

Wastewater Treatment Plant Operations and Facility Study

City of Northfield, MN.

June 8, 2021



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Agenda

1. Background
2. Capacity Assessment
3. Facility Plan Update Items
4. Implementation and Spending Plan
5. Next Steps
6. Questions/Comments

1. Background



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Incidents that prompted review of the WWTP

- Jan 2018: Flooding of the Biological Aerated Filter (BAF) building basement due to a pipe plug failure.
 - 5 ft of water in basement, 200 gal released to ground
 - Wiring and actuator replacements

Incidents that prompted review of the WWTP

- May 2018: Fire in the biosolids handling facility
 - Significant damage
 - Required emergency biosolids hauling
 - Required emergency temporary treatment system
 - Repair and rebuild of the permanent facility

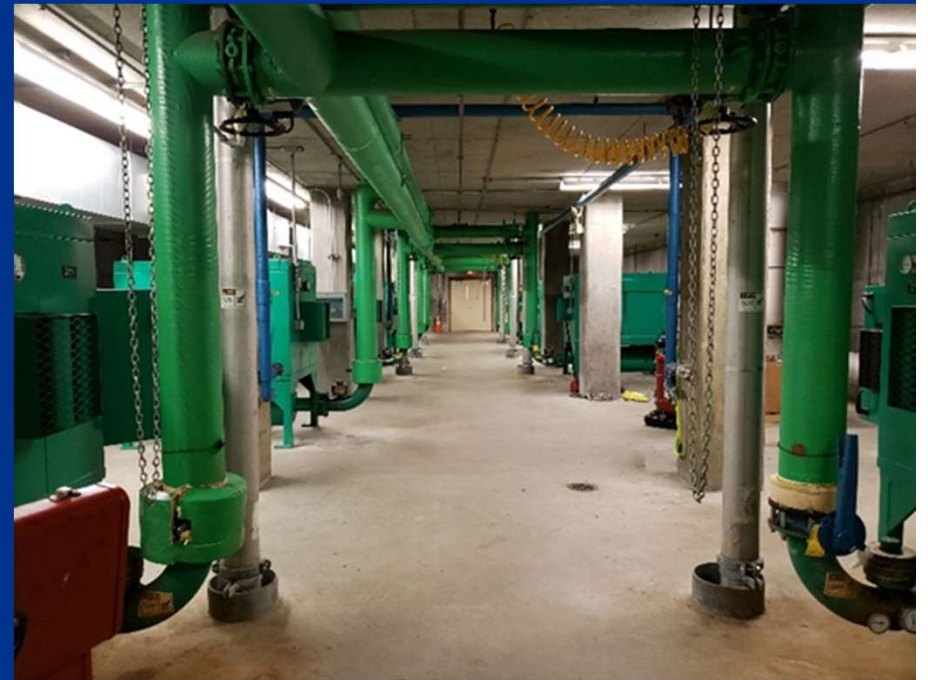
Incidents that prompted review of the WWTP

- July 2018: Pipe failure in the Sludge Pump Room
 - 6 ft of wastewater in basement
 - 1 MG discharge to river

Project Deliverables

- Operations Study and Condition Assessment
 - Completed April 2020
 - Operations recommendations are being implemented
 - Condition assessment results used to inform the Facility Plan Update and improve CMMS data capture
- Facility Plan Update
 - Drafts Oct 2020 and Jan 2021
 - Discussed today

