Validating the Long-Term Cost-Effectiveness of Proactive Asset Renewal

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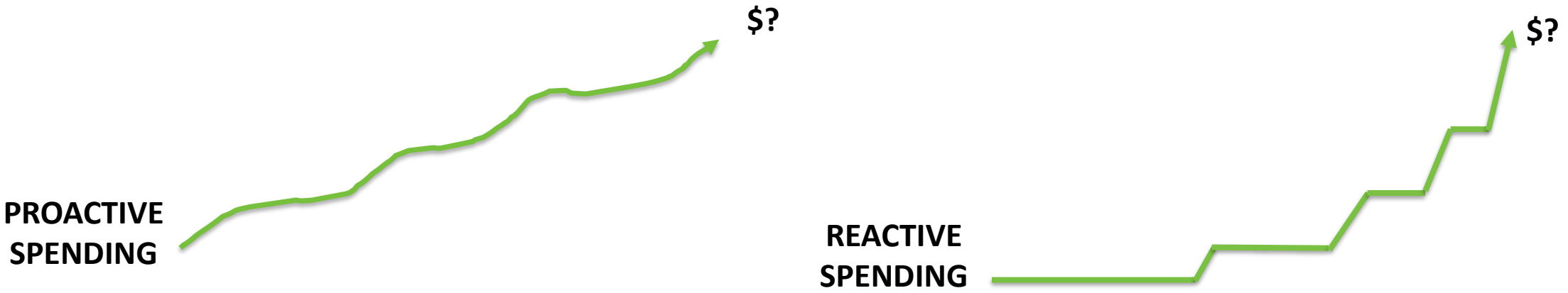
Presentation Overview

- Introduction
- Overview of District's sewer and water infrastructure
- Water/Sewer improvements planned per 2018 Integrated Plan (IP) and Long-Term CSO Control Plan (LTCP)
- How to prove being proactive in fixing aging infrastructure is financially right move
- Conclusions of proactive rehab/replacement vs. reactive repairs evaluation



