# Data analytics for wet weather solutions: *sharing our experience in getting the most out of your data to achieve the best possible outcomes.*

**Nicholas Anderson, Stantec**

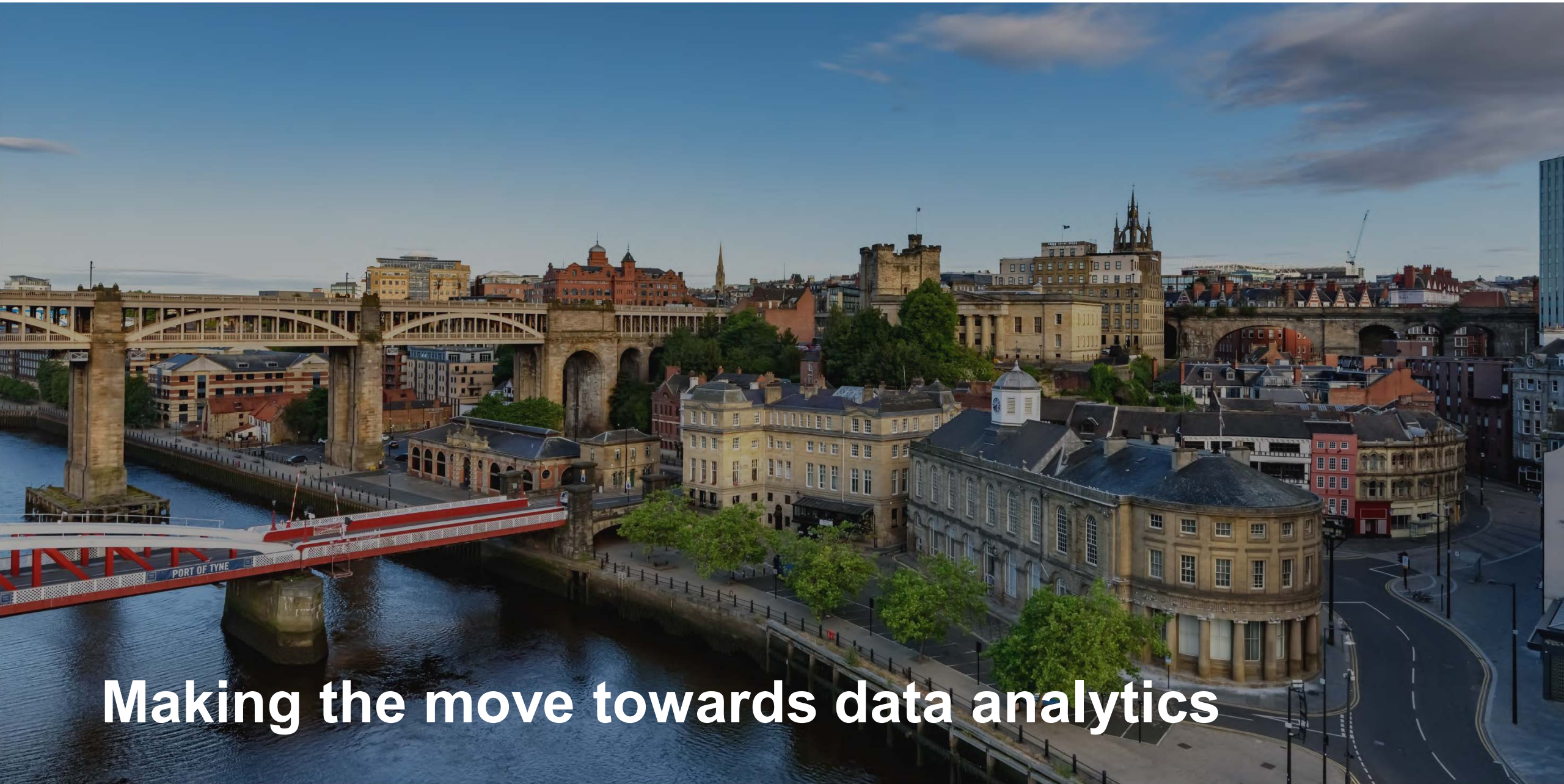
NEWEA CSO Wet Weather Issues Conference, September 29-30, 2021

Stantec

NEW ENGLAND WATER ENVIRONMENT ASSOCIATION
NEWEA
WORKING FOR WATER QUALITY

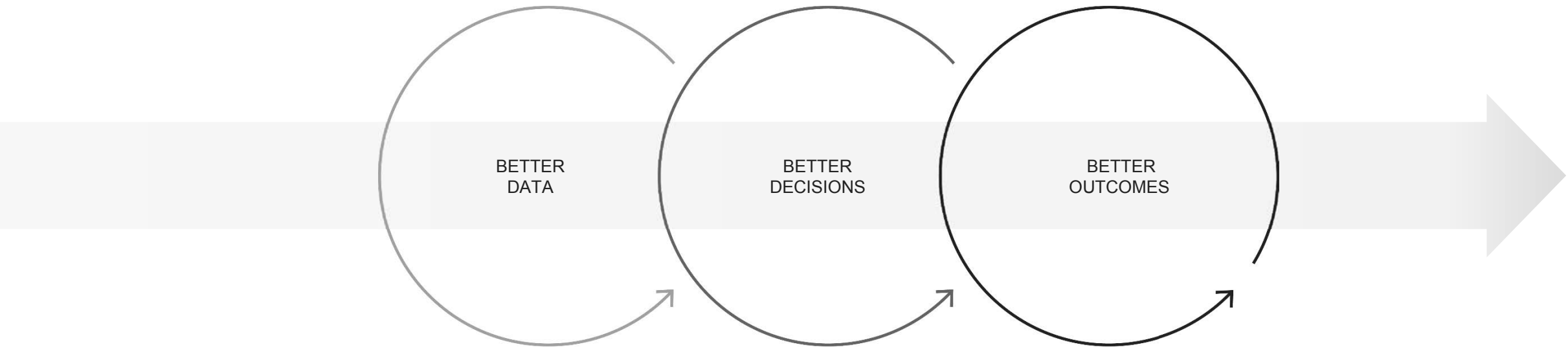
# Agenda

1. Making the move towards data analytics
2. What is data analytics achieving in Wet Weather?
3. Case studies
4. Key takeaways
5. Questions

