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December, 2019

Reducing leakage: using data to inform on current incidents and predict future ones



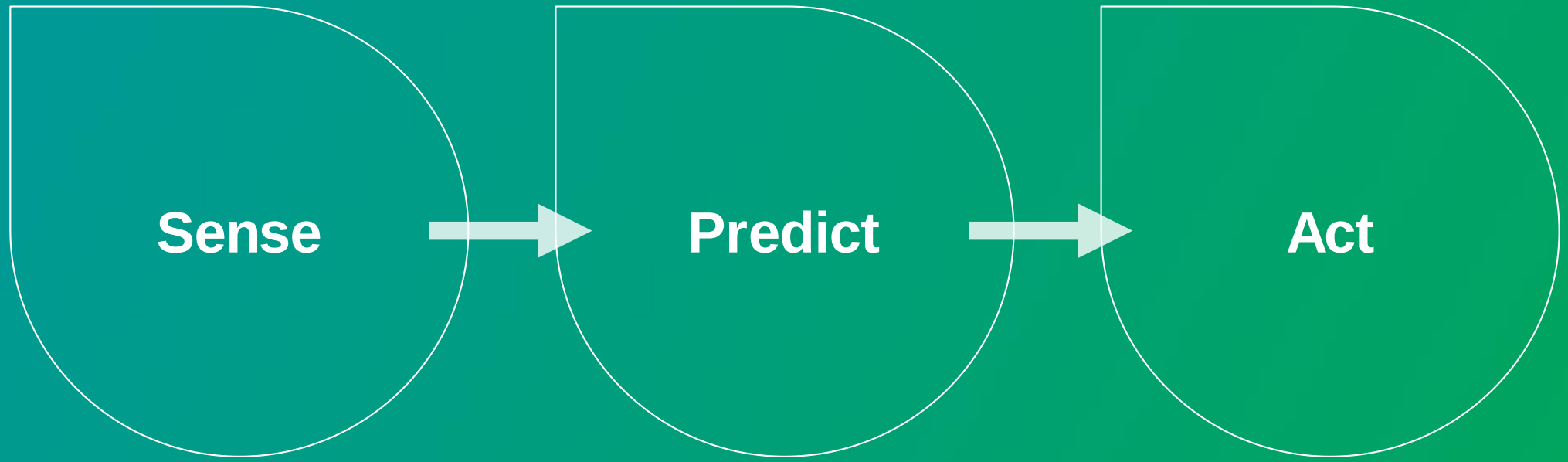
Xylem – A Global Water Technology Company Based in the USA



WE ARE A WATER INDUSTRY LEADER WITH GLOBAL REACH …

- Leading global water technology provider
- Approximately 16,800 global employees
- Headquarters: Rye Brook, NY; ~350 global locations
- Doing business in 150+ countries on 6 continents
- $5.2 billion in combined sales in 2018

…UNIQUELY POSITIONED TO HELP OUR PARTNERS SOLVE THE WORLD'S WATER CHALLENGES



- Sensor networks
- Data management
- Structured / Unstructured data

- Digital Twin
- AI-enabled anomaly detection
- Predictive modeling

- Decision algorithms & recommendations
- Visualization & control

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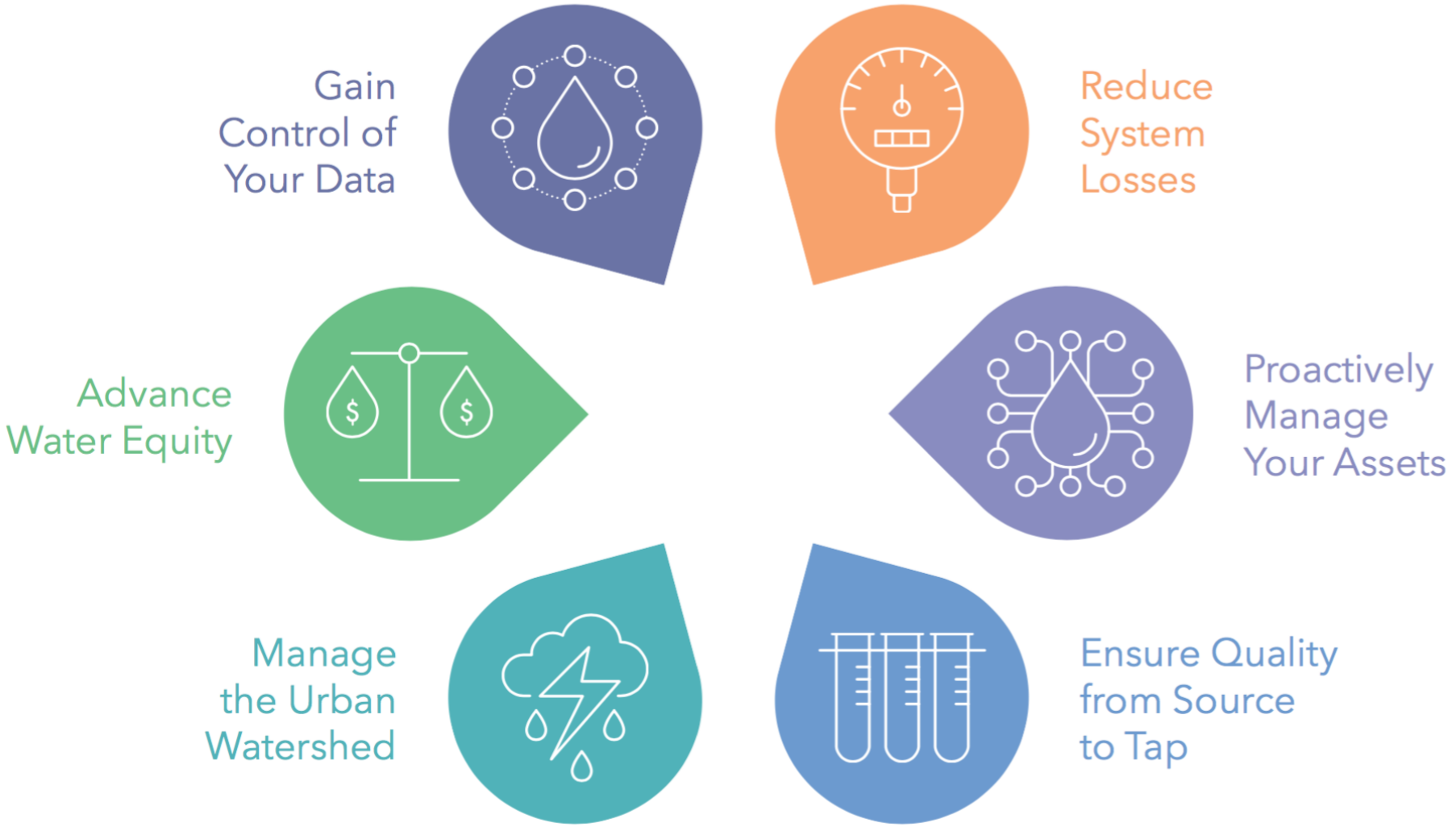
Strategies Powered By Decision Intelligence



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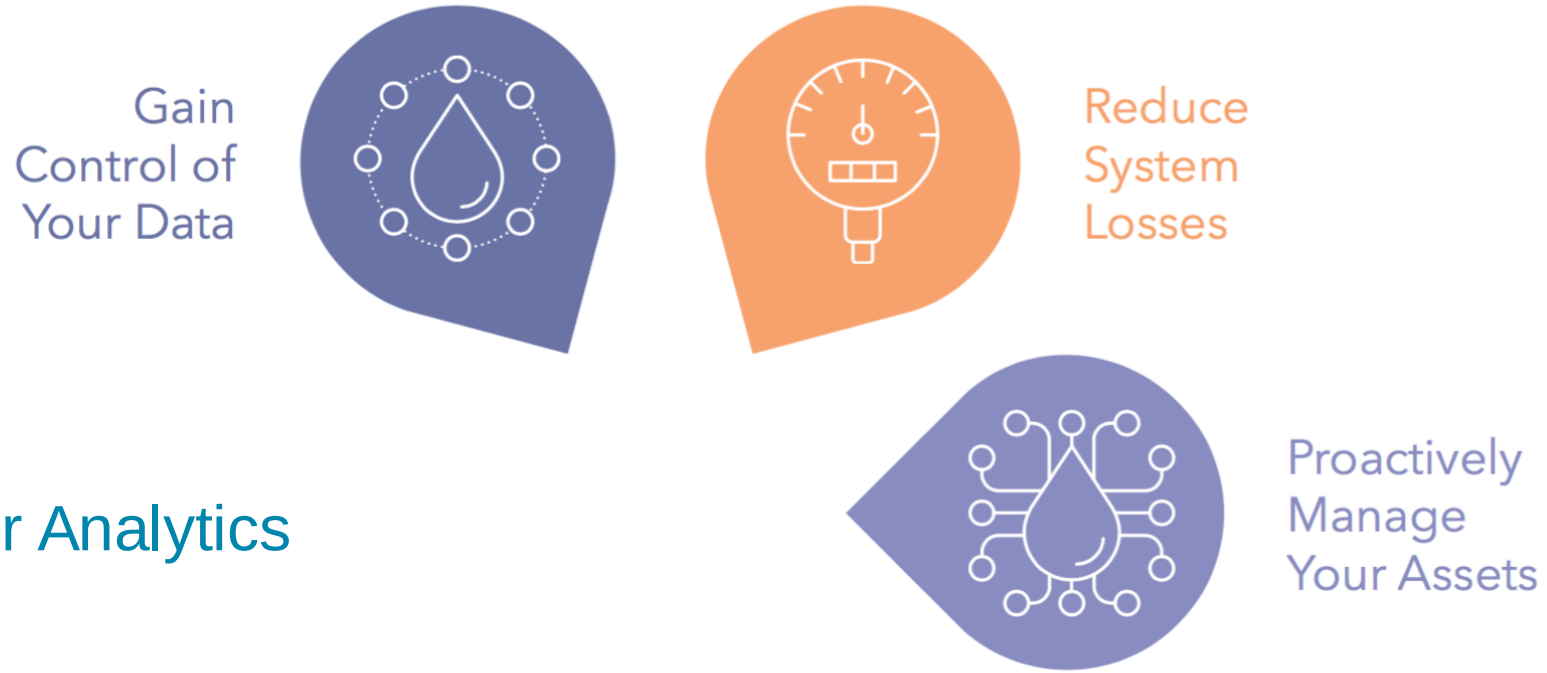
More Proactive, Predictive Network Operation



Smart Water Analytics

- Understand where problems are, and get to them faster
- Predict better where problems are going to be
- Leverage legacy data sources & existing fixed monitoring instrumentation

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South Australia Water

CASE STUDY

ADELAIDE'S SMART WATER NETWORK

SA WATER USES TECHNOLOGY TO IMPROVE WATER SERVICES

SA Water provides water and sewerage services for around 1.6 million people across the state of South Australia.

In July 2017, SA Water implemented the first stage of its smart water network, integrating more than 400 sensors across the Adelaide CBD. The sensors are paired with a world-leading analytics platform, providing a detailed picture of the water network. At a cost of $4 million, it was the largest of its kind in Australia. The technology has enabled SA Water to identify and proactively fix leaks before they impact customers. i.e. work is scheduled to have minimal impact (often at night – while the city sleeps) on customers and commuters.

