

Green River Filtration Facility Plant Overview

PNWS-AWWA Conference
Bellevue, WA

Gary Fox & Hilary Lorenz
April 29, 2015

IN THE BEGINNING...

TACOMA  WATER
TACOMA PUBLIC UTILITIES

PILOT PLANT – OWNED AND OPERATED BY TACOMA WATER STAFF



ALL THAT HARD WORK PAID OFF



**10 gpm/sf high rate
filtration approved by
Washington State DOH
April 2012.**

**Donating the trailer to
education – Green River
CC**

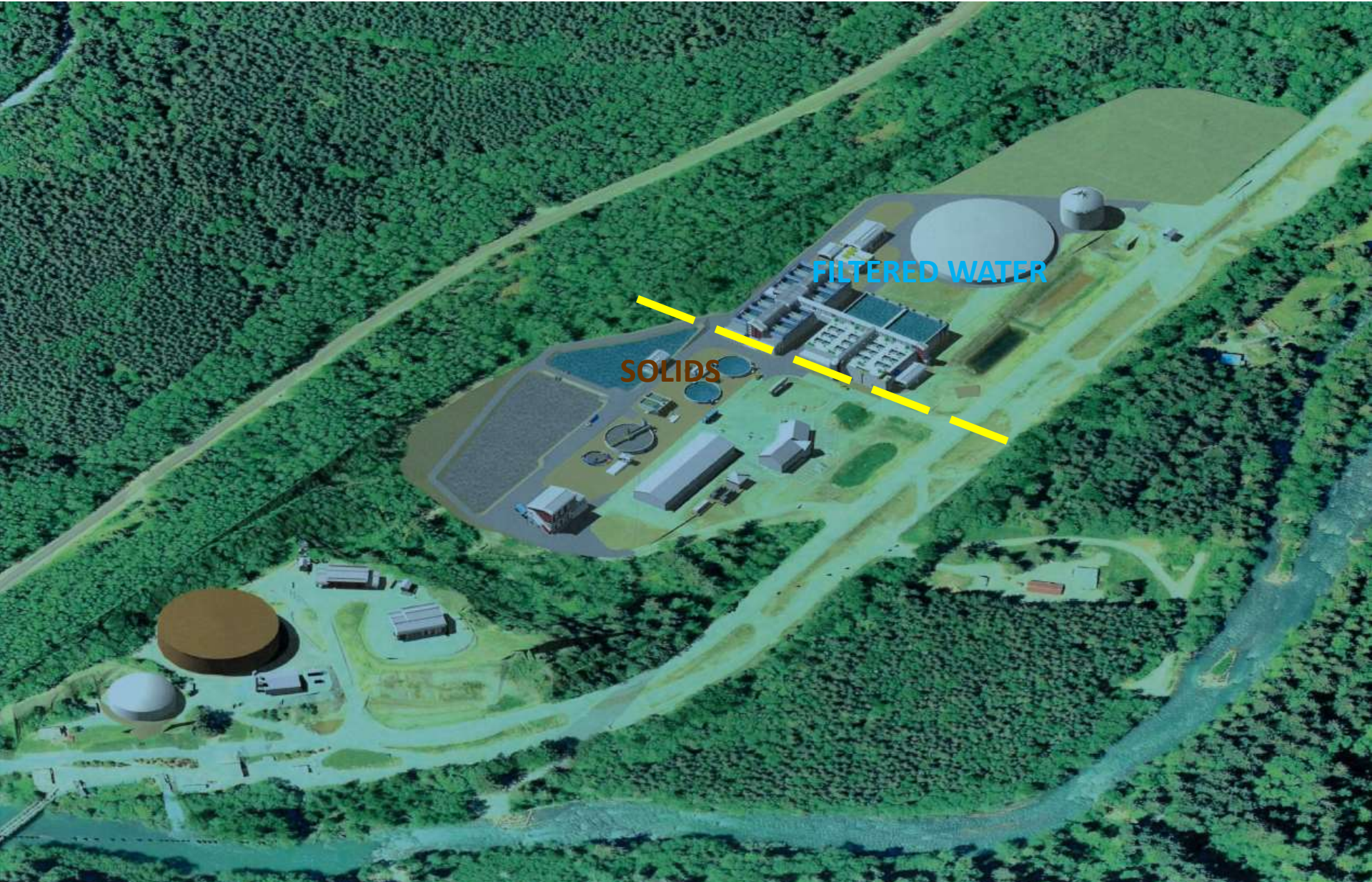
GREEN RIVER FILTRATION FACILITY

OVERVIEW OF THE GRFF

The Big Chunks:

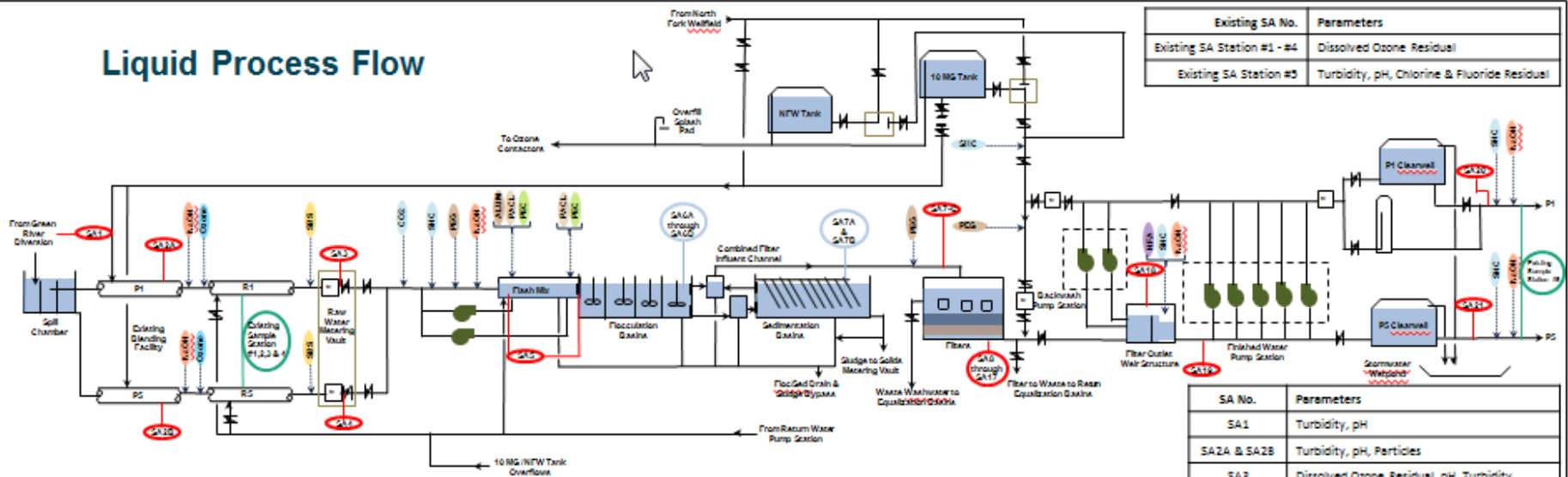
- Sources - Green River and North Fork Well field
- Capacity - 90 MGD Conventional / 150 MGD Direct
- Chemicals – Coagulant, coagulant aid, polymers...
- Filter Media – Dual media: Sand and anthracite
- Solids – Process flow, Basins, Screw Press, and Haul

GRFF SITE PLAN – WEST VS. SOUTH LAYOUT



PROCESS FLOW DIAGRAMS

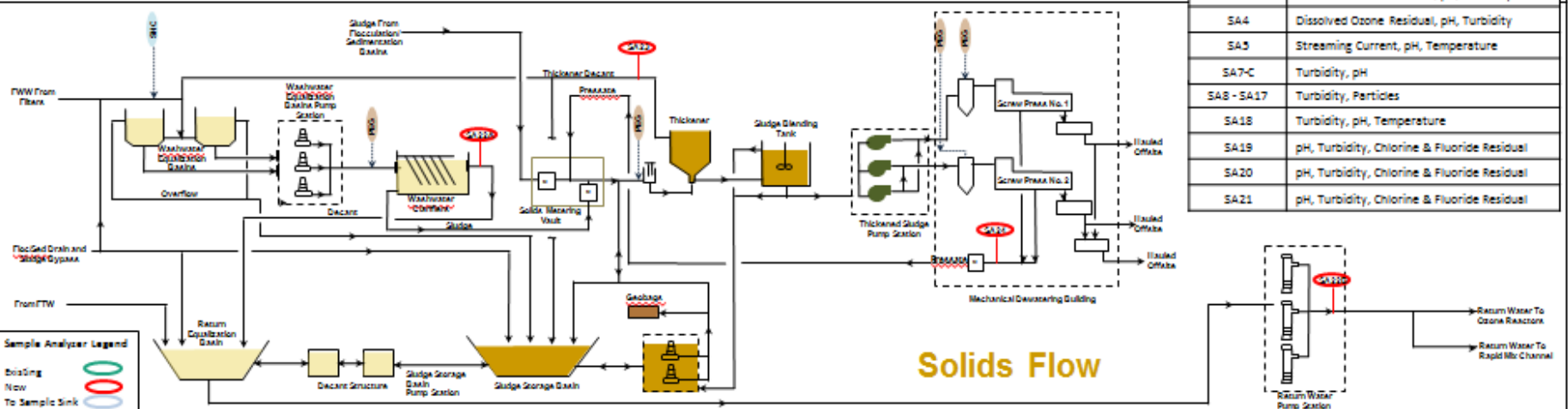
Liquid Process Flow



Existing SA No.	Parameters
Existing SA Station #1 - #4	Dissolved Ozone Residual
Existing SA Station #5	Turbidity, pH, Chlorine & Fluoride Residual

SA No.	Parameters
SA1	Turbidity, pH
SA2A & SA2B	Turbidity, pH, Particles
SA3	Dissolved Ozone Residual, pH, Turbidity
SA4	Dissolved Ozone Residual, pH, Turbidity
SA5	Streaming Current, pH, Temperature
SA7-C	Turbidity, pH
SA8 - SA17	Turbidity, Particles
SA18	Turbidity, pH, Temperature
SA19	pH, Turbidity, Chlorine & Fluoride Residual
SA20	pH, Turbidity, Chlorine & Fluoride Residual
SA21	pH, Turbidity, Chlorine & Fluoride Residual

Solids Flow



Sample Analyzer Legend

- Existing (Green circle)
- New (Red circle)
- To Sample Sink (Blue circle)



GREEN RIVER FILTRATION FACILITY

OPERATION & MAINTENANCE MANUAL

PROCESS FLOW DIAGRAM

NOT TO SCALE

MAY 15, 2012 - 0 MONTHS



**Green River Filtration Facility
May 15, 2012**

DECEMBER 21, 2012 – 7 MONTHS



MAY 15, 2013 – 12 MONTHS



DECEMBER 19, 2013 – 19 MONTHS



Pumping ~ 10 MGD Ground Water

Upwards of 190 workers per day.



JUNE 17, 2014 – 26 MONTHS



~30,000 Cu/Yds of concrete
poured site-wide

4464 Settling plates (304 SS material),
pre-assembled in frames -per basin



DECEMBER 2, 2014 – 33 MONTHS



Substantial Completion – December 16!

