AVEVA PI WORLD

Leak Detection Models: Using PI Data to fight Non-Revenue Water

Water Utilities

Presented By:
Andrew May – Principal for MMM & Utilities, Nukon
Darren Hickmott – Senior SCADA & Controls Planning Engineer, Gippsland Water

Andrew May

Principal Consultant – MMM & Utilities

- Nukon
- andrew@nukon.com

Darren Hickmott

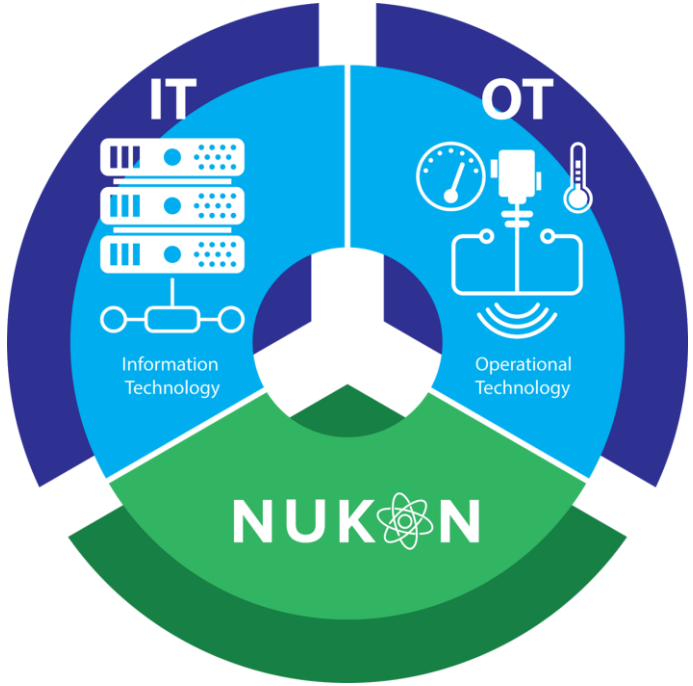
Senior SCADA & Controls Planning Engineer

- Gippsland Water
- ContactUs@gippswater.com.au

AVEVA

NUKON

- Nukon has 30+ full-time staff located in Victoria, Tasmania, Queensland, Western Australia, New South Wales and South Australia
- Nukon work to bring the worlds of operational technology and information technology together
- Nukon provides solutions and services for the following key market segments:
  - Food and Beverage
  - Infrastructure and Utilities
  - General Manufacturing
  - Oil and Gas
  - Water Utilities
  - Resources
  - Defence



"Preferred partners in unlocking data for decisions that matter"

Case Study: Minimum Night Flows, Leak and Burst Detection

“…to detect leaks as early as possible to reduce costs and impacts to our customers.

The system is showing promise in supporting our operational staff…”

Darren Hickmott, Senior SCADA & Controls Planning Engineer, Gippsland Water

Gippsland Water

About Gippsland Water

- service area that covers **over 5,000 square kilometres** and stretches from Drouin in the west to Stratford in the east, and from Mirboo North in the south to Rawson and Briagolong in the north.

- supply clean drinking water to **72,000 households and businesses** across 39 towns and communities, and wastewater services to more than **64,000 households and businesses** across 29 towns and communities.

- maintain a **$1 billion infrastructure network** which includes more than 2,000 km of water mains, 15 water treatment plants, over 1,700 km of wastewater mains and 14 wastewater treatment plants.

Pictured: Moondarra Reservoir, Gippsland Water's largest catchment and storage reservoir.

AVEVA

Minimum Night Flows, Leak and Burst Detection

Gippsland Water

Challenge

Historically leaks complicated to detect using existing flow data models.

Looking to trial a different, real-time method of detecting common failure modes, utilising their existing remote telemetry system, data stored in the PI System and time-series analytics provided by Seeq.

