Easterly WWTP – Dry and Wet Weather Treatment Strategies

OWEA 2017 Technical Conference & Expo

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Agenda

1 NEORSD and Easterly WWTP

2 Operational Challenges

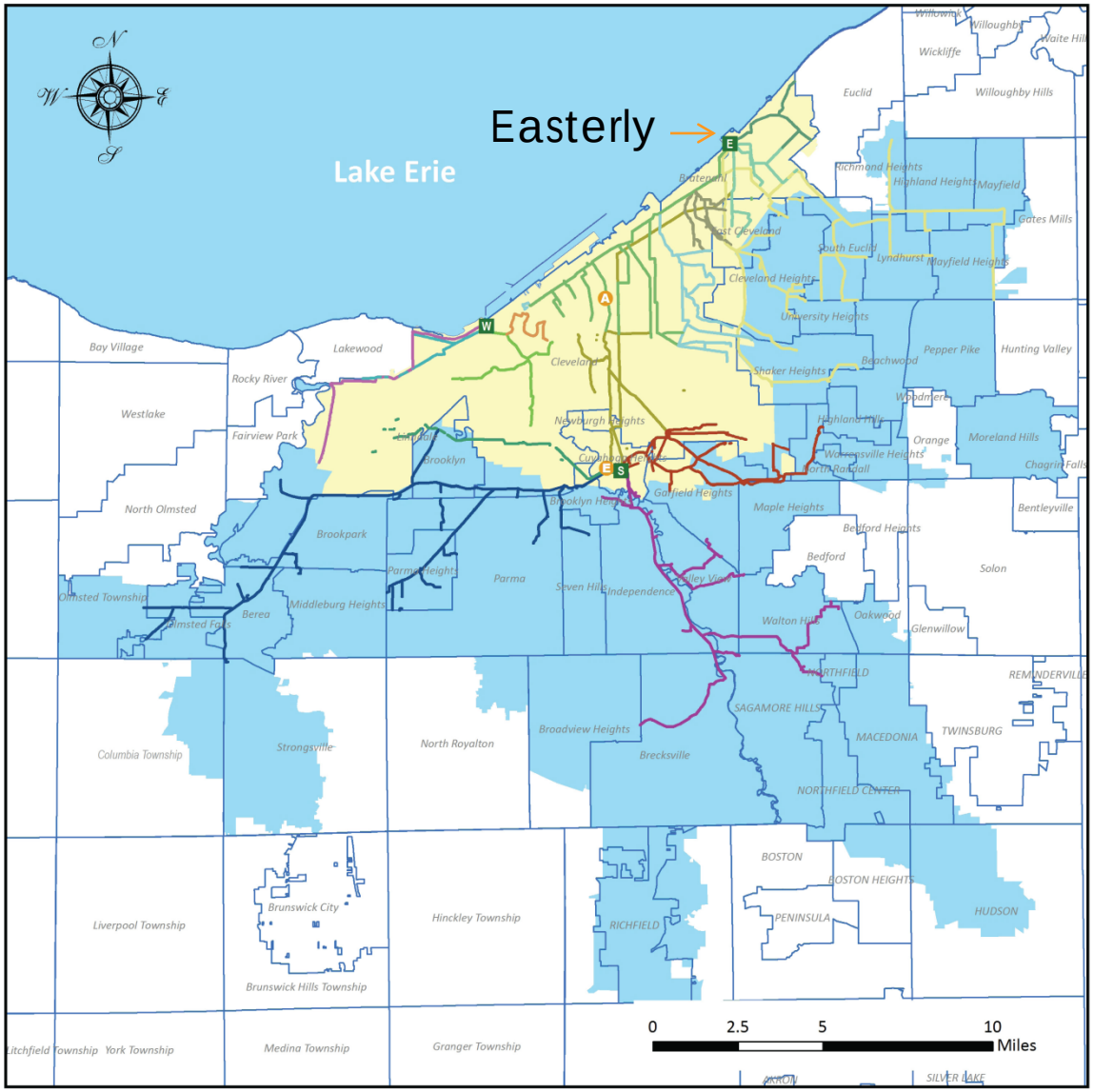
3 Dry and Wet Weather Flow Strategies

4 Case Examples

5 Future Activities

6 Questions

Combined and Separate Sewer Areas



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- A McMonagle Administration Building- 3900 Euclid Avenue
- E Environmental & Mantance Services Center- 4747 E. 49th Street
- E Easterly Treatment Plant- 14021 Lakeshore Boulevard
- S Southerly Treatment Plant- 6000 Canal Road
- W Westerly Treatment Plant- 5800 W. Memorial Shoreway
- Combined Sewer Area
- Seperate Sewer Area

EASTERLY WASTEWATER TREATMENT PLANT INTERCEPTOR SYSTEM

- E. 140th/E. 152nd-Ivanhoe Interceptors
- Easterly Interceptor
- Doan Valley Interceptor
- Dugway Interceptor
- Heights-Hilltop Interceptors & ICRS
- Lakeshore-Nottingham interceptors

