

# USING GIS & AMI TECHNOLOGY TO FURTHER TACOMA WATER'S SMART WATER PROGRAM

AWWA CONFERENCE PRESENTATION BY:

COREY BEDIENT



**TACOMA**  **WATER**  
TACOMA PUBLIC UTILITIES

# AGENDA:

- **Smart Water Journey**
- **AMI Project Deployment /ESRI Technology**
  - 1) Meter box and lid survey
  - 2) Survey evaluation and categorization App for "real-time" data capture monitoring
  - 3) Meter box upgrade planning and work management by area App
  - 4) Deployment audit (Private/Public) partnership work process
  - 5) Next day AMI active status updates in main BlueWave (GIS Web Viewer technology by GeoCortex now called VertiGIS)
- **Next Steps & Future**

# SMART WATER NETWORK DEFINED

## What is it?

*A fully integrated set of data-driven components and solutions which allow water utilities to optimize all aspects of their water system.*

## Why is the water industry pursuing it?

*Smart water solutions improve the efficiency, longevity, and reliability of a utility's underlying physical assets by **better measuring, collecting, analyzing, and acting** upon a wide range of network events.*

# LAYERS OF SMART WATER NETWORK



## 5 Data Fusion and Analysis

Solutions that integrate data analytics, modeling, communication channels, sensing devices with the network in near real time.  
Common Operating View | Digital Twin



## 4 Data Management and Display

AMI – Headend systems

Hydraulic Model

GIS - ESRI

Dash Boards  
Tableau,  
Smartsheet

SCADA – supervisory control and data acquisition



## 3 Collection and Communication

AMI Flexnet Network

3<sup>rd</sup> Party Cloud Solutions

ESRI Survey 123, GeoEvent

Manual

Cellular

Fiber



## 2 Sensing and Control

Metering and equipment which measures parameters such as flow, pressure, noise, water quality. Includes remote controlled equipment such as actuators



## 1 Physical Assets

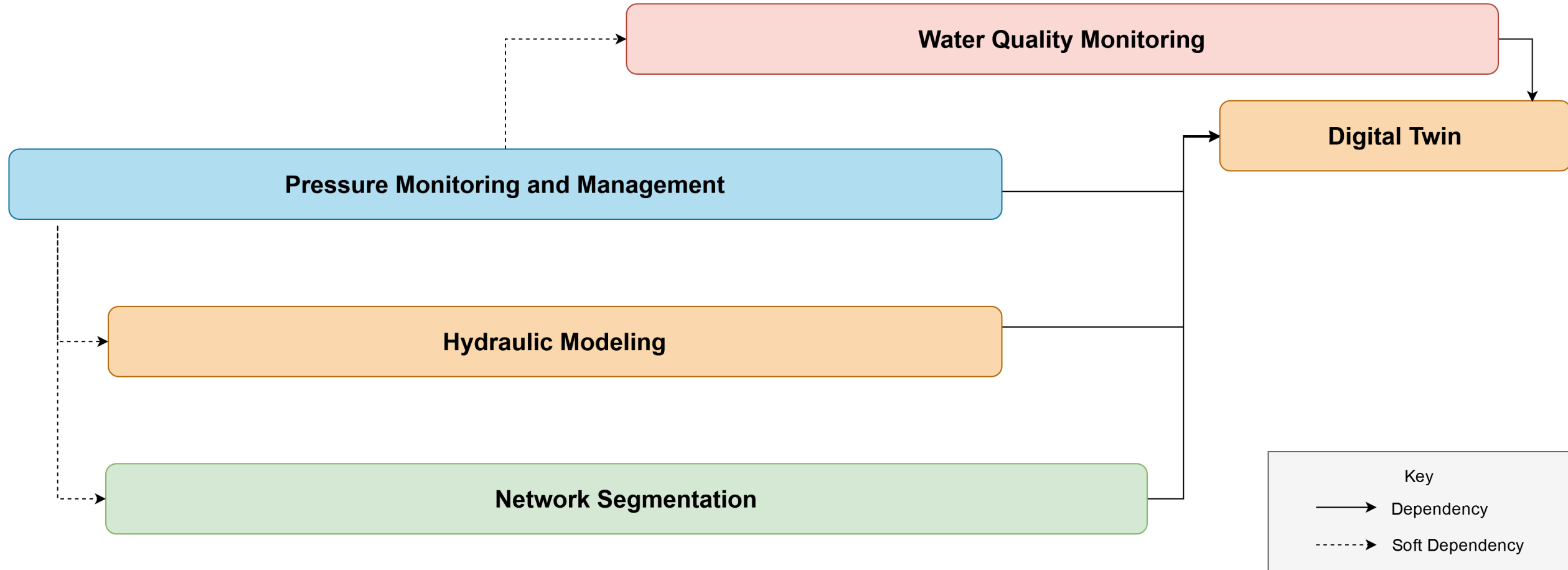
Pumps, Pipes, Pressure Reducing Valves, Tanks, etc

