

Wisconsin Wastewater Operators Association

October 9, 2019

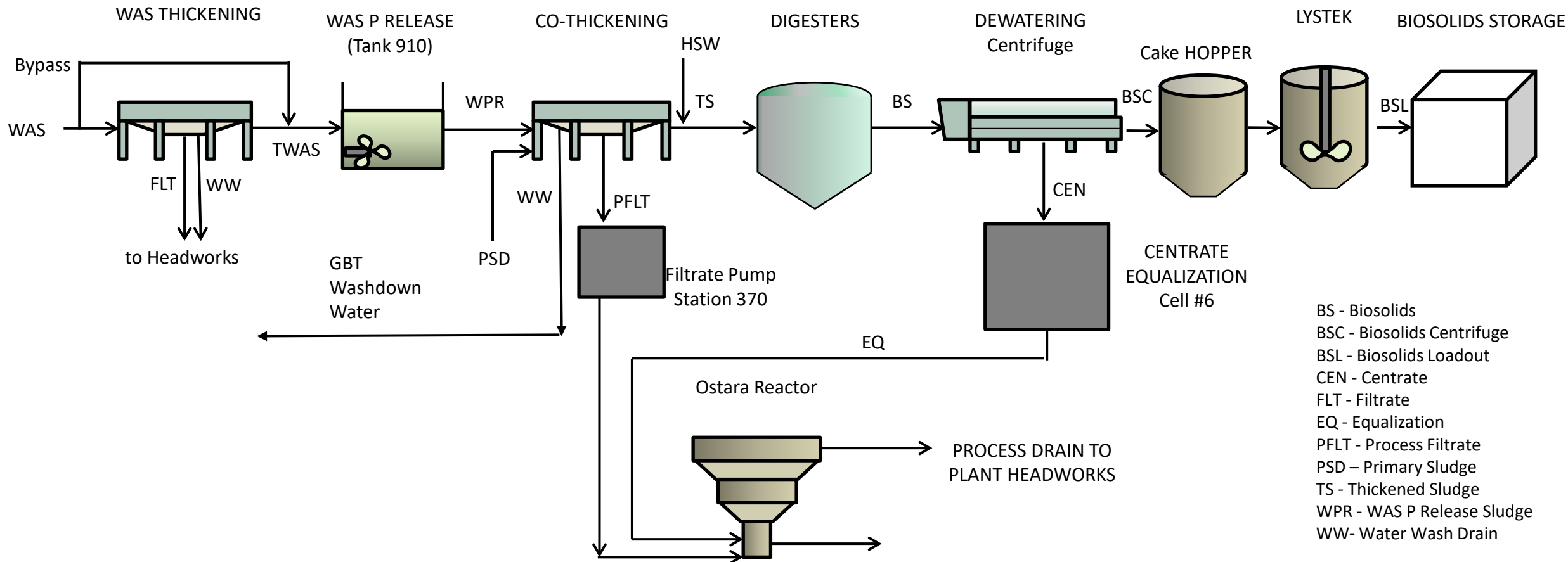
UNIQUE THICKENING AND DEWATERING OPERATIONS RELATED TO NUTRIENT REMOVAL

Allen Williams

St. Cloud NEW Recovery Facility



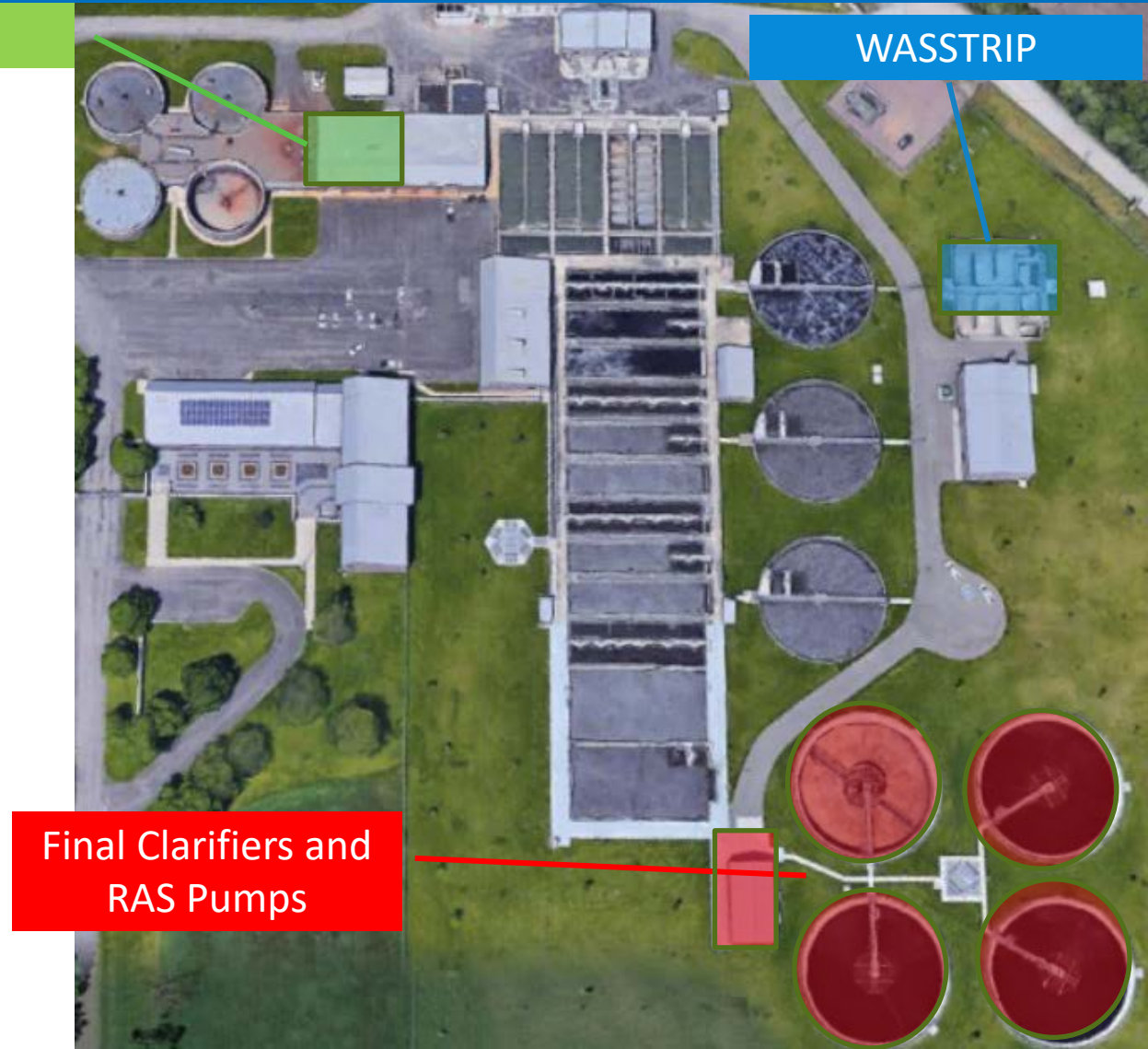
Overall Nutrient and Resource Recovery (NR2) Process Flow



