

SPRINGBROOK WATER RECLAMATION CENTER

**Program
Overview
&
Update**



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
- CIP summary
- Discussion & Questions



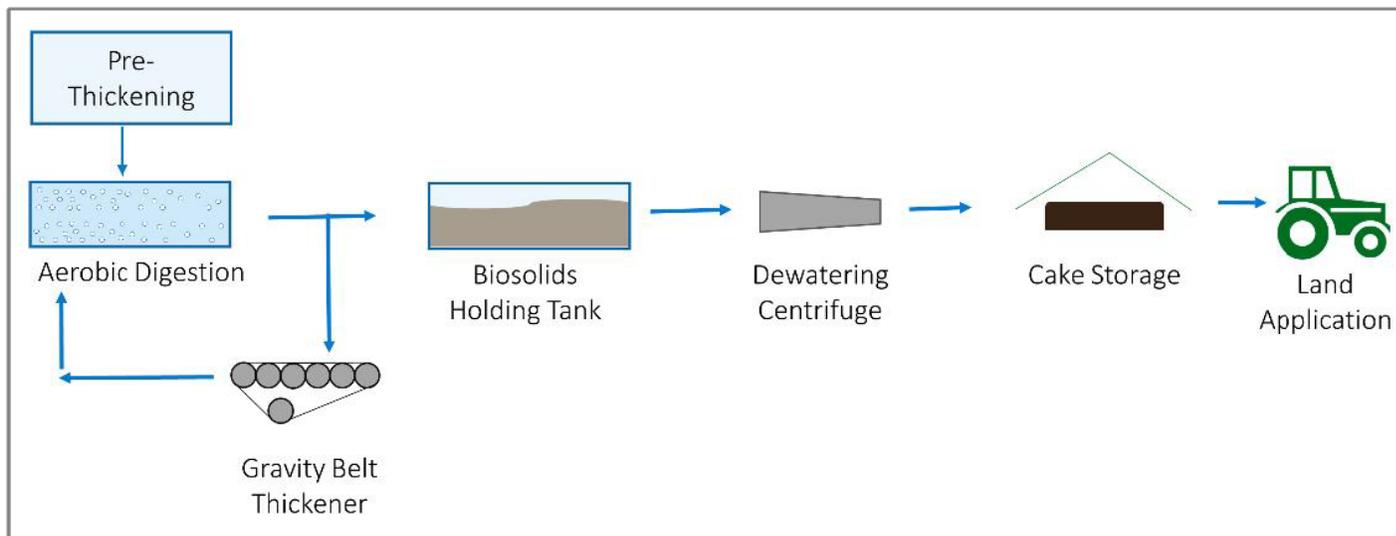
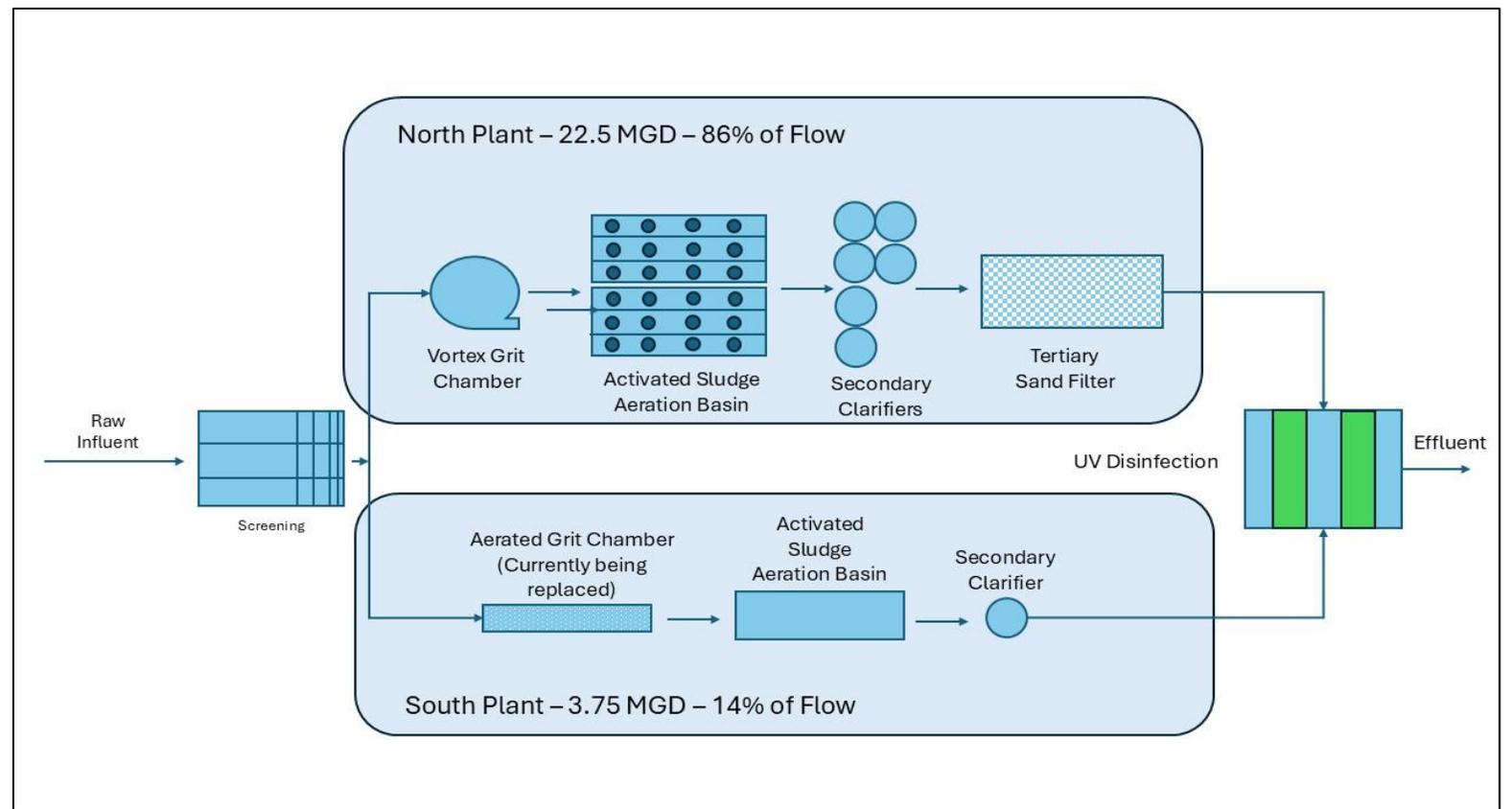