# HIGH LEVEL SMART WATER JOURNEY

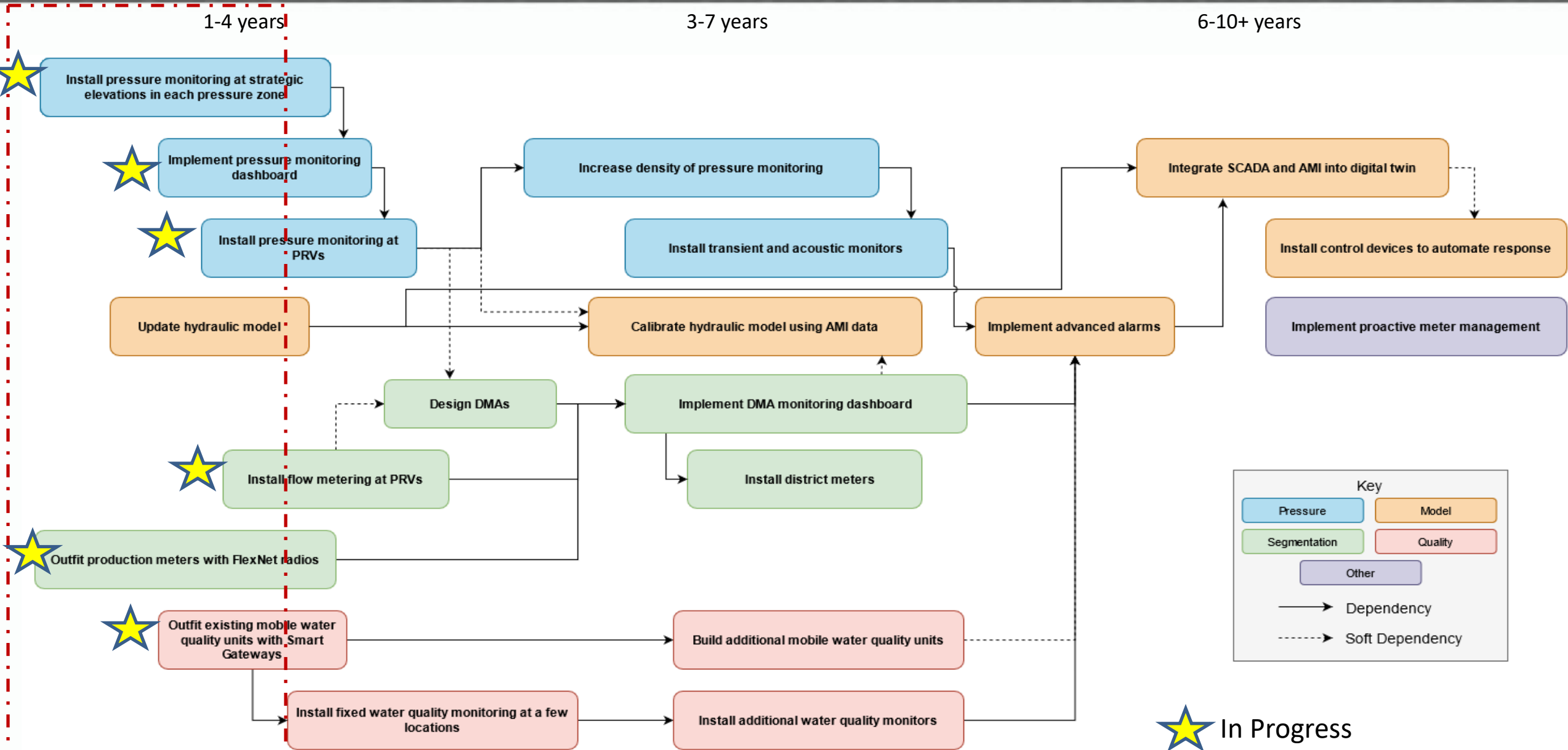
1-4 years

3-7 years

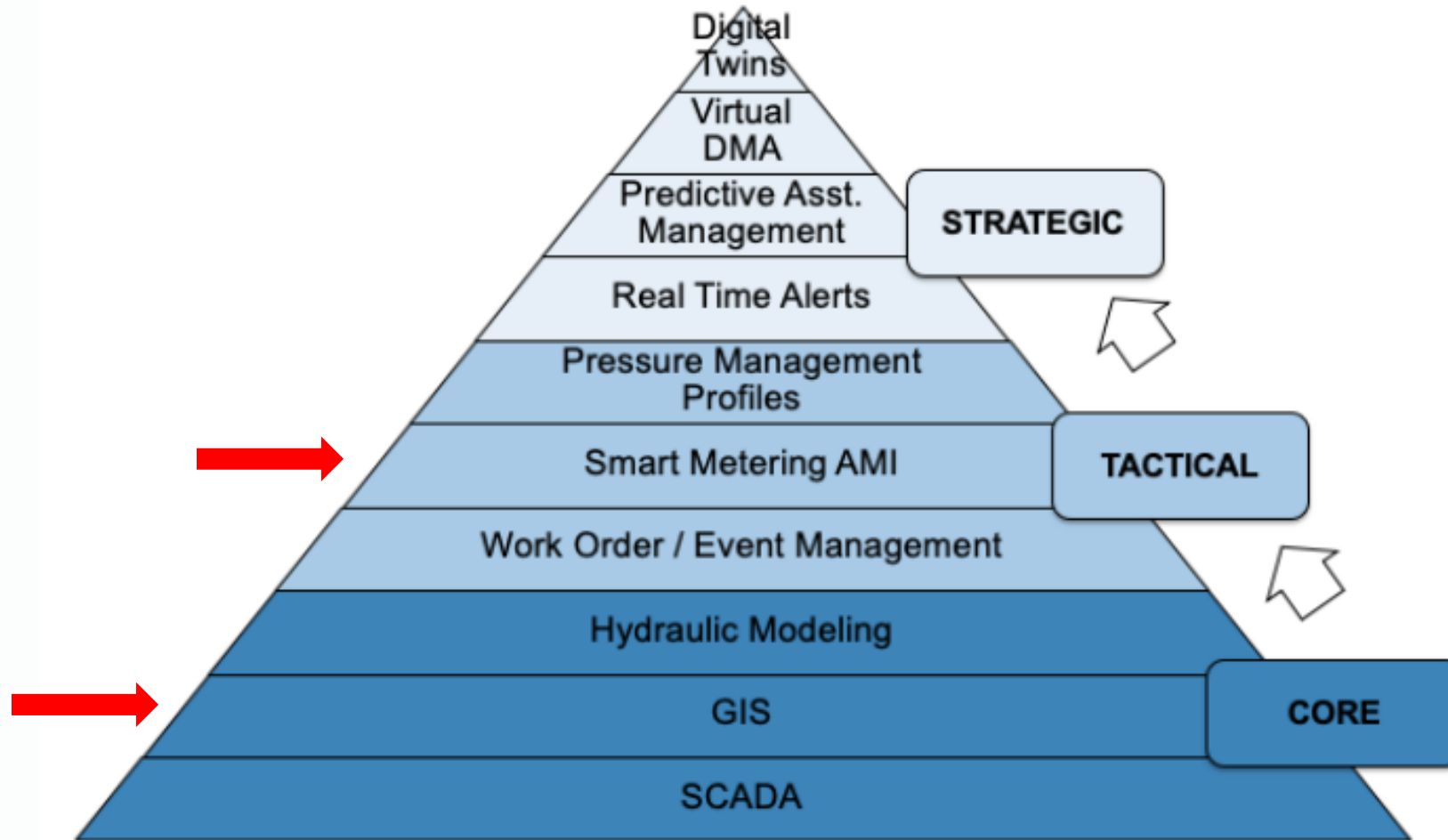
6-10+ years



# SMART WATER NETWORK ROADMAP PROGRESS



# GIS/ESRI IS FOUNDATIONAL TO THE SMART WATER JOURNEY



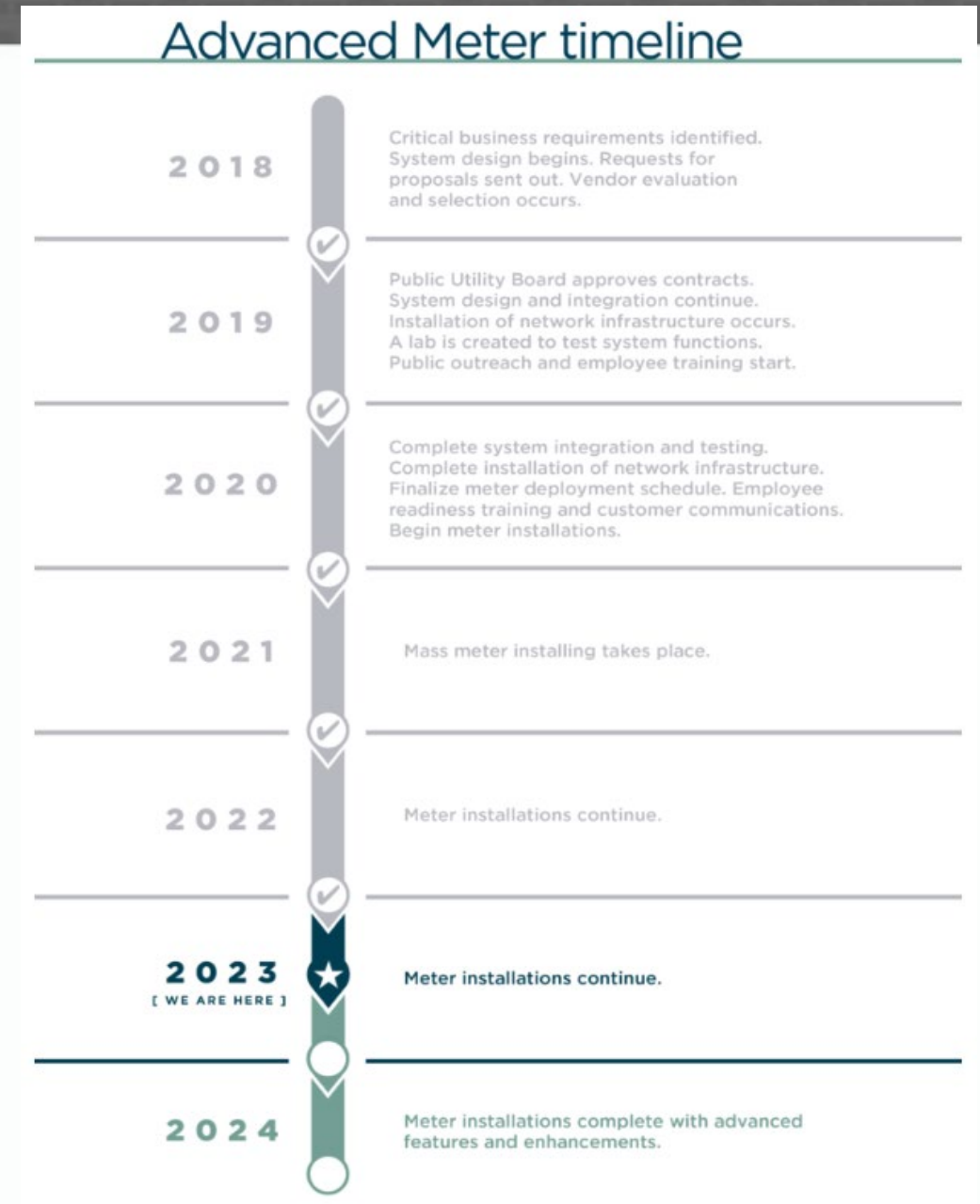
-GIS and Scada are fundamental building blocks

Figure 1: The digital journey pyramid

# USING ESRI TO BETTER COLLECT AND ACT ON DATA

## EXAMPLES FROM AMI DEPLOYMENT:

1. Meter box and lid survey
2. Survey evaluation and categorization
3. Meter box upgrade planning and work management by area
4. Deployment QA/QC partnership work process
5. Next day AMI active status updates





# AMI Meter Survey Project

## Lack of Data about our Meter Boxes:

- Caused a large variation in the Water portion of the AMI Project Costs
- Too many unknown factors
- *Literally guessing on the costs for the water part of the AMI project*

## So we decided to do a survey...

- We released an RFP for the Survey Work
  - 3 proposals were submitted from firms outside of Washington
  - All were expensive and paper based – between \$800K to \$900K
  - None of the submissions could meet the December 30<sup>th</sup> 2019 deadline
- Decided to Use Survey123 and ArcGIS Online
  - Hired temporary project staff
  - Created our own electronic Survey
  - Budget of \$480K - Goal of 80K surveys done by December 30<sup>th</sup> 2019




# AMI Meter Survey Project (Survey123)

Survey123 for ArcGIS Help Sign In

## Survey123 for ArcGIS


Smarter Forms, Smarter Field Work



Accurate Field Data Collection Made Easy


Replace unreliable paper-based data collection with a trustworthy digital solution that fits the needs of field personnel in diverse environments.

### TW Meter Survey



**A survey of Tacoma Water's Existing Meters**  
By asimpson@ci.tacoma.wa.us\_tacoma  
Created: 12/15/18  
Last modified: 9/24/19

Observed meter locations in preparation for the AMI project

 Collect >


### TW Meter Survey

**Meter Address:**

**New AMI Box & Lid: \***  
 No  Yes


**Observed Challenges: \***  
None

**Surrounding Env. Material: \***  
 Asphalt  Concrete  Dirt/Grass/Bark  Gravel/rocks  
 Brick/Paver  Other - Specify?

**Surrounding Env. Pic #1: \***  


**Meter Box Height to Grade: \***  
 > 6" Below Grade  
 0-6" Below Grade  
 At Grade  
 0-6" Above Grade  
 >6" Above Grade

**Box Type: \***

**Close-Up Pic of Meter Box w/Lid Off #2: \***  


**Lid Material: \***  
Concrete

**Lid Position: \***  
Sits in box on lip

**Lid Type: \***



# AMI Meter Survey Project (AGOL)

Home Gallery Map Scene Groups Content Organization

AMI Meter Survey Project 2019

Overview Content Members Settings

Add Item to Group Search group content List Title Filter

Filters 1 - 5 of 5 Filters Type: Apps X Clear filters

- Group Categories
  - AMI Project Tools (2)
  - AMI Survey Project Datasets (4)
- Item Type Clear
  - Maps
  - Layers
  - Scenes
  - Apps
    - Web Apps
    - StoryMaps
    - Mobile Apps
    - Desktop Apps
  - Registered Apps Only
- Tools
  - Files
  - Location
  - Date Modified
  - Tags
  - Shared
  - Collaboration

