



# ANAEROBIC TREATMENT OF CREAM CHEESE WHEY

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# Cream Cheese Whey

- ▶ 1 kg cheese >> 5-10 kg of whey
- ▶ 115 million tons of whey world-wide
- ▶ Globally - 50% disposed of into the environment
- ▶ August 2018 - Fonterra commenced new Cream Cheese production in Darfield



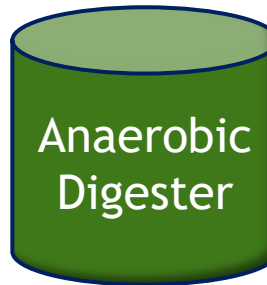
# Cream Cheese Whey

- ▶ Cream cheese whey (CCW)
  - ▶ Lactose (44 - 52 g/L)
  - ▶ Proteins (6 - 8 g/L)
  - ▶ Mineral salts (4 - 10 g/L)
- ▶ High COD > 60,000 -120,000 mg/L
- ▶ High nutrient content:
  - ▶ TN 800 - 900 mg/L
  - ▶ TP 600 mg/L
  - ▶ Ca 1,100 mg/L

# Anaerobic Digestion of CCW



CCW = Organics + Nutrients



Nutrients to land  
or treatment

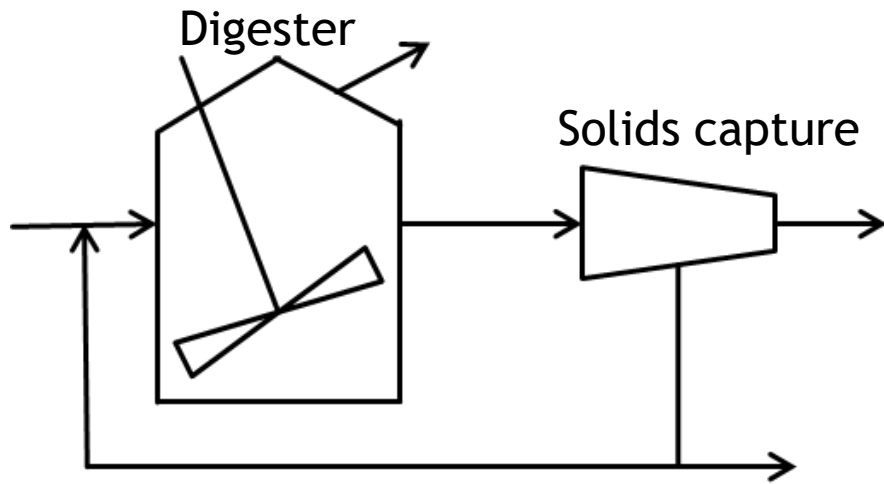
Biogas = Energy

1 tonne whey ➡ 60 kg COD ➡ 20 m<sup>3</sup> methane ➡ 716 MJ of energy

# Technology Selection

Process Risk	Technology Feature
Fluctuating load (COD, FOG)	High process robustness
Calcium phosphate precipitation	Solids removal efficiency
High solids (fats) content	Low pre-treatment requirements

