

# FULL SCALE PILOT TARGETING LOW PHOSPHORUS AT JANESVILLE WPCF

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# Presentation Outline

- Project background
- Pilot overview
- Results
- Conclusions



# Project Background

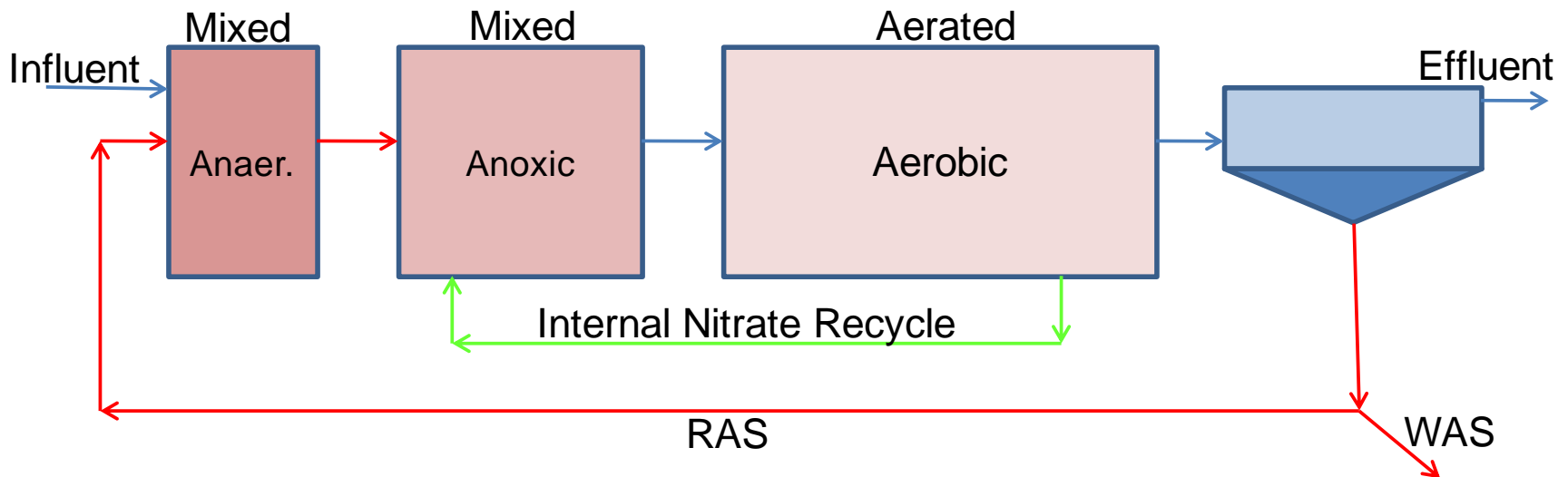
# Project Background

- Current flow of 14 mgd
- Serves population of 60,000
- 2010 – 2011 upgrade project
  - \$32 million upgrade
  - Capacity increase to 19 mgd
  - Incorporated biological nutrient removal (BNR)
  - Renovation of several 30+ year-old facilities



# Project Background

- BNR process configuration
  - Anaerobic / Anoxic / Oxidic (A<sup>2</sup>O)
- Effluent phosphorus goal between 0.3 mg/L and 0.5 mg/L



# Project Background

- TMDL Implementation for Rock River
  - Janesville is expecting permit renewal late this year
  - Monthly mass allocations will necessitate effluent P concentrations at or below 0.1 mg/L
  - Compliance schedule of 7 – 9 years

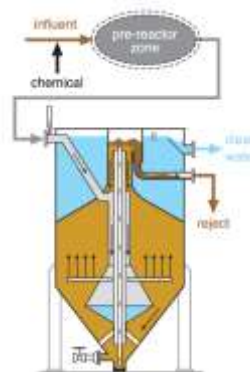
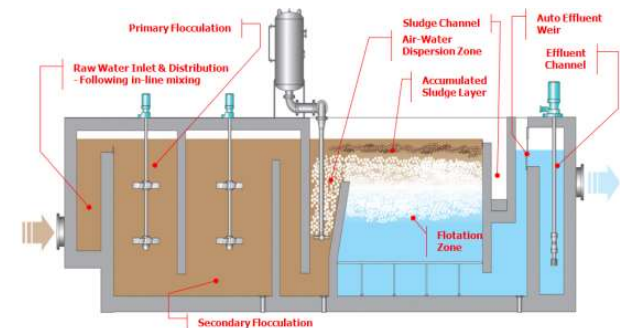
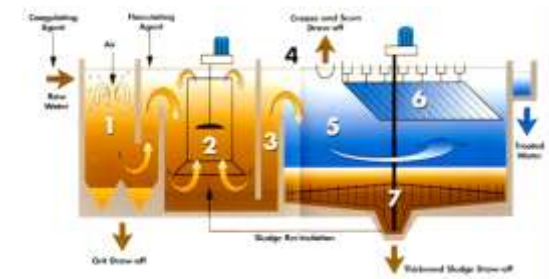
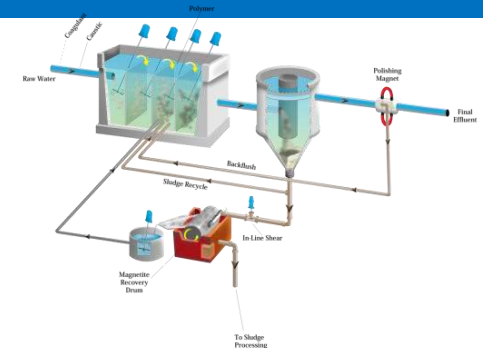


# Pilot Overview

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## ➤ Lower than 0.1 mg/L technologies

- ACTIFLO® - Kruger, Inc.
- Densadeg® - Infilco Degremont, Inc.
- AquaDAF® - Infilco Degremont, Inc.
- Blue PRO™ - Blue Water Technologies, Inc.
- CoMag™ - Cambridge Water Technology
- DynaSand D2 Dual Filtration System - Parkson
- Ultra Filtration Membranes

