Stress Testing for Consent Decree Compliance Case Study

2017 Five Cities Plus Conference

Presentation Outline

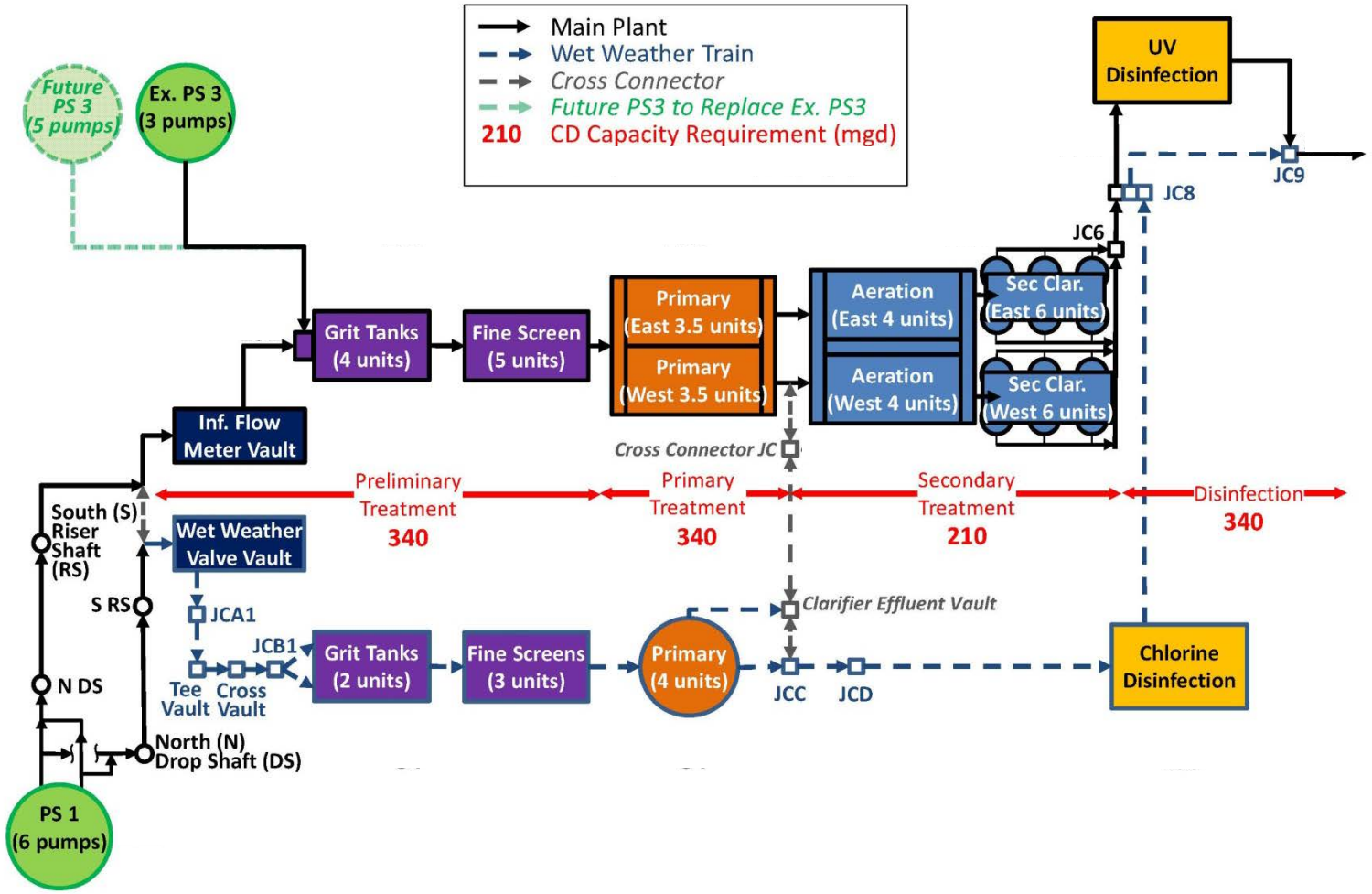
- Lemay WWTF Overview
- CD Stress Test Requirements
- Testing Plan Approach
  - Hydraulics
  - Performance Assessment
- Testing Effort
- Results
- Lessons Learned

Lemay WWTF Overview

CD Stress Test Requirements

CSO Control Measure	Description	Design Criteria	Performance Criteria	Critical Milestones
Lemay Treatment Plant – Increase Secondary Treatment Capacity	Upgrade aeration tanks and ancillary systems to achieve peak wet-weather capacity of 210 MGD	10 CSR 20-8 for new facilities Existing facilities Design Basis	Provide peak wet-weather flow capacity of 210 MGD through secondary treatment. Operate treatment facilities to comply with Missouri State Operating Permit requirements. Upon completion of the stress test required by Appendix E, MSD shall operate the WWTP in accordance with the maximum treatable flow rate for each treatment step.	• Achievement of Full Operation – 12/31/2015
Lemay Treatment Plant – Utilize Excess Primary Treatment Capacity – Phase II	Increase influent pumping, preliminary treatment and primary treatment capacity from 290 MGD to 340 MGD	10 CSR 20-8 for new facilities Existing facilities Design Basis	Provide peak wet weather flow capacity of 340 MGD through primary treatment when plant flows exceed secondary treatment capacity. Operate treatment facilities to comply with Missouri State Operating Permit requirements.	• Achievement of Full Operation – 12/31/2015

