

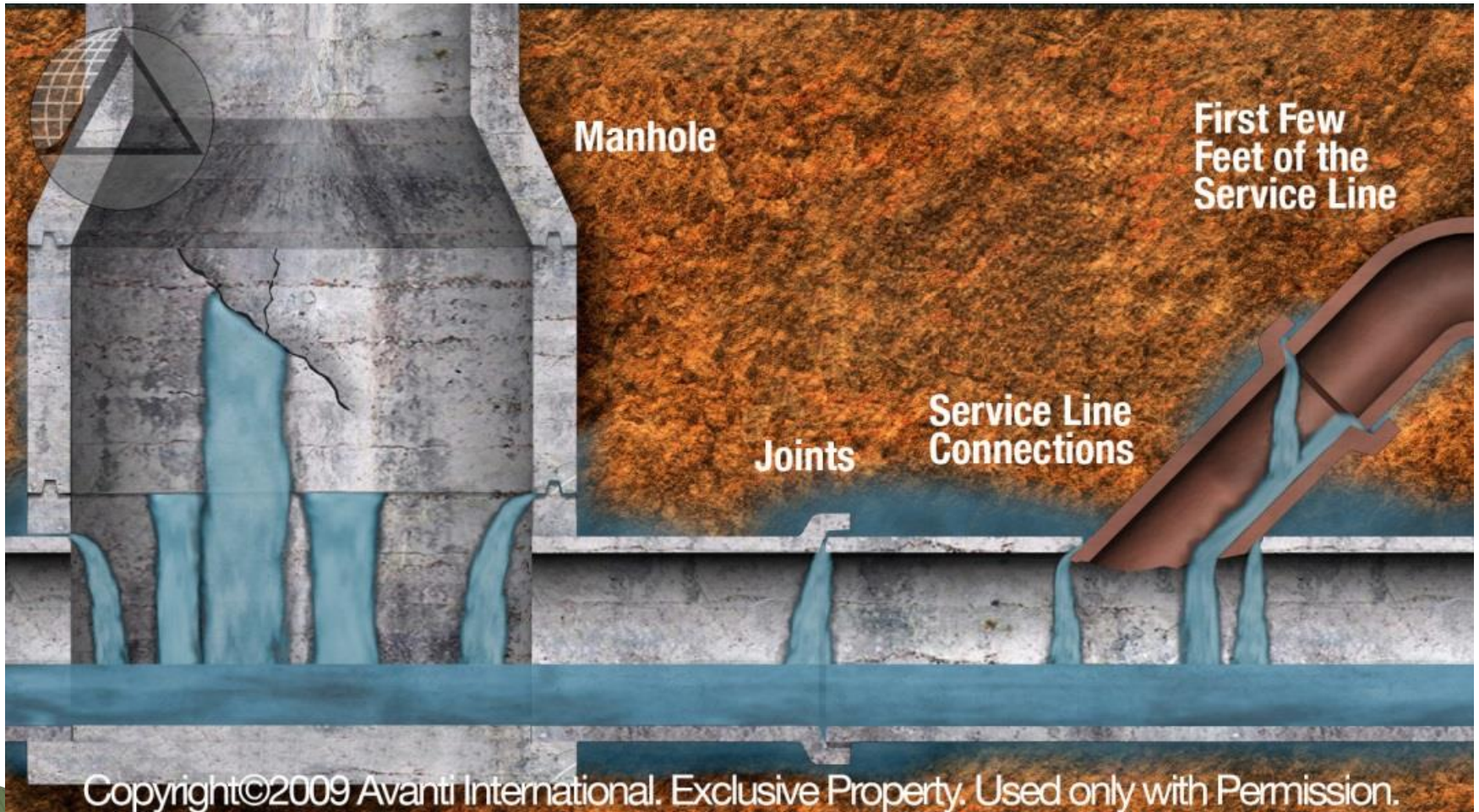
2016 WWOA Annual Conference

Cost Effective Private Property I&I Reduction Case Study - Wauwatosa, WI



Presented By:
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4 Sources of Inflow & Infiltration



