SPRINGBROOK WATER RECLAMATION CENTER

Asset Evaluation & 5 Year CIP Overview

Naperville Water Utilities | May 4, 2021

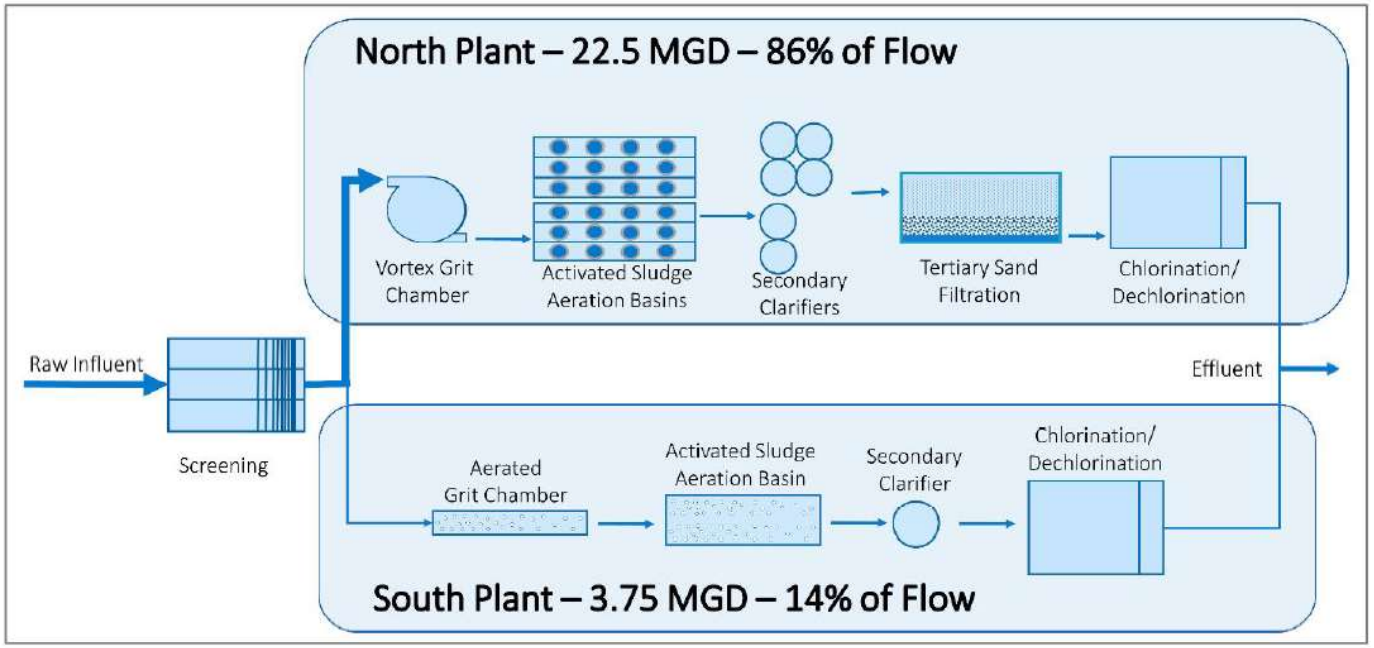
TODAY'S OBJECTIVES

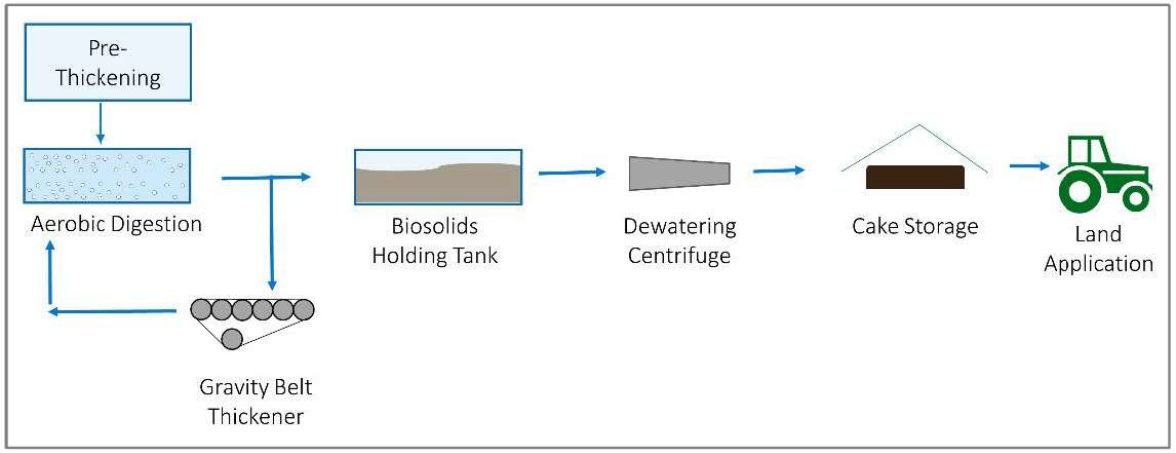
- Brief historical overview of Springbrook Water Reclamation Center
- Regulatory background information
- Where have we been?
- Where are we now?
  - Asset Inspection and Evaluation
- 5 Year CIP summary
- Discussion & Questions

SPRINGBROOK WATER RECLAMATION CENTER

- Activated sludge, aerobic digestion process
- Originally constructed in 1973-74
  - 10 MGD (DAF)
  - Many original facilities still in use today
- Expansions in 1982, 1989,1996 and 1999
- Rated Capacity:
  - 26.25 MGD (DAF)
  - 55.13 MGD (DMF)