CD Stress Test Requirements

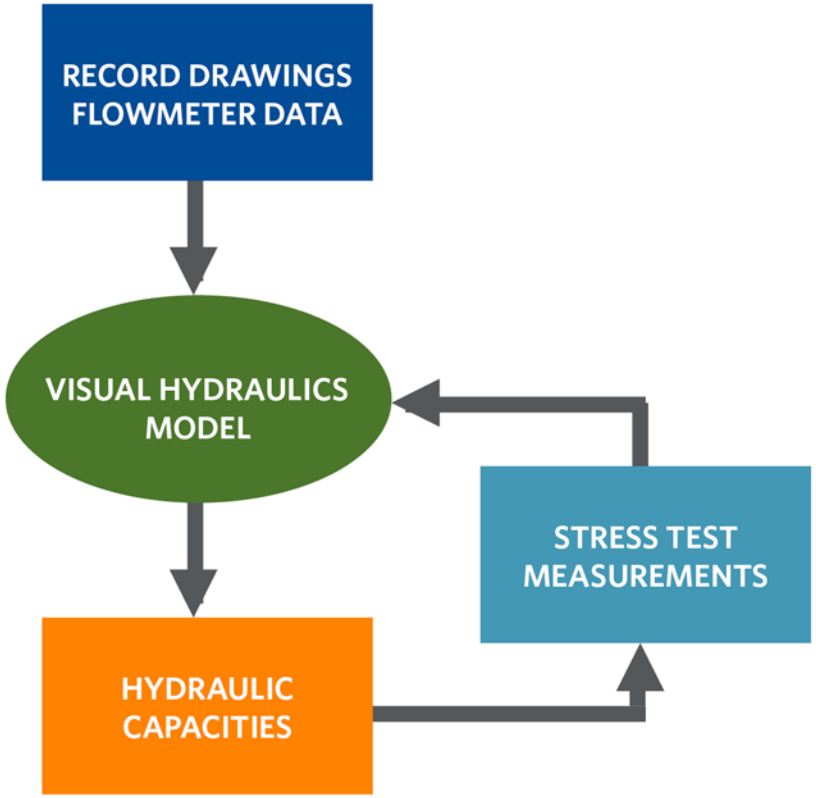


CD Stress Test Requirements

	Unit Process	Description	Hydraulic Simulation	Performance Assessment
Preliminary Treatment	**Lemay No. 1 Influent Pumping Station**			
		Six 44,000 gpm pumps. Firm capacity based on five pumps.	X	not required
	Lemay No. 3 Influent Pumping Station			
		Three 8,500 gpm pumps. Firm capacity based on two pumps.	X	not required
	Grit Removal			
	Main Plant	Four 55-foot square tanks	X	not required
	Wet Weather Plant	Two 35-foot square tanks	X	not required
	Fine Screens			
	Main Plant	5 screens @ estimated 55 MGD each	X	not required
	Wet Weather Plant	2 screens @ estimated 50 MGD each	X	not required
Primary Treatment	**Primary Settling**			
	Main Plant	Eight 80' x 268' clarifiers, 10' deep	X	X
	Wet Weather Plant	Four 133-ft dia. clarifiers, 12¼' SWD	X	X
Secondary Treatment	**Secondary Aeration**			
		Eight 4-pass aeration tanks operated in sludge reaeration/ step feed mode Each pass is 30' x 204' x 15' deep.	X	X
	Secondary Settling			
		Twelve 150-ft dia. peripheral feed Tow-Bro clarifiers, 12' SWD	X	X
Disinfection	**Disinfection**			
	Main Plant Secondary Effluent	Low pressure, high intensity lamp ultraviolet disinfection	X	X
	Wet Weather Plant Primary Effluent	Chlorination (sodium hypochlorite) and dechlorination	X	X