FURTHER TRIALS UNDERWAY

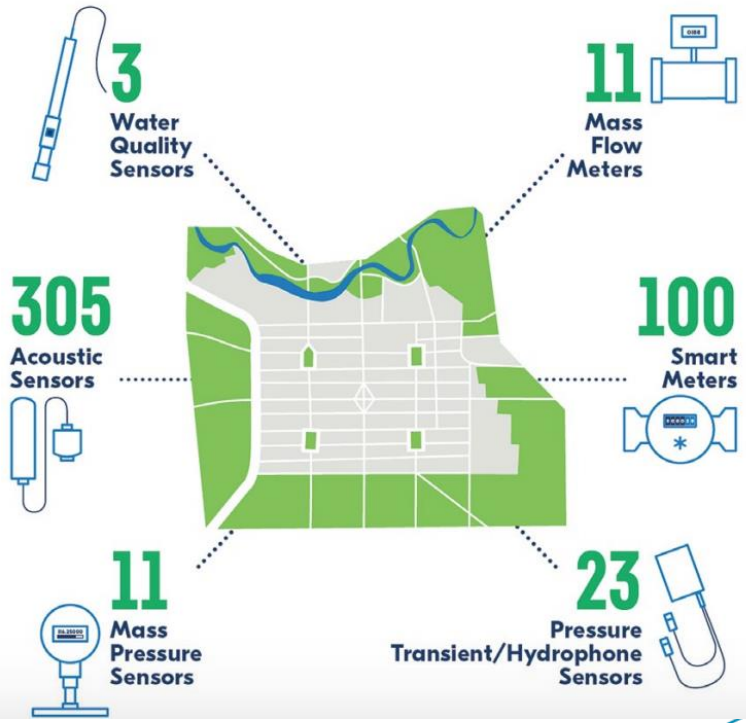
Following the success of this trial, the smart water network is expanding to Penneshaw (Kangaroo Island), including the investment in the installation of flow and pressure sensors in the main supply network, plus 300 smart meters for residential and business customers. While Penneshaw is a small community it has known NRW issues and relies on desalinated water. As this has a high treatment cost, there is significant cost saving benefits by reducing the amount of NRW in this region. A similar program will be rolled out in Port Lincoln.

This project has been recognised both nationally and internationally, winning two awards at the 2018 Australian Internet of Things Awards, a bronze prize at the International Water Association's Project Innovation Award, the title of 2018 Australian Digital Utility of the Year and Customer Service Awards from the Institute of Asset Management.

> *"In just 12 months, our smart technology has enabled us to identify and proactively fix leaks before they impact customers and commuters."*

In its first year, it has:

- **20+** water main incidents pre-empted
- Reduced reactive work by **70%**
- **50%** savings delivered by undertaking proactive versus reactive repair



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Park City, Utah

Park City Utah has demand of 16.35 MLD and hidden leakage issue

6 month campaign using pressure/acoustic sensors and real-time leak & burst detection analytics

Found 1.1 MLD of leakage at cost of **$57k**

Park City estimate saving of **$160k** in operating costs / year



http://www.kpcw.org/post/park-city-municipal-discovers-leaks-upper-deer-valley#stream/0

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Private Utility, Singapore

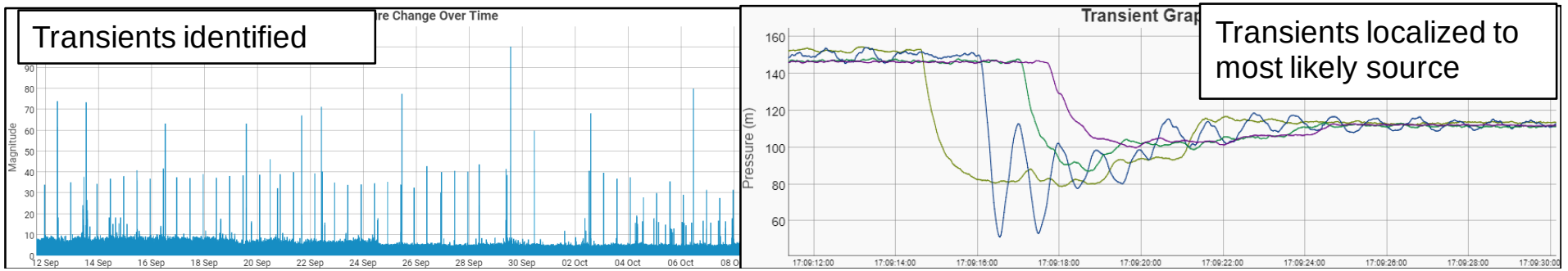
Experiencing leaks & bursts breaks on 9 miles of new steel trunk main, unknown cause

Implemented high sampling rate pressure sensors and advanced analytics

Large magnitude, damaging pressure transients were quickly detected, located and mitigated

Approximately **$15 million** saved





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Smart Water Analytics

1. Detect & locate pipe bursts faster
   - Avoid £m's emergency pipe repairs, public image

2. Track and prioritise pipe leaks before they become bursts
   - Avoid £m's emergency repairs, optimise leak detection activities

3. Improve asset lifetime, support better asset replacement strategy
   - Avoid £m's in unnecessary pipe replacement

4. Maximise benefit of existing and future monitoring investments
   - Don't waste the £100k's to £m's spent on equipment and systems

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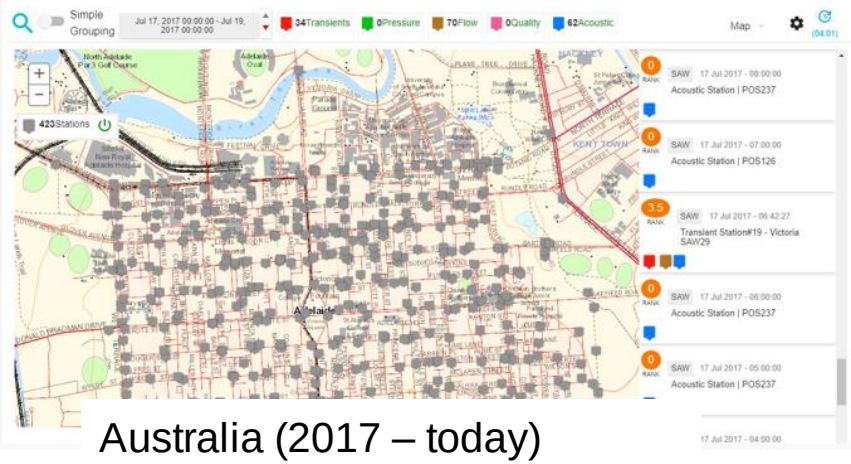
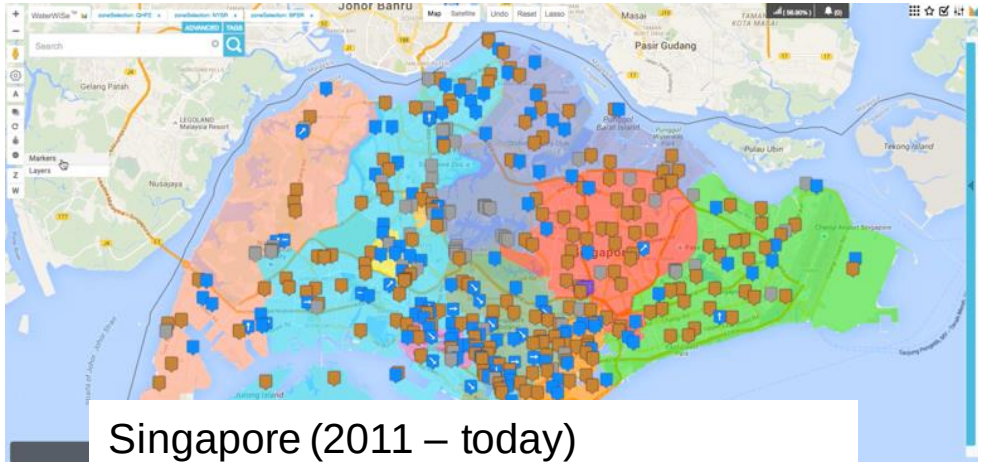
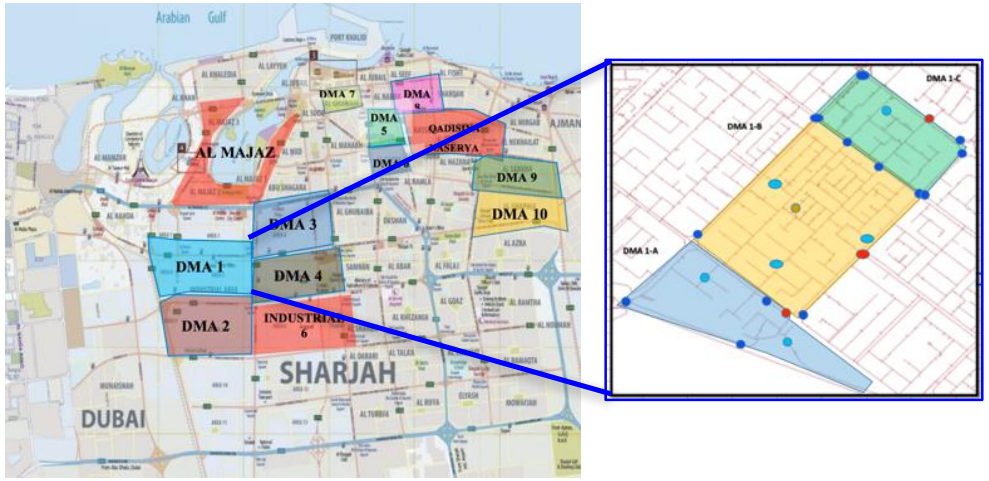
Smart Water Networks Around The World



Australia (2017 – today)
Smart Water Analytics Platform



Singapore (2011 – today)
Decision support, Leak/Burst Detection



Sharjah (2015 – today) – Non Revenue Water



Malaysia (2017 – today)
Leak & Burst Detection

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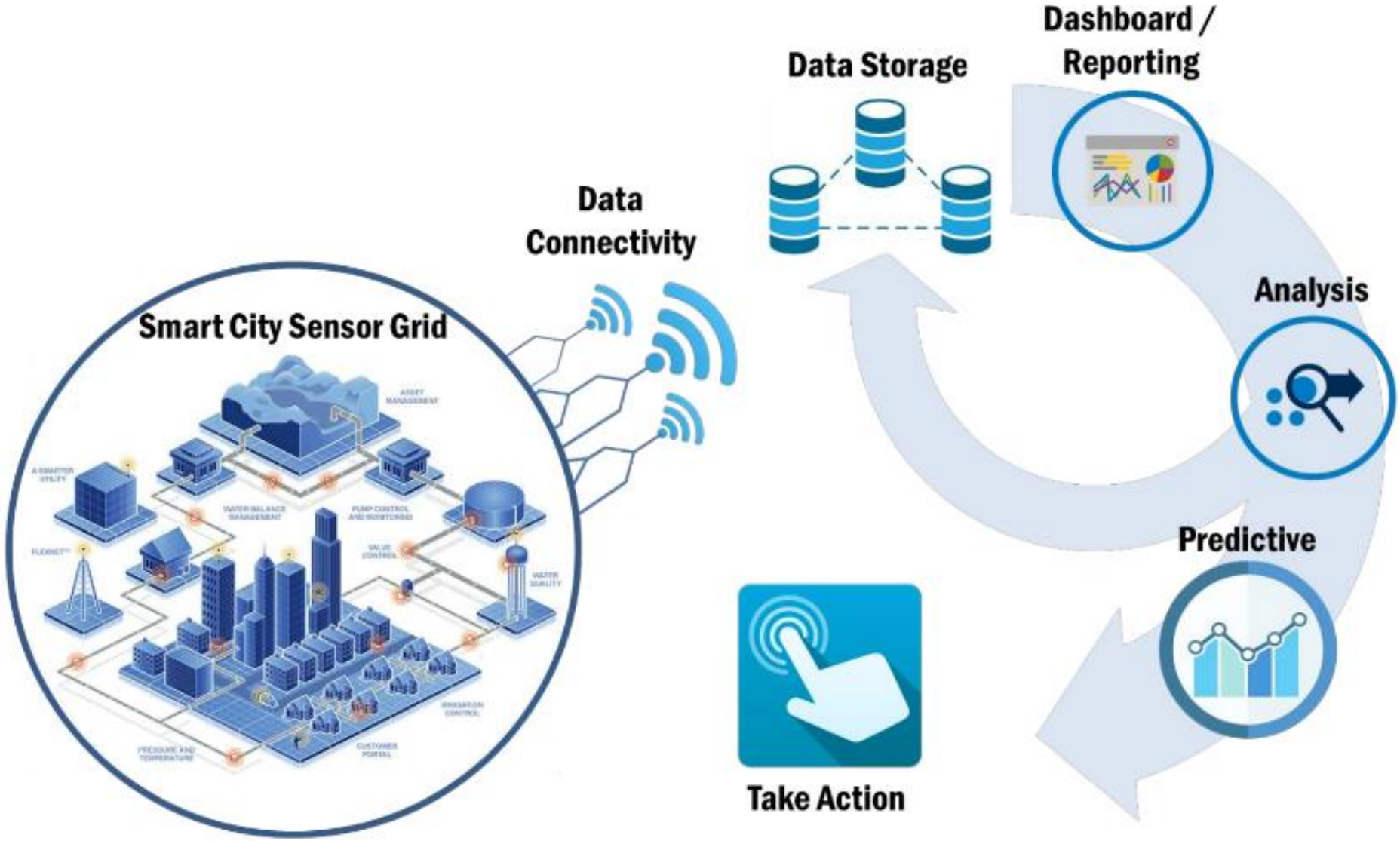
The need for actionable information