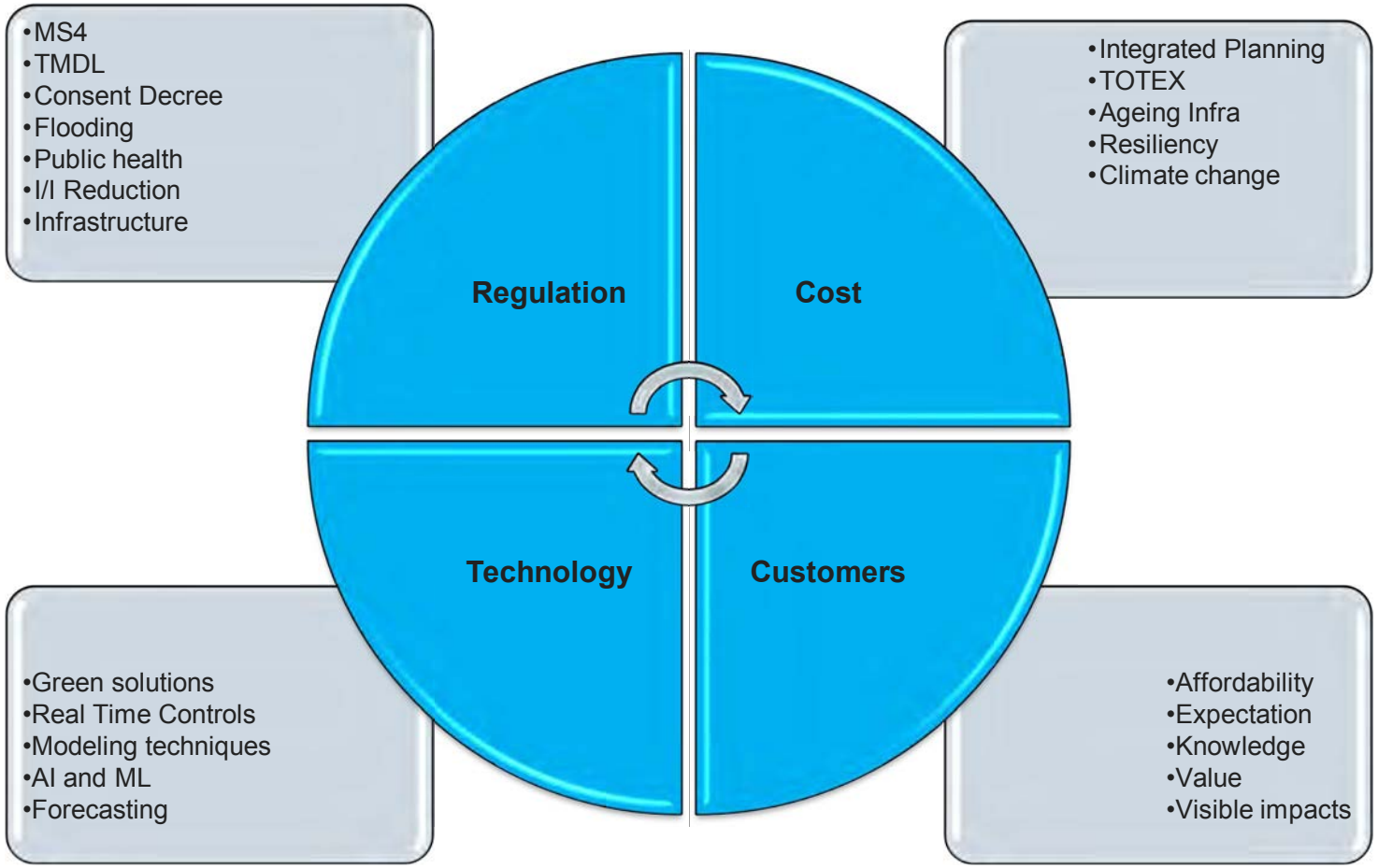



# Making the move towards data analytics

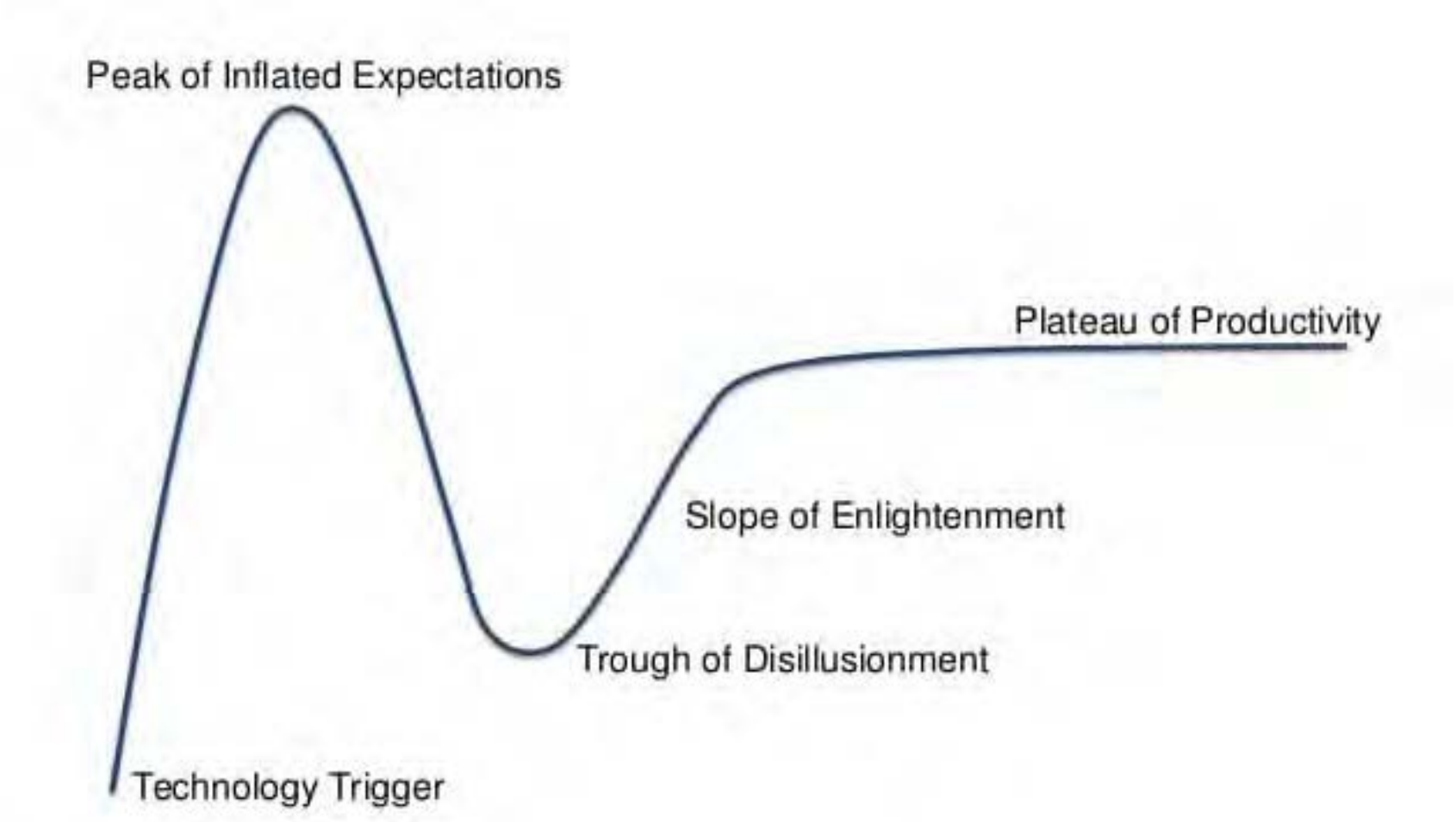
# Digital utilities use data and data analytics to help their organizations and people be more informed and achieve better outcomes



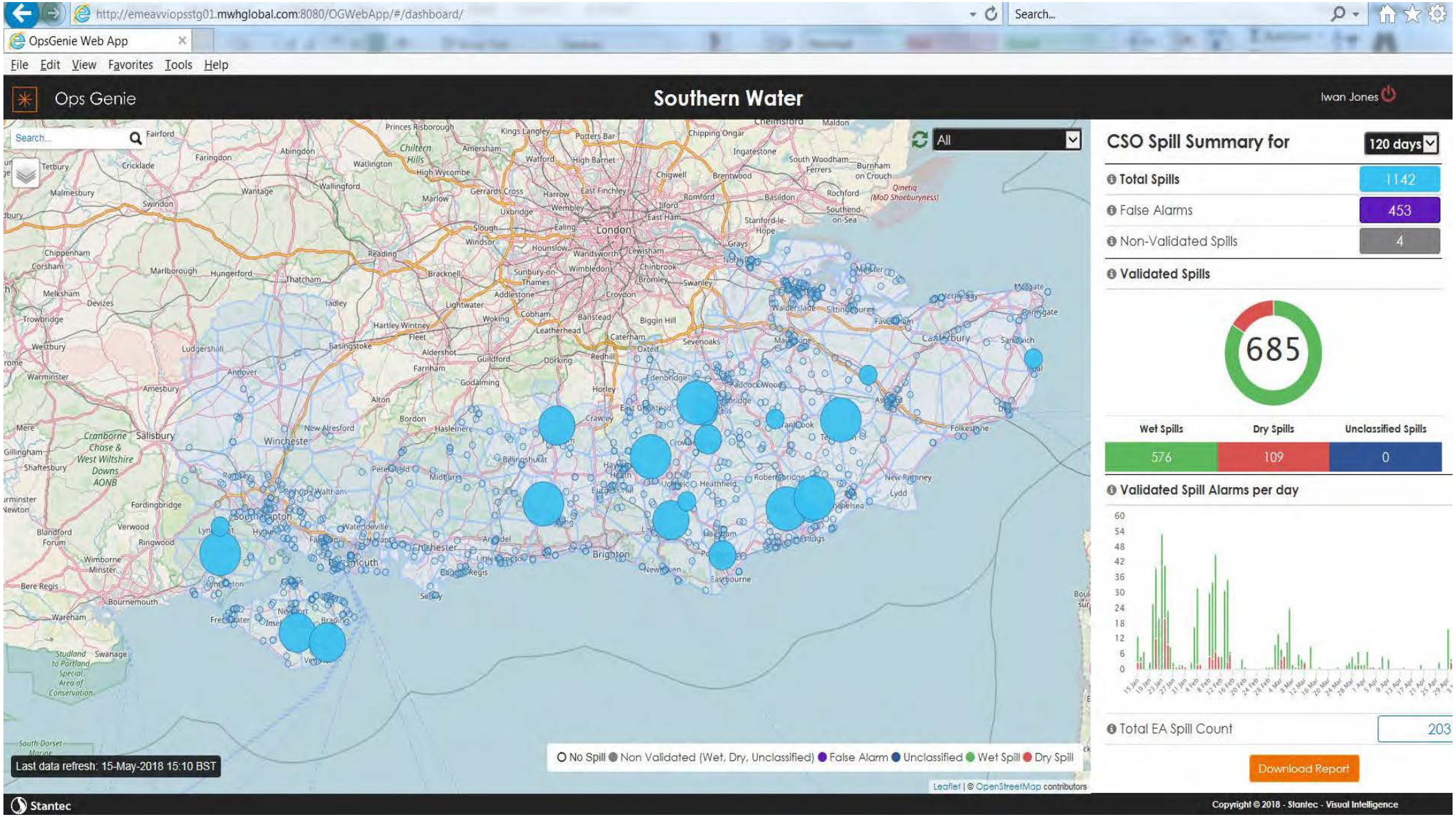
# What's driving the need for data analytics?



# Gartner Hype Cycle Model



# What is data analytics achieving in Wet Weather?


http://emeavviopsstg01.mwhglobal.com:8080/OGWebApp/#/dashboard/
OpsGenie Web App
File Edit View Favorites Tools Help
Ops Genie
Southern Water
Iwan Jones
Search...
All
CSO Spill Summary for
120 days
Total Spills 1142
False Alarms 453
Non-Validated Spills 4
Validated Spills
685
Wet Spills
Dry Spills
Unclassified Spills
576
109
0
Validated Spill Alarms per day
60
54
48
42
36
30
24
18
12
6
0
Total EA Spill Count 203
Download Report
Last data refresh: 15-May-2018 15:10 BST
No Spill Non Validated (Wet, Dry, Unclassified) False Alarm Unclassified Wet Spill Dry Spill
Leaflet | © OpenStreetMap contributors
Stantec
Copyright © 2018 - Stantec - Visual Intelligence

## CSO Spill Summary for 120 days

| | |
|---|---|
| Total Spills | 1142 |
| False Alarms | 453 |
| Non-Validated Spills | 4 |

Time Period: 16-Jan-2018 00:00:00 GMT to 15-May-2018 15:56:51 BST

| CSO Name | Receiving Watercourse | Total Validated Spills | Wet Spills | Dry Spills | Unclassified Spills | Total Non-Validated Spills | Wet Spills | Dry Spills | Unclassified Spills | False Alarms |
|---|---|---|---|---|---|---|---|---|---|---|
| ASHINGTON WTW | Fishing activities | 22 | 15 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNDERHILL GOUDHURST WTW | Footpaths | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 3 |
| GOLF ROAD DEAL SST | Bathing Water | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LYNDHURST WTW | Shellfish | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| PRICHETTS WAY ROOKLEY CEO | Shellfish | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| CHARING WTW | Picnic | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| REDGATE MILL CROWBOROUGH WTW | Settlement | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| HALLAND WTW | Fishing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WARNHAM WTW | Settlement | 14 | 9 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| DANEHILL WTW | Footpaths | 27 | 21 | 6 | 0 | 1 | 0 | 1 | 0 | 39 |
| DITTONS ROAD POLEGATE CSO | SAC | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WESTFIELD WTW CSO Storm tank overflow | Footpaths | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| HOPE BEACH SHANKLIN SST | Bathing Water | 15 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| TUNBRIDGE WELLS SOUTH WTW | Tourist attractions | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| NEAVES LANE RINGMER WTW | Discharge to coast | 13 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| HIGH HALDEN WTW | NA | 290 | 249 | 41 | 0 | 0 | 0 | 0 | 0 | 19 |

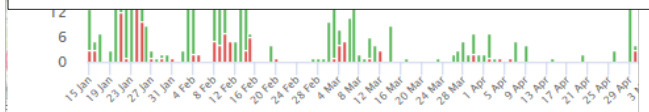
**From:** opsgenie@mwhglobal.com [mailto:opsgenie@mwhglobal.com]
**Sent:** 08 May 2018 21:10
**To:** Jones, Iwan <Iwan.Jones@stantec.com>
**Subject:** Dry Spill(s) Alert

Hello Iwan Jones ,

We have identified Dry Weather CSO Spills in your subscribed area(s) –

| Area | CSO Name | Receiving Watercourse | Start Timestamp | End Timestamp | Spill Status | Spill Type |
|---|---|---|---|---|---|---|
| Hants West | BROCKENHURST WTW | Shellfish | 2018-05-08 18:32:14.0 | | Non Validated | Dry |

