New Technologies Reduce Sludge Handling at Northern Moraine Utility Commission

Wisconsin Wastewater Operators’ Association
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Presented by Phil Korth
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Existing Wastewater Facility

- Constructed in 1976
- Multiple Remote Influent Lift Stations
- Mechanical Screen
- Two Package Activated Sludge Plants
- Seepage Cell Discharge
Existing Wastewater Facility BioSolids Handling

- Aerobic Digestion
- No Separate Biosolids Storage
- Staff Liquid Haul Biosolids in Summer
- Contract Haul Liquid Biosolids in Winter
Existing WWTP Capacity

- Average Daily Flow: 0.560 mgd
- BOD Load: 561 lbs/day
- TSS Load: 660 lbs/day
2008 WWTP Flows and Loads

- Average Daily Flow: 0.345 mgd
- BOD Load: 721 lbs/day
- TSS Load: 690 lbs/day
## 2008 Operation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>BOD</td>
<td>5 mg/l</td>
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<tr>
<td>TSS</td>
<td>4 mg/l</td>
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<tr>
<td>TKN</td>
<td>2 mg/l</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>9 mg/l</td>
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</tbody>
</table>
2008 Capacity Limitations

- Limited Aerobic Digestion Capacity
- Sludge Storage Not Adequate for 180 Days
- Headworks Aging and Need of Physical Replacement
- Future Loads Will Exceed Capacity of Package Plants
2008 WPDES Permit Limits

- **BOD\textsubscript{5}** 50 mg/l\textsuperscript{1}
- **TSS** N/A
- **NO\textsubscript{2} + NO\textsubscript{3}** 14.6\textsuperscript{2}
- **NH\textsubscript{3}** 2.1\textsuperscript{2}
- **Organic Nitrogen** 2.1\textsuperscript{2}

1 – Wastewater Effluent Limit
2 – Groundwater Limit
Future Conditions

- **Average Daily Flow**: 0.403 mgd
- **BOD Load**: 820 lbs/day
- **TSS Load**: 806 lbs/day
- **TKN Load**: 121
Alternatives for Biosolids Treatment

- Sludge Storage Tank
- Sludge Minimization with Aquarius Multi-Stage Activated Biological Process (MSABP)
MSABP Pilot Plant

- Demonstrate MSABP Ability to Remove BOD, TSS, and Total Nitrogen
- Test Under Cold Weather Conditions
- Use Data in Facilities Plan
MSABP Pilot Plant

- Pilot Plant Started Operation February, 2007
- Trial Operation Ran from March 16, 2007 to June 20, 2007
MSABP Pilot Plant Results

- Good Performance Through April
- Sewer Cleaning in May Thought to Cause Grit in Tank and Discharge
- Heavy Loads from Memorial Day Caused Septic Conditions and Treatment Upset
MSABP Pilot Plant Results

- Process Met NMUC Permit Requirements
- BOD/TSS < 10 mg/l for First 6 Weeks
- BOD/TSS > 10 mg/l for Next 6 Weeks
- Lack of Grit Removal Impacted Performance
- Lack of D.O. Control Impacted Performance
MSABP Pilot Plant Results

- Second Pilot Test Immediately After NMUC at Roselle, Ill.
- 9 Month Trial Showed Consistent Performance for NMUC Effluent Limits
Facilities Planning

- Recommended MSABP
- Added Grit Removal
- Added Salsnes Screen for Lower BOD Loading and Better Screening
- Two Phased Construction Approach to Allow Full Scale Testing
New Technology Challenges

- Presentation of Technology to WDNR
- Presentation of Technology to NMUC
- Minimize Risk to NMUC
- Operate Pilot Plant To Simulate NMUC Conditions
Minimize Risk with New Technology

- Required Equipment Supplier to be Responsible for Process Design
- Performance Warranty Based on MSABP Effluent
- Provide Additional Processes (Final Clarifier, Sludge Pumping) to Meet Unexpected Challenges
Design Features – Grit Removal

