

Metropolitan District of Hartford, CT Infiltration/Inflow Everywhere

Past, Present & Future Initiatives to address Public and Private I/I

MDC



Jason Waterbury, P.E.
Joseph Laliberte, P.E.

November 9, 2021



**CDM
Smith**

PNCWA/NEWEA Joint Webinar – Collection Systems Committee
Infiltration and Inflow Coast to Coast: Tools and Technologies Webinar

Agenda

- Background on The Metropolitan District of Hartford
- Early sewer rehabilitation efforts
- Sewer rehabilitation pilot study
- Developed Integrated Plan & combined sewer overflow Long-Term Control Plan (CSO LTCP) focused on aging infrastructure



Background on Hartford MDC

- Provides water and wastewater to greater Hartford area
- Population served about 400,000
- 4 wastewater treatment plants (stars)
- 1,200 miles of sewers dating back to mid 1800s



Typical Old Mill City with Brooks & Sewers

Hartford Daily Courant (1840-1887); Nov 3, 1877; pg. 4

CORPORATION NOTICES.

ASSESSMENT FOR RIGHT OF WAY FOR GULLY BROOK SEWER.

Street Department.

CITY OF HARTFORD.

The Board of Street Commissioners of the City of Hartford, acting as assessors of damages, pursuant to the provisions of section 8, chapter 402, of the acts passed by the Legislature of the State of Connecticut, in compliance with the ordinance of said city, having given due and legal notice of the time and place of meeting for the purpose of appraising the damages and assessing the necessary expenses to be levied out of a public sewer, from Edwards street and Liberty street, through private lands to the west side of the city, and thence northerly through Brook street to Albany avenue, that portion of same leading through private lands, being the same as follows: Commencing at the west end of the Edwards street culvert, and thence northerly, curving to the right with a radius of 200 feet for a distance of 25 feet, thence westerly curving to the left with a radius of 200 feet for a distance of 125 feet, thence westerly and northerly curving to the right with a radius of 400 feet for a distance of 141 feet, thence southerly in a line tangent to the last described curve for a distance of 20 feet, thence through lands now or formerly owned or occupied by Charles Collins, Robert Tamblin, Conception Waters, railroad company, and Charles A. Hartwell, now and formerly Blackwelder, etc. at the office of the board in said city on the 31st day of July, A. D. 1877, at 12 o'clock p. m., the time and place designated in said notice, and by adjournment from time to time did on the 31st day of October, 1877, at the same place, having viewed the premises and heard all the parties present and heard evidence, did make the following appraisement and award of damages as set forth in the several pages hereof, and maintain the same through their respective properties, and assessed the benefits upon the same persons who shall hereafter be found to be benefited by the construction of said sewer, and in the same proportions:

Charles Collins	\$ 100.00
Conception Waters railroad company	200.00
Robert Tamblin	75.00
Charles A. Hartwell	50.00
Total	\$ 325.00

And we find no damage to any other persons or party, loss or property.

JOHN C. BARROWS, Board of Street Commissioners

FRED S. BROWN, Assessor

JAMES EDWARDS, Assessor

E. E. HUNT, Assessor

JAMES EDWARDS, Assessor

City of Hartford, October 25th, 1877.

CITY OF HARTFORD.

CITY CLERK'S OFFICE, Nov. 1st, 1877.

A true copy as above in full effect.

Attest: **JOHN E. BRIDGE,** City Clerk.

Gully Brook Sewer.

CITY OF HARTFORD.

The Board of Street Commissioners have made the following schedule of proposed

MISCELLANEOUS ADVERTISEMENTS.

HOLMAN'S

Ague and Liver Pad

is marvelous in its prompt and radical cure for every variety of Liver and Bowel Difficulties. It contains only harmless vegetable compounds and is worn **E. X. C. T. E. Y.** **WATER.** **SECRET.** **It restores vitality, over the vitals, the liver and stomach. It resolves scrophulous humors, breaks up the stomach from its downward course, acting for purgation, torpor and constipation by giving it the general quantity of bile and gastric juice. It also restores the system with Nature's true juice. It purges all obstructions and obstructions in the stomach and bowels, thus restoring their natural way of circulation. It expels from the body every particle of BILIOUS MATTER, whether manifested or unmanifest, and leaves the system in perfect health. See by mail, free of charge, on receipt of 25 Cts. Address **HOLMAN'S LIVER PAD** 110 N. 7th Street, New York, N. Y., or 124 W. Fourth Street, Philadelphia, Pa., or Correspondent Address: **DR. JOHN M. HARTFORD.** All the drug stores keep them.**

Boots

RU

For the Pa

E. C. Hart

W

ONE

364 Main

The T

French

Cassimer

Box Toes

very hand

SOMETHING

For Lad

Boots are

York and

NEW

Boat an

NEW ENGLAND CONSTRUCTION

NOVEMBER, 1937



Construction of the sedimentation tanks at Hartford with the concrete plant at the left.