SPRINGBROOK WATER RECLAMATION CENTER

- 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
- Current Rated Capacity:
 - 26.25 MGD (DAF)
 - 55.13 MGD (DMF)



Existing treatment process

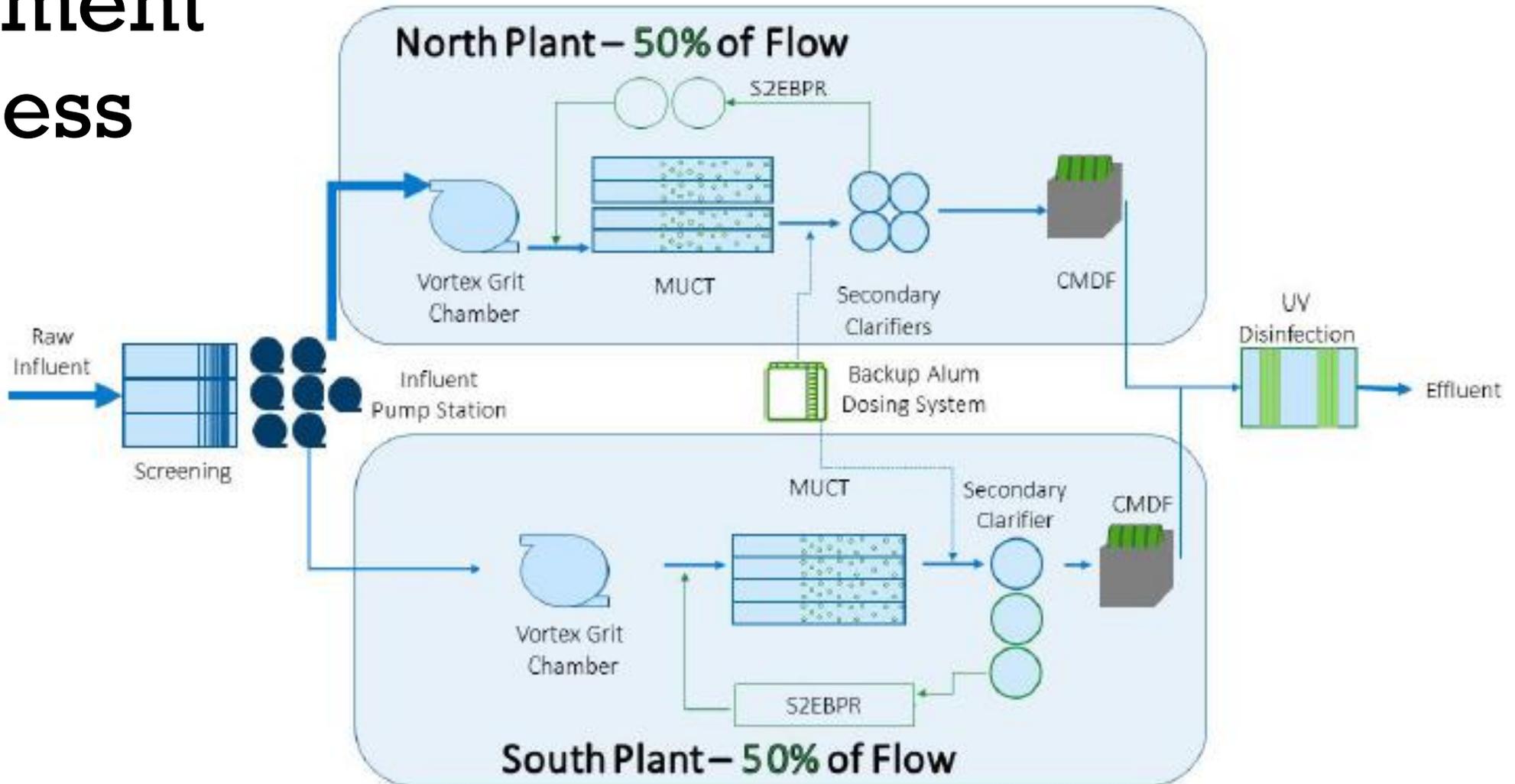


Influent is water, wastewater, solids, or other liquid flowing into a treatment plant.