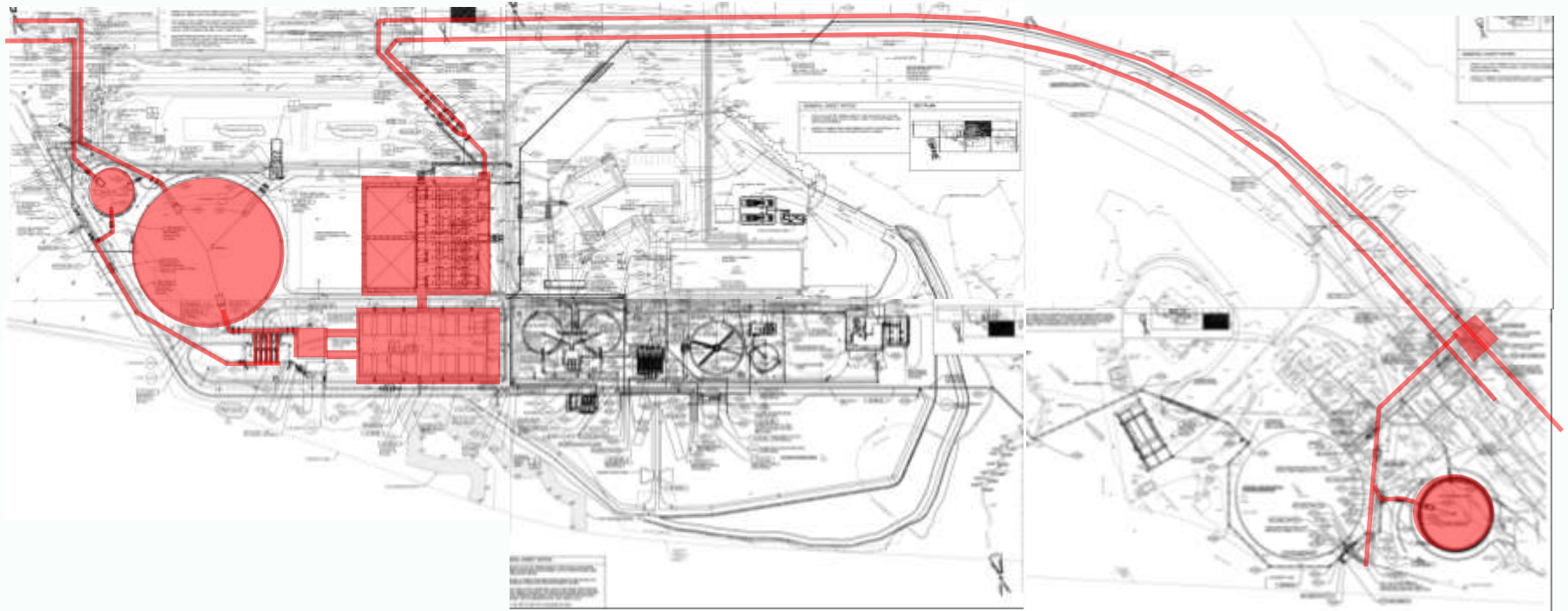


Declare filtration 5-1-15

APRIL 5, 2015



MAIN WATER PROCESS FLOW



INTAKE STRUCTURE IMPROVEMENTS

GREEN RIVER INTAKE PROJECT



GUIDE VANE ARRAY



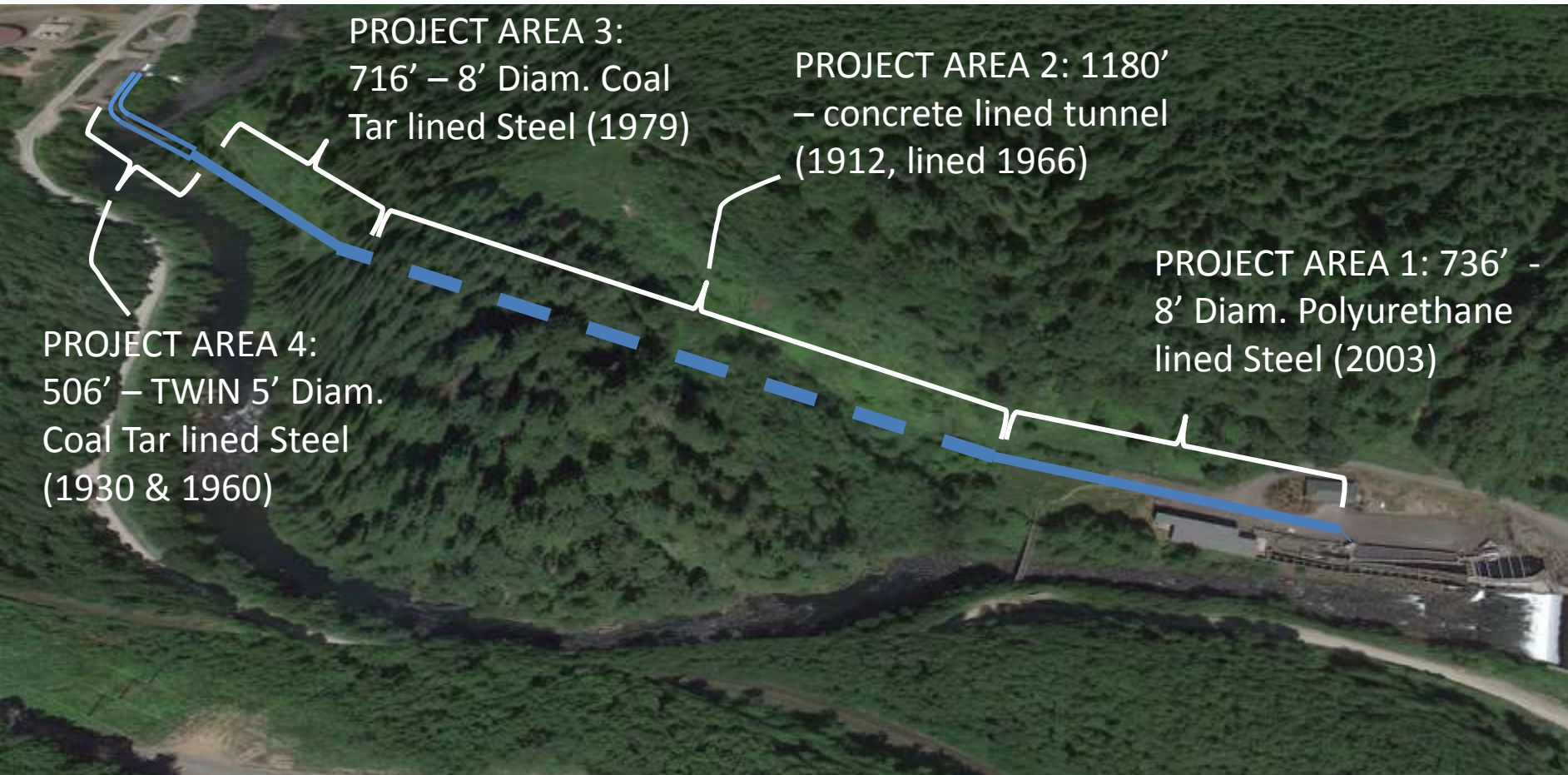
BRUSH SCREEN CLEANER



BEHIND SCREEN-EDUCTOR BASIN



THE GREEN RIVER SUPPLY CONDUITS



AREA 2- CONCRETE FINAL TUNNEL



Tunnel Before Repair Work



Tunnel After Repair Work

AREA 4: 1930'S 60" PIPELINE



1930's Pipe Before Repair Work



1930's Pipe Pitting Before Repair Work

AREA 4: 1930'S 60" PIPELINE

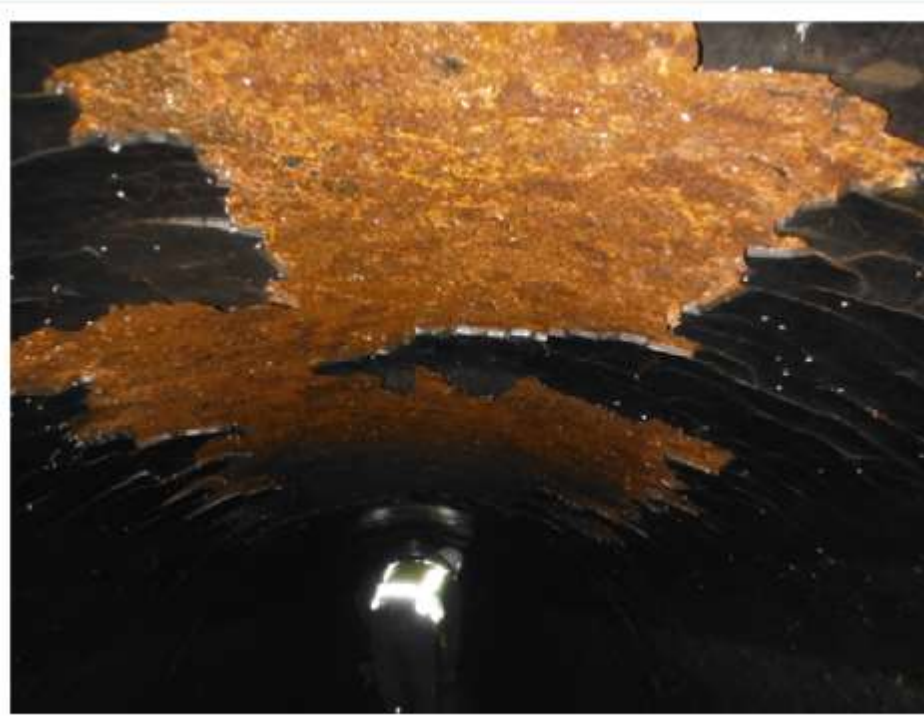


1930's Pipe During Repair Work (prior to polyurea lining)



