

# Improvements for Nutrient Removal at a Package Plant

Package Plant Nutrient Management



# The Teams

- ▶ Regional Sewer District
  - ▶ Collections
  - ▶ Engineers
  - ▶ Maintenance/Electronic Maintenance
  - ▶ Operations
- ▶ Consulting Engineers



# What

- ▶ TIN and TN limits
- ▶ Current Improvements
- ▶ Nutrient Profiling
- ▶ Future Improvements
  - ▶ Package Plant Upgrades
  - ▶ Studies
- ▶ CIP vs In-House
  - ▶ Fine-bubble diffusers
  - ▶ Mixers

# Where

- ▶ Package Plants
  - ▶ Tartan Fields
  - ▶ Scioto Reserve
  - ▶ Lower Scioto



# When and Why

- ▶ Implementation of the LAMP permits
- ▶ Regulatory-driven

## Part I, A. - FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

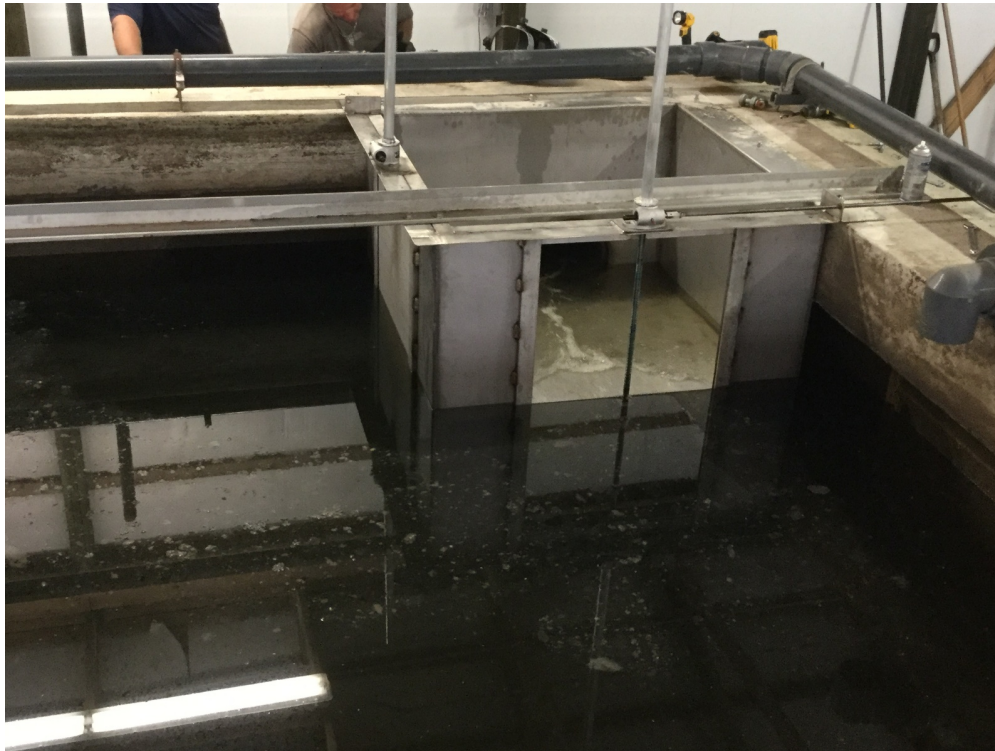
1. During the period beginning on the effective date of this permit and lasting until the expiration date, the permittee is authorized to discharge in accordance with the following limitations and monitoring requirements from outfall 4MP00008601. See Part II, OTHER REQUIREMENTS, for locations of effluent sampling.

Table - Final Outfall - 601 - Final

Effluent Characteristic	Discharge Limitations							Monitoring Requirements		
	Concentration Specified Units				Loading* kg/day			Measuring Frequency	Sampling Type	Monitoring Months
	Maximum	Minimum	Weekly	Monthly	Daily	Weekly	Monthly			
00400 - pH - S.U.	9.0	6.0	-	-	-	-	-	1/Month	Grab	All
00530 - Total Suspended Solids - mg/l	-	-	-	45	-	-	-	1/Week	Composite	All
00552 - Oil and Grease, Hexane Extr Method - mg/l	10	-	-	-	-	-	-	1/Quarter	Grab	Quarterly
00640 - Nitrogen, Inorganic, Total - mg/l	-	-	-	10	-	-	-	1/Week	Composite	All
00951 - Fluoride, Total (F) - mg/l	1.0	-	-	-	-	-	-	1/Year	Grab	Yearly
01002 - Arsenic, Total (As) - ug/l	100	-	-	-	-	-	-	1/Year	Grab	Yearly
01012 - Beryllium, Total - ug/l	100	-	-	-	-	-	-	1/Year	Grab	Yearly
01022 - Boron, Total - ug/l	750	-	-	-	-	-	-	1/Year	Grab	Yearly
01037 - Cobalt, Total (Co) - ug/l	50	-	-	-	-	-	-	1/Year	Grab	Yearly
01045 - Iron, Total (Fe) - ug/l	5000	-	-	-	-	-	-	1/Year	Grab	Yearly

