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Solids Handling using Screw Presses, a Case Study

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MWH®

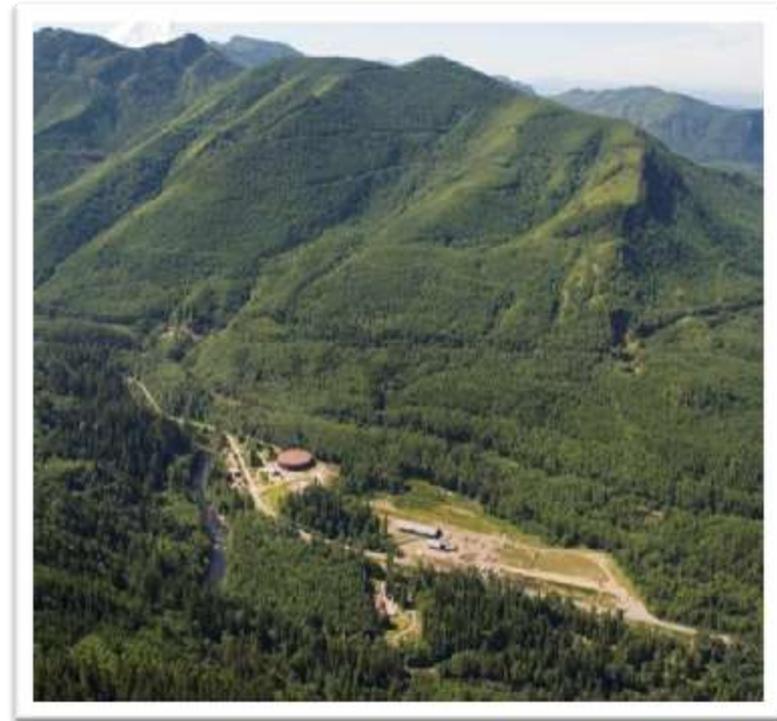
BUILDING A BETTER WORLD

Overview

- History and Background
- Solids Production at GRFF
- Dewatering Options and Screw Press Selection
- Design Features
- Performance and Solids Disposal

History and Background

- Tacoma Water has been diverting from the Green River since 1913
- At the GRFF, Tacoma Water has capability to divert year-round from the Green River under all river conditions.
- Historically, when river turbidity is high or carrying excessive debris, North Fork Wellfield used to supplement Green River water to improve quality



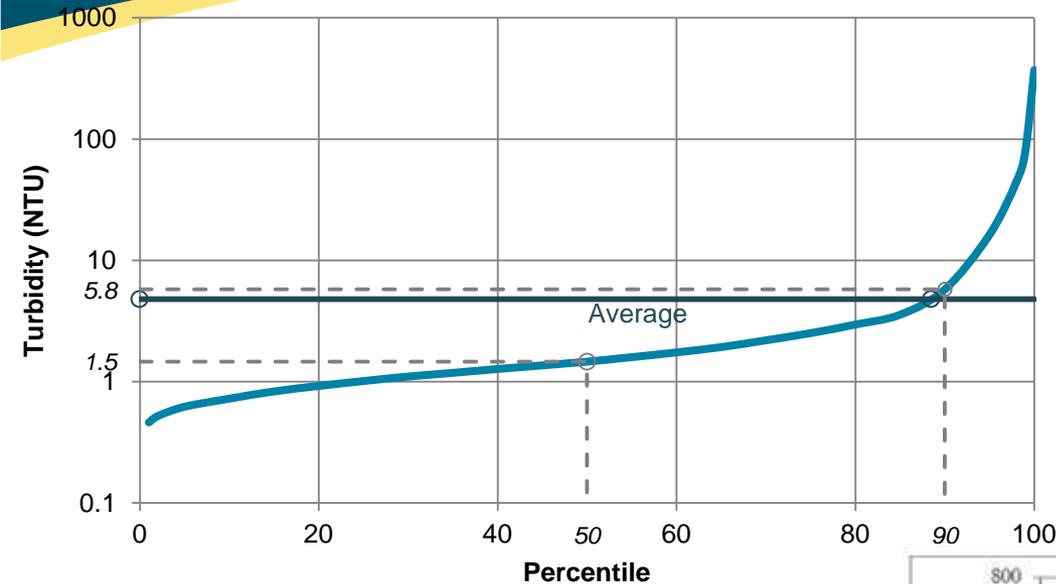
History and Background

- To limit solids handling at the plant, a goal was established to blend Green River with NFW supply so that influent turbidity <5 NTU at all times.
- North Fork Wellfield has 72 MGD capacity and is typically available from December to April

