

The logo for CWMAG (Clean Water Modelling Advisory Group) features the text "cwmag" in a bold, lowercase, blue sans-serif font. The letters are contained within a blue rounded rectangular border. Below the main text, the words "clean water" and "modelling advisory group" are written in a smaller, lighter blue font, stacked vertically.

clean water
modelling advisory group

CwMAG WORKSHOP 2023

AI in the water Industry

TRIDENT Group Solutions

Experts in Water and Infrastructure



Workshop Programme

Thursday 23rd November

09:25 - 09:30

Welcome & Introduction – Simon Croft (Trident)

Session 1

09:30 – 10:00

What is AI? – Jack Saunders and Ryan Searle (Trident)

10:00 – 10:35

What scares you the most about AI? – Jack Saunders and Ryan Searle (Trident)

10:35 - 11:00

Tea and Coffee Break

Session 2

11:00 – 11:30

How can AI applications be used in the water industry? - Jack Saunders and
Ryan Searle (Trident)

11:30 – 11:45

South West Water example - Jeremy Hilderley (South West Water)

11:45 – 12:15

Scottish Water example – Scott Young (Scottish Water)

12:15– 12:30

Conclusion and questions – Jack Saunders and Ryan Searle (Trident)

12:30

Lunch



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What is Artificial Intelligence?

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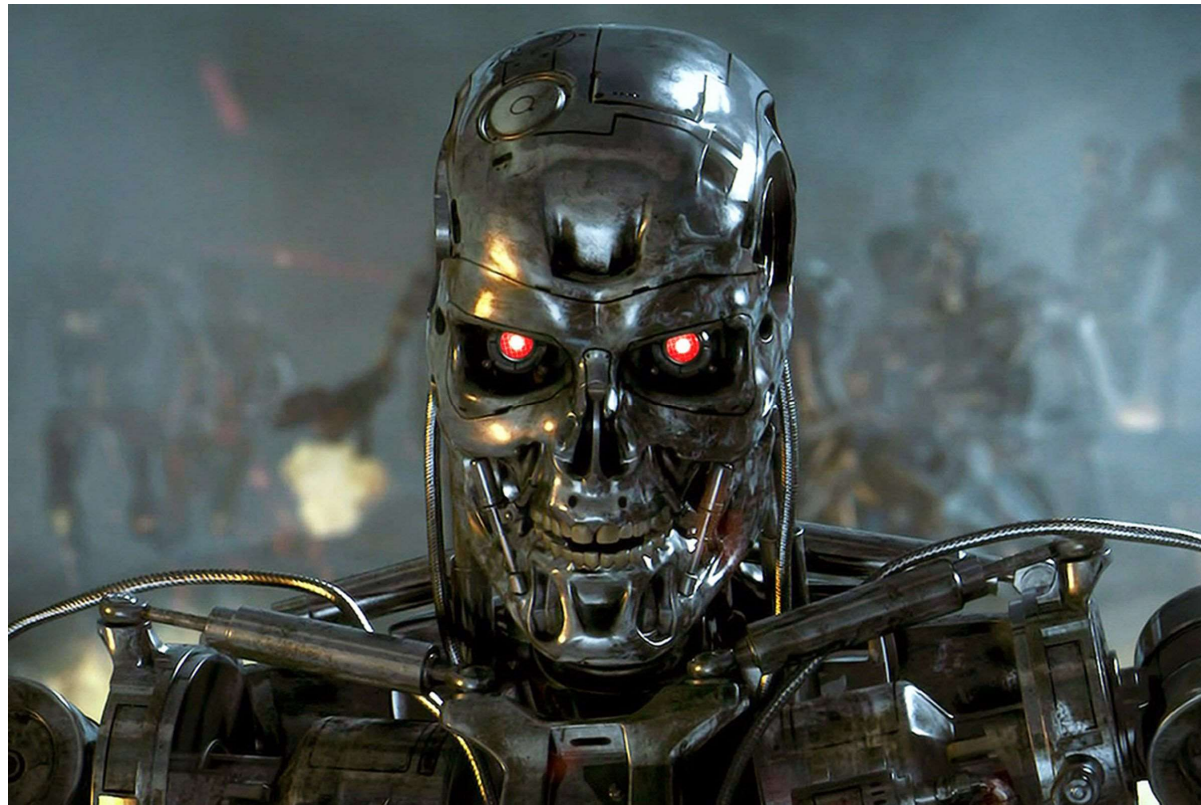
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Expectation



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Reality

Items you may enjoy



You might also like



You might also like



Coolamp Battery Wall Light, Indoor Wall Lamp with Remote/Touch Control, Rechargeable Battery, 3 C...