2. Capacity Assessment



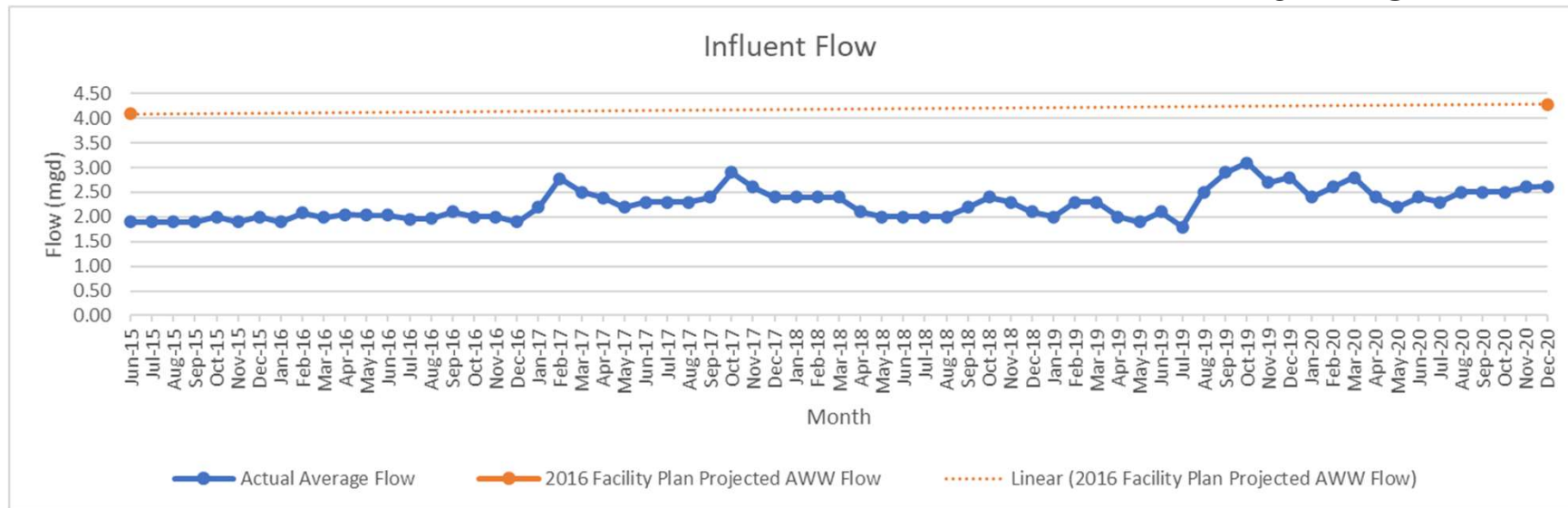
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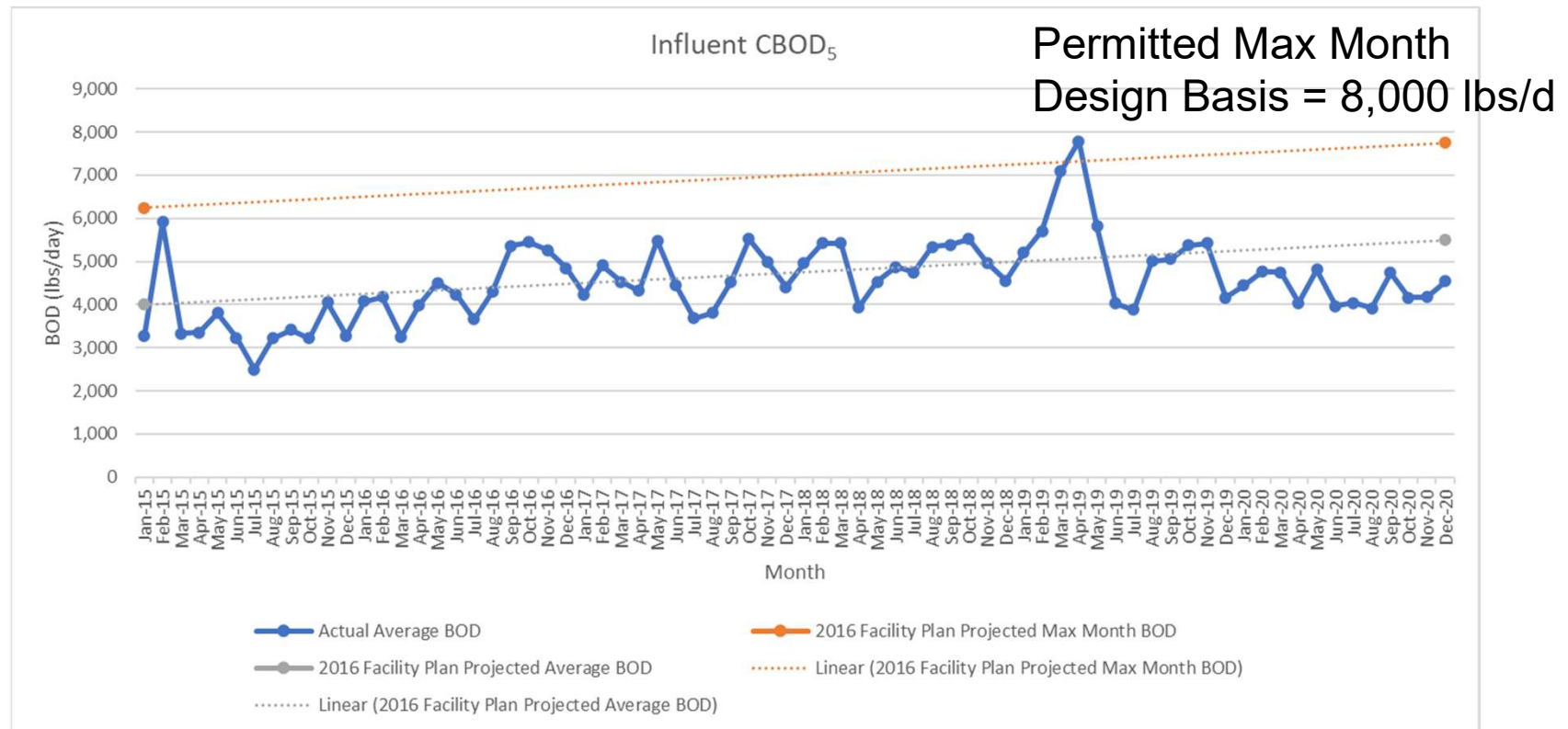
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Recent Trends – Plant Influent Flow