# Where We Left Off

- ▶ Hydraulic Improvements to Tartan



# Hydraulics First, Biology Next



# TF Drawbacks

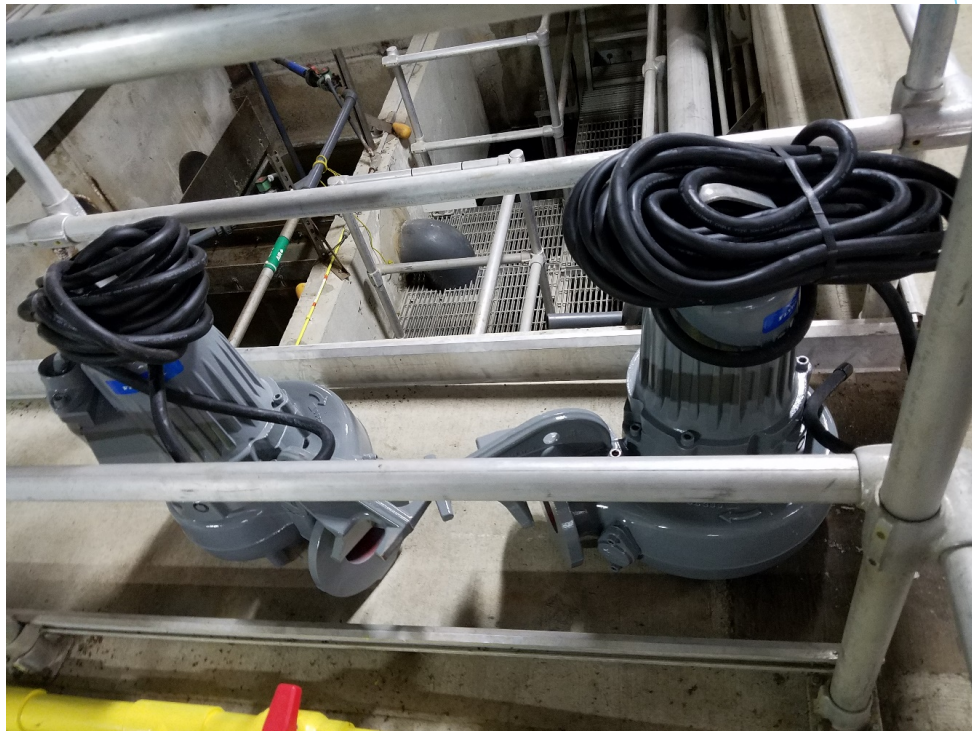
- ▶ No EQ
- ▶ Sludge Holding Tank
  - ▶ Storage Space
  - ▶ Decanting
- ▶ RAS control
- ▶ New Neighbors/odor control





# How SR differs

- ▶ Aeration in hand
- ▶ Parallel tanks/two plants
- ▶ Less corrosion



# Modeling

- ▶ OECC
- ▶ Lower Scioto
- ▶ Tartan Fields
- ▶ Northstar



# Nutrient Reduction is for Everyone!

- ▶ Nitrification/Denitrification
- ▶ Make an anoxic zone in your aeration tank
  - ▶ Blower Timers
  - ▶ Sampling
  - ▶ Settrometer



