Preliminary Design of the DC Water Enhanced Clarification Facility

New England Water Environment Association

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Presentation Outline

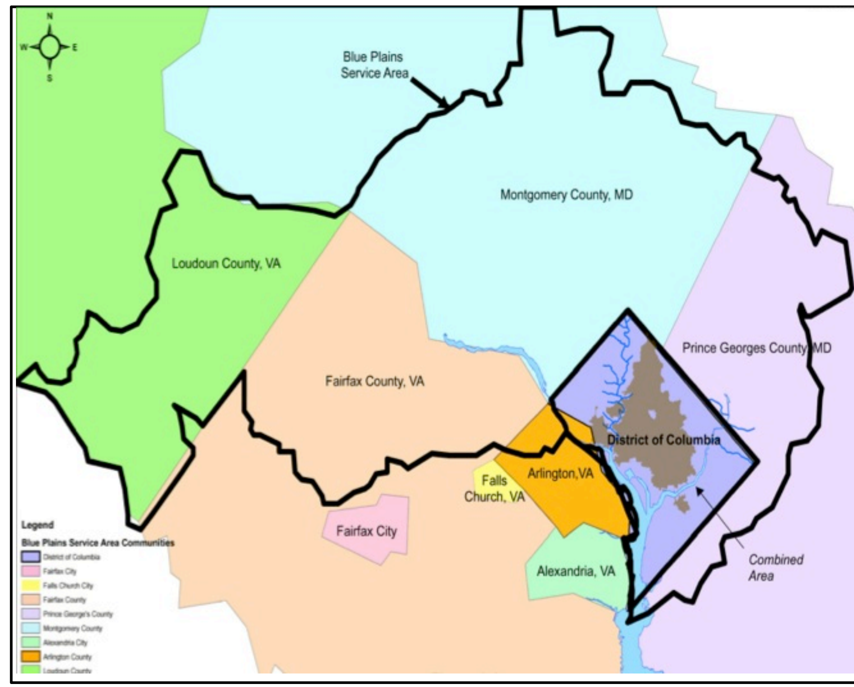
- Background
- Project objectives
- Description of ECF treatment process
- Findings and lessons learned
- Conclusions

Start of Blue Plains Tunnel

Background

DC Water Service Area

- Water and wastewater services
  - 500,000 customers in D.C.
- Wastewater conveyance and treatment services
  - 1.6 million customers in four surrounding counties



Blue Plains AWTP

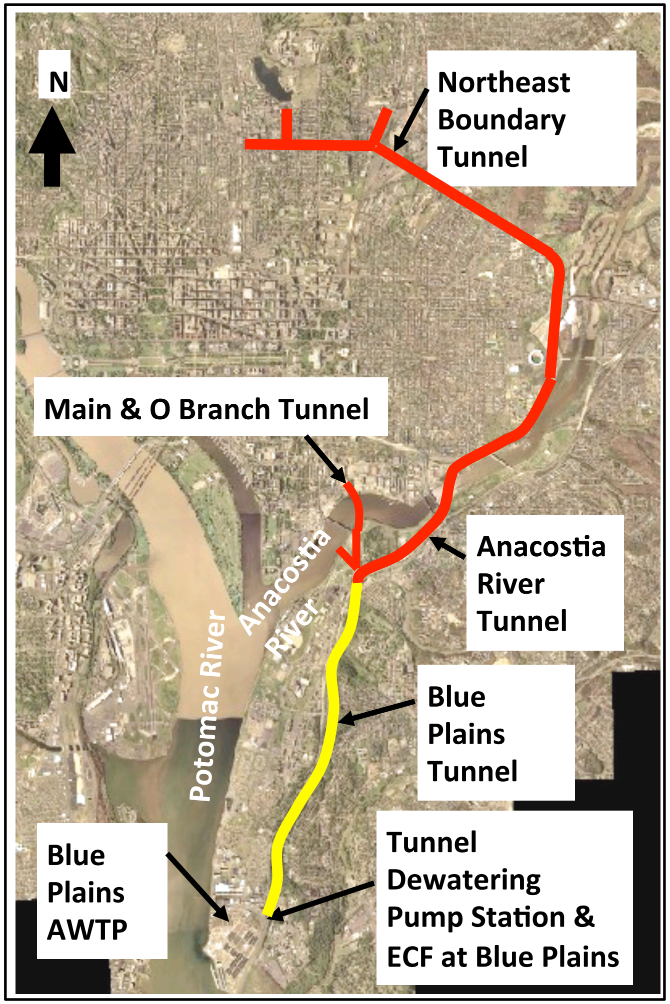
- Largest advanced wastewater treatment plant in the world
  - 370 mgd ADF design capacity
  - 150 acre site