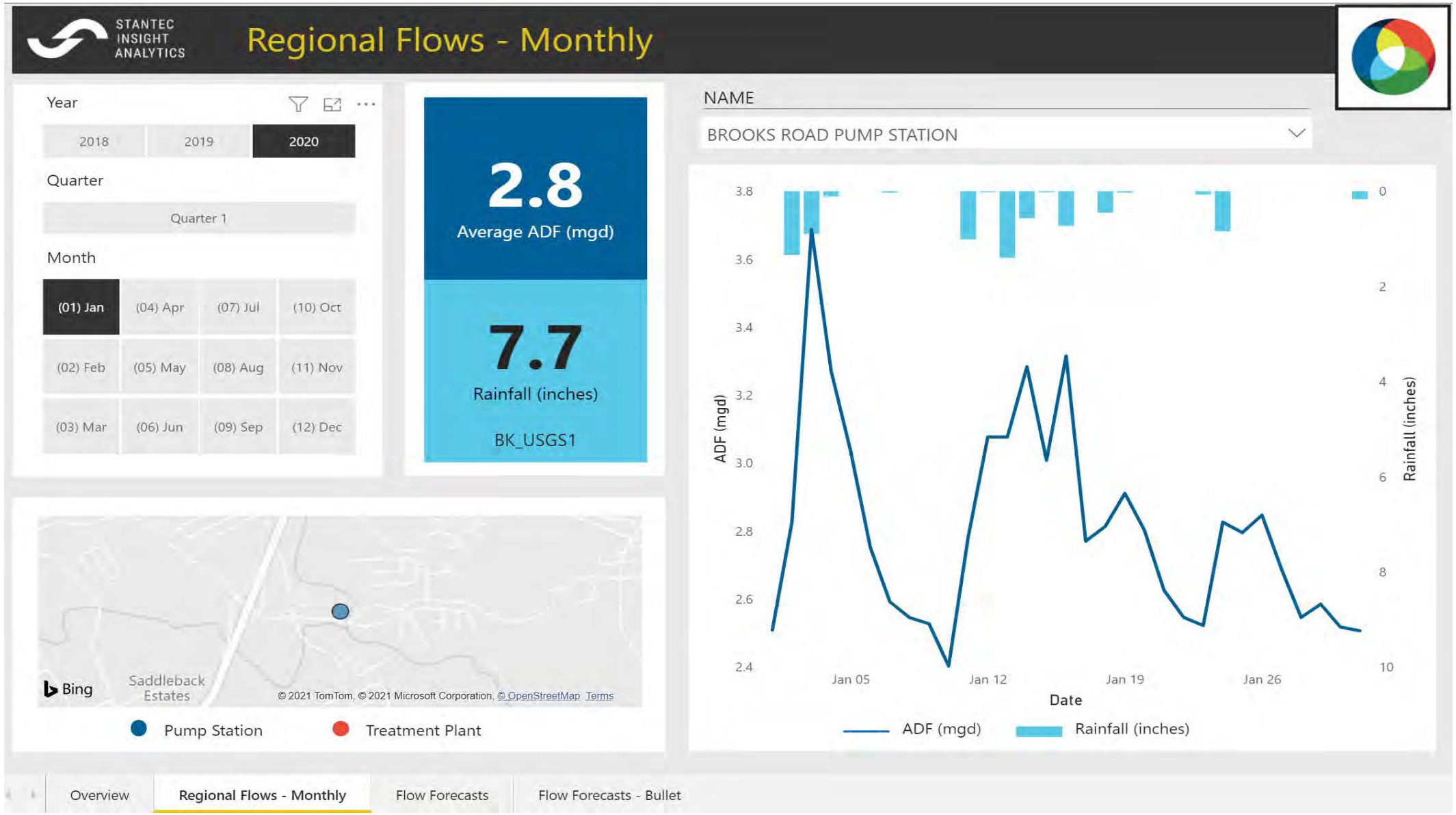
Thanks,
Ops Genie

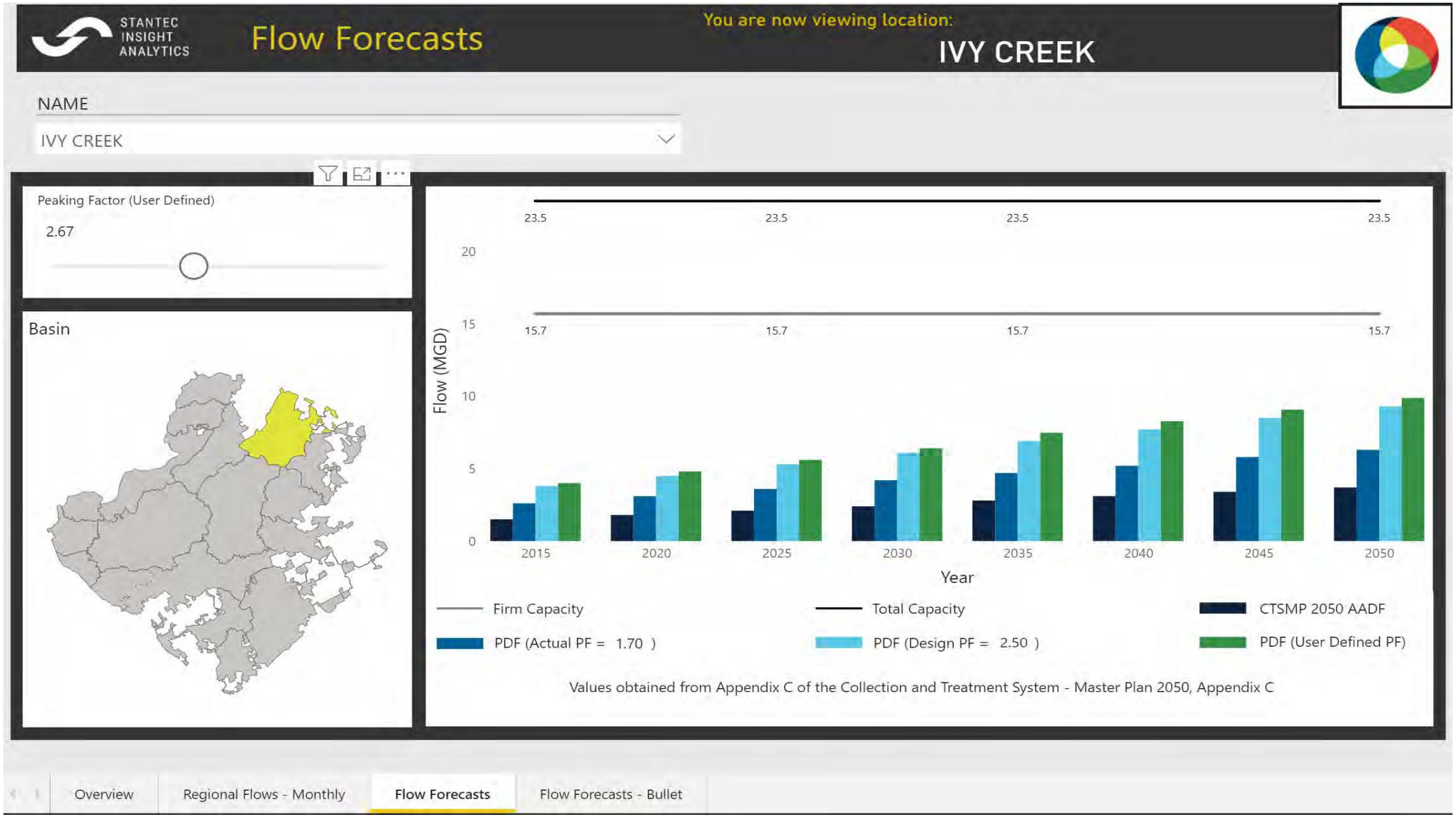


Total EA Spill Count 203

Download Report

| | | | | | |
|---|---|---|---|---|---|
| 19 | 16-Jan-2018 13:25:17 | 16-Jan-2018 14:25:17 | STUBBS LANE BREDE WTW | SAC | False Alarm |
| 20 | 16-Jan-2018 13:59:28 | 16-Jan-2018 14:59:28 | BROCKENHURST WTW | Shellfish | Wet Spill |
| 21 | 16-Jan-2018 14:25:17 | 16-Jan-2018 16:25:17 | STUBBS LANE BREDE WTW | SAC | Wet Spill |
| 22 | 16-Jan-2018 14:59:28 | 16-Jan-2018 22:59:28 | BROCKENHURST WTW | Shellfish | False Alarm |
| 23 | 16-Jan-2018 15:15:32 | 16-Jan-2018 19:30:08 | ASHINGTON WTW | Fishing activities | Dry Spill |
| 24 | 16-Jan-2018 15:28:58 | 16-Jan-2018 17:12:24 | WARNHAM WTW | Settlement | Dry Spill |
| 25 | 16-Jan-2018 16:25:17 | 16-Jan-2018 17:25:17 | STUBBS LANE BREDE WTW | SAC | False Alarm |
| 26 | 16-Jan-2018 17:25:17 | 16-Jan-2018 19:25:17 | STUBBS LANE BREDE WTW | SAC | Wet Spill |
| 27 | 16-Jan-2018 19:25:17 | 16-Jan-2018 20:25:17 | STUBBS LANE BREDE WTW | SAC | False Alarm |
| 28 | 16-Jan-2018 20:04:04 | 16-Jan-2018 21:28:40 | LYNDHURST WTW | Shellfish | False Alarm |
| 29 | 16-Jan-2018 20:25:17 | 16-Jan-2018 21:25:17 | STUBBS LANE BREDE WTW | SAC | Wet Spill |


STANTEC INSIGHT ANALYTICS
Regional Flows - Monthly
Year
2018
2019
2020
Quarter
Quarter 1
Month
(01) Jan
(04) Apr
(07) Jul
(10) Oct
(02) Feb
(05) May
(08) Aug
(11) Nov
(03) Mar
(06) Jun
(09) Sep
(12) Dec
2.8
Average ADF (mgd)
7.7
Rainfall (inches)
BK_USGS1
NAME
BROOKS ROAD PUMP STATION
ADF (mgd)
Rainfall (inches)
Jan 05
Jan 12
Jan 19
Jan 26
Date
Bing
Saddleback Estates
© 2021 TomTom, © 2021 Microsoft Corporation, © OpenStreetMap Terms
Pump Station
Treatment Plant
ADF (mgd)
Rainfall (inches)
Overview
Regional Flows - Monthly
Flow Forecasts
Flow Forecasts - Bullet


STANTEC
INSIGHT
ANALYTICS
Flow Forecasts
You are now viewing location:
IVY CREEK
NAME
IVY CREEK
Peaking Factor (User Defined)
2.67
Basin
23.5
23.5
23.5
23.5
15.7
15.7
15.7
15.7
Flow (MGD)
0
5
10
15
20
2015
2020
2025
2030
2035
2040
2045
2050
Year
Firm Capacity
Total Capacity
CTSMP 2050 AADF
PDF (Actual PF = 1.70 )
PDF (Design PF = 2.50 )
PDF (User Defined PF)
Values obtained from Appendix C of the Collection and Treatment System - Master Plan 2050, Appendix C
Overview
Regional Flows - Monthly
Flow Forecasts
Flow Forecasts - Bullet

