MAPPING THE UNDERGROUND INFRASTRUCTURE:

LEVERAGING GPS TECHNOLOGY TO LOCATE AND IDENTIFY PROBLEMS

North American Society for Trenchless Technology

Presenter: Joe Purtell

Objective:

- Discuss and illustrate the feasibility, accuracy and productivity associated with using GIS, GPS, electromagnetic locators and robotic cameras to trace and record the positions of buried water lines to reduce the chance of crossbore accidents

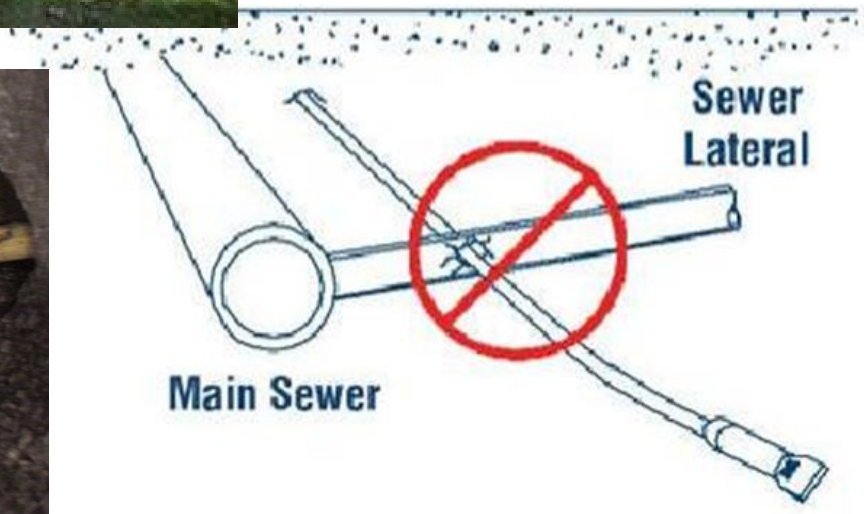
Focus:

- Focus on High Impact Risk

  (natural gas in sewer lines)
- Identify technology widely available now to help reduce the risk
- Understand the shared benefits to multiple utilities

Overview of a ‘Cross-bore’

“an intersection of an existing underground utility ….that compromises…”



Worst Case:

NEW ENGLAND JURY VERDICT REVIEW & ANALYSIS

$17,200,000 RECOVERY – UTILITY COMPANY NEGLIGENCE – ALLEGED IMPROPER MAINTENANCE OF GAS EQUIPMENT – GAS EXPLOSION IN RESIDENTIAL HOME – WRONGFUL DEATH OF TWO CHILDREN AGES FIVE AND FOUR.

Hopkinton, MA 7-26-02 Settlement to surviving parents

An explosion blew Benny and Martha Cryer out of their bed and trapped them under burning rubble.

"My husband tried to put a hose on them to keep them from burning. We didn't know what else to do….we couldn't quite reach them because it was so hot." Dallas 10-16-06

Middletown, Ohio, March 13, 2006

Gas in Sewer Cross Bore Connection ruptured during drain cleaning

Old Methods:

Open Trench Sewer Construction Circa 1889

Old Meets New:

GPS technology is ubiquitous today and mapping locations is much easier to do.

But what about all the old infrastructure that is in the ground now -but nobody is quite sure where it is located?

Port St. Lucie, FL 4-26-08

Natural Gas is Strategic

- Reduce dependence on foreign oil
- Replacement of lines that are reaching their end-of-life
- Societal *Quality-of-life* benefits

Risk Mitigation

- Metrics indicate 2.5 crossbores identified per mile of installed sewer line
- Consequence of failure can be enormous
- Sheer quantity of potential legacy crossbores is significant
- HDD Best Practices can prevent damage on new gas line installations with location data from robotic GPS collection