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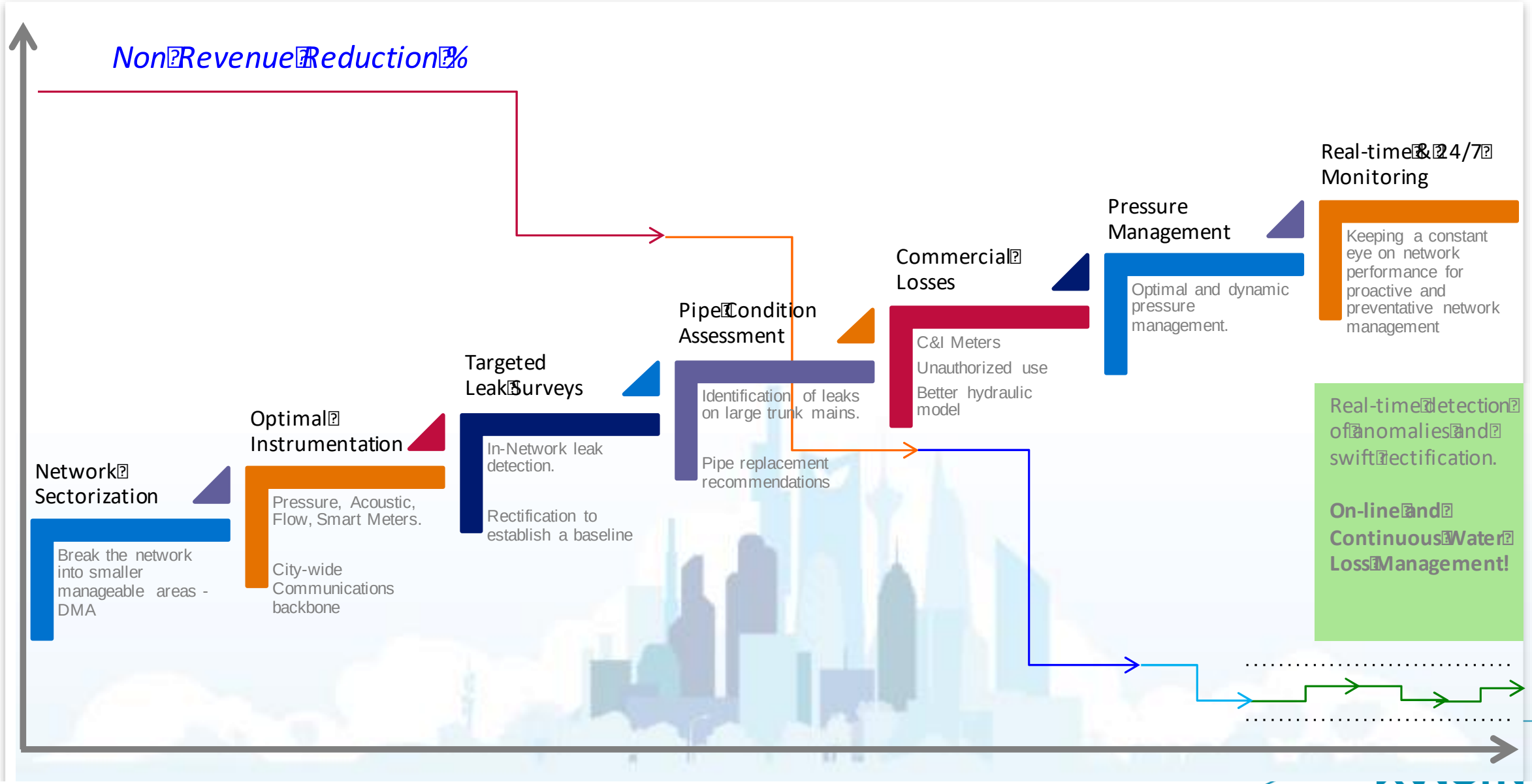
The need for proactive and predictive operation



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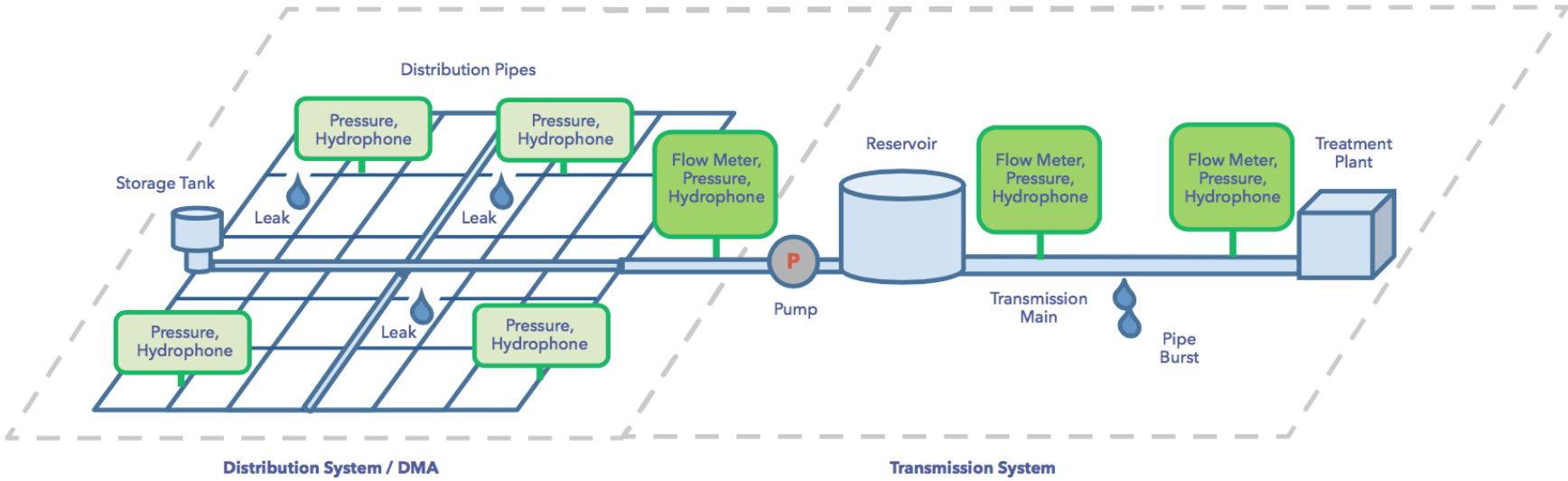
Gain Control of Your Data: Leakage

Leverage real-time data from SCADA & DMA level leak & burst sensors

Leakage detection with real-time alarms

Advanced Incident Management – group events instead of alarms



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Instrumentation for Leak and Burst Detection



- Real time data transmission over 3G
- Retrofit to existing chambers / hydrants (region-specific)
- High rate sampling of pressure (100Hz+) and acoustics (kHz)
- GPS time sync (to allow burst localisation)

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Leak and Burst Detection

	Bursts	Leaks
	Pressure Transients	**Hydrophones**
Network	Long Distance up to 1.0 Km	Small Distance up to 500m
Pipe Size	All pipe diameters	Most effective on pipe diameters below 600mm
Pipe Material	All pipe materials	Best suited on metallic pipes
Detection Time	24/7 Detection	Most effective during night time/ during quiet hours
Network Types	Suitable to all network configurations – DMA, Trunk Mains, Open Networks	Suitable to all network configurations – DMA, Trunk Mains, Open Networks
Localization Accuracy	Leak Localization Accuracy up to +/-50m – with each sensor covering several Km of pipe	Can potentially Pin-point leak events up to +/- 5m
Alert Time	Alerts sent within minutes of the occurrence of pipe burst	Alerts are monitored over a period of 24-48 hours to confirm existence of developing leak
Type of Leak	Detects newly occurring bursts	Detects leaks growing over time

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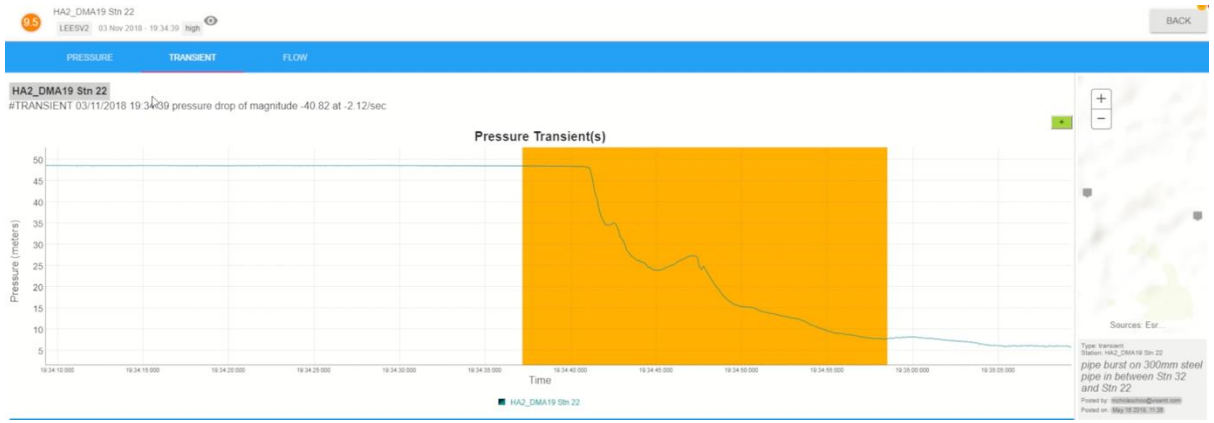
Real-Time Burst Detection

- Reduce run time of catastrophic events
- Minimize property damage and flooding
- Identify bursts in remote locations
- Helps address PR issues



Update: The leak occurred on an underground 700mm diameter watermain and was detected by our sensors.