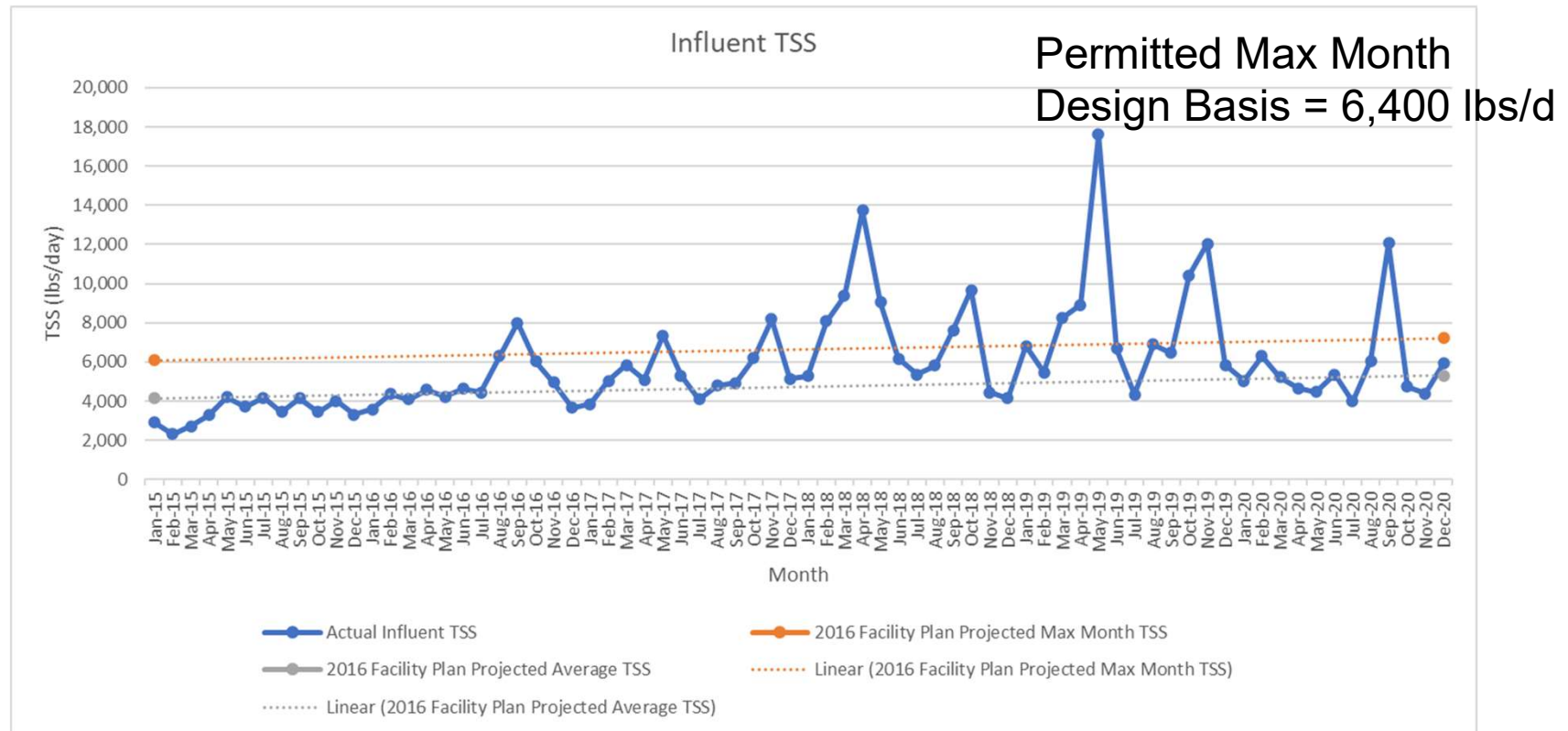
Permitted AWW Design
Basis = 5.2 MGD



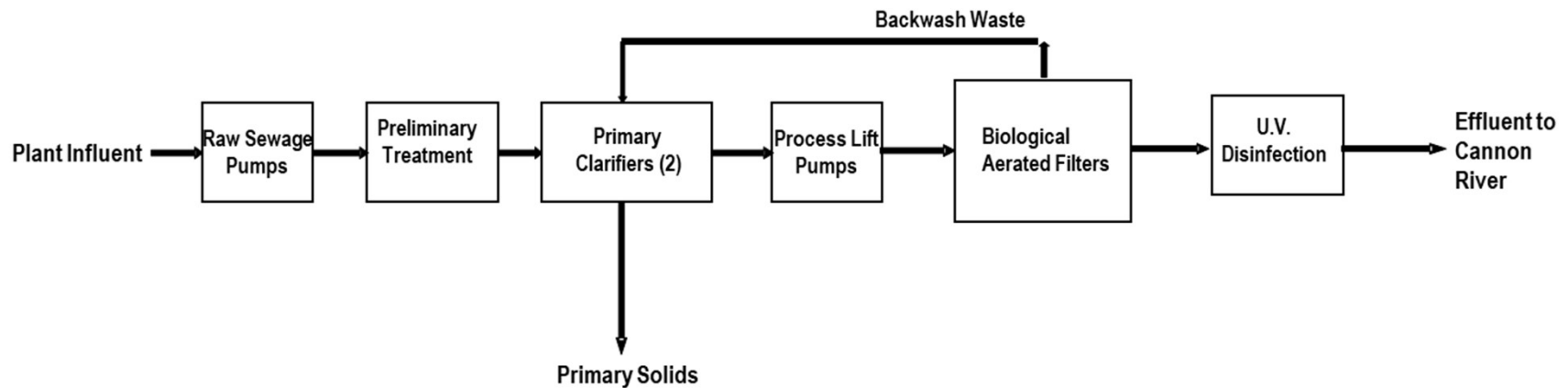
Recent Trends – Plant Influent CBOD₅