£18⁹⁹ Was: £23.99



Grocery deals from Fresh



Shop grocery deals

More items to explore

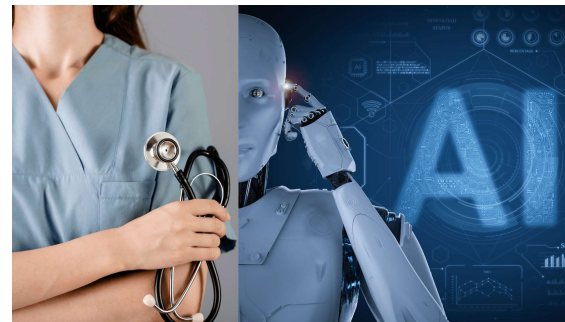


What is AI?

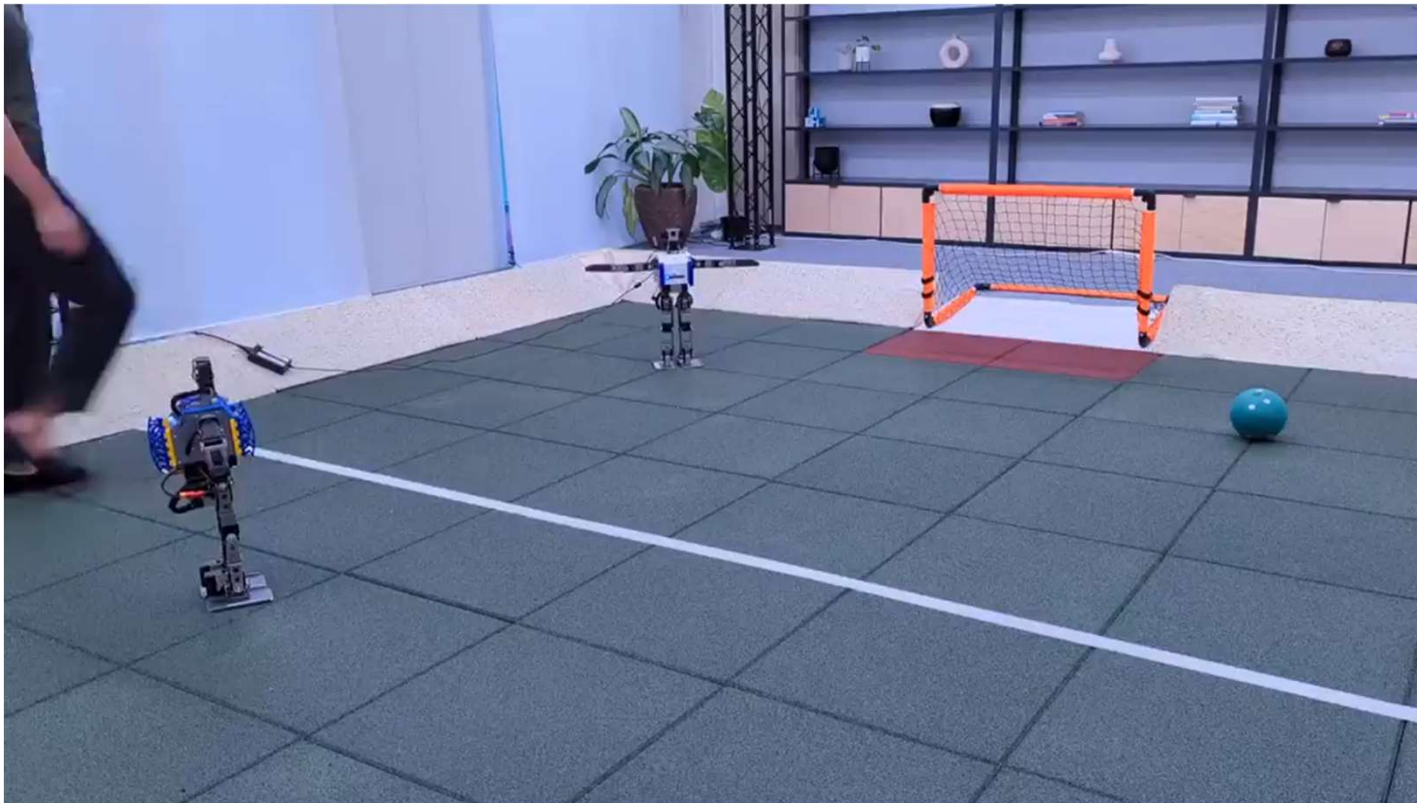
- Virtual assistants
- Ad targeting
- Email filtering
- Product recommendations

What is AI?

