

Presented for
PNWS-AWWA
Bellevue, WA
April 30, 2015

2nd Year of Construction: Start-Up of New Pre-Treatment & Solids Handling Processes at the LO-T WTP

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Lake Oswego · Tigard
Water Partnership
sharing water · connecting communities



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BUILDING A BETTER WORLD

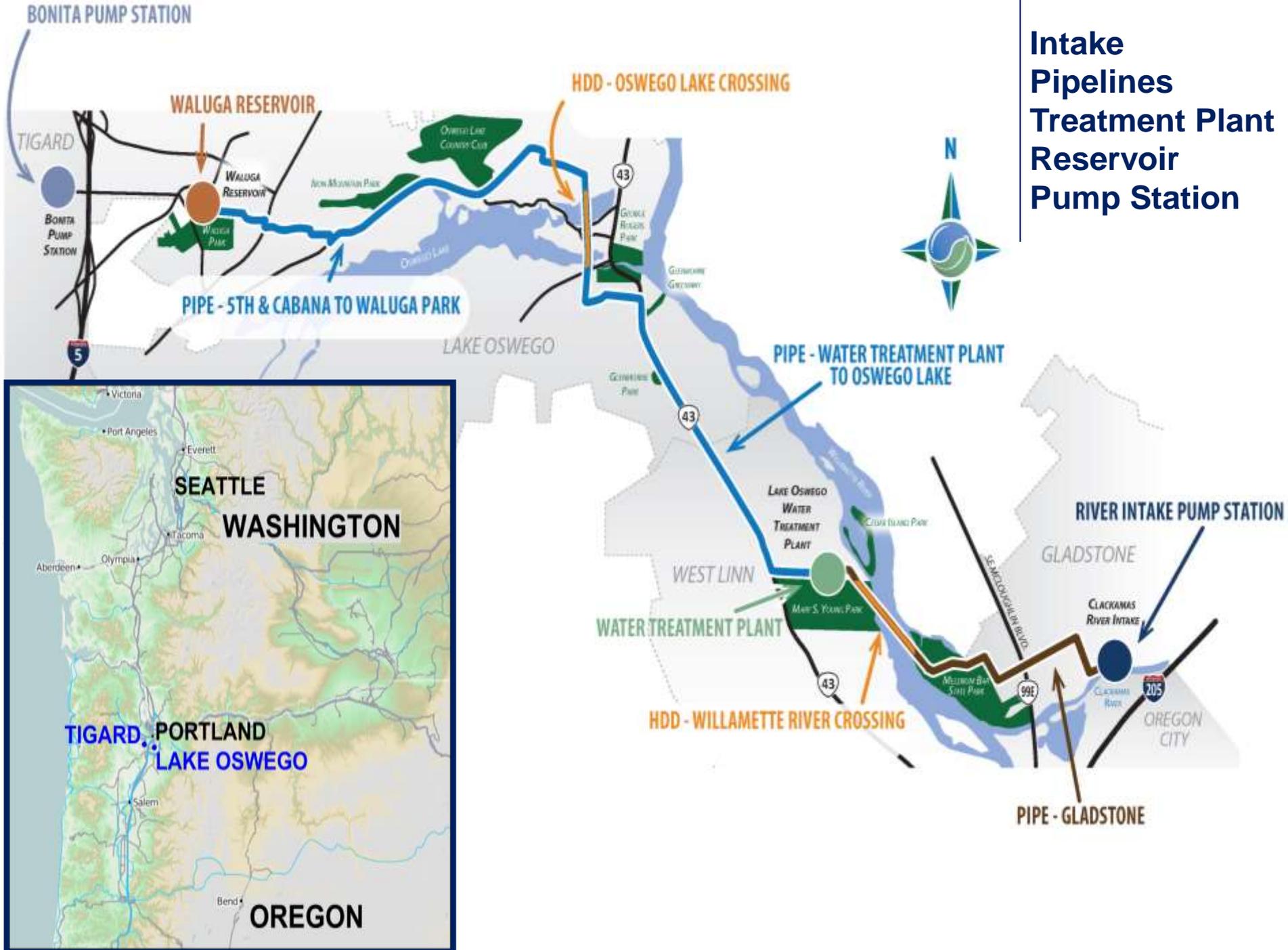
Outline

- 
- Quick Program Overview and Project Background
 - The Start-up & Commissioning Process
 - New Solids Handling System Start-up
 - New Pre-Treatment System Start-up
 - Challenges & Success Factors
 - Lessons Learned & Conclusions



QUICK PROJECT OVERVIEW & BACKGROUND

Intake Pipelines Treatment Plant Reservoir Pump Station



LO-T WTP Expansion – Project Overview

Current Plant

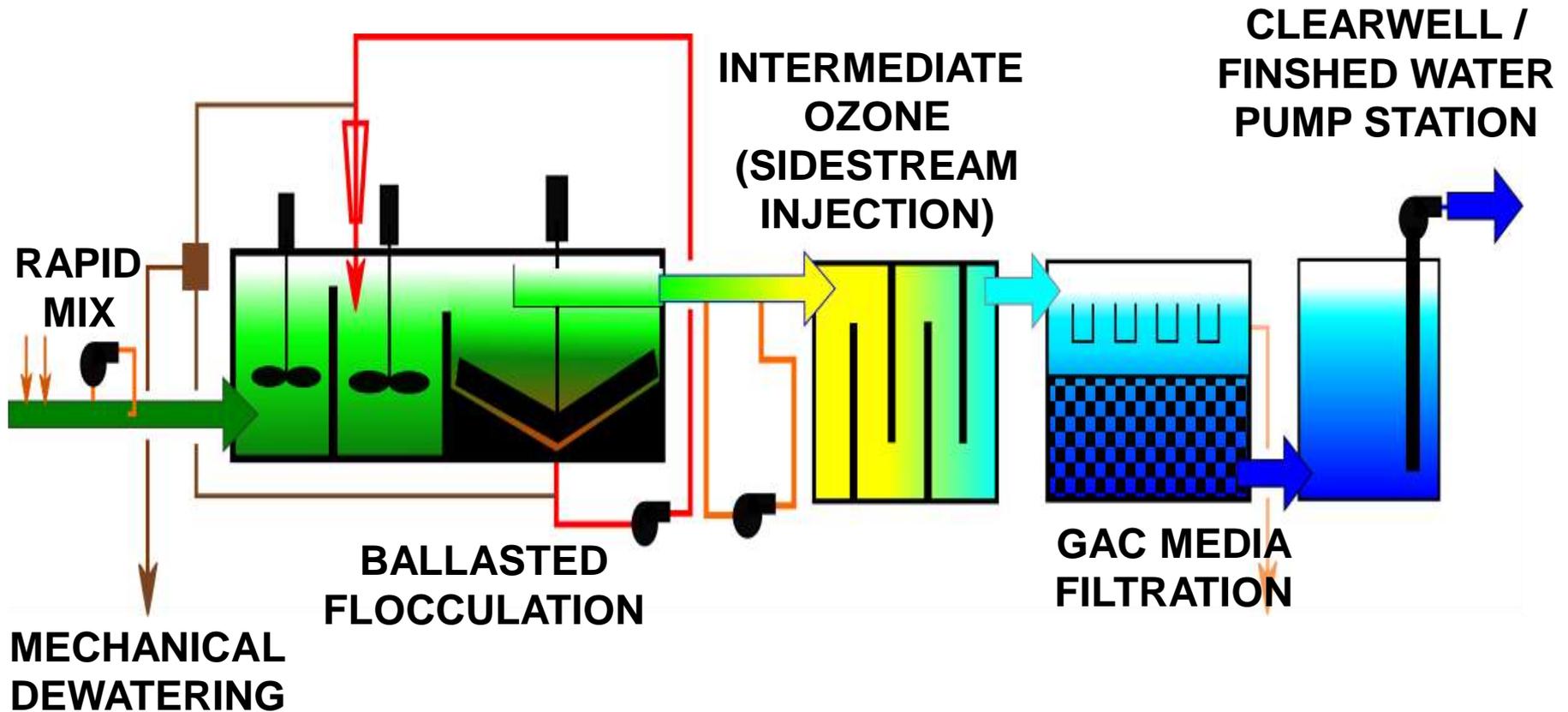
- 16 MGD Capacity
- Direct Filtration
- Solids Dewatering Lagoons
- 5.44 acre site

