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Prioritizing Sanitary Sewer Collection System Repair on an Aging System

Case Study - Norwalk CT

NEWEA 2022 Annual Conference

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Norwalk Water Pollution Control Authority

- Services over 70,000 people
- Over 200 miles of sanitary sewer
- 22 Pump Stations
- Estimated $20 Million in system repairs
- Over 75% of the collection system sewer pipe had been PACP inspected by 2016

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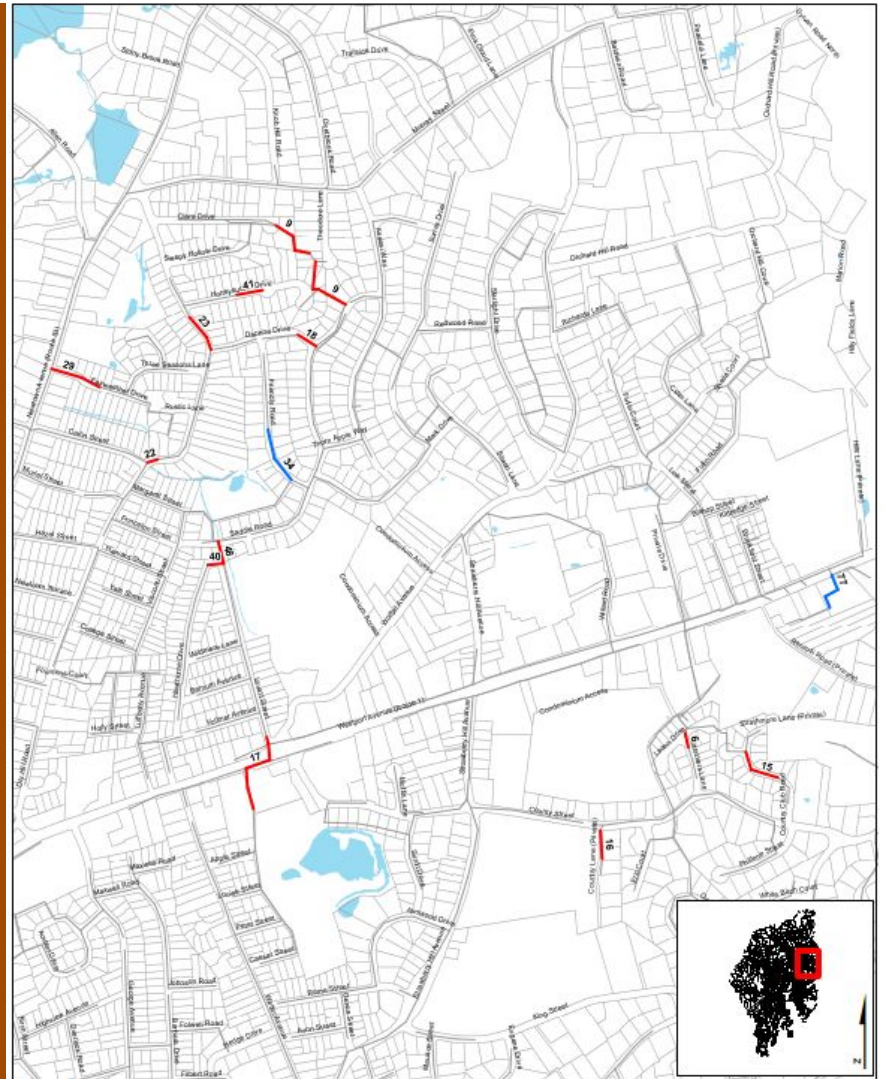

Where does a Municipality begin to take on millions of dollars' worth of system repairs?

