

October 13, 2016

# **An Efficient Aeration Strategy Sits on a Three-Legged Stool**

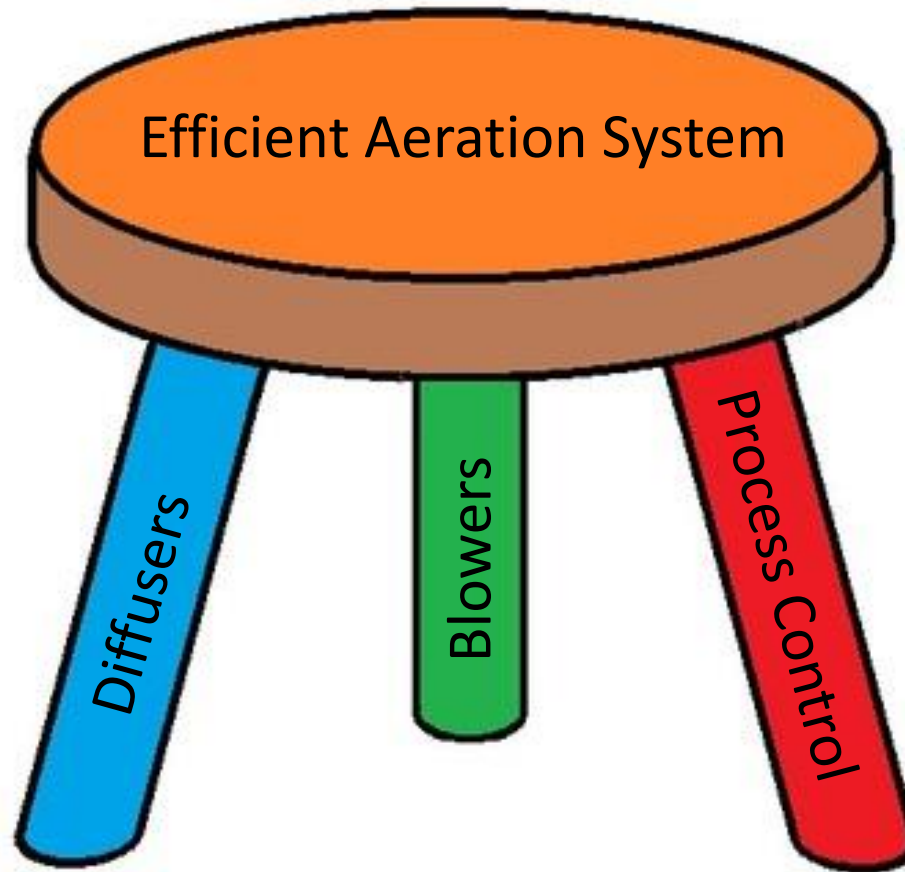
## **A Case Study of Brookfield, WI**

by Wendy Raisbeck

# Outline

- Aeration Efficiency Study
- Existing Conditions and Project Goals
- Aeration System Efficiency Evaluations
  - Diffuser Performance and Technology
  - In-Basin Aeration Piping
  - Post-Aeration Air Requirements
  - Airflow Requirements
  - Blower Performance and Technology
- Post-Construction Operation Data

# Aeration Efficiency Stool

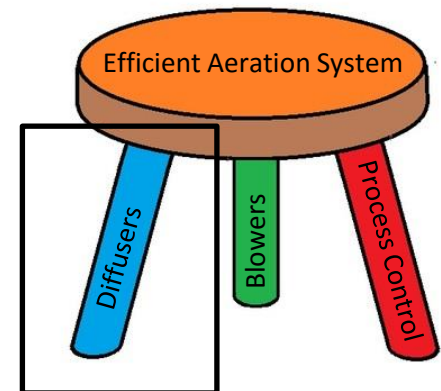


# Existing Conditions

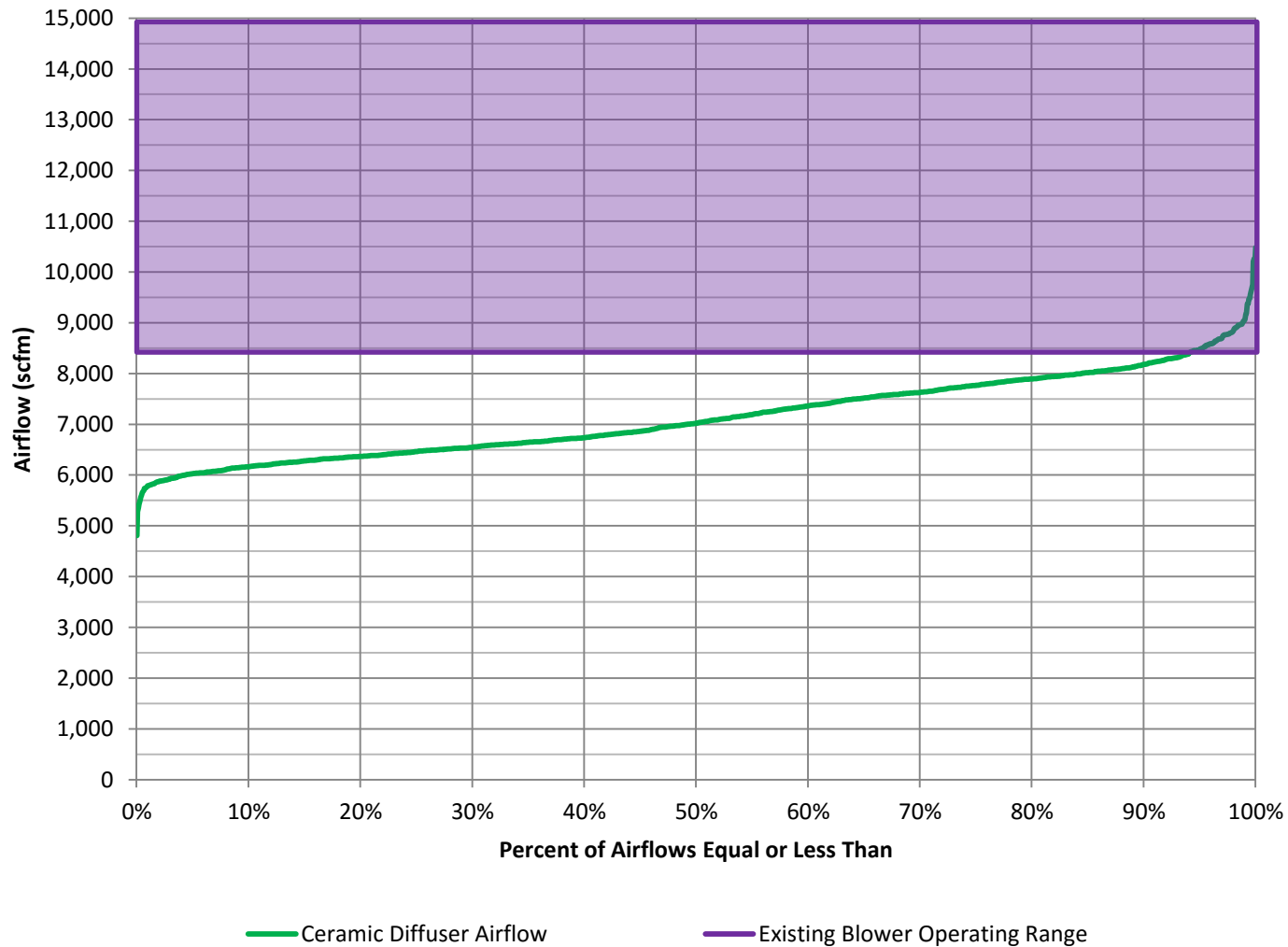
- Original Construction in 1974
- Major Upgrades in 1985 and 2000
  - 12.5 mgd average flow
  - 31.2 mgd peak flow full treatment
  - 50.1 mgd peak flow wet weather (blended)
- Liquid Train
  - Screening, Grit Removal, Primary Clarification, BNR Activated Sludge, Sand Filtration, Disinfection