1930's Pipe After Repair Work

AREA 4: 1960'S 60" PIPELINE



1960's Pipe Before Repair Work



1960's Pipe After Repair Work

NORTH FORK SUPPLY

NORTH FORK SUPPLY



Natural river bank filtration

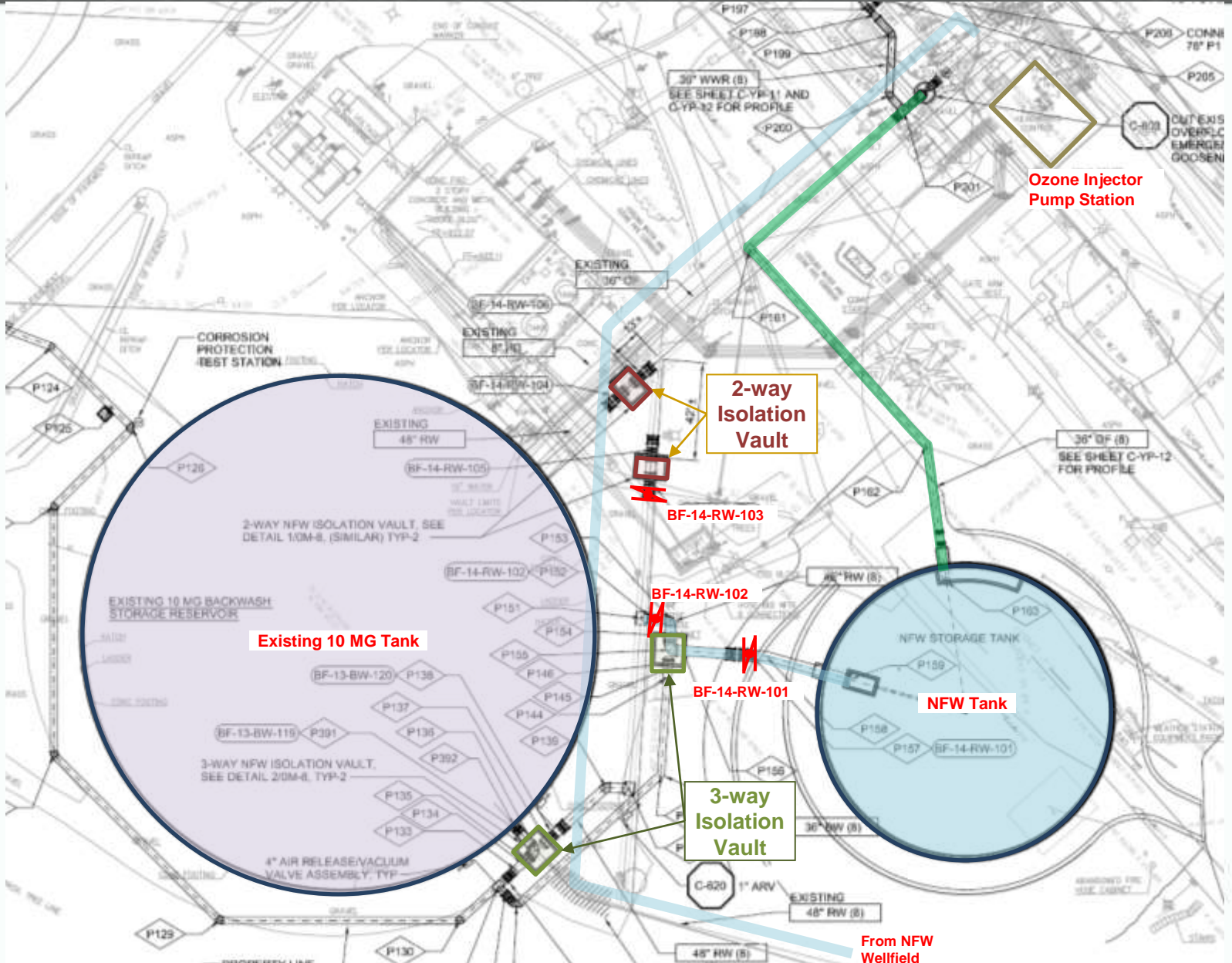
Remote sites – 7 miles upstream
of GRFF



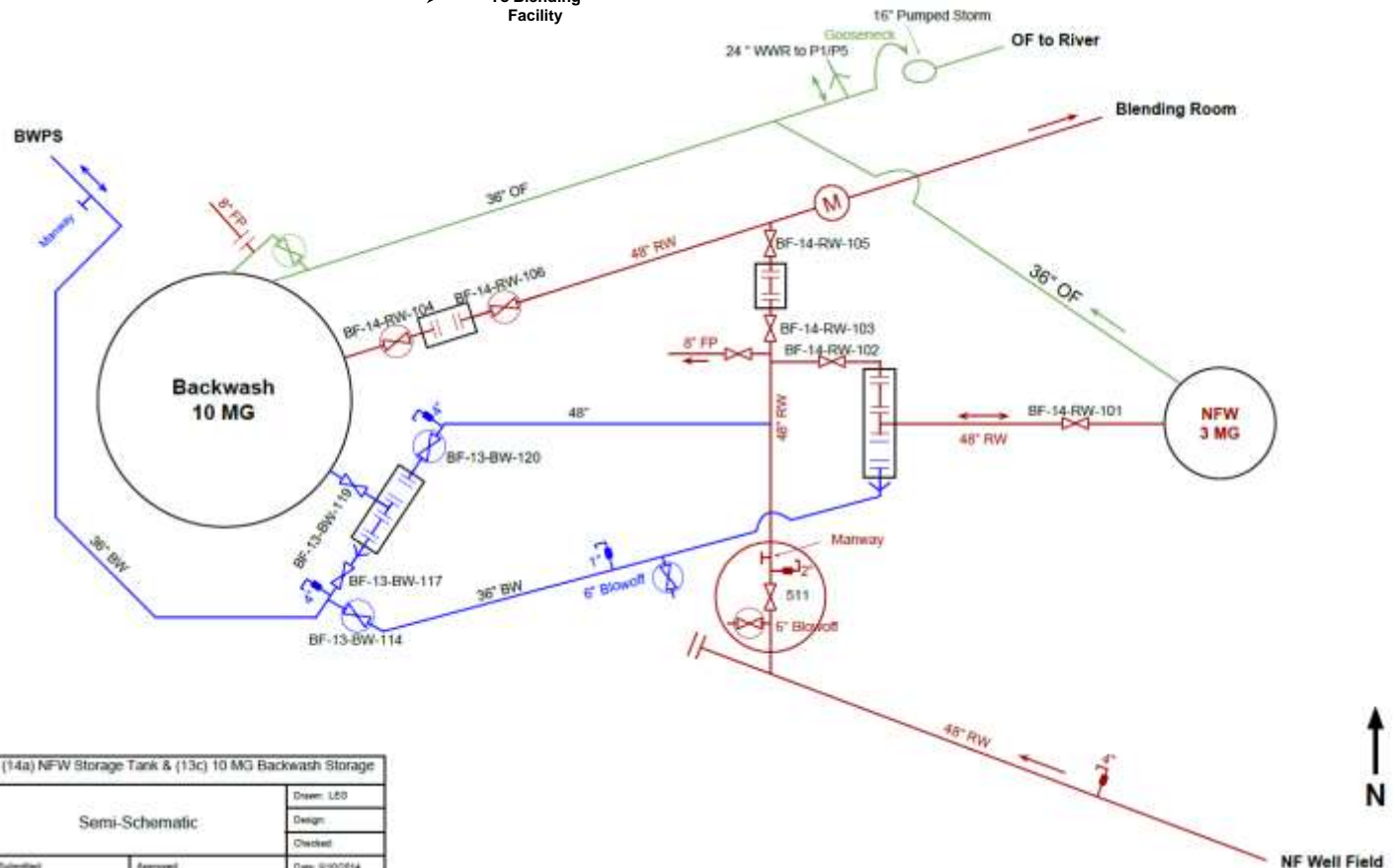
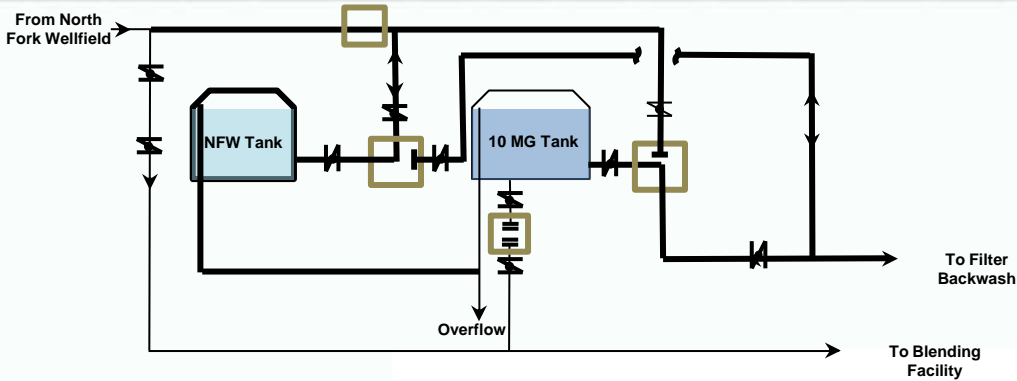
NORTH FORK TANK = 3MG BACKWASH SUPPLY TANK = 10 MG



TANK PIPING



NEW NFW TANK VS. EXISTING 10 MG TANK



(14a) NFW Storage Tank & (13c) 10 MG Backwash Storage	
Semi-Schematic	Drawn: LEO
	Design:
	Checked:
Submitted:	Approved:
Date: 3/10/2014	