Integrated CSO LTCP and Nutrient Removal Planning

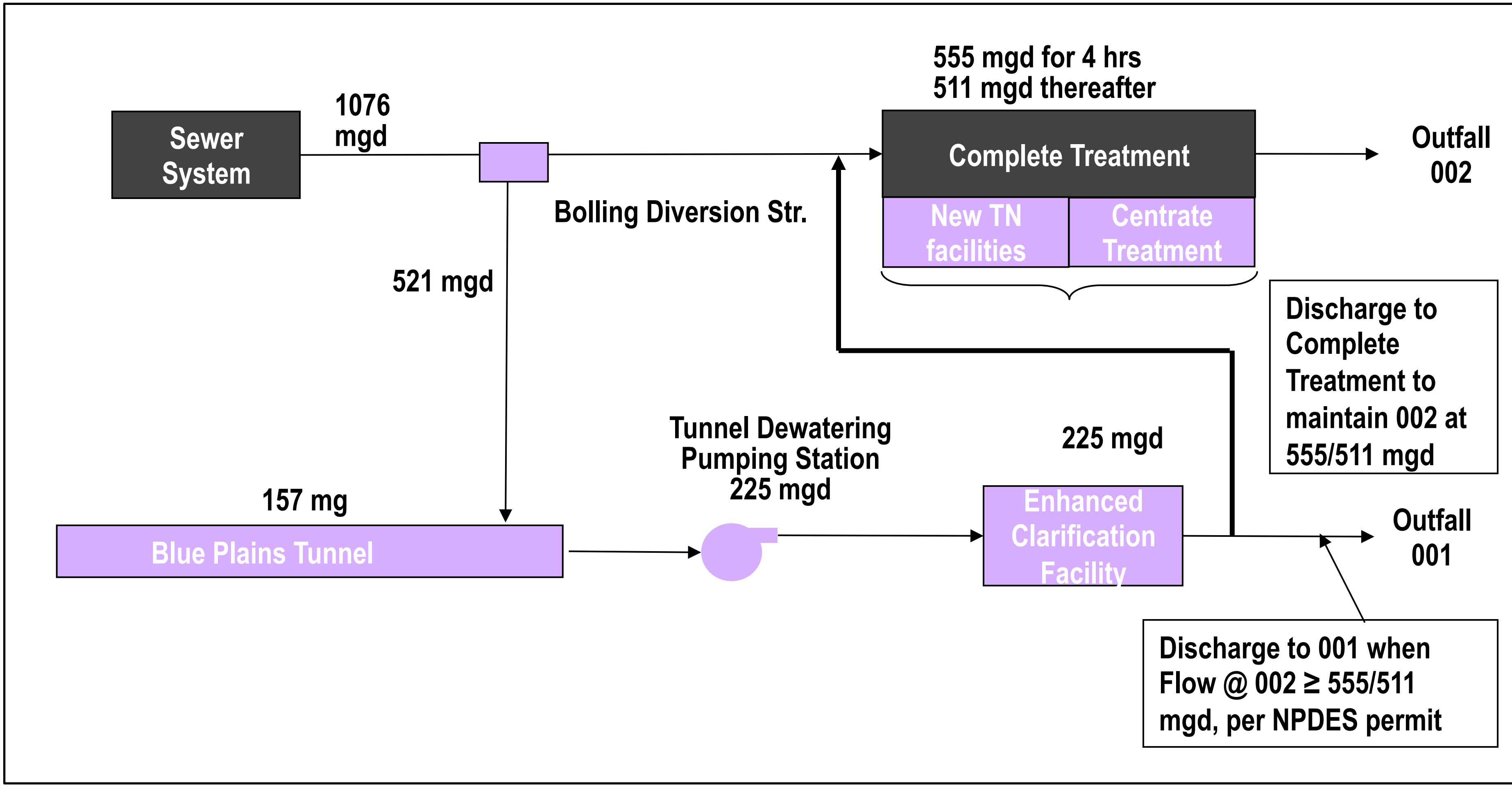
- DC Water LTCP completed in 2002
  - Enhanced nutrient removal requirements not in place at that time
- Planning for holistic wet weather treatment and nutrient removal begun in 2004
- LTCP Supplement No. 1 completed in 2007