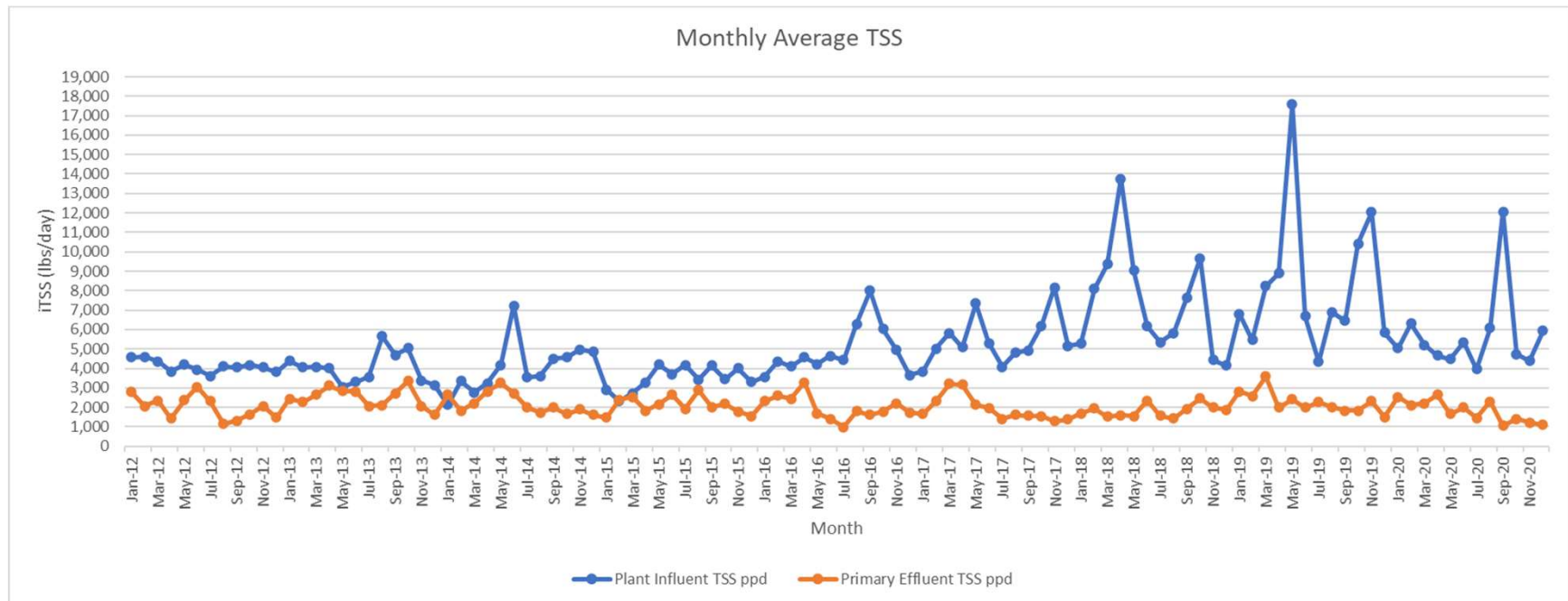
Recent Trends – Plant Influent TSS



Why Does the Plant Perform Well at High TSS Influent Loads?