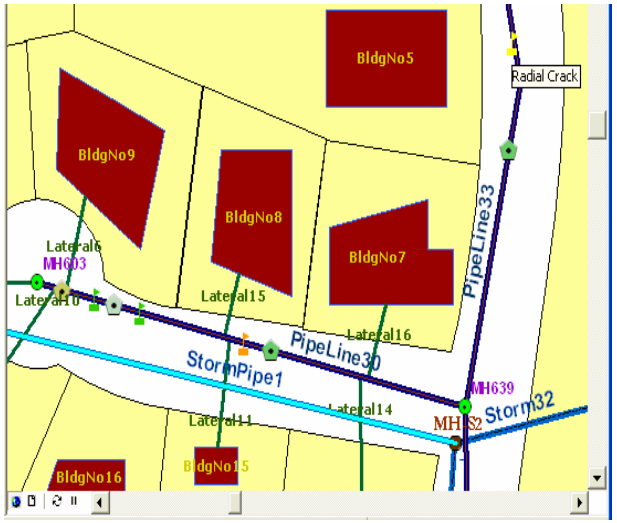
The Plan

- Gas company had little location information about the Sewer department's assets (1930's)
- Homeowner Sewer connections and their condition were unknown to the Sewer Department (pollution was occurring)
- Both Utilities agreed to share GIS information
- Both Utilities notified the public that inspections would be taking place to better insure water quality and safety
- An experienced contractor assembled the equipment, the software and operators on-site
- The GPS data was collected and synchronized to the utility GIS maps for future reference

Office Strategy (Startup):

-Review and approve contract
-Prepare equipment (to acquire depth, location of sewer system etc.)
-Prepare Infrastructure layers, mapping and prioritize work

Locating & Verification Process



QA/QC – Data Analysis and Report Generation:

-Review field data
-QA/QC – request recollection if necessary
-Integrate field collected data with organization Decision Support or Asset Management System
-Prepare and distribute final reports (e.g. hard copy, e-mail)
-Follow-up with gas client for report approval

Field Work:

-Locate manhole/sewer line
-Locate depth of the sanitary system
-Verify access points
-Inspect laterals for cross bores
-Fix cross bores
-Re-inspect to confirm repair is acceptable
-Create on-the-fly assets (e.g. buried, new constructed assets etc.)

Inspection Case Study of Sewer lines:

Search for Legacy Crossbores Prior to Replacement of new Gas Lines

Validate Technology & Procedure

Location: Lexington KY

Date: January 26th & 27th, 2007

LEXINGTONKY.GOV
Horse Capital of the World

Columbia Gas of Kentucky
A NiSource Company

The Tools: CCTV camera Robot; GIS & GPS software; electromagnetic sonde reciever

Locating method & technology Patent Pending, CUES 2007

CCTV Truck

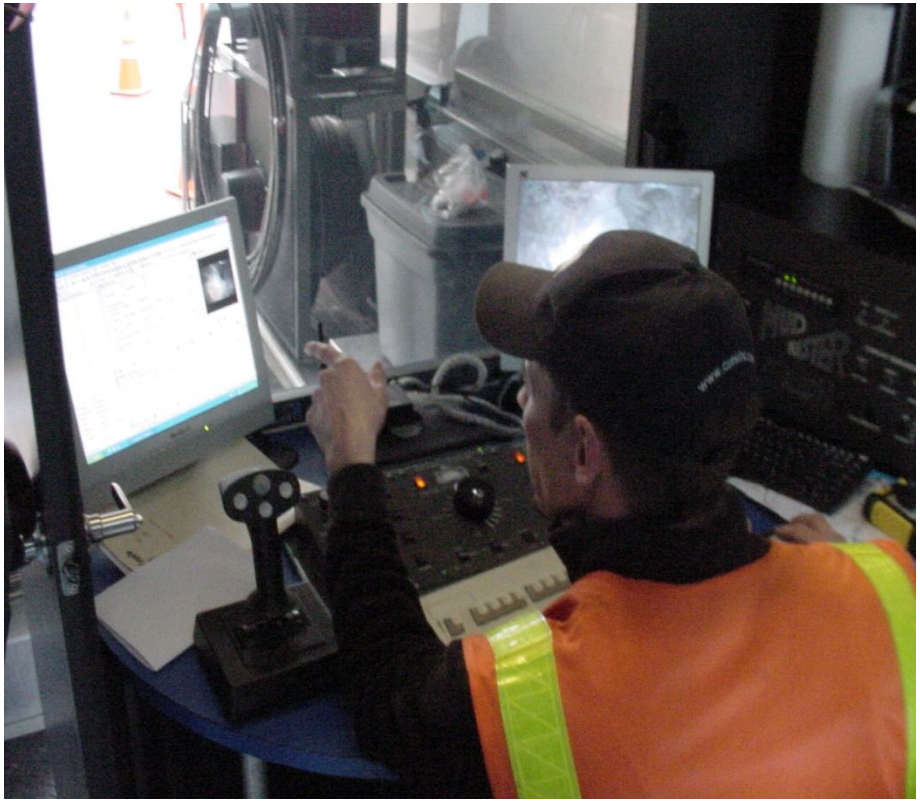
Lateral and Mainline Camera placed in the pipe

Lateral Locating underway..