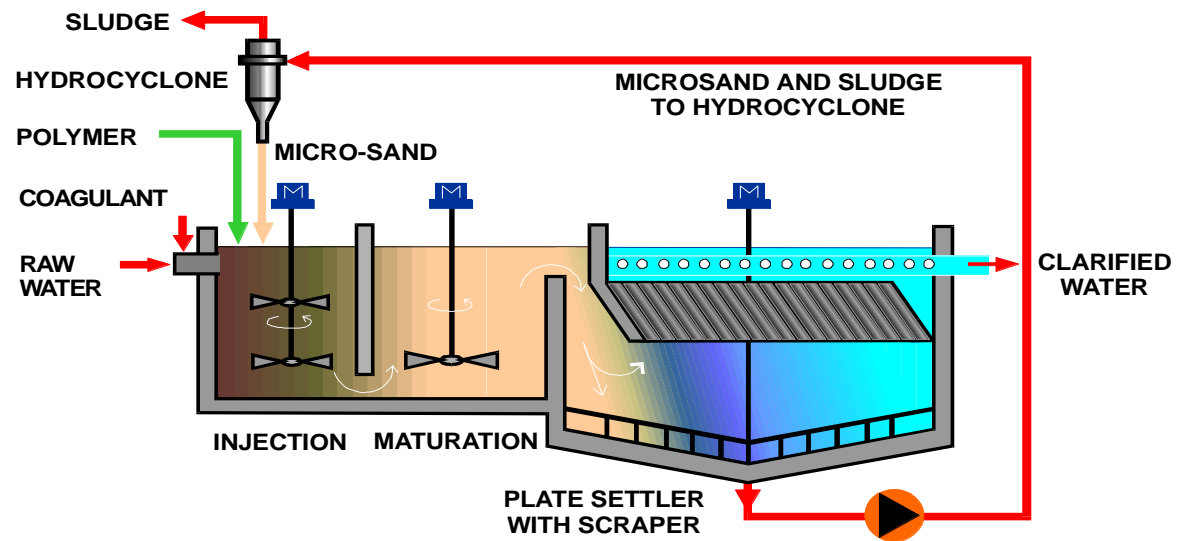




# Pilot Overview

## ➤ ACTIFLO<sup>®</sup> - Kruger, Inc.

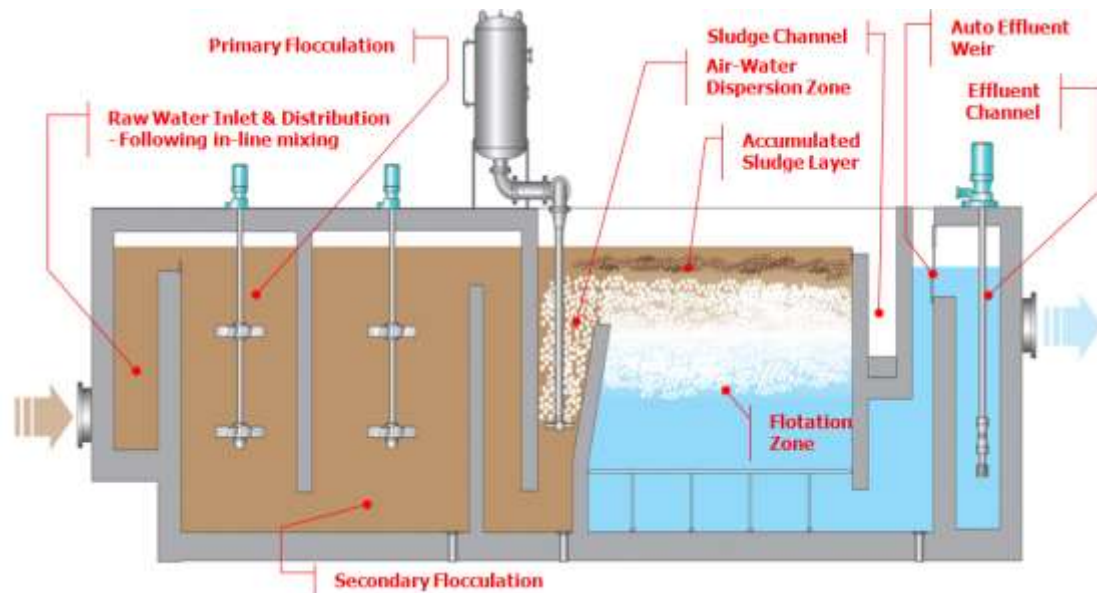
- Chemical demand – coagulant + 0.3 mg/l polymer
  - 30 mg/l  $\text{FeCl}_3$
  - 75 mg /l  $\text{Al}_2 (\text{SO}_4)_3$
  - 85 mg/l PAC



# Pilot Overview

## ➤ AquaDAF<sup>®</sup> - Infilco Degremont, Inc.

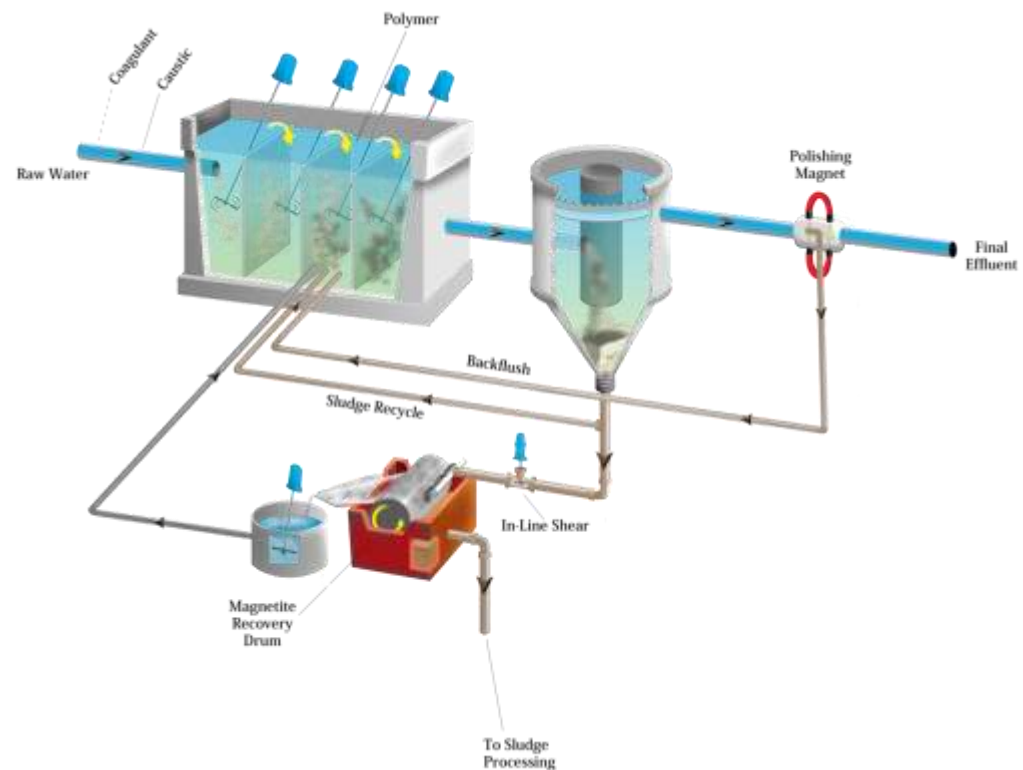
- Chemical demand – coagulant + 0.3 mg/l polymer
  - 40 mg/L  $\text{FeCl}_3$
  - 60 mg/L  $\text{Al}_2(\text{SO}_4)_3$
  - 80 mg/L PAC



# Pilot Overview

## ➤ CoMag™ - Cambridge Water Technology

- Chemical demand – coagulant + 3 mg/L polymer
  - 30 mg/l  $\text{FeCl}_3$
  - 70 mg/l  $\text{Al}_2(\text{SO}_4)_3$
  - 80 mg/l PAC



# Pilot Overview

## ➤ Pilot objectives

- Use coagulant + polymer dosing scheme to secondary treatment
- Evaluate if 0.10 mg/L effluent P is achievable without addition of tertiary treatment
- Establish chemical dosing requirements