Expanded Plant

- 38 MGD Capacity
- Conventional Treatment
 - High-rate Clarification
 - Intermediate Ozone
 - High-rate GAC Filtration (10 gpm/sf)
 - Mechanical Dewatering
- Expanded 9.24 acre site
75% increase in overall plant footprint

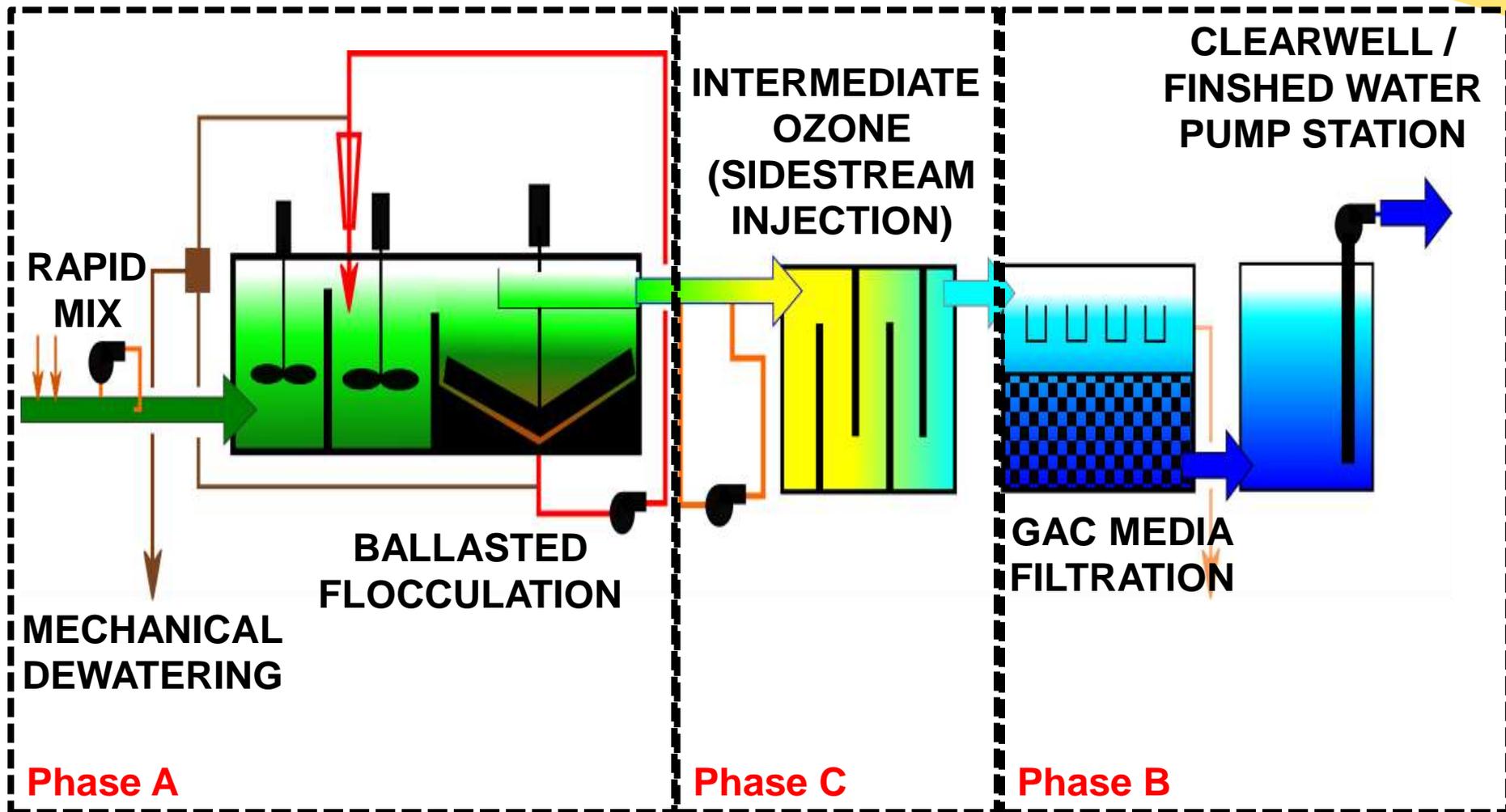


Completed Project Process Overview



New processes to be constructed on top of existing processes in phased approach

Completed Project Process Overview



Existing Plant



Expanded Plant



Expanded Plant



2013

2014

2015

Q3

Q4

Q1

Q2

Q3

Q4

Q1

Q2

Q3

Q4

Existing Plant



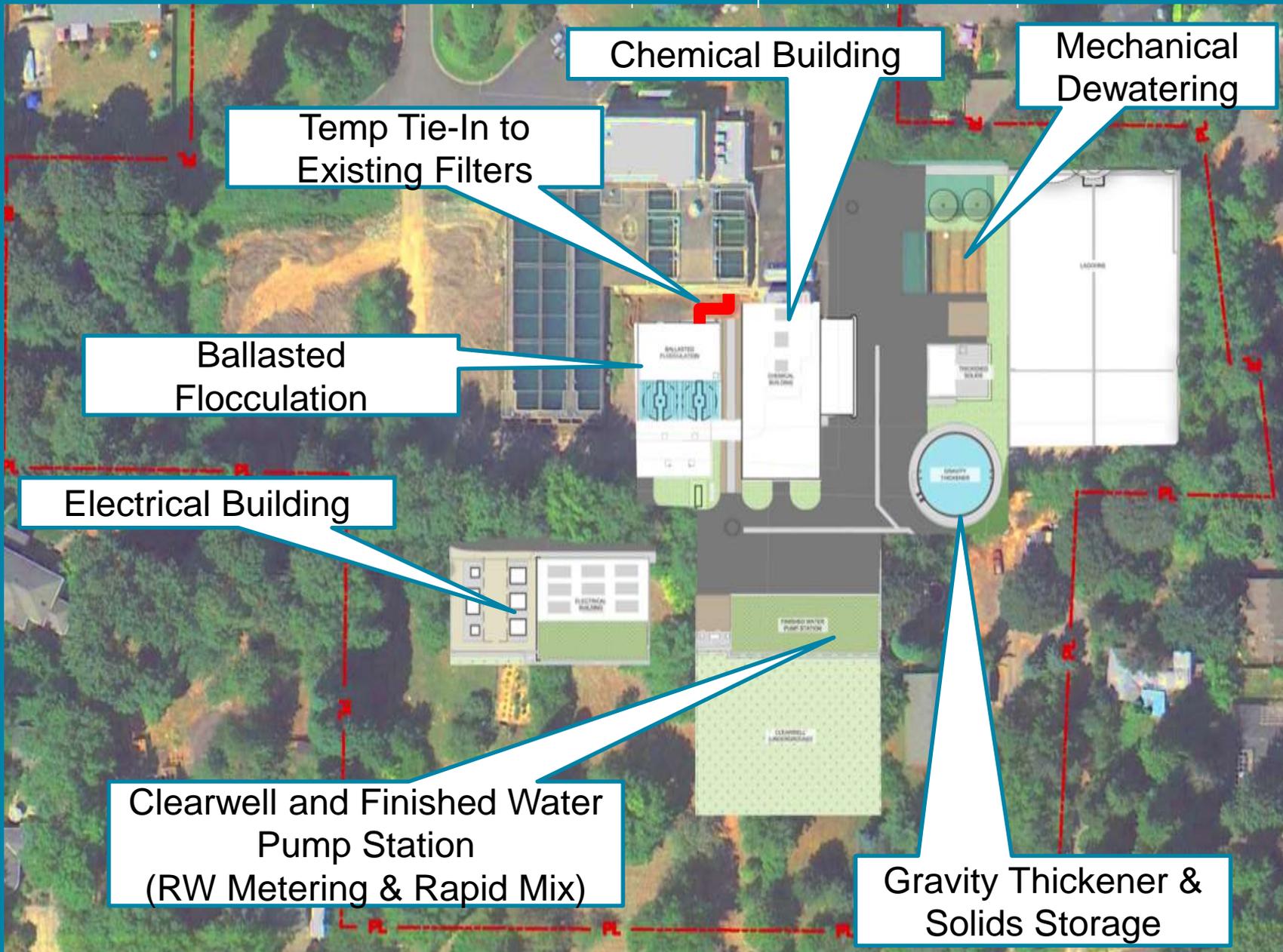
2013

2014

2015

Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
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Construction Phase A