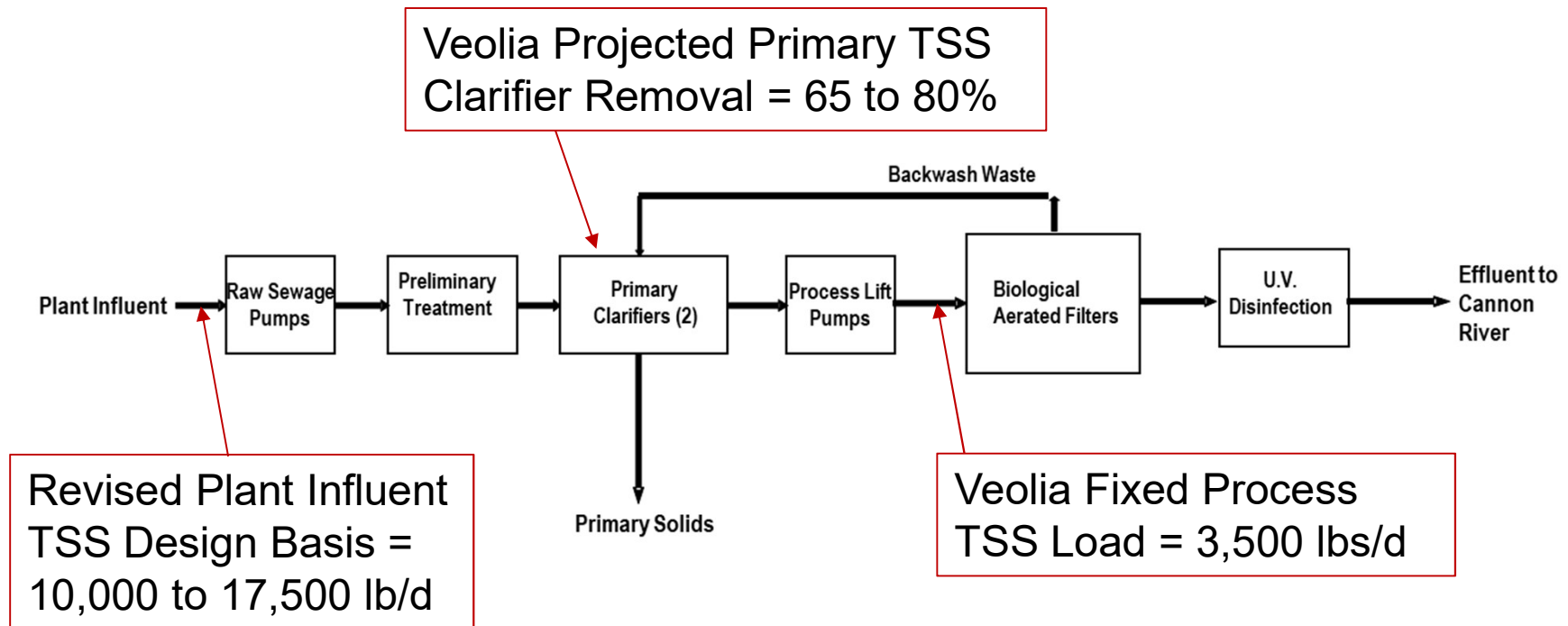
Primary Clarifiers Perform Far Better than Design Criteria



Kruger (Now Veolia) Review of Performance

- Performed simulations using latest design tools
- Fixed the primary effluent to match historical performance at 3,100 lb/d and then projected to 3,500 lb/d by 2040
- Confirmed the existing BAF process can handle the future flow and load cases through 2040 easily with 10 cells in service.