Introduction

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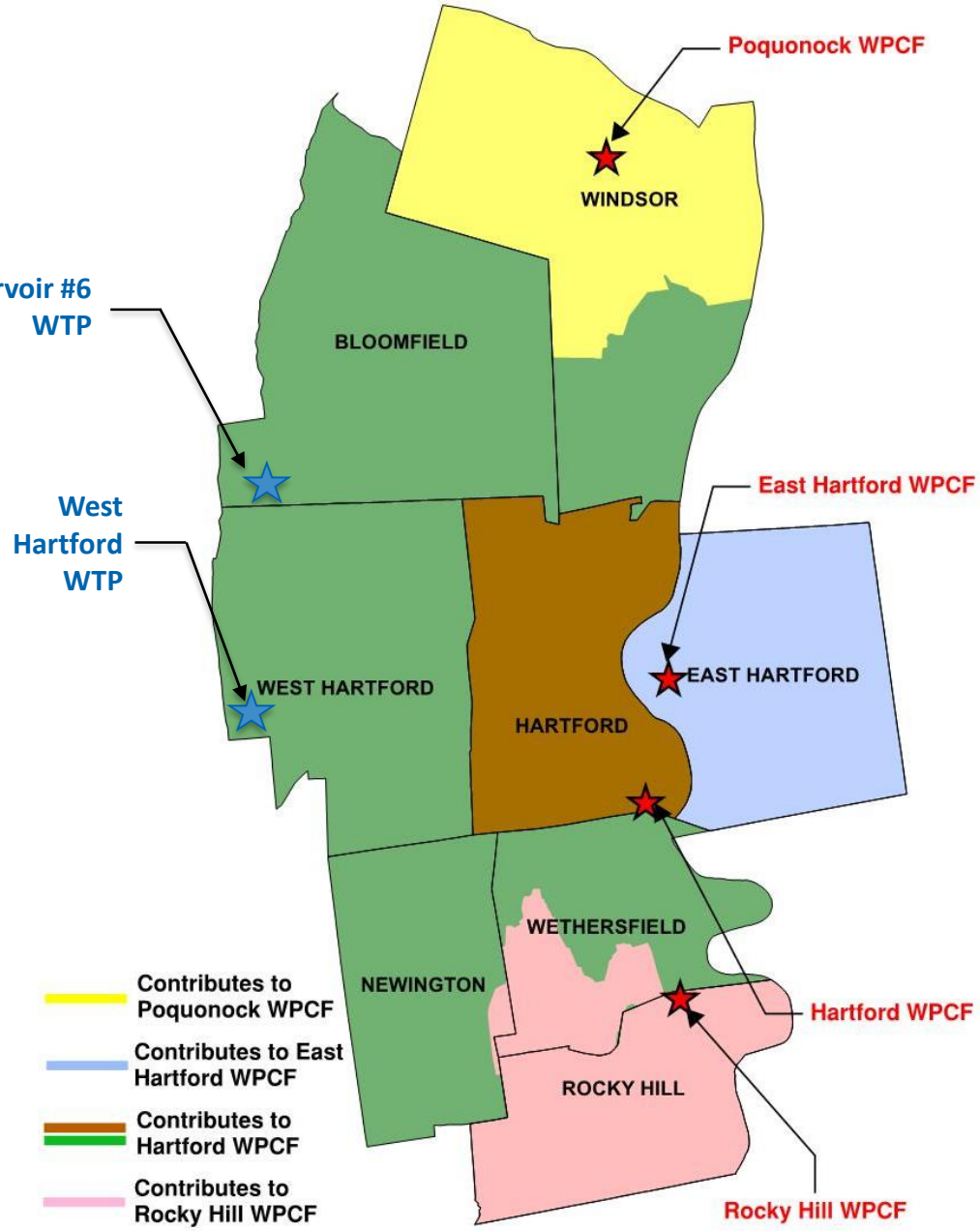
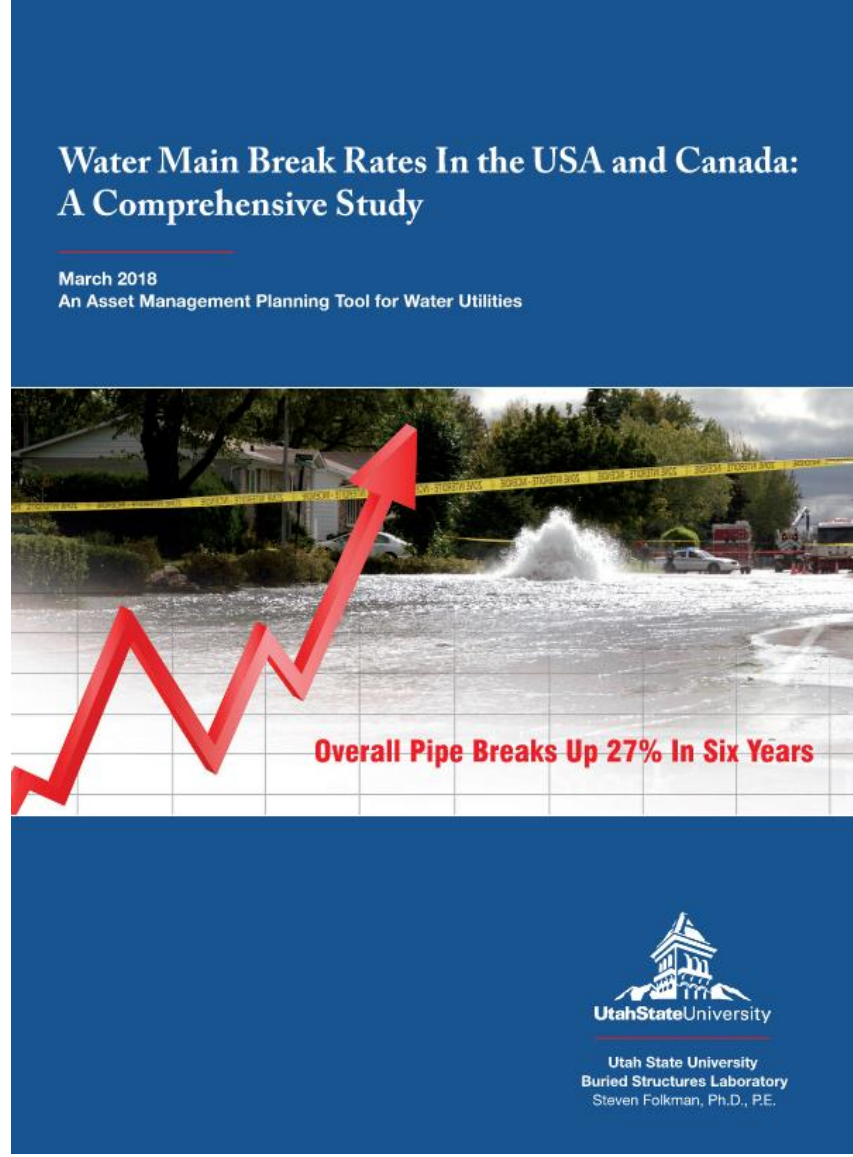
- MDC is a nonprofit municipal corporation chartered by the Connecticut General Assembly in 1929
- Mission is to provide customers with safe, pure drinking water and environmentally protective wastewater collection and treatment
- Provide water, sewer and household hazardous waste collection to its member towns and treated water to portions of non-member towns
- ~1,200 miles of sewer (combined and sanitary)
- ~1,600 miles of water main
- Existing pipes date as far back as the 1850s



