# Man-Entry vs Multi-Sensor CCTV Inspections of Large Diameter Sewers and Manholes

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# Agenda:

- Large Sewer Inspection with MSI Technologies
  - Traditional CCTV
  - Laser Profiling
  - Sonar Profiling
  - Pipe Penetrating Radar (PPR)
- Alternative Techniques for Sewer and Manhole Inspections
  - Man-Entry Action Camera Video
  - Manhole Inspections
  - Odologgers
- Data Management and Deliverables





# Multi-Sensor Sewer Inspections CCTV, Laser Profiling, & Sonar





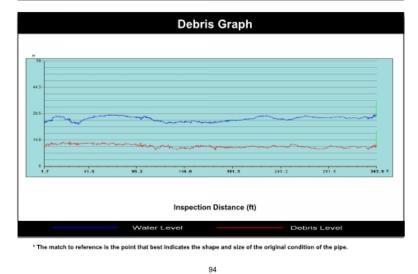


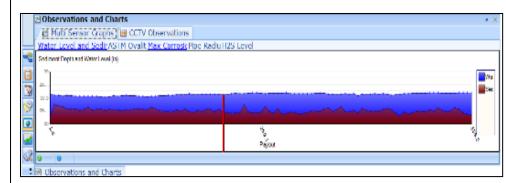
#### Sonar Data / Graph Review

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Asset Number	PCI-74B - PCI-75 Length			343.9 ft
Upstream MH	PCI-74B	Dimensions		48" x 59"
Downstream MH	PCI-75	Material	Reinforced (	Concrete Pipe
Survey Direction	Downstream	Shape		Other
Date Installed		Match to Reference *		312.7 ft
Date Profiled	09 September 2014	Operator		

Observations						
Average Debris Depth	12 in					
Average Water Level	27 in					
Debris Volume	895.4 cubic feet					

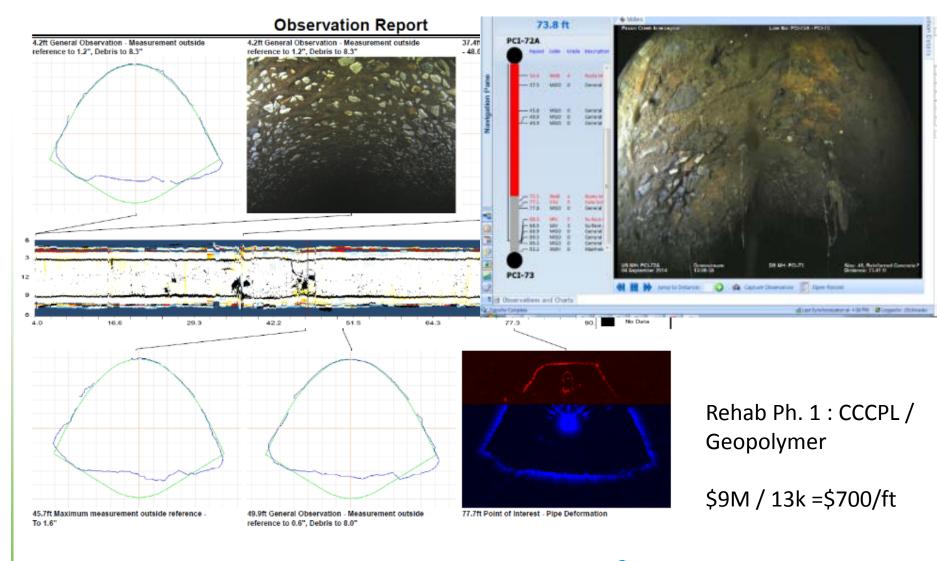








#### **CCTV & Laser Review**





# Pipe Penetrating Radar (PPR) Case Study: Cochella Valley CA

#### SewerVue

- In-Pipe Ground Penetrating Radar
- Identify and quantify voids behind the pipe wall
- Approximates wall thickness
- Robot rotated sensors between 9 o'clock & 12 o'clock
- Rotated sensors between 10 o'clock and 2 o'clock on return







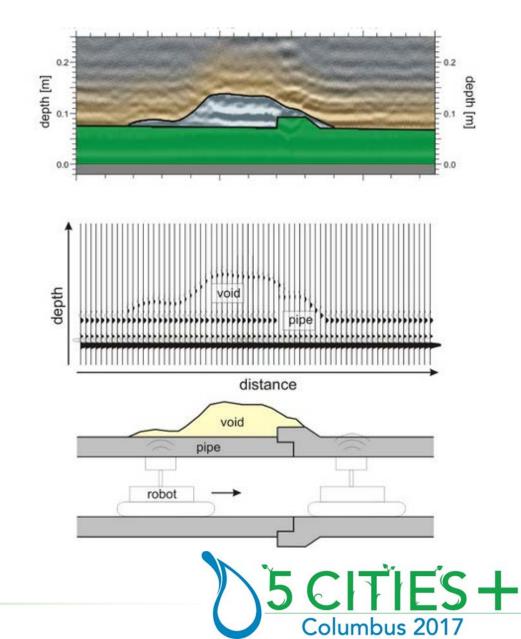
### Pipe Penetrating Radar (PPR)