Revised Plant Influent TSS Design Basis

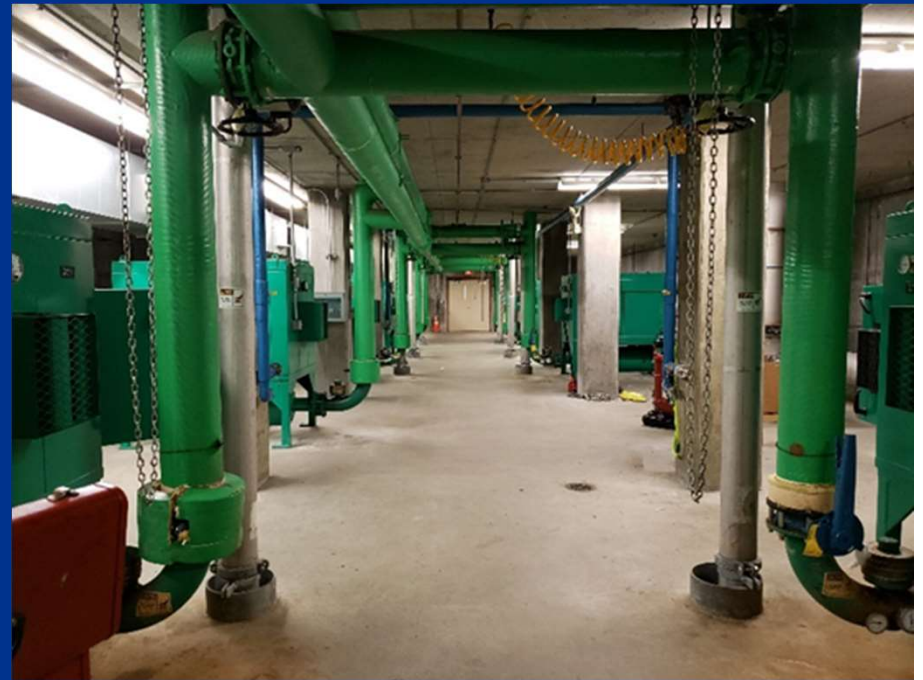


Future Flow and Load Projections

Item	Original/Permitted Design Basis	2025	2030	2035	2040
Population		23,228	24,174	25,155	26,177
AWW Flow (mgd)	5.2	3.25	3.38	3.51	3.65
CBOD ₅ – Max Month (lb/d)	7,999	7,504	7,657	7,817	7,984
TSS – Max Month (lb/d)	6,400	8,817	9,118	9,432	9,758
	Revised Design Basis				
TSS – Max Month (lb/d)	10,000 to 17,500 ^a	8,817	9,118	9,432	9,758

^a For primary clarifier percent removals of 65 to 80

3. Facility Plan Update Items



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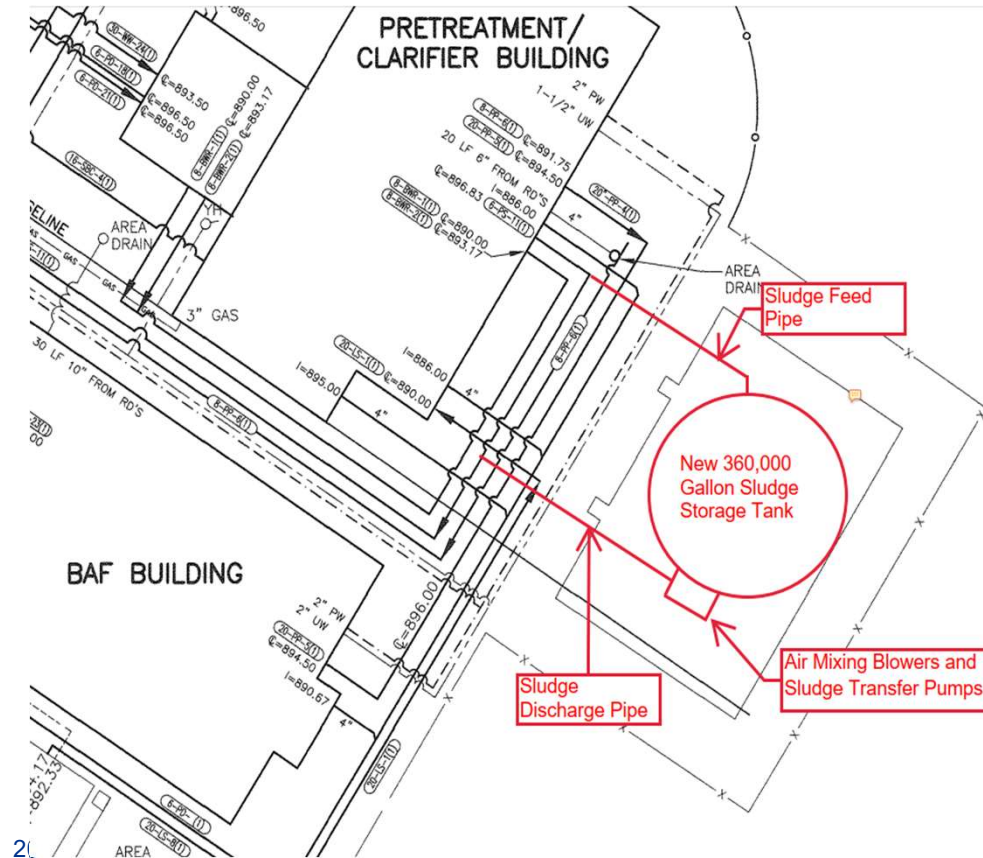
2016 Facility Plan

- What recommendations have already been completed?
 - UV Disinfection
 - Biosolids Processing Facility
 - BAF Gate Replacement

Liquid Sludge Storage

- Why is it needed?
 - Existing Sludge Holding Tank = 3 days storage
 - Biosolids processing facility has a single train. Major equipment failure requires immediate corrective action
- Proposed Facility
 - Add 360,000-gal storage tank to increase sludge storage from 3 days to 10 days.