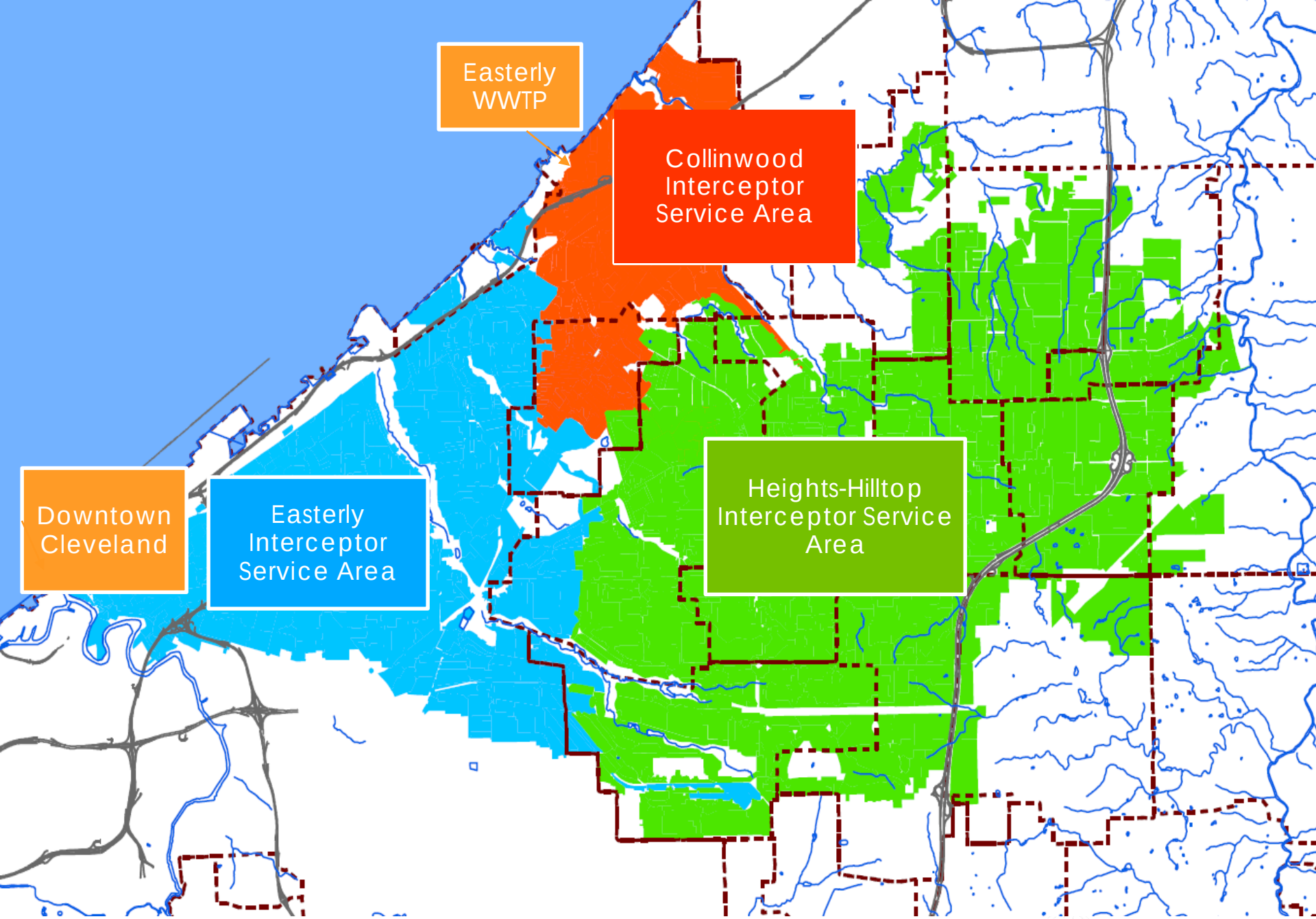
SOUTHERLY WASTEWATER TREATMENT PLANT INTERCEPTOR SYSTEM

- Big Creek Interceptor
- Cuyahoga Valley Interceptor
- Mill Creek Interceptor
- Southerly Interceptor
- Southwest, West Leg Interceptors & ICRS

WESTERLY WASTEWATER TREATMENT PLANT INTERCEPTOR SYSTEM

- Low Level Interceptor
- Northwest Interceptor
- Walworth Run Interceptor
- Westerly Interceptor

Your Sewer District... **Keeping our Great Lake great.**



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Easterly WWTP Service Area

INTERCEPTOR SYSTEM	SERVICE AREA $(miles)^2$	LENGTH OF INTERCEPTORS AND ICRs (miles)
Easterly	38	48
Heights-Hilltop	38	46
Collinwood	13	16

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Easterly WWTP
2016 HIGHLIGHTS

ACCOMPLISHMENTS	METRIC
COMPLETE TREATMENT	26.26 BILLION GALLONS
AVERAGE DAILY FLOW	71.7 MGD
NPDES PERMIT	ALL PERMIT REQUIREMENTS MET
BUDGET / ACTUAL	$ 8.84 MILLION / $ 7.77 MILLION
NUMBER OF EMPLOYEES	55

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Easterly WWTP
NPDES PERMIT REQUIREMENTS

Parameter	Units	Monthly Conc.	Weekly Conc.	30-Day Load.	Weekly Load.
				(kg/day)	(kg/day)
Total Suspended Solids	mg/L	20	30	11,734	17,600
Oil and Grease	mg/L	≤ 10 grab 2x/month		year round	
Total Phosphorus	mg/L	1.0	1.5	587	880
E-Coli (Summer)	#/100 mL	126	284	geometric mean	
Total Chlorine Residual	mg/L	≤ 0.038 grab 3x/day		May 1 – Oct 31	
Total Mercury	ng/L	4.5	-	0.00264	-
pH		between 6.0 and 9.0		continuous	
CBOD5	mg/L	15	22.5	8,800	13,200

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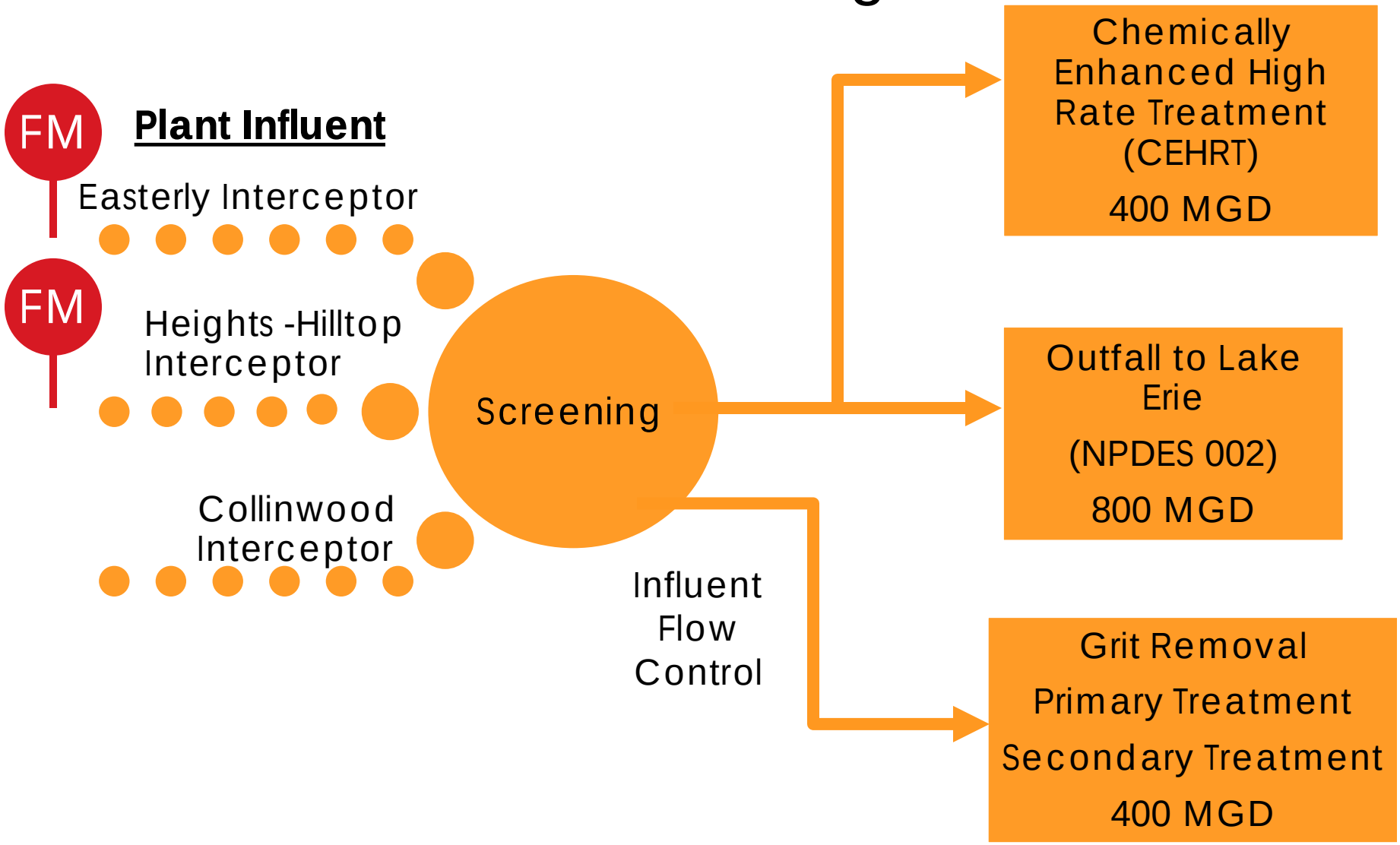
Influent Process Flow Diagram