INSIDE THE 10MG TANK



OZONE SYSTEM

OZONE GENERATION AND SIDE-STREAM INJECTION

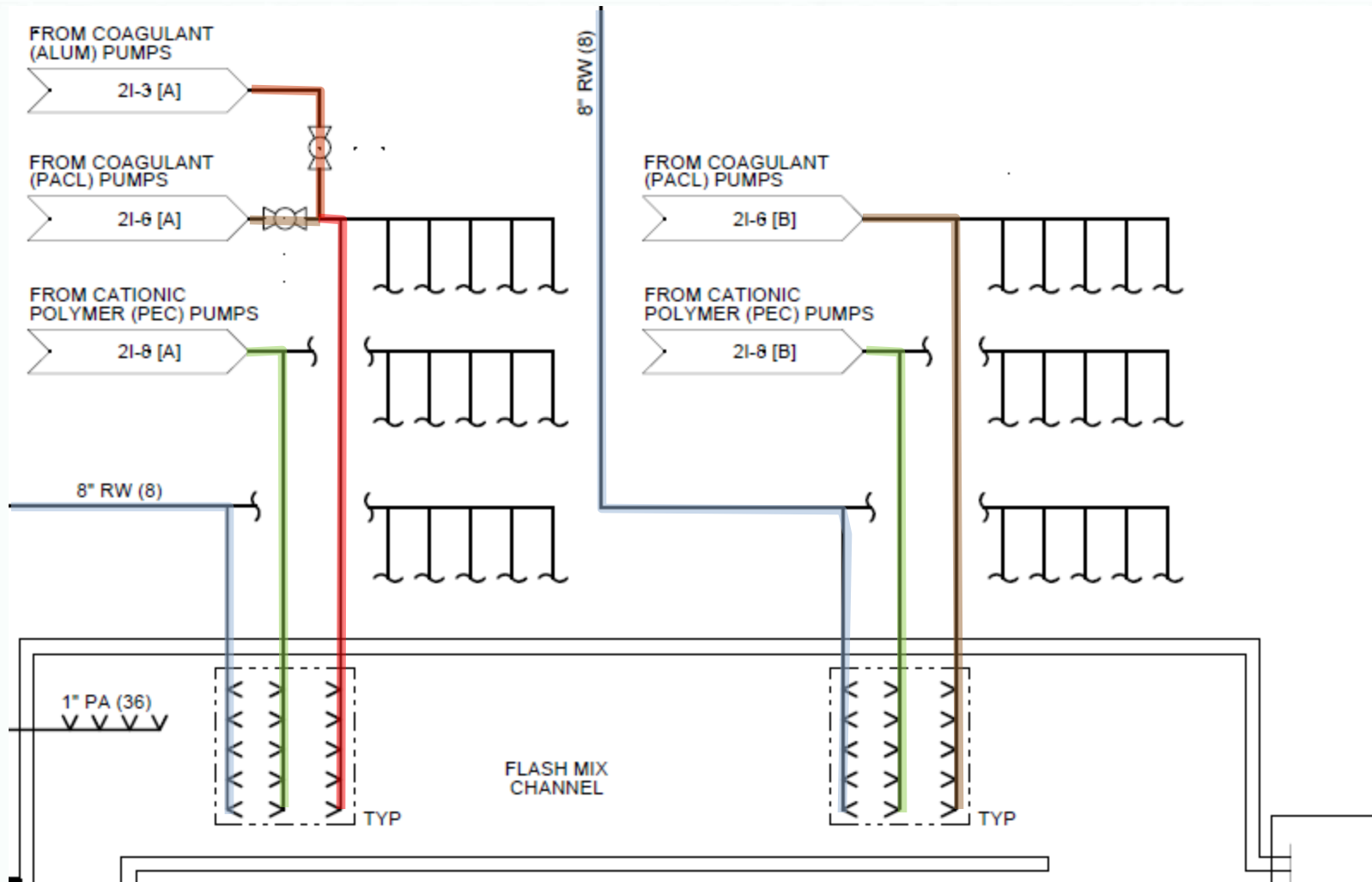


PRE-TREATMENT AND FLASH MIX

RAW WATER METERING STRUCTURE



FLASH MIX INJECTION AT THE DECK



CHEMICAL INJECTION GRID



FLASH MIX ACROSS A CHANNEL



CHEMICAL BUILDING AND COMPONENTS

NUMBER OF NEW TANKS: 20 INCLUDING NEW HYPO TANKS



COMPLEX CHEMICAL PIPING - REDUNDANCY



POINT A TO POINT Z FLEXIBILITY

MANIFOLD ASSEMBLY



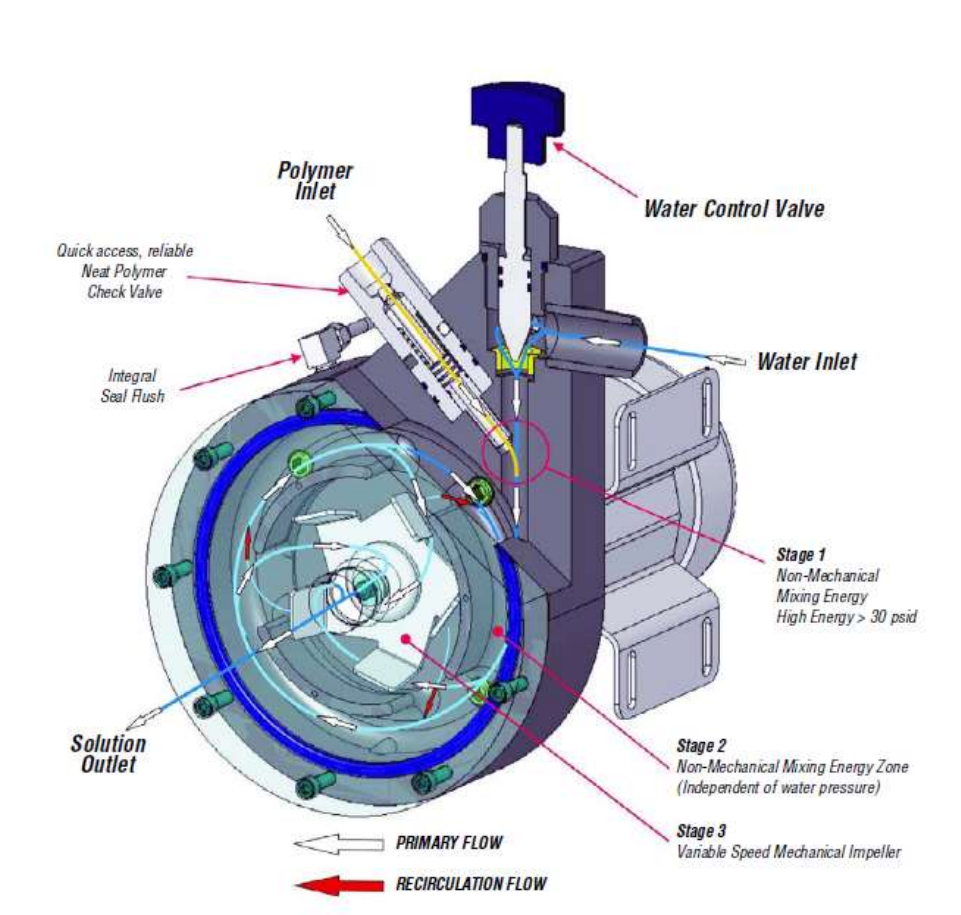
COMMISSIONING AND STARTUP

PUMPS AND ACCESSORIES

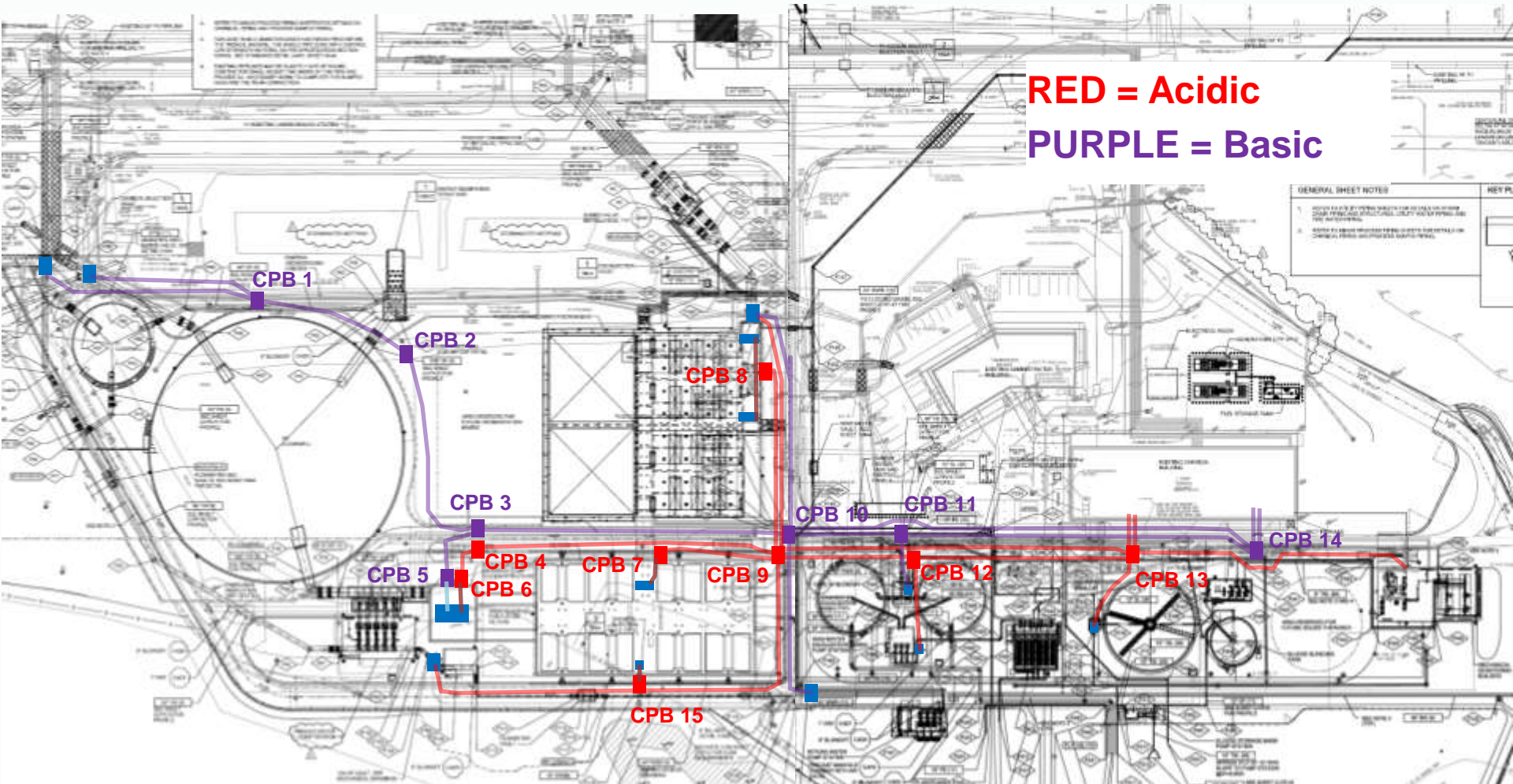


EMULSIFIED POLYMER ACTIVATION

Polymer Blending Units



CHEMICALS - FROM POINT A TO POINT B



LABELS, LABELS, LABELS- LEFT OR RIGHT?



FLOCCULATION / SEDIMENTATION

FLOCCULATION AND SEDIMENTATION



- 4 flocculation trains
- 32 flocculators
- 44'x88' floc trains
- 20 minutes detention time @ 42 MGD
- 2 sedimentation basins with 90 MGD capacity winter 168 MGD summer (algae)
- 89'x89' sed basins
- Hybrid filtration plant

FLOW THROUGH FLOCCULATION AND SEDIMENTATION BASIN

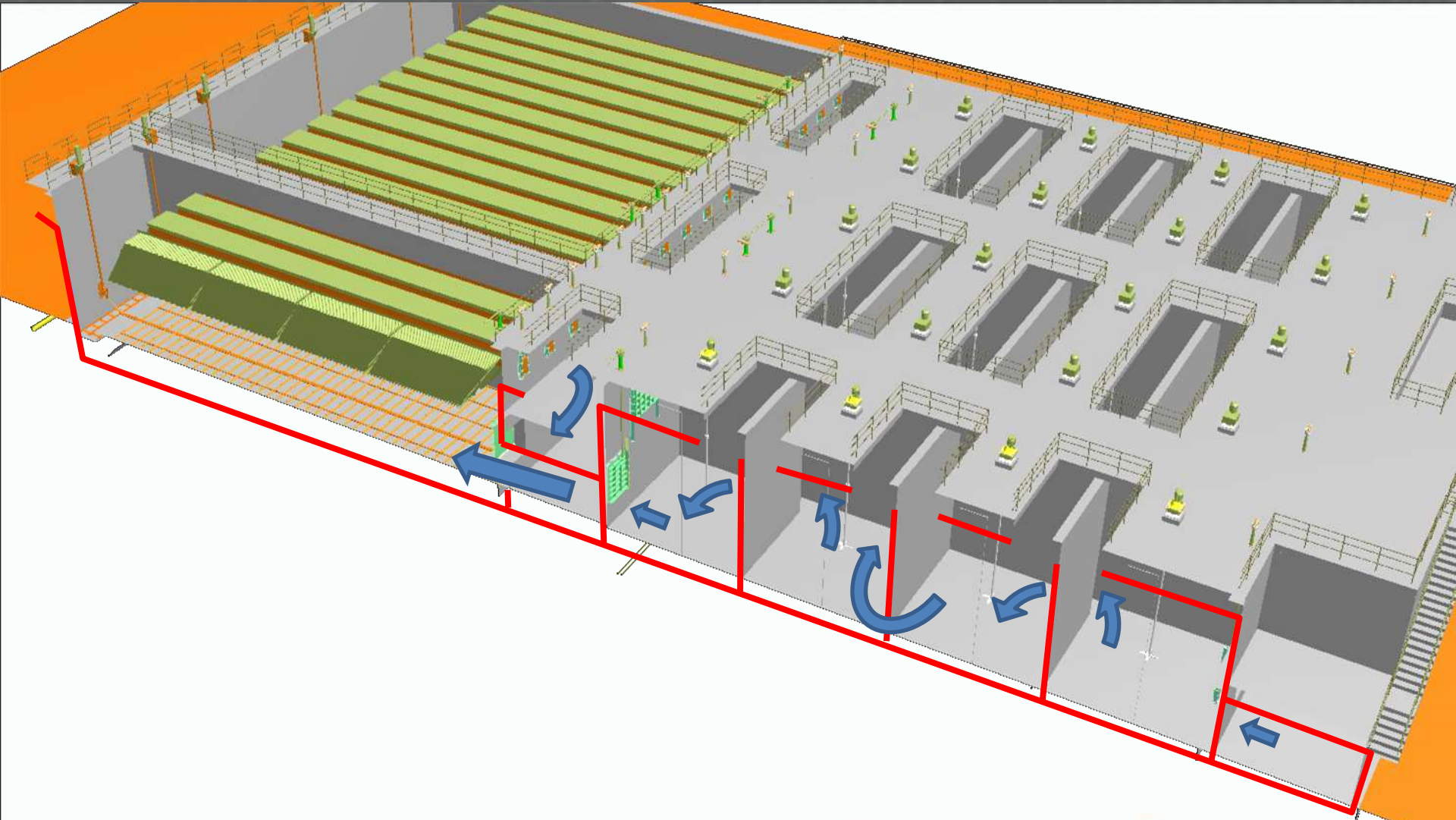
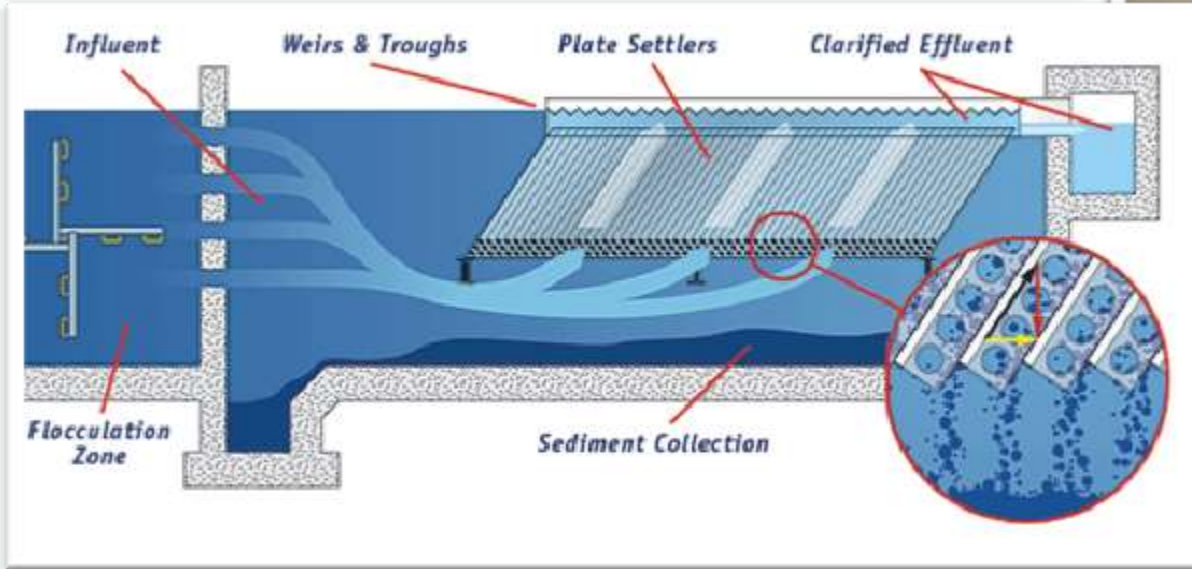
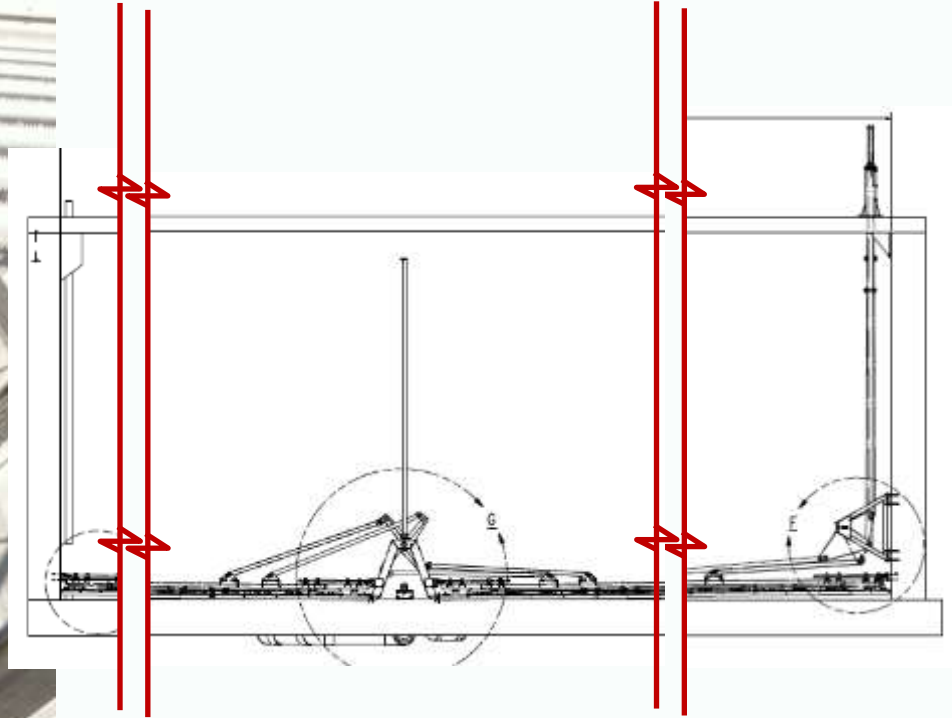
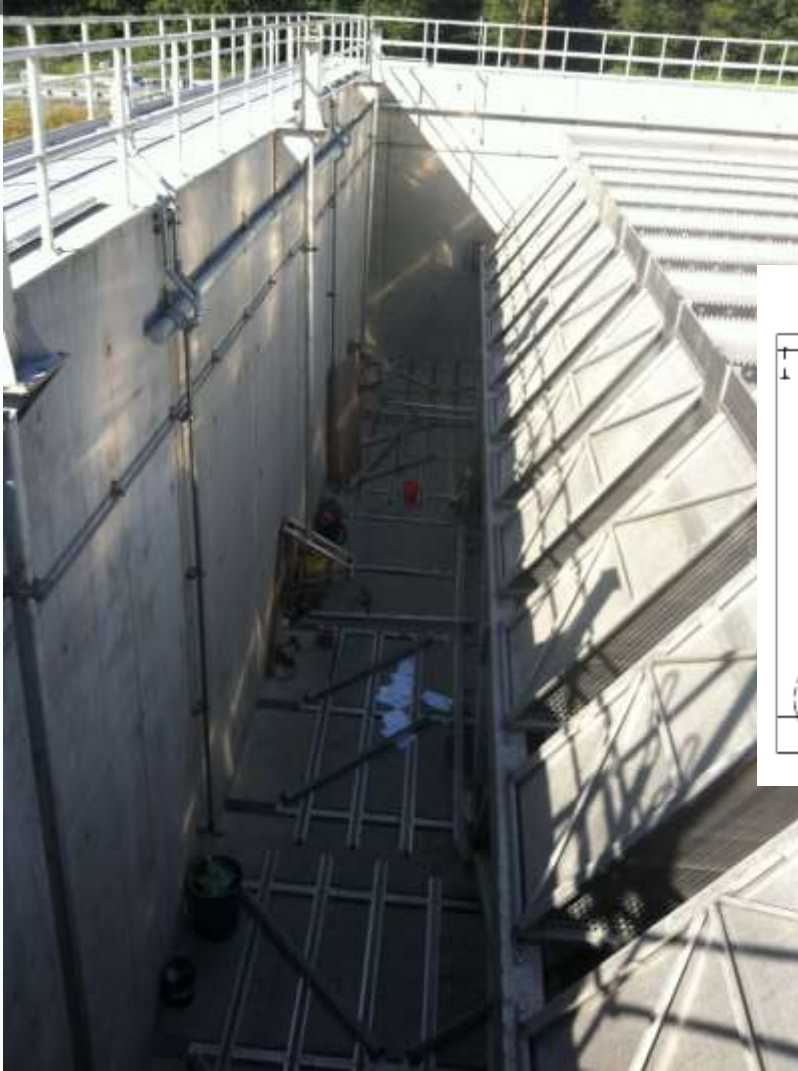