WASSTRIP Related Innovative Design and Process Opportunity

GBT's

- Target: 24+ hours detention in WASSTRIP
- Thin WAS (<1% TS)
- WASSTRIP requiring 2% TS for 24 hours detention
 - Solution: Instead of introducing a new process to thicken – repurpose and utilize one of the existing GBT's to thicken WAS to 2% and then send to the WASSTRIP tank



GBT WAS Thickening Pilot

- Piloted getting 2% WAS off of the GBT
 - Belt Speed (20 to 100%)
 - WAS flow (110 – 180 gpm)
 - Dam position
 - Chicane positions
 - Polymer dose
 - Discussed different weave size of the belt



2% WAS



WAS Filtrate



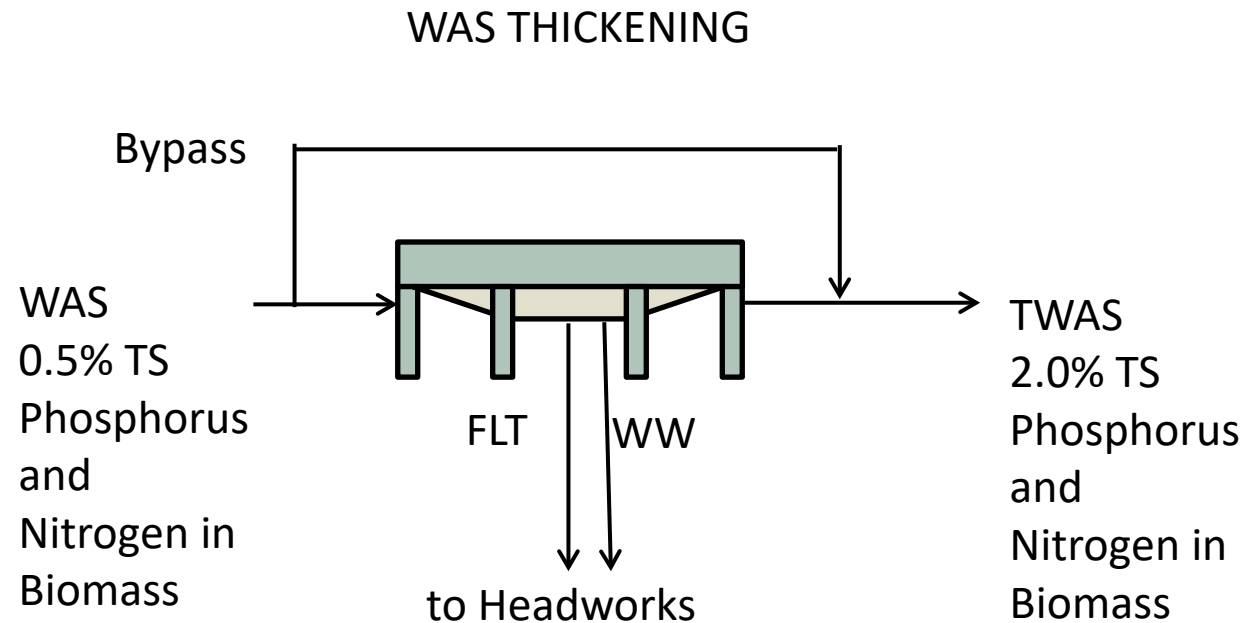
WAS and Co-thickening GBT Floc Hopper issues

- Low flows (100 gpm) to the large GBT's causing solids settling in upfront hopper and flow distribution problems on the gravity deck
 - Solution: Reduce the hopper size

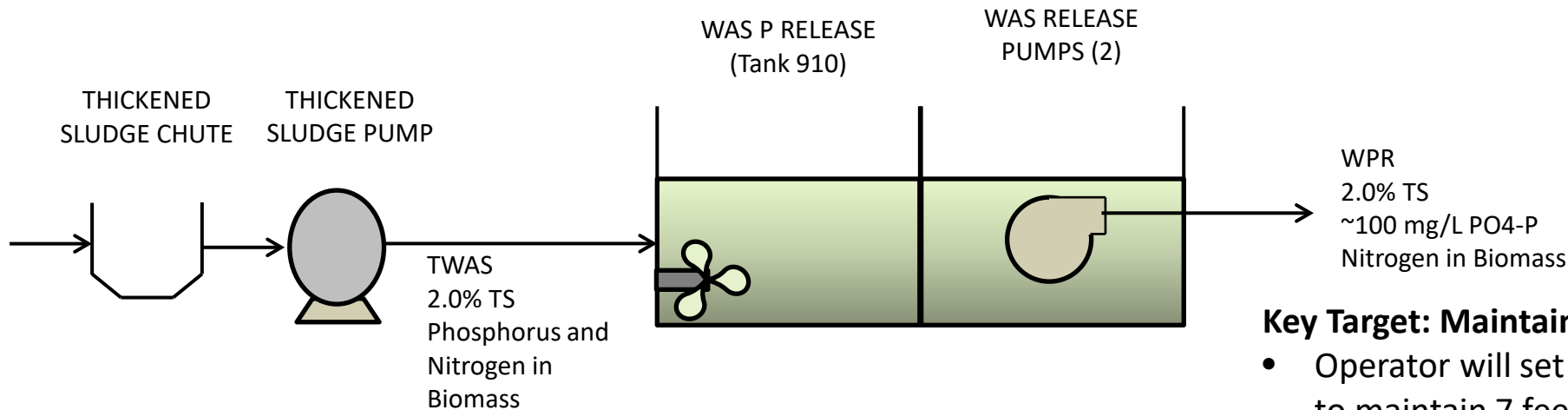


WAS Pre-Thickening

- Operates 24/7
- Bypass designed for blending to 2.0% solids, not typically used



