

# Aerobic Granular Sludge Process

Wolcott WWTP Unified Govt. of KCK

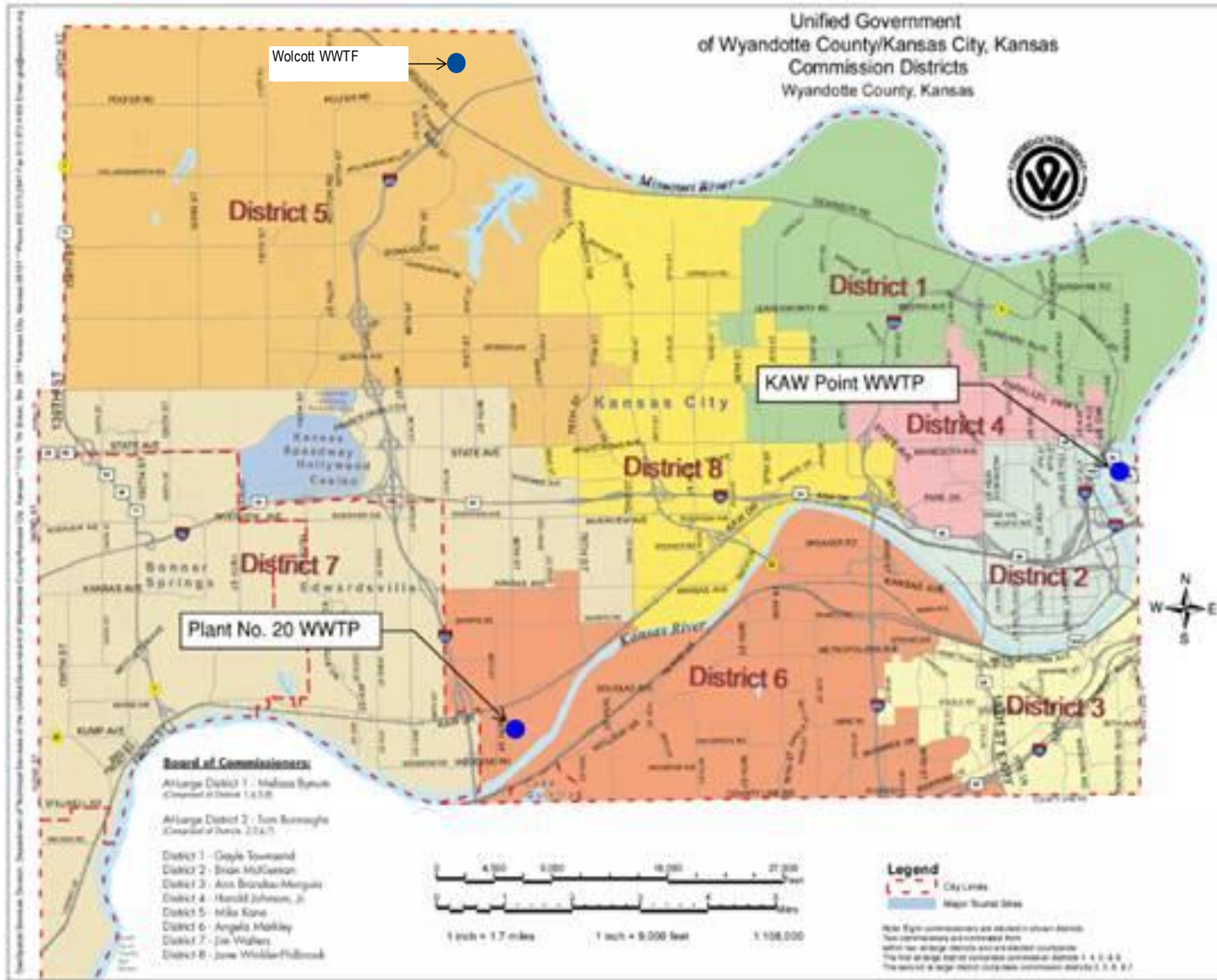
Lewes BPW Presentation by Brandon J. Coleman, PE