# Existing Conditions – Aeration System

- Four Activated Sludge Basins
  - Fouled Ceramic Diffusers (2000)
  - Large Aeration Piping (1985)
  - Dormant Basins
- Activated Sludge Effluent Channels
- Post-Aeration
  - DO Measurement
- Primary Effluent Splitter Box
- Four Blowers (1985)
  - Centrifugal, 600 HP



# Existing Aeration System Performance



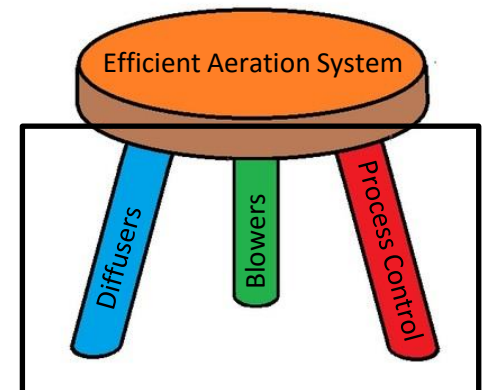
# Project Goals

- Identify and Evaluate Solutions for Excess Energy Usage within Aeration System
- Implement Recommendations

**INCREASED ENERGY EFFICIENCY**

# Aeration System Efficiency Evaluations

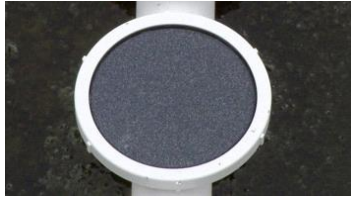



- Diffuser Performance and Technology
- Post-Aeration Air Requirements
- Air Control Piping and DO Control
- Blower Performance and Technology



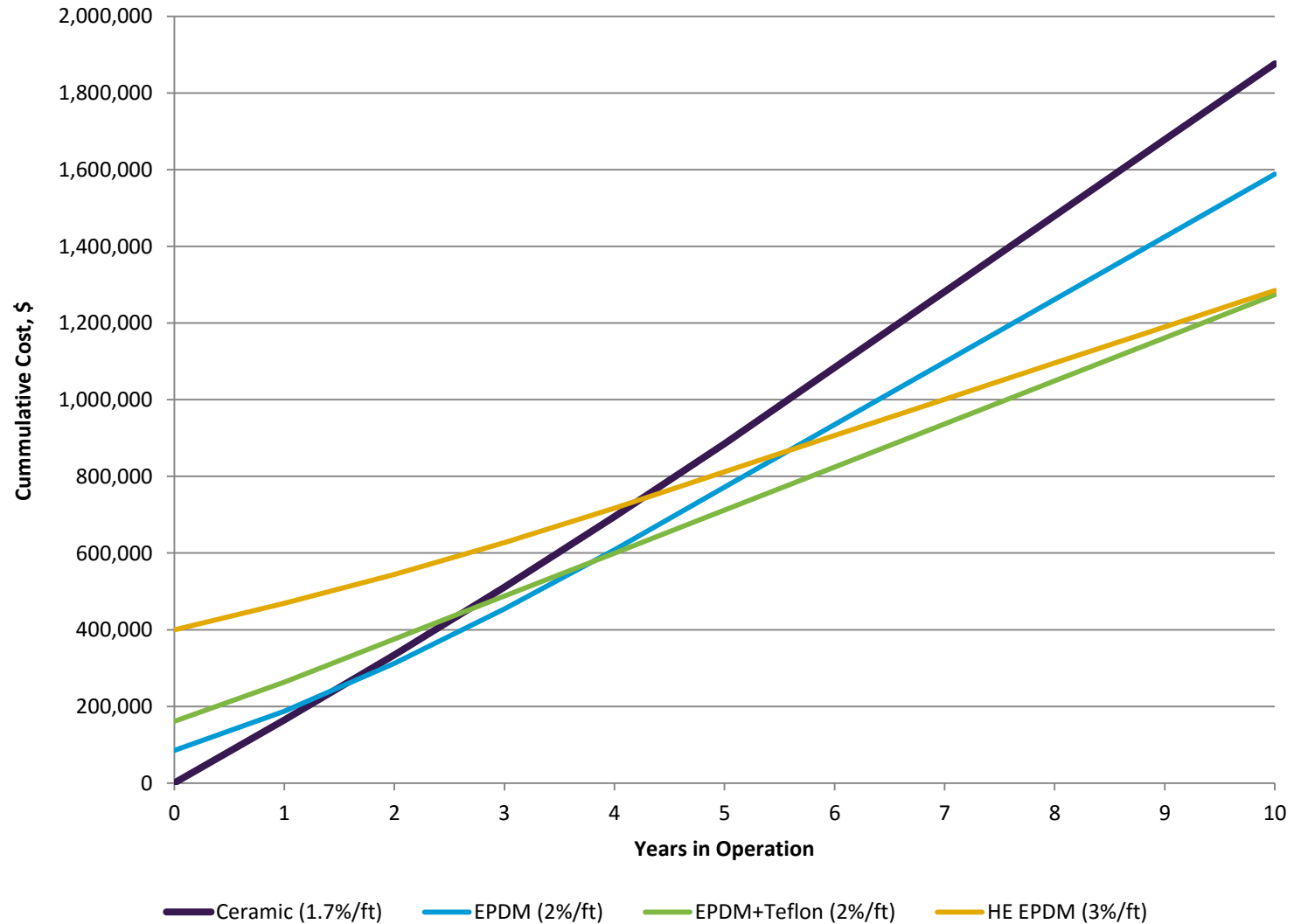
# Aeration System Efficiency Evaluations