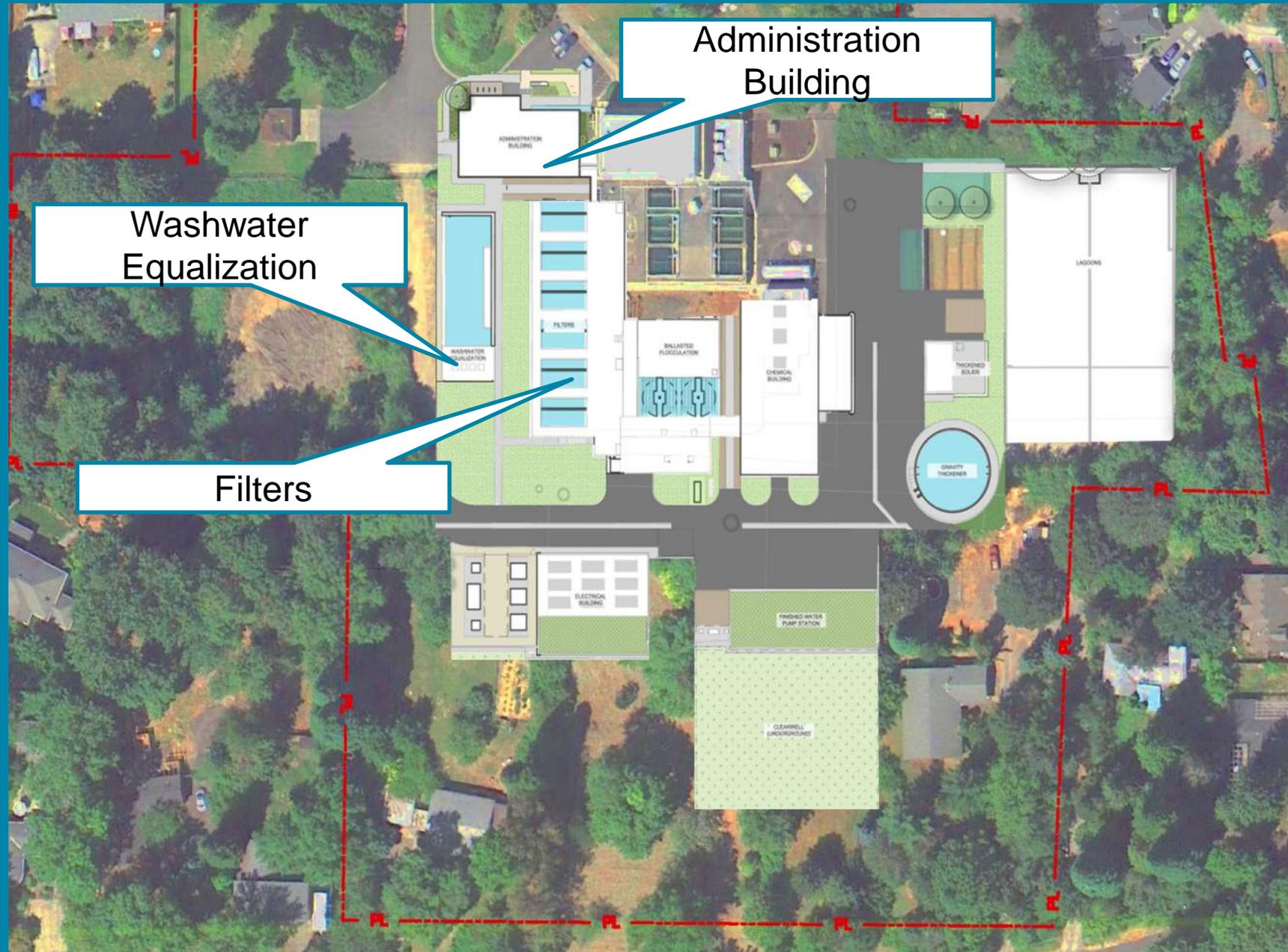
2015

2016

2017

Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
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Construction Phase B