WASSTRIP



Key Target: Maintain level in 910 at 7 feet

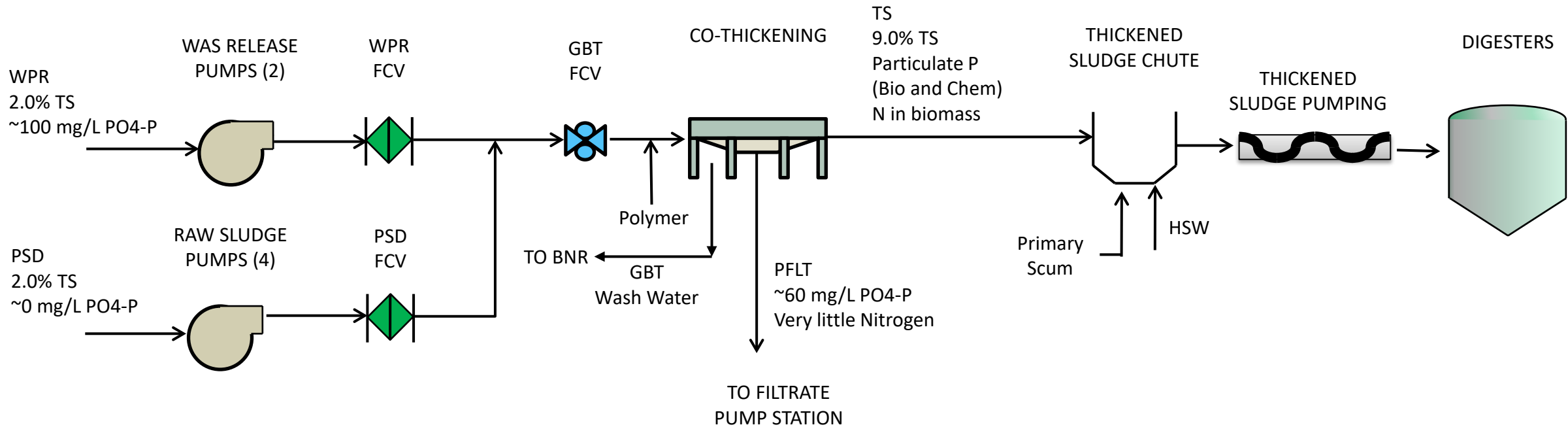
- Operator will set the GBT feed flow to the co-thickener to maintain 7 feet
- Pumps operate to maintain GBT feed flow setpoint

Secondary Target: WASSTRIP HRT of 24 hrs at 2% Solids

- Level is continuously monitored and HRT checked periodically
- GBT feed flow adjusted as needed to adjust HRT
- Mixers continuously run

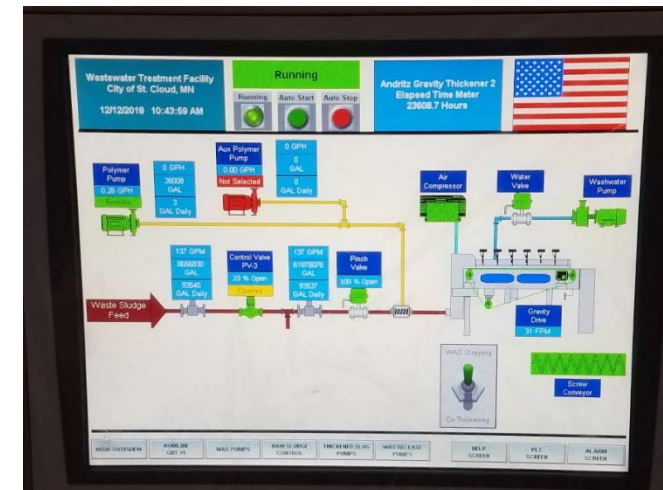
WAS P-RELEASE TANK (WPRS)	WASSTRIP			
WASSTRIP Tank	Co-Thickener/ 910 Tank			
Level	WPRS, Total Solids	WPRS ORP	WPRS Temp	HRT – 20 to 50 hours
feet	%		Deg F	
7	2	-200 or less	50 – 60	

GBT flow pattern – Co-thickening



Co-thickening GBT

- **Key Target: Maintain level in 910 at 7 feet**
 - Operator will set the GBT feed flow to the co-thickener to maintain 7 feet in 910 (WASSTRIP)
 - Operators will basically match flow leaving and going to WASSTRIP (approximately 40 gpm)
 - Pumps operate to maintain GBT feed flow setpoint
 - Primary sludge flow typically 60 gpm
 - Cake is coming off at 8% to 9% TS
- **Secondary Target: Filtrate TSS <500 ppm**
 - Very important to have clean filtrate going to Ostara process

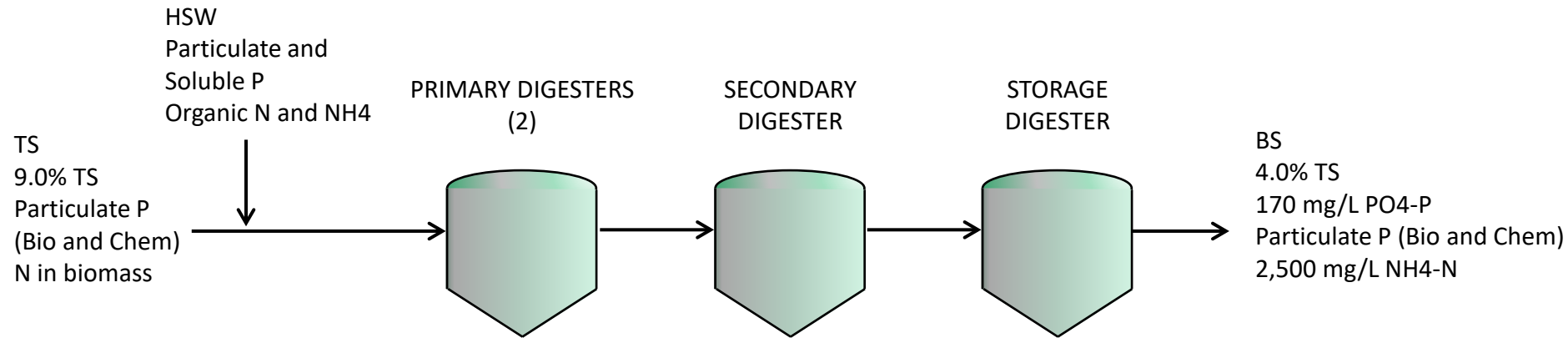


High Strength Waste

- HSW added to thickened sludge
- Receiving up to 10,000-17,000 gpd HSW including dairy, soda, brewery and food processing waste
- Design average TS flow 30,000 gpd