- **Diffuser Performance and Technology**
- Post-Aeration Air Requirements
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# Diffuser Performance and Technology

Diffuser Type		Advantages	Disadvantages
Ceramic Discs		<ul style="list-style-type: none"> <li>• High new efficiency (1.2-2.2% per ft)</li> <li>• 20 year life</li> <li>• 9" disc: Industry standard</li> <li>• Many manufacturers</li> <li>• Resistant to corrosive compounds</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of efficiency over time</li> <li>• Requires constant airflow to diffuser</li> <li>• Prone to plugging</li> </ul>
EPDM Discs		<ul style="list-style-type: none"> <li>• High efficiency (1.2-2.2% per ft)</li> <li>• 7-12 year life</li> <li>• 9" disc: Industry standard</li> <li>• Many manufacturers</li> <li>• Can use in-basin piping</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of efficiency over time</li> <li>• ~1% per year over time</li> </ul>
EPDM Discs + Teflon Coating		<ul style="list-style-type: none"> <li>• High efficiency (1.2-2.2% per ft)</li> <li>• 7-12 year life</li> <li>• 9" disc: Industry standard</li> <li>• No efficiency loss over time</li> <li>• Resistant to corrosive compounds</li> <li>• Can use in-basin piping</li> </ul>	<ul style="list-style-type: none"> <li>• Increased cost over EPDM</li> <li>• Limited manufacturers</li> </ul>
High Efficiency		<ul style="list-style-type: none"> <li>• Highest efficiency (2.2-3.8% per ft)</li> <li>• 7-12 year life</li> <li>• Single diffuser vs. multiple discs</li> </ul>	<ul style="list-style-type: none"> <li>• High capital</li> <li>• Limited manufacturers</li> <li>• Cannot use in-basin piping</li> </ul>

# Diffuser Performance and Technology



# Diffuser Performance and Technology

## ➤ Recommendation

- Reuse In-Basin Piping
- Bid EPDM Discs and EPDM Discs with Teflon Coating

## ➤ Implementation

- EPDM Discs with Teflon Coating

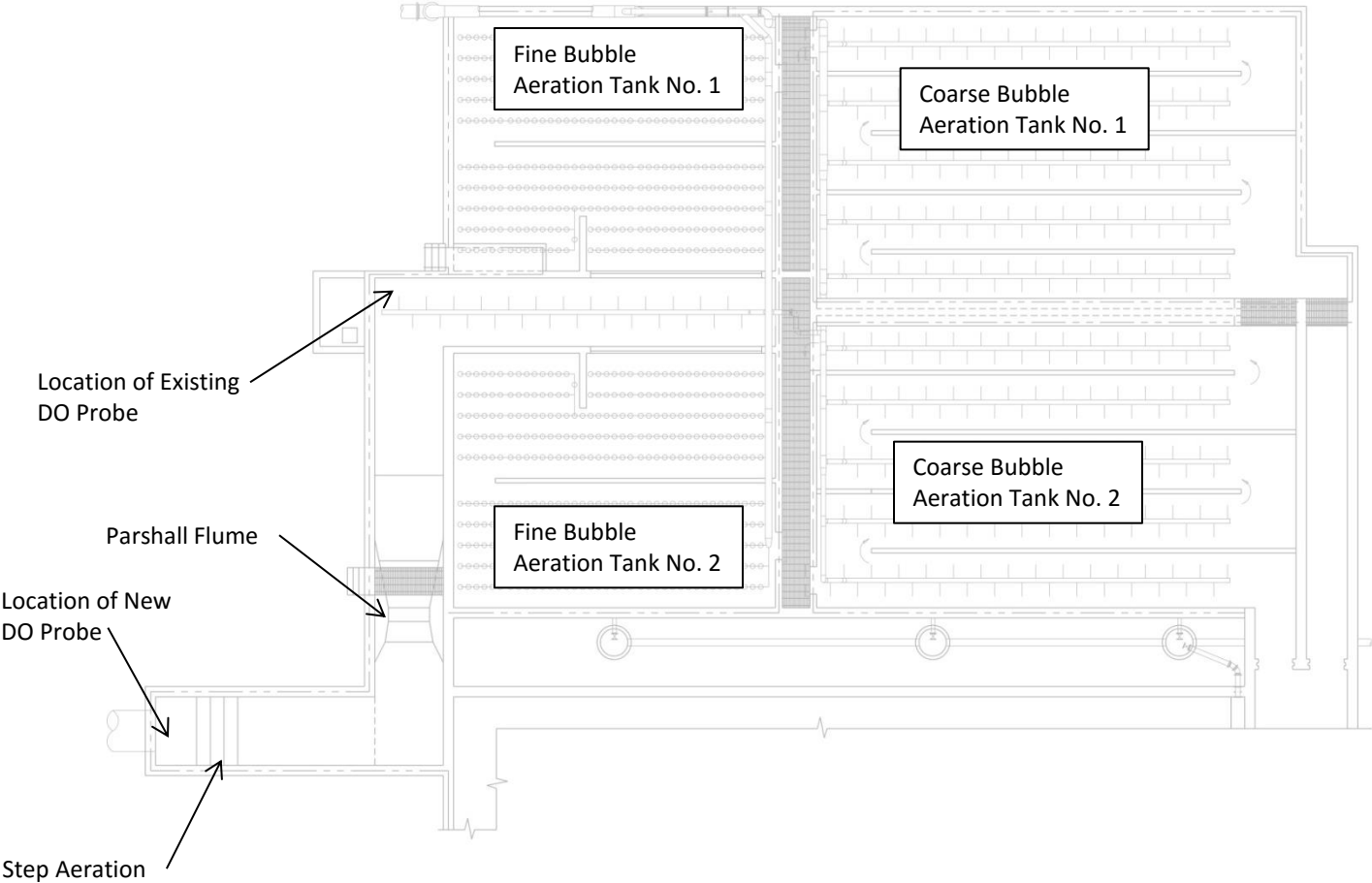
# Aeration System Efficiency Evaluations

