



# **NARUC Summer Meeting**

**Dallas, Texas**

**Pipeline Safety:**

**Cross Bores - The Next Safety Frontier**

**July 15, 2014**

**By: Mark Bruce, President,  
Cross Bore Safety Association**

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# Cross Bores - Recognized in 1976

- 2 persons killed
- 4 persons injured
- Entered house through 6” sewer lateral
- Drain cleaner punctured 2-inch plastic main.

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

FOR RELEASE: 6:30 A.M., E.S.T., NOVEMBER 12, 1976

(202) 426-8787

ISSUED: November 12, 1976

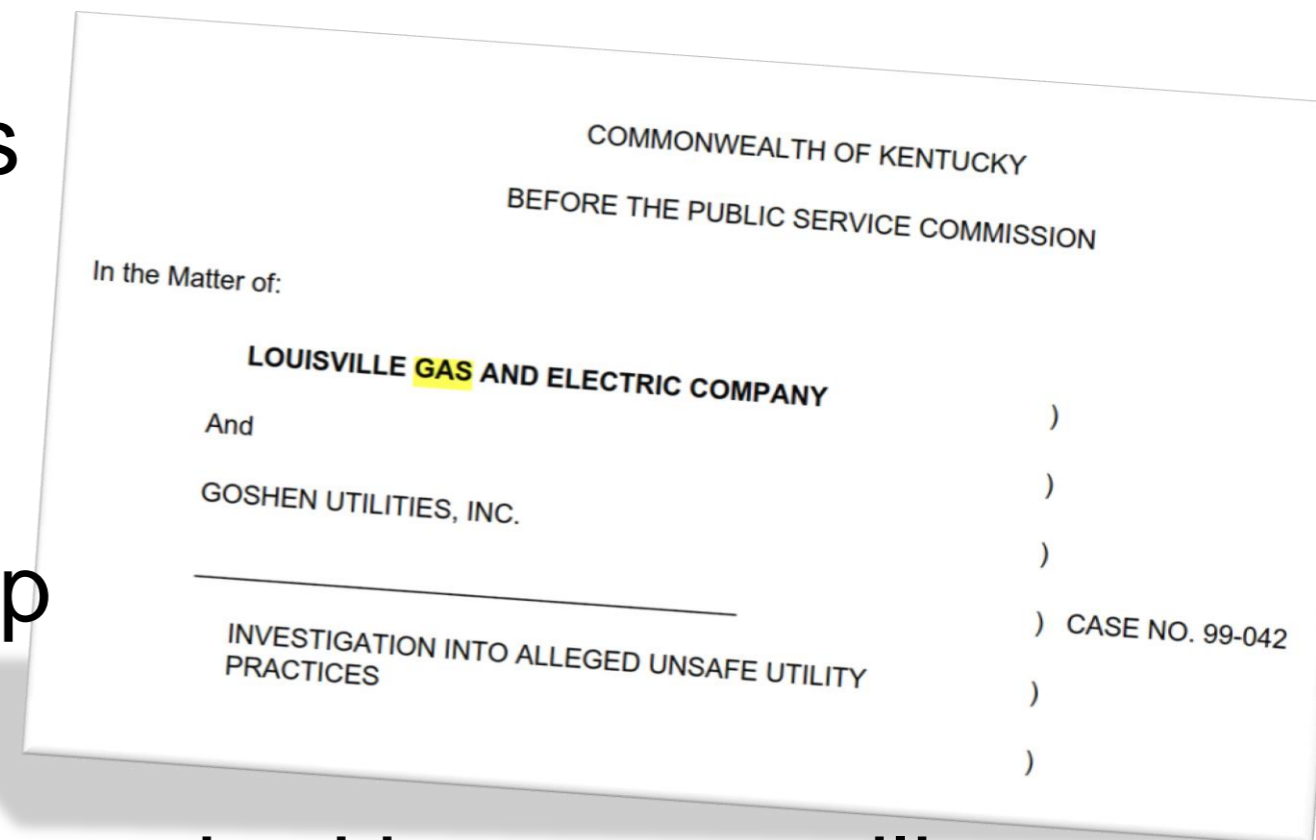
Forwarded to:  
Mr. C. S. McNeer  
President  
Wisconsin Natural Gas Company  
233 Lake Avenue  
Racine, Wisconsin 53401

SAFETY RECOMMENDATION(S)  
P-76-83 through P-76-86

At 8:53 a.m., on August 29, 1976, an explosion and fire destroyed a house at 6521 20th Avenue in Kenosha, Wisconsin. Two persons were killed, four persons were injured, and two adjacent houses were damaged. The destroyed house was not served by natural gas. However, natural gas, which was escaping at 58 psig pressure from a punctured 2-inch plastic main located 39 feet away, had entered the house through a 6-inch sewer lateral. The gas was ignited by an unknown source. After the accident, the National Transportation Safety Board's investigation disclosed that the gas main had been installed by boring through the bottom of the sewer tile; the gas main was perpendicular to the sewer tile. 1/

# Kentucky Public Service Safety Hearing – 1999 Ruling

- A dispute between 2 utilities
  - LG&E, gas distribution
  - Goshen Utilities, sewer
- Sewer lines were backing up from gas cross bores
- Sewers were required to be marked by sewer utility
- Gas utility was required to use visual verification that cross bores do not exist after construction



# Definition

“Cross bores are defined as an intersection of an existing underground utility or underground structure by a second utility resulting in direct contact between the transactions of the utilities that compromises the integrity of either utility or underground structure.” \*



# Quantifying Cross Bore Issue

- Large projects up to 3 per mile
- Found at a hospital and at schools
- Small project 12 cross bores of 147 inspections
- Most expensive cross bore explosion = \$30 million, 2 girls burned
- Expected average estimate =  $\pm 0.4$  / mile.

# Cross Bore Risks Factors

- Trenchless construction methods used
  - slip lining / insertion of gas laterals – may reduce cross bore risks
- Sewer utilities are unknown or unmarked
- Depths of utilities are unknown
- No post construction video inspections of sewers adjacent to construction?





