

Digital Approaches to Improving Collection System Asset Management in an Ever- Evolving World

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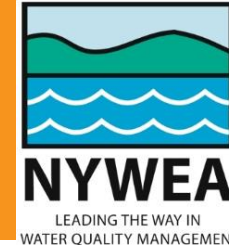


Challenging today.
Reinventing tomorrow.

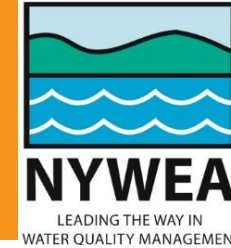
- 1. Collection System Asset Management – Current Approaches**
- 2. Why use Digital OneWater approach?**
- 3. Condition Assessment with Digital Tools**
- 4. Asset Management**
- 5. Smart Sensors for Insights into Operations of Collection System**

Collection System Asset Management

– Current Approaches



- **Sewers are inspected via many methods**
 - Smoke testing
 - Acoustic testing
 - CCTV inspection
- **Data from inspections is coded either by contractor or in-house crew**
- **Results of the coding are sometimes entered into CMMS, but what do you do with these results?**



1.2M+ miles of US sewer pipe infrastructure

US Sewer O&M market: \$50B/year
Pipe/infrastructure inspection : ~\$4B/year
(Current total inspection cost \$7~\$10 per Linear foot)

- » **CCTV Footage Collection: \$3.7B/year**
- » **Footage Review and Defect Coding: \$300M/year**
(current cost \$0.5 - \$1 / LF)

Most cities aim/try to inspect **10% of system per year**

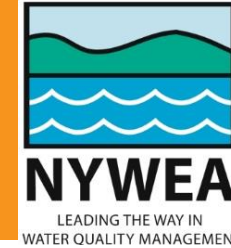
Every year, additional 1M+ miles of CCTV inspection footage is collected

Municipalities typically use in-house (crews and trucks) resources or contract work out to private companies, or have a blend of both

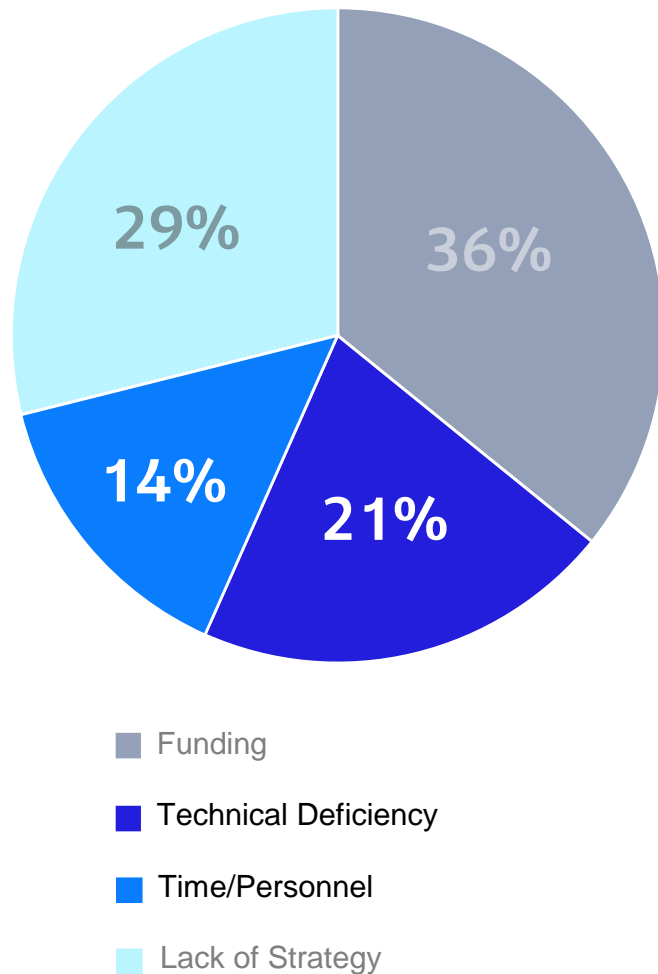
Many Issues for Utilities –

1) Massive CCTV backlogs, 2) Low visibility into aging Networks, 3) Shortage of skilled resources, 4) Limited capacity to allocate for time-intensive, slow and tedious tasks, 5) labor is costly 6) Manual coding of defects is also highly error-prone, subjective and inconsistent