	Average Daily Demand (ADD) mgd	Peak Daily Demand (PDD) mgd	Minimum Daily Demand (MDD) mgd
Annual Basis	106	150	n/a
Winter Period	71	90	20
Summer Period	118	150	36

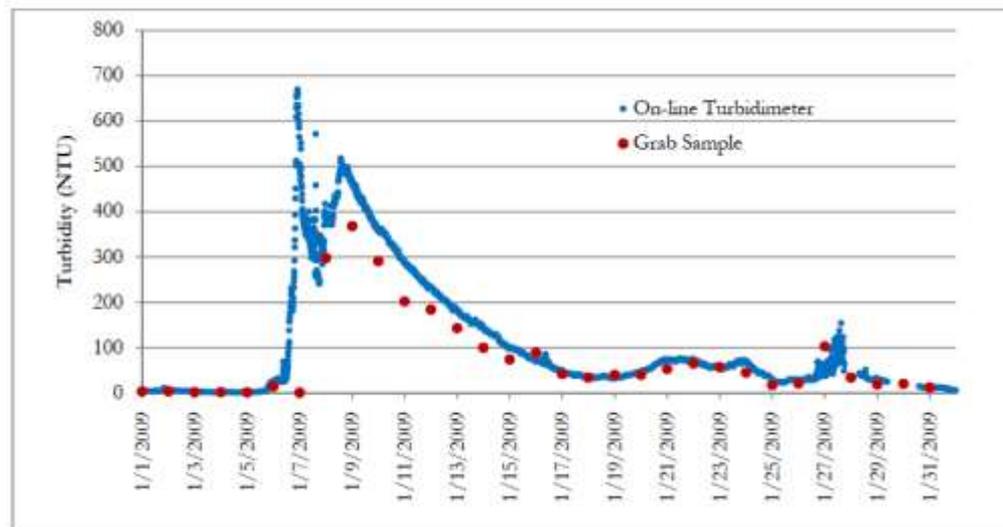
History and Background

Raw Water Turbidity



**Green River Composite Turbidity
(1998-2010)**

Peak Week Event, January 2009



Solids Production at GRFF

- Solids at plant generated from:
 - Suspended solids carried from the river
 - Alum/PACL and Cationic Polymer added the flash mix channel

WTP Operating Scenario				Est. Weekly Solids Production (dry lbs/week)
Plant Flow	NFW Blending	Event		
Winter	90 MGD	Yes	Avg Week	45,000
	90 MGD	Yes	Peak Week	416,000
	90 MGD	No	Peak Week	1,860,000
Summer	150 MGD	Yes	Avg Week	26,000
	150 MGD	Yes	Peak Week	256,000
	150 MGD	No	Peak Week	454,000

Peak Week: Jan 8-14, 2009; Summer Peak: May 17-23, 2009

Solids Handling/Dewatering Options Considered

Technology	Advantages	Disadvantages	
Drying beds/lagoons	Simple technology Lowest capital cost	Large land area required; constant “working” may be required	 <p>Tolt WTP, SPU</p>
Mechanical (e.g. centrifuge, screw press, belt press)	Easily used year-round; small footprint	Higher capital cost, higher O&M	

Note: Sewer Disposal not available at GRFF

Lagoons and Drying Beds at GRFF

- Based on climate, estimated drying rate of 6 lbs dry solids/sf
 - Worst-case year requires more space than available on site
- Effectiveness also dependent on weather conditions (Annual Rainfall = 93") and staff effort at turning solids and managing flows



Tolt WTP
SPU

Period	ADD (MGD)	Max Annual Production (dry lbs)		Est. Min Acreage Required	
		Worst-Case Year	Average Year	Worst-Case Year	Average Year
Year 1	82	1,386,000	1,345,000	5.3	5.2
Year 10	95	1,804,000	1,576,000	6.9	6.0
Year 25	106	2,320,000	1,795,000	8.9	6.9

