



# You've Got the Data – Now What?

How to Effectively Integrate and Visualize Data to Facilitate Effective Process Control Decisions

**NEWEA Annual Conference & Exhibit**  
**Session 8 – Plant Operations 1: Data/Instrumentation**  
**January 27, 2020**



**Susan Guswa, P.E.**

COMMITMENT & INTEGRITY DRIVE RESULTS

## Current Buzz

- Technology
  - Internet of Things (IoT)
  - Big Data
  - Sensors/Real-Time Data
  - Data Analytics
  - Artificial Intelligence
- Data-Driven Decision Making
  - Asset Management
  - Optimization
  - Intelligent Systems
  - Smart Cities



# Data Science Hierarchy

## THE DATA SCIENCE HIERARCHY OF NEEDS

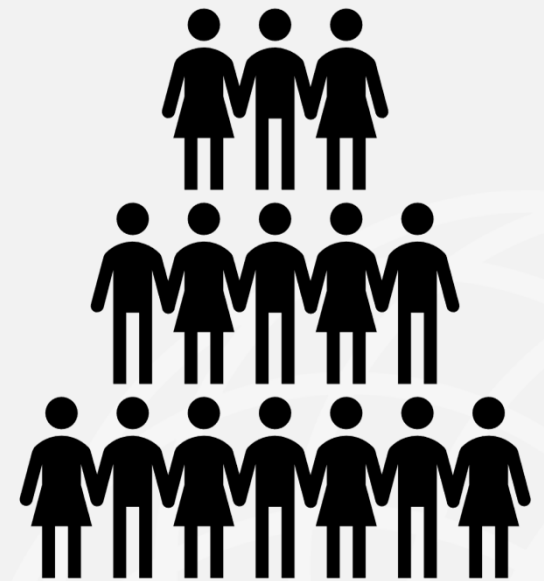
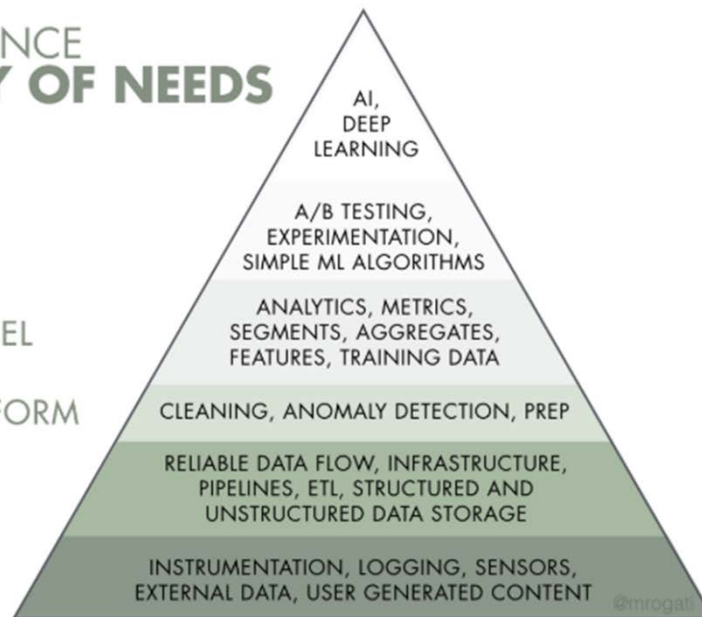
LEARN/OPTIMIZE

AGGREGATE/LABEL

EXPLORE/TRANSFORM

MOVE/STORE

COLLECT



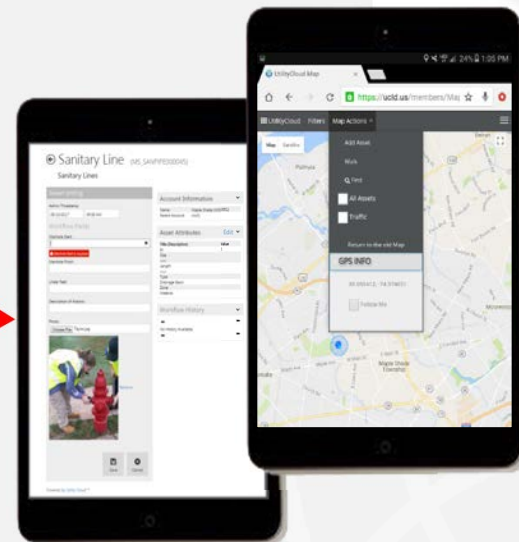
# Technology is Changing Data Collection

Then

Sketch / Other:  
 Aug 7 33" Top of platform to water  
 Plus  
 0815 7.22 2.40C  
 0940 7.35 3.1  
 0930 7.43 4.1  
 1030 7.57 4.4  
 1230 7.61 2.5°C