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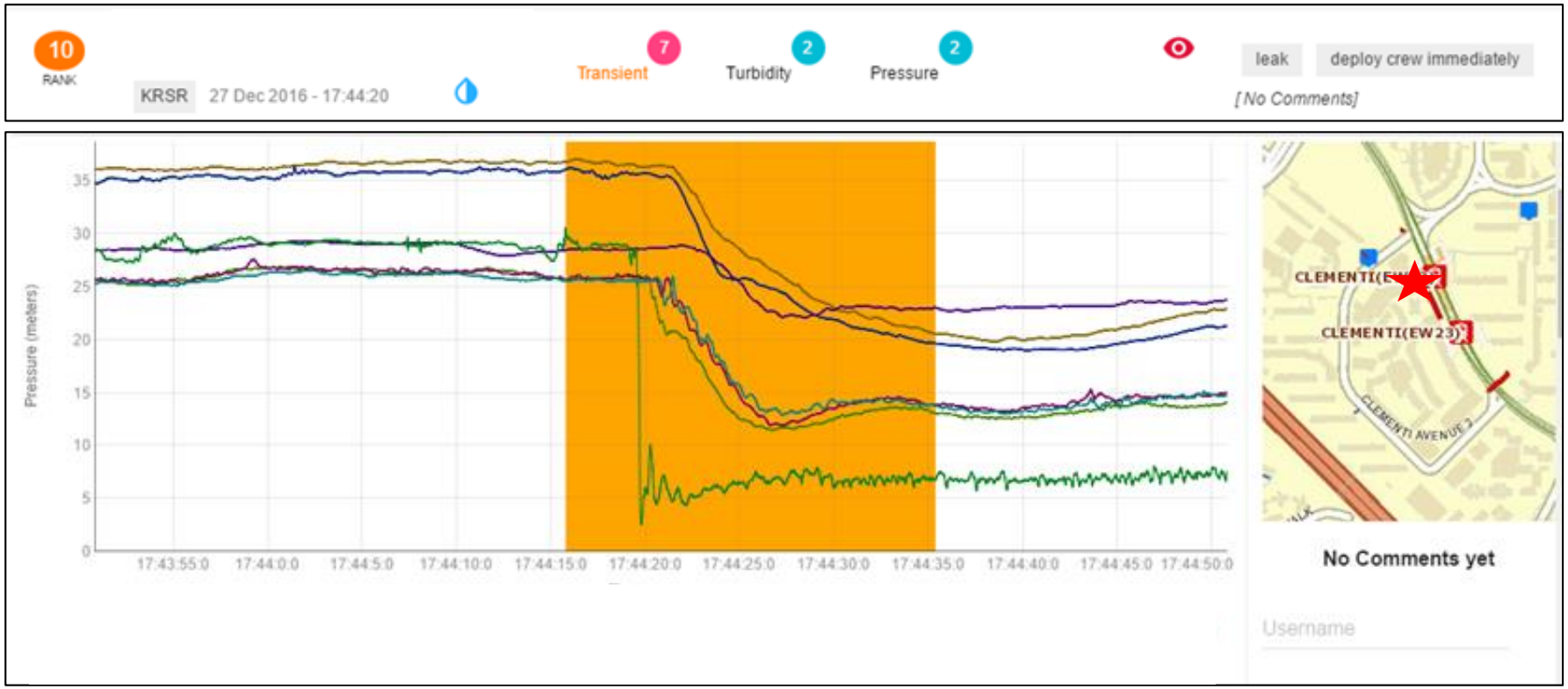
Pipe Burst Detection Analytics



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Existing or developing leaks

- Detection is based on acoustic noise trend
- Localization accuracy dependent on the sensor layout density
- Alerts are send within one week after the acoustic noise uptrend is clear
- Allows the utility to fix the leak before it develops to a pipe burst





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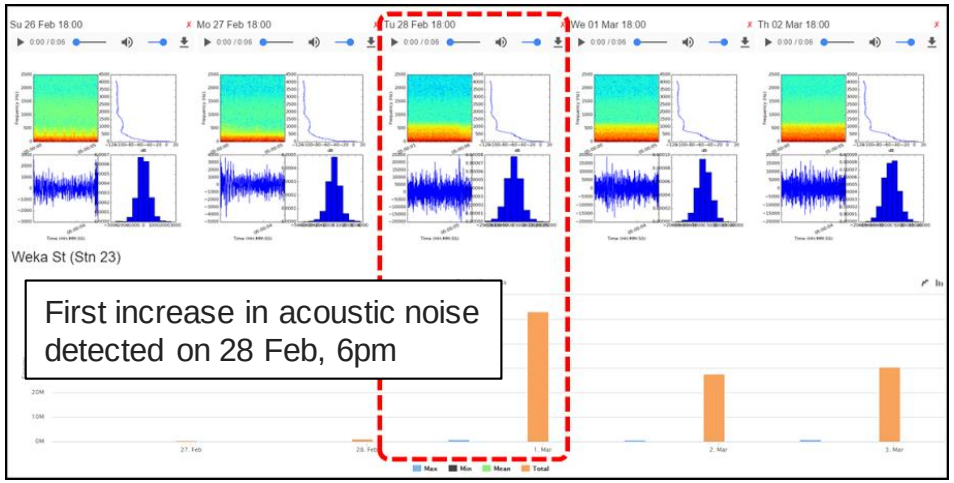
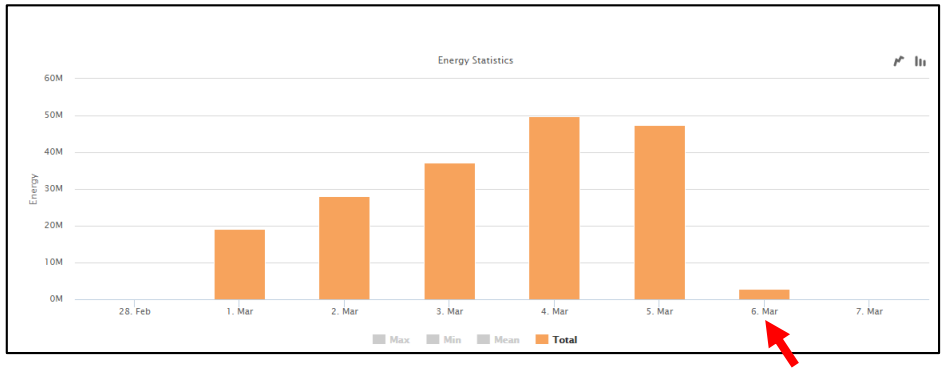
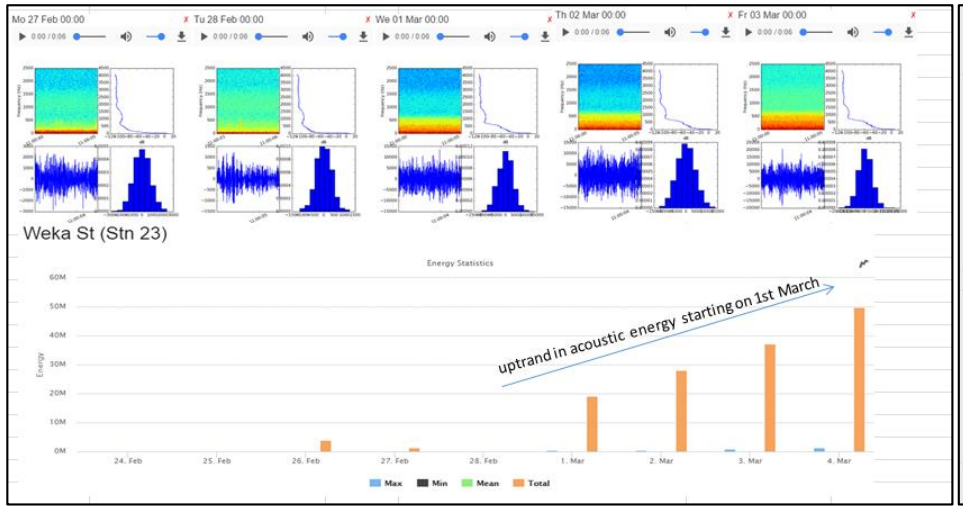
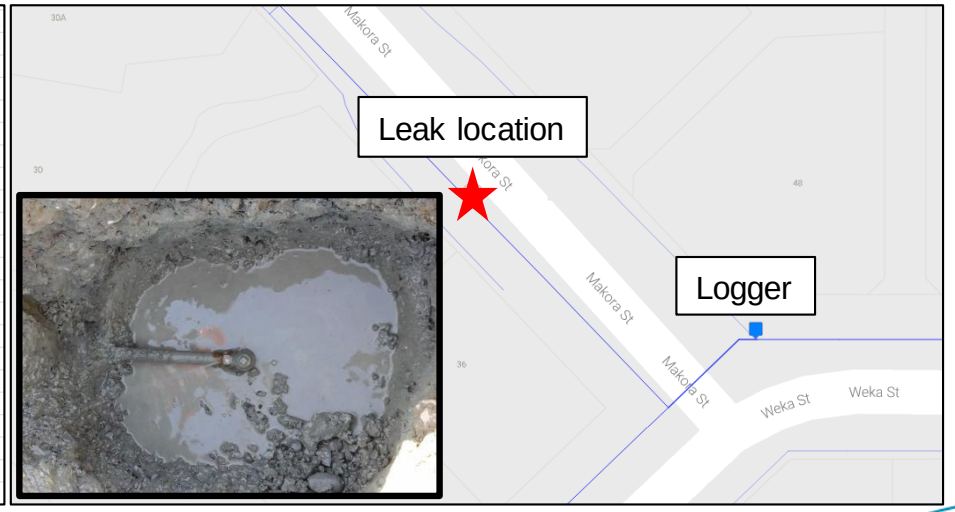
Leak Detection Analytics





Leak repair was completed on 6 Mar - decrease in acoustic noise from 6 Mar onward





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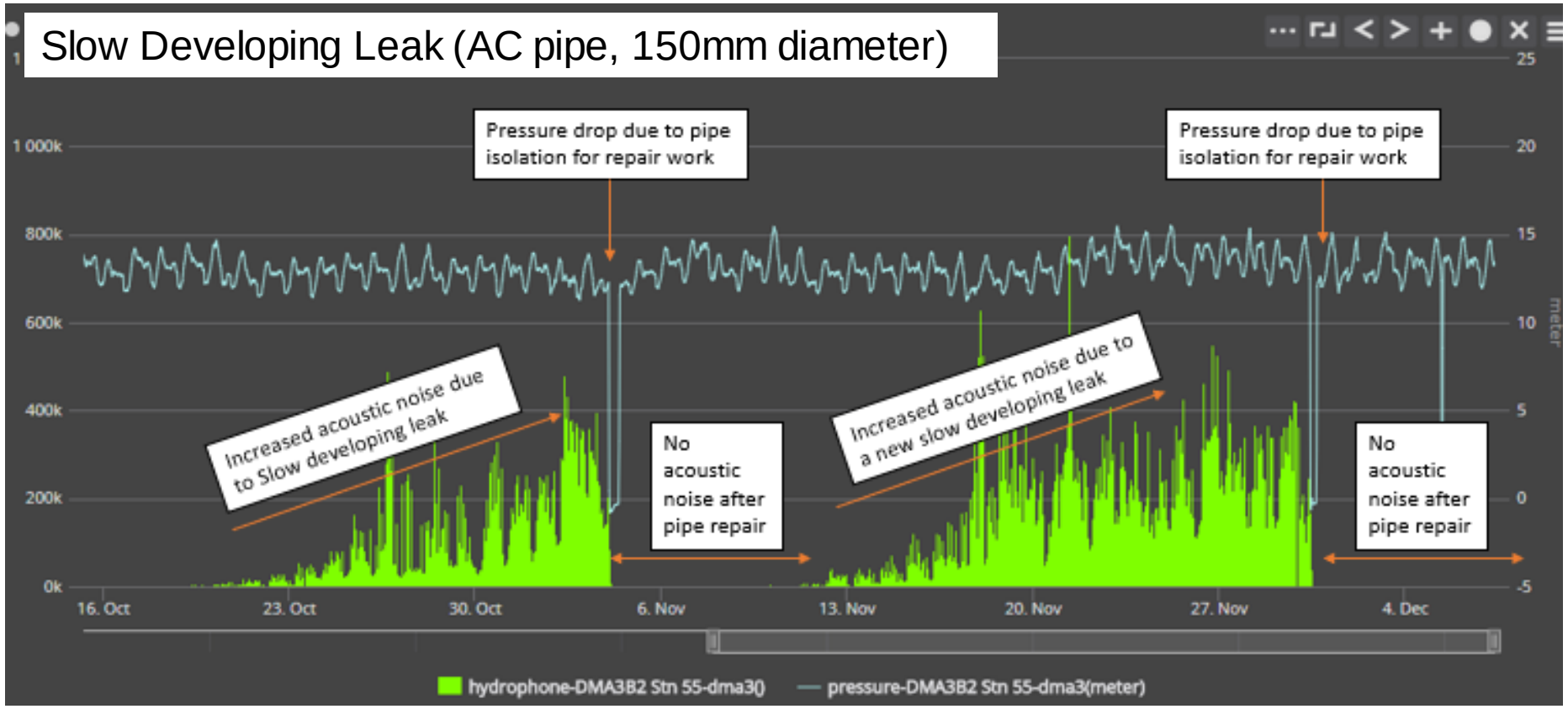
Leak Detection