2015

2016

2017

Q3

Q4

Q1

Q2

Q3

Q4

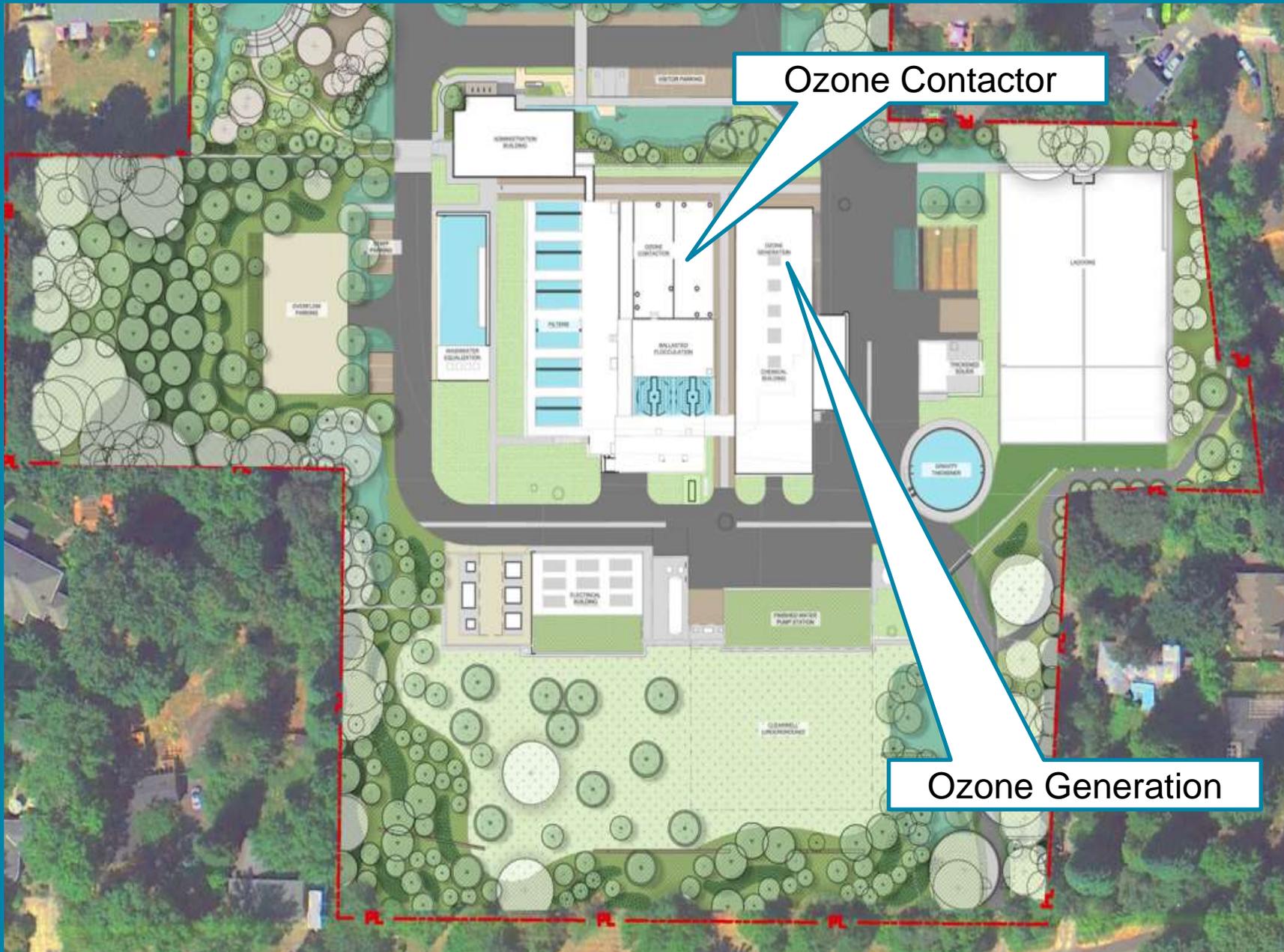
Q1

Q2

Q3

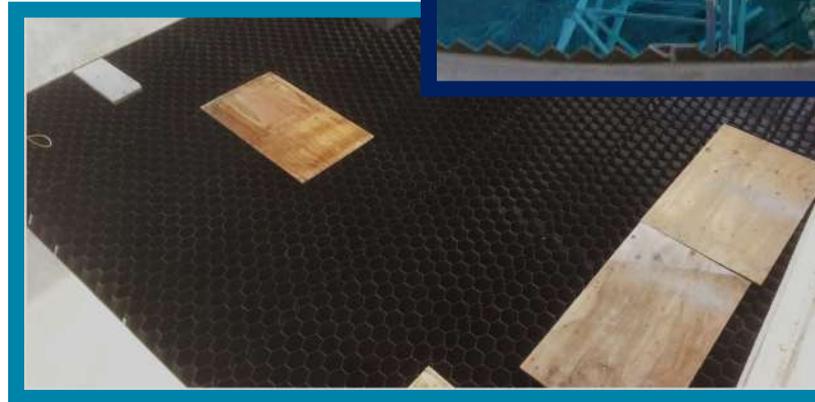
Q4

Construction Phase C



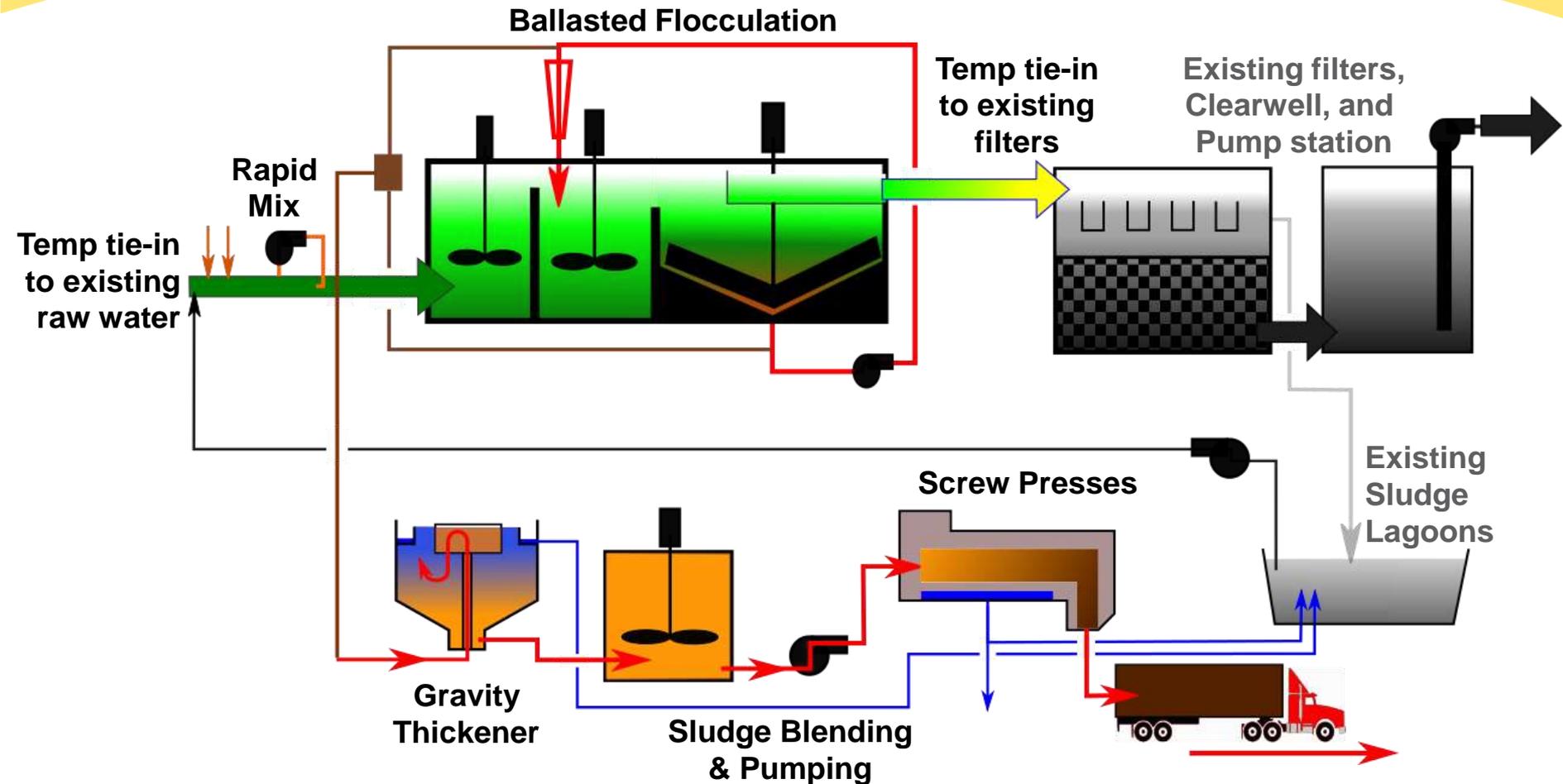
Key Components of Phase A

- Solids Handling System
 - Gravity Thickener
 - Thickened Solids Tank
 - Tank Mixing System
 - Thickened Solids Pumps
 - Screw Presses
 - Polymer Feed System
- Pre-Treatment System
 - Raw Water Metering
 - Rapid Mix System
 - Ballasted Flocculation Process
- Chemical Systems
- New Electrical Feed



Phase A – New Process Overview

Conventional Treatment with Mechanical Residuals Handling



2nd Year Update: Current Construction / Start-Up Progress



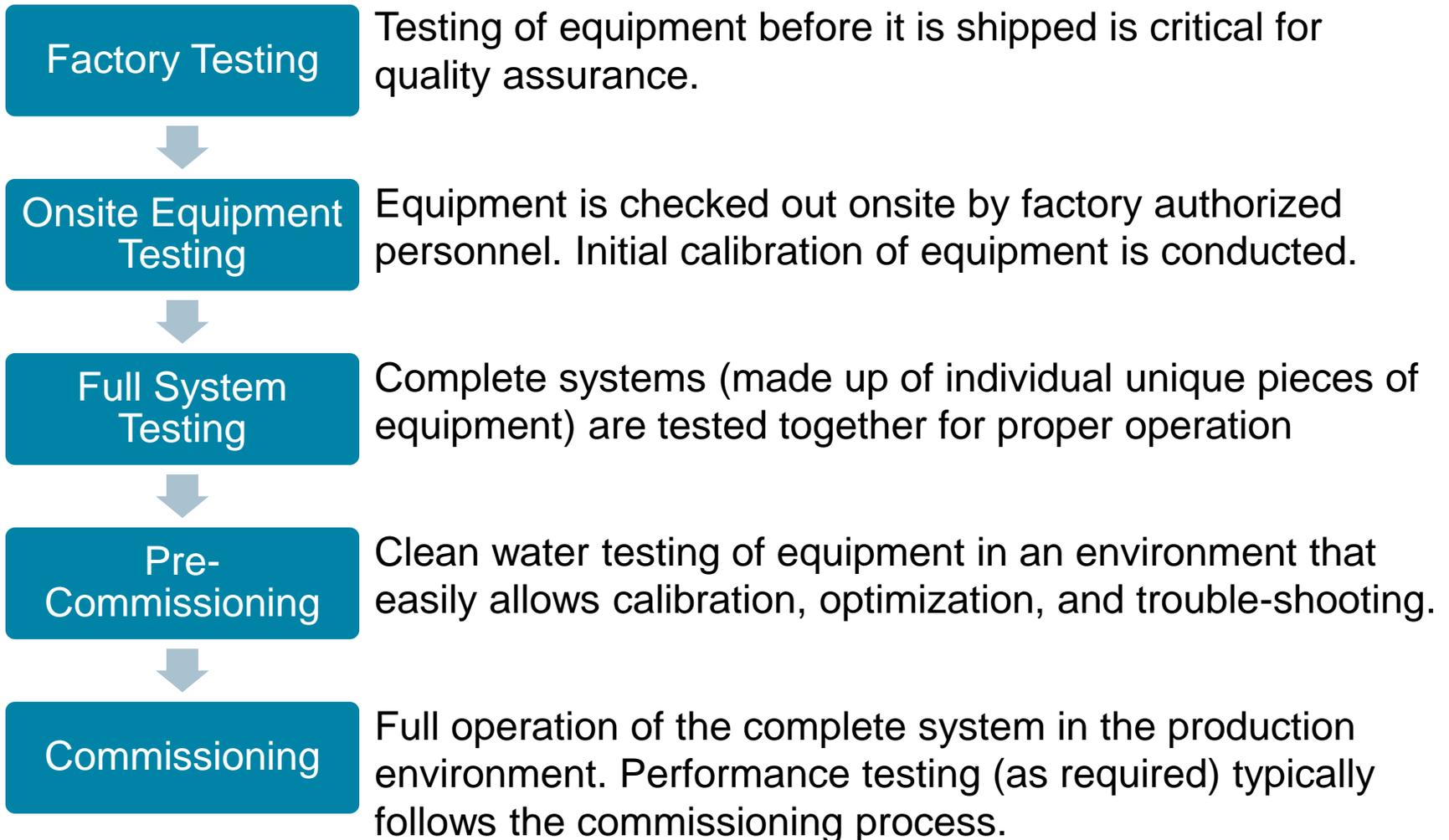
- Phase A: Solids handling system started up dewatering existing lagoon solids
- Phase A: Ballasted flocculation & chemical systems started up – currently performance testing
- Phase A architectural finishes ongoing, Phase B construction just beginning