Solution

PI Server

Asset Framework

Seeq Advanced Analytics

Benefits

Multiple anomalies detected

Detect common NRW failure modes using a uniquely designed, asset-specific model to detect >95% of leaks using flow data

Further expand the model to additional like assets for further tuning using AF templates

AVEVA

Business Challenge

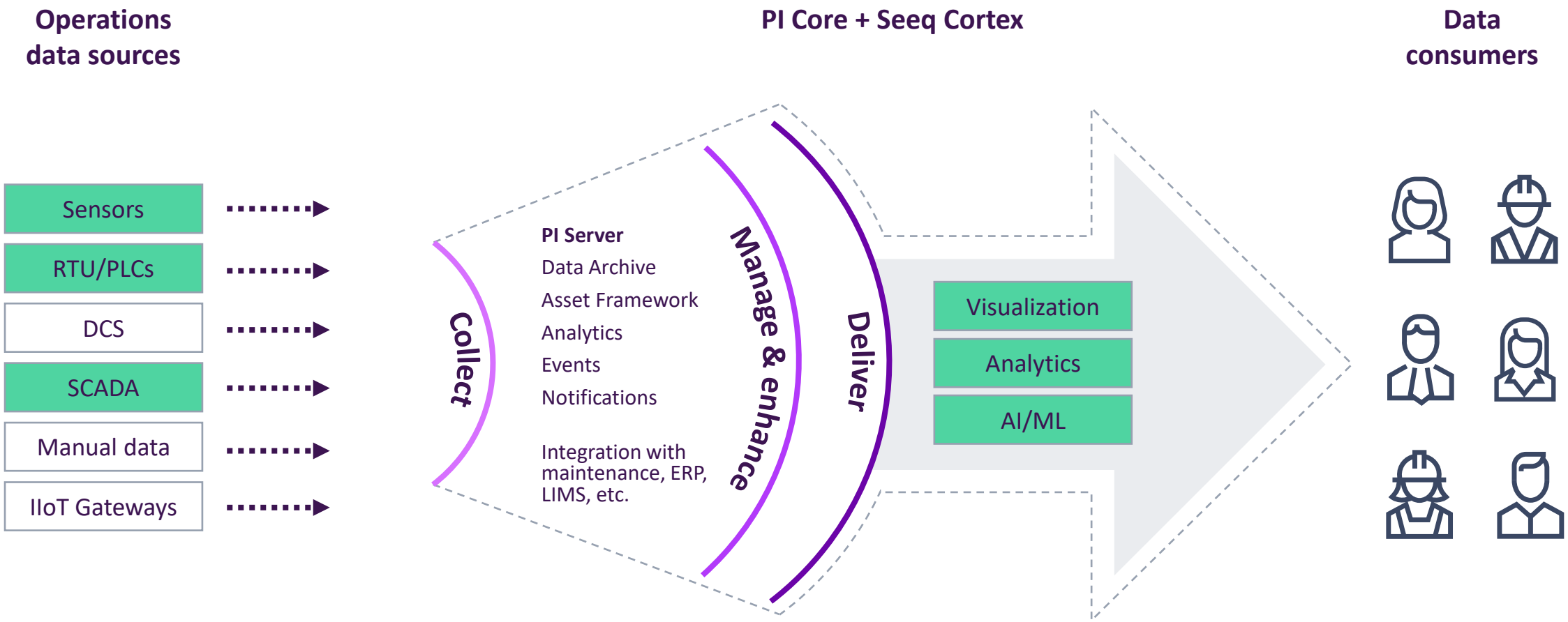
Goals

- Use existing PI Data and Seeq to investigate Minimum Night Flows use case
- Increase visibility of the network
- Determine which failure modes can be monitored easily
- Monitor a pilot site in real-time for these failure modes