LTCP Supplement No. 1 Recommended Plan

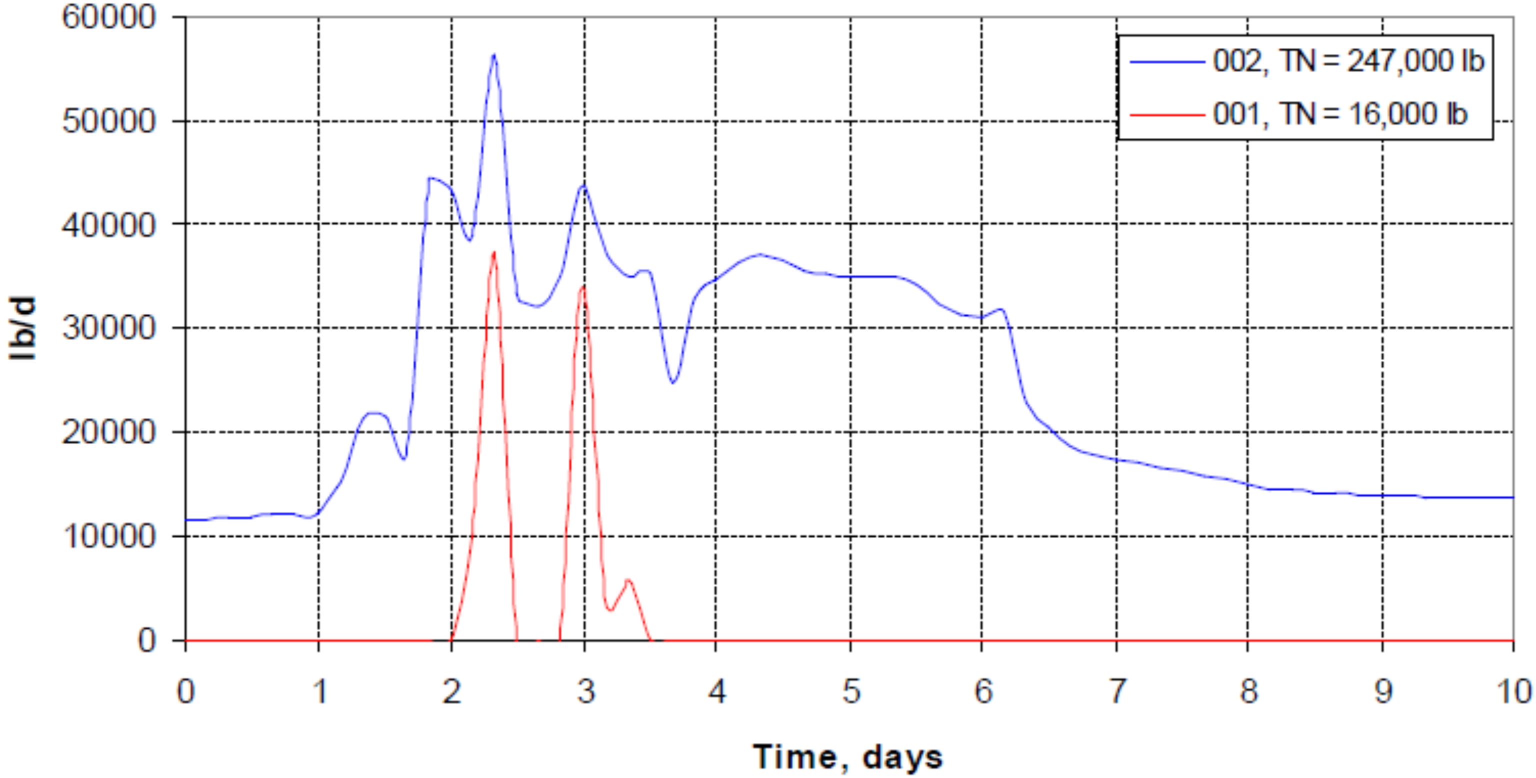
- 157 MG tunnel system
- Complete treatment up to 555/511 mgd
- Excess plant flow diverted to tunnel
- 225 mgd TDPS/ECF
- Reduces peak flow from 740 to 555 mgd
  - (P.F. from 2.0 to 1.5)



