

What Tool is the Best Tool?

Pipe Diagnostics



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Overview



- **Pipeline Diagnostics Key Drivers**
- **Benefits of Pipeline Inspection**
- **Risk Based Pipeline Diagnostics**
- **Pipeline Diagnostics Process**
- **The Pipeline Diagnostics Toolbox and the factors that influence tool selection**
- **Pipeline Diagnostics Tools and their Application**
- **Condition Assessment and Asset Management in Santa Monica**



Pipeline Diagnostics Key Drivers



Life Expectancy

Capital Planning

Water Loss Control

System
Optimization

System
Vulnerability

Risk Analysis



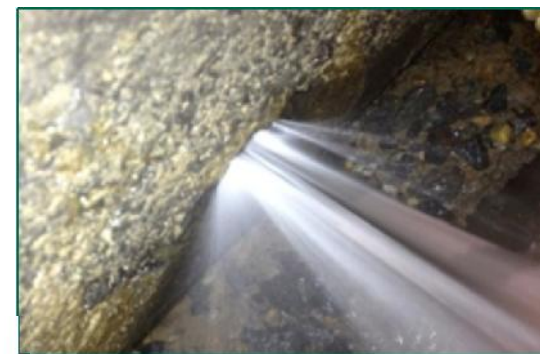
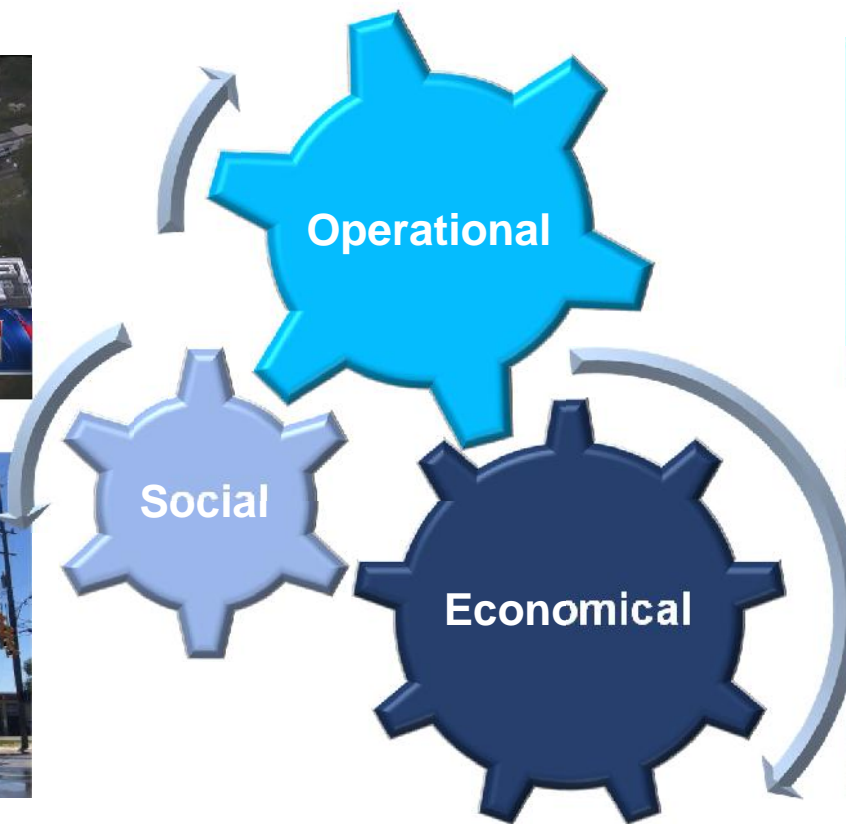
Common Causes of Pipeline Degradation



- Corrosion – Internal and External
- High incidence of leakage
- Pressure Surges
- Environmental Factors
- Operational
- 3rd Party Damage
- Installation
- Material Quality

