



Pinpointing I&I

Utilizing Microdetection to Pinpoint I&I
Principles, Execution and Information
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Industry Approaches

Established Monitoring Approaches to Detect and Locate RDII (or I&I)


1. Area Velocity (in Manhole)
2. Lift Station Data / Monitoring
3. Level Only (I&I)
4. Level Only (Alarming)




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WHAT WE ALREADY KNOW

1. We spend more time looking for I&I than we do fixing it.
2. We often get into a “paralysis by analysis” where we are in a seemingly constant state of inspection (\$\$).
3. We seem to only get a 1-sided view of our system from the data.
4. Our key stakeholders are constantly pressuring us to be more efficient (\$\$) and effective when it comes to finding and prioritizing our I&I.





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No software, just a regular website. Save it as a favorite.


Data at Lift / Pump Stations

1. Wetwell Level
2. Run Time
3. Pump Current Draw (amps)
4. Force Main Discharge PSI
5. Influent Flow Rate
6. Pump Flow Rate

Web Based Data Platform
100% Turn-Key Service




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General Approach to Locate I&I

1. Rarely (never) enough budget to “find” and “fix” everything
2. Isolate study area into smaller areas to determine which areas warrant limited resources
3. Data “density” depends on budget, overall strategy, technology used, and mapping characteristics

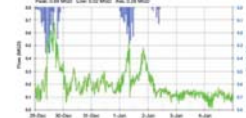


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FLOW METERS – MAJOR BASIN MONITORING


Portable flow meters monitor operating conditions in major basins in order to quantify the extent of inflow and infiltration.

Hydrographs are then created for each major basin showing increases in wastewater volume during periods of wet weather



Single unit meters are difficult to confirm accuracy.



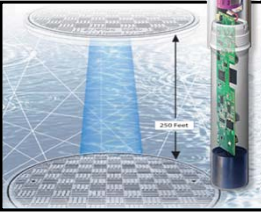



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PRECISION I&I MICRODETECTION – PINPOINT I&I

Purpose: Pinpoint the contributors of inflow and infiltration within adjacent manholes utilizing precision sensors and auto analytics platform to determine RDII and produce actionable results

WHERE	WHAT	WHEN
Where is the Inflow and infiltration coming from specifically? Which pipes are showing increased RDI?	Is the increase in RDI related to inflow or infiltration related sources? Is it private or public?	When are we seeing the RDI occur? Is it after a 1" or 2" or consecutive rain event pattern?

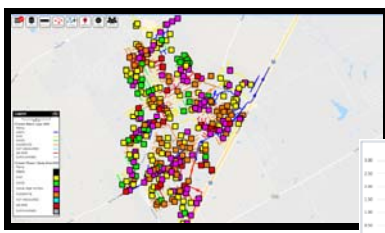




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PRECISION I&I MICRODETECTION – MASS DEPLOYMENT STRATEGY



Keys to Success:

- Rapid deployment of units
- Estimates RDII in same rain event
- Rain data collected to create local climate
- 60-Day studies
- Installations approximately every 1200LF
- Linking units to each other to pinpoint I&I sources





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What's Involved?

- Tools of the Trade:
 - Ultrasonic Meters
 - Acoustic Monitoring
 - GIS project management





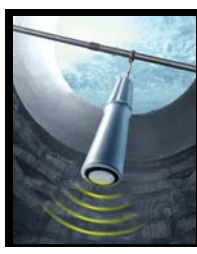



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PRECISION I&I MICRODETECTION – PINPOINT I&I

- iTrackers® monitor and record changes in wastewater volume as small as 1/10"
- Rapid deployment (20 units installed per day per crew)
- No confined space entry, no drilling into structures to install
- No sensor fouling due to debris build up over sensors
- Bridges the gap between flow meters and inspection CCTV camera equipment to determine RDII patterns in collection system and normally low volume points in the system.



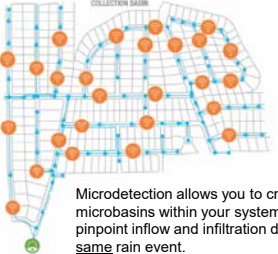




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CREATE MICROBASINS




Monitors major basins for signs of I&I

Pinpoints I&I down to mini and micro-basins

Multiple inline linked units are easier to compare accuracy.

When flow meters are used they can be verified against each other


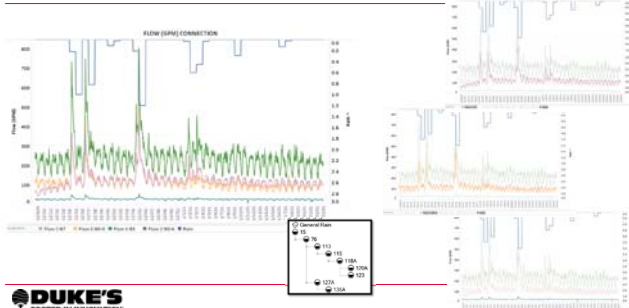
Microdetection allows you to create microbasins within your system to isolate and pinpoint inflow and infiltration during the same rain event.