AMI Survey Dashboard  
Dashboard by asimpson@ci.tacoma.wa.us\_tacomawater  
AMI Survey Dashboard for evaluating different survey data real-time. This survey is being completed as part of the AMI project at TPU  
Created: Dec 20, 2018 Updated: Oct 21, 2019 View Count: 1,066  
Authoritative

Meter Survey Data - QA/QC  
Application by asimpson@ci.tacoma.wa.us\_tacomawater  
Created: Sep 11, 2019 Updated: Sep 11, 2019 View Count: 0  
Authoritative

Meter Survey Progress  
Insights Workbook by jchedick@ci.tacoma.wa.us\_tacomawater  
Created: Sep 20, 2019 Updated: Nov 7, 2019 View Count: 31

Meter Survey Progress App  
Web Mapping Application by asimpson@ci.tacoma.wa.us\_tacomawater  
2018 Tacoma Water Meter Survey Progress Application  
Created: Dec 16, 2018 Updated: Nov 7, 2019 View Count: 7,720  
Authoritative

Meter Survey Review Pictures  
Web Mapping Application by asimpson@ci.tacoma.wa.us\_tacomawater  
Created: Jul 18, 2019 Updated: Aug 14, 2019 View Count: 84

## ➤ Meter Survey Progress App (AGOL)

Meter Survey Progress App

Overview

Edit Thumbnail

Meter Survey Progress Map

Remove from Favorites

2018 Tacoma Water Meter Survey Progress Application

Web Mapping Application by asimpson@ci.tacoma.wa.us\_tacomawater

Created: Dec 16, 2018 Updated: Nov 7, 2019 View Count: 7,720

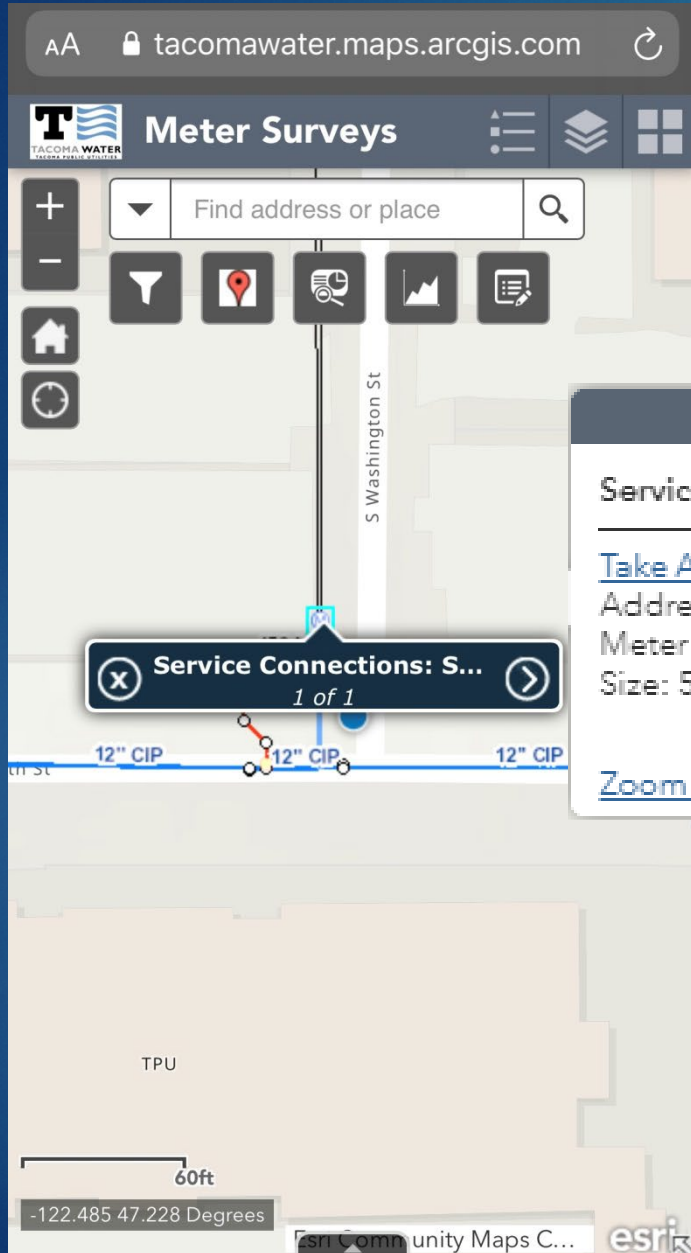
Authoritative

View Application

Edit Application



# Meter Survey Progress App (iPhone)



Service Connections: SC-0100060

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[Take A Meter Survey!](#)  
Address: 10621 11TH AVENUE CT S  
Meter #: 169715  
Size: 5/8"

[Zoom to](#) \*\*\*\*

**TW Meter Survey**

**Meter Address:**  
3410 S WASHINGTON ST

**New AMI Box & Lid: \***  
 No  Yes

**Observed Challenges: \***  
None

**Surrounding Env. Material: \***

<input type="checkbox"/> Asphalt	<input type="checkbox"/> Concrete
<input type="checkbox"/> Dirt/Grass/Bark	<input type="checkbox"/> Gravel/rocks
<input type="checkbox"/> Brick/Paver	<input type="checkbox"/> Other - Specify?

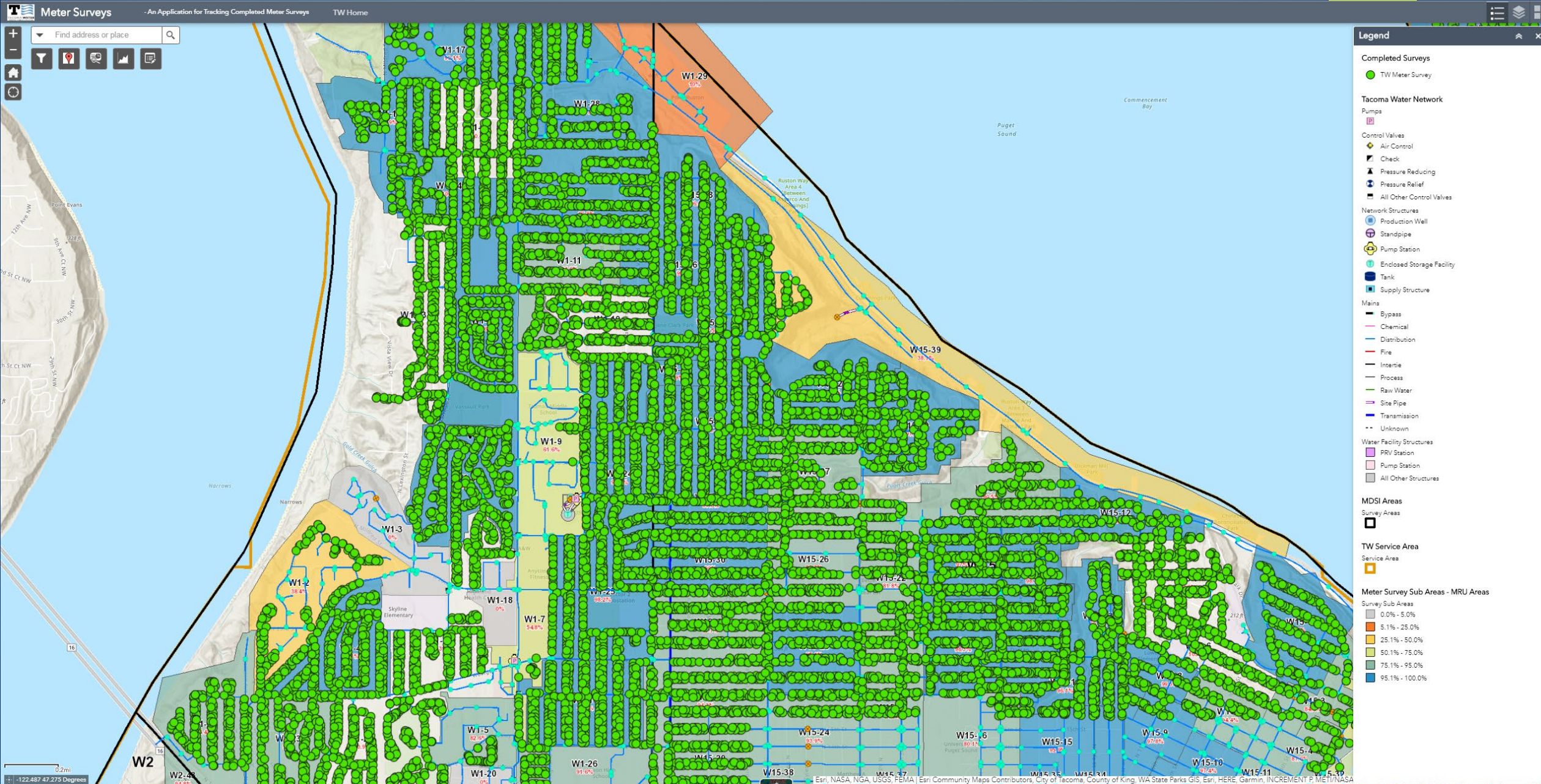
**Surrounding Env. Pic #1: \***

**Meter Box Height to Grade: \***

> 6" Below Grade  
 0-6" Below Grade  
 At Grade  
 0-6" Above Grade



# Meter Survey Progress App



# Finding the 445's

The screenshot shows a SharePoint site for the 'AMI Meter Survey Project 2019'. The top navigation bar includes 'Home', 'Gallery', 'Map', 'Scene', 'Groups', 'Content', and 'Organization'. The user 'Andy Simpson' is logged in. The site has tabs for 'Overview', 'Content', 'Members', and 'Settings'. A search bar and 'Add Item to Group' button are visible. The left sidebar contains filters for 'Group Categories', 'Item Type', 'Tools', and 'Files'. The main content area displays a list of items with the following details:

- AMI Survey Dashboard**: Dashboard by asimpson@ci.tacoma.wa.us\_tacomawater. Description: AMI Survey Dashboard for evaluating different survey data real-time. This survey is being completed as part of the AMI project at TPU. Created: Dec 20, 2018. Updated: Oct 21, 2019. View Count: 1,066. Status: Authoritative.
- Meter Survey Data - QA/QC**: Application by asimpson@ci.tacoma.wa.us\_tacomawater. Created: Sep 11, 2019. Updated: Sep 11, 2019. View Count: 0. Status: Authoritative.
- Meter Survey Progress**: Insights Workbook by jchedick@ci.tacoma.wa.us\_tacomawater. Created: Sep 20, 2019. Updated: Nov 7, 2019. View Count: 31.
- Meter Survey Progress App**: Web Mapping Application by asimpson@ci.tacoma.wa.us\_tacomawater. Description: 2018 Tacoma Water Meter Survey Progress Application. Created: Dec 16, 2018. Updated: Nov 7, 2019. View Count: 7,720. Status: Authoritative.
- Meter Survey Review Pictures**: Web Mapping Application by asimpson@ci.tacoma.wa.us\_tacomawater. Created: Jul 18, 2019. Updated: Aug 14, 2019. View Count: 84.