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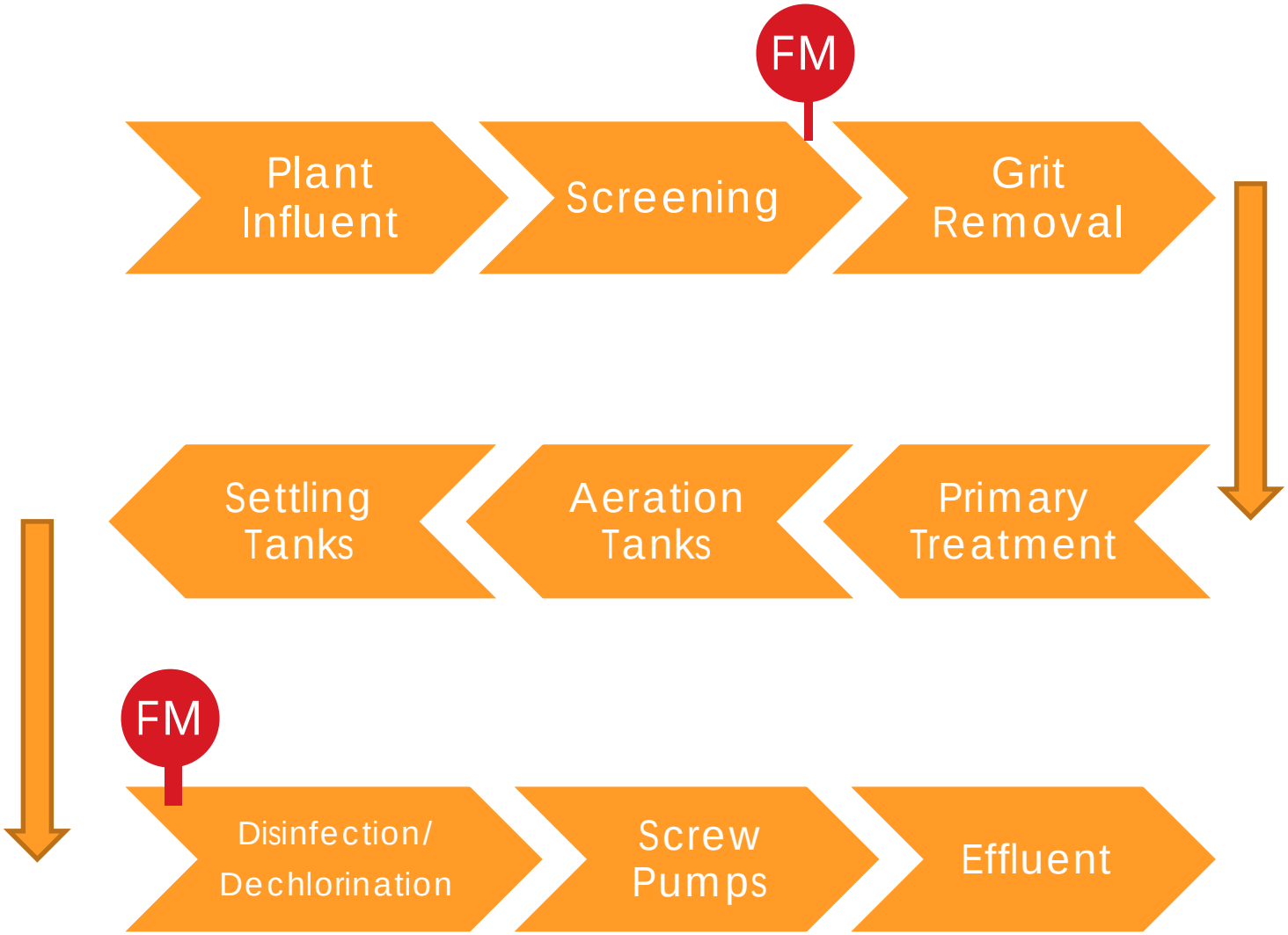
Plant Process Flow Diagram



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Operational Challenges

- Raw influent **flow rates** vary significantly due to storms/runoff in the combined sewer systems
  - Average daily flow rates 65 – 85 MGD
  - Wet weather flow rates can exceed 1,000 MGD (1 BGD)

Operational Challenges

- Maintain process performance at average daily flow rates using a select number of unit process tanks and accommodate sudden wet weather flow
  - Ten State Standards:
    - Primary Settling Tanks SOR
      1,000 – 3,000 gal/day–ft^2
    - F:M ratio
      0.2 lb/lb-day
    - Final Settling Tanks SOR
      800 – 1,200 gal/day–ft^2

Easterly WWTP
2016 Average Wastewater Concentrations

PARAMETER	Raw Influent (mg/l)	Primary Effluent (mg/l)	Treated Effluent (mg/l)
Total Suspended Solids	160	50	6
$CBOD_5$	80	47	4
Total Phosphorus	2.23	1.58	0.45

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Dry and Wet Weather Process Tanks

PROCESS TANKS	TOTAL	DRY WEATHER	WET WEATHER
AERATED GRIT	4	2	4
PRIMARY SETTLING TANKS	12	4	12
AERATION TANKS	8	5	7 - 8
FINAL SETTLING TANKS	26	16 -18	24 - 26

Dry Weather Strategies

Using 75 MGD

Primary Settling Tank SOR

- **4/12 PSTs = 1,974 gal/day–ft²**

❖ **Maintain higher Primary Effluent C_{BOD}**

F:M Ratio (MLSS = 1,200 mg/l)

