WPCA Facilities Planning in Bridgeport:

Balancing Critical WWTP Infrastructure Needs & Resolving CSO Discharges

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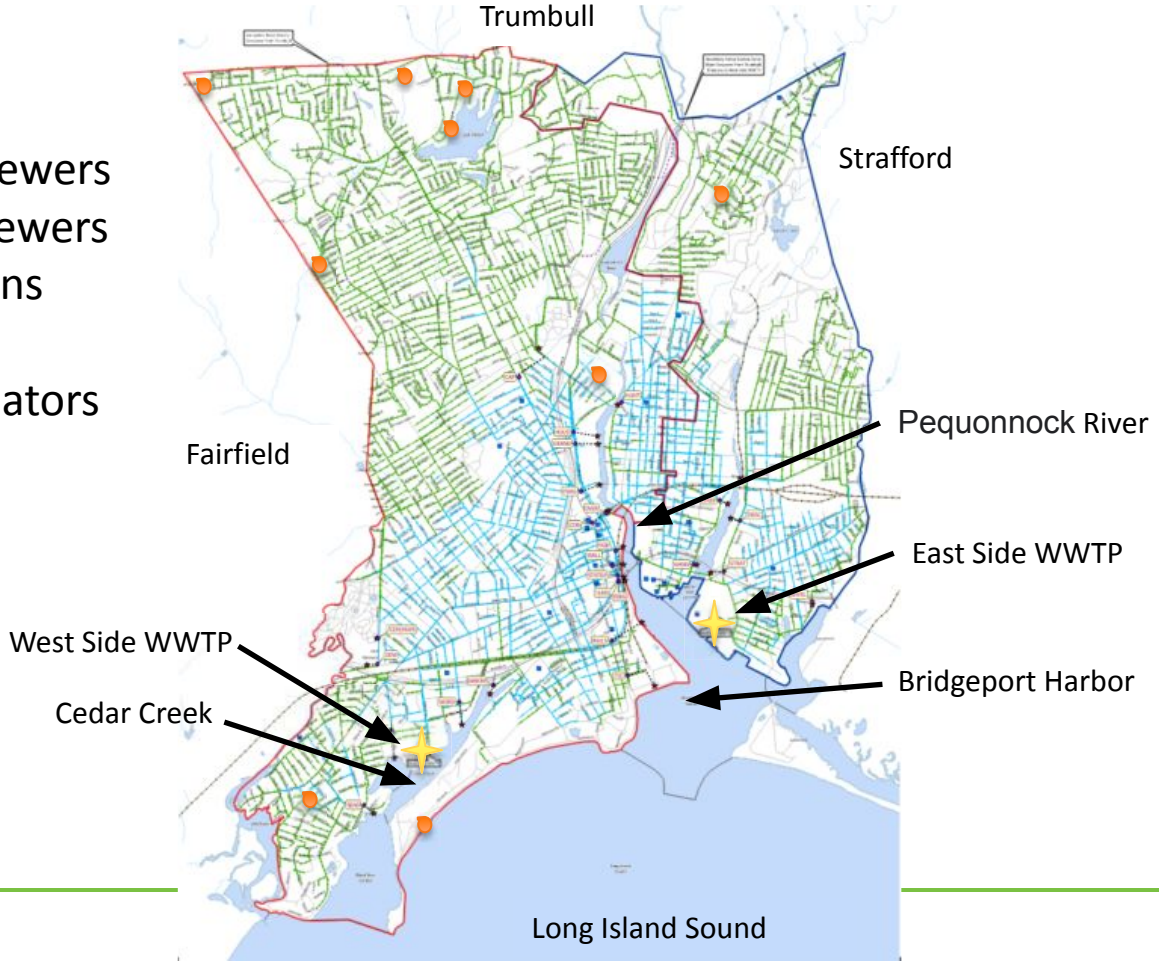
January 24, 2022

CDM Smith

WPCA, City of Bridgeport, CT

- Combined Sewers
- Separated Sewers
- Pump Stations
- WWTPs
- Sewer Regulators



Administrative Order

Long-Term CSO Control Plan (LTCP)

Objective: control the 1-year, 24-hour storm

- Illicit connection elimination program
- Sewer Separation in four sewersheds
- Low impact technologies (green infrastructure)
- Two, 1.5-MG CSO storage tanks
- CSO relief sewers
- Deep rock CSO storage tunnel
- Continuous WQ monitoring and modeling program

Approved by CT DEEP in January 2018

Second Administrative Order: March 2019

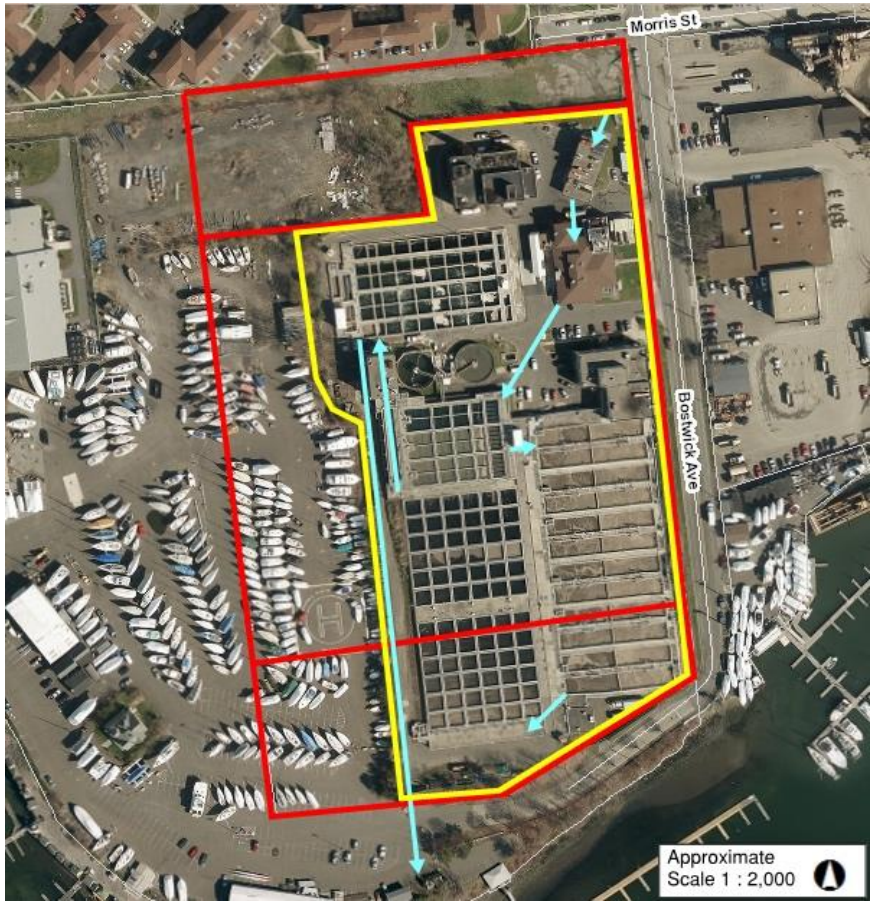
WWTP Facilities Plan

Objectives:

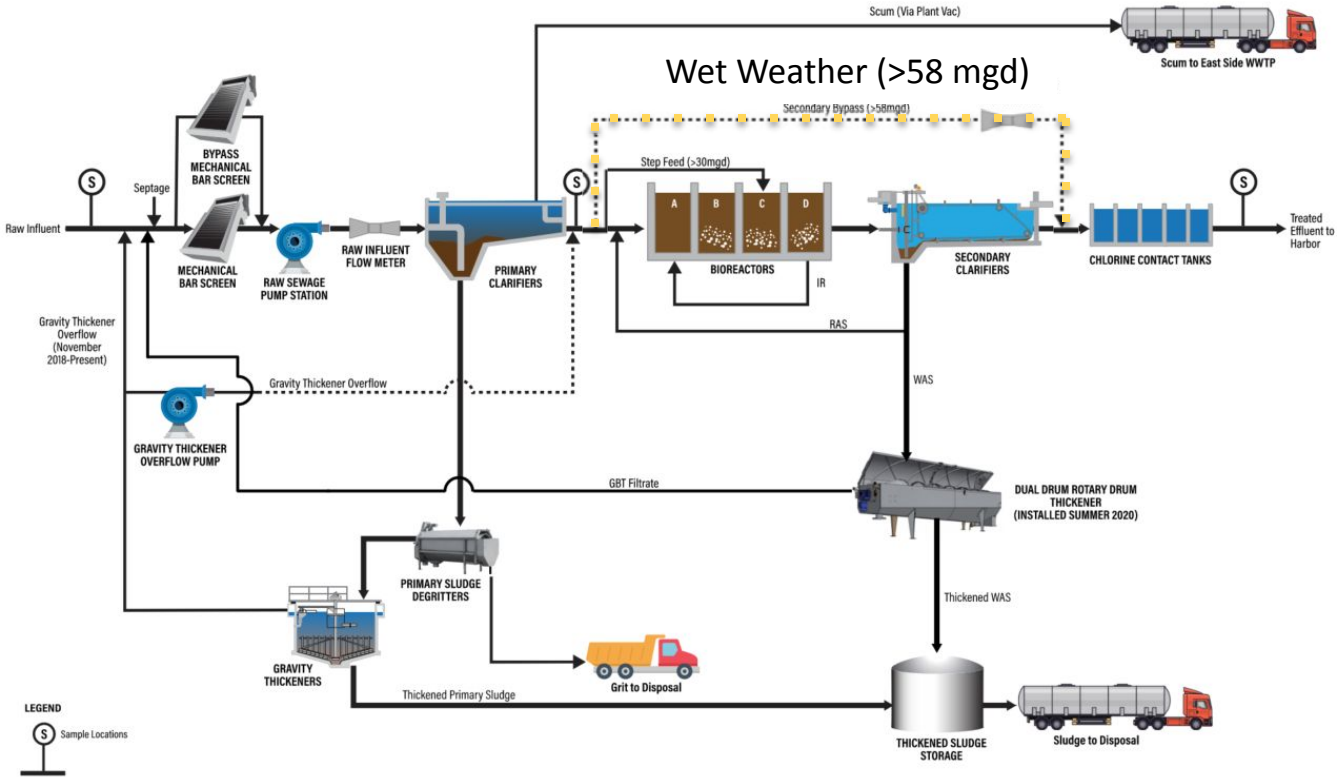
- Improve performance and operation of WWTPs
- Replace aging assets
- Manage high flows to reduce CSOs
- Improve wet weather discharge quality
- Improve BNR to optimize nitrogen credits
- Provide system resiliency
- Update instrumentation and controls

West Side WWTP

- AADF: 30 mgd
- Secondary Treatment Capacity: 58 mgd
- WW Capacity: 90 mgd
- General Permit for Nitrogen: 1,041 lb/day (4.2 mg/L)
- 19 NPDES Permitted CSO Outfalls