➤ AMI Meter Survey Dashboard

This block provides a detailed view of the 'AMI Survey Dashboard' item. It includes a thumbnail image and a larger preview image of the dashboard interface. The dashboard features a map, a pie chart, and various data visualizations. The text below the images reads: 'AMI Survey Dashboard', 'Dashboard by asimpson@ci.tacoma.wa.us\_tacomawater', 'AMI Survey Dashboard for evaluating different survey data real-time at TPU', 'Created: Dec 20, 2018 Updated: Oct 21, 2019 View Count: 1,066', and 'Authoritative'.



# Finding the 445's

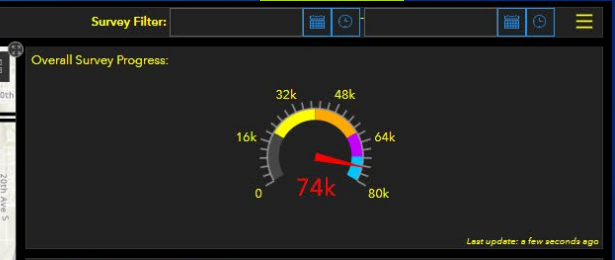
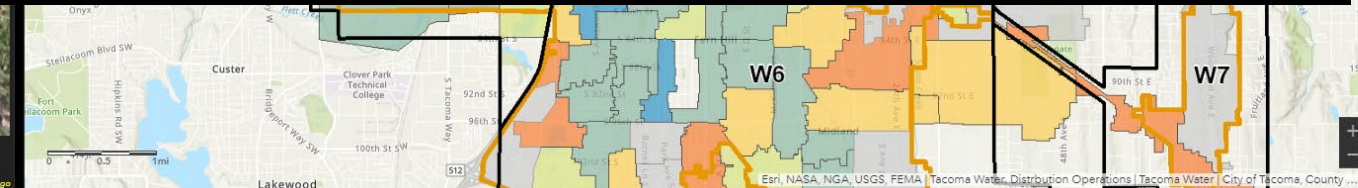
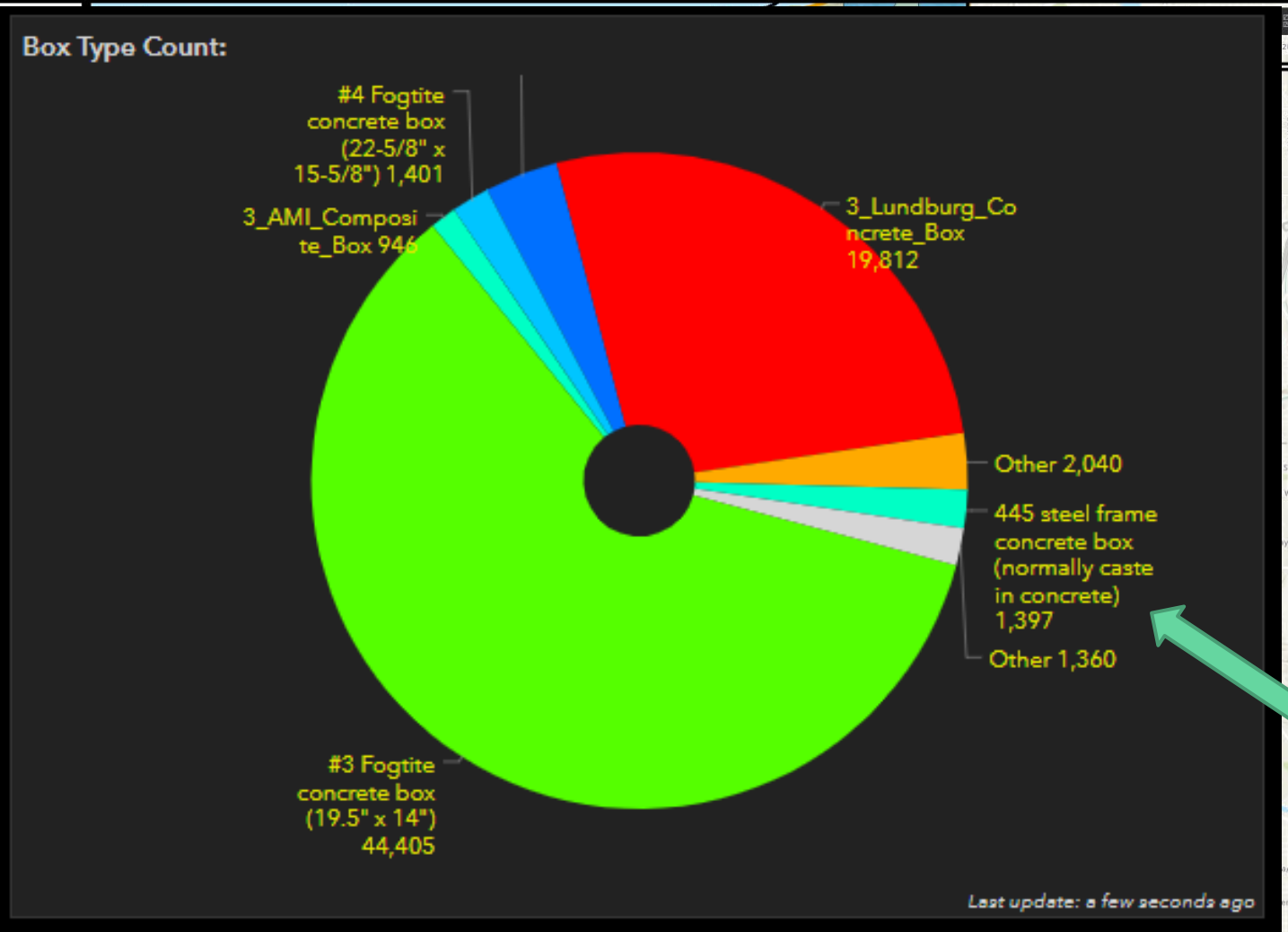
Meter Survey Dashboard

Survey's Completed in the Past 12 hours:

●	Facility ID: SC-0044531 - Date: 11/14/2019, 3:51 PM Address: 4057 E SPOKANE ST Survey Taker: Anthony Garza
●	Facility ID: SC-0044768 - Date: 11/14/2019, 3:51 PM Address: 4060 E SPOKANE ST Survey Taker: Dutch Mylan
●	Facility ID: SC-0044438 - Date: 11/14/2019, 3:50 PM Address: 857 E 43RD ST Survey Taker: Anthony Garza
●	Facility ID: SC-0044503 - Date: 11/14/2019, 3:50 PM Address: 4056 E SPOKANE ST Survey Taker: Dutch Mylan
●	Facility ID: SC-0044505 - Date: 11/14/2019, 3:49 PM Address: 4048 E SPOKANE ST Survey Taker: Dutch Mylan

Survey Picture Review:  
Survey ID: SC-0044531 - 11/14/2019, 3:51 PM

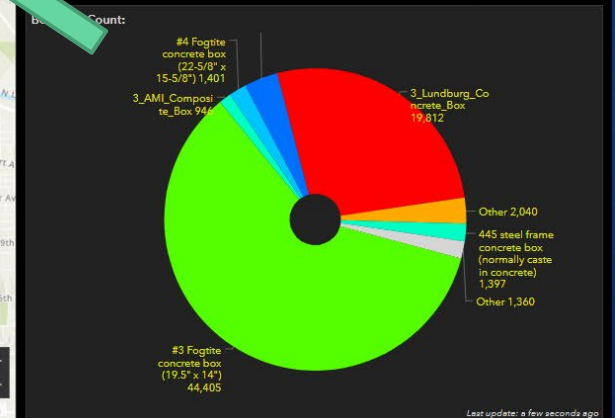
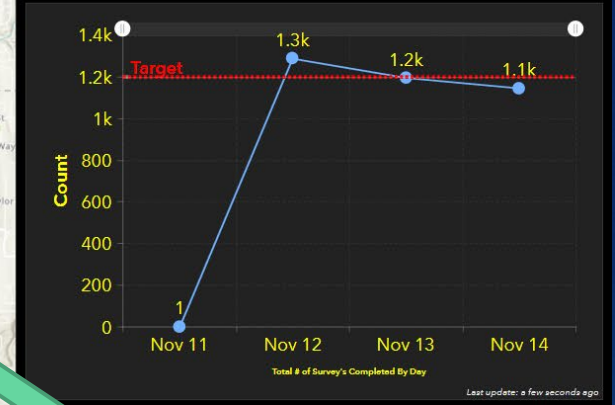
SURENPIC-20191114-235206.jpg



Need More Surveys for Daily Goal:

**1,145**  
1,200

Last update: a few seconds ago



# Work Management

## QA 1

## QA 2

Initial 104k Surveys Completed

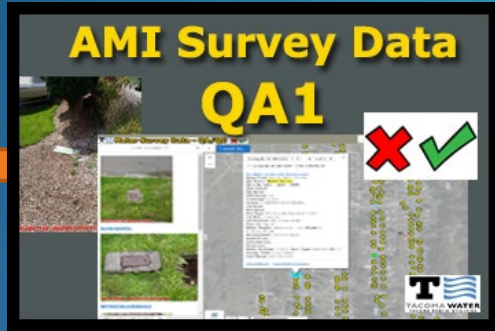
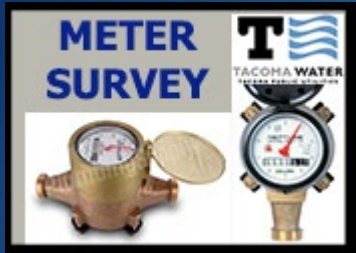
Review the Surveys and Pictures

QA 1 Work Gathered into Projects and sent to SAP

### AMI Survey Data Analysis



Ready for AMI Deployment



>> SAP Notif. & Work Force Assignments Created



>> Workforce Assignments and SAP Notif. (W2) Evaluated and parsed into buckets



MIV Ready?