January 29, 2024



# Unified Government Wastewater Service Area

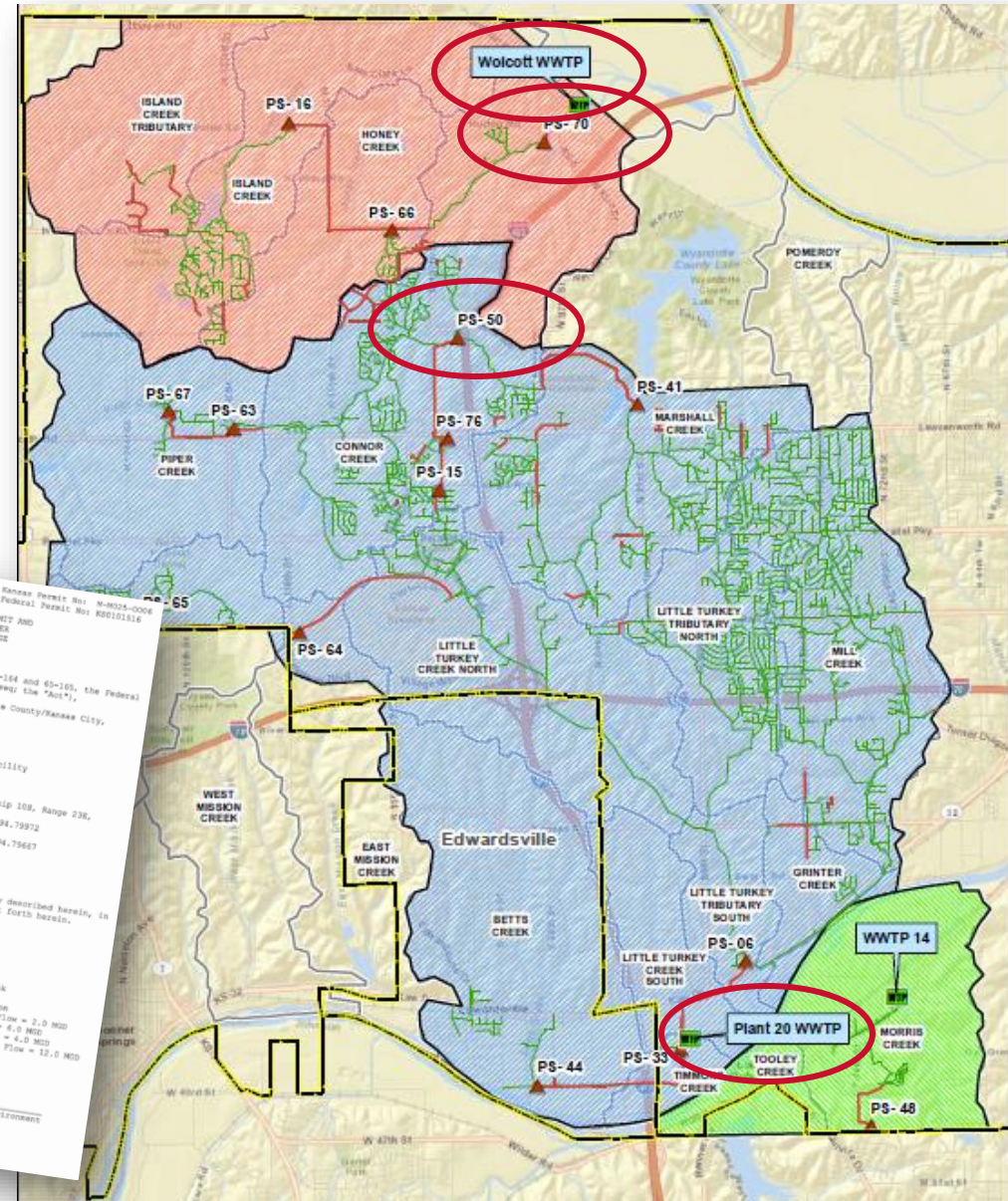


- Service area
  - 160,000 people
  - 150 square miles
- 5 WWTPs over 8 service districts
  - Kaw Point
  - Plant 3
  - Plant 14
  - Plant 20
  - Wolcott
- Combined treatment: 35 MGD

# Wolcott Wastewater Treatment Plant

## Project Drivers

- Growth within Wolcott watershed
- Reduce sanitary sewer overflows
- Reduce pollutant load to Kansas River
  - Improve dissolved oxygen conditions



# Secondary Treatment Alternatives Evaluation

**ALT 1**

Conventional  
3-Stage  
(Diffused)

**ALT 2**

Conventional  
3-Stage  
(Mechanical)

**ALT 3**

Integrated fixed-  
film activated  
sludge  
(IFAS)

**ALT 4**

Single basin,  
phased nit/denit  
(PNDN)

**ALT 5**

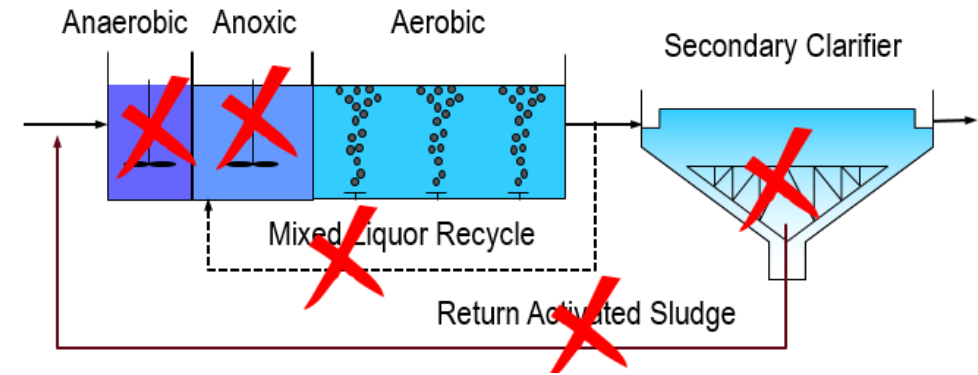
Aerobic Granular  
Sludge  
(AGS)

# ALT 5

## AGS

### Features

- Similar to SBR, single tank operation (parallel trains)
- BNR via granular microbe population
- No separate clarification / RAS pumping

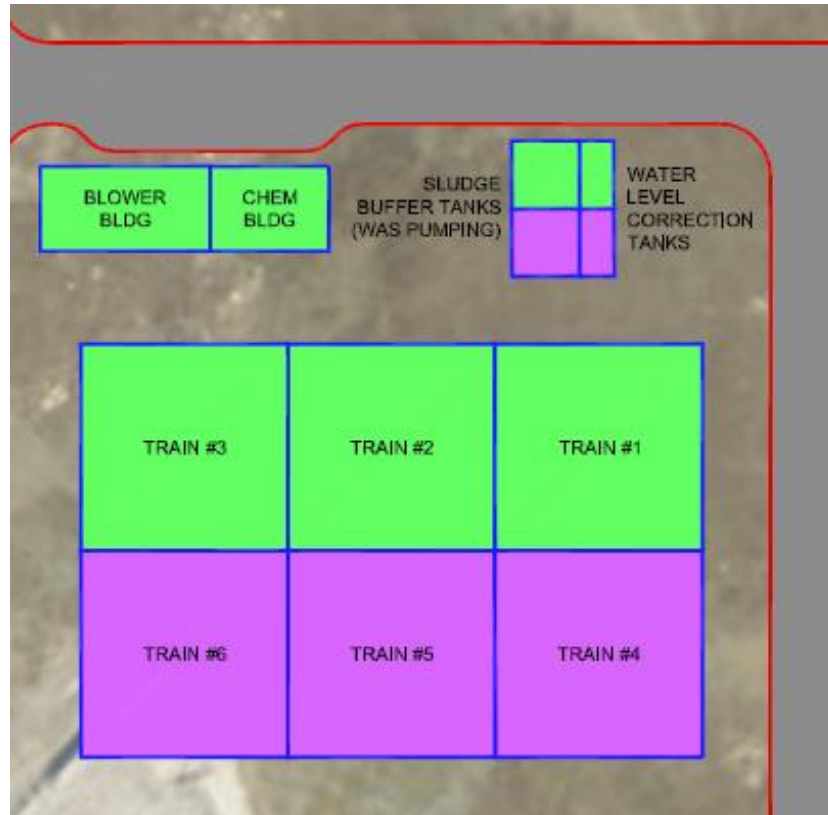


### Advantages

- Reduced footprint, deep SWD, process intensification, no separate biological stages, clarifiers / RAS pumping (*applicable to Lewes*)
- Advanced treatment levels (*applicable to Lewes*)
- Rapid settling granules

