

Prioritizing Sewer Cleaning in Cincinnati with Acoustic Inspection

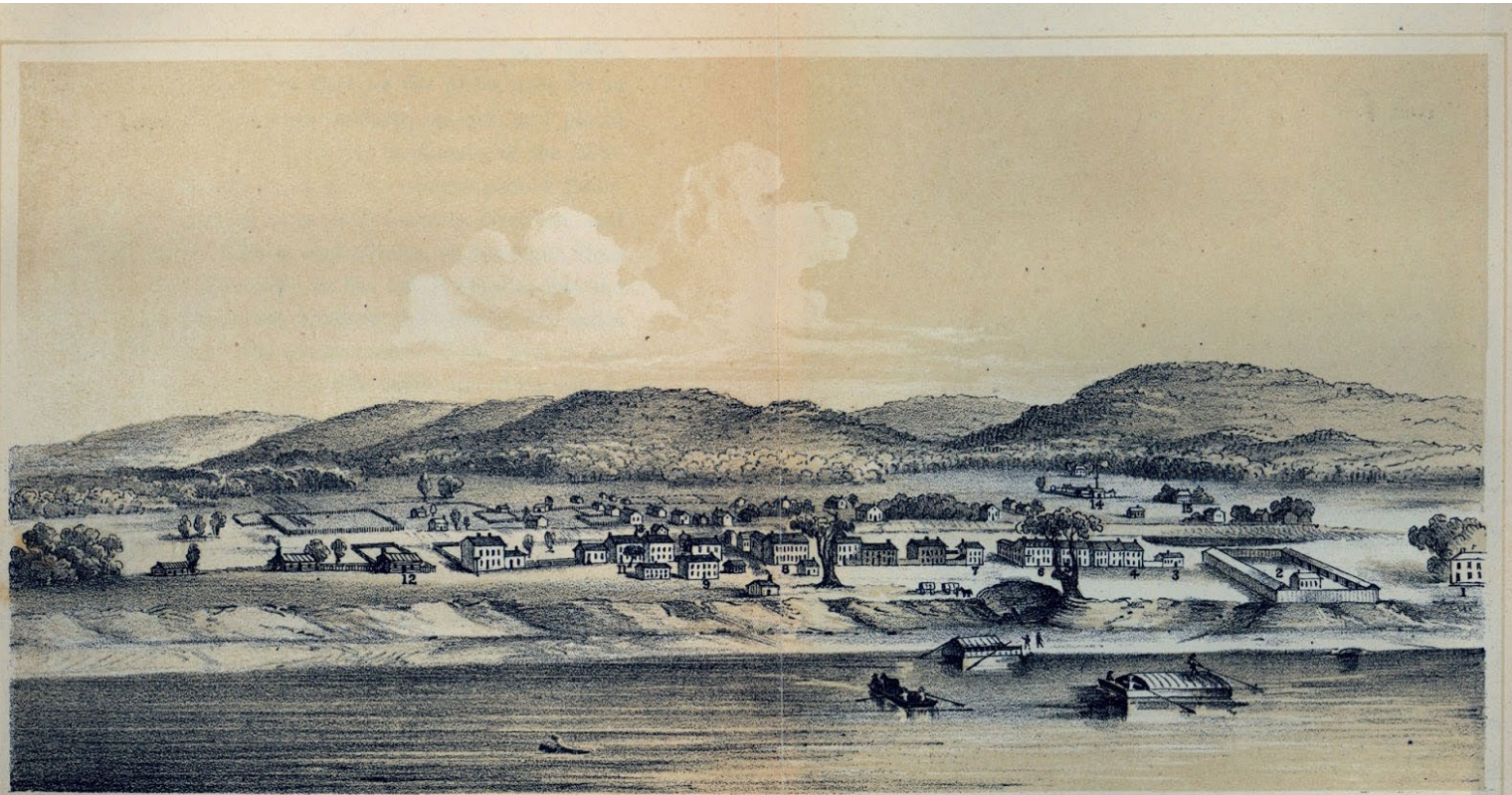
Todd Trabert & Randy Schneider
Wastewater Collection Division of MSD







Cincinnati Topography



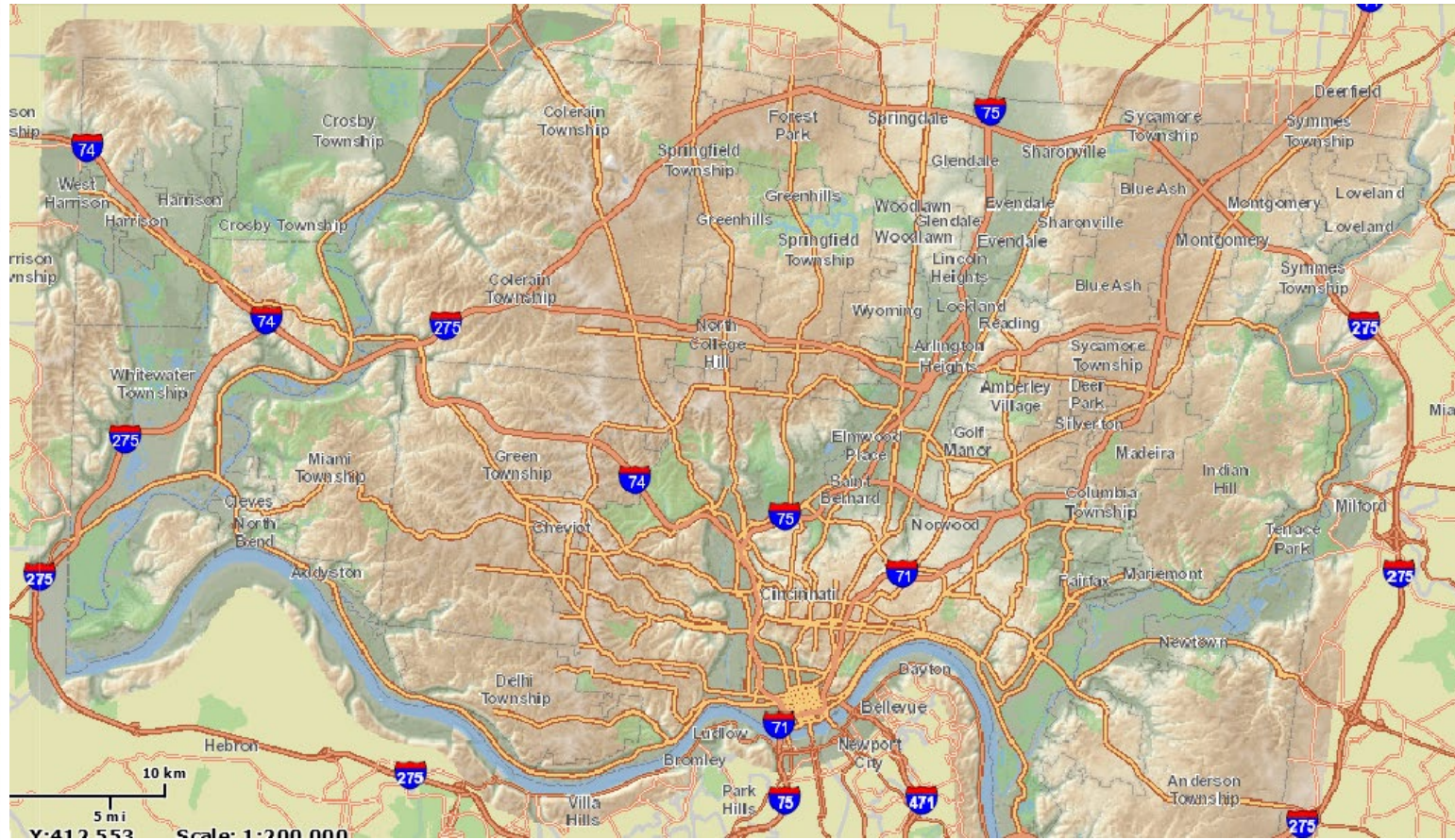
1. MAJ. WM. RUFFIN,
2. ARTIFGER'S YARD,
3. CHARLES VATTIER,
4. JAMES SMITH,
5. DAVID ZIEGLER,
6. GRIFFIN YEATMAN,
7. MARTIN BAUM,
8. COL. GIBSON,