Metropolitan District Sewage Plant at Hartford

By WILLIAM A. D. WORTS
Assistant City Engineer, Hartford

probably take this time to flow through the tank. Flow through the tanks is continuous and not on the "fill and dump" principle.

THE sewage treatment plant of the Metropolitan District of Hartford is nearing completion and will be in operation early in 1938. The plant

Wastewater system issues – SSOs and CSOs

- 8 structural sanitary sewer overflows (SSOs)
- 84 combined sewer overflows (CSOs)
- Discharged over 1 billion gallons per year before 2005



Overflow from Manhole



Basement Backup



Structural Overflow to River

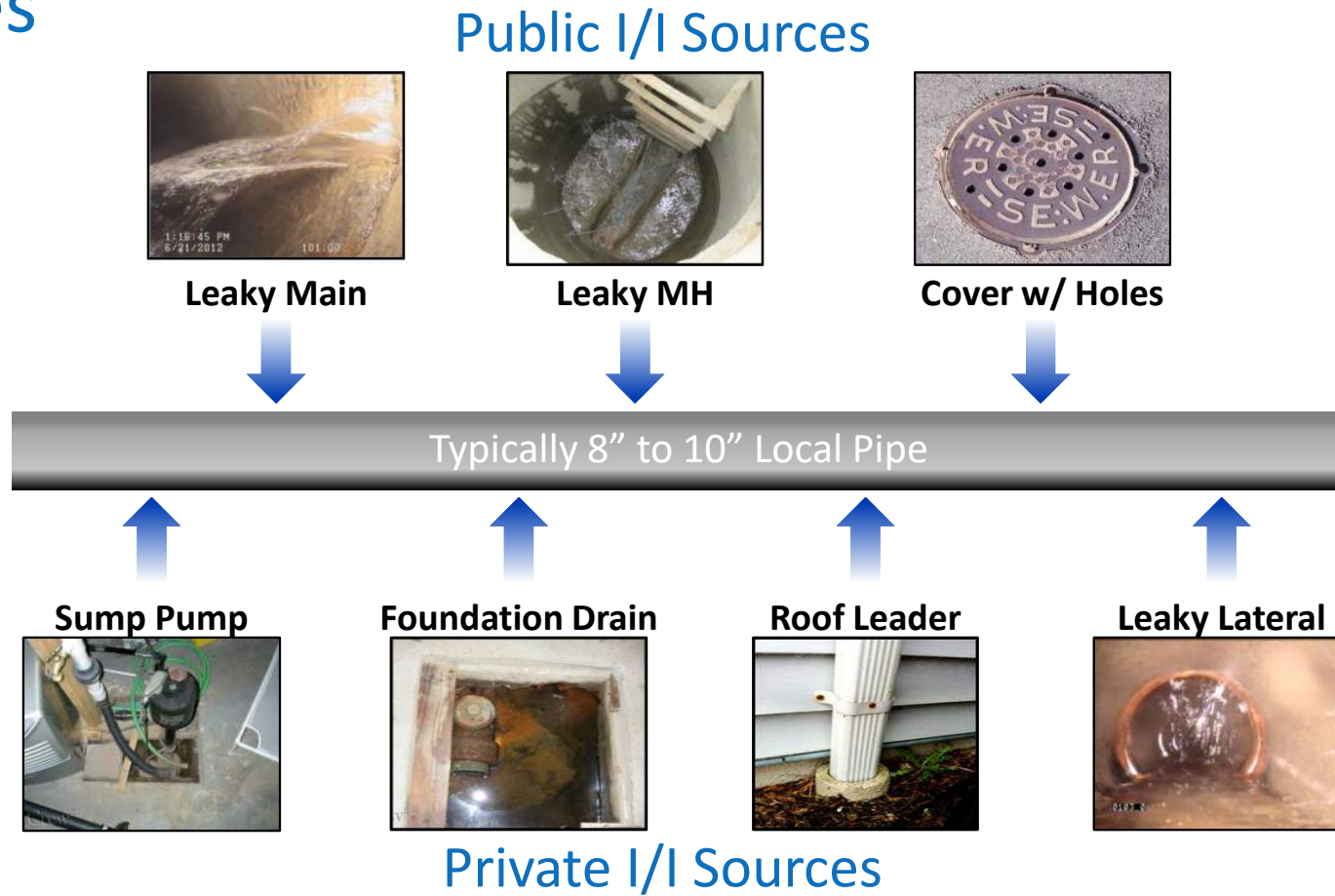
Clean Water Project (CWP)