### Disadvantages

- Newer technology (Over 100 installations with 16 in the US)
- Need for flow EQ (>3:1 PF ratio, 2 basin operation)
- Controls/instruments/modulating valves complexity (compared to traditional CAS)



# Secondary Treatment Alternatives Evaluated

Alternative	Capital Cost <sup>(1)</sup> (Millions)	Annual O&M Cost <sup>(1)</sup>	20-Year NPV Cost <sup>(1)</sup> (Millions)
Alt. 1 – Conventional 3-stage (Diffused)	\$16.6	\$198,000	\$19.9
Alt. 2 – Conventional 3-stage (Mechanical)	\$18.9	\$333,000	\$24.3
Alt. 3 – IFAS	\$18.2	\$246,000	\$22.3
Alt. 4 – Conventional Single Basin (Phased NDN)	\$17.9	\$263,000	\$22.1
Alt. 5 – AGS <b>PREFERRED ALTERNATIVE</b>	\$12.0	\$163,000	\$14.7

(1) Cost for secondary treatment train only, 2018 dollars.

# HDR Installations/Evaluations of AquaNereda®

## Operational:

Location	Design Capacity (mgd, average daily)
Wolcott, KS	2.0
South Sioux City, NE	2.5

## Under Design:

Location	Design Capacity (mgd max month)
Cedar Rapids, IA	67
Omaha, NE Missouri River WWTF	46
Omaha, NE Papillion Creek WWTF	95
Charlotte, NC	15

## Pilot Studies:

Location	Design Capacity (mgd max month)
Reno, NV	16

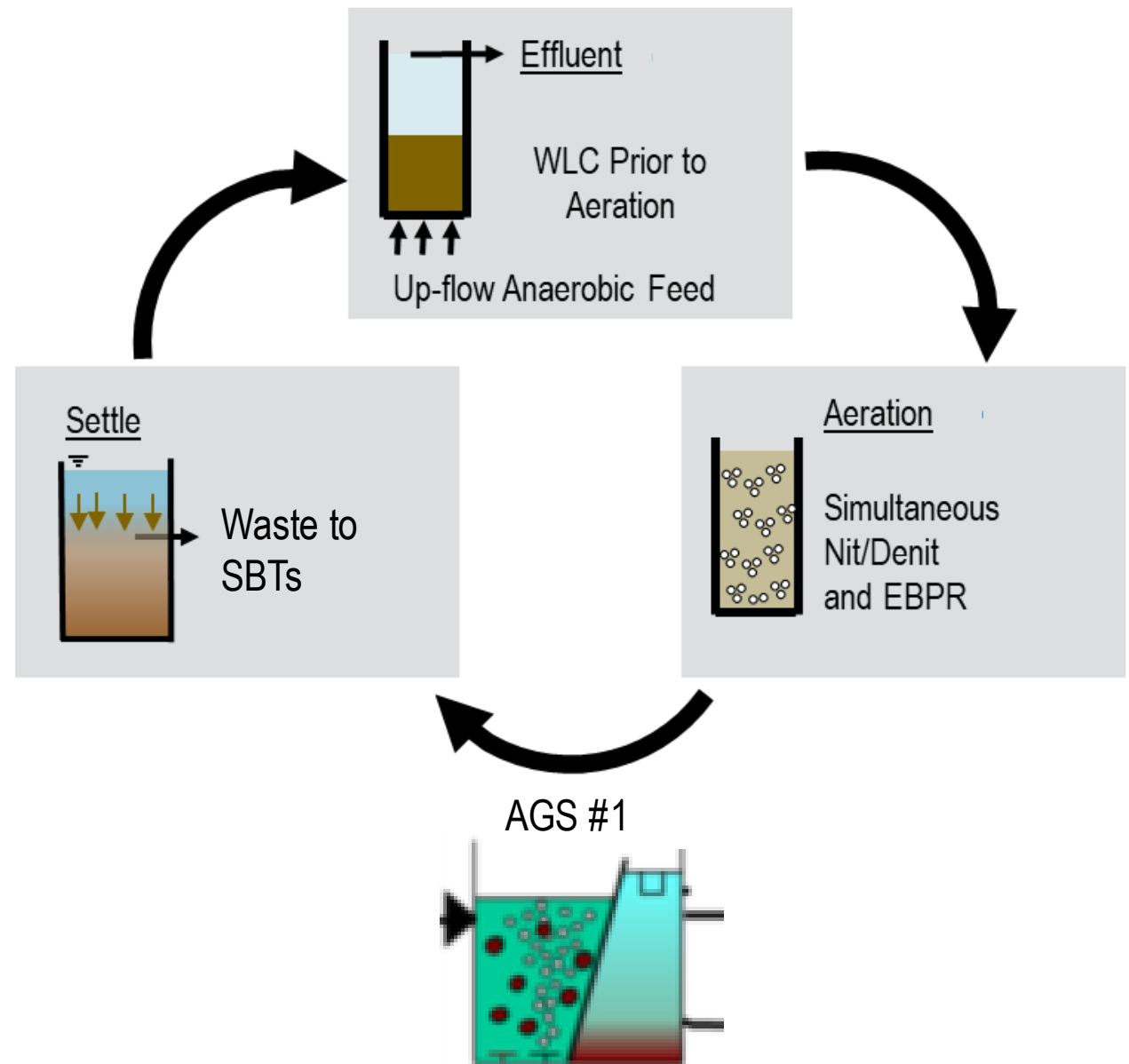
## Desktop Evaluations:

Location	Design Capacity (mgd max month)	
Perryville, MO	3.0	2019
Ames, IA	2.9 initial/8.8 buildout	2018
Council Bluffs, IA	14	
Rock Hill, SC	20	2018
Central San., CA	40	2018
Delta Diablo, CA	16	2019
Pacifica, CA	6	2019
East Bay MUD, CA	91	2019
Lewisville, TX	27	2020
Clear Lake, IA	3.6	2020
Wilkesboro, NC	8	2021