Aging and Failing Sewer & Water Assets

- A major university study followed America's infrastructure failures from 2012 to 2018
  - Specifically analyzed drinking water, 300 Utilities serving 52 million people (14.5%) population, 200,000 miles of pipes
  - New England was solidly represented
  - Water breaks were found to have increased by 27%
    - Cast Iron breaks increased by 46%
- District is experiencing similar trend in water and sewer, i.e. more breaks, and more $ on emergency failures



Water Main Break Rates in the USA and Canada: A Comprehensive Study (2018)

Overview of District's Sewer and Water Infrastructure

District Sewer & Water Assets

- 2018 Asset Management Plan analyzed the District's sewer/water assets
  - Estimated sewer/water EULs (Estimated Useful Life) based on combination of industry standards and District's performance data
- Number of pipes close to/past EULs
  - Water: 72% of system is cast iron, of which 22% is within 25 years of (or past) its EUL
  - Sewer: 40% of system is clay, brick, or AC, of which 73% is within 25 years of (or past) its EUL
- Overall: ~**25% of sewer/water will be past its EUL within 25 years**
- **11% of system is 100 years old or more already**

Example EULs (sewer) from 2018 Asset Management Plan

Material	Description	Size	Install Decades	Length (ft)	Failure Rate	EUL (years)
CONC	Concrete	<=12"	1870 - 1959	10092	9.4%	100
		<=12"	1960 - 1979	3950	0.0%	100
		>12"<=24"	1910-1929	1008	6.7%	100
		>12"<=24"	1930 - 1989	19898	0.0%	100
		>24"<=48"	1900 - 1959	35172	10.7%	100
		>24"<=48"	1960 - 1979	2811	0.0%	100
		>48"<=72"	1870 - 1939	11729	6.7%	100
		>48"<=72"	1960 - 1969	821	0.0%	100
		>72"	1900 - 1919	382	6.7%	100
CONC Reline	Concrete Relined	All	1990 - 2015	11906	0.0%	100
		All	1850 - 1969	107405	10.4%	100