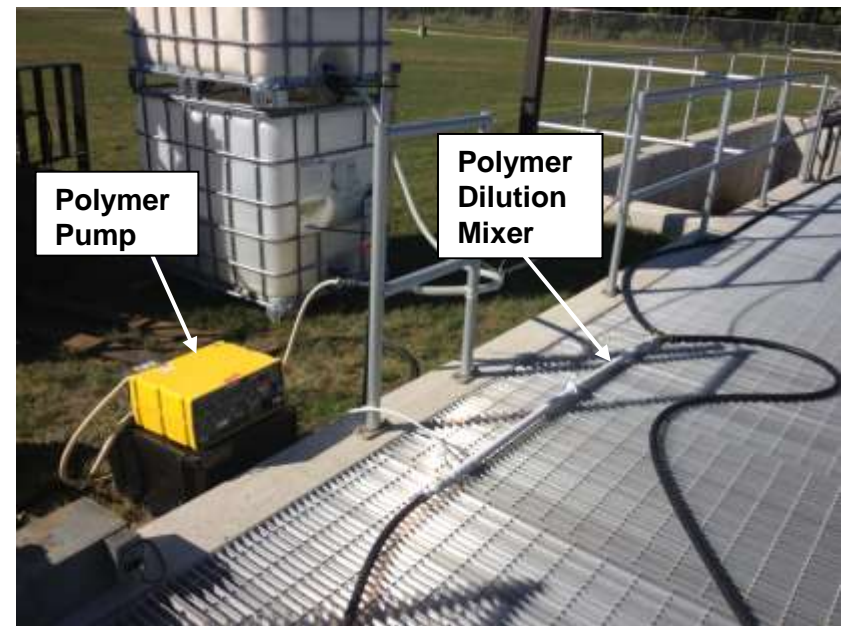
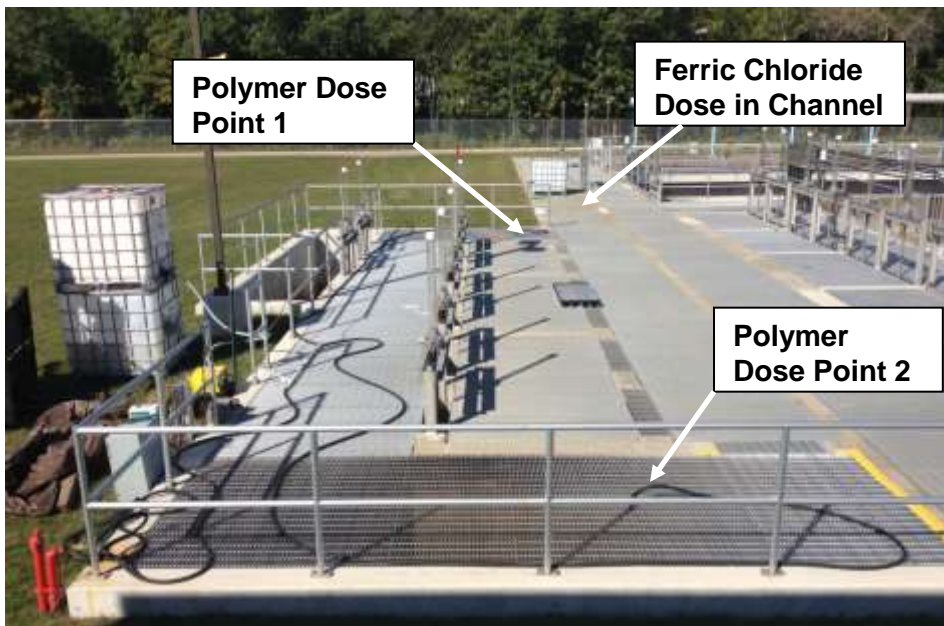
# Pilot Overview

- Pilot methodology (Sept. 3 – Oct. 5, 2013)
  - Phase 1 – ferric chloride dosing only
    - 35 mg/L ferric dose (300 gpd ferric, Q = 12 MGD)
    - 3 week duration
  - Phase 2 – ferric chloride + polymer dosing
    - Maintain 35 mg/L ferric dose
    - 1.2 mg/L polymer dose (48 gpd, Q = 12 MGD)
    - 2 week duration



# Pilot Overview

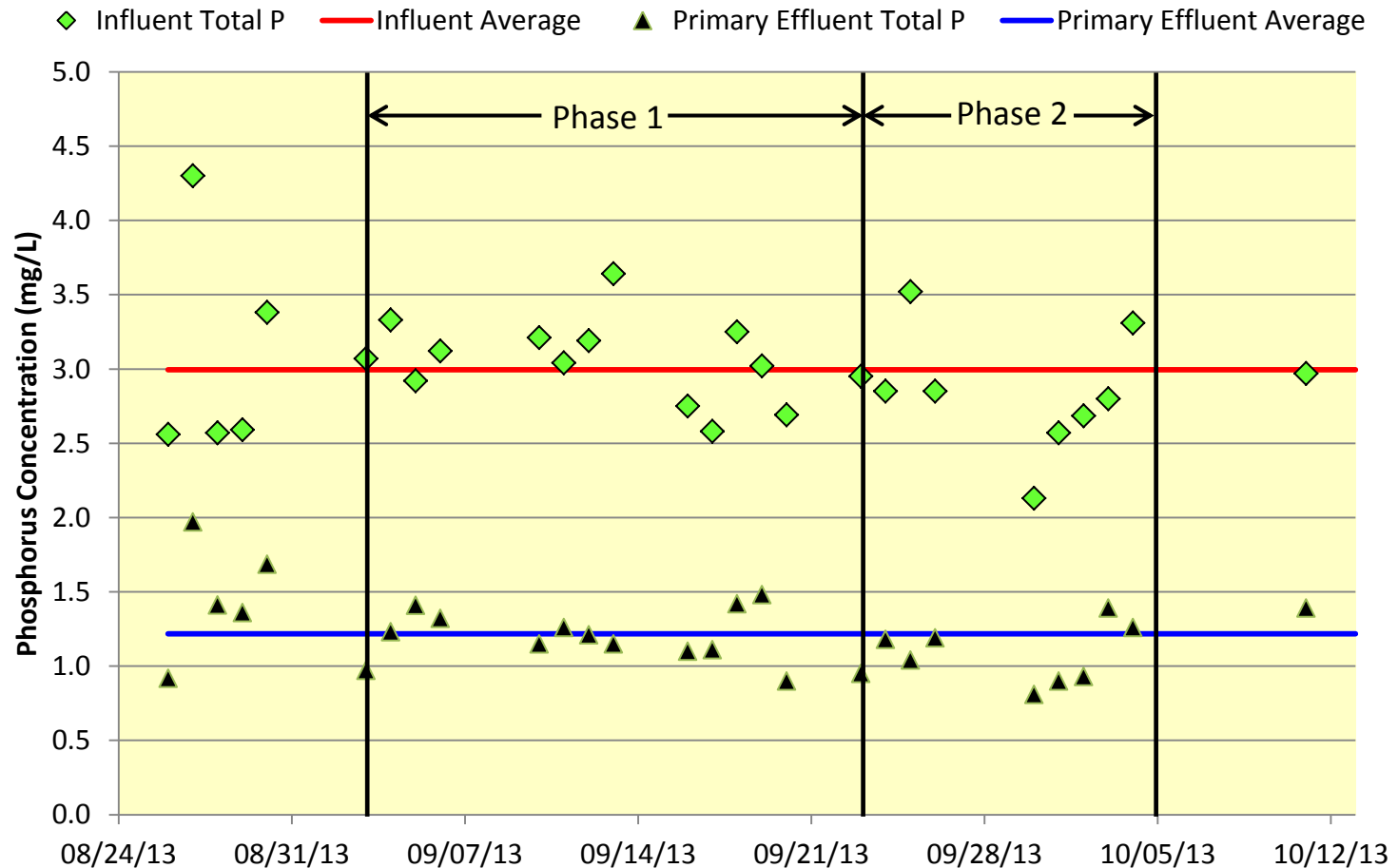
- Ferric dosing – use existing system
- Polymer dosing – set up temporary system



