Sidestream Treatment at the Fresno RWRF

City of Fresno, CA

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carollo

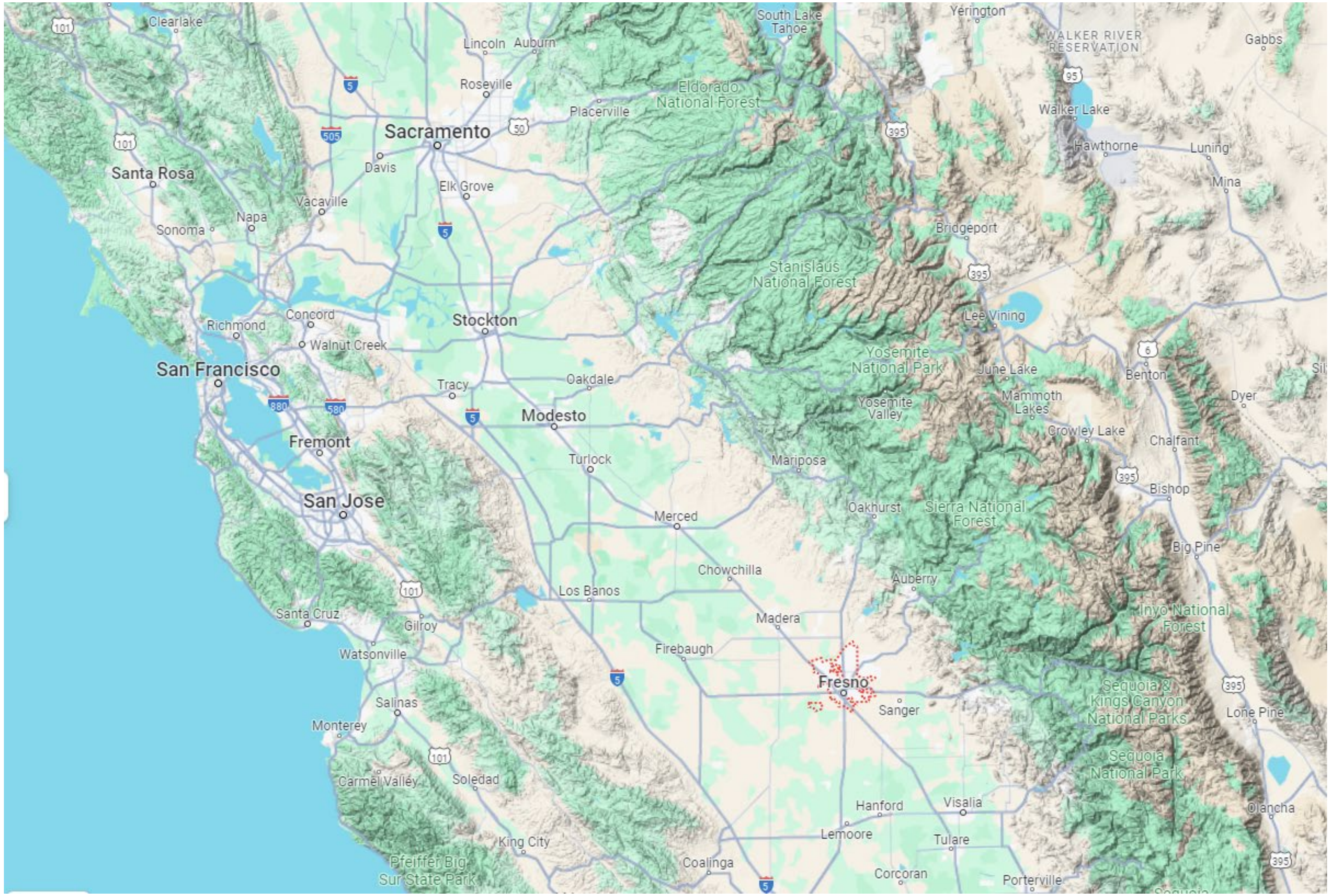
City of FRESNO
DEPARTMENT OF PUBLIC UTILITIES

Agenda

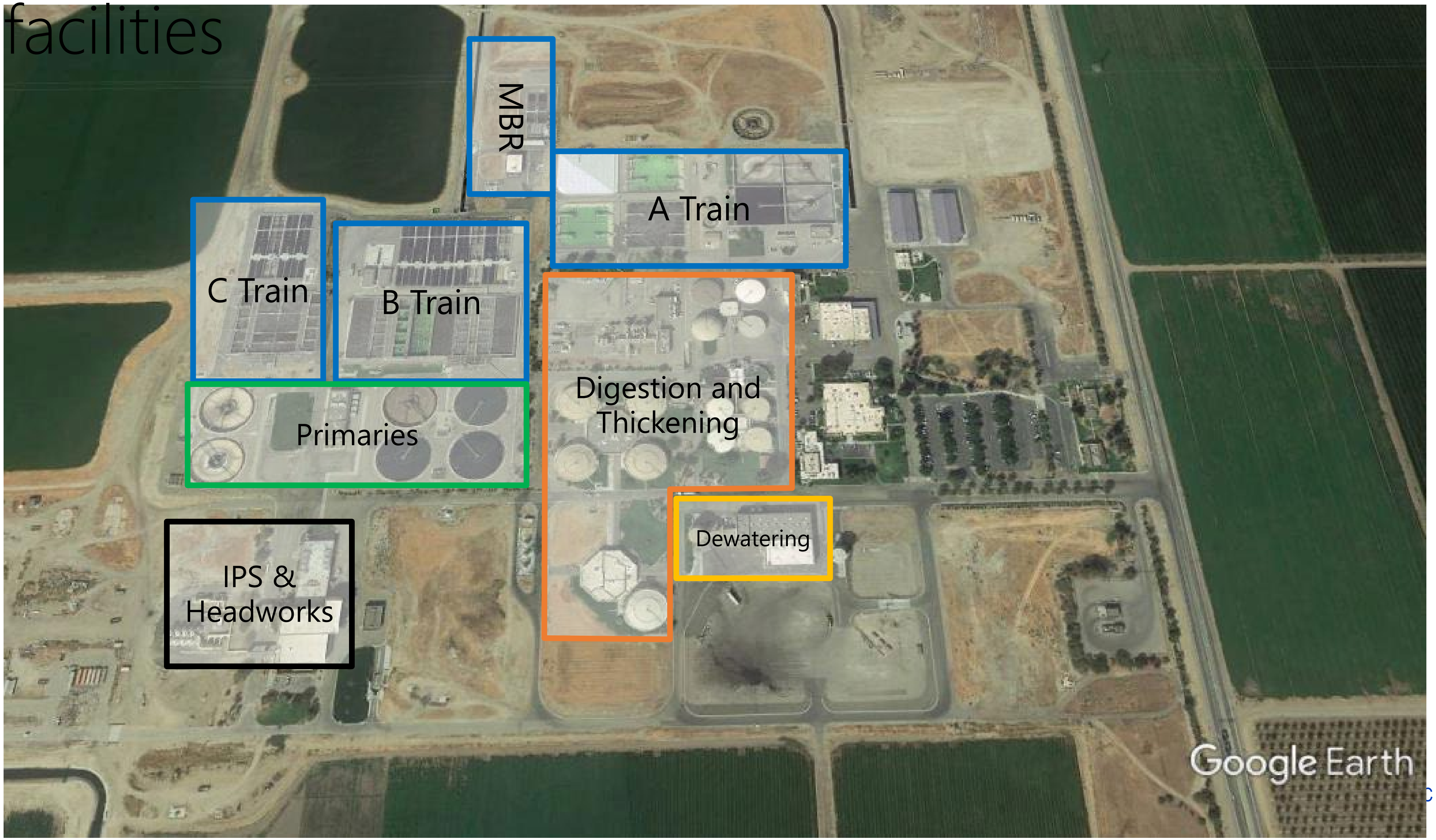
- Fresno Background and Overview
- Project Drivers
- Technology Selection
- Piloting and Design
- Lessons Learned and Next Steps