2018 Integrated Plan (IP) and Long-Term CSO Control Plan (LTCP)

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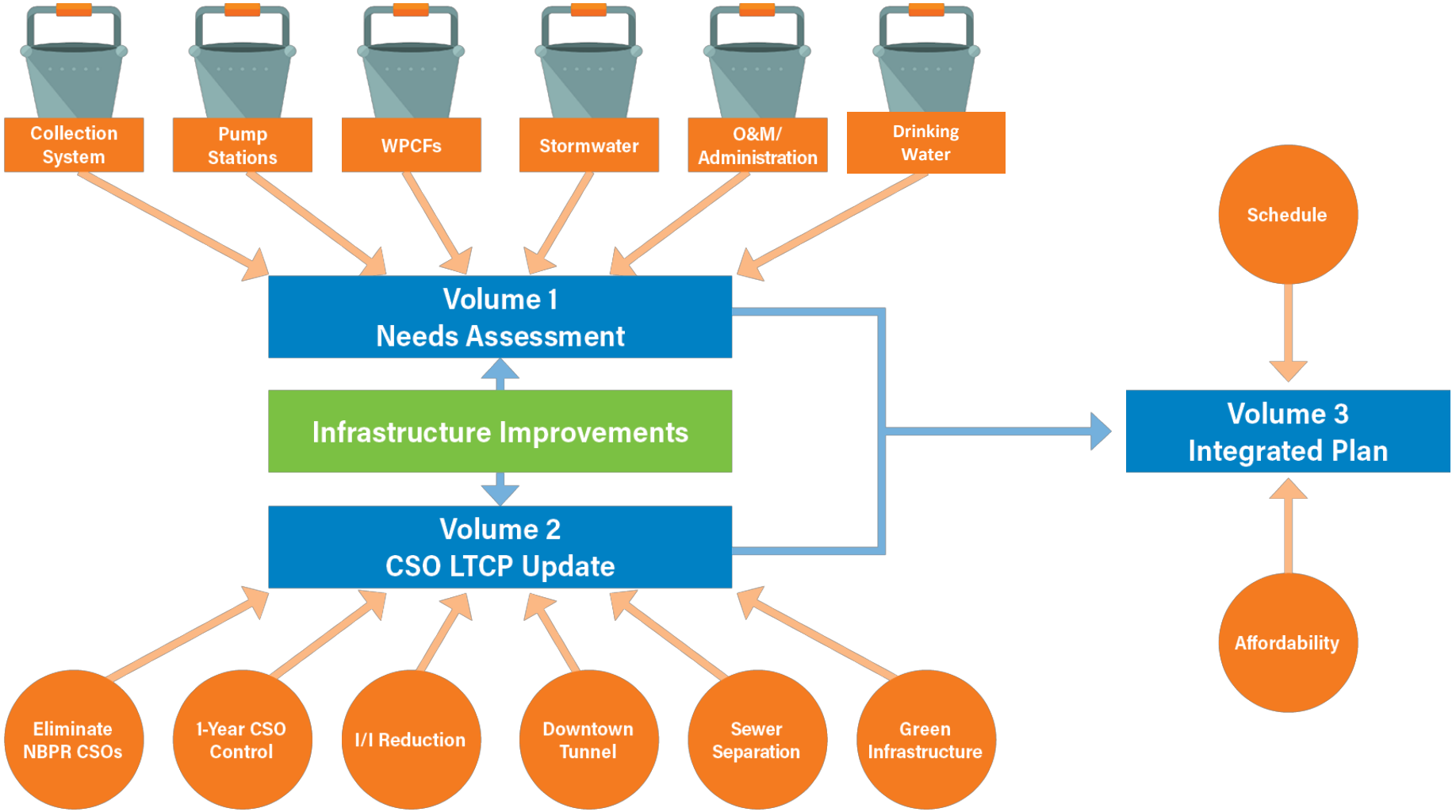
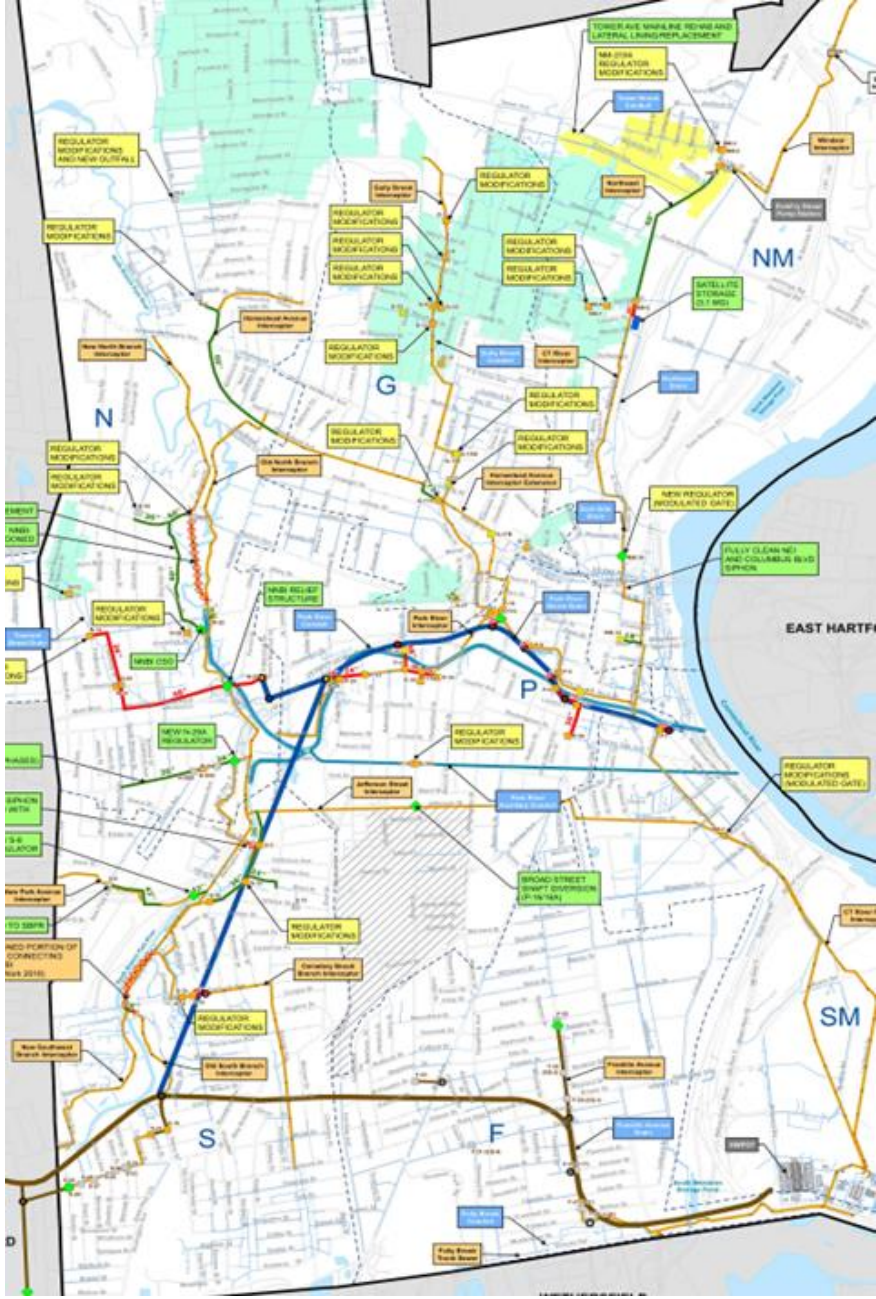