- Disease diagnosis/treatment
- Space exploration
- Art/music generation
- Robotics development



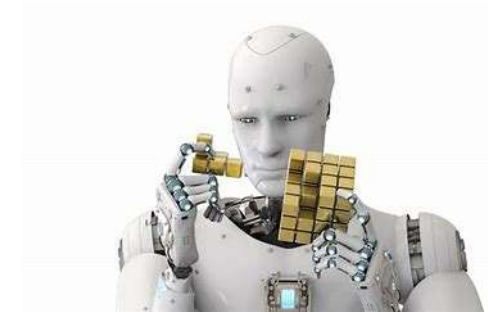
What is AI?



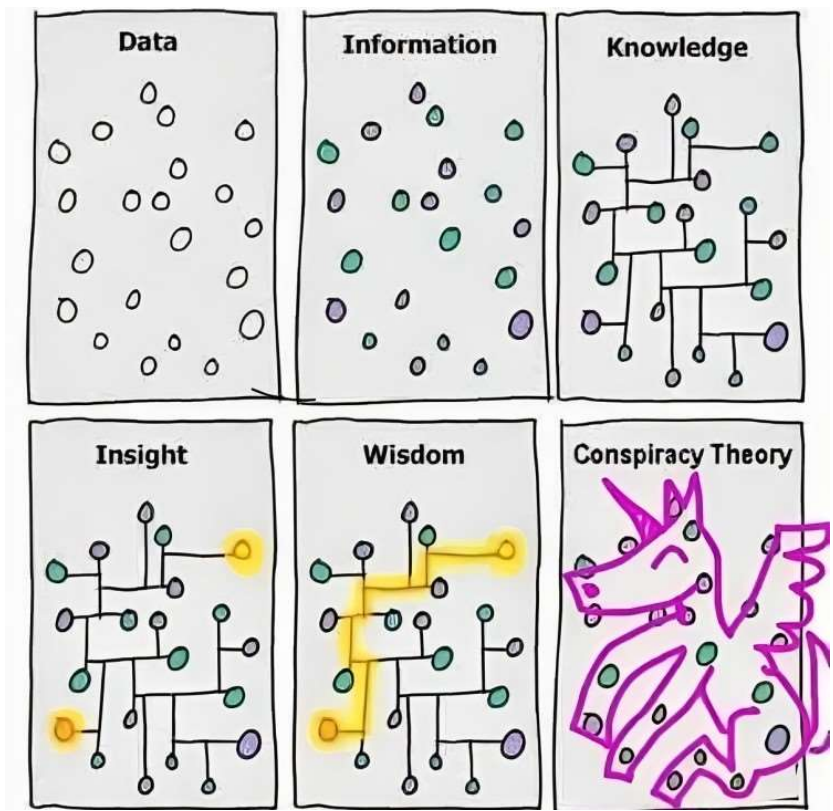
Deepmind - <https://www.youtube.com/watch?v=KSvLcr5HtNc>

What is AI?

- Computer systems and software that can perform tasks that typically require human intelligence.
 - Recognising patterns
 - Make decisions
 - Solve problems
 - Make predictions

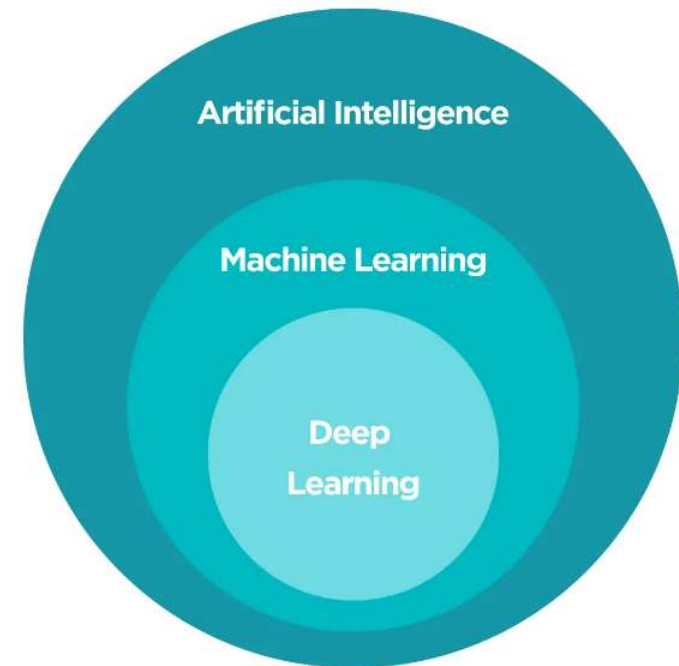


What is AI?



What is AI?

- Artificial Intelligence
- Machine Learning
- Deep Learning



What is machine learning?