City of Fresno Service Area

- Population 550,000
- 2% Annual Growth
- 135 square miles
- 180 miles to SF and 220 miles to LA
- 1,600 miles of sanitary sewer
- 15 lift stations
- 2 Treatment Plants
  - » Fresno-Clovis RWRF
  - » North Fresno WRF

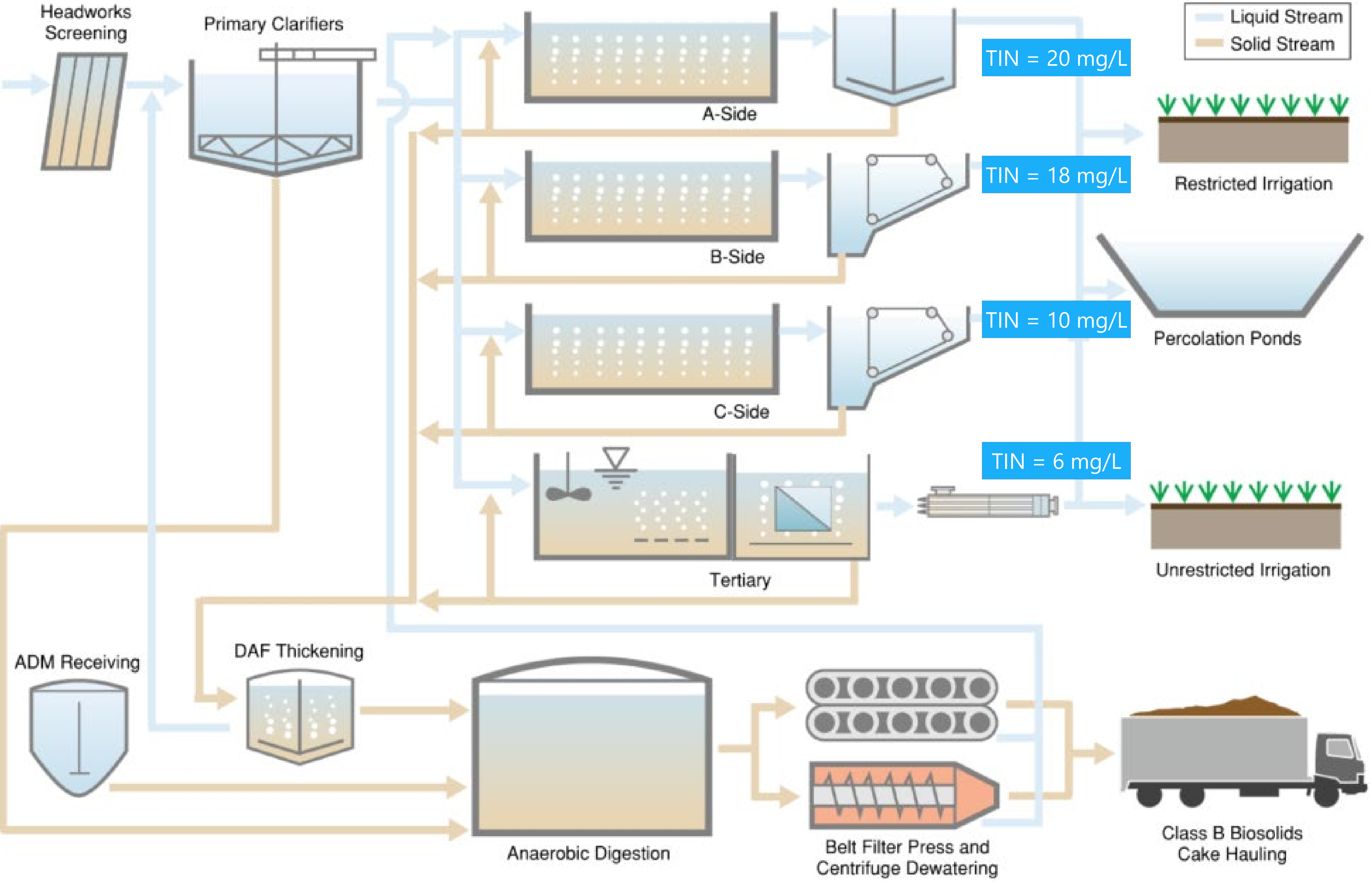


// RWRF was master planned with room for future facilities



RWRF Process Flow Diagram

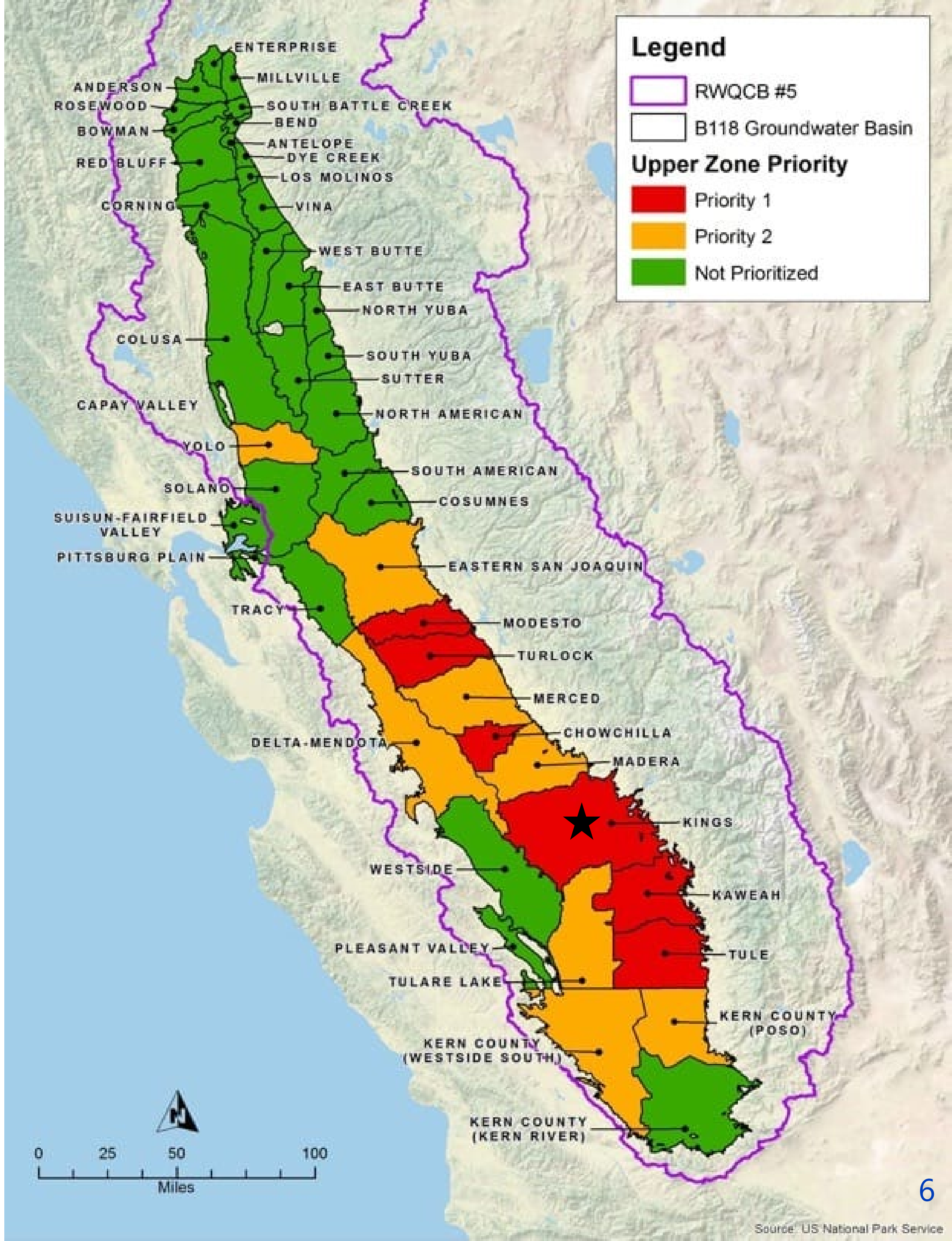
- Current 55 mgd, design 91.5 mgd