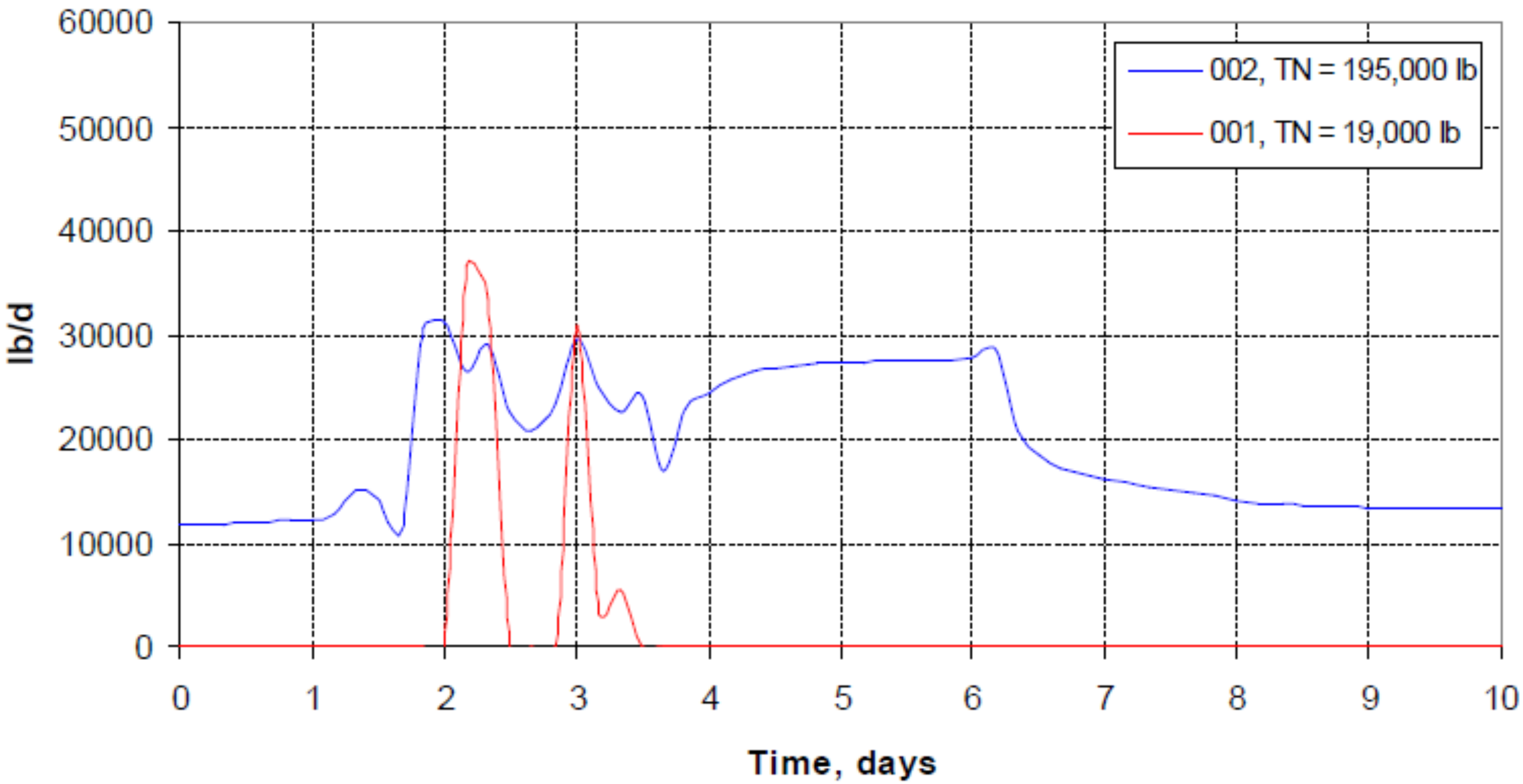
Flow Management With ECF On-Line



Reduction in TN to Potomac, PF = 2.0



Reduction in TN to Potomac, PF = 1.5



Project Objectives

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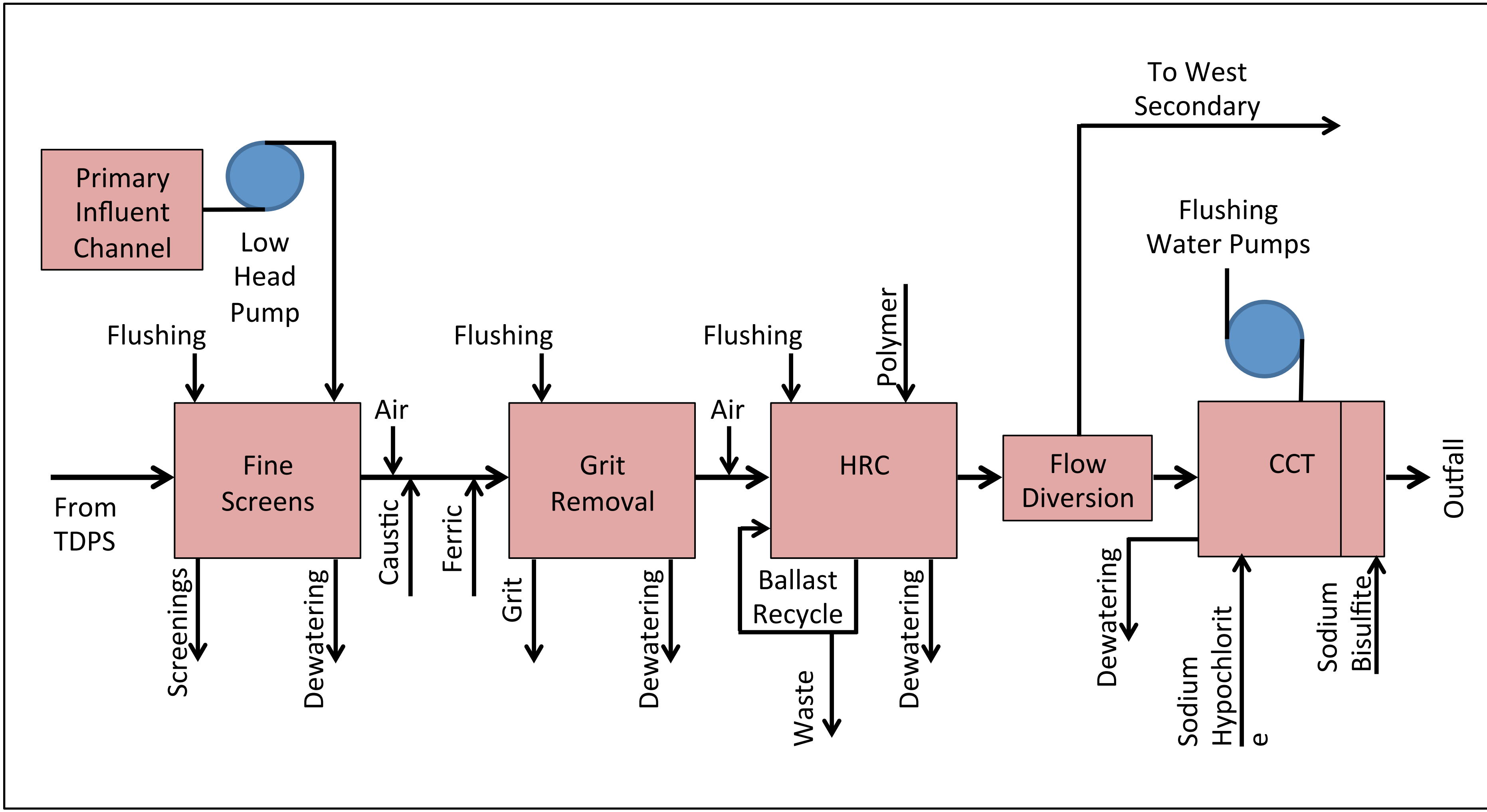
- Meet effluent quality established in 2007 LTCP Supplement
  - Drove selection of ballasted flocculation process
- Provide preliminary treatment consistent with:
  - Ballasted flocculation
  - Return flow to main plant
- Rugged, reliable equipment
  - Intermittent duty
- Fit confined site