- Supervised learning
 - Classification
 - Regression
 - Tasks involving labelled data
- Unsupervised learning
 - Clustering
 - Dimensionality reduction
 - Tasks involving unlabelled data
- Reinforcement learning
 - Agent decision making
 - Reward-based training



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What is machine learning?



What is AI?

- Generative AI
 - Text-to-text
 - ChatGPT, Grok, Bard
 - Text-to-image
 - DALL-E, Midjourney, StarryAI
 - Text-to-music
 - Lyria, Suno
- Large language models



What is AI?

- Computer systems that learn patterns in data to make decisions
- Artificial intelligence
 - Machine learning
 - Deep learning
- Supervised learning, unsupervised learning, reinforcement learning

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Break

What are your fears and concerns surrounding AI?

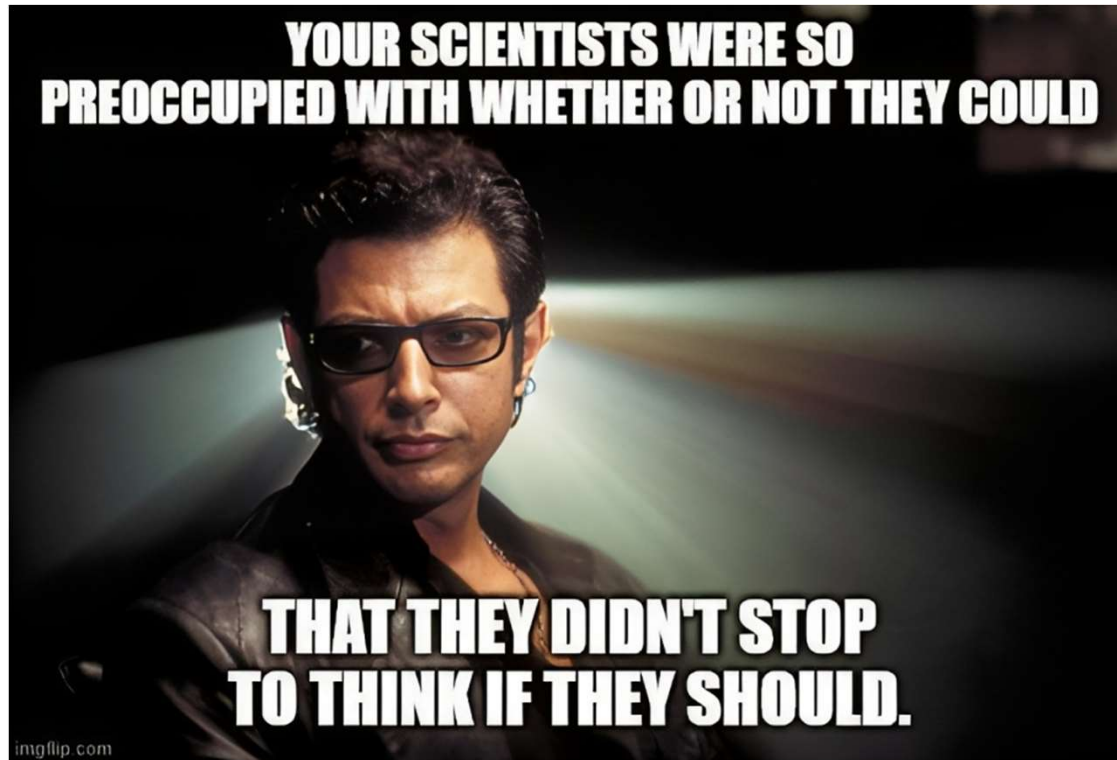
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Fears and concerns

What are your fears and concerns surrounding AI?





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What are your fears and concerns surrounding AI?

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Fears and concerns

- Privacy and surveillance
 - Facial recognition, tracking, personal information mining
- Bias and discrimination
 - Black box systems
- Accountability
 - Who pays for AI mistakes
- Loss of control
 - Autonomous systems without human input
- Job displacement



Privacy and surveillance / Bias and discrimination

- Regulation and ethical guidelines
 - UNESCO ethics of AI, UK Gov data ethics framework
- Transparency and consent
 - GDPR, CCPA
- Interpretability
 - Whitebox models
- Dataset bias evaluation
 - Label mechanism
- Diverse development teams