- 4 sludges (3 secondary; 1 tertiary)
- 2 types of dewatering
- MAD with FOG codigestion
- Avg Eff TIN 15 mg/L to Soil Aquifer Treatment percolation beds
- SAT denitrifies



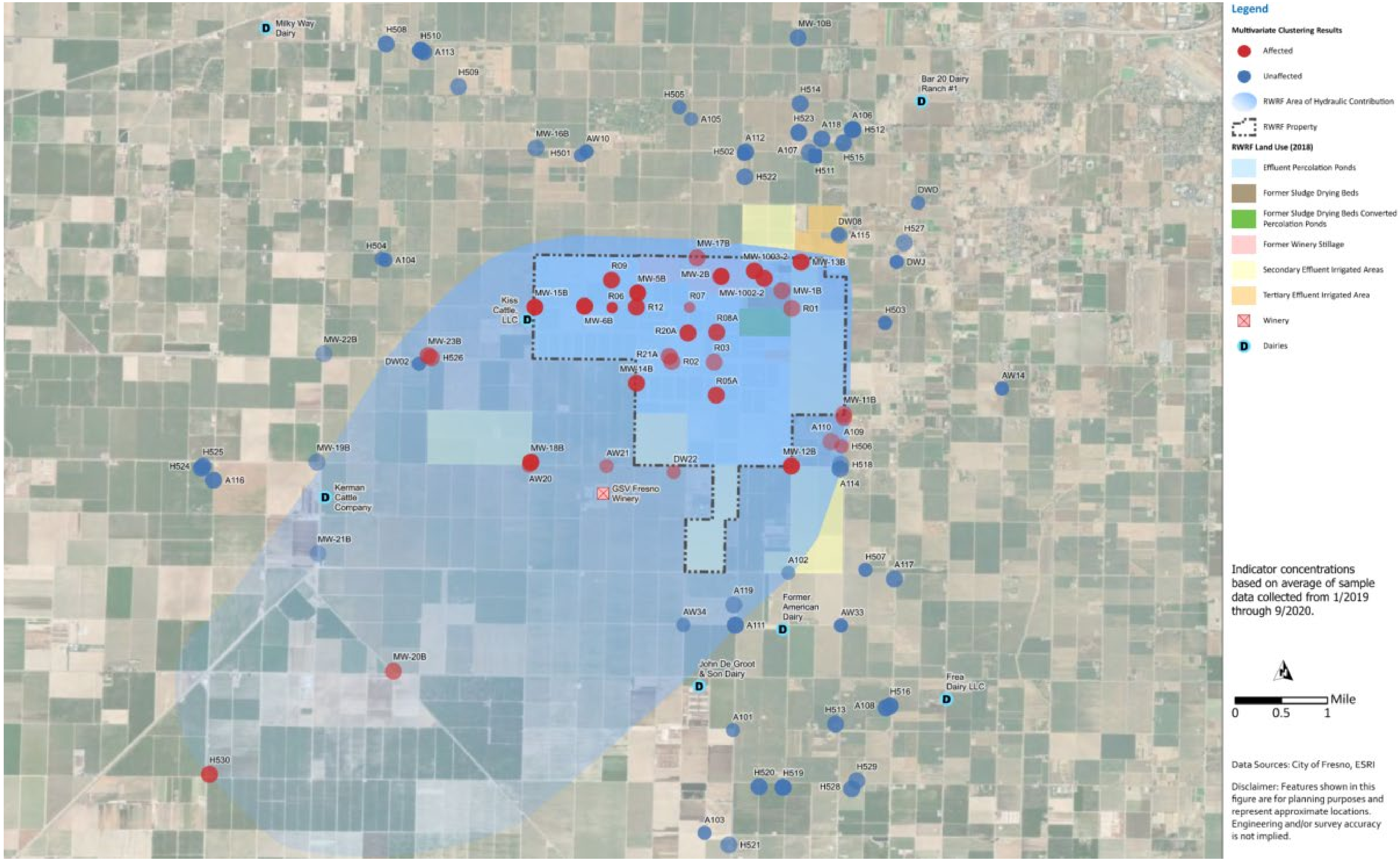
Project Drivers

- CV Salts – Nitrate Control Program
  - » Requires compliance with 10 mg/L groundwater nitrate objective
  - » RWRF path to nitrate removal
    - – Soil aquifer treatment
    - – Process optimization
    - – NATES Project

