Michigan’s Water Quality Event

June 25, 2019

UTILITY OF THE FUTURE
THE CONTINUED JOURNEY AT ST CLOUD, MN

Nathan Cassity
St. Cloud Resource Recovery Facility
The St. Cloud Way

Revitalization of Used Water

Saving Energy, Producing Energy, and Recovering Nutrients

+ Enhancing Cost Effectiveness and Maximizing Return on Previous Infrastructure Investments
St. Cloud Utility of the Future

- Reclaiming and reusing water
- Solar Energy Production
- Extracting nutrients
- Biogas utilization
Recent Projects
Recent Projects

- Biogas Conditioning, Storage, and Utilization (CHP)
- High-Strength Waste (HSW) Receiving and Co-Digestion
- Solar
Biogas Treatment (H2S Removal, Siloxane Removal, and Moisture Removal)
Jenbacher Engine

Biogas to Renewable Electricity
Solar Garden
High-Strength Waste and Re-Purposed Infrastructure
Biogas Storage
Nutrient Recovery and Efficiency (NR2) Project
Overall NR2 Process Flow
NR2 Project areas
Sludge Storage Conversion

Centrate EQ and Lystek Biosolids Storage

- **Centrate EQ**: Red area
- **Lystek Storage**: Green area
- **Lystek Biosolids Storage**: Green area. 198 days of storage at future average flow.
- **Digested Sludge Storage**: Blue area. 39 days of storage at future average flow.
- **Sidestream EQ/Treatment**: Orange area. 21 days of storage at future max month flow.
Biosolids Building Conversion

Lystek and Ostara processes
NR2 Project in the Biosolids Building

- Biosolids Loadout
- Nutrient Harvesting
- Chemical Storage
- Polymer Storage
- Lystek
- Centrifuge
- Boiler
NR2 Project in the Biosolids Building
The Digester Complex

GBT’s

Heat Exchangers and piping changes

Filtrate Pumping

HSW
Focus Areas of Innovative Design & Process Opportunities
Focus: GBT’s, WASSTRIP, and Centrifuge
• Lower than anticipated soluble phosphorus due to alum in primary sludge
  – Primary sludge and WAS are co-thickened and digested
  – Phosphorus is bound with alum
    • Solution: Install WAS phosphorus release process to separate soluble phosphorus prior to thickening
• Repurposed Chlorine Contact tank

• Other Potential Process Opportunities
• Thin WAS (<1% TS)
  – WASSTRIPT requiring 2%
    • Solution: Instead of introducing a new process to thicken – repurpose and utilize one of the existing GBT’s to thicken WAS to 2% and then send to the WASSTRIPT tank
WAS Thickening Pilot Studies
Gravity Thickening Pilot
GBT WAS Thickening Pilot

• Piloted getting 2% WAS off of the GBT
  – Belt Speed (20 to 100%)
  – WAS flow (110 – 180 gpm)
  – Dam position
  – Chicane positions
  – Polymer dose
  – Discussed different weave size of the belt
2% WAS
WAS Filtrate
Large GBT
NR2 original design

Waste Activated Sludge from Secondary Clarifiers

Primary Sludge from Primary Clarifiers

WAS P Release

GBT

DIGESTERS

DEWATERING

To Lystek

EQUALIZATION

HARVESTING

Struvite

To Plant Headworks
NR2 modified design

Waste Activated Sludge from Secondary Clarifiers

Primary Sludge from Primary Clarifiers

WAS P Release  GBT  DIGESTERS  DEWATERING

To Lystek

EQUALIZATION

HARVESTING

Struvite  To Plant Headworks
GBT Operations

Co-thickening

WAS Thickening
• Primary Sludge pumping and FCV operation with cyclic intervals between clarifiers at ~60 gpm
• Constant Thickened WAS flow from tank 910 WASSTRIP at approximately 40 gpm
Co-thickening GBT

• **Key Target:** Maintain level in 910 at 7 feet
  - Operator will set the GBT feed flow to the co-thickener to maintain 7 feet in 910 (WASSTRIP)
  - Operators will basically match flow leaving and going to tank 910 (approximately 40 gpm)
  - Pumps operate to maintain GBT feed flow setpoint
  - Primary sludge flow typically 60 gpm
  - Cake is coming off at 8% to 9% TS

• **Secondary Target:** Filtrate TSS <500 ppm
  - Very important to have clean filtrate going to Ostara process
Co-thickening GBT - Filtrate

Filtrate Valve Vault

Filtrate Pump Station Wetwell

Level Element

High & Low Level Floats

Filtrate from GBT's

Overflow to PE Channel

To Struvite System
WAS and Co-thickening GBT Floc Hopper issues

- Low flows (100 gpm) to the large GBT’s causing solids settling in upfront hopper and flow distribution problems on the gravity deck
  - Solution: Reduce the hopper size
WASSTRIP
**Key Target: Maintain level in 910 at 7 feet**
- Operator will set the GBT feed flow to the co-thickener to maintain 7 feet
- Pumps operate to maintain GBT feed flow setpoint

**Secondary Target: WASSTRIP HRT of 24 hrs at 2% Solids**
- If HRT should be between 20 hours and 50 hours
- Level is continuously monitored and HRT checked periodically
- Mixers continuously run

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**WASSTRIP**

<table>
<thead>
<tr>
<th>WAS P-RELEASE TANK (WPRS)</th>
<th>WASSTRIP</th>
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<tbody>
<tr>
<td>WASSTRIP Tank</td>
<td>Co-Thickener/ 910 Tank</td>
</tr>
<tr>
<td>Level</td>
<td>WPRS, Total Solids</td>
</tr>
<tr>
<td>feet</td>
<td>%</td>
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</tbody>
</table>
• Vortices
Centrifuge
Centrifuge
Centrifuge Dewatering

- Normal digested biosolids flow to centrifuge - 75 gpm
- Unique operation – 15% TS and operating from Tuesday through Friday
- Important to have clean centrate
Centrifuge Dewatering
Centrifuge Dewatering
Centrifuge Operation

Examples of throughput changes:
- 75 gallons per minute at 3.5% solids = 1314 lb/hr
- 75 gallons per minute at 4.0% solids = 1501 lb/hr
Centrifuge Operation
The Way
Nutrient Recovery Process

Co-Thickening

Digestion and Energy Utilization

Dewatering

WAS

Primary Sludge

Filtrate

Centrate
NR2 Nutrient Recovery

- **Struvite Recovery**
  - Protect anaerobic digestion system
    - Maintenance benefit
  - Remove P from biosolids
    - Enhance land application logistics
    - Reduce costs
  - Enhance dewatering performance
    - Reduce costs
  - Recovery P for reuse
    - Revenue
Class A Biosolids Process

WAS-Thickening

WAS

<1%

Primary Sludge

2%

Co-Thickening

Thickened Sludge

9% TS

Digestion and Energy Utilization

Digested Sludge

4% TS

Dewatering

Dewatered Biosolids

15% TS

Biosolids

12% TS

Lystek
Biosolids Product Enhancement: Lystek
- **Class A**
  - Enhance land application logistics
- **12% Flowable/Pumpable Liquid**
  - Decrease liquid storage needs (increase storage capacity)
  - Decrease hauling time and costs
Continued Collaboration
Some of the Next Steps

- Convert Storage Digester to 3\textsuperscript{rd} Primary Digester
- Install a second 633 kW CHP unit
  - Gas treatment (H2S, Siloxane, and conditioning skid sized for 1MW)
The Team
Thank You

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