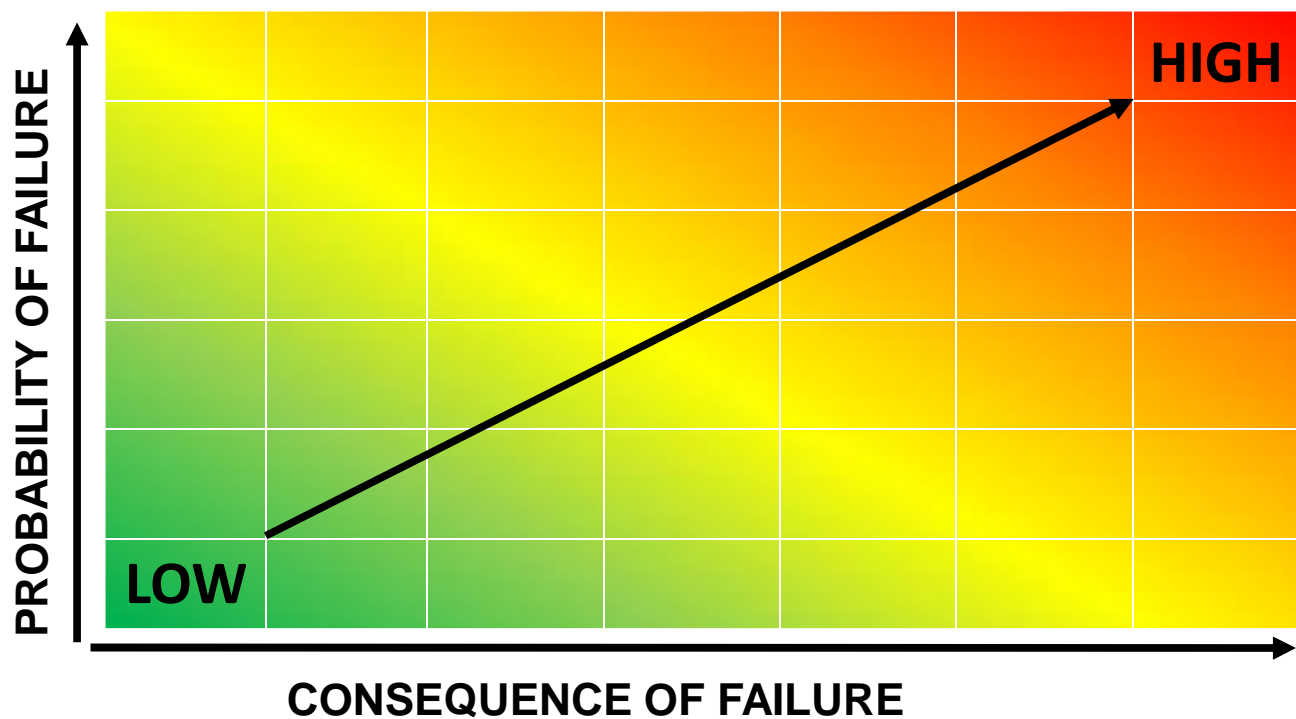


Pipeline Diagnostics Benefits



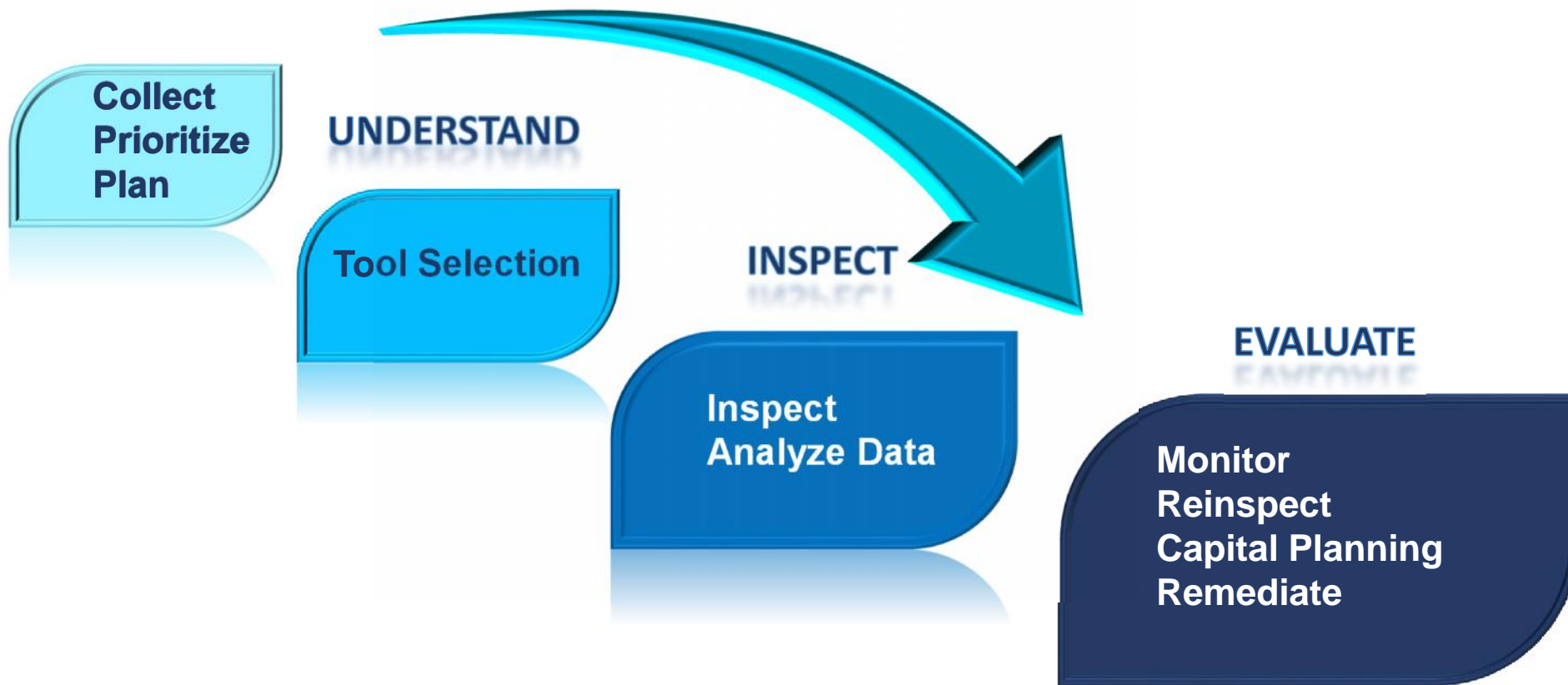


Pipeline Diagnostics Risk Assessment





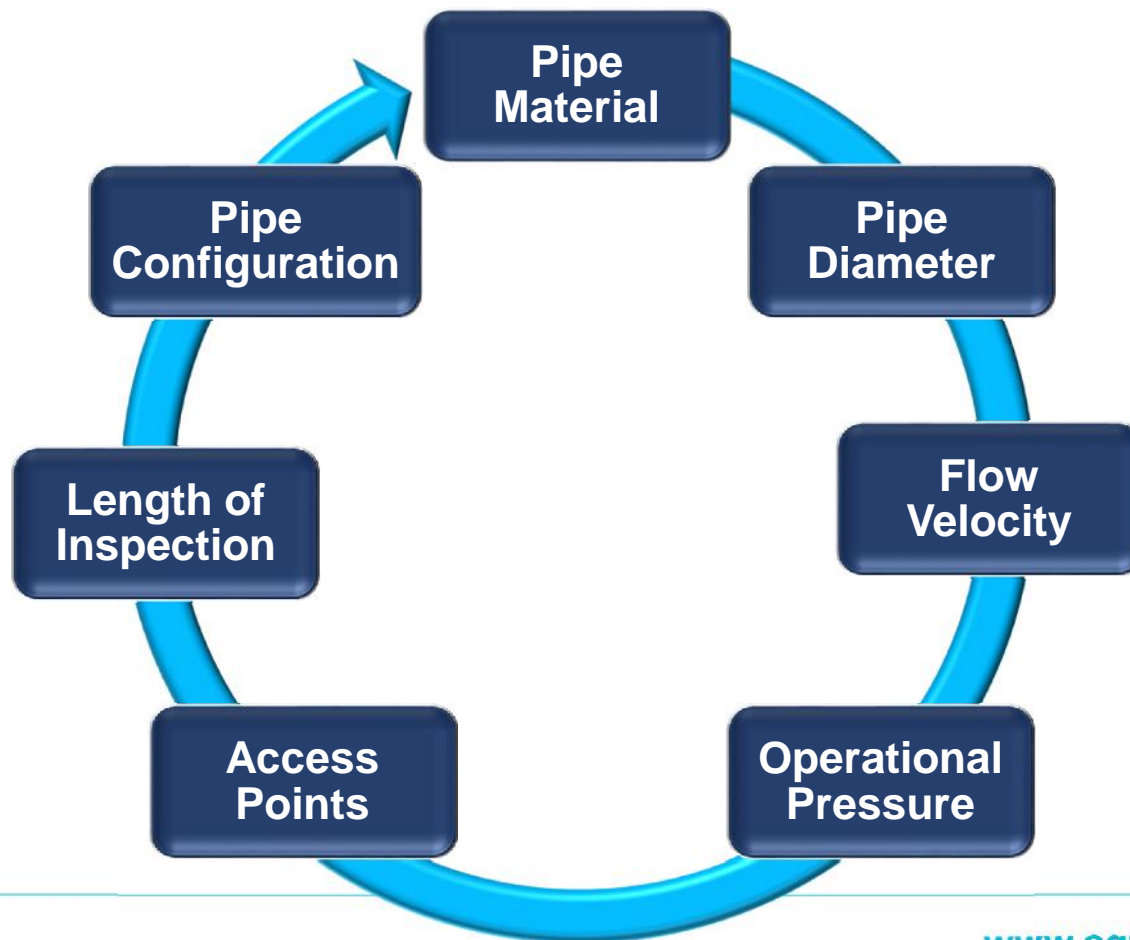
Pipeline Diagnostics Process



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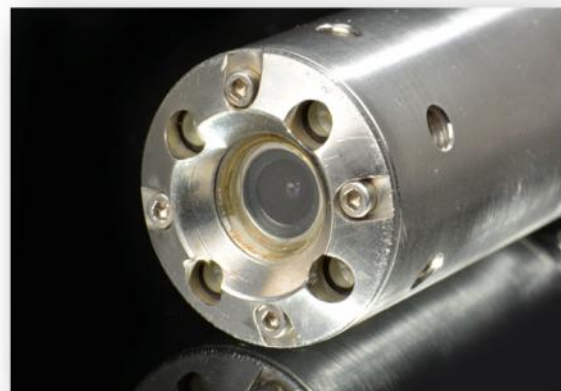
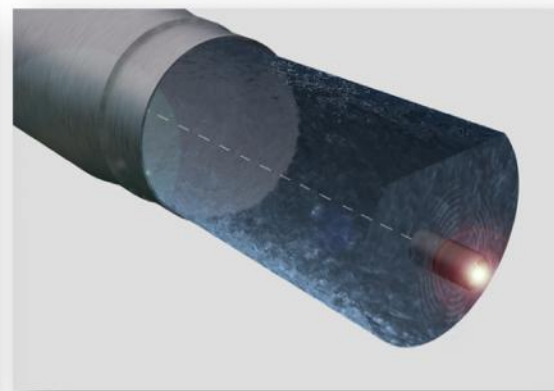
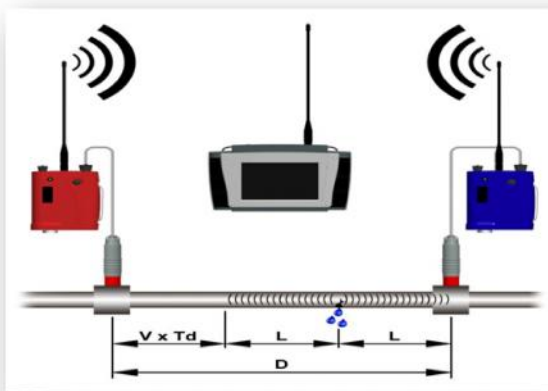


Understanding Your System





Pipeline Diagnostics The Toolbox






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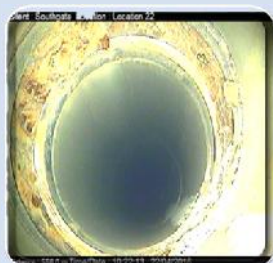
Pipeline Diagnostics Technology Selection