# Cross Bore CCTV Inspection





# Class 1 Cross Bores

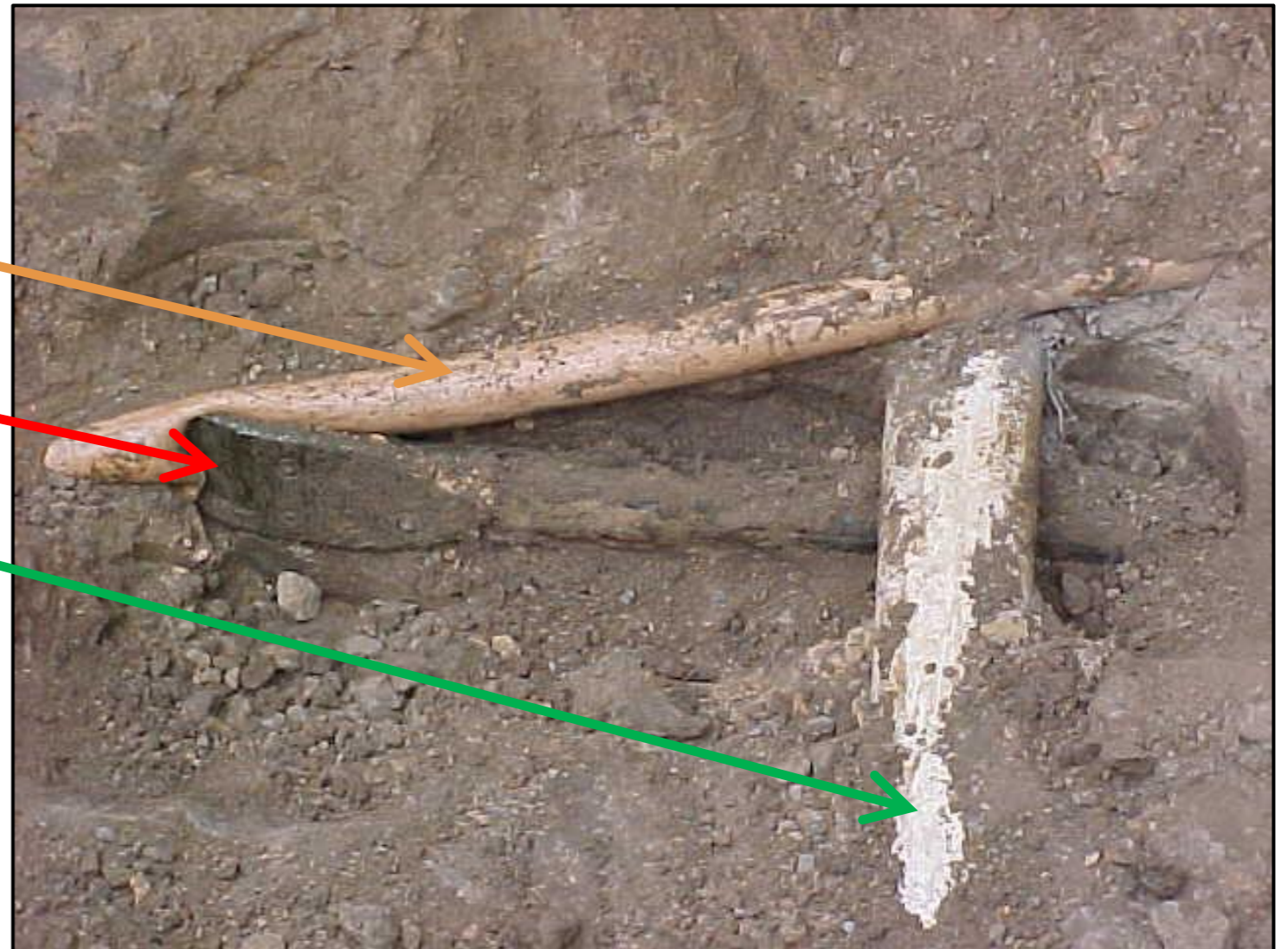


# Class 1 Crossbore Explosions



# Class 2 Cross Bore

Gas line  
HDD tool  
Sewer to house



# Class 2 Cross Bore Explosion



# Cross Bore Required Repairs

- Gas cross bore repairs to sewers shown on this slide cost >\$150,000.
- EPA illegal pollution, fines
- Disruptive to community



# Inspection Project Planning

- Select management team
- Determine goals
  - New construction
  - Post construction / Legacy
  - Both?
- Determine reasonable timeline
  - Large systems >15 years for legacy?
- Communicate with utility commission early
- Develop processes & quantify volume
- Determine budget, get approval & funding

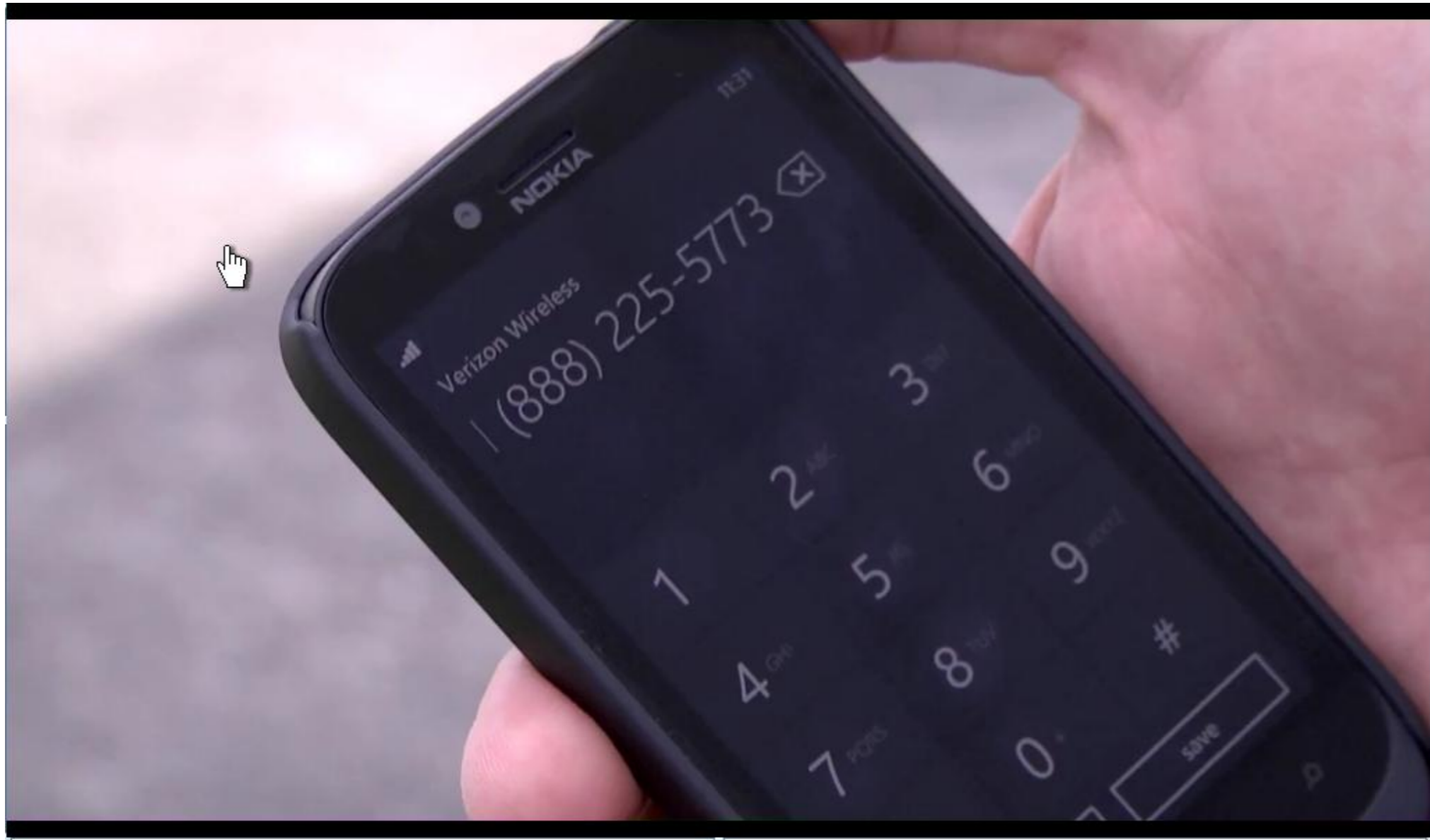




# Community Outreach

- Integrate community outreach program early
  - Include residents
  - Include plumbers & drain cleaners
  - Include drain cleaning rental companies
  - Include municipalities & sewer utilities
- Media methods
  - Door hangers, meetings, mailings, TV news, website, social media
- Emphasis safety efforts for newly recognize risk
- Ask for help and cooperation from all

# Community Outreach Video



Online Links to Video:

<https://www.pse.com/safety/NaturalGasSafety/Pages/Blocked-Sewer.aspx>

<http://www.youtube.com/watch?v=jPAR-3YiSEM&feature=youtu.be>



# Plumbers Beware! - Virginia




Effective July 1, 2002, the Virginia Underground Utility Damage Prevention Act ("Act") was amended to require that any plastic or other nonmetallic utility lines installed underground shall be installed in such a manner as to be locatable.