CINCINNATI IN 1802.

STROBRIDGE & CO. LITH. CINCINNATI.

9. JOEL WILLIAMS,
10. ISRAEL LUDLOW,
11. GREEN TREE HOTEL,
12. SAMUEL BEST,
13. PRESBYTERIANER CHURCH,
14. FORT WASHINGTON,
15. DR. ALLISON,

Cincinnati Topography



Off-Road Sewers



Off-Road Inspection



Why Acoustic Inspection?

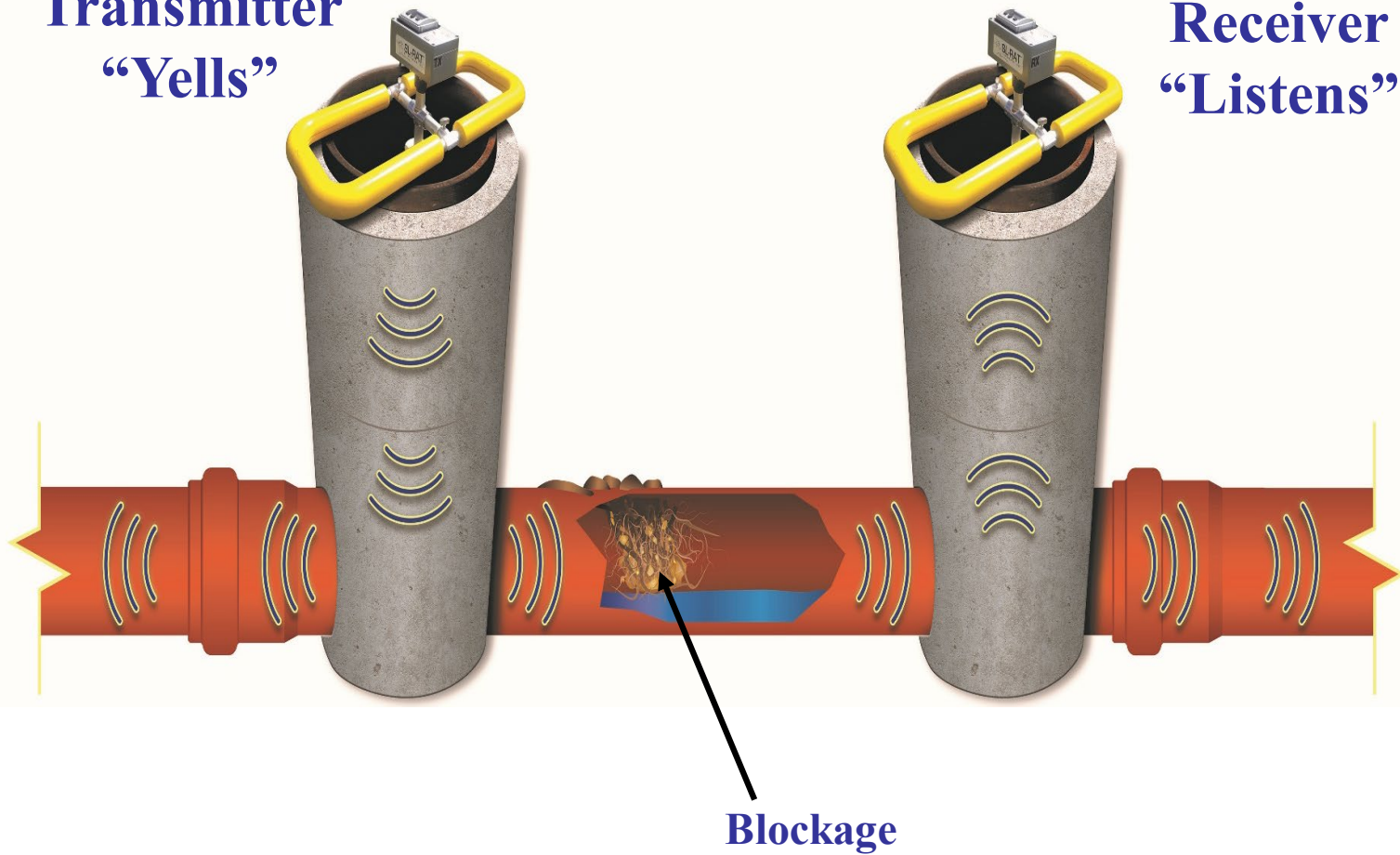
- EPA Tested
- Faster than CCTV
- No Flow Contact
- No Confined Space Entry
- Simple to Use
- Light Weight and Portable
- Battery Powered
- Durable
- Rapid Onsite Results – Under 3 min per segment
- GIS Integration – GPS Enabled