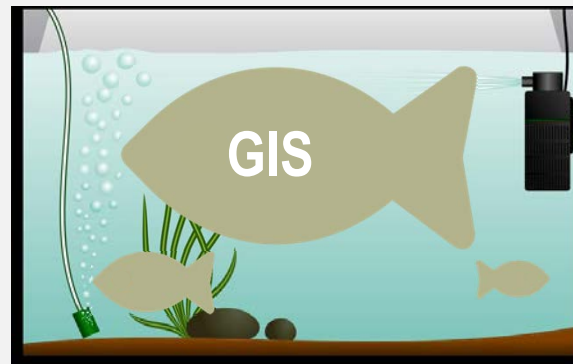
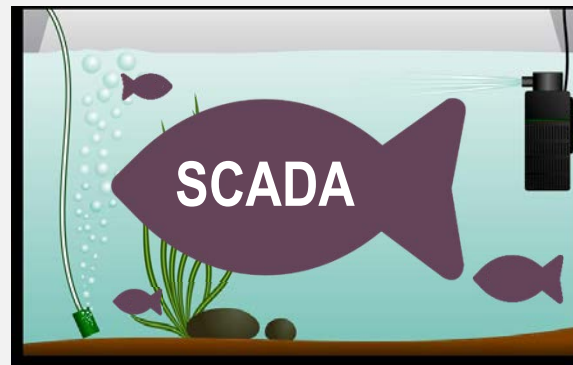


Now

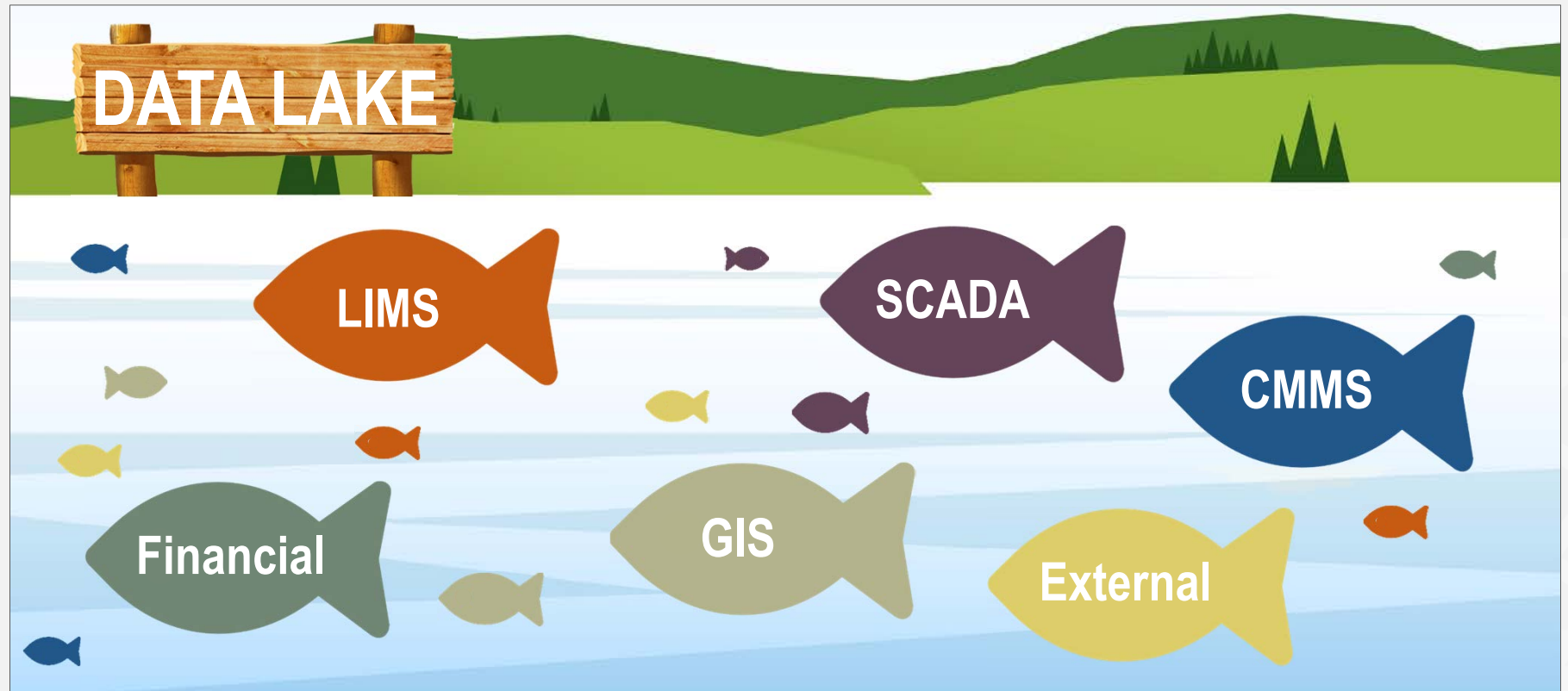




# Data Integration: Historical Data Management



# Data Integration: Technology is Transforming Aquariums to Lakes



**Picture this:**

---



**Nighttime in a  
small town nestled  
among rolling hills**

## Did you imagine something like this?



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Or something like this:



Vincent van Gogh *The Starry Night* 1886



# Data Visualization: Dashboards Can Magnify its Communication Potential



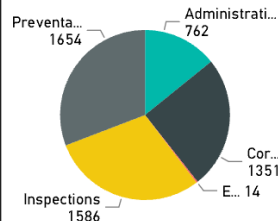
1/1/2014

3/1/2017

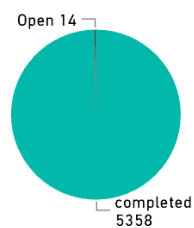
## Work History Reporting

To clear filters click on the white space in any pie chart

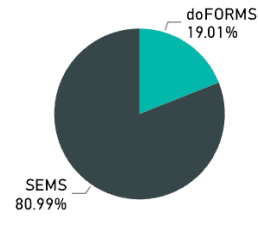
### Type Breakdown



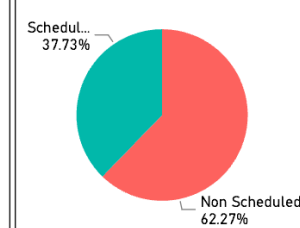
### Pending Vs Completed



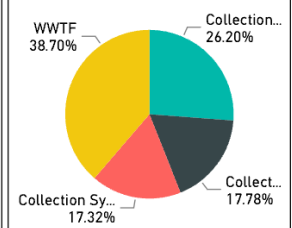
### Created on doFORMS



### Scheduled vs Non Scheduled



### Department Breakdown



Status Date	Schedule Date	#	Asset Name	Description	Type	Employee	Hours	Status	History Notes
3/1/2017	4/24/2017	2808	Instrumentation	Instrument Cleaning - Weekly	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/15/2017	2804	ORP controller	Sensor calibration - Monthly	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/15/2017	2802	pH controller #1	Sensor calibration - Monthly	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/15/2017	2803	pH controller #2	Sensor calibration - Monthly	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/1/2017	2801	2013 Ford F150	Oil Change - F150 Truck	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/10/2017	2800	4 Gas monitor	4 gas meter calibration - Monthly	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/1/2017	2799	ALL SAFETY LIGHTING	Test all e-lighting.	Inspections	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/14/2017	2796	ALL EMERGENCY EYEWASH & SHOWE...	Eye Wash Inspection - Weekly	Inspections	Jeff Leonard	0.0	completed	Service Incident Created
3/1/2017	4/21/2017	2797	ALL EMERGENCY EYEWASH & SHOWE...	Eye Wash Inspection - Weekly	Inspections	Jeff Leonard	0.0	completed	Service Incident Created
3/1/2017	4/28/2017	2798	ALL EMERGENCY EYEWASH & SHOWE...	Eye Wash Inspection - Weekly	Inspections	Jeff Leonard	0.0	completed	Service Incident Created
3/1/2017	4/26/2017	2792	PH EQUIPMENT FOR EFFLUENT	Effluent pH meter	Preventative Maintenance	Jim Wilson	0.0	completed	Service Incident Created
3/1/2017	4/25/2017	2791	PLANT EFFLUENT SAMPLER	Effluent Sampler Monthly PM	Preventative Maintenance	Jeff Leonard	0.0	completed	Service Incident Created
3/1/2017	4/26/2017	2788	TRAVELING BRIDGE FILTER #1	Filter #1 Monthly PM	Preventative Maintenance	Jeff Leonard	0.0	completed	Service Incident Created
3/1/2017	4/10/2017	2788	UV DISINFECTION UNIT #1	UV Cleaning - Monthly	Preventative Maintenance	Jeff Leonard	0.0	completed	Service Incident Created

# Start with Defining Value

- What question are you trying to answer?
- You don't have to fill the whole lake or catch all the fish at once