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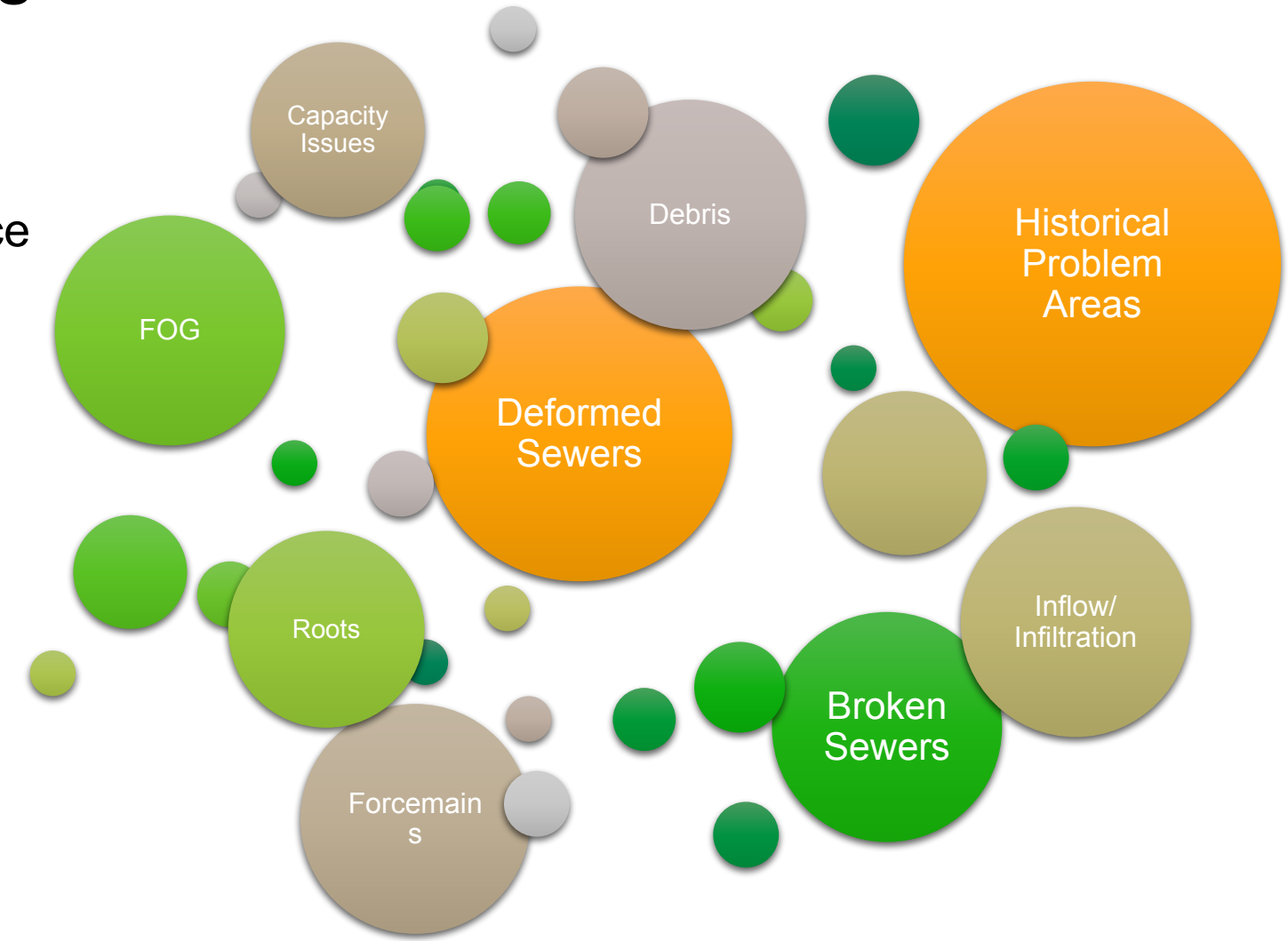
Collection System Repair Planning Process

Collection System Concerns

- Norwalk chose to focus on:
  - Broken/Deformed Sewers
    - Using Likelihood and Consequence of Failure Matrices
  - Historical Problem Areas (Hot Spots)
  - Force mains and pipes down stream of force mains



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Likelihood of Failure

- Pipeline Assessment and Certification Program (PACP) was used to code defects found on televised pipe segments and were used to develop the LOF matrix.