# Aerobic Granular Sludge (AGS) Process

## What is AGS?

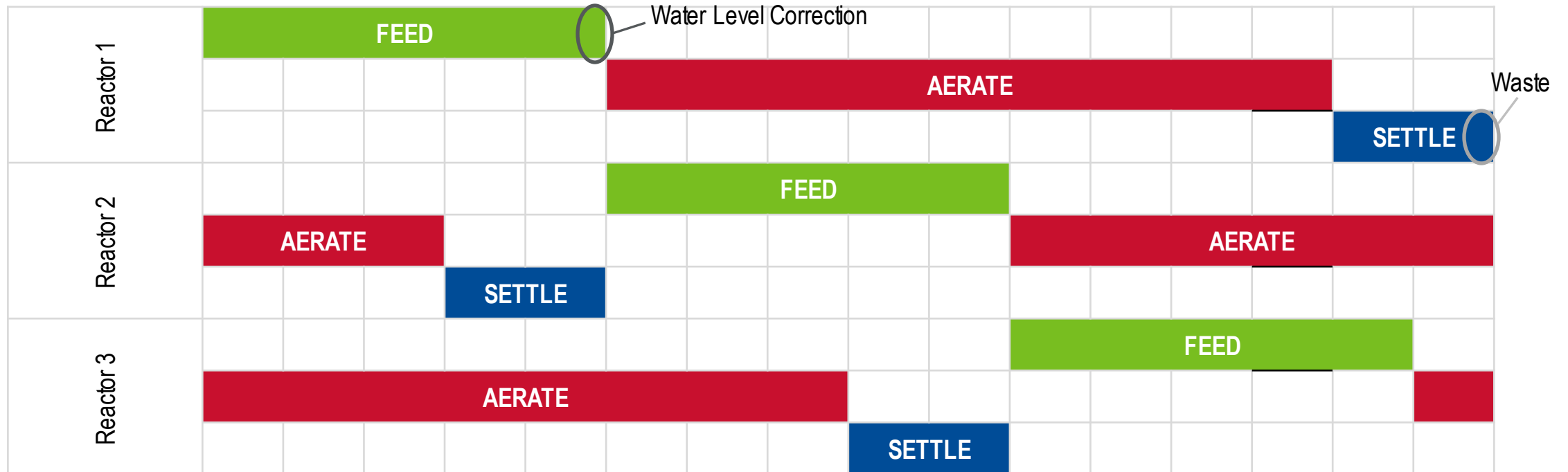
- Royal Haskoning DHV, Licensed in United States by Aqua-Aerobic
- “AquaNereda®”
- Cyclic process, similar to SBR with three primary cycles





# AGS Process – Cycles

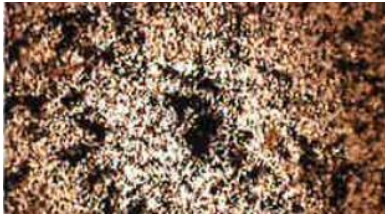
## Process Cycle



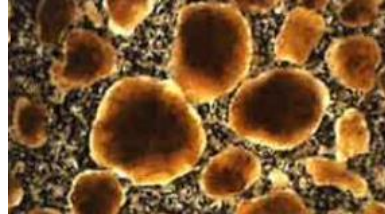
- Continuous Reactor Feed (one at a time)
- Modulating Airflow Between Active Basins

# What is a Granule?

- Microbial biofilms in the shape of a granule, formed without carrier media
- Much larger than traditional floc, particle sizes larger than 200 micron

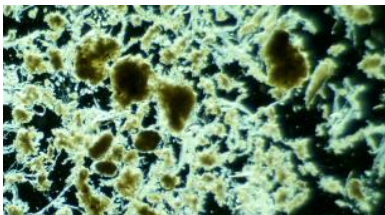


Conventional Activated Sludge

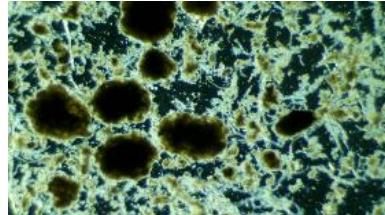


Aerobic Granular Sludge

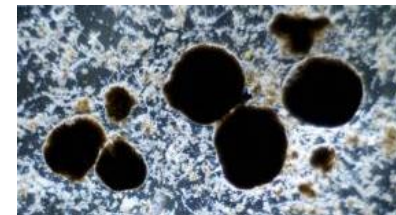
## Wolcott Granule Development



March 1st  
(~ 2 months)



March 24th  
(~ 3 months)



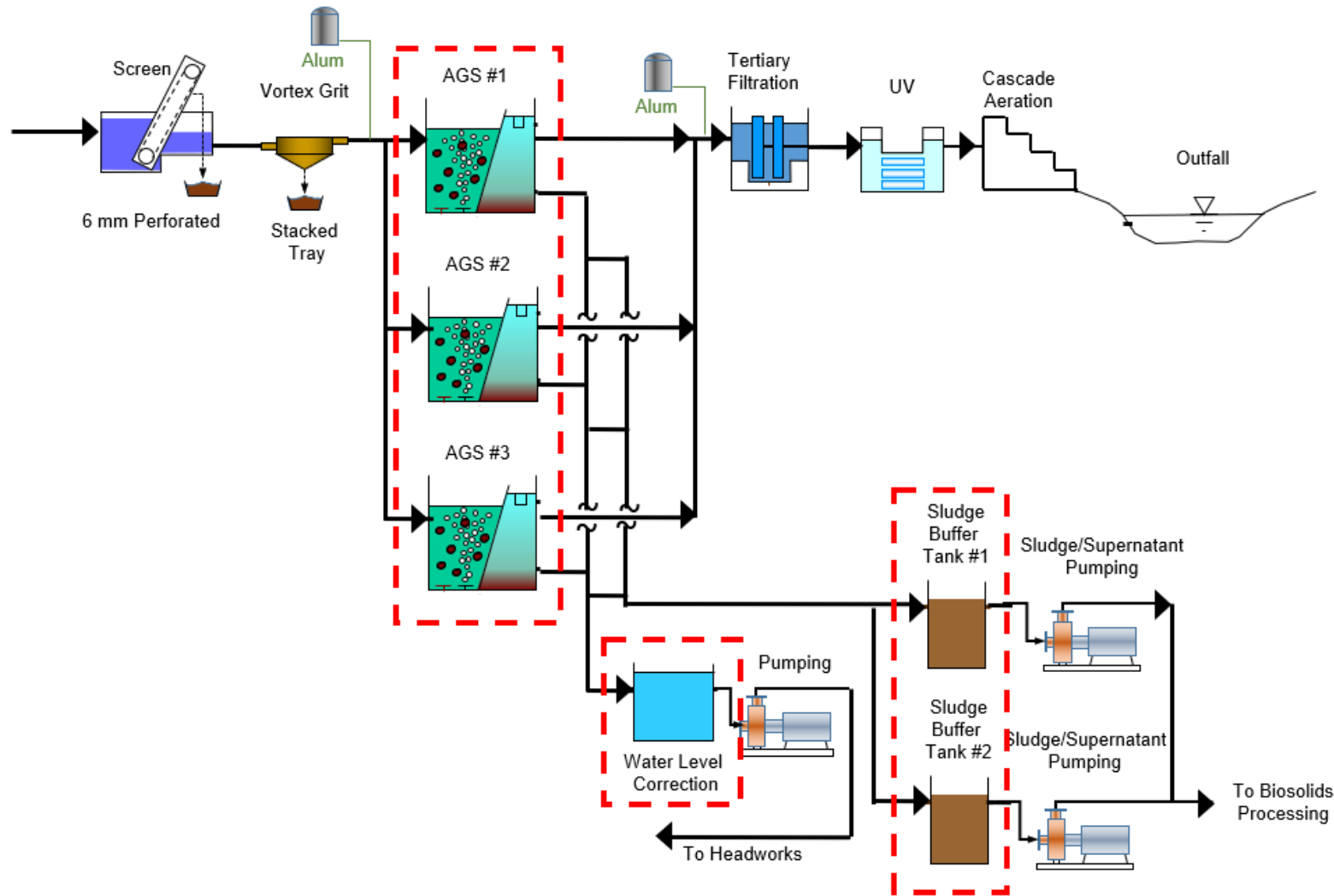
August 6<sup>th</sup>  
(~ 6 months)