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CHARTS / GRAPHS – FLOW CONNECTION ANALYSIS





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MICRO BASIN MONITORING



Linked analytical tools show individual line segment RDII contribution in volume and dollars

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ACOUSTIC INSPECTION



AUTO ANALYSIS



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FINAL MAP


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What is Acoustic Line Inspection?

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DUKE'S
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[illegible]

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MicroDetection "Street Level" I&I Detection														
Asset ID	Priority	Pipe Diam	Depth Max (in)	Depth Min (in)	Average Dry Level (in)	% of Full pipe (Dry) (Capacity or GPM)	Time in Surcharge (hours)	Estimated ADWV (GPM)	Estimated GWS (GPM)	4 Day Rain Event 10 Gallons Estimated (inches)	Local Estimated 4 Day GWS (inches) from upstream	Local Estimated 4 Day GWS (inches) from upstream	Peak Factor	Local Estimated 4 Day GWS (inches) from upstream
15335	1	12	6.29	1.11	1.38	11.3%	0	21.82	5.00	321,000	205,000	12.9	7,744.6	
15278	1	32	25.97	1.87	2.82	8.9%	0	85.03	31.00	1,543,000	300,000	38.4	5,586.9	
15867	1	8	7.35	1.03	1.15	14.3%	15	4.09	2.00	195,000	80,000	13.8	5,305.5	
16022	1	8	4.16	1.18	1.88	23.1%	0	33.96	9.00	160,000	100,000	4.1	4,390.2	
15382	1	8	8.04	0.78	0.94	11.7%	3	5.13	2.00	100,000	70,000	23.0	4,837.7	
15876	1	8	8.62	0.68	0.78	9.8%	5	2.97	1.00	60,000	19,000	19.8	4,431.8	
15808	1	10	9.28											
15854	1	8	7.05											
15214	1	8	6.37											
15872	1	6	3.34	1.97	2.54	42.4%	0	23.04	5.00	10,000	10,000	1.6	105.4	
16009	1	8	3.57	0.91	1.27	15.9%	0	5.13	2.00	15,000	10,000	4.9	456.6	
15266	1	8	1.95	0.53	0.65	8.2%	0	2.11	1.41	15,000	5,000	5.2	361.1	
15040	1	10	1.21	0.25	0.53	5.3%	0	0.09	1.00	5,000	1,000	4.1	277.9	
16013	1	8	1.91	0.99	1.14	14.2%	0	3.99	1.00	5,000	5,000	2.7	260.8	
15126	1	8	2.31	0.76	0.95	11.8%	0	1.05	0.93	5,000	5,000	5.4	240.8	
15090	1	8	1.49	0.65	0.95	11.9%	0	7.36	2.00	25,000	100	5.9	267.9	
15362	1	6	4.85	1.05	1.24	20.7%	5	7.90	3.00	125,000	1,000	7.2	85.4	
15846	1	8	5.44	1.21	1.36	17.0%	0	6.01	3.00	60,000	5,000	7.1	73.1	
15229	1	32	11.90	2.22	2.63	8.2%	0	18.83	20.00	140,000	5,000	11.4	59.1	
15935	1	8	1.65	0.92	1.11	13.9%	0	9.36	3.00	16,000	1,000	1.8	46.2	
15430	1	8	7.09	1.99	2.49	31.1%	0	11.28	5.00	187,000	1,000	4.0	44.0	
15443	1	12	5.97	1.43	1.99	15.8%	0	26.79	10.00	302,000	1,000	4.8	40.1	

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POST INSPECTION – PRIVATE PROPERTY INSPECTION

Private property inflow can be a significant contributor of I&I to the collection system. Turnkey inspection services of private properties can help identify those illicit connections.





Click to play public outreach video

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POST INSPECTION – I&I CONFIRMATION



Post inspection technology such as CCTV inspection, smoke/dye testing, manhole inspections or private building inspections are used to ascertain the exact cause of the Rain Derived Inflow & Infiltration (RDII) entering micro basin 1C



Click to play public outreach video

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Our Capabilities & Coverage



- National Coverage** – Over 20 Facilities Across Country
- Broad Service Portfolio** - Over 20 Services/Programs
- Significant Fleet** - 250+ vehicles
 - ~50 CCTV Trucks
 - ~40 Root Control Trucks
 - ~40 Sewer Cleaning Combos
 - 12 Hydro Trucks
 - MSI and Spot Repair units and capabilities
- Equipment**
 - ~2,000 Micro Detection units
 - ~100 Flow Monitors
 - 15+ Manhole Cameras
 - Plus, a variety of other SSES equipment



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POST INSPECTION – SMOKE / DYE TESTING

Indicators of inflow can be located during smoke testing. Defects found within smoking storm sewers can be located through sewer dye testing.



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