*Infrastructure improvements that satisfy a "**Need**" and accomplish **CSO reduction** ranked high

- **Sewer Renewal:** Dual benefit of repairing infrastructure proactively and controlling wet weather responses in areas. Able to integrate with aging water main infrastructure improvements

2018 Integrated Plan (IP) and Long-Term CSO Control Plan (LTCP)

- How to address aging infrastructure, yet still accomplish other requirements/needs?
  - The District formalized its 2018 IP and LTCP in 2018
  - Plan committed over $6 billion (2018 $'s) of water/sewer improvements over ~40 years
  - Integrates infrastructure improvement needs with the District's Consent Order/Decree requirements
- 40-year plan includes proactive rehabilitation (2018 $'s)
  - Over $400M of sewer replacement/rehabilitation
  - Over $1,300M of water replacement/rehabilitation
- Proactive over reactive approach to reduce costly emergency failures
- **<u>However, how to prove that a proactive plan is cost effective???</u>**



Evaluating Proactive Rehabilitation versus Reactive Repair

Proactive Rehabilitation Evaluation

Question proposed by members of District's Board: Is Proactive Rehabilitation the most financially sound decision? Why not "let the system break" and fix at a later date?

- To answer this, must estimate sewer and water replacement/rehabilitation spending in two different scenarios:
  - Scenario 1 - **"Proactive Rehabilitation":** The District maintains current sewer rehabilitation and water replacement program (per 2018 IP/LTCP recommendations)
  - Scenario 2 - **"Reactive Repair":** The District stops rehabilitation of sewer and water infrastructure, and performs repairs/replacement only as breaks occur

Capen Street Hartford
September 2018

Process

- Establish timeframe/forecast: 40 years (length of the 2018 IP/LTCP schedule)
- Establish costs to be evaluated: *Planned Rehabilitation + Repairs*
- Planned Rehabilitation costs:
  - In Proactive scenario, annual planned rehabilitation costs have been established by the District's 2018 IP/LTCP
  - In Reactive scenario, annual planned rehabilitation costs = $0 for all years
- Repair costs:
  - More challenging to estimate than annual planned rehabilitation costs
  - Need to estimate **cost and number** of repairs
    - How to estimate cost of repair?
    - How to estimate number of failures 40 years from today?