The Status Quo for Sewer CCTV Condition Assessment Cannot Keep Up



Impediments to Proactive Approach



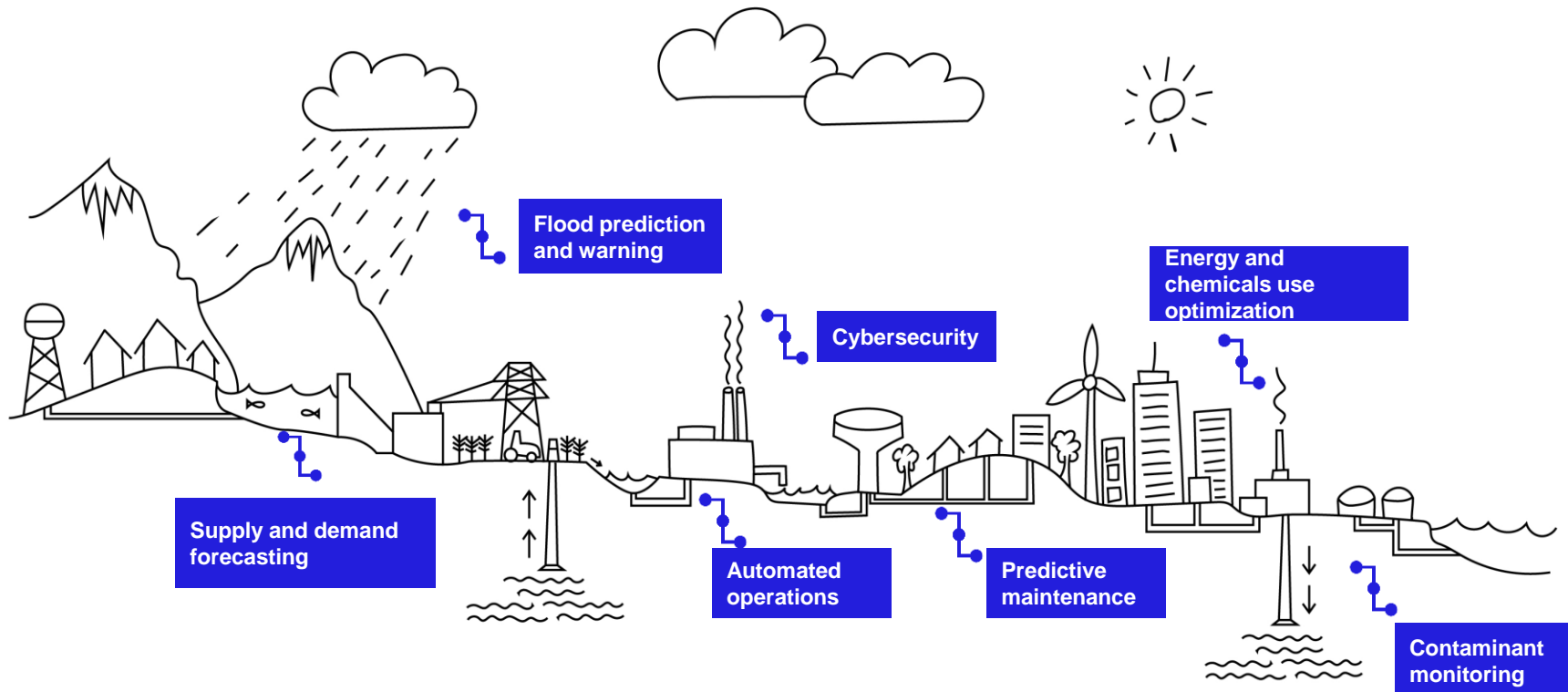
- Most cities conduct regular sewer CCTV inspections but still find:
 - Personnel don't have time available to focus on defect coding
 - Methods for defect coding are technically deficient
- In the life span of 1,000LF worth of sewer video: 2-6 hours (30-40% of the total acquisition time) is spent doing defect coding

...Leads to Digital Solutions & Digital OneWater

What is Digital OneWater?



- » Tools that transform big data into actionable information
- » Creates an integrated ecosystem of data-enabled solutions



How Can Digital OneWater Assist Today's Utilities?