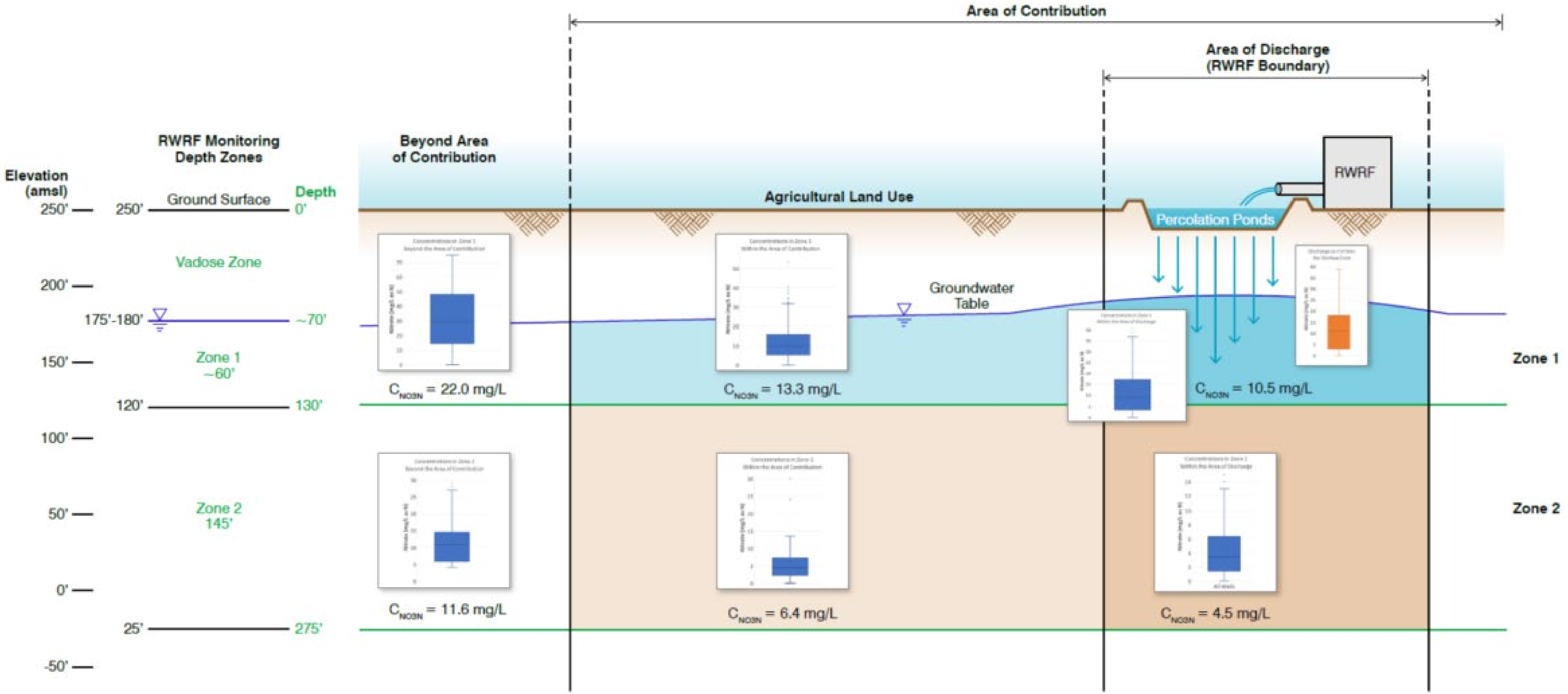
- Sidestream nitrogen overloads tertiary train, reducing recycled water production



RWRF Monitoring Wells



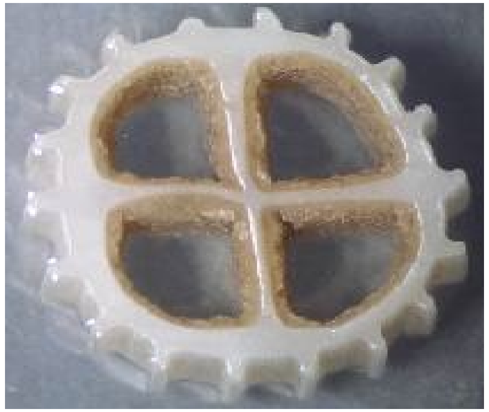
Groundwater Nitrate around RWRF

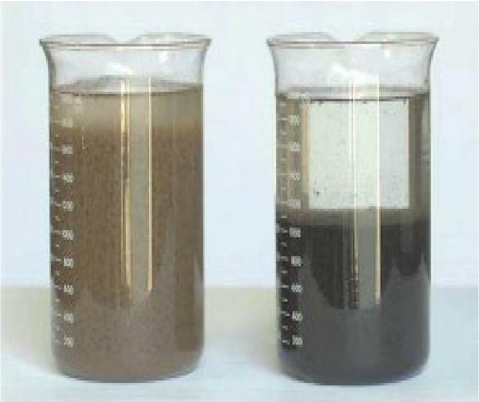


NATES Considered "Universe of Technologies"