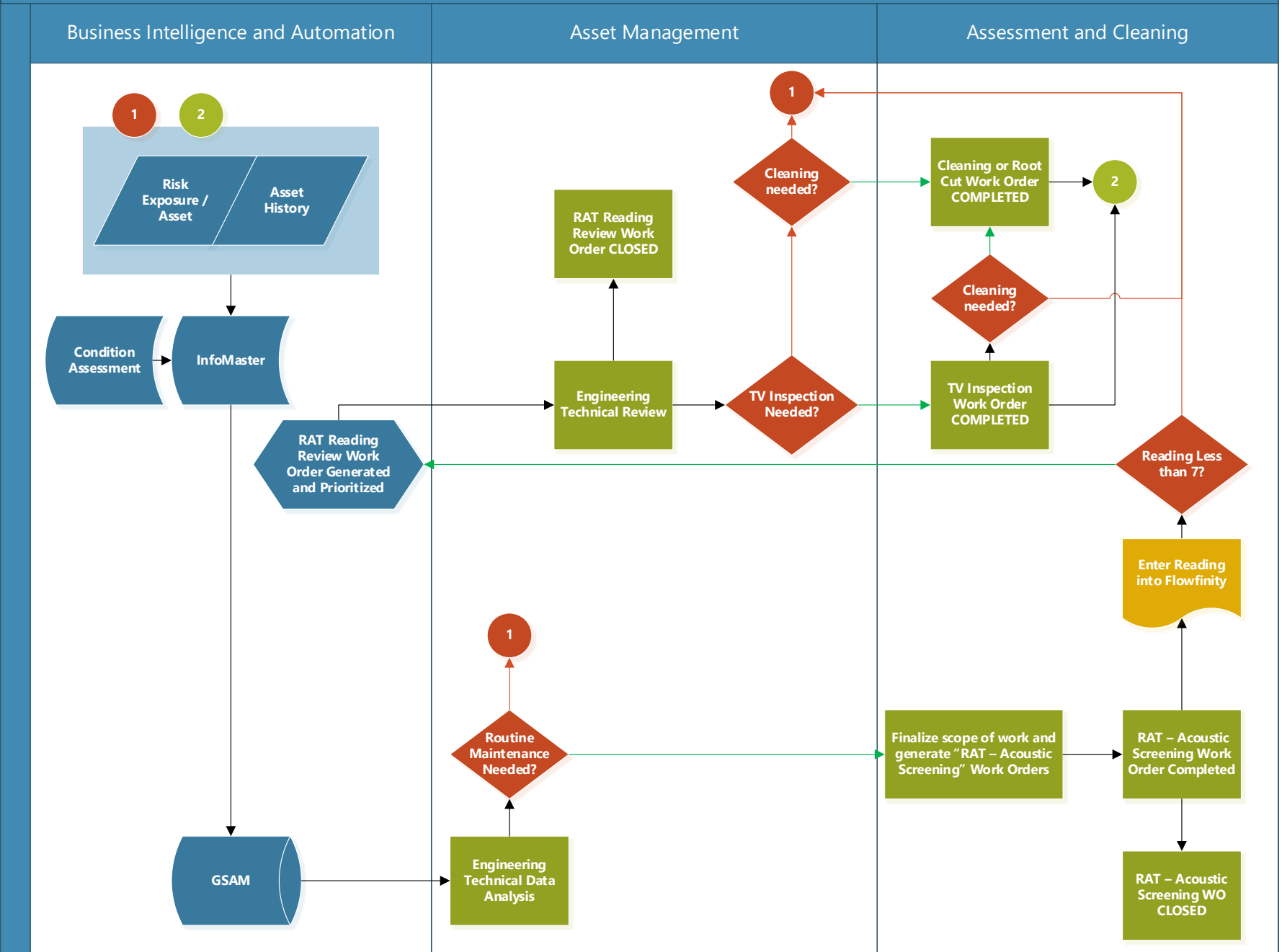
How Does Acoustic Inspection Work?

Transmitter
“Yells”

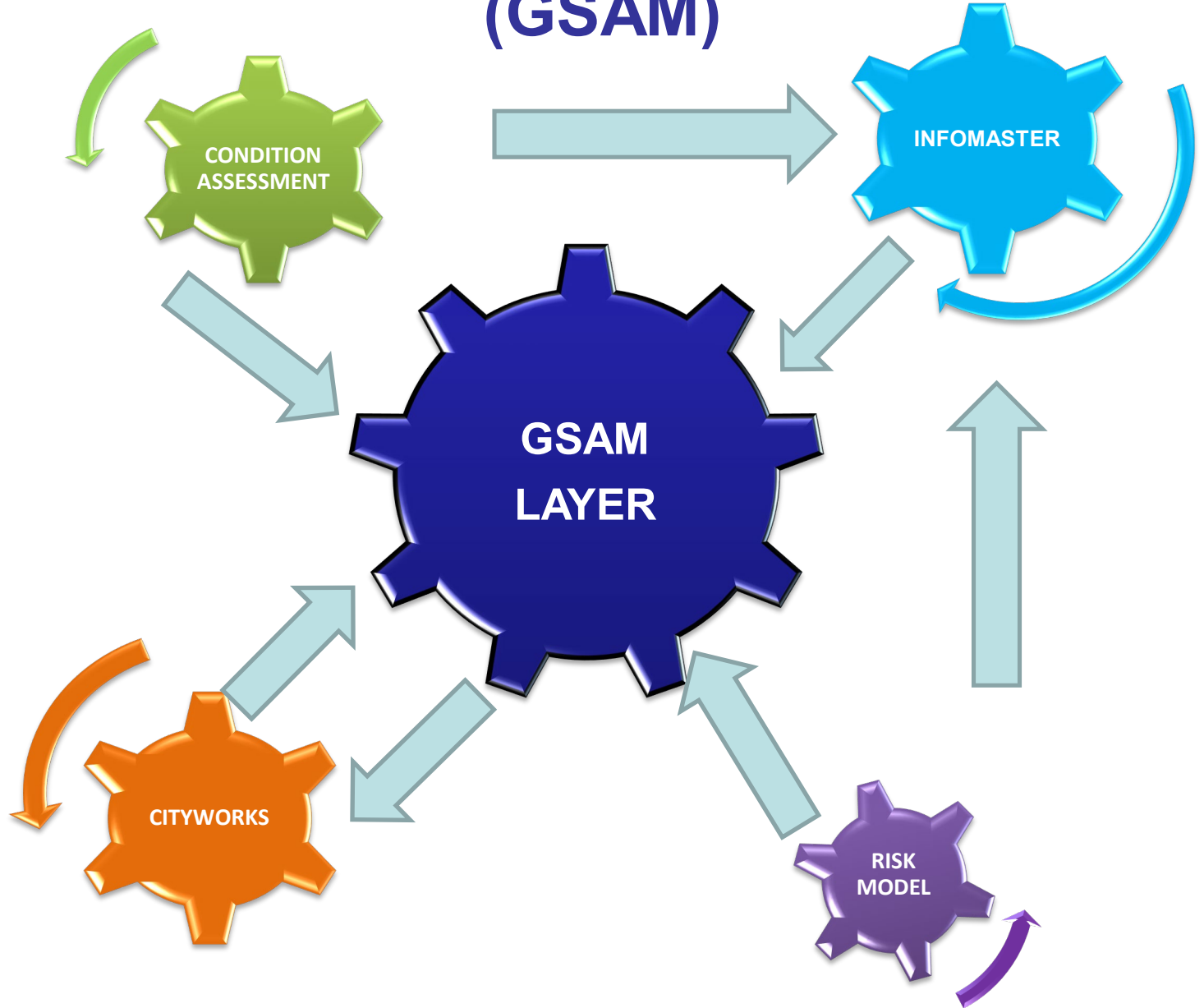
Receiver
“Listens”