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



Proposed future treatment process



REGULATORY BACKGROUND INFORMATION

- SWRC current NPDES permit IL0034061
- Current permit term 1/1/2019 – 12/31/2023
 - Applied for a new permit June 2023
 - Still waiting for a finalized permit
- 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)

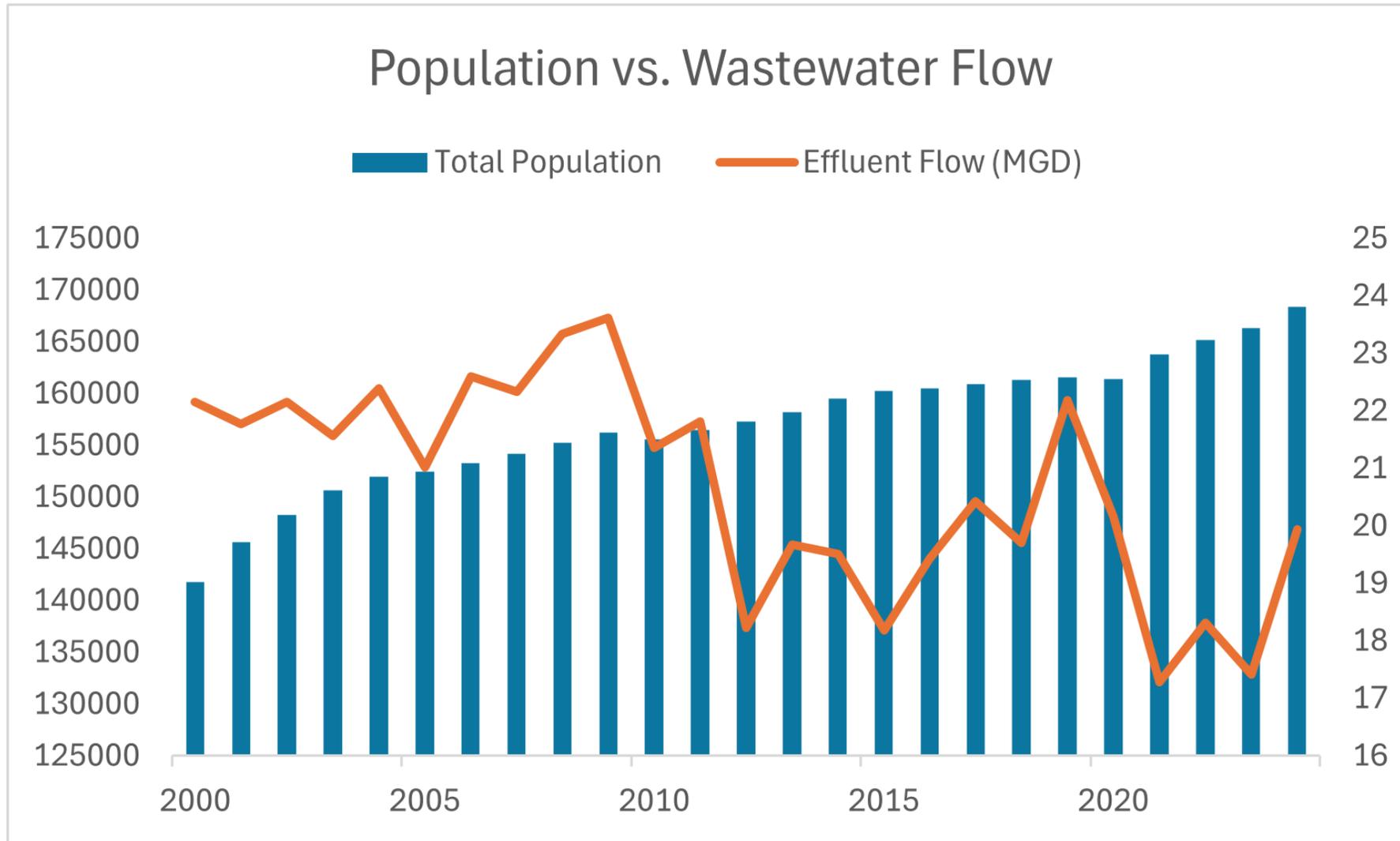


FLOWS TO SWRC ARE DECREASING . . .