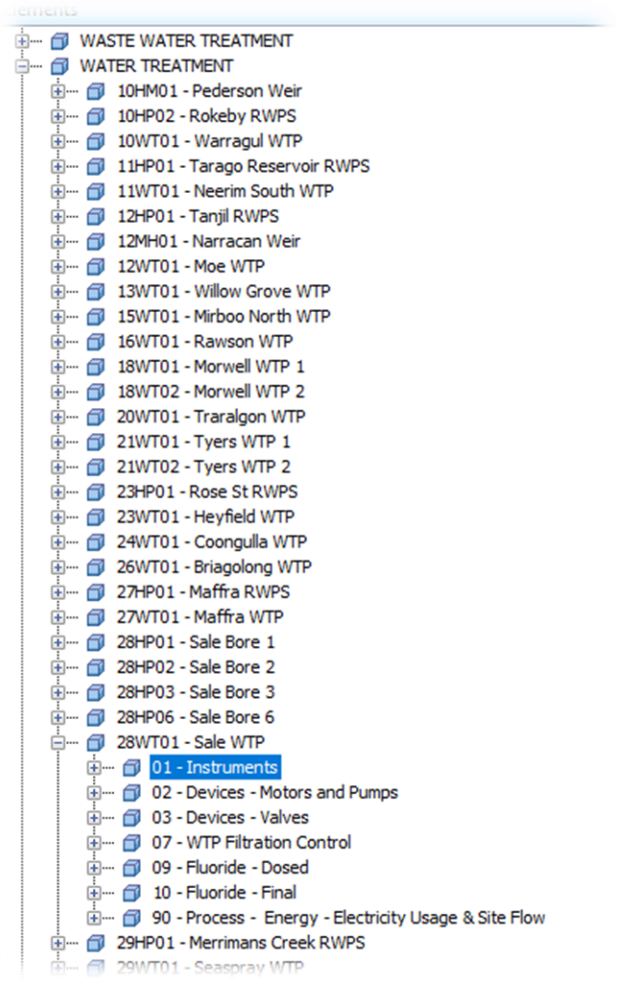
While exploring this use case on defined assets, the leak events were classified into two main categories:

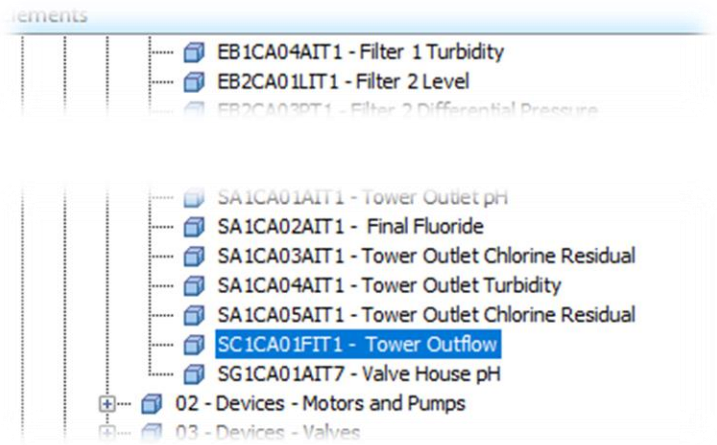
- Short term leaks with high step-change in flows due to main breaks, and
- Long-term leaks, which were slow leaks due to cracks in pipes.