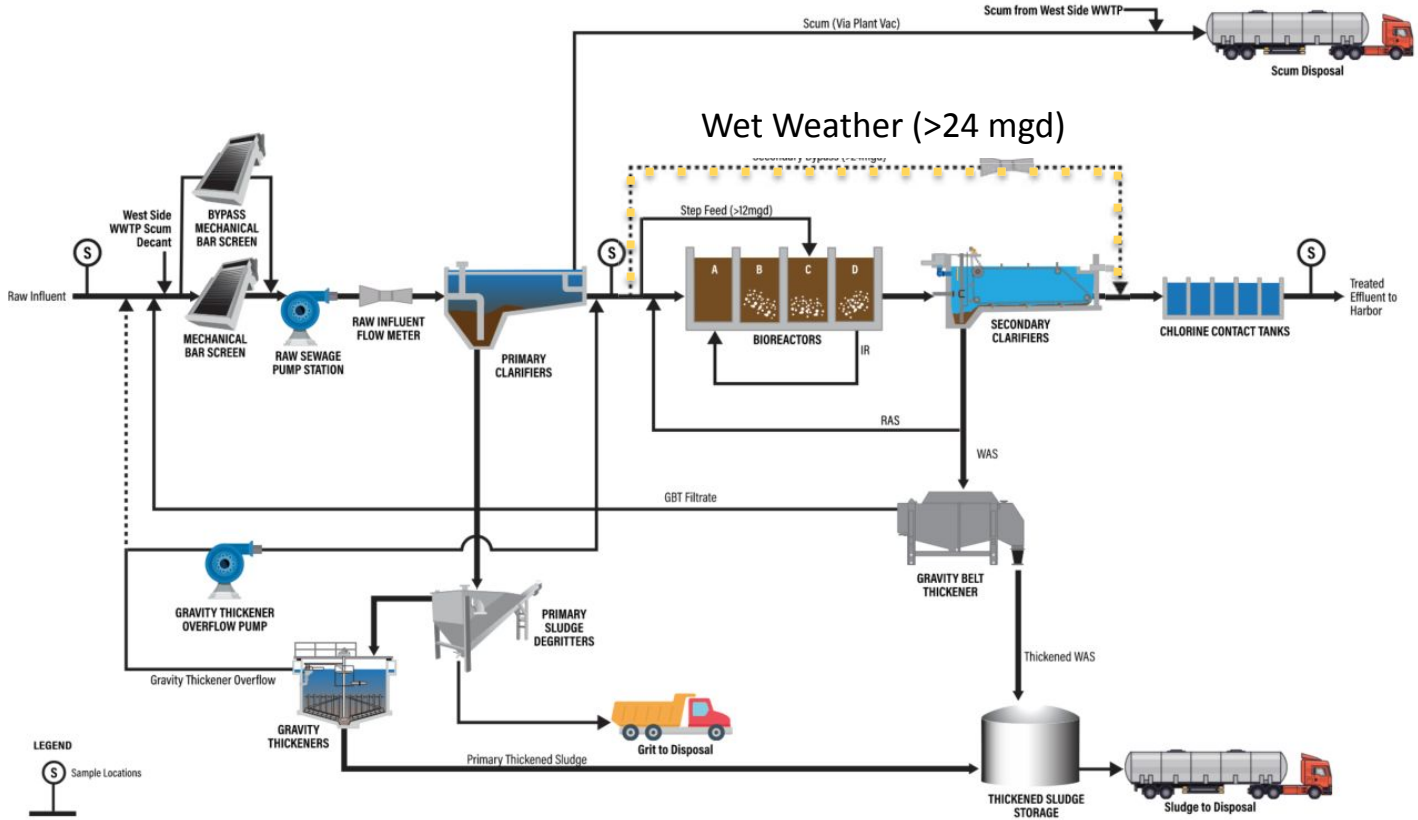
West Side WWTP Process Flow



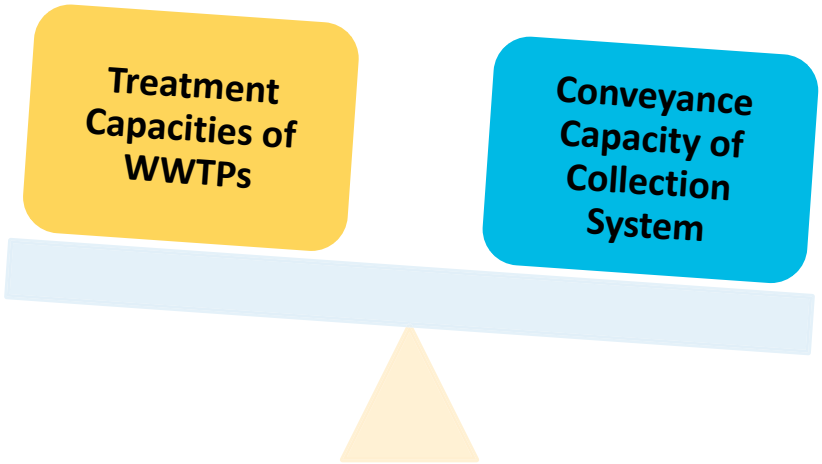
East Side WWTP

- AADF: 10 mgd
- Secondary Treatment Capacity: 24 mgd
- WW Capacity: 40 mgd
- General Permit for Nitrogen: 362 lb/day (4.3 mg/L)
- 6 NPDES Permitted CSO Outfalls

East Side WWTP Process Flow



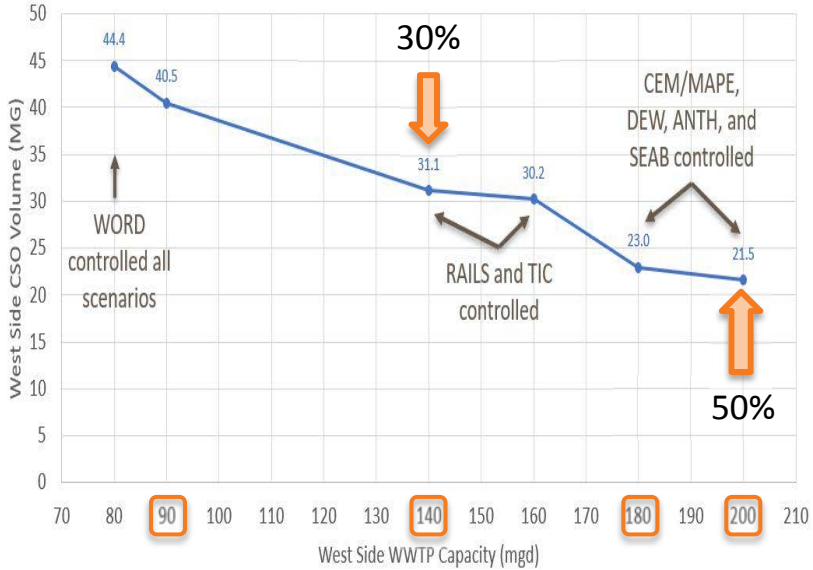
Revisiting & Refining the LTCP's SWMM Model



- LTCP did not evaluate expanding WW capacities at WWTPs per EPA's CSO Control Guidance Documents
- Modeled CSO volumes at various WWTP capacities @ 1-year, 24-hour storm