Using 47 mg/l Primary Effluent C_{BOD}

- **5/8 ATs = 0.15 lb/lb-day**

Final Settling Tank SOR

- **18/26 FSTs = 1,269 gal/day–ft²**


During dry weather flow...
Aeration Tanks
05/15/20


Mixed Liquor Channel

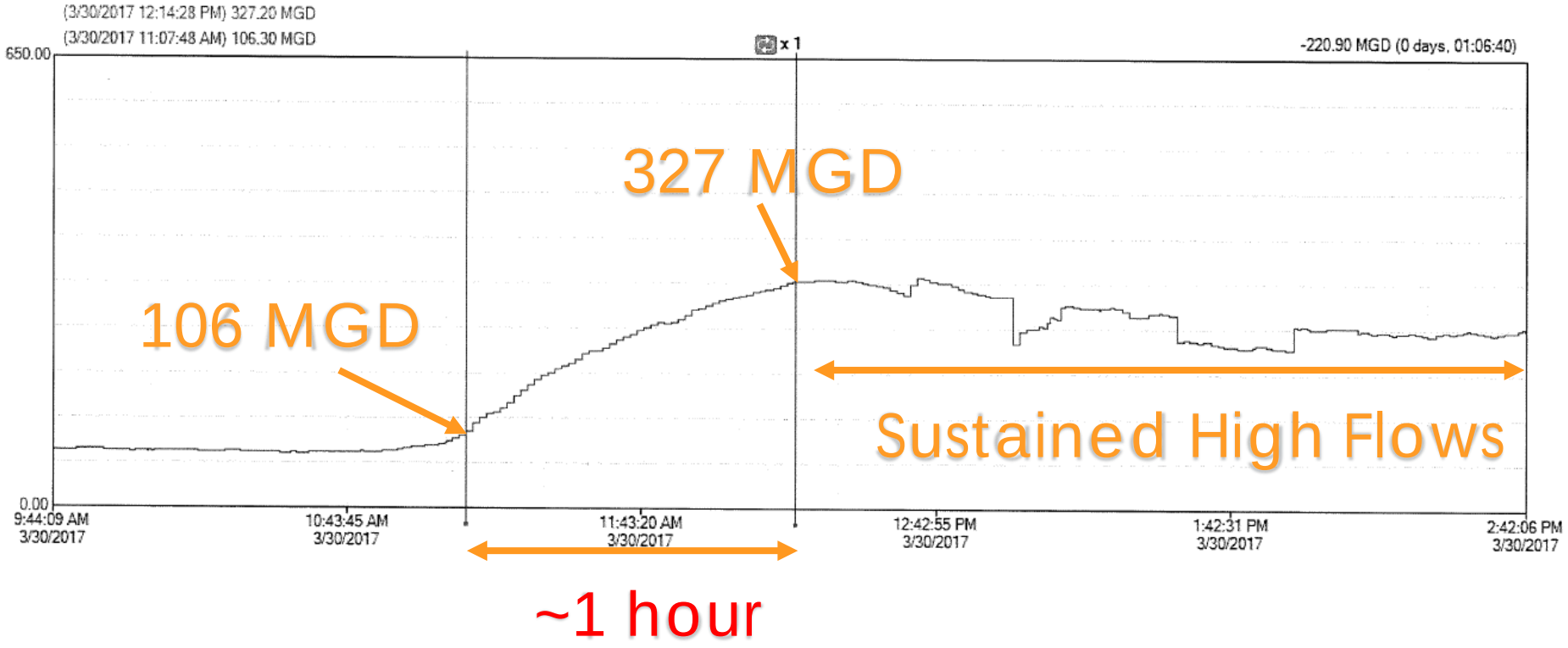

During dry weather flow… FSTs
05/15/2017

Dry to Wet Weather Flow Strategies

Tools available for increasing flow rates:

- Radar/Weather forecast
- Offsite control structure (LSRS)
- Three (3) Influent flow meters and channel levels inside the plant
- Future flow meters in two (2) upstream interceptors (1 mile from plant)

Moderate Increase in Flow Rate



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Dry to Wet Weather Flow Strategies

- During increasing flow rates - standby process tanks are used as **equalization basins**
- Filled ***slowly*** with wastewater to prevent damage to equipment inside the tanks
  - PSTs - inlet gates OPEN 3%
  - Aeration tanks - inlet gates OPEN 3%
- FSTs – inlet gates OPEN 100%


PST Collectors

Aeration Tank Inlet Gates

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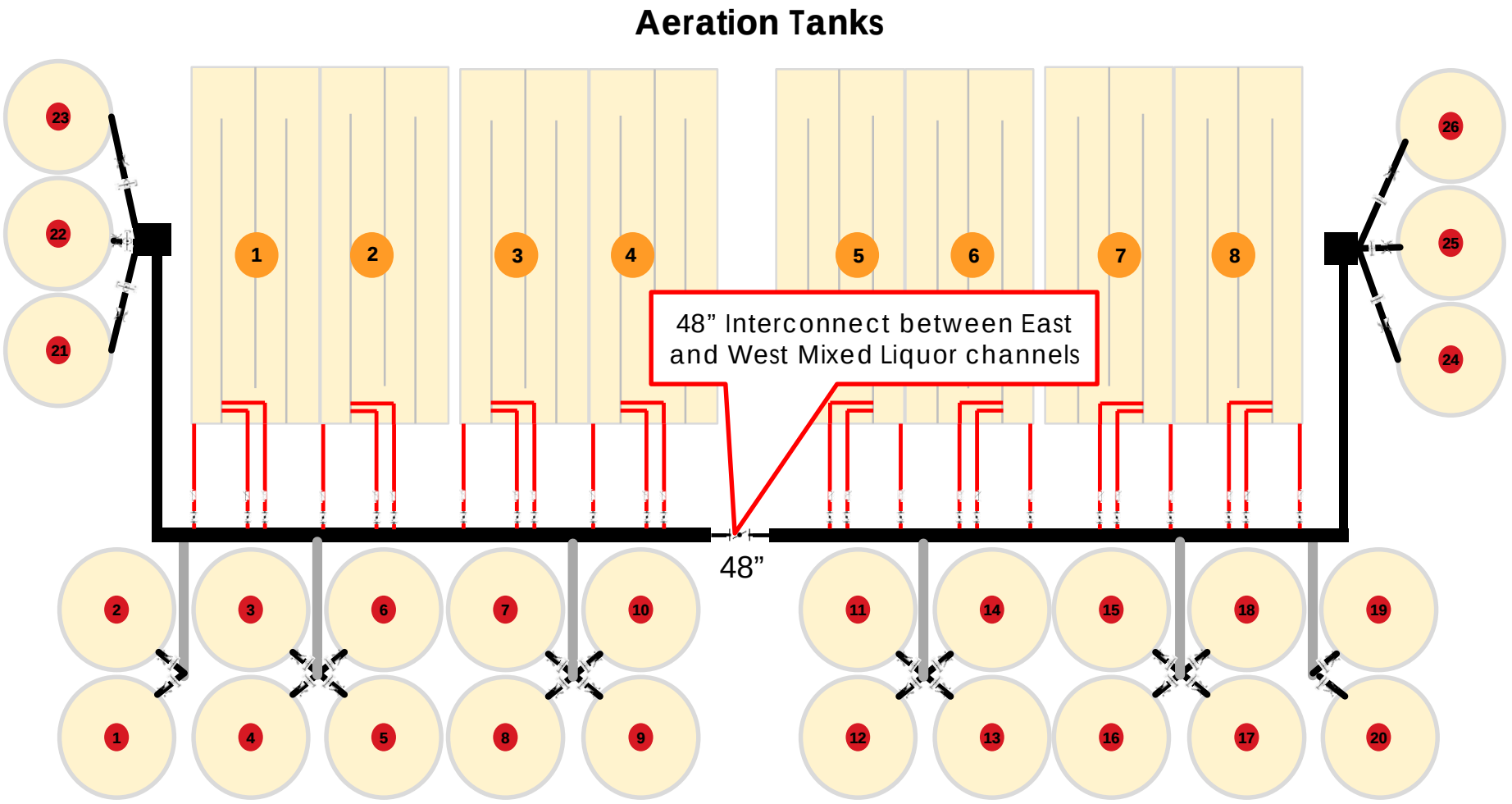
Secondary System Improvements to increase hydraulic capacity