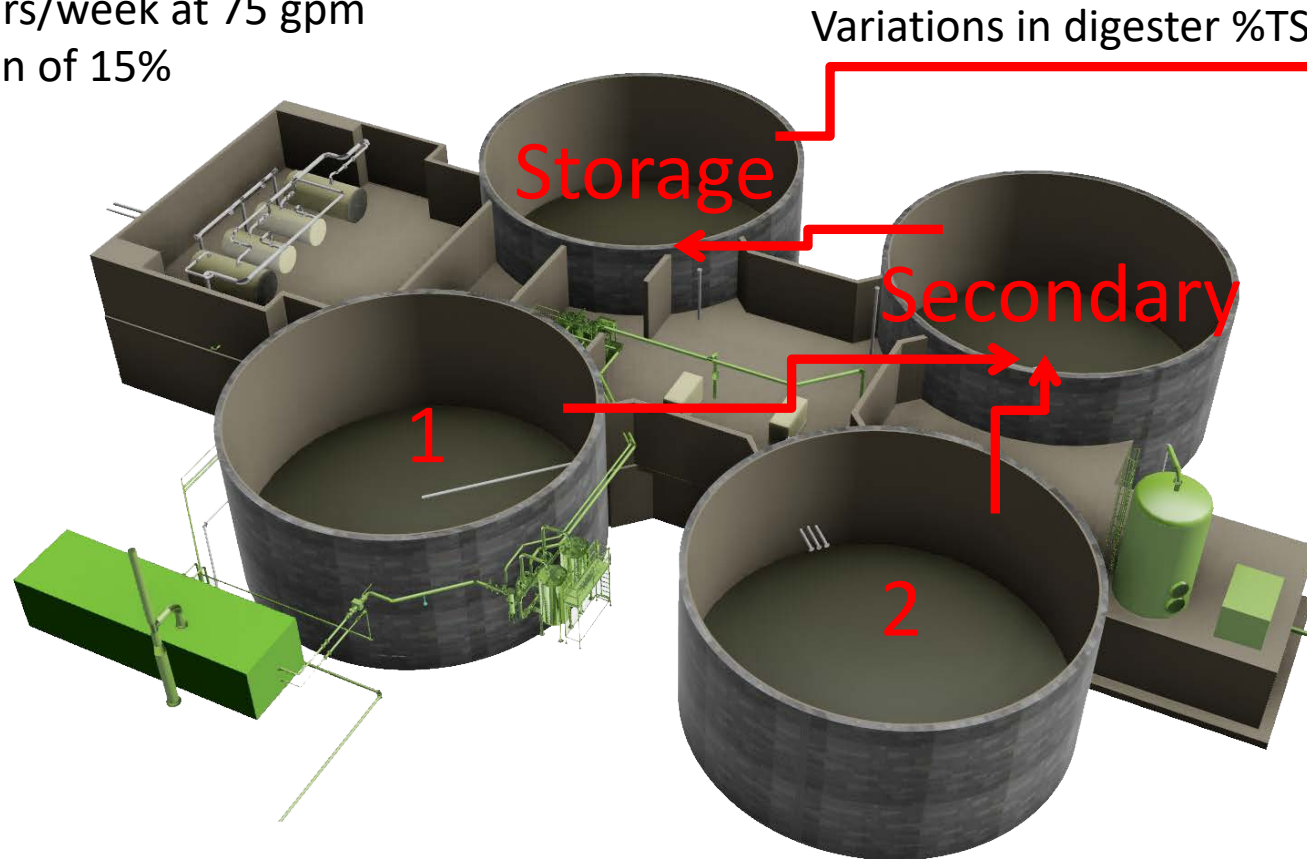
Digestion



- Biological phosphorus converted to soluble phosphorus during digestion
- Some soluble phosphorus bound with Al, Ca and Mg in digestion
- Organic nitrogen converted to ammonia during digestion
- Storage digester to be converted to primary digester

Digester and Centrifuge Operation

- Operates 48 to 72 hours/week at 75 gpm
- Target TS concentration of 15%

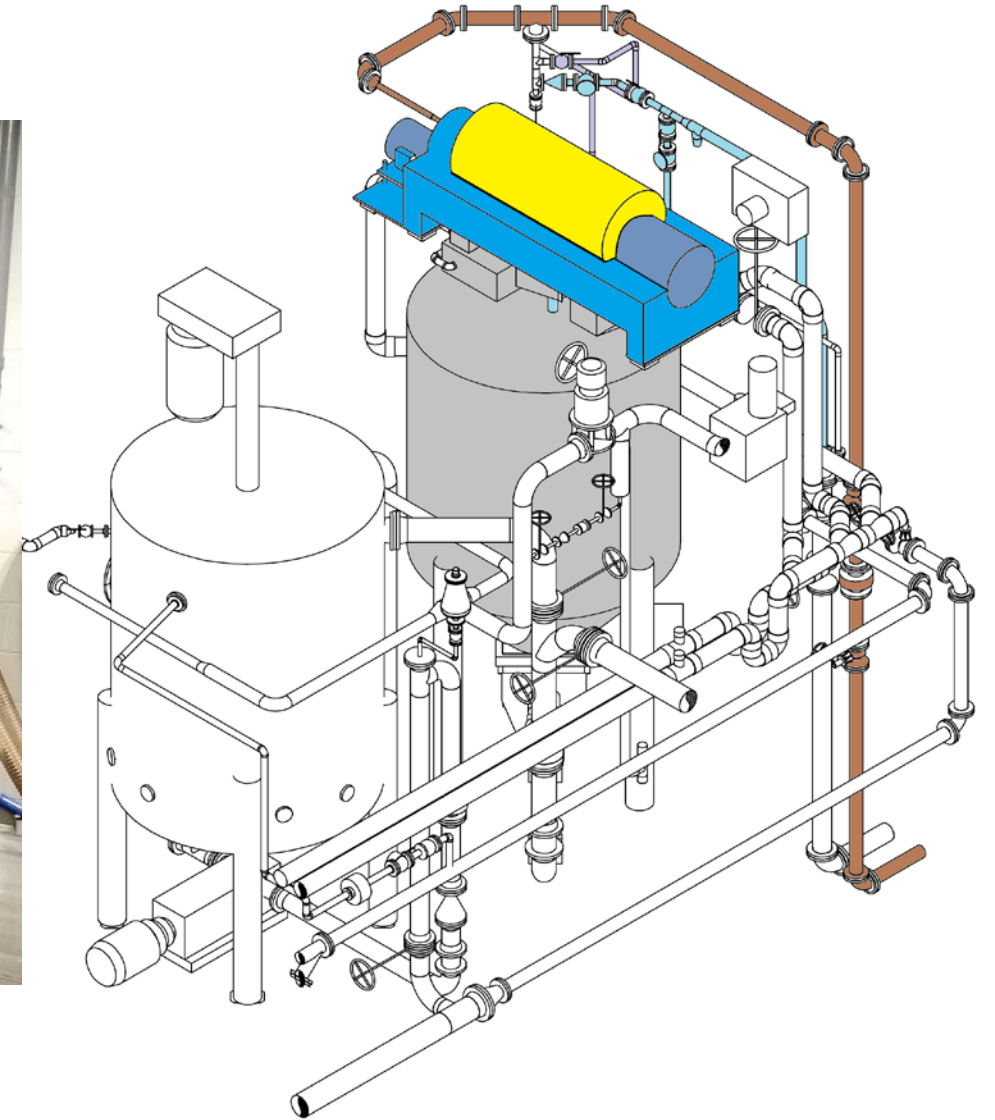


Examples of throughput changes:

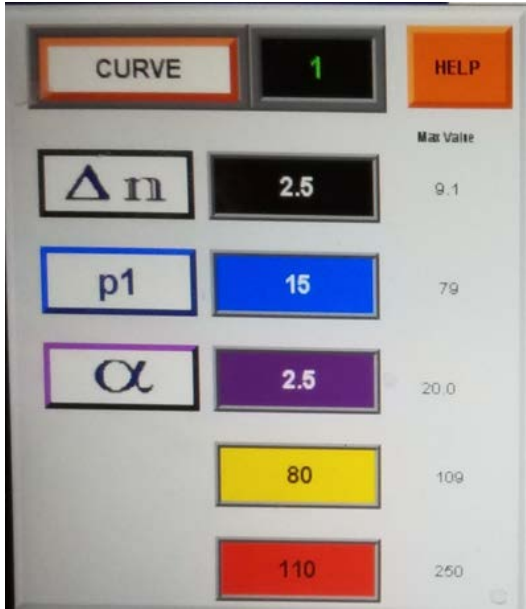
75 gallons per minute at 3.5% solids = 1314 lb/hr

75 gallons per minute at 4.0% solids = 1501 lb/hr

Centrifuge Dewatering



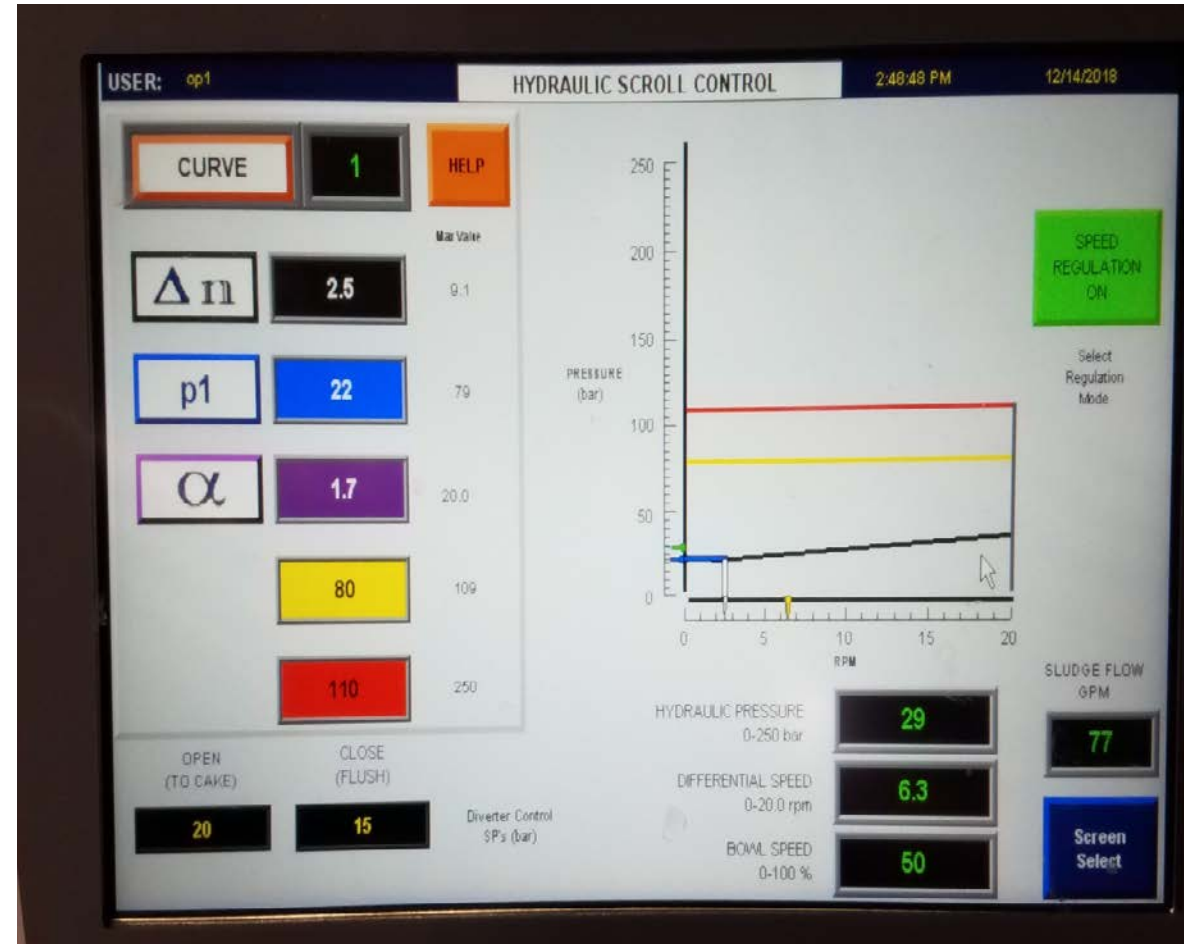
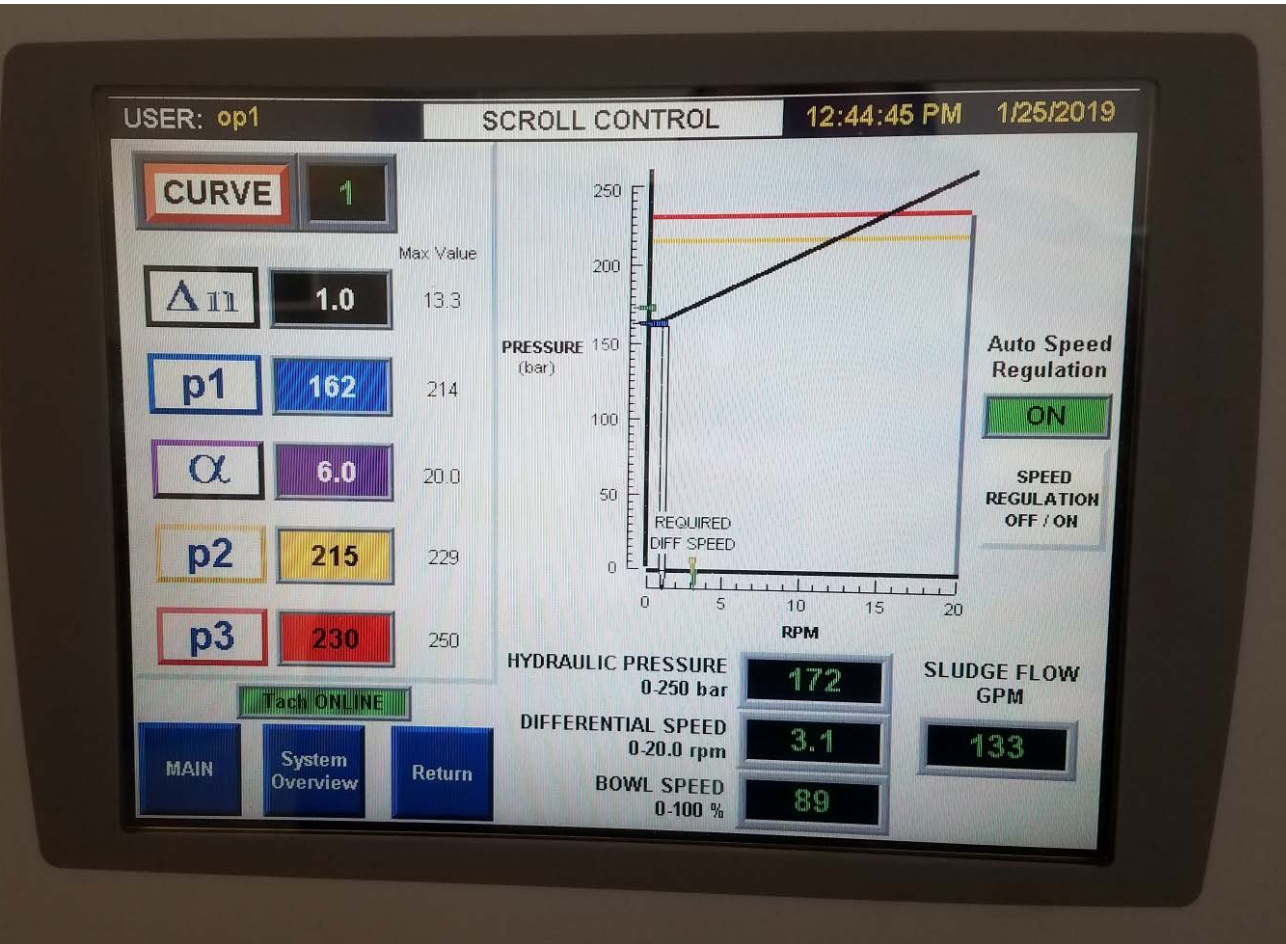
Centrifuge Operation