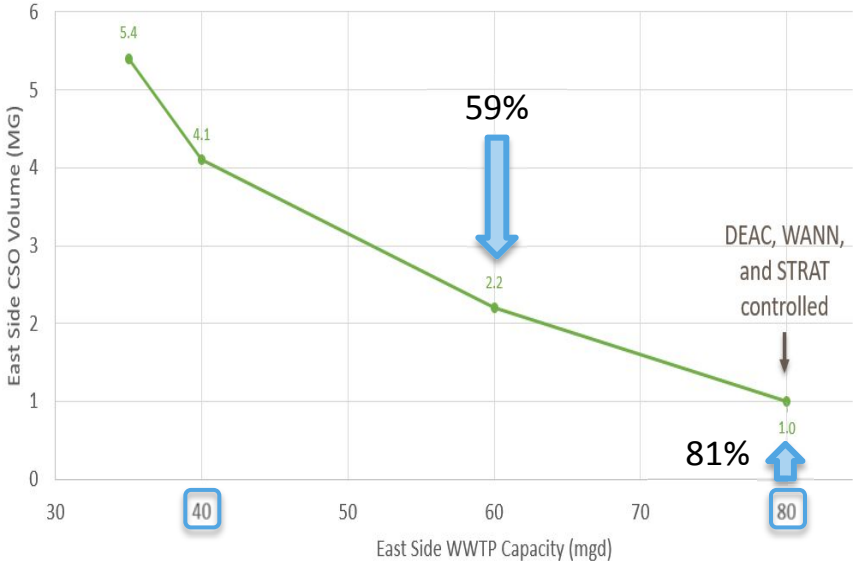
Increase WWTP Capacities to Reduce CSOs

West Side WWTP



Consider Expansion to: 90, 140, 180 & 200 mgd

East Side WWTP

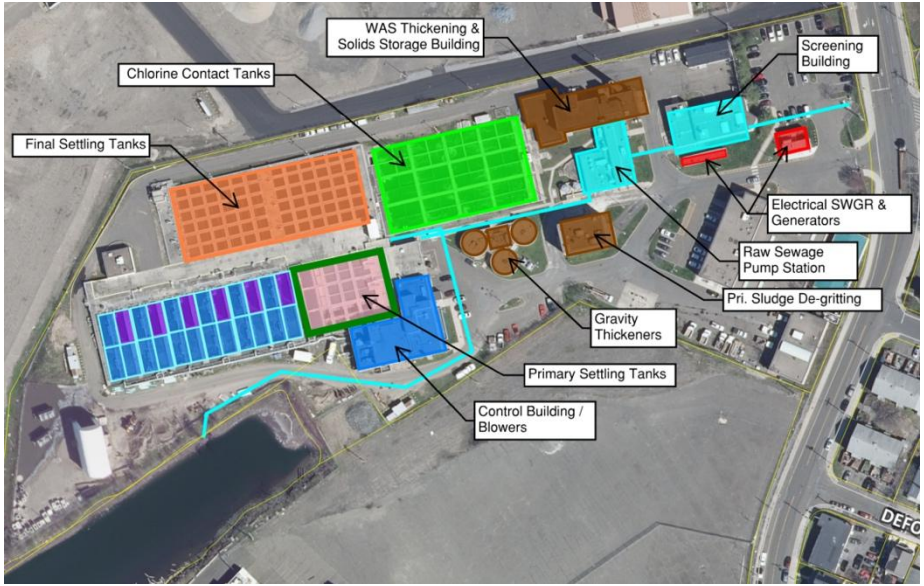


Consider Expansion to: 40 & 80 mgd

How to expand capacities at built-out sites?

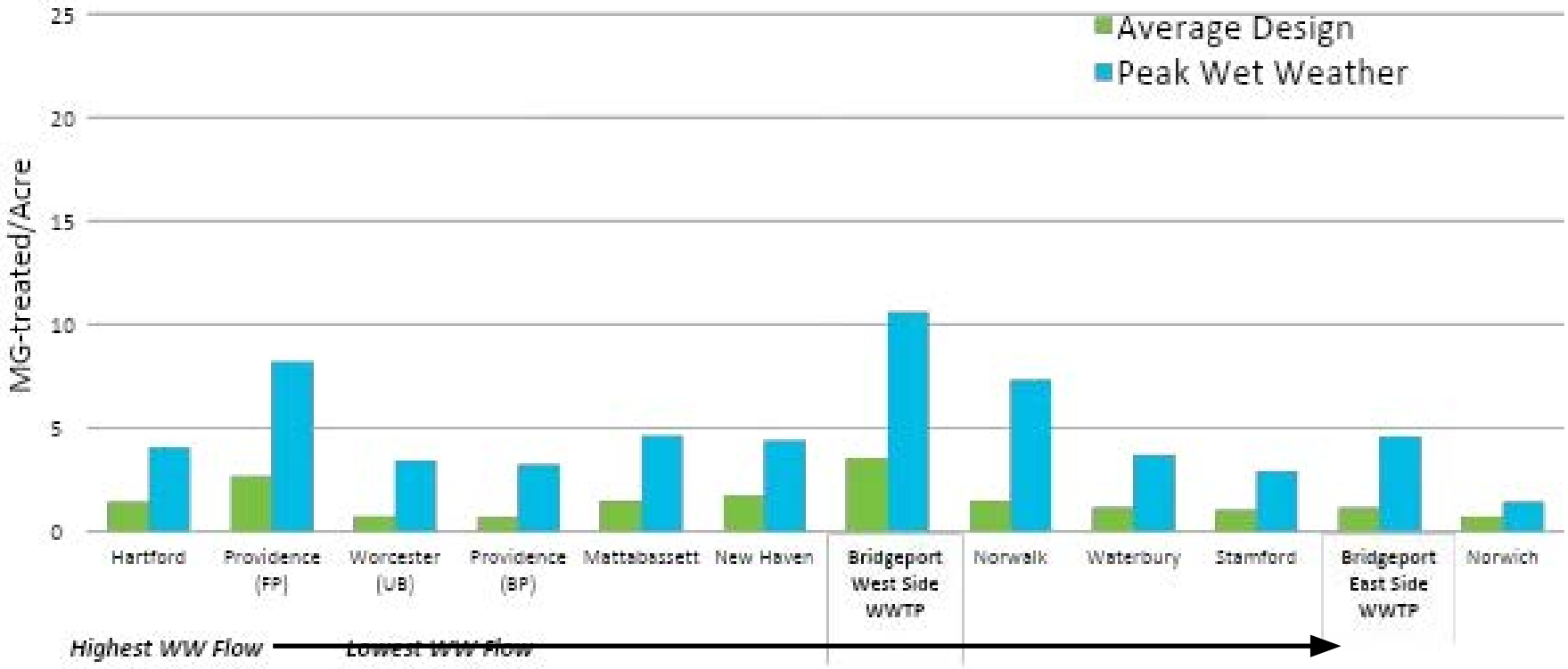
West Side WWTP: 8.5 acres

East Side WWTP: 8.8 acres



Sizing Up Other WWTPs:

MG-treated/Acre



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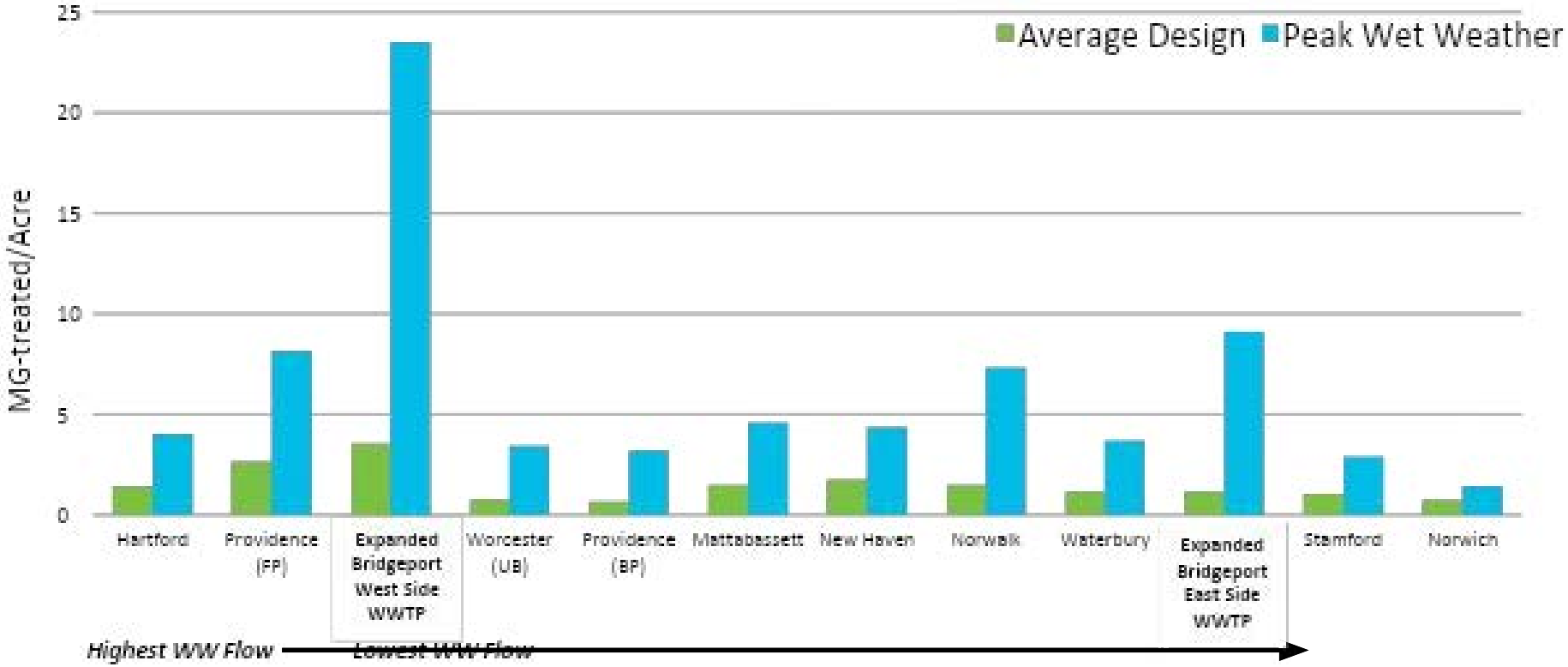
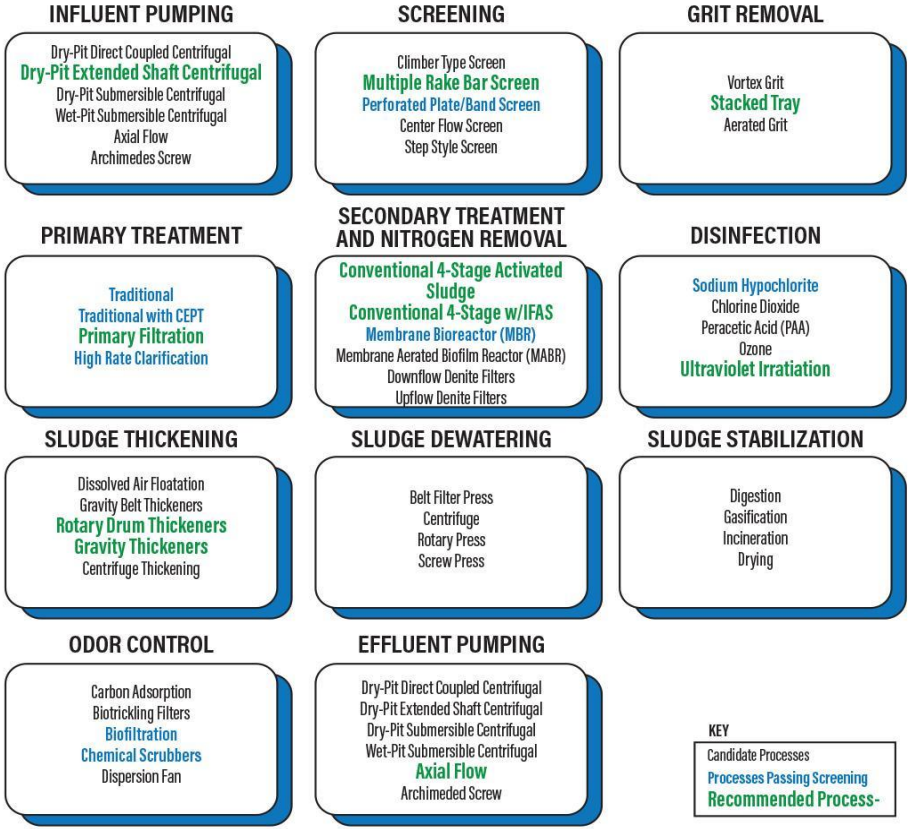
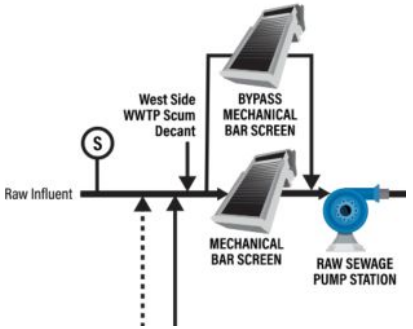


Liquid Treatment Train Technologies



Preliminary Treatment

- Deficient screening
  - Equipment > 30 years old
  - No grit removal
  - Primary sludge degritting ineffective
  - Entire facility below existing flood el.
- Deficient influent pumping
  - 3 duty/1 standby 23,500 gpm @ 51 TDH
  - 400 HP motors w/VFDs
  - At pumped flows >80 mgd, wet well level > high level set point



Preliminary Treatment Recommended Improvements

Coarse Bar Screens | Pumping | Fine Screens | Grit Removal

Multiple Rake Bar Screen

Climber Screen

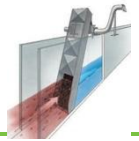
Dry-pit centrifugal – close coupled

Extended shaft centrifugal

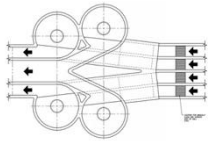
Dry-pit submersible centrifugal

Perf plate/band screens

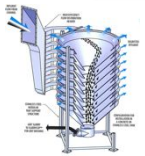
Center flow screens



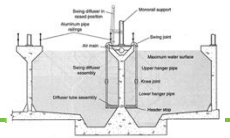
Step screens



Vortex grit



Headcell



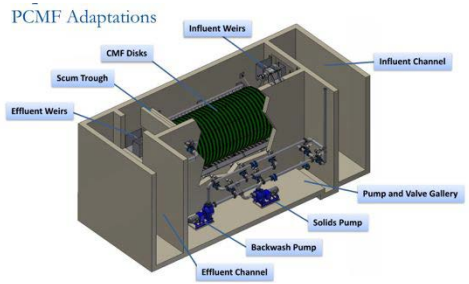
Aerated grit

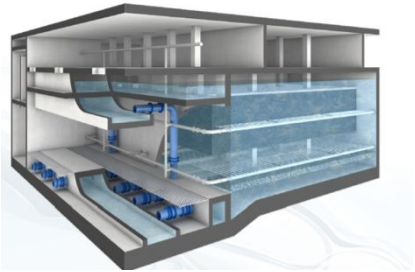
Dual-Use Wet Weather/Primary Clarification

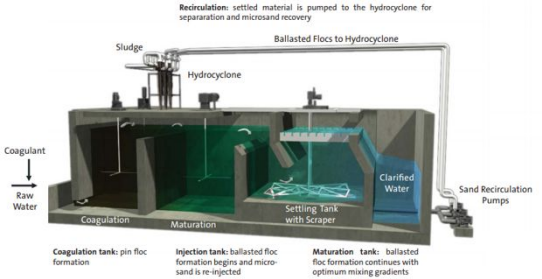
Flow Condition	Overflow Rate (all three tanks in service)	TR-16 Overflow Rate
Design ADF: 30 mgd	2,042 gpd/ft^2	1,200 gpd/ft^2
Design Wet Weather: 90 mgd	6,127 gpd/ft^2	3,000 gpd/ft^2

- Undersized
- Poor performance (negligible removal)
- Conventional clarification + CEPT not viable

Alternative Primary Treatment Technologies







AquaPrime

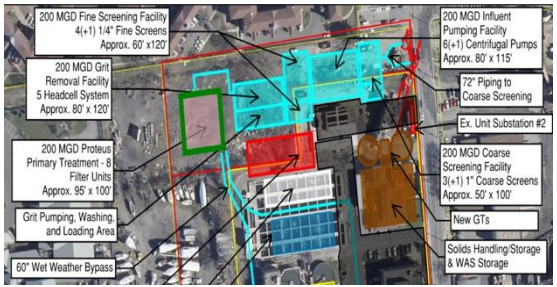
Primary Cloth Filtration

Aqua Aerobic Systems, Inc.

