# This presentation premiered at WaterSmart Innovations

watersmartinnovations.com





#### Out of Sight, But Not Out of Mind: Using Satellites to Find Leaks



Watersmart Innovations October 2021

## **Irving Water Utilities**

- Irving lies between Dallas and Fort Worth; east side of DFW Airport
- 68 square miles
- Population: 256,684
- Three Systems
  - Water Supply
  - Water Distribution
  - Wastewater Collection
- Functions
  - Pumping
  - Maintenance/Repairs
  - Regulatory Compliance
  - Engineering/Project Management
  - Water Conservation
  - Customer service, billing, metering
  - GIS Mapping



## Water Supply



Average use – 37 MGD:

- Jim Chapman Lake: 85%
- Dallas Purchase: 15%

**Distribution System:** 

- 731 miles of pipe
- 6 Pump Stations
  - 9 elevated storage tanks
- 10 ground storage tanks
- Flow ranges:

•

- Summer: up to 70 MGD
- Winter: drops to 25 MGD
- Water Loss ranges between 8% and 10%

3

#### **Proactive Leak Detection**

- Test 546,103 LF/year
- Logger and Manual Patrols
- Goal: 100% every 7 years
  - 2014: 52 leaks
  - 2015: 90 leaks
  - 2016: 64 leaks
  - 2017: 40 leaks
  - 2018: 41 leaks
  - 2019: 82 leaks; +38 Sat.
  - 2020: 64 leaks; +133 Sat.
  - 2021: 61 leaks; +61 Sat. so far



#### **Reactive Leak Detection**



- Pinpoint leaks to support water repair crews
- Minimizes disruption/digging
- May use correlation
- Crews learn LD basics
- 2018: 87
- 2019: 101
- 2020: 105
- 2021: 71 so far

#### FY2018-19 Pilot Project: Detecting Non-Revenue Water from Space

- <u>Pilot Project</u> evaluated 500 (69%) miles of contiguous water lines with 1 satellite pass on 12/25/18
- Technology Uses groundpenetrating L-band microwave signals and proprietary algorithms to track the spectral signature of drinking water
- Potential leaks captured and analyzed (accounting for recent repair work)
- Follow up field investigations within a 100 meter radius: Pilot completed February 2019



6

#### Leak Detection Process

- Image is analyzed to track the spectral signature of drinking water subsurface in relation to the utility's water infrastructure
- Follow-up with field operations requires acoustic leak equipment with experienced operators
  - Locate
  - Pinpoint



#### Main Leak: Cast Iron

Map View:

- 8" Line
- Location required multiple repairs

Area Photo:



	100			
Leak ID: 00005	Date: 2/1/2019			
Leak Status: Leak	Type of Leak: Main			
Pipe Size (in): 8	Pipe Material: Cast Iron			
Leak Subtype:				
Address: 5002 Riverside Dr				
Cross Street:				
Location Description:				
Surface Material:				
Sound Strength:				
Surfacing:				
Comments: Appears to have been recently repaired				



## Main Leak: Ductile Iron

- 6" Line
- Work order submitted to Fire Hydrant Crew

Leak Photo:





Area Photo:



Leak ID: 00006	<b>Date:</b> 2/4/2019			
Leak Status: Leak	Type of Leak: Main			
Pipe Size (in): 6	Pipe Material: Ductile Iron			
Leak Subtype: Hydrant				
Address: 3349 University Park Ln				
Cross Street:				
Location Description:				
Surface Material: Dirt/Grass				
Sound Strength: 426				
Surfacing: No - Unable to Visually Confirm				

Comments: Possibly leaking from weep hole

## **Residential Leak: Copper**

- ¾ inch line
- Repairs made by resident; follow-up by utilities staff

#### Area Photo:



		apresent of
Leak ID: 00031	Date: 1/28/2	2019
Leak Status: Leak	Type of Leak:	Residentia
Pipe Size (in): 3/4	Pipe Material:	Copper
Leak Subtype: Outside Meter	Pit (Unknown)	
Address: 3609 W Rochelle Ro	1	
Cross Street:		
Location Description:		
Surface Material: Dirt/Grass		
Sound Strength: 222		
Surfacing: Yes - Surfacing		
Comments:		



## **Residential Service Leak: Copper**

- Meter Connection
- Improper Installation repaired by contractor

Leak Photo:



#### Summary of Pilot Satellite Project



- 96 potential leak findings
  - vs. random approach
- 30.41 miles audited in the field
  - 1 leak found for every0.8 miles audited
- 38 leaks found in 7 days of field work (extended days)
  - vs. 95 days to find 38 leaks using standard methods at rate of .4/day (Irving avg.)