- 2006 **Consent Order** from state (CT DEEP) for CSOs
 - Projects outlined in a Long-Term CSO Control Plan (CSO LTCP) report
- 2006 **Consent Decree** from USEPA for SSOs
 - Projects outlined in a SSO Master Plan
- Projects to date have reduced overflows by over 50%



Separated Sewer System Infiltration & Inflow (I/I) Sources



2005 to 2012: Early Sewer Rehabilitation

- Based on Phase I/II Sanitary Sewer Evaluation Survey (SSES) results
 - Primarily used traditional methods to find and remove I/I (i.e. flow metering/CCTV and trenchless rehab)
- 2005 CSO LTCP included goal to remove 10% I/I in each town
- **Public Inflow** outside of Hartford (SSO communities)
 - All removed when found
 - Replace manhole covers with holes
 - Removed any catch basins
- **Public Infiltration** outside of Hartford
 - Rehabilitated 17% of sewer system to date
 - Cured-in-Place Pipe (CIPP) lining & replacements
 - Point repairs/CIPP short liners
 - Manhole rehabilitation



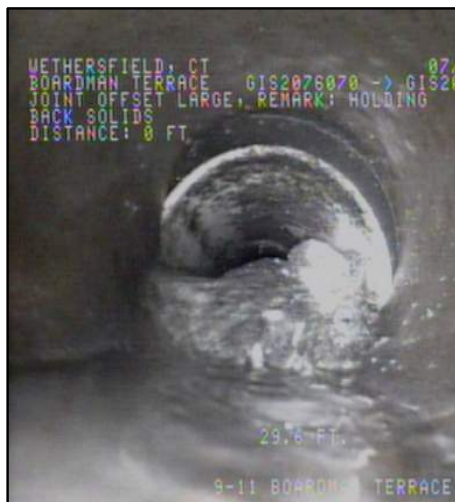
2005 to 2012: \$50M in Sewer Rehabilitation

Town	Sewer Main Lining (LF)	Pipe Replaced (LF)	Point Repairs (Ea)	Manhole Lining (Ea)	Manhole Sealing (Ea)	F&C Replaced (Ea)
Newington	161,419	1,396	1	142	39	763
West Hartford	503,112	16,469	169	403	21	1,617
Windsor	117,999	1,616	10	369	50	389
Wethersfield	169,122	2,522	15	361	43	453
Rocky Hill	22,031	0	2	90	0	142
Totals	973,683	22,003	197	1,365	153	3,364

2012 to 2014: \$25M Sewer Rehab Pilot Study

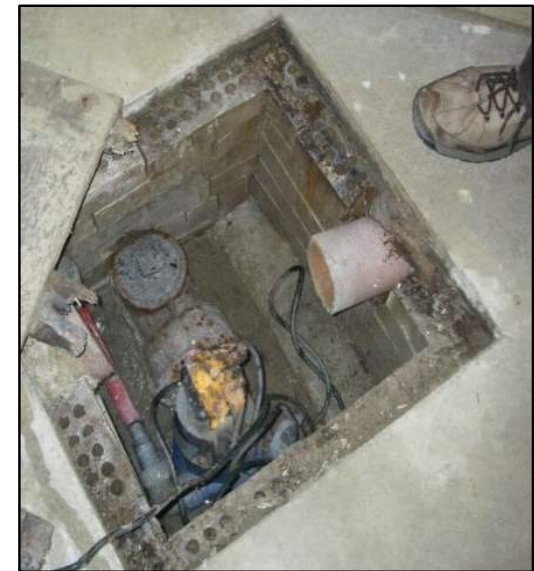
Objective

- Validate 10% I/I Reduction
- Develop 'Toolbox' of Rehabilitation Techniques
- Identify Cost Effective Solutions