- Yes
- No
- Unsure






# AMI METER BOX SURVEY EVALUATIONS

**TACOMA WATER** **AMI Survey Data Review - QA1**  

QA1 App Instructions



Welcome. To begin a new Meter Survey QA/QC Session, please click on the link below:

[<<< CLICK HERE >>>](#)

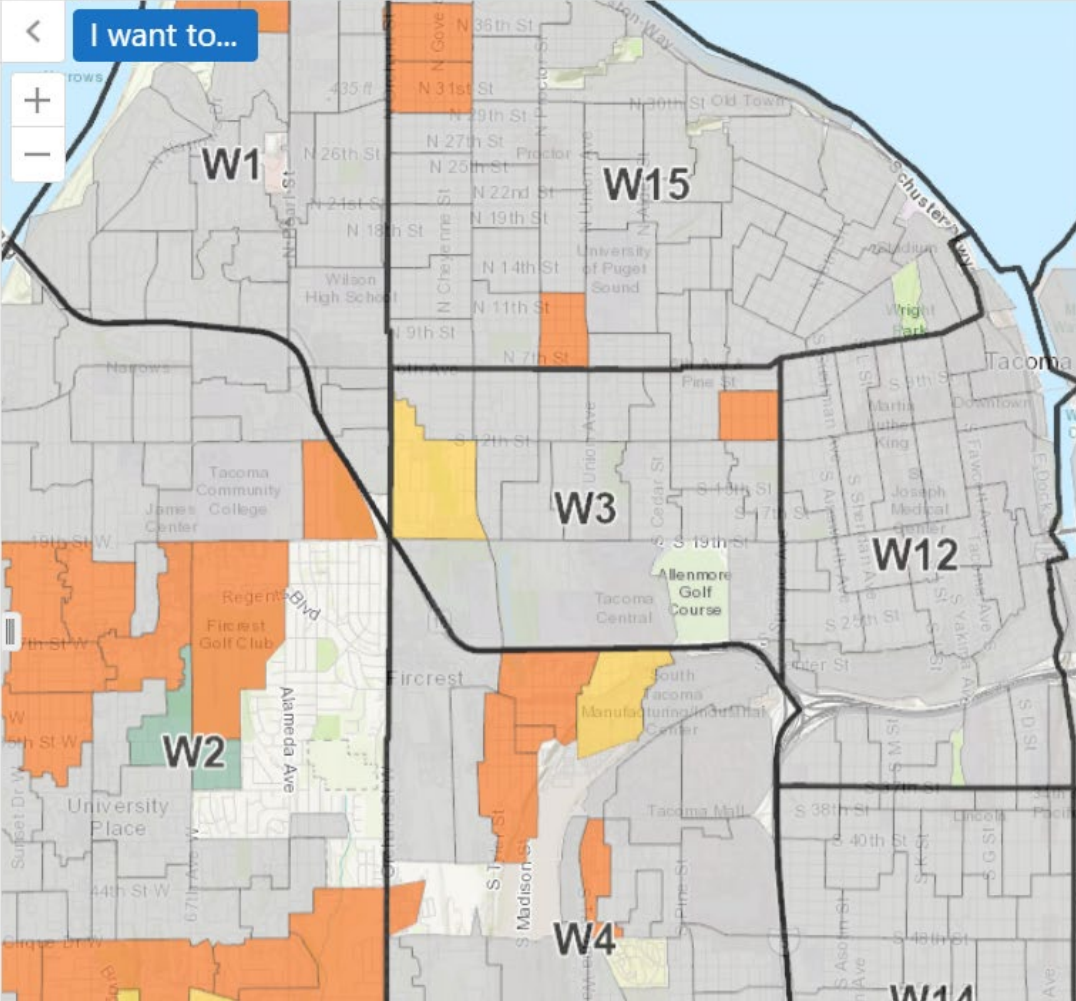
[Meter Survey QA/QC](#)

[QA Instructions](#)

[How To QA Video](#)

[QA Progress Dashboard](#)

[Find MIV Unknowns](#)



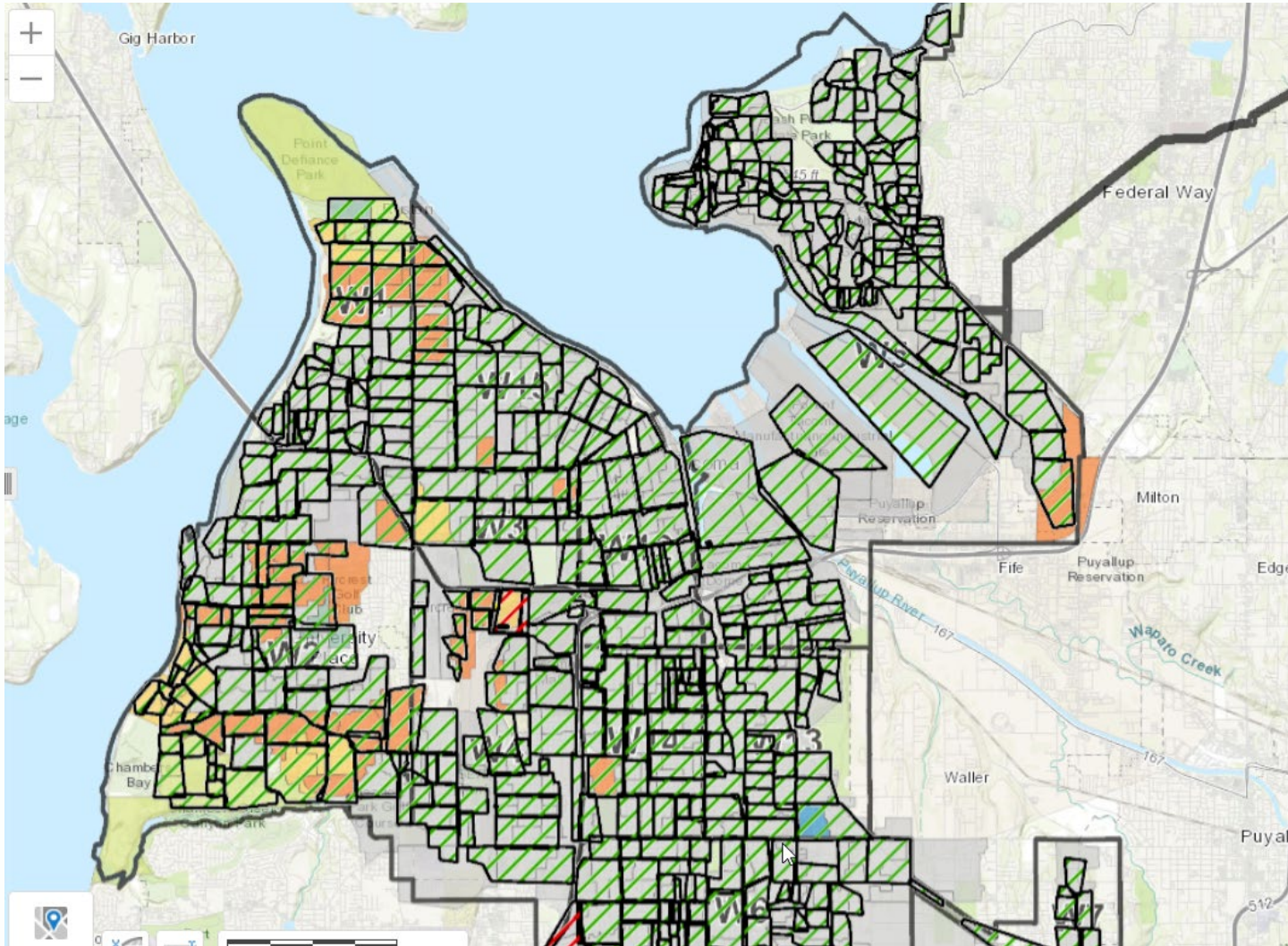
## Benefits

- Enabled field staff to work from home at beginning of COVID-19
- Photos of assets enable evaluation beyond data reported and to validate or correct data