Likelihood of Failure (LOF) Matrix						
Likelihood Category	Wt.	Negligible=1	Low=2	Moderate=3	High=4	Severe=5
Critical Crossings	100%	Very good. Condition grade 1. New or nearly new. No defects. PVC pipe. All laterals are factory connections. Only normal maintenance required. **10-year cycle for CCTV.**	Good. Condition grade 2. Any concrete, clay, or PVC pipe with minor wear. Factory connections. **5-year cycle for CCTV.**	Fair. Condition grade 3. Major wear impacting level of service. Light cracks. No I/I. No roots. No protruding laterals. No obstructions to CCTV or breaks in connection. Does not need repair now, but should be monitored. **3-year CCTV for CCTV.**	Poor. Condition grade 4. Heavy roots. Lots of cracking. Pipe is still able to be cleaned. I/I. Poor shape with carious defects. Unable to meet level of service life. Failure imminent. **Yearly CCTV.**	Deteriorated. Grade 5. Requires complete rehabilitation or replacement. Too fragile to be cleaned safely. Failure imminent or has already happened. **Repairs must be scheduled.**

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Lessons Learned: Multiple Scoring Systems

- PACP Pipe Scores are determined based on interpretations made from the pipe defects detected during inspection. These interpretations have been known to miss critically deformed or broken pipes or exaggerate pipe condition.
- Using a second scoring system to augment PACP is beneficial because:
  - Shows inconsistency's between PACP and other scoring system
  - Can provide more information like I/I or maintenance needs.

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Consequence of Failure

Consequence of Failure (COF) Matrix						
Consequence Category	Wt.	Negligible=1	Low=2	Moderate=3	High=4	Severe=5
Service Area	20%	These pipe segments have no upstream tributary branches	These pipe segments have 2 upstream tributary branches	These pipes have 4 upstream tributary branches	These pipes have 5 upstream tributary branches	These pipes have more than 5 upstream tributary branches
	15%	Not crossing a major water body				Crossing a major water body
Critical Crossings	30%	Not crossing a railroad				Crossing railroad
	15%	Not crossing major thoroughfare				Crossing major thoroughfare
	20%	Pipe diameter is 8 inches or less	Pipe diameter is grater that 8 inches but less than 15 inches	Pipe diameter is greater than 15 inches but less than 27 inches	Pipe diameter is greater than 27 inches but less than 48 inches	Pipe diameter is greater than 48 inches
Total	100%					