- Diffuser Performance and Technology
- **Post-Aeration Air Requirements**
- Air Control Piping and DO Control
- Blower Performance and Technology

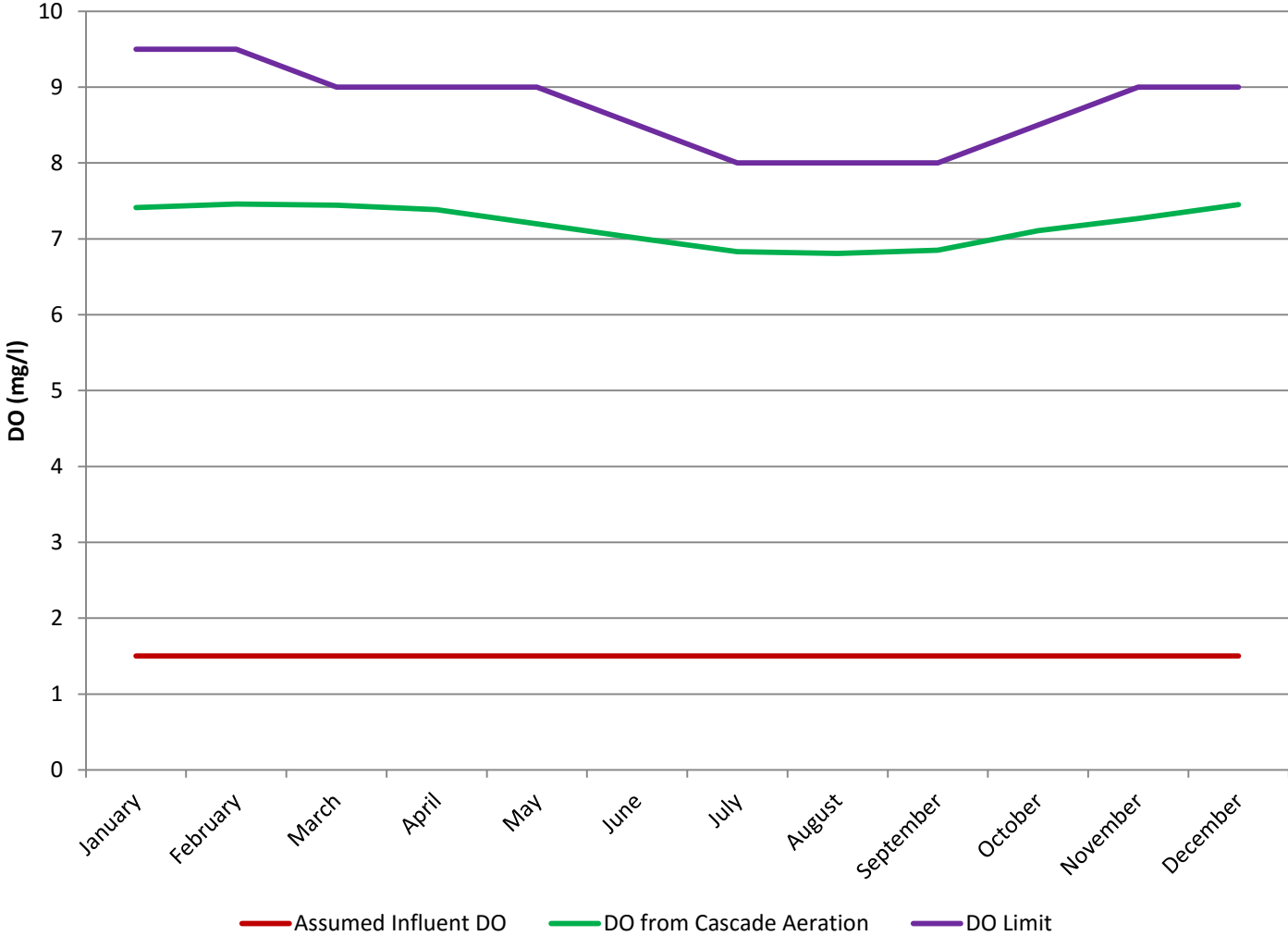
# Post-Aeration Air Requirements

- Blowers
  - Aeration Blowers
  - Dedicated Post-Aeration Blower
- Effluent DO Measurement Location