Aging Infrastructure

More Stringent Regulations

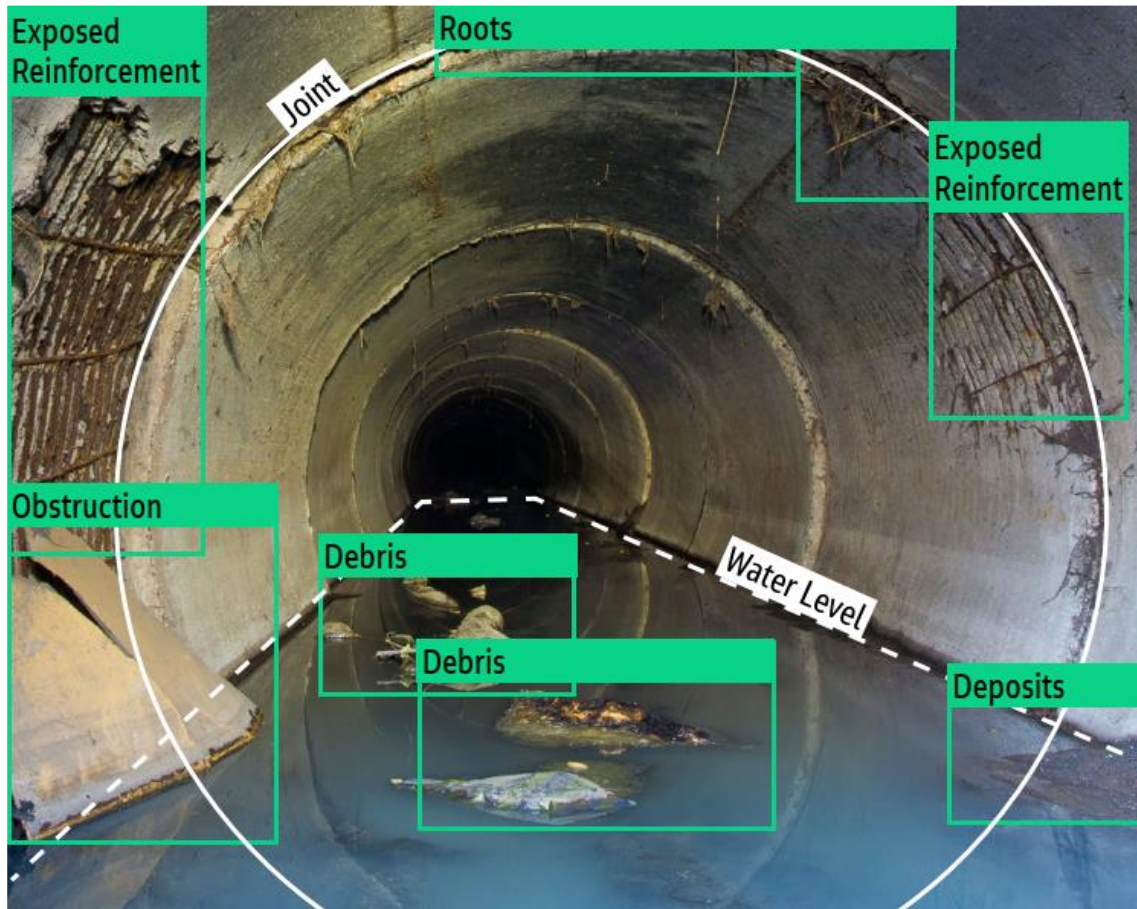
Digital OneWater

Staffing Pressures

Shrinking Budgets



Sewer Condition Assessment with Digital Tools



Automated Sewer CCTV Defect Coding

Dragonfly applies artificial intelligence to automatically detect defects in raw CCTV inspection videos

Industry Standard Output

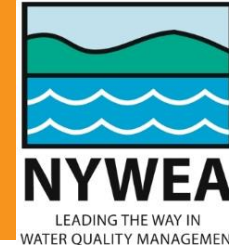
Dragonfly rapidly produces consistent, accurate PACP output, usable in any pre-existing workflow and CMMS/CCTV software

Reliable Business Intelligence

Dragonfly integrates with Jacobs' Argon tool and supports asset management

- Optimizes reinspection and maintenance schedules
- Prioritizes asset rehabilitation lists

How can Utilities utilize Automated CCTV Defect Coding?



Use Automated CCTV Defect Coding to -

- To Process historic data – code your old videos to track assets over time
- To Compare pre- and post-construction videos
- To Correct quality issues – if you don't trust the coding, have your videos re-coded
- To Include in your in-house process – have your crews focus on running the camera, not coding
- To Add to your contractor SOP – Have your contractors work directly with digital tool for additional QC and video quality review

And how can Utilities get more out of their sewer management investments?