# Pilot Results

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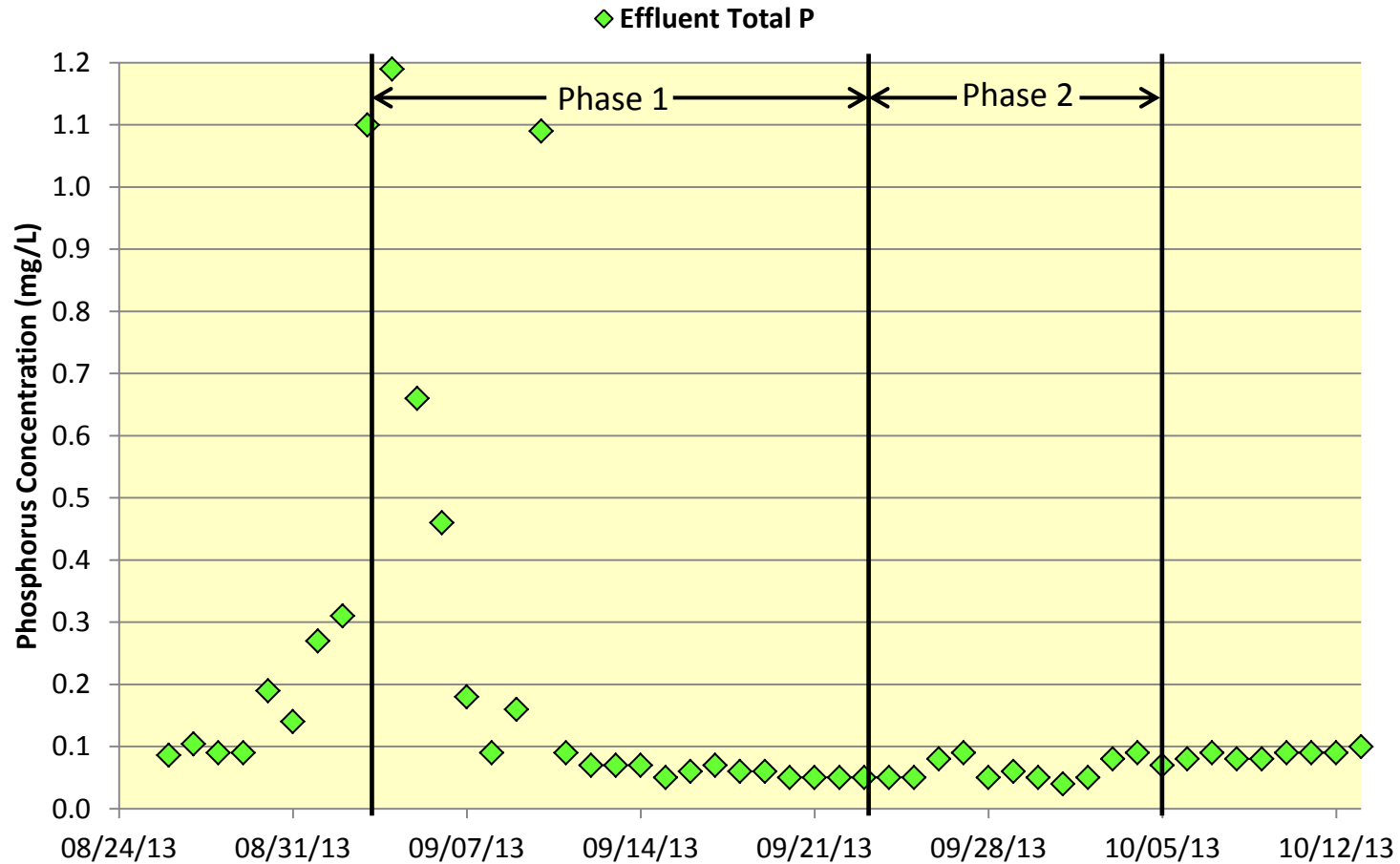
## ➤ Influent and primary effluent total P