Cloud Storage

Analytical Platform

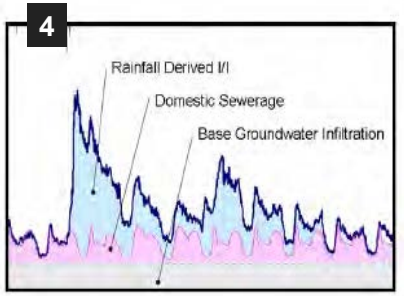
Metering Data

Server

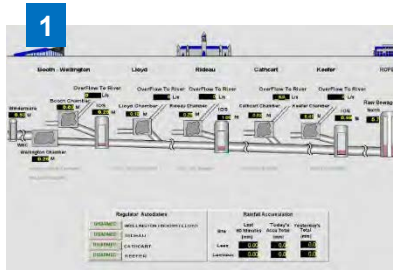
PC

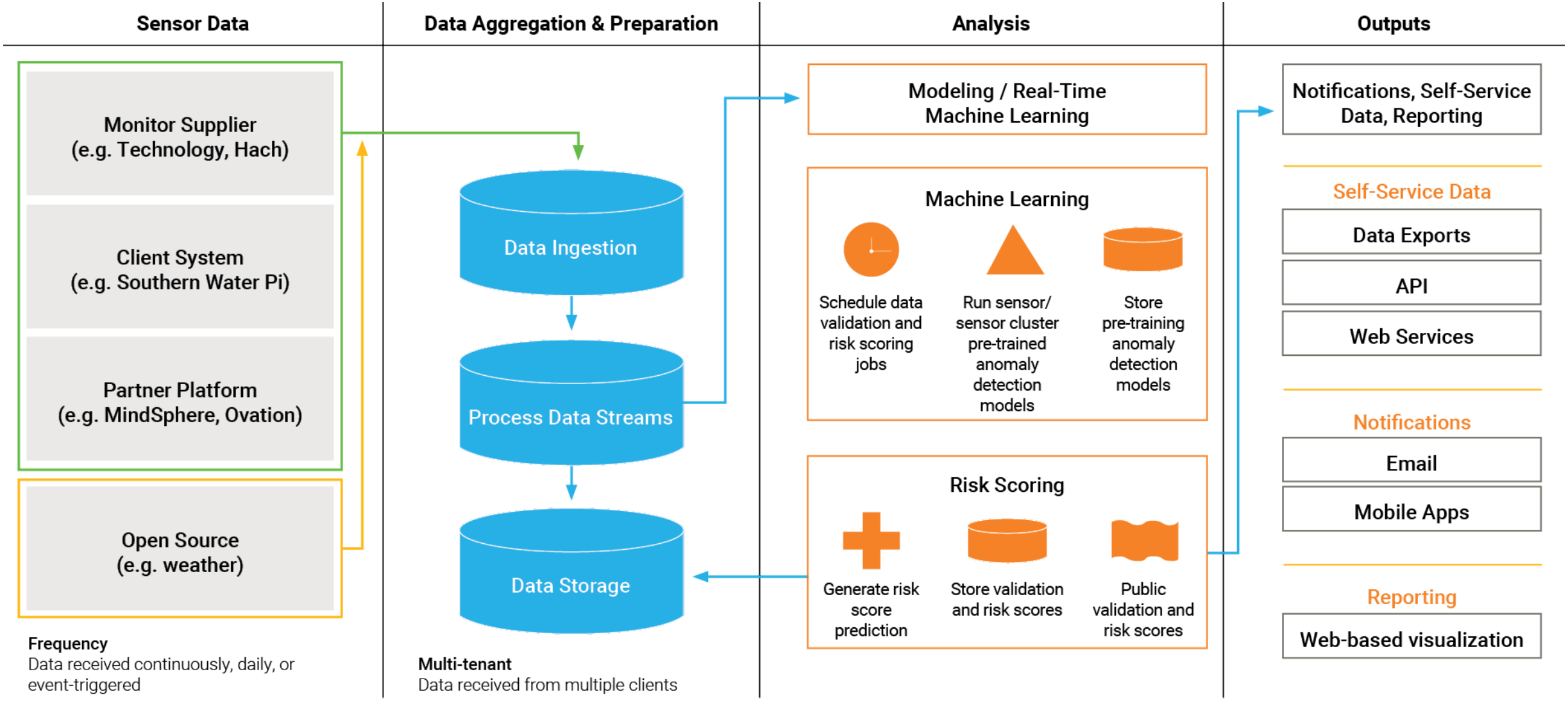
Python Script

Local PC




Software




Sensor Data
Data Aggregation & Preparation
Analysis
Outputs
Monitor Supplier
(e.g. Technology, Hach)
Client System
(e.g. Southern Water Pi)
Partner Platform
(e.g. MindSphere, Ovation)
Open Source
(e.g. weather)
Frequency
Data received continuously, daily, or event-triggered
Data Ingestion
Process Data Streams
Data Storage
Multi-tenant
Data received from multiple clients
Modeling / Real-Time Machine Learning
Machine Learning
Schedule data validation and risk scoring jobs
Run sensor/ sensor cluster pre-trained anomaly detection models
Store pre-training anomaly detection models
Risk Scoring
Generate risk score prediction
Store validation and risk scores
Public validation and risk scores
Notifications, Self-Service Data, Reporting
Self-Service Data
Data Exports
API
Web Services
Notifications
Email
Mobile Apps
Reporting
Web-based visualization

# Case Studies

# Springfield Water & Sewer Commission: Regulatory reporting

**Population Served:**

105,000

**Problem:**

Increase system understanding

Regulatory reporting

**Solution:**

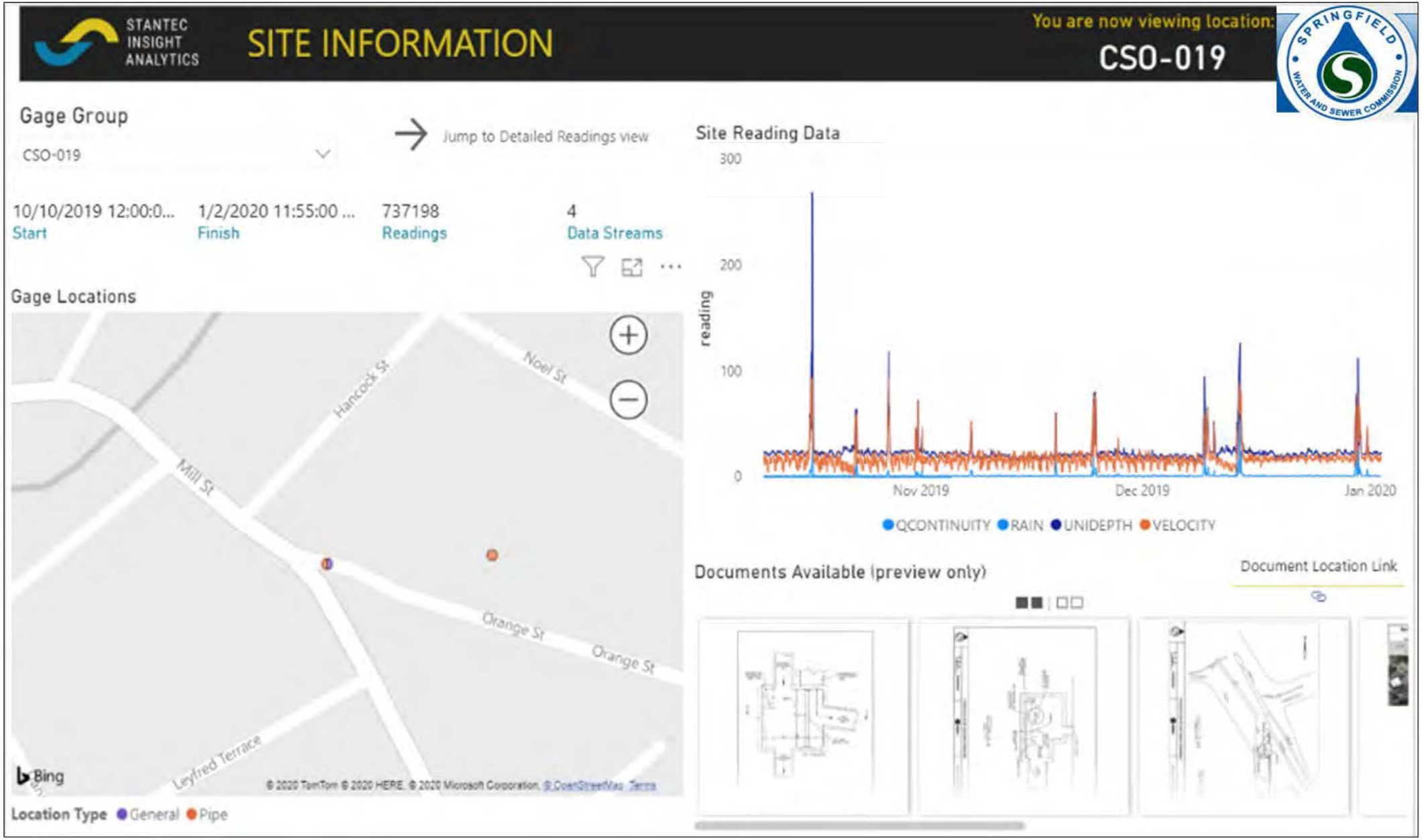
Data available for platform:

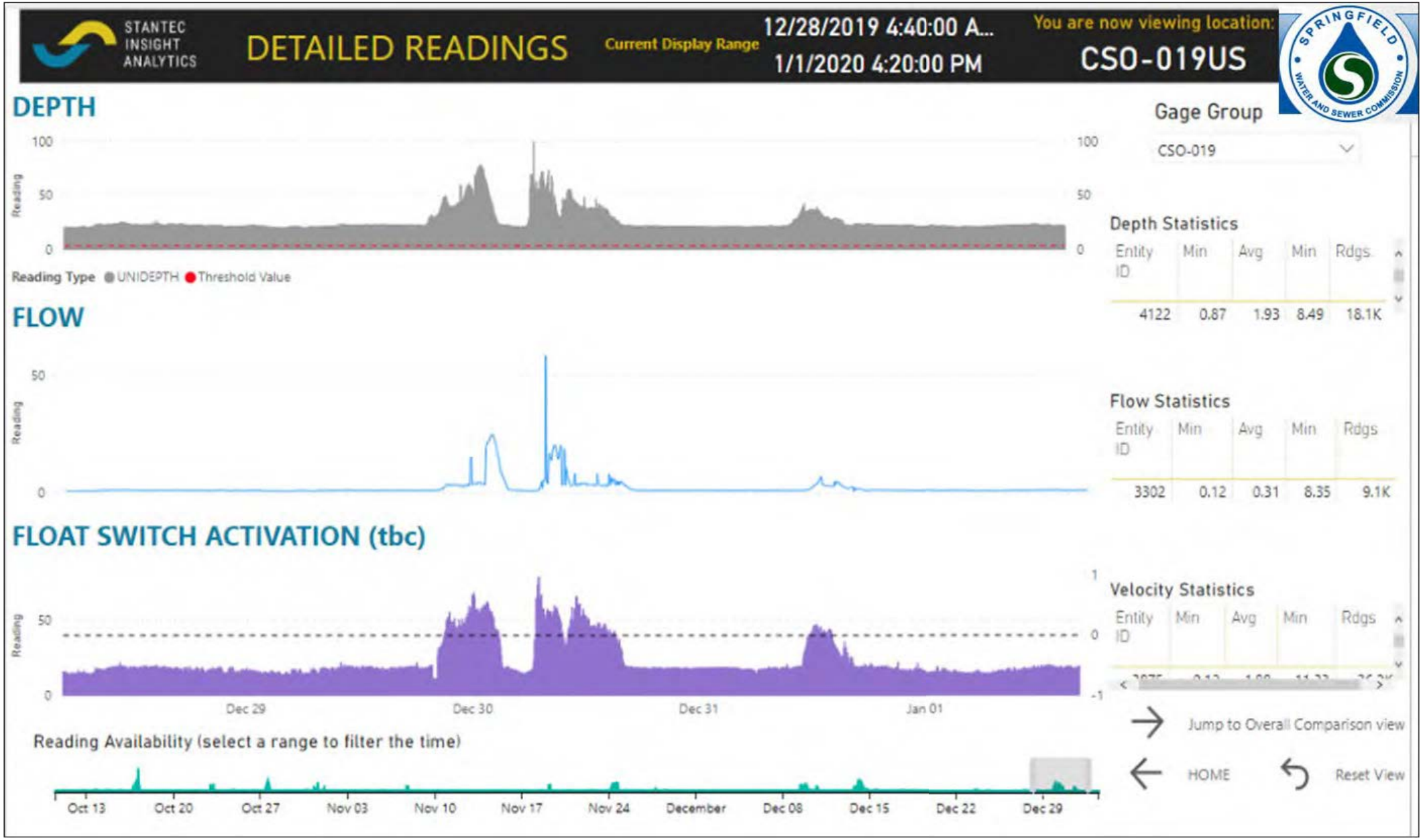
- Flow Metering

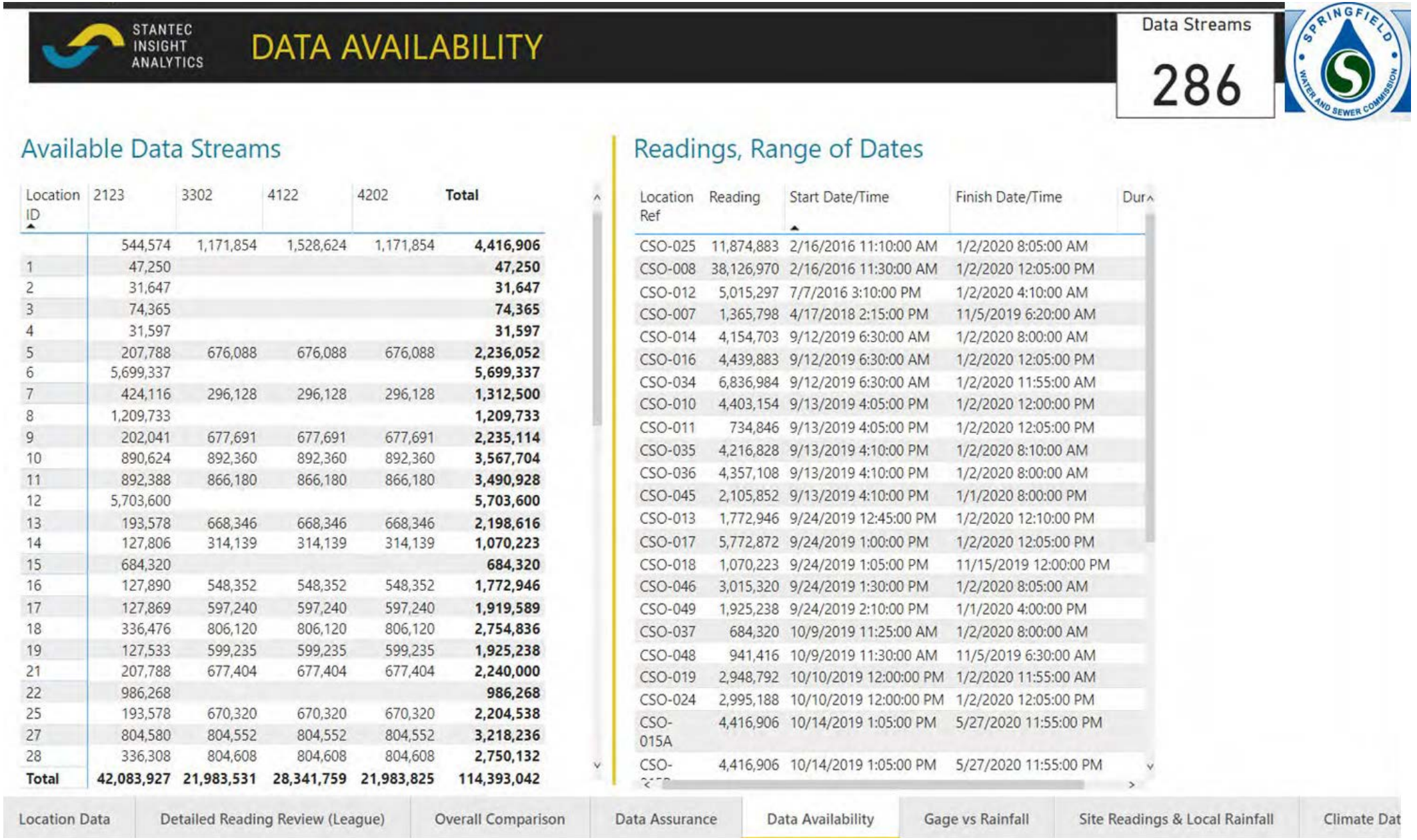
**Result:**

Pilot has proved the concept and met all success criteria:

- Multiple data sources can be linked
- A simple dashboard will provide increased understanding
- Regulatory reporting within 4 hours is feasible


STANTEC INSIGHT ANALYTICS
SITE INFORMATION
You are now viewing location:
CSO-019
SPRINGFIELD WATER AND SEWER COMMISSION
Gage Group
CSO-019
Jump to Detailed Readings view
10/10/2019 12:00:0...
Start
1/2/2020 11:55:00 ...
Finish
737198
Readings
4
Data Streams
Gage Locations
Hancock St
Noel St
Mill St
Orange St
Orange St
Leyfred Terrace
Bing
© 2020 TomTom © 2020 HERE, © 2020 Microsoft Corporation, © OpenStreetMap Terms
Location Type General Pipe
Site Reading Data
300
200
100
0
reading
Nov 2019
Dec 2019
Jan 2020
QCONTINUITY RAIN UNIDEPTH VELOCITY
Documents Available (preview only)
Document Location Link


STANTEC INSIGHT ANALYTICS
DETAILED READINGS
Current Display Range
12/28/2019 4:40:00 A...
1/1/2020 4:20:00 PM
You are now viewing location:
CSO-019US
SPRINGFIELD WATER AND SEWER COMMISSION
DEPTH
Reading
100
50
0
Reading Type UNIDEPTH Threshold Value
FLOW
Reading
50
0
FLOAT SWITCH ACTIVATION (tbc)
Reading
50
0
1
0
-1
Dec 29
Dec 30
Dec 31
Jan 01
Reading Availability (select a range to filter the time)
Oct 13
Oct 20
Oct 27
Nov 03
Nov 10
Nov 17
Nov 24
December
Dec 08
Dec 15
Dec 22
Dec 29
Gage Group
CSO-019
Depth Statistics
Entity ID
Min
Avg
Min
Rdgs
4122
0.87
1.93
8.49
18.1K
Flow Statistics
Entity ID
Min
Avg
Min
Rdgs
3302
0.12
0.31
8.35
9.1K
Velocity Statistics
Entity ID
Min
Avg
Min
Rdgs
Jump to Overall Comparison view
HOME
Reset View



