



InfoSense, Inc
Innovating Acoustic Inspection Technology™

Acoustic Inspection of Sanitary Sewer Lines

2012 VRWA Conference
April 4, 2012

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Acoustic Inspection of Sanitary Sewer Lines

Presentation Outline

- ▶ What is the Problem?
- ▶ Sewer Line Inspection Methods
- ▶ Acoustic Inspection Technology
- ▶ Field Performance
- ▶ Acoustic Inspection Applications
- ▶ Summary

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2

What is the Problem?

- ▶ Overflows are a Symptom – Not the Problem

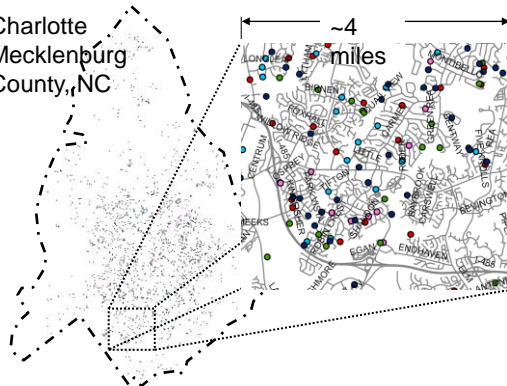


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3

Problem – Condition Information

Charlotte
Mecklenburg
County, NC



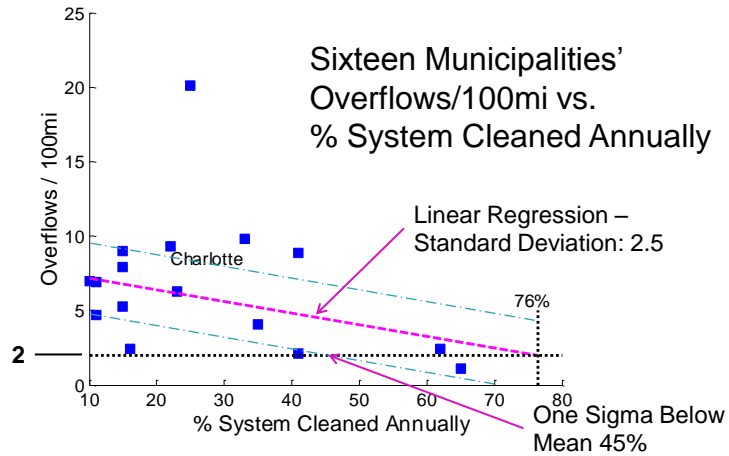
Five Year Overflow Record –
Different Color / Year

- ▶ Overflow locations – “Random”
- ▶ Historical GIS – Helpful – But Insufficient
- ▶ Where & When to Deploy Cleaning Resources
- ▶ Cost Effective & Timely Condition Information

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How Much Cleaning is Required?



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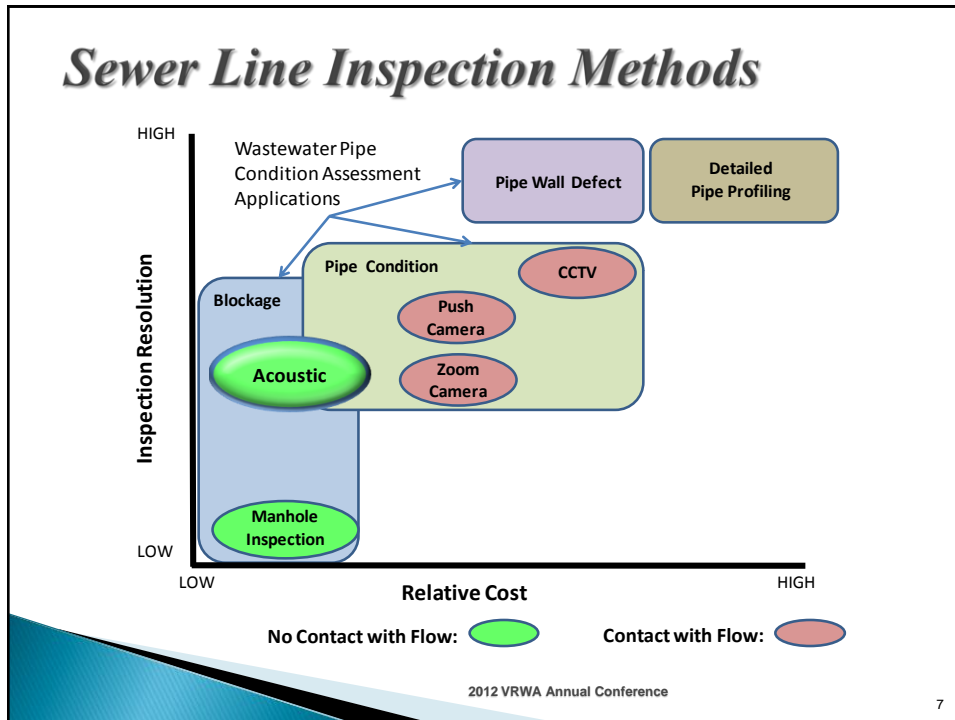
5