Key Aspects of 5 Demonstration Projects

- 76,000 feet of mainline lining/replacement
 - 30 point repairs
 - 440 MH frame and covers
 - Lining 400 manholes
 - 100 top hats
- 28,000 feet of lateral lining/replacement
 - 100 private lateral removals



2012 to 2014: \$6M Four Mile Road Project

- Comprehensive approach on 40 acres (\$150k/acre)
 - Sewer main size increase -> 4,000 LF of 24" PVC sewer
 - Sewer lateral replacement -> 1,000 LF @ 80 services
 - Sewer lateral CIPP -> 1,200 LF @ 50 services
 - Private Inflow Removal -> 50 residential homes
 - 5,100 feet of collector drains/drain services
 - Drainage system improvements



2012 to 2014: Pilot Study/Four Mile Rd Results

Sewer Rehabilitation Technique	Removal %
■ Sewer lining only	5-25%
■ Full mainline/manhole rehab with top hats	25%
■ Full mainline/manhole plus lateral rehab	20-50%
■ Sewer lining only plus private inflow removal	20-75%
■ Full public/private rehab with private removals	50-75%

Pilot Study Lessons Learned

- Piecemeal approach = inconclusive results
 - Water migrates!
- Systemwide approaches are challenging
 - Each town/area/street/house is variable
- Systemwide vs. targeted area approach
 - Public and private
- Need to consider antecedent moisture conditions
 - Back-to-back storms and seasonal adjustments
 - Need to look at long-term simulations vs. just design storms

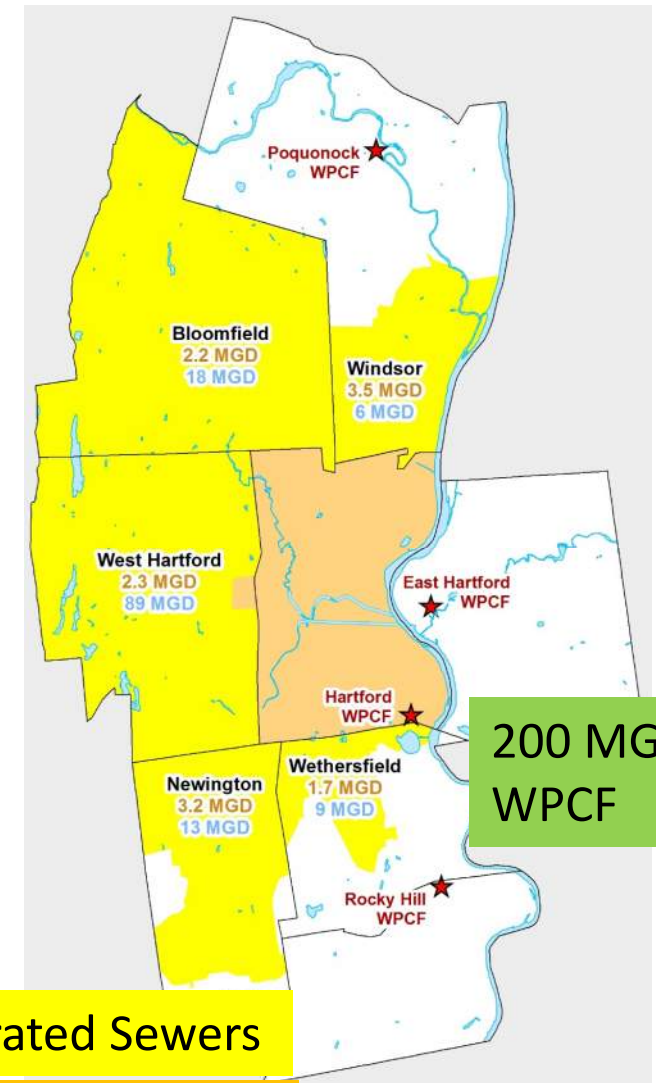
Average Costs of Various Techniques

Replacement (8" to 24", per LF)	CIPP Rehabilitation (8" to 24", per LF)	Point repair (8" to 24", per EA)	Manhole Rehab (per EA)	Private Inflow Removal (per home)	Lateral Top Hat (per EA)	Lateral Lining (per EA)
\$680 to \$1,250	\$70 to \$300	\$31,000 to \$50,000	\$3,750	\$25,000	\$4,000	\$6,000