Existing treatment process





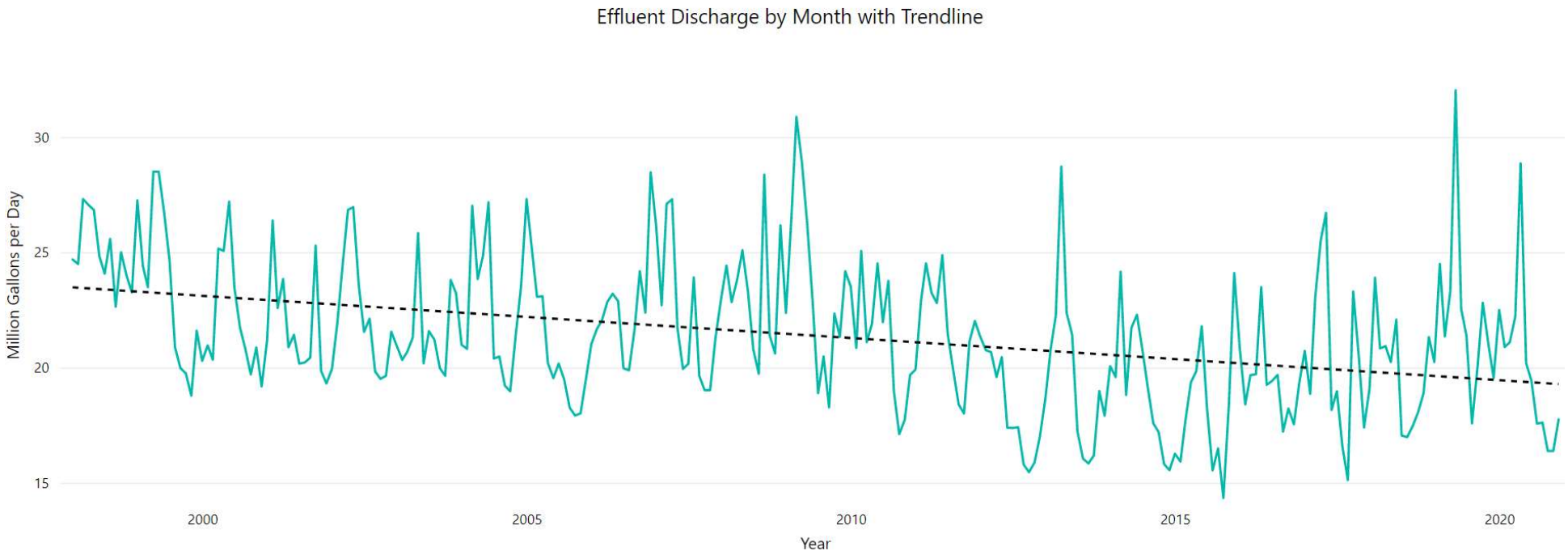
Influent is water, wastewater, solids, or other liquid flowing into a treatment plant.

Effluent is wastewater - treated or untreated - that flows out of a treatment plant.