Pipeline Inspection and video recording underway…

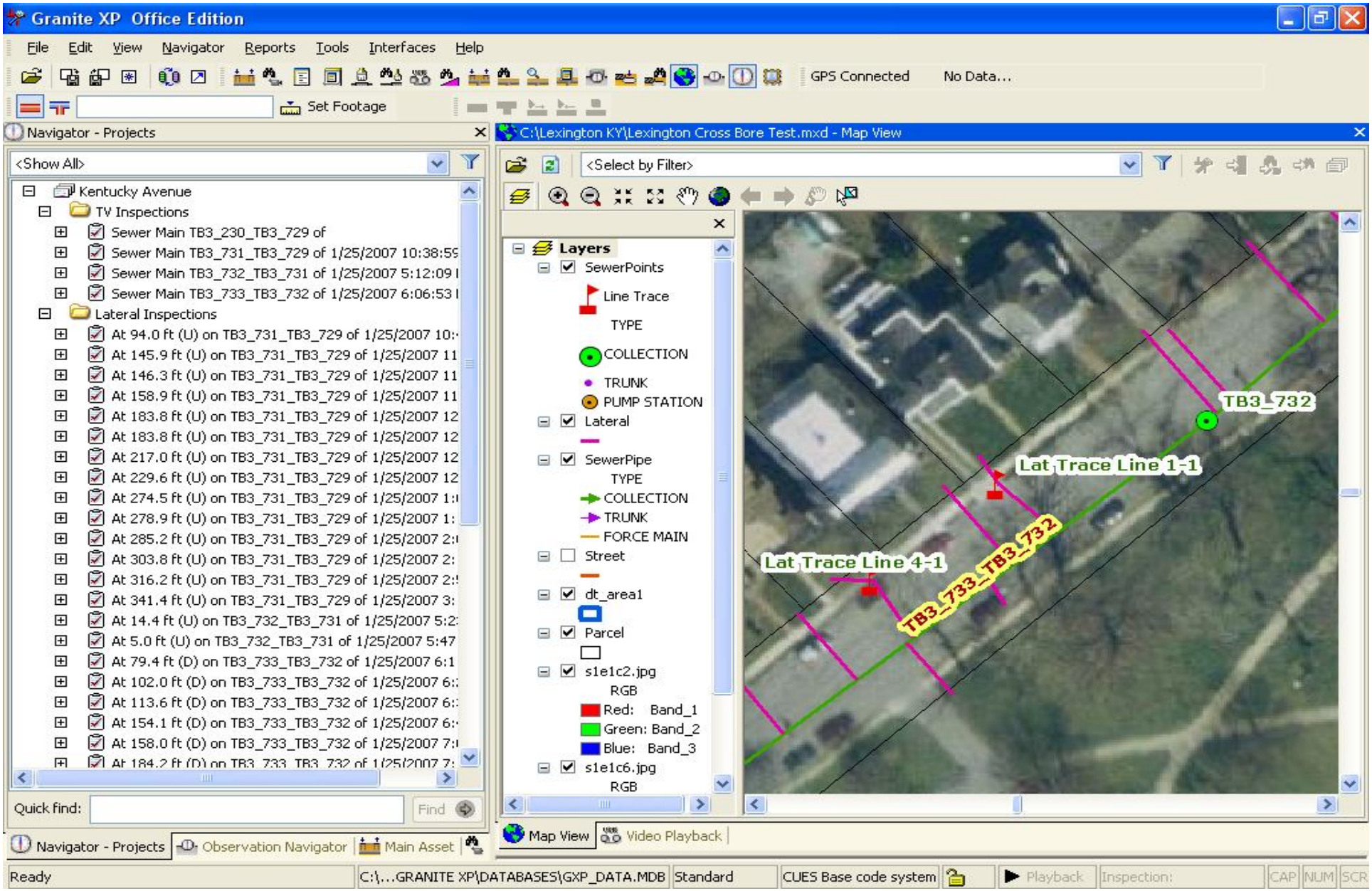
Verification is made for Lateral's X, Y, and Z* coordinates…

Lots of communication…truck operator sees real-time 'cookie crumb' in the software to pinpoint the trace line