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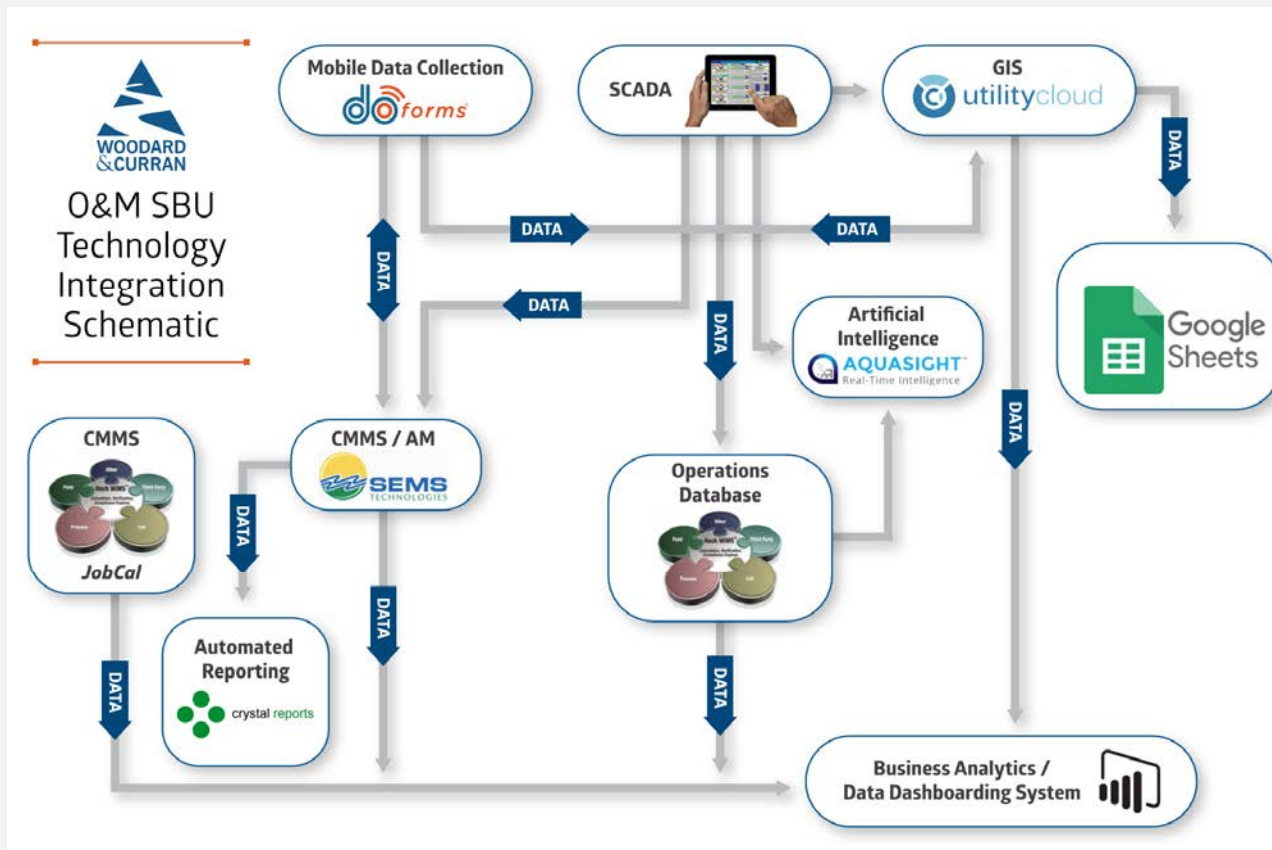
# Woodard & Curran's O&M Journey

*Vision: Transform to a data-driven decision-making culture at our more than 50 O&M facilities*

- Our destination – the top of the pyramid
- Use of technology and innovation for predictive / proactive decision making

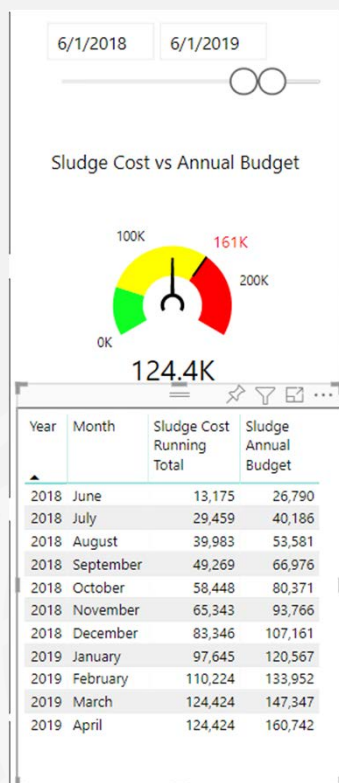
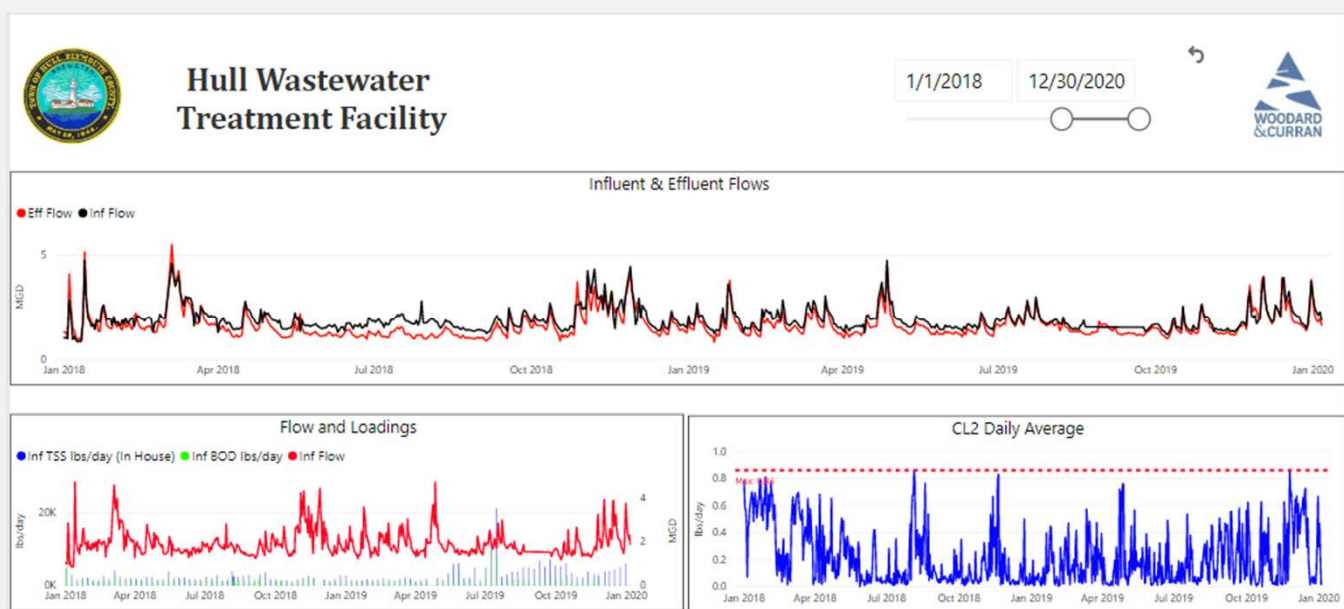