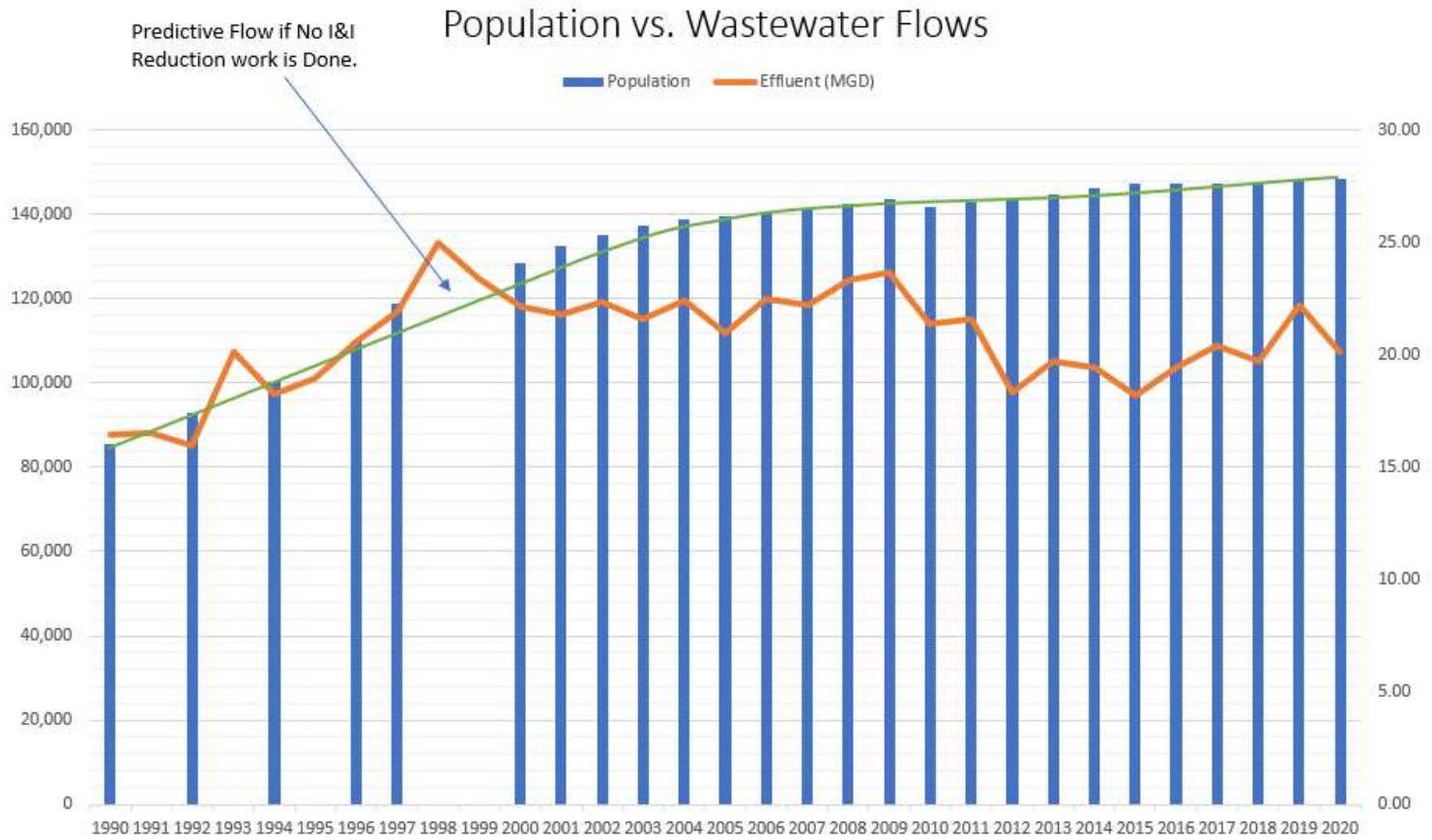
REGULATORY BACKGROUND INFORMATION

- SWRC current NPDES permit IL0034061
- Current permit term 1/1/2019 – 12/31/2023
- 26.25 MGD (DAF), 55.13 MGD (DMF)
  - Expansion to 30 MGD (DAF), 63 MGD (DMF) allowed but will trigger a 1.0 mg/L P limit
- 1.0 mg/L total Phosphorus limit compliance by January 1, 2030
- Membership and contributions to LDRWC
- Changing regulatory environment
  - Success of watershed groups negotiating favorable permit conditions
  - NIP/NARP results anticipated, lower limits possible
  - Nitrogen limits
  - Contaminants of emerging concern (PFAS, DBP's, hormones)

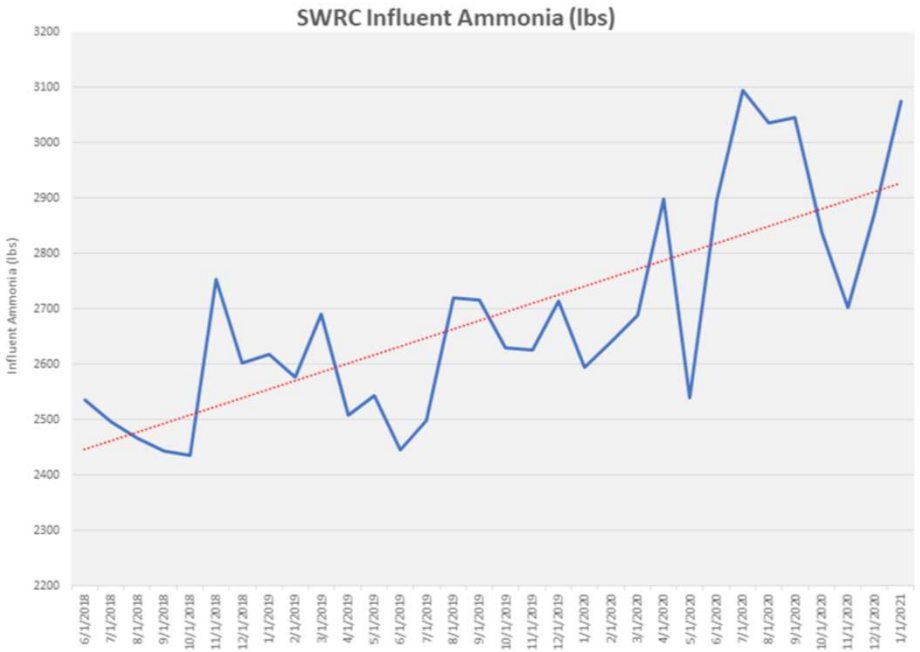
FLOWS TO SWRC ARE DECREASING….

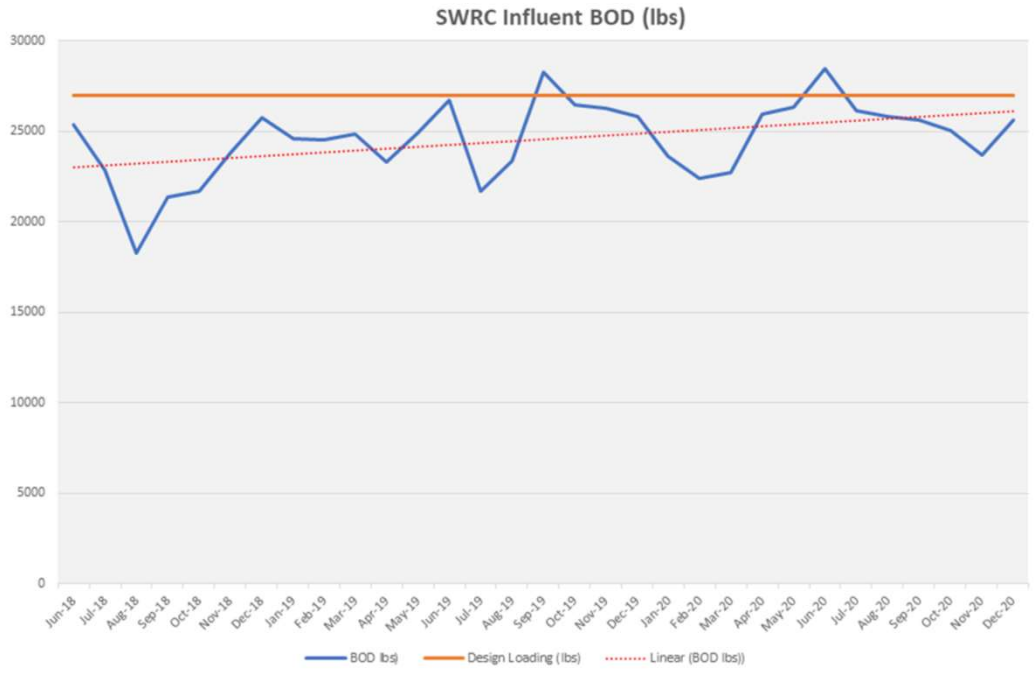


BUT POPULATION IS INCREASING….