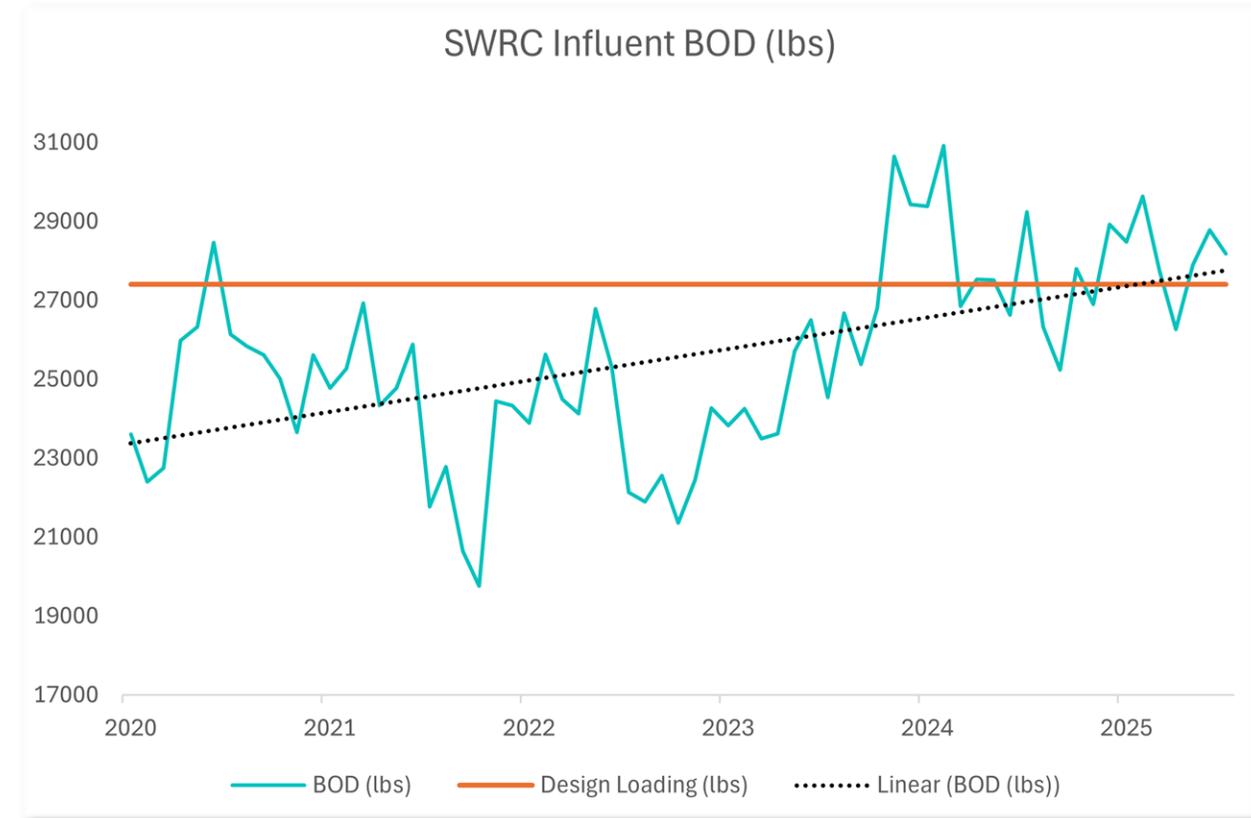
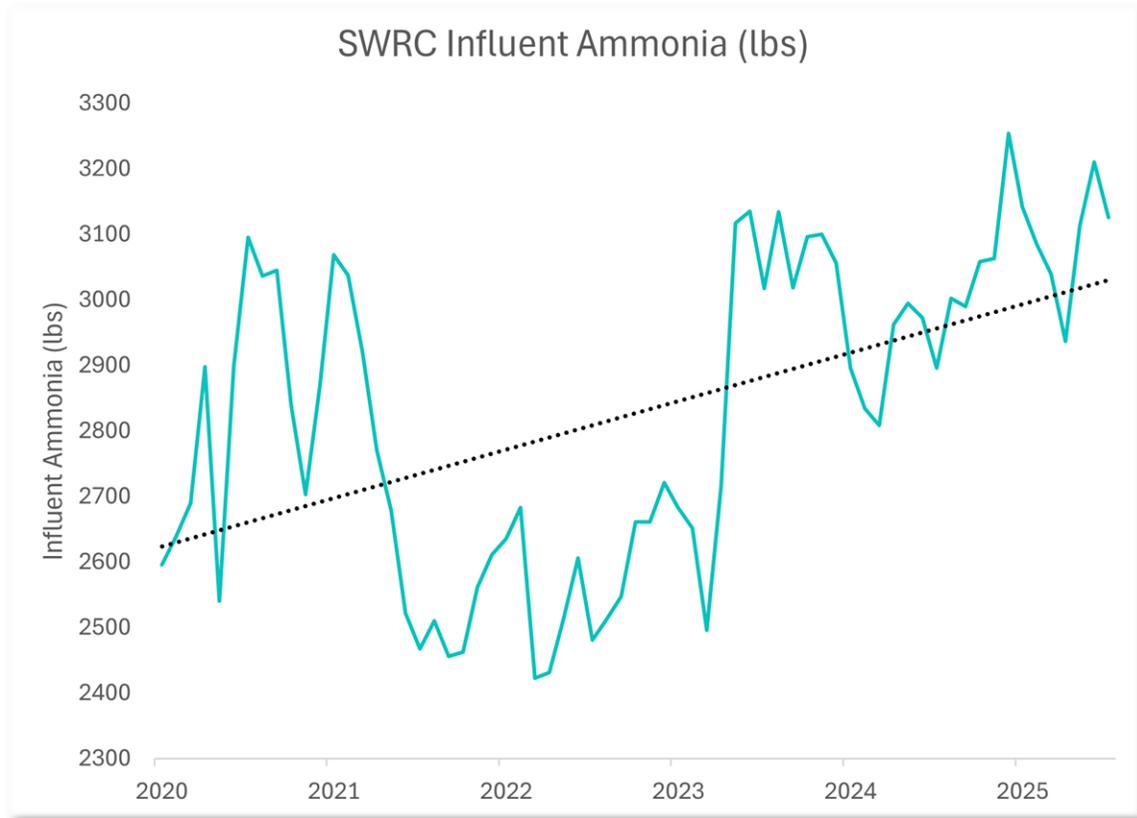
Effluent Discharge by Month with Trendline



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 - completed
 - Includes asset condition evaluation (plant systems, facilities and equipment), risk assessment
 - Definitive evidence that plant is at or exceeding capacity
 - BOD (lbs., hydraulic retention time), N. Clarifiers (SOR), Sand filters (hydraulic loading rate)



GETTING READY FOR PHOSPHORUS: MAJOR PROJECTS

- Under Construction
 - South Plant Grit and RAS improvements
 - Additional Biosolids Holding Tank
 - Influent Pump Station improvements
- Ultraviolet Light Disinfection (2024)
- Influent Screening Improvements (2017)
- Biosolids Holding Tank (2016)
- North Plant RAS/Grit Improvements (2014)
- Tertiary Filter Rehabilitation (2011-12)
- Aerobic Digestion Improvements (2008)