Operating
(interim)

Commissioning

Construction

Typical Start-up & Commissioning Process

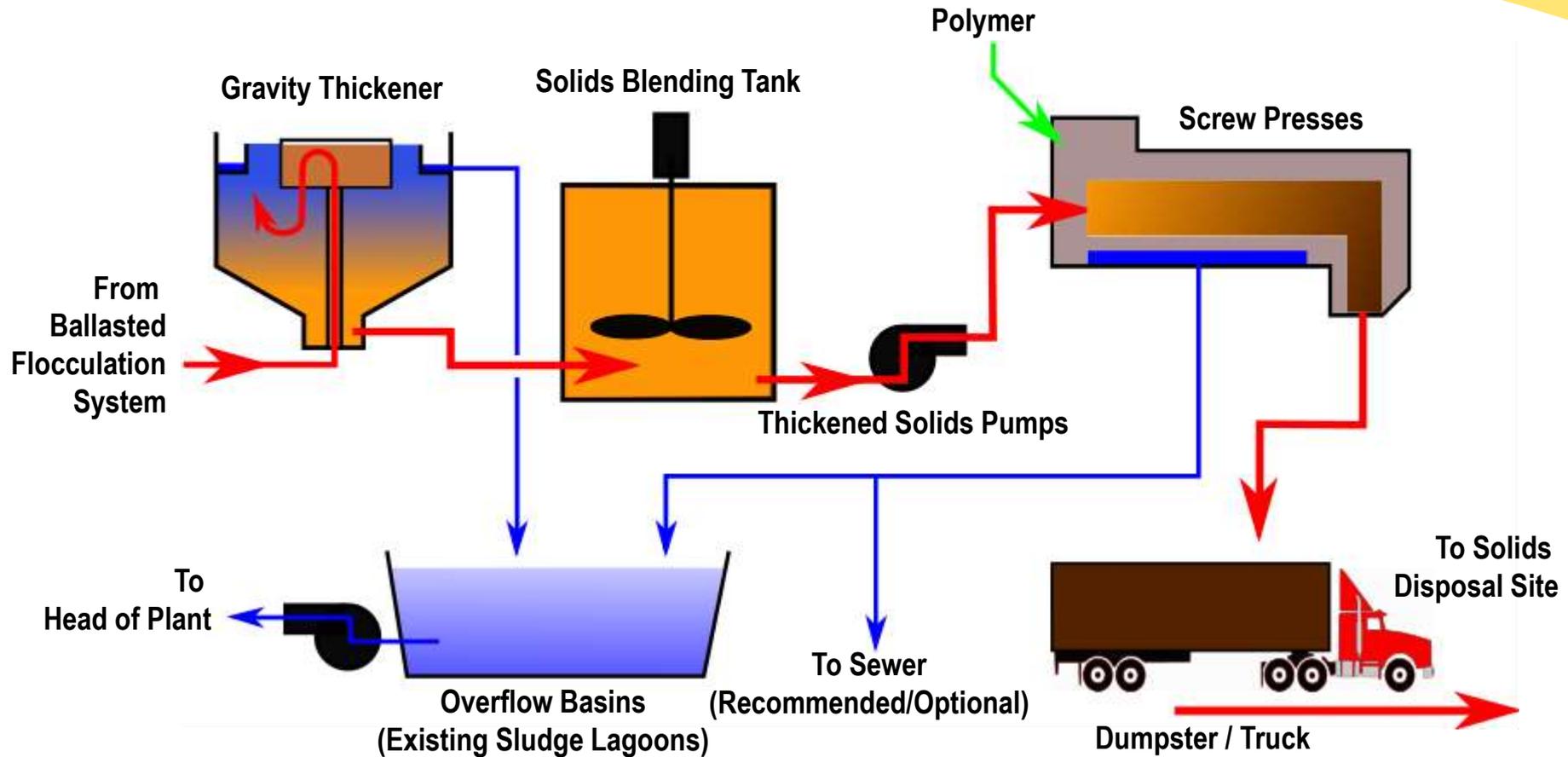




NEW SOLIDS HANDLING SYSTEM START-UP

INCLUDING GRAVITY THICKENER, THICKENED SOLIDS TANK, TANK MIXING SYSTEM, THICKENED SOLIDS PUMPS, & SCREW PRESSES

Operation of the New Solids Handling Processes



Interim Dewatering Operation

- Existing sludge lagoons contained approximately 40 tons of solids (dry).
- Sludge was accumulated over 18 months, include leaves, pine needles, and other 'foreign bodies'.
- Sludge contains a mix of alum, filter aid, and backwash aid polymers.
- Earlier attempts using geo-bags to dewater sludge proved time consuming somewhat ineffective.