Developed by Industry Experts

Combines domain expertise with deep computer vision, artificial intelligence, and machine learning expertise

Includes multiple computer models of increasing maturity and sophistication

Rigorous Quality Assurance

AI/ML system trained on over 10 million feet of sewer video footage

Validated by NASSCO PACP certified technicians

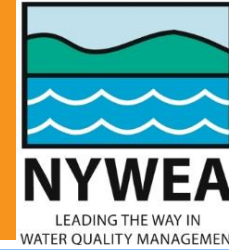
Includes on-demand technical support and guidance

Integrates with Existing Asset Management Tools & Programs

Data are easily imported into existing GIS, CMMS, or CCTV data tools and workflows

Informs maintenance and rehabilitation plans, schedules, and costs

Case Study: City in Southern US



City sent 70,000 LF of video to review – uploaded to web-based solution

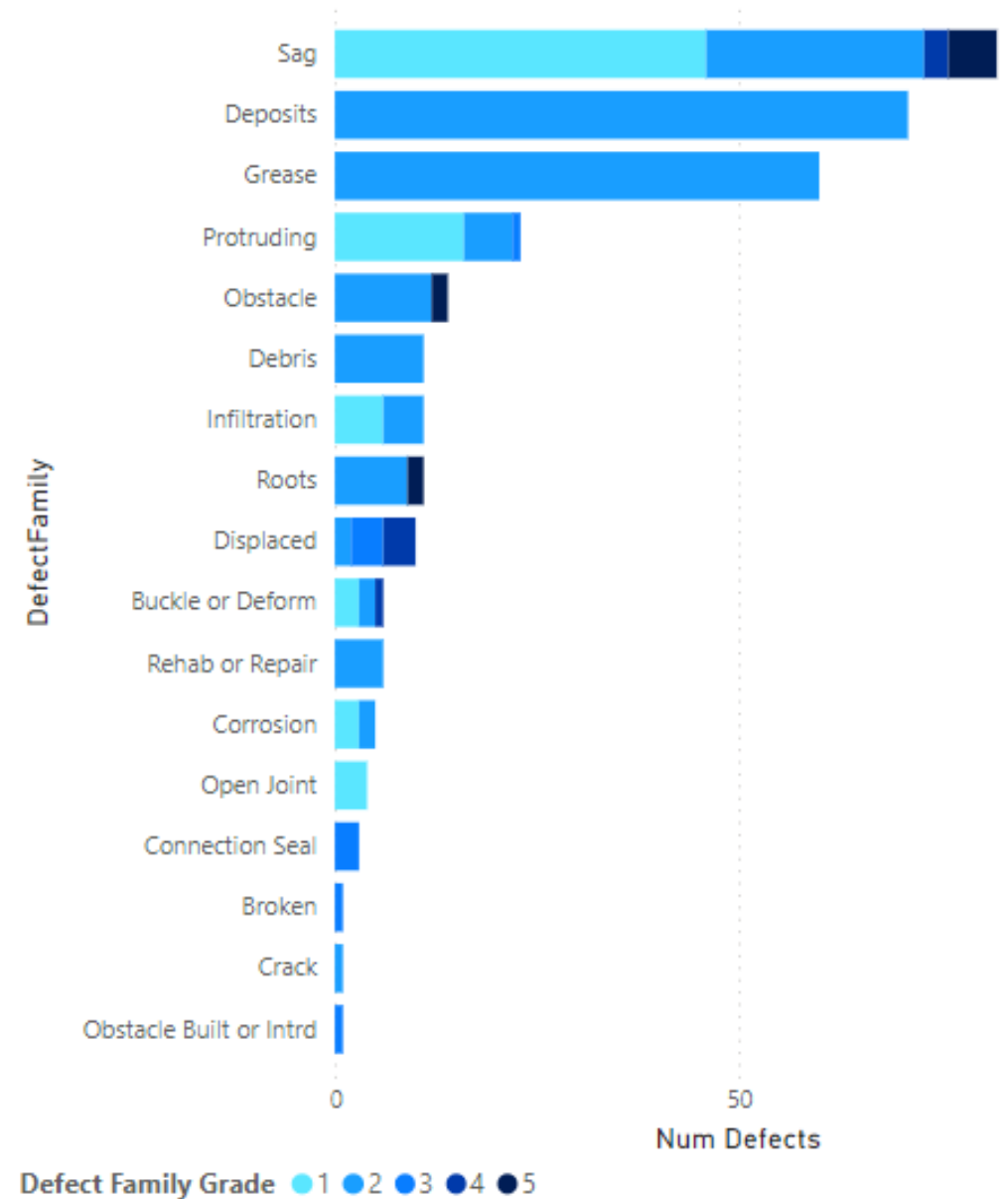
Automated tool provided coding for videos review