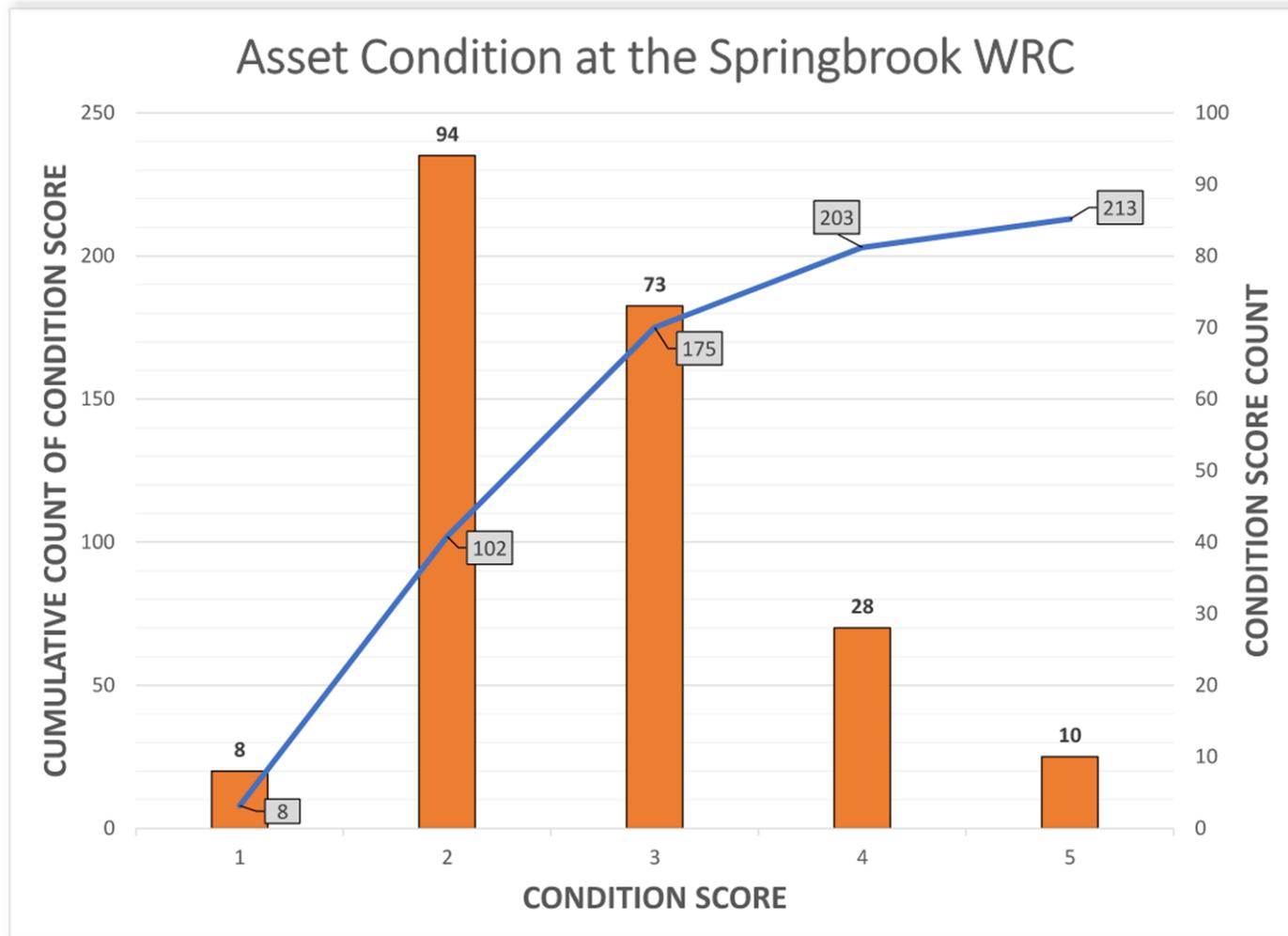


WHERE ARE WE NOW?

- 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.

