

Asset Management Update – The Life of an Asset

MWPAAC Rates & Finance and Engineering & Planning
Subcommittees

January 5, 2023



King County

Department of Natural Resources and Parks
Wastewater Treatment Division

Overview

- Goal
- Challenge
- Lifecycle Continuum Phases
- Portfolio Management Introduction
- Project Request Process
- Project Evaluation Process
- Portfolio Inventory
- Individual Project Cost Estimating and Forecasting
- Asset Management (AM) Portfolio Category Forecast Development



The Goal

Asset Management

- Manage over 87,000 assets including treatment plants, pumps and motors, pipelines and storage tanks, pump and regulator stations, offices and shop buildings, vehicles and technology, software and databases.
- Address the backlog of work and fund the highest priority items.
- Coordinate maintenance activities with affected groups to promote efficiency (maintenance, operations, etc.).
- Identify opportunities to improve energy efficiency resulting in cost savings (heat and biogas system improvement, etc.).

South Plant 1965

West Point 1966



Citizens, Aquarists and Metro employees gather to celebrate the dedication of the West Point Treatment Plant on July 20, 1966.

The Challenge

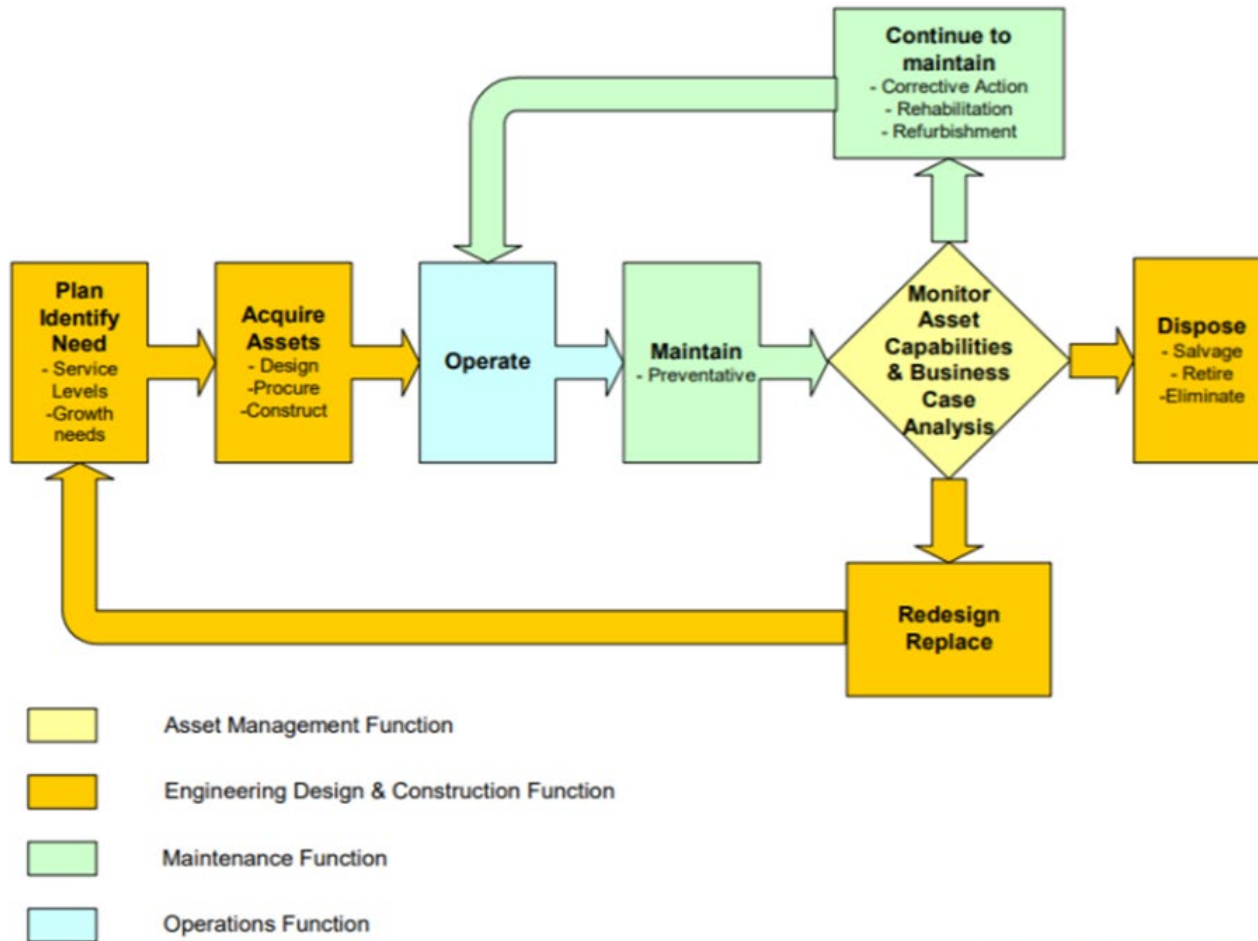
WTD owns and maintains about \$5 billion in assets, including:

- ✓ **5 Treatment Plants**
- ✓ **4 Combined Sewer Overflow Treatment Plants**
- ✓ **400 Miles of Conveyance Pipe**
- ✓ **43 Pump Stations**
- ✓ **2,398 Pumps**
- ✓ **2,413 Motors**
- ✓ **863 Variable Frequency Drives**
- ✓ **67 Engines**
- ✓ **112 Blowers**
- ✓ **162 Air handling units**
- ✓ **7 Turbines**
- ✓ **15 Boilers**



Lifecycle Continuum Phases

Asset Life-Cycle



- Capital Improvement Planning and Finance Phase – Plan, Prioritize and Fund Capital Projects
- Project Delivery Phase – Design, Deliver and Commission Infrastructure, Produce AM Deliverables
- Operate / Maintain Phase – Beneficial Use, Collect Risk Data, Analyze Lifecycle Data, Submit Project Requests



Operate / Maintain Phase

- Operate and maintain assets to meet Level of Service targets
- Source of lifecycle cost data
- Majority of New Project Request Forms (NPRF)
- Source of asset condition information
- Reliability Engineering – Maintenance Best Practice (MBP)
- Work order planning and scheduling
- Key Performance Indicators (KPI)



Operate / Maintain Phase – Building the Case

Raw Sewage Pump Replacement

2015 Raw Sewage Pump Replacement South Plant

Replacement Case Study: RSP #1, #4, #6

- Age: Installed 1965
- Criticality: High
- Documented Lifecycle Maintenance and Condition Monitoring: End of useful Life
- Parts Availability: Obsolete
- Energy Efficiency: Replacement with new technology and VFD Drives: Savings \$150,000/year
- Reliability: Improved
- Performance: Improved / Operability improved with elimination of Eddy Current Clutch
- Opportunity: Puget Sound Energy Grant Funded \$894,970



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Operate / Maintain Phase – Building the Case

Raw Sewage Pump Replacement

2023-2024 Raw Sewage Pump Replacement South Plant

Replacement Case Study: RSP #3

- Age: Oldest in operation, Manufactured in 1972
- Criticality: High
- Documented Lifecycle Maintenance and Condition Monitoring: End of useful Life
- Parts Availability: Obsolete
- Energy Efficiency: Replacement with new technology and VFD Drives, Savings to be evaluated
- Reliability: Improved
- Performance: Improved / Operability improved with elimination of Eddy Current Clutch
- Opportunity: Grants being sought



Capital Improvement Planning and Finance Phase

- Intake NPRFs
- Prioritize requested projects
- Formulate projects
- Balance portfolio
- Collaborate with Finance on biennial budget requests
- Manage long-term capital forecast