- Pilot Plant Showed Grit Removal Important
- Vortex Type Selected for Low Head Loss
Design Features – Salsnes Screen

- Provides Excellent Screening (350 Micron)
- 25% BOD$_5$ Removal
- 40% TSS Removal
- Reduces BOD$_5$ Loading on MSABP
Design Features – MSABP

- Retained Final Clarifier For Solids Removal
- Retained Ability to Waste Sludge from Final Clarifier
- Provided Means of Solids Removal From Each Cell
- Solids Can Be Pumped to Headworks for Removal in Screening Process
## North Cell - 50% Flow - 5/21/10 - 9/1/10

<table>
<thead>
<tr>
<th></th>
<th>North Plant Cell 12</th>
<th>Plant Effluent</th>
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</thead>
<tbody>
<tr>
<td><strong>BOD$_5$</strong></td>
<td>5.8</td>
<td>6.5</td>
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<tr>
<td><strong>TSS</strong></td>
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<td><strong>TN</strong></td>
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<td>17.1</td>
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<tr>
<td></td>
<td>North Plant Cell 12</td>
<td>Plant Effluent</td>
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<tr>
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<tr>
<td>TN</td>
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## North and South Cells – Split Flow
### – 1/24/11 – 3/30/11

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<tbody>
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<td><strong>BOD$_5$</strong></td>
<td>35.6</td>
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<td>14.4</td>
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<tr>
<td><strong>TSS</strong></td>
<td>34.8</td>
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<td>3.4</td>
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<tr>
<td><strong>NH$_3$</strong></td>
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<td>2.0</td>
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<tr>
<td><strong>TN</strong></td>
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<td></td>
<td>26.3</td>
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# North and South Cells – Split Flow

- 4/1/11 – 7/23/11

<table>
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<td><strong>BOD$_5$</strong></td>
<td>92.4</td>
<td>83.9</td>
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<tr>
<td><strong>TSS</strong></td>
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<tr>
<td><strong>NH$_3$</strong></td>
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<tr>
<td><strong>TN</strong></td>
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<td>25.0</td>
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## North and South Cells – Split Flow – 8/1/11 – 9/14/11

<table>
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<th>South Plant Cell 12</th>
<th>Plant Effluent</th>
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<tbody>
<tr>
<td>BOD(_5)</td>
<td>14.4</td>
<td>7.7</td>
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<tr>
<td>TN</td>
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<td>23.8</td>
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Start-up Issues

- Gradual Start-up Improved Performance Over Rapid Start-up
- Inert Solids Causing High Effluent TSS from MSABP
- Biosolids Removal Was Required at Low Rate
- Biosolids Hauling Reached Equilibrium in August 2011
Biosolids Minimization Assessment

- Activated Sludge Typical Yield
  - 0.8 lbs VSS/lb \( \text{BOD}_5 \) Removed

- MSABP Yield at NMUC
  - 0.12 lbs VSS/lb \( \text{BOD}_5 \) Removed

- MSABP Net Biosolids Production 15% of Typical Activated Sludge
New Technology - Salsnes Screen

- 31% BOD$_5$ Removal
- 56% TSS Removal
- Similar Performance to Primary Clarifier
- Sensitive to Slug Loads
- Cannot Waste Biosolids to Screen
New Technology - MSABP

- Low Sludge Yield
- Needs Final Clarifier
- TN Removal May Require Internal Recycle
- Fine Tuning On-going
Summary

- Biosolids Minimization Achieved
- New Technologies Expanded Capacity Within Same Footprint
- Process Met Plant Effluent Limits
- Pilot Plant ≠ Full Scale Operation
- Still Fine Tuning Operation
Flow Equalization
Headworks/Salsnes Screens
Headworks/Salsnes Screens
Headworks/Salsnes Screens
Headworks/Salsnes Screens
Dewatered Screen Solids
Screening Blower
Screening Control Panels
Cell 1 - MSABP
Cell 1/2 - MSABP
Solids Removal Piping