## Standard Acoustic Survey vs. Satellite-guided Acoustic Survey

	Standard Acoustic Survey	Satellite-guided Acoustic Survey
<ul> <li>Leaks found per day:</li> </ul>	<ul> <li>1.16 is daily national avg.</li> </ul>	<ul> <li>Up to 8 per day</li> </ul>
<ul> <li>Leak Density per mile:</li> </ul>	<ul> <li>1 leak finding per 2.5 –</li> <li>3.7 miles</li> </ul>	<ul> <li>1 leak every .8 miles</li> </ul>
• Survey Cycle:	• 1-5 years	<ul> <li>Quarterly, Bi- annual or Annual</li> </ul>
• 30.41 miles in Irving	• 8-12 leaks	<ul> <li>38 leaks</li> </ul>

#### From Image to Repair in 4 Easy Steps

#### **PROJECT IN IRVING, TX**

It all started in a small Texas town in 2020



1) Image Acquisition and Analysis  $\Rightarrow$  2) POI Delivery  $\Rightarrow$  3) Pinpoint Leaks  $\Rightarrow$  4) Mark/Repair

Satellite imagery enables noninvasive, indirect condition assessment of water lines.

#### **2020 Satellite Leak Detection Results**

- Pass #1: 289 POIs (March)
  - 72 leaks found
  - Main/Valve/Hydrant 10
  - Angle stop/service 23
    - 11 not surfacing
  - Private 39
- 40 Day Evaluation of:
  - 326,704 lf
  - 6,513 Meters
  - 783 Hydrants
  - 1,073 Valves



Customer-Side 
Main 
Service 
WO 
Other

Leaks Suspected

## 2020 Satellite Leak Detection Results, Cont.

- Pass #2: 257 POIs (June)
  - 61 leaks found
  - Main/Valve/Hydrant 6
  - Angle stop/service 33
    - 4 not surfacing
  - Private 22
- 36 Day Evaluation:
  - 266,327 lf
  - 4,758 Meters
  - 611 Hydrants
  - 836 Valves



#### Value Metrics

- POI/LLLs: 546
- Leaks: 133; 76 NR
- Crew Days: 77
- Leaks per day: 1.7
- Miles: 120.7
- Leaks per mile: 1.1
- Estimated savings -\$112,420/year
- Investment of \$164,400
   payback of 17 months



## 2021 Satellite Leak Detection Results

- Pass #1: 311 POIs (May)
  - 61 leaks found
  - Main/Valve/Hydrant 4
  - Angle stop/service 20
    - 15 not surfacing
  - Private 37
- 43 Day Evaluation:
  - 284,679 lf
  - **5,446 Meters**
  - 676 Hydrants
  - 763 Valves



06-01-2021

06-25-202

Customer-Side Main Service WO Other

📕 Leaks 📕 Suspected

07-30-202

07-17-2021

18

## Planning Considerations



- Internal vs. contracted leak detection crews
- Number of appurtenances listened to
- Number of satellite passes to use
- Completion of repairs by Field Operations

## The Unfindable: A Game-changer

- 50-year old 16" main
  - Inaccessible by vehicle
  - Under Loop 12
  - In Wooded area
  - Between creek and railroad tracks
  - No listening points
  - No visible leak
  - Audible water flowing into the creek







A Hidden Leak is Discovered by leak detection staff: *"I would have never found the leak without the POI being there."* 



## Benefits

- Find leaks before catastrophic pipeline failures - significant potential savings
- Regular use allows for consistent, virtually continual oversight of entire system
  - ID problem areas for constant oversight
- Identifies focus areas for field crews
  - Improved utilization/efficiency of personnel and resources
- Time required without satellite technology is significantly longer
  - Prior Annual Average (6 years): 62
  - Satellite Pilot study: 38 (7 days)
  - 2020 Satellite work: 133 (77 days)
  - 2021 Satellite work: 61 (43 days)



#### What Satellite Leak Detection Ensures

• What is out of sight in Irving is never out of mind



#### **Texas Cities Using Satellite Leak Detection**

- Galveston
- Garland
- Georgetown
- Irving
- League City
- New Braunfels
- North Texas Municipal Water District
- Plano
- SAWS San Antonio



#### **Contact Information**

Donna Starling Water Programs Manager City of Irving dstarling@cityofirving.org 972) 721-2431

Technical Information: inquiry@utiliscorp.com www.utiliscorp.com