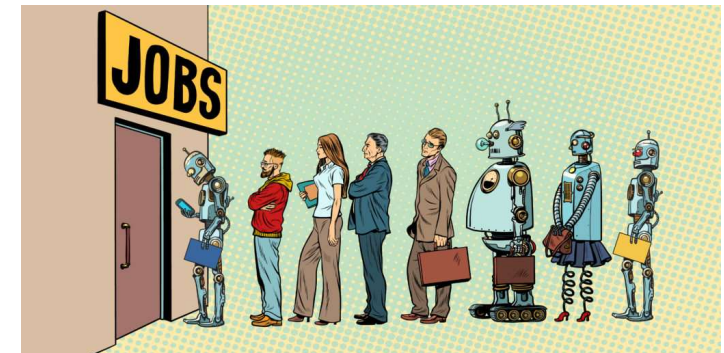


Accountability / Loss of control

- Legal frameworks
 - CENTRIC AI accountability framework
 - Human-in-the-loop
 - Consideration of AI autonomy
 - Public engagement
 - Public engagement and AI: A values analysis of national strategies – Christopher Wilson
 - AI ethics committees
 - Harvard advocacy
 - Open source
-

Job displacement

- Re/Upskilling
 - Emphasis on businesses
- Job creation
 - New technology creates new opportunities
- Lifelong learning
 - Societal shift
- Human-AI collaboration
 - AI is a tool, not a replacement



Human-AI collaboration

- Combining the strengths of radiologists and AI for breast cancer screening: a retrospective analysis
 - Christian Leibig, Moritz Brehmer, Stefan Bunk, Danalyn Byng, Katja Pinker, Lale Umutlu
- Humans and AI working together produces better results than either working alone





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Break

How can AI be used in the water industry?

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How can AI be used in the water industry?

- Knowledge discovery
- Problem solving
- Decision making
- Prediction





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The logo for the Clean Water Modelling Advisory Group (cwmag) is located in the top left corner. It features the lowercase letters 'cwmag' in a bold, blue, sans-serif font. Below the letters, the words 'clean water' and 'modelling advisory group' are written in a smaller, lighter blue font, stacked vertically. The entire logo is contained within a blue rounded rectangular border.

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South West Water

Automated Supply Interruption Management



The logo for 'cwmag' is displayed in a blue rounded rectangle. The letters 'cwmag' are in a bold, lowercase, sans-serif font. Below the letters, the text 'clean water modelling advisory group' is written in a smaller, lowercase, sans-serif font.

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Aim

- Automate all stages of SI event handling
 - Registration of events
 - Customer management
 - Cause determination
 - Reporting

Motivation

- Improved service reliability
 - Early detection and resolution
- Cost efficiency
 - Reduced SI durations
- Resource optimisation
 - Cause determination
- Customer communication and trust
 - Identification and outreach

Event Detection

- Basic
 - Spatio-temporal clustering of customer calls
- Enhanced
 - Telemetry analysis
- Advanced
 - Multi-dimensional forecasting

Basic Event Detection

- Identify clusters of customer calls
 - Clustering based on distance and time
 - Unsupervised approach
 - User defined approach



Enhanced Event Detection

- Identification with customer calls and telemetry data
 - Same approach as previously, with advanced warning
 - Telemetry data may indicate event before customers are aware



Advanced Event Detection

- Multi-dimensional forecasting
 - Predict events before they occur
 - Train system on all available data
 - Determine patterns that generally lead to SI events

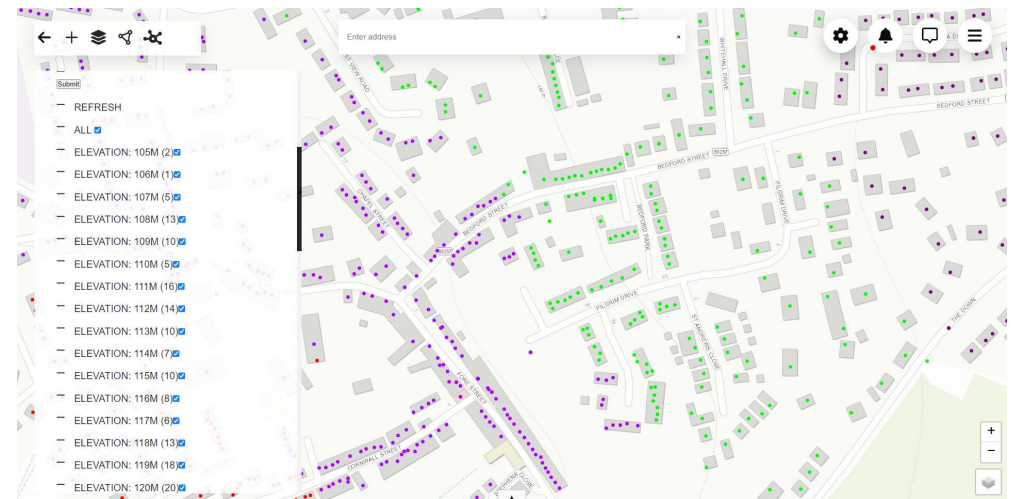
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Customer Management