* 2021 planning level costs including 25% contingency

Flow from “Separated” Towns After 2005 to 2014 Rehabilitation

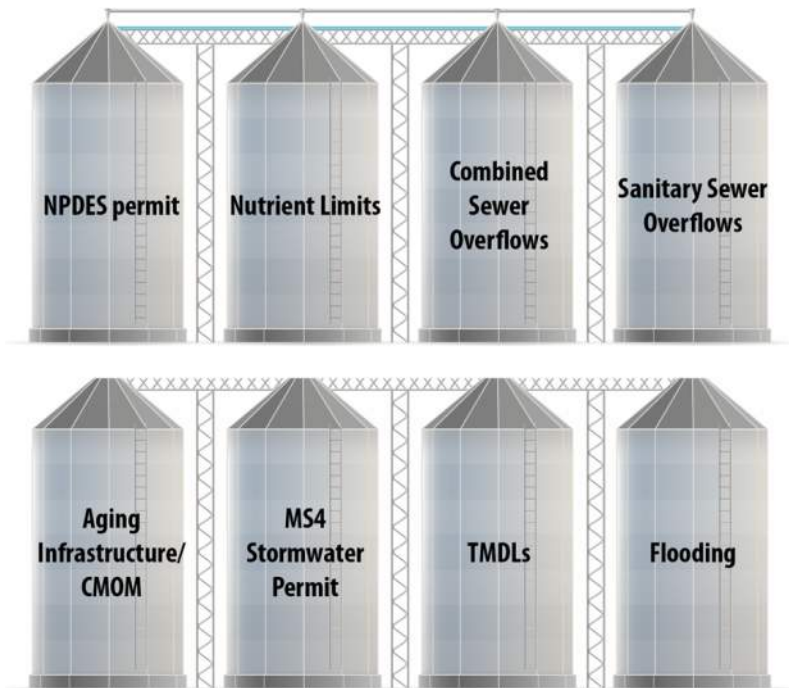
Member Town	Sanitary Sewer Flow (mgd)	Peak Wet Weather Flow (mgd)
Windsor	3.5	6
Bloomfield	2.2	18
West Hartford	2.3	89
Newington	3.2	13
Wethersfield	1.7	9
Total	13	135



*All towns consider excessive per EPA gallon per capita day for both dry and wet weather

Separated Sewers
Combined Sewers

2014 to 2018: Integrated Planning Eliminate the Silos



- Municipalities, Conference of Mayors and National Organizations plead for balanced approach
- 2012: EPA recognizes need and issues Integrated Planning Framework
- 2019: Bi-partisan bill signed into law (Water Infrastructure Improvement Act)

2014 to 2018: Shift Focus to Address Aging Infrastructure

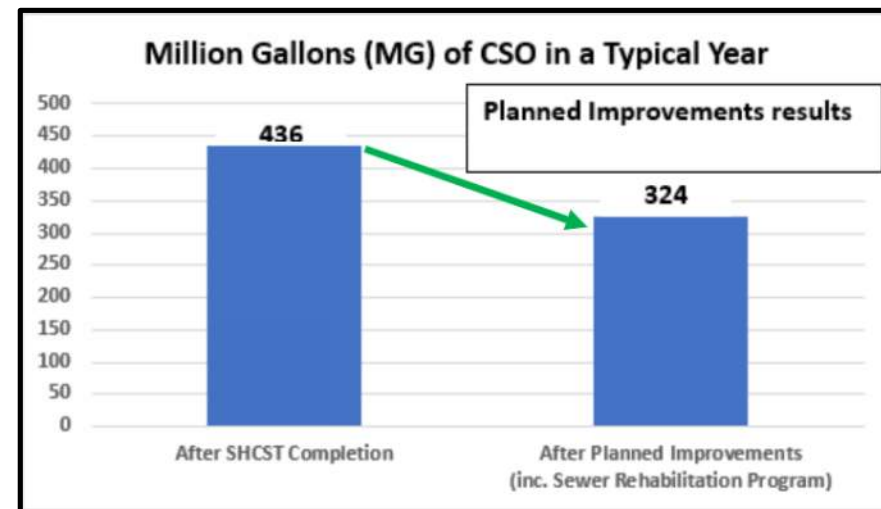
- 2017 Emergency Repairs = \$3.5M
 - 2018 Emergency Repairs = \$4M
 - 2019 Emergency Repairs = \$8.6M
 - 2020 Emergency Repairs = \$6.5M
 - 2021 Emergency Repairs = \$6.8M
-
- CMOM* program has identified **\$450M in additional repairs**