THEREFORE, LOADING TO THE PLANT IS INCREASING.





BOD = Biochemical Oxygen Demand

WHERE HAVE WE BEEN?

- BioWin modeling - 2004, 2005, 2007, 2013(2), 2016, 2020
- Pilot studies- MBR, full scale P removal South Plant, Digestion mixers
- Phosphorus Discharge Optimization Plan
- Phosphorus Feasibility Study
- Industrial Pre-treatment survey
- Ultimate Flow & Loading evaluation completed in November 2019
  - Plant nearing its treatment capacity
  - Results invited further study
- Facilities Plan- underway
  - Includes asset condition evaluation (plant systems, facilities and equipment), risk assessment
  - Definitive evidence that plant is nearing capacity
    - BOD (lbs., hydraulic retention time), N. Clarifiers (SOR), Sand filters (hydraulic loading rate)

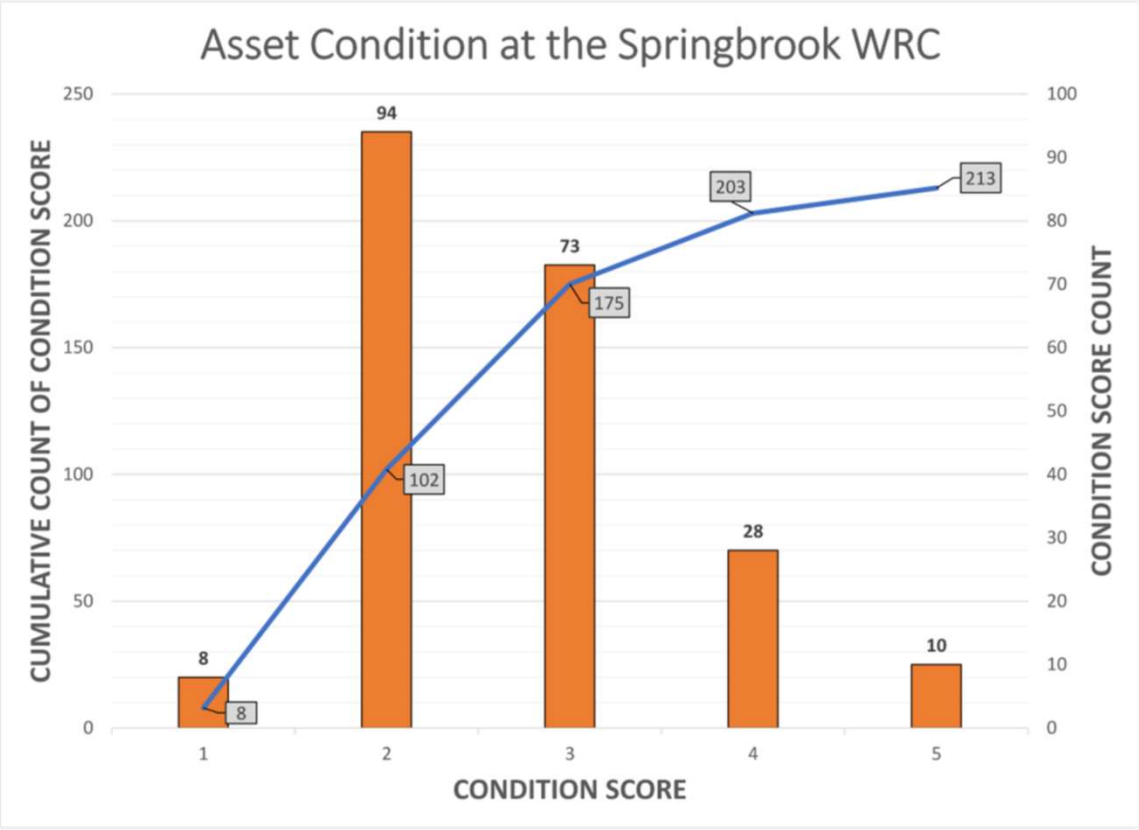
GETTING READY FOR PHOSPHORUS: MAJOR PROJECTS

- Influent Screening Improvements (2017)
- Biosolids Holding Tank (2016)
- North Plant RAS/Grit Improvements (2014)
- Tertiary Filter Rehabilitation (2011-12)
- Aerobic Digestion Improvements (2008)

WHERE ARE WE NOW?