## Challenges

- Identifying clear output
- Setting evaluation standards and training

# AMI PREP WORK PLANNING BY SUB AREAS



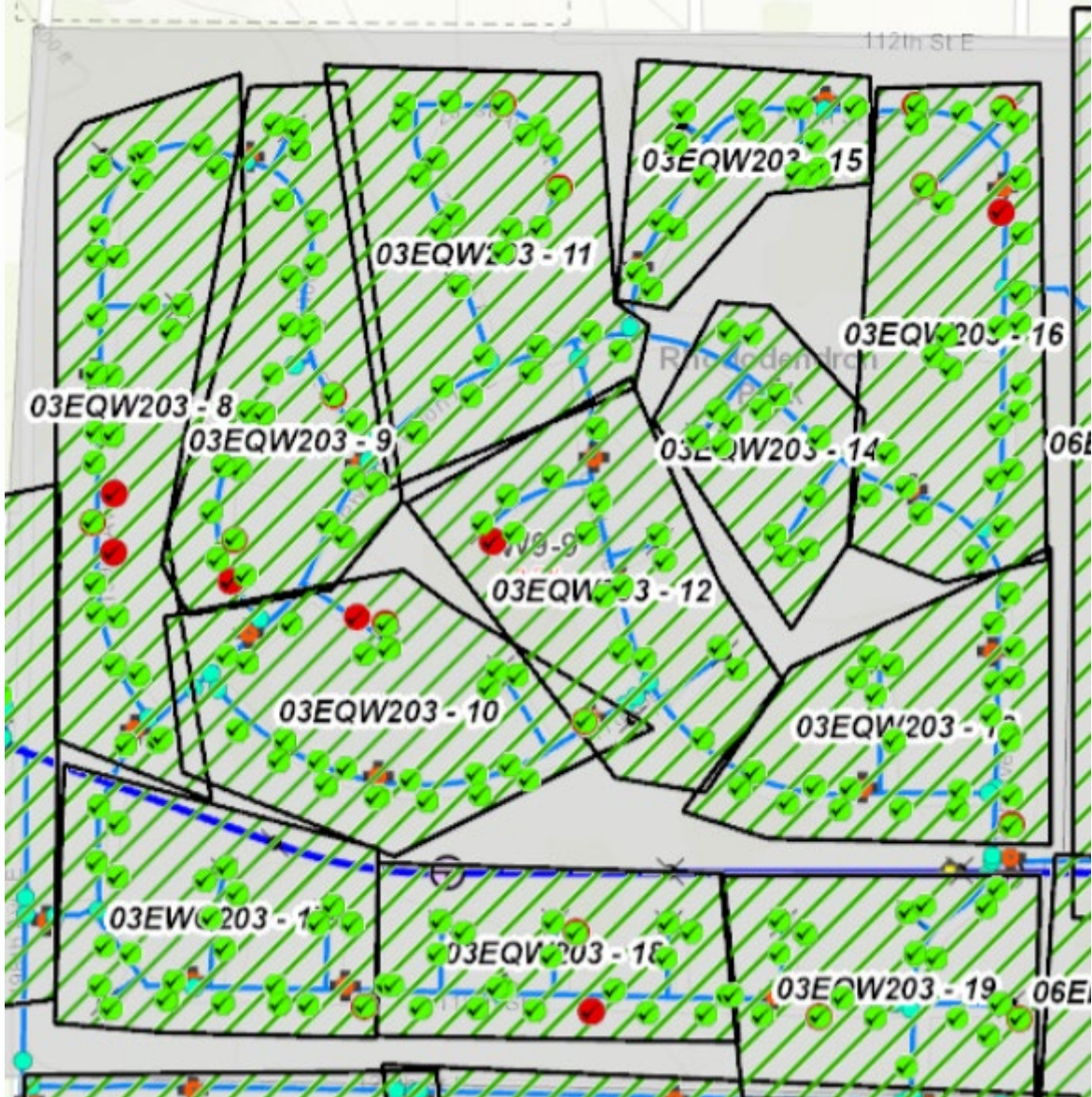
## Benefits:

- Planning by area improved efficiency for field staff
- Scripting automated creation of work tasks for field staff

## Challenges:

- 20k+ follow up inspections to confirm AMI ready
- 1,790 Work Orders to make service AMI Read
- Multiple status tracking in one view

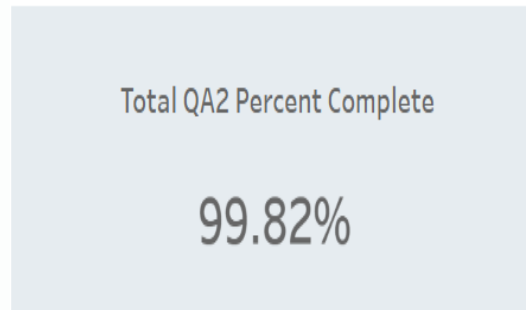
# METER BOX IMPROVEMENT WORK MANAGEMENT



## AMI Meter Survey Progress Dashboard

Operational Technology | System & Asset Planning  
Manual refresh weekly | Last refresh 4.26.2023  
Questions? Contact [dmartin@cityoftacoma.org](mailto:dmartin@cityoftacoma.org)

### Total Meter Box Improvements Identified



### QA2 Complete by W Area

W Area	Count of FL	Total QA2 Identified	QA2 Complete	QA2 In Progress	QA2% Complete
W12	5,139	459	459	0	100.00%
W14	7,596	1,843	1,843	0	100.00%
W4	7,546	846	846	0	100.00%
W13	7,175	958	958	0	100.00%
W6	9,062	3,076	3,076	0	100.00%
W2	11,631	2,004	2,004	0	100.00%
W1	6,549	1,330	1,330	0	100.00%
W15	10,322	853	853	0	100.00%
W3	4,247	345	345	0	100.00%
W5	13,383	3,567	3,567	0	100.00%
W8	5,950	3,537	3,537	0	100.00%
W9	8,402	3,065	3,065	0	100.00%
W10	87	43	0	43	0.00%
Grand Total	97,009	21,926	21,883	43	

### Follow On Work Progress by W Area

W Area	Total Follow On Work Identified	Needs Work Order	WO Total	Is Complete?	In Progress	% Complete
W12	153	1	79	79	0	100%
W14	72	0	87	87	0	100%
W4	124	0	123	123	0	100%
W13	88	0	98	98	0	100%
W6	321	0	331	331	0	100%
W2	170	0	145	143	2	99%
W1	63	0	55	29	26	53%
W15	72	0	63	17	46	27%
W7	188	0	169	122	47	72%
W8	133	0	125	118	7	94%
W9	234	0	217	132	85	61%
W10	0	0	0	0	0	
W5	296	2	264	63	201	24%
W3	29	0	34	34	0	100%
Grand Total	1,943	3	1,790	1,376	414	77%




# AMI DEPLOYMENT MIV - AUDIT RESOLUTION SURVEY

MIV Installation QA/QC

Enter or Scan Meter Number\*

Picture of surrounding environment (5 feet on all sides)\*

Drop image here or select image 

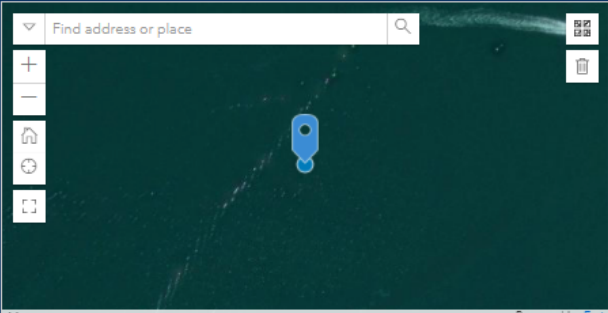
Does MIV Meter Installation meet Water's expectations?\*

Yes

No

Field Location

Find address or place



Powered by Esri

Lat: 47.605550 Lon: -122.358770

Powered by ArcGIS Survey123

## Benefits:

- Leveraged mobile phone app staff is already familiar with
- Shared environment between Utility and MIV
- Eliminated need for weekly meetings
- Resolution photos eliminated validation field visits

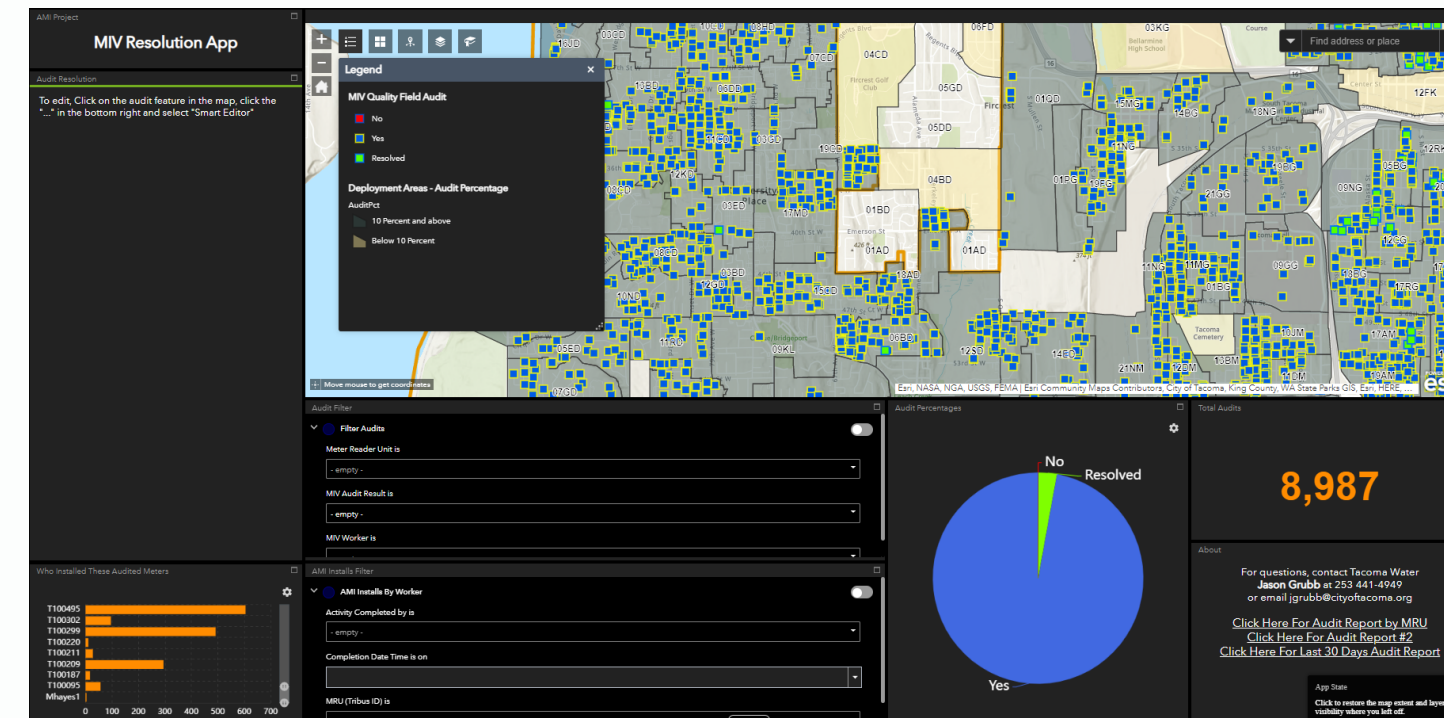
## Challenges:

- MIV mobile phone security
- Where and who to audit
- What problem are we trying to solve?