Liquid Sludge Storage

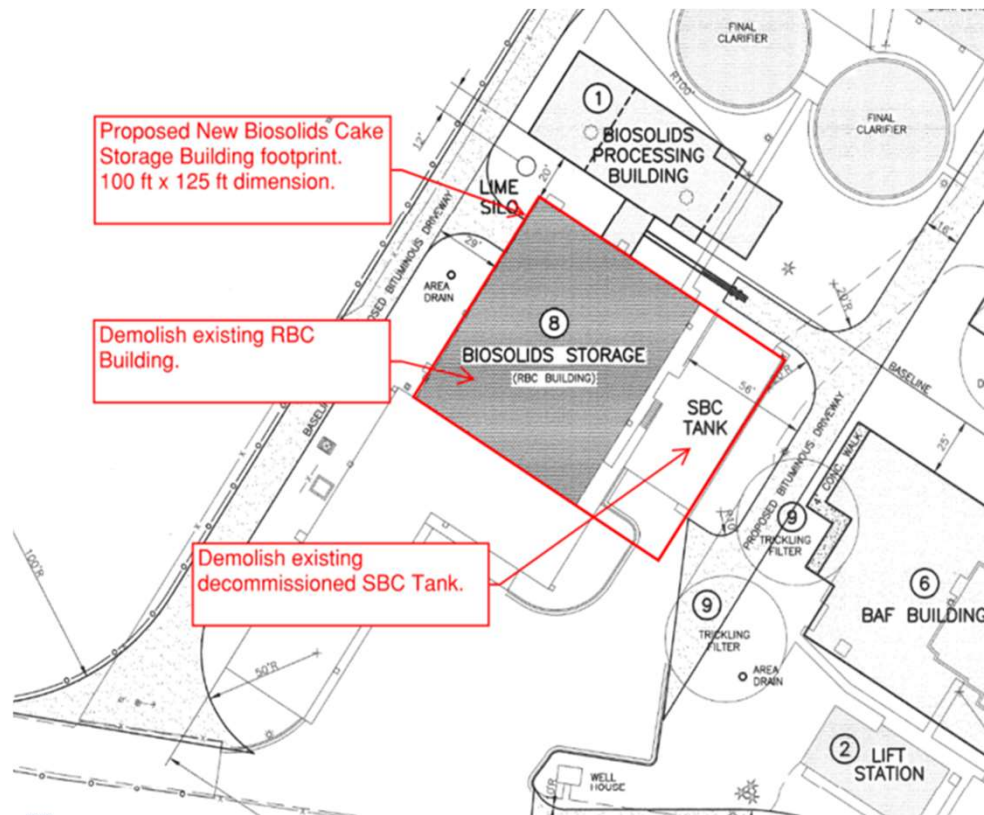


- New Cost Estimate = \$3.8M

Biosolids Cake Storage

- Why is it needed?
 - Existing storage facility = 40 to 80 days of storage
 - Existing storage facility is deteriorating
 - Typical recommended criteria = 180 days storage
- Proposed Facility
 - Demolish existing facility and construct new storage facility with 180 days of storage at 2040 average solids production.

Biosolids Cake Storage



- New Cost Estimate = \$3.9M

BAF Process Blower Replacement

- Why is it needed?
 - 11 existing rotary lobe process blowers
 - Age and excessive maintenance requirements
 - Improve efficiency
- Blower evaluation
 - Compared replacement in kind (rotary lobe), but with added VFD versus replacement with high-speed turbo (HST) blowers.

BAF Process Blower Replacement

- HST options requires fewer larger blowers
- The energy usage with HSTs is estimated to be approximately 79 percent of rotary lobe blowers with VFDs.
- HST Cost Estimate = \$2.1M
- Rotary Lobe Cost Estimate = \$1.9M
 - Constructing the rotary lobe option is less disruptive to plant operations

BAF Process Blower Replacement

Blower Type	Capital Cost	Annual Electric Cost	20-year Life Cycle Electric Cost	Life Cycle Cost of Capital and Electric
HST Blowers	\$2,119,000	\$48,900	\$886,500	\$3,005,500
Positive Displacement (Rotary Lobe) Blowers with VFDs	\$1,901,600	\$62,200	\$1,128,300	\$3,029,900
Assumes 3.25% discount rate and 2.3% inflation				

Equipment Renewal Recommendations – Age and Condition

Item	Facility Plan Update Capital Cost
Influent Lift Pumps	\$720,000
Preliminary Treatment	\$300,000
Primary Clarification	\$354,000
Process Lift Pumps	\$210,000
HVAC Equipment Replacement	\$215,568
Roof Replacement	\$763,000
Standby Generator	\$600,000

Control System and Card Access System Upgrades

- Major control system upgrades were completed on the UV Disinfection Facility (2017) and the Biosolids Dewatering and Process Facility (2020).
- Pretreatment Building, BAF Building, and Influent Pump Building require upgrades.
- Expand the existing card access system to all external doors on each plant building.