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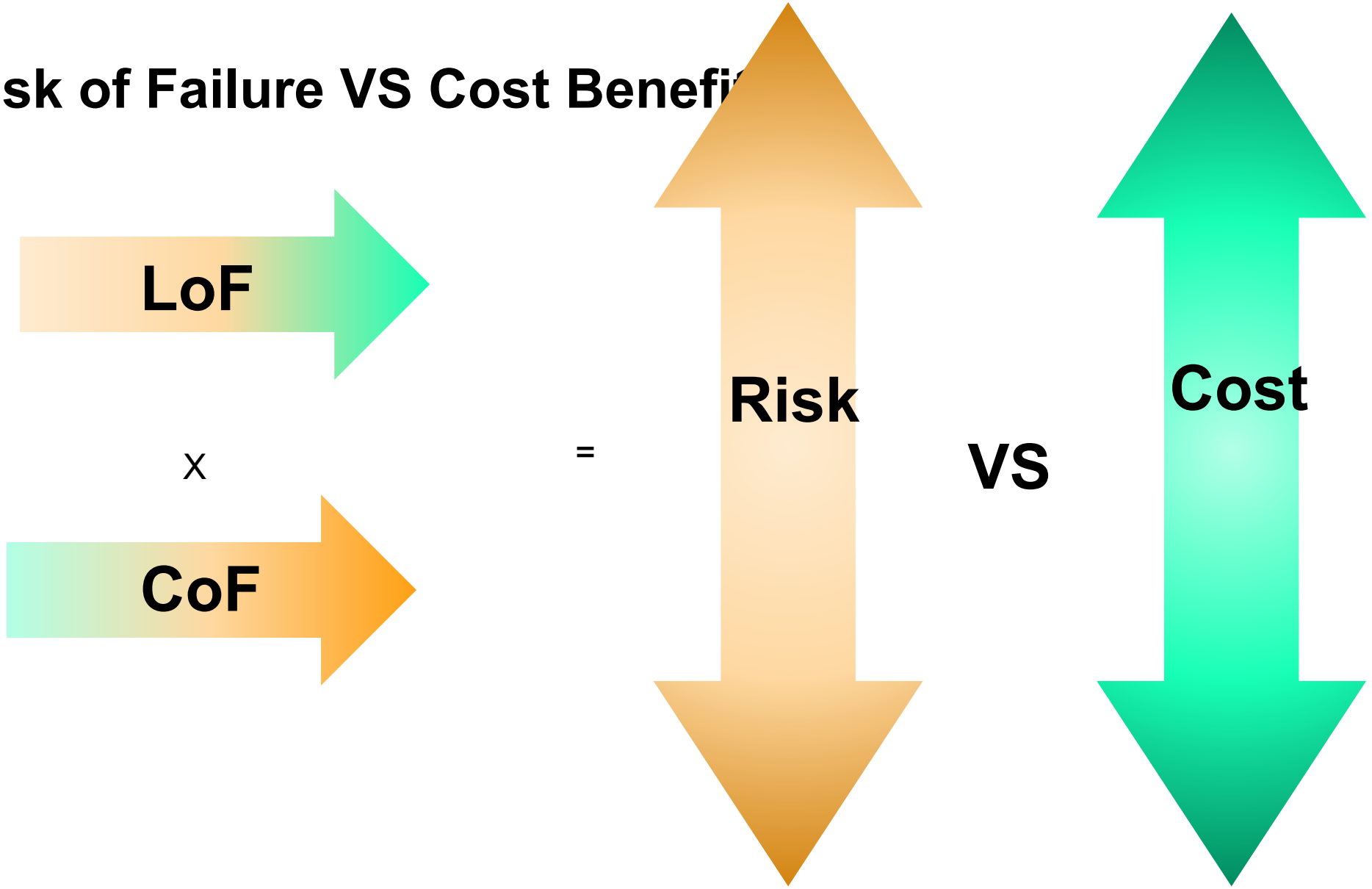
Risk of Failure VS Cost Benefi



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Hot Spots

- Sewers in need of cleaning quarterly or more frequently were routinely added to the Hot Spot list during cleaning activities.
- To develop a rehabilitation list Hot Spot items were evaluated to determine if:
  - Sewer rehabilitation was needed
  - Needed to be added to a watchlist
  - It should be left on the hot spot list
  - If it should be removed from the list

