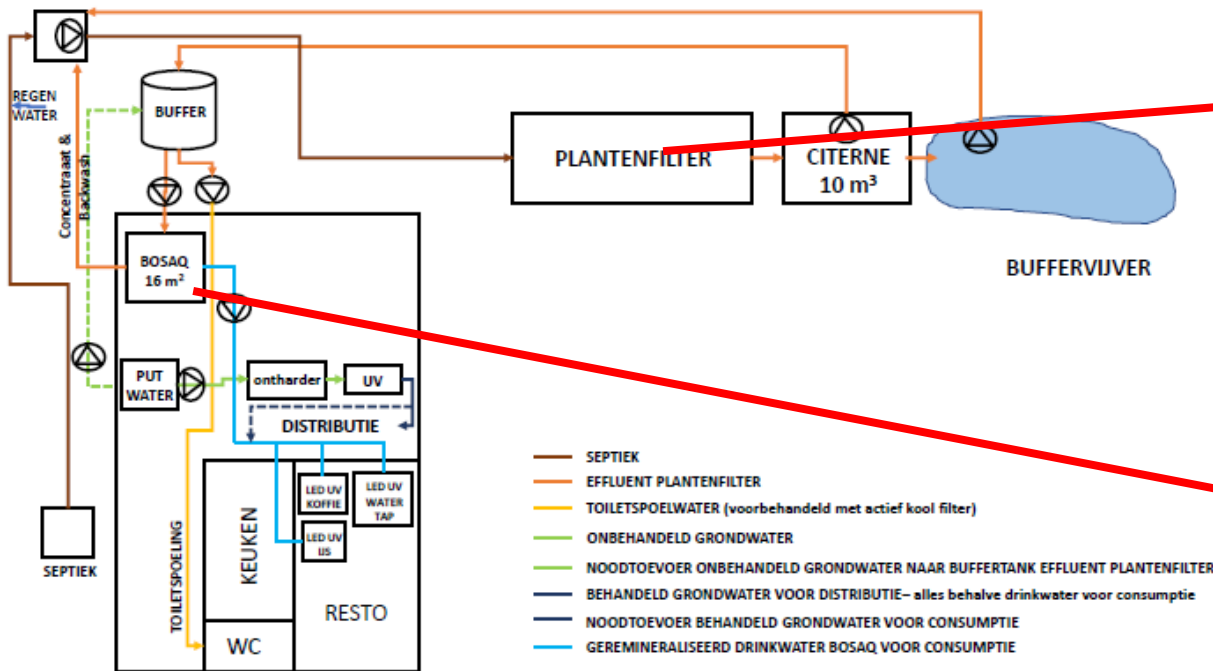
What is next?

- Focus on water re-use in music festival



What is next?

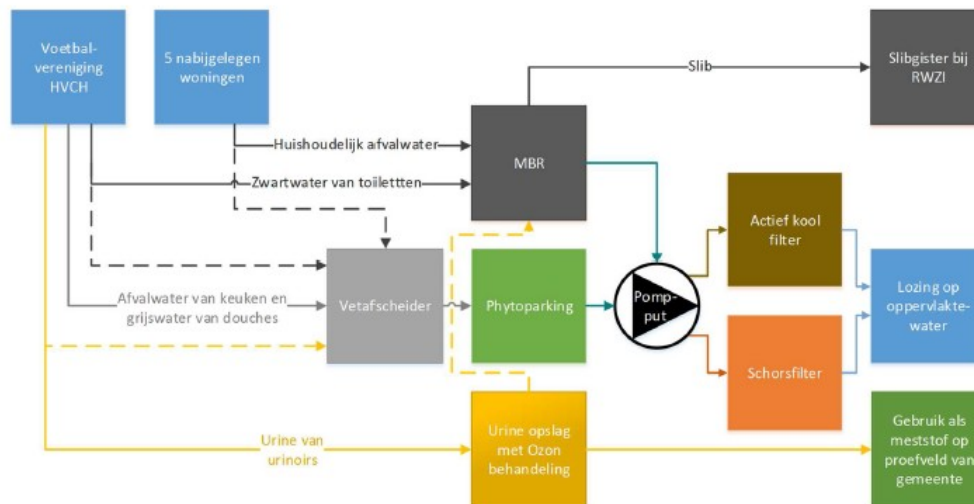
- Focus on water re-use in restaurant



What is next

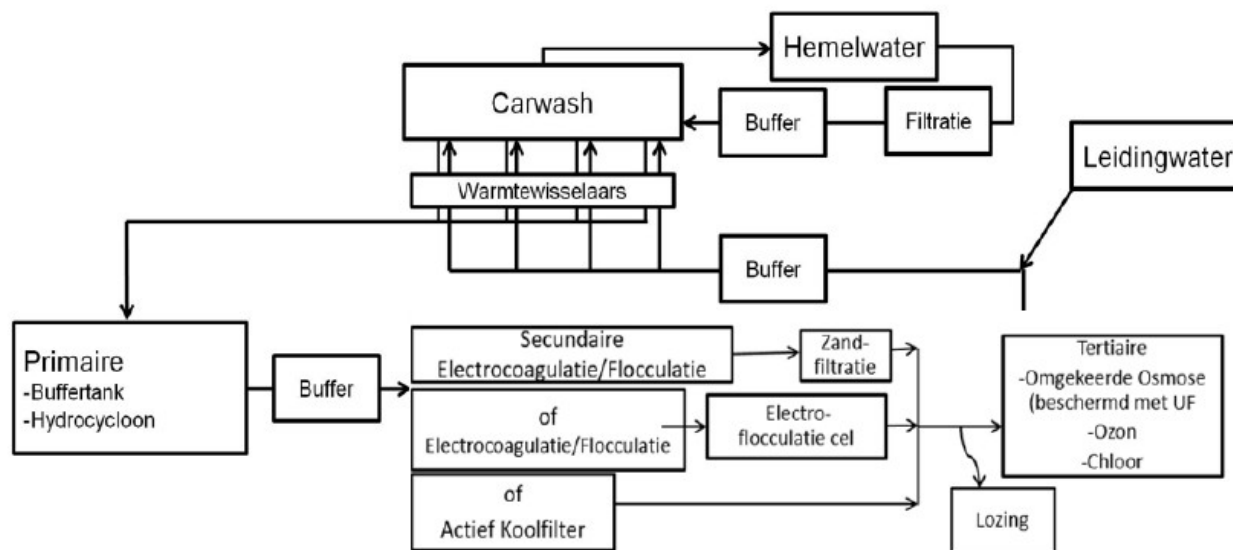


- Separate water treatment at football infrastructure
 - Grey, yellow, black water treatment



What is next?

- Maximal water re-use at carwash



Thanks to the sponsors



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Some references

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- Van Hulle, Stijn, Audenaert, W., Decostere, B., Hogie, J., & Dejans, P. (2008). Sustainable wastewater treatment of temporary events: the Dranouter Music Festival case study. Water Science and Technology, 58(8), 1653–1657.
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QUESTIONS?