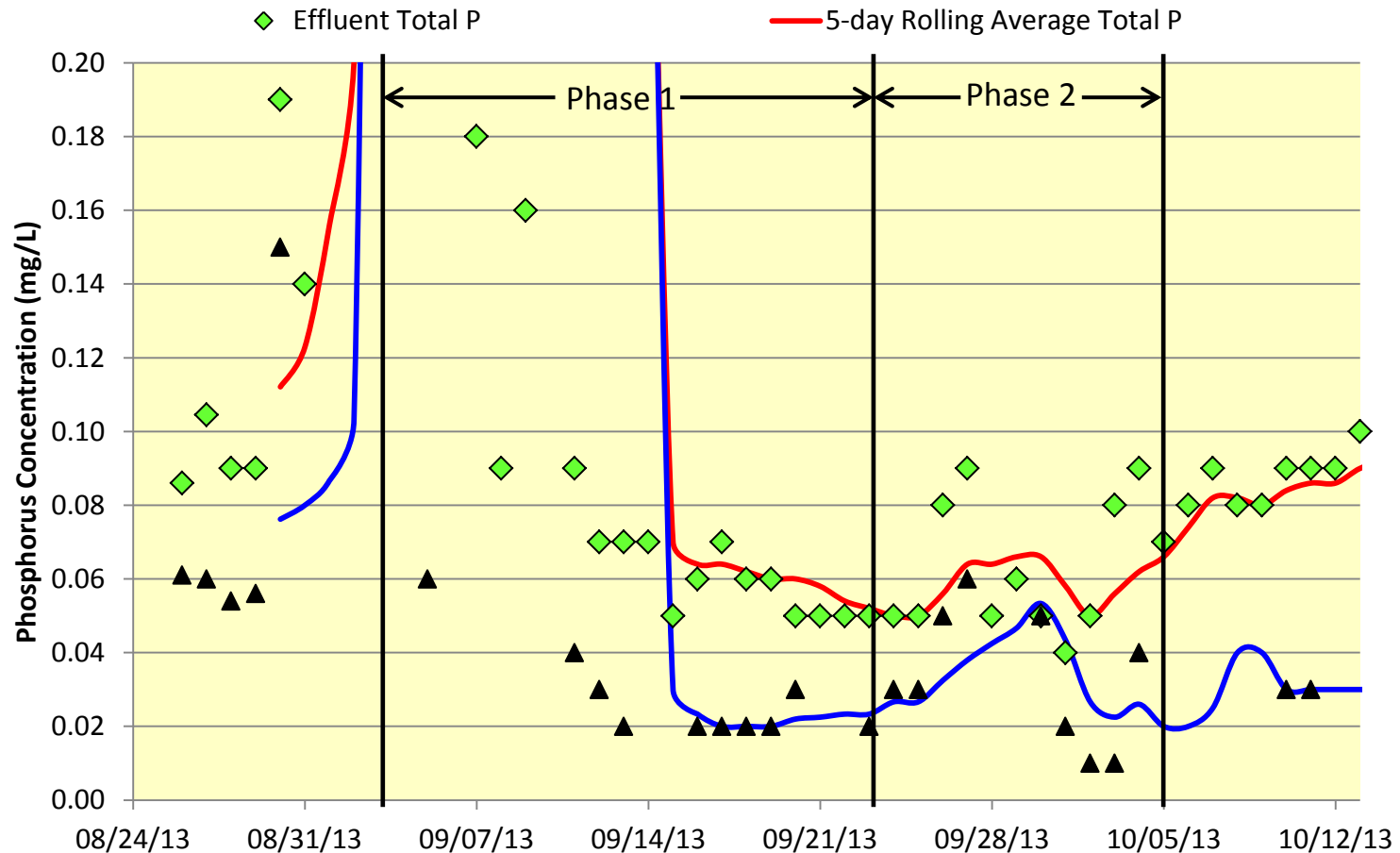
# Pilot Results

## ➤ Effluent total P



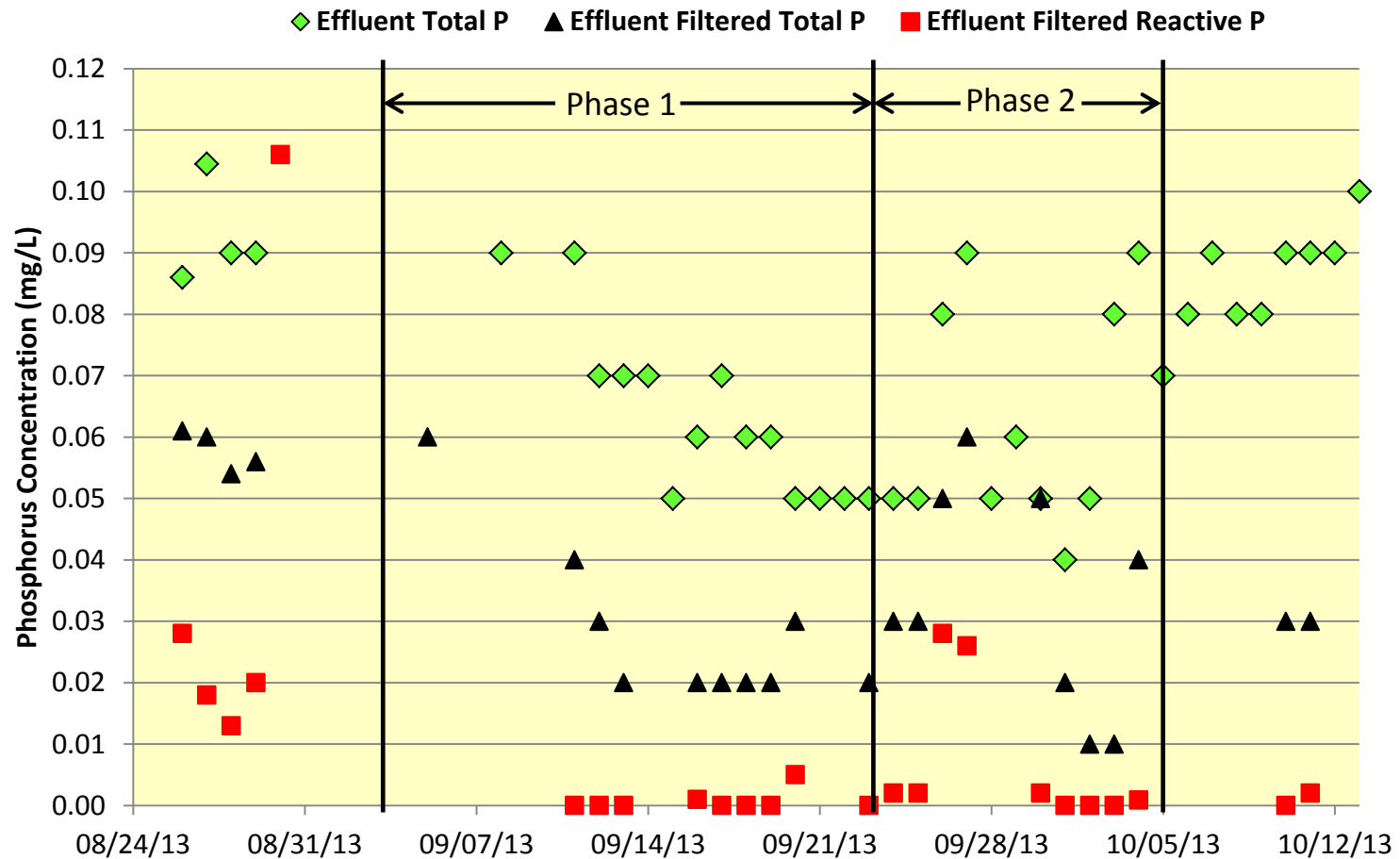
# Pilot Results

## ➤ Effluent total P and filtered (soluble) total P



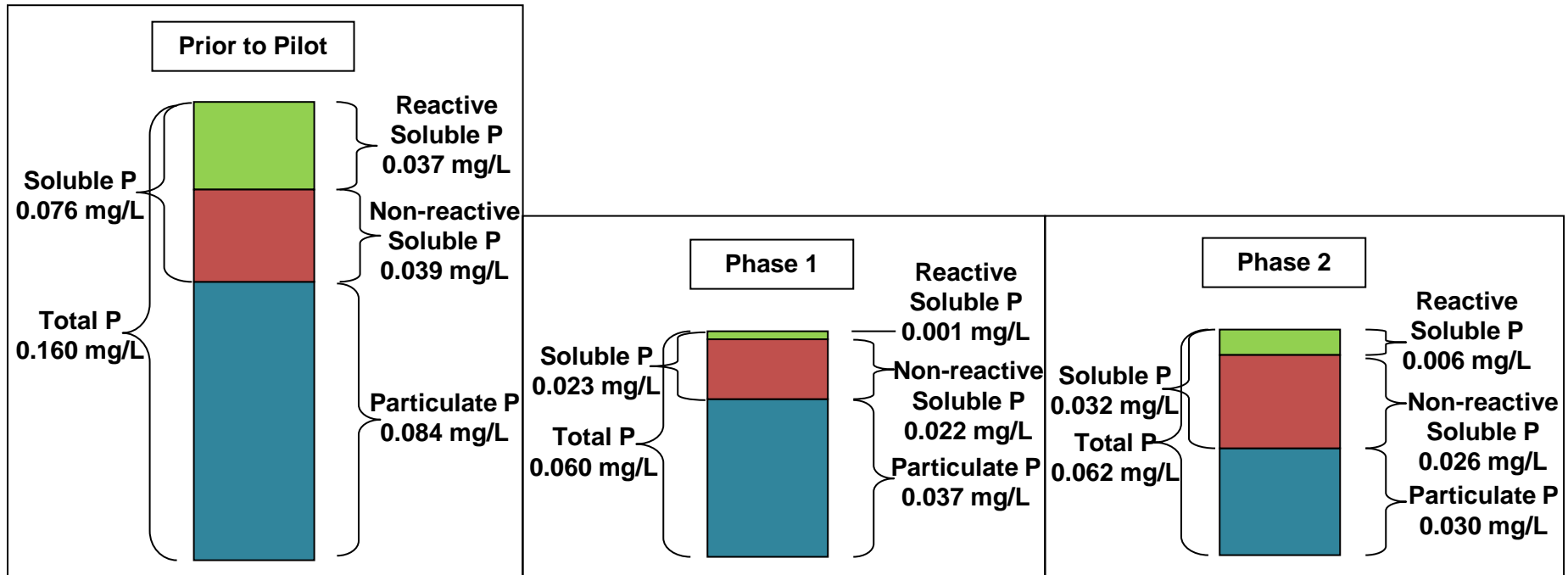