	TECHNOLOGY	PIPE MATERIAL						PIPE DIAMETER	INSERTION REQUIREMENTS	ACCESS	PRESSURE
		CIP	DIP	STEEL	AC	PVC	PCCP				
LOW	 LEAK DETECTION	✓	✓	✓	✓	✓	✓	<20"	AVAILABLE APPURTENANCES	FIRE HYDRANT, VALVE, PIPE WALL	30PSI
		✓	✓	✓	✓	✓	✓	4 - 12"	2" BORE	FIRE HYDRANT, MOST VALVES, HOT TAP	232PSI
Resolution	 LEAK DETECTION CCTV LINE TRACING	✓	✓	✓	✓	✓	✓	12"+	2" BORE	MOST VALVES, HOT TAPS	232PSI
		✓	✓	✓	✓	✓	✓	4"+	2" BORE	MOST VALVES, HOT TAPS	232PSI
		✓	✓	✓	✓	✓	✓	4 - 12"	4" BORE	FIRE HYDRANT, MOST VALVES, HOT TAP	145PSI
HIGH	 CCTV WALL THICKNESS LIFE EXPECTANCY LEAK DETECTION	✓	✓	✓	X	✓	X	8" +	4" BORE	MOST VALVES	90PSI
		✓	✓	✓	X	✓	X				