$8-10/lb N

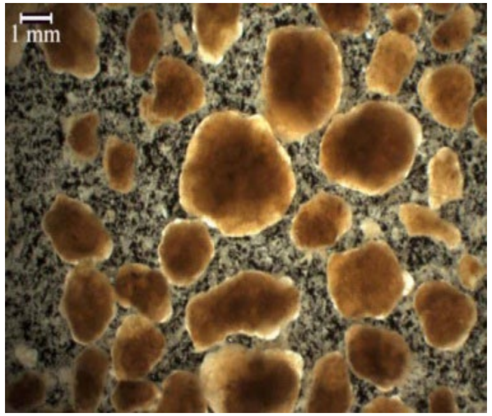
Conventional Activated Sludge BNR





Activated Sludge Intensification

Post Secondary Removal



Emerging Technologies

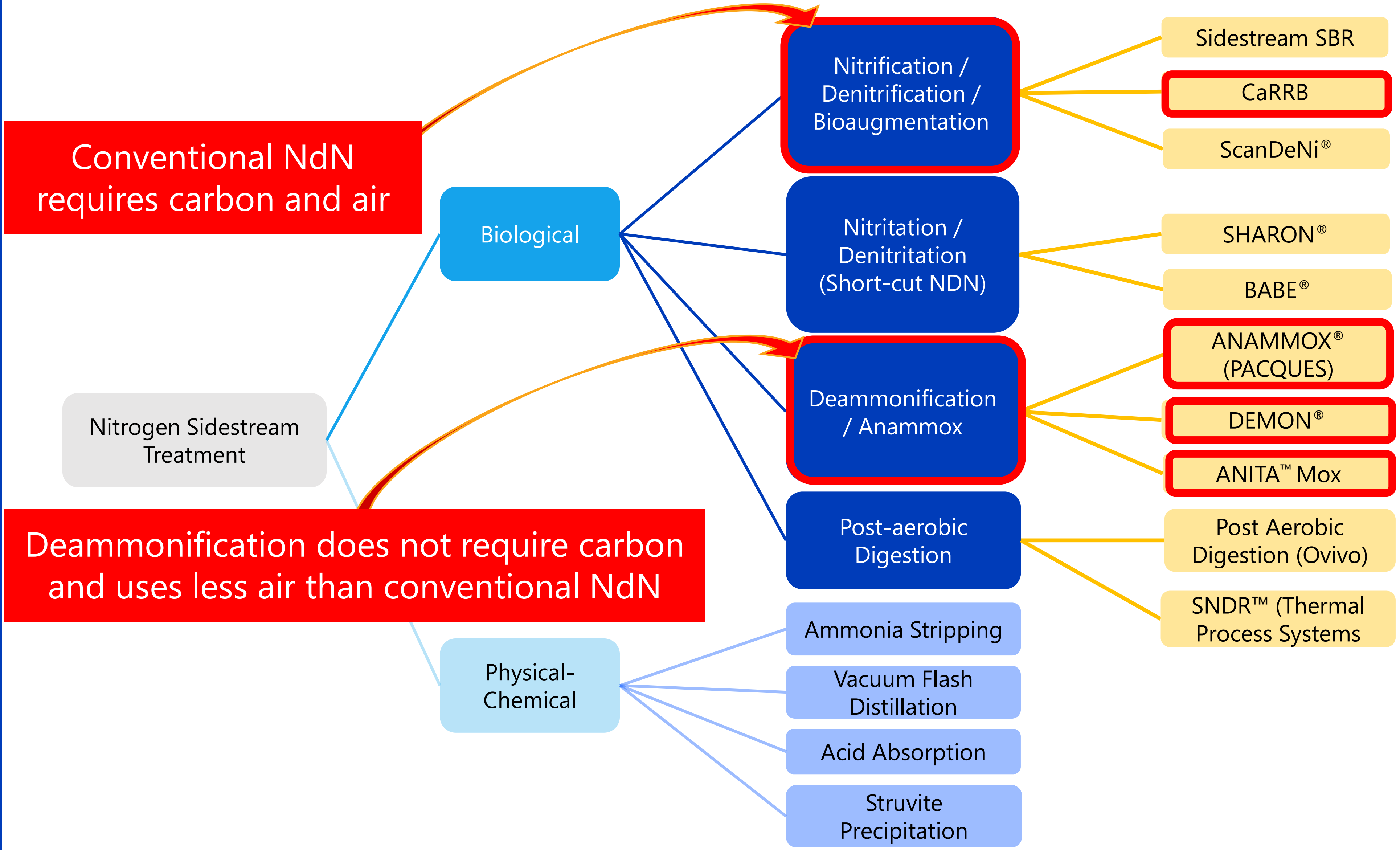
Sidestream treatment provided sufficient removal to meet proposed target

Defers more costly liquid stream capacity expansions

Sidestream Treatment

$2-3/lb N

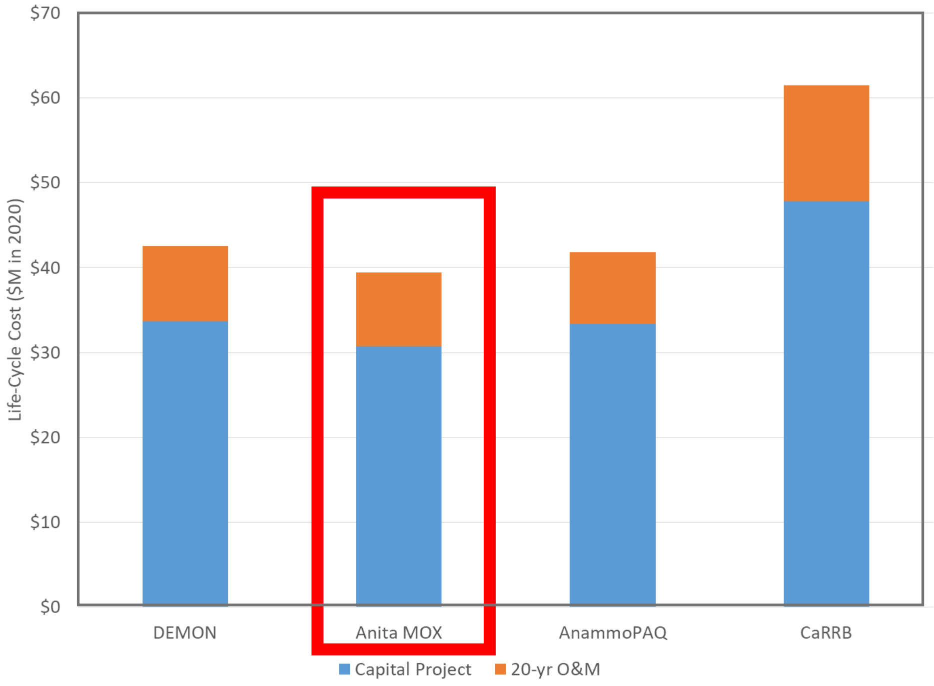
Types of Sidestream Nitrogen Removal

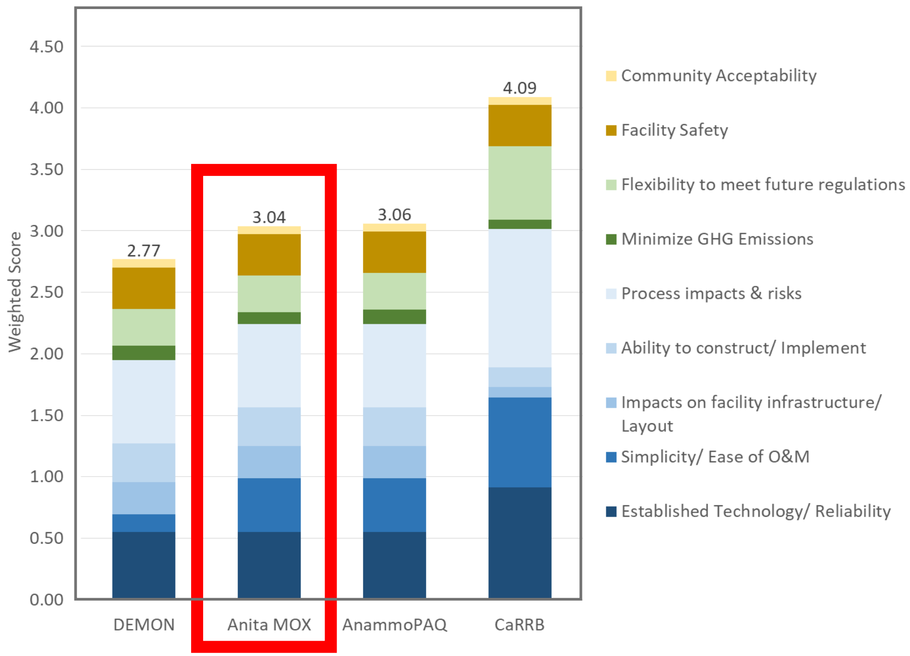


ANITA™ Mox process was selected based on economic and non-economic comparison

- ANITA™ Mox had lowest capital and NPW
- CaRRB required larger reactors
- Integrating 4 process trains and sludges drove up CaRRB cost