### Be a damage prevention partner.

You can do your part by ensuring that any nonmetallic utility line that you install underground meets the requirements of the Act. By doing so, you will be complying with the law and helping reduce the possibility of the sewer line being bored through in the future, and most importantly protecting the citizens and communities you serve!

### Underground Utility Color Codes

-  RED - Electric Power Lines, Cables, Conduit and Lighting Cables
-  YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
-  ORANGE - Communications, Alarm or Signal Lines, Cables or Conduits
-  BLUE - Potable Water
-  PURPLE - Reclaimed Water, Irrigation and Slurry lines
-  GREEN - Sewer and Drain Lines
-  PINK - Temporary Survey Markings
-  WHITE - Proposed Excavation

This brochure should be used for educational purposes only. It is not intended to be an opinion, legal or otherwise, of the State Corporation Commission.

## Plumbers Beware!

A blocked sewer line may be the result of another utility line (gas, electric, telecommunications) having been accidentally bored through the sewer line.



Attempting to clear this type of blockage can result in a serious accident involving loss of life, injuries, and significant property damage.

Please follow the precautionary measures in this brochure to help prevent such accidents.



Prepared by  
Virginia State Corporation Commission  
Division of Utility and Railroad Safety  
July 2007



# Prioritize – Higher Risk First

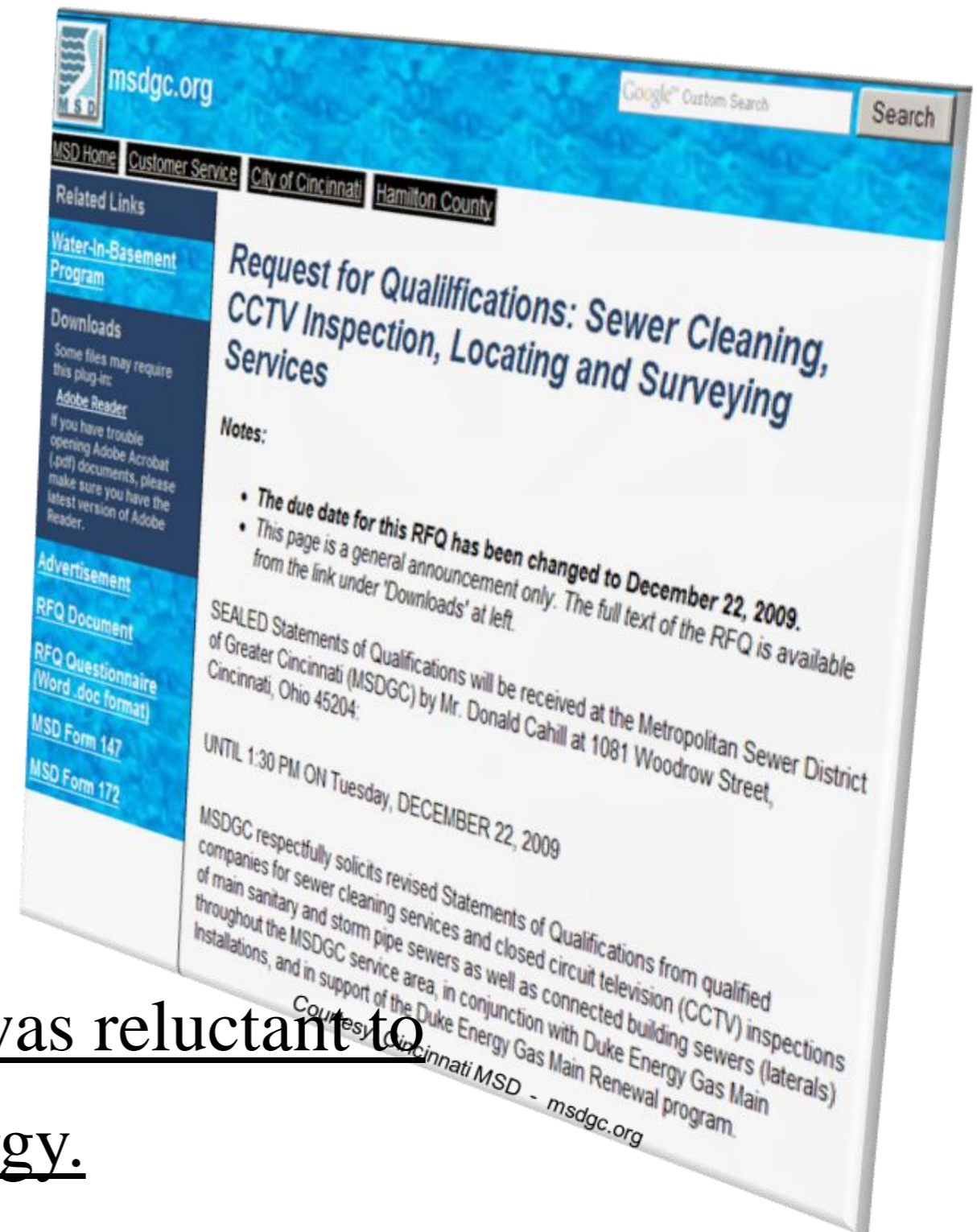
- Higher occupancy – schools, hospitals, apartments
- Difficult to evacuate
- Higher pressure mains
- New gas installs
  - Cross bore may cause backup soon after installation
- Areas where multiple utilities are likely to be near the same elevation
  - High water table, rock, slab home construction affect utility locations

# MOU's and Agreements for Access

- Local street access, GIS mapping
- Highway access, GIS mapping
- Franchise Agreement
- MOU's for sewer access, GIS based sewer mapping
- Typically negotiate trade of data for sewer utility assistance
  - Sewer video for sewer mapping and cleaning
  - Sharing costs – Cincinnati equal cost sharing between gas and sewer utility
- Water meter access for cleaning and flushing sewers

# Cooperation of Sewer and Gas Utilities - 2009

- Cincinnati Sewer Department (MSDGC) joins with Duke Energy to inspect sewers for deterioration and for gas cross bores.
- First known joint cooperation.
- Several years before, MSDGC was reluctant to provide sewer maps to Duke Energy.