Description of ECF Treatment Processes

Process Flow Diagram

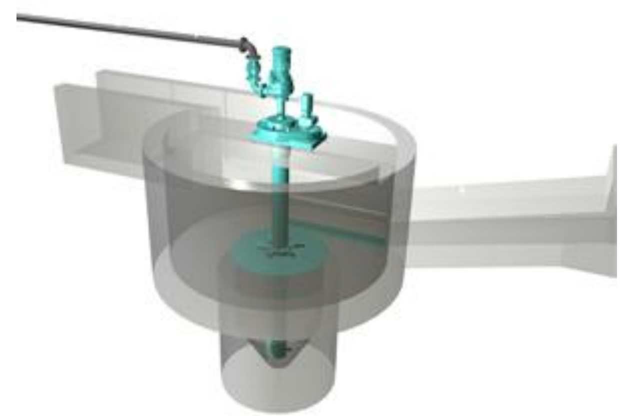


Fine Screening

- ¼” perforated plate, 125 mgd unit capacity
- Dedicated washer compactors
- Odor control
- Two duty screens
  - n + 2 redundancy
  - “hot” stand-by
  - Hot water spray system
- Start/stop with lead TDP

Grit Removal

- Vortex technology, 83.3 mgd unit capacity
  - 90 to 95% removal 212 micron or larger particles at peak flow
  - Maintains characteristics of micro-sand
  - Removes grit in flow returned to main plant
- Classifiers and washers
- Odor control
- n + 0 redundancy
- Start/stop with lead TDP