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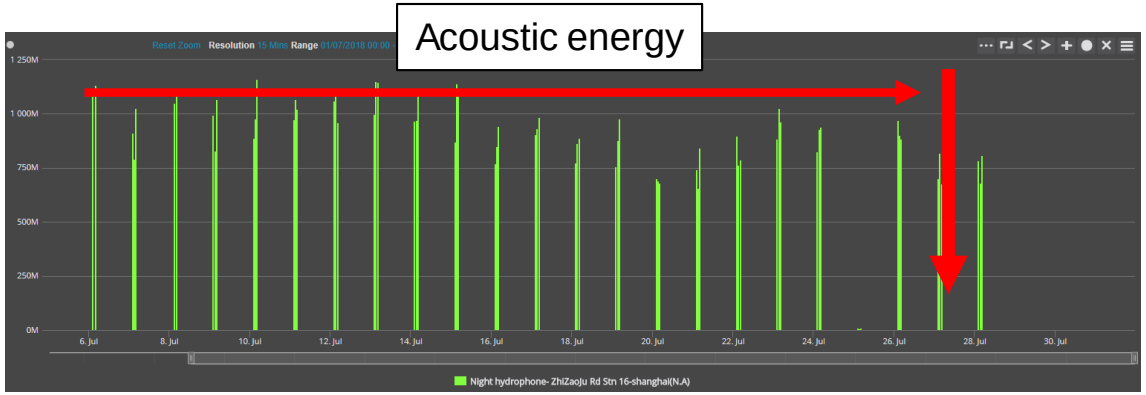
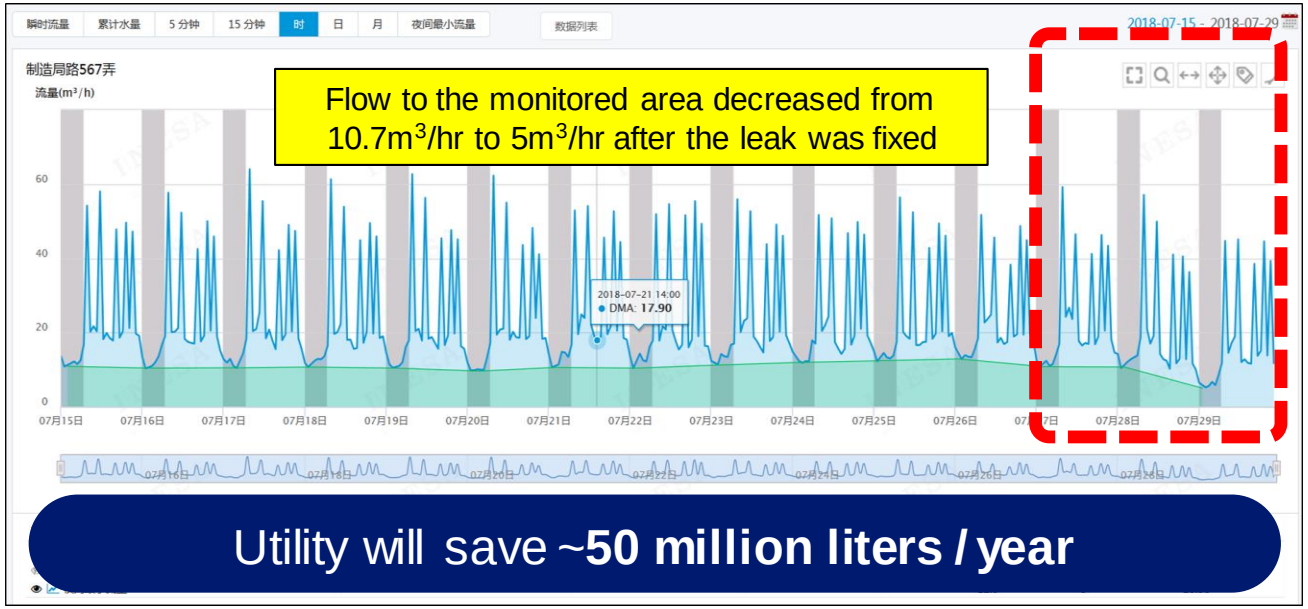
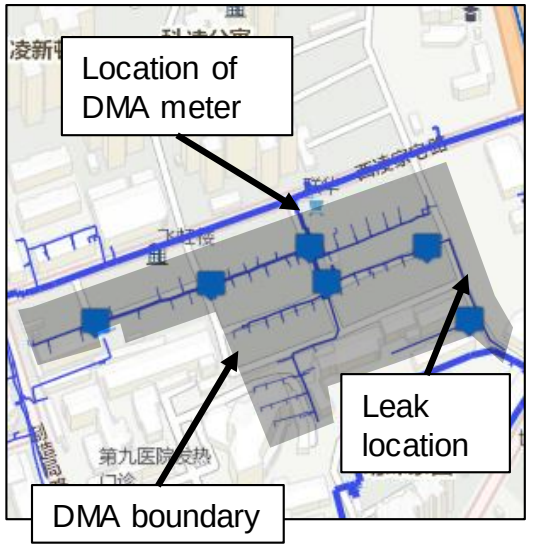
Hidden Leaks









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Customer Side Leakage Analytics