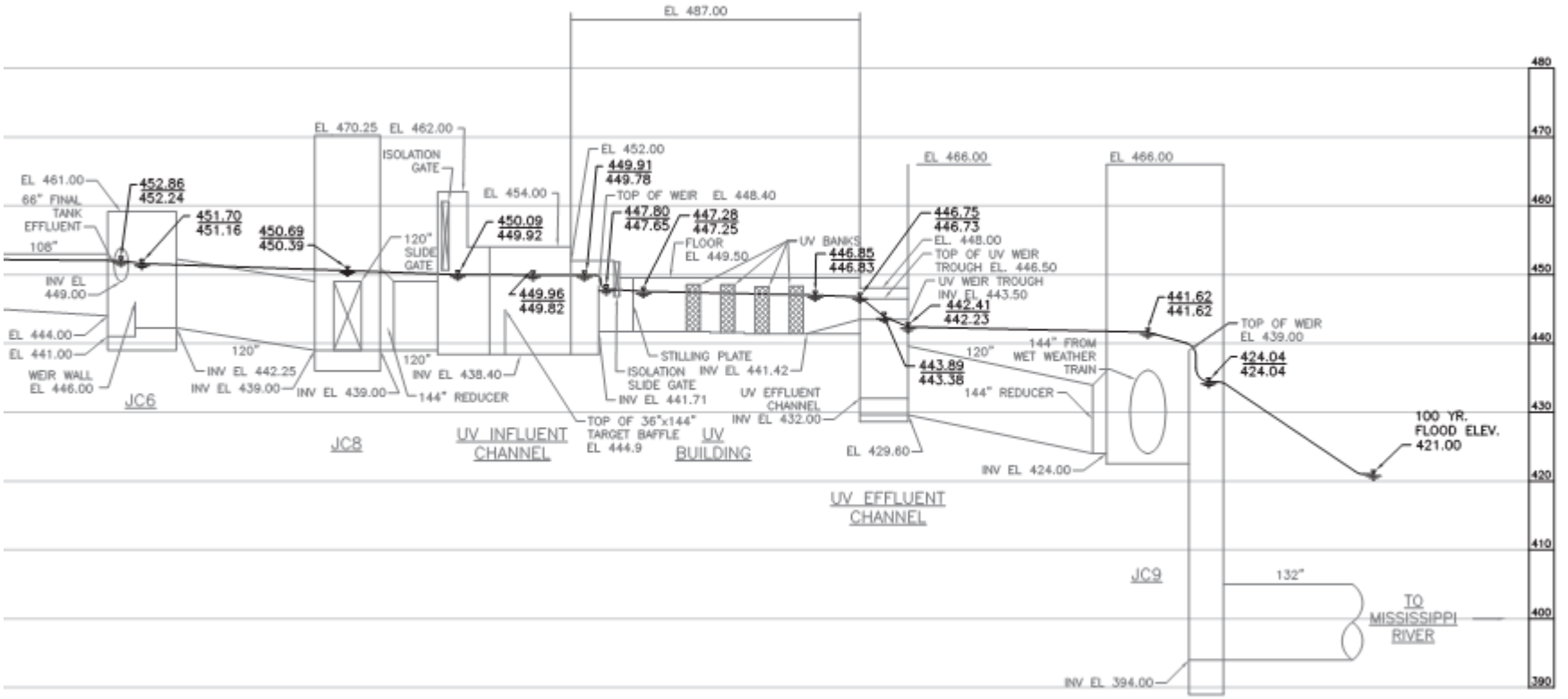
Stress Testing Plan Approach

Hydraulics



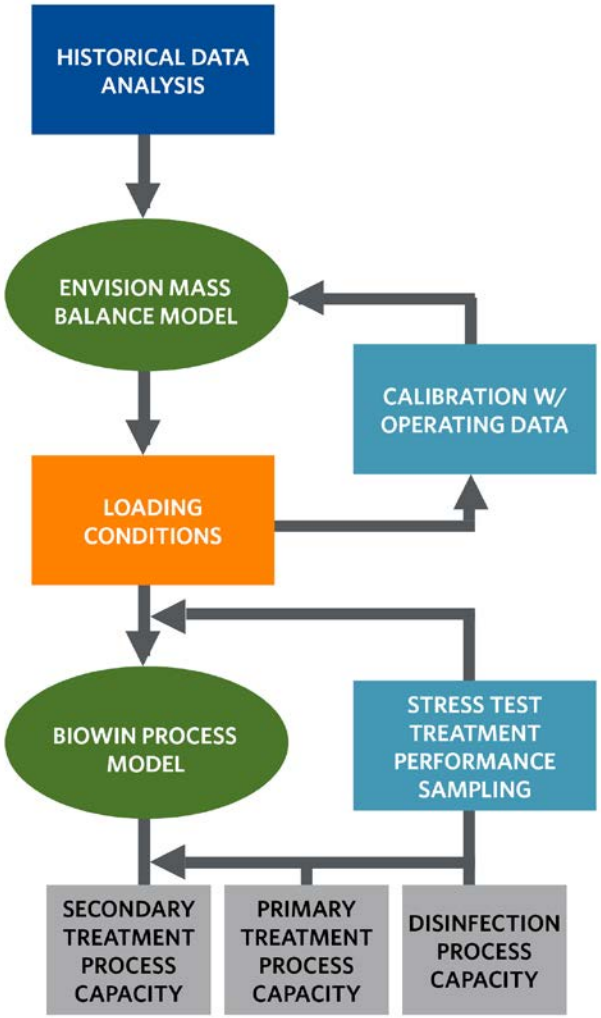
Stress Testing Plan Approach

Hydraulics



Stress Testing Plan Approach

Performance Assessment



Stress Testing Plan Approach

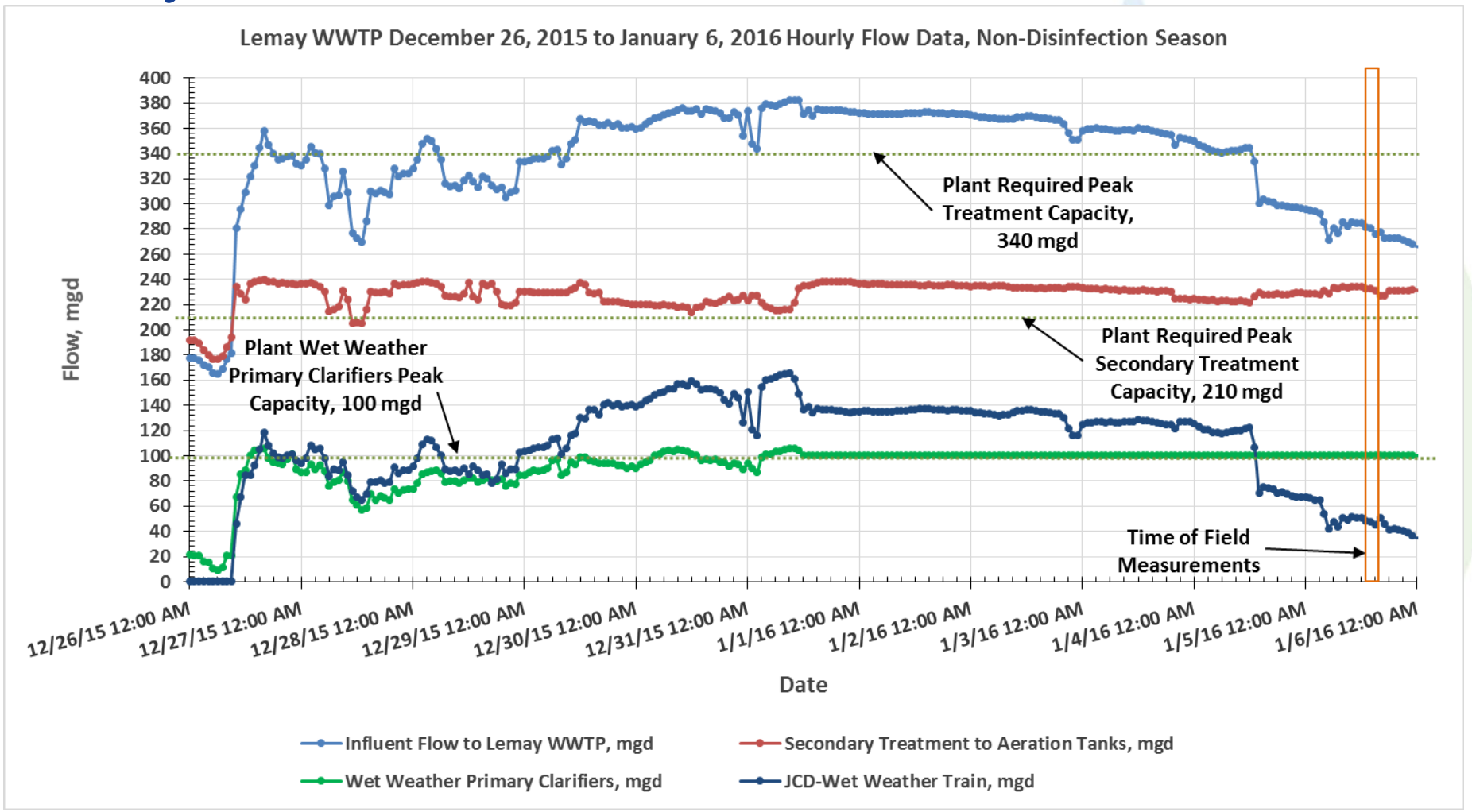
Performance Assessment

– Phased sampling

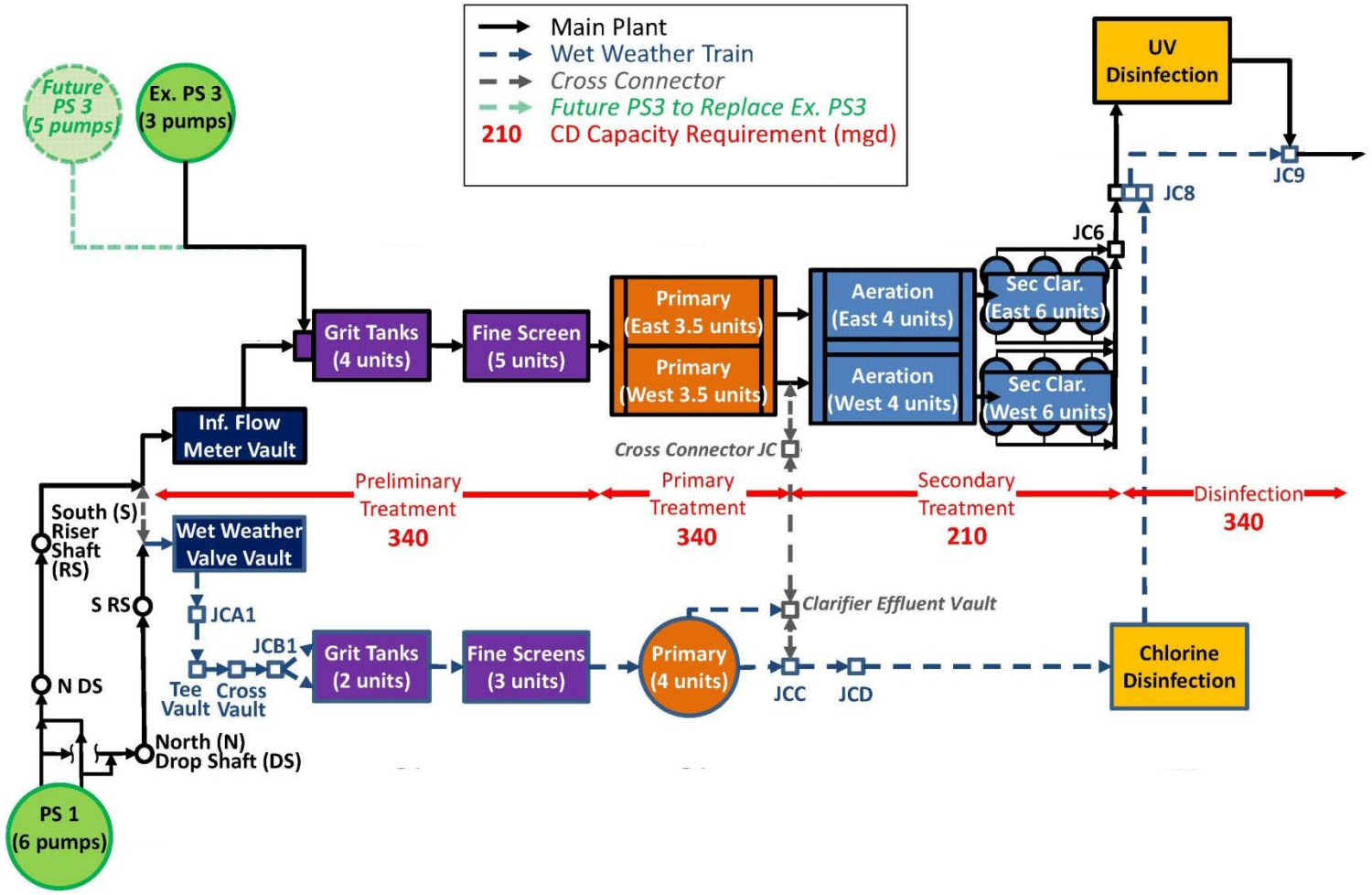
Phase	Objective	Trigger
1. Dry Weather	Baseline performance	Avg. Daily Flow < 150 mgd Peak Flow < 180 mgd
2. Wet Weather	Determine peak capacities	Avg. Daily Flow ≥ 150 mgd Peak Flow ≥ 180 mgd
3. Special Conditions	Simulate wet weather to determine peak capacities	No flows above 180 mgd observed by June 1, simulate peak flow by operating fewer basins.
4. Diurnal Peak	Characterize diurnal peak	Two days under Phase 1 sampling Two days under Phase 2 sampling