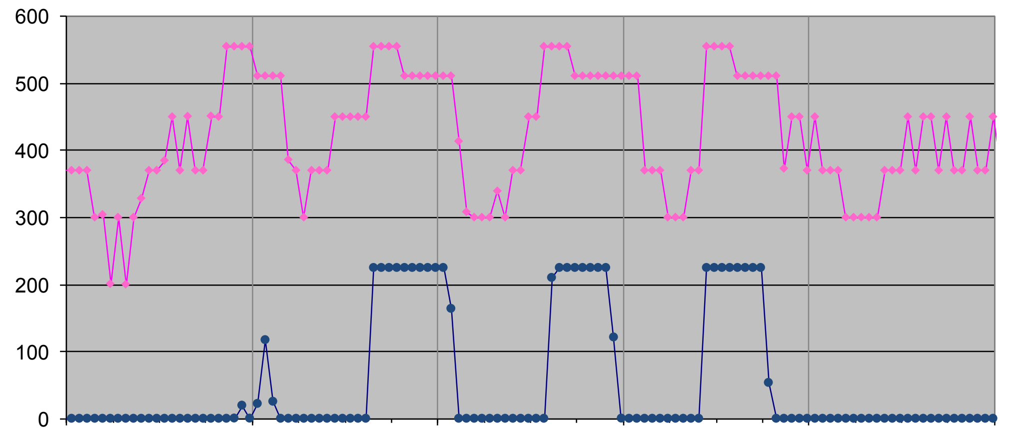


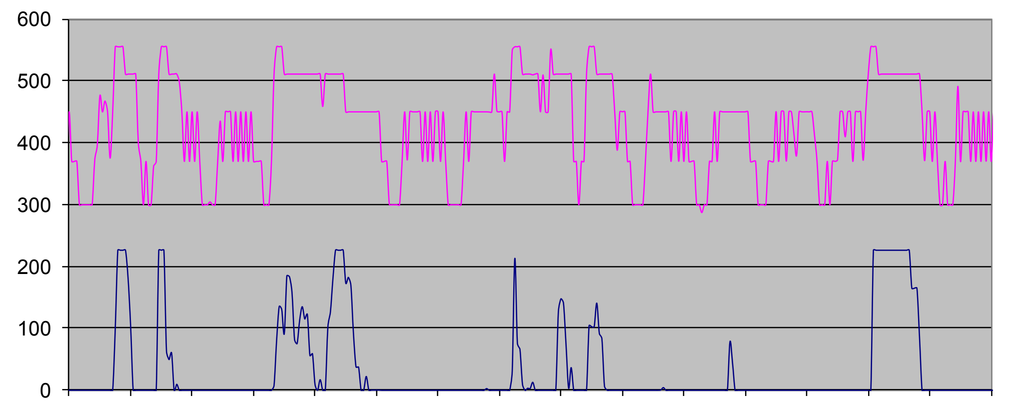
High-Rate Clarification

- Ballasted flocculation (sand or recycled sludge)
  - 62.5 mgd unit capacity
- Performance based on influent TSS ranges
  - Set coagulant and polymer limits, and TSS effluent / percent removal requirements
- Co-settle sludge in primaries
- n + 0 redundancy
- Start on rising influent channel level & stop with lead TDP

Flow Diversion to West Secondary

- Able to divert up to 100 mgd HRC effluent to west secondary
  - ECF start-up
  - To maintain 555/511 mgd to main plant
- Parallel flow control valves





Disinfection

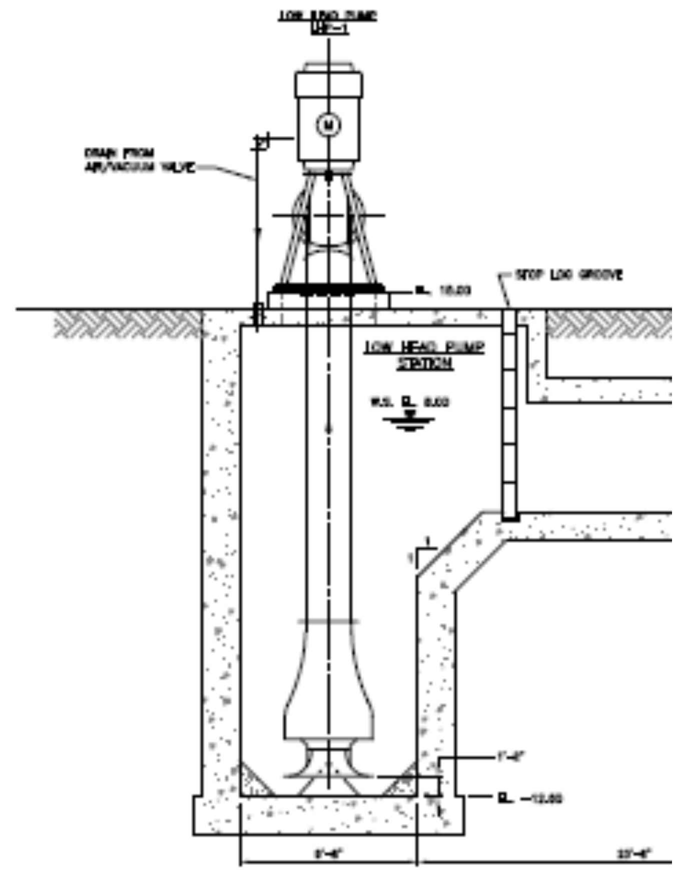
- Sodium hypochlorite disinfection
  - 20 mg/L at peak flow
  - 5 mg/L at minimum flow
  - 15 minute contact time
  - 4 basins, 3 passes, n + 0 redundancy
- Sodium bisulfite de-chlorination
  - 5.5 mg/L at peak flow
  - 1 mg/L at minimum flow
  - 30 second contact time

Disinfection (cont.)