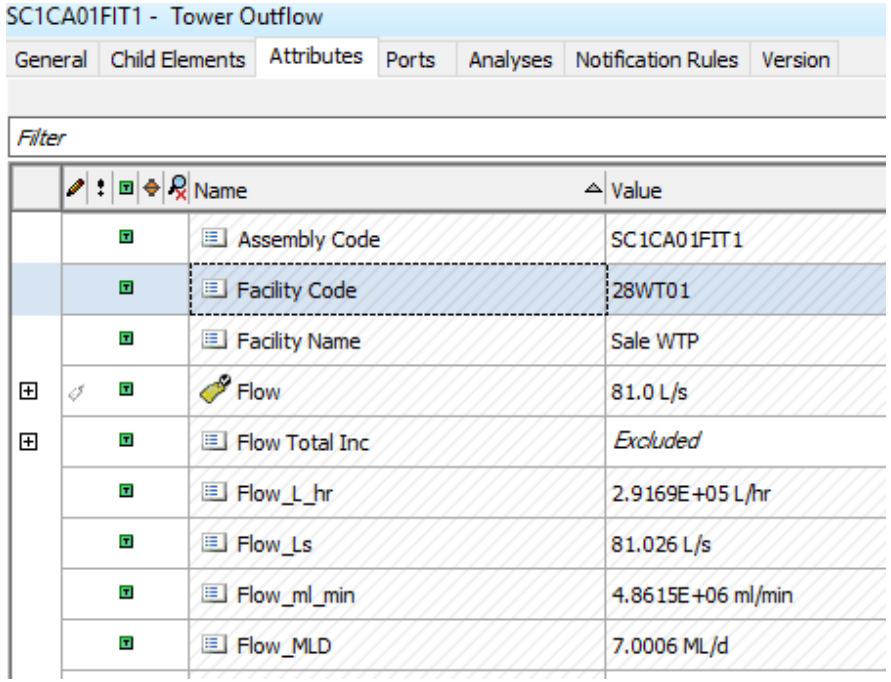
Operations data infrastructure

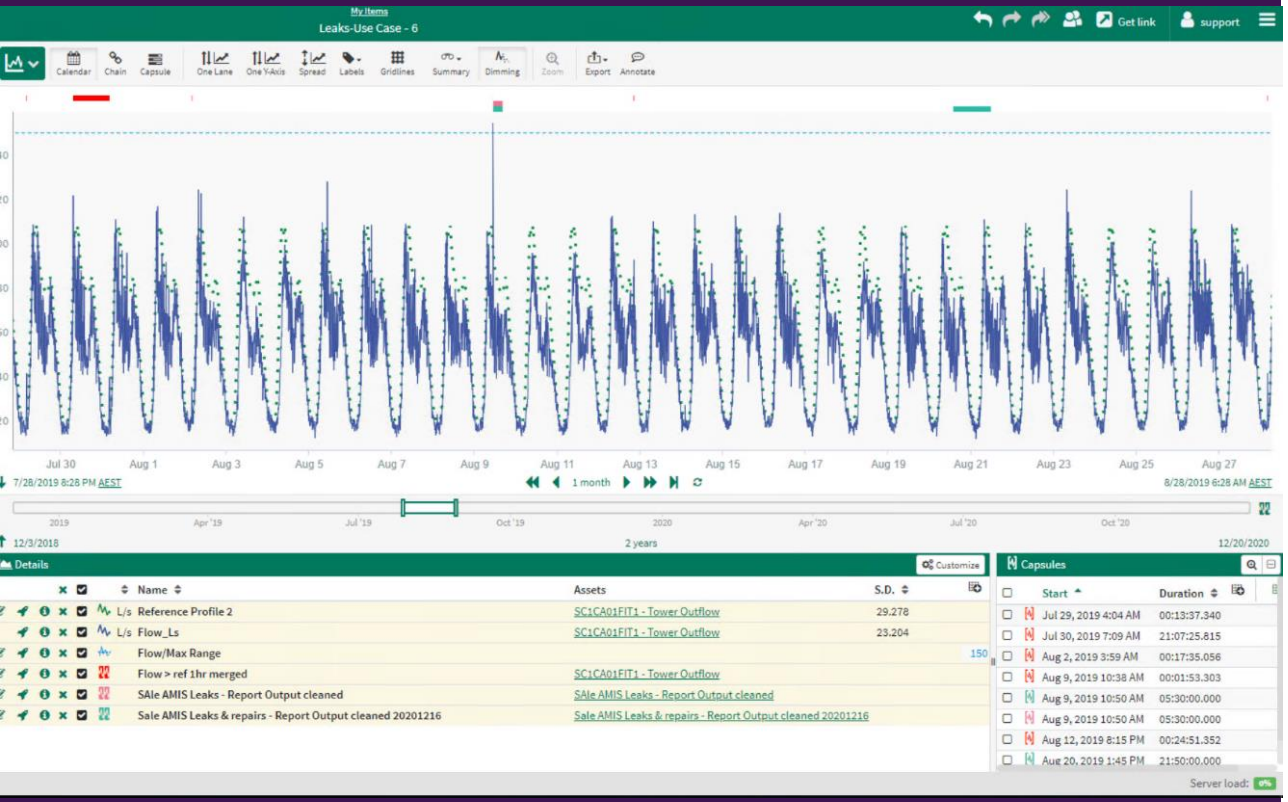


Asset Framework (AF) Data Model





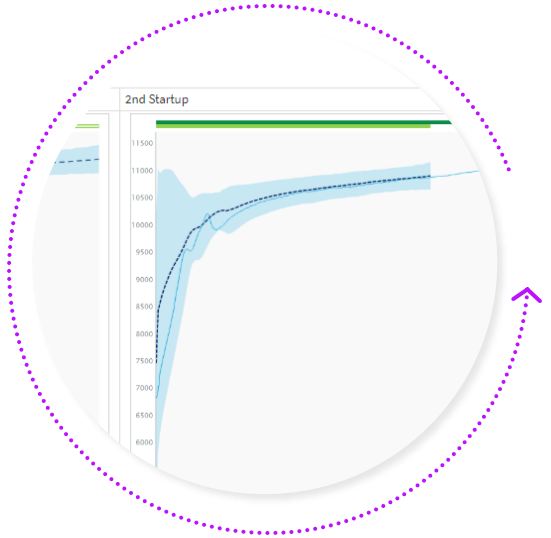




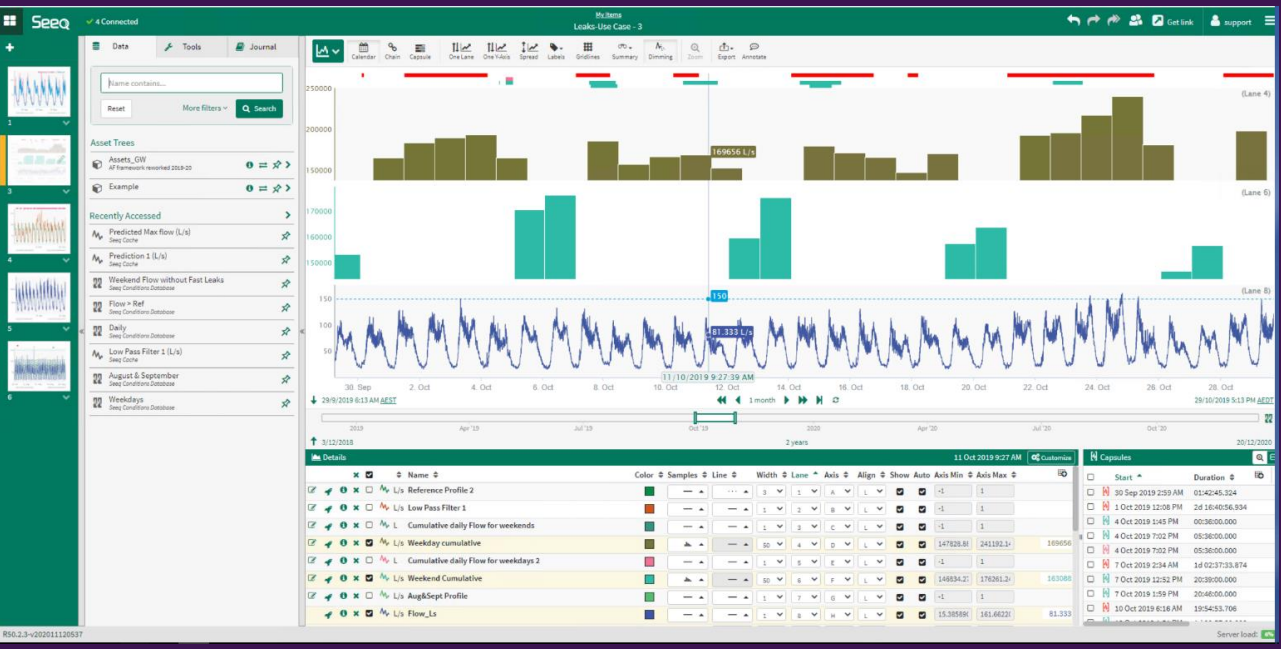
Failure Mode Detection

Main Break

- It was found that main breaks (or very large leaks) can be reliably determined by creating a ***Reference Profile*** against the asset flow's upper limit, cross referenced against predictable and recurring weekday and weekend night-flow patterns.