# AGS Design Considerations

- Non-Disclosure Agreements (NDA)
- Regulatory Approval (first AGS facility in KS)
- Influent Screening Requirements
- FOG limitations (60 mg/L avg)
- Hydraulic constraints from Screening to AGS basins if retrofitting
- Start-up timeline requirements
  - With or without granule seed
- Instrumentation & Controls/Redundancy

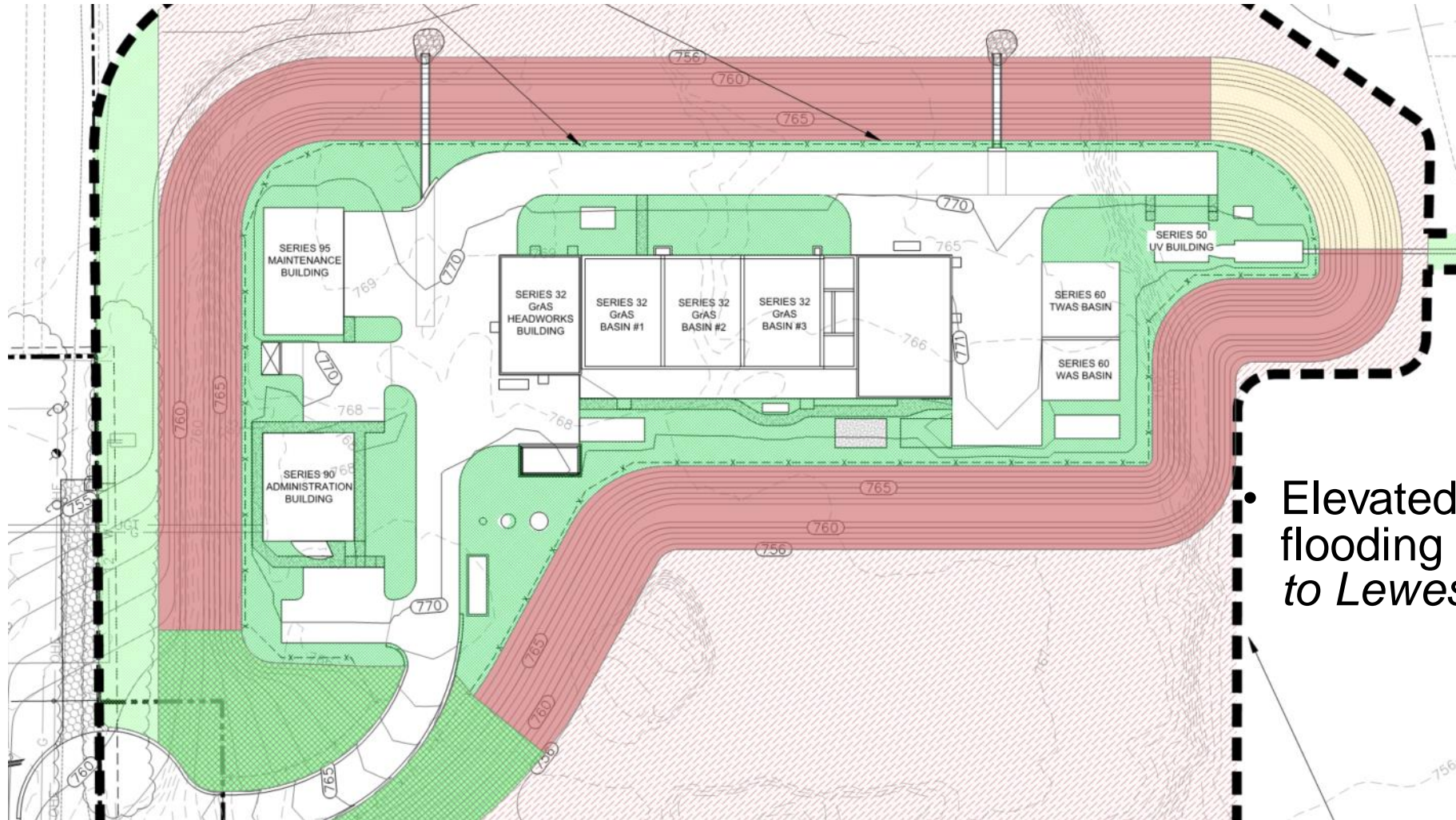


