Future water networks:

Enabling data transformation for leak location

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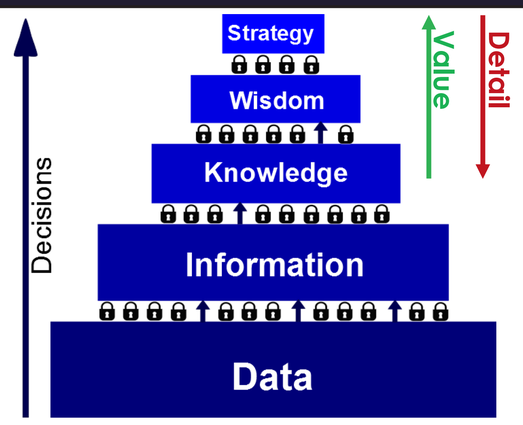
As the world continues to hurtle into the digital age, the water industry is no exception. Fuelled by improvements and availability of monitoring equipment, "big data" is increasingly available. Yet, transforming this data into operational and strategic value to inform future water networks remains a challenge. This work focuses on pathways enabling data transformation into actionable information.



One way to explore this problem is through the data, information, knowledge, wisdom (DIKW) pyramid. The adapted model (left) shows how there are many pathways that may take us through from the fine detail of the raw data (which doesn't make a lot of sense without context) all the way up to the 'big picture' wisdom that can help inform companies' long term strategies. The tough bit is deciding on the best set of tools to enable that journey.

Understanding and making use of the DIKW pyramid can help us avoid the drip:

Data

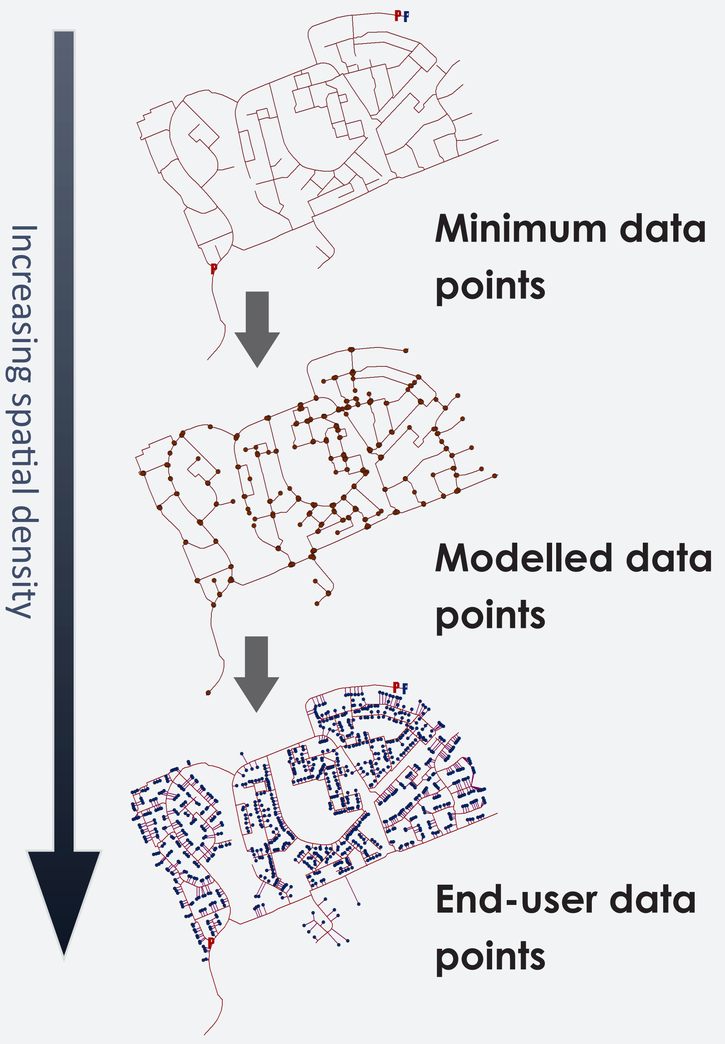
Rich

Information

Poor

Data and leakage

In the UK and many other countries across the world, the practise of dividing up the water distribution network into monitored and isolatable sectors is common practise. These district metered areas (DMA) can be used to identify increases in leakage or bursts. Data is typically collected from a few monitoring points, such that it is possible to detect leakage or a burst within the DMA, but not locate it. Many leak detection methods consider minimising the number of sensors within the networks. Fewer sensors requires greater reliance on models to increase the number of data points for network analysis. Utilising customer meters and advanced metering infrastructure it is possible to transform every customer property into a data point.



FIELD TRIAL

What has been done?

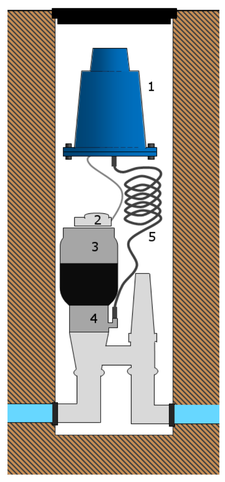
A field trial was established within a DMA, in order to create a data set of co-located pressure and flow data. The data is currently being collected at 50 properties across the DMA, by installing a dual channel data logger (with internal pressure transducer) within the boundary box, thus utilising the meters that are already in place.

Why collect data at the customer boundary box?

Pressure data can provide information on the network side, whilst flow data can tell us what is happening on the customer side.

What are the benefits?

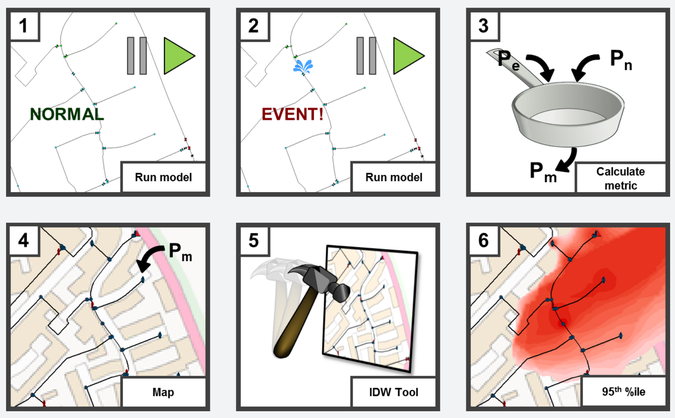
- A novel, high density, co-located flow and pressure data set
- Improved understanding of the relationship between flow and pressure in a water distribution system
- Development of a method to reduce search area for leaks and bursts
- Differentiation between network and customer -side events



Meter chamber configuration

(1) HWM Dual channel data logger
(2) Elster pulse head
(3) Elster V210P water meter
(4) Langham p and q adaptor
(5) Recoil hose