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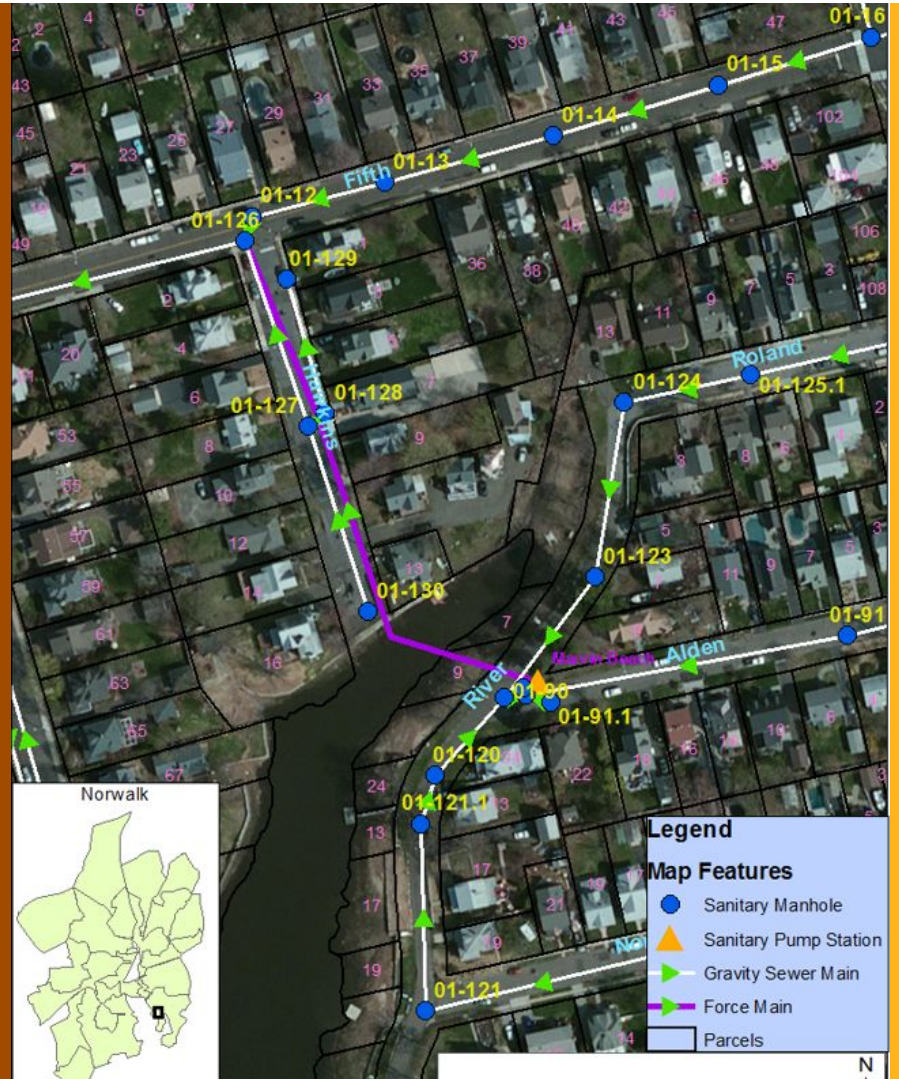
Force mains



- Marvin Beach Forcemain was selected to be repaired due to multiple pipe segment replacements taking place.
- Marvin Beach Force main broke during 90% design and was then completed under emergency conditions.
- Pipes down stream of other force mains were targeted due to H2S gas.

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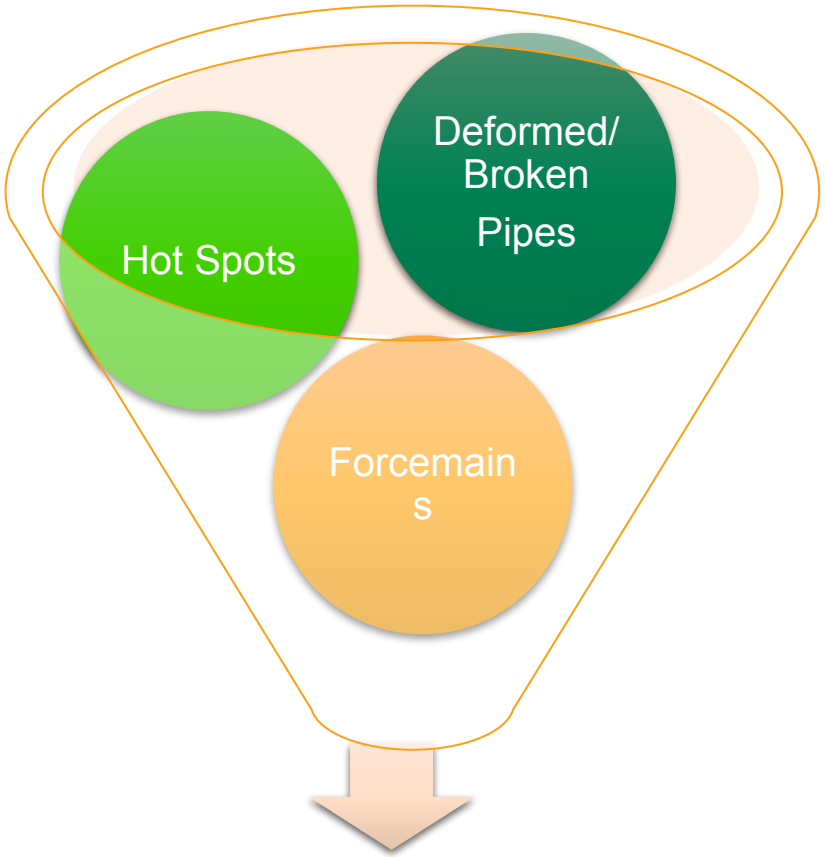
Initial Prioritized List of Repairs