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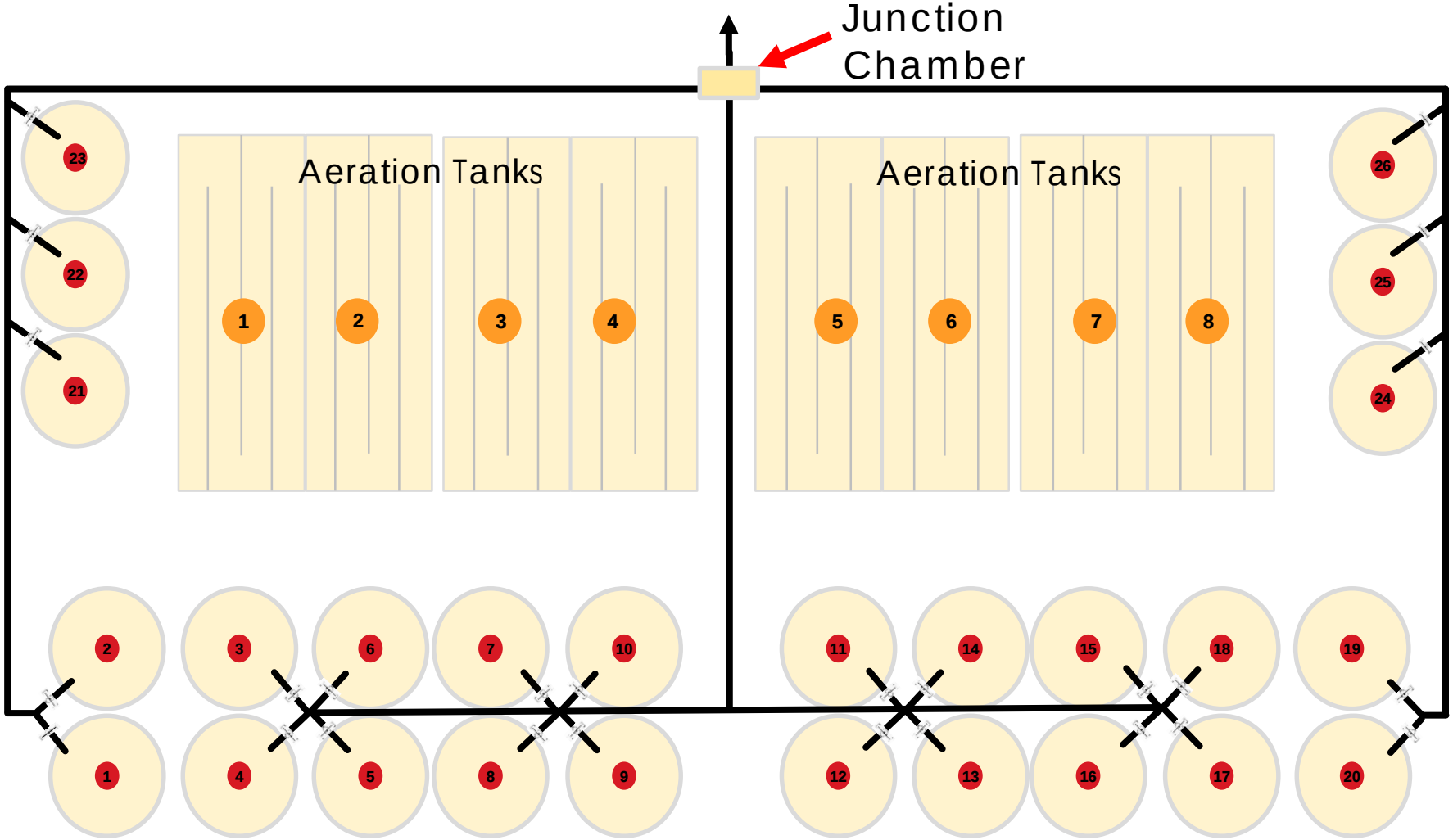
Secondary System Improvements to increase hydraulic capacity



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Wet Weather Strategies
Improvements to existing 20 FSTs

- Density current baffles
- Polymer and ferric piping
- Effluent Gate Actuators
- Mixed liquor distribution chamber modifications (cut throat flumes)

Density Current Baffle (reduce short circuiting)

Energy Dissipating Inlet (EDI)

Wet Weather Strategies – 6 new FSTs

Drive Unit

Center Column and Inlet Ports (Feeds and distributes solids into the clarifier)

Flocculating Well (Allows solid particles to become larger)

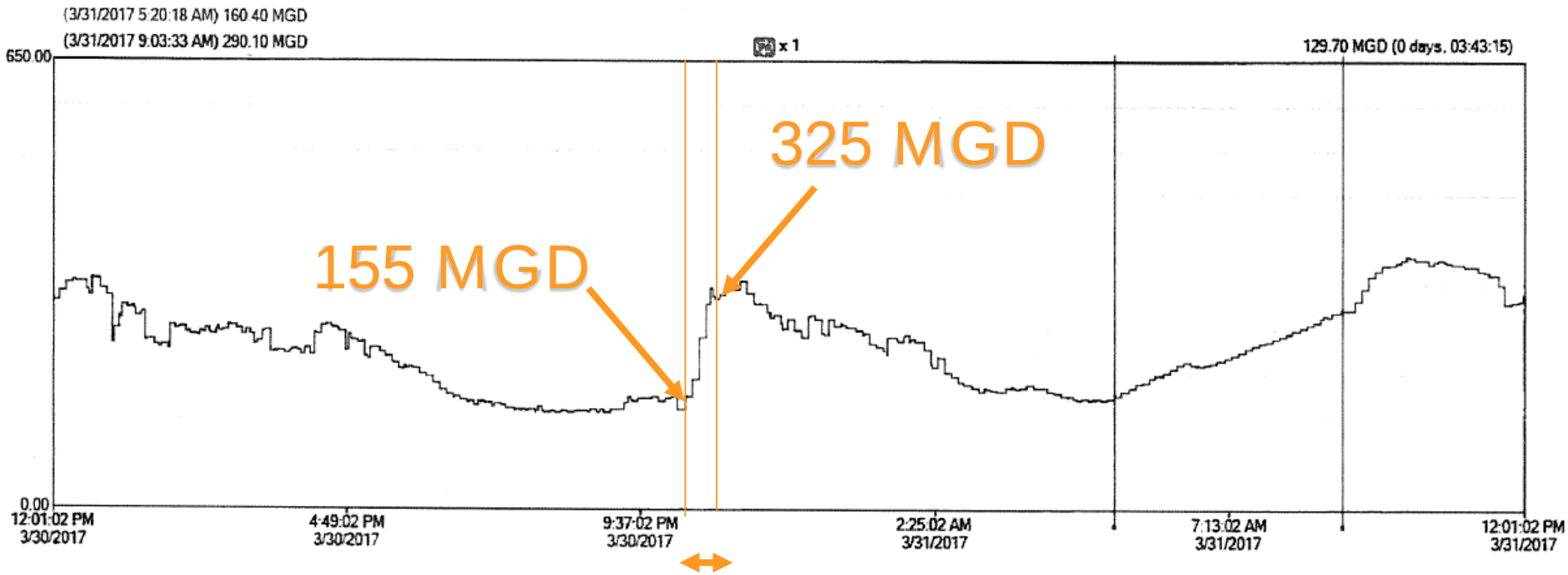
Energy Dissipating Inlet (Slows down solids entering the tank)

Effluent Weirs with Square Notch Design

Effluent Trough (Collects secondary effluent)

Sludge Collection Arm (Designed to rapidly remove settled solids)