Rapid Assessment Tool Workflow



Gravity Sewer Asset Management (GSAM)



Gravity Sewer Asset Management (GSAM)

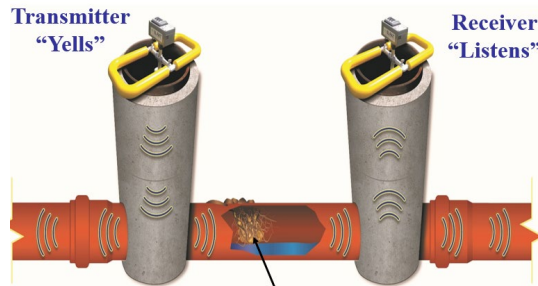
Maintenance Frequency	Consequence of Failure	Likelihood of Failure	Maintenance Risk Bin #
10	1	1	1
9	2	1	2
8	1	2	3
7	2	2	4
6	3	1	5
5	3	2	6
4	1	3	7
4	2	3	8
4	3	3	9
3	4	1	10
3	4	2	11
3	5	1	12
2	1	4	13
2	2	4	14
2	3	4	15
2	4	3	16
2	5	2	17
2	5	3	18
1	1	5	19
1	2	5	20
1	3	5	21
1	4	4	22
1	4	5	23
1	5	4	24
1	5	5	25

- Maintenance Risk Score is established by the number of cleaning activities over a 10 year period.
- More Cleaning equals higher Risk score
- Risk score drives frequency

<i>Open Maintenance Action Plan</i>	<i>Open Maintenance Activity WO#</i>	<i>Planned Maintenance Activity</i>	<i>Planned Maintenance Activity Date</i>
<i>Last Structural Activity</i>	<i>Last Structural Activity WO#</i>	<i>Last Structural Activity Date</i>	<i>Last Structural Activity Cost</i>

Gravity Sewer Asset Management (GSAM)

Maintenance Frequency	Consequence of Failure	Likelihood of Failure	Maintenance Risk Bin #
10	1	1	1
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6	3	1	5
5	3	1	6
4	1	3	7
4	2	3	8
4	3	3	9

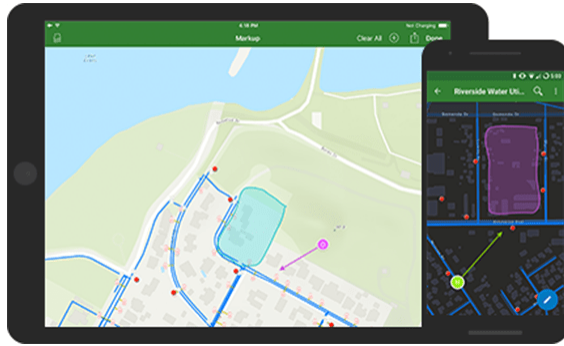


Last Maintenance Activity Date



Planned Maintenance Activity Date

Field Process



Explorer for ArcGIS

Custom Workflow
Field App



Basic Inspection

Work Order Integration





Assessment and Cleaning

WWC Equipment Rates



Search by
Vehicle/Equi...
Number

SL-RAT Acoustic Screening Work Order



Complete SL-
RAT Evaluation



View All
Records



View All
Records - For
Exporting

Manhole Access Inspections



View All
Records



Ready for
Desktop
Review



Ready for Field
Investigation



Review
Complete



Field
Investigation -
Distance

Complete SL-RAT Evaluation



Work Order Information

Work Order Number

24583

Work Order Description

RAT - Acoustic Condition Screening

Sewer Segment ID

27189008-27189009

Entity ID

678594

GIS Sewer Length

67.8

Completed By



Trabert, Todd

Arrival Date/Time



Next page

Complete SL-RAT Evaluation



Main Sewer SL-RAT Evaluation

Please complete the SL-RAT Evaluation of

Need help? [SL-RAT Equipment Job Aid](#)

Are you able to move forward with the Main Sewer SL-RAT Evaluation?

Yes

Pipe Length for SL-RAT Input **50**

SL-RAT RX Equipment Number

Enter RX Number, or use Touch Barcode Icon to Scan

000104



SL-RAT Displayed Value

8



Next page



Complete SL-RAT Evaluation



Work Order Comments

The following Comment will be added to Work Order

SL-RAT Evaluation Score of "8" completed on by Trabert, Todd on .

Additional Comments?