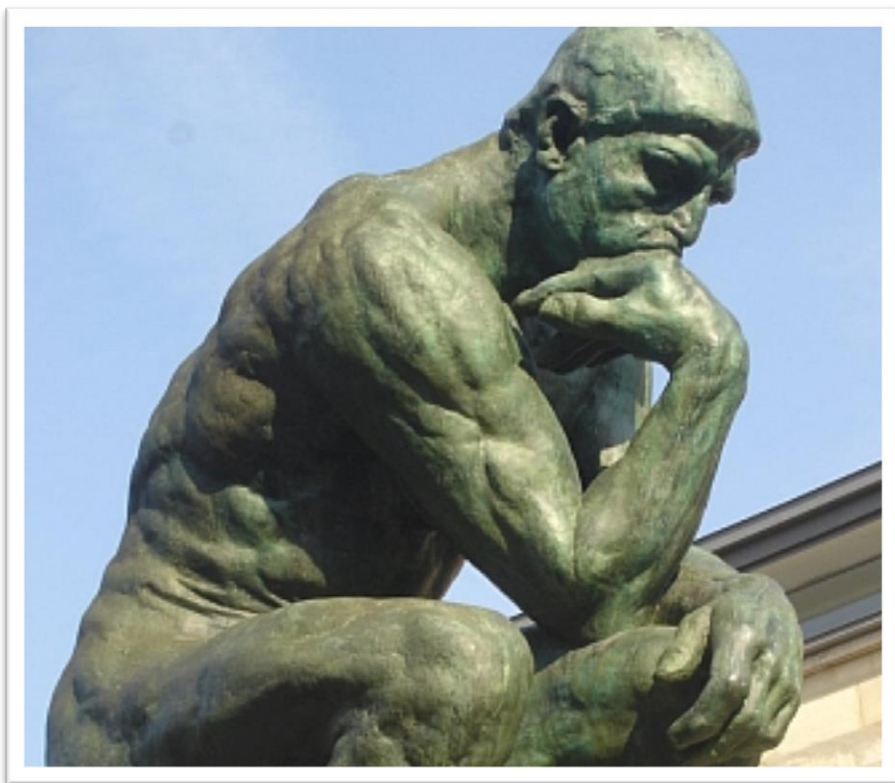
EPA Estimates

-The EPA estimates there are up to 75,000 SSOs per year (not including sewage backups into buildings).

General result of high wet weather flows when collection system see 100-500% increases in average daily flows.



Rehabilitation Technologies For I&I Removal



How can I get the most return from my investment?