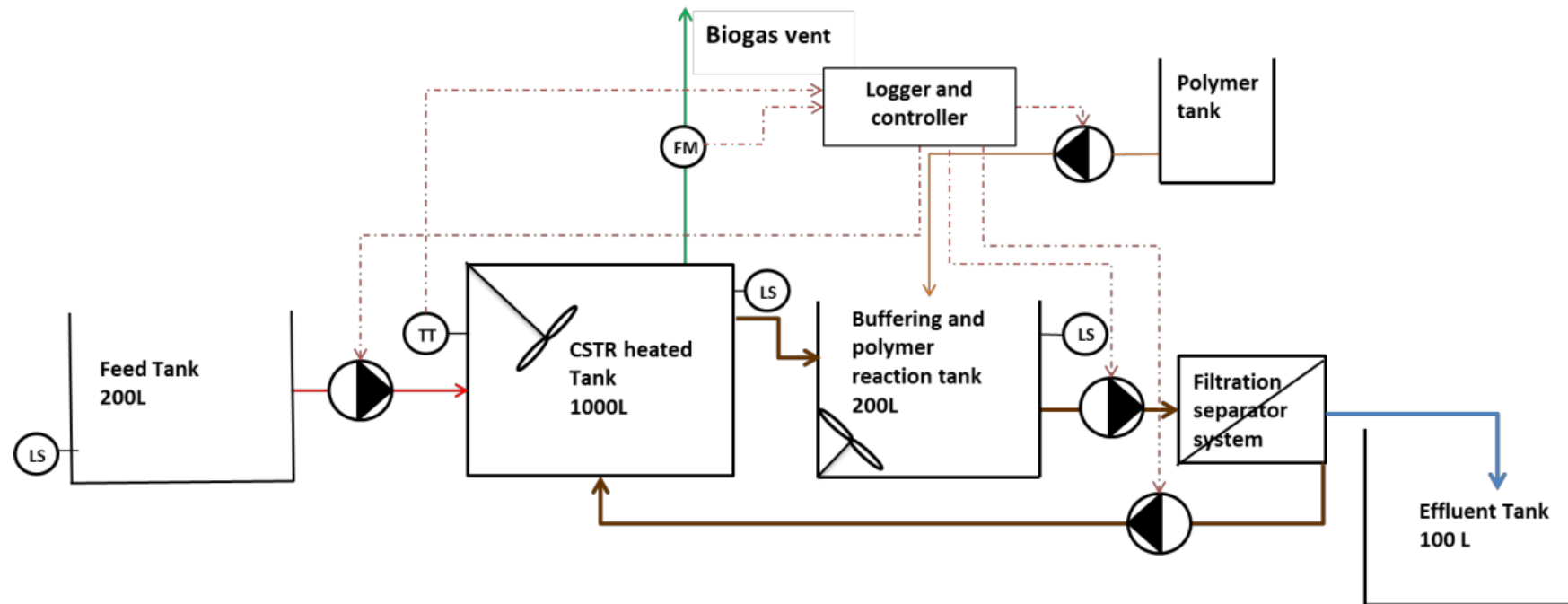
# Anaerobic Contact Process



## ► Benefits of Anaerobic Contact process:

- High treatment efficiency
- Operating robustness
- Medium-high loading rate
- Controlled solids (precipitation) removal
- Low pre-treatment requirements

# Pilot Trial





# Trial Objectives

- 1) Design basis for full scale digestion
- 2) Maximum organic loading rates
- 3) Treatment efficiency
- 4) Biological methane potential of CCW