- Basic
 - Automatic customer impact assessment
- Enhanced
 - Customer communication
- Advanced
 - Event management prioritisation

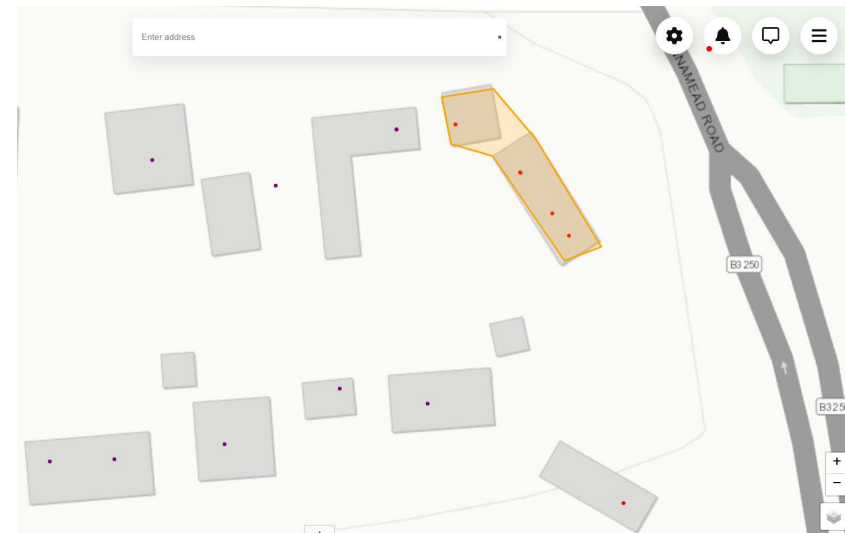
Basic Customer Management

- Automate existing analysis
 - Modelling team follows set steps to analyse events
 - Workflow automation based on existing data



Enhanced Customer Management

- Automatic customer communication
 - Identify key customer groups
 - Communicate based on event characteristics and customer impact
 - Fast and reliable customer communication



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Advanced Customer Management

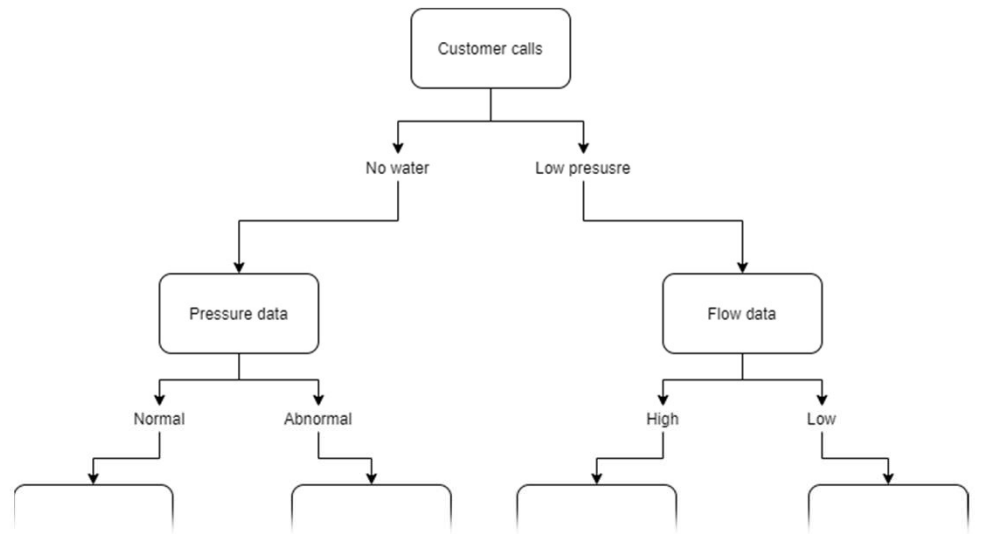
- Automatic assessment of existing and potential SI events
 - Determine customer impact
 - Prioritise event management resources
 - Dispatch resources

Cause Determination

- Basic
 - Impact / telemetry rule-based assessment
- Enhanced
 - Multi-factor determination
- Advanced
 - Area of interest identification

Basic Cause Determination

- Series of rules considering customer impact and telemetry data
 - E.g., if calls say x, telemetry shows y, cause probably z



Enhanced Cause Determination

- Multi-factor determination
 - Train a machine learning algorithm on characteristics of previous events
 - Learn patterns that relate to specific causes

Advanced Cause Determination

- Determine areas of interest
 - Consider the multi-factor determination alongside network characteristics
 - Identify vulnerable assets likely to be involved

