<1 ppm Phosphorus – A BNR With No Chemical Addition
Case Study

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Acknowledgements:

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City of Phillips, WI WWTP

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Oconto Falls, WI

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Oconto Falls, WI

Jeff Simpson & Karen Harter – WWOA
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City of Phillips Price Co. WI WWTP

<table>
<thead>
<tr>
<th>Plant Info</th>
<th>mgd</th>
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</thead>
<tbody>
<tr>
<td>Avg. Annual Flow</td>
<td>0.374</td>
</tr>
<tr>
<td>Max. Daily</td>
<td>1.2</td>
</tr>
<tr>
<td>Peak</td>
<td>1.4</td>
</tr>
<tr>
<td>Discharge to Elk Lake</td>
<td></td>
</tr>
</tbody>
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Current WPDES Limit (mg/l)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
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<tbody>
<tr>
<td>CBOD – Mo. Avg.</td>
<td>25</td>
</tr>
<tr>
<td>CBOD – Wk. Avg.</td>
<td>40</td>
</tr>
<tr>
<td>SS – Mo. Avg.</td>
<td>30</td>
</tr>
<tr>
<td>SS – Wk. Avg.</td>
<td>45</td>
</tr>
<tr>
<td>Tot Phos. – 6-mo. Avg</td>
<td>0.7</td>
</tr>
<tr>
<td>May – Oct.</td>
<td></td>
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<tr>
<td>Tot Phos. – Mo. Avg</td>
<td>1.0</td>
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1980’s Plant Process Flow

- Process incapable of year 2000 Nutrient Effluent Limits
- Evaluate several process change options
• Biological phosphorus removal was the Lowest Net Present Worth over 20-year Life.

• Add Return Sludge, Sludge Contact Tank and optimize operation – no chemical addition

• Add DAFT for thickening waste secondary sludge
- SCT design allows RSS to be added to any of 4 compartments and primary effluent to enter either half of the tank. Primary clarifier effluent presently mixes with RSS in the 1st compartment for anoxic reaction favorable for denitrification and SBOD$_5$ removal.
- Flow then passes into anaerobic compartment with conditions favorable for phosphorus accumulating organisms (PAO), allowing phosphorus release and SBOD$_5$ removal.
- Reactor compartments are mixed. Mechanical aeration is provided for any compartment to be aerated if additional aerobic treatment is needed.
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30 year old
RBC’s replaced

4 compartment
Sludge Contact
Tank (SCT)
-approx. 10,000 gal each
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PHILLIPS WASTEWATER TREATMENT PLANT
EFFLUENT CHARACTERISTICS

- Historical BOD and SS effluent levels well below limits
- Historical Phosphorus effluent shown
- Phosphorus Limit lowered to 1.0 mg/l and 0.7 mg/l in 2013

1992

2002: SR/RBC BNR process operational, Phosphorus limit permitted at 1.6 mg/l
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Jan. 2015 thru mid 2017 Phosphorus consistently <1 mg/l year-round and < 0.7 on 6-mo. avg. May-Oct.

<table>
<thead>
<tr>
<th>Secondary Treatment Characteristic</th>
<th>% Removal from Primary Effluent</th>
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<tbody>
<tr>
<td>SBOD$_5$</td>
<td>96</td>
</tr>
<tr>
<td>TSS</td>
<td>92</td>
</tr>
<tr>
<td>TKN</td>
<td>81</td>
</tr>
<tr>
<td>N-NH$_3$</td>
<td>77</td>
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<tr>
<td>TP</td>
<td>90</td>
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<tr>
<td>Orthophosphate</td>
<td>91</td>
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</table>

Additional sampling and analysis was done during cold-water Winter months of 2016 along with Volatile Fatty Acid addition in the SCT to explore the relationship between low temperature/primary sludge fermentation organism dormancy and ‘artificial’ VFA augmentation to feed the PAO.

Somewhat surprisingly, the BNR did not deteriorate in colder water conditions. Thus the VFA addition had little effect.
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SUMMARY

-BNR with RBC’s and well engineered, modest investment process addition meet current Phosphorus standards

-Potential Final Limit of 0.04 mg/l Total P would require new Tertiary Treatment
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For More Information:

COMPLETE CASE STUDY REPORT:
www.walker-process.com
Select: Literature
Select: Featured Articles
1ppm EFFLUENT PHOSPHORUS FROM SR/RBC PROCESS - PLANT TRIAL RESULTS

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