* Capacity, Management, Operation and Maintenance



2014 to 2018: Integrated Planning Address Failing Infrastructure

- Additional 10% I/I removal and interceptor cleaning program at a cost of about \$400M in HWPCF sewershed
 - Rehab of 33% of sewers -> maintain 50-year average pipe age
 - Rehab of 67% of sewers in Hartford -> reduce average pipe age from 74 to 39
- Reduce CSOs in typical year by 25%



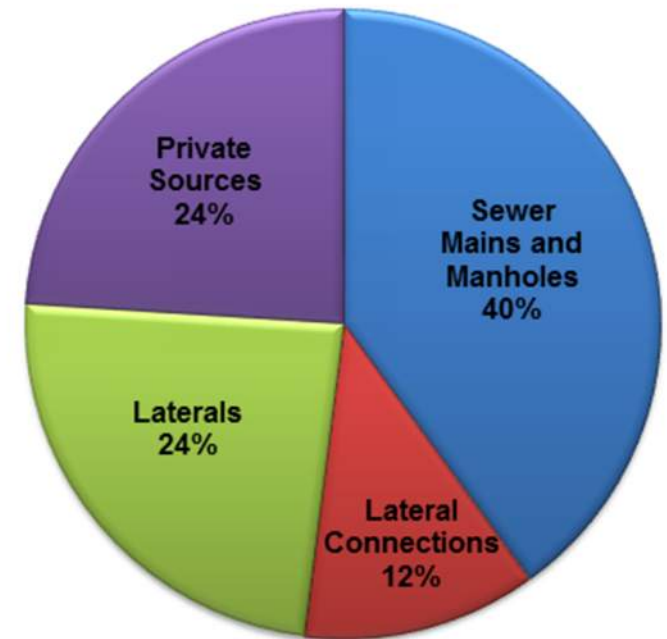
2019 to 2050: Sewer System Renewal = I/I Reduction

Town	Miles	Sewer Rehabilitation (%)			Sewer Age (years)		
		Completed	Recommended	Total	Prior to CWP (2005)	If Infrastructure Ignored (2043)	After IP (2043)
Bloomfield	118	6%	35%	41%	34 yrs	70 yrs	50 yrs
East Hartford	168	3%	23%	26%	45 yrs	81 yrs	62 yrs
Hartford	217	5%	67%	72%	74 yrs	107 yrs	39 yrs
Newington	128	27%	14%	41%	38 yrs	64 yrs	54 yrs
Rocky Hill	90	7%	10%	17%	30 yrs	65 yrs	59 yrs
West Hartford	223	36%	43%	79%	53 yrs	69 yrs	38 yrs
Wethersfield	122	32%	22%	54%	45 yrs	63 yrs	47 yrs
Windsor	152	18%	12%	30%	36 yrs	62 yrs	53 yrs
Total	1,218	17%	33%	50%	50 yrs	75 yrs	49 yrs

2019 to 2050: What about Private I/I?

- As public rehabilitation is completed larger I/I % from private side
- Houses predominately built with foundation drains connected to sewer
- Connections are now illegal
- Disconnection from MDC sewer requires connection to Town drains
- \$1B question: How paid??

West Hartford Composite



% Private = 60%

% Public = 40%

Stormwater and Private I/I Considerations

- Four Mile Road project confirmed the benefit of private I/I removal
- Towns need to address their stormwater issues/flooding
 - Urbanized area with high impervious area with undersized drain pipes
 - More frequent/high intensity rain events and development causes increased flow that exceeds capacity of the existing drainage system
 - High groundwater and poor draining soil
- Sewer Surcharging
 - Private property stormwater connections to sewer system
- Towns need to enforce their ordinances
 - Private I/I connections to sewer are illegal

Summary

- Accomplished a lot to date (last two decades)
 - Removed public inflow sources when found
 - 17% of sewer mains rehabilitated to date
 - Pilot projects show benefit of comprehensive rehabilitation with private I/I removal
- Long way to go (next three decades)
 - Integrated Planning provides multi-decade program to come
 - 33% more of system recommended for rehabilitation
 - Coordinating with towns/residents to remove private I/I connections



Questions