# Settlometer vs Centrifuge



# Nitrification

- ▶ Oxygen
- ▶ Time
- ▶ Temperature
- ▶ MLSS
- ▶ Alkalinity



# Denitrification

- ▶ Nitrate
- ▶ Time
- ▶ Temperature
- ▶ MLSS
- ▶ Alkalinity

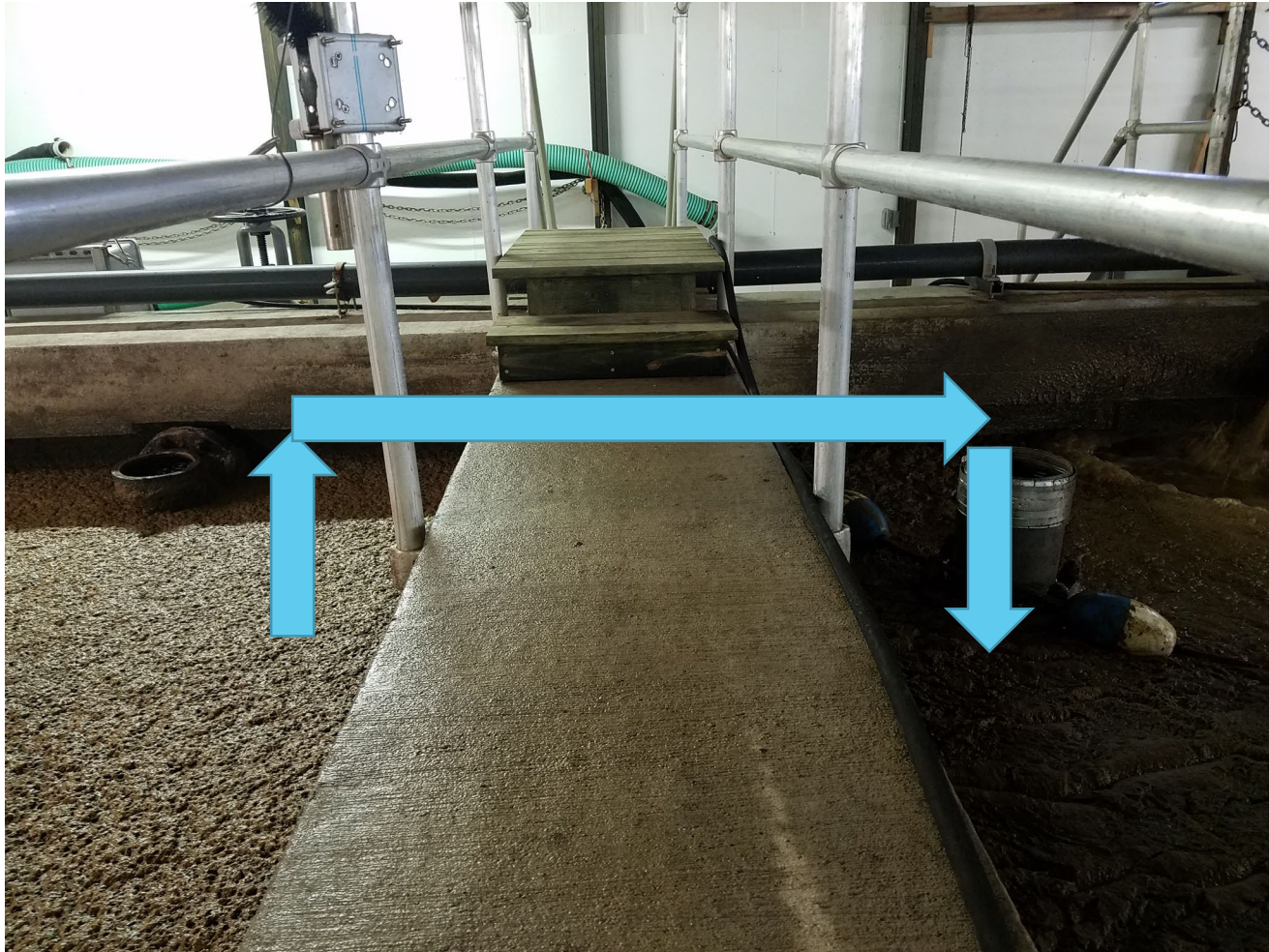


# IMLR

- ▶ Nitrate Recycle
- ▶ Not RAS
- ▶ To feed or not to feed (Carbon)