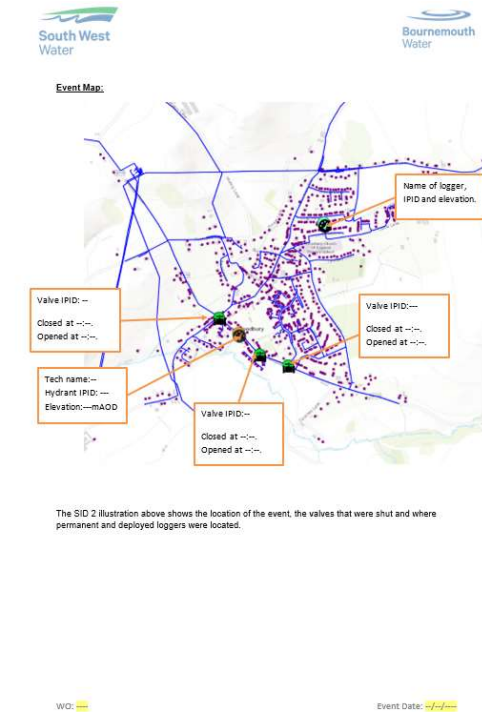


Reporting

- Basic
 - Automatic reporting framework
- Enhanced
 - Automatic reporting analysis
- Advanced
 - Reporting on XAI characteristics of previous event handling steps

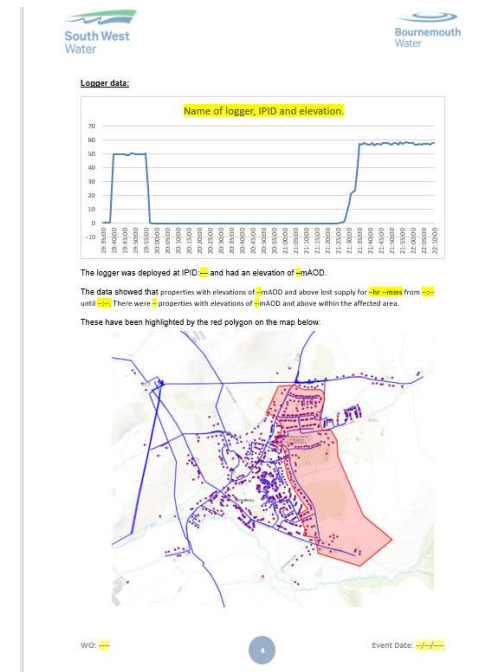
Basic Reporting

- Automatic report framework generation
 - Generate a framework for the report
 - Available data
 - Event characteristics



Enhanced Reporting

- Automatic reporting analysis
 - Automatically conduct all reporting analysis
 - Based on available data



Advanced Reporting

- Reporting on XAI characteristics of previous event handling steps
 - For the previous steps involving AI, report on *why* the AI made the decisions / recommendations / predictions it made

Summary

- Manual
 - Inefficient and laborious
- Basic
 - Utilising simple rule-based systems
- Enhanced
 - Leveraging historic data to train machine learning systems
- Advanced
 - AI + workflow automation



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: Transient Detection with High-speed Dataloggers