Example Reference Profile



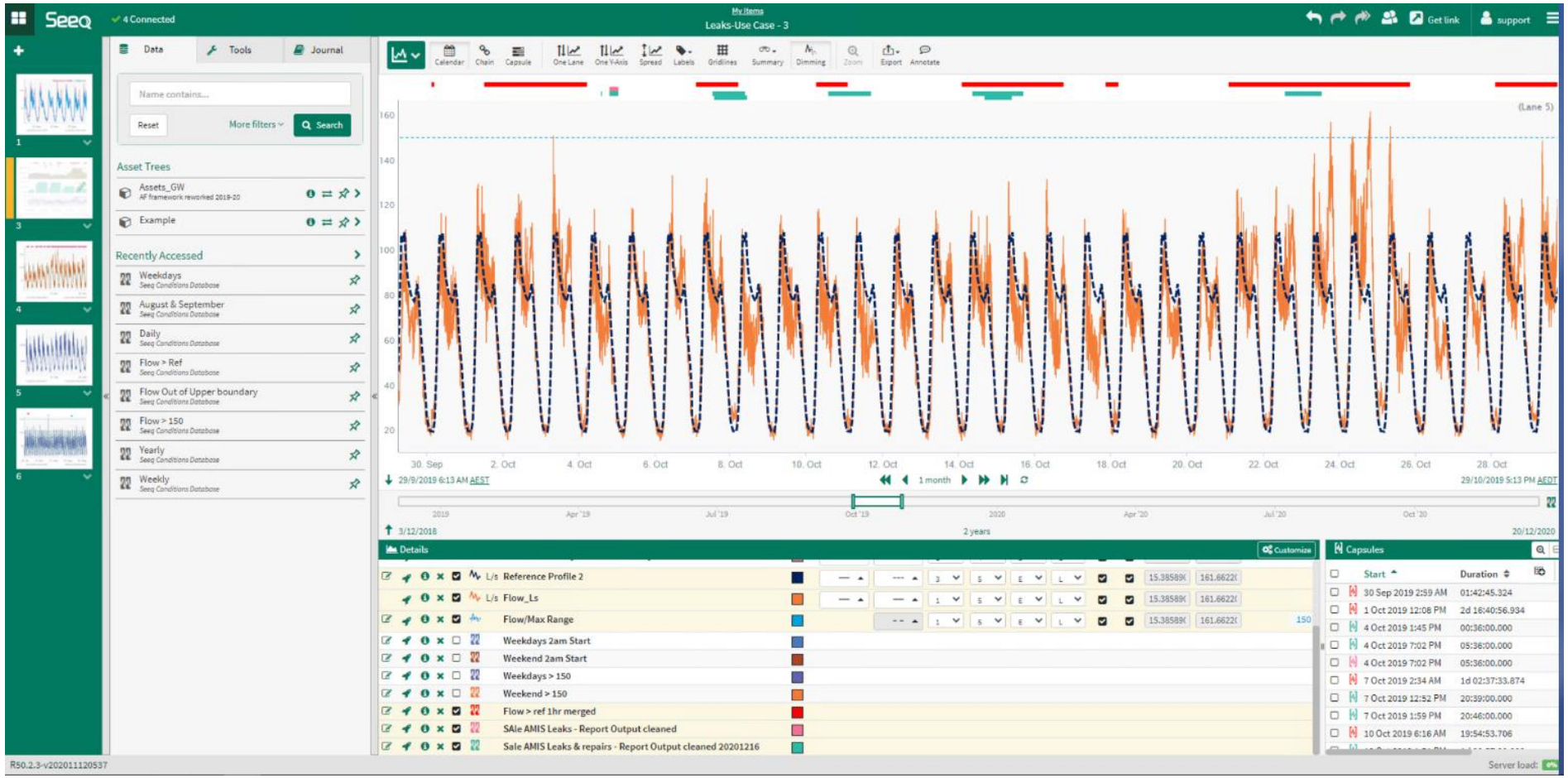
Failure Mode Detection

Slow Leaks

- Slow and long-term leaks are more difficult, due to the fact that there are not many reference points or constant conditions for leaks to be detected from the asset daily flow pattern.
- Reliable detection of slow-leaks therefore depends on additional factors such as seasonal usage, weekday and weekend profiles, which varies every 2-3 weeks. Leaks also had to be detected amongst various changes to flow volumes over the time period of interest.
- Use the CUSUM Method