# Wolcott WWTF – Schematic/Design Values

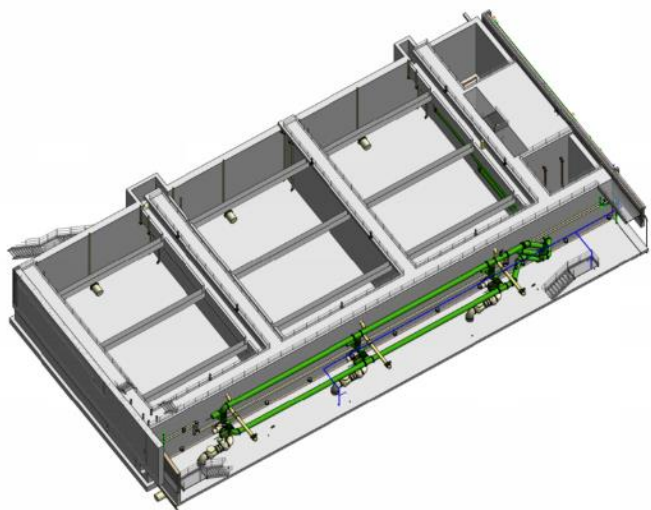
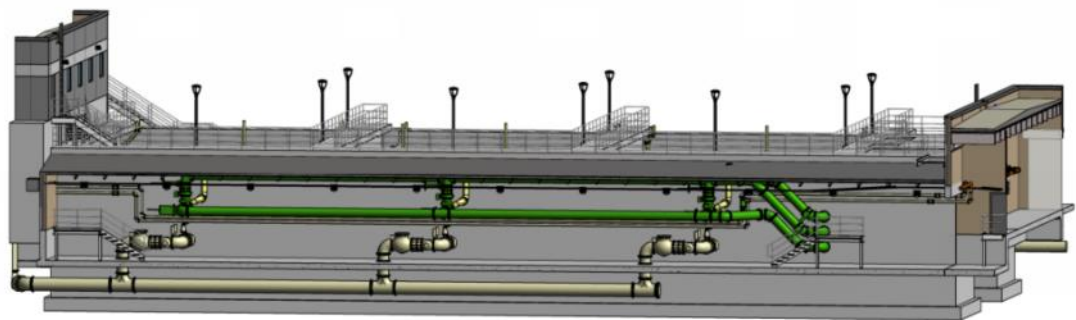
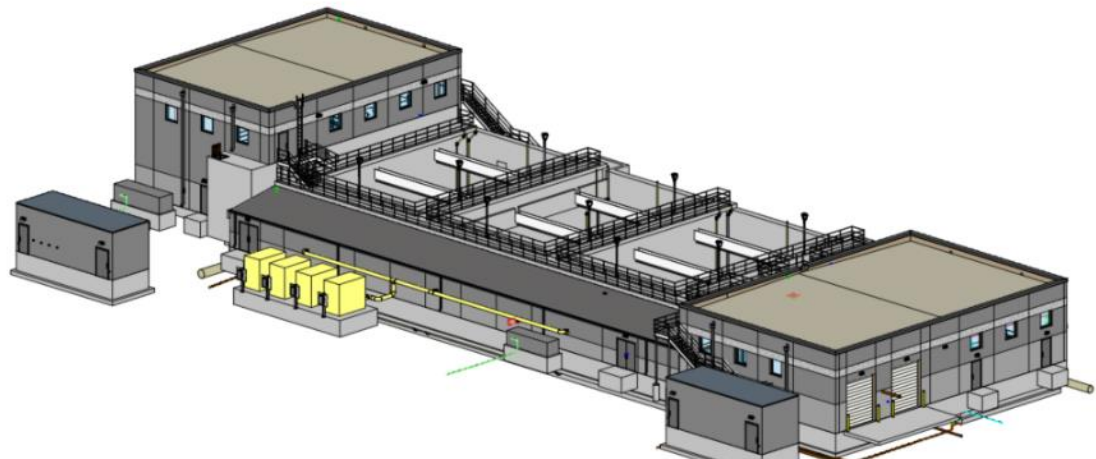


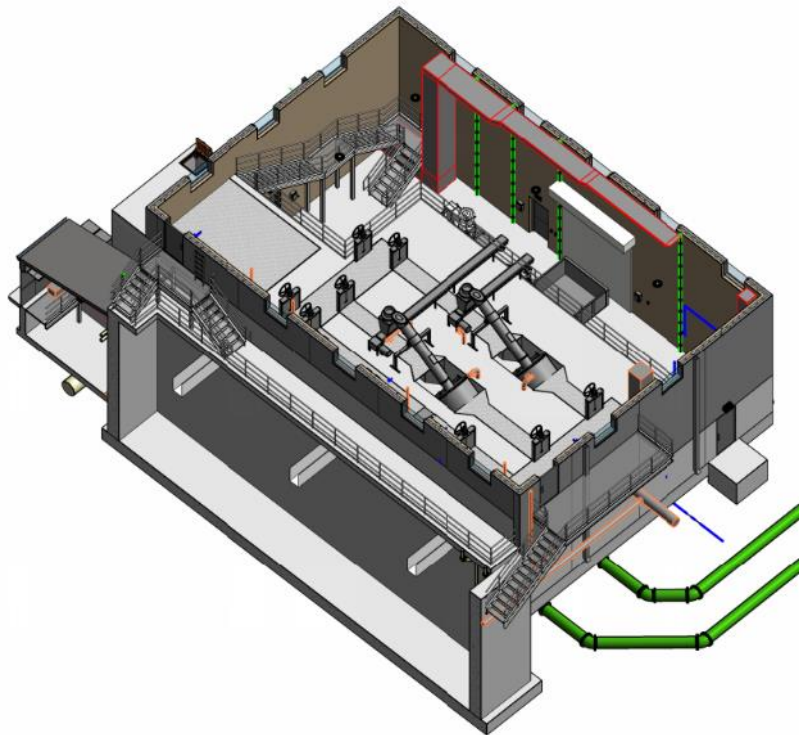
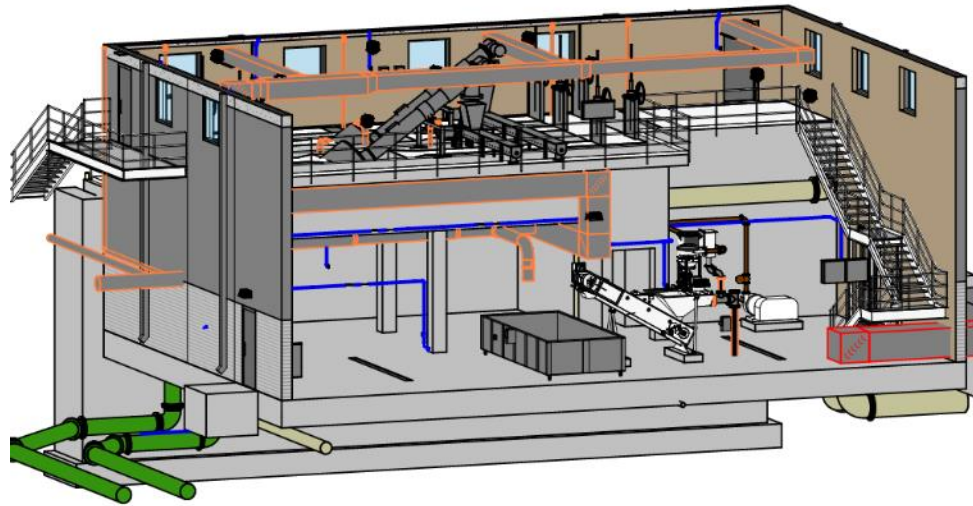
Design Criteria	
Design Average Flow	2.0 MGD
SRT @ 8,000 mg/l MLSS	18 Days
HRT	15 Hrs
Basin Volume, Total	1.23 MG
Number of Trains	3
Basin Dimensions (W x L)	42' x 62'
Train Depth (SWD)	21'