# Pilot Results

## ➤ Effluent P speciation data



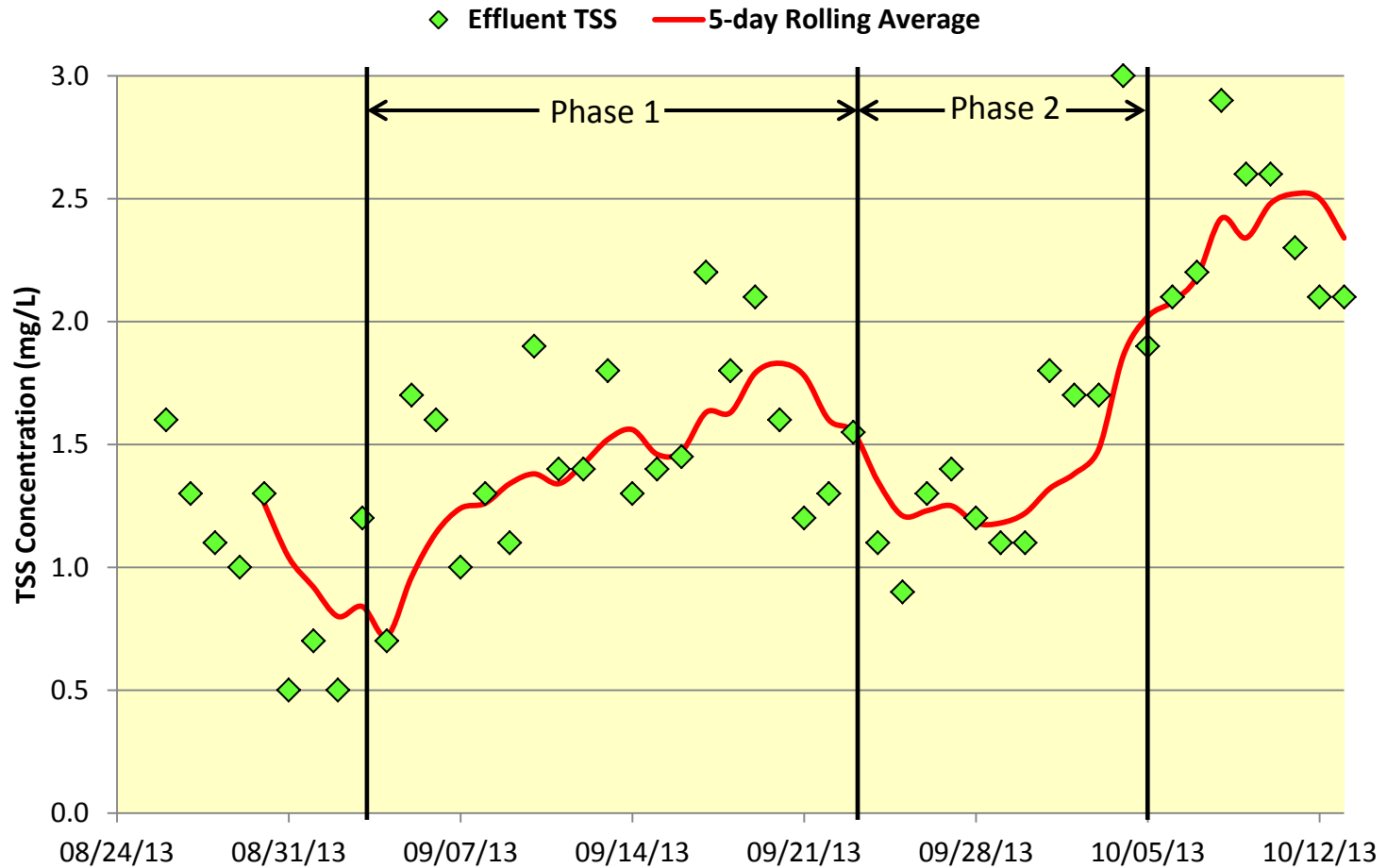
# Pilot Results

- Effluent phosphorus speciation – average values
  - Note: Ortho P is part of reactive P