- CaRRB had highest non-economic score, but higher cost and integration challenges
- Based on interviewed of full-scale facilities, ANITA™ Mox scored highest in O&M

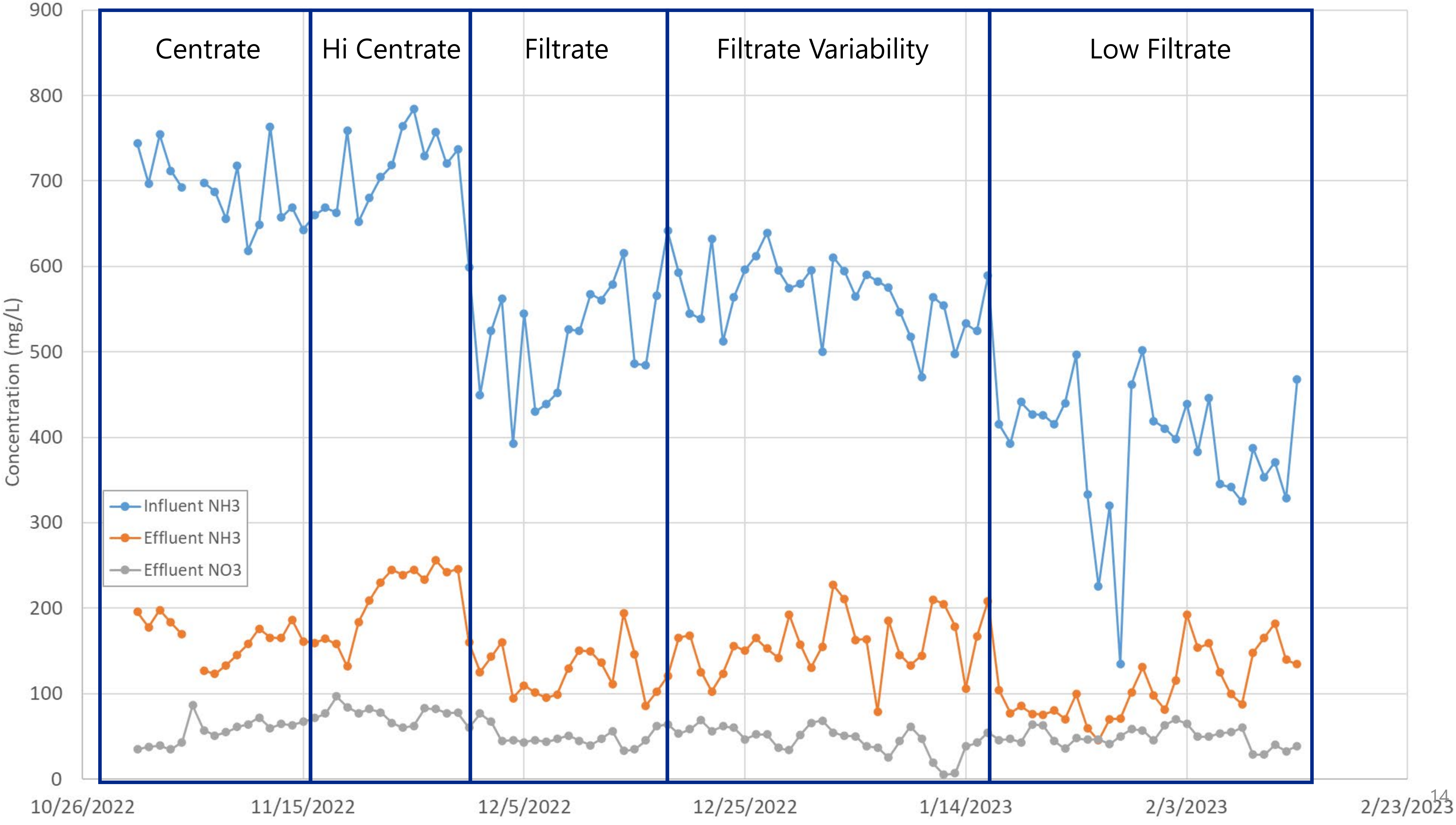




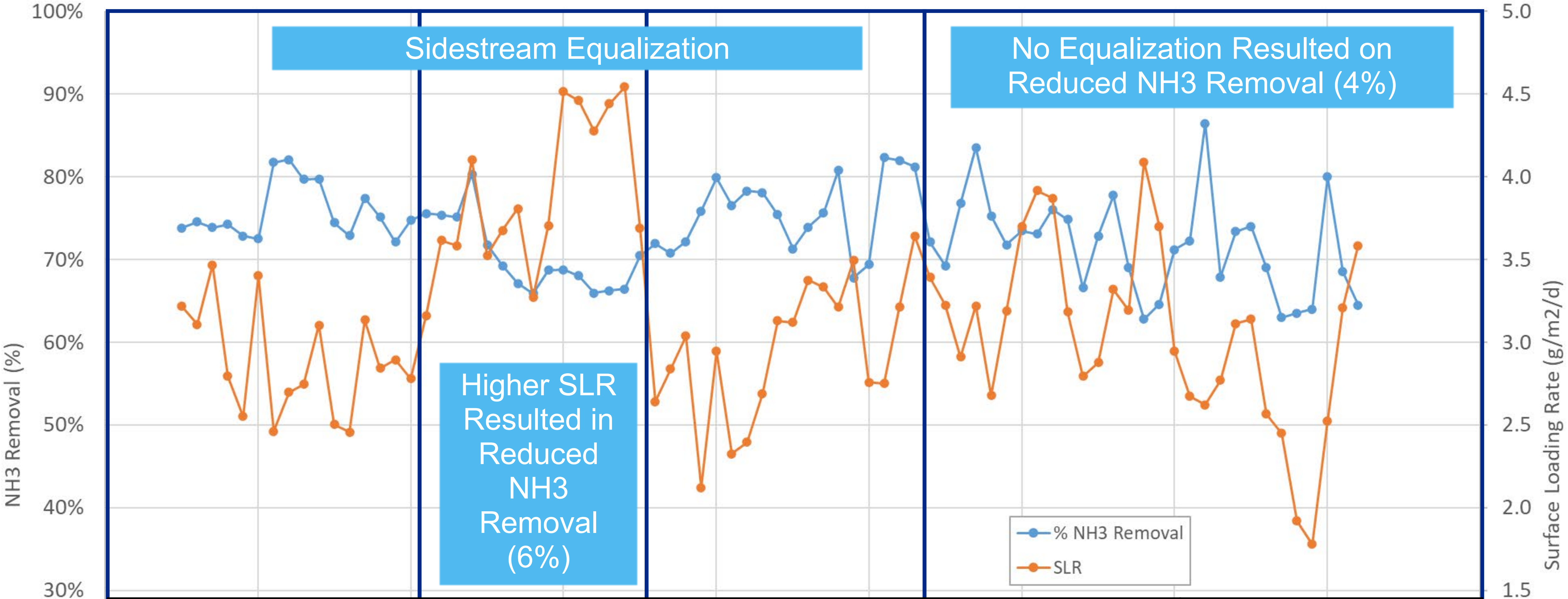
Piloting was recommended as first step in design process