PLATE SETTLERS



SLUDGE SCRAPERS



SOLIDS BUILDUP



CONSIDER THE MATTER SETTLED



FILTERS

FILTER SPECS: NUMBERS FOR THE NUMBERS PEOPLE

<u>Plant Capacity:</u>	150 mgd Initial 168 mgd Ultimate
<u>Filter Type :</u>	Constant Level & Rate
<u>Number of Filters:</u>	8
<u>Cell Dimensions:</u>	42 ft x 20 ft
<u>Cells per Filter:</u>	2
<u>Filter Area (each):</u>	1,680 sf
<u>Filter Area (total):</u>	13,440 sf
<u>Filtration Rate (Nominal – not including recycle):</u>	
-All 8 Filters	7.7 gpm/sf (150 mgd) 8.7 gpm/sf (168 mgd)
-One Off-Line	8.9 gpm/sf (150 mgd) 9.9 gpm/sf (168 mgd)

FILTER MEDIA SPECS:

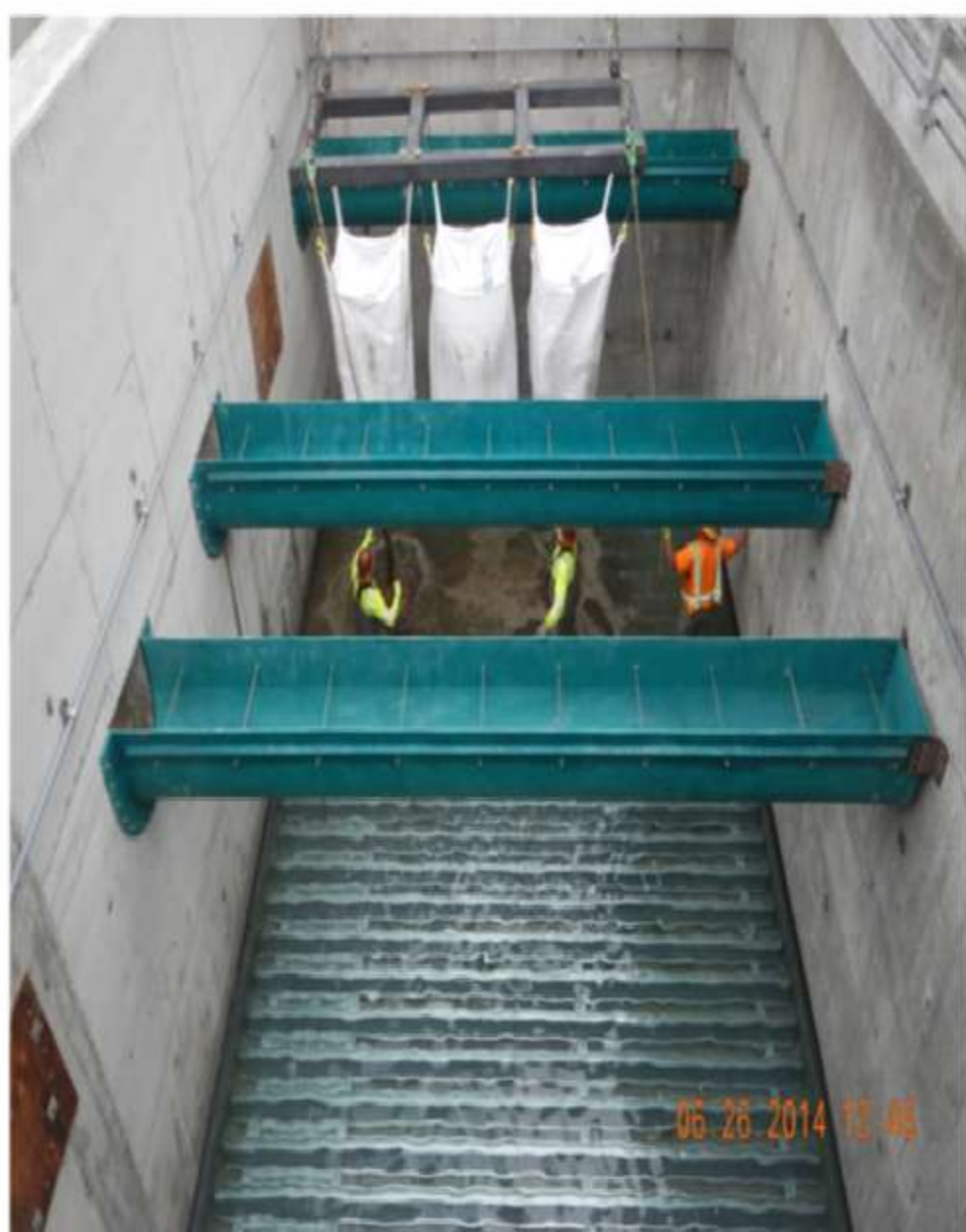


Criterion	Value
Anthracite Media	
-Depth	50 in
-Effective Size	1.32 ± 0.05
-Uniformity Coefficient	<1.4
-Specific Gravity	1.65
Number of super sacks (2500 lbs)	1360
Sand Media	
-Depth	20 in
-Effective Size	0.66 ± 0.03
-Uniformity Coefficient	<1.4
-Specific Gravity	2.63
Number of super sacks (4000 lbs)	688