Sharp Increase in Flow Rate



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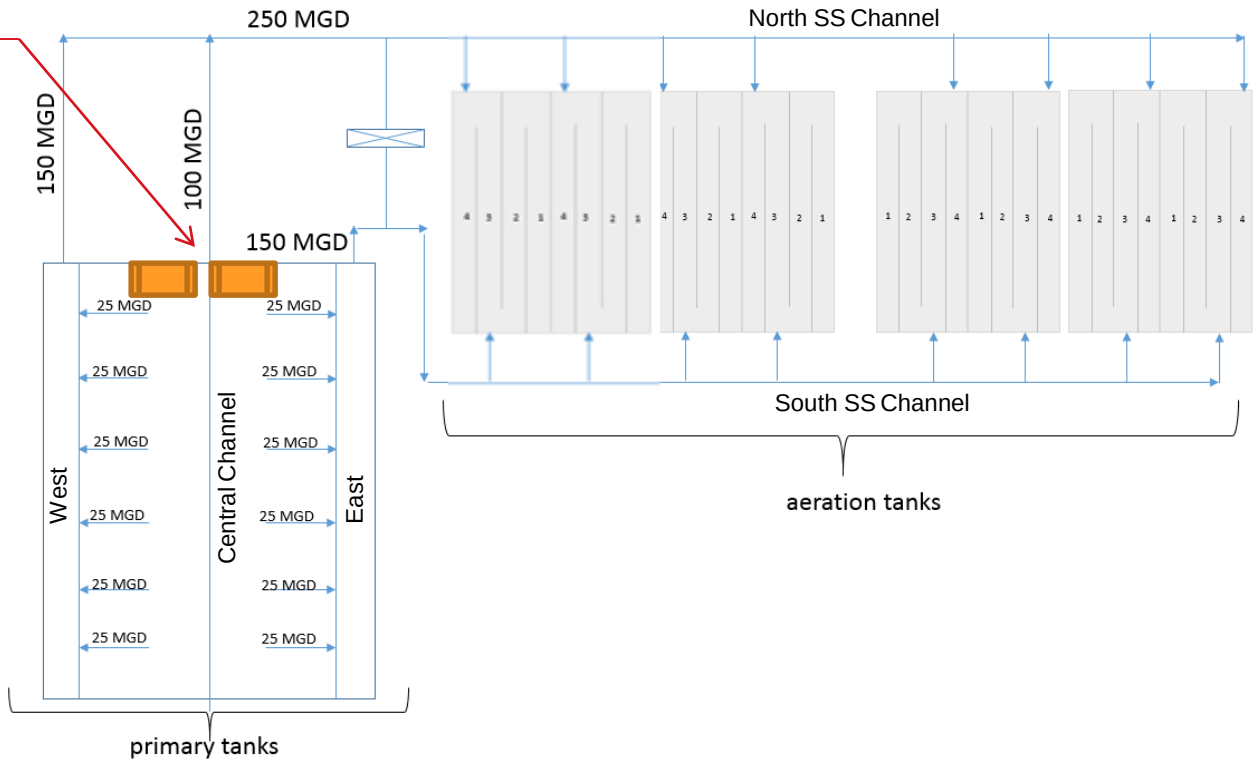
Dry to Wet Weather Flow Strategies

- Sharp increases in influent flow rates can result in the need to have more tanks in full operation before the empty tanks are filled
  - Primary Settling Tanks
  - Aeration Tanks
  - Final Settling Tanks

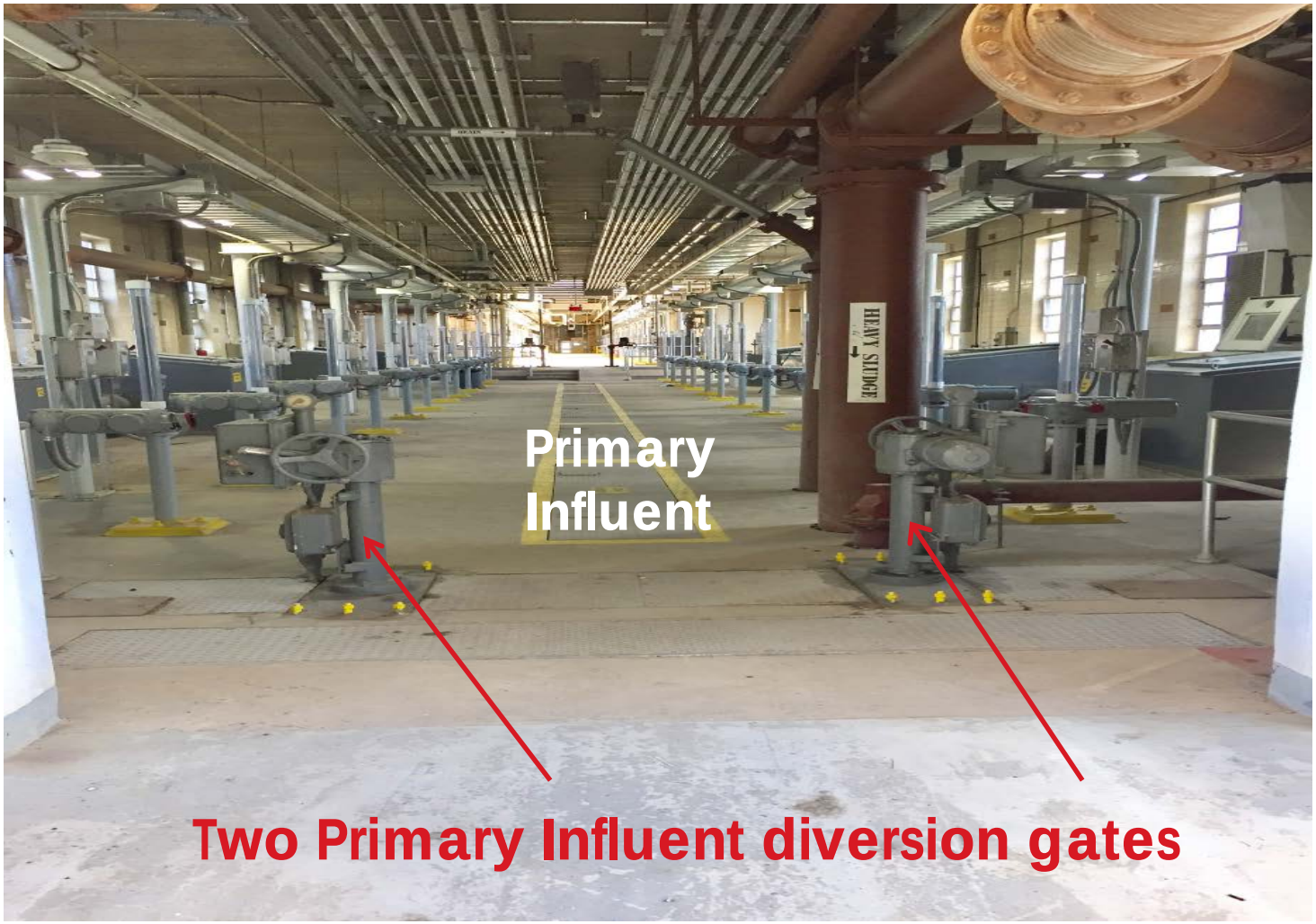
Dry to Wet Weather Flow Strategies

- **At increasing flow rates, while PSTs are slowly filling – open two (2) gates to direct primary influent channel flow to the Settled Sewage channels leading to the Aeration Tanks**

- Two (2) Primary Influent diversion gates to Primary Effluent (Settled Sewage) channels