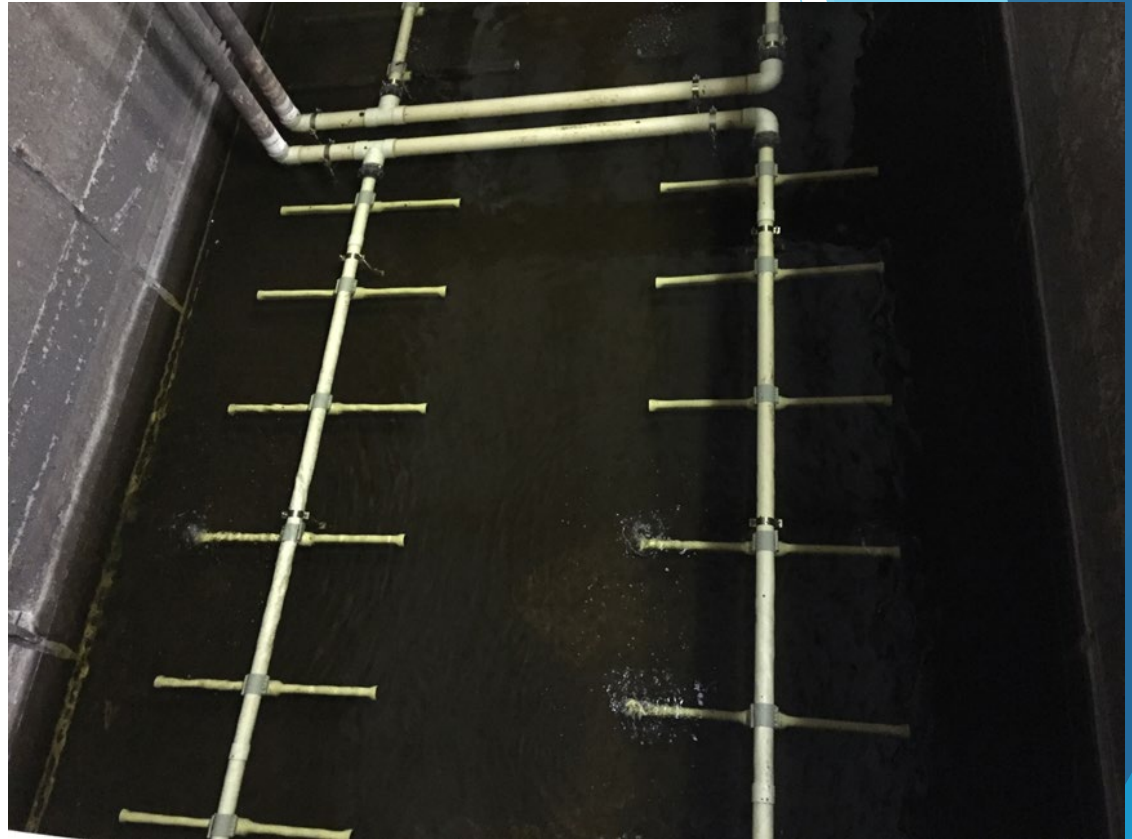
# IMLR at Tartan





# Mixing

- ▶ Course Bubble
- ▶ Floating Surface

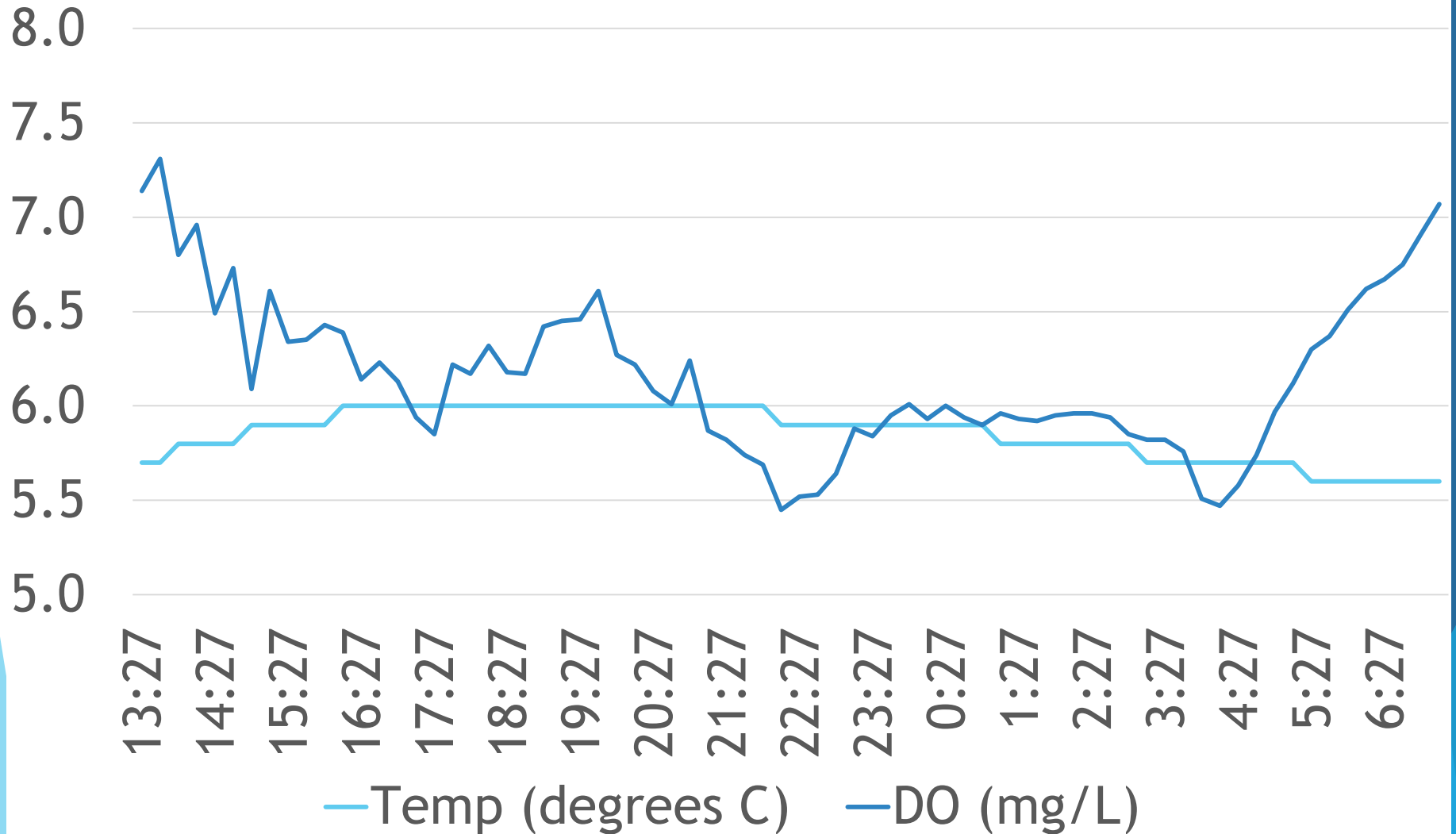


# Mini Mixing Study

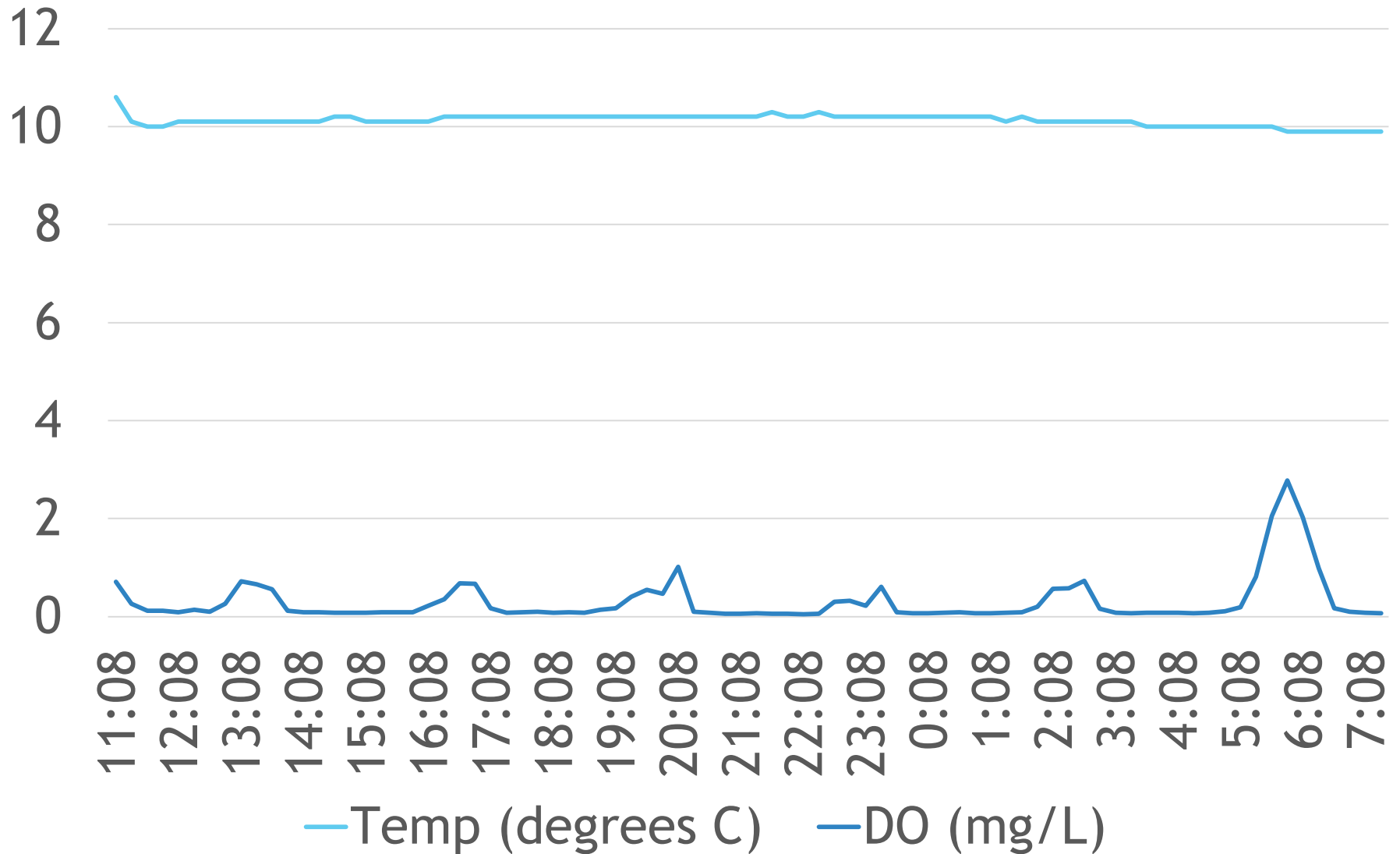
- ▶ Course bubble mixing
- ▶ Lower Scioto vs Northstar
- ▶ DO profiling



# Northstar Mixing Study



# Lower Scioto Mixing Study



# Nitrite Shunt

- ▶ Nitrification/Denitrification Shortcut
- ▶ Simultaneous nitrification/denitrification
- ▶ Ammonium to Nitrite to Nitrogen Gas
- ▶ Nitrite oxidizing bacteria repressed
  - ▶ Low DO?

# Nitrite Lock

- ▶ Typical Effluent Nitrite is less than 1 mg/L
- ▶ Nitrite interferes with  $\text{Cl}_2$  residual
  - ▶ 1 mg/L of Nitrite consumes 2 mg/L of  $\text{Cl}_2$  residual
- ▶ Short aeration detention time
- ▶ Ammonia oxidizing bacteria
  - ▶ Nitrite oxidizing bacteria?

# Current Process Control

- ▶ Ammonia results in 18 minutes
- ▶ Nitrate results in 5 minutes
- ▶ Anoxic Zones
- ▶ Aeration Zones
- ▶ Nutrient Probes for Real-time results



# Monthly Nutrient Profiling

- ▶ Ammonia
- ▶ Nitrate
- ▶ Orthophosphate





# Nutrient Profiling

- ▶ Influent
- ▶ Digester Decent
- ▶ Anoxic Tank
- ▶ RAS
- ▶ Aeration Tank
- ▶ Clarifier
- ▶ Effluent