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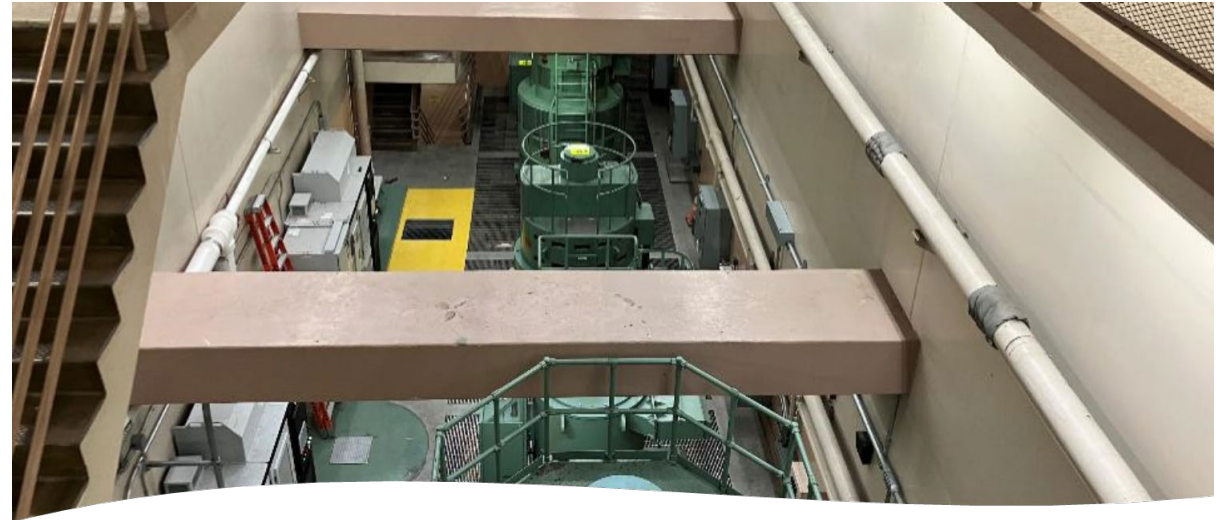
Capital Improvement Planning and Finance Phase

Objective -

- Manage infrastructure risk
- Prioritize, fund and staff the right projects at the right time for the right reasons