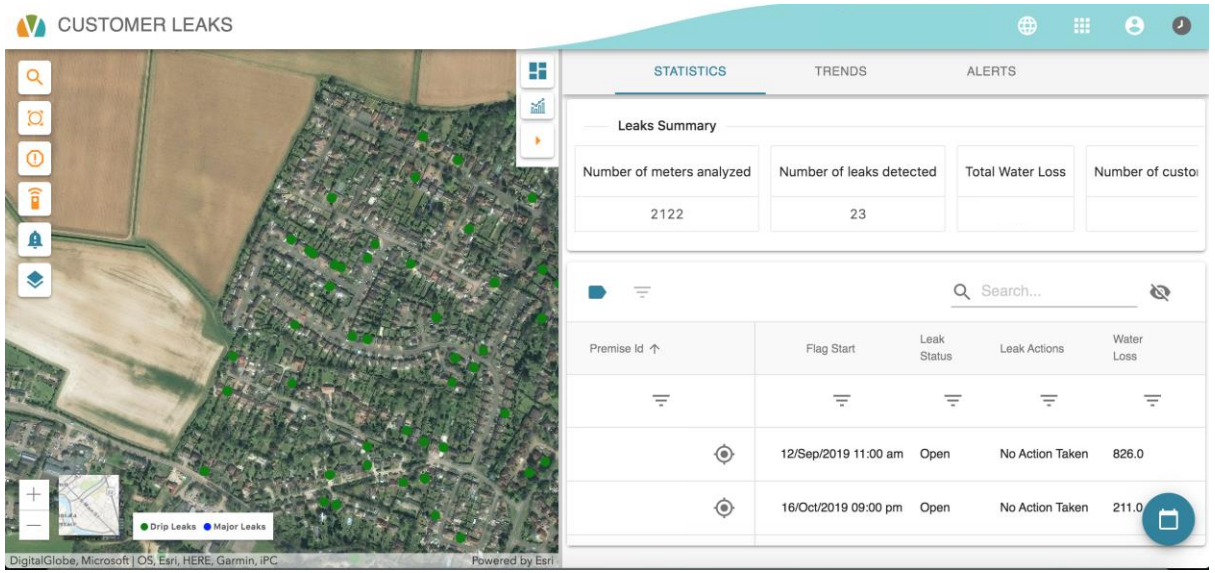
Leveraging Smart Meter data sources

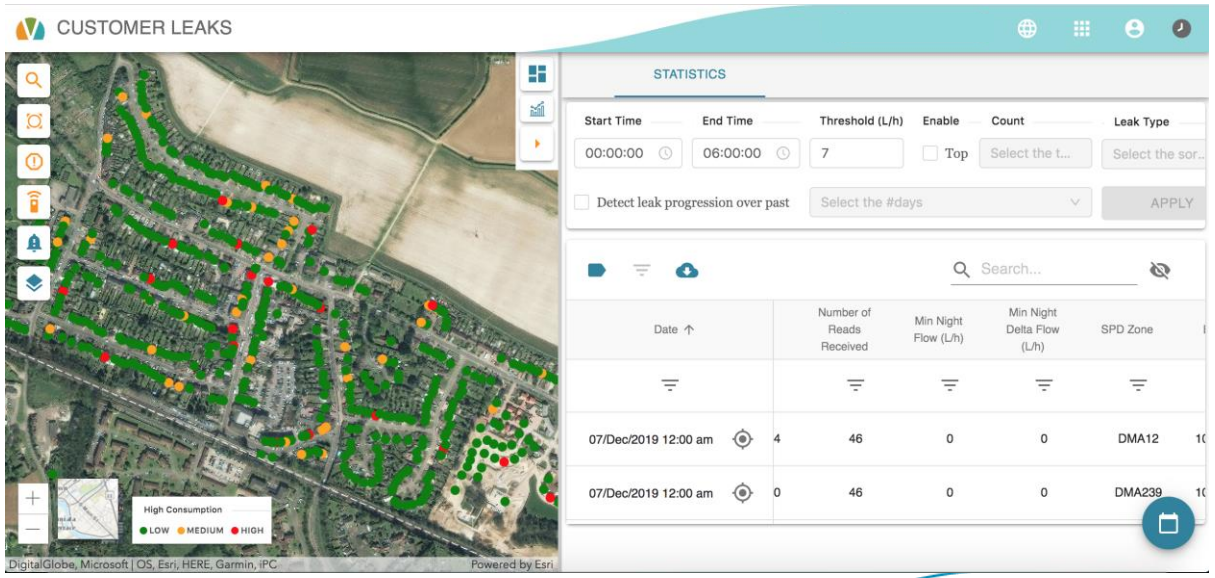
Consumption profile

Intelligent alarms on abnormal trends

Individual and aggregate leakage estimation

Lifecycle management of leak events





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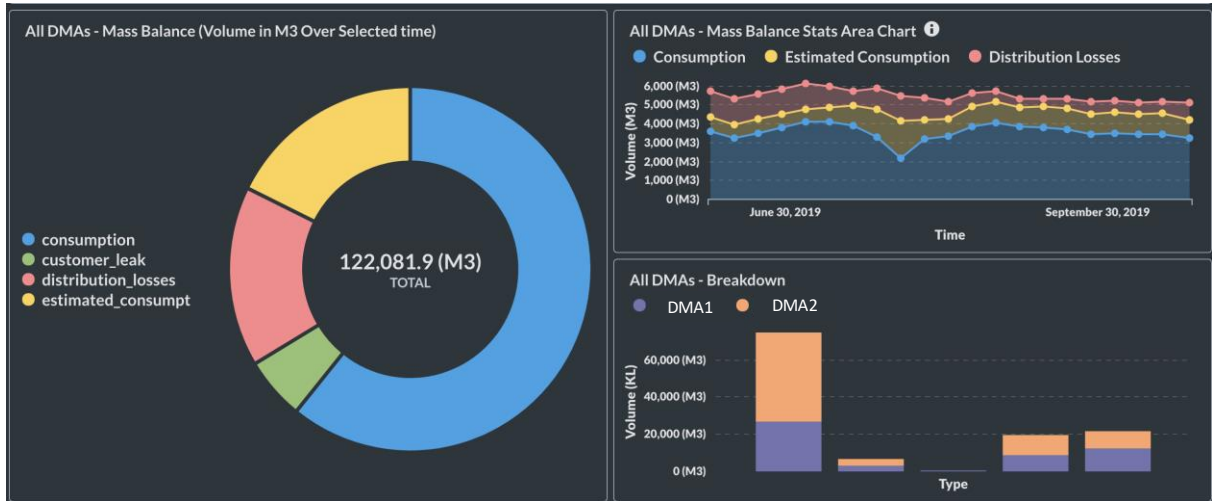
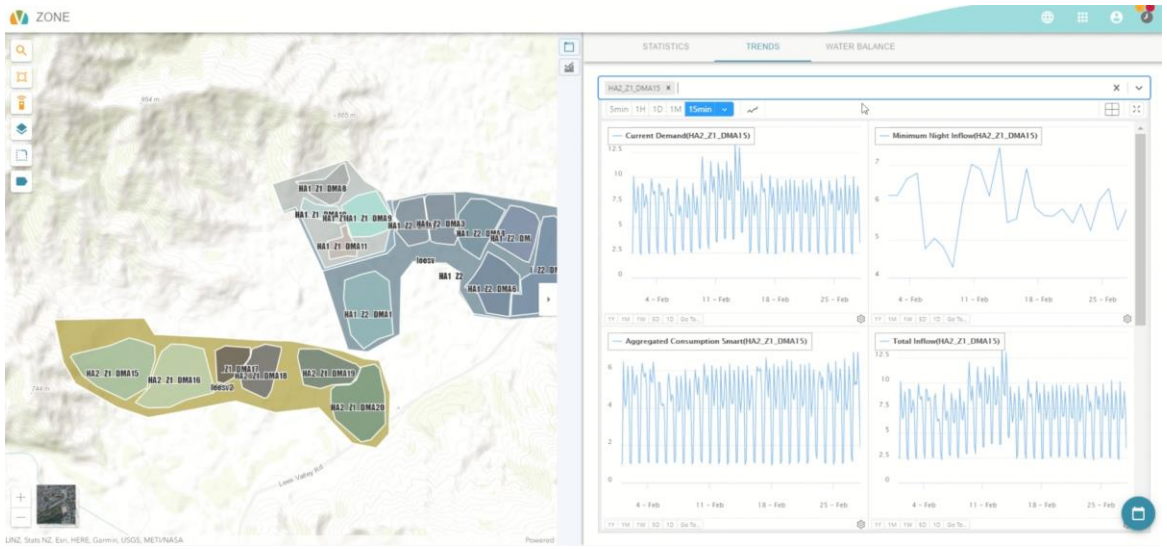
DMA Leakage Assessment

DMA level management

Dynamic water balance

Leakage estimation

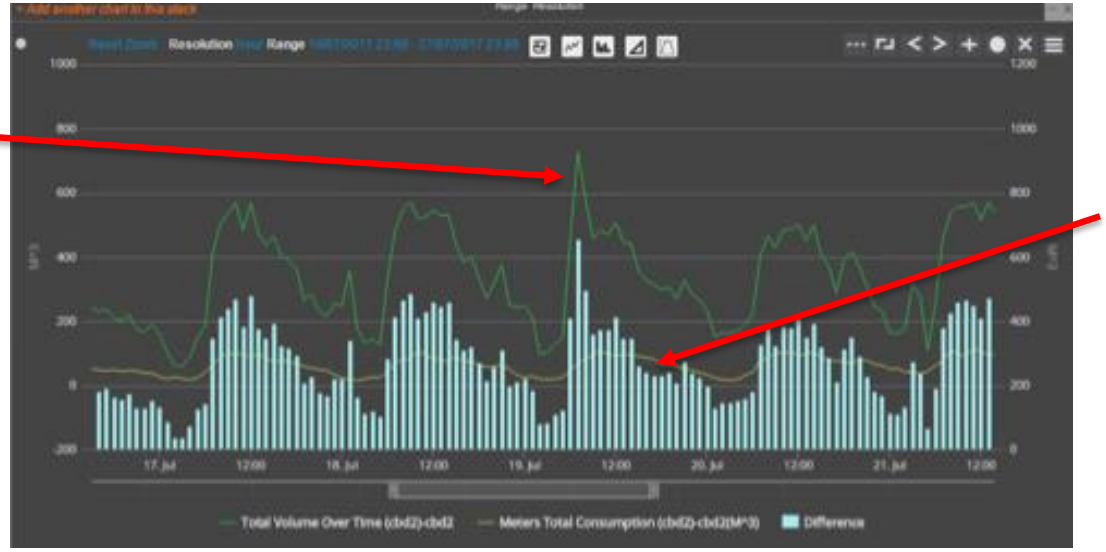






Smart Alarms: Advanced Incident Management

DMA Inflow Increase Detected

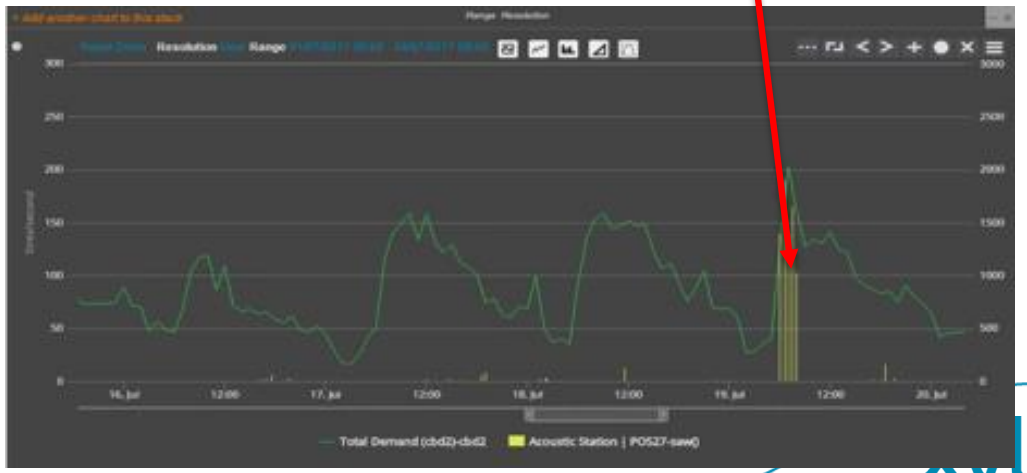


Stable Customer Consumption Detected

Pressure Transient Detected



Increased Acoustic Noise Detected



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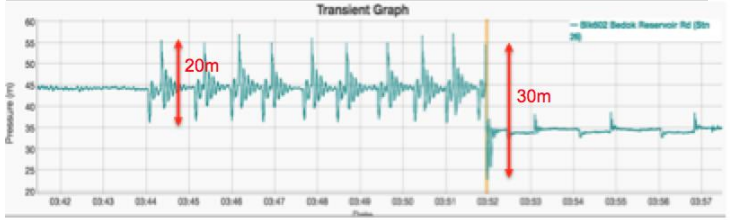
Proactively Manage Your Assets