Proteus

Upflow Media Filtration

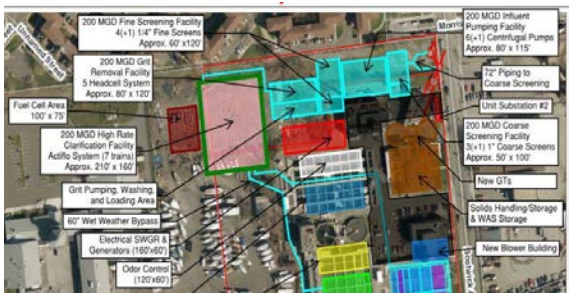
Tomorrow Water



ACTIFLO

Ballasted Flocculation

Kruger



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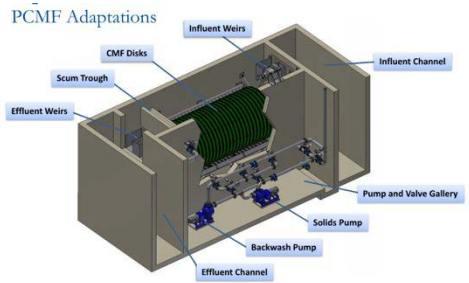

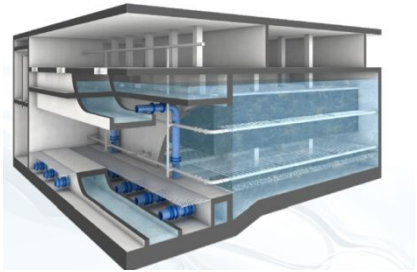

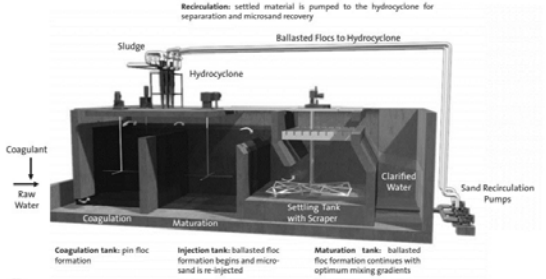

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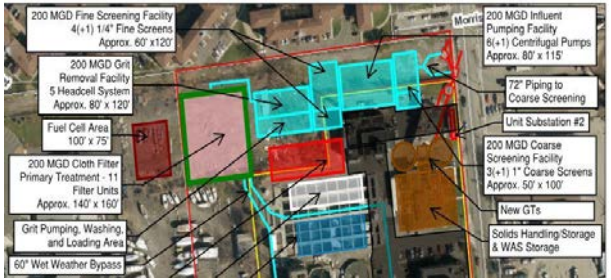
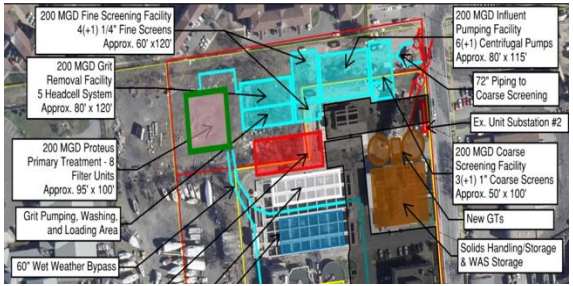
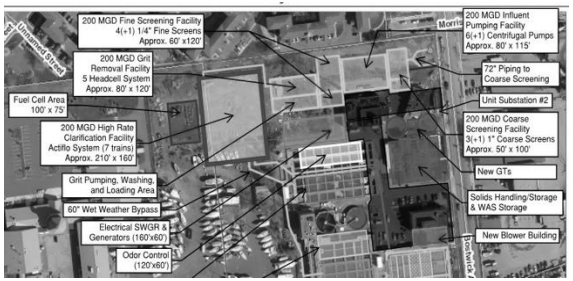
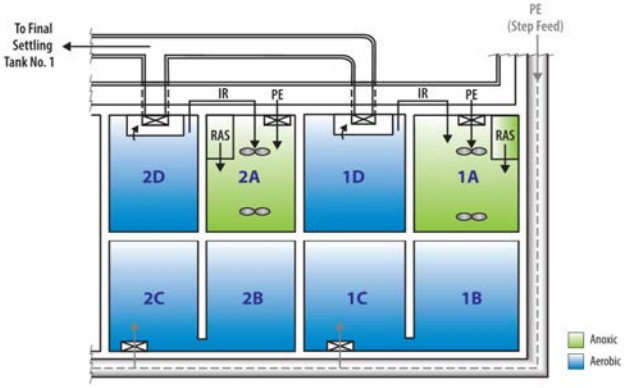