- Although plant dewaters 24/7, see significant variability in feed characteristics
  - » belt filter presses and centrifuges
  - » washwater contributions and equipment cycling
- Wanted to evaluate benefit of reducing washwater dilution and impact to performance and struvite potential
- Desired additional data to optimize design and develop reasonable performance guarantee
- Is sidestream equalization necessary?
- Is chemical addition (alkalinity and micronutrients) necessary?
- No City experience with deammonification

ANITA™ Mox pilot at RWRF

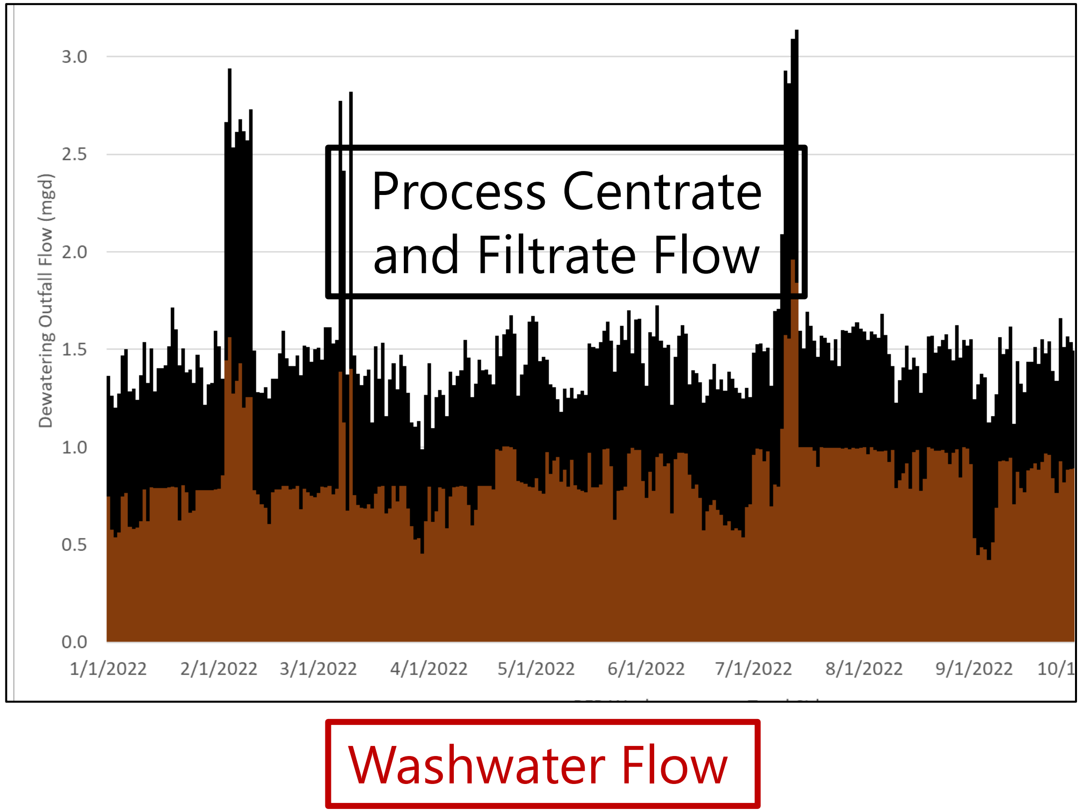


Centrate
Hi Centrate
Filtrate
Filtrate Variability
Low Filtrate
Concentration (mg/L)
900
800
700
600
500
400
300
200
100
0
10/26/2022
11/15/2022
12/5/2022
12/25/2022
1/14/2023
2/3/2023
2/23/2023
Influent NH3
Effluent NH3
Effluent NO3



Centrate	High Centrate	Filtrate	Filtrate Variability	**Phase**
2.9	3.9	2.9	3.1	**SLR (g/m2/d)**
76	70	76	72	**% NH3 Removal**
67	59	65	62	**% TIN Removal**

Optimizing BFP operation and minimizing washwater was key for deammonification performance