Testing Effort

Hydraulic Measurements

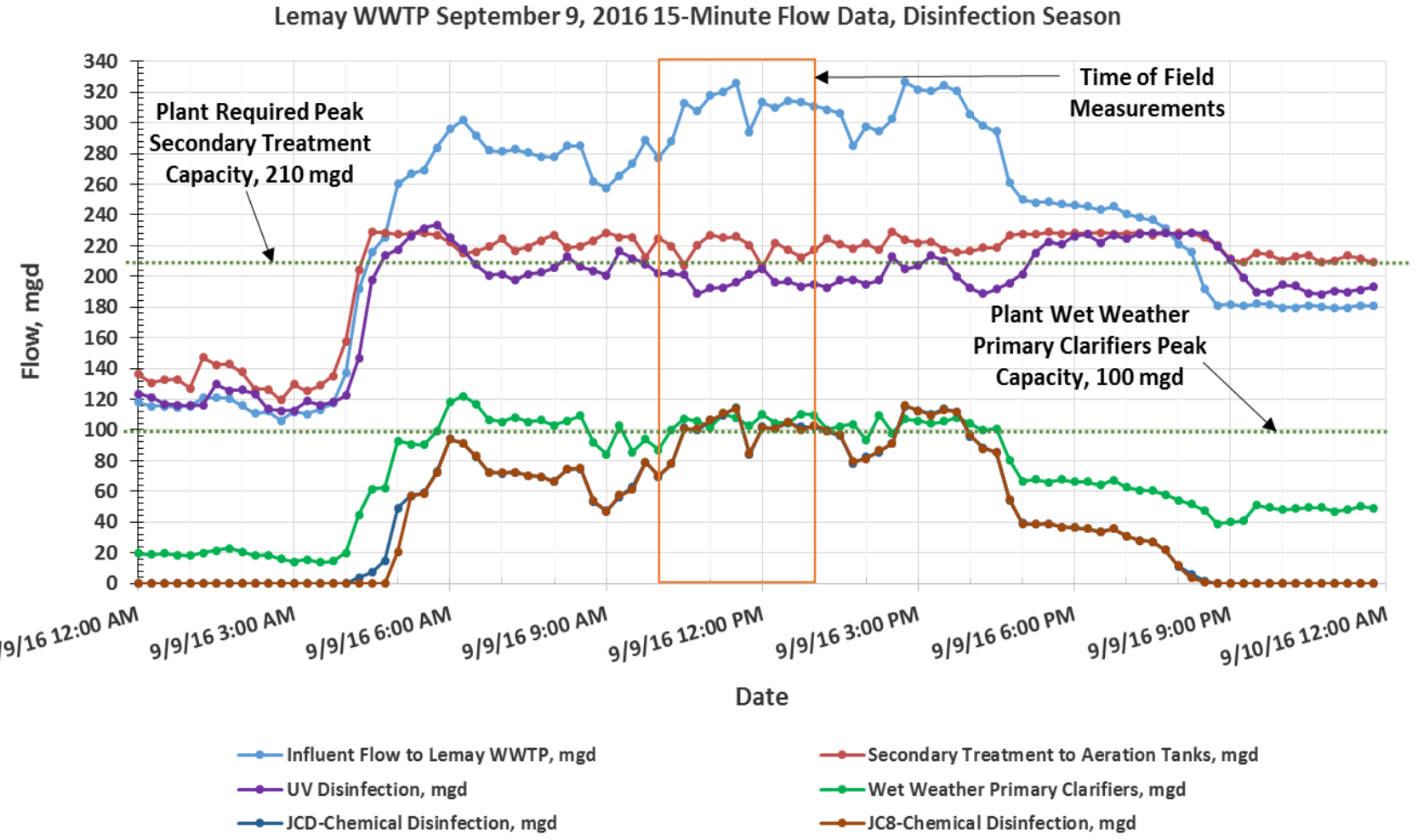


Lemay WWTF Overview



Testing Effort

Hydraulic Measurements



Testing Effort

- Hydraulic Measurements

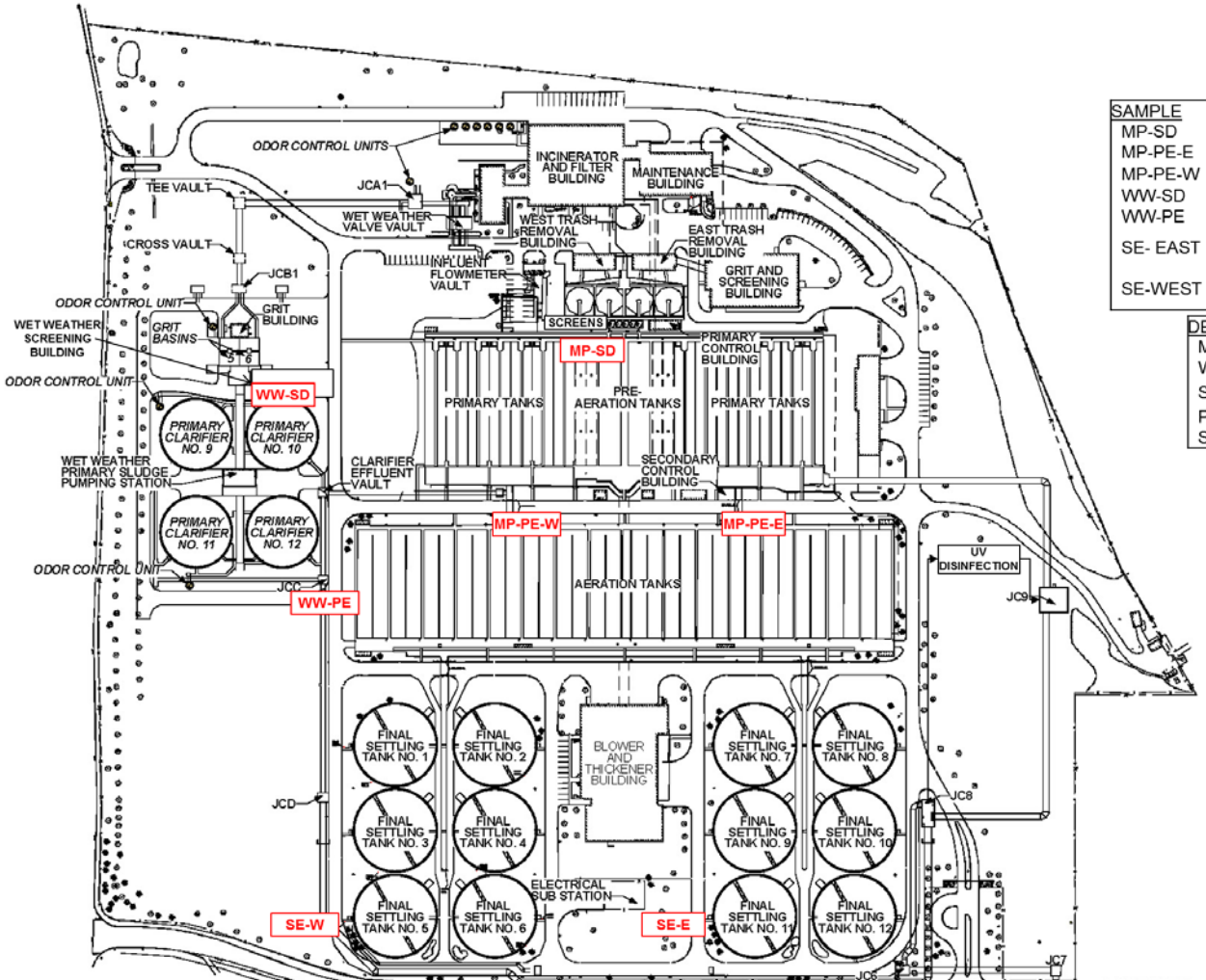
Testing Effort

Performance Sampling - Plan vs. Actual

Phase	Planned Events	Desired Duration	Events Captured	Duration Captured
1. Dry Weather	1	14 days	1	14 days
2. Wet Weather	3	72 hours	2	18-28 hours
3. Special Conditions	N/A	N/A	1	5 days
4. Diurnal Peak	2 Dry 2 Wet	24 hours	2 Dry 2 Wet	24 hours