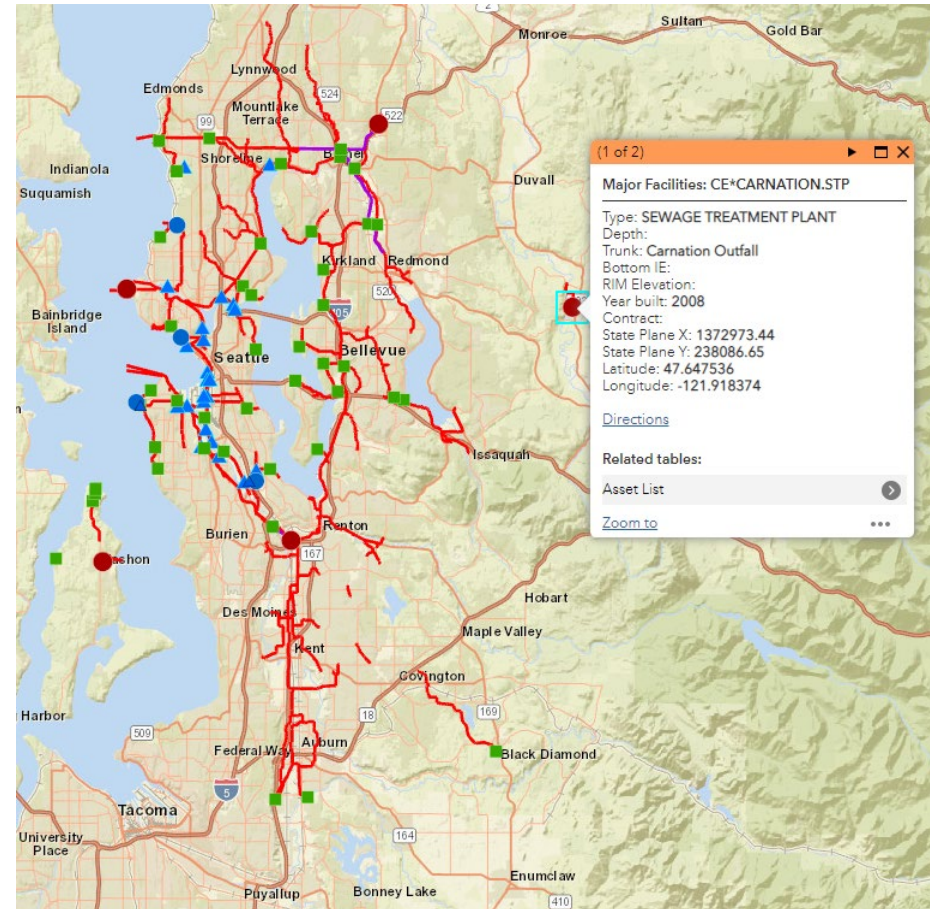
Delivery Opportunities -

- Lifecycle replacement programs
- Performance upgrades
- Energy efficiency program
- Connect to larger projects
- Coordinate with Conveyance System Improvement (CSI) Program



Project Delivery Phase

- Fund Projects
- Staff project teams
- Design and deliver projects
- Collaborate with Operations to commission infrastructure
- Produce asset management deliverables
- Project Oversight Boards



Portfolio Management

- In 2018, King County WTD implemented the Portfolio Management process to prioritize its capital program
 - Centralized management of multiple portfolio categories to **achieve strategic objectives**
 - AM Category aligned with Sewer Rate goal: *Advance the most critical asset management projects*
- WTD maintains inventories of projects in all categories, forms basis of Capital Improvement Program (CIP) forecasts
- Projects enter inventory through a project request process



Asset Management
– Plants and
Conveyance



Capacity
Improvements



Operational
Enhancements



Regulatory



Resiliency



Resource Recovery



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Project Request Process

- South Plant Raw Sewage Pump #3 Request [Portfolio Management \(vms-pro.com\)](https://vms-pro.com)



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Project Request Process

King County Crystal Fleet

Request New Project

* Project Name:

* Project Type:

If Project is greater than \$2.5m choose one of these

Standalone Capital Project

Program (Roll-Up)

If Project is less than \$2.5m choose this

Subproject


[Create Project](#)



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Project Request Process

 Crystal Fleet

South Plant Raw Sewage Pump #3 Replacement

1139064 | Asset Management - Plants | SOUTH TP OVERALL

Estimated Total Cost: [See PRISM](#) | Duration: [See PRISM](#) | Portfolio Status: **Approved**

Saved 2 years ago

PRISM | **Project Details** | Conceptual Model | Evaluation

Project Summary - 1139064

Project Name	Project Type	Portfolio Category	Estimated Project Duration			
South Plant Raw Sewage Pump #3 Replacement	Standalone Capital Project	Asset Management - Plants	36 Months			
Est. Construction Costs	Est. Non-Construction Costs	Est. Contingency Costs	Est. Total Project Costs			
\$4,795,000	+	\$2,471,000	+	\$2,152,000	=	\$9,418,000.00

Project Location(s)

- SOUTH TP OVERALL

Objective

Project Objective

Replace equipment at the end of life and provide safe, reliable, and energy-efficient raw sewage pumping at South Plant.

Fast Track

Does this need to be fast tracked?


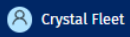
No



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Project Request Process

Potential Consequences

Consequences of Non-Approval

New RSPs 1, 4, and 6 were recently installed to replace aging assets, to convert from a clutch drive design to a variable speed drive, and to reduce overall pumping energy use. RSP4 is estimated to run 6,348-hrs/year (assuming its available 365 days per year) to minimize overall pumping energy. These heavy runtime hours will degrade the asset sooner, require more maintenance per year, and likely reduce RSP4's efficiency sooner. The "Classic" RSPs 2, 3 and 5 are available to run instead of RSP4, but they are quite inefficient at most plant flows, and each has a lower flow capacity than RSP4. Electricity use will increase when RSP4 is not available, making it harder to meet energy reduction goals. Electricity costs will also increase but not drastically (e.g., estimated \$1000/week). Replacing RSP3 with an energy efficient RSP will replace an aging asset, increase overall capacity, and provide reliability in minimizing energy use at the influent pump station for years to come.