Dig & Replace
Pipe Bursting
Cured-in-Place Pipe (CIPP)
Chemical Grouting

Cost Effective Private Property I&I Reduction Case Study–Wauwatosa, WI

Project Origination & Limitations

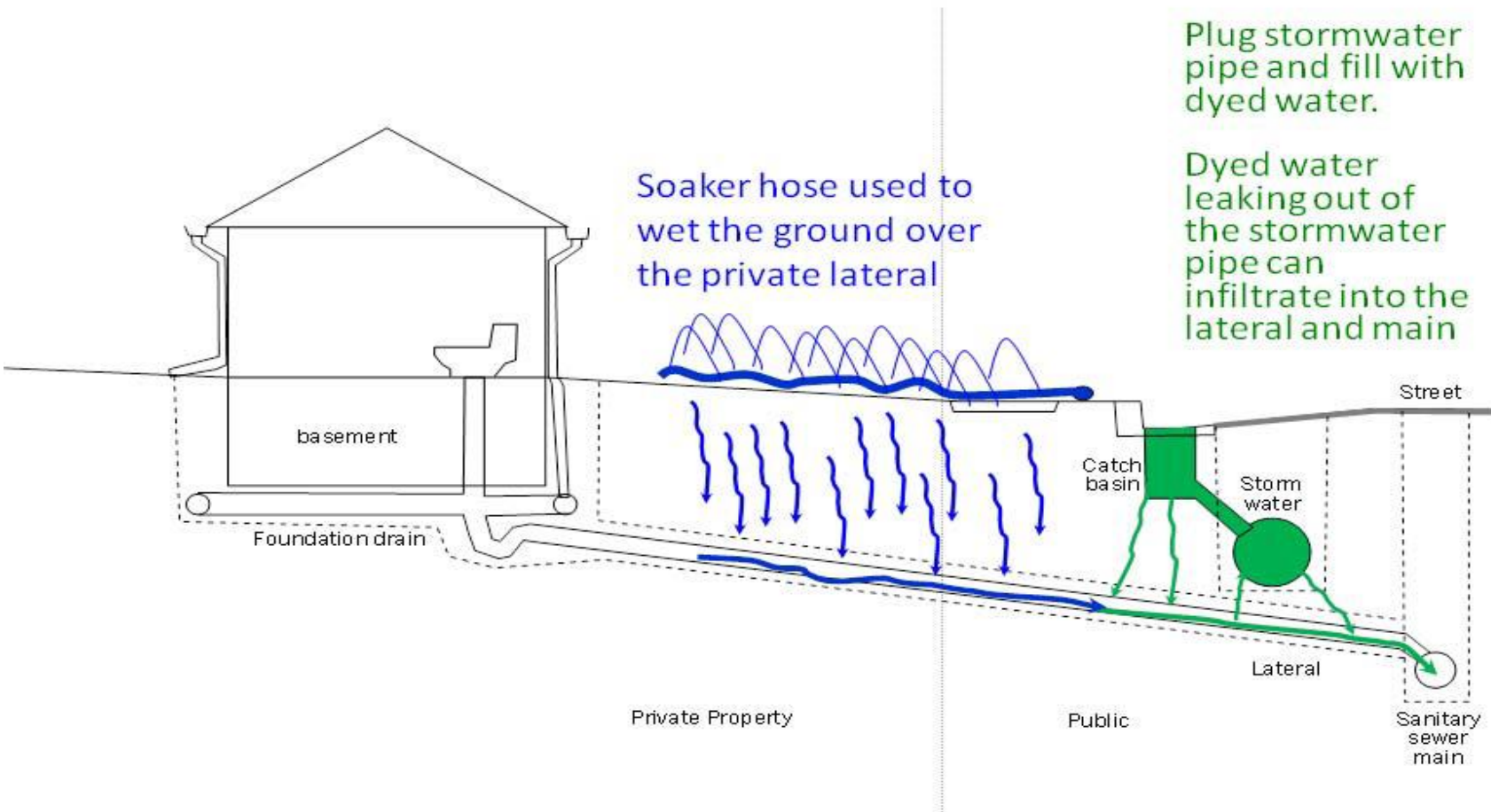
- Milwaukee Metropolitan Sewerage District:
 - 28 member communities
 - 2010 – 2020 Private Property I&I Program
 - Incentivize member communities to address PPII
 - Budget– \$59 million from 2011–2021
 - 80% rehabilitation & 20% investigation
 - Exceeding maximum flow limits

Project Approach

- Multi-phase investigative approach with rehabilitation
 - CCTV required as part of selected rehabilitation method
 - Rain event simulation:
 - Soaker Hose & Storm Sewer Dye Flooding
 - Flow monitoring – V-notch weir flow meter



Soaker Hose and Dyed Water Test



Round 0 (Pre-Rehabilitation)