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- SewerVue
  - In-Pipe GPR
  - Can identify and quantify voids outside/ behind the pipe wall
  - ~\$10 per foot



# Multi Senor Inspections (MSI) Pros and Cons

- Pros:
  - Detailed pipe information on dimensions and debris
  - Equipment can tolerate unsafe and toxic gases
  - Multiple sensors/equipment can collect information simultaneously
  - Can float equipment on top of high flow conditions
- Cons:
  - Relatively expensive (\$4 to \$10 per linear foot)
  - Time to collect, process, and analyze data
  - Coordination with limited specialty contractors who are typically very busy
  - Data can be challenging to interpret and sometimes misleading



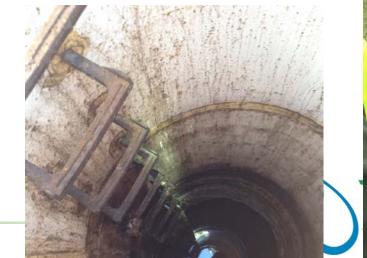
### **Man-Entry Sewer and Manhole Inspections**

- Storm and Combined Sewer with Action Cameras and Zoom Cameras
  - Provides good alternatives to CCTV
  - Can be done in NASSCO PACP formatting with post processing
- Manhole Inspections with tablets, polemounted action camera connected via bluetooth cell phone
  - Allows detailed photos and video that meet MACP Level 2 Inspections











# Man-Entry Equipment















## Man-Entry Inspection Equipment (cont.)

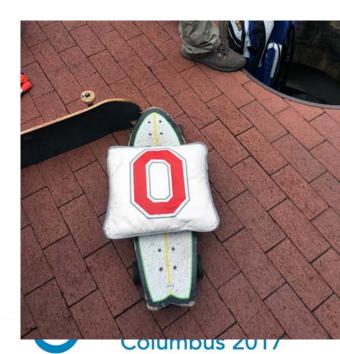








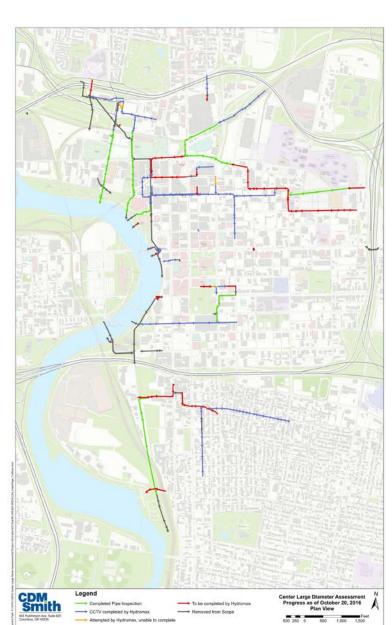




### Man-Entry GoPro Inspections

- Man-entry pipe inspections during the summer of 2016
- 14,060 LF of Man-entry inspections
- 33,750 LF of traditional CCTV
- Man-entry: \$2.00 to \$3.00 per LF
- MSI: \$4.00 to \$5.00 per LF





#### Man-Entry GoPro Inspections

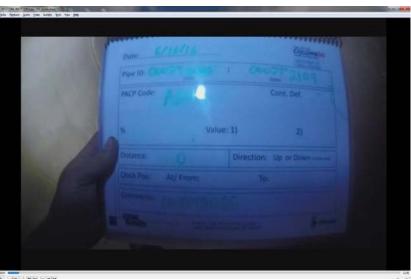
~ 2500' in one walk



#### **GoPro Data Conversion**

- Download data from GoPro
- Open blank .ptd file and code video based on observations
- Use video converter to convert video from .mp4 to .mpg
- Combine .ptd files into a data library and link video files