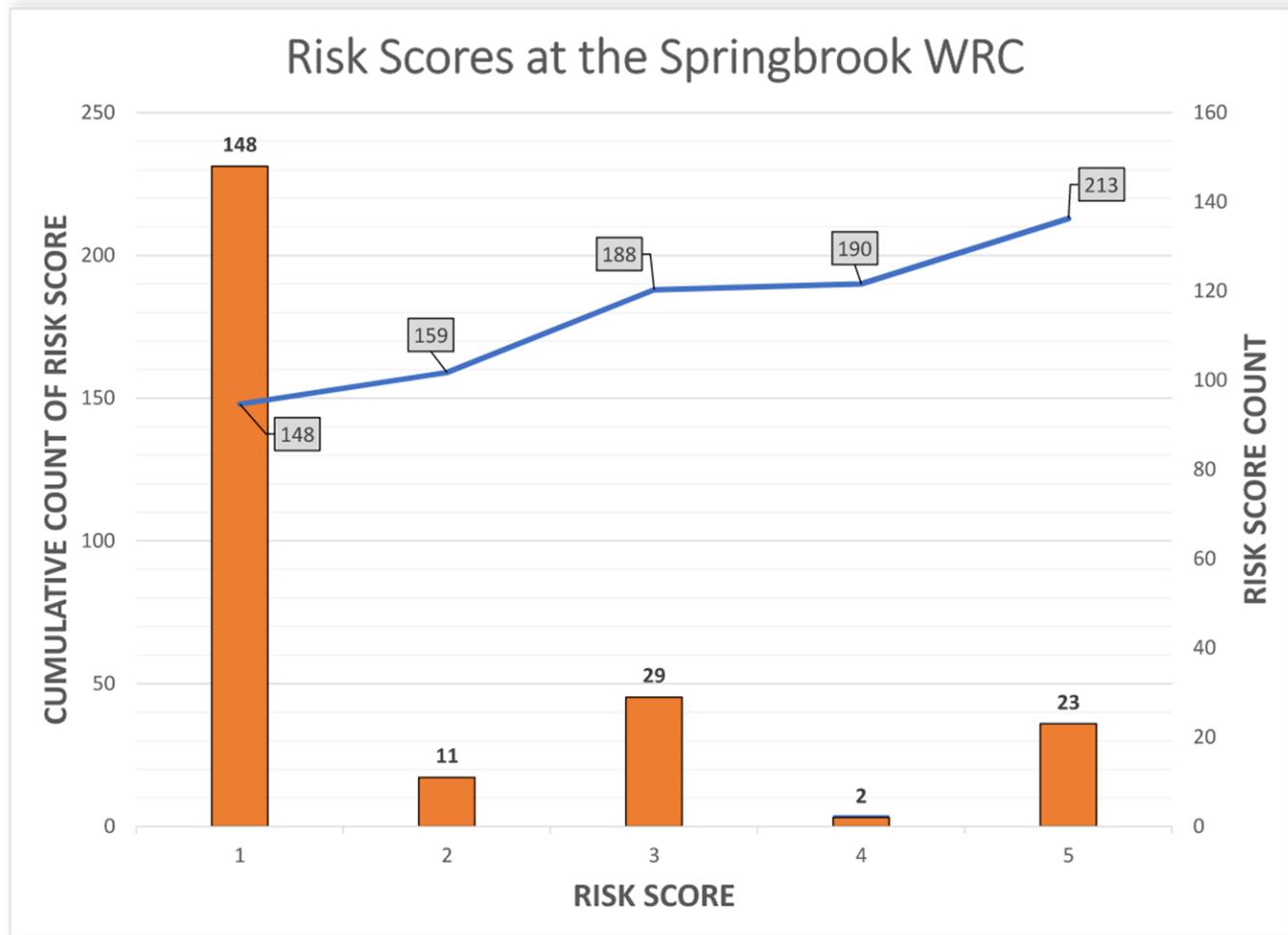
The graph indicates that most of the assets that were assessed had a low to medium condition rating.

"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:

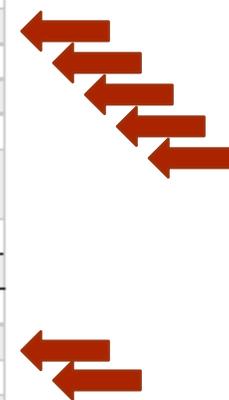
- Most assets are assessed to have a low risk.
- Capital projects to prioritize assets with a high-risk score have been developed.



TREATMENT PROCESSES EVALUATED

- Plant loading capacity issues:

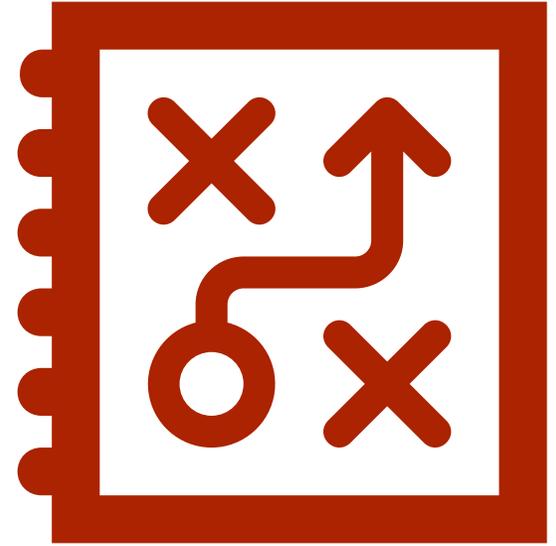
Unit Process	Design Criteria	Design Conditions	Units	Requirement	Capacity	
					Current	Future
Influent						
Influent Pumping	Hydraulic Capacity	Peak	MGD		125.6/65.8	125.6/75.1
Screening	Approach Velocity	DAF-Peak	ft/sec	1.25-3	1.3-2.1 ^A	1.7-2.4 ^A
North Plant (86% of flow)						
Grit Removal	Hydraulic 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.



**CAPITAL
IMPROVEMENT
PLAN**



COST DRIVERS

- **Increased Demand** 
 - The treatment plant is currently over capacity and further strain is expected as the population grows
- **Aging Infrastructure** 
 - A facility assessment revealed major repairs are necessary to maintain service
- **Regulatory Changes** 
 - Upcoming changes to Phosphorus limits require new infrastructure to maintain compliance



CIP PROJECT SUMMARY

MULTI-YEAR REQUIRED REVITALIZATION OF SPRINGBROOK

UV Disinfection



Influent Pump Stations



South Plant Grit and RAS



South Plant Capacity Upgrades



Nutrient Removal & North Plant Aeration



Cloth Media Disc Filters



\$180M
Estimated Investment
2021-2030
Tied to NPDES
permit renewal



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
- Not currently capable of meeting upcoming phosphorus removal requirements



SOUTH PLANT IMPROVEMENTS

Projects

- Grit and RAS improvements are under construction
- South Plant Capacity Upgrade
 - Capacity increased to split flow 50/50 with North Plant