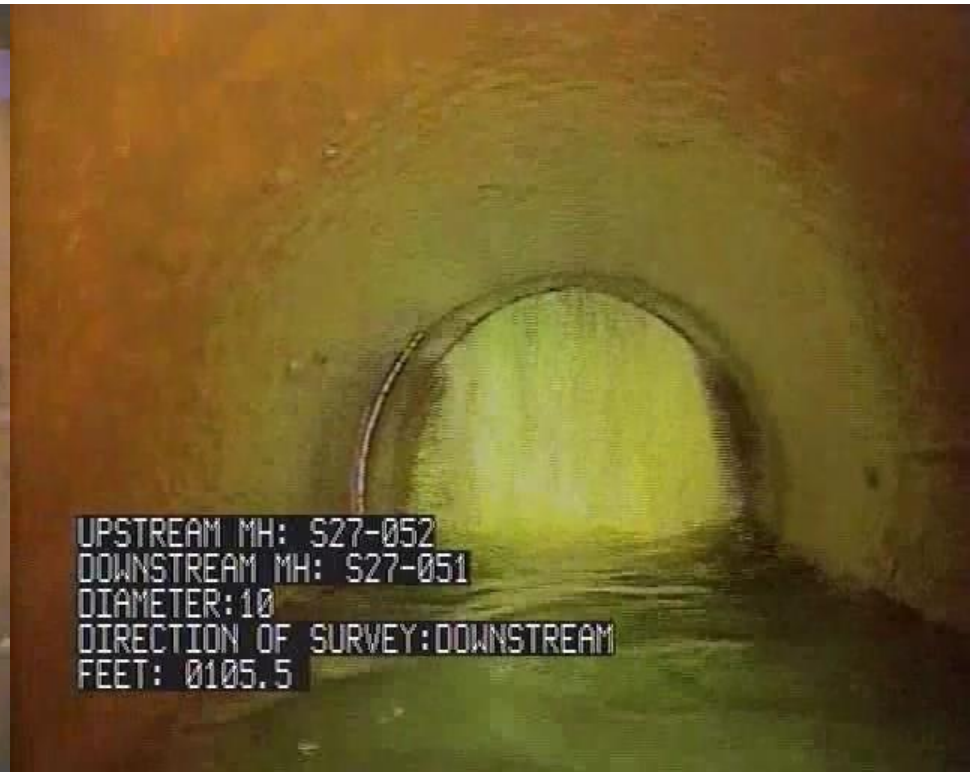
- Establishing Baseline Flows
 - 2011 storm sewer dye flooding
 - Manholes Surcharged to casting
 - Round one of soaker hose testing
 - 3" per hour simulated rain event
 - Soaker hose components
 - Nearby hydrants
 - LETS camera inspections
 - Lateral leak location detection



Round 0 (Pre-Rehabilitation)



Sewer main & lateral connection
prior to dye flooding



Sewer main & lateral connection
during dye flooding

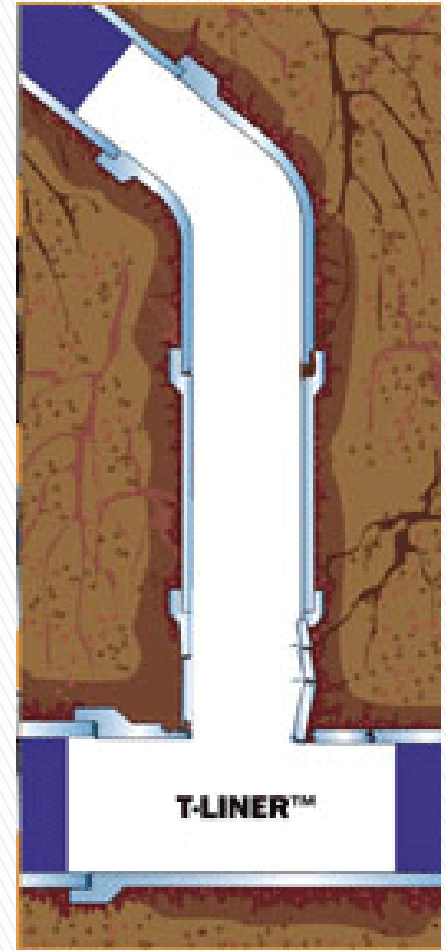
City of Wauwatosa PPII Investigative Pilot Project

Eagle St. (Between 76th St. & 80th St.)–2011 storm sewer dye flooding data.