Preliminary Scope Statement

- 1 What do you think the solution is?**

Replace existing RSP3 motor, drive and pump (installed 1971) due to aging asset and lowered capacity, and to provide redundancy for the new RSP4 so energy reduction goals can reliably be achieved.
This project will provide a second, energy-efficient, 100-mgd raw sewage pump (it would be redundant to new RSP4) to replace an aging asset with reduced capacity, and to assure energy reduction goals are reliably achieved.
Demo existing equipment, install new MCC section, Variable Frequency drive, motor and pump. Pump went into service 1971, will fit in existing location, no size increase needed, no barriers.
- 2 Are there other feasible solutions?**

TBD
- 3 Is this a study to determine alternatives?**

no

Scope Information

Formulation?

Is this an Assessment/Evaluation/Study?

Originating Section
Operations Section - East, South Plant

Sponsor
Tyler Brenton

3PMO
Crystal Fleet

Requester
Alex Cole

Enter Related Projects P#M and/or PRISM IDs

Asset(s)


Asset Number(s)
MTR131045, P131045



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Project Request Process

Crystal Fleet

1 What is the basic need for the project?
This asset is at end of-life, has the lowest capacity of the four "100-mgd pumps" and is the least energy efficient RSP at SP. Equipment is no longer efficient, and at the end of life. Life to-date costs: 119K (labor), 103K (material).

2 Are there any uncertain and/or relatively risky aspects of this project request?
No

3 What do you think the problem is? When did this happen?
Old RSP/equipment

4 Are there any permit/initiative/code implications if the project is not completed (related to the problem, not to the solution)?
No

5 What are the safety implications?
No

6 Do you think this is a system/operational problem, or is this a problem with some specific piece(s) of equipment? Can the problem be solved via operational changes? If so, why haven't these changes been pursued?
Equipment

7 Will there be any service disruptions or other impacts resulting from asset failure?
Potentially

8 What is the deadline to begin or complete the project? Describe why this is the necessary date of completion and the rationale for how long until it becomes a critical issue.
Begin no later than 2023.







Planning and Schedule Information

Timeline
Desired Start Date
2021-01-01
Desired End Date
2024-01-01

Deadlines
• Internal
Operational, RSP#4 has shown significant wear in two years of almost constant operation, installing #3 will cut down use of #4 by 50%.

Scheduling Constraints
Yes
construction should begin in the spring and be completed in one dry season (2022)

Attachments

-  [NPRF#_1731_Original](#) 
-  [cost info and timing info](#) 
-  [estimate](#) 



[+ Add Attachments](#)



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Project Request Process

 Crystal Fleet 

8 What is the deadline to begin or complete the project? Describe why this is the necessary date of completion and the rationale for how long until it becomes a critical issue.
Begin no later than 2023.










9 Would this project provide any benefits that are aligned with the other portfolio categories? If so, which categories?
Resource Recovery
Capacity Improvements

10 Is there anything else that should be known about this project request?
NPRF# 1731
Original Requestor - Wohlfert, Mike
Compliance: Provides Pumping Capacity
a good cost estimate is needed and,

 [estimate](#) 

[Add Attachments](#)

Help Documents and FAQ

-  [PfM Category Placemat](#)
-  [Strategic Opportunity Indicators](#)
-  [Asset Management - Conveyance](#)
-  [Asset Management - Plants](#)
-  [Capacity Improvements](#)
-  [Operational Enhancements](#)
-  [Regulatory](#)
-  [Resiliency](#)
-  [Resource Recovery](#)