$2.75M Sanitary Sewer Rehabilitation Project

- Targeted 36 pipe segments determined by Risk Analysis
- Out of 79 Hot Spot items
  - 43 locations needed sewer rehabilitation
  - 13 locations were put on a watch list
  - 12 locations will remain on the hot spot list
  - 11 locations were removed.
- Marvin Beach Forcemain Replacement

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Construction Phase

Pipe Replacement

Cementitious and Epoxy Manhole Lining

Cured-in-Place Pipe Lining

Sewer Repairs

Short Cured-in-Place Pipe Lining

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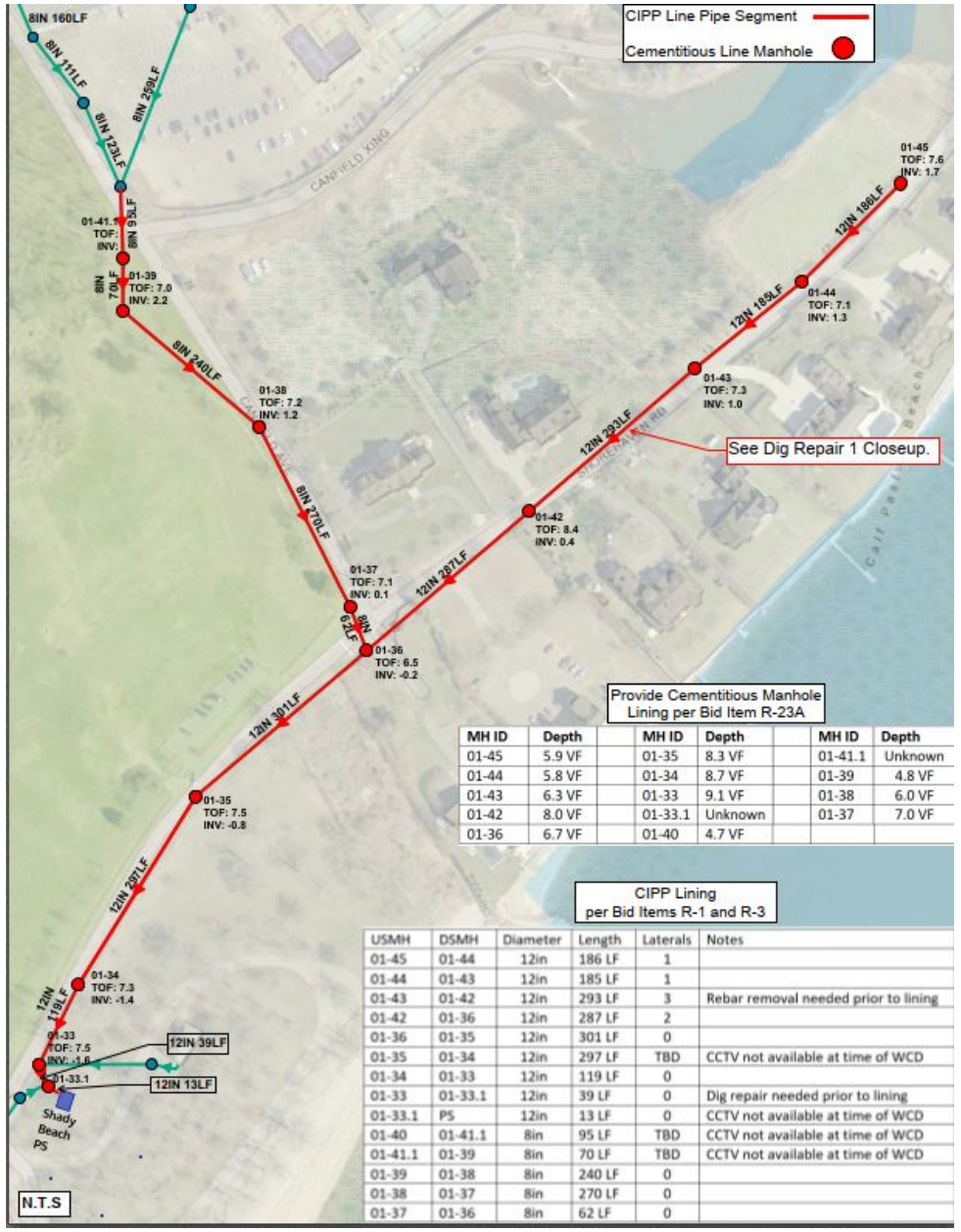
Program Modifications