Testing Effort

Performance Sampling



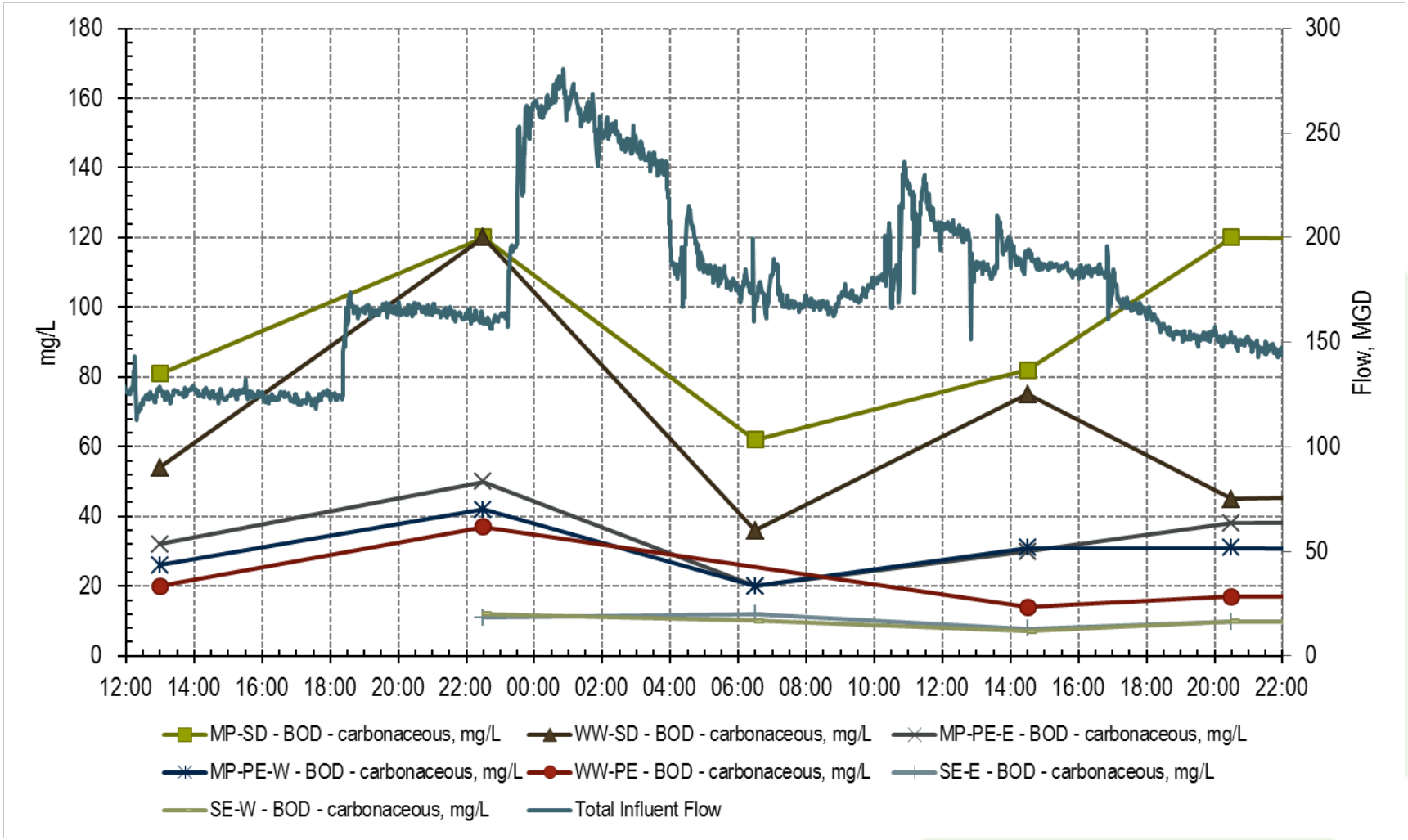
SAMPLE		LOCATION
MP-SD	-	INFLUENT CHANNEL AT SCREEN DISCHARGE
MP-PE-E	-	PRIMARY EFFLUENT EAST CHANNEL
MP-PE-W	-	PRIMARY EFFLUENT WEST CHANNEL
WW-SD	-	WW SCREENING EFFLUENT CHANNEL
WW-PE	-	JCC
SE- EAST	-	AT FINAL SETTLING TANK NO. 5 (INCLUDES EFFLUENT FROM FST 1, 3, AND 5)
SE-WEST	-	AT FINAL SETTLING TANK NO. 11 (INCLUDES EFFLUENT FROM FST 7, 9, AND 11)

DEFINITIONS		
MP	-	LEMAY MAIN PLANT
WW	-	WET WEATHER PLANT
SD	-	SCREENED AND DE-GRITTED INFLUENT
PE	-	PRIMARY EFFLUENT
SE	-	SECONDARY EFFLUENT