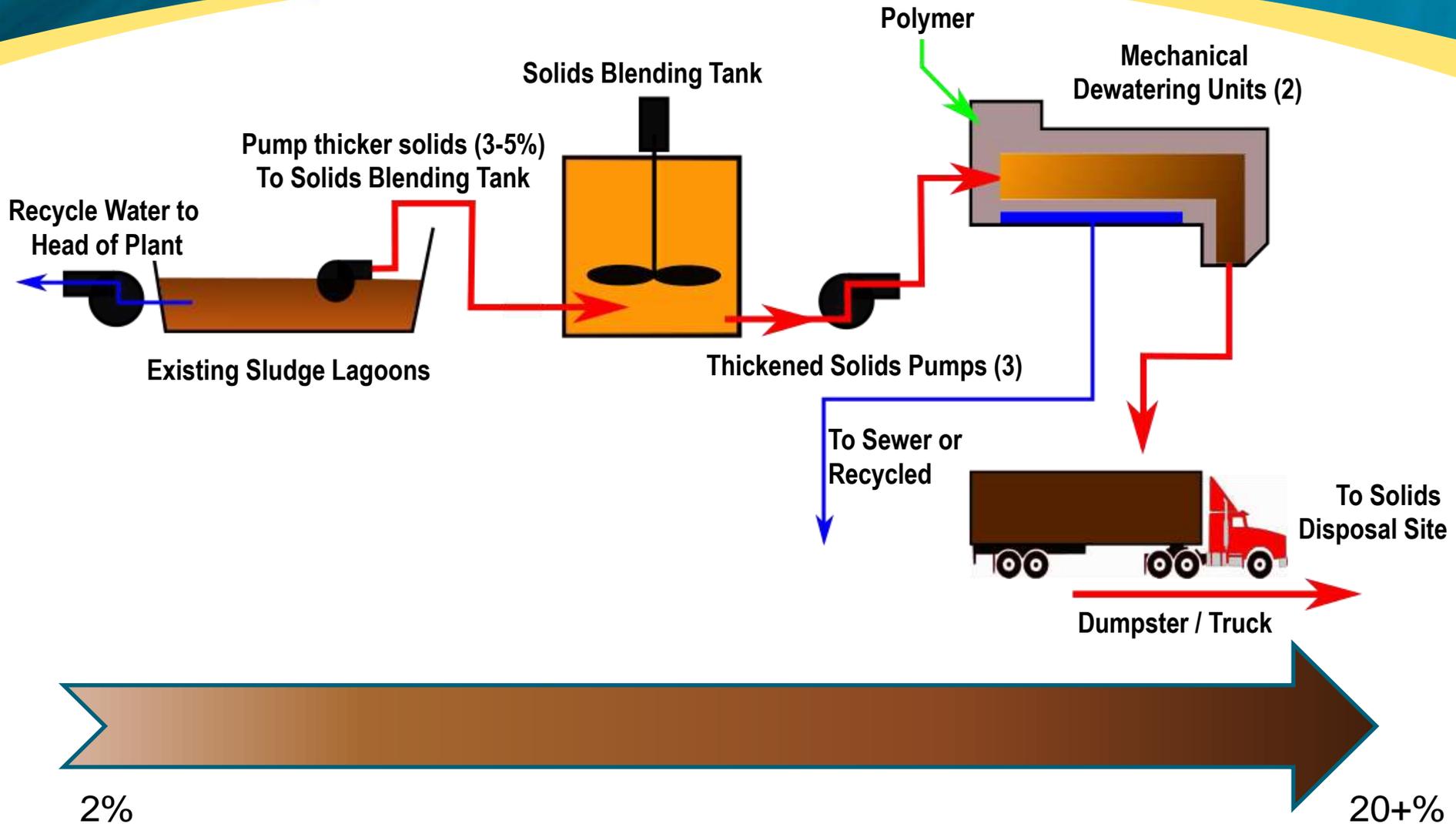


Benefits:

- More cost effective than transporting weak solids.
- More time effective than drying the solids during dry months.
- More focused operator training and process optimization.



Interim Operation of the New Solids Handling Processes



Solids Handling System First Impressions



- Screw Presses are effective at dewatering water treatment plant residual alum sludge
- Screw presses successfully dewatered all lagoon solids plus solids from the existing sedimentation basins.
- Optimization (Polymer type, Feed Rate, Screw Speed etc.) is critical
- Current 'interim' dewatering strategy requires constant oversight
- Lagoon solids are 'un-predictable'
- Leaves, pine needles, and other 'foreign bodies' are not good for the Screw Presses

Feed Sludge (Dry Solids, Average)	Cake Concentration (Dry Solids)	Polymer Usage (lbs/dry ton)
2% - 5%	15% - 25%	15 - 20



PRE-TREATMENT SYSTEM STARTUP

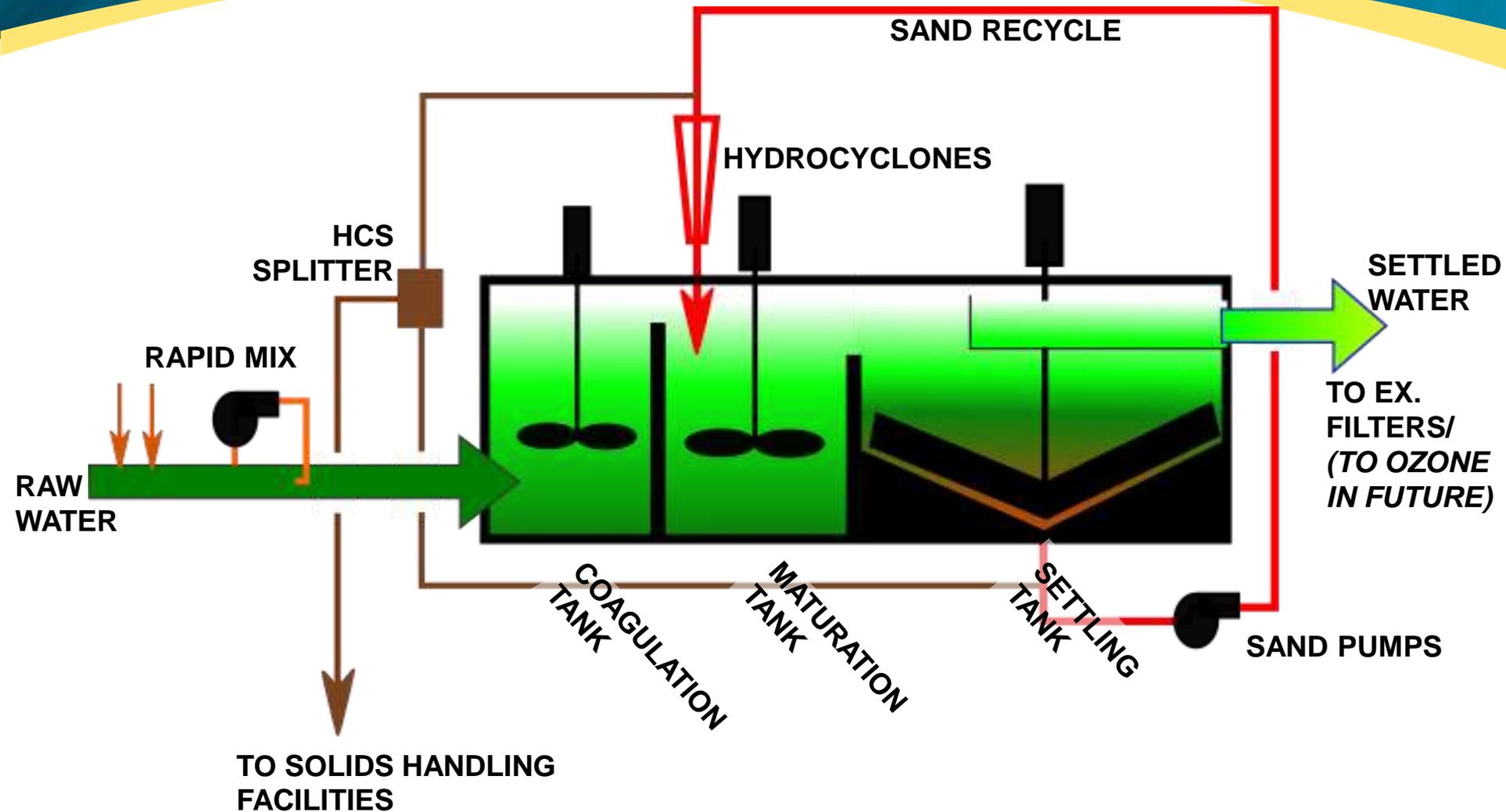
INCLUDING BALLASTED FLOCCULATION RAPID MIX AND
CHEMICAL SYSTEMS

Key Elements of the New Pre-Treatment System

- Pumped Diffusion Rapid Mix
- Kruger Actiflo Turbo[®] (footprint reduction)
- High Concentration Solids (HCS) System (residuals reduction)
- New Chemical Building, Chemical Storage, and Feed System
- Temporary tie-in to existing filters



Operation & Features of the New Pre-Treatment System



Operation & Features of the New Chemical Building, Chemical Storage & Feed System

- Seven new 6,000 gallon FRP tanks
- 2 new dry polymer batch systems
- Peristaltic Chemical Feed Pumps



Pre-Treatment System Start-up Challenges

- **Tie in to existing filters:**
 - Sensitive plant hydraulics
 - Multiple plant shut downs
 - Significant changes to existing filter operation / control
- Confirmation of polymer selection and polymer dose
 - Continue to produce high quality drinking water
- Ongoing major construction activities (building finishes)
- Multiple and varied demands on plant staff
 - Coordination with other components of the program (new raw water pump station, pipelines, reservoirs)
 - Hours and hours of training in a variety of locations



Pre-Treatment System Start-up Results

- Successful operation as a Conventional Treatment Plant
- Approx. 15M gallons of drinking water has been produced through the new pre-treatment system
- Settled Water Turbidity 0.4 – 0.6
- Filtered Water Turbidity 0.04 – 0.06
- Continued adjustment of chemistry will continue to improve overall treatment performance