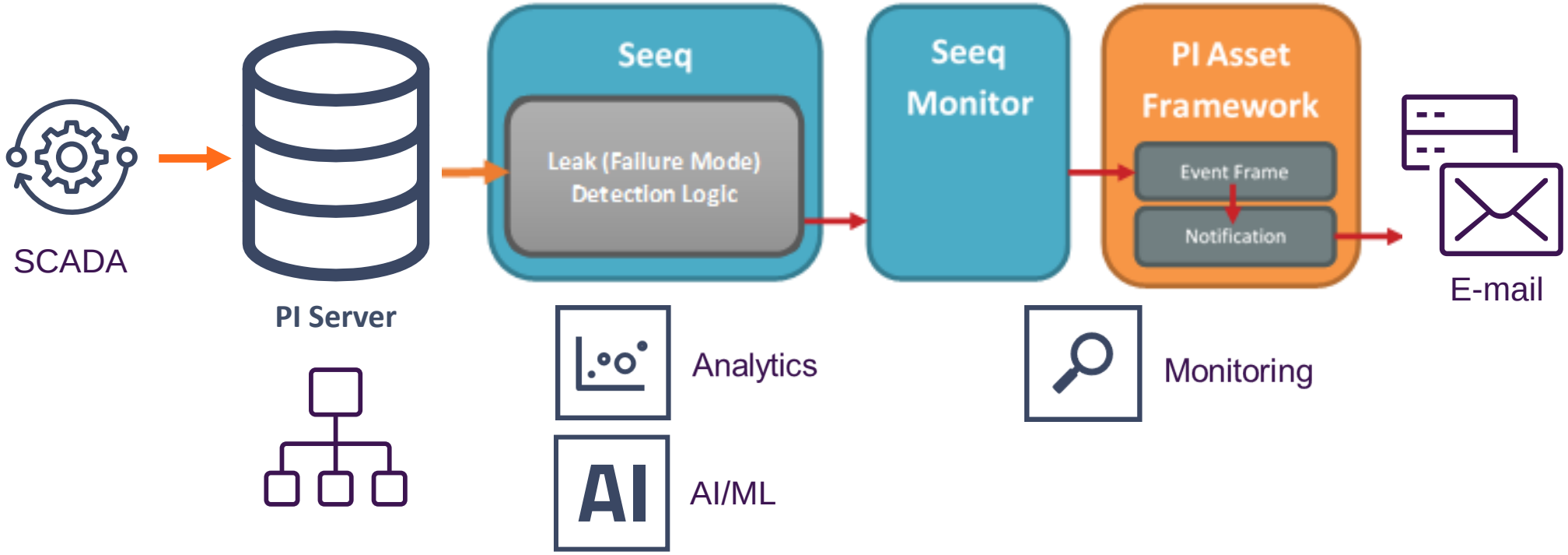
Failure Mode Detection

Combined Method



Closing the Loop

Generate Event Frames and Notifications



Potential Benefits

- Reduced waste (may help detect leaks that occur that are not easily visually identified, such as in remote areas or rocky/porous soil)
- Reduce risk by detecting abnormal flows and small leaks before major failure
- Early detection would allow the repair to be planned to reduce customer impact and improve safety
- Improve customer/community experience/reputation by attending to leaks in a proactive and timely manner

However…

- The alerts still require human vetting to assess the alert and determine the likely cause. If considered genuine, then the location of the leak will needs to be found in the field, which can be challenging.
- Still need to build confidence in model and reduce false positives.
- Other reticulation system have other disturbances (pumps stations, downstream storages, 24/7 industrial users, etc.) that will need to be accounted for in the analysis.

AVEVA

Client feedback

Problem statement

Gippsland Water has trialled Seeq in combination with OSI PI for automated leak detection in our networks. The aim of this trial project is ***to detect leaks as early as possible to reduce costs and impacts to our customers****.*

The system is showing promise in supporting our operational staff to have a closer look at a system with a flagged issue. This automated system doesn't get distracted with other issues like our operational staff who traditionally monitor the system trends to detect changes. In a situation like a recent weather event we had in our region, our operational staff may be forgiven for missing a slight change in this data.

Gippsland Water

Darren Hickmott, Senior SCADA & Controls Planning Engineer, Gippsland Water

AVEVA

Next Steps

Refine and Expand