- During construction, the WPCA decided to use funds for more sewer repairs.
- Hot spots put on watch list were included if needed
- Using the same risk analysis over pipe segments were added to the Contractors Scope.
- Pipe segments and manholes in Shorehaven Pump Stations tributary area were lined to aid in Infiltration removal.



MH ID	Depth	MH ID	Depth	MH ID	Depth
01-45	5.9 VF	01-35	8.3 VF	01-41.1	Unknown
01-44	5.8 VF	01-34	8.7 VF	01-39	4.8 VF
01-43	6.3 VF	01-33	9.1 VF	01-38	6.0 VF
01-42	8.0 VF	01-33.1	Unknown	01-37	7.0 VF
01-36	6.7 VF	01-40	4.7 VF		

USMH	DSMH	Diameter	Length	Laterals	Notes
01-45	01-44	12in	186 LF	1	
01-44	01-43	12in	185 LF	1	
01-43	01-42	12in	293 LF	3	Rebar removal needed prior to lining
01-42	01-36	12in	287 LF	2	
01-36	01-35	12in	301 LF	0	
01-35	01-34	12in	297 LF	TBD	CCTV not available at time of WCD
01-34	01-33	12in	119 LF	0	
01-33	01-33.1	12in	39 LF	0	Dig repair needed prior to lining
01-33.1	PS	12in	13 LF	0	CCTV not available at time of WCD
01-40	01-41.1	8in	95 LF	TBD	CCTV not available at time of WCD
01-41.1	01-39	8in	70 LF	TBD	CCTV not available at time of WCD
01-39	01-38	8in	240 LF	0	
01-38	01-37	8in	270 LF	0	
01-37	01-36	8in	62 LF	0	

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Lesson Learned: Pipe defects deteriorate quickly

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Program Summary

	Original Program Metrics	Final Program Metrics
Total Project Cost	$2,775,775.00	$5,361,426.45
Small Diameter CIPP (LF)	26,000	44,000
Large Diameter CIPP (LF)	4,000	6,000
Sewer Replacement (LF)	500	1,600
Short Liners (LF)	0	150

- CIPP – Cured-in-Place-Pipe
- VF – Vertical Feet
- LF – Linear Feet
- Small Diameter - 15inches or less
- Large Diameter – Larger than 15inches