# Influent

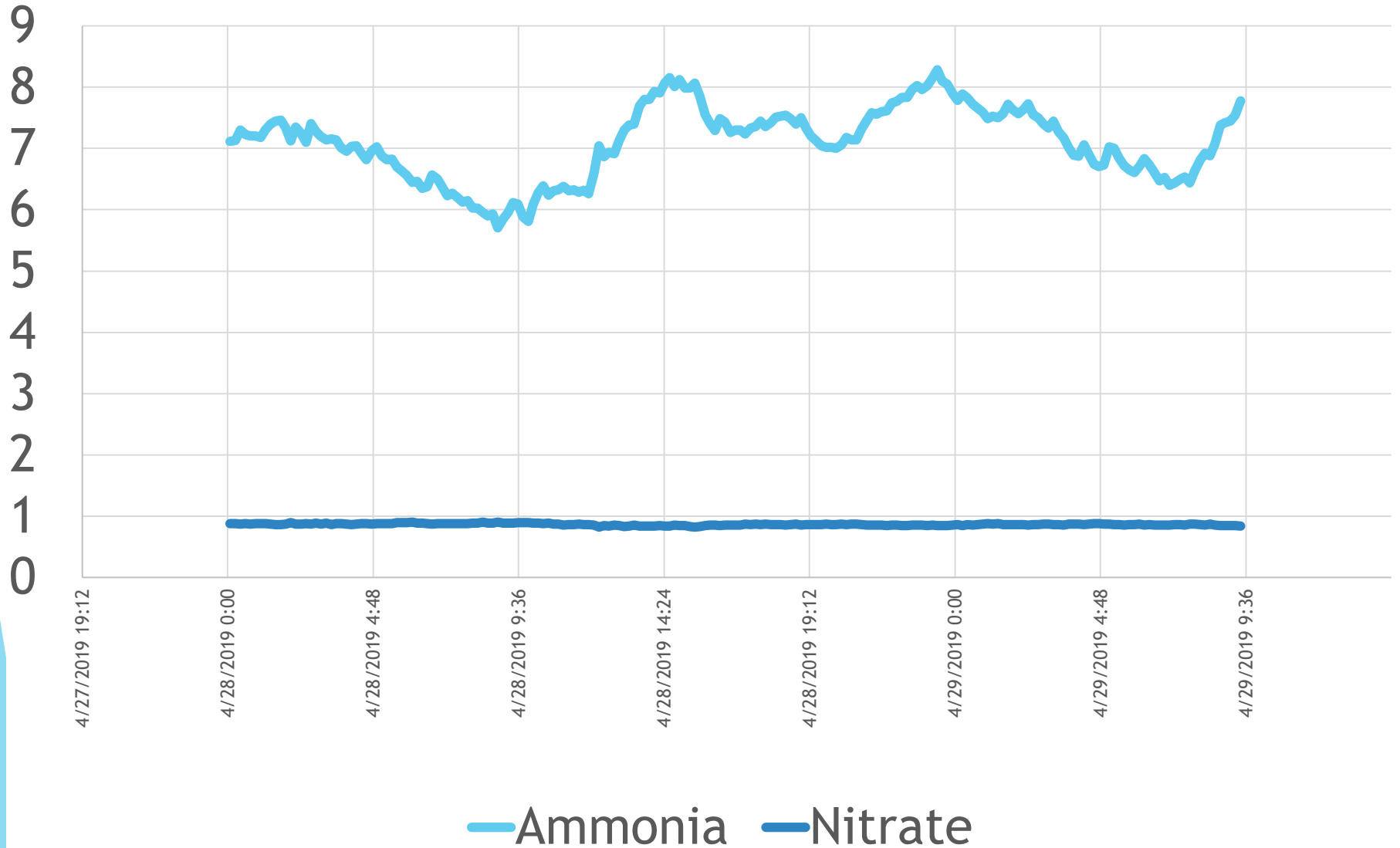
- ▶ CBOD
- ▶ Ammonia
- ▶ Nitrate
- ▶ Total Phosphorus



# Decent Numbers

	Ammonia		Nitrate		Ortho-Phosphate	
	Influent	Effluent	Influent	Effluent	Influent	Effluent
Lower Scioto	15.7	0.3	7.0	4.4	6.6	1.0
Tartan Fields	35.3	0.8	1.1	4.9	14.3	3.0
Scioto Reserve	38.8	2.2	0.8	3.1	15.1	7.8
Northstar	37.8	1.3	1.1	6.0	12.9	9.5

# Varion Probe Data - TF Anoxic



# Lower Scioto Treatability



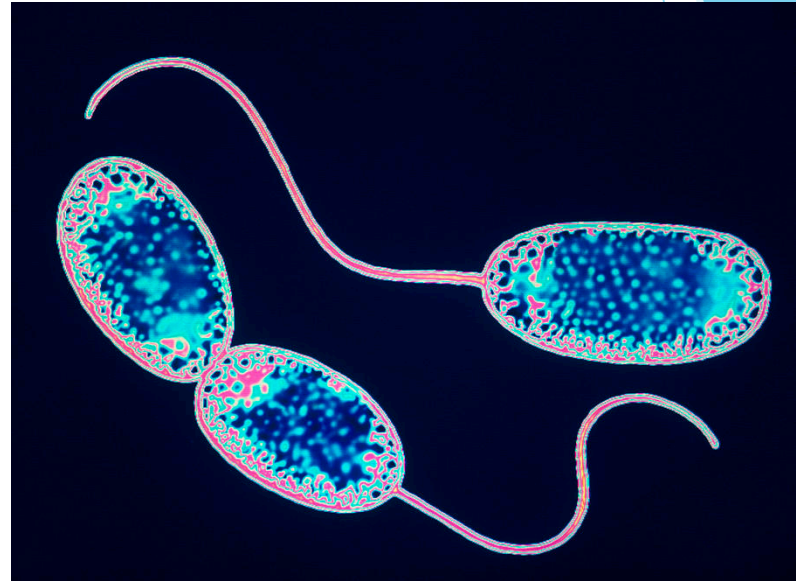
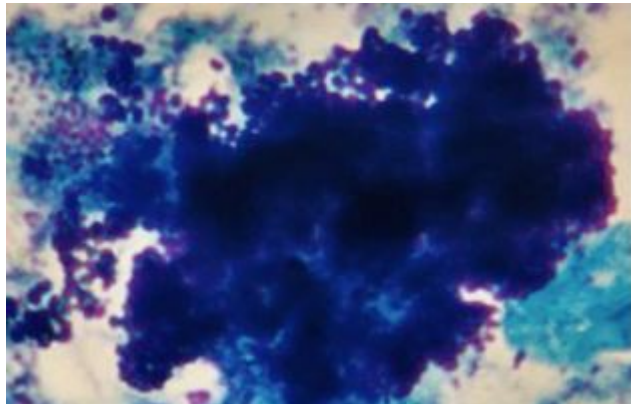
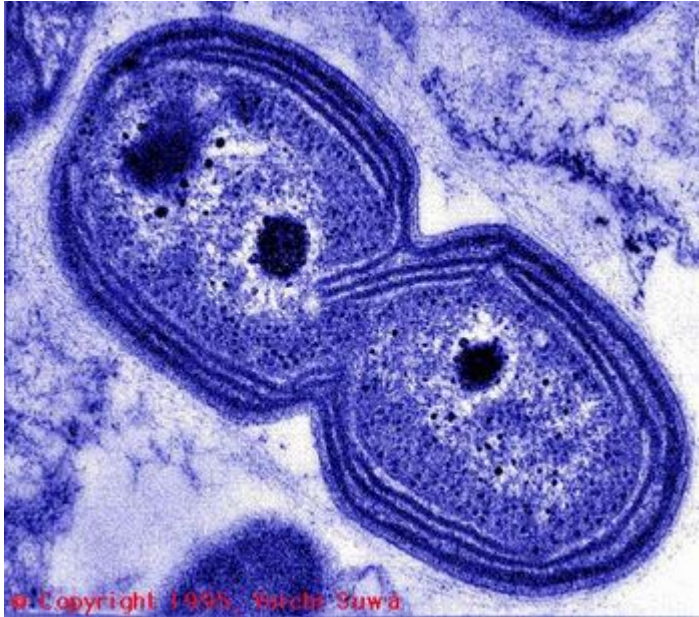
# Package Plant Upgrades