Complete Work Order

Completion Date/Time

6/24/2019

12:22 PM



Submit

Submit and New

Work Order View [Icons] Save Close Delete [Icons]

Description: RAT - Acoustic Condition Screening
 Number: 289879
 Initiated By: INGOLE, KATRINA M Date: 8/24/2018 1:21 PM
 Entity Type: SEWER READINGS
 Category: Planned Preventative
 Reactive?
SBU DATE: [Calendar]
 Status: CLOSED Priority: Priority
 Requested By: INGOLE, KATRINA M Work Group: MAINTENANCE MANAG
 Submit To: PITTS, LARRY L Date: 3/13/2019 4:42 PM
 Work Completed By: PITTS, LARRY L MSD/Contractor: [Dropdown]
 Projected Start: 8/24/2018 1:20 PM Projected Finish: 3/22/2019 4:42 PM
 Actual Start: 3/14/2019 1:25 PM Actual Finish: 3/14/2019 1:28 PM
 Order of Work: [Dropdown] Plumbers Receipt: [Calendar]
 Originating WO# [Green Box] Description [Green Box]
 Stru. Risk Bin: [Green Box] Maint. Risk Bin: [Green Box]
 HOLD For WO#: [Dropdown] Final Result: [Dropdown]
 Add Comments: [Text Area]
 Existing Comments: By INGOLE, KATRINA M: 8/24/2018 1:21:02 PM
 Perform acoustic assessment for segment 42404015-42404014 to determine if maintenance is needed.
 By WebAPI,: 3/14/2019 1:28:44 PM
 SL-RAT Evaluation Score of "2" completed on 42404015-42404014 by Pitts, Larry on 14 Mar 2019 13:28:00. . Stick Camera Inspection from DSMH 42404014 showed NO Visible Blockage in main sewer. . No Stick Camera Inspection completed from USMH 42404015. By Pitts,
 Instructions: [Text Area]

Location Information
 WO Address: 3429 CUSTER AV
 Municipality\CNAS: CINC-MOUNT LOOKOU Critical Zones: [Dropdown]
 TP Sewer Shed: LITTLE MIAMI 24hr Rainfall: 0 - <2 mo. - 24 - 140
 Location Details: 3429 CUSTER AV
 X Location: 1,424,306.21 Y Location: 419,751.34

Assets

<input type="checkbox"/>	Asset	AssetID	Location	Warranty Date	Work Completed
<input type="checkbox"/>	SEWER READINGS	653513	3429 CUSTER AV		<input type="checkbox"/>

< [Dropdown] >
 - Pink rows indicate inventory still under warranty.
 [Icons]

Related Work Activities

Work Orders

Add Request: [Text Area]
 Parent WO: [Text Area]
 [Dropdown] Create Child Work Order

Id	Description	Priority	Status	Submit To	Proj Start Date
314550	RAT Reading Review	5	CLOSED	INGOLE, KATRINA M	3/14/2019

< [Dropdown] >
 Add Inspection: [Text Area]

Work Cycle

Repeat: Never
 Interval: 2 Months
 From: Projected Start Date
 Date Printed: Next Print Date: 8/22/2018

Attachments

+ Add attachments... [Icon] Remove all attachments

289879Date03142019Time132800.pdf 99.57 KB
 Attached by Flowfinity Interface 03/14/2019 [Icon]

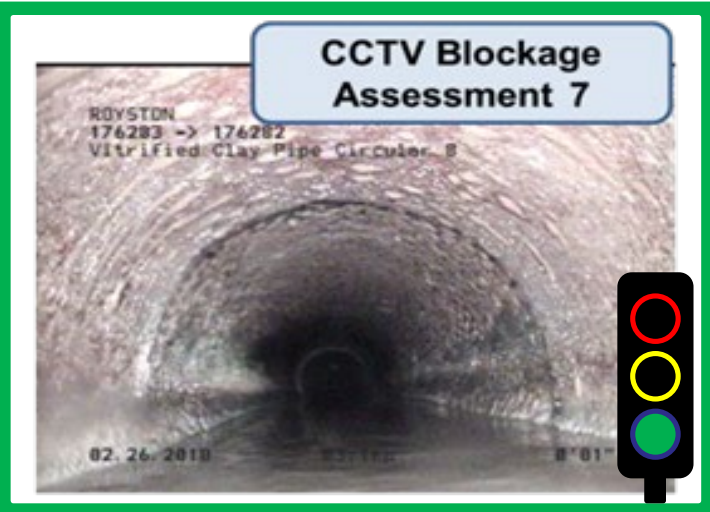
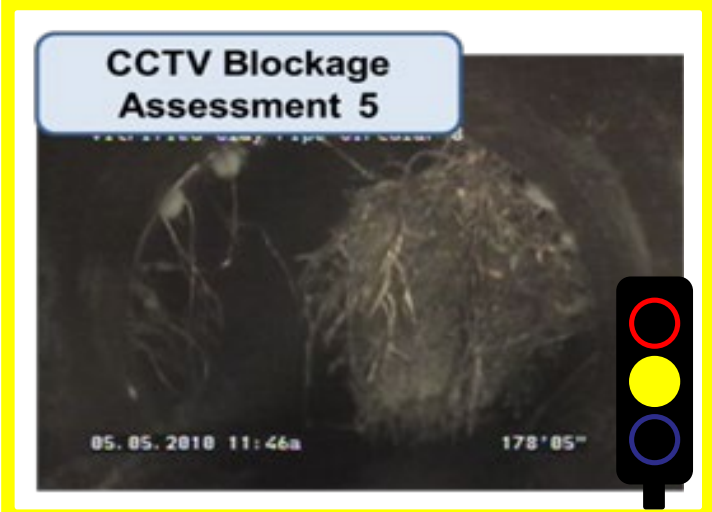
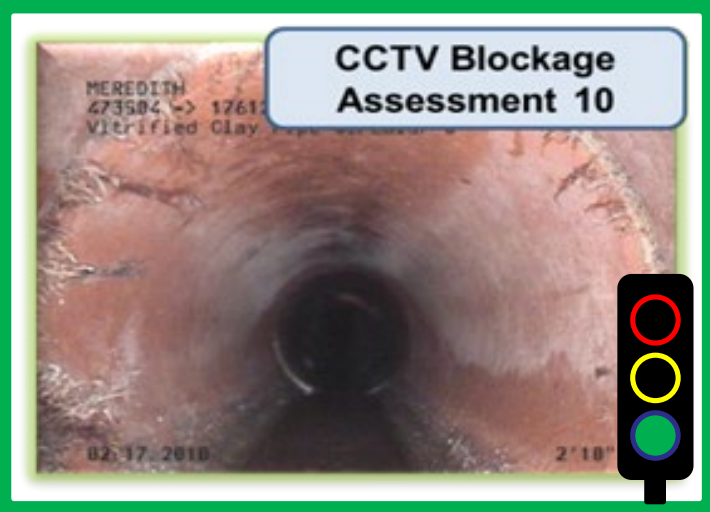
Details

Project: [Dropdown] Account: 4505000
 Project Tree
 Contract: [Dropdown] Contractor: [Dropdown]