Pipeline Diagnostics Application



LEAK DETECTION

In Line
External

VISUAL INSPECTION

CCTV

CONDITION ASSESSMENT

Screening
Pipe Wall
Analysis
Life
Expectancy

ASSET MANAGEMENT

Asset Inventory
Asset Condition
Pipeline Tracing
GIS Updates

Reported Leakage

- Short Awareness
- Short Run Time
- Minimal Location Time
- Efficient Repair
- Reduced costs and water loss



Unreported Leakage

- Extensive Awareness Time
- Lengthy Run Time
- Significant Location Time
- Low priority Repair
- Multiple small undetected leaks have a greater impact on leakage losses annually





Pipeline Diagnostics Leak Detection

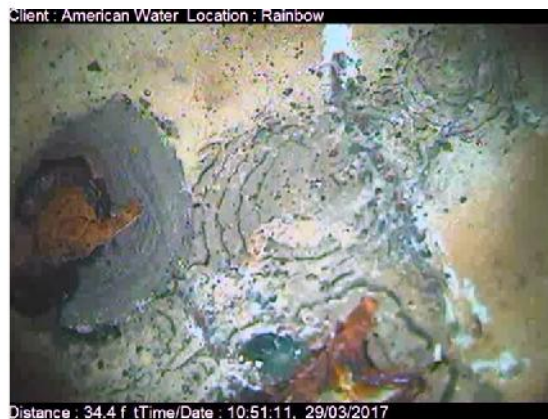


In Line Leak Detection		
Solutions	Applications	Benefits
<ul style="list-style-type: none"> • Tethered • Untethered 	<ul style="list-style-type: none"> • 3" and above • Transmission Mains • All Pipe Materials (providing pressure is adequate) • Complex Environments (urban, under railroads, highways, excessive noise) • Pressurized Inspections • Existing pressurized fittings, fire hydrants and hot taps • Low operational Pressure (15psi+) 	<ul style="list-style-type: none"> • No limitations due to pipe material • LD on high risk pipes = >ROI • Increased Accuracy – sensor is brought to actual leak location • Real Time – On site Results • Identification of air pockets • Untethered – long inspection distances • Minimalizes Collateral Damage • Positively impacts Real Water Losses • Screening tool for higher resolution condition assessment tools • No disruption to service
External Leak Detection		
Solutions	Applications	Benefits
<ul style="list-style-type: none"> • Loggers • Correlators • Ground Mics 	<ul style="list-style-type: none"> • Maximum pipe diameter 20" • Most effective on metallic pipe • Leak Localization • Abundance of access points • Limited Budget 	<ul style="list-style-type: none"> • Efficient 'on site' results • Increased response time for repair • Simple Installation • No disruption to service • Inexpensive screening tools • Prioritize where higher resolution tools need to be introduced • Positively impacts real water loss • Proactive approach when utilized as part of a water loss program