- Facilities Plan Completed
  - Asset Evaluation Complete
  - Treatment Processes Evaluated
  - Capital Programs Created (5-Year, 10-Year, 20-Year)

ASSET EVALUATION: CONDITION



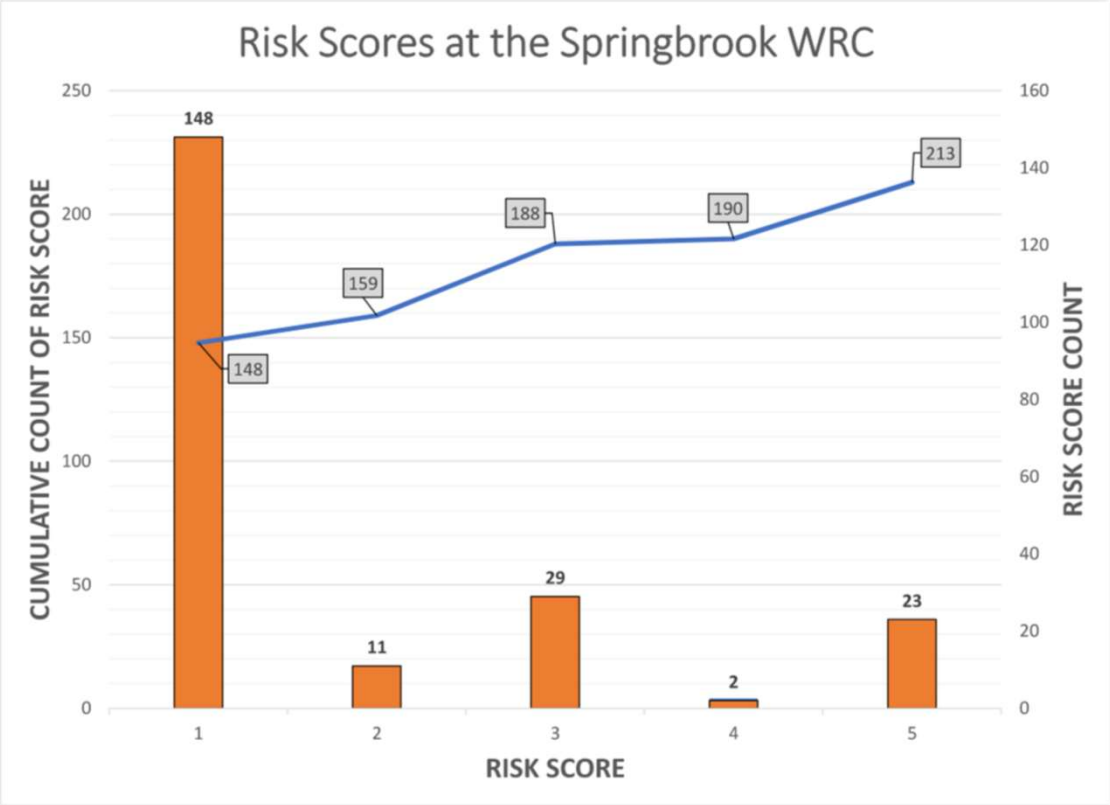
A score of 1 indicates the asset is 'like new' and 5 indicates the asset is in poor condition.

The graph indicates that most of the assets that were assessed had a low to medium condition rating.

"This is expected because the facility is older, but well maintained."

There is a good understanding of the assets that are at the highest risk of near-term failure.

ASSET EVALUATION: RISK



This graph shows the risk rating for assets. Risk is a combination of the condition score and criticality rating.

A higher risk score (i.e., 5) represents an asset that is in poor condition and that would result in a severe consequence upon failure.

Conclusion:

- Most assets are assessed to have a low risk.
- Capital projects to prioritize assets with a high-risk score have been developed.

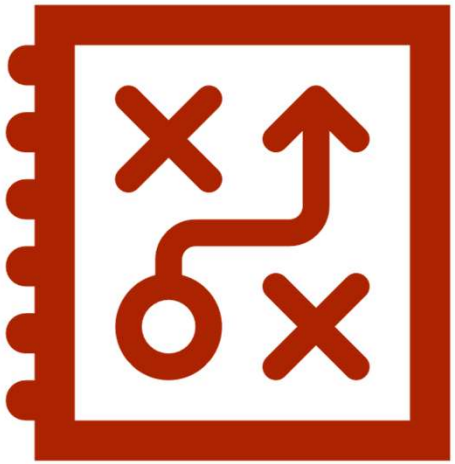
TREATMENT PROCESSES EVALUATED

- Plant loading capacity issues:

					Capacity	
Unit Process	**Design Criteria**	**Design Conditions**	**Units**	**Requirement**	**Current**	**Future**
Influent						
Influent Pumping	Hydraulic Capacity	Peak	MGD		125.6/65.8	125.6/75.1
Screening	Approach Velocity	DAF-Peak	ft/sec	1.25-3	1.3-2.1[A]	1.7-2.4[A]
North Plant (86% of flow)						
Grit Removal	Hydraulic Capacity	Peak Instantaneous	MGD	30/Unit[C]	60/56	60/63
Aeration	BOD Loading Rate	Average	ppd/1,000 ft^3	15[A]	32	38
	Hydraulic Retention Time	Average	hours	8[A]	7.0	5.5
Final Clarification[D]	Surface Overflow Rate	Peak Hour	gpd/1,000 ft^2	1,000	1,337	1,515
	Solids Loading Rate	Max Day	ppd/ft^2	35	31	38
Sand Filters	Hydraulic Loading Rate	Peak with 1 unit out of service	gpm/sf	<5	6.6[B]	7.6[B]
Disinfection	Currently Under Evaluation (Refer to TM5)					
South Plant (14% of flow)						
Grit Removal	Hydraulic Retention Time	Peak	minutes	3-5	22	19
Aeration	BOD Loading Rate	Average	ppd/1,000 ft^3	15[A]	31	37
	Hydraulic Retention Time	Average	hours	8	7.1	5.6
Final Clarification	Surface Overflow Rate	Peak Hour	gpd/1,000 ft^2	1,000	870	986
	Solids Loading Rate	Max Day	ppd/ft^2	35	15	18
Disinfection	Currently Under Evaluation (Refer to TM5)					
Solids Handling						
Aerobic Digesters	Capacity per Population Equivalent		ft^3/PE	2	4.67	4.67
Thickening – GBT	Hydraulic Capacity (2 units; each unit at 350 gpm)[G]		gpm	NA	700	700
Dewatering – Centrifuge	Hydraulic Capacity (2 units; each unit at 350 gpm)		gpm	NA	700	700
Biosolids Storage	Minimum days of storage		days	180[A]	287[E]	221[F]

Facilities Plan confirmed the need to increase plant capacity.