Dry to Wet Weather Flow Strategies



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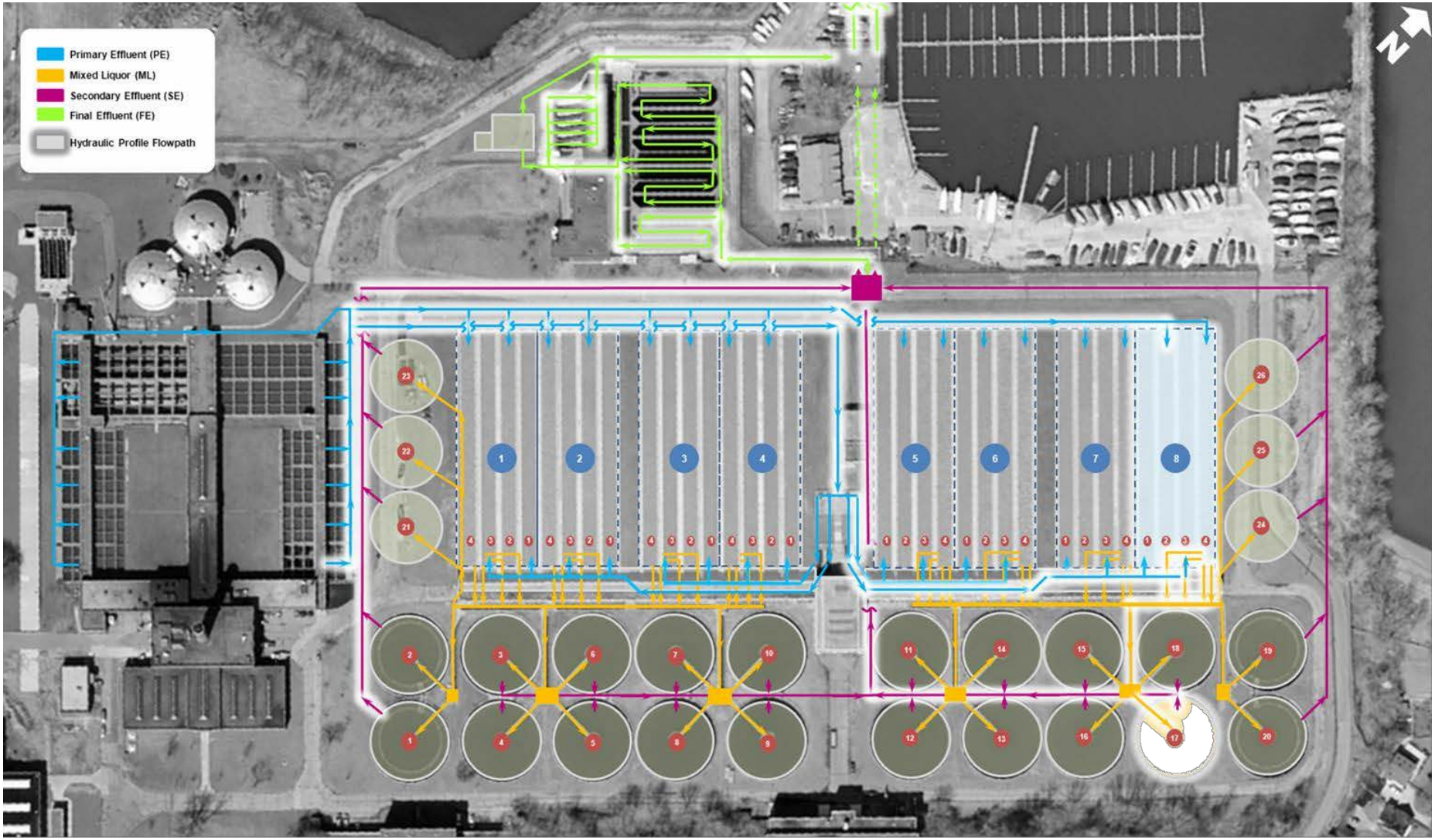
Dry to Wet Weather Flow Strategies



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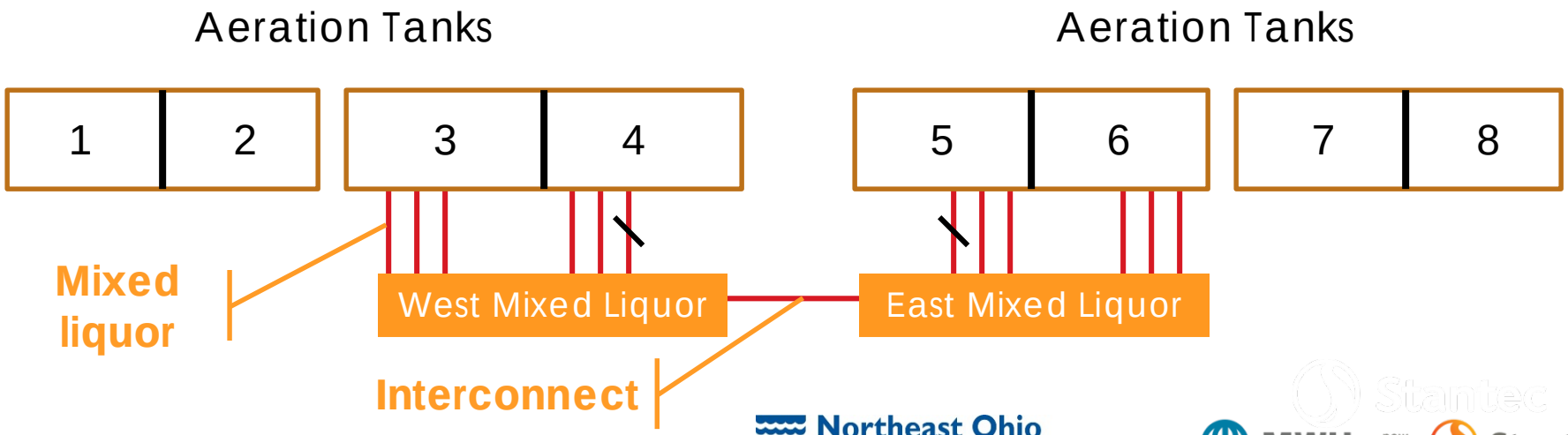
Case Examples

- During construction, wet weather caused a sharp flow increase. The Primary Influent diversion gates were opened slightly to divert incoming flows as PSTs were filling.

Case Examples

Other construction activities:

- Two ML pipes non-operational
- Stop logs and bulkheads in ML channel
- ML interconnect between the west and east aeration systems being installed