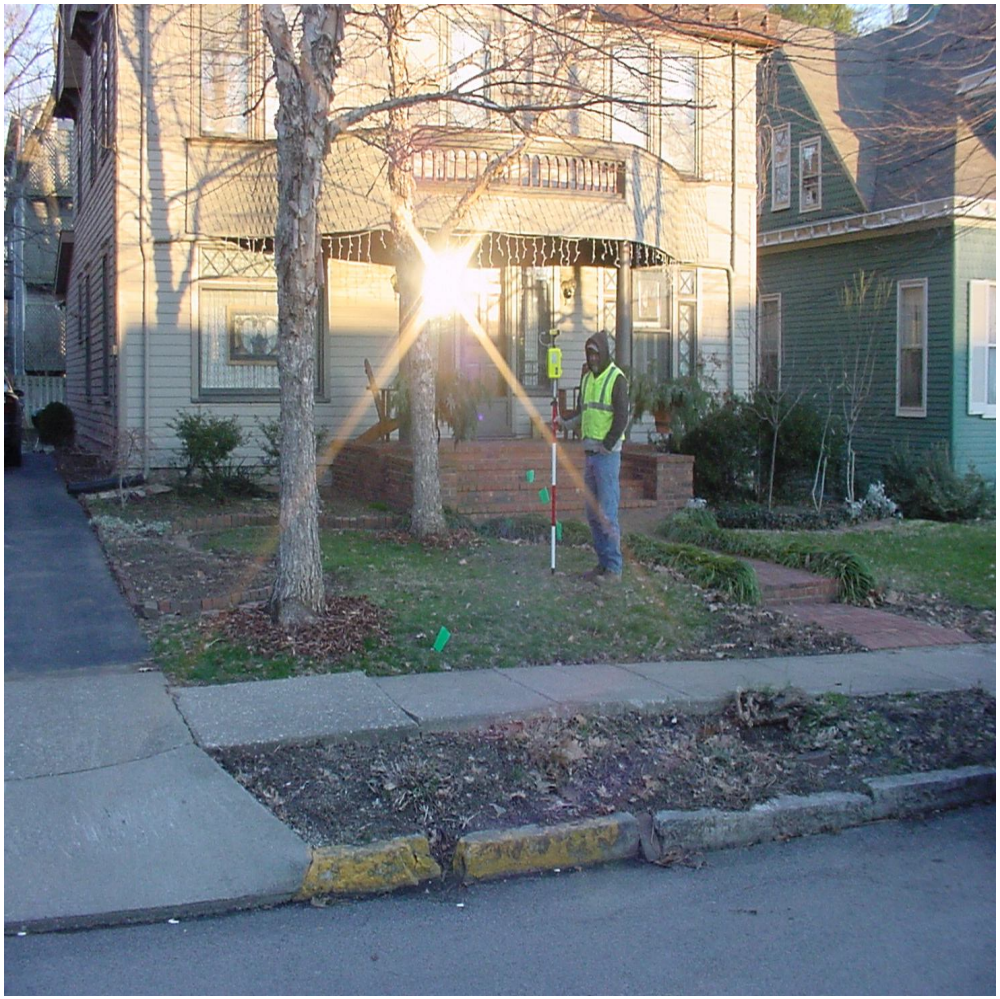
* Z is depth and is subject to soil conditions