# Post-Aeration Air Requirements



# Post-Aeration Air Requirements



# Post-Aeration Air Requirements

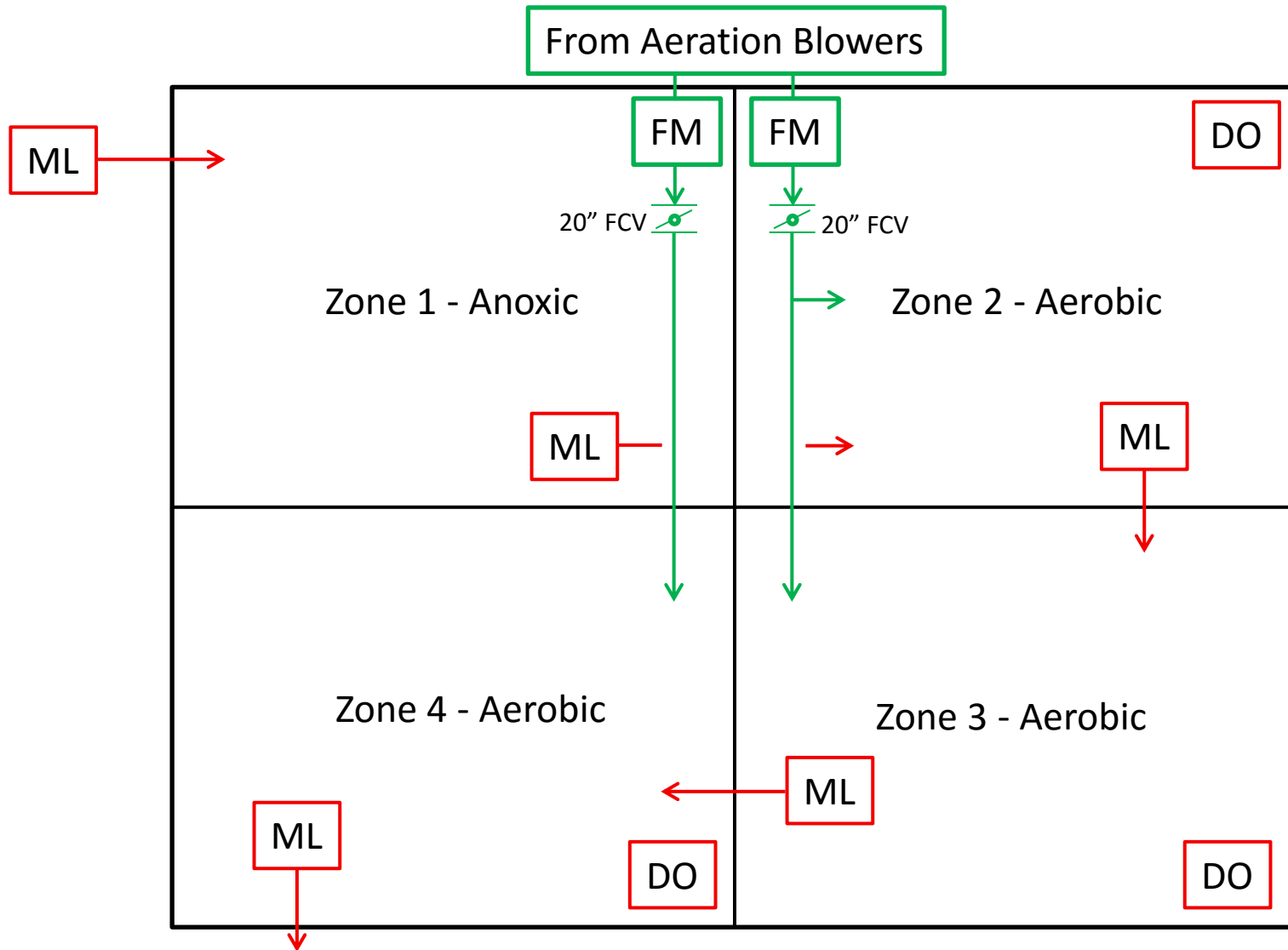
- Recommendation
  - Aeration Blowers to Provide Air
  - Relocate DO Probe



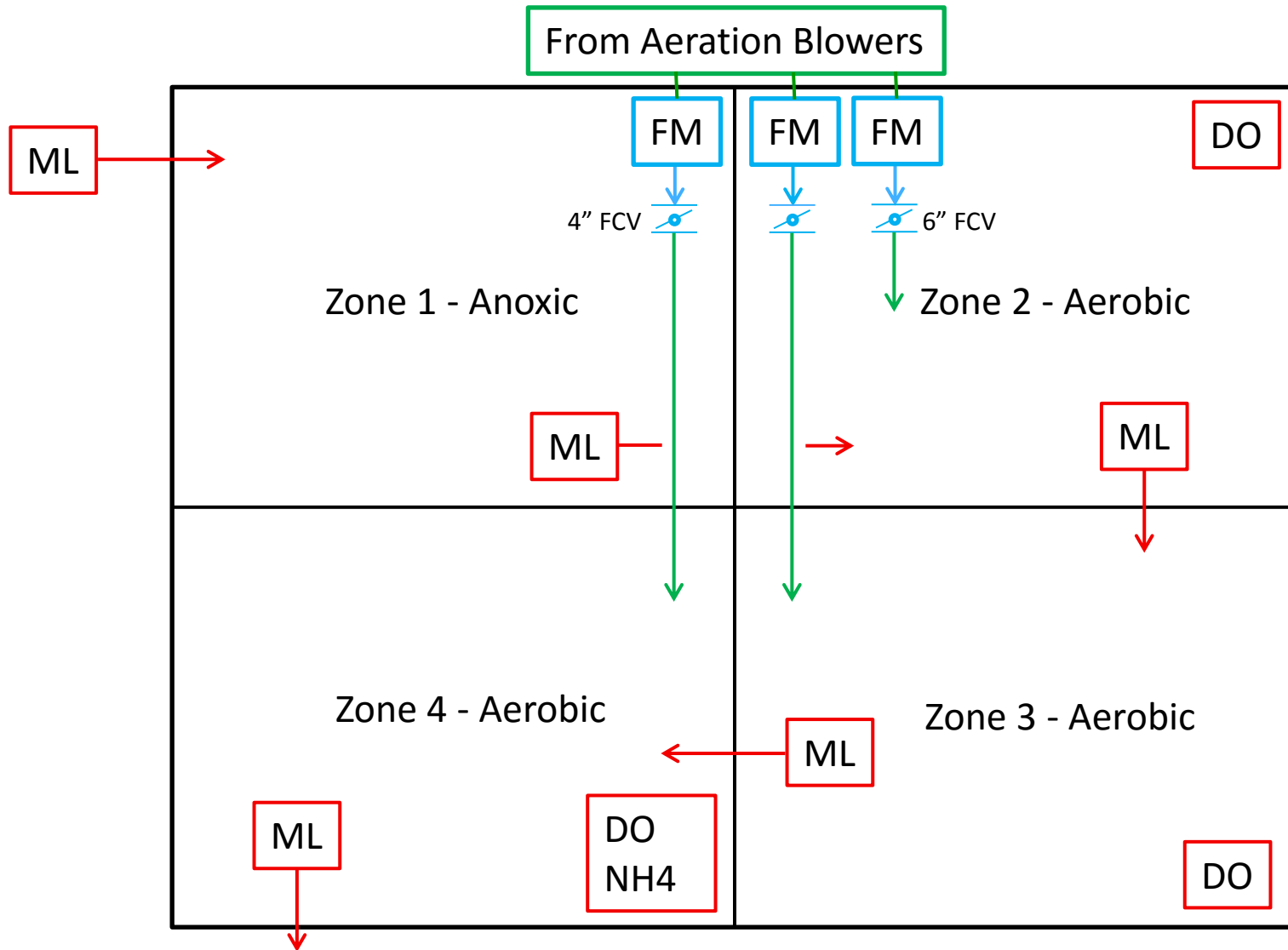
# Aeration System Efficiency Evaluations