STANTEC INSIGHT ANALYTICS

# DATA AVAILABILITY

Data Streams

286

SPRINGFIELD WATER AND SEWER COMMISSION

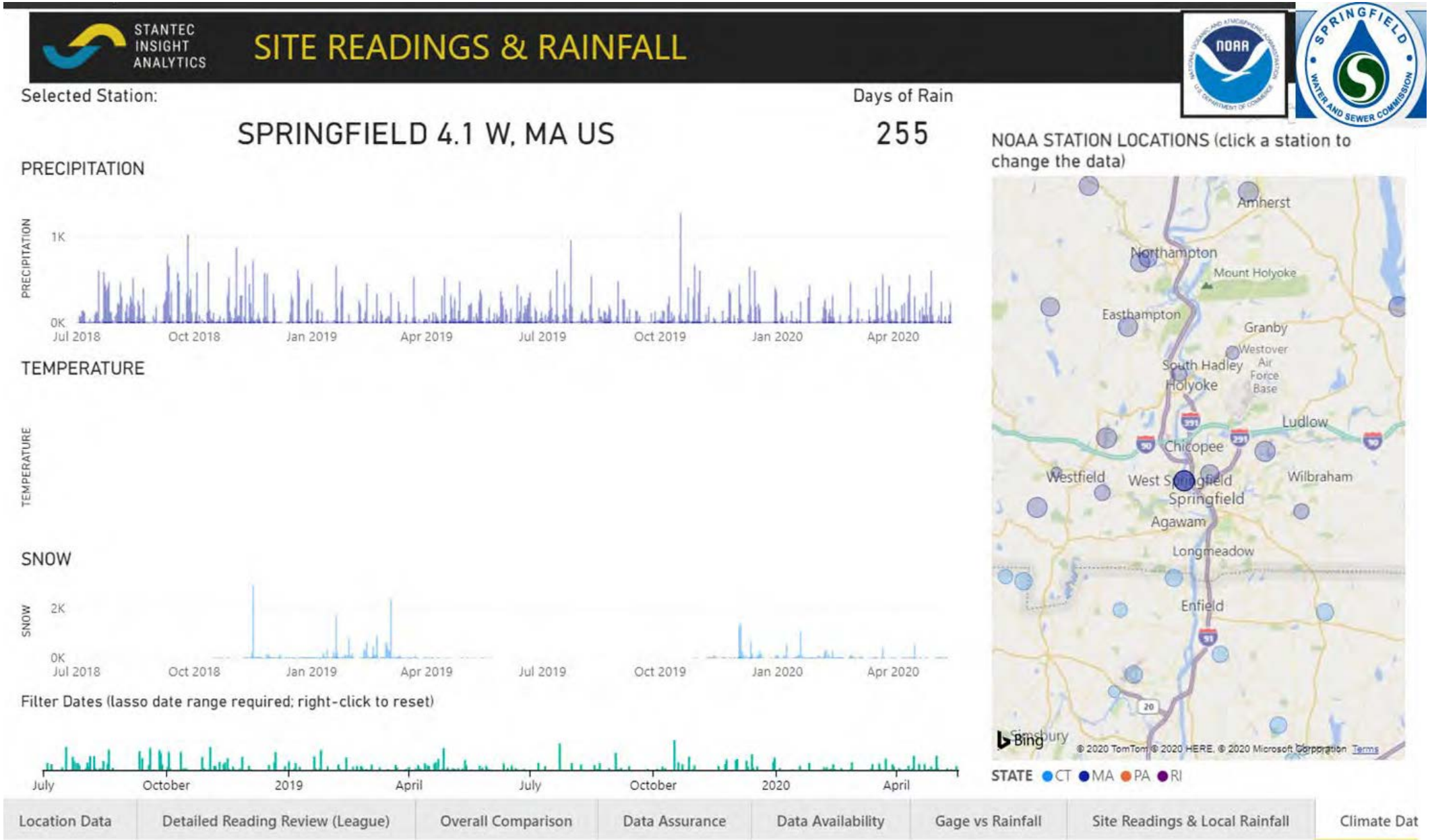
## Available Data Streams

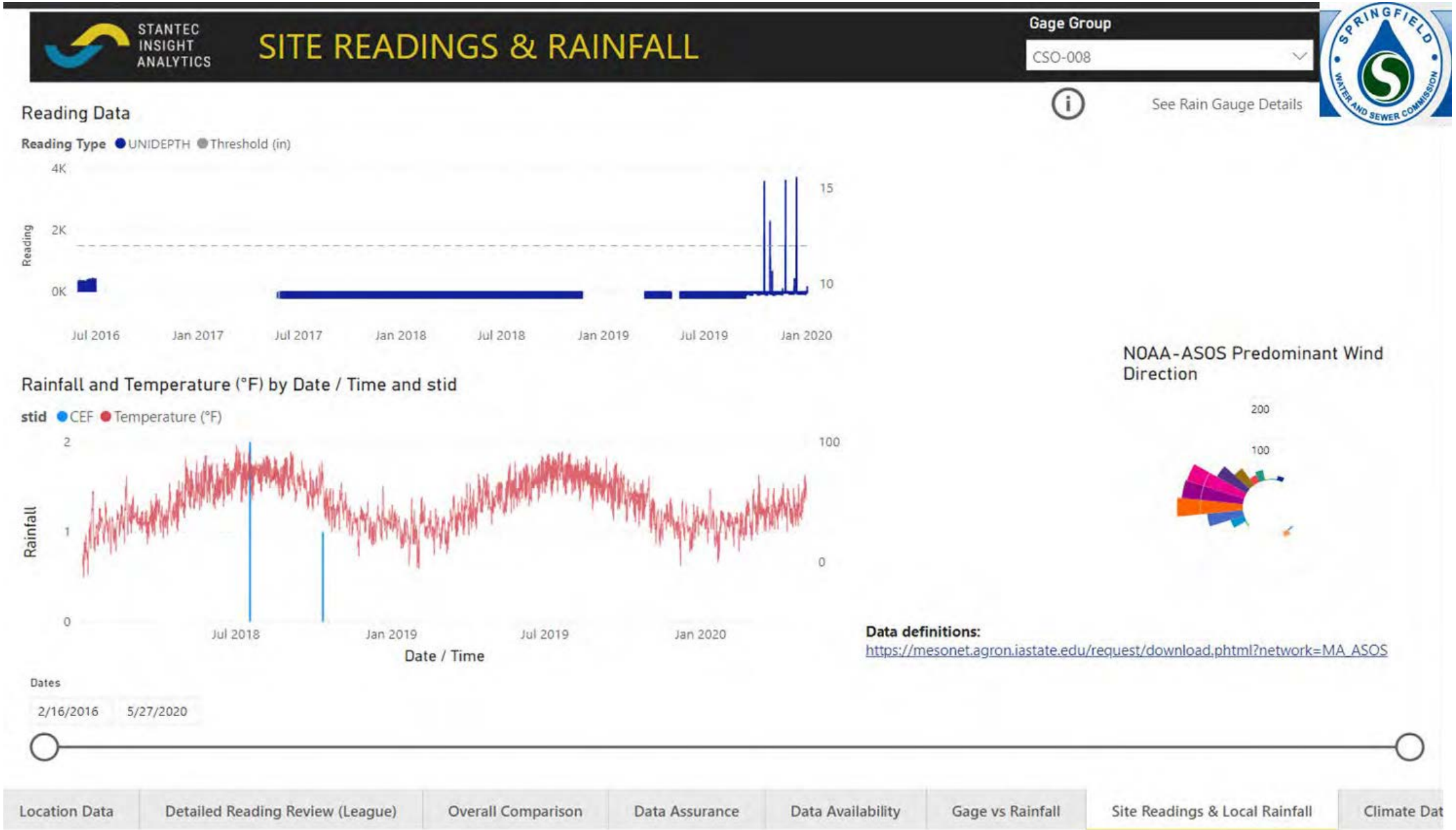
| Location ID | 2123 | 3302 | 4122 | 4202 | Total |
|---|---|---|---|---|---|
| | 544,574 | 1,171,854 | 1,528,624 | 1,171,854 | **4,416,906** |
| 1 | 47,250 | | | | **47,250** |
| 2 | 31,647 | | | | **31,647** |
| 3 | 74,365 | | | | **74,365** |
| 4 | 31,597 | | | | **31,597** |
| 5 | 207,788 | 676,088 | 676,088 | 676,088 | **2,236,052** |
| 6 | 5,699,337 | | | | **5,699,337** |
| 7 | 424,116 | 296,128 | 296,128 | 296,128 | **1,312,500** |
| 8 | 1,209,733 | | | | **1,209,733** |
| 9 | 202,041 | 677,691 | 677,691 | 677,691 | **2,235,114** |
| 10 | 890,624 | 892,360 | 892,360 | 892,360 | **3,567,704** |
| 11 | 892,388 | 866,180 | 866,180 | 866,180 | **3,490,928** |
| 12 | 5,703,600 | | | | **5,703,600** |
| 13 | 193,578 | 668,346 | 668,346 | 668,346 | **2,198,616** |
| 14 | 127,806 | 314,139 | 314,139 | 314,139 | **1,070,223** |
| 15 | 684,320 | | | | **684,320** |
| 16 | 127,890 | 548,352 | 548,352 | 548,352 | **1,772,946** |
| 17 | 127,869 | 597,240 | 597,240 | 597,240 | **1,919,589** |
| 18 | 336,476 | 806,120 | 806,120 | 806,120 | **2,754,836** |
| 19 | 127,533 | 599,235 | 599,235 | 599,235 | **1,925,238** |
| 21 | 207,788 | 677,404 | 677,404 | 677,404 | **2,240,000** |
| 22 | 986,268 | | | | **986,268** |
| 25 | 193,578 | 670,320 | 670,320 | 670,320 | **2,204,538** |
| 27 | 804,580 | 804,552 | 804,552 | 804,552 | **3,218,236** |
| 28 | 336,308 | 804,608 | 804,608 | 804,608 | **2,750,132** |
| **Total** | **42,083,927** | **21,983,531** | **28,341,759** | **21,983,825** | **114,393,042** |

## Readings, Range of Dates

| Location Ref | Reading | Start Date/Time | Finish Date/Time | Dur |
|---|---|---|---|---|
| CSO-025 | 11,874,883 | 2/16/2016 11:10:00 AM | 1/2/2020 8:05:00 AM | |
| CSO-008 | 38,126,970 | 2/16/2016 11:30:00 AM | 1/2/2020 12:05:00 PM | |
| CSO-012 | 5,015,297 | 7/7/2016 3:10:00 PM | 1/2/2020 4:10:00 AM | |
| CSO-007 | 1,365,798 | 4/17/2018 2:15:00 PM | 11/5/2019 6:20:00 AM | |
| CSO-014 | 4,154,703 | 9/12/2019 6:30:00 AM | 1/2/2020 8:00:00 AM | |
| CSO-016 | 4,439,883 | 9/12/2019 6:30:00 AM | 1/2/2020 12:05:00 PM | |
| CSO-034 | 6,836,984 | 9/12/2019 6:30:00 AM | 1/2/2020 11:55:00 AM | |
| CSO-010 | 4,403,154 | 9/13/2019 4:05:00 PM | 1/2/2020 12:00:00 PM | |
| CSO-011 | 734,846 | 9/13/2019 4:05:00 PM | 1/2/2020 12:05:00 PM | |
| CSO-035 | 4,216,828 | 9/13/2019 4:10:00 PM | 1/2/2020 8:10:00 AM | |
| CSO-036 | 4,357,108 | 9/13/2019 4:10:00 PM | 1/2/2020 8:00:00 AM | |
| CSO-045 | 2,105,852 | 9/13/2019 4:10:00 PM | 1/1/2020 8:00:00 PM | |
| CSO-013 | 1,772,946 | 9/24/2019 12:45:00 PM | 1/2/2020 12:10:00 PM | |
| CSO-017 | 5,772,872 | 9/24/2019 1:00:00 PM | 1/2/2020 12:05:00 PM | |
| CSO-018 | 1,070,223 | 9/24/2019 1:05:00 PM | 11/15/2019 12:00:00 PM | |
| CSO-046 | 3,015,320 | 9/24/2019 1:30:00 PM | 1/2/2020 8:05:00 AM | |
| CSO-049 | 1,925,238 | 9/24/2019 2:10:00 PM | 1/1/2020 4:00:00 PM | |
| CSO-037 | 684,320 | 10/9/2019 11:25:00 AM | 1/2/2020 8:00:00 AM | |
| CSO-048 | 941,416 | 10/9/2019 11:30:00 AM | 11/5/2019 6:30:00 AM | |
| CSO-019 | 2,948,792 | 10/10/2019 12:00:00 PM | 1/2/2020 11:55:00 AM | |
| CSO-024 | 2,995,188 | 10/10/2019 12:00:00 PM | 1/2/2020 12:05:00 PM | |
| CSO-015A | 4,416,906 | 10/14/2019 1:05:00 PM | 5/27/2020 11:55:00 PM | |
| CSO- | 4,416,906 | 10/14/2019 1:05:00 PM | 5/27/2020 11:55:00 PM | |

Location Data | Detailed Reading Review (League) | Overall Comparison | Data Assurance | Data Availability | Gage vs Rainfall | Site Readings & Local Rainfall | Climate Dat