Risk assessment tool then provided easily read Power BI dashboards to first break down the codes that were seen

City can now see what their biggest issues are and where they are

Information is downloadable and can be incorporated into GIS and CMMS

Defects by Defect Family and Condition Grade (latest insp ONLY)



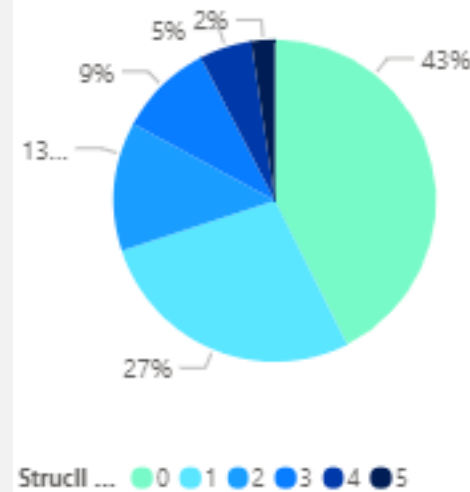
Case Study: City in Southern US



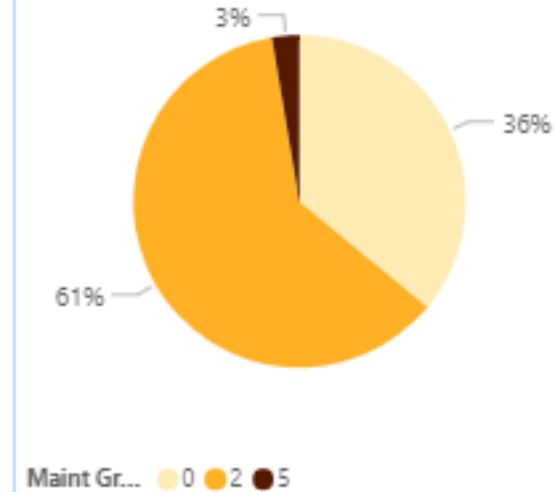
Using defect codes from automated tool, pipes are given a structural and maintenance grade and are prioritized for re-inspection, rehabilitation, or replacement using an AI trigger

This client has only repair, reinspection, and cleaning recommendations. They can now get the rehabilitation into the CIP at the appropriate time and input reinspection and cleaning work orders into CMMS.