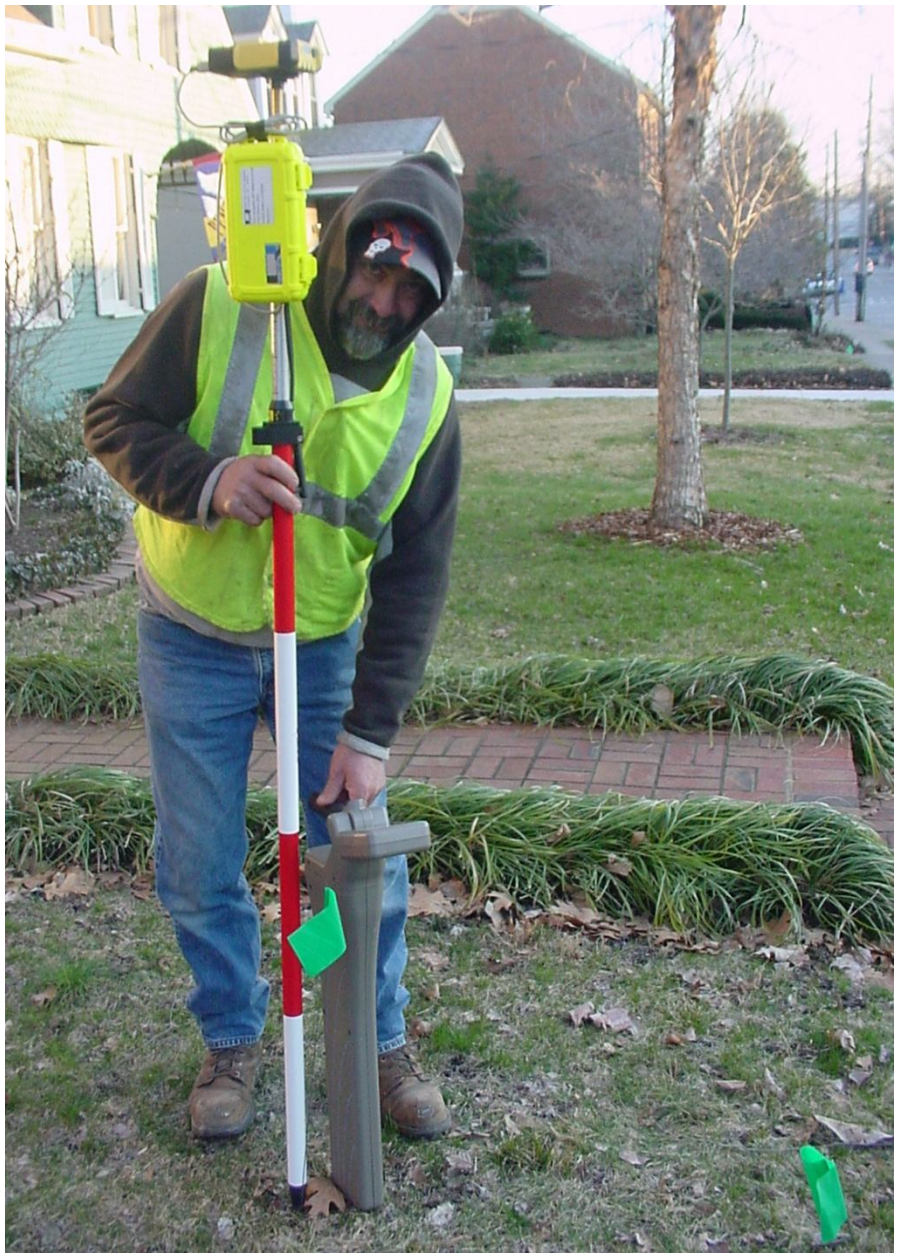
As seen in the truck, each buried wastewater asset is made available in GIS 'Layers'. Now Laterals are added as "*Lat Trace Line*" and given a unique ID#...



The Line Trace is completed up to the homeowner's service connection….

Here is the combination of the " GPS Wireless Mapping Stick" and the Sonde locator used to trace the lines below ground