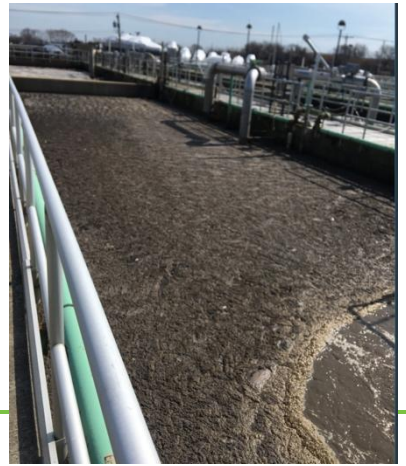


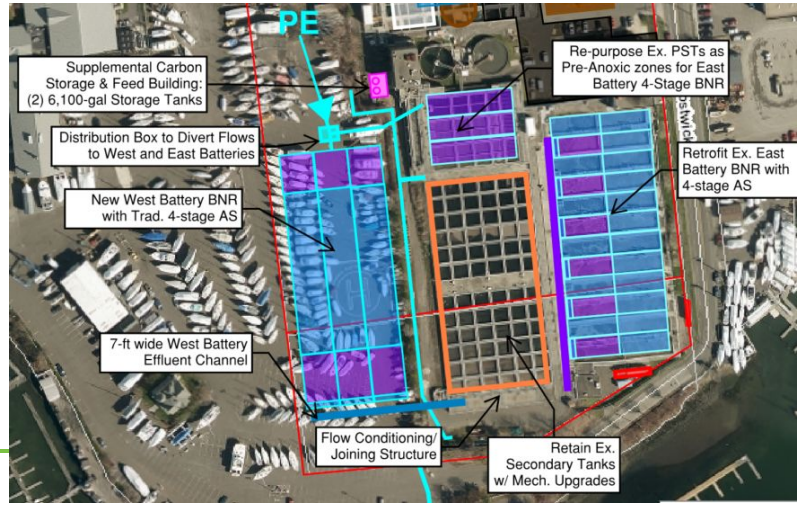


Biological Nitrogen Removal

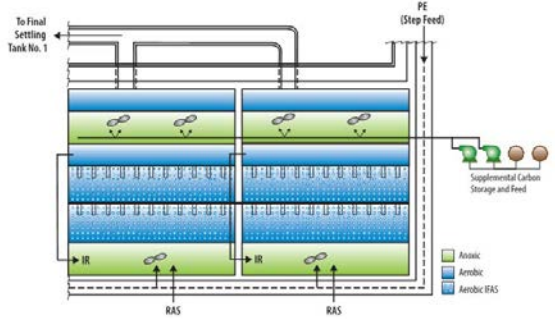
- 6 bioreactors (MLE) □ 3 secondary clarifiers
- Insufficient $V_{aeration}$ [>5 MG deficit]
  - Carry HIGH MLSS exceeding secondary clarifier capacity (solids washout)
- Conventional suspended growth AS processes NOT viable
- Must intensify process

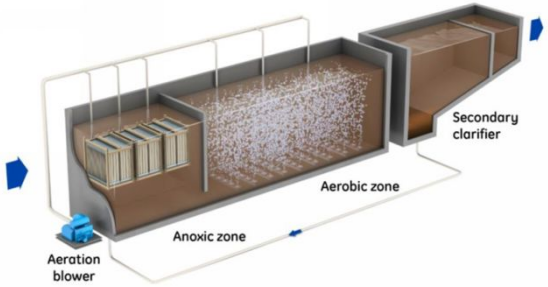


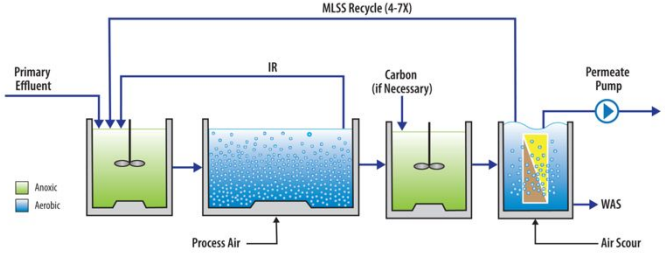




Alt Integrated Activated Sludge Processes

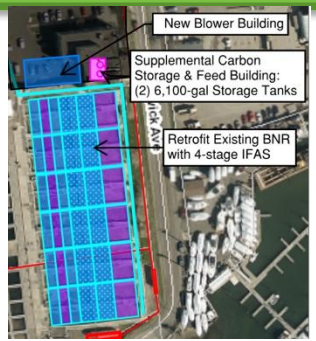






IFAS

4-Stage Suspended AS w/ Media + Secondary Clarification



ZeeLung (MABR)

2-Stage Suspended AS w/Membrane Diffused Air in Anoxic + Secondary Clarification

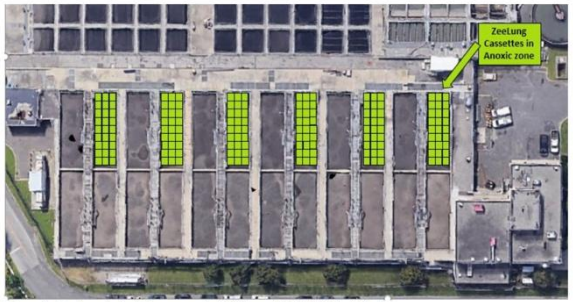
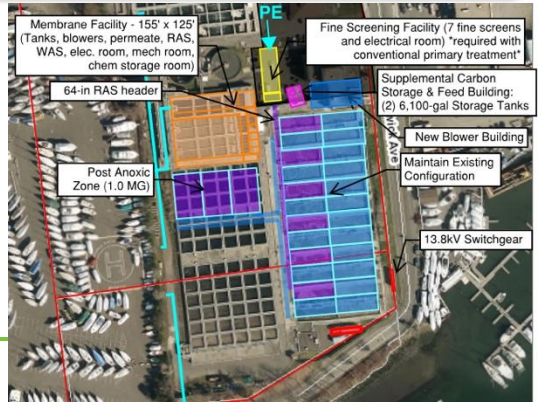


Figure 6: ZeeLung installation concept at Bridgeport WWTP West Plant

MBRs

4-Stage Suspended AS + Membrane Filtration



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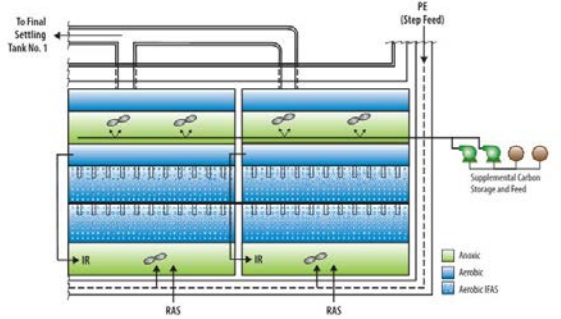
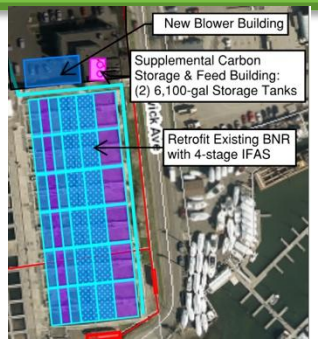
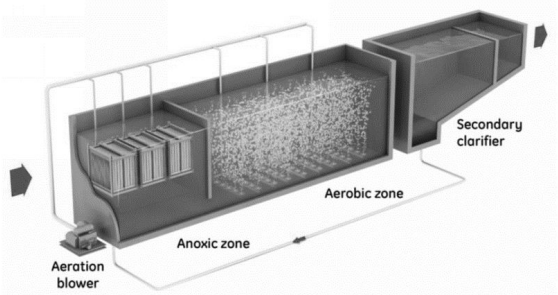


IFAS

4-Stage Suspended AS w/ Media + Secondary Clarification





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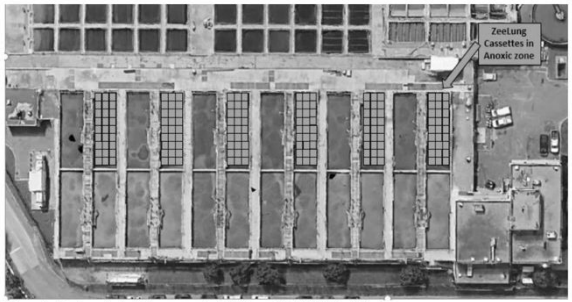