Pipe Diagnostics Visual Inspection



Obstructions

Illegal Connections

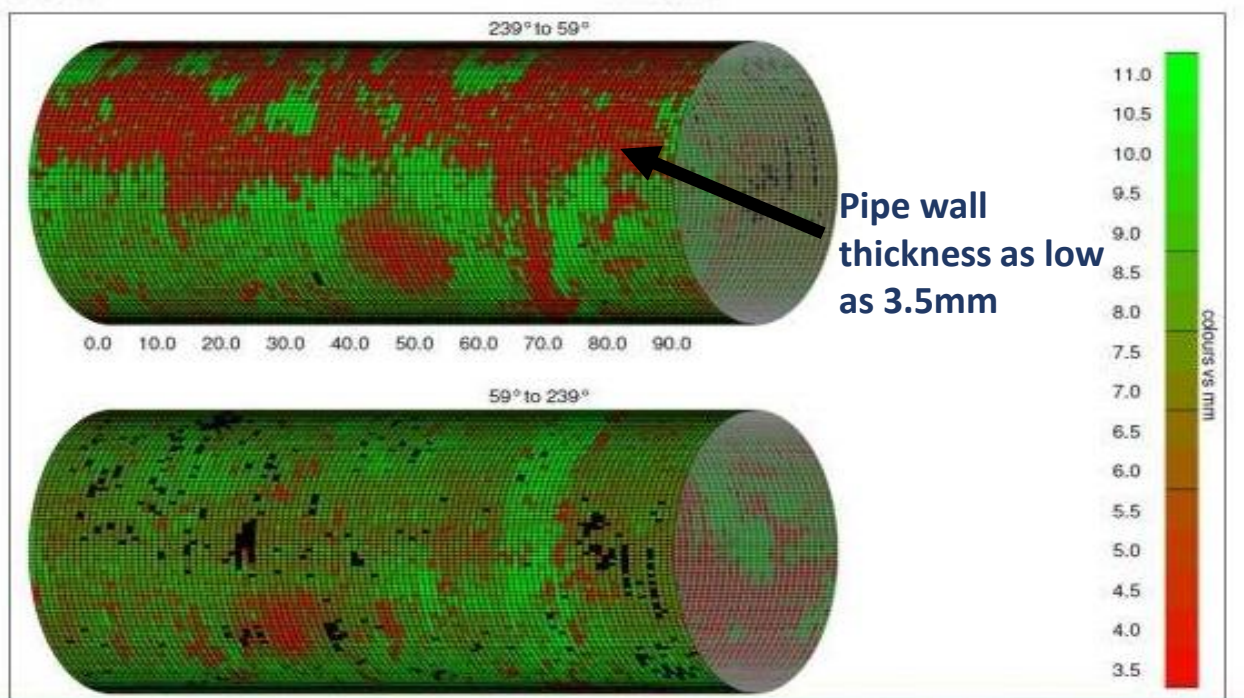
Deflected Joints

Fractures

Tuberculation

Air Pockets

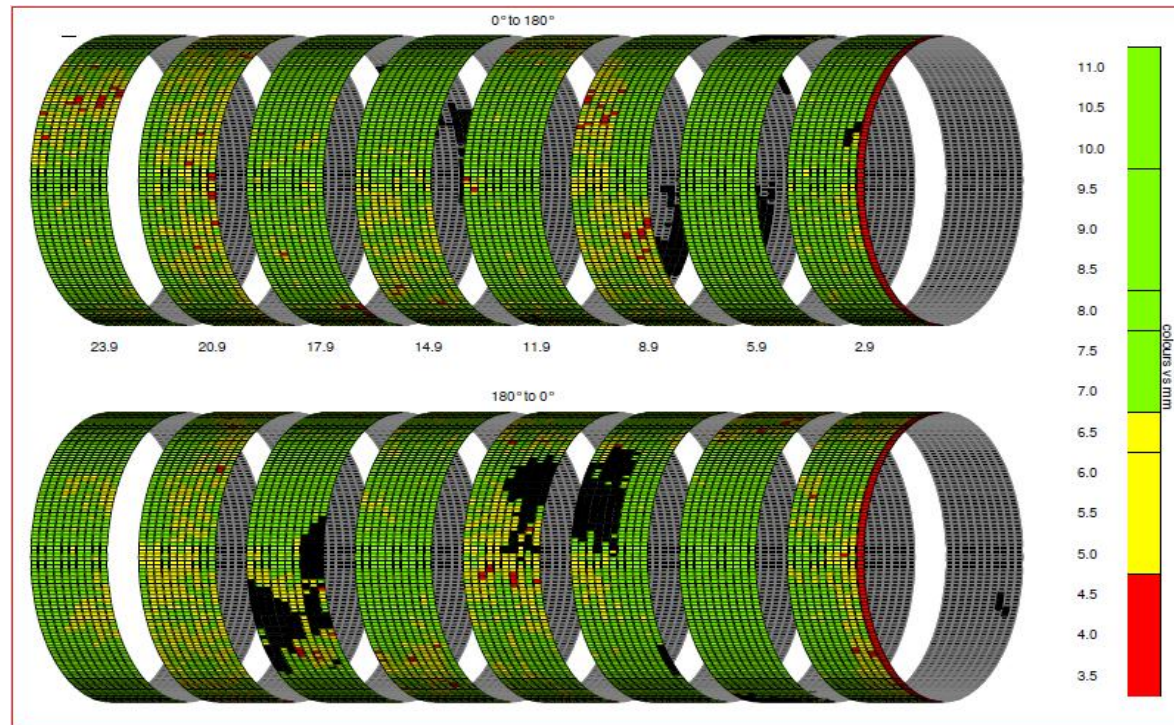
Sedimentation



- NDT Pipe Wall Thickness
- Interior and Exterior corrosion
- Estimated Life Expectancy
- Risk Assessment

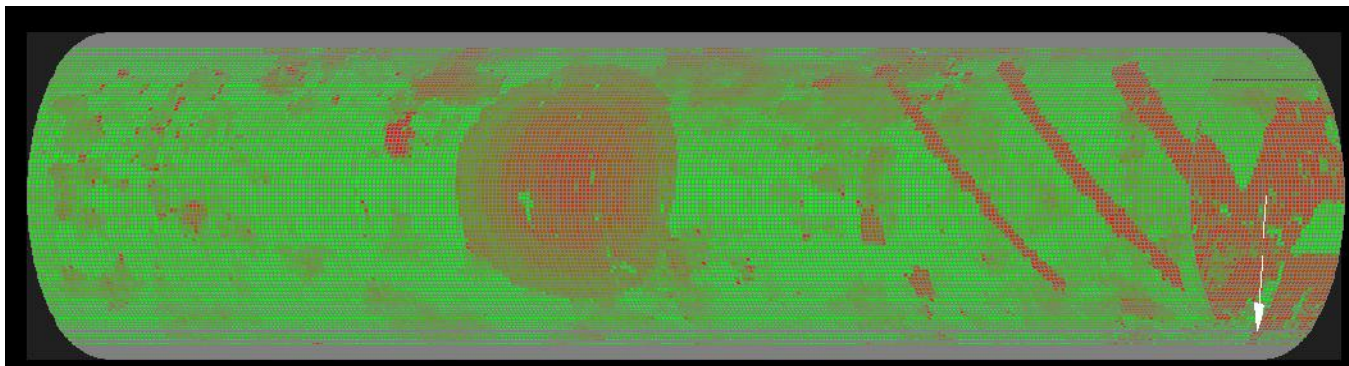


Pipeline Diagnostics Condition Assessment





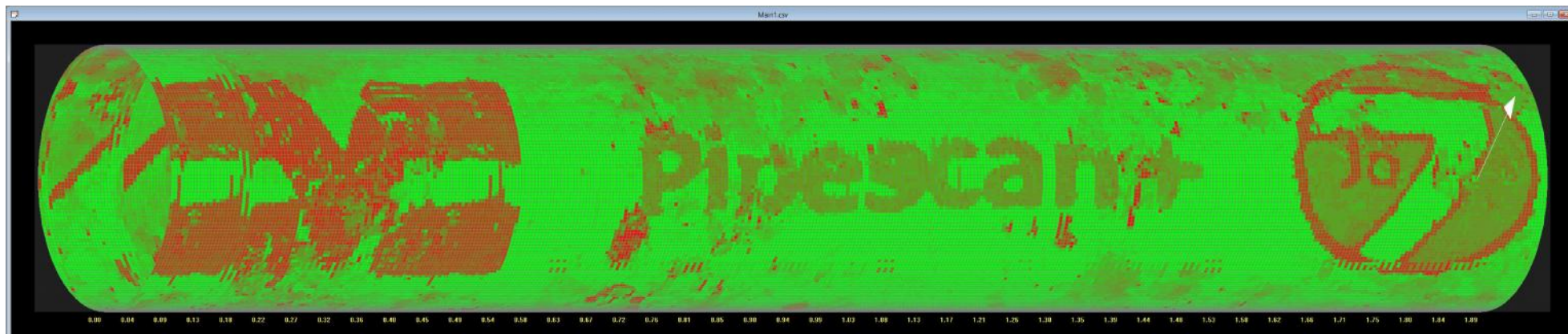
Pipeline Diagnostics Condition Assessment