Visual Comparison

METROPOLITAN SEWER DISTRICT



Metropolitan Sewer District

Wastewater Collection Division

Sewer Segment: 643272

Maintenance Number: 4505000

Type of Pipe: **Vitrified Clay Pipe**

Pipe Size: **12"**

Section Length: **2'**

Sewer Length: **274.2'**

Crewleader: **D MULLIS**

Municipality: **CINC**

RAT Score: 0

TV Date: **11/14/2018 12:00:00 AM**

Company: **MSD**

Street: **3510 WOODFORD RD**



Metropolitan Sewer District

Wastewater Collection Division

Sewer Segment: 594438

Maintenance Number: 4505000

TV Date: 1/30/2018 12:00:00 AM

Type of Pipe: **Vitrified Clay Pipe**

Pipe Size: **8"**

Section Length: **3'**

Sewer Length: **279.8'**

Crewleader: **D MULLIS**

Municipality: **DEERPK**

RAT Score: 2

Company: **MSD**

Street: **4324 DUNEDEN AV**



RAT Score: 2

Company: **MSD**

Street: **1618 PLEASANT ST**





TV MAINLINE INSPECTION IMAGE REPORT

Printed on: 06/21/2019 13:52

Metropolitan Sewer District

Wastewater Collection Division

Sewer Segment: 586919

Maintenance Number: 4505000

Type of Pipe: **Concrete Pipe (non-reinforced)**

Pipe Size: **8"**

Section Length: **0'**

Sewer Length: **180'**

Crewleader: **J DAVENPORT**

Municipality: **ADDY**

RAT Score: 3

TV Date: **6/27/2018 12:00:00 AM**

Company: **MSD**

Street: **243 MAIN ST**



Metropolitan Sewer District

Wastewater Collection Division

Sewer Segment: 574098

Maintenance Number: 4505000

TV Date: 3/28/2018 12:00:00 AM

Type of Pipe: **Vitrified Clay Pipe**

Pipe Size: **0"**

Section Length: **3'**

Sewer Length: **255.9'**

Crewleader: **N POWERS**

Municipality: **ADDY**

RAT Score: 4

Company: **MSD**

Street: **374 THREE RIVERS PKWY**



Metropolitan Sewer District

Wastewater Collection Division

Sewer Segment: 633276

Maintenance Number: 4505000

Type of Pipe: **Other**

Pipe Size: **12"**

Section Length: **0'**

Sewer Length: **296.2'**

Crewleader: **K JOHNSON**

Municipality: **BLUE**

RAT Score: 5

TV Date: **1/11/2018 12:00:00 AM**

Company: **MSD**

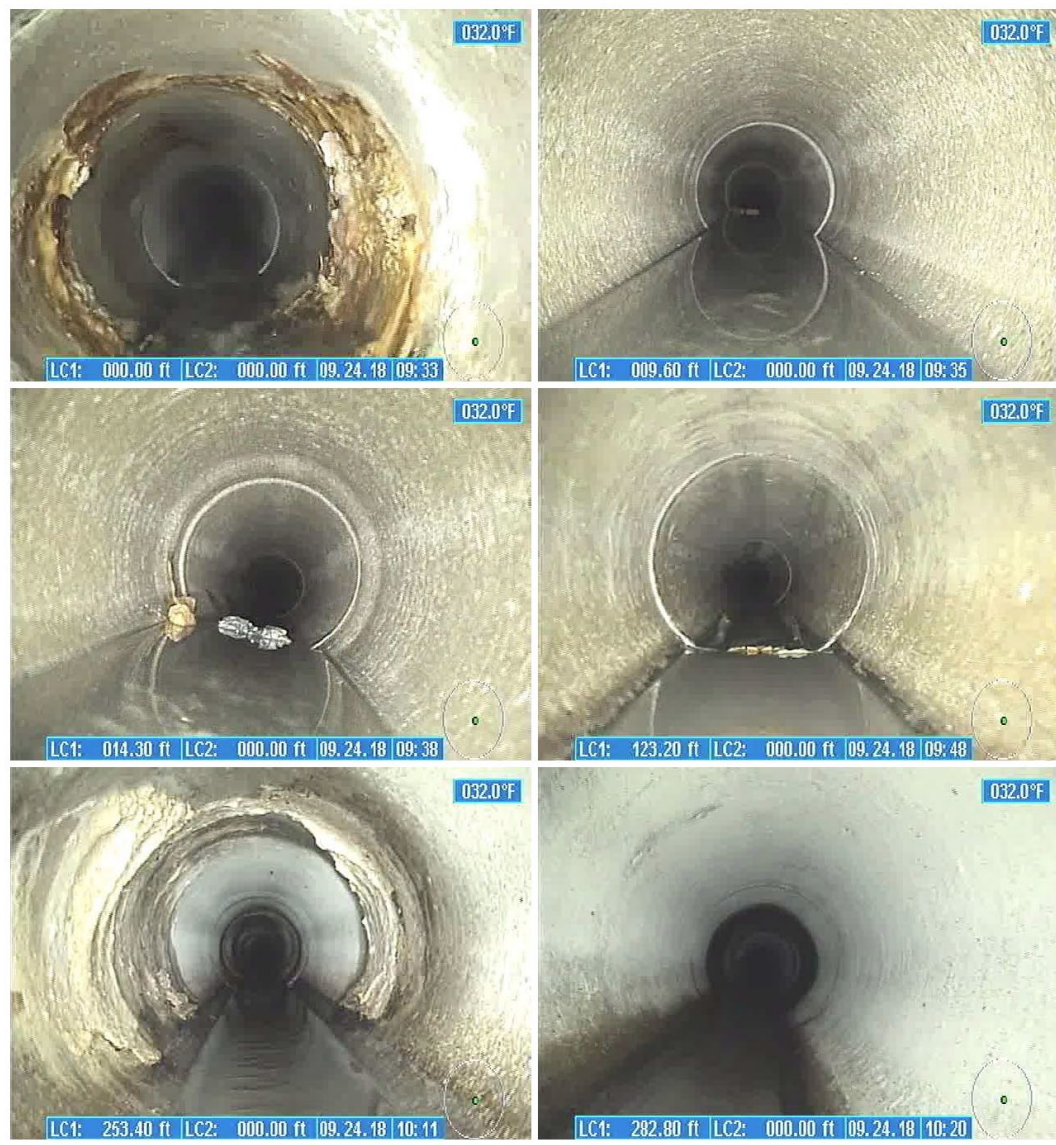
Street: **4471 LESLIE AV**



RAT Score: 6

Company: **MSD**
Street: **7947 HUNTERSKNOLL CT**

Type of Pipe: **Concrete Pipe (non-reinforced)**
Pipe Size: **8"**
Section Length: **0'**
Sewer Length: **300.5'**
Crewleader: **D ARMSTRONG**
Municipality: **MNTGMY**