AERATION IMPROVEMENTS & PROCESS MODIFICATIONS

- North and South Plants are to be converted to Modified University of Cape Town (MUCT) systems with Side-stream Enhanced Biological Phosphorus Removal
- Necessary to meet upcoming phosphorus limits
- Chosen due to lowest cost estimate based on Total Present Worth (TPW)
- Requires the replacement of the current aeration systems in both plants



ALTERNATIVES EVALUATED

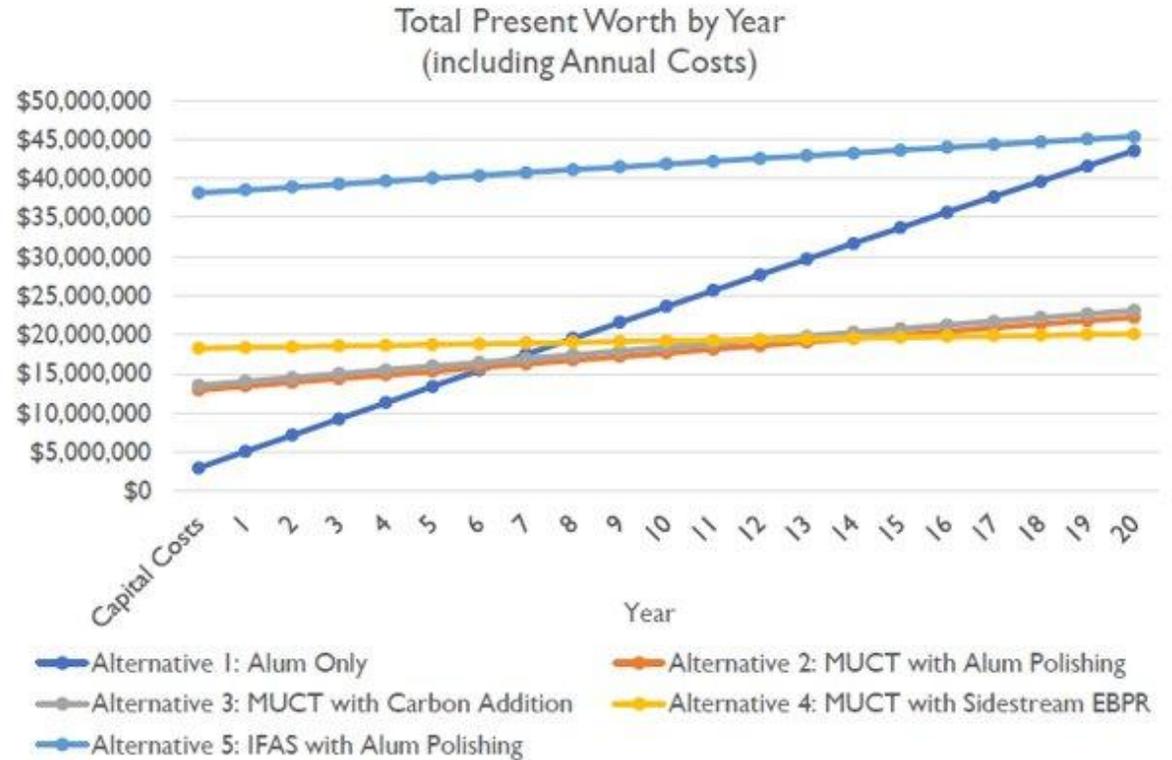


Figure 7 - Total Present Worth by Year

Table 6 – 20 Year Total Present Worth

Alternative	20-Year TPW
1 Alum Only	\$43,562,000
2 MUCT with Alum Polishing	\$22,239,000
3 MUCT with Carbon Addition	\$23,100,000
4 MUCT with S2EBPR	\$20,113,000
5 IFAS with Alum Polishing	\$45,375,000



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 had exceeded design life

Project Scope:

- Replace Influent Pumps (7 pumps)
 - Pumps 1 and 2 are being replaced with just 1 pump
- Replace electrical and I&C
- Replace gas safety
- Replace broken flow gates
- Installed additional force main for future South Plant expansion



BEYOND 2025: 10 AND 20-YEAR CIP

- Design engineering for Phosphorus Improvements underway
 - Project cost estimated at \$50-\$60 million, more for a lower P limit
 - North Plant Construction to begin in 2027-28
- Biosolids Holding Tank Phase 2 (Under Construction)
- South Plant RAS/Grit System Upgrades (Under Construction)
- Tertiary filters- 2033, maybe sooner
- 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