5-YEAR CAPITAL IMPROVEMENT PLAN



PROPOSED: 5 YEAR CIP PROJECT SUMMARY

Project	Total Costs		2021	2022	2023	2024	2025
Phosphorus Engineering	$2,900,000						$2,900,000
Asphalt Roadway Improvements	$150,000		$50,000	$50,000		$50,000	
SWRC CIP Evaluation & Facilities Plan	$135,950		$135,950				
Lab AA System Replacement	$100,000		$100,000				
South Blower Building Roof Repair	$70,000			$70,000			
Admin Building Roof Repair	$80,000		$80,000				
Structural Repairs (Aeration, Biosolids, etc.)	$300,000			$100,000	$100,000	$100,000	
Influent Channel & Conveyor Support	$277,000		$277,000				
Influent Screening Building HVAC	$200,000			$200,000			
Biosolids Holding Tank (Phase 2)	$880,000					$880,000	
Disinfection System Improvements	$6,420,000		$1,284,000	$4,173,000	$963,000		
North Plant Aeration Improvements	$9,200,000			$1,380,000	$3,910,000	$3,910,000	
Influent Mag Meter Replacements	$100,000		$100,000				

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CIP PROJECT SUMMARY…CONT.

Project	Total Costs		2021	2022	2023	2024	2025
SCADA/PLC Upgrades	$200,000			$50,000	$50,000	$50,000	$50,000
Influent Pump Station Improvements	$1,716,000					$686,400	$1,029,600
South Plant Grit Removal & RAS Upgrades	$75,000						$75,000
South Plan Blowers Replacement	$400,000						$400,000
South Plan Filter Installation	$7,100,000			$1,100,000	$2,500,000	$3,500,000	
Total	**$30,303,950**		**$2,026,950**	**$7,123,000**	**$7,523,000**	**$9,176,400**	**$4,454,600**

Large Capital Projects are Primarily Driven by Regulatory Compliance Needs

5 YEAR CIP COMPARISONS: SWRC

CY	Actual CIP	Current CIP	Proposed CIP
2015	$5,223,162		
2016	$3,051,843		
2017	$924,184		
2018	$831,423		
2019	$1,089,986		
2020	$881,695		
2021		*$1,885,950*	*$2,026,950*
2022		*$5,070,000*	*$7,123,000*
2023		*$3,950,000*	*$7,523,000*
2024		*$6,880,000*	*$9,176,400*
2025		*$2,525,000*	*$4,454,600*
Total	$12,002,293	*$20,310,950*	*$30,303,950*
Avg/Year	$2,000,382	*$4,062,190*	*$6,060,790*

NORTH PLANT AERATION IMPROVEMENTS

Key Condition Issues:

- Half of Existing Aerators are >45 years old (remainder are >25 years old). Exceed service life, critical danger of multiple failures.
- Walkways are damaged
- Electrical and I&C need replacement

Process Concerns:

- Process is reaching its loading capacity for BOD and ammonia (NH_3)
- Challenges with DO during the summer
- Undersized for expected growth

AERATION IMPROVEMENTS

Proposed Improvements:

- Decommission existing mechanical aeration system
- Install fine bubble membrane aeration system
- High efficiency blowers
- Electrical, process-mechanical, piping
- HVAC
- Instrumentation and controls