- In order to achieve 15% TS:
 - Adjustments to polymer dosage and make up water
 - Adjustments to centrifuge speed settings



Centrifuge Operation



Centrifuge Operation

Polymer make up water

Changed make up water to warmer REC EFF

Sludge temperature

Sludge feed % solids

Polymer Dosage Calculation							
St. Cloud							
Sludge type:	Anaerobic digested biosolids at 55% VS						
Dewatering equipment:	Centrysis CS18-4						
Polymer Used:	Polydyne C-6275 (liquid emulsion)						
Polymer % Active:	45						
Polmer Makeup Water Temp °F:	49						
Typical Sludge pH:	7.5						
Typical Sludge Temperature deg °F:	95						
						Specified	Average
Date:	08/16/18	08/17/18	08/17/18	09/12/18	12/14/18		
Time:				5:00 PM	2:30 PM		
Centrifuge Δn :		1	1	2.5	2.5		1.750
Centifuge p1 :		20	20	15	22		19.250
Centifuge α :		4.5	4.5	2.5	1.7		3.300
Sludge temp:							#DIV/0!
Sludge pH:							#DIV/0!
Sludge Feed (%TS):	3.8	3.8	3.8	3.8	3.2		3.680
Sludge Feed (%TVS):							#DIV/0!
Sludge Flow Rate (gpm):	76	76	76	75	77		76.000
Sludge Throughput (lbs/hr):	1445	1445	1445	1426	1233		1398.918
Polymer Pump Capacity (gph):	10.36	10.36	10.36	10.36	10.36		10.360
Stroke Length (%):	100	100	100	100	100		100.000
Polymer Pump Speed (%):	62	53	50	39	42		49.200
Polymer Flow Rate (gpm):	0.11	0.09	0.09	0.07	0.07		0.085
Neat Polymer Flow Rate (gph):	6.42	5.49	5.18	4.04	4.35		5.097
Polymer Dosage (lbs/ton):	74.14	63.37	59.79	47.26	58.86		60.684
Active Polymer Dosage (lb/ton):	33.36	28.52	26.90	21.27	26.49	30	27.308
Polymer Sol. (%):	1.07	1.02	1.02	1.12	1.04		1.052
Polymer Sol. Flow Rate/dilution H2O flow (gpm):	10.00	9.00	8.50	6.00	7.00		8.100
Polymer Dosage (lbs/ton):	74.14	63.37	59.79	47.26	58.86		60.684
Centrate TSS (mg/l):	50	80	100	200	50		96.000
Thickened/Cake Solids (%TS):	22	14	13.8	13.5	13		15.260
Capture (%):	99.9	99.8	99.8	99.6	99.9		99.812

Centrifuge Dewatering

BS - Biosolids
 BSC - Biosolids Centrifuge
 BSL - Biosolids Loadout
 CEN - Centrate
 FLT - Filtrate
 EQ - Equalization
 PFLT - Process Filtrate
 PSD – Primary Sludge
 TS - Thickened Sludge
 WPR - WAS P Release Sludge
 WW- Water Wash Drain

BS
 4.0% TS
 170 mg/L PO₄-P
 Particulate P (Bio and Chem)
 2,500 mg/L NH₄-N

Polymer

SULFURIC ACID (optional)

DEWATERING CENTRIFUGE

BSC
 15.0% TS
 P and N are mostly particulate form

CAKE HOPPER AND PUMP

LYSTEK

Rotary Lobe Pump

BIOSOLIDS STORAGE

CEN
 170 mg/L PO₄-P
 2,500 mg/L NH₄-N

PD

TO EQUALIZATION TANK

TO PROCESS DRAIN PUMP STATION

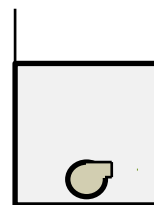
BSC

BSL

BSL

BSC

TO CAKE LOADOUT



- Dirty centrate diverted to process drain pump station
- Clean centrate to equalization tank
- Cake biosolids processed in thermal hydrolysis process