Asset Management - Plants Preliminary Criteria Evaluation

Organizational Impacts

7 High
Rationale
this is if another pump were to fail

Condition of Asset -- Treatment Plants & Pump Stations


8.6 Very Poor Condition
Rationale
pump is nearing end of life, installed in "71"



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Project Request Process

 Crystal Fleet

Asset Obsolescence

8 High

Rationale
doesn't pump at capacity because it's old

Asset Criticality -- Treatment Plants & Pump Stations

7.1 Probable and Vital Importance

Rationale
if any other pump is down for maintenance or repair criticalaty would be higher

Preliminary Criteria Evaluation Score

7.7 Based off of your criteria ranking, this project is well aligned with the designated portfolio category and is likely to perform competitively when evaluated against similar projects and considered for funding.

History Add Note


- 2020-12-02 10:32 am: Project was included in Project Evaluation Portfolio Project Evaluation #5 - 2021-2022 Biennium which was closed on 2020-12-02.
- 2020-06-23 02:23 pm: Integration job jcn1kfcxXiDN19knrHFRpY Approved this project.
- 2019-10-03 10:20 am: Crystal Fleet Approved this project pending funding.
- 2019-09-12 03:59 pm: Jacquelynn Roswell submitted this project for Sponsor Acceptance. - "this item needs a good cost estimate and more work on the narrative"
- 2019-06-03 04:45 pm: Tyler Brenton submitted this project for 3PMO Validation.
- 2019-05-30 04:46 pm: Alex Cole submitted this project for Sponsor Validation.
- 2019-05-30 04:42 pm: Alex Cole created this project.



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Project Evaluation Process

 Crystal Fleet

South Plant Raw Sewage Pump #3 Replacement

1139064 | Asset Management - Plants | SOUTH TP OVERALL

Estimated Total Cost: [See PRISM](#) | Duration: [See PRISM](#) | Portfolio Status: **Approved**

Saved 2 years ago

PRISM | Project Details | Conceptual Model | **Evaluation**

Category Criteria Evaluation

Criteria	Group Aggregate Rating	Group Rationale	Last Validated
Organizational Impacts	6.5	The poor condition of pump 3 is leading to an overreliance on pump 4, which is reducing its life. Additionally pump 3 is a less efficient pump that is driving up energy use. Pump 3 can only be used effectively at full speed, which is reducing redundancy.	2019-10-08
Condition of Asset -- Treatment Plants & Pump Stations	7.5	Pump is showing signs of significant wear and is only operating at 80% capacity.	2019-10-08
Asset Obsolescence	8.6	Pump does not have vendor support and replacement parts cannot be sourced.	2019-10-08
Asset Criticality -- Treatment Plants & Pump Stations	7.2	Asset failure is not probable. Asset is slightly less critical due to available redundancy of other pumps, but at wet weather if this pump has failed SP would near full capacity. Pump is required for wet weather flows.	2019-10-08