Sewer Line Inspection Methods

- ▶ Manhole Inspection
- ▶ *Acoustic*
- ▶ Zoom Camera
- ▶ Push Camera
- ▶ CCTV/Robotic Camera
- ▶ Pipe Wall Defect Scanners
- ▶ Pipe Profiling / Robotic Multi-Sensor

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6



7

Acoustic Inspection Technology

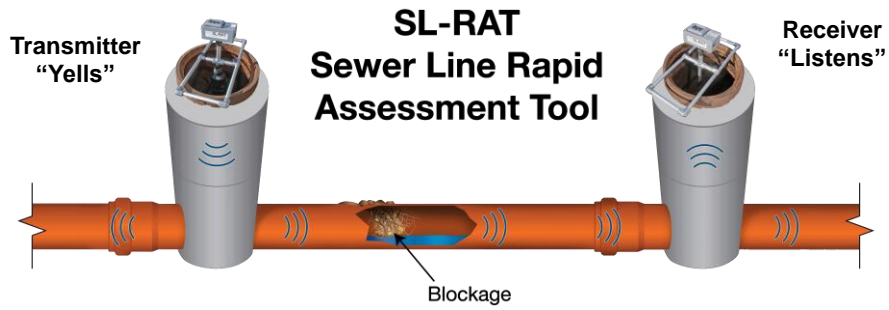
- ▶ How it Got Started – UNCC & CMU "Brainstorming" Session
- ▶ Sewer Lines – Natural Acoustic Wave Guides
- ▶ Obstructions – Acoustic Signals Absorb & Reflect
- ▶ Diagnostic Tool – Evaluates Aggregate Blockage

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Acoustic Inspection Technology

- ▶ How Does it Work?



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Acoustic Inspection Technology

- ▶ Demonstration Video



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Key Features of Acoustic Inspection



- ▶ No Flow Contact / No Confined Space Entry
- ▶ Low Cost-Pennies/foot
- ▶ Rapid Onsite Results – Under 3 min./segment
- ▶ Portable < 30 lbs
- ▶ GIS Integration – GPS Enabled
- ▶ Archive Pipe Segment Blockage Assessment

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Limitations of Acoustic Inspection

- ▶ Currently Does Not Indicate What is Causing the Blockage
 - FOG, Rootballs, Non-dispersibles, etc.
- ▶ Generally Does Not Assess Condition of Pipe Walls
- ▶ Does Not Pinpoint the Blockage – Gives an Aggregate Score for at Segment – Identifies Pipe Segments
- ▶ Under High Flow Conditions a Segment can be Assessed as Being Dirtier