# Roadmap and Guides are Essential



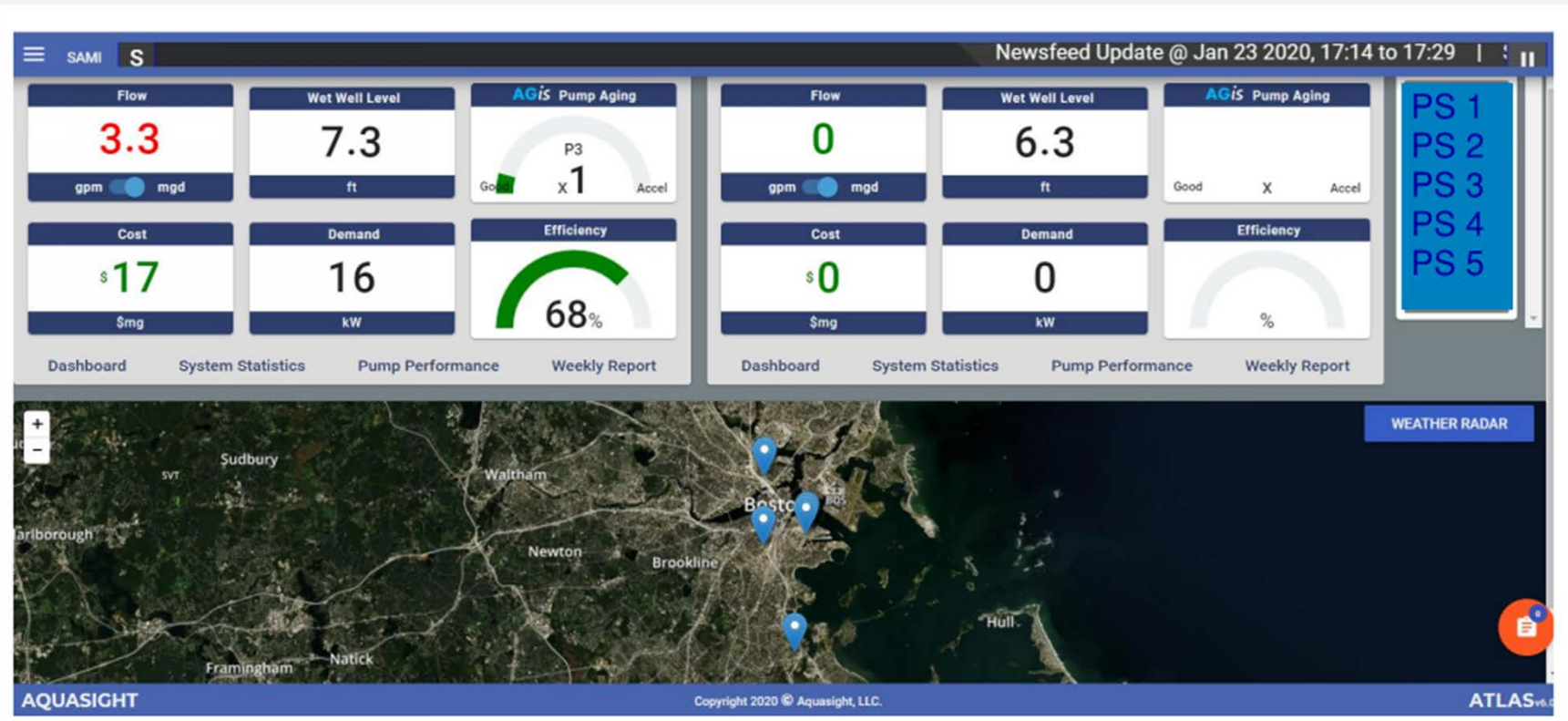


# Where Are We Five Years into Our Journey?





# Pilot Projects: Integration of AI into Operations at BWSC to Optimize