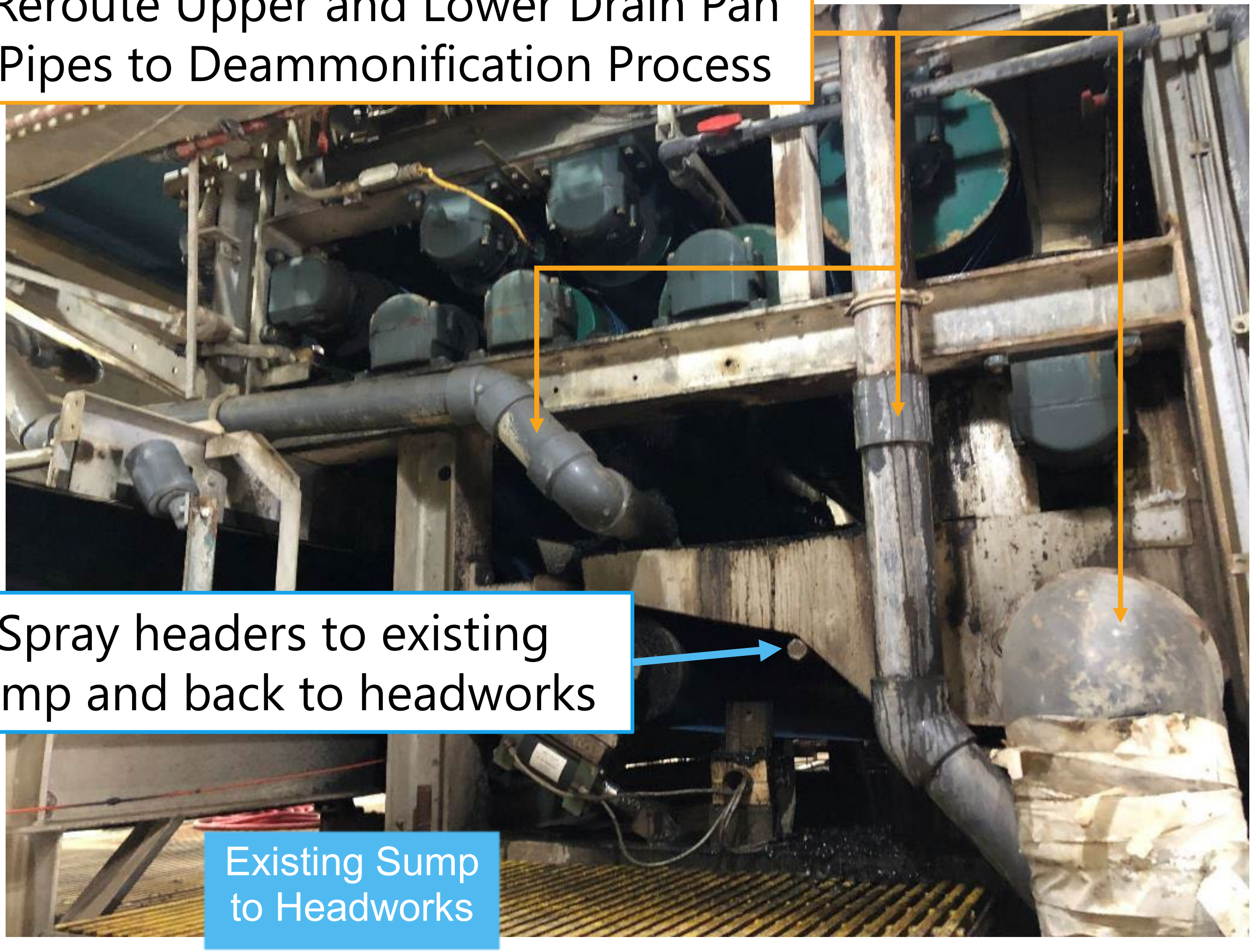


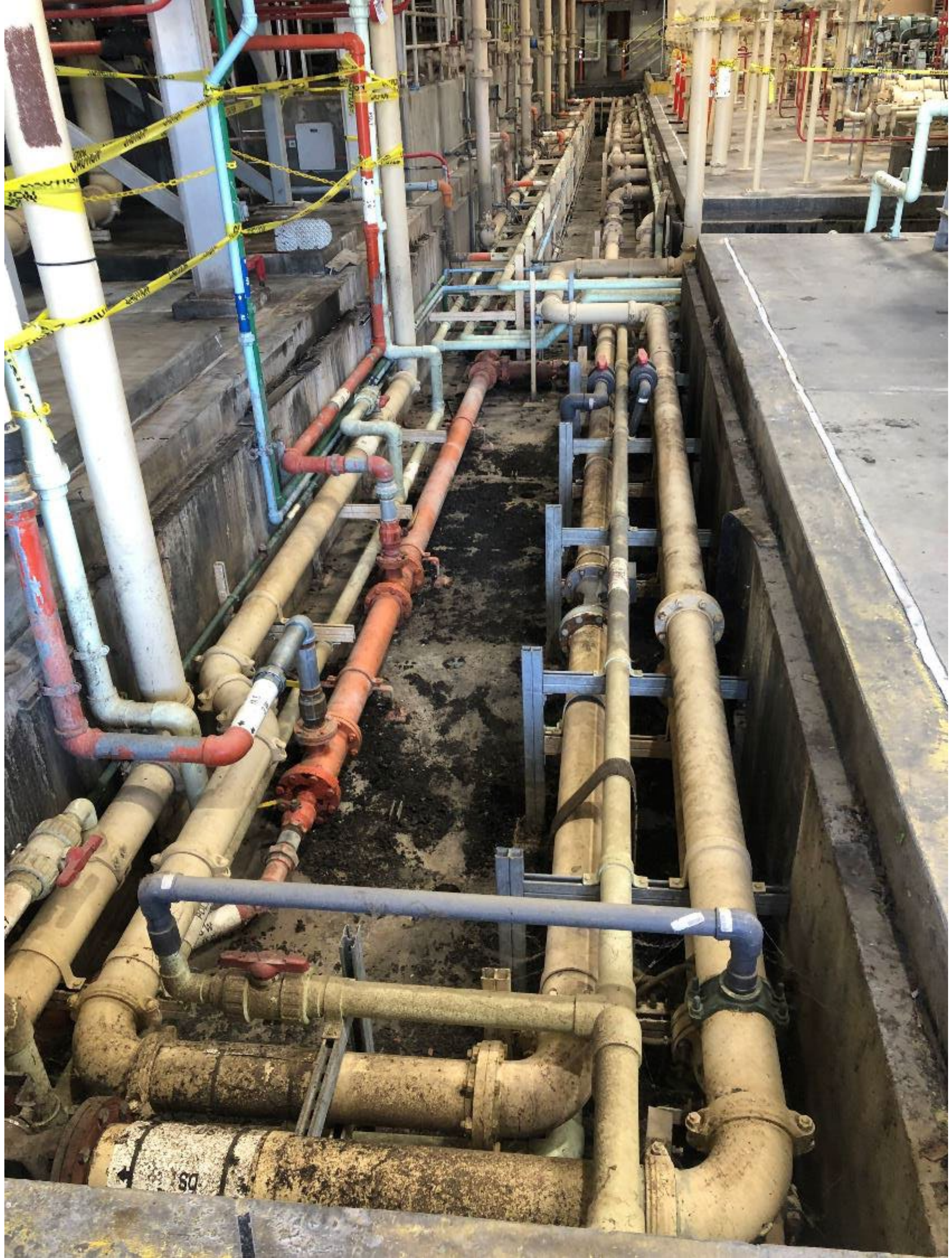
Residual NH_3 is necessary to maintain proper ratio of AOBs, NOBs, and anammox bacteria

Parameter	Current Characteristics	With Dewatering Optimization
Feed NH_3, mg/L	400	700
Eff/Reactor NH_3, mg/L	150	150
% NH_3 Removal	60%	80%
% TIN Removal	50%	70%

Increased NH_3 concentration increases struvite potential, additional piloting to mitigate

Piping Modifications to Reduce Washwater in Sidestream





Decided to include Equalization in Project

- Little full-scale experience w/o EQ
- Improvement in performance
- Easier to operate and reduced variability
- Can be used for media storage if reactor needs to be taken OOS
- Wide spot for solids accumulation (observed in pilot)
- EQ could be leveraged for future struvite harvesting facility




Project Status

- Currently negotiating NCP compliance details with Regional Board
- 100% ANITA™ Mox Design Complete
- Pursuing SRF loan
- Bid in Spring 2025
- 24-month construction duration
- Design for 7,250 lb/d NH_3, 1.2 mgd
- Expand to 9,500 lb/d NH_3 with additional media fill
- Construction cost opinion at $38M

Lessons Learned and Next Steps

- Great value and benefit from piloting
- Deammonification works, industry still learning best practices for design
- Consider site visits
- Don’t forget procurement of specialized equipment packages

Thank you!

Questions?

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