Cost Per Repair

- For a complete analysis, need to look at **all** aspects of a repair
  - Labor
  - Equipment, such as
    - Trucks, excavators, etc.
    - Trench support, pumps, generators, compactors, etc.
    - Cones and signs
  - Materials, such as
    - Pipe and fittings
    - Trench fill and road restoration
    - Other miscellaneous restoration (sidewalk, curbing, etc)

Can be as much as 40% of additional cost

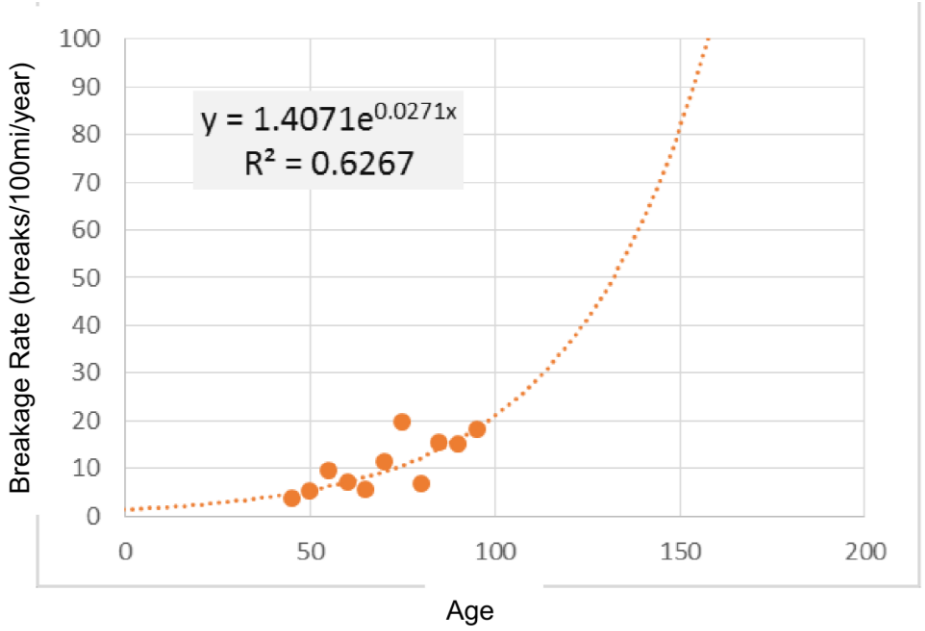
- Outreach to public, town officials, business owners, etc
- Traffic control (police, flagging, etc)
- Repair to nearby utilities
- Addressing health and safety needs
- Disposal of soils
- Oversight
- Engineering
- Loss of revenue (water)

Homestead Ave, Hartford
September 2017

- Unit cost established for in-house repairs vs. Contractor performed repairs
- As failures increase in Reactive scenario, must rely more on Contractor assistance, as District crews can only handle so much
  - Estimate that repair costs increases anywhere from 45% to 65% for Contractor to perform repair (primarily due to additional oversight, Engineering time, etc)

Number of Repairs

- To estimate number of repairs/breaks in Proactive and Reactive scenarios:
  - Must understand the make-up of system (age, materials, EULs)
  - Must understand current failures rates and how will they increase
    - Use deterioration curves (from Asset Management Report) to project increase in breaks
    - Use known defect rates that have been established through CMOM (Capacity, Management, Operation, and Maintenance) activities to project increase in failures



Example Water Main Deterioration Curve from 2018 Asset Management Plan

Example Sewer Main Failure Rates from 2018 IP/LTCP

Sewer Material	Percentage of Total System[1]	Potential Failure Rate (%)[2]
Asbestos Cement	8.8	6.8
Brick	2.4	34.6
Cast Iron	0.8	4.4
Clay Tile – Glazed	19.8	20.7
Clay Tile – Unglazed	6.0	33.0
Concrete	1.4	2.5
Lined	14.1	0.3
Plastic-Composite Truss	1.4	5.3
Plastic – Styrene Rubber	3.2	66[3]
PVC	30.0	1.3
Reinforced Concrete	9.7	2.7