Metropolitan Sewer District

Wastewater Collection Division

Sewer Segment: 579171

Maintenance Number: 4505000

Type of Pipe:

Pipe Size: 12"

Section Length: 0'

Sewer Length: 337.4'

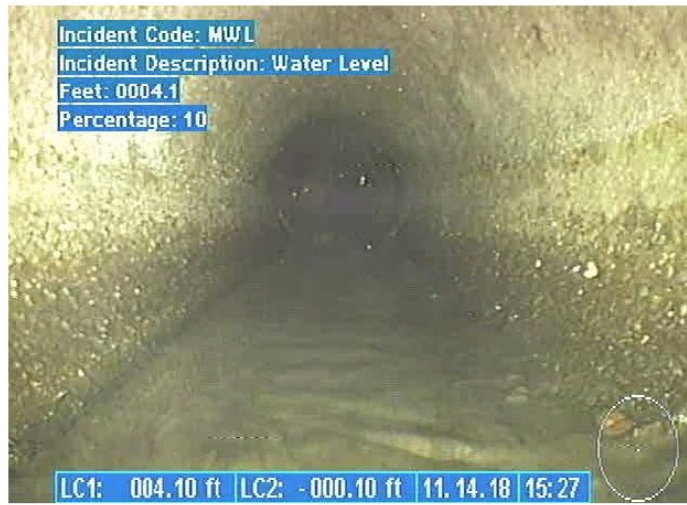
Crewleader: M SMITH

Municipality: FRSTPK

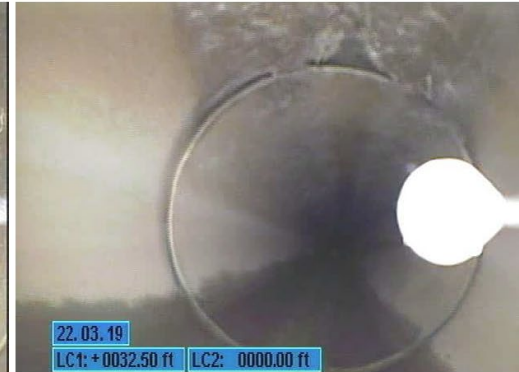
RAT Score: 6 TV Date: 11/14/2018 12:00:00 AM

