Application of Process Simulators and CFD to Optimize Process Capacity of WRRFs

November 13, 2017
DRAFT:
Icon is Optional

Date or speaker or subtitle
## BC SmartArt Color Sequence

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</table>
Name of Presentation or Other Text

Subsection Title or Presenters Name
Modeling Platforms

- inCTRL SIMBA#
- EnviroSim BioWin
- 2Dc and 2Dr
- ANSYS Fluent
- Dynamita SUMO
- Hydromantis GPS-X
- MIKE WEST
- FLOW Science FLOW-3D
- Hydraulic Modeling ???
Case Study #1: Lynchburg, VA

Date or speaker or subtitle
To change the slide layout (grid) or to change the color of the top bar:

- Select the slide thumbnail along the left side.
- Right Click and go to “Layout”
- Choose the corresponding color and/or layout to apply to the slide.
- Avoid using the Design tab to change layouts or color themes, there is an application bug that causes PowerPoint to crash.
Case Study #2:
HRSD, Williamsburg, VA

Date or speaker or subtitle
Effluent Suspended Solids (mg/L)

- 3.5 g/L - 77 SVI
- 4.0 g/L - 77 SVI
- 4.5 g/L - 77 SVI
- 3.5 g/L - 105 SVI
- 4.0 g/L - 105 SVI
- 4.5 g/L - 105 SVI

Time (min)
• Can pass 55 MGD peak hour flow
• Do not need to consider plant expansion as part of Regional Wet-weather Management Plan
Case Study #3: Pueblo, CO

SIMBA#
Process Flow Diagram

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
WATER QUALITY CONTROL COMMISSION
REGULATION #85
NUTRIENTS MANAGEMENT CONTROL REGULATION
5 CCR 1002-85

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Annual Median</th>
<th>95th Percentile</th>
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<tbody>
<tr>
<td>TP</td>
<td>1.0 mg/L</td>
<td>2.5 mg/L</td>
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<tr>
<td>TIN</td>
<td>15 mg/L</td>
<td>20 mg/L</td>
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</table>
Existing Biological Reactor Configuration

- Primary Effluent
- Pre-Anoxic A
- Anaerobic A
- Anaerobic B

- Oxic 1
- Oxic 2
- Oxic 3
- Oxic 4
- Oxic 5
- Oxic 6
- Oxic 7
- Oxic 8

- RAS
- To Secondary Clarifiers

- DO Probes
- NH4 and NOx Probes
**Existing DO Control Loops**

- **Air Distribution Control (8X)**
  - DO Set-point
  - DO Reactor
  - DO Controller – Graded Deadband
  - Flow Control Valve Position f(DO)
  - %FCV Setpoint
  - FCV Controller Maintains the %FCV Setpoint
  - Current %FCV

- **Air Supply Control (1X)**
  - Most Open Valve – Linear
  - CMP Set-point (%FCV of MOV)
  - Current %FCV
  - CMP Setpoint
  - Blower Speed Controller – PID
  - Blower Speed f(CMP)
  - Min/Max Threshold
  - Blower Switching Duty-Assist Combination f(Blower Speed)

**Proposed AvN Control Loop**

- **Air Distribution Control**
  - NH4 /NOx Set-point
  - NH4 /NOx Reactor
  - NH4 Controller – PID
  - DO f(NH4/NOx)
  - NH4 /NOx Set-point
  - DO Reactor
  - DO Set-point
  - SCFM Setpoint
  - %FCV Setpoint
  - %FCV Setpoint
  - FCV Controller Maintains the %FCV Setpoint
  - Current %FCV

- **Air Supply Control (1X)**
  - Most Open Valve – Linear
  - CMP Set-point (%FCV of MOV)
  - Current %FCV
  - CMP Setpoint
  - Blower Speed Controller – PID
  - Blower Speed f(CMP)
  - Min/Max Threshold
  - Blower Switching Duty-Assist Combination f(Blower Speed)
AvN and DO Control Loops
Modeling Aeration Control

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<th>Eff. TAN</th>
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</thead>
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<td>Min Day</td>
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<td>0.92</td>
<td>0.22</td>
<td>0.25</td>
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Case Study #4:
MWS, Nashville, TN

Date or speaker or subtitle
Table Sample
Secondary Clarifier Testing

MODEL INPUTS
- Sludge Settling Characteristics
- Discrete Settling Fractions
Comparison of Baffling Alternatives

No baffle

WWF

Higher surface vel and roll

RAS

5x10 chimney

5x5 conduit with 10° openings

RAS

vane

baffle

5x10 chimney

RAS
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Fun new elements to incorporate in your slides
Callout for emphasis