STANTEC INSIGHT ANALYTICS
SITE READINGS & RAINFALL
Selected Station:
SPRINGFIELD 4.1 W, MA US
Days of Rain
255
PRECIPITATION
PRECIPITATION
1K
0K
Jul 2018
Oct 2018
Jan 2019
Apr 2019
Jul 2019
Oct 2019
Jan 2020
Apr 2020
TEMPERATURE
TEMPERATURE
SNOW
SNOW
2K
0K
Jul 2018
Oct 2018
Jan 2019
Apr 2019
Jul 2019
Oct 2019
Jan 2020
Apr 2020
Filter Dates (lasso date range required; right-click to reset)
July
October
2019
April
July
October
2020
April
NOAA STATION LOCATIONS (click a station to change the data)
Amherst
Northampton
Mount Holyoke
Easthampton
Granby
Westover Air Force Base
South Hadley
Holyoke
Ludlow
Chicopee
Westfield
West Springfield
Springfield
Wilbraham
Agawam
Longmeadow
Enfield
Bing
© 2020 TomTom © 2020 HERE, © 2020 Microsoft Corporation Terms
STATE CT MA PA RI
Location Data
Detailed Reading Review (League)
Overall Comparison
Data Assurance
Data Availability
Gage vs Rainfall
Site Readings & Local Rainfall
Climate Dat


STANTEC INSIGHT ANALYTICS
SITE READINGS & RAINFALL
Gage Group
CSO-008
See Rain Gauge Details
SPRINGFIELD WATER AND SEWER COMMISSION
Reading Data
Reading Type UNIDEPTH Threshold (in)
4K
2K
0K
Reading
15
10
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Rainfall and Temperature (°F) by Date / Time and stid
stid CEF Temperature (°F)
2
1
0
Rainfall
100
0
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Date / Time
NOAA-ASOS Predominant Wind Direction
200
100
Data definitions:
https://mesonet.agron.iastate.edu/request/download.phtml?network=MA_ASOS
Dates
2/16/2016
5/27/2020
Location Data
Detailed Reading Review (League)
Overall Comparison
Data Assurance
Data Availability
Gage vs Rainfall
Site Readings & Local Rainfall
Climate Dat

# Wessex Water: Reducing sewer flooding by proactive blockage detection

**Situation:**

>50% reduction in the number of sewer flooding incidents

Significant fines for under-performance

**Problem:**

Many utilities need better visibility into how their assets are performing at a residential level to reduce costly flooding incidents

**Solution:**

Create a risk-based sensor network for better data on residential assets.

Use analytics to identify which alarms indicate higher risk of overflow.

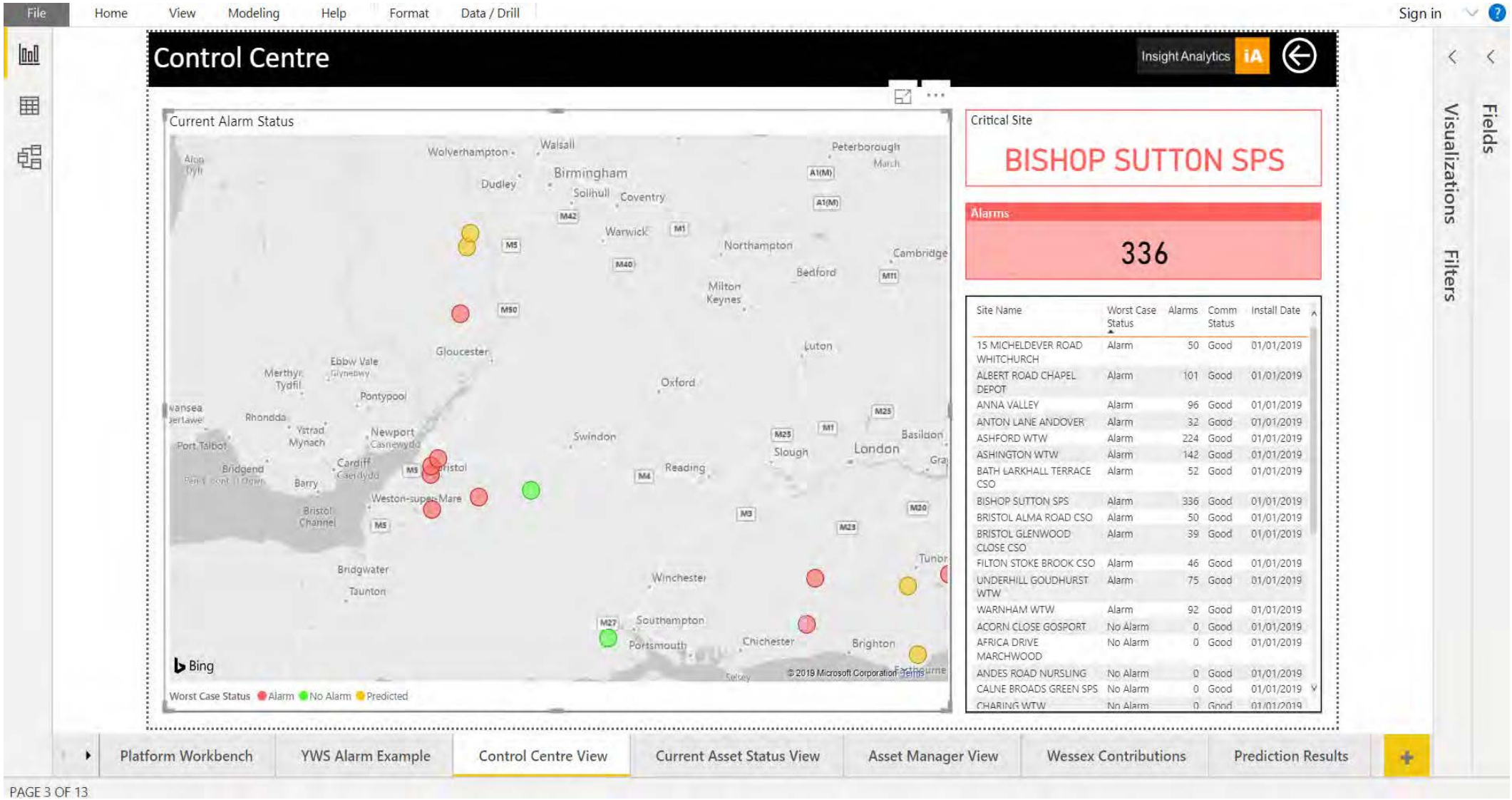
Improve business processes to realize desired outcome—fewer overflows.

**Result:**

Incident reduction and improved customer engagement

Better understanding of assets at the residential level

Demonstrated value of using analytics to help reduce sewer flooding


File
Home
View
Modeling
Help
Format
Data / Drill
Sign in
Control Centre
Insight Analytics
iA
Current Alarm Status
Wolverhampton
Walsall
Peterborough
Birmingham
Dudley
Solihull
Coventry
Warwick
Northampton
Cambridge
Bedford
Milton Keynes
Luton
Gloucester
Oxford
Swindon
Reading
Slough
London
Basildon
Bristol
Newport
Cardiff
Weston-super-Mare
Bridgwater
Taunton
Winchester
Southampton
Portsmouth
Chichester
Brighton
Bing
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Worst Case Status Alarm No Alarm Predicted
Critical Site
BISHOP SUTTON SPS
Alarms
336
Site Name
Worst Case Status
Alarms
Comm Status
Install Date
15 MICHELDEVER ROAD WHITCHURCH Alarm 50 Good 01/01/2019
ALBERT ROAD CHAPEL DEPOT Alarm 101 Good 01/01/2019
ANNA VALLEY Alarm 96 Good 01/01/2019
ANTON LANE ANDOVER Alarm 32 Good 01/01/2019
ASHFORD WTW Alarm 224 Good 01/01/2019
ASHINGTON WTW Alarm 142 Good 01/01/2019
BATH LARKHALL TERRACE CSO Alarm 52 Good 01/01/2019
BISHOP SUTTON SPS Alarm 336 Good 01/01/2019
BRISTOL ALMA ROAD CSO Alarm 50 Good 01/01/2019
BRISTOL GLENWOOD CLOSE CSO Alarm 39 Good 01/01/2019
FILTON STOKE BROOK CSO Alarm 46 Good 01/01/2019
UNDERHILL GOUDHURST WTW Alarm 75 Good 01/01/2019
WARNHAM WTW Alarm 92 Good 01/01/2019
ACORN CLOSE GOSPORT No Alarm 0 Good 01/01/2019
AFRICA DRIVE MARCHWOOD No Alarm 0 Good 01/01/2019
ANDES ROAD NURSLING No Alarm 0 Good 01/01/2019
CALNE BROADS GREEN SPS No Alarm 0 Good 01/01/2019
CHARING WTW No Alarm 0 Good 01/01/2019
Visualizations
Filters
Fields
Platform Workbench
YWS Alarm Example
Control Centre View
Current Asset Status View
Asset Manager View
Wessex Contributions
Prediction Results
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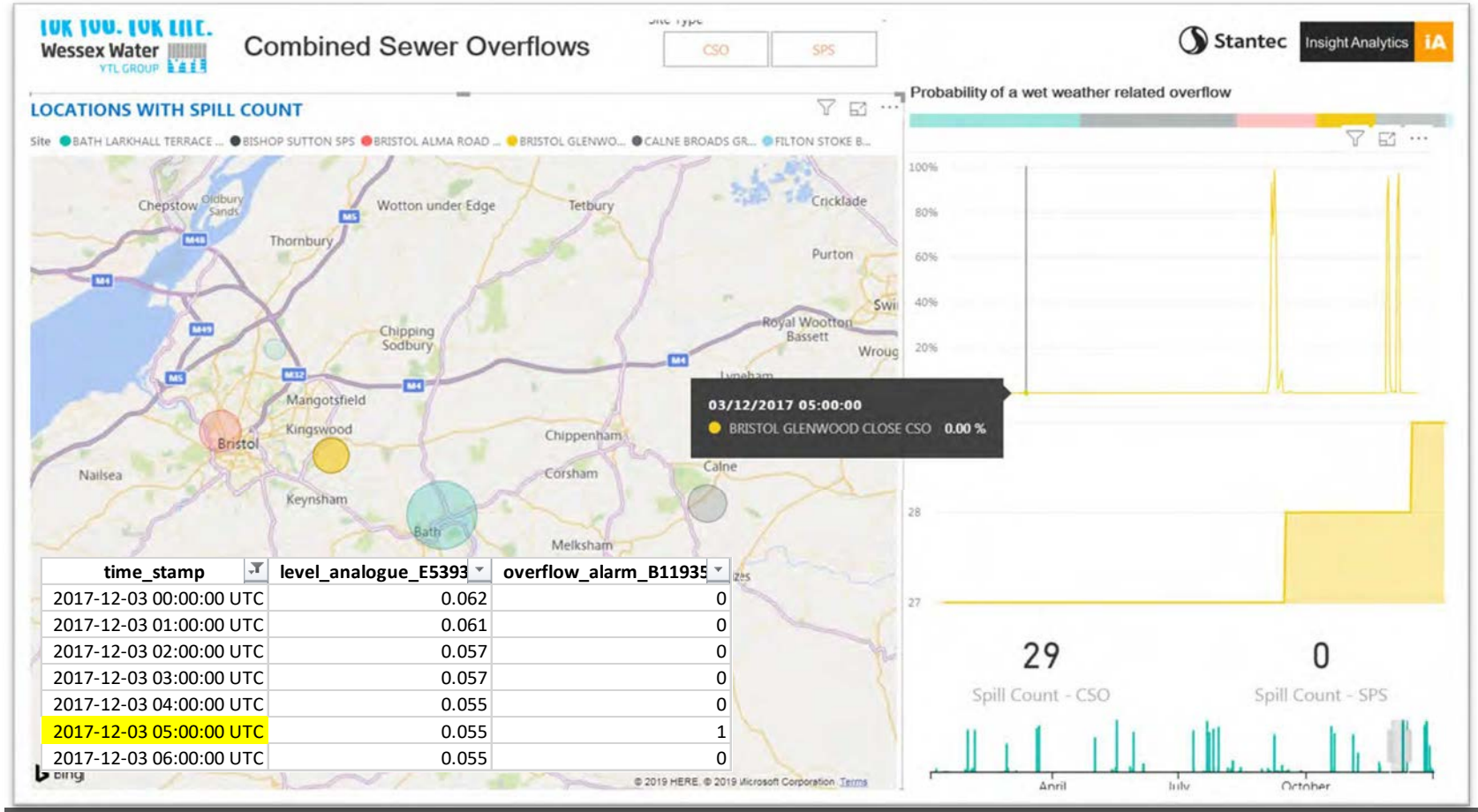