Not enough space on site to accommodate future worst-case years

Comparison of Mechanical Dewatering Technologies

	Pros	Cons
Centrifuge	<ul style="list-style-type: none">• Smaller Footprint• Proven Technology	<ul style="list-style-type: none">• Higher Speed• Higher Power Usage (50 Hp)• Specialized maintenance requirements• Less likely to operate unattended for extended periods
Belt Press	<ul style="list-style-type: none">• Proven Technology• Moderate power usage (25 hp)	<ul style="list-style-type: none">• Most operator attention required• Lower cake solids
Screw Press	<ul style="list-style-type: none">• Lower Speed• Lower Power Use (5 Hp)• Reduced Maintenance• More likely to operate unattended for extended periods	<ul style="list-style-type: none">• Limited experience with WTP solids• Larger footprint• Heavier Equipment• More expensive

Deciding Factors:

- An analysis of life-cycle costs supported the use of screw presses over the other technologies.
- Tacoma Water staff had positive experiences with screw presses in WW applications

Screw Presses

Lab Tests During Predesign

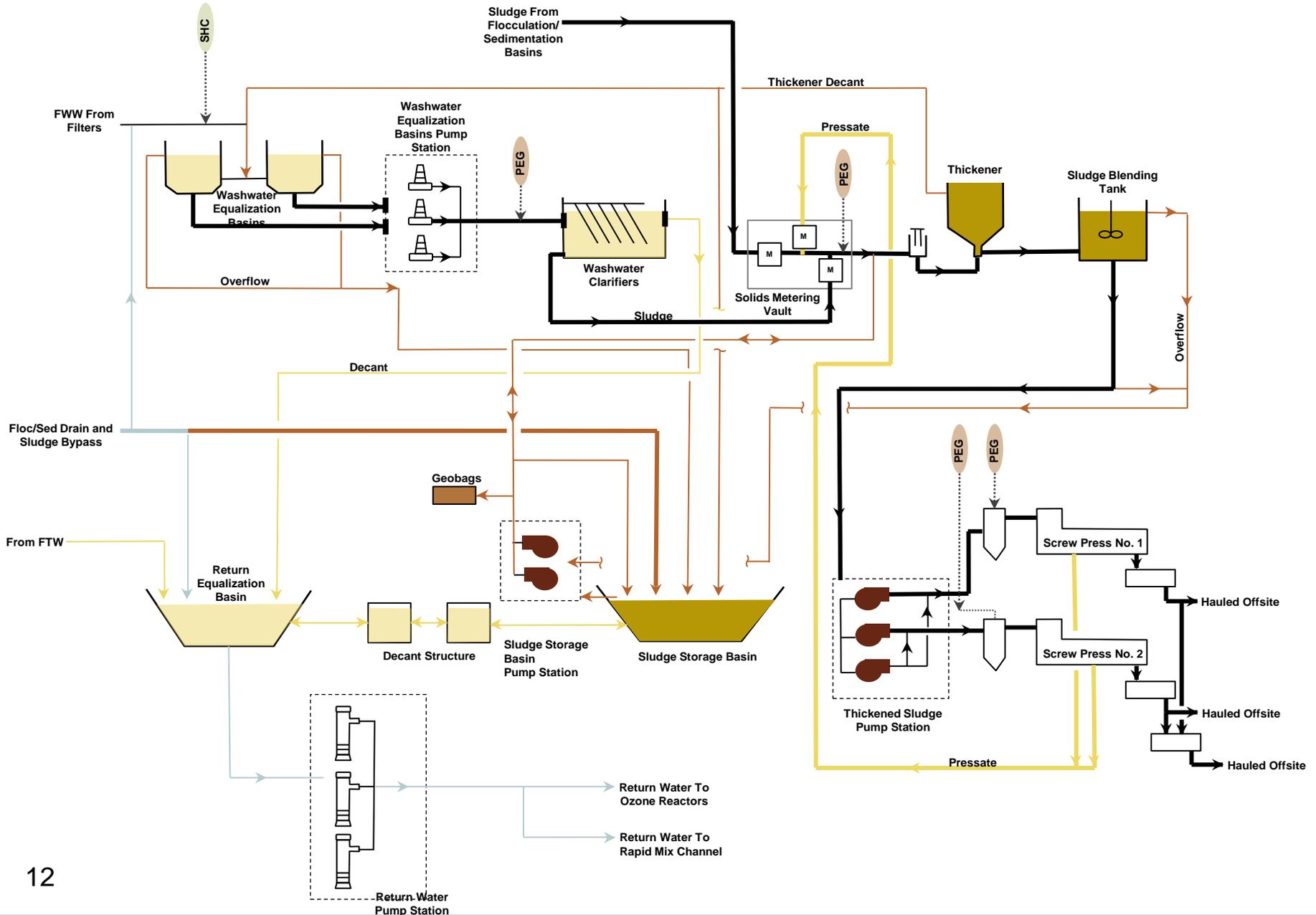
- Samples from the pilot plant were sent to FKC and Huber during the predesign phase:
- Based on the results, screw presses considered viable for this facility.