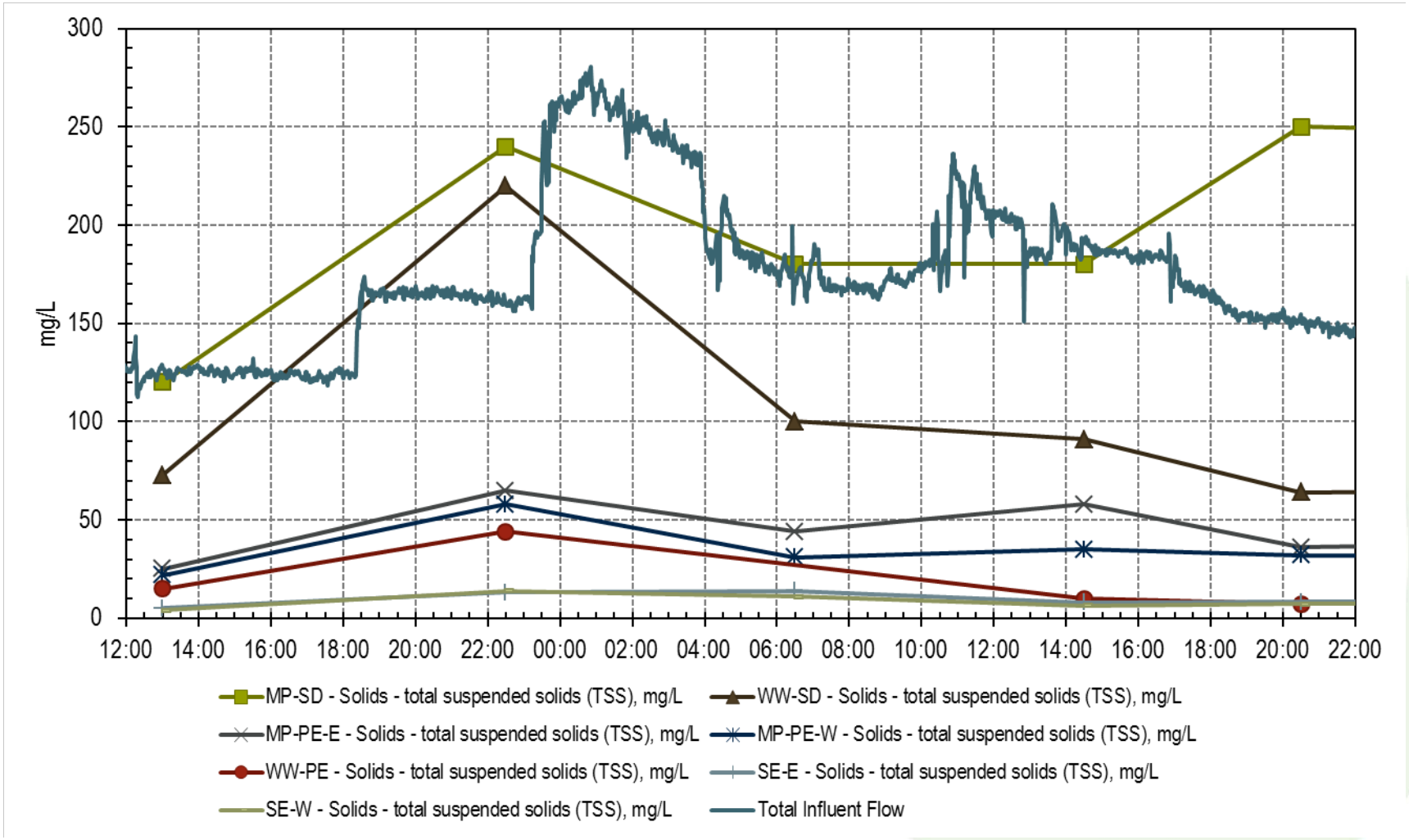
Testing Effort

- Performance Sampling
  - Phase I (Dry Weather)
    - 70 samples over 14 days
  - Phase II (Wet Weather)
    - 63 samples over 2 events
  - Phase III (Simulated Wet Weather)
    - 33 samples over 5 days
  - Phase IV (Wet and Dry Diurnal)
    - 412 samples over 4 – 24 hr periods
  - 578 Total Samples