NR2 Biosolids

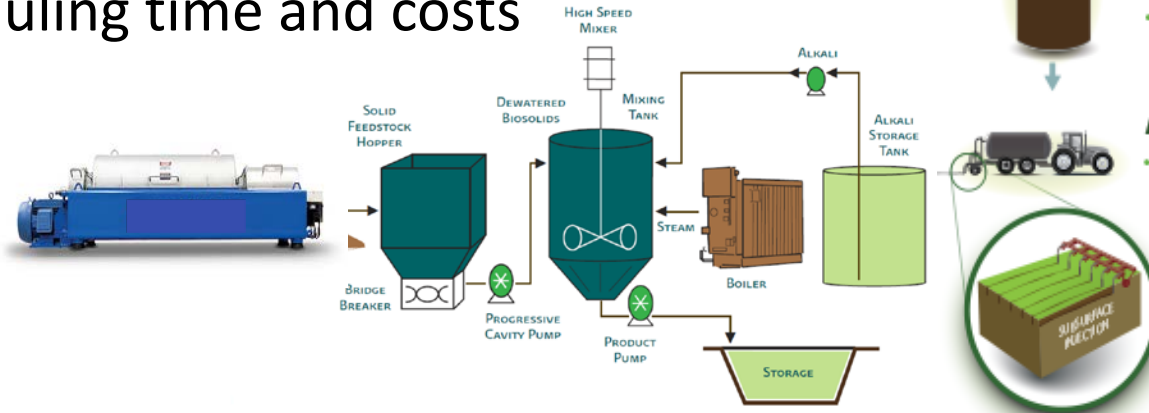
○ Biosolids Product Enhancement: Lystek

■ Class A

- Enhance land application logistics

■ 12% Flowable/Pumpable Liquid

- Decrease liquid storage needs (increase storage capacity)
- Decrease hauling time and costs



Nutrient
Recovery






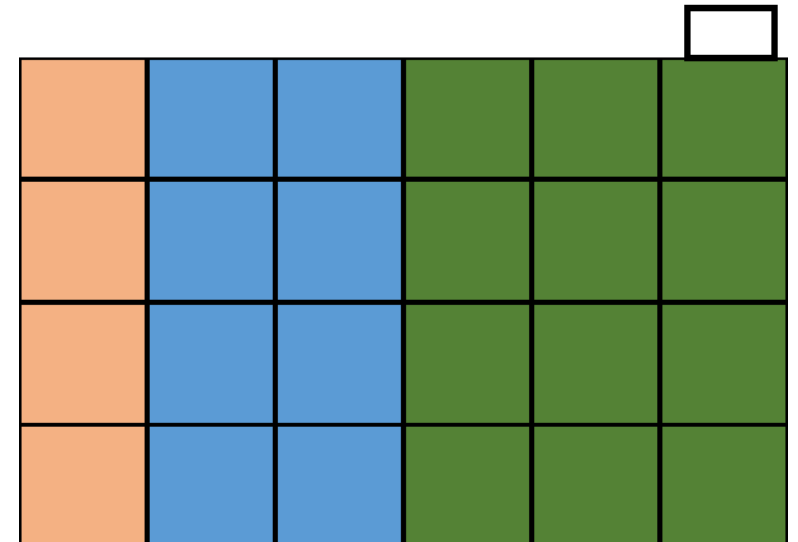
Nutrient
Reuse

Sludge Storage Conversion

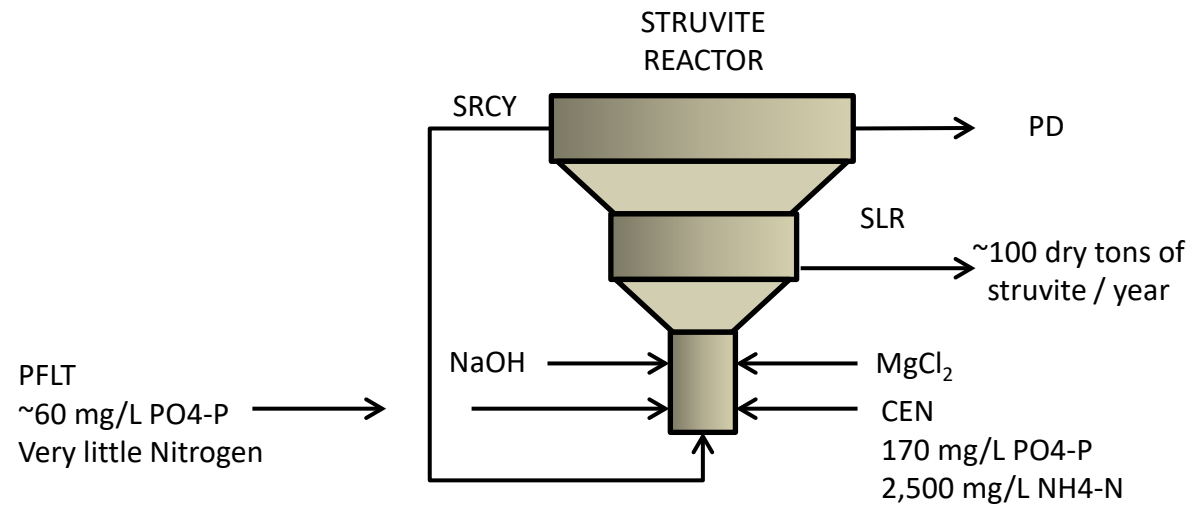
Centrate EQ and Lystek Biosolids Storage



-  Lystek Biosolids Storage
•198 days of storage at future average flow
-  Digested Sludge Storage
•39 days of storage at future average flow
-  Sidestream EQ/Treatment
•21 days of storage at future max month flow