Company: MSD

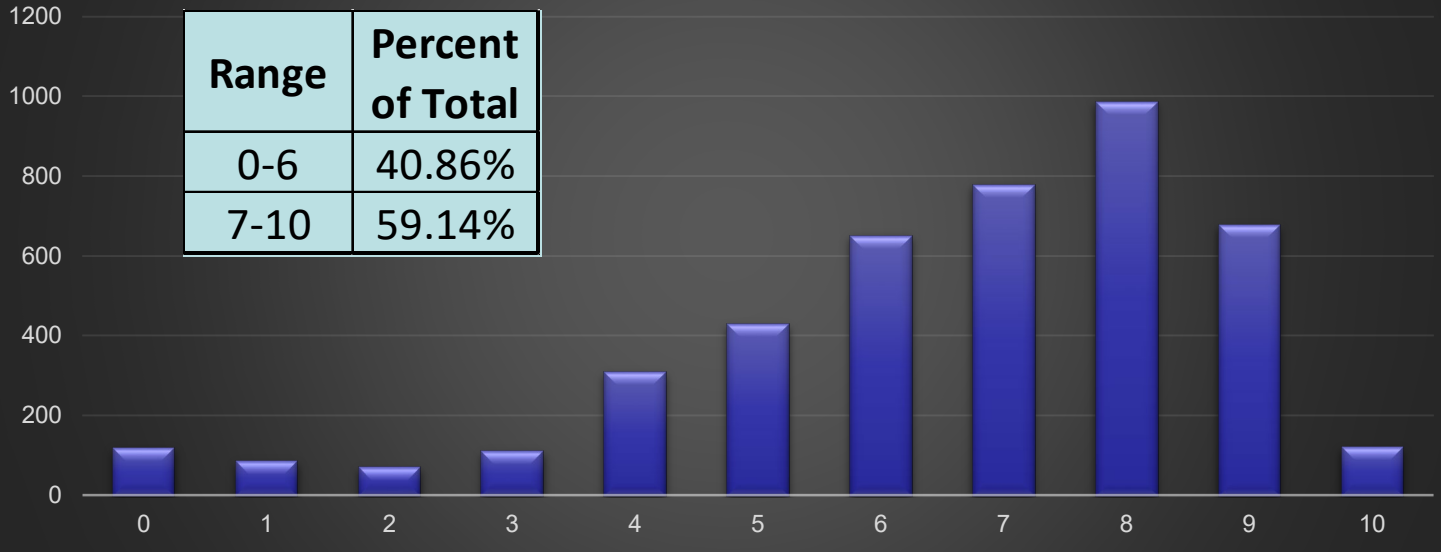
Street: 11500 FARMINGTON RD



RAT Score: 9

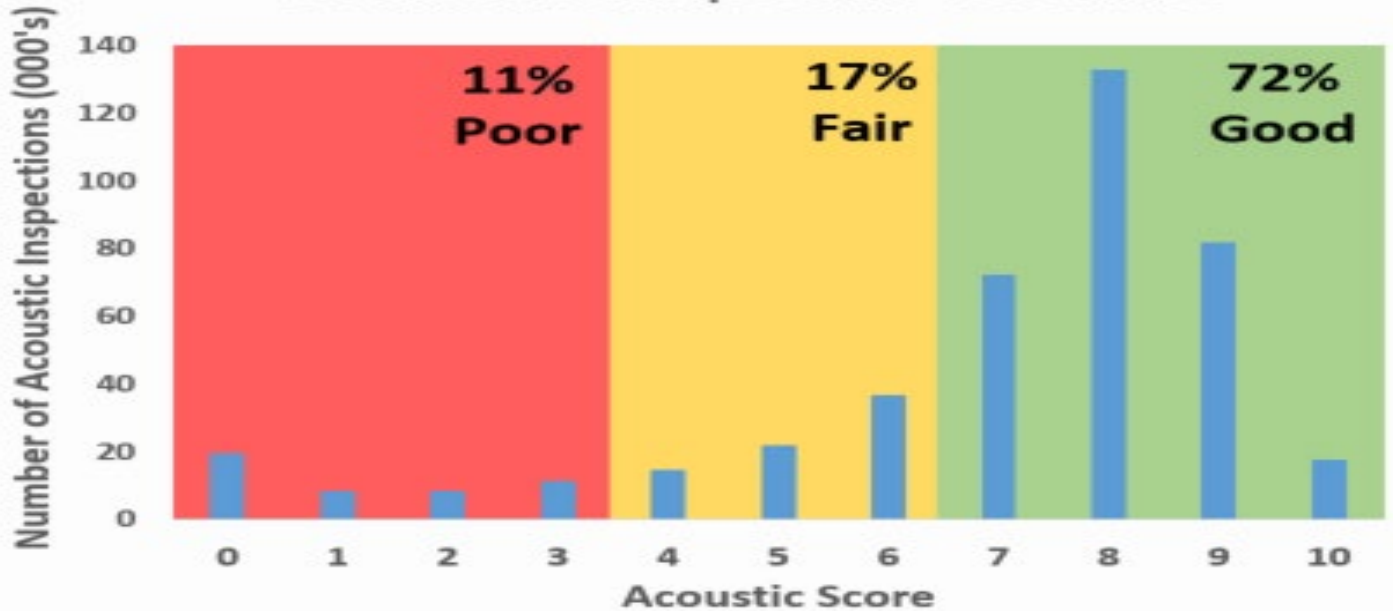


Cincinnati Acoustic Scores Totals



Acoustic Inspection Results

~120 Million Feet Inspected in ~280 Utilities



Data Analysis

DISTRICT

Work Description	Reading	Length	RAT Cost	Maintenance Risk	Maintenance Frequency	Next Maint. Date	Maint. Actions	Maint. Costs
RAT - Acoustic Condition Screening	6.00	141.29	10.00	5.00	72.00	Sunday, August 23, 2020		
RAT - Acoustic Condition Screening	4.00	362.83	12.38	13.00	24.00	Monday, August 10, 2020	Root Cut	2,176.98
RAT - Acoustic Condition Screening	3.00	233.43	23.14	14.00	24.00	Sunday, August 09, 2020	Cleaning	23,343.00
RAT - Acoustic Condition Screening	7.00	217.50	15.40	5.00	72.00	Sunday, June 28, 2020	Monitor	1,087.50
RAT - Acoustic Condition Screening	7.00	325.67	7.15	4.00	84.00	Friday, June 26, 2020		
RAT - Acoustic Condition Screening	1.00	147.08	18.82	14.00	24.00	Monday, June 22, 2020	Cleaning	441.24
RAT - Acoustic Condition Screening	2.00	267.10	12.14	14.00	24.00	Monday, June 15, 2020	Root Cut	1,602.60
RAT - Acoustic Condition Screening	7.00	205.57	5.54	3.00	96.00	Sunday, June 14, 2020	Monitor	1,027.85
RAT - Acoustic Condition Screening	6.00	148.31	22.16	21.00	12.00	Saturday, May 16, 2020	Root Cut	889.86
RAT - Acoustic Condition Screening	8.00	97.76	10.78	11.00	36.00	Saturday, April 25, 2020		
RAT - Acoustic Condition Screening	7.00	171.79	1.52	20.00	12.00	Friday, April 03, 2020	Heavy Cleaning	1,030.74
RAT - Acoustic Condition Screening	4.00	159.63	12.32	6.00	60.00	Wednesday, March 25, 2020	Monitor	798.15
RAT - Acoustic Condition Screening	0.00	35.00	4.55	14.00	24.00	Sunday, March 22, 2020	Cleaning	105.00
RAT - Acoustic Condition Screening	0.00	413.93	17.70	15.00	24.00	Friday, February 21, 2020	Cleaning	1,241.79
RAT - Acoustic Condition Screening	6.00	129.42	4.16	3.00	96.00	Saturday, February 08, 2020	Monitor	647.10
RAT - Acoustic Condition Screening	4.00	316.00	5.54	19.00	12.00	Saturday, January 11, 2020	Root Cut	1,896.00
RAT - Acoustic Condition Screening	0.00	548.32	221.62	24.00	12.00	Friday, November 15, 2019	Cleaning	822.48
RAT - Acoustic Condition Screening	1.00	187.00	42.89	21.00	12.00	Wednesday, November 06, 2019	Root Cut	1,122.00
		934,838.77	81,568.11					59,483,810.89

Data Analysis

- Nearly 5,000 Inspections with one crew in less than 1,000 hours.
- Less than \$0.10 per foot to assess the maintenance condition of Assets

Count of RAT - Acoustic Condition Screening	Reading	Length	RAT Cost	WOHours
669	0.00	117,437.35	10,756.80	117.44
86	1.00	18,380.52	13,229.95	158.10
70	2.00	17,380.69	1,707.86	18.32
110	3.00	26,985.85	2,800.54	30.22
308	4.00	63,658.68	4,555.19	47.99
428	5.00	90,277.69	5,693.87	62.65
650	6.00	131,038.48	8,499.28	92.55
778	7.00	148,268.24	9,939.58	108.71
986	8.00	176,872.01	13,889.43	151.81
678	9.00	125,780.38	9,512.87	103.10
121	10.00	27,062.39	1,792.51	19.77
4884		943,142.27	82,377.88	910.67

Data Analysis

- The tables below shows the costs savings for the assets where the reading was above 6 and TV and cleaning were not needed.
- Approximately 3% of the cost to clean and 4% of the cost to TV

Count of RAT Screenings	RAT Costs	Maintenance Recommendation	Estimated Maintenance Costs
900	\$ 8,733.00	Cleaning	\$ 306,000.00
187	\$ 2,714.00	Root Cut	\$ 63,580.00
1087	\$ 11,447.00		\$ 369,580.00

Count of RAT Screenings	RAT Costs	Estimated TV Costs
1087	\$ 11,447.00	\$ 295,664.00

Lessons Learned

- Successful in Minimizing Cleaning/CCTV
- Acoustic Screening worked in Larger Sewers
- Not Accurate in Combined Sewers during Rain
- Many Assets Inaccessible
 - Buried Manholes
 - Difficult locations
- Cleaning not necessarily needed in the 5 to 6 range
- Good opportunity to identify manhole defects
- Crews can use time onsite to perform manhole and surface condition assessments

Next Steps

- Adjust RAT Reviews down to “5” and below
- Track Follow up Work Orders
 - TV & Cleaning
 - Manhole Locating
 - Reschedule RAT Work Orders
- Modify Flowfinity App to Capture:
 - Basic Manhole Inspection
 - Ground Survey (Cave-ins, Sunken Areas)
 - Record Signs of Overflow/Surcharging
 - GIS Updates

Questions?