- Diffuser Performance and Technology
- Post-Aeration Air Requirements
- **Air Control Piping and DO Control**
- Blower Performance and Technology

# Air Control Piping and DO Control Existing Layout



# Air Control Piping and DO Control New Layout



# Air Control Piping and DO Control New Layout

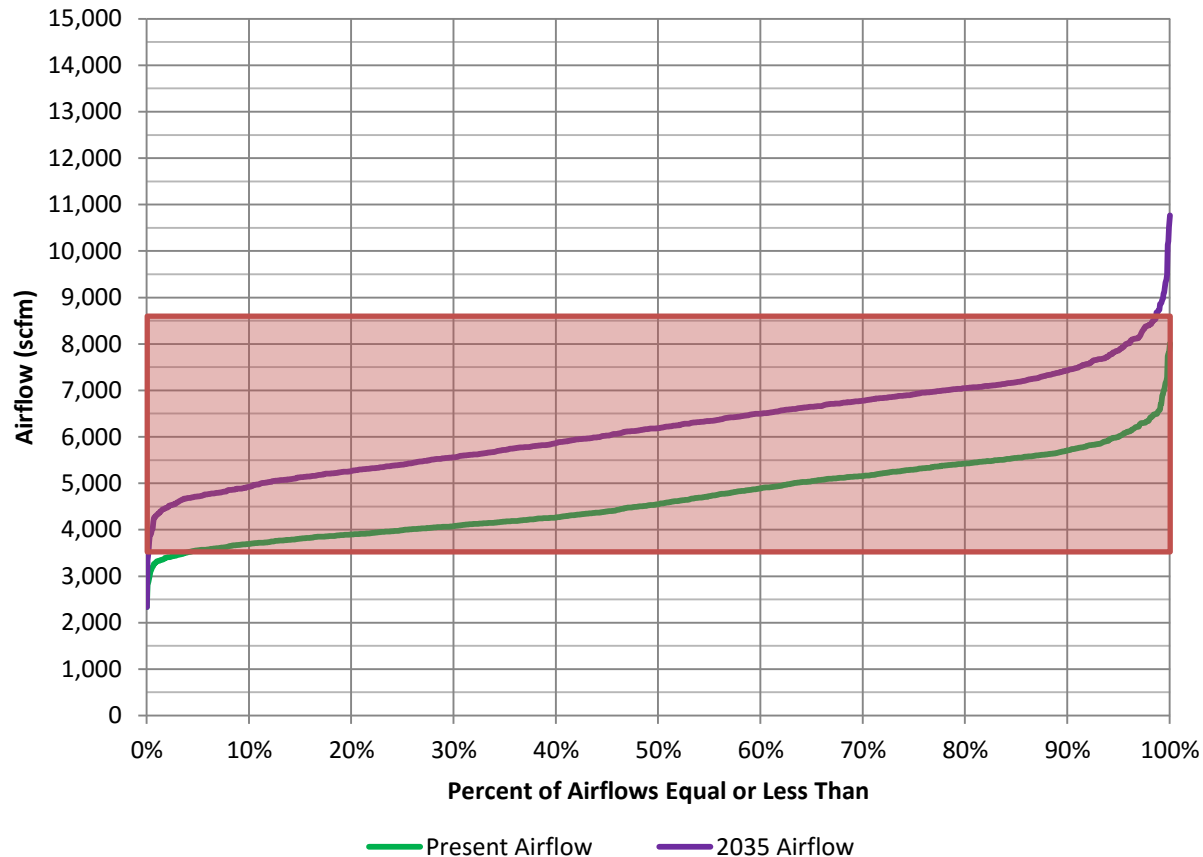


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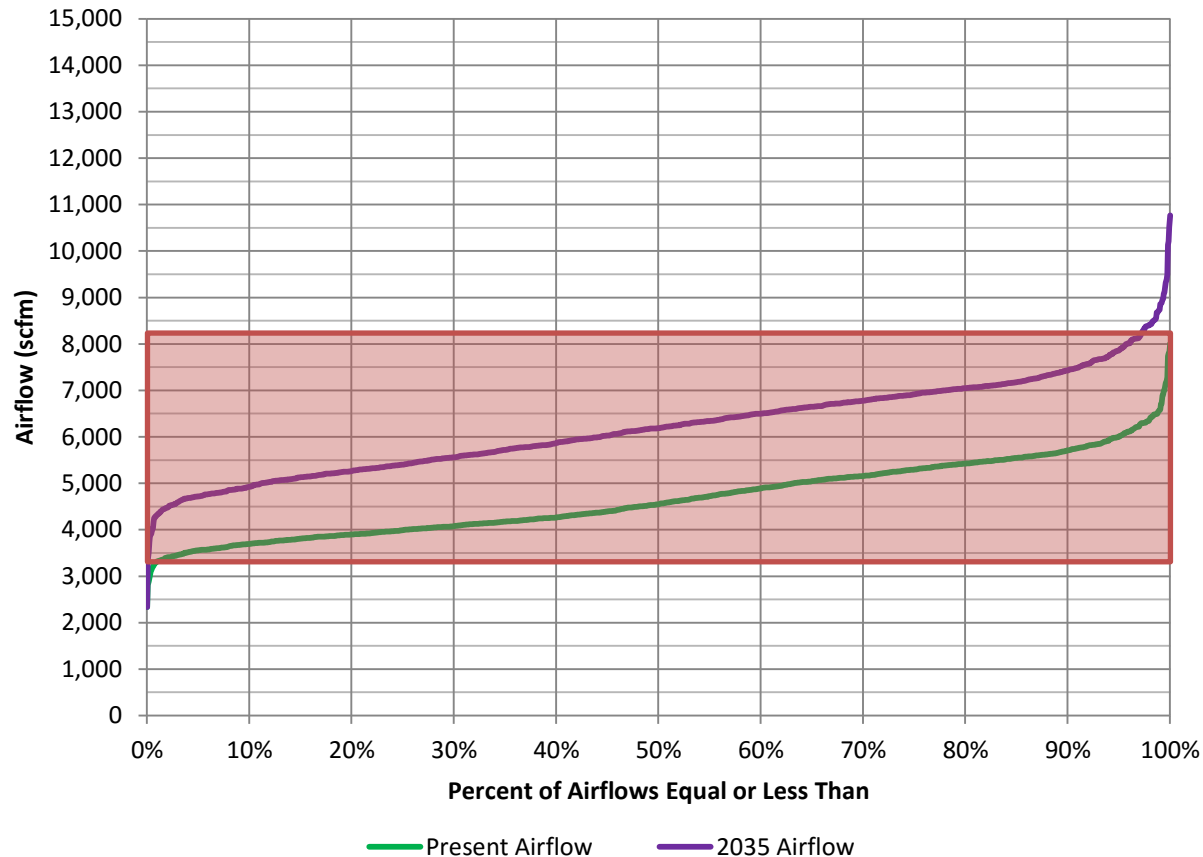
# Blower Performance and Technology