- Although this solution has potential to detect common NRW failure modes using a uniquely designed, asset-specific model to detect >95% of leaks using flow data, there is still more work to do around making the model more robust, through considering seasonal variations and collecting more real data on leak scenarios.
- The intent is to further expand the model to additional like assets using AF and Seeq Workbench Analysis templates and tune the model further to provide high-reliability, advanced detection of leaks further reduce NRW.

AVEVA

Steps to Success

How can I apply this?

- Valid for most processes or assets with a repeatable and predictable normal operating envelope

1. **Get** the relevant field **data** into the PI Server
2. **Model the system** in the Asset Framework
3. **Determine** your good (or best) **normal operating conditions**
4. **Use** Seeq's advanced machine learning algorithms to **define dynamic boundaries**
5. **Apply** the **Boundary Profile** to your use case
6. **Validate** the model
7. **Monitor** for excursions
8. **Scale** using PI-AF Templates
9. **Execute** and **Automate** the anomaly response using PI Notifications or Workflow

AVEVA

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

linkedin.com/company/aveva

@avevagroup

ABOUT AVEVA

AVEVA, a global leader in industrial software, drives digital transformation for industrial organizations managing complex operational processes. Through Performance Intelligence, AVEVA connects the power of information and artificial intelligence (AI) with human insight, to enable faster and more precise decision making, helping industries to boost operational delivery and sustainability. Our cloud-enabled data platform, combined with software that spans design, engineering and operations, asset performance, monitoring and control solutions delivers proven business value and outcomes to over 20,000 customers worldwide, supported by the largest industrial software ecosystem, including 5,500 partners and 5,700 certified developers. AVEVA is headquartered in Cambridge, UK, with over 6,000 employees at 90 locations in more than 40 countries. For more details visit: www.aveva.com

AVEVA