STAINLESS STEEL UNDERDRAINS



LOADING FILTER MEDIA



FILTERING SOLIDS



SETTLED WATER INTO FILTERS

BACKWASH WATER OUT OF FILTERS



FILTER PIPE GALLERY



FINISHED WATER PUMP STATION

5 PUMPS – 200 HP EACH – 73 MGD CAPACITY



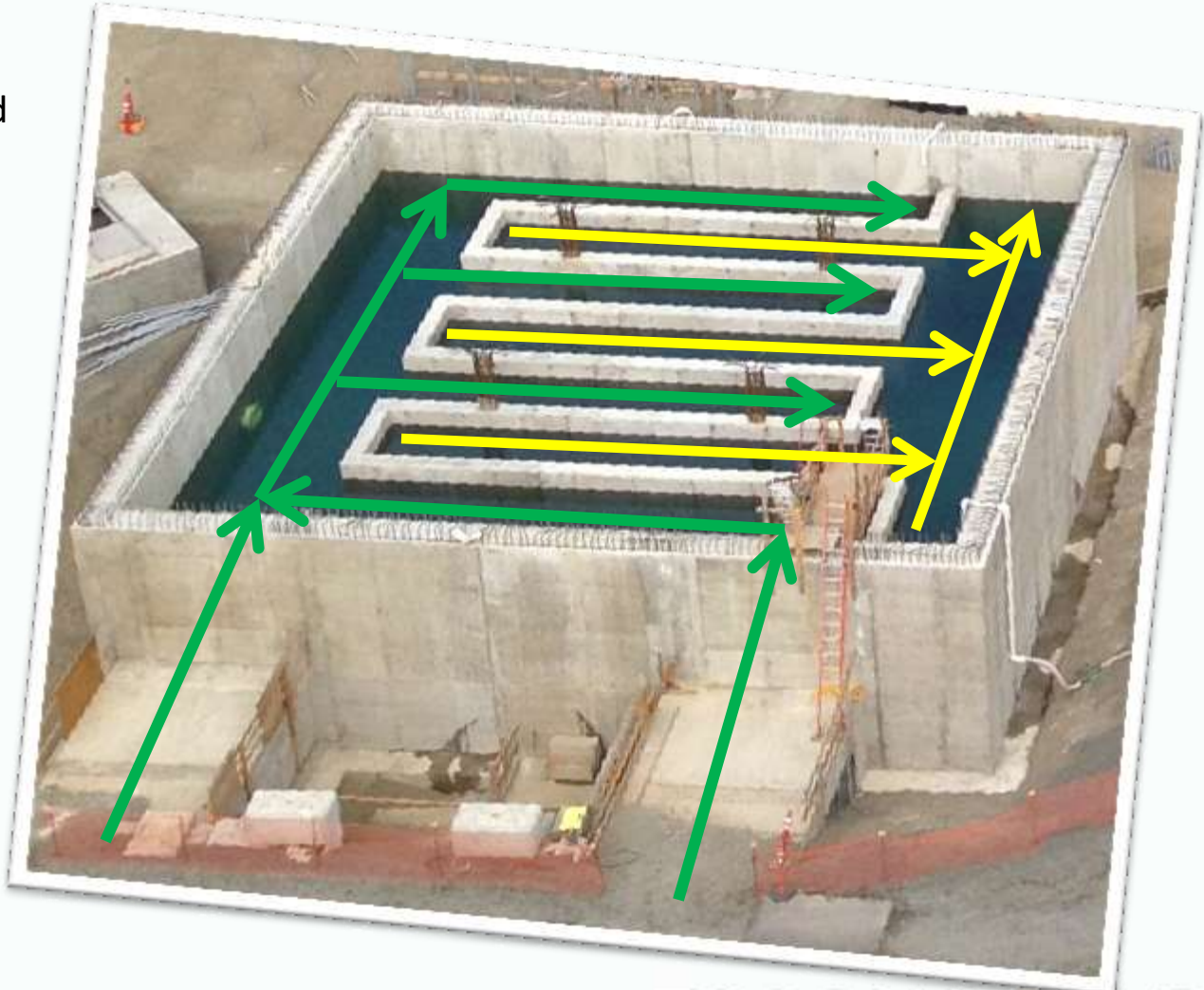
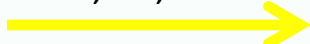


FILTER OUTLET WEIR STRUCTURE

Filtered unchlorinated



SHC, CS, F- added



108" BUTTERFLY VALVE



CLEARWELLS

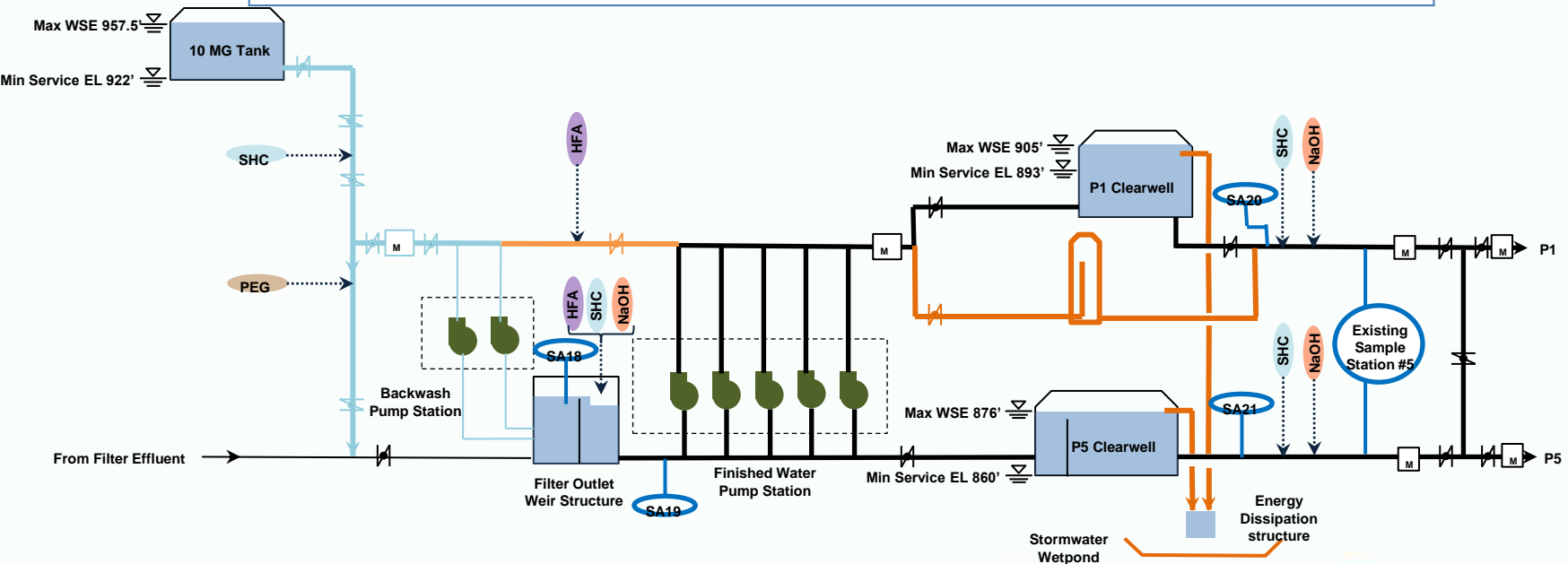
CLEARWELLS



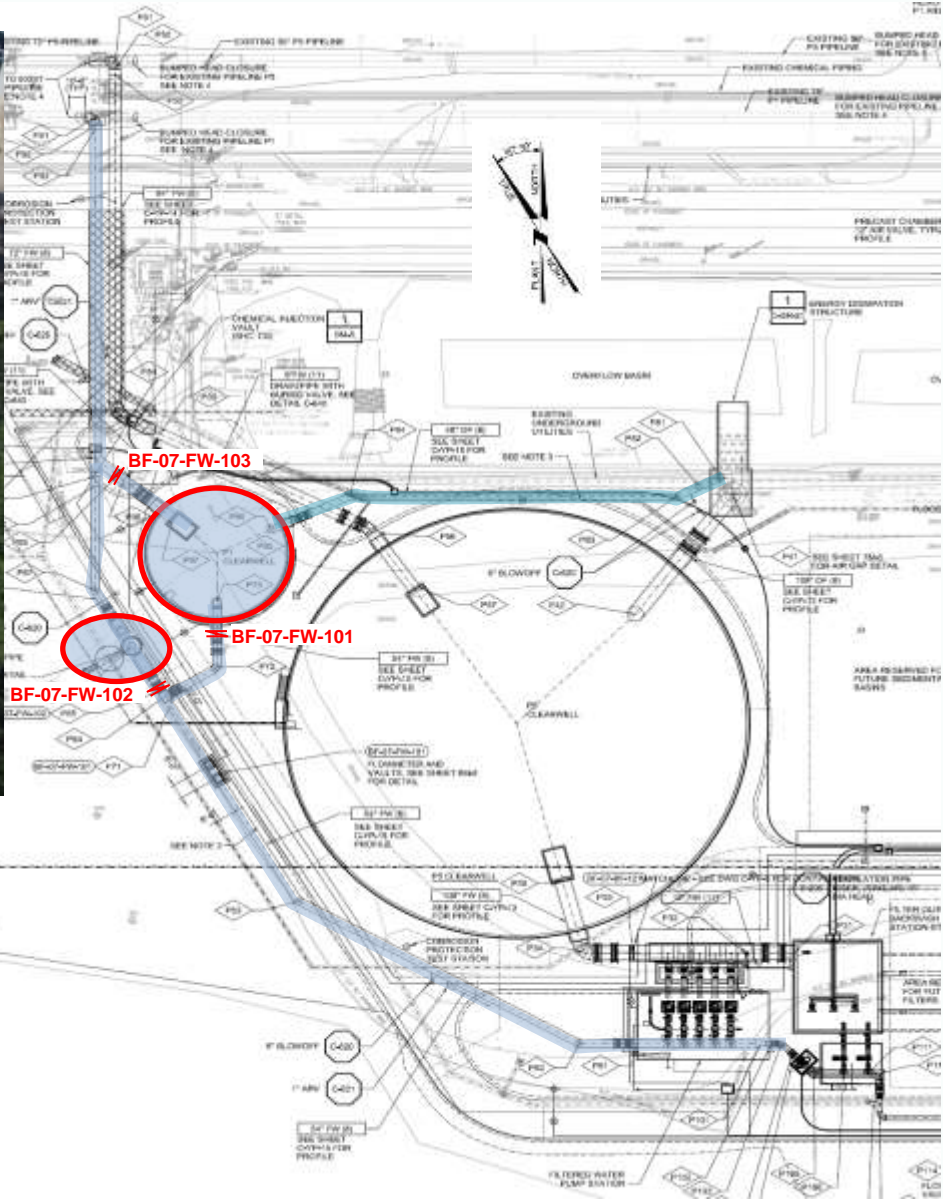
BACKGROUND – WHAT IS CLEARWELL USED FOR?

- Clearwells provide operational storage to accommodate short-term variations between plant production and plant outflow, to allow for a controlled shutdown and to maintain hydraulic grade lines in P1 and P5 pipelines.
- CT is achieved in P1 and P5 pipelines, not in the clearwells.

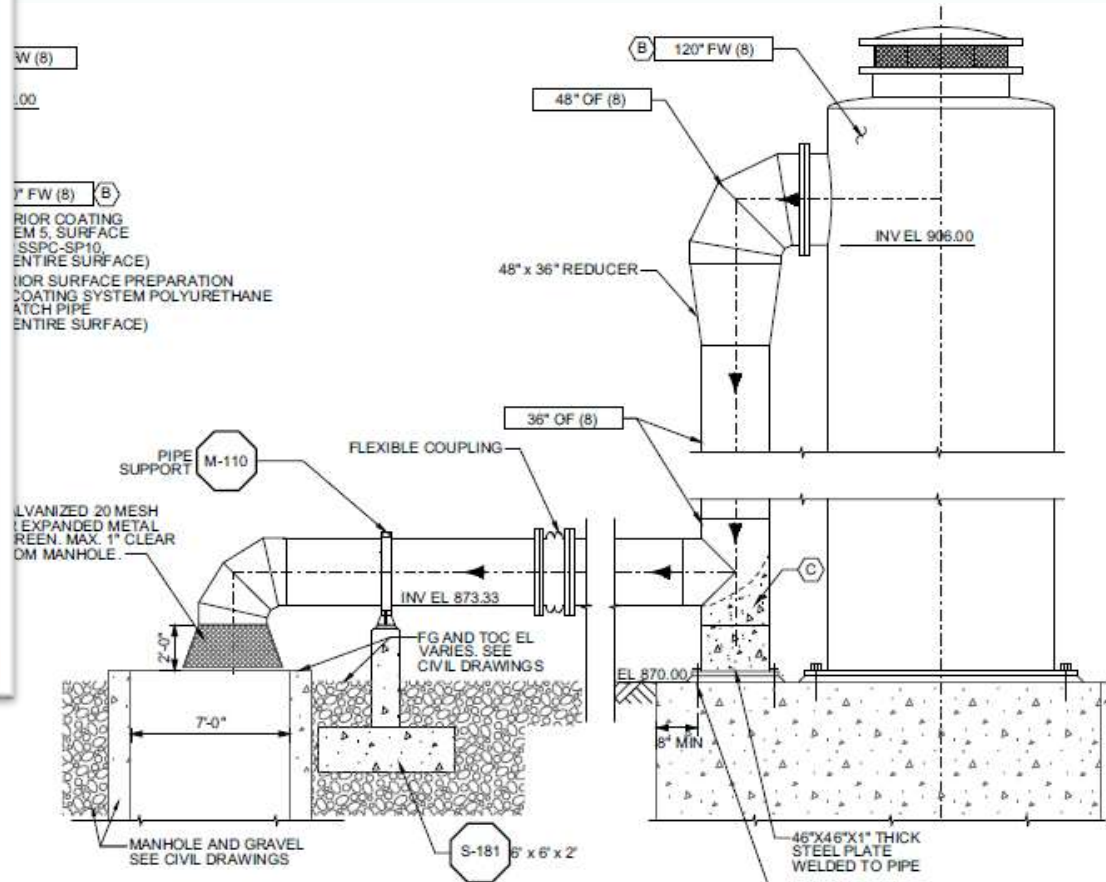
	Total Volume	Operational Volume	Max. Design Flow of Served Pipeline	Emergency Supply Duration at Peak Flow
P1 Clearwell	1.3 MG	0.45 MG	73 MGD	25 min (3 hour with 10 MG tank supply)
P5 Clearwell	6.6 MG	6.2 MG	95 MGD	1.6 hour