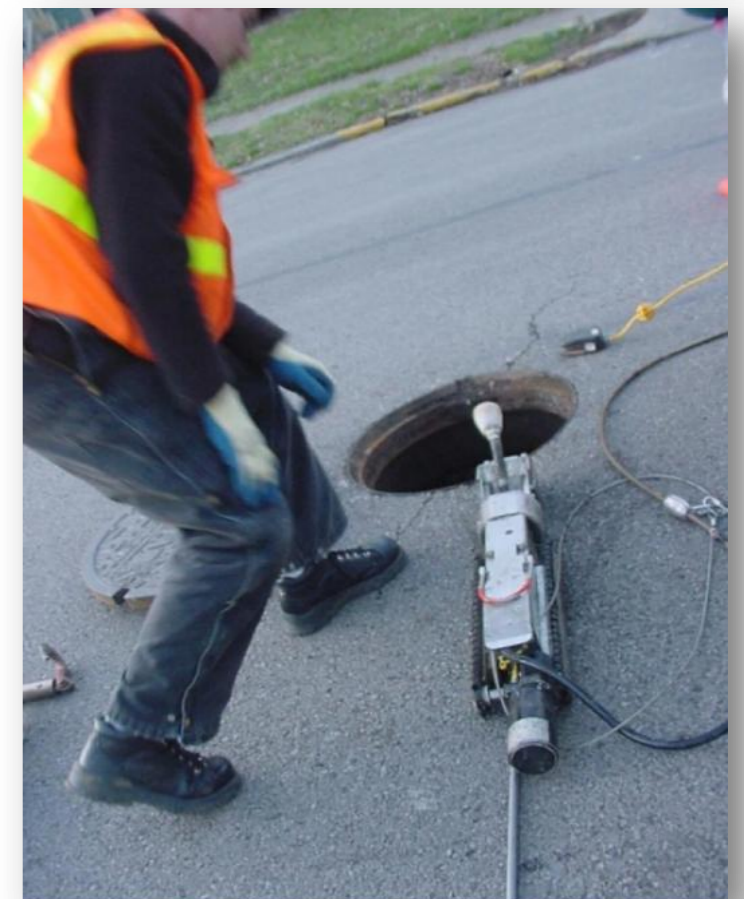


# Location of Sanitary Sewers Are Often Not Known



# Mainline Cameras w/ Lateral Launch Camera

- Inspect mainline sewers for cross bores through manholes
  - 550 feet from manhole
  - Determines # of laterals, structures may have multiple
- Inspect lateral sewer up to 120 ft from sewer tap in good conditions



# Lateral Line Traces could remain flagged / spray painted until Gas Line installation crews arrive...

This trace line has bends in the line...which are now reflected in GIS



# Push Cameras

- Manual push camera on stiff cable
- Distance to 200 ft or more of cable
- Used when mainline robotic cameras do not reach required limits of inspection
- Video, depth and GPS loaded into GIS mapping



Sonde - Radio Frequency Transmitter & Camera



# Locator, Frequency Generator, Sonde & GPS

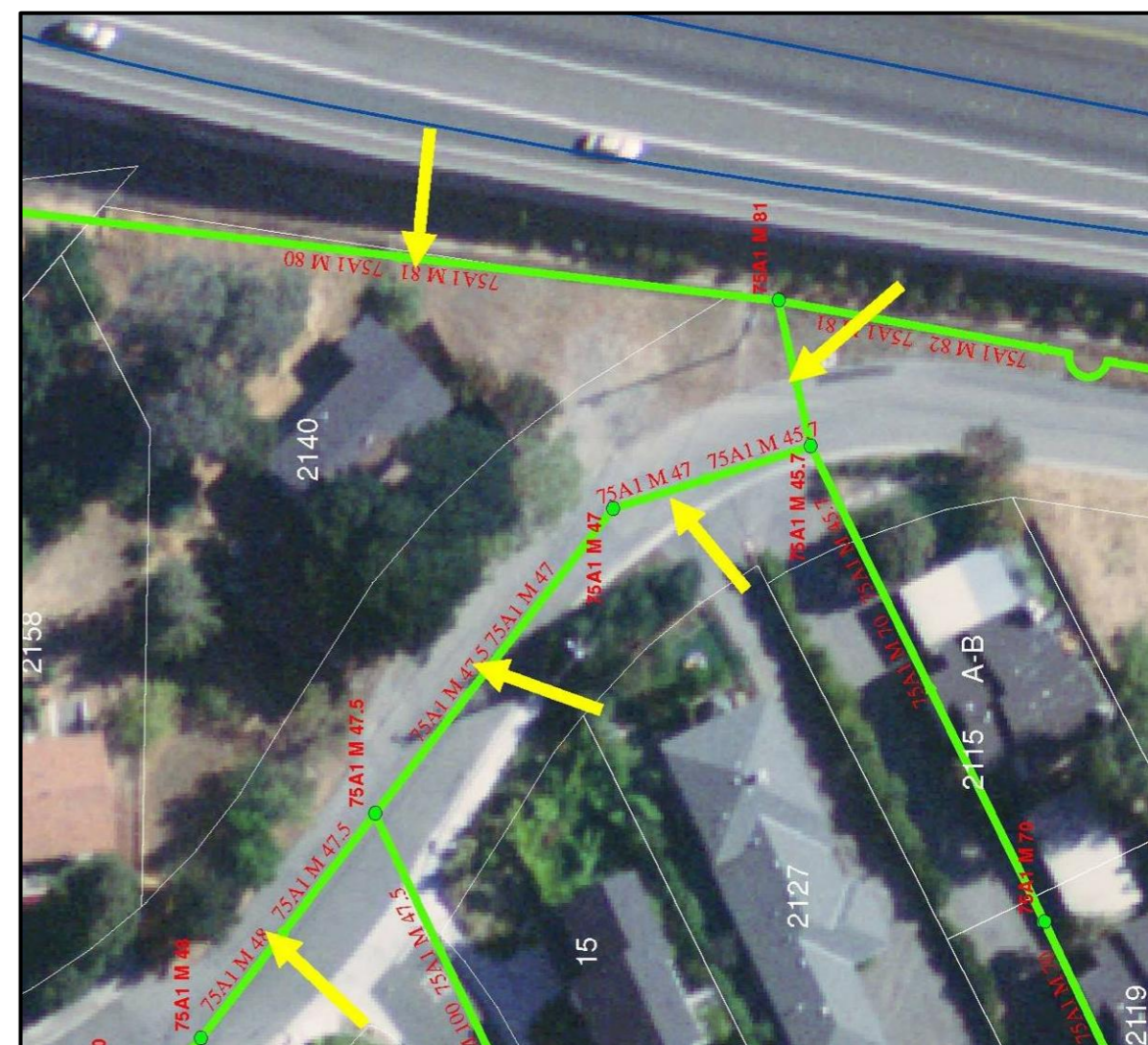
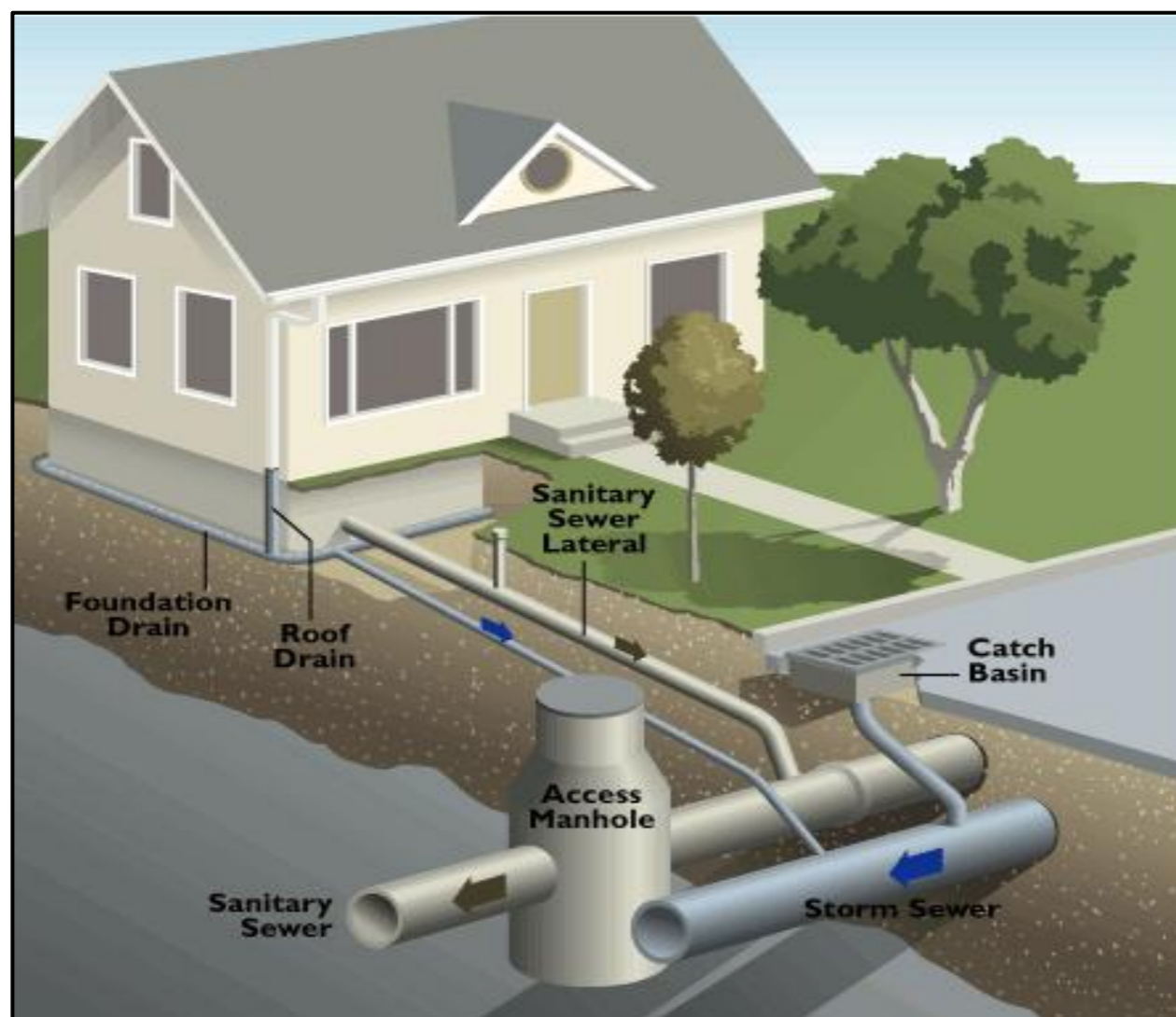
- Locator - horizontal and vertical
- Sonde - (behind camera) transmits to above ground walk over receiver
- Frequency induced (energized) in tracer conductor transmits to receiver
- Receives signal determines depth and horizontal position of signal
- GPS records location for GIS mapping