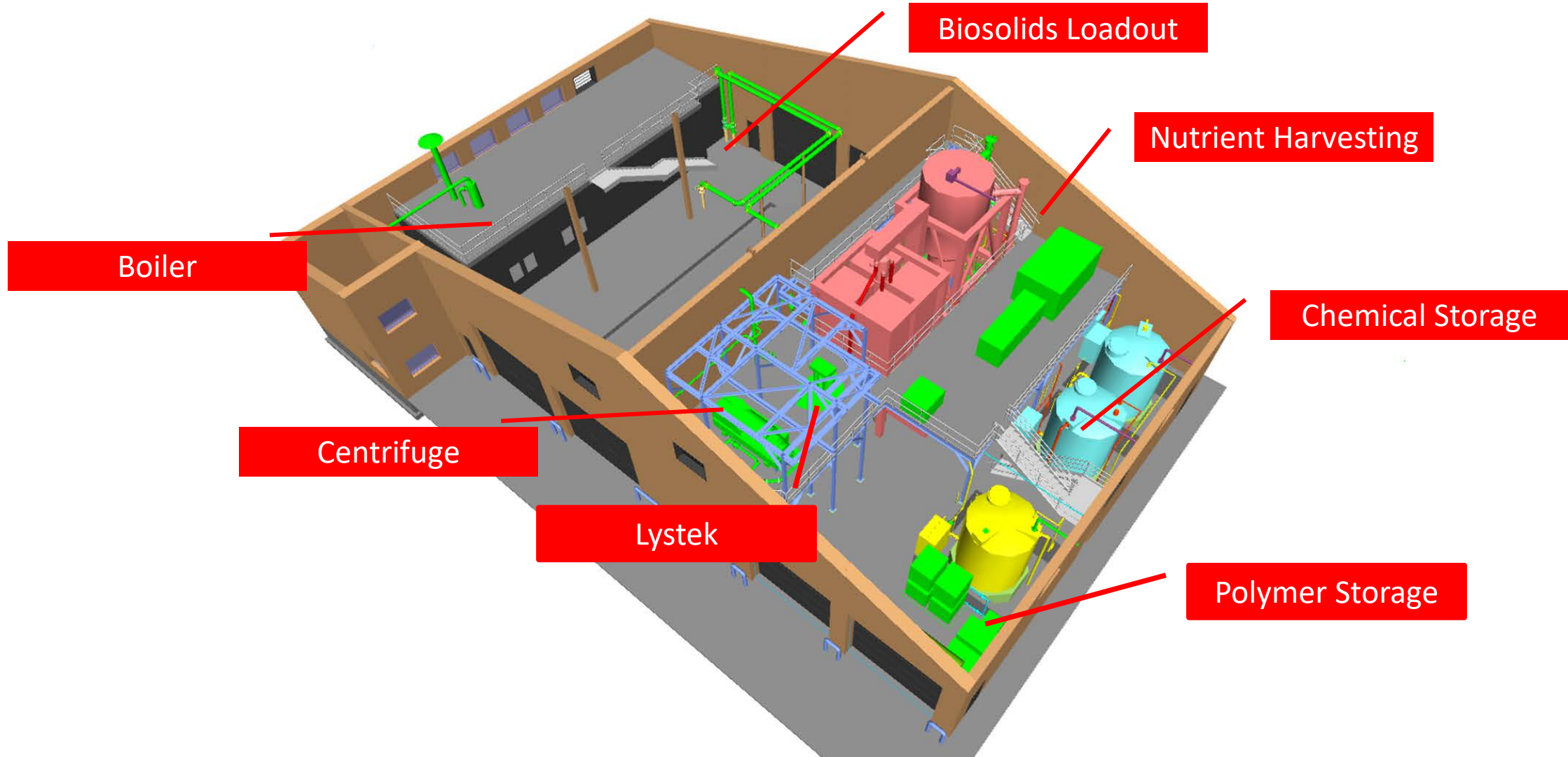


Nutrient Recovery Process

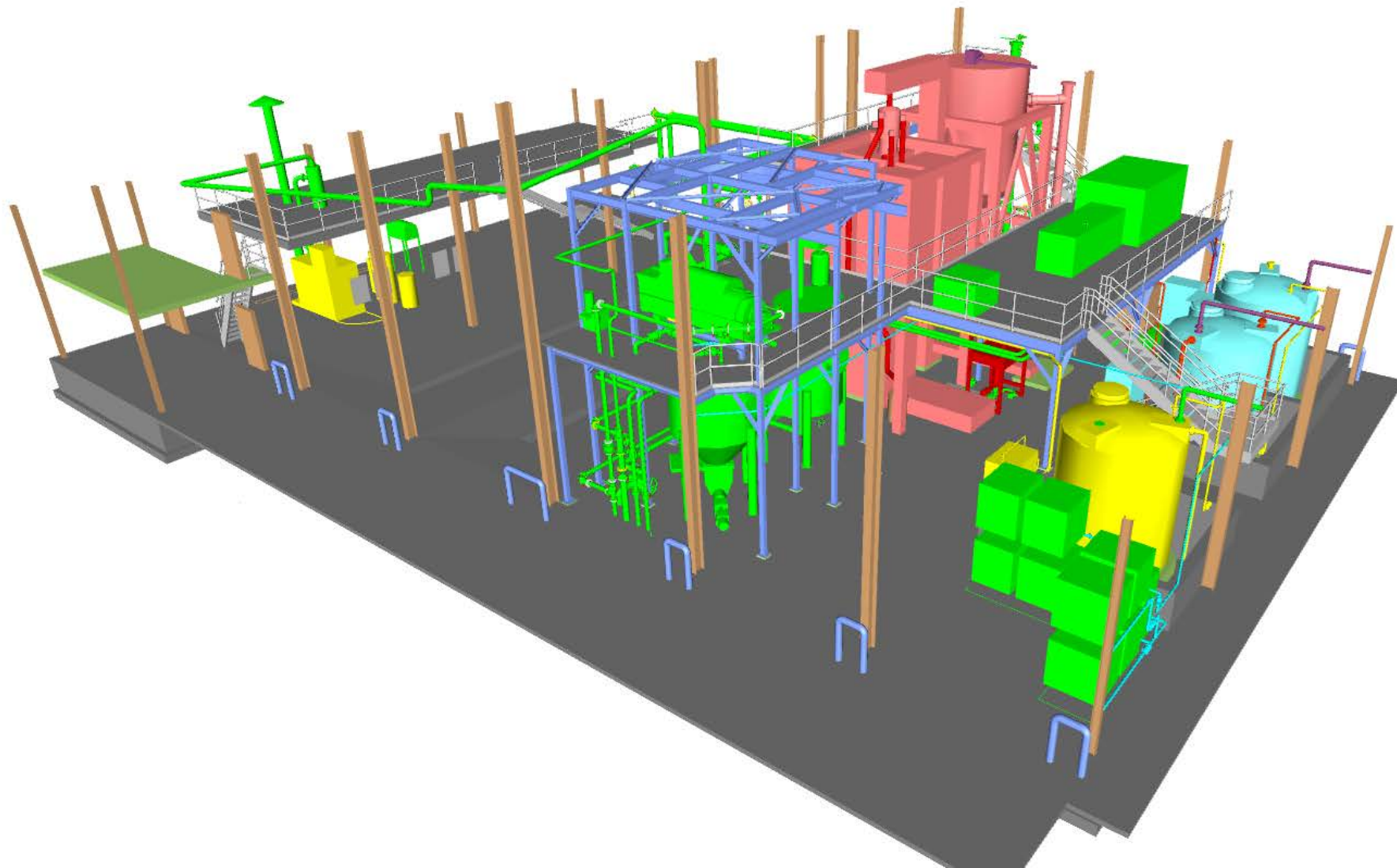


- PO₄-P and NH₄-N converted to struvite

NR2 Project in the Biosolids Building



NR2 Project in the Biosolids Building



The Team



OSTARA



Thank You

Donohue & Associates, Inc.

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