Round A (Laterals in ROW)

- ROW lateral lining from sewer main
 - Sewer main previously lined with CIPP
 - Lined 30 feet with LMK T-liner
 - Required Vac-A-Tee near foundation
 - Second round of rain event simulation, CCTV inspection and flow monitoring



Lateral T-Liners & Vac-A-Tees

- T-Liner limited length without Vac-A-Tee upstream
- Up to 200' with a Vac-A-Tee



Round B (Targeted Laterals)

- Targeted laterals were lined from the ROW to the Vac-A-Tee near the foundation.
 - Laterals targeted–leakage rate of 5 gpm or more (During 2011 dye flooding project)
 - Approximately 30 additional feet with LMK lateral liner
 - Third round of rain event simulation, CCTV inspection and continuous flow monitoring

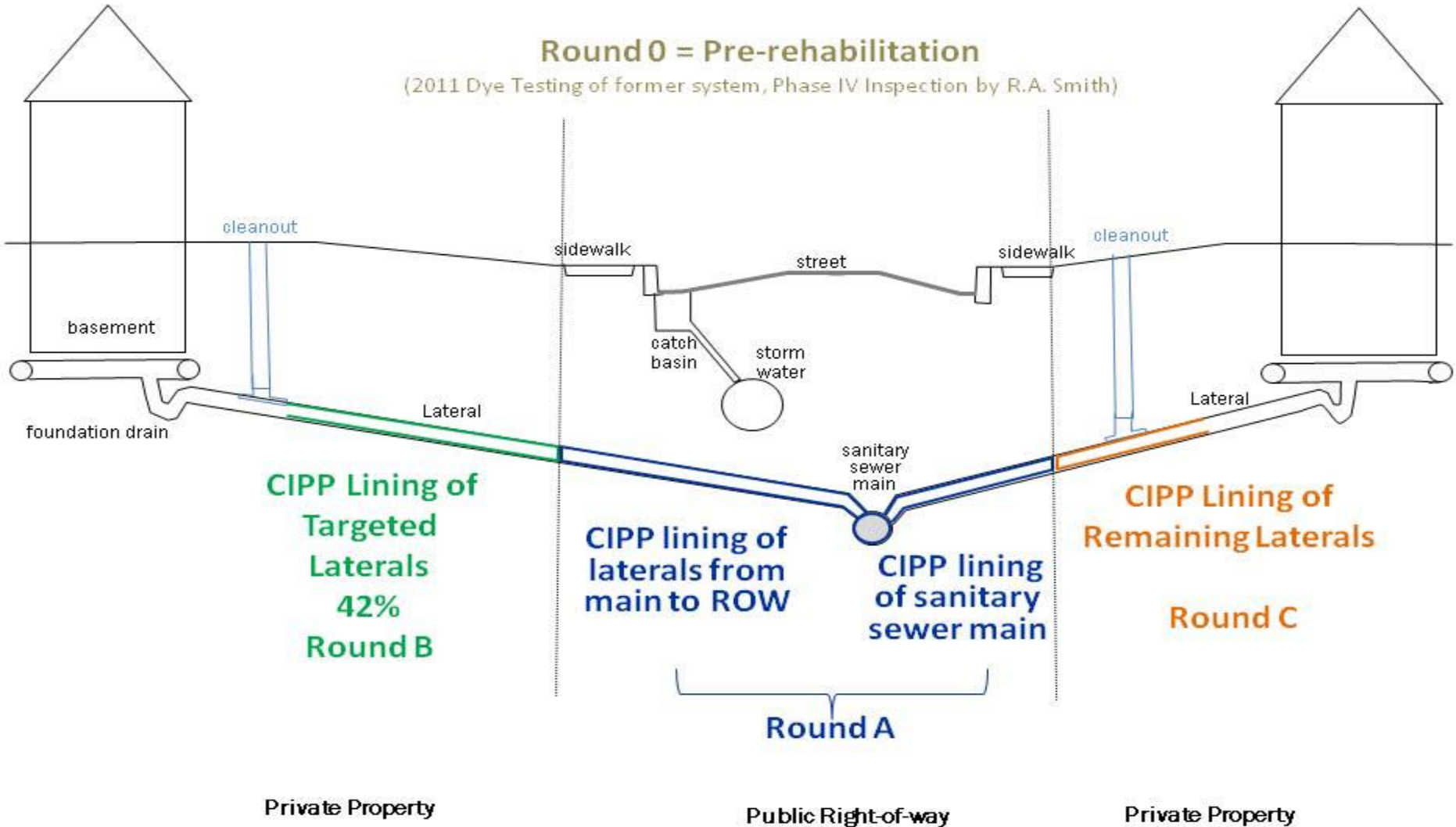
Round C (Remaining Laterals)