Building an Intelligent Asset Base

Pressure Transients

2014

Linking transients with burst frequency.
Initial pilot study, model build

2015

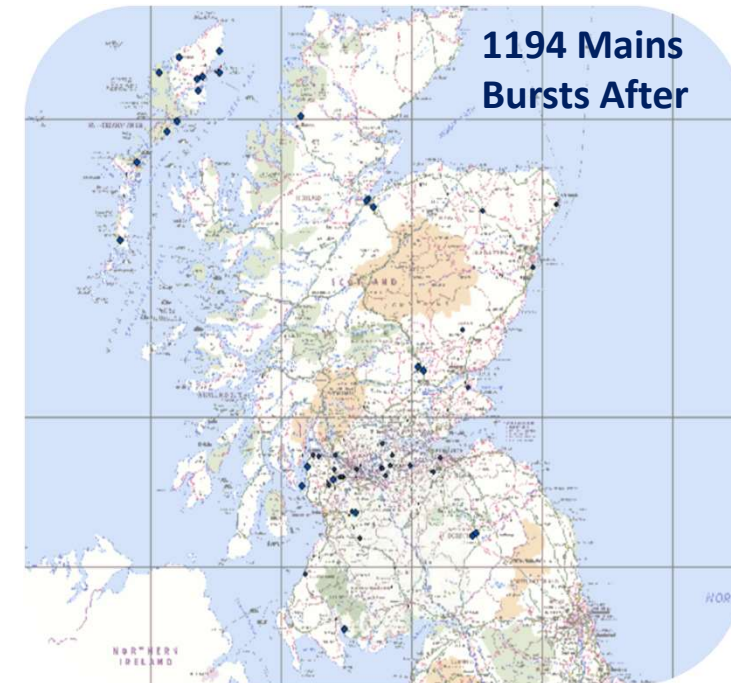
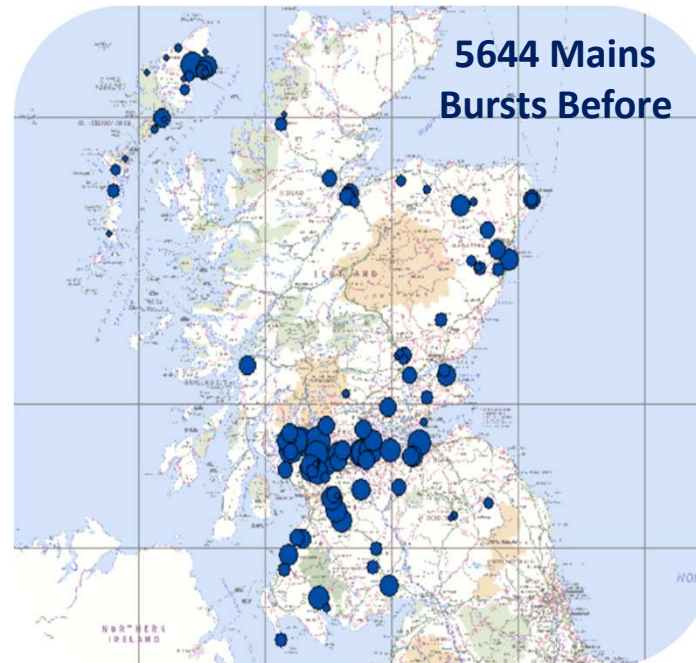
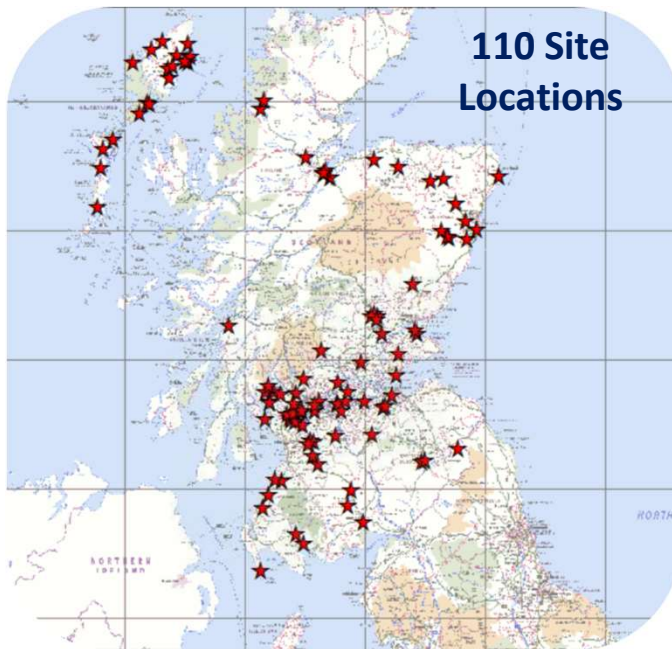
Creation of business case

2016

Increasing business awareness and accelerated delivery

SR17

Project delivery exceeding expectations



2018

Scotland wide RCA development.
SW Public General

2019

Service reservoir analysis
Links to water quality and pipe material

2020

Business insights and strategic deployment.

SR21

Intelligent Asset Base construction

Pressure Transients – *Building An Intelligent Asset Base*

Basic question – How to make better decisions to deliver Service Excellence, Great Value and Net Zero?

- What is the portfolio of initiatives to improve understanding of asset performance, allowing asset optimisation to fulfil objectives
- How do we develop capability to anticipate of failures, improve safety, shift our quality of interaction with customers, to reduce emissions to serve and demand for embedded carbon by enhancing asset life?
- How can we generate greater value from existing capability (people, processes & technology) and what capability is required for the future?

Context

Scottish Water has millions of assets connected via a complex system to deliver service to our customers. Linking these complex assets and systems is often difficult and insights tend to be after they are needed. The value leveraged from the assets has improved over the years in particular the reactive customer responses but is often limited by silos of control.

However, the next shift in capability to optimise, predict and prevent will depend on greater insights, captured from existing asset base, improving decision making and a future strategy to create greater value for our customers. Right information, Right person, Right time.

What are we trying to achieve? - Build asset intelligence related to the condition and performance of our networks and assets to help predict performance issues across the water & wastewater network which will lead to customer or environmental impact and mitigate them



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By using enhanced information, skills and processes we will be enabled to better plan, predict and prevent issues before they impact customers and the environment



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Any Questions?

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