Total Cost: $9,200,000

May Trigger Phosphorus Improvements

INFLUENT PUMP STATION IMPROVEMENTS

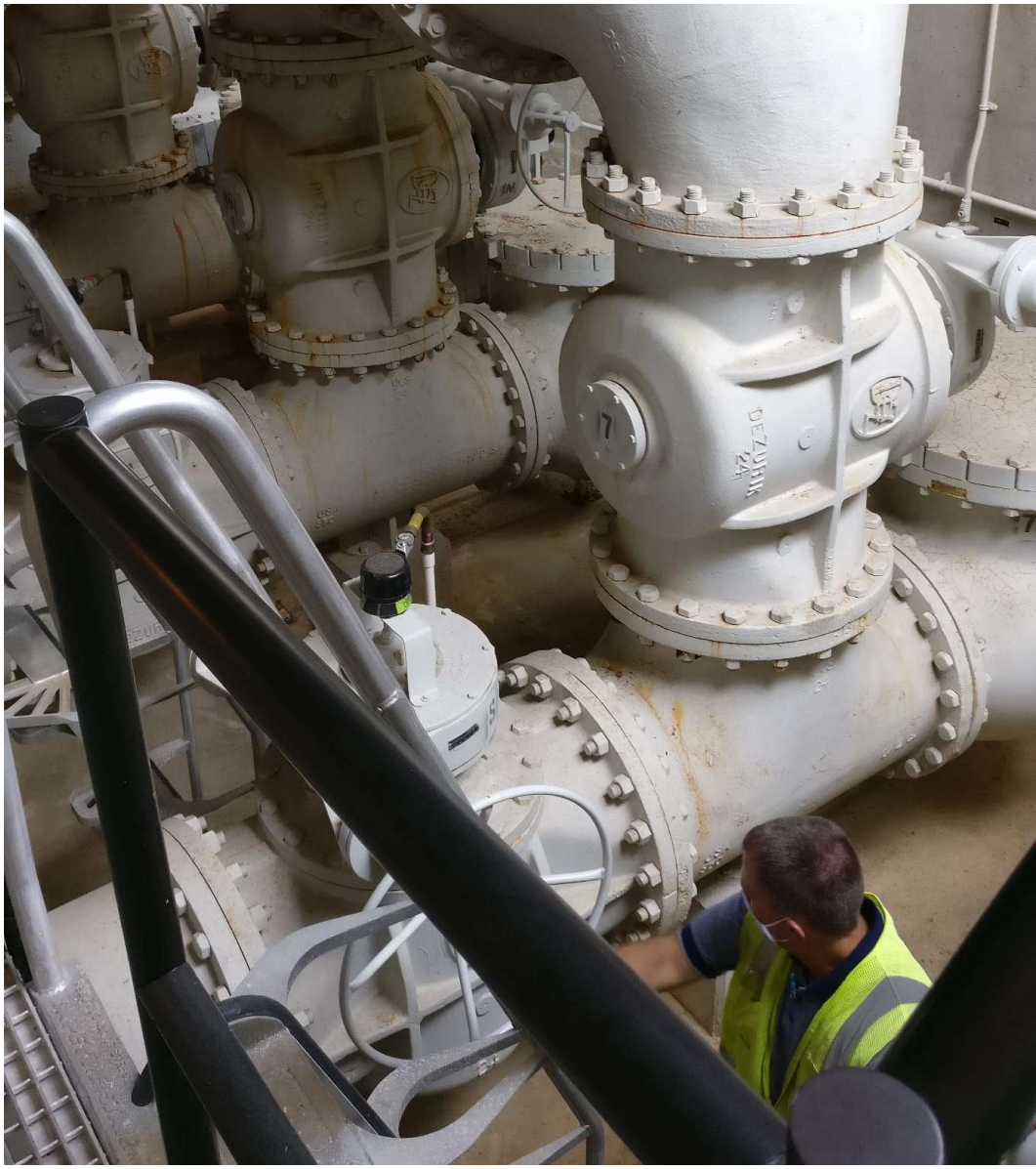
Key Condition Issues:

- No spare parts available
- Pump 2 – Tested 12/2020 – 40% efficiency drop
- Electrical and I&C need replacement
- Gas safety and HVAC have exceeded design life
- Minor building and roof improvements

Recommendation:

- Replace two 100 hp pumps
- Replace electrical and I&C
- Replace gas safety and HVAC
- Repair building and roof leaks

Total Cost: $1,716,000



BEYOND 2025: 10 AND 20-YEAR CIP

- Design engineering for Phosphorus Improvements beginning in 2025
  - Project cost estimated at $50-$60 million, more for a lower P limit
  - Construction to begin in 2027-28
- Tertiary filters- 2033, maybe sooner
- South Plant RAS/Grit System Upgrades
- Biosolids Holding Tank Phase 2
- Potential lower P limits, N limits, other regulatory pressure
- Additional staff at the plant necessary to handle increased capacity and more complex processes
- Additional engineering staff necessary to execute capital and O&M projects

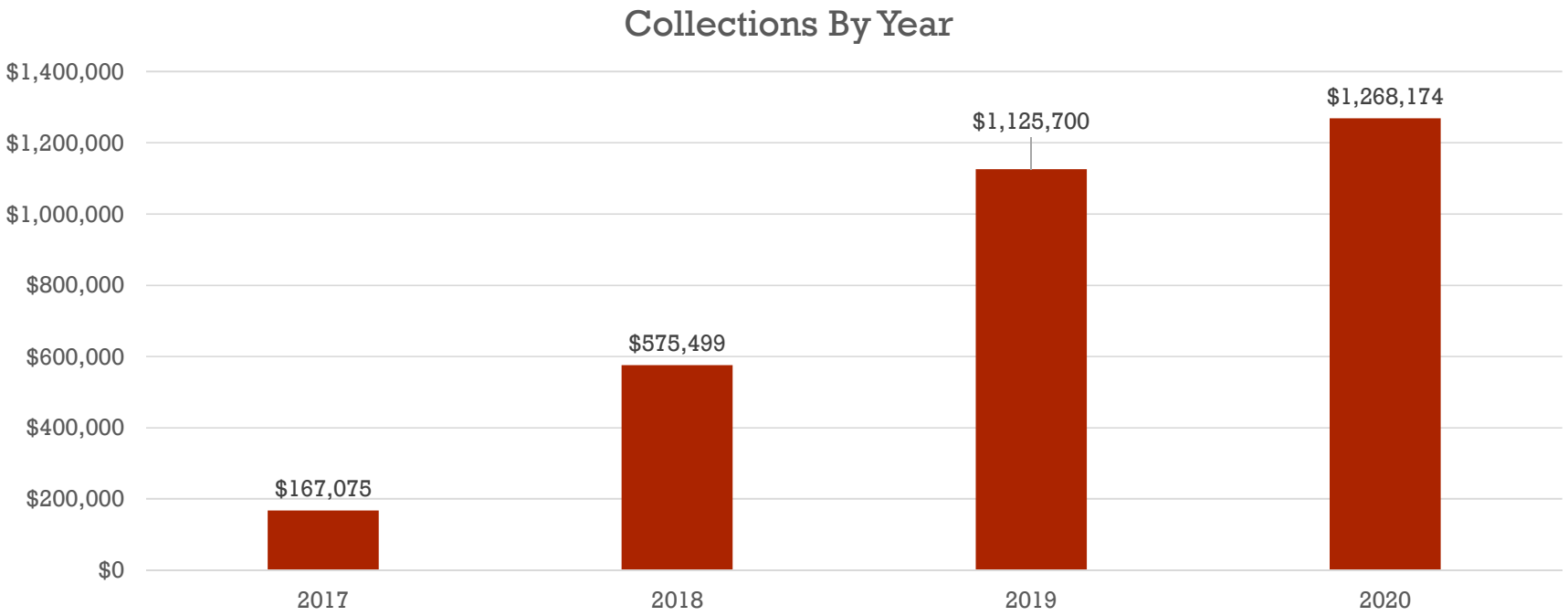
Name: Phosphorus
Symbol: P
Atomic Number: 15
Atomic Mass: 30.97376 amu
Melting Point: 44.1 °C (317.25 K, 111.38 °F)
Boiling Point: 280.0 °C (553.15 K, 536.0 °F)
Number of Protons/Electrons: 15
Number of Neutrons: 16
Classification: Non-metal
Crystal Structure: Monoclinic
Density @ 293 K: 1.82 g/cm^3
Color: white