Use real-time pressure surge data to identify at-risk areas

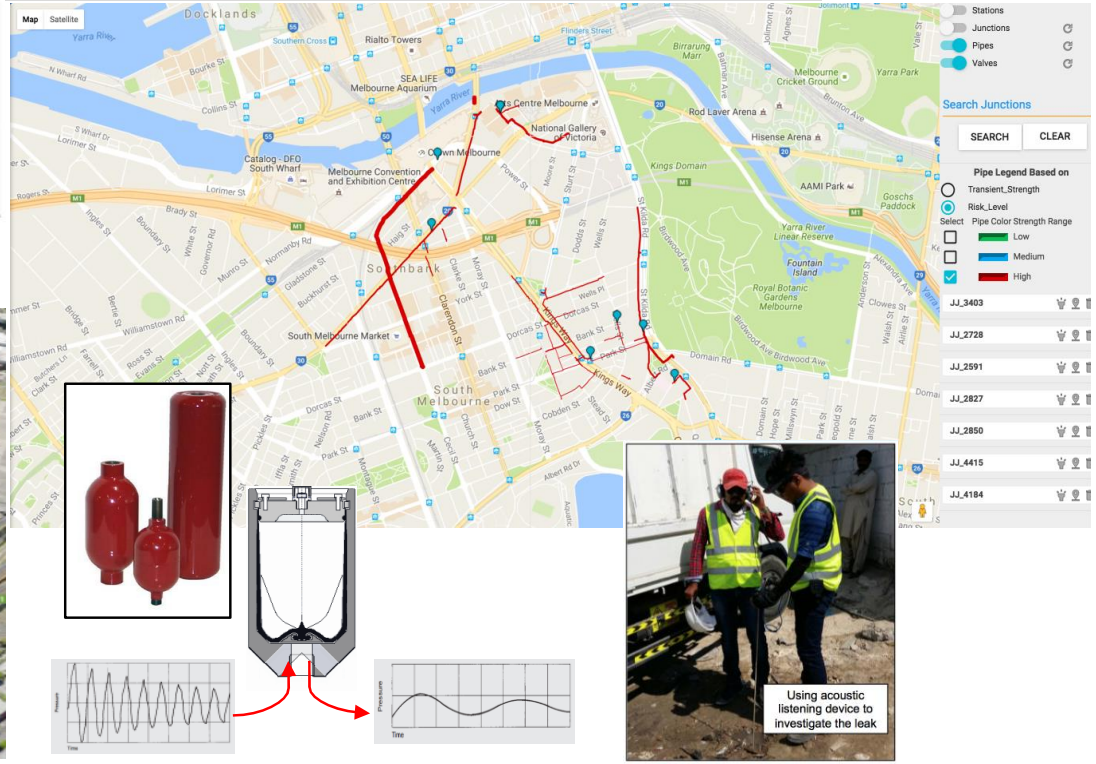
1. Detection of Damaging Transients



2. Identification of Sources



3. Identification of Pipes at Risk of Failure



4. Recommendations on how to reduce the negative impact of transients

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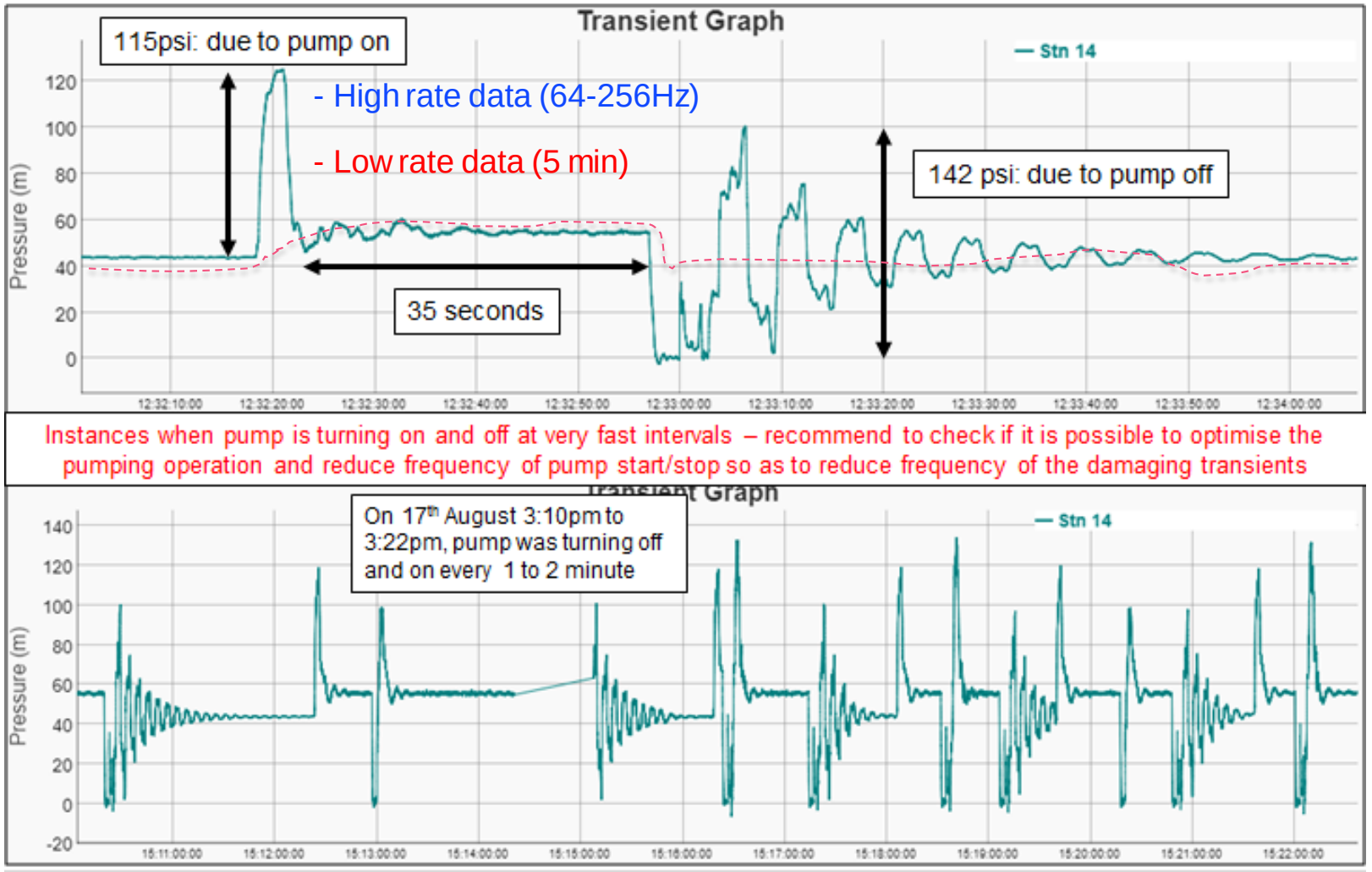
Examples of Damaging Transients



Instances when pump is turning on and off at very fast intervals – recommend to check if it is possible to optimise the pumping operation and reduce frequency of pump start/stop so as to reduce frequency of the damaging transients

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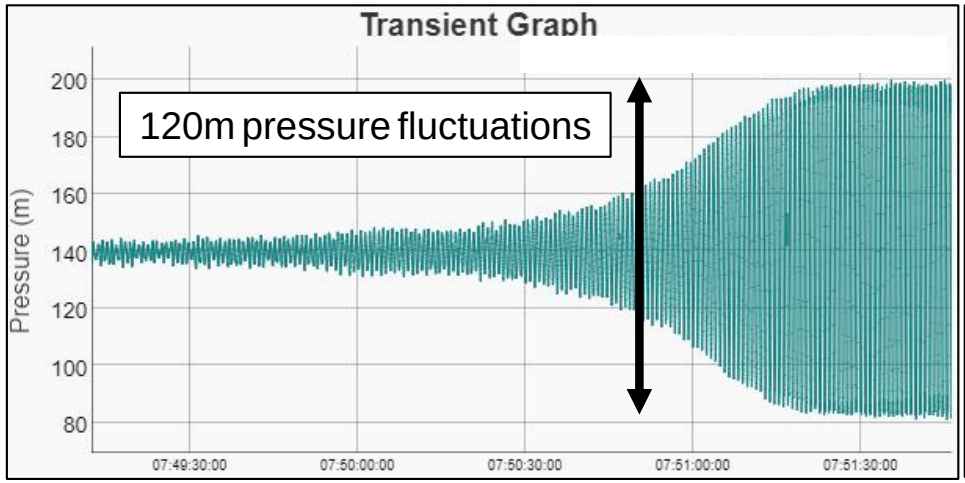
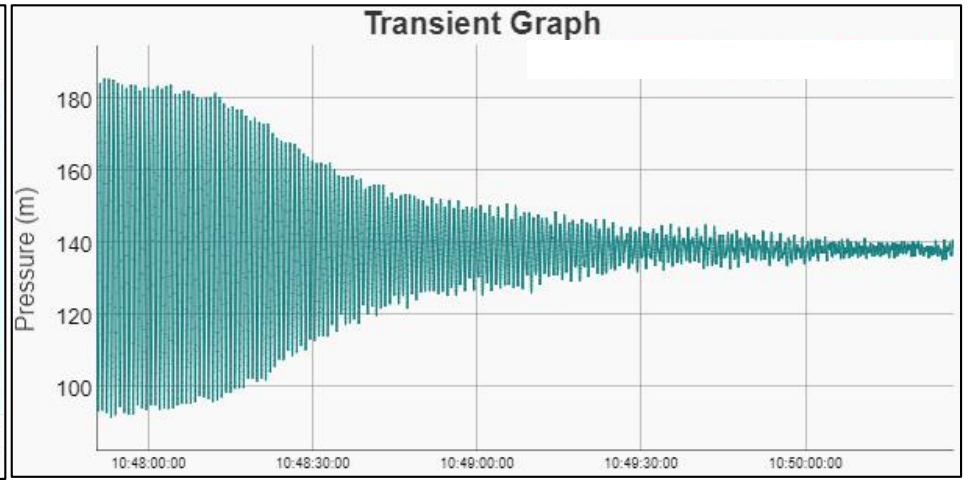
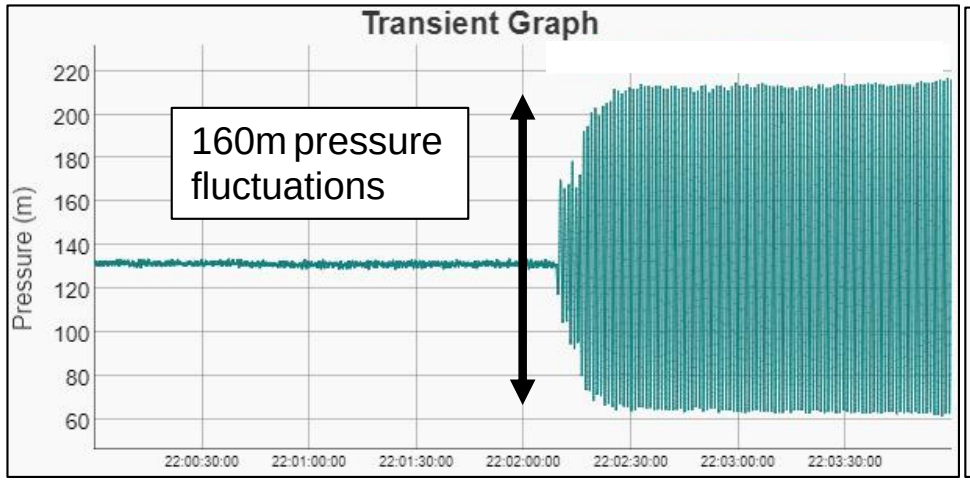
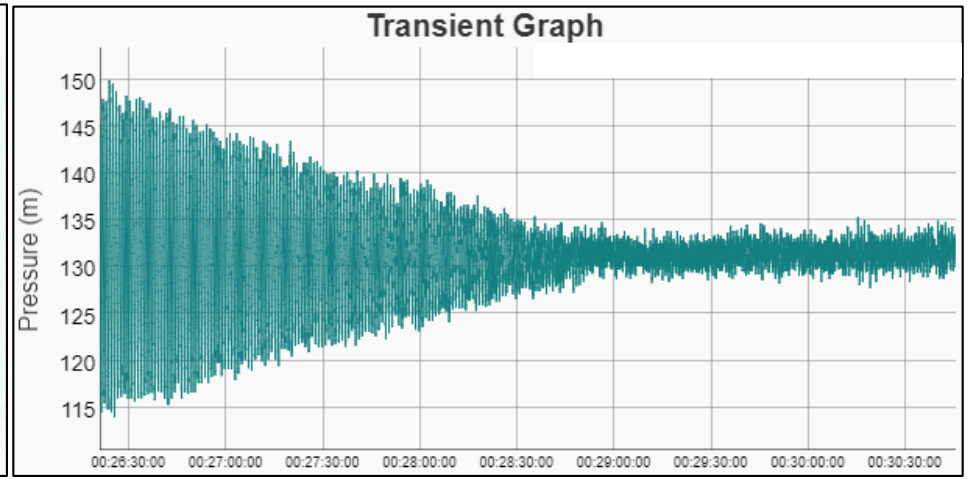
Examples of Damaging Transients









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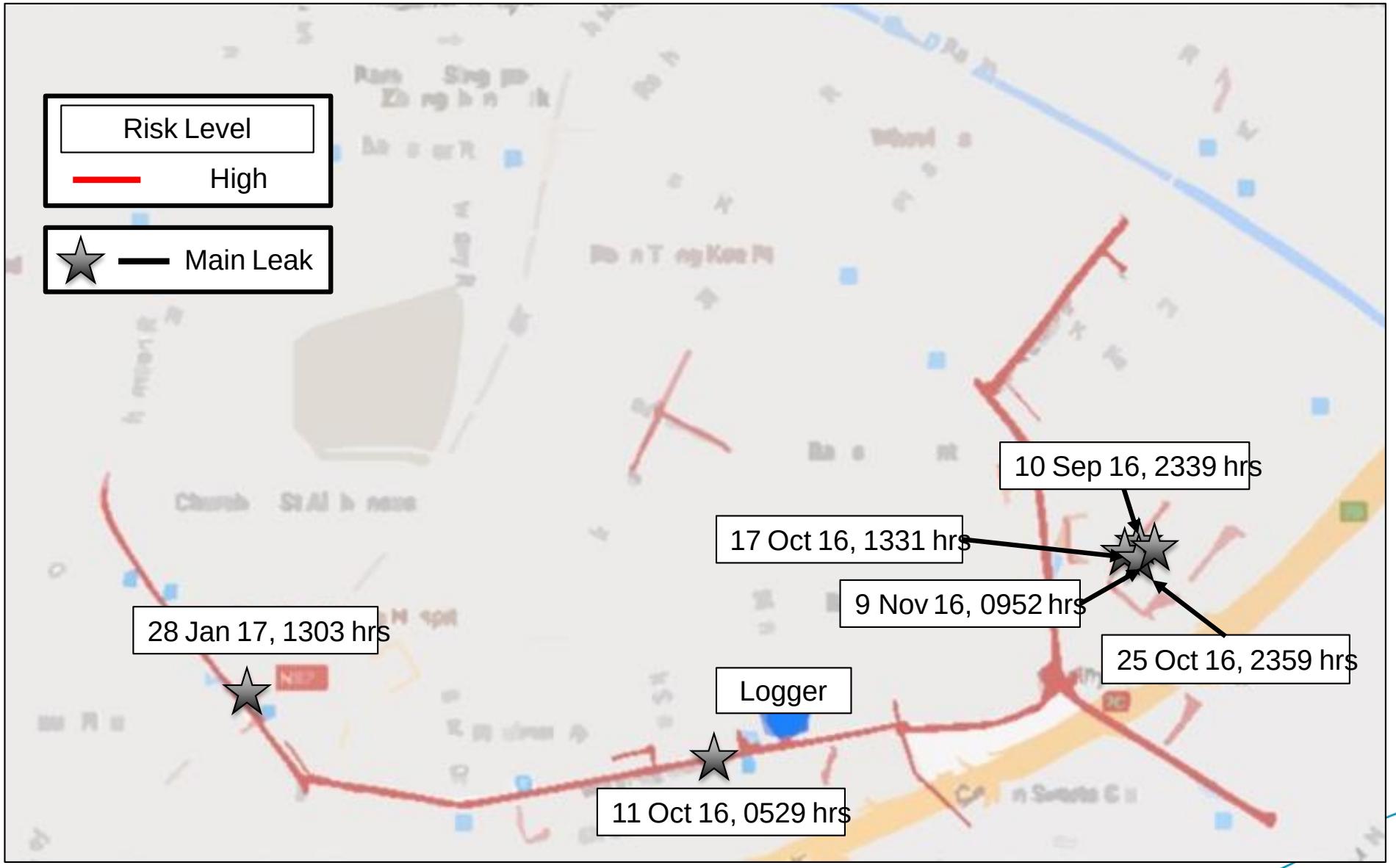
Asset Prioritisation - Proactive Asset Management