Control System and Card Access System Upgrades

Item	Facility Plan Update Capital Cost
Control System and Card Access System Upgrades	\$864,000

Water Supply System

- The WWTP utility water is supplied from an onsite well
- The well has limited capacity and will not meet the demands of a fire suppression system.
- Fire suppression system requirements are still being investigated.
- \$1M cost to connect the City water supply if fire suppression is required

4. Implementation and Spending Plan



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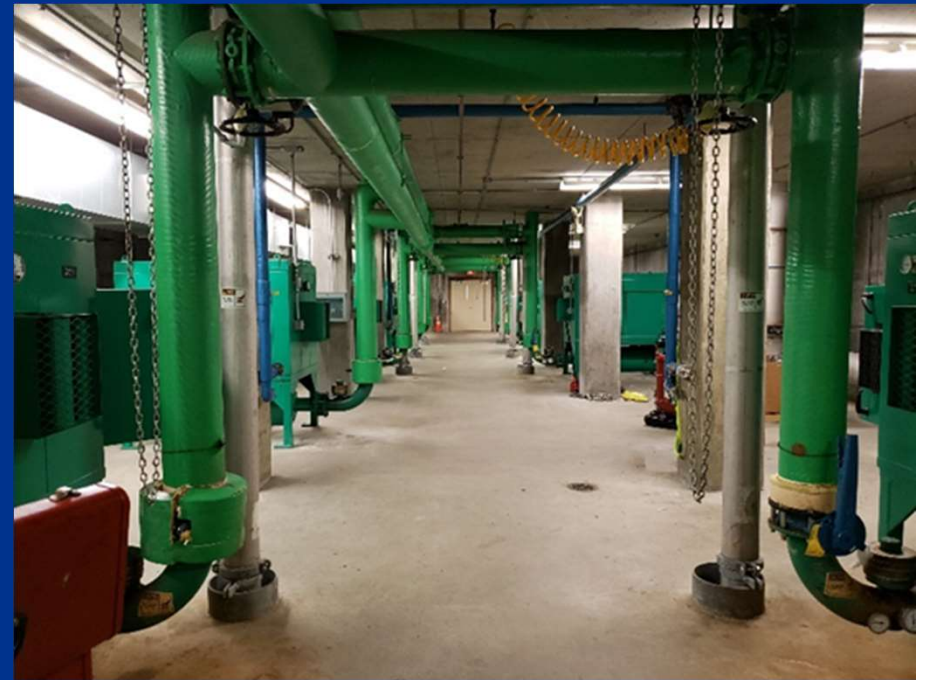
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Implementation and Spending Plan

Item	2022-2025	2026-2030
Liquid Sludge Storage	\$3,820,313	
Biosolids Cake Storage		\$3,945,875
Influent Lift Pumps	\$720,000	
Preliminary Treatment		\$300,000
Primary Clarification	\$354,000	
Process Lift Pumps		\$210,000
BAF Blower Replacement	\$1,901,600	
Control System and Card Access System Upgrades	\$864,000	
HVAC Equipment Replacement	\$215,568	
Water Supply System		\$1,000,000
Roof Replacement	\$763,000	
Standby Generator		\$600,000
Total	\$8,638,481	\$6,055,875

5. Next Steps

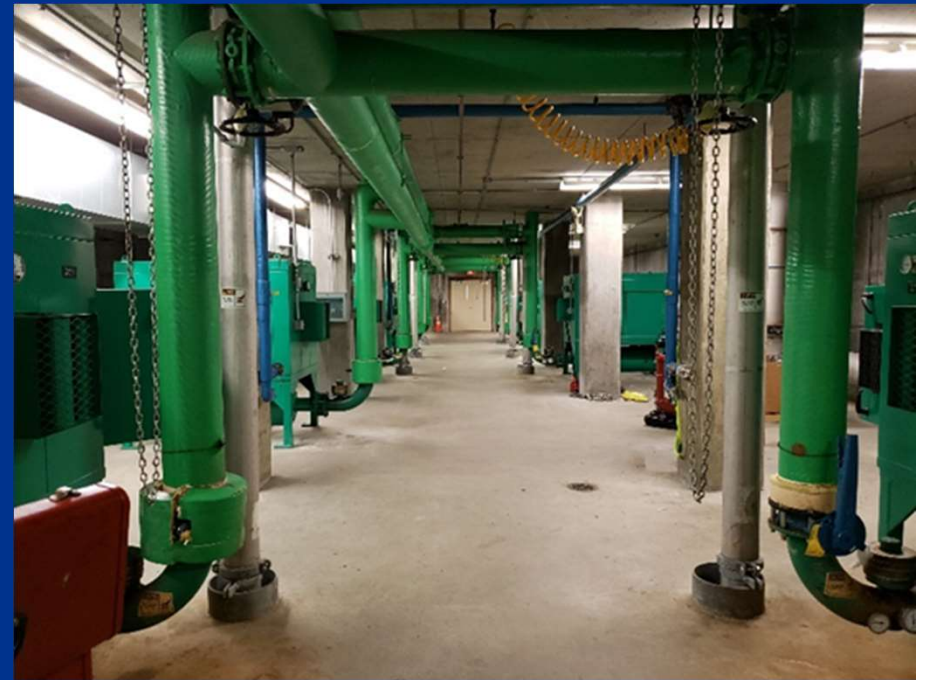


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6. Questions/Comments



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