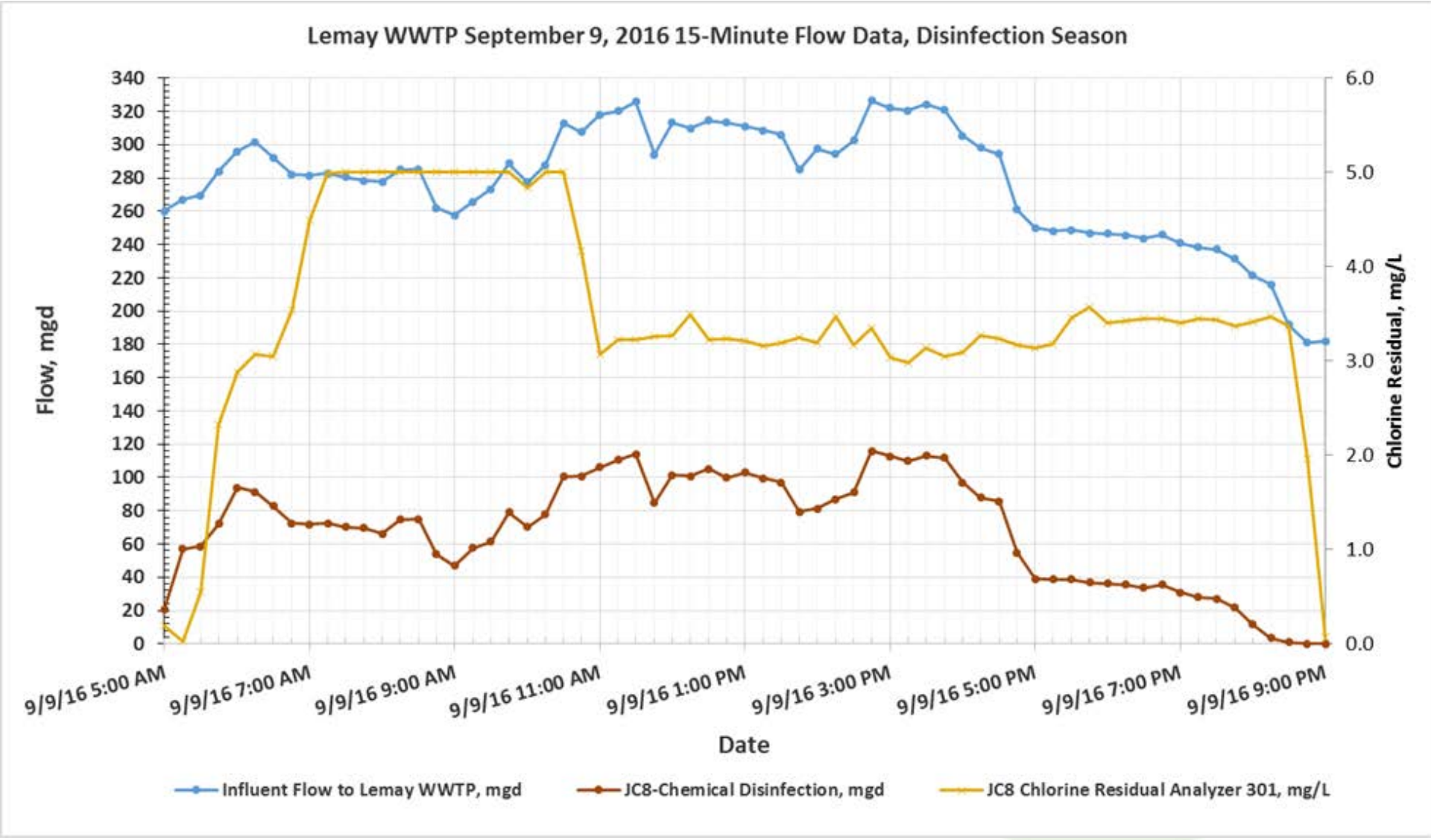
Results – Phase II (Wet Weather) - BOD



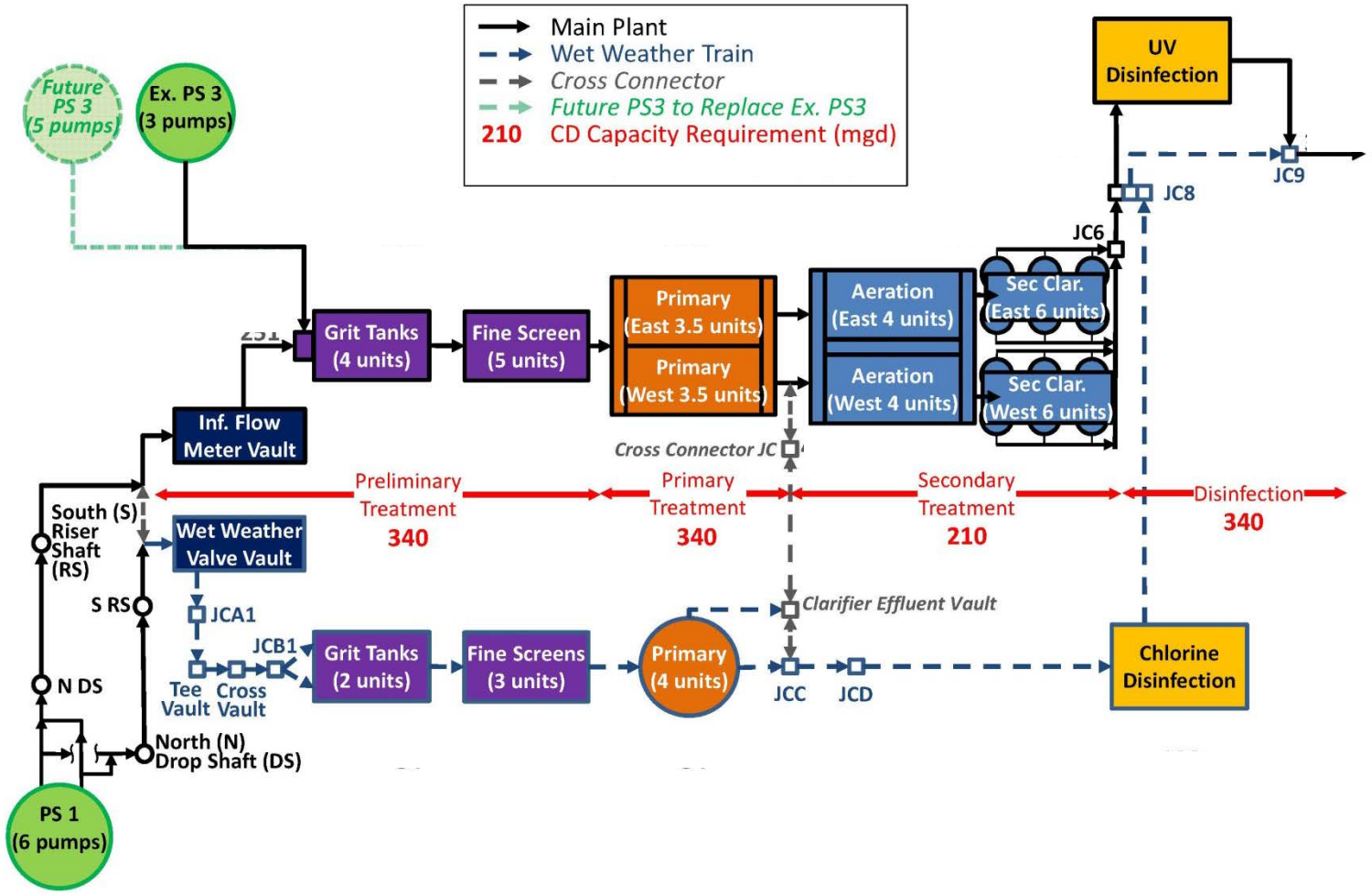
Results – Phase II (Wet Weather) TSS



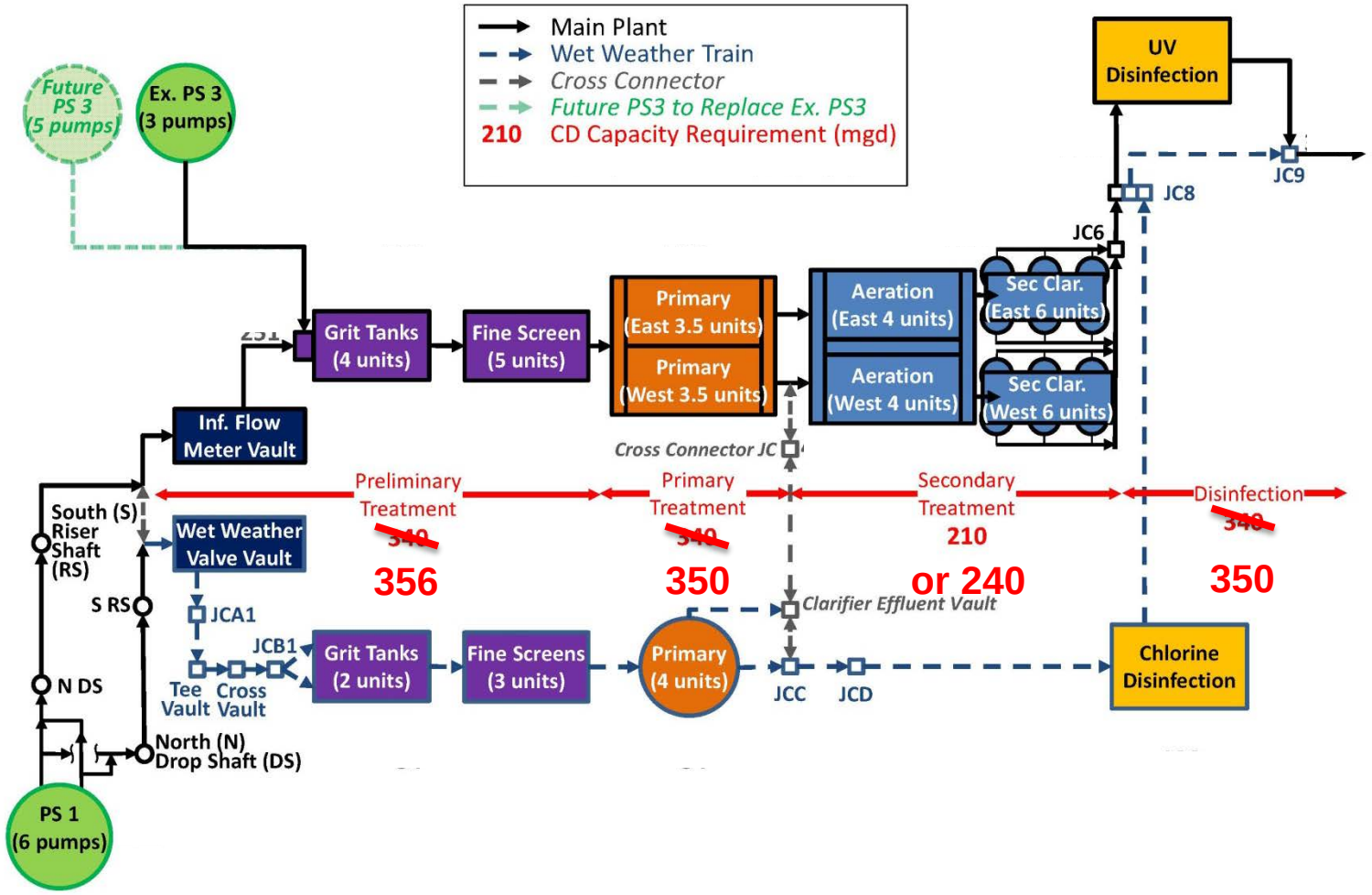
Results – Disinfection



Maximum Wet Weather Treatable Flows



Maximum Wet Weather Treatable Flows



Lessons Learned

- Need to tie operational limitations to treatment capacities
  - Hydraulic restraint on disinfection
  - Number of units on-line
- Hydraulic and process models provide good support for field observations
- If you don't want it to rain, schedule a stress test

Questions?