PHOSPHORUS REQUIREMENT OVERVIEW

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/cm³

Color: white

PHOSPHORUS ROAD MAP- 2017 FEASIBILITY STUDY

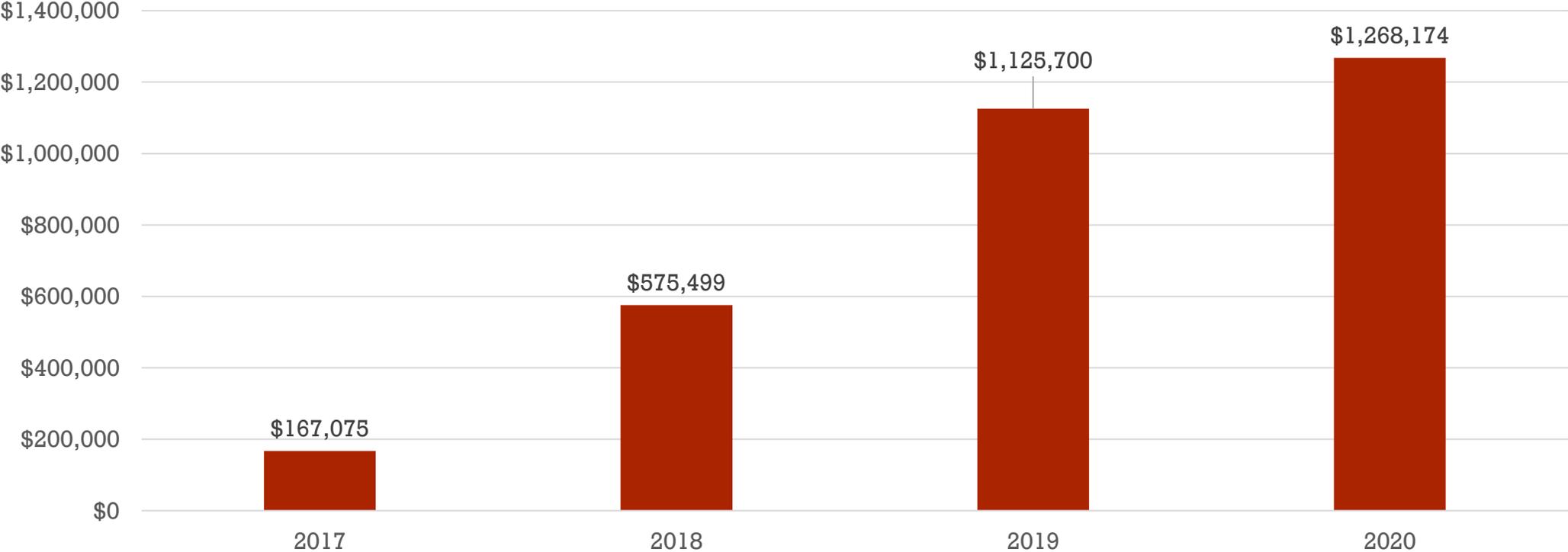
- NPDES Permit requirement = 1 mg/L
- Three Phosphorus limits were evaluated: 1mg/L, 0.5 mg/L, 0.1 mg/L
- Biological, chemical or combination
- Permit requirement to be online by January 1, 2030

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

Collections By Year



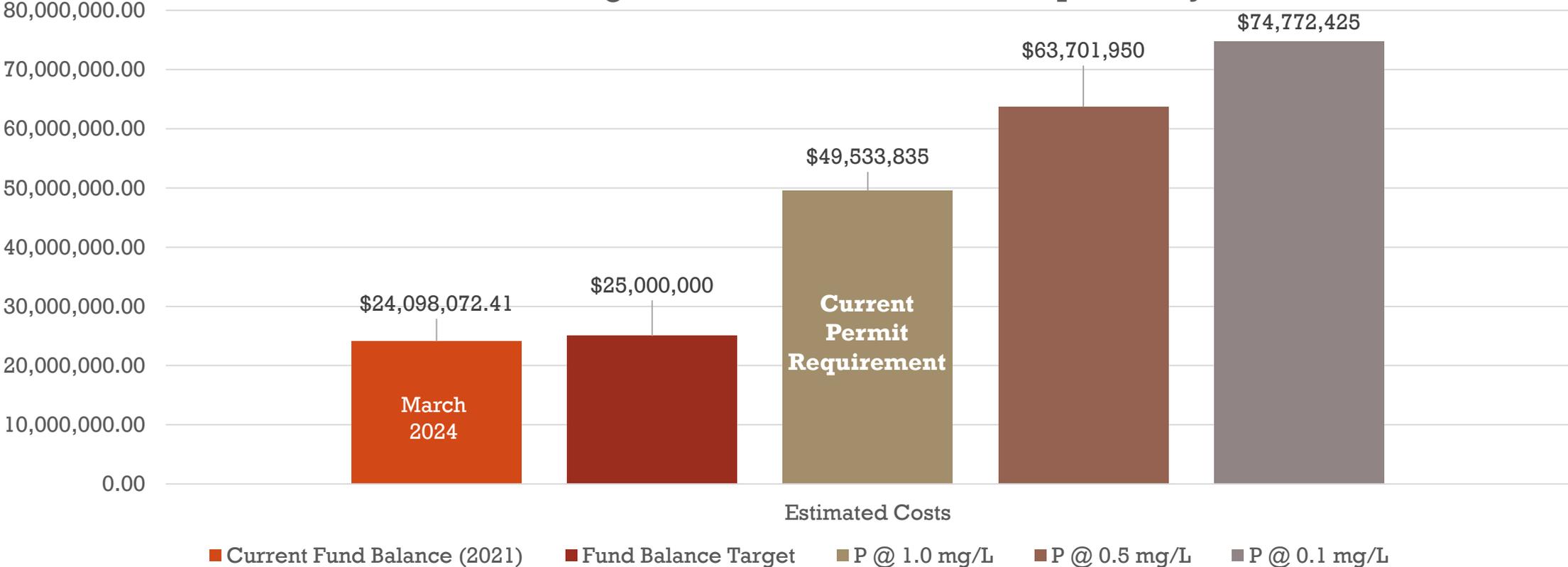
\$14,588,889 Transferred from Electric to the Fund as Loan Payback

\$1.80 monthly charge for Residential customers



PHOSPHORUS FUND

Current Balance vs Target Balance vs Estimated Capital Project Costs



**Estimated Capital Costs in 2019 Dollars
Not Adjusted For Inflation**



Discussion & Questions