- ▶ Tartan Fields
- ▶ Scioto Reserve
- ▶ Lower Scioto

# Other Package Plants

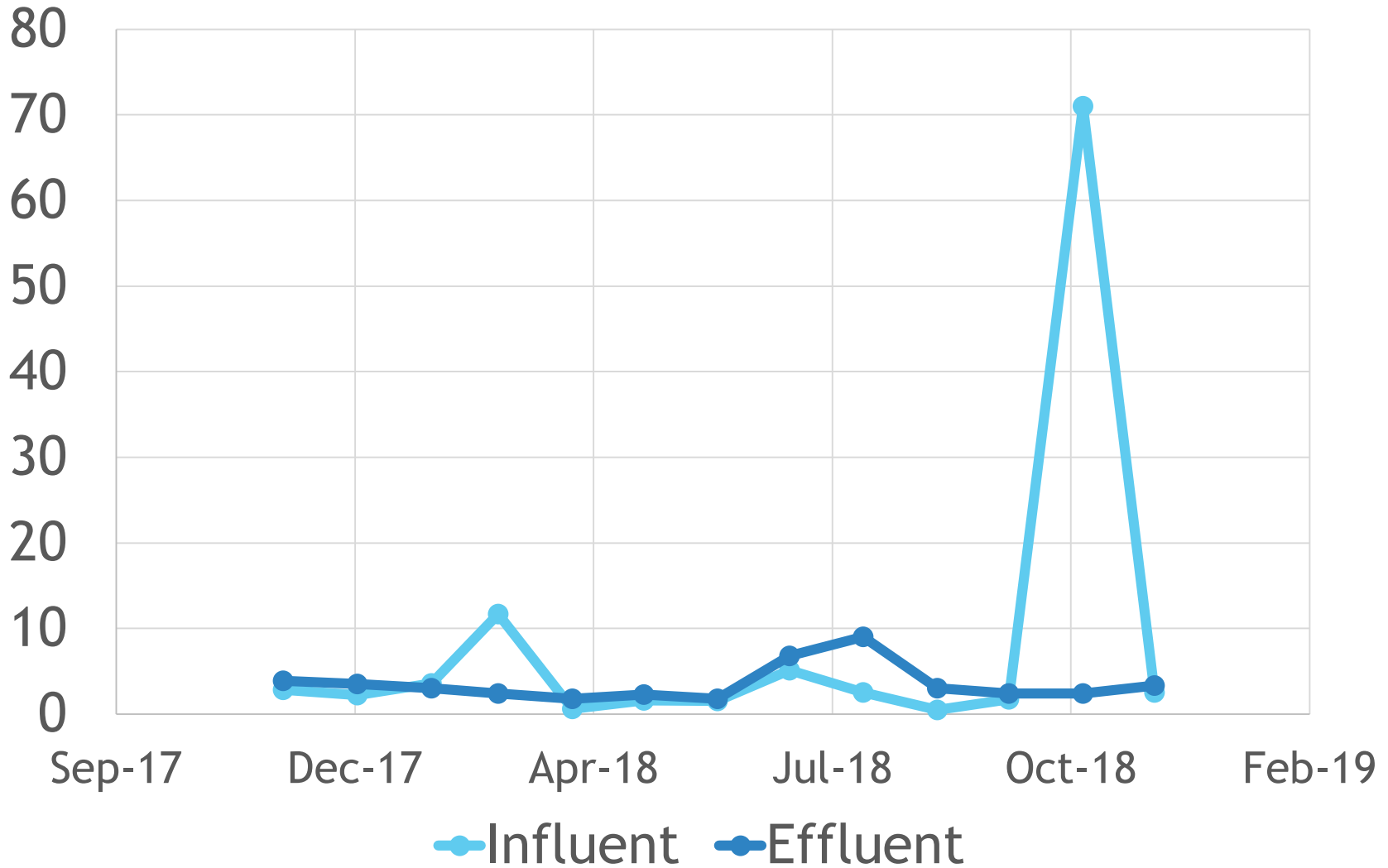
- ▶ Future NPDES discharge for Northstar
- ▶ Ammonia Limits for three smaller package plants