	Inlet Solids Conc (%)	Ib Active Polymer per dry lb solids	Dewatered Solids Conc (%)
FKC Test 1	4.5	4.6	37.3
	2.3	9.3	39.3
	1.2	18.1	39.7
FKC Test 2	1.5	10.4	26.9
FKC Test 3	5.7	3.6	40.3
Huber	3.4	5-20	40-56

SOLIDS HANDLING FACILITIES AT GRFF



Solids Handling – Process Flow

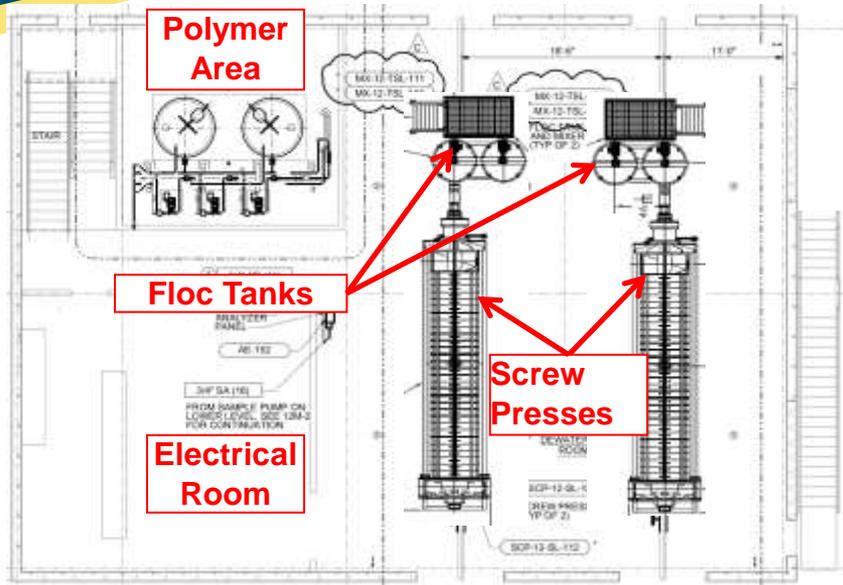


Solids Handling Facilities