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12

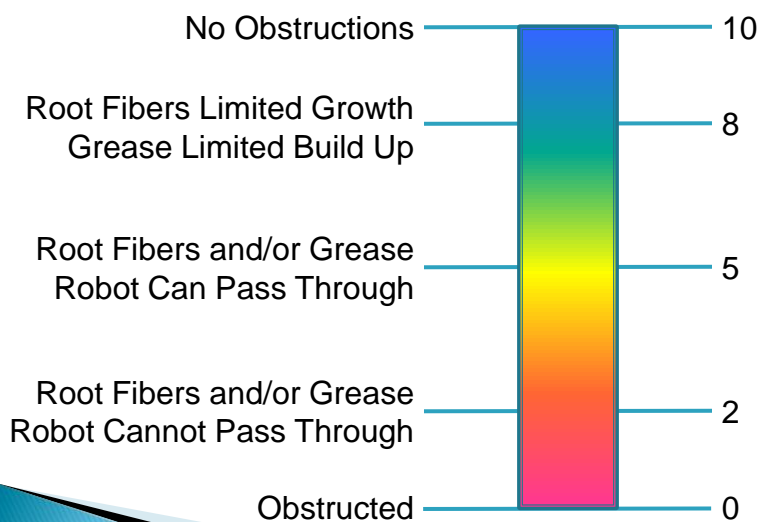
Field Performance

- ▶ Two Central Questions Performance & Operational Cost
 - Evaluated During 2010 CMU / InfoSense Acoustic (SL-RAT) Field Trial
 - NC-AWWA 2010 Spring Fling & Annual Meeting
- ▶ Blockage Assessment Performance Evaluation Based on Comparison with CCTV

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13

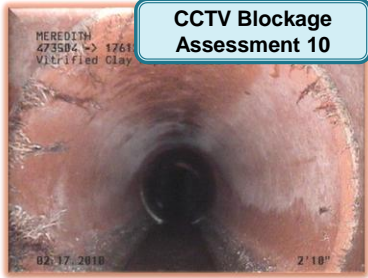
CCTV Blockage Assessment



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14

CCTV Blockage Assessment

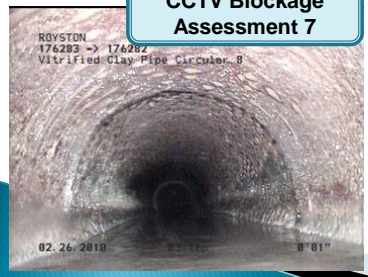


CCTV Blockage Assessment 10



CCTV Blockage Assessment 5

CCTV Robot was Able to Pass Through Root Fibers



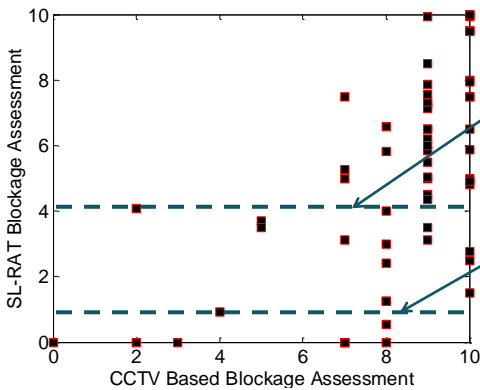
CCTV Blockage Assessment 7



CCTV Blockage Assessment 2

CCTV Robot was Not Able to Pass Through Obstruction

Field Performance



Acoustic Standard Threshold

- 61% Reduction in Cleaning
- All Pipes Requiring Cleaning are Cleaned

Acoustic Critical Threshold

- 85% Reduction in Cleaning
- Identify Pipes in Critical Need of Further Action

- ▶ **CCTV & Acoustic Inspection**
 >50% Pipe Segments Did Not Require Cleaning
- ▶ **Acoustic Assessment Correlated with CCTV**
- ▶ **Acoustic Provides Conservative Assessment**

Field Performance

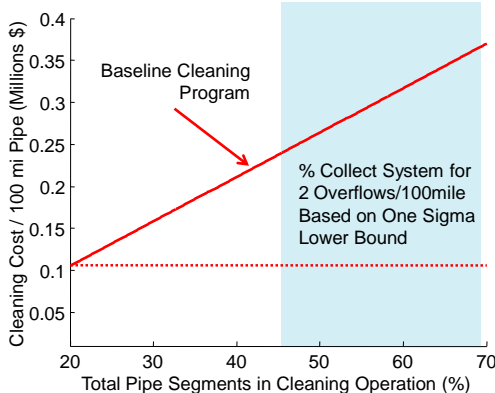
- ▶ Typical Industry Values : Cleaning Crew \$1.00/foot
- ▶ Estimated Acoustic Inspection Crew

Number of Crew Members	2
Annual Fully Loaded Salary Per Crew Member	\$68,000
Annual Equipment Costs (Including Truck & SL-RAT)	\$24,000
Work Days Per Year	251
Onsite Work Hours Per Day	5.5
SL- RAT Average Number of Segments Inspected Per Hour	6
Average Sewer Line Segment Length in feet	220
Cost Per Foot	\$0.09/ft