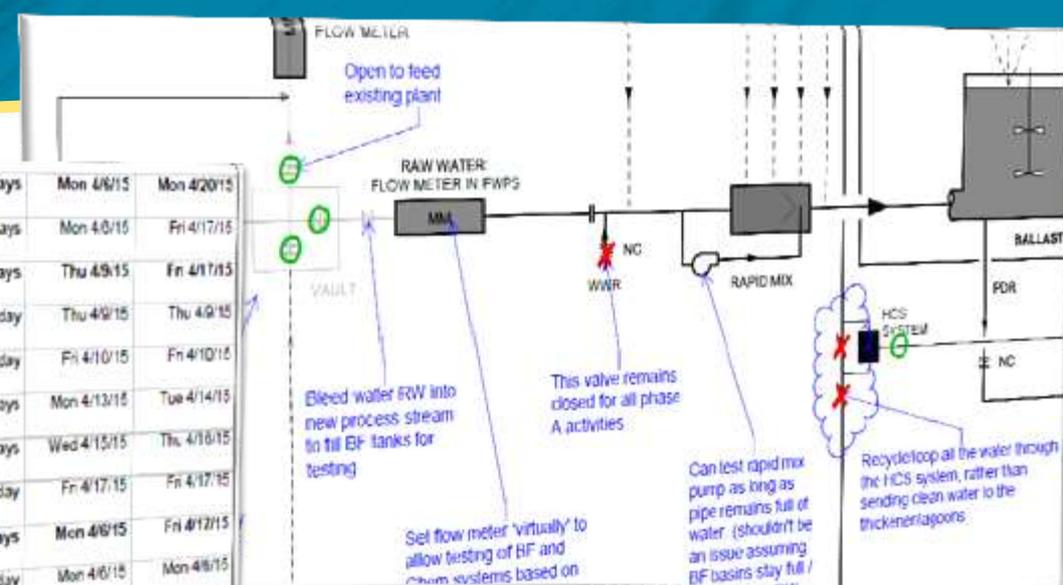
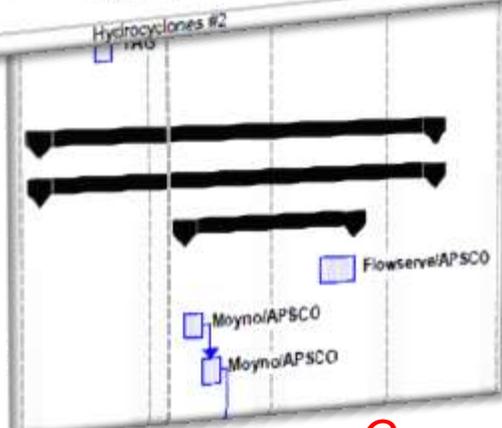
STRATEGIES FOR START-UP SUCCESS

Challenge: Many Cooks in the Kitchen

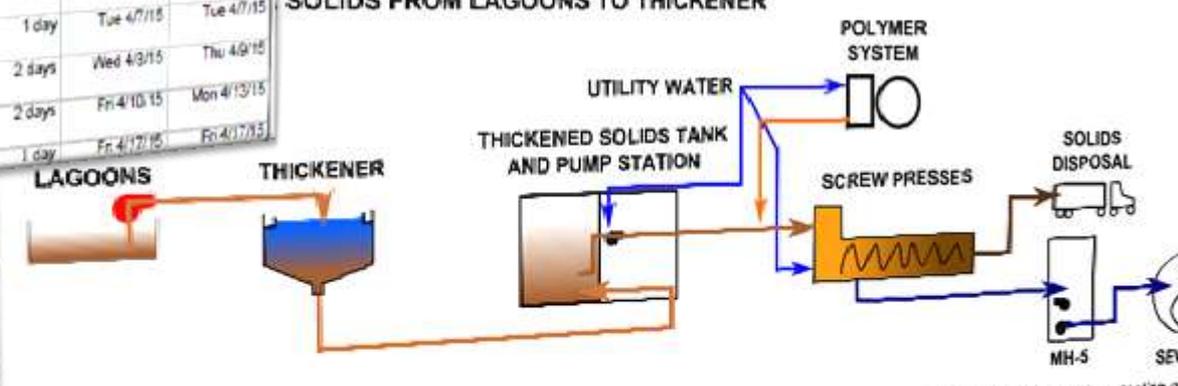


Solution: Detailed Schedules and Start-up Plans

15	Ballasted Flocc (area 11)	11 days	Mon 4/6/15	Mon 4/20/15
16	Kruger I&C/PEI	10 days	Mon 4/6/15	Fri 4/17/15
17	Train #1	7 days	Thu 4/9/15	Fri 4/17/15
18	Coagulation Mixer #1	1 day	Thu 4/9/15	Thu 4/9/15
19	Maturation Mixer #1	1 day	Fri 4/10/15	Fri 4/10/15
20	Settling Tank #1	2 days	Mon 4/13/15	Tue 4/14/15
21	Sand Pumps #1	2 days	Wed 4/15/15	Thu 4/16/15
22	Hydrocyclones #1	1 day	Fri 4/17/15	Fri 4/17/15
23	Train #2	10 days	Mon 4/6/15	Fri 4/17/15
24	Coagulation Mixer #2	1 day	Mon 4/6/15	Mon 4/6/15
25	Maturation Mixer #2	1 day	Tue 4/7/15	Tue 4/7/15
26	Settling Tank #2	2 days	Wed 4/8/15	Thu 4/9/15
27	Sand Pumps #2	2 days	Fri 4/10/15	Mon 4/13/15
28	Hydrocyclones #2	1 day	Fri 4/17/15	Fri 4/17/15



SOLIDS FROM LAGOONS TO THICKENER



OBJECTIVES: Dewater thin lagoon solids. Test operation of gravity thickener, TSS meter, thickened solids control valve. Continue testing and optimize controls and operation of solids feed system, polymer system, and screw press dewatering.

Repeat steps 3 and 4 after completion of solids removal for Lagoon 3 to process the solids in Lagoon 4.

Communication: Numerous start-up meetings, early and often.