# New Inspection Tools – Potential for Wider Acceptance

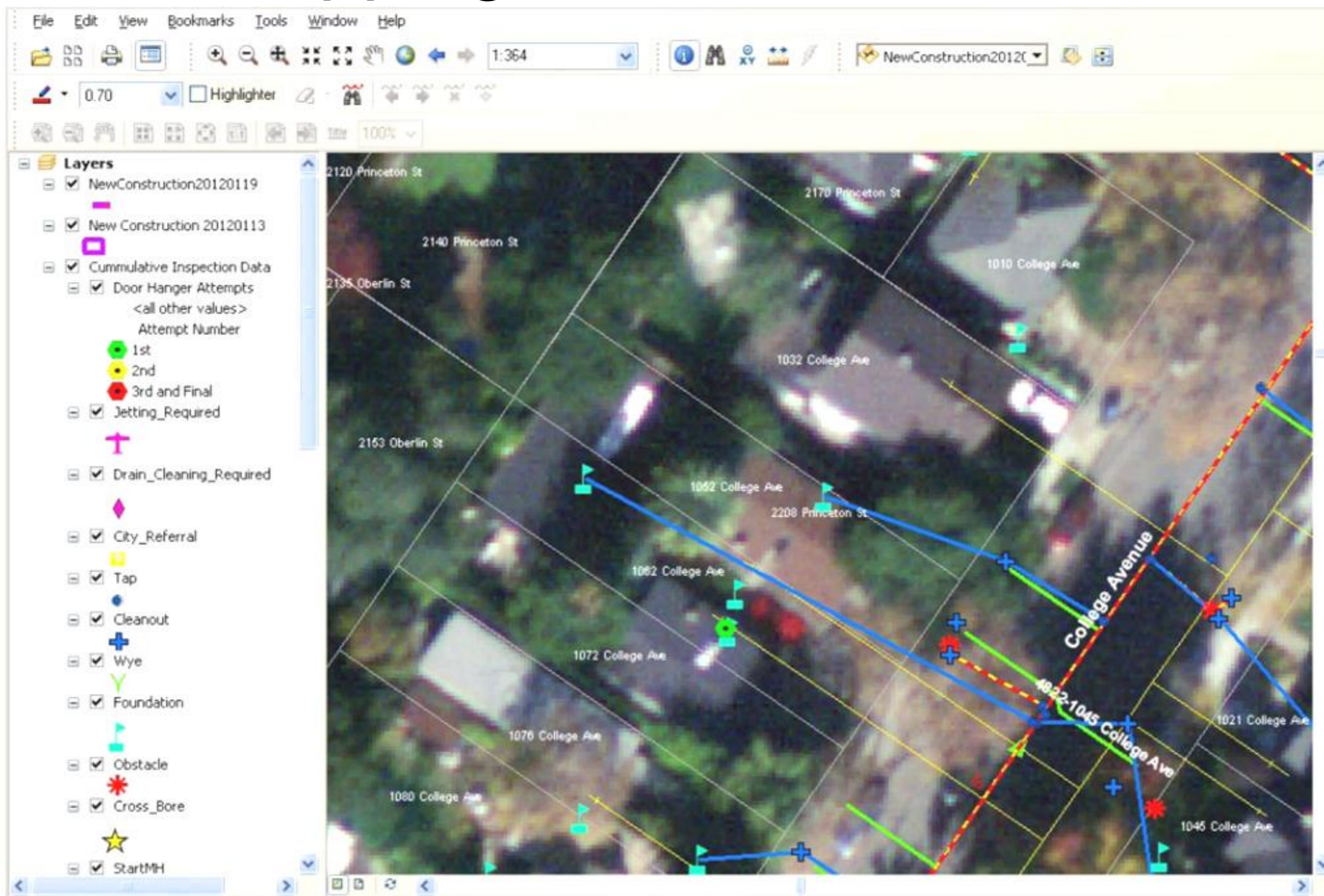
- GPR – ground penetrating radar
- Multi channel GPR
- Electromagnetic induction arrays
- Pull back cameras – after bore completed
- Drill fluid lost pressure sensors
- Forward looking sensors on HDD tool
- Acoustic sensor for plastic pipes