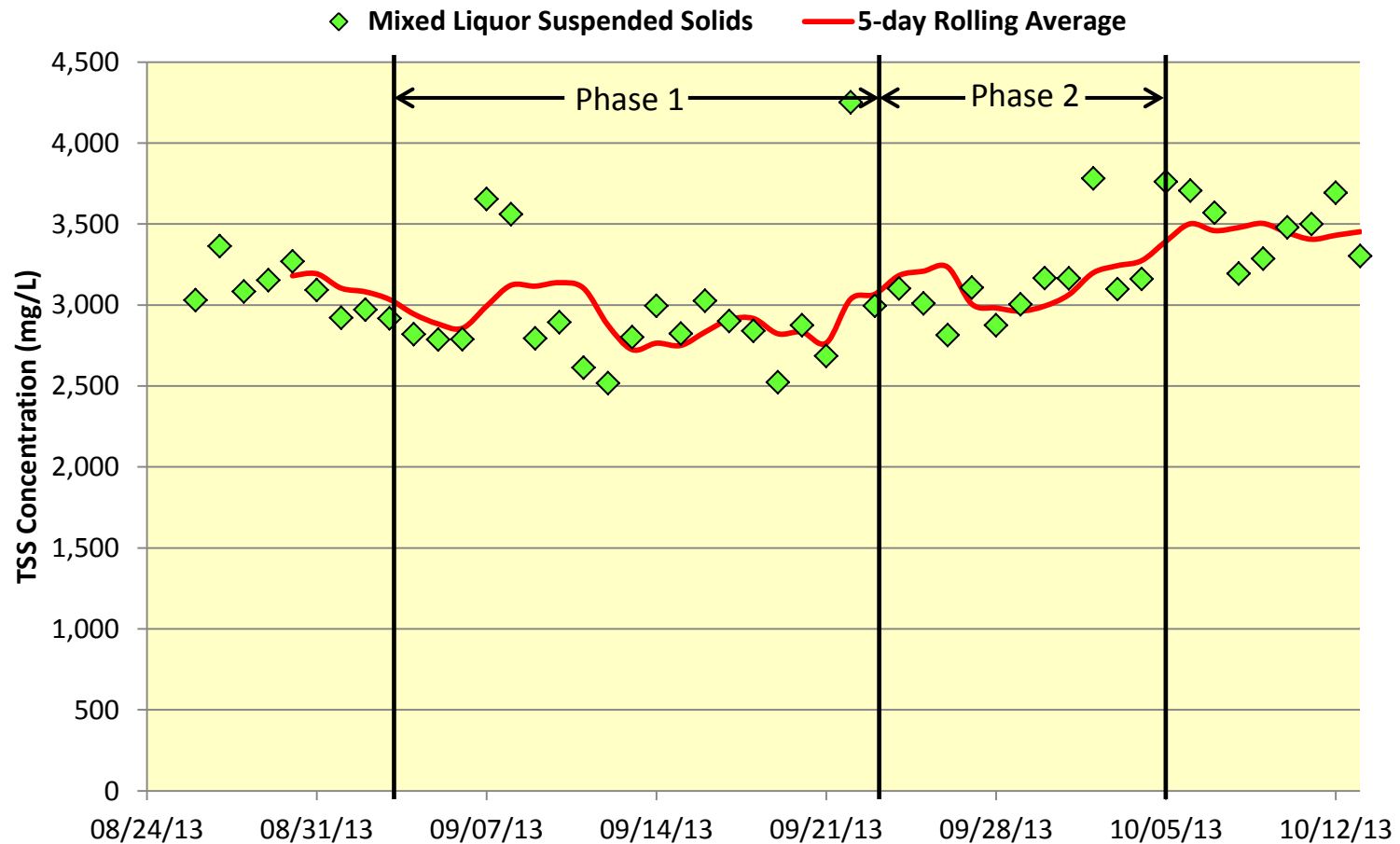
# Pilot Results

## ➤ Effluent TSS



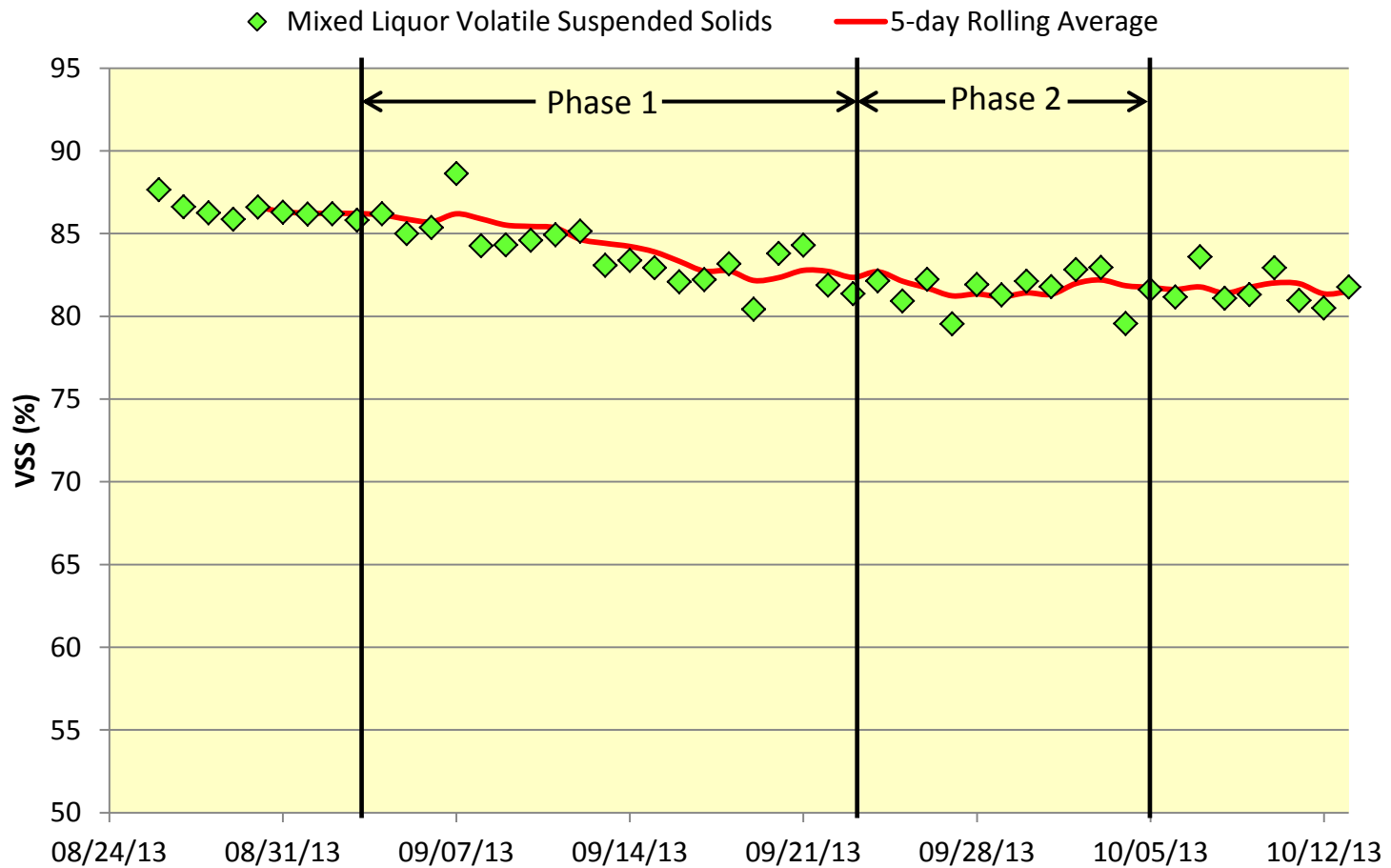
# Pilot Results

## ➤ Mixed liquor MLSS



# Pilot Results

## ➤ Mixed liquor MLVSS



# Phase 2

- Summer 2014 long-term pilot
  - 10-week duration starting June 1st
  - Better measure of variability / stability
  - June flows elevated
    - Better comparison to TMDL mass limits
  - Refine chemical doses and annual cost estimates