Challenge: Significantly Different Operation

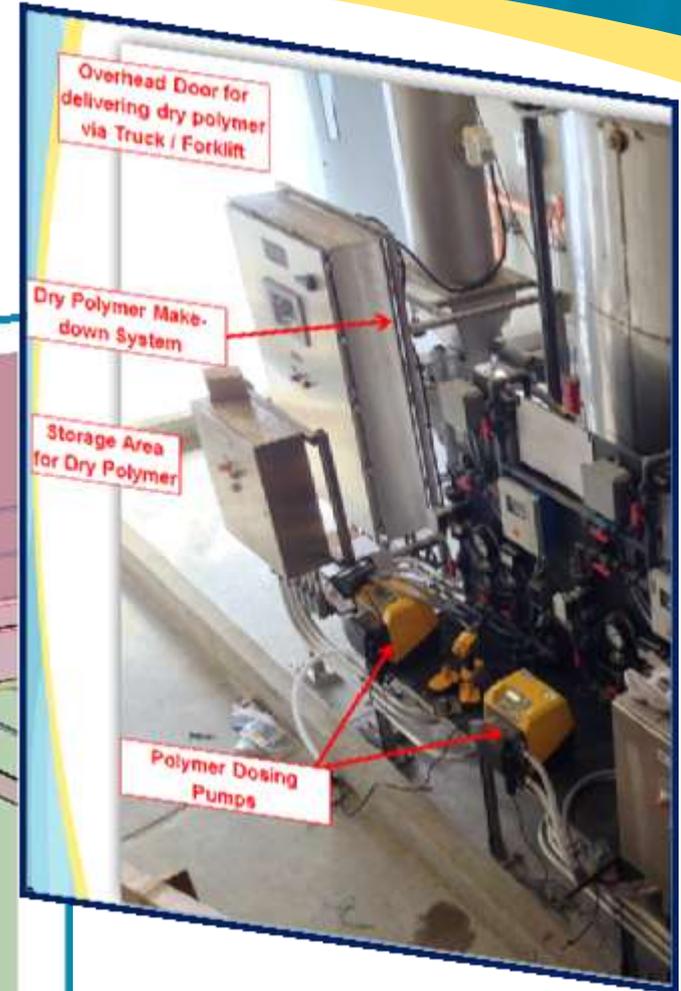
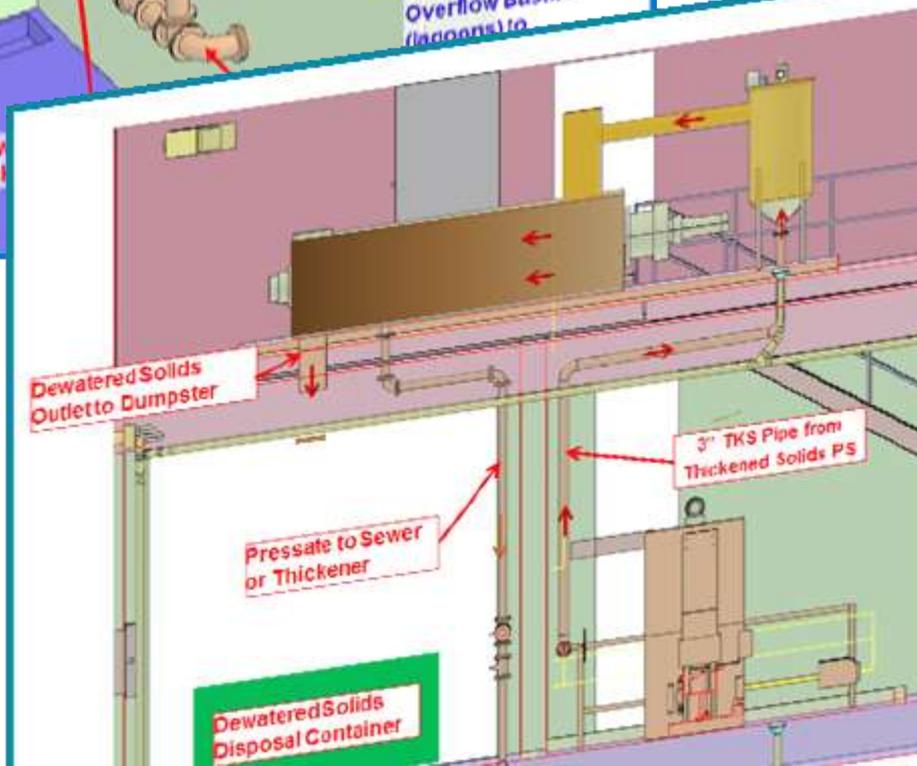
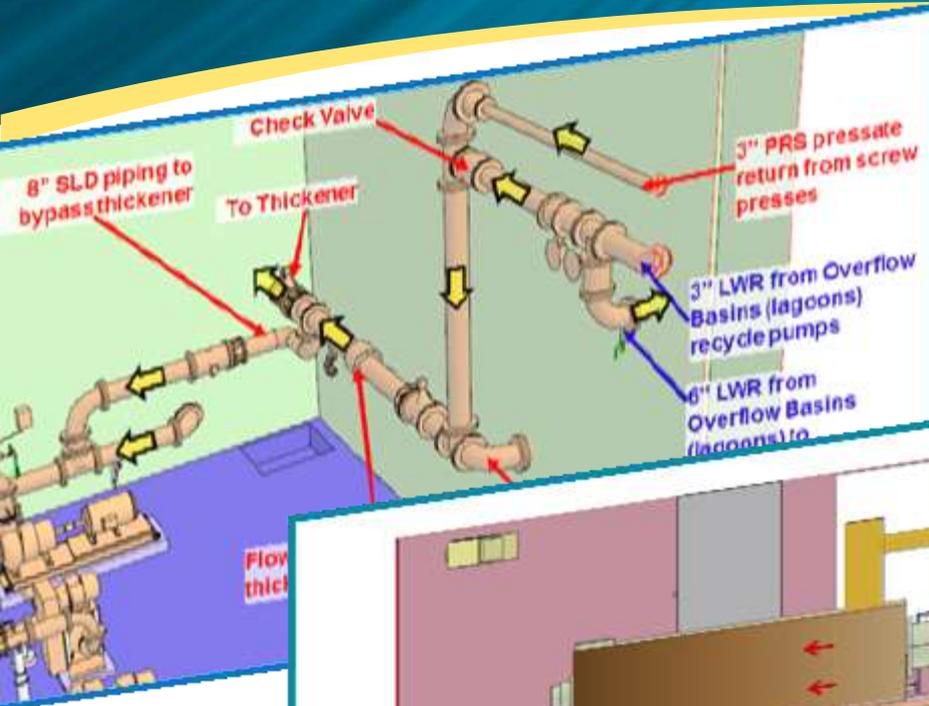
From This:



To This:



Solution: Conduct Detailed Training Programs and Develop O&M Manuals



Solution: Develop & Utilize New Tools For Quick Re-Calibration & Re-Calculation



Moisture Analyzer

Polymer Jar Testing

Mechanical Dewatering Polymer Feed Rate

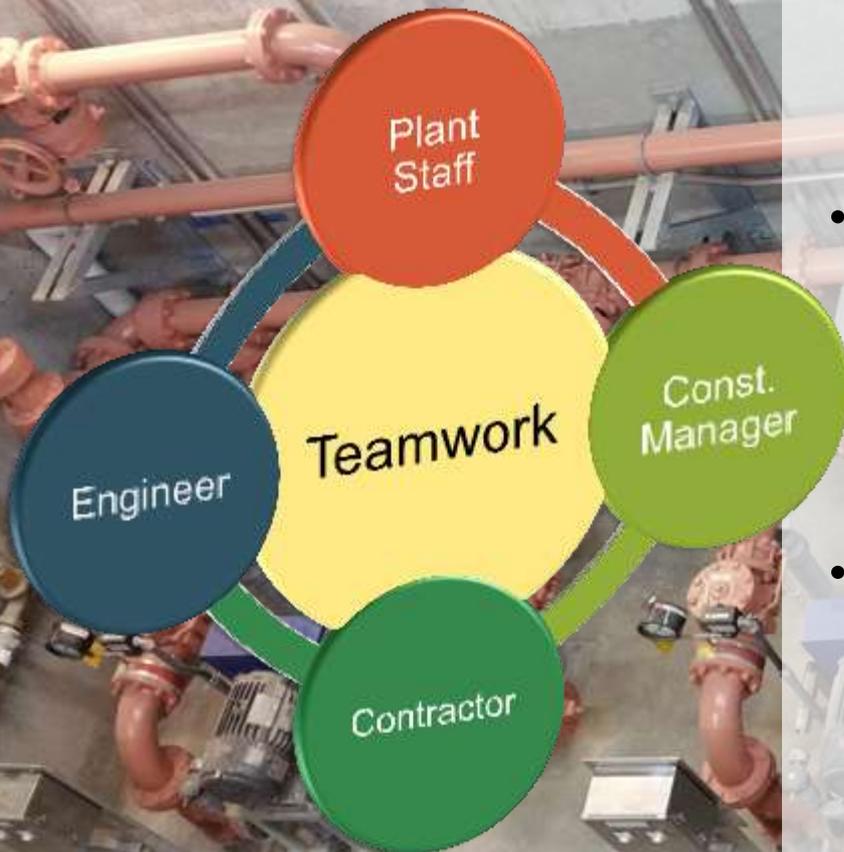
Select what you would like to calculate

Calculate using mechanical dewatering influent flow rate Calculate using mechanical dewatering solids feed rate

Mechanical Dewatering Feed Rate, gpm	22	Polymer Dosage Rate, lbs/dry ton	12
Percent Solids of Feed Sludge, %	4.3	Dry Polymer Batched Concentration, % Active	0.5
RESULTS			
CALCULATE			
Dry Tons of Sludge Fed Per Hour, Tons	0.243	Density of Sludge, lbs/gallon	8.57
Polymer Usage Rate, lbs/hour (by weight)	2.92	Feed Concentration of Polymer, lbs Active/gallon	0.042
Polymer Feed / Solids Feed Ratio (gph/gpm)	0.19	Polymer Feed Rate, gallons/hour (by volume)	69.97

Web Based Calculation Tools

More Strategies for Startup Success



- **Utilize temporary valves to allow easy switching between old and new**
 - Minimize number of long plant shut-downs
- **Decouple startup processes where possible – start one process at a time**
 - Early solids handling startup
 - Run treatment plants simultaneously (old in production, new in testing)
- **Plan for change (be flexible)**
 - Expect to make significant adjustments during startup

Lessons Learned & Conclusions

During Design

- Plan for startup
- Get plant staff buy-in

During Construction

- Install necessary temporary systems
- Schedule adequate time for startup activities

During Startup

- Get the right people on site at the right time
- Process Champions in Operations
- Keep Engineer involved
- Be patient!



Thank You

Questions?