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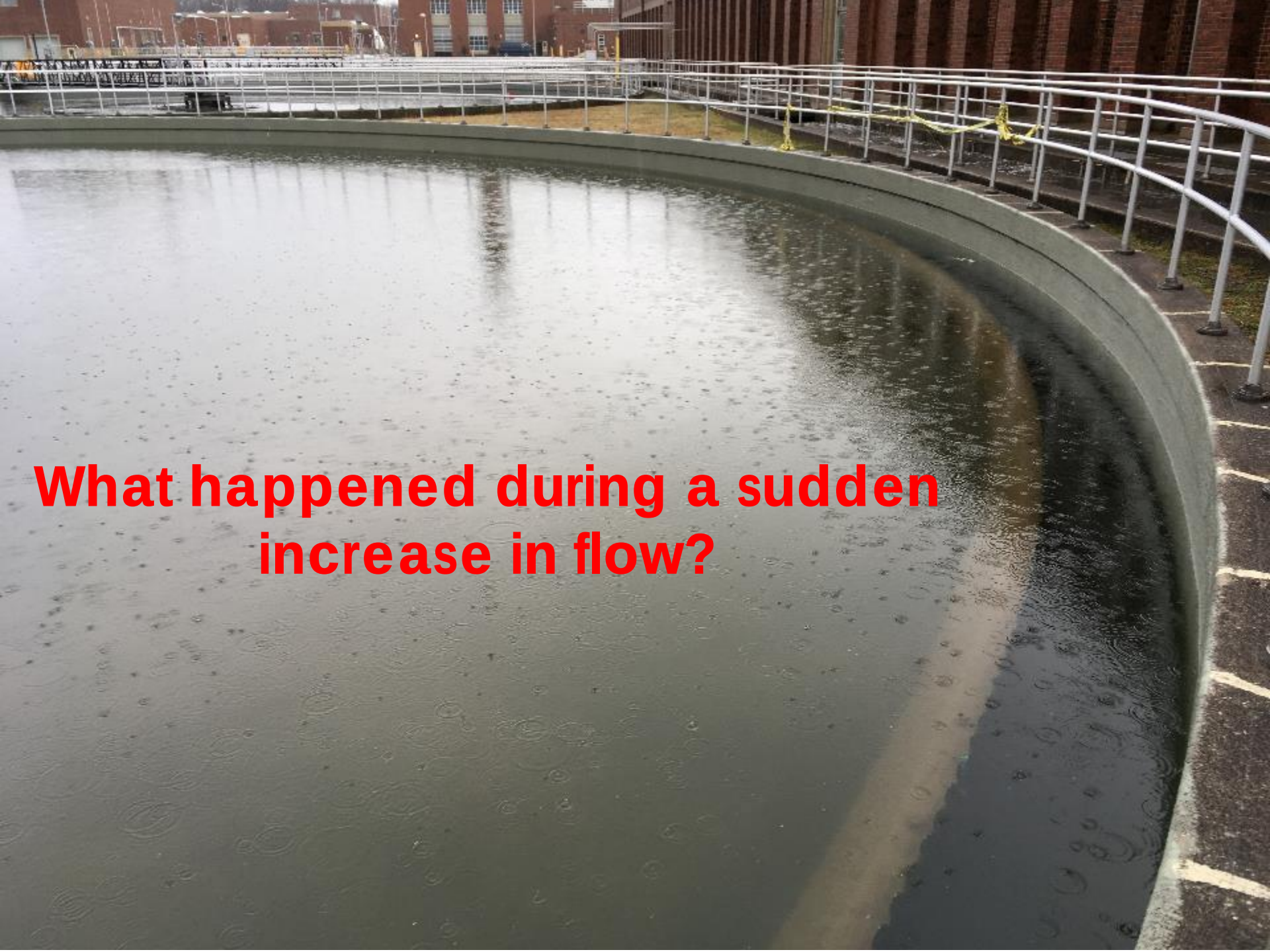
What happened during a sudden increase in flow?


What happened during a sudden increase in flow?

Future Activities

- Design & install baffles at the PST inlet gates
- Automate the operation of the Primary Influent diversion gates (modulate gate based on channel levels)
- Design & install baffles at the Aeration tank inlet gate

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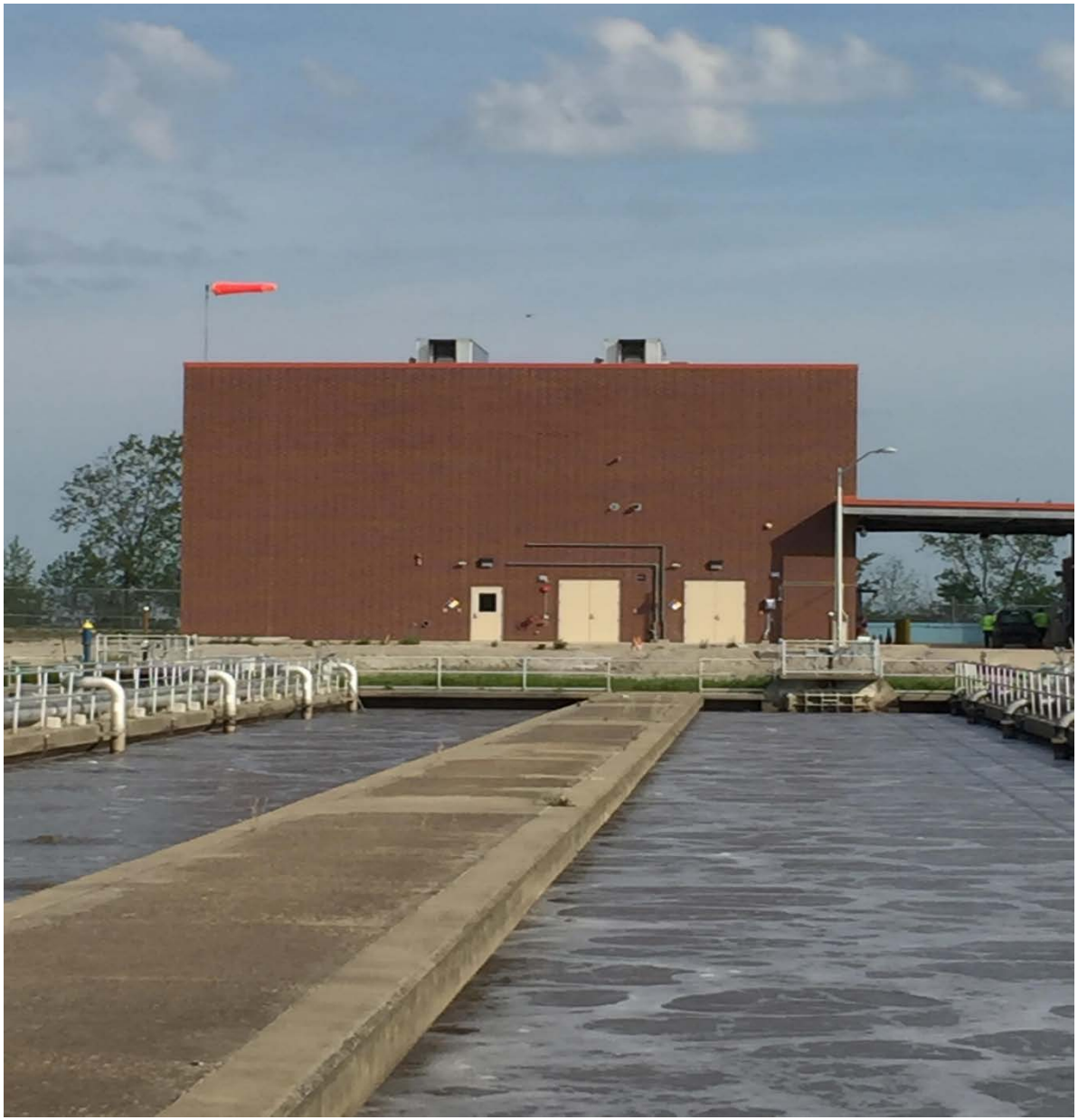
Future Activities

- Activated Sludge Process
  - Each Aeration Tank has four passes
  - Pass 1 has two Settled Sewage gates
  - Passes 2, 3 and 4 each have one gate
- Dry weather flow **(Conventional)**
  - Settled Sewage into passes 1 & 2
- Wet weather flow >225 MGD
  (Contact Stabilization)
  - Open Settled Sewage gates into passes 3 & 4. Close gates into passes 1 & 2

Operational Challenges

Wet Weather to Dry Weather – Drain and clean tanks quickly between high flow events

Odors – Check wind direction before dewatering tanks



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Final Effluent Screw Pumps