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17

Field Performance

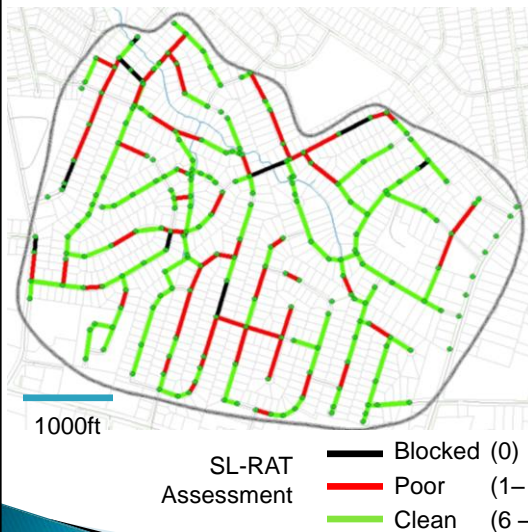


- ▶ Cleaning Program – Current Practice
- ▶ Cost Model
 - Cleaning Cost / Foot \$1
- ▶ Performance Model
 - Linear Regression for 16 Municipalities Overflows vs %System Cleaned
- ▶ Benchmark
 - 2 Overflows/100mi
 - 45% System Cleaned – Low Confidence
 - 75% System Cleaned – Modest Confidence

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18

Field Performance



- ▶ Acoustic Inspection Prior to Cleaning
- ▶ Only Clean Segments Below Standard Threshold
- ▶ Illustrative Case
 - 52,000 ft Basin
 - 30,000 ft Assessed by Acoustic as "Clean"
 - Remaining 22,000 ft were Cleaned
 - 58% Reduction in Cleaning

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19

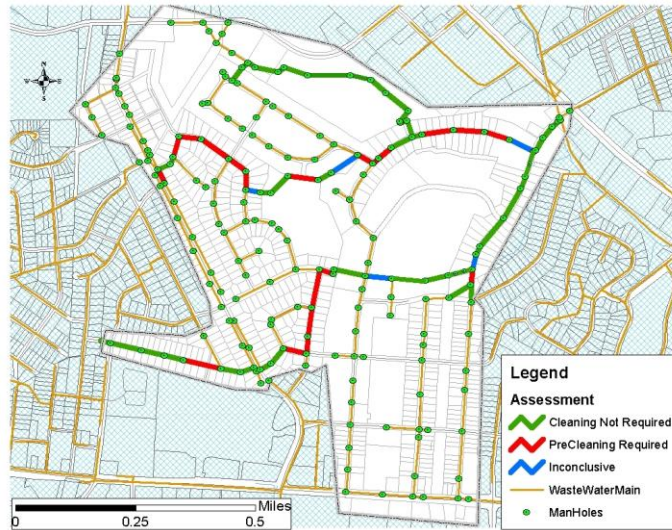
Acoustic Inspection Applications

- ▶ Focus Cleaning Effort - Reduce Cleaning by Over 50%
- ▶ Pre-Maintenance Inspection - Perform Low Cost Basin Assessments
- ▶ Eliminate Repeat & Downstream Overflows
- ▶ Post Cleaning - Quality Assurance

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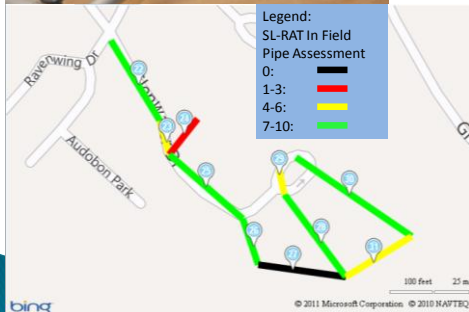
20

Example – Identify Hot Spots in Basin Cleaning Project



21

Historical Archive – SL-DOG



- ▶ Sewer Line Data Organizer – SL-DOG
- ▶ Convert Assessment Data to Actions
- ▶ Better Schedule Cleaning Activities
- ▶ Better Management of Inspection Activities
- ▶ Improve Your Collection Cleaning Effectiveness

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Summary

- ▶ Inspection is much Cheaper than Cleaning
- ▶ Acoustic Inspection is an Effective Method to Make Blockage Assessments
 - Quick
 - Cheap
 - Easy / Safe
- ▶ Acoustic Inspection Does Not Replace Cleaning or Detailed Inspection
 - Helps Determine how to Effectively Deploy Cleaning and CCTV resources

Additional Information



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