Latest Struct Grade by Length

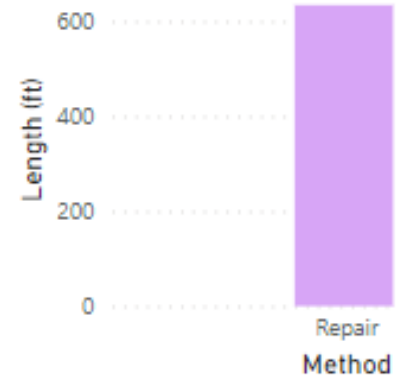


Latest Maint Grade by Length



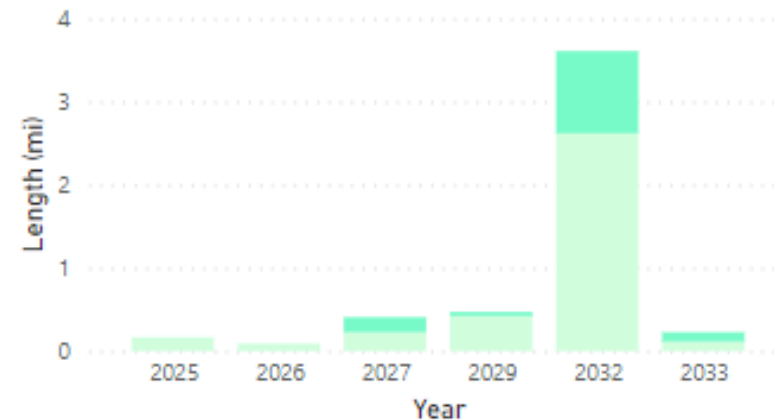
Pipes Needing Rehab

Priority ● Priority 3



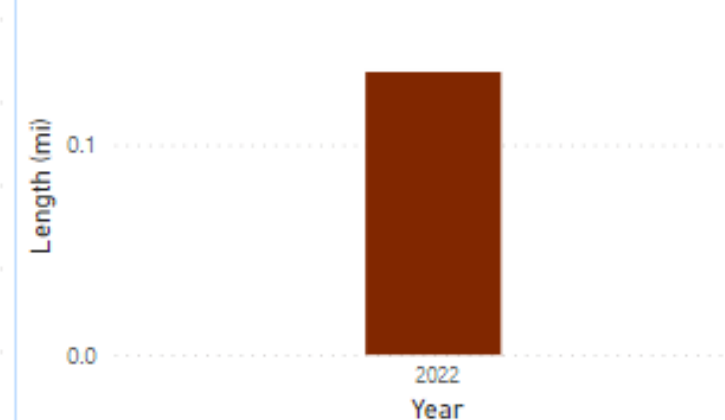
Pipes Needing Reinspection

COFGrade ● 1 ● 2

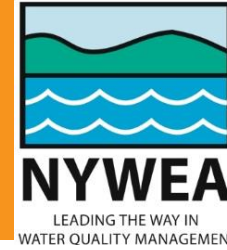


Pipes Needing Cleaning

Maintenance... ● 5



What about insights into operations?



- **Condition assessment & CIP are half the battle**
- **Most utilities are operating aging systems with high consequence of failure**
- **Many digital sensors/data capture tools have come into play in the last 10 years**
- **However, utilities only use about 10% of the data that they capture**

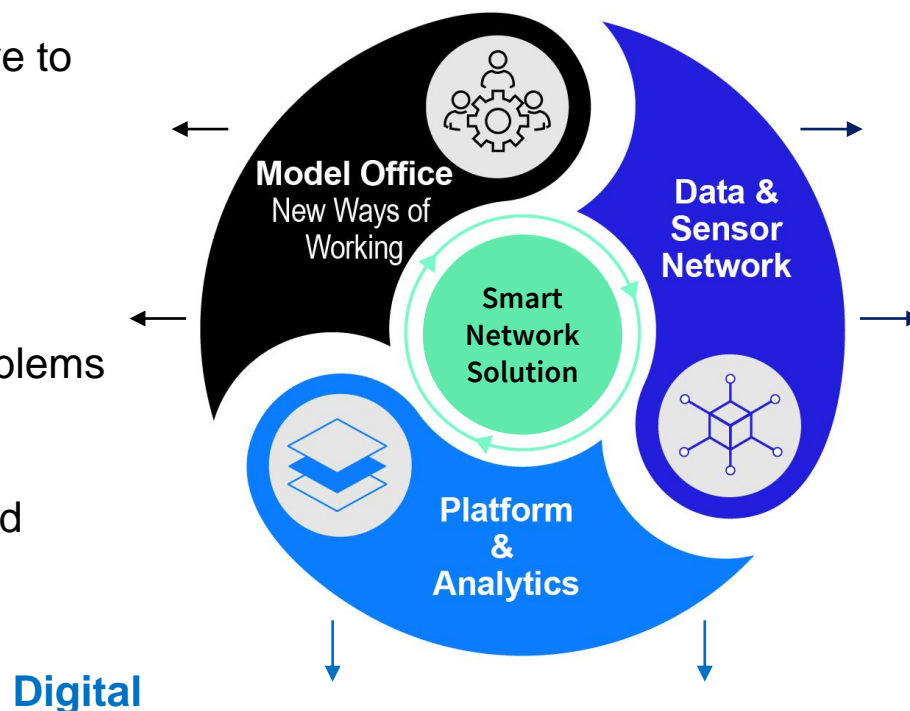
How do you gain insights when you are inundated with data???