# Phase 2 - Pilot Methodology

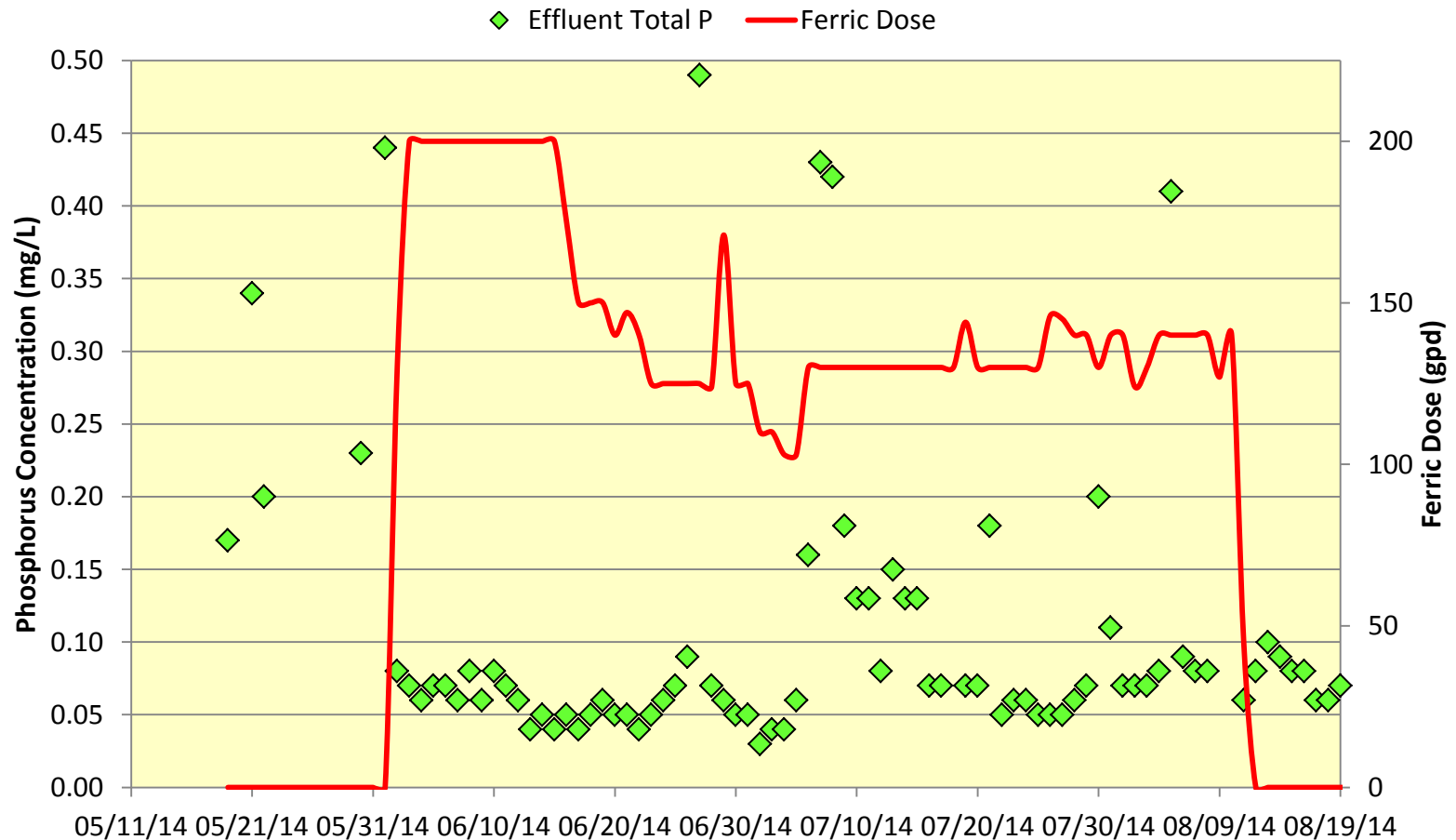
- Phase 1, Ferric chloride dosing only
  - Start on Monday, June 2nd and run through July 13th
  - Initial ferric dose of 19 mg/L (200 gpd ferric, Q = 15 MGD)
  - Ended at 11.5 mg/L (130 gpd, Q = 16 MGD)
  - 6 week duration

# Phase 2 - Pilot Methodology

- Phase 2 – ferric chloride + polymer dosing
  - This phase was canceled due to low effluent TSS and no need for polymer
  - Monday, July 14<sup>th</sup> through August 10<sup>th</sup>
  - Maintain phase 1 ferric dose
  - 0.7 mg/L initial polymer dose (35 gpd, Q = 15 MGD)
  - 4 week duration

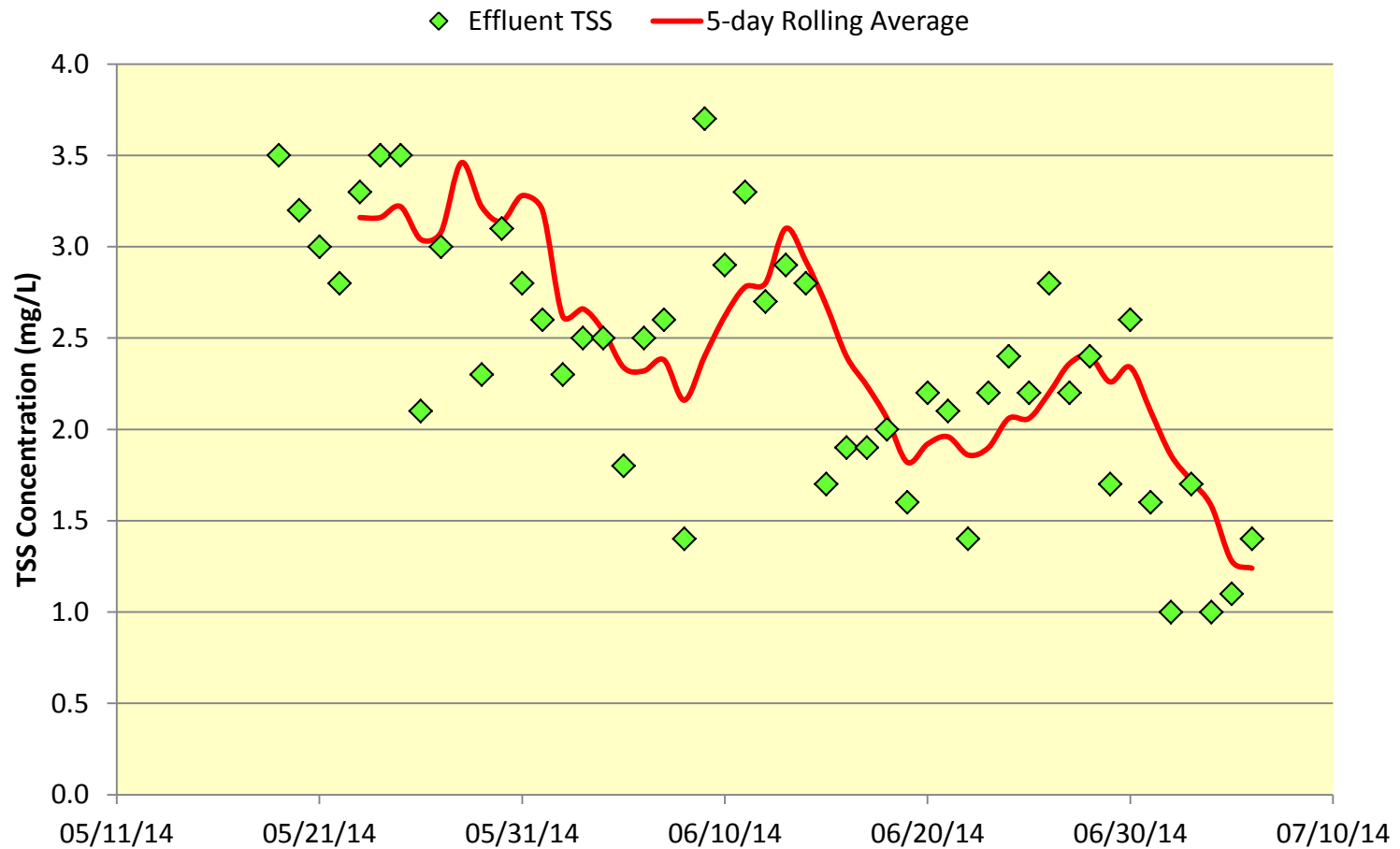
# Phase 2 - Pilot Results

## ➤ Effluent total P versus ferric dose



# Phase 2 - Pilot Results

## ➤ Effluent TSS



# Phase 2 - Pilot Results So Far



# Conclusions

# Conclusions

- Low primary effluent P = great advantage
- Effluent average P of 0.06 mg/L would allow Janesville to meet TMDL limits
- Phase 1 ferric dose response suggested over-dosing at 35 mg/L (300 gpd) dose
- Phase 2 ferric dose response suggests we are at the correct dose at 11.5 mg/L (130 gpd).

# Conclusions

- Polymer benefits have not been fully tested
- Average TSS of 2 mg/L = great advantage
- Phase 1 cost analysis
  - Annual ferric chloride \$104,000
  - Annual polymer \$176,000
- Phase 2 cost analysis
  - Annual ferric chloride \$45,000
  - Annual polymer \$???