# AMI DEPLOYMENT AUDIT RESOLUTION

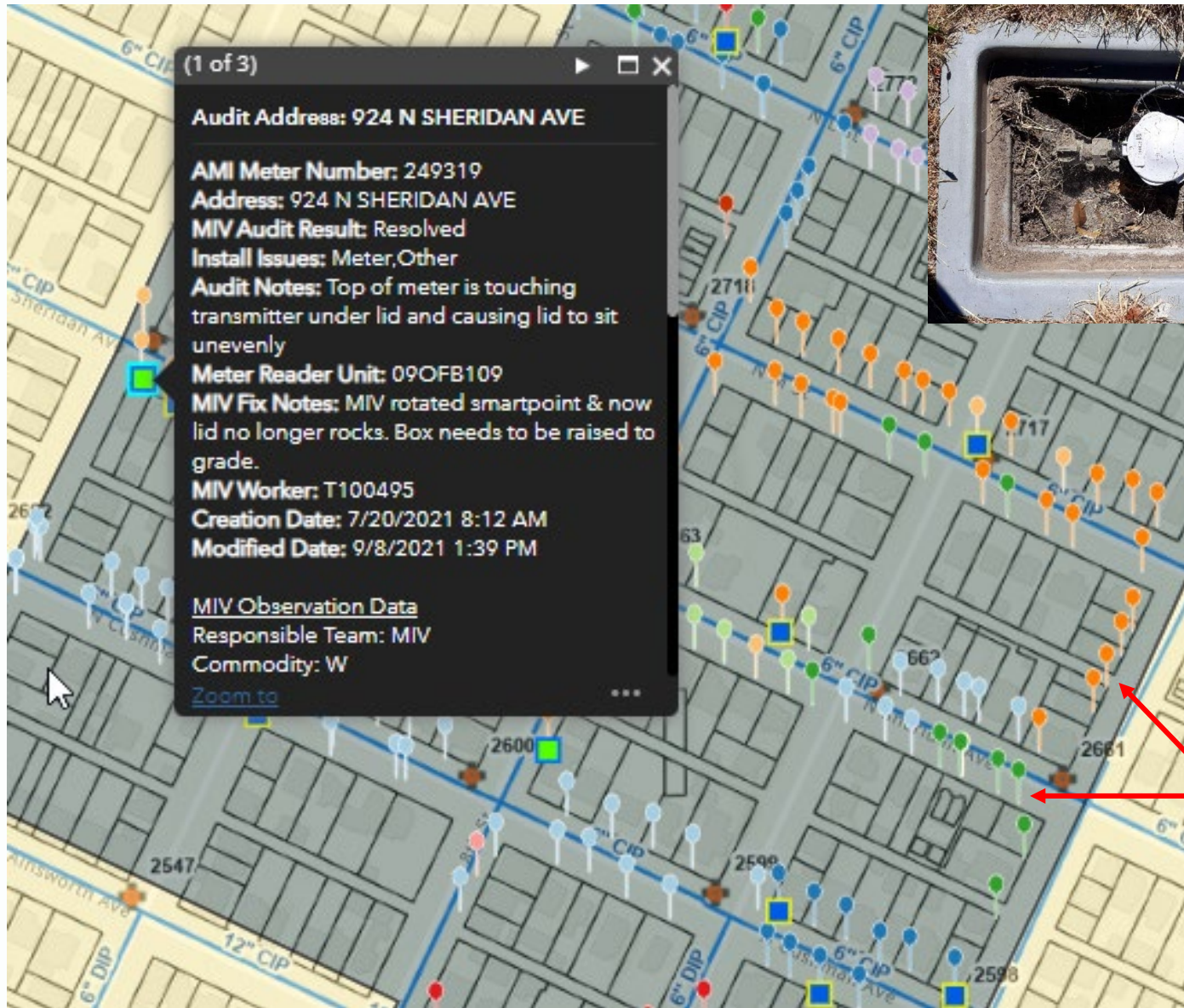
All Tribus Workers with Installs Last 30 days										
Worker	Installs Last 30 days	Most Recent Install Date	Total Installs	10% Audit	30% Audit	Total Audits	Acceptable Fails 10%	Acceptable Fails 30%	Failed Audits	Action
T100299	225	January 12	4541	455	1363	460	46	137	26	Audit For Worker is Complete
T100302	230	January 12	918	92	276	64	10	28	0	Need to complete more audits to reach 10%
T100495	204	January 12	4768	477	1431	563	48	144	24	Audit For Worker is Complete
T100528	206	January 12	4345	435	1304	506	44	131	17	Audit For Worker is Complete
T100538	45	January 10	1686	169	506	272	17	51	6	Audit For Worker is Complete
T100540	222	January 12	4444	445	1334	470	45	134	13	Audit For Worker is Complete
T100541	199	January 11	4373	438	1312	484	44	132	21	Audit For Worker is Complete
T100544	190	January 11	4911	492	1474	580	50	148	29	Audit For Worker is Complete
T100560	192	January 11	4727	473	1419	474	48	142	28	Audit For Worker is Complete
T100720	189	January 12	3239	324	972	296	33	98	3	Need to complete more audits to reach 10%
T100721	244	January 11	3834	384	1151	346	39	116	2	Need to complete more audits to reach 10%
T100796	188	January 11	3208	321	963	231	33	97	1	Need to complete more audits to reach 10%
T100818	226	January 12	917	92	276	27	10	28	0	Need to complete more audits to reach 10%
T100869	199	January 11	2587	259	777	172	26	78	2	Need to complete more audits to reach 10%
<b>Tribus Totals</b>	<b>2759</b>		<b>48498</b>	<b>4856</b>	<b>14558</b>	<b>4945</b>	<b>493</b>	<b>1464</b>	<b>172</b>	

- Weekly Report for last 30 days of audits by MIV installer. Yellow highlights where more audits are needed to reach 10% goal



- Dashboard could then be used to identify where to audit.
- MIV also used the Dashboard to identify failed audits needing resolution.

