Project ‘Driver’
Jackson Pike Wastewater Treatment Plant

- Two (2) Consent Orders (2002 & 2004)
- Signed with Ohio EPA to eliminate SSOs and reduce CSOs
- Development of Wet Weather Management Plan as a response
Project Background

Jackson Pike Wastewater Treatment Plant

Contract J210 included:

- **Rehabilitation of Secondary Clarifiers**
  - Replacement of Sludge Collection Mechanisms
  - Replacement of Inlet Structures
  - Addition of Scum Collection Systems
  - Upgrade of all clarifiers electrical and controls
Project Background
Jackson Pike Wastewater Treatment Plant

Contract J210 included:

- Modifications to Pumping Systems
  - Upgrade of Influent Pumps’ electrical/controls
  - Increase capacity of flushing water system
Project Background
Jackson Pike Wastewater Treatment Plant

Contract J210 included:

- Wet Weather Management Improvements
  - Increase RAS pumping capacity
  - Addition of step feed aeration capabilities
  - Replacement of aeration diffuser systems
  - Elimination of various plant hydraulic restrictions
  - Addition of flocculation baffles in secondary clarifiers
Facility Background
Jackson Pike Wastewater Treatment Plant

- Peak Hourly Design Flow: 165 MGD
- Total Average Daily Design Flow: 68.0 MGD
- A-Plant ADDF: 45.3 MGD
- B-Plant ADDF: 22.7 MGD
- Design RAS Rates: 30% Min. & 75% Max.
- A-Plant RAS Range: 14-34 MGD
- B-Plant RAS Range: 7-17 MGD
Design Objectives
Jackson Pike Wastewater Treatment Plant

- Increase RAS pumping capacity/capability to 75% of ADDF
- Provide a minimum RAS rate of 30% ADDF
- Maintain an equal RAS flow distribution
- ‘Draw-off’ equal volumes from each secondary clarifier
- Provide all components for a complete automated RAS system
Design Challenges
Jackson Pike Wastewater Treatment Plant

“Skewed Geometry”
- Four (4) Aeration Tanks (A-09 to A-12)
- Two (2) RAS Pumping Wells (B-Plant East & West)
- Five (5) Secondary Clarifiers (S-10 to S14)
West RAS Well
3 Clarifiers
10.2 MGD Firm

East RAS Well
2 Clarifiers
6.8 MGD Firm
The Design Process
Jackson Pike Wastewater Treatment Plant

- Evaluate clarifier ‘underflow’ to RAS Wells
- Consider Valve Modulation vs. Most-Open-Valve concepts for ‘underflow’
- Evaluate flow metering options
  - RAS Pumps’ Discharge to Aeration Tanks
  - Clarifier Underflow Piping to RAS Wells
- Consider AFDs for each pumping unit
- Develop an effective control strategy
The Design Process
Jackson Pike Wastewater Treatment Plant

- Select appropriate pumps that can meet RAS return rates (30 to 75% of ADDF)
- Determine range of flows for the various pump operating combinations by varying speeds
- Evaluate RAS underflow hydraulics to ensure equal ‘draw-off’ can be achieved
- Evaluate all existing piping and valves suitable for increased flow rates – upsize as necessary
The Design Process

Jackson Pike Wastewater Treatment Plant

Pump Design

- Size pump for max condition: two pumps operating at full speed, i.e. 10.2 MGD/2 = 5.1 MGD = 3,550 gpm (60 Hz)
- Determine system pumping head (TDH) at this condition
- Select pump/impeller based on this design point
- Determine minimum speed turndown for pumps
- Check one pump operation for NPSH and reduced speeds
- Evaluate the effect of a clarifier out of service
The Design Process
Jackson Pike Wastewater Treatment Plant
Utilized a Pump Hydraulics Program with AFD analysis (Fathom by Applied Flow Technologies)
The Design Process

Jackson Pike Wastewater Treatment Plant
The Design Solution
Jackson Pike Wastewater Treatment Plant

Pump Selection

- Three (3) horizontal centrifugal, solids handling pumps for each RAS Well - identical in size
- Two (2) pumps operating at full speed achieve maximum RAS return rate; one standby
- Capability to run all three (3) pumps if desired
- Turndown limit established for the pumps = 37 Hz (62%)
The Design Solution
Jackson Pike Wastewater Treatment Plant

Design Features For Automated RAS Control

- Modulating valves and flow meters on each underflow pipe from the secondary clarifiers
- AFD for each RAS pump to vary speed and expand range of RAS return rate
- Flow meters on pump discharge from each RAS Well
- Level instrumentation provided for each RAS Well
- All required electrical panels and inputs/outputs for complete automated control of clarifier draw-off and return pumping
The Design Solution
Jackson Pike Wastewater Treatment Plant

- Manual and Automatic Control Modes
- Design provided components for complete automated control and flexibility
- Control narratives, algorithms, programming, and screen shots developed with DOSD input
- “Automatic” = Prompt User to manually change settings (start/stop RAS pumps)
- Programming could be modified in future to revise operating strategies
The Design Solution
Jackson Pike Wastewater Treatment Plant

Manual Control

- Human Machine Interface
- Area Operator Interface Terminal
- AFD Panel
- Pumps’ Local Control Station
The Design Solution
Jackson Pike Wastewater Treatment Plant

Automatic Control Modes

RAS Flow Setpoint Control
- Human Machine Interface
- Area Operator Interface Terminal

Plant Flow-Pace Control
- Human Machine Interface
- Area Interface Terminal
# The Design Solution

**Jackson Pike Wastewater Treatment Plant**

## RAS Control – “Cheat Sheet”

<table>
<thead>
<tr>
<th>B-Plant West RAS Well Flow</th>
<th>Setpoints</th>
<th># of Pumps Needed</th>
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<tbody>
<tr>
<td>&gt;12.8 MGD</td>
<td></td>
<td>Not Recommended</td>
</tr>
<tr>
<td>10.3 to 12.8 MGD</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>6.2 to 10.2 MGD</td>
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<td>2</td>
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<tr>
<td>3.5 to 6.1 MGD</td>
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<td>1</td>
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<tr>
<td>0.1 to 3.4 MGD</td>
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<td>Not Recommended</td>
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<tr>
<td>0 MGD</td>
<td></td>
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</tr>
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</table>
RAS Control Operation
Jackson Pike Wastewater Treatment Plant
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RAS Control Operation
Jackson Pike Wastewater Treatment Plant

Calculator is **ONLY** a tool to establish RAS flow setpoints for the operator.
When the pumps are running, but NOT achieving the flow setpoint this box will either indicate:
“Flow < Setpoint - Add a Pump” OR “Flow > Setpoint - Stop a Pump”
Operator must ‘manually’ start or stop a pump. Then, speeds will be adjusted automatically once the appropriate number of pumps are in operation.
Why utilize such a ‘manual’ operating approach?

- Abrupt inflow variations experiences at plant
- Potential to divert flow to Southerly WWTP
- Informed staff influences positive reactions to plant variations
- Operator flexibility
Project Completion
Jackson Pike Wastewater Treatment Plant

Before

After
Project Completion
Jackson Pike Wastewater Treatment Plant

Before

After
Project Completion
Jackson Pike Wastewater Treatment Plant

Before

After
Questions?

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