**Exhumed cast iron
pipe with
machined features**



Pipeline Diagnostics Condition Assessment



**Pipescan+ Ultrasonic Image of
Engraved Carbon Steel Pipe**

Thames Water - Shoot-up-Hill DMA08 Mains Replacement



Overview

- Regulator expectations
 - Cost benefit
 - Synergy between serviceability & enhancement
 - Leakage reduction
 - Improved customer service
 - Innovation
 - Efficiency
- Thames Water have analysed every street in London, comparing cost of ownership with cost of replacement, to identify areas (hot spots) for potential cost effective mains replacement.
- Field trials were undertaken to confirm the desk-top study analysis for the first DMA to help develop the delivery model for mains replacement. JD7 have been a key part of this process.



Thames Water - Shoot-up Hill DMA08



Hot Spot B

SuH08 is located central London
Western Boundary – Regents Park
Southern boundary – Euston Road
Eastern Boundary – Hampstead Road
Northern Boundary – Grand Union Canal

Hot Spot A

The key parameters of the DMA are;
4892 properties, 1531 connections
50% buildings are flats
90% dwellings are flats
19km distribution main
4.2km trunk main
Highly ranked on burst/km

Thames Water - Shoot-up Hill DMA08



1873



Predominantly terraced housing

1991



Predominantly flats

Thames Water - Shoot-up Hill DMA08



Pipescan+ vs Coupon Analysis – 4” pipes

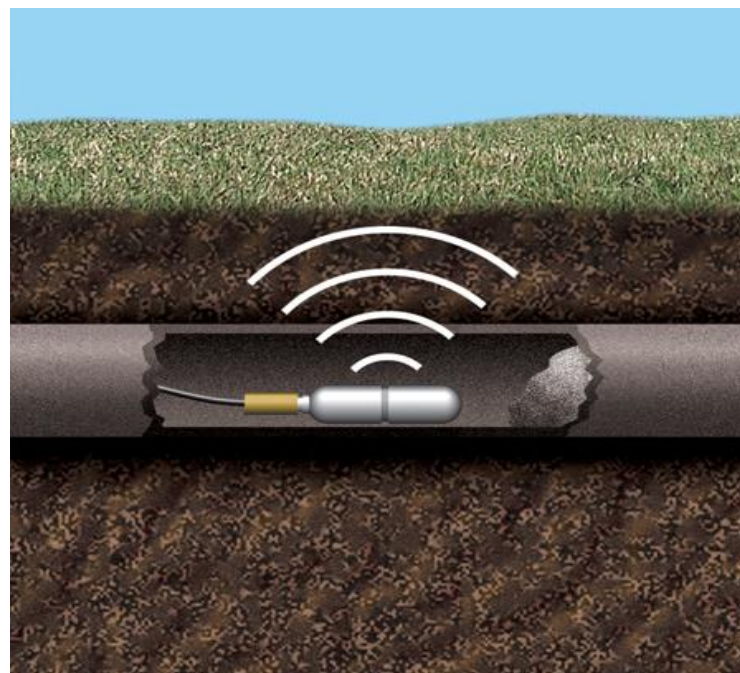
4-inch Pipe Analysis					
	4 mm	6 mm	8 mm	10 mm	12 mm
Robert Street (West)					
Mackworth Street					
Granby Terrace					
Stanhope Street (o/s Scaffell)					
Stanhope Street (o/s Langdale)					
Regents Park Road (East)					
Regents Park Road (West)					
	Coupon Analysis - Range from 'Maximum Thickness' to 'Maximum Thickness minus the larger of Maximum Internal and External Pi JD7 Analysis - Range from 'Average Thickness' to 'Minimum Thickness'				



Pipeline Diagnostics Asset Management



- **Asset Inventory**
- **Condition of System Components**
- **Verification of Asset Status**
- **Pipeline Tracing**
- **GIS Updates**





Pipeline Diagnostics Asset Management



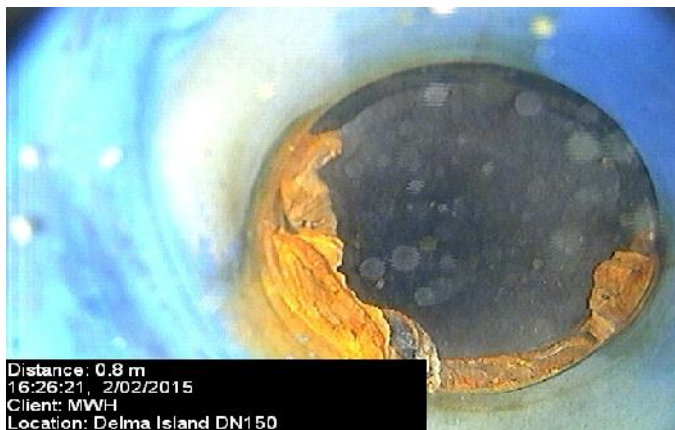
Valve Verification



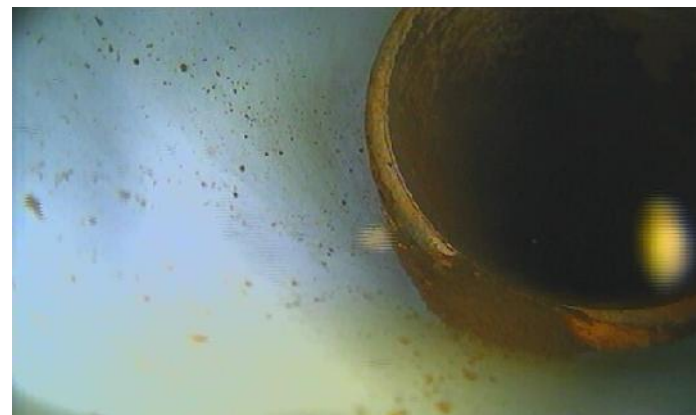
Closed

Partially Open

Open



- Valve Corrosion
- Pipe Material Changes
- Identification of unknown assets
- Illegal Connections