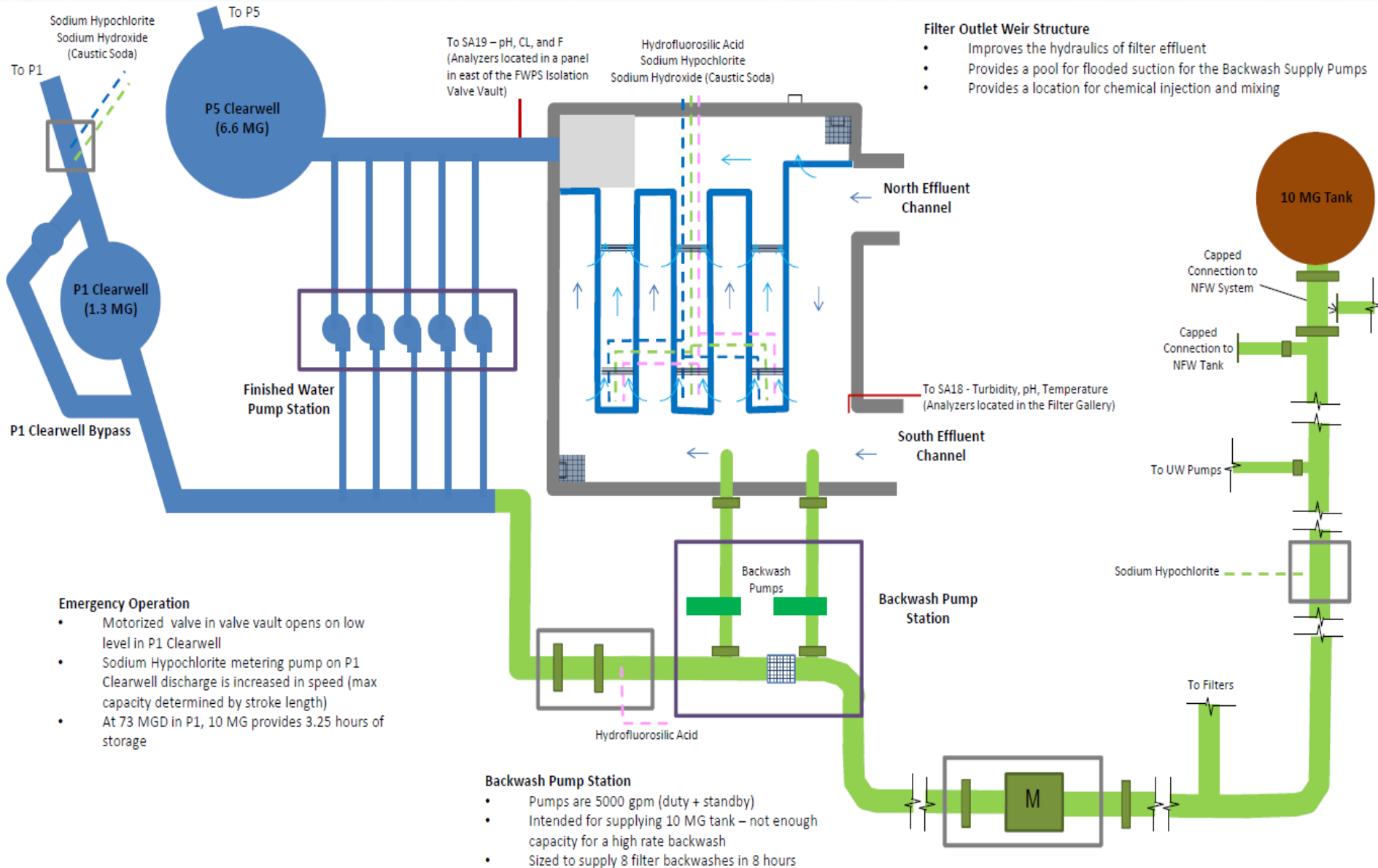
P1 CLEARWELL & STAND PIPE



P1 CLEARWELL – 10' STAND PIPE



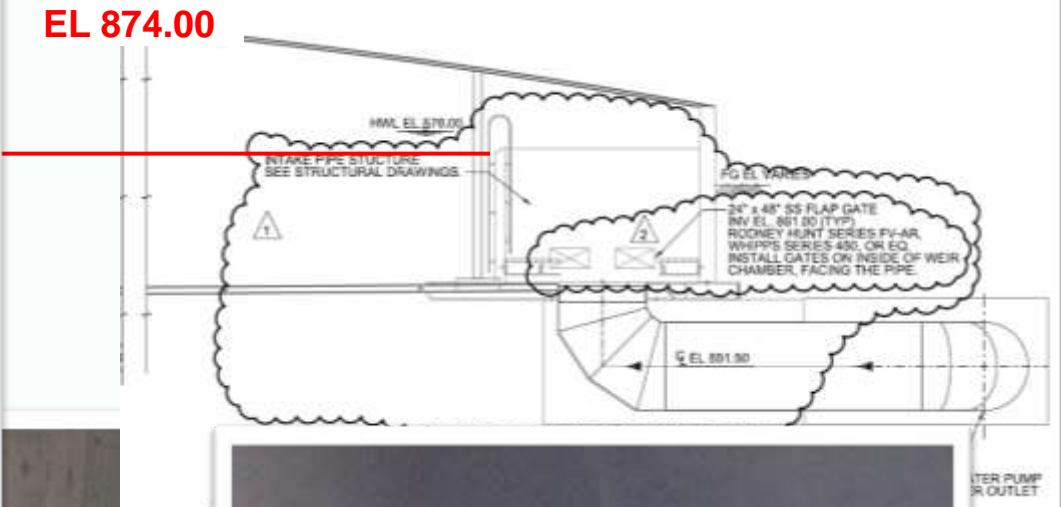
SCHEMATIC OF BACKWASH SUPPLY – FIGURE 13-1