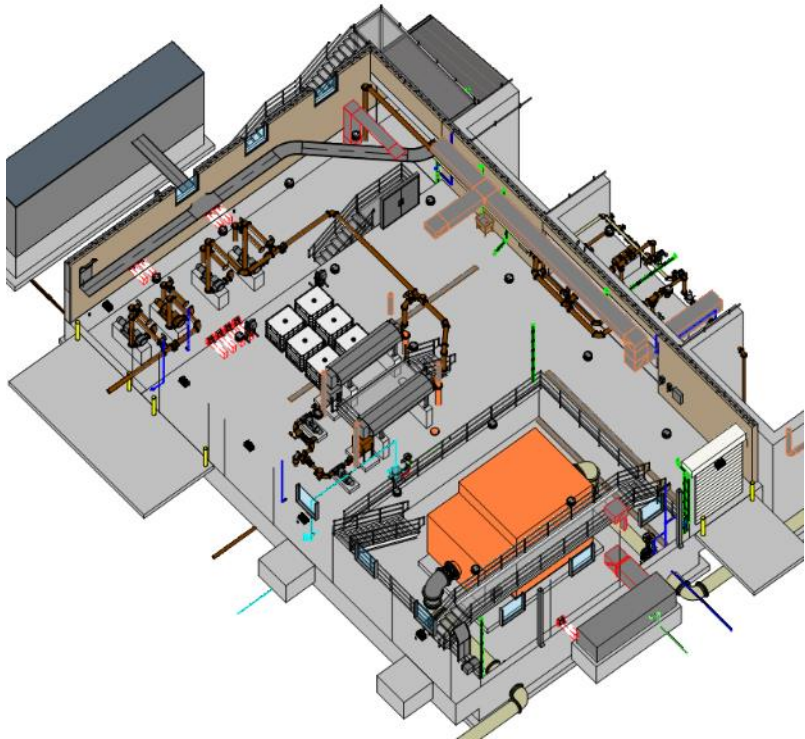
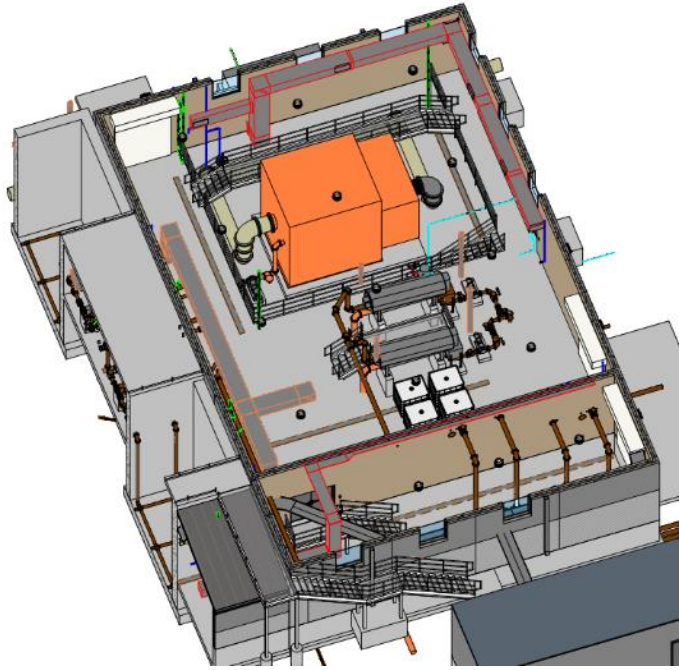
# Wolcott Site Plan – Design



• Elevated site due to flooding (*applicable to Lewes*)