Asset Management and Condition Assessment



Objectives

- Determine pipe and asset condition
- Identify sections of pipe that require intervention
- Provide defensible data to support Capital Expenditure
- Prioritize investment and CIP projects

Scope

- Inspect 40 pressurized pipe sections of various materials, age, diameter, and operational pressures using wet barrel fire hydrants as access points, with a minimum of 50ft upstream and downstream of the insertion point





Asset Management and Condition Assessment



- **Operational Conditions** – Pipe Diameter, Operational Pressures, Inspection Distances
- **Insertion Points** – Fire Hydrants
- **Project Objectives** – Video Inspection, Condition Assessment, Leak Detection
- **Data Output** - Leaks, Corrosion, and pipe wall defects





Asset Management and Condition Assessment



Results

- Little correlation between age and condition of pipe.
- Laterals were in worse condition than the main lines
- Unlined CIP located closest to the Pacific Ocean was in the worst condition. Lined pipe was minimally affected in the same location
- Mapping discrepancies





FRAUD DETECTION, LEAK DETECTION, CONDITION ASSESSMENT (Bogotá, Colombia)



Objectives

- First time that this pipes were going to be inspected
- Inventory of Legal Connections in the Pipe
- Identification of Illegal Connections
- Determine pipe and asset condition
- Identify sections of pipe that require intervention

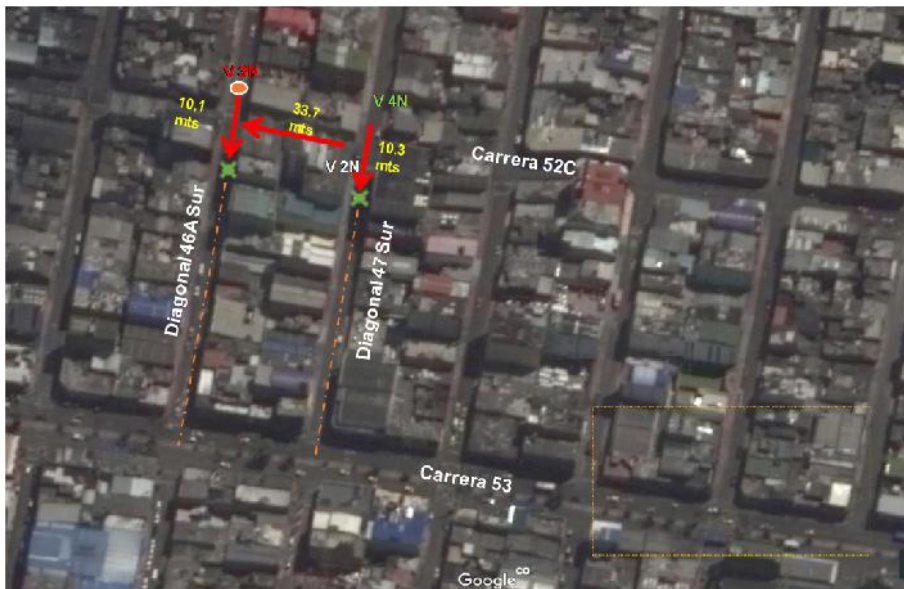


Scope

- Inspect 4 pressurized distribution pipe sections of old Asbestos Cement pipe without suspending service
- Diameter 3-4 Inch Pipe
- Installed Valves and Ts for Insertion. (100 Meters per direction)



FRAUD DETECTION, LEAK DETECTION, CONDITION ASSESMENT (Bogotá, Colombia)



Location: Motel Zone, Lotts of Frauds



FRAUD DETECTION, LEAK DETECTION, CONDITION ASSESSMENT (Bogotá, Colombia)

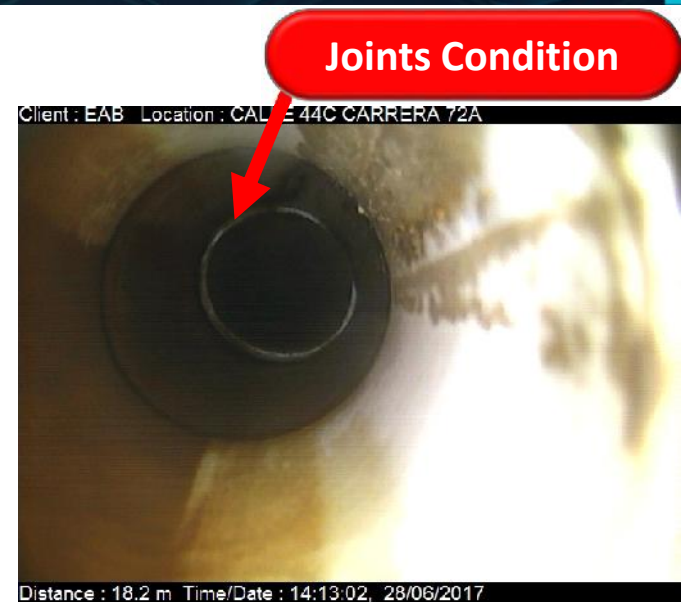


Technology Used: Investigator





- Inventory of Connection and Detection of Additional Ones
- Condition Assessment
- Identification of unknown assets
- Identification of Illegal Connections (or additional ones)