Operation





# Pilot Projects: Manual Pump De-Ragging is Dramatically Reduced



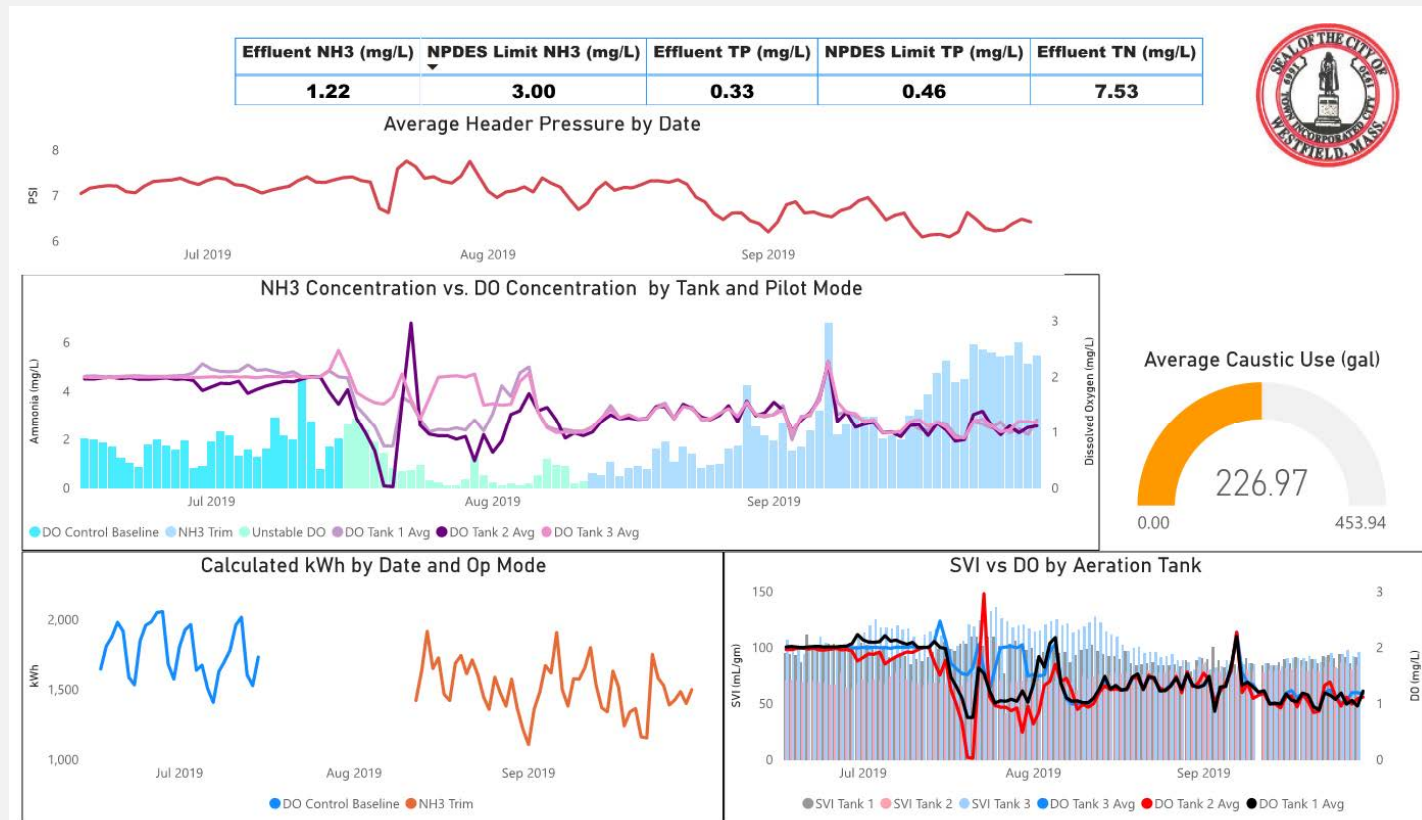
# Westfield Ammonia-Based Aeration Control Pilot Test – Another Step Toward Optimization