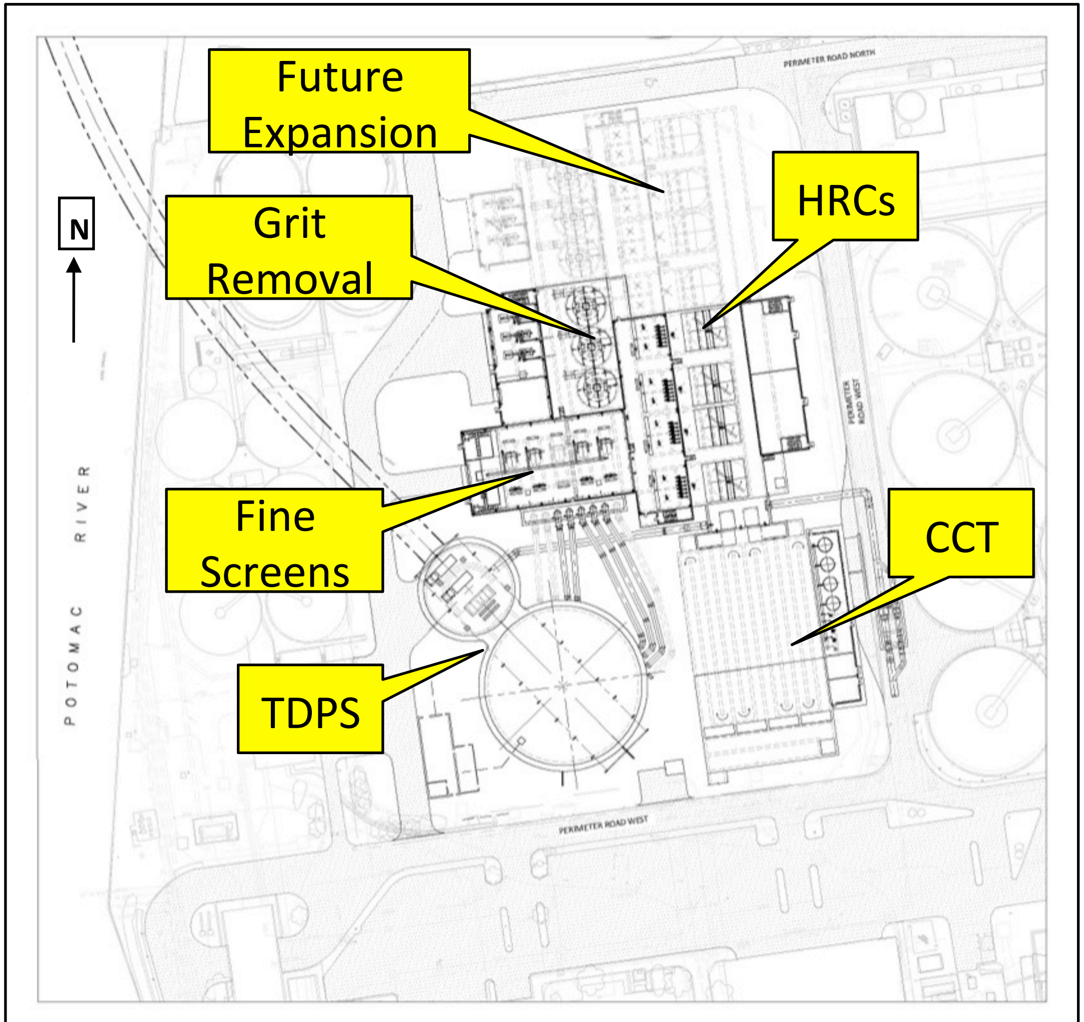
- Induction mixers for hypochlorite and bisulfite
- Chlorine residual analyzers
- Recycle CCT contents for flushing/clean-up
- Tipping buckets for CCT clean-up
- Start-stop on flow into CCT

Ancillary Processes

- Channel aeration
- Odor control
- Post-storm dewatering / clean-up
- Flow diversion for dry weather testing
- HRC chemical storage and feed systems



Site Layout



Future Expansion
Grit Removal
HRCs
Fine Screens
TDPS
CCT
N
POTOMAC RIVER
PERIMETER ROAD NORTH
PERIMETER ROAD WEST

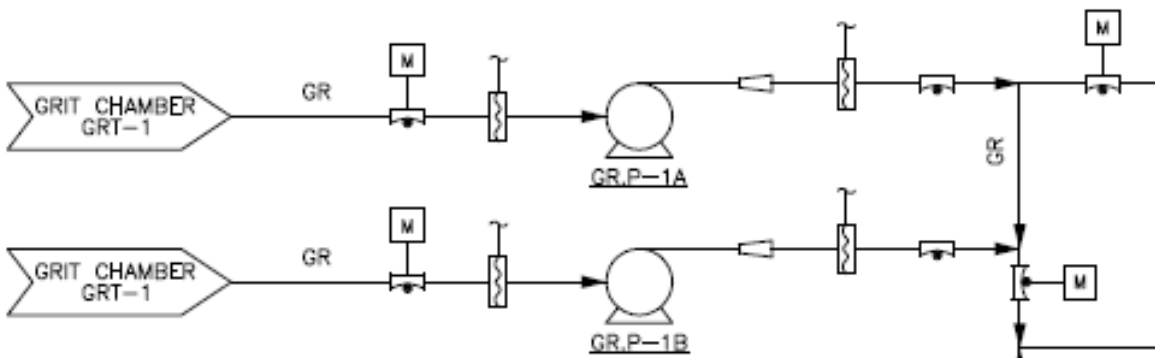
Findings and Lessons Learned

Design Unit Processes to be Robust

- Uncertainties surrounding “first flush” and “last flush” loadings
- Examples of robust design
  - Over-sized screenings washer/compactors
  - 100% redundancy in suction piping, valves, and pumps on grit system
  - Over-sized grit washer-classifier system