- **Remaining laterals were lined from the ROW to the upstream access point near the foundation.**
 - **30 feet with LMK lateral liner**
 - **Bury vac-a-tee access points**
 - **Fourth round of rain event simulation, CCTV inspection and continuous flow monitoring**

Eagle St.-Project Implementation Diagram

Round 0 = Pre-rehabilitation

(2011 Dye Testing of former system, Phase IV Inspection by R.A. Smith)

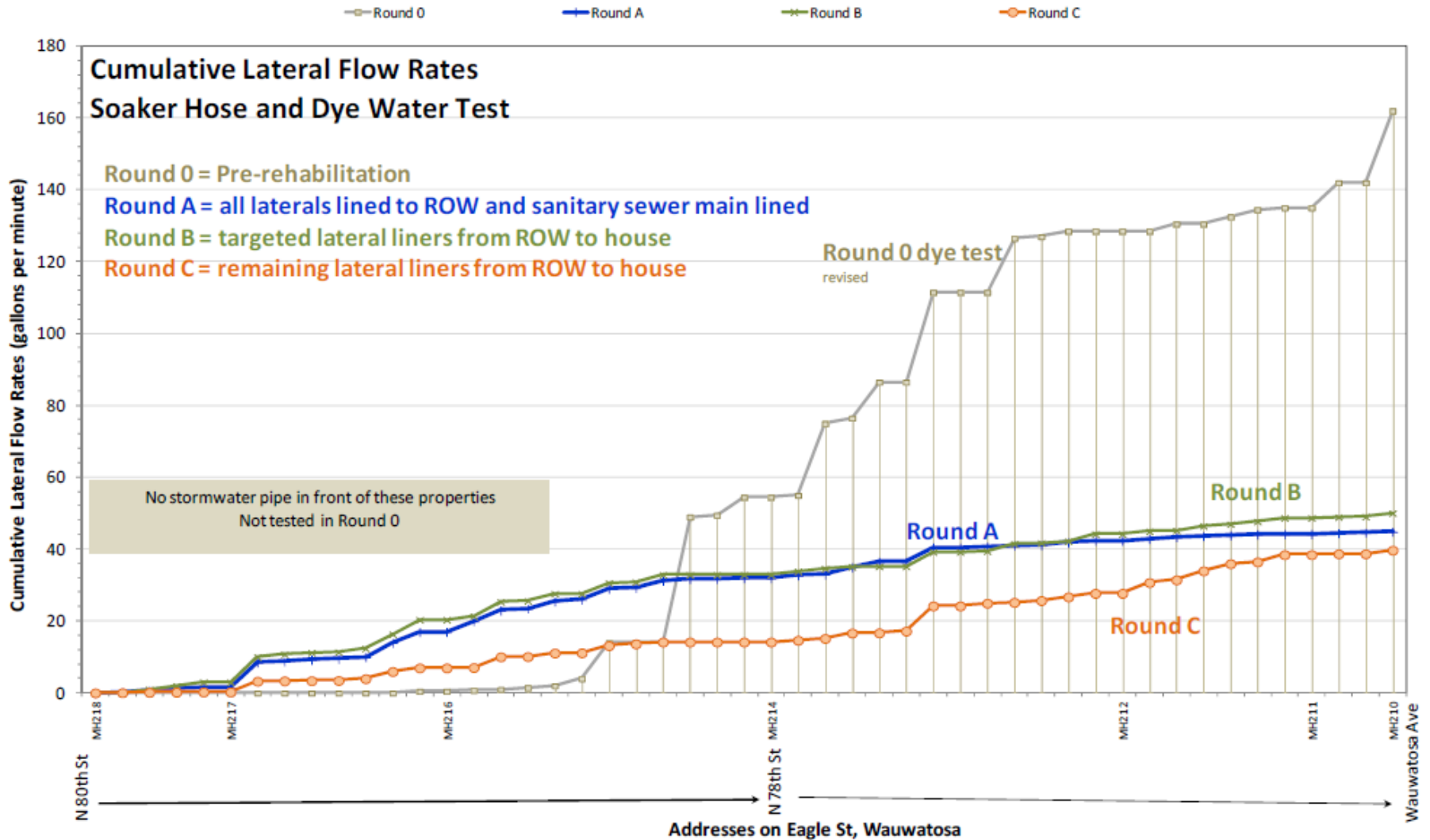


Private Property