- Goal: define the benefits and impacts of ABAC at the Westfield WRF
- Spent the most time exploring and transforming the data
  - Pyramid Level 3
- Data Sources
  - Lab spreadsheets
  - Chemical usage spreadsheets
  - **On-line analyzers**
  - SCADA



Westfield WRF has one Hach AISE sc ISE  
Ammonium Probe installed

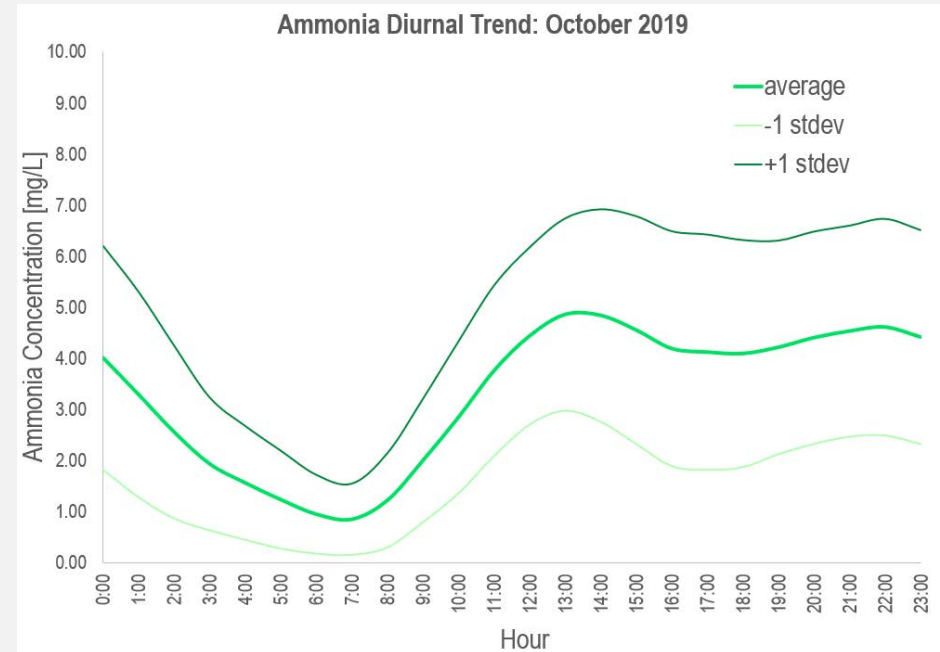
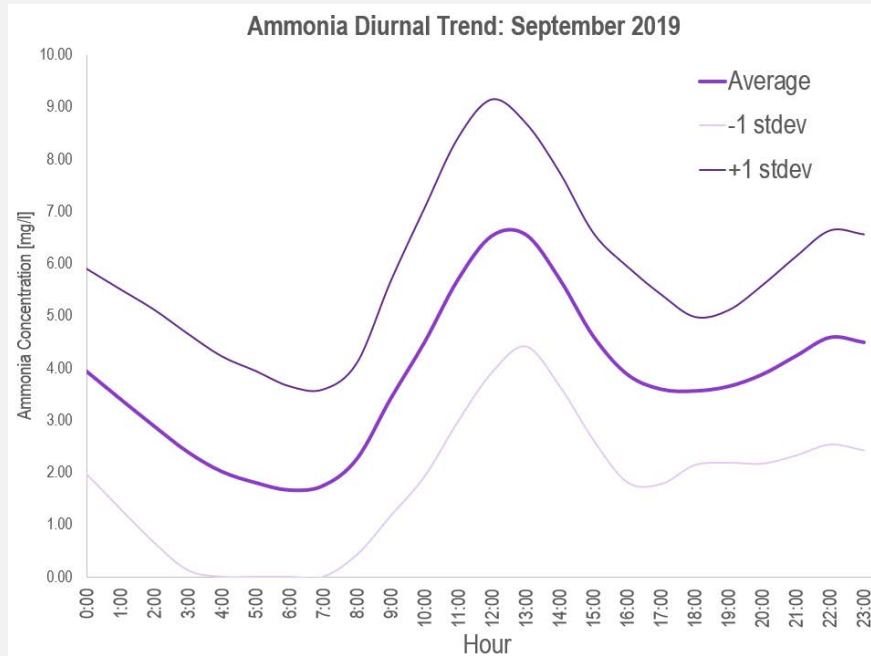
# Power BI Enabled Integration and Analysis of Data from the Pilot Test Period