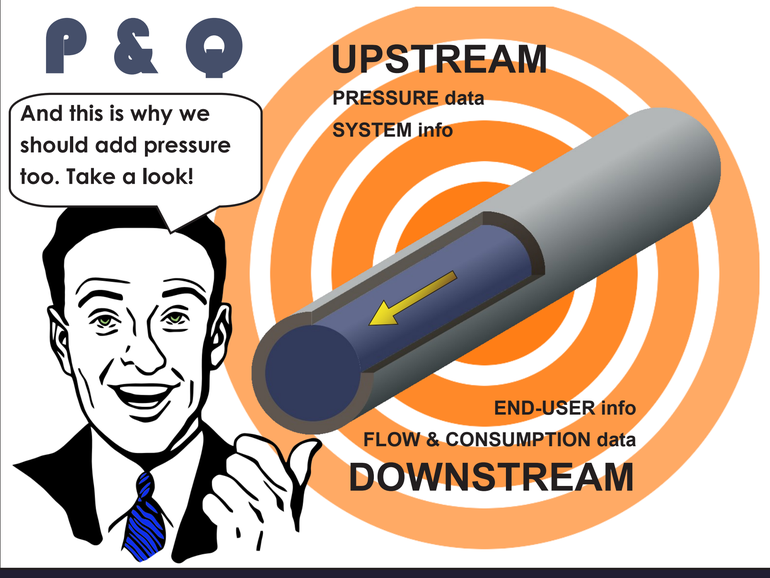
Pressure mapping



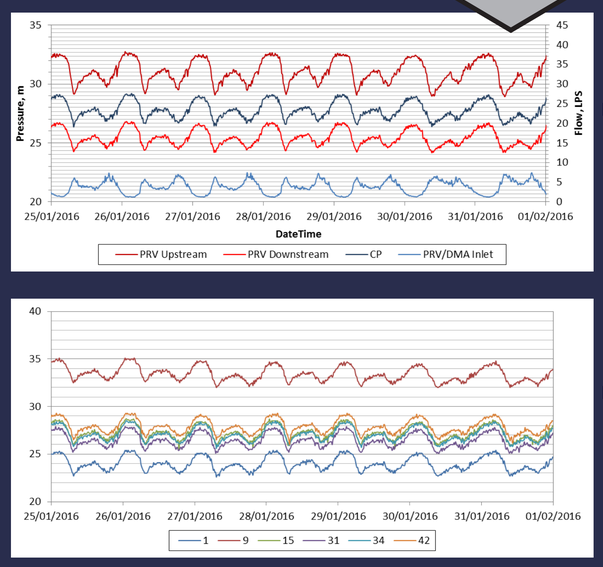
- Pressure data utilised to locate leak/burst in network
- Utilising spatial analysis capability of GIS
- Data from instrumentation could be used instead of modelled data
- More data points = reduced interpolation distance

The effectiveness of finding a pressure change to reduce the search area was explored by plotting pressure change for just 50 locations (to match the number being used in the field trial).

P & Q



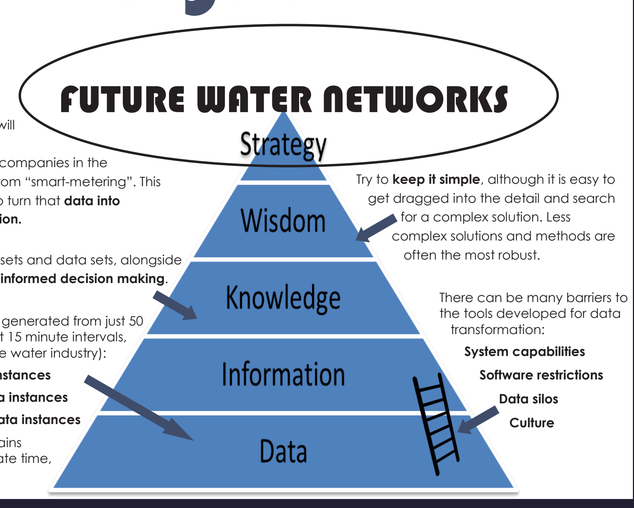
FIELD DATA



Minimum Monitoring Points*
(*In a pressure monitored area)

End-user Monitoring Points
(Pressure only)

Summary...



It is likely that there will be a lot more data collected by water companies in the future, particularly from "smart-metering". This work looks at how to turn that **data into actionable information.**

Leverage current assets and data sets, alongside new data for **better informed decision making**.

The **amount of data** generated from just 50 locations, logging at 15 minute intervals, can be huge (for the water industry):

1 day = 4800 data instances
1 week = 33600 data instances
1 month = 144000 data instances

Each instance contains multiple features: date time, pressure, flow.

Try to **keep it simple**, although it is easy to get dragged into the detail and search for a complex solution. Less complex solutions and methods are often the most robust.

There can be many barriers to the tools developed for data transformation:

System capabilities
Software restrictions
Data silos
Culture

The University Of Sheffield.

love every drop anglianwater

EPSRC
Engineering and Physical Sciences Research Council

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