# Residential Plumbing Connection to City Sewers



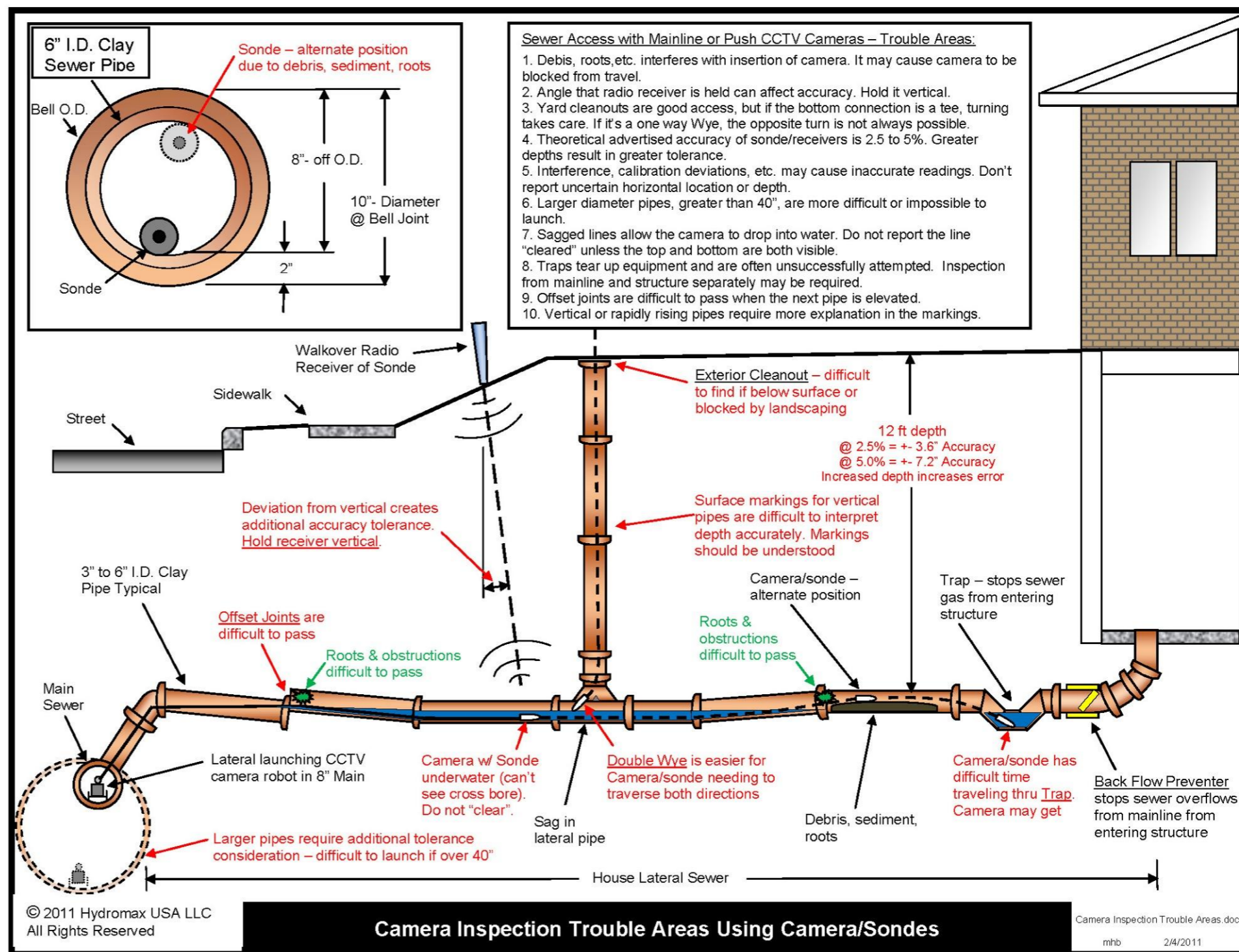
House with 5 mainline sewers on perimeter

# GIS Mapping – Visual Data Results



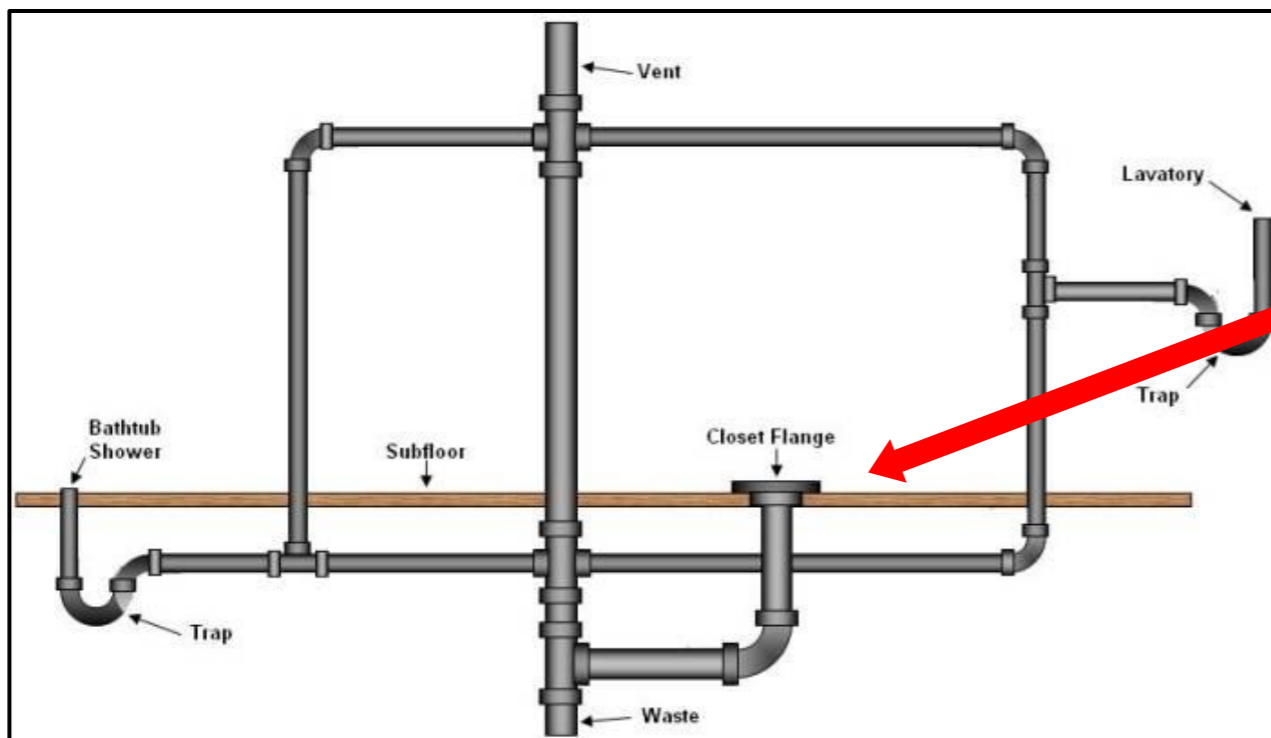
# Camera Inspection Trouble Areas

- Water in sags
- Roots
- Sonde Angle
- Sonde Position
- Traps
- Back flow preventers