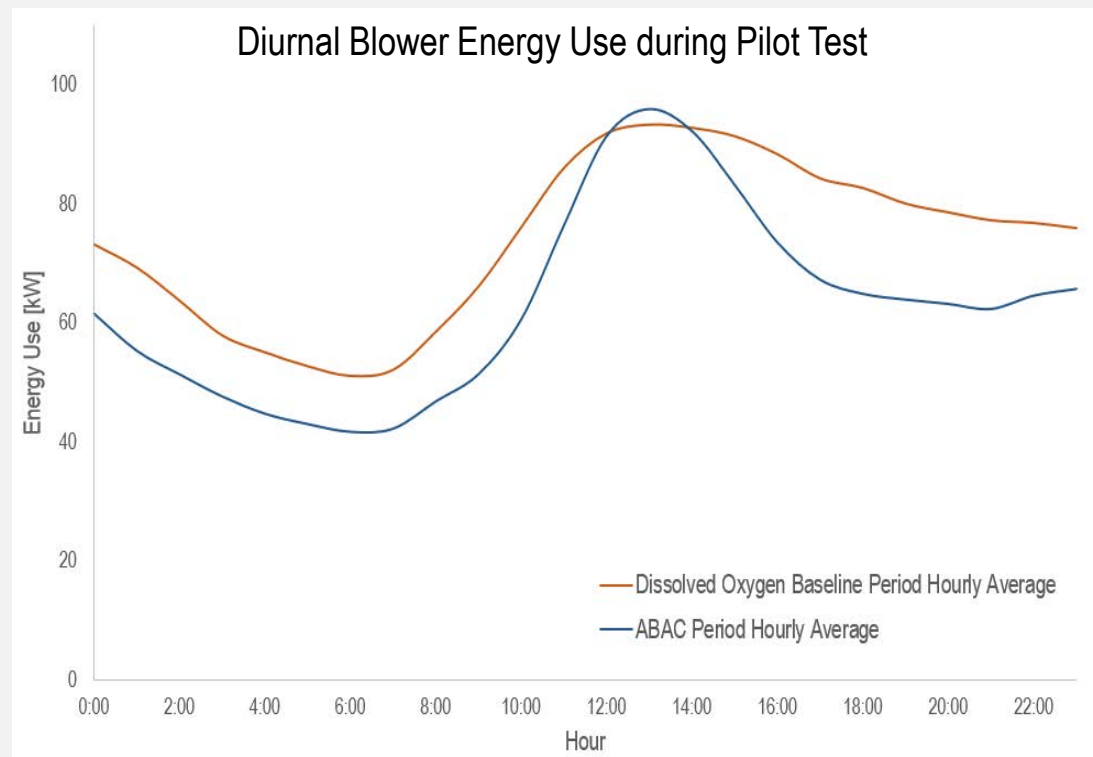


# On-Line Analyzers Provided a Window into Loading Changes During the Pilot Test

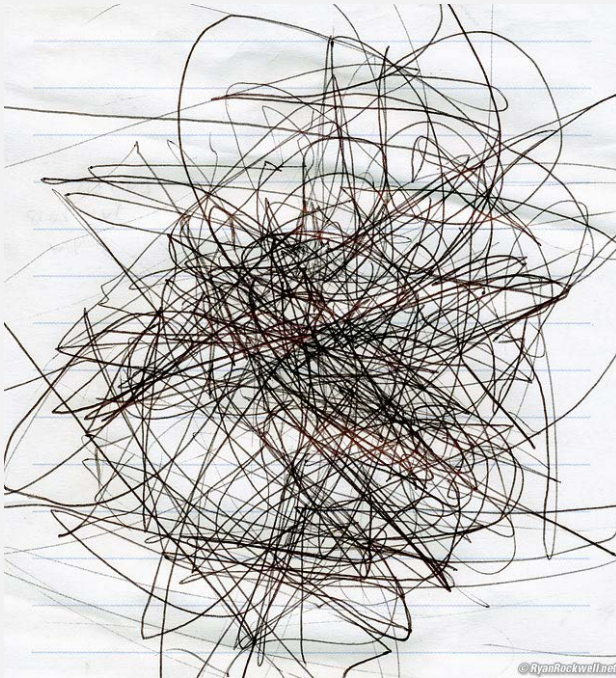


## Westfield ABAC Pilot Test Results

- 20% alkalinity chemical Savings
- 15% aeration energy savings
- No degradation in performance
- Favorable ROI



# Data Management Plan



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- What data to collect
- Technology for collection and analysis
- Who manages - governance
- Data quality

*Without it, run risk of not being able to see what the data are trying to tell you*

# Keys to Creating a Culture of Data-Driven Decision Making

1. Empower the Team
2. Define Value
3. Collect Accurate Data
4. Understand the Technology
5. Follow Your Path that Leads to Victory



Emanuel Gottlieb Leutze *Washington Crossing the Delaware* 1851: This Photo by Unknown Author is licensed under CC BY-SA



# Acknowledgements & Discussion

- City of Westfield
  - Jeff Gamelli, Deputy Superintendent
  - Ken Gagnon, Chief Operator
- Woodard & Curran
  - Alan Fabiano, O&M Technology Manager
  - Frank Cavaleri, O&M Senior Area Manager
  - Bob Amaral, Director of Intelligent Technology Services



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