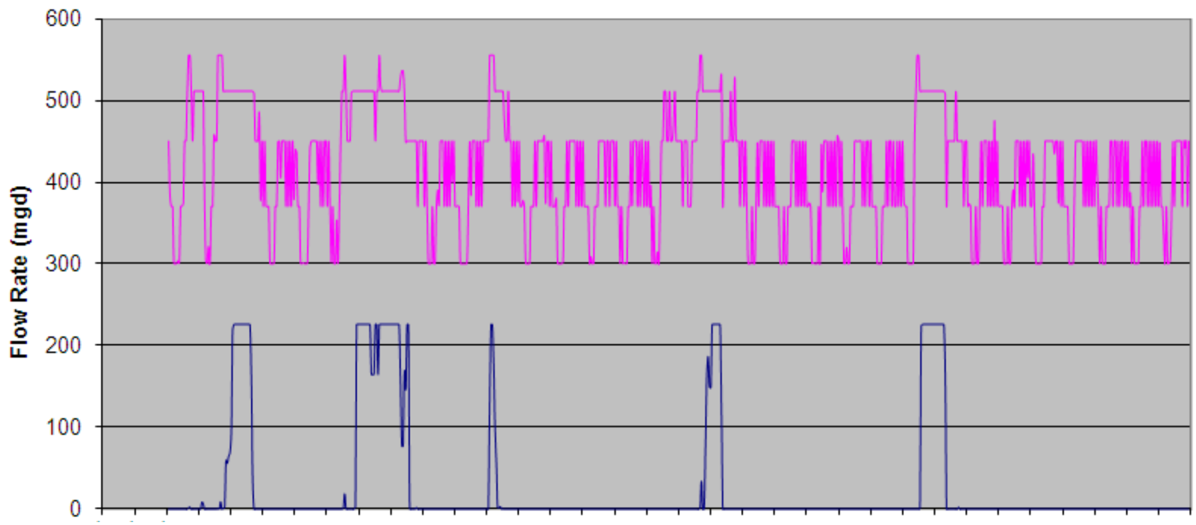
Balance Redundancy with Intermittent Nature of ECF Operation

- Redundant ancillary equipment instead of redundant process trains
  - Grit suction piping, pumps, and valves
  - HRC sludge recirculation pumps
  - Induction mixers (shelf spares)



Account for Wide Variation in Flows

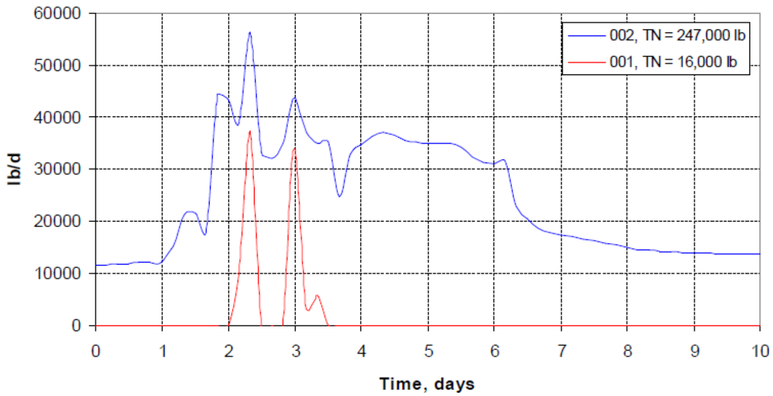
- 10:1 turn-down on HRC
- As much as 0 to 225 mgd to CCT
- Drives number and turn-down capability, especially for chemical metering pumps

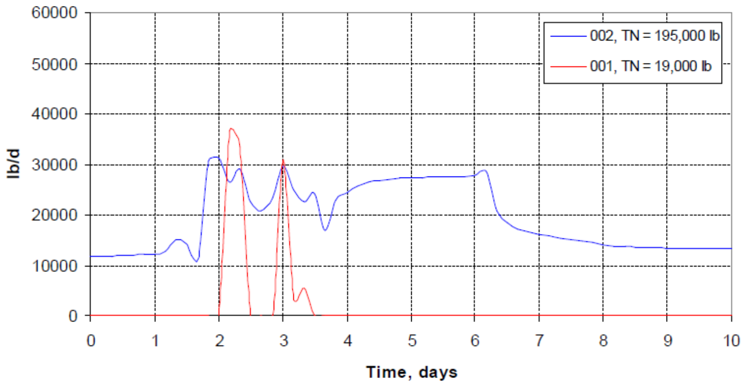


Conclusions

Key to Integrated TN / Wet Weather Plan is Reduced Peak Flow to Blue Plains AWTP

- Increases efficiency of primary and BNR
- ECF produces high quality wet weather effluent





Supports Future Application of Integrated TN/Wet Weather Approach

- Establishes precedent for off-loading main plant to achieve reduced effluent loading
- Increases depth / breadth of knowledge for design of wet weather treatment at downstream end of tunnel systems
- Provides design experience / lessons learned for one of the largest ballasted flocculation wet weather treatment systems in North America

Questions