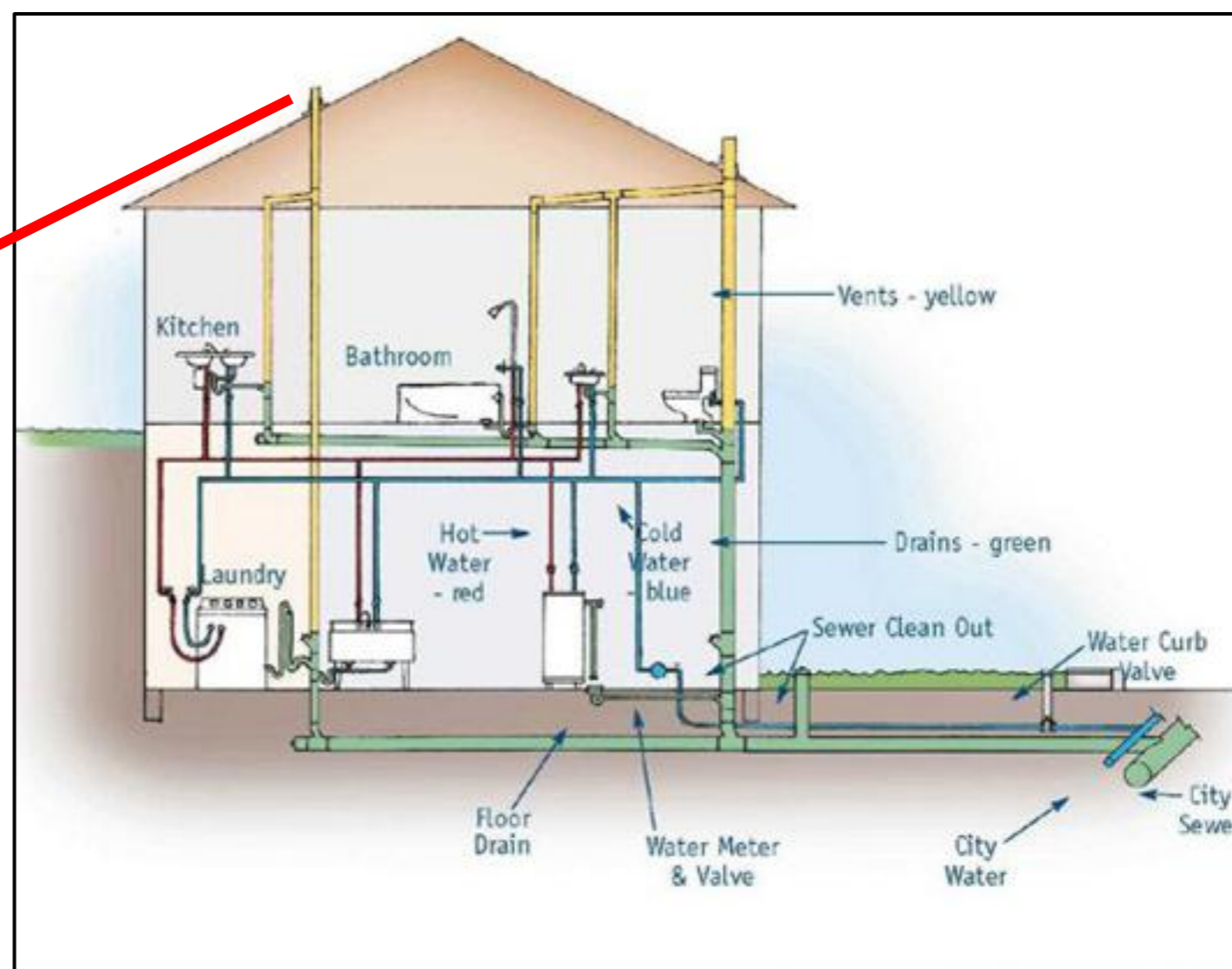
# When Exterior Access is Limited or Pipes Impassable

- Interior access through pipe, roof vents or interior cleanouts
- Permission from owner



# Roof Vent Access

- Usually only 1 story houses
- Permission from owner
- Protect from falls



# Roof Vent Access



Cross Bore



# Cross Bore Report

## Cross Bore

HYDROMAX USA

### Cross Bore Report

Date: 2/5/2014

Address: 222 3th Ave W  
City, ST 88888

Parcel Number: 69175  
 Claim Number: 8870f351  
 Crew Operator: Jarred Stull Sewer  
 Asset Type: Service Lateral Distance from Mainline Tap (for lateral sewer cross bore): 25' upstream from mainline tap.  
 Distance from Manhole (for main sewer cross bore): N/A  
 Sewer Diameter: 4"  
 Sewer Pipe Material: Concrete Pipe  
 Gas Mapping Review:  
 Gas Asset Type: Mainline  
 Gas Line Diameter: 6"  
 Gas Line Material: MPE  
 Gas Installation #: 95385  
 Gas Installation Date: 1/1/1996  
 Yrs/Mos Since Install: 18yrs/1mos  
 Installation Method:  
 Hole Hog 2 HDD Unknown

Type of Inspection:  
 Emergency (if checked fill in below)  
 Time Call Received \_\_\_\_\_  
 Arrival Time \_\_\_\_\_  
 New Construction  
 **Legacy**

Cross Bore Type:  
 New Construction  
 **Legacy**

Job Type:  
 Simple Service  
 **Main & Service**  
 Main with Test & Ties

Primary Equipment Used:  
 **Mainline Lateral Launch CCTV**  
 Push Rod CCTV  
 Other (specify): \_\_\_\_\_

Additional Equipment Used:  
 Mainline Lateral Launch CCTV  
 Other (specify): \_\_\_\_\_

Additional Notes:



Aerial Photo



Above Ground Site Photo



Interior Pipe Photo

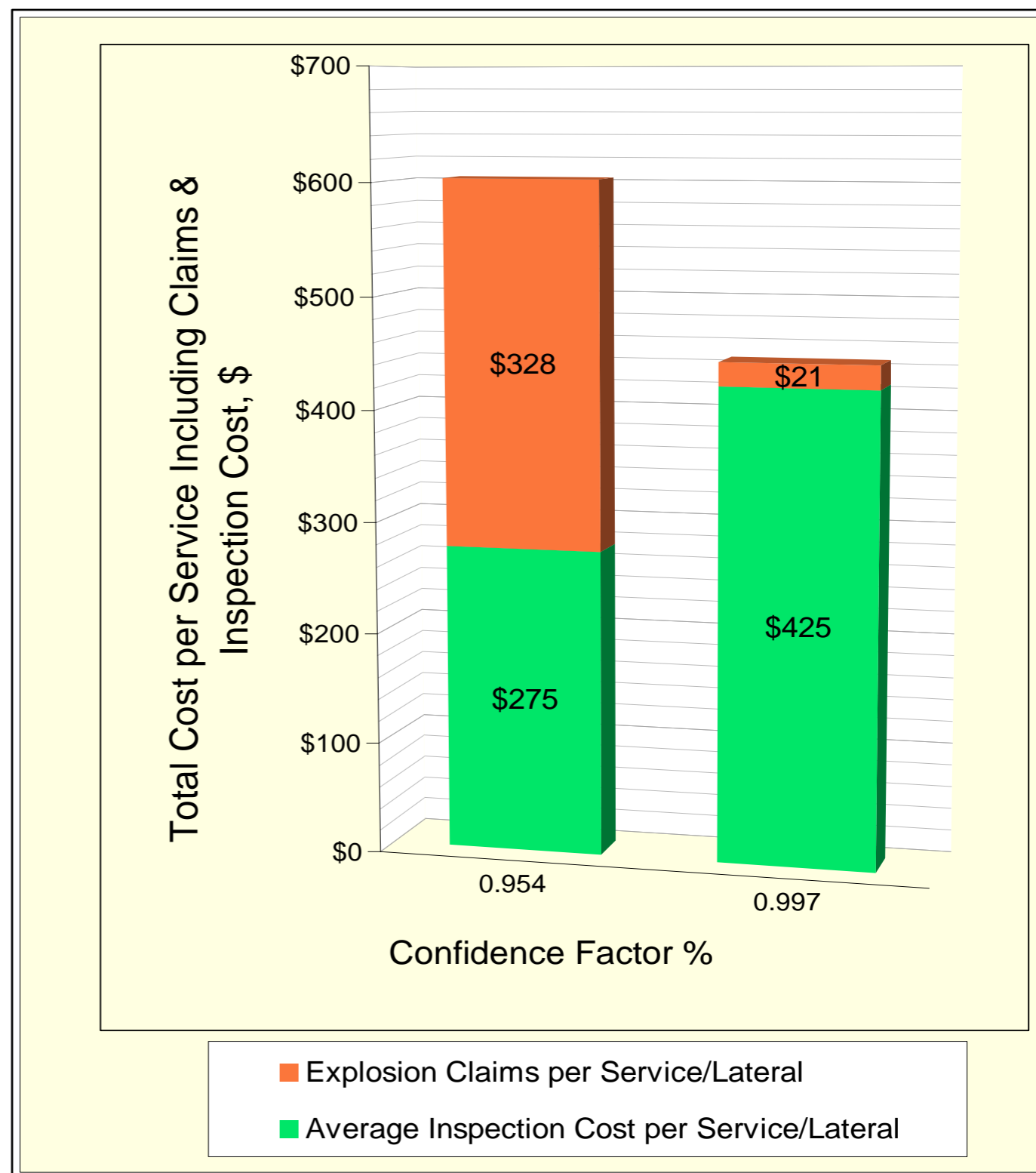


# Higher Confidence Program Justification

Based Upon Total Gas Services in U.S. and Canada = +/- 75,000,000		
Confidence Factor of Locate / Inspection Processes	<b>95.4% (2 <math>\sigma</math>)</b>	<b>99.7% (3 <math>\sigma</math>)</b>
Total Cross Bores Expected to be in Project Area	267,000	267,000
Cross Bores Expected to be NOT Found	12,288	796
Cross Bores Not Found & Expected to Result In Explosion Claims, expect 20% <u>will</u> result in explosion.	2458	159
Expected \$ Cost of Cross Bore Explosion Claims	<b>\$24,580,000,000</b>	\$1,590,000,000
Explosion Claims per Total Services in Project Area	<b>\$328</b>	\$21
Avg. Inspection Cost per Lateral Estimated, (Note: excludes program management, scoping, data storage costs – variable as to trenchless usage and sewer configurations)	<b>\$275</b>	\$425
Total Apparent Cost per Service/Lateral	<b>\$578</b>	<b>\$421</b>
<b>Net Cost Savings, 2 <math>\sigma</math> vs. 3 <math>\sigma</math></b>	<b>\$13.6 Billion <u>Savings</u> &amp; <u>Many Lives</u></b>	

# High Confidence Processes Saves \$

- Net cost of high confidence work is less expensive<sup>1</sup>.
- Higher percentage of explosions from lower confidence processes.
- Net savings = US\$12 Billion
- Less impact on reputation
- Less impact on regulatory rate making process



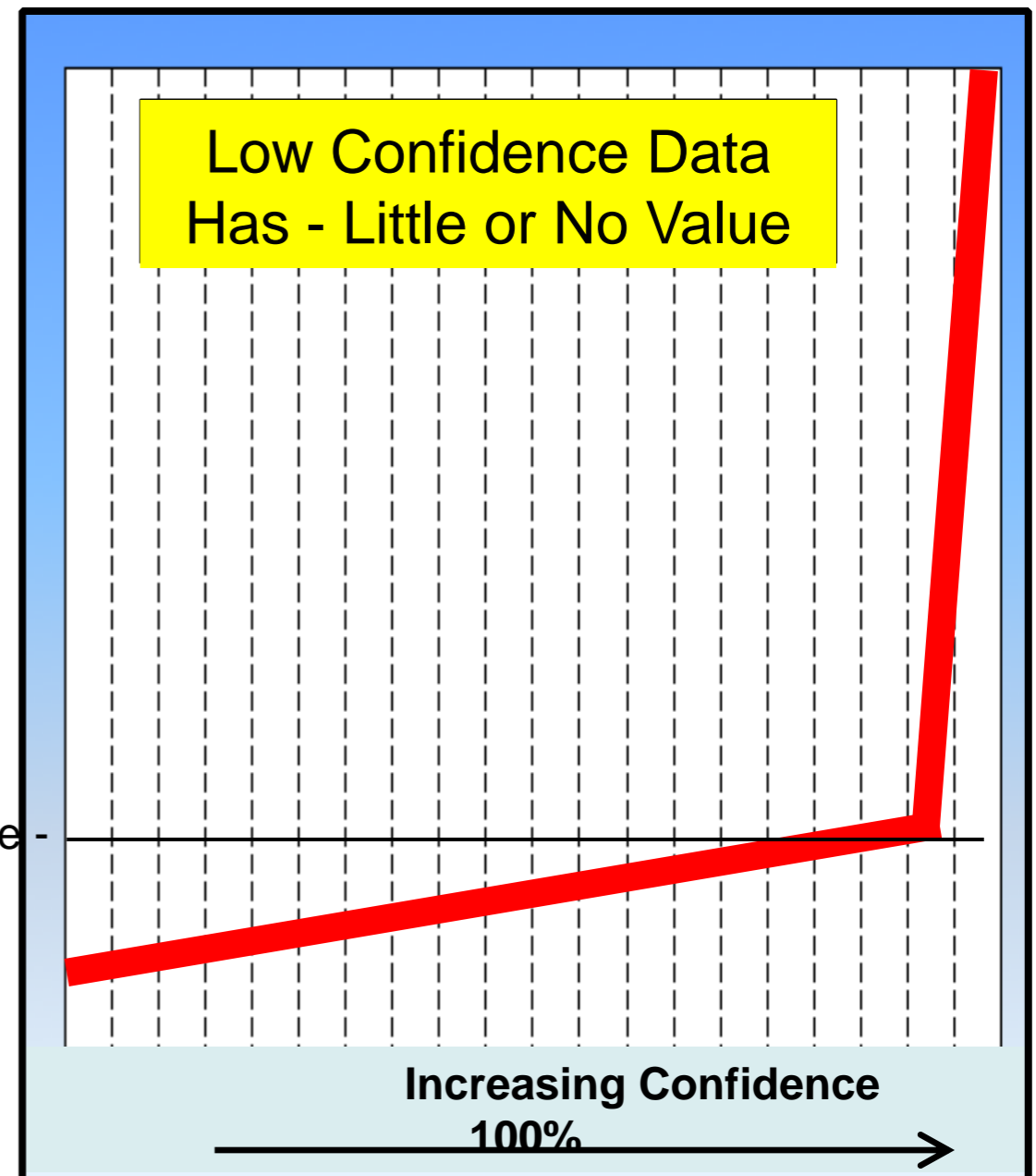
<sup>1</sup> Creating High Confidence Results for Cross Bore Elimination Projects, NoDig 2012 Conference, M. Bruce & J. Graham, revised

# Value Increases with Higher Confidence Processes

- Low confidence results create false security
- Low confidence results may have negative value
- Low quality work may have to be completely reworked.

100% Value -

0 Value -





# OK – What's The Cost – An Estimate

- +/- 75,000,000 service in U.S. and Canada
  - 60% of legacy pipes need inspections, estimated
  - = 45 million
- Expected increase during next 2 decades @ 1.2% new services per year = 25%
  - = 18.7 million
- Total inspections = 63.8 million services, 20 years
- Avg. cost inspections + program management
  - High confidence >\$425 avg. = >\$27.1 billion + damages
  - Low confidence >\$275 avg. = >\$17.5 billion + damages
- Some utilities budget +/- 6 % of new construction

# When Risks Are Very High .....



.....And Errors Are Costly.....

.... It Pays to Do It Right!



# Survey

1. Were you aware of cross bore impacts before today?
2. Will cross bore risk reduction programs impact your organization?
3. What is the appropriate timeline to fix these: 5, 10, 20 years?
4. Does the magnitude of costs / benefits appear appropriate?
  1. Too high of cost?
  2. Too low of cost?
  3. Roughly agree?
5. Does the increased safety justify the benefit?



# Questions?

For more information on cross bores:

[www.crossboresafety.org](http://www.crossboresafety.org)