PHOSPHORUS ROAD MAP- FEASIBILITY STUDY

- NPDES Permit requirement = 1 mg/L
- Three Phosphorus limits were evaluated: 1mg/L, 0.5 mg/L, 0.1 mg/L
- Biological, chemical or combination
- Permit requirement to be online by January 1, 2030

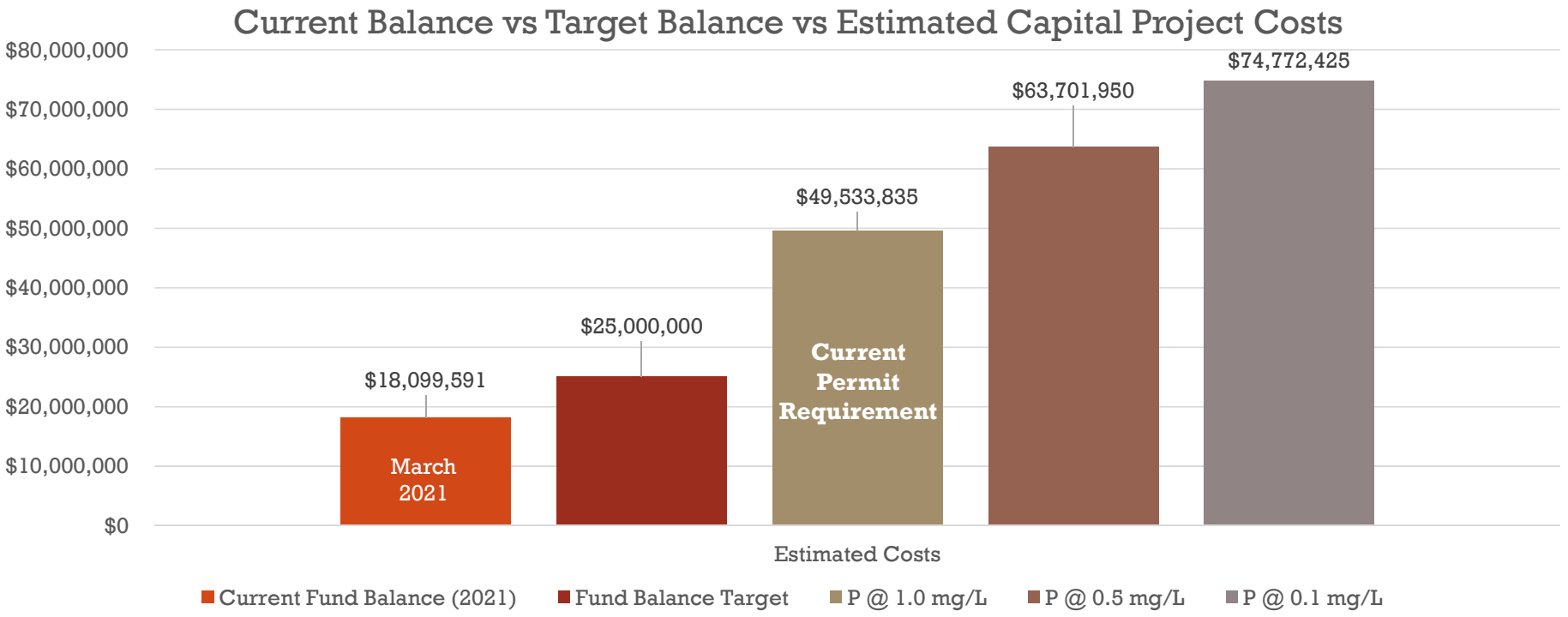
Concentration Limit	Permit Scenario	Capital Cost	Annual Cost	20-Year TPW
1.0 mg/L	Annual Average	$49,533,835	$86,778	$50,650,516
	Seasonal Average	$49,533,835	$134,754	$51,267,876
	Monthly Average	$49,533,835	$254,693	$52,811,276
0.5 mg/L	Annual Average	$63,701,950	$348,371	$68,184,845
	Seasonal Average	$63,701,950	$417,211	$69,070,691
	Monthly Average	$63,701,950	$486,051	$69,956,536
0.1 mg/L	Annual Average	$74,772,425	$1,370,504	$92,408,316
	Seasonal Average	$74,772,425	$1,433,059	$93,213,287
	Monthly Average	$74,772,425	$1,495,614	$94,018,258

PHOSPHORUS SURCHARGE REVENUES



$14,588,889 Transferred from Electric to the Fund as Loan Payback

PHOSPHORUS FUND



Estimated Capital Costs in 2019 Dollars
Not Adjusted For Inflation

Discussion & Questions