Public Right-of-way

Private Property

Total Infiltration Reduction Diagram



Total PPII Reduction & Lining Costs

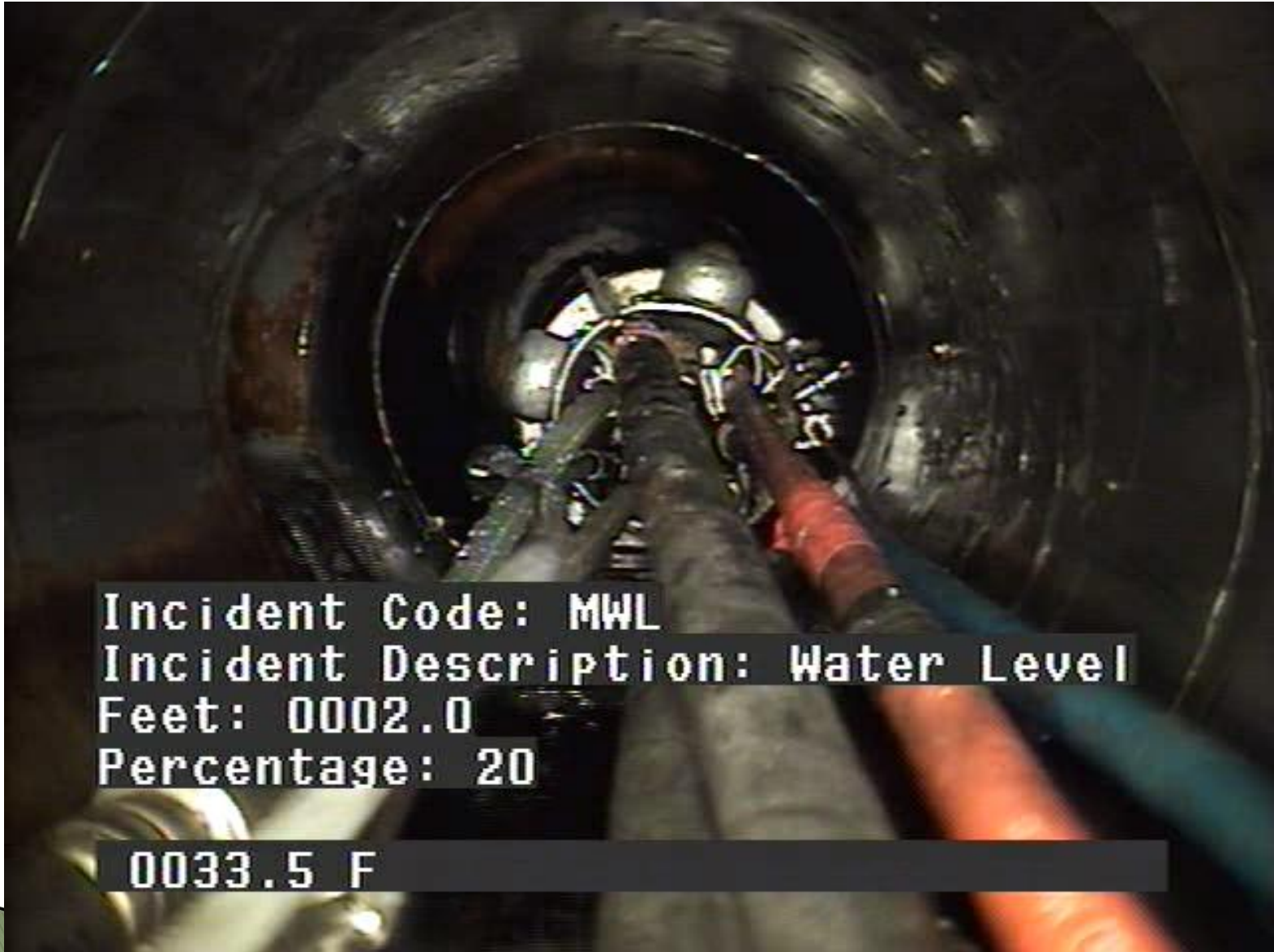
- Average of 75% cumulative PPII reduction
 - Foundation drains and sump pump connections
 - Majority of PPII reduction achieved in the ROW
- Estimated larger scope lining costs:
 - Sewer main to the ROW – \$4,700.00
 - Sewer main to the upstream access point– \$6,000.00
- Not cost effective solely for PPII reduction