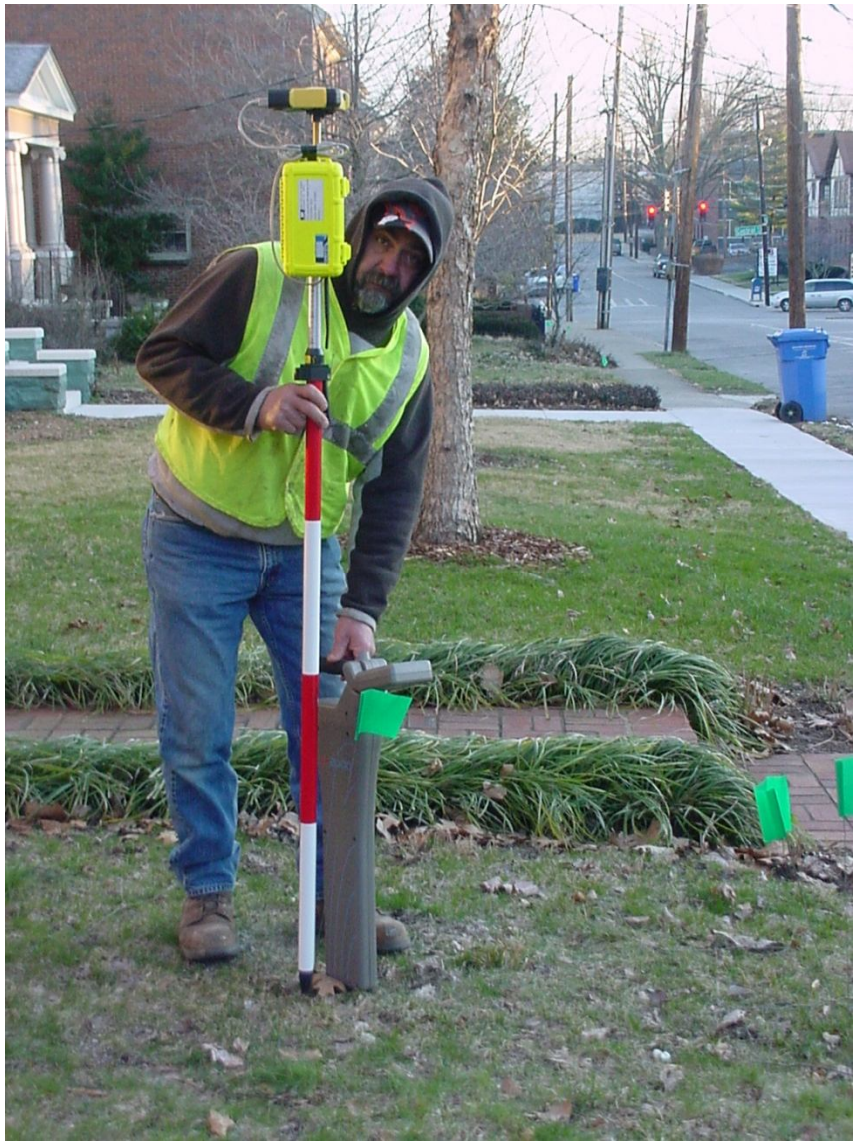




Lateral Line Traces remain flagged / spray painted until Gas Line installation crews arrive…

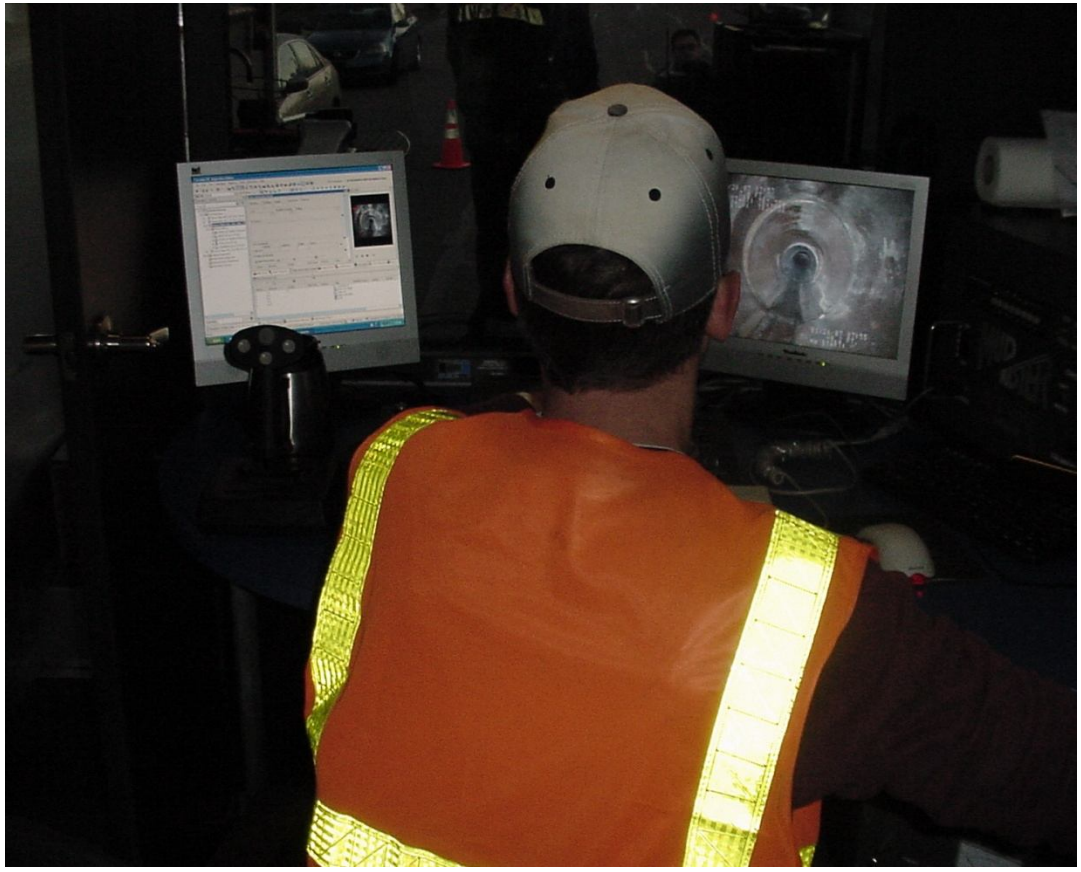
This trace line has bends in the line…which are now reflected in GIS

