Reed Bed Treatment System

Sewage treatment plant
Lahstedt-Gadenstedt

Owner:
Municipality Lahstedt
Am Breiten Tor 1
D-31246 Lahstedt, Germany

Optimization of a trickling filter
for domestic sewage treatment with
planted artificial wetlands

Population equivalent:
3000 PE in Gadenstedt

Planning: 1995-1996
Construction: 1997-1998

Presented as registered project of world exhibition
Expo 2000 Hannover

Wastewater treatment plant from 1959:
- trickling filter

Structural alteration measure:
- new grit chamber and screen
Enhancement of the old trickling filter:
- 4 reed planted artificial wetlands
- 3 reed planted sludge drying beds
- storm water treatment biotope

Space requirement for artificial wetlands:
10,000 m² gross; 6,500 m² net
Design parameters:
500 m³/d (dry weather) – 2000 m³/d
(stormwater)

Space requirement for storm water treatment:
- 17,000 m² with green areas around

Design parameters:
123,000 m³/a and 19,250 kg COD/a from
38,5 hectare paved area

Special features:
- successful operation
  of the artificial wetland
  as secondary
  treatment step
  (shutdown of trickling
  filter, see results
  on the next page)
Performance of the reed bed treatment system in Lahstedt-Gadenstedt

Tertiary treatment of trickling filter effluent
October 2004 - September 2005
Primary/secondary treatment: fine screen, aerated grit chamber, primary sedimentation, trickling filter

<table>
<thead>
<tr>
<th></th>
<th>COD</th>
<th>BOD5</th>
<th>NO2-N</th>
<th>NO3-N</th>
<th>NH4-N</th>
<th>TN</th>
<th>TP</th>
<th>pH</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influent</td>
<td>54</td>
<td>16</td>
<td>0.3</td>
<td>14.0</td>
<td>2.0</td>
<td>16.0</td>
<td>2.0</td>
<td>7.2</td>
<td>50</td>
</tr>
<tr>
<td>Effluent</td>
<td>15</td>
<td>4</td>
<td>0.1</td>
<td>9.0</td>
<td>0.7</td>
<td>9.0</td>
<td>2.0</td>
<td>7.4</td>
<td>50</td>
</tr>
</tbody>
</table>

Average hydraulic loading rate: 128 Vm³/d

Secondary treatment of municipal wastewater
December 2001 - April 2002
Primary treatment: fine screen, aerated grit chamber, primary sedimentation

<table>
<thead>
<tr>
<th></th>
<th>COD</th>
<th>BOD5</th>
<th>NO2-N</th>
<th>NO3-N</th>
<th>NH4-N</th>
<th>TN</th>
<th>TP</th>
<th>pH</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influent</td>
<td>301</td>
<td>165</td>
<td>0.6</td>
<td>9.8</td>
<td>13.4</td>
<td>22.1</td>
<td>4.1</td>
<td>7.5</td>
<td>19</td>
</tr>
<tr>
<td>Effluent</td>
<td>24</td>
<td>4</td>
<td>0.1</td>
<td>3.1</td>
<td>7.5</td>
<td>10.7</td>
<td>2.9</td>
<td>7.3</td>
<td>19</td>
</tr>
</tbody>
</table>

Average hydraulic loading rate: 137 Vm³/d

n * = number of samples

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Ingenieurbüro Blumberg
Pathogen removal of the reed bed treatment system in Lahstedt-Gadenstedt

Tertiary treatment of trickling filter effluent
July 1998 - November 2001
Primary/secondary treatment: fine screen, aerated grit chamber, primary sedimentation, trickling filter

<table>
<thead>
<tr>
<th></th>
<th>[1 ml]</th>
<th>[10 ml]</th>
<th>[100 ml]</th>
<th>[1000 ml]</th>
<th>[1000 ml]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ClO₂</td>
<td>2.0E-06</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>1.1E+00</td>
<td>0.0</td>
</tr>
<tr>
<td>Total coliforms</td>
<td>2.4E-07</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>0.0</td>
</tr>
<tr>
<td>Fecal coliforms</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>0.0</td>
</tr>
<tr>
<td>Fecal streptococci</td>
<td>1.4E+00</td>
<td>1.4E+00</td>
<td>1.4E+00</td>
<td>1.4E+00</td>
<td>0.0</td>
</tr>
<tr>
<td>Salmonella</td>
<td>1.1E-04</td>
<td>1.1E-04</td>
<td>1.1E-04</td>
<td>1.1E-04</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 3

Performance of the combined wastewater biotope in Lahstedt-Gadenstedt

July 1998 - September 2001

<table>
<thead>
<tr>
<th></th>
<th>COD</th>
<th>BOD₅</th>
<th>NO₂-N</th>
<th>NO₃-N</th>
<th>NH₄-N</th>
<th>TN</th>
<th>TP</th>
<th>TSS</th>
<th>n°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influent</td>
<td>279</td>
<td>35</td>
<td>0.5</td>
<td>6.1</td>
<td>7.0</td>
<td>6.4</td>
<td>4.1</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>Effluent</td>
<td>19</td>
<td>3.0</td>
<td>0.0</td>
<td>1.3</td>
<td>1.3</td>
<td>2.5</td>
<td>0.9</td>
<td>6.0</td>
<td>47</td>
</tr>
</tbody>
</table>

n° - number of samples

Table 4

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<table>
<thead>
<tr>
<th></th>
<th>ClO₂</th>
<th>Total coliforms</th>
<th>Fecal coliforms</th>
<th>Fecal streptococci</th>
<th>Salmonella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influent</td>
<td>2.0E-06</td>
<td>2.4E-07</td>
<td>1.1E-07</td>
<td>1.1E-07</td>
<td>1.4E+00</td>
</tr>
<tr>
<td>Effluent</td>
<td>1.0E-04</td>
<td>1.1E-04</td>
<td>1.1E-04</td>
<td>1.8E-04</td>
<td>0.0</td>
</tr>
<tr>
<td>Red bed effluent</td>
<td>4.9E-02</td>
<td>1.5E-03</td>
<td>1.5E-02</td>
<td>7.0E-01</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Badegewässerfähigkeit
Leitungwert
Limiting value (76/160/EEC)

5.0E+02, 1.0E+02, 1.0E+02
1.0E+04, 2.0E-03, 1.0E+02
0.0