## ➤ Sulzer-ABS 400-hp Blower Selection



# Blower Performance and Technology

## ➤ Aerzen 400-hp Blower Selection

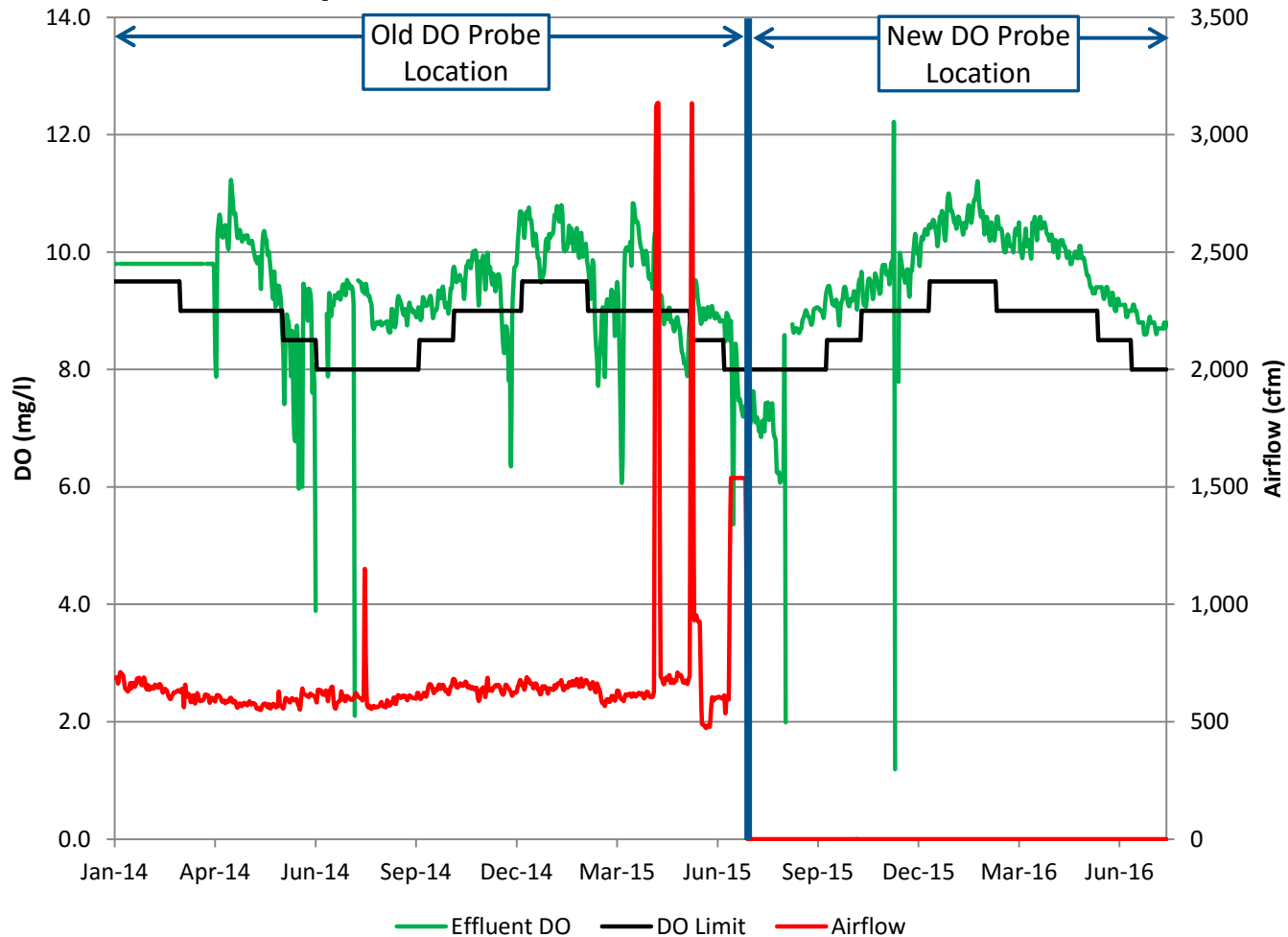


# Blower Performance and Technology



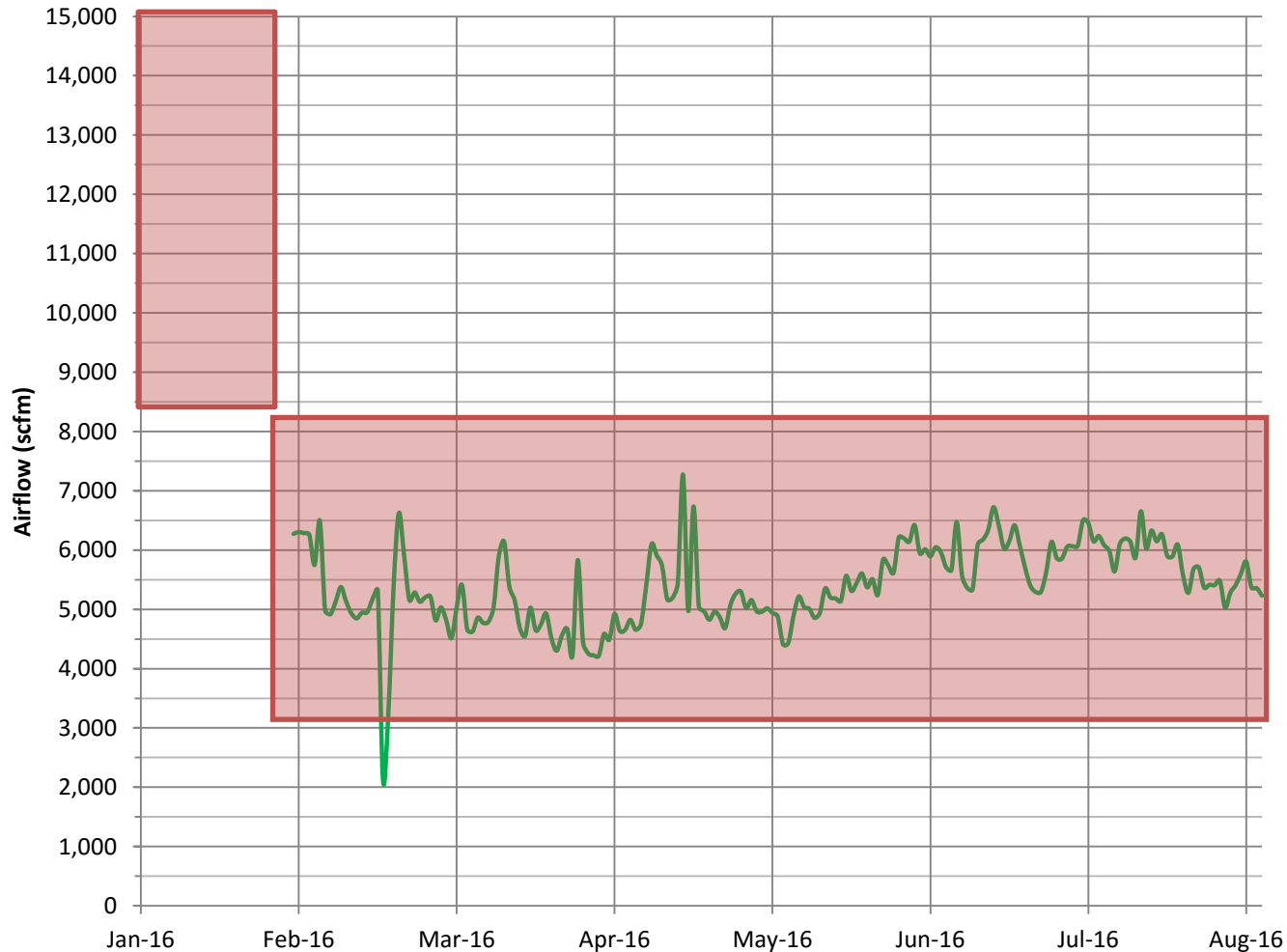
# Post-Construction Operation Data

## ➤ Post-Aeration Operational Data



# Post-Construction Operation Data

## ➤ Blower Operational Data

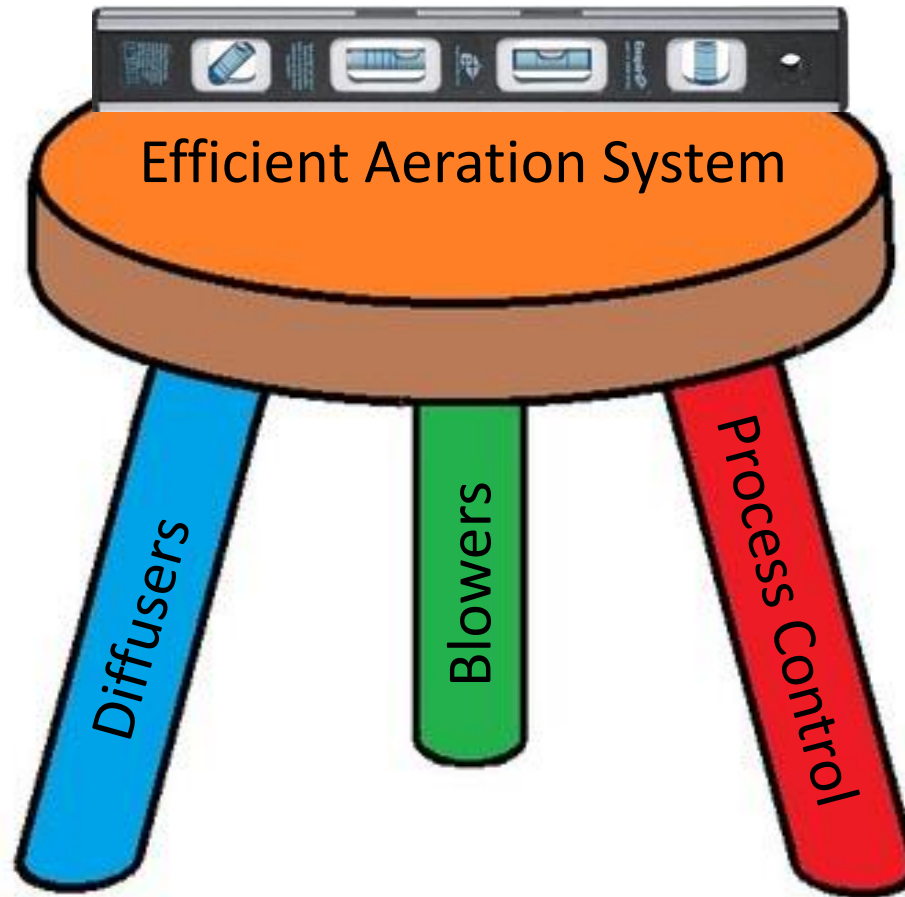


# Post-Construction Operation Data

- Blower Operational Data (2/26/16-8/28/16)
  - Decreased Power Usage
    - 411,600 kwh (2,225 kwh/day)
  - Energy Savings to Date\*
    - \$33,750 (\$182/day)
  - Estimated Annual Energy Savings\*
    - \$75,000

\* Does not include demand charges

# Post-Construction, A Level Stool





Questions