Digging 100% Exactitude After locating equipment and registering an additional/possible illegal connection



Location of any Observation on the surface. It is Marked



- **Identification of Additional Connections**
- **Location on the surface**
- **Digging on the point where it is, Identified 100% exactitude**



- Valve Corrosion
- Identification of unknown assets
- Condition Assesment



- Valve operation





FRAUD DETECTION, LEAK DETECTION, CONDITION ASSESSMENT (Bogotá, Colombia)



Results

- Little correlation between age and condition of pipe.
- Identification of all legal Connections
- **Identification of Additional Connections (1 that goes to a Gas Station) possible to be Illegal**
- Surface identification of all Connections
- Exactitud of 100%
- Condition assessment of 100% of the pipe (pipe in good condition)
- Joints condition assessment
- Debris was observed inside the pipe
- Pipe Material verification
- No leaks were detected in the pipe



LEAK DETECTION, CONDITION ASSESSMENT (Pereira, Colombia)



Objectives

- First time that this pipes were going to be inspected
- Inventory of Legal Connections in the Pipe
- Leak Detection
- Determine pipe and asset condition
- Identify sections of pipe that require intervention



Scope

- Inspect 6 KM pressurized main pipe sections of old Asbestos Cement, Steel, CCP without suspending service
- Diameter 12-48 Inch Pipe
- Installed Valves and Ts for Insertion. (1000 Meters per insertion)



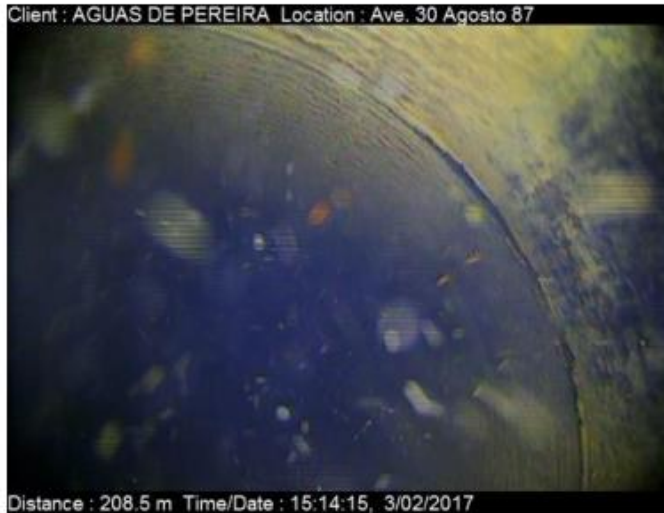
LEAK DETECTION, CONDITION ASSESSMENT (Pereira, Colombia)



Technology Used: LDS 1000



LEAK DETECTION, CONDITION ASSESSMENT (Pereira, Colombia)



- Joint Condition Verification
- Condition Assessment
- Identification of unknown assets and accesories
- Leaks Were Identified and located



TRAMOS	LONGITUD INSPECCIONADA	# DE FUGAS	Ubicación de fugas halladas*			FUGAS/ LONGITUD
			Inicio de intensidad	Máxima intensidad	Fin de intensidad	
TANQUE DE CARGA VILLA SANTANA	934,9	1	573,9	574,8	584,3	934,9
AVENIDA 30 DE AGOSTO	353,8	0	-	-	-	0
EL VIAJERO - MEGA BUS	140,2	2	12,6	14,5	16,4	70,1
			137,8	140,2	-	
LA MELLIZA B"	-	-				



LEAK DETECTION, CONDITION ASSESMENT (Pereira, Colombia)



Client : Aguas de Pereira Location : Intercambiador MegaBus hasia Cuba P



Distance : 34.1 m Time/Date : 11:07:45, 6/02/2017

Client : AGUAS Y AGUAS DE PEREIRA Location : INTERCABIADOR MEC



Distance : 0.0 m Time/Date : 12:43:00, 4/02/2017

- Valve Corrosion
- Identification of unknown assets
- Condition Assesment
- Valve operation
- Leak Detection

Client : AGUAS Y AGUAS DE PEREIRA Location : TANQUE DE CARGA V



Distance : 2.0 m Time/Date : 11:43:20, 7/02/2017

Client : AGUAS DE PEREIRA Location : INTERCABIADOR MEGA BUS



Distance : -20.0 m Time/Date : 17:19:54, 4/02/2017



LEAK DETECTION, CONDITION ASSESMENT (Pereira, Colombia)



Results

- Little correlation between age and condition of pipe.
- Identification of Leaks
- Condition assessment of the pipe (pipe in good condition)
- Joints condition assessment
- Debris was observed inside the pipe
- Pipe Material verification
- Valve operation

Conclusion

- Tool selection is critical to extrapolate actionable data
- Age is not a reliable indicator of pipe condition
- Visual Inspection is an excellent screening tool and can prioritize where higher resolution technologies need to be introduced.
- Asset Condition is fundamental.
- Capital Investments should be an informed decision.





System Matrix



	Bullet	Investigator	PipeScan+	LDS1000	Amplus
Live Mains	✓	✓	✓	✓	✓
All Materials	✓	✓	✓	✓	✓
Location	✓	✓	✓	✓	✓
Inspection	✓	✓	✓	✓	✓
Failure	✓	✓	✓	✓	✓
Condition			✓		✓
Water	✓	✓	✓	✓	✓
Wastewater	✓	✓	✓	✓	✓
Gas		✓			
Pre/Post Lining		✓	✓		

80-300mm

100-300mm

350-1500mm



Upcoming Conferences



 **weftec** | 2017 APD BOOTH #6139
the water quality event™

October 2nd – October 4th 2017 Chicago IL



APD BOOTH # 122

October 30th – November 1st 2017 Houston, TX



APD BOOTH # 304

December 3rd – 5th 2017 San Diego, CA



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QUESTIONS?

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