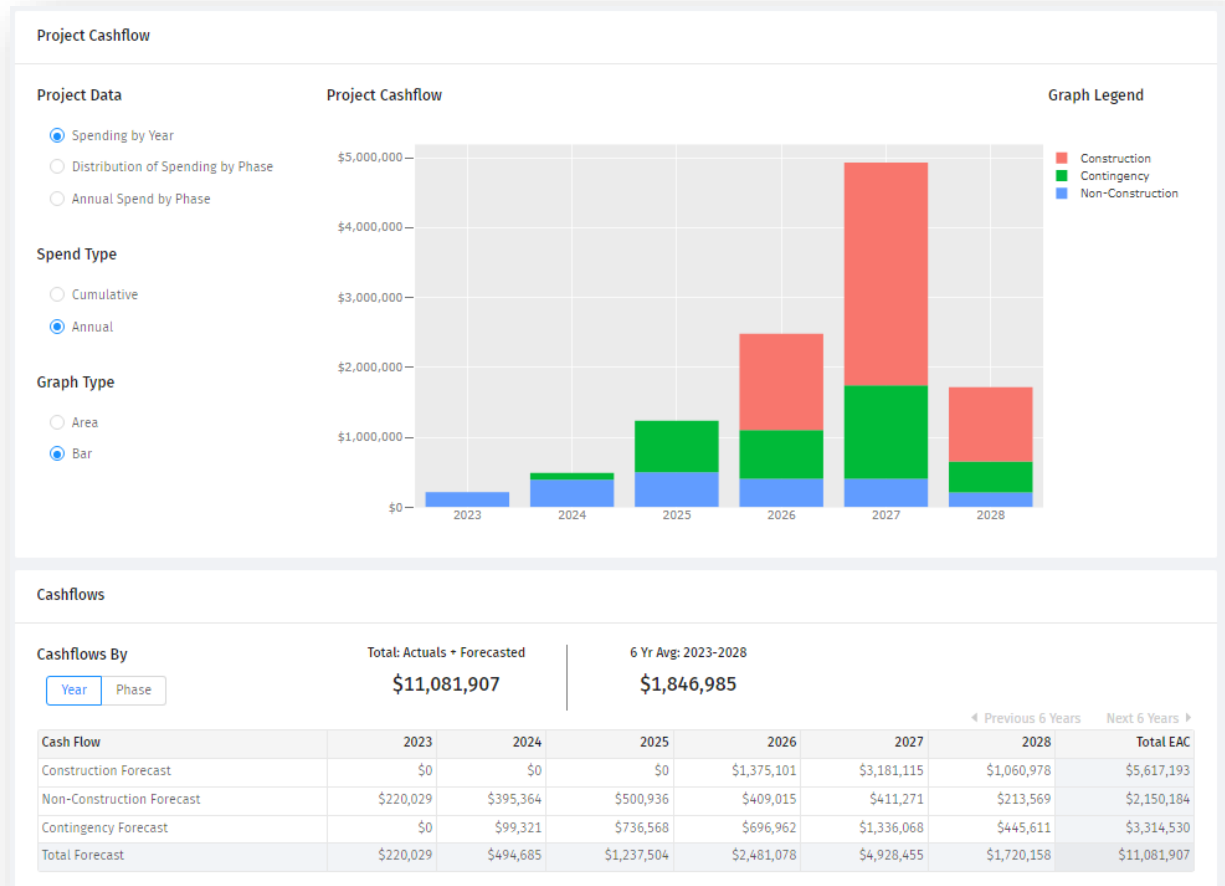


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Project Cost Estimating and Forecasting

Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost	
1				\$	-	
2				\$	-	
3				\$	-	
4				\$	-	
5				\$	-	
6				\$	-	
7				\$	-	
8				\$	-	
9				\$	-	
10				\$	-	
Subtotal Construction Costs					\$	-
Allowance for Indeterminates (Design Allowance)					\$	-
Street Use Permit					\$	-
ESTIMATED PROBABLE COST OF CONSTRUCTION BID					\$	-
DIRECT: SUBTOTAL ADDITIONAL CONSTRUCTION COSTS						
Mitigation Construction Contracts					\$	-
Construction Change Order Allowance					\$	-
Material Pricing Uncertainty Allowance					\$	-
Subtotal Primary Construction Amount					\$	-
Construction Sales Tax					\$	-
Owner Furnished Equipment					\$	-
Outside Agency Construction					\$	-
Subtotal KC Contribution to Construction					\$	-
DIRECT: SUBTOTAL OTHER CAPITAL CHARGES						
KC/WTD Direct Implementation					\$	-
Misc. Capital Costs					\$	-
TOTAL DIRECT CONSTRUCTION COSTS					\$	-
INDIRECT: NON-CONSTRUCTION COSTS						
Design and Construction Consulting					\$	-
Other Consulting Services					\$	-
Permitting & Other Agency Support					\$	-
Right-of-Way					\$	-
Misc. Service & Materials					\$	-
Non-WTD Support					\$	-
WTD Staff Labor					\$	-
Subtotal Non-Construction Costs					\$	-
Project Contingency					\$	-
Initiatives					\$	-
TOTAL INDIRECT NON-CONSTRUCTION COSTS					\$	-
TOTAL PROJECT COST					\$	-