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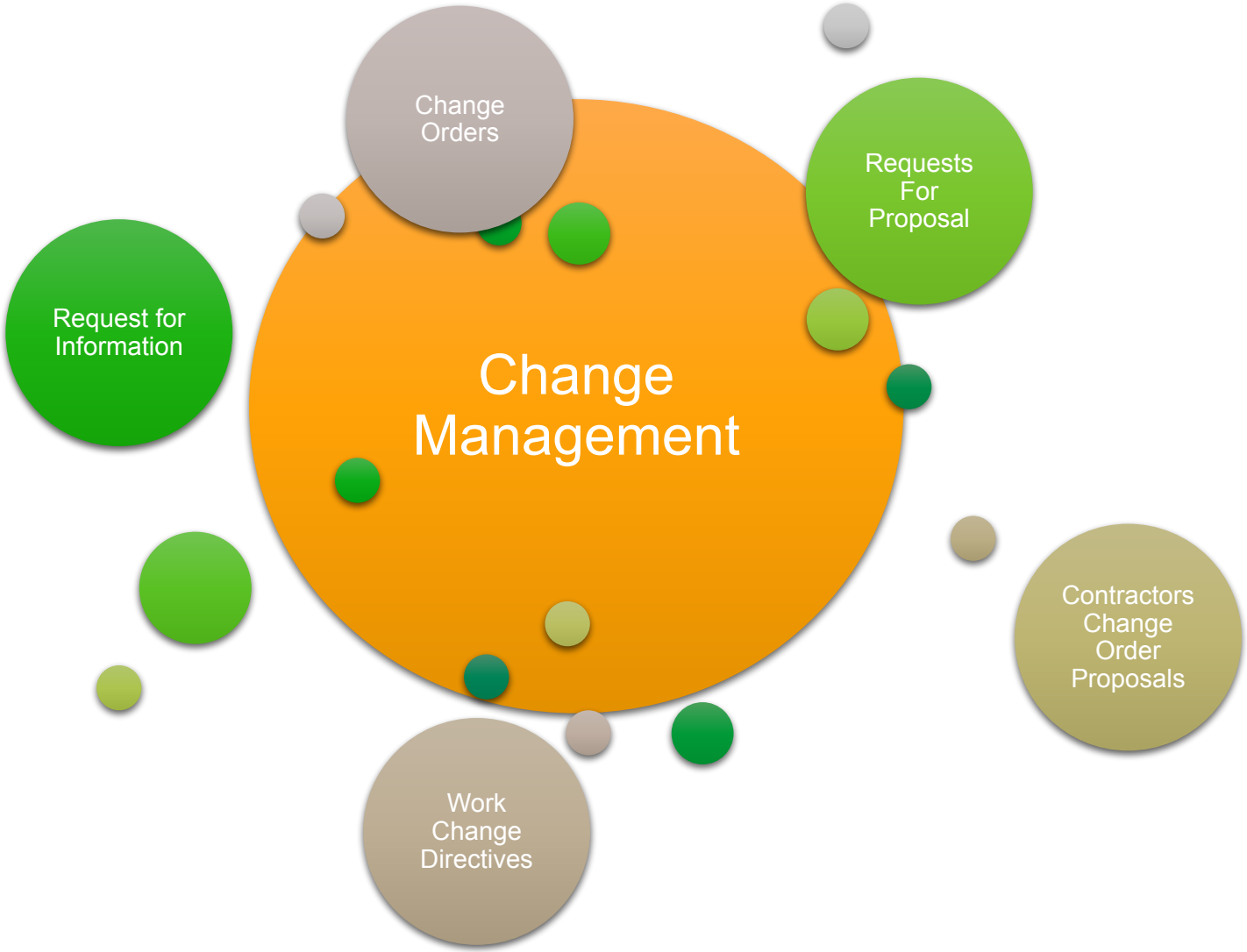
Construction Management Challenges



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Project Achievements

- Targeted Municipality Concerns in a cost-effective manner
- Added twice the scope to the original contract and was able to repair over 21,000 additional feet of pipe.
- Rehabilitated pipes prior to them needing to be replaced. Saving the client over 10x the cost of dig repairs by CIPP lining.

- Next steps - Target new concerns:
  - Large Diameter Pipe
  - Bottleneck areas
  - Forcemains
  - Prevent Other Utility Damage

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Questions?

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