# AMI DEPLOYMENT AUDIT RESOLUTION



Audit by Utility

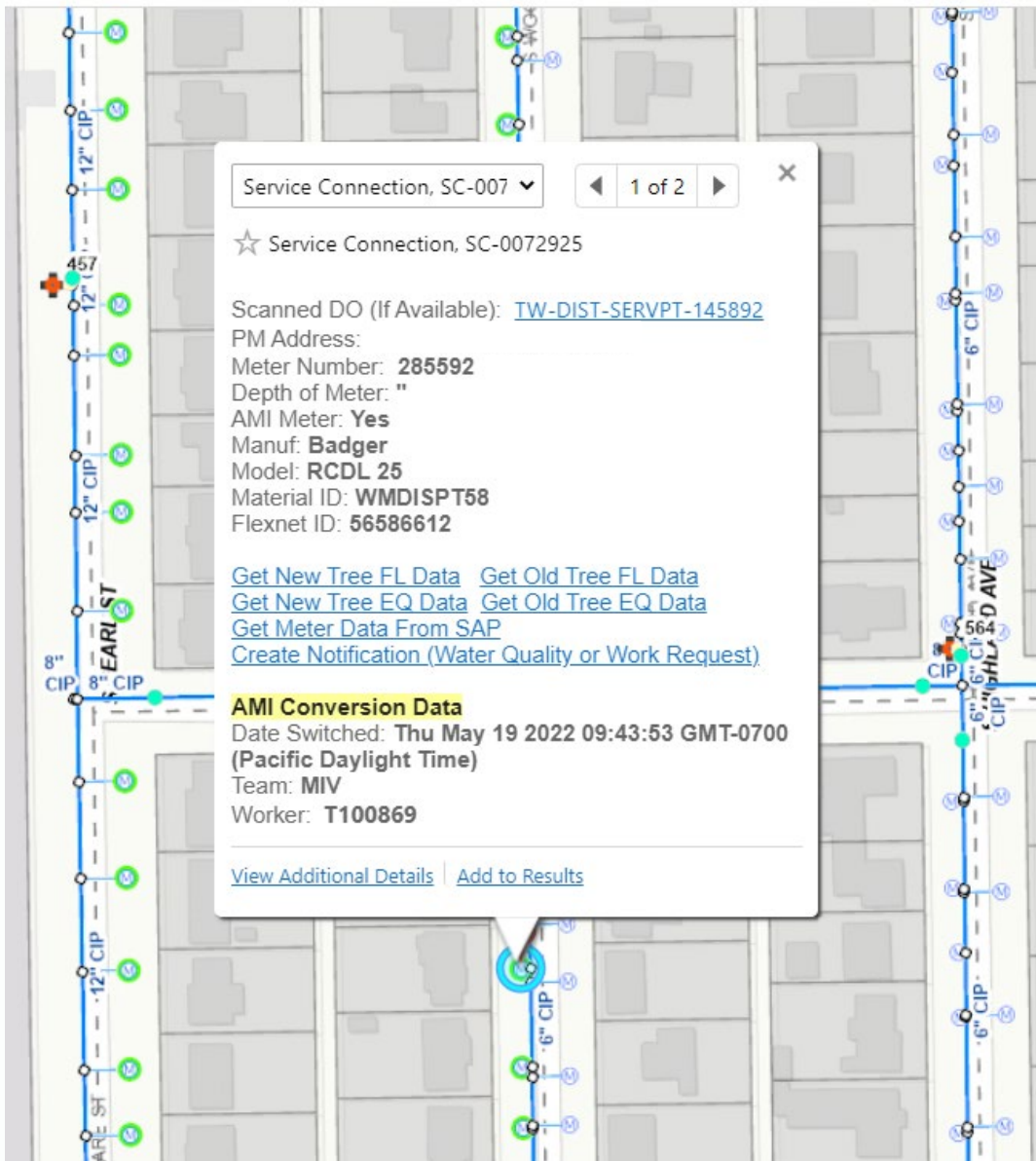


Validation of Resolution



Colors identify individual installers

# DAILY AMI METER STATUS UPDATES



## Benefits

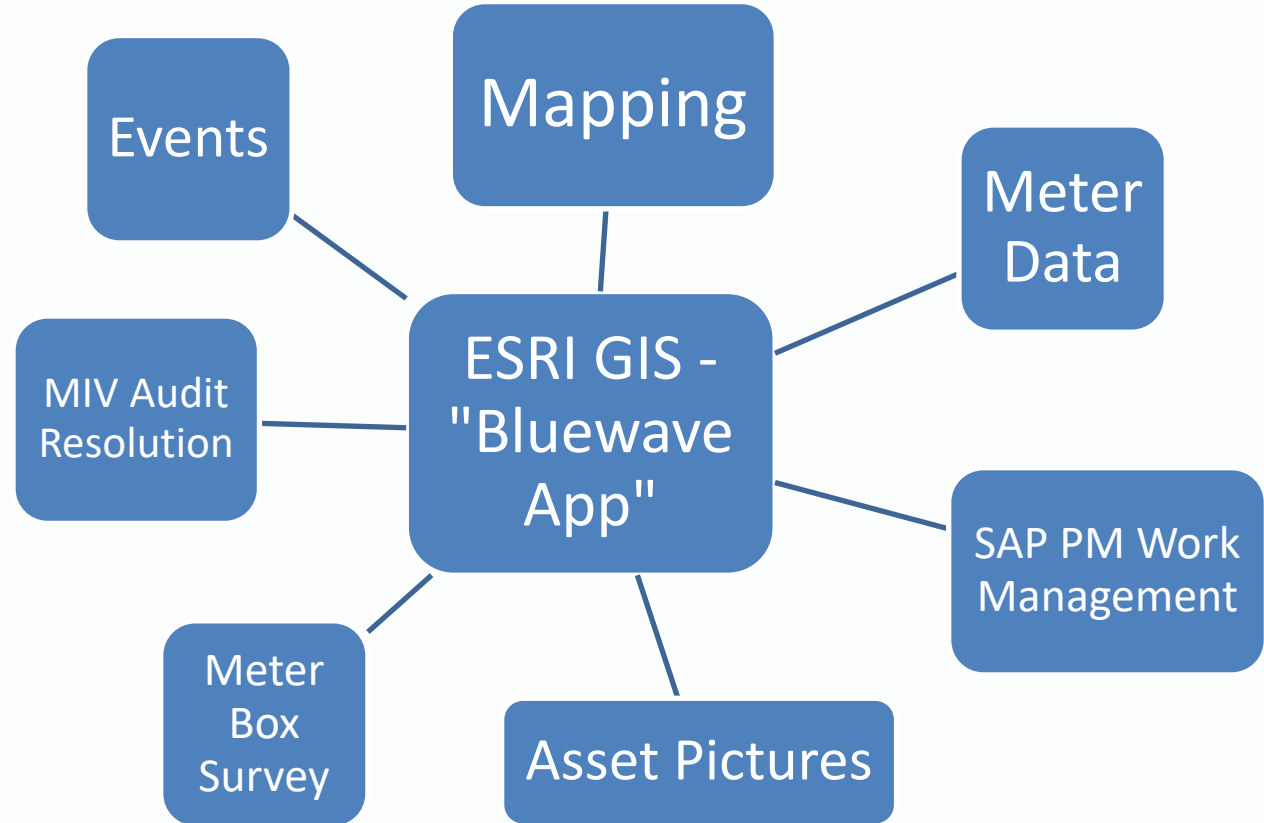
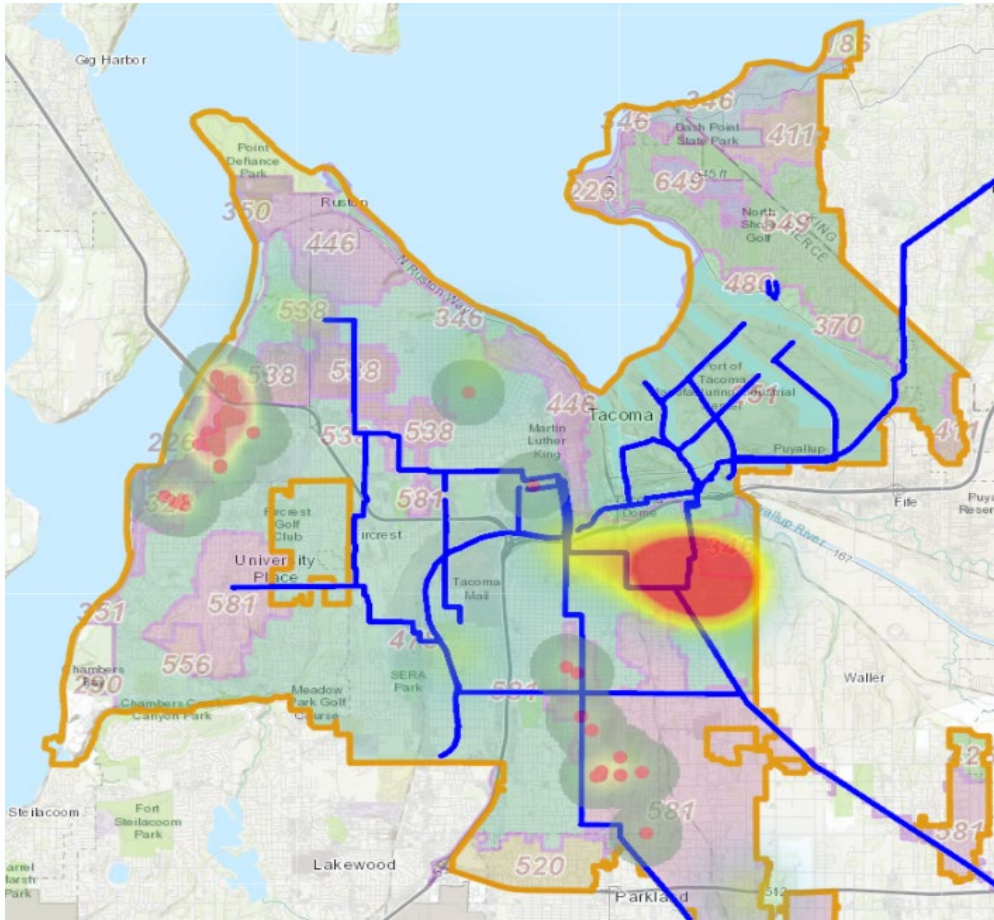
- Platform available to all staff
- Visually identify AMI status
- Quick source for identifying who installed and when for trouble shooting

## Challenges

- Data structures in SAP were not readily accessible and took some work to automate
- Multiple status tracking in one view

# LESSON LEARNED UTILIZING ESRI TO BETTER COLLECT & ACT ON DATA

ESRI has become the hub staff have come to rely upon for asset and meter information.



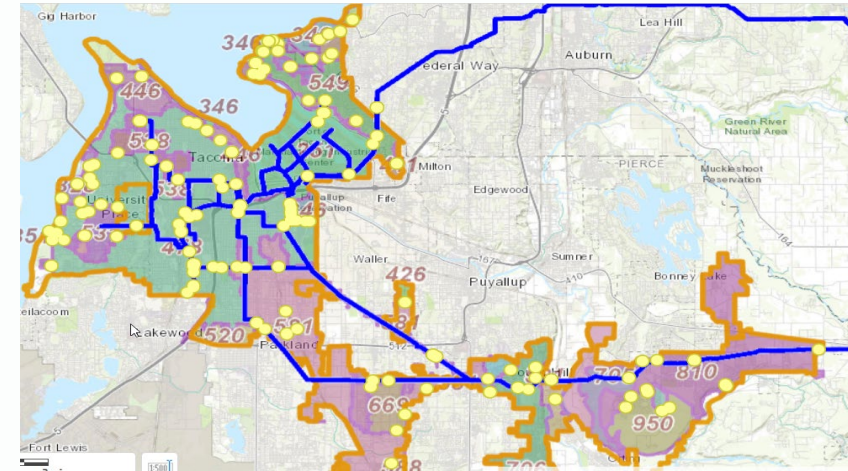
Can ESRI also become a hub for operational data to better measure, analyze & act on system events?



# THE BIG PICTURE – BRINGING IT ALL TOGETHER

## 1. COMMON OPERATING VIEW (2025-26)

- Sensors from multiple sources available in one operational view.
- Near real time refresh rate
- Foundational sources: SCADA, AMI, Quality, ESRI
- Compare dynamic sensor to static modeled values



## 2. DIGITAL TWIN: DYNAMIC INTEGRATED MODEL (2029-30)

A digital twin is the **assimilation of data and a computer model** that helps operators **understand how a physical asset, process or system should be performing**, and helps to **predict performance under changing conditions**.



**Detect and diagnose anomalies**