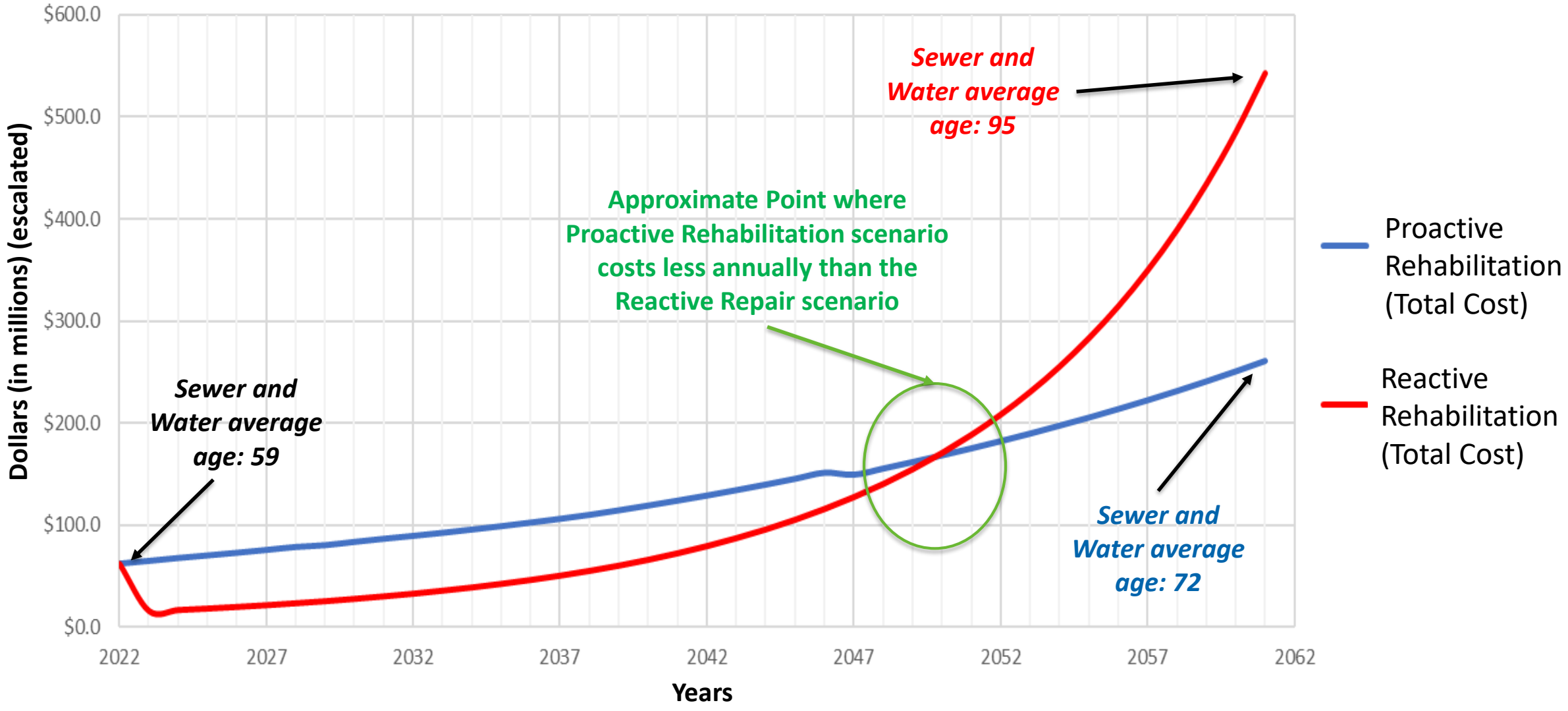
Conclusions

Calculation Results

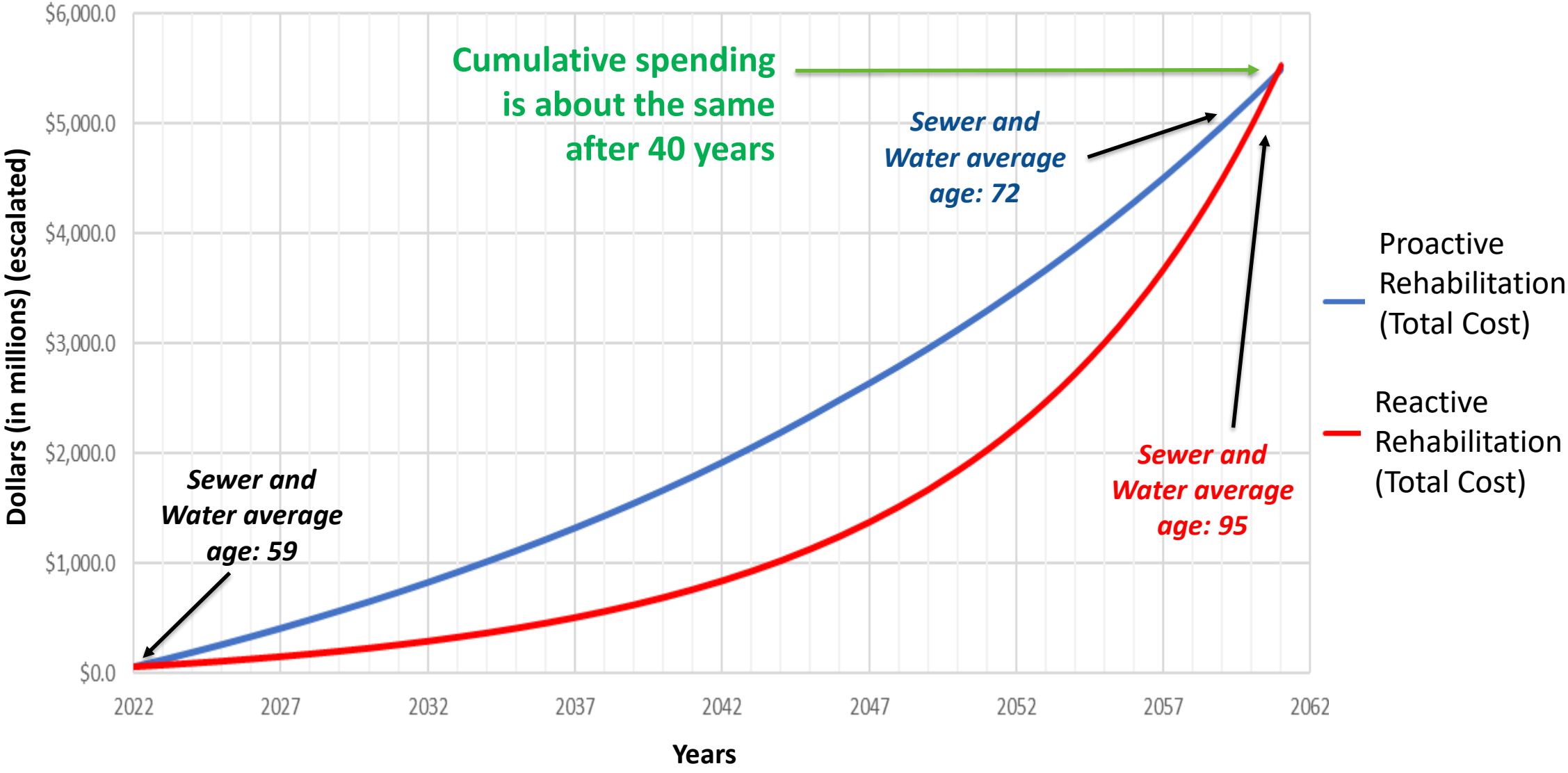
- Calculations showed that over 40 years:
  - In Proactive scenario: annual cumulative water and sewer repair spending would stay relatively similar over the 40 year schedule due to the large-scale rehab
  - In Reactive scenario: could increase over **7 times** by year 40

Year in the 40 Year Schedule	Proactive Scenario		Reactive Scenario	
	Water repairs	Sewer repairs	Water repairs	Sewer repairs
Year 1	$5M	$9M	$5M	$9M
Year 10	$7M	$6M	$8M	$13M
Year 20	$7M	$5M	$13M	$20M
Year 30	$7M	$4M	$26M	$32M
Year 40	$8M	$4M	$57M	$50M

Estimated Annual Sewer + Water Spending



Estimated Cumulative Sewer + Water Spending



Summary

- To understand the true costs of repairs, must account for other efforts outside of the more intuitive costs (labor, equipment, material)
- Must understand and project how breaks in system will accelerate
- Reactive Repair
  - Less expensive in short term
  - **After about 25 to 30 years, failures accelerate rapidly**
  - **By year 40, has become approximately twice as expensive annually (and increasing) to "keep up with" failures**
  - Likely need to incorporate "new" IP projects to offset loss of I/I reduction
- Proactive Rehabilitation/Replacement
  - More expensive in short term
  - Achieves quicker I/I reduction (reducing CSOs/SSOs)
  - **However, less expensive annually by the end of the schedule, and results in a reduced average age of infrastructure at the end of the schedule**
  - **About same amount of money spent through the 40-year program as Reactive**

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