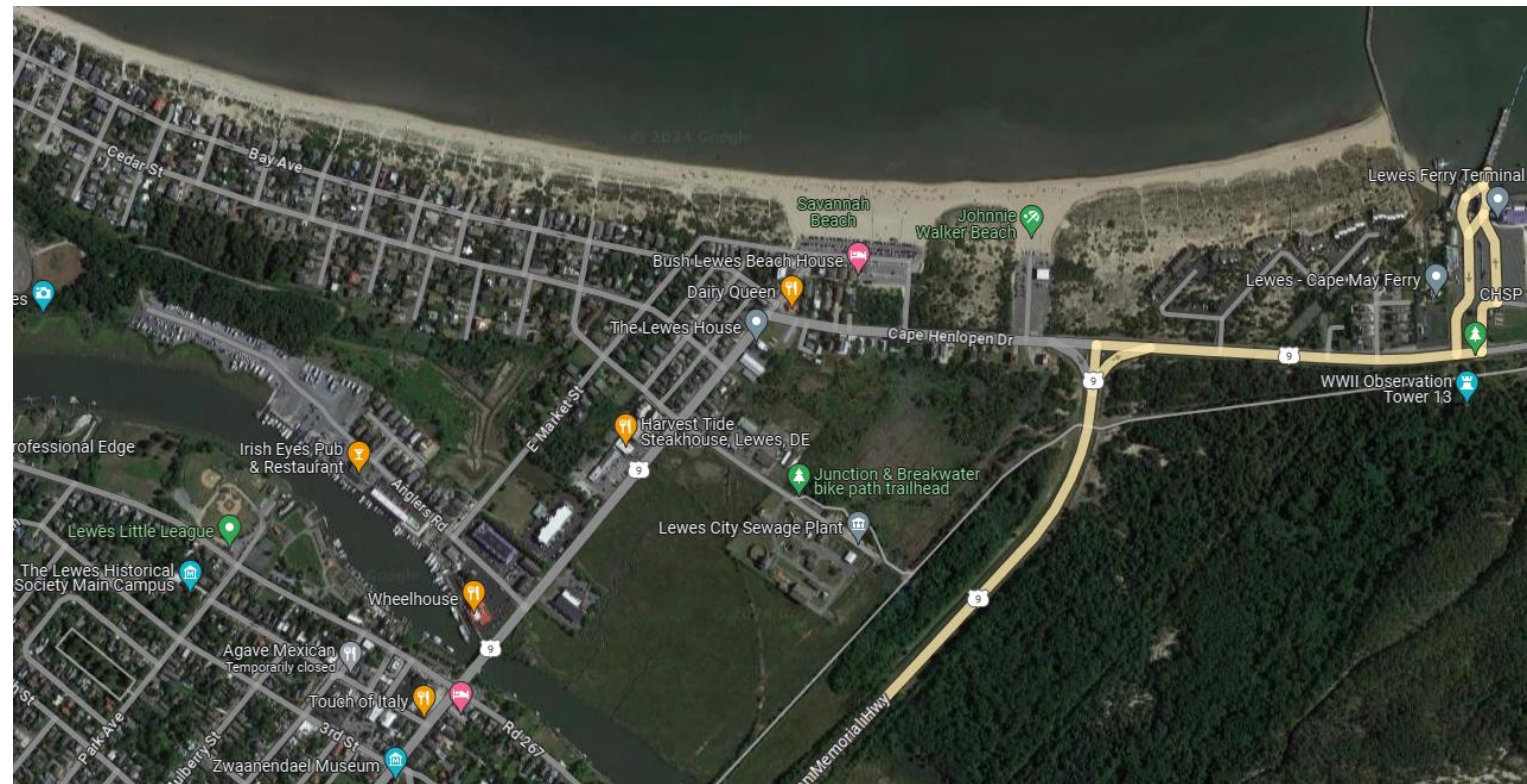




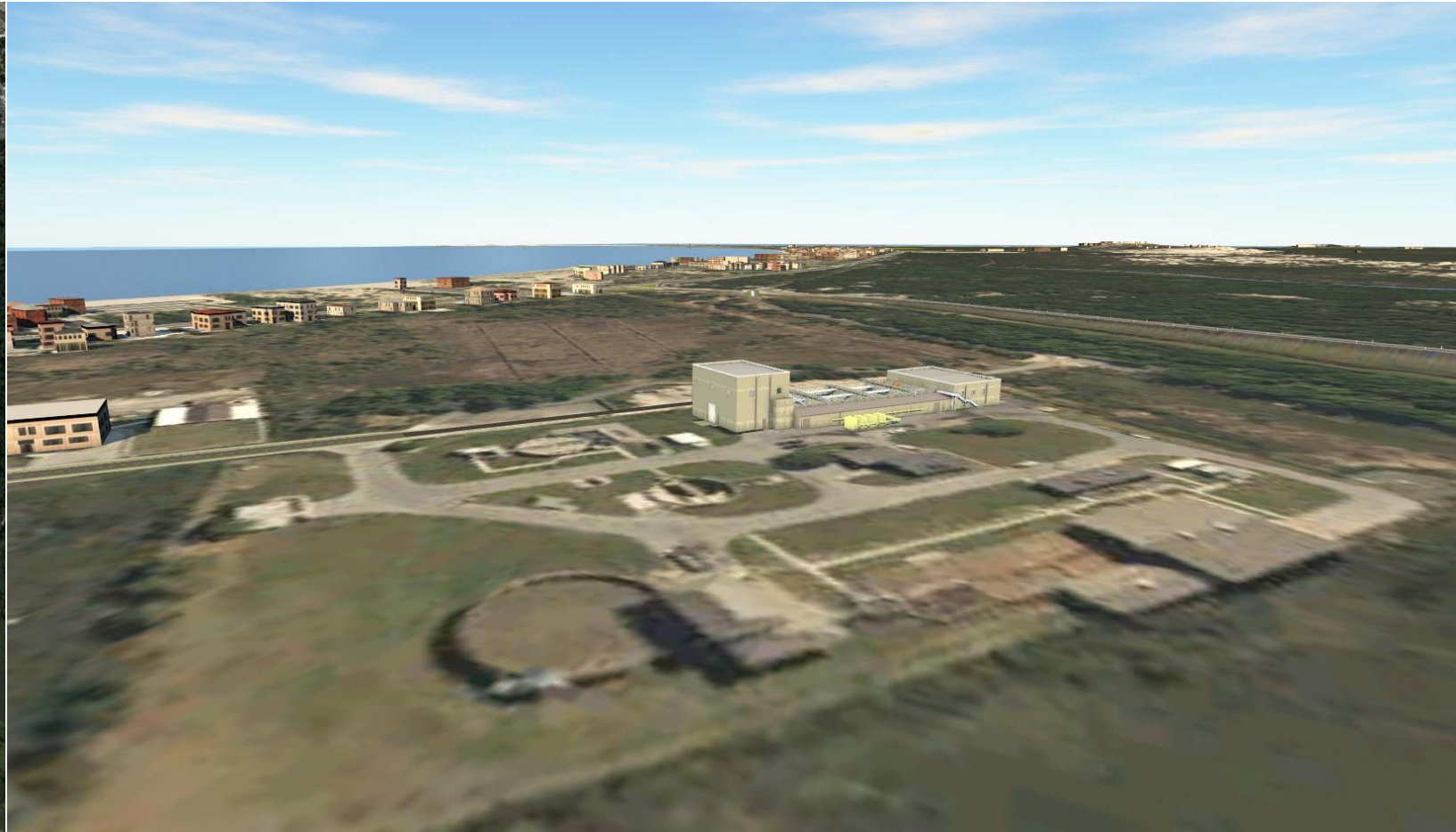


# Lewes Project Drivers

- Storm surge / flooding vulnerability at existing site
- O&M cost / complexity of membrane bioreactor system
- Influent screening requirements / complexity



# Lewes Site Option 1A – Located Over Existing Drying Beds



# Lewes Option 1B – Located on Existing Open Ground



# Lewes Option 2 – Alternative Site South of Canal





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