# You Nutrient Team

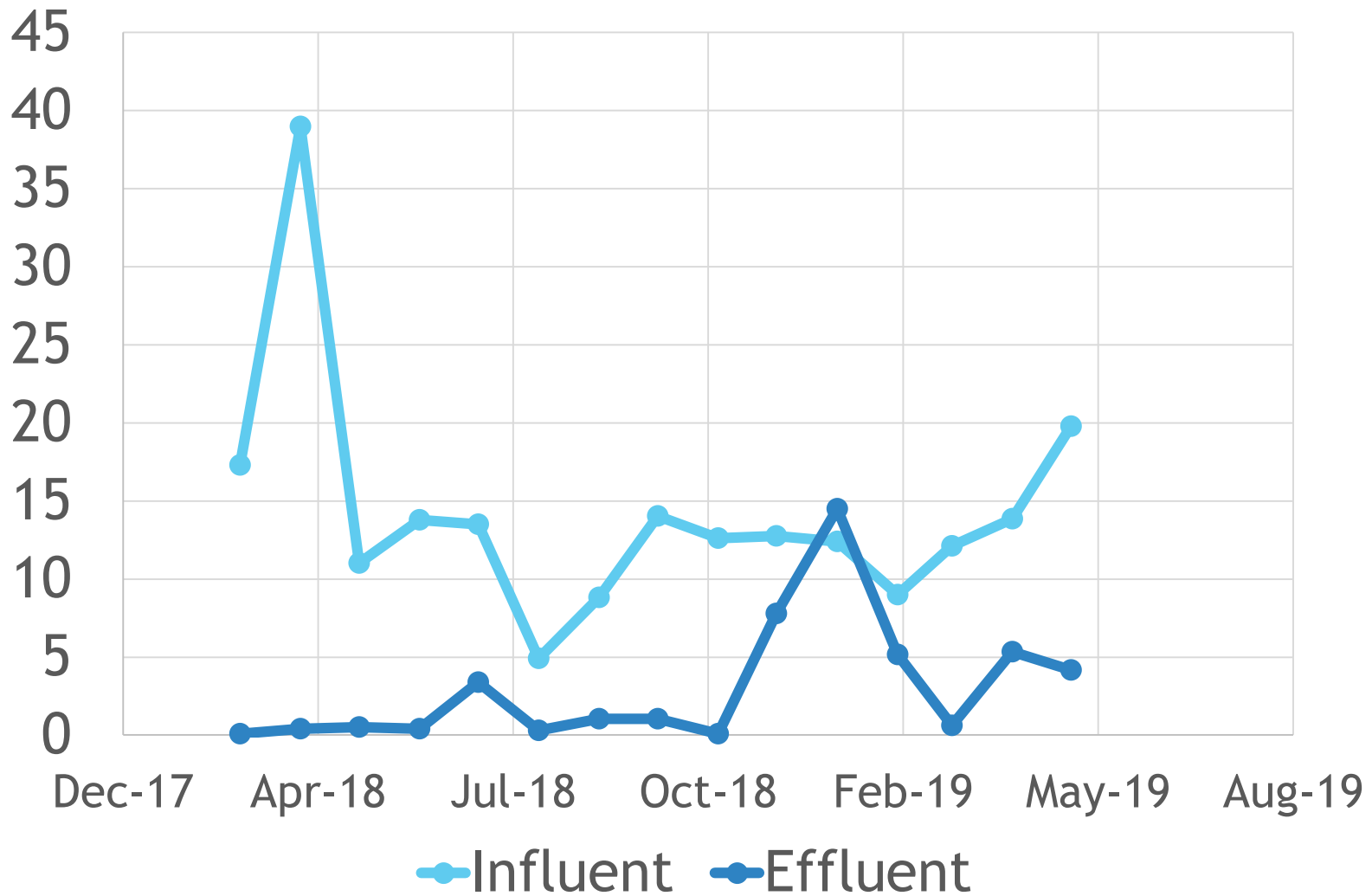




# Lower Scioto Nitrate Spike



# Ortho-Phosphate at TF



# Future Projects

- ▶ High Ammonia at Scioto Reserve
- ▶ Low Ammonia at Lower Scioto
- ▶ IMLR pump at Tartan Fields
- ▶ Nutrient Modeling At Northstar
- ▶ Blowers at Lower Scioto
  - ▶ Constant air vs cyclic aeration

# Key Take Away

“You really have to do the lab work, and you have to do the documentation, so you know that when a change is made, this is what you got. And then look at trends to know what happened over a period of time.”

-Tim Pfeifer, Slinger (WI) WRF

# Thank You!

To all the operators and engineers contributing to  
these projects!



# Questions

## FEATURED NEWS

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### Cease the Grease

Posted **Monday, June 4, 2018**

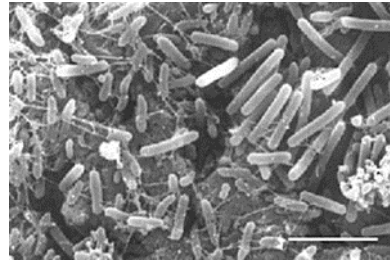


### Keep Wipes out of Pipes

Posted **Monday, June 4, 2018**



# Bug's Menu



- ▶ Dissolved Oxygen



- ▶ Nitrate



- ▶ Sulfate