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ROI for Proactive Asset Management

Infrastructure

- Save CAPEX – Identify failure-prone points in network for proactive asset management
- Optimize Operational Costs – for prevention of pipe failures

Asset Management

- Extend Asset Life – Identify and eliminate damaging transients that reduces asset life
- Reduce Rehabilitation Costs Dramatically – savings on unnecessary pipe replacement

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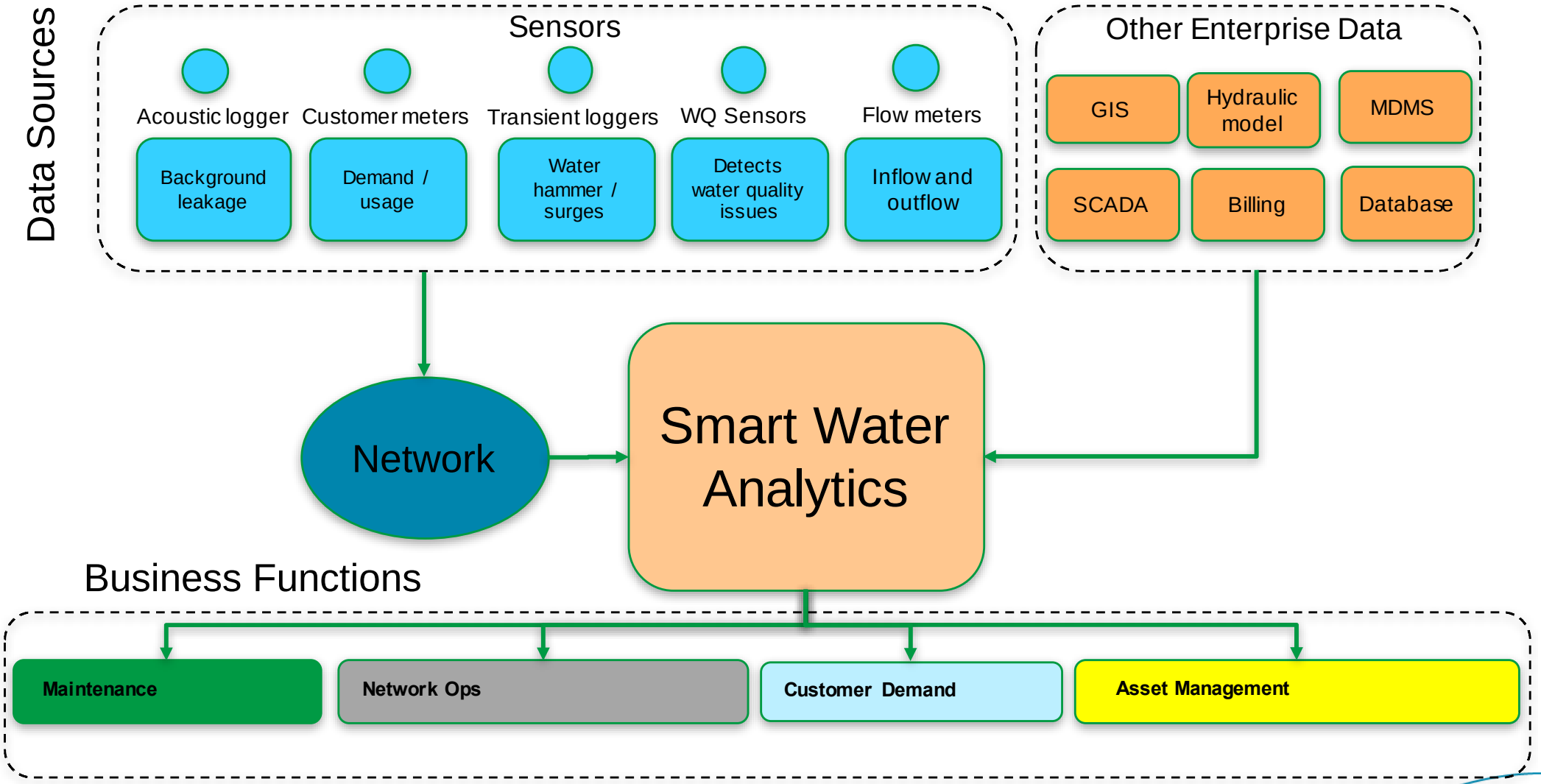
The need for a **data-agnostic** unifying platform



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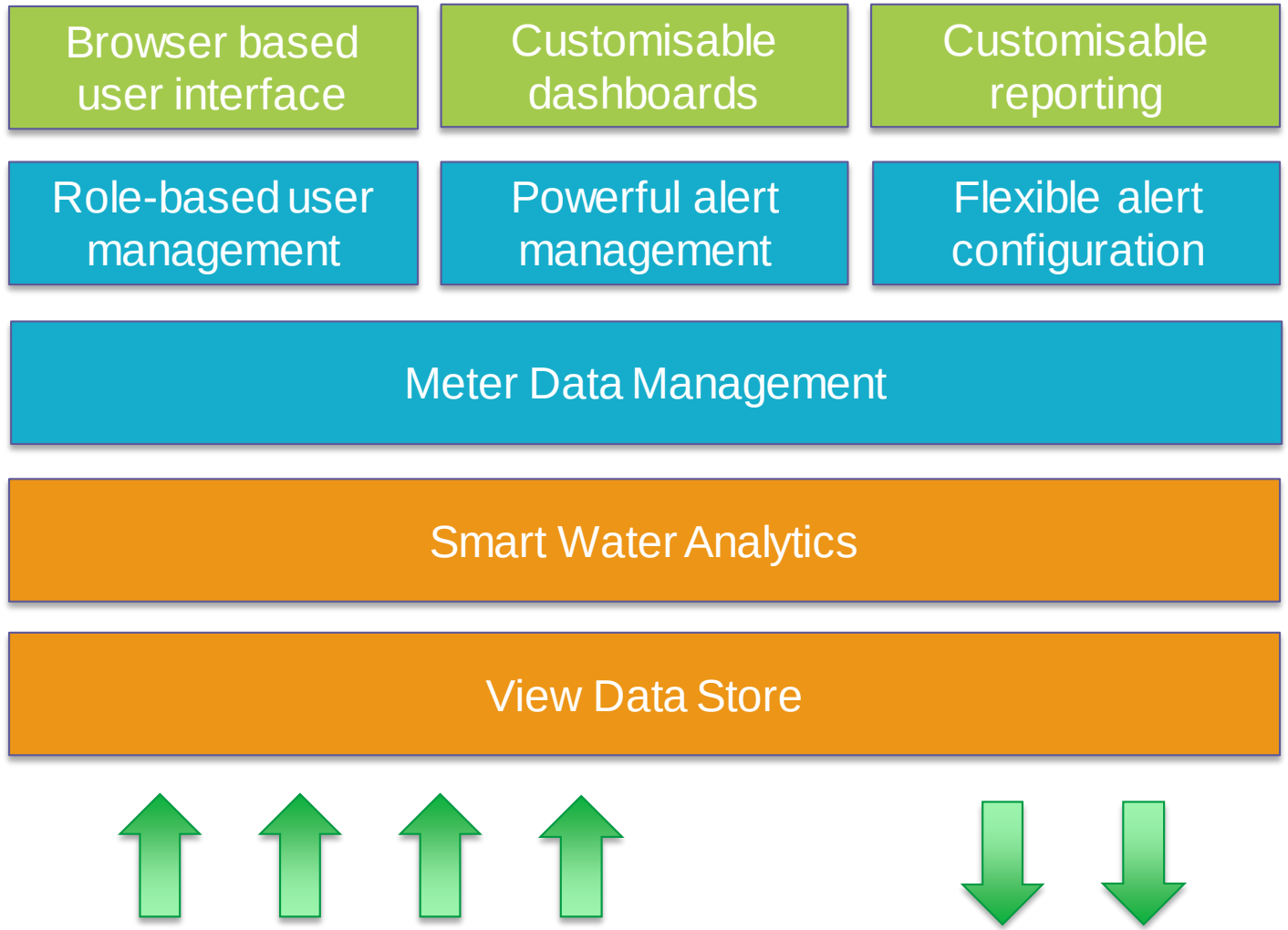
Xylem's Smart Water Analytics platform

- ✓ Interaction/ delivery
- ✓ Management/ configuration
- ✓ Analytics
- ✓ Data Lake



- ✓ Batch import
- ✓ Real-time import
- ✓ Manual data upload
- ✓ REST API

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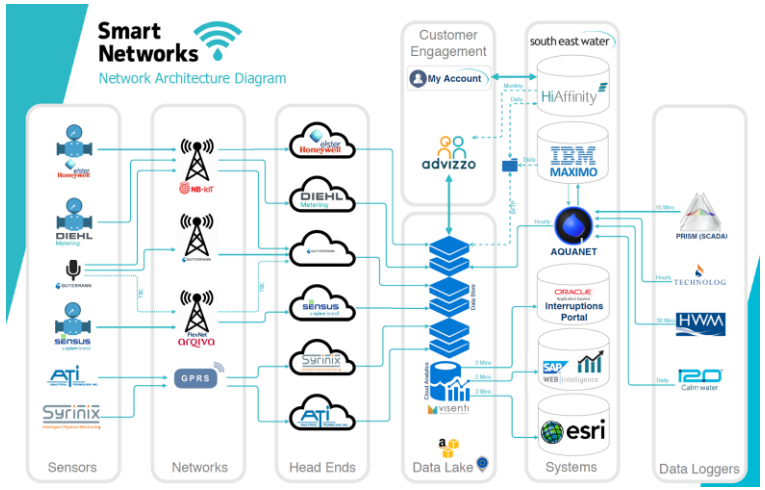
Southeast Water, UK

- **SEW needed to integrate**
  - Data gathered by multiple sensor and meter technologies
  - FlexNet, NB-IoT and 3G/4G cellular
  - Existing systems for billing, resource management, customer engagement



- **A central management system was specified**
  - Flexible enough to interface seamlessly to the wide variety of systems
  - Powerful enough to handle the vast quantities of data collected
  - Provide alarm notifications, advanced network analytics and leak detection



- **SEW selected the Xylem View platform**
  - **View is now successfully operating in the South East Water data centre**

https://corporate.southeastwater.co.uk/news-info/a-smarter-future-with-an-intelligent-network

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Using data to inform current incidents and predict future ones

With Smart Water Analytics you can be more **proactive** and **predictive**

Xylem helps you **make best use of existing data & systems**, reduce silos

View is Xylem's data agnostic, cloud / on-premise **Smart Water platform**

Supports **real-time decisions** and **longer term planning**

Expands in scale & functionality on **your smart water journey**

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Questions?

Contact:

ruth.clarke@xyleminc.com

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