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OC2C0484	000202481	E-CID4_CCTV_Fmal000200454-000203481_1/000200484-000203483_92320%-1421_Limpg	SPACIAL STRENG	Sale Williami	U-915-02001047	City of Columbus	COC.	unknown	1788	0002C3484_0000C2483	6/25/201
00203484	000000481	E/CLD4_CCTV_Final.0012C0484_0002C0483-0002C0484-0002C0483_9202016-1401_D-spg		Bale Williams	U-915-00010-07	City of Columbus	COC	unknown	1785	000200484_0000000481	\$/23/201
00200524	000202688	E-CLD4, CCTV_FWak200220524_0022C3644_0002C0524_0002C0524_0002C0534-0002C0686_12142018-1325_3.upg		Sale Willow	U-915-07001047	City of Calutions	COC		1789	000200534:0000000888	12/14/201
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00200632	00020272	E/CLD4_CCTV_Final-0000C0612_0002C0272/0002C0612_0002C0612-0002C0612-0002C0272_12212016-1117_B.mpg		Bake William	U-915-07001047	City of Columbus	COC		1788	000200632-000200272	12/21/201
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DEECOT 16	0000008714	E/CLD4_CCT1_FMM0002C0716_0002C0714-0003C0716_0002C0714-0002C0716-0002C0714_1162017-1604_0.4pg		MDC	0-715-07000628	City of Calumbus	000		1789	000200716:000000014	1/16/201
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00201156	000202671	E/CL04_CCTV_Fiel0002C1116_0002C0673-0003C1154-0002C0673_10102016-1117_0.mpg		Sale Willow	U-915-07001047	City of Columbus	000	unknown	1788	000201156_000000673	10/10/201
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002022326	0000023544	E//CLD4_CCTV_Final0002C2306_0000C2344.0003C2326_0002C2344.0002C2326-0002C2344_1252016-1140_D.inpg		Bake William	U-915-070010-07	City of Columbus	COC		1789	0002023326-0000002344	12/1/201
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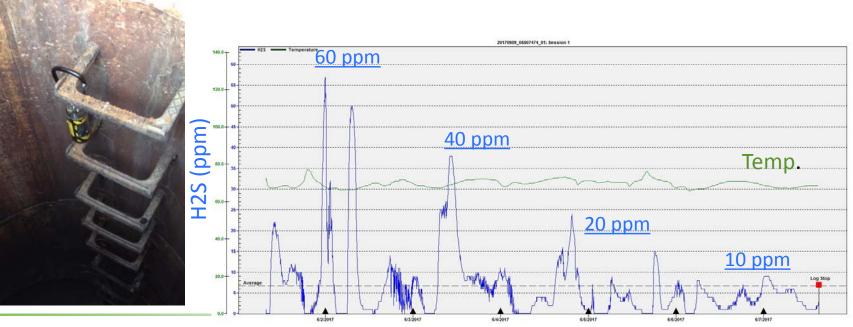


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#### Manhole Inspection and Assessment



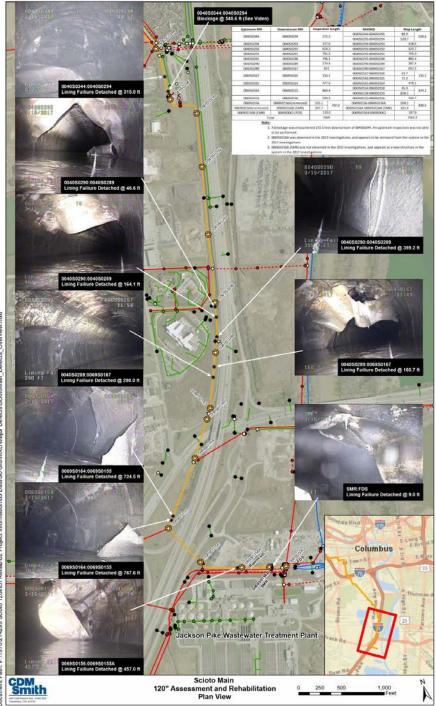




Period Diaplayed: 0/1/2017 - 6/7/2017 (Ods Fie: 20170609\_05507474\_01.ods - Senal Number: Odstog Type L3-RTx 05507474 Instrument Range 0-0P9M)

# Scioto Main 120" Assessment and Rehabilitation Project















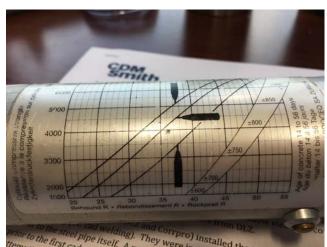


- Schmidt Hammer Test
- Six test on each side of pipe
- Avg. 54 = 7700 psi
- Avg. 50 = 6700 psi











- Successfully performed Schmidt Hammer test
- Confirmed pipe wall is sound
- Removed portion of failing liner
- Determined length of blockage ~44 ft







# Man-Entry Pros and Cons

- Pros:
  - Hands-on assessment of pipe condition by experienced engineers
    - NDT Testing (ie. Schmidt Hammer)
    - Measuring Taps, Debris etc.
  - Low cost mobilization and deployment
  - Less Scheduling Conflicts
  - Multiple platforms to collect data
  - Crews are able to navigate obstacles (debris, drops etc.)
  - No Distance Restrictions
  - Better control of lighting and camera location / panning
- Cons:
  - Large onsite crew for safety; Safety Training;
  - Must purchase wide variety of Camera, CSE, Traffic, Safety equipment
  - Can't perform all pipes due to flow and gas conditions
  - More issues with weather
  - No on-screen display of distances and codes were manually written





# **Questions?**