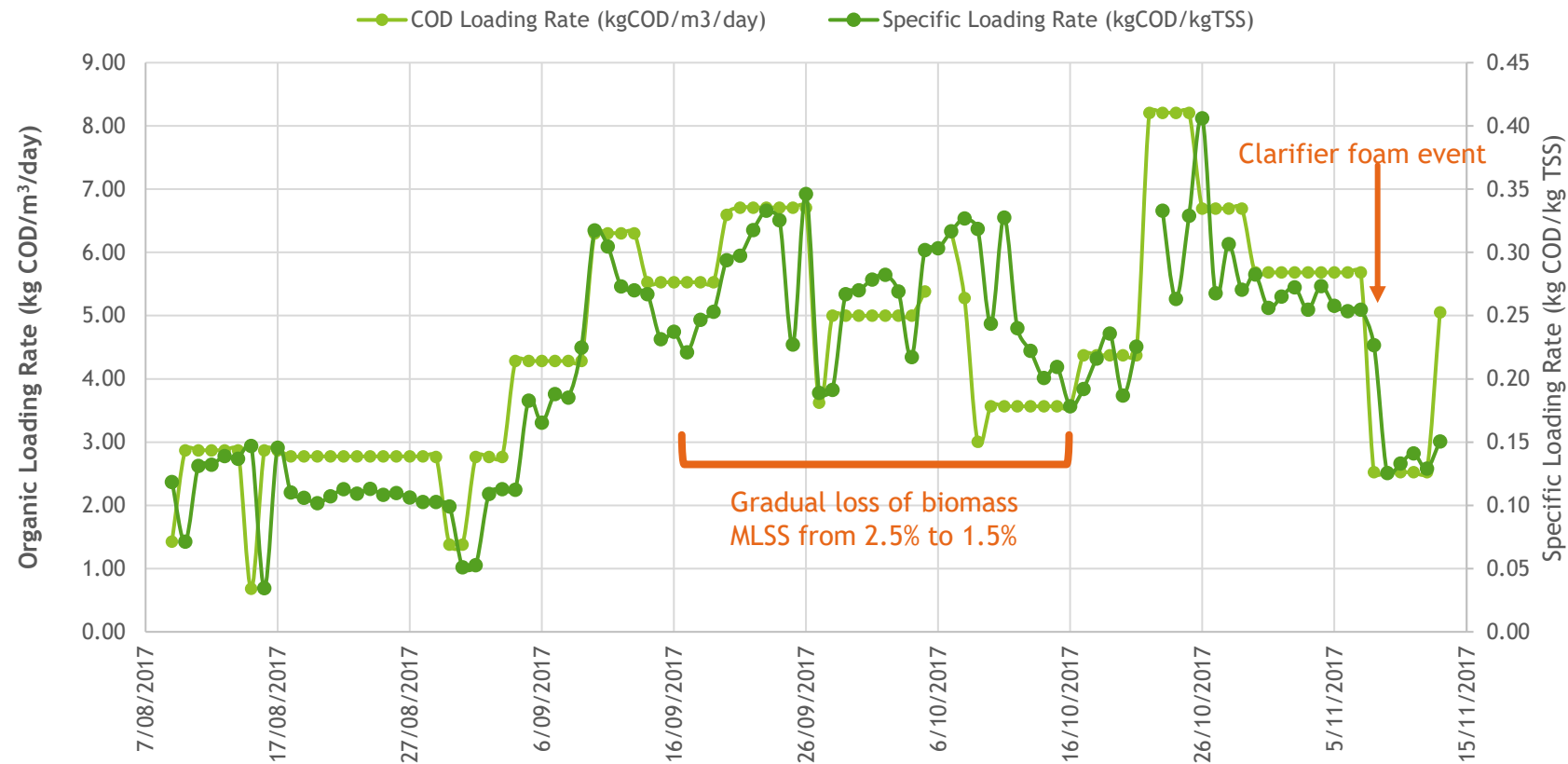




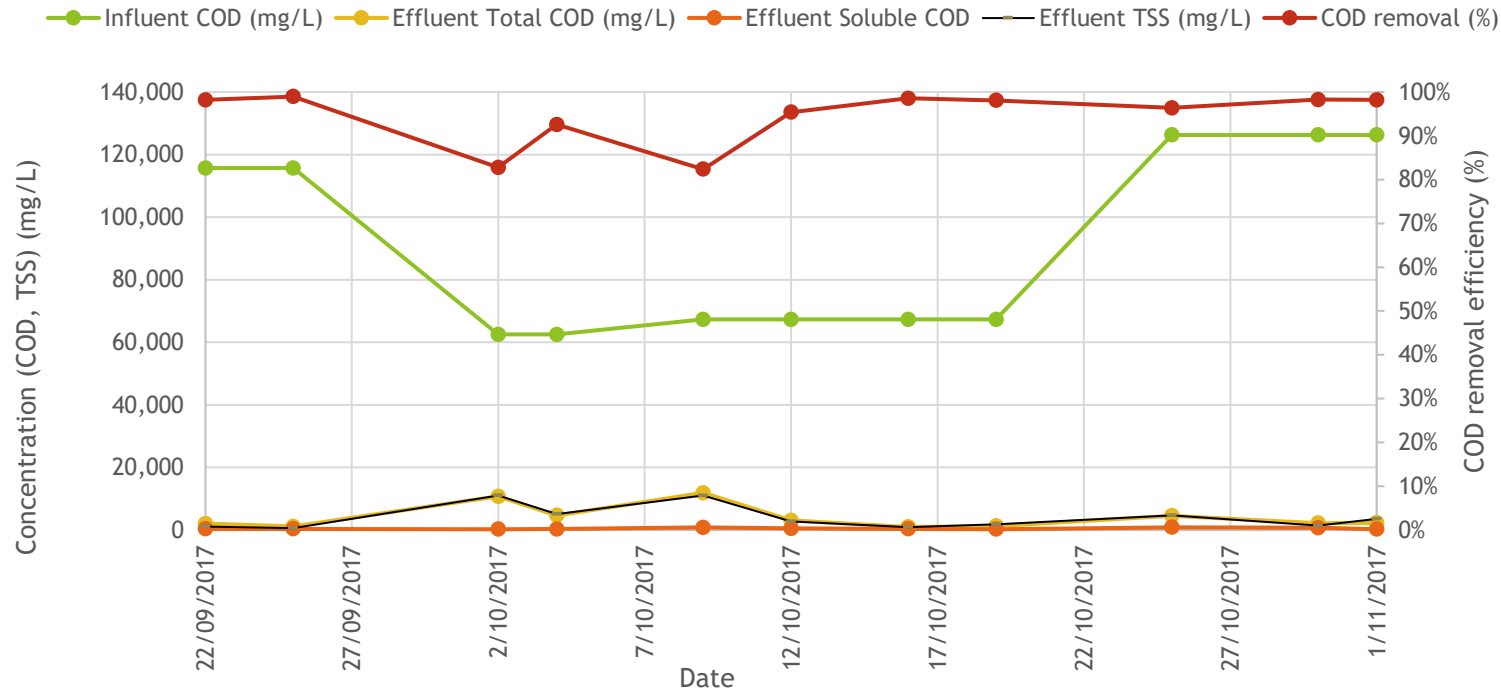
# CCW Characteristics - Trial results

Parameter	Unit	Range	Average
Total COD	mg/l	62,500 - 126,300	87,700
Filtered COD	mg/l	47,100 - 62,800	56,520
TSS	mg/l	2,310 - 35,500	14,850
pH		3.49 - 3.64	3.55
Fat	%	0.45 - 1.98	0.89
Protein	%	0.38 - 0.98	0.65

