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

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(De)centralised water treatment

(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
Decentralised water treatment
• E.g. music festivals
Decentralised water treatment

- E.g. music festivals

<table>
<thead>
<tr>
<th></th>
<th>TSS mg/l</th>
<th>COD mg O₂/l</th>
<th>Total N mg/l</th>
<th>Total P mg P/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge limit</td>
<td>35</td>
<td>125</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Untreated wastewater</td>
<td>83.7</td>
<td>202</td>
<td>9</td>
<td>1.3</td>
</tr>
<tr>
<td>Treated wastewater</td>
<td>5.33</td>
<td>23</td>
<td>8</td>
<td>1.6</td>
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</tbody>
</table>
Decentralised water treatment

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

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

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

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:
    - $\text{NH}_4^+ \rightarrow 55\%$
    - TN removal but no $\text{NO}_3^-$
  - 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) AIEX 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 festivals
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
Some references


QUESTIONS?