| time_stamp | level_analogue_E5393 | overflow_alarm_B11935 |
|---|---|---|
| 2017-12-03 00:00:00 UTC | 0.062 | 0 |
| 2017-12-03 01:00:00 UTC | 0.061 | 0 |
| 2017-12-03 02:00:00 UTC | 0.057 | 0 |
| 2017-12-03 03:00:00 UTC | 0.057 | 0 |
| 2017-12-03 04:00:00 UTC | 0.055 | 0 |
| 2017-12-03 05:00:00 UTC | 0.055 | 1 |
| 2017-12-03 06:00:00 UTC | 0.055 | 0 |

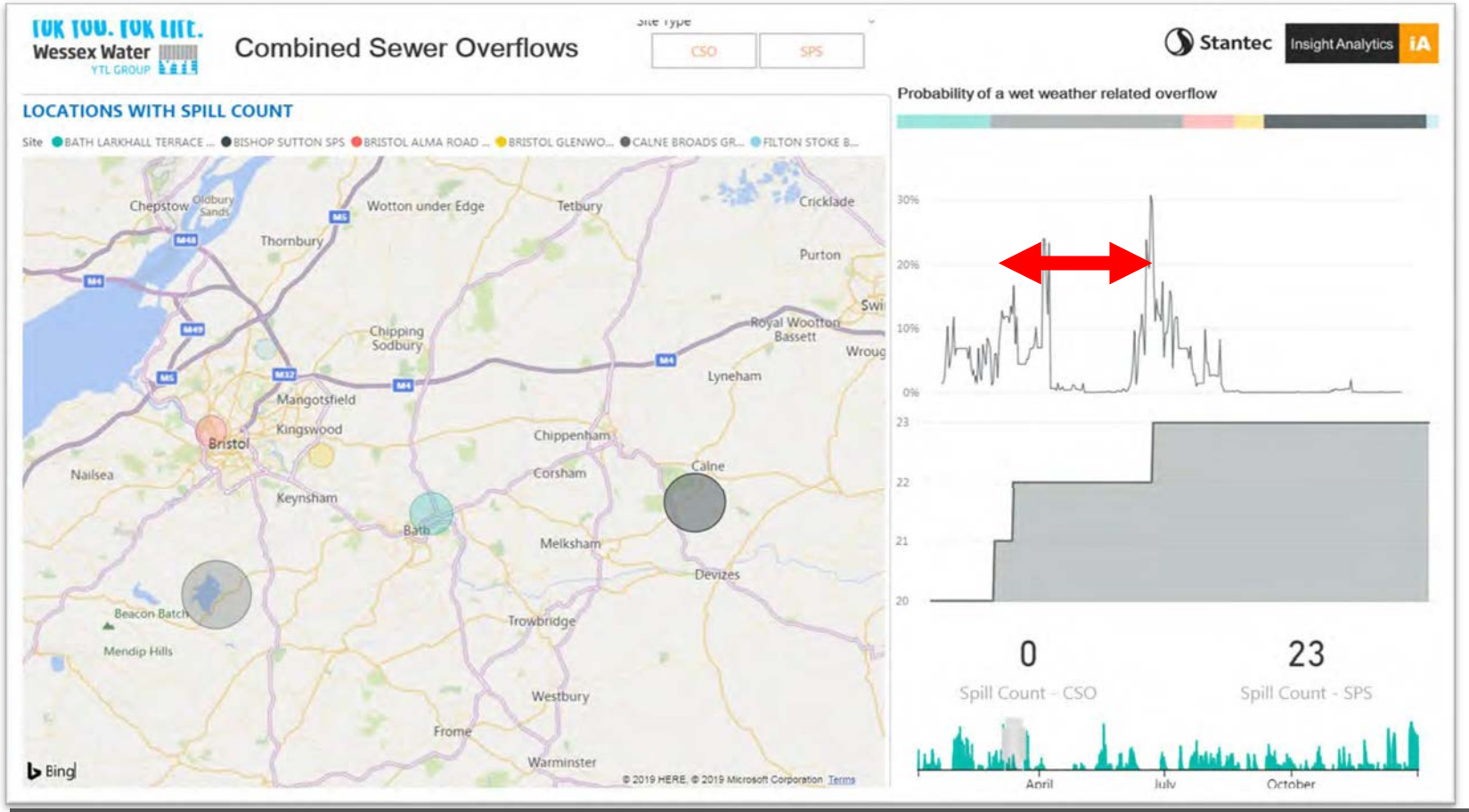
False overflow alarm at 05:00 identified and filtered out

**Notify**

**Operational response:**
Confidently do nothing

**False alarm**

High Confidence



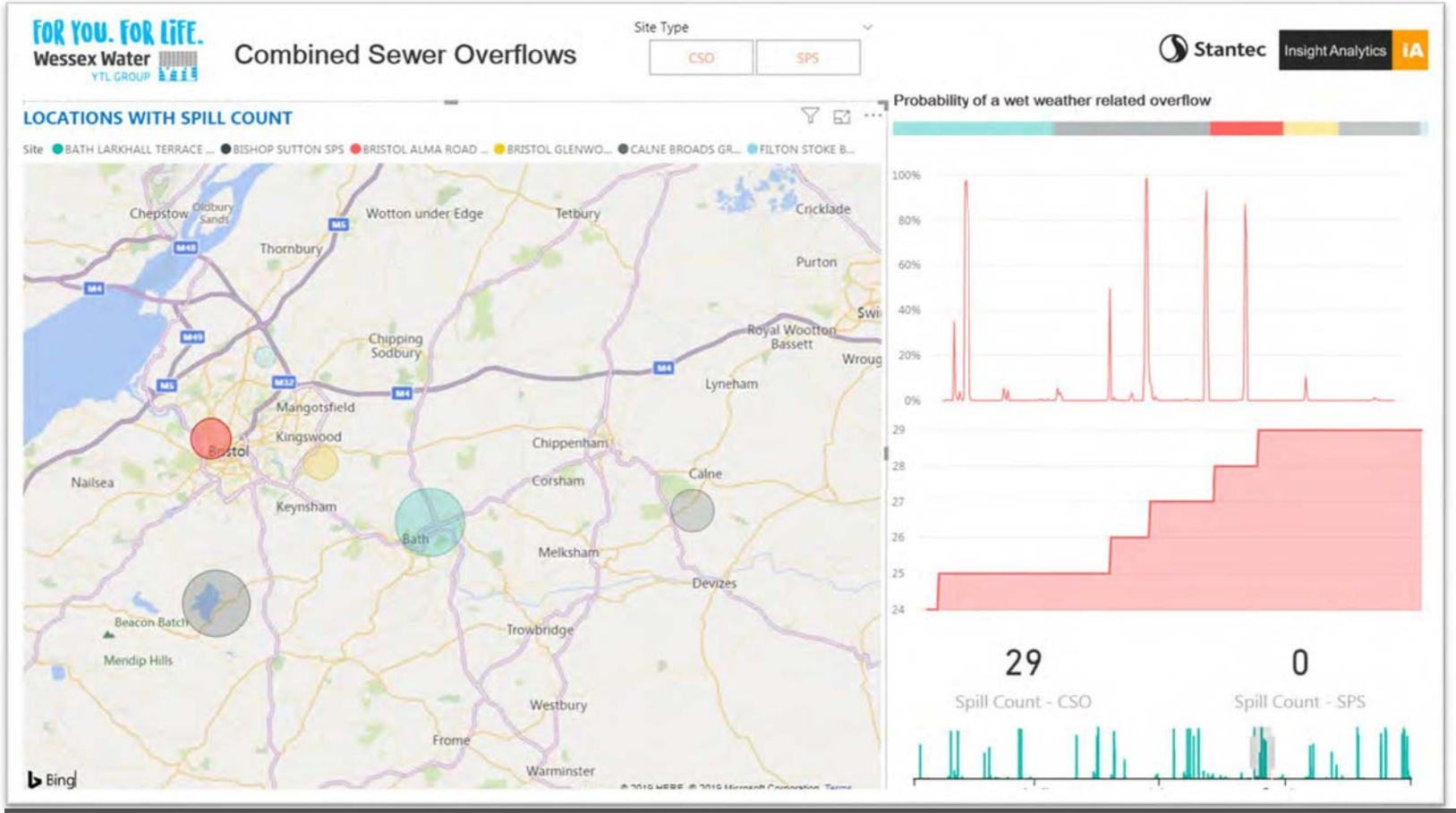

Three overflows occur when the probability of rainfall related overflow is less than 30%

**Detect / Diagnose**

**Operational response:**
Confidently action

**Potential pollution**

High Confidence




Each overlfow consistently coincides with a high probability of a wet weather related overflow

**Confirm**

**Operational response:**
Confidently report and monitor

**Wet weather overflow**

High Confidence

# Key Takeaways

# Lessons Learned

- Create a **vision** with **outcomes** in and adopt a **phased approach** to build momentum
- **Prioritize** what you **need** to know and by what date
- **Data analytics** is **not** just adding **telemetry** and collecting data
- Choose the **right technology** for your vision, but be pragmatic
- **People** need to be at the **heart** of the process
- Review **performance** and if necessary, apply **corrective actions**
- Realizing the **value** of data analytics is a **journey** – don’t expect the first generation to be the last

**Data analytics for wet weather solutions:** ***sharing our experience in getting the most out of your data to achieve the best possible outcomes.***

# *Questions*

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Stantec

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