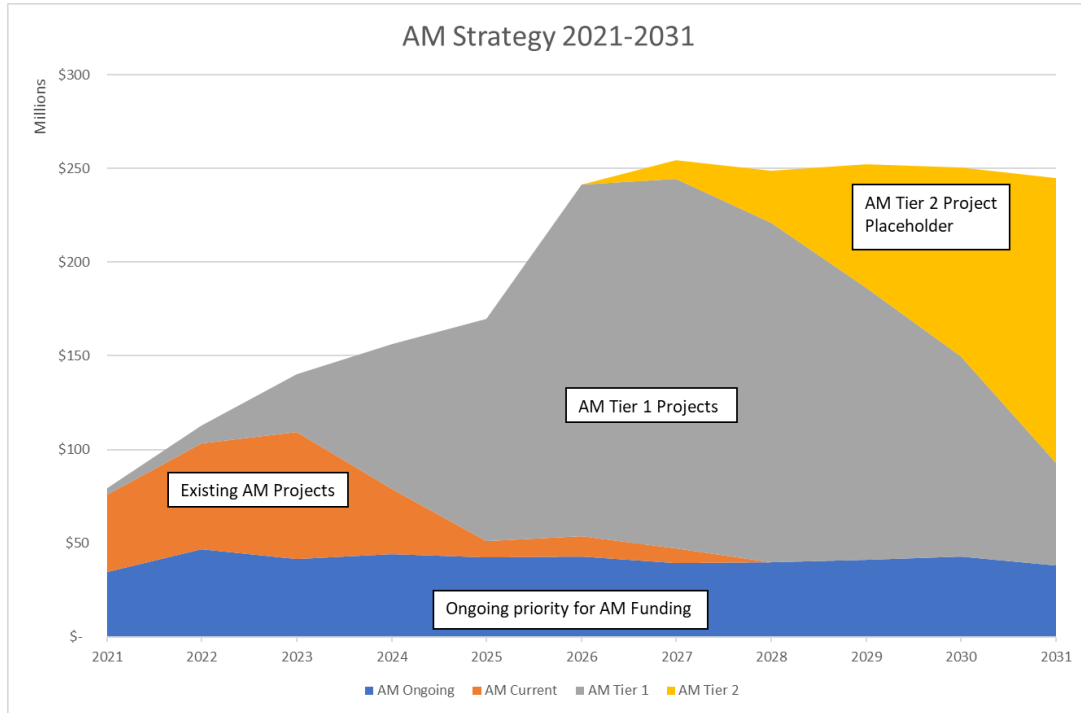


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AM Category Forecast Development

2022 Sewer Rate AM Category



How Each Layer is Estimated

Layer	Forecast Type	Potential Variability
Ongoing Priority – low cost, routine	Individual subproject forecasts + historical spending averages	Low
Existing AM Projects – highest priority, currently in delivery	Individual project cost and schedule forecasts	Moderate – cost estimates range from planning level through construction bid, durations subject to individual and global risks
AM Tier 1 Projects – currently poor condition or obsolete; high consequences of failure	Individual project cost estimates and analogous durations, composed of unfunded projects sequenced to meet 2030 priority inventory goal	Significant – cost estimates range from pre-planning through planning level, projects may be added or rescheduled based on emerging conditions, highly dependent on completing existing projects and future resource availability
AM Tier 2 Project Placeholder – assets expected to age into inventory	Extrapolates peak forecast average	Significant – rough order of magnitude



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Conclusion

- Assets are managed in a whole life continuum approach
- Projects are inventoried in the capital portfolio through a project request process, which relies on human decision making
- Projects in the inventory are scored by subject matter experts using objective criteria to evaluate information from the project request
- The portfolio forecast relies on aggregation of individual inventoried project forecasts aligned to meet strategic goals
- The further out the forecast, the more uncertainty there is



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Questions?

Crystal Fleet

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Alden Wyma

WTD Asset Management Program Supervisor

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