# Organic Loading Rate

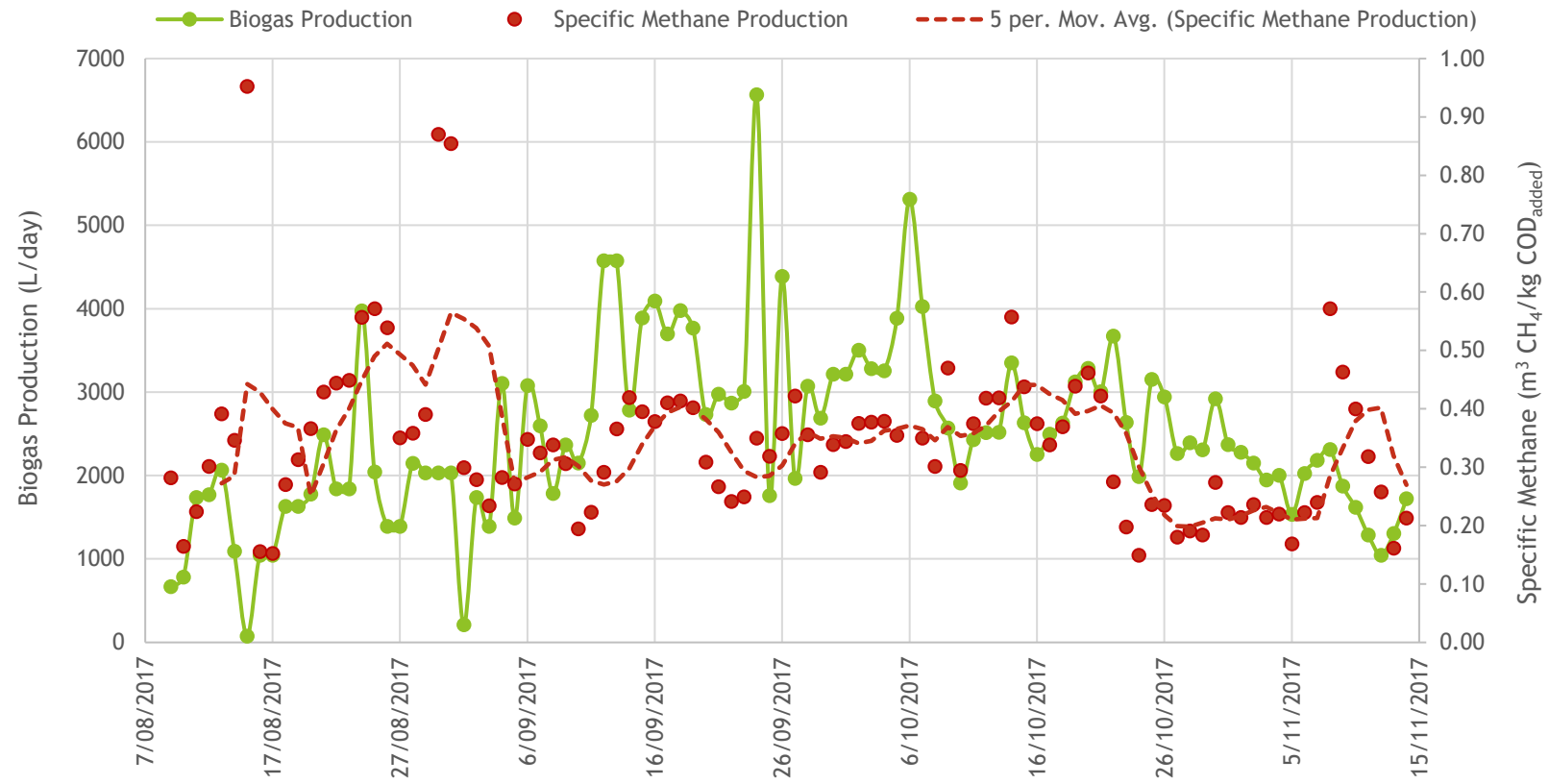


# Treatment Efficiency

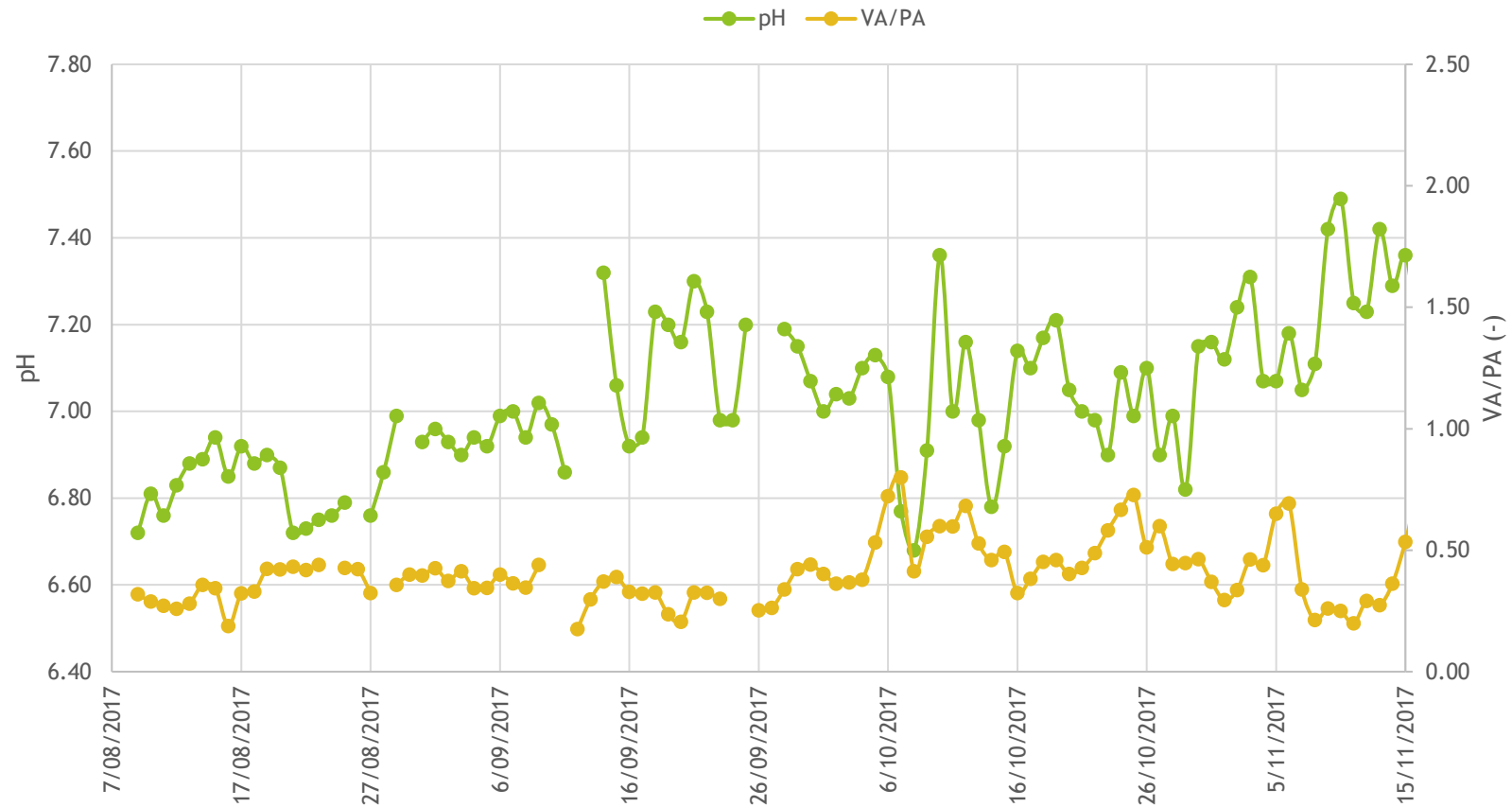


Nutrients		Process
Phosphorus	90% - 96%	Precipitation, removed with solids
Nitrogen	50%	Mineralisation to ammonia

# Methane potential



# Operating Stability





# Pilot Trial Performance

- ▶ Successful operation for ~100 days
- ▶ Some modifications were required due to mechanical issues
- ▶ Operation not fully automated
- ▶ Sufficient amount of operating results was obtained for design of full-scale system

## Operating issues:

- ▶ Delay in whey characterisation
- ▶ Pipe blockage
- ▶ Loss of biomass
- ▶ Clarifier foaming



# Conclusions

- ▶ Proof of technology
- ▶ Organic Loading Rate 5 kg COD/m<sup>3</sup>/day
- ▶ Ability to cope with as high fat content as 2%
- ▶ High COD removal efficiency >> high biogas yield
- ▶ No alkalinity supplementation required
- ▶ Significant phosphorus removal occurring due to precipitation

# Acknowledgement

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