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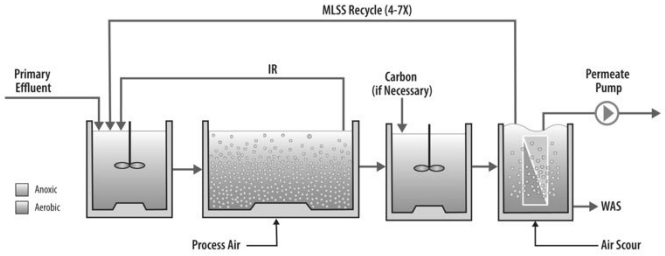
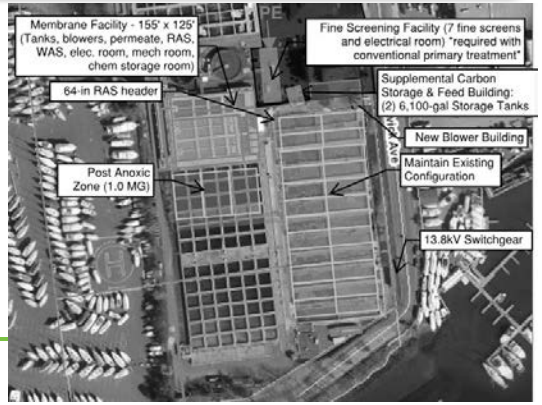


MBRs

4-Stage Suspended AS + Membrane Filtration



Disinfection

- Dual-use wet weather and secondary effluent
- Sodium Hypochlorite and sodium bisulfite
- CCT old primary settling tanks - not appropriately sized
  - L:W ratio causes short circuiting
- Aerate CCT
- Scum on CCTs
- Below 100-year flood plain elevation

Alternative Disinfection Technologies

- Conventional disinfection w/hypo and dechlor not feasible due to site constrains
- Peracetic acid (PAA) disinfection
  - Potentially short contact time
  - No dechlorination required
- UV disinfection
- Combined primary effluent + secondary effluent system?
- Two separate disinfection systems?

13 Treatment Trains w/Site Layouts Developed

90 mgd

140 mgd

180 mgd

200 mgd

Extensive considerations taken into account:

- Maintenance of plant operations
- Hydraulics
- Constructability

Facilities Plan Revised Schedule

Overall Schedule Considerations

CONSENT ORDER SCHEDULE

- Facilities Plan 11/30/20
- WWTP Design (Both Plants) by 5/31/22
- WWTP Construction (Both Plants) by 8/15/26

NOV 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030

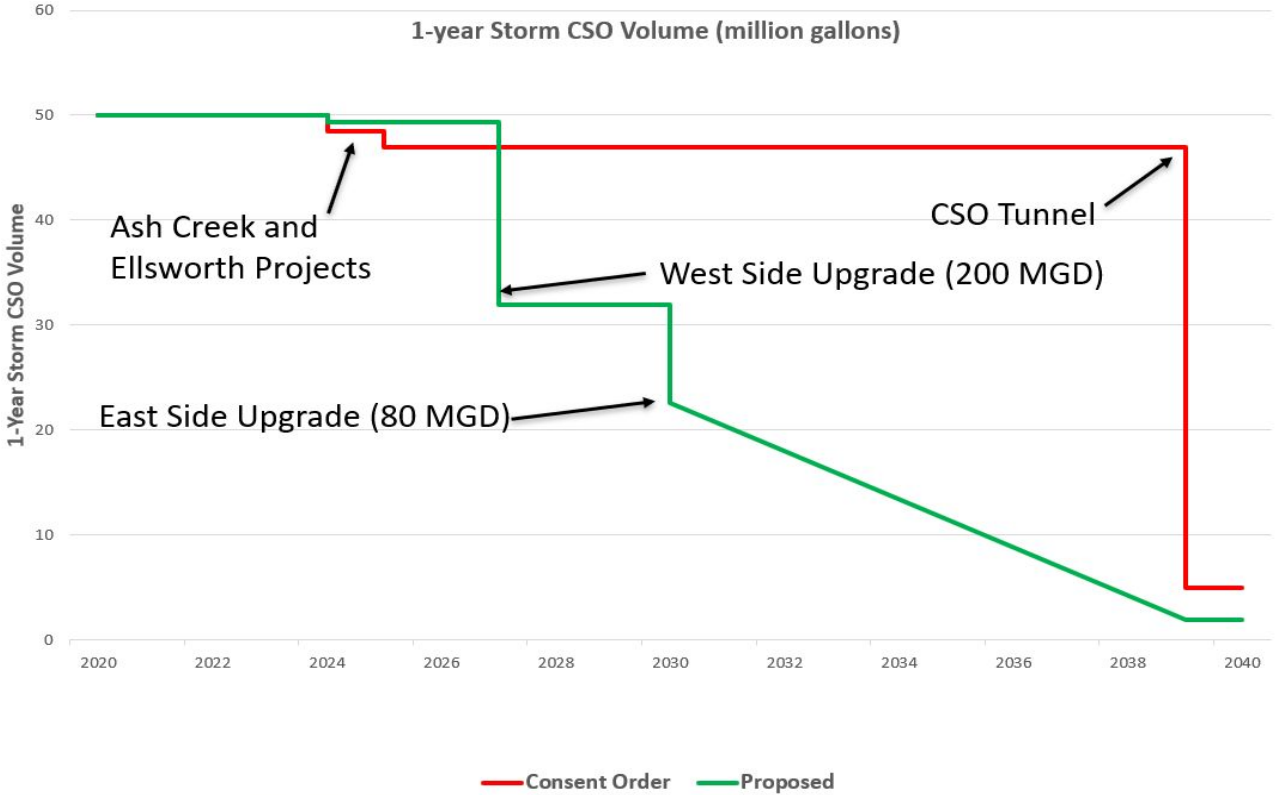
ANTICIPATED PROPOSED SCHEDULE

- Facilities Plan 11/30/20
- West Side WWTP Design by 11/30/22
- West Side WWTP Construction by 8/31/27
- East Side WWTP Design by 11/30/25
- East Side WWTP Construction by 11/30/29

Dual-Use Primary/Wet Weather Treatment Pilot

- Establish TSS, BOD & TKN removals
  - Limit BOD removal
- Monitor PE UVT for UV disinfection system size
- Confirm vendor proposed design criteria
  - Hydraulic loading rates
  - Solids loading rates
  - Backwash frequencies & volumes
- Quantify solids generation & settleability
- System response to FOG
- Inform O&M costs
- Refine system performance guarantees
- Demonstrate system operation to staff

Revised Implementation Schedule Drives Results



Water Partnership with CDM Smith

Precious resources · Powerful insights · A future we build together

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