39 Laterals Inspected: NO CROSS BORES
Both Utilities pleased with today's work!
RISK Mitigated

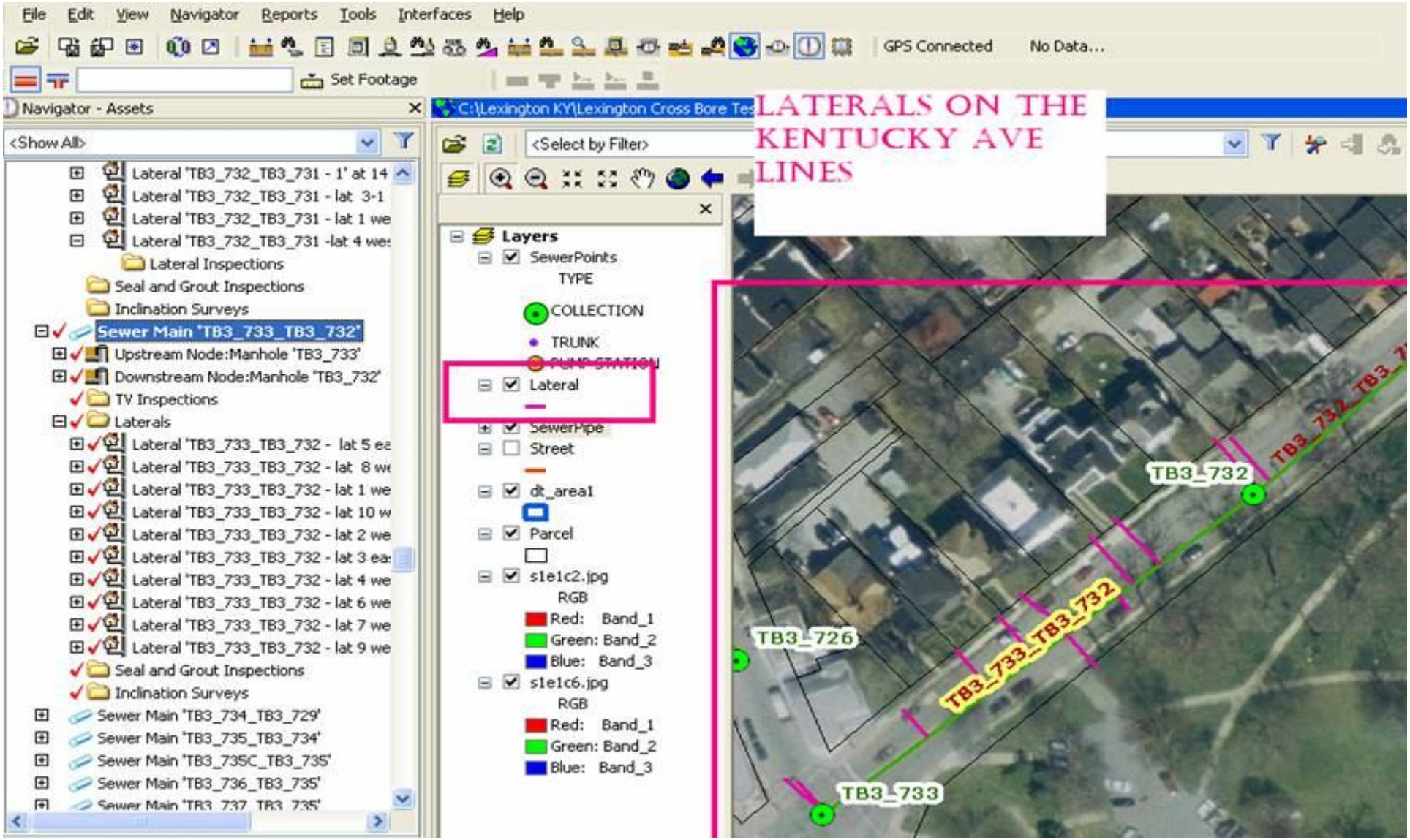


Added Benefits:

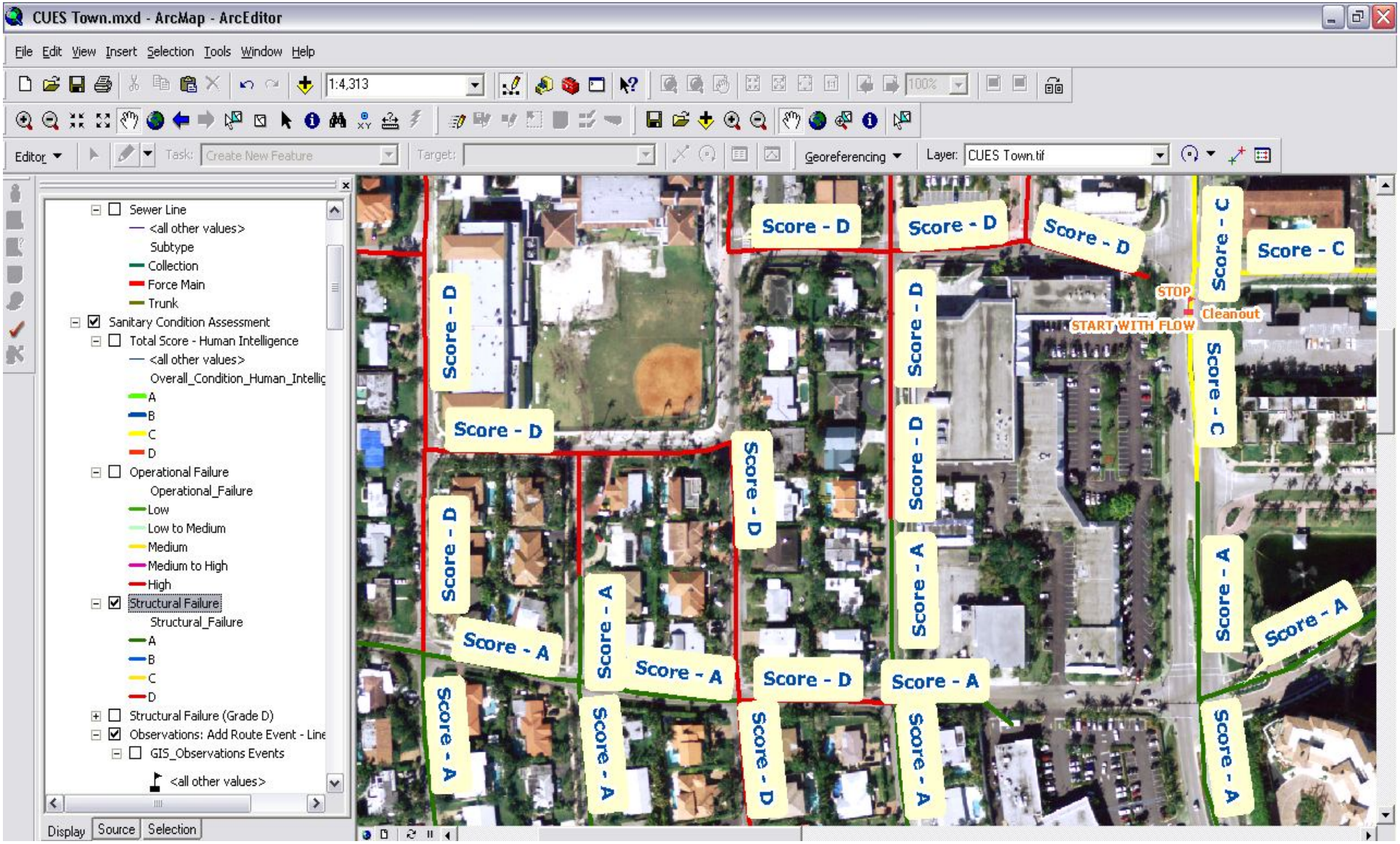
- **Once collected and retained in GIS, future utility construction will be easier (fiber, etc.) and SAFER**
- **Water utilities can ascertain probable Inflow and Infiltration (I&I) problems**
- **Homeowners will experience fewer service issues when lines are jetted**
- **Illegal taps can be identified**



Lateral Service Connections are Identified for avoidance



Location and Condition Data is permanently stored for future reference



1 Day Result:

- 39 Lateral Service Connection Lines inspected, traced and digitally captured in GIS for permanent record
- Zero Cross bores found
- Old section of Lexington will be scheduled for gas line replacement to retire aging pipe; HDD crews will have access to highly accurate GIS maps to document the “no conflict” zone surrounding each Sewer Lateral Connection for replacement gas lines
- Public Safety is better and Risk is reduced

Questions?

Thank You!

Joe Purtell

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Piercing Tools, pulling a utility behind the piercing head