New Ways of Working – Combine Digital with Domain



High Value Advisory Domain

- Moving from Reactive to Proactive working practices
- Transformation from chasing problems to getting ahead of problems before they manifest
- Improving control and allocation of field resources



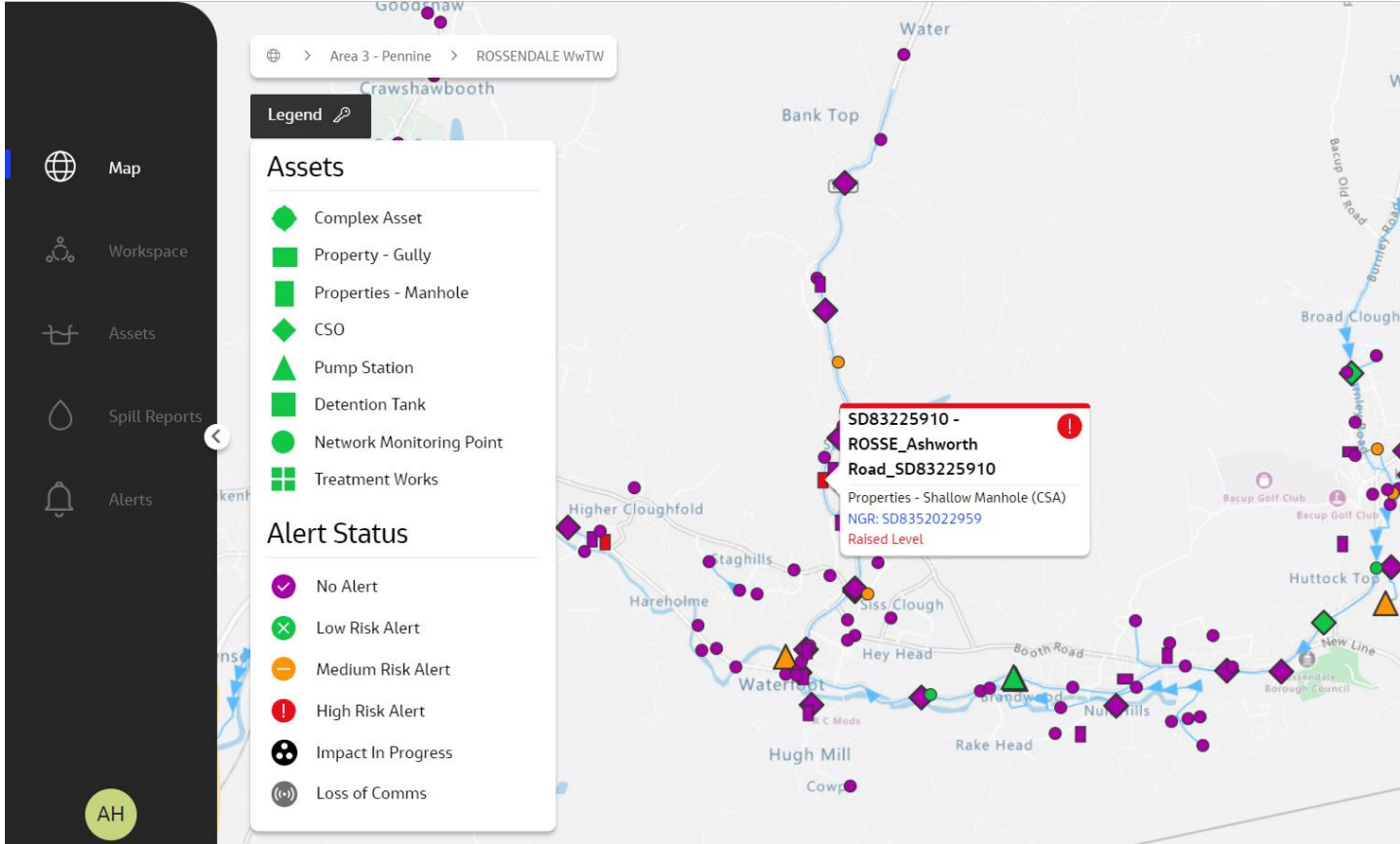
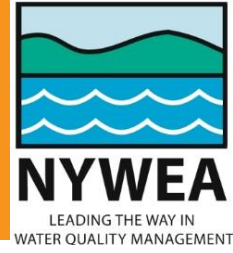
Engineering Domain

- Harvest existing client data – SCADA, telemetry and monitoring
- Monitor points of greatest risk or concern

Digital

- Add value to monitoring data through applied analytics
- Learn behaviour of normal, safe operation
- Identify Emerging Issues, allowing a Response Window for correction