The Quest for an Affordable Alternative

- Lateral & lateral connection chemical grouting
 - Acrylamide Grout (Avanti's AV100)
 - Effective– Stops leaks & stabilizes pipe
 - Affordable

- Contractors consulted for project parameters
 - LETS Lateral Inspections
 - Lateral cleaning & root cutting
 - Up to 15" mainline grout packers (readily available)
 - 5 foot lateral bladder lengths (high rate of success)

Lateral Grouting Example



Incident Code: MWL
Incident Description: Water Level
Feet: 0002.0
Percentage: 20

0033.5 F

Wauwatosa – Lateral & Lateral Connection Grouting Projects 2012–2014

- Grouting Challenges:
 - Protruding laterals
 - Root & deposit blockages
 - Structural defects
 - Tuberculation
- Solutions:
 - Mainline & Lateral jetting/cutting
 - Excavation or elimination?



City of Wauwatosa 2014 Lateral & Lateral Connection Grouting Project

- Project scope: 931 private sanitary sewer laterals in sewer basin WA 4002
 - 8" – 15" sewer main diameters
 - 5 gallons per lateral (AV100 or equal)
 - Removal of 83 protruding laterals
 - Root removal from 56 laterals (Mains & manholes)
 - CCTV connection verification of 78 laterals

City of Wauwatosa–2014 Lateral & Lateral Connection Grouting Project

- Actual project quantities:
 - 857 laterals grouted (92 % of planned quantity)
 - 77 protruding laterals (92.7% of planned quantity)
 - Root removal 79 laterals (141% of planned quantity)
 - 2,993 gallons of excess (\$8.00 per gallon)
 - City of Wauwatosa video review estimated 25% PPII reduction

2014 Project Costs vs. Benefits

- Lateral Lining (ROW):
 - 75% reduction in overall PPII
 - \$4,700.00/ lateral (Estimated)
 - \$4.02 million for 857 laterals
- Lateral & Lateral Connection Grouting:
 - 25% reduction in overall PPII (Estimated)
 - \$469.49/lateral (Actual)
 - \$402,352 for 857 laterals–10% of the cost to achieve a 33% reduction
 - 3.3 times greater reduction in PPII volume (dollar for dollar)

Conclusions & Future Projects

- Grouting laterals and lateral connections:
 - Effective, Affordable, Sustainable
 - Lining laterals for PPII & structural rehabilitation
 - Public vs. private benefits
 - Lining solely for PPII reduction
 - Cost prohibitive for large scale
 - Not financially sustainable



Questions?