P5 CLEARWELL



EL 874.00



ER

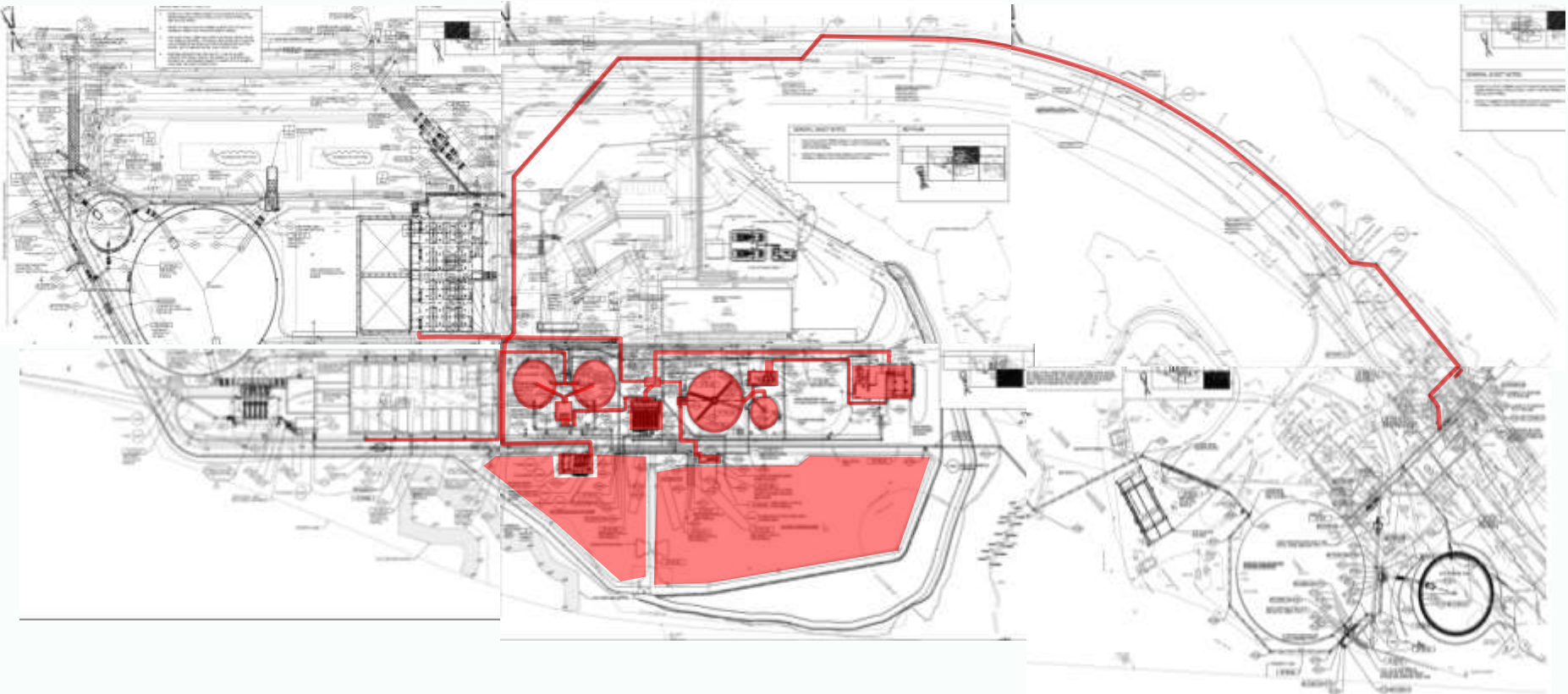
INSIDE P5 CLEARWELL



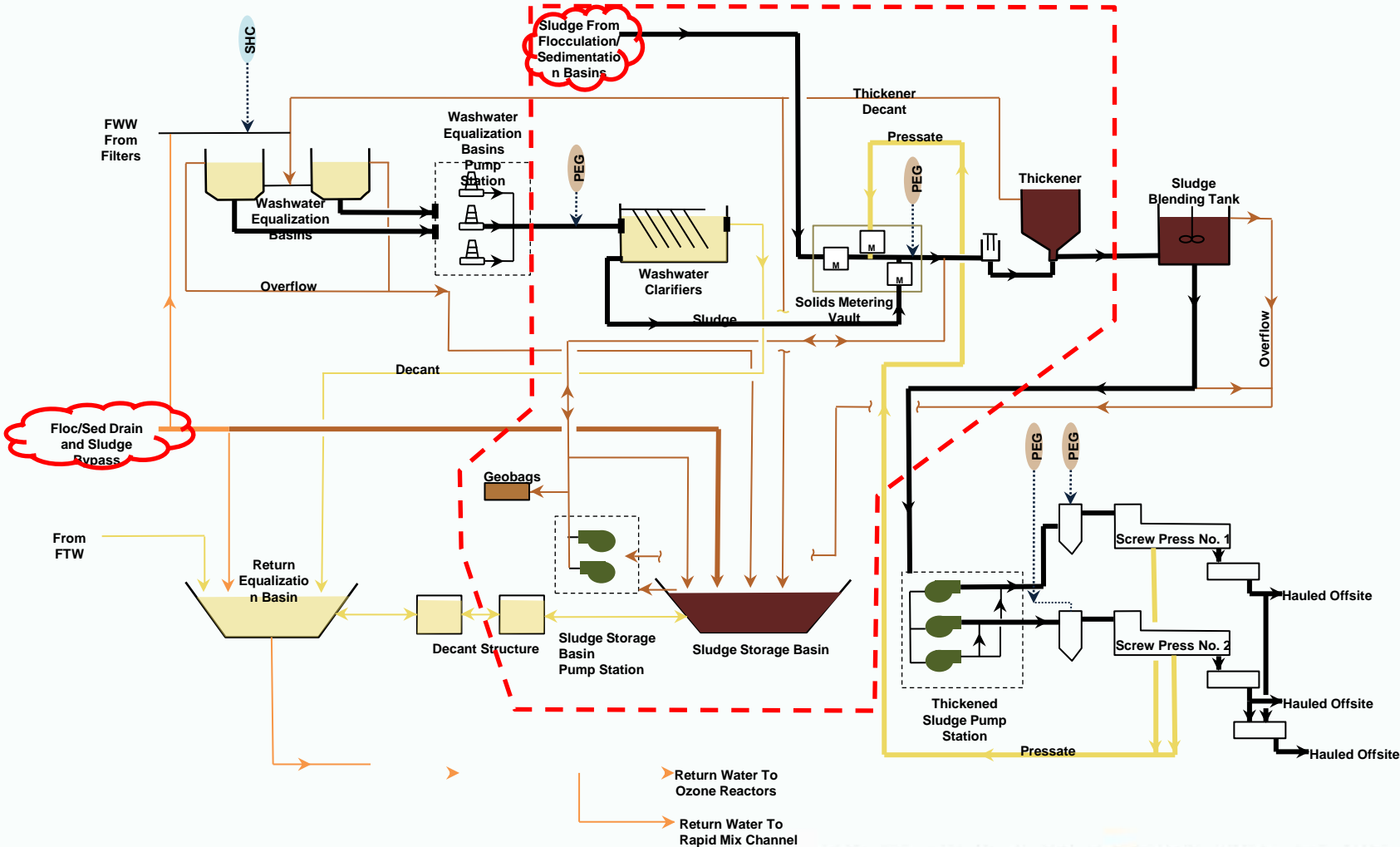
11.04.2014 11:06

SOLIDS PRODUCTION FACILITY

SOLIDS HANDLING – MAIN PROCESS FLOW



SOLIDS PROCESS FLOW DAIGRAM



EAST PLANT SOLIDS PRODUCTION



RETURN WATER PS



THICKENER



WASHWATER CLARIFIERS

- 2 BASINS (20'X42' EACH)
- SIDE WATER DEPTH = 15 FEET
- DESIGN FLOW:
 - 3,200 gpm (Normal)
 - 6,400 gpm (Max)
- SURFACE LOADING RATE = 3.8 GPM/SF
- EFFECTIVE PLATE LOADING RATE = 0.35 GPM/SF



**Inflow pipes from Washwater
EQ Basins Pump Station**

INCLINED PLATE SETTLERS



DESIGN CRITERIA:

DESIGN CAPACITY: 6,400 GPM (9.22 MGD); 3,200 GPM / BASIN

DESIGN EFFECTIVE LOADING RATE: 0.35 GPM/SF

HYDRAULIC CAPACITY: 6,400 GPM / BASIN 0.7 GPM/SF

SLUDGE BLENDING 3-5% SOLIDS

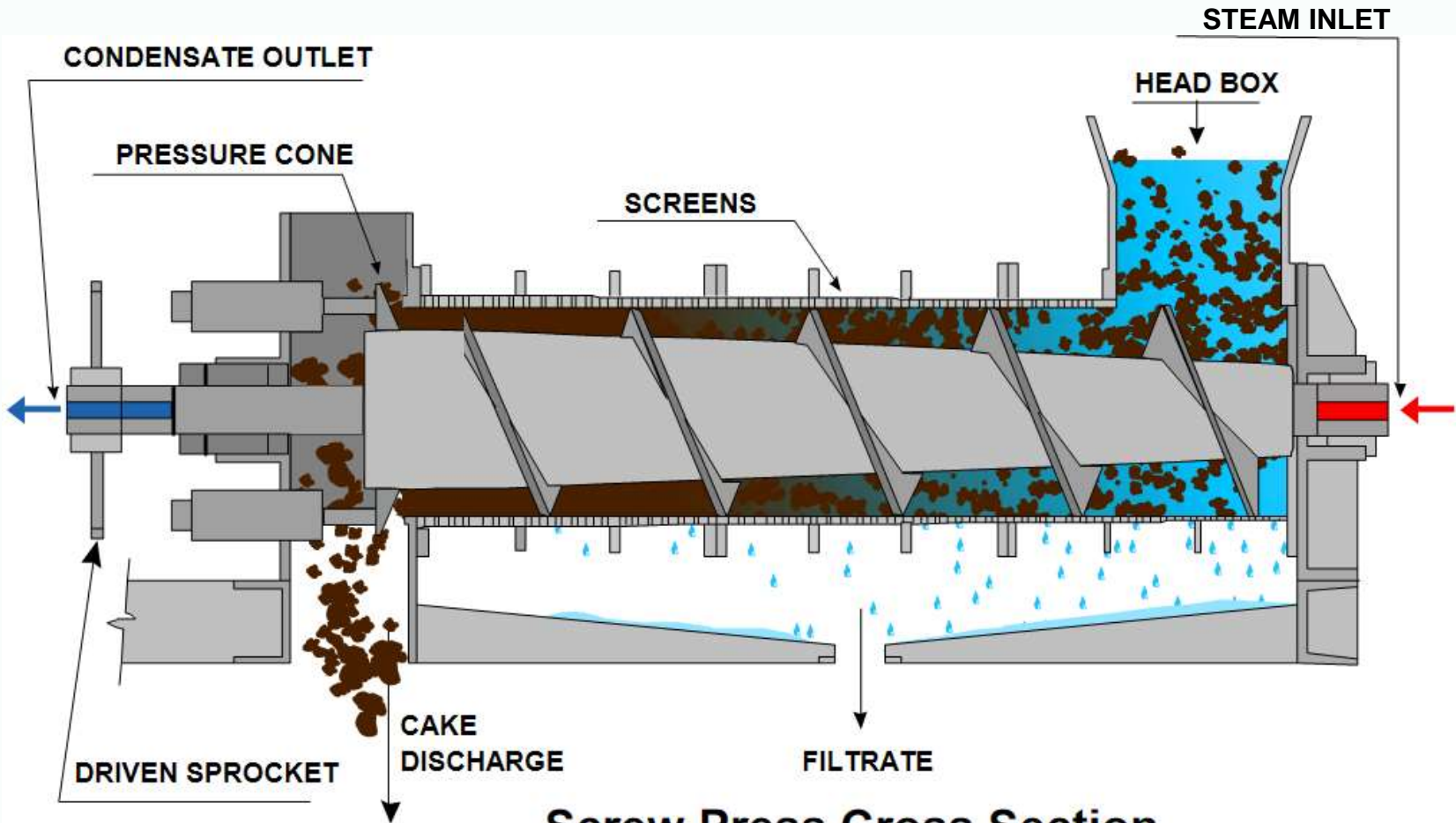


THICKENED SLUDGE PUMP STATION – PROGRESSIVE CAVITY PUMPS



MECHANICAL DEWATERING

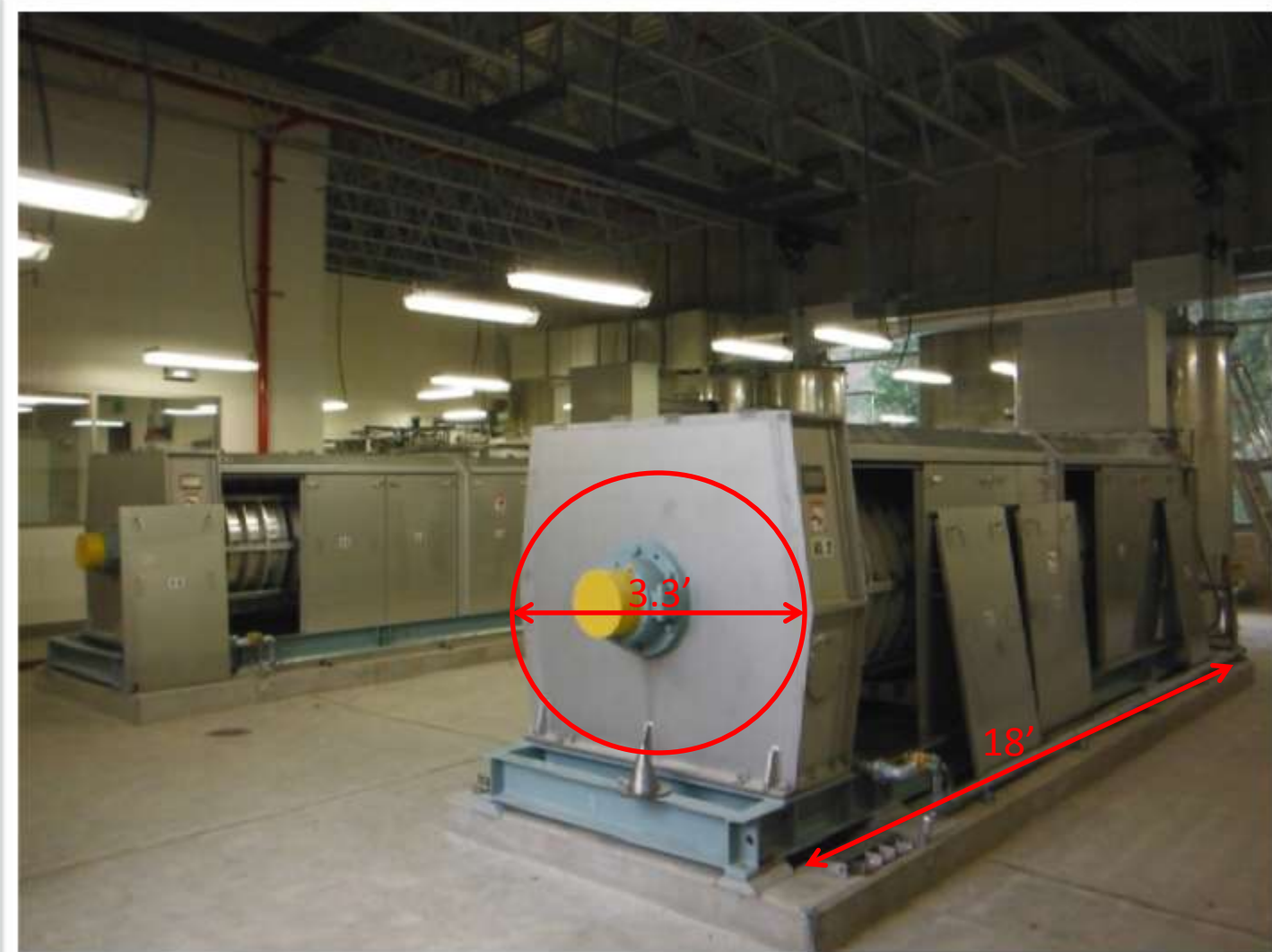
SCREW PRESS CROSS SECTION



Screw Press Cross Section

<http://www.fkcscrewpress.com/spintro.html>

SCREW PRESSES - 24 DRY TONS / DAY



SCREW PRESS FLOCCULATION TANK



-SNF Polydyne Chemical
A-6320 (Anionic polymer)

-Dosing 7 lbs active polymer
per dry ton of solids

PRESSATE



CAKE- 25% SOLIDS



CONTAINER BAYS



AWAY THEY GO