Getting Ahead of the Problem – United Utilities in UK



- Emerging Issues are risk ranked and priority action assigned to field teams
- Teams get ahead of the issue and prevent sewer problems impacting the customers or the environment

United Utilities Outcomes



+4,000
Proactive
Fixes

13% ↓
Sewer
Blockages

20% ↓
Sewer
Flooding

Operational Benefit

50% ↑
Proactive vs
Reactive

37% ↓
Customer
Complaints

25% ↓
Lift Station
Call Outs

Business Benefits

Reduced Operational Costs

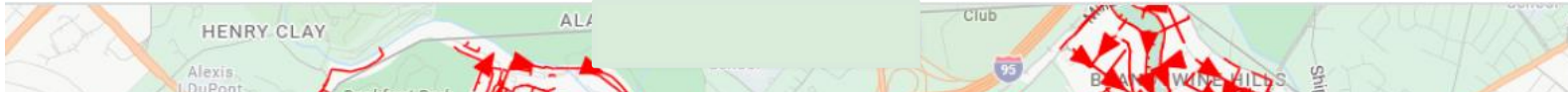
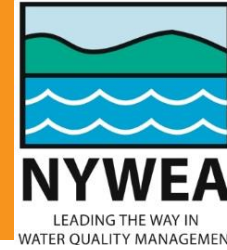
Reduced/Avoided Capital Investment

Improved Environmental Performance

Customer Bill Impact Reduced

Asset Management Benefits

City in Mid-Atlantic US

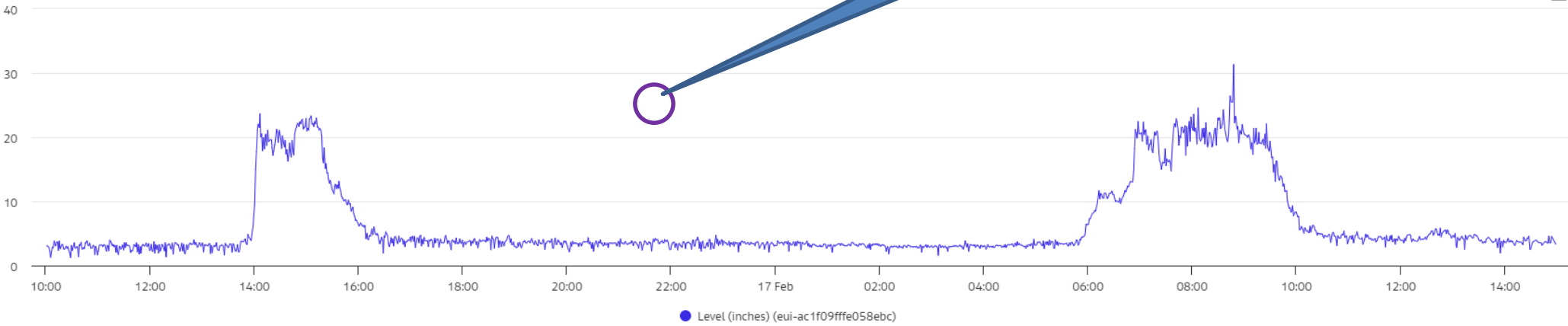


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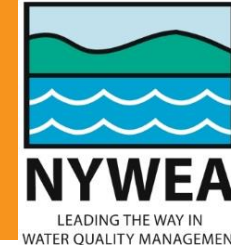
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Value Count: 1634



Summary and Conclusions



- **Utilities are experiencing greater challenges that lead to using digital tools**
- **Condition assessment, asset management, and risk assessment in your collection system can be performed more efficiently with digital solutions**
- **Most utilities have more data than a human can ingest/visualize**

AI/ML tools can assist with visualizing data and providing insights into the condition and behavior of your collection system



OneWater expertise

- Drinking water & reuse
- Wastewater
- Water resources
- Conveyance & storage

Lifecycle expertise

- Planning
- Design
- Construction
- Operations

Digital expertise

- Data analytics
- Transformation advisory
- Digital Twins
- AI & machine learning

Digital OneWater outcomes

- Cybersecurity
- Predictive maintenance
- Energy and chemicals optimization
- Capital prioritization
- Automated operations
- Pipeline defect detection
- Overflow mitigation
- Flood forecasting

Learn more: [Jacobs.com | Digital OneWater](https://www.jacobs.com/digital-one-water)