Screw Presses

Equipment Arrangement



Screw Presses

Key Facts

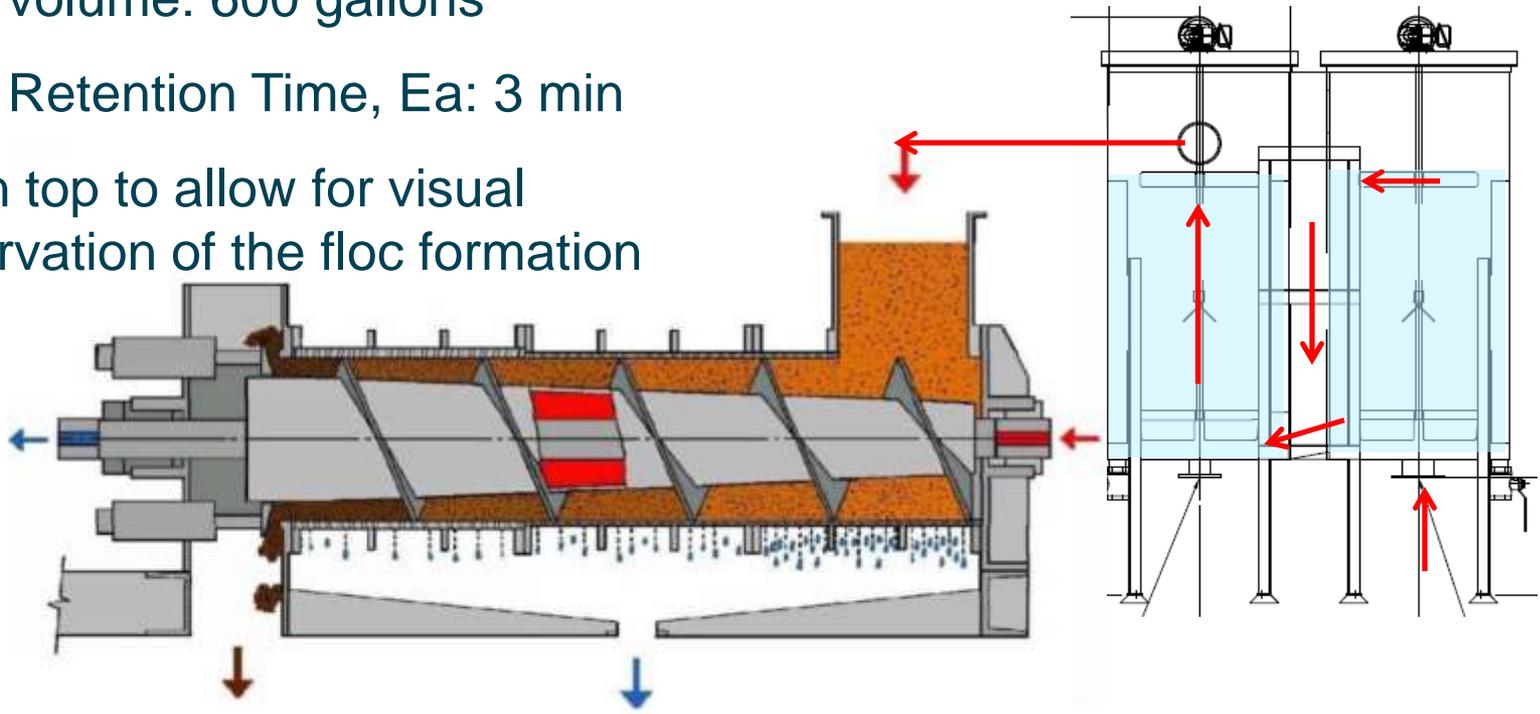
- FKC Model BHX-1000x5500L
- Solids Capacity, each: 1000 dry lbs/hr
- Hydraulic Capacity, each: 50-100 gpm
- Operating Speed: 0.3 rpm
- Unit Weight: 17,637 lbs (dry), 25,353 lbs (operating)
- Length: 5500 mm (216.5")
- Drum Diameter: 1000 mm (39.4")



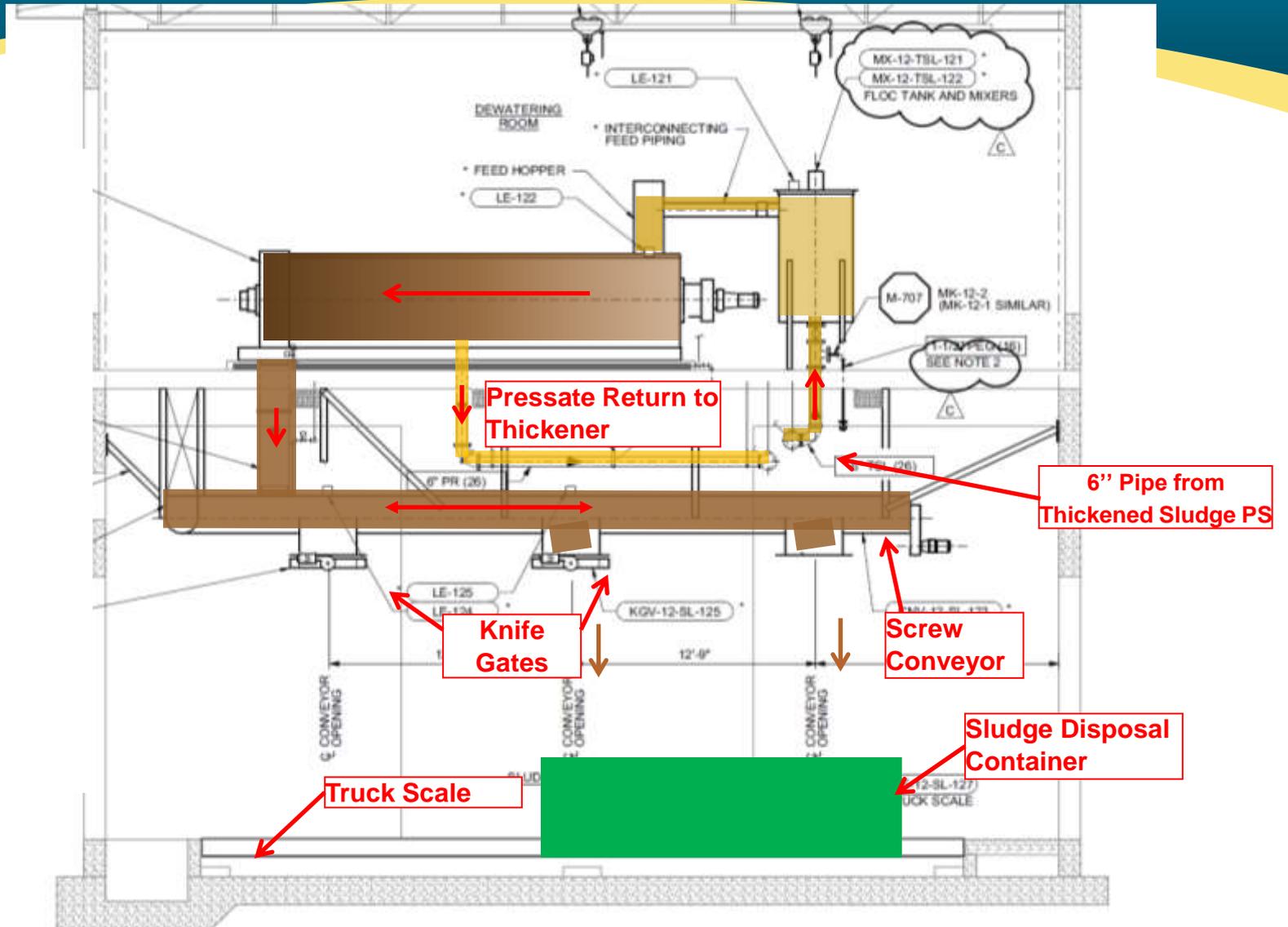
Flocculation Tanks

Key Facts

- 2 units for each press to accommodate multiple polymer use
- Continuous shaft and paddle agitation in each tank
- Total volume: 600 gallons
- Tank Retention Time, E_a : 3 min
- Open top to allow for visual observation of the floc formation



Screw Presses



Screw Press Operation



Solids Disposal

- Containers positioned beneath screw conveyors, each with 22 cy capacity
- Truck scales measures weight added to containers
- Private trucking company hauls off containers
- Tacoma Water is seeking certification as “inert” to reduce disposal costs



Screw Press Results

- Dewatered Cake Solids %:
 - Median: 22%
 - Max: 32%
 - Min 17%
- Polymer Dose (lbs active/dry ton)
 - Median: 3.1
 - Max: 4.8
 - Min: 1.1
- As of Feb 24th, the GRFF has processed and sent out 282.1 tons of sludge
- Note: Results from analysis of the screw press log, which is based on sampling



Contingency Plans



Sludge Storage Basin

What if one or both presses fail?

- Temporary storage in thickener, blending tank, sedimentation basins
- Emergency sludge storage basin
- Sludge Conveyor Overflow
- Geobags



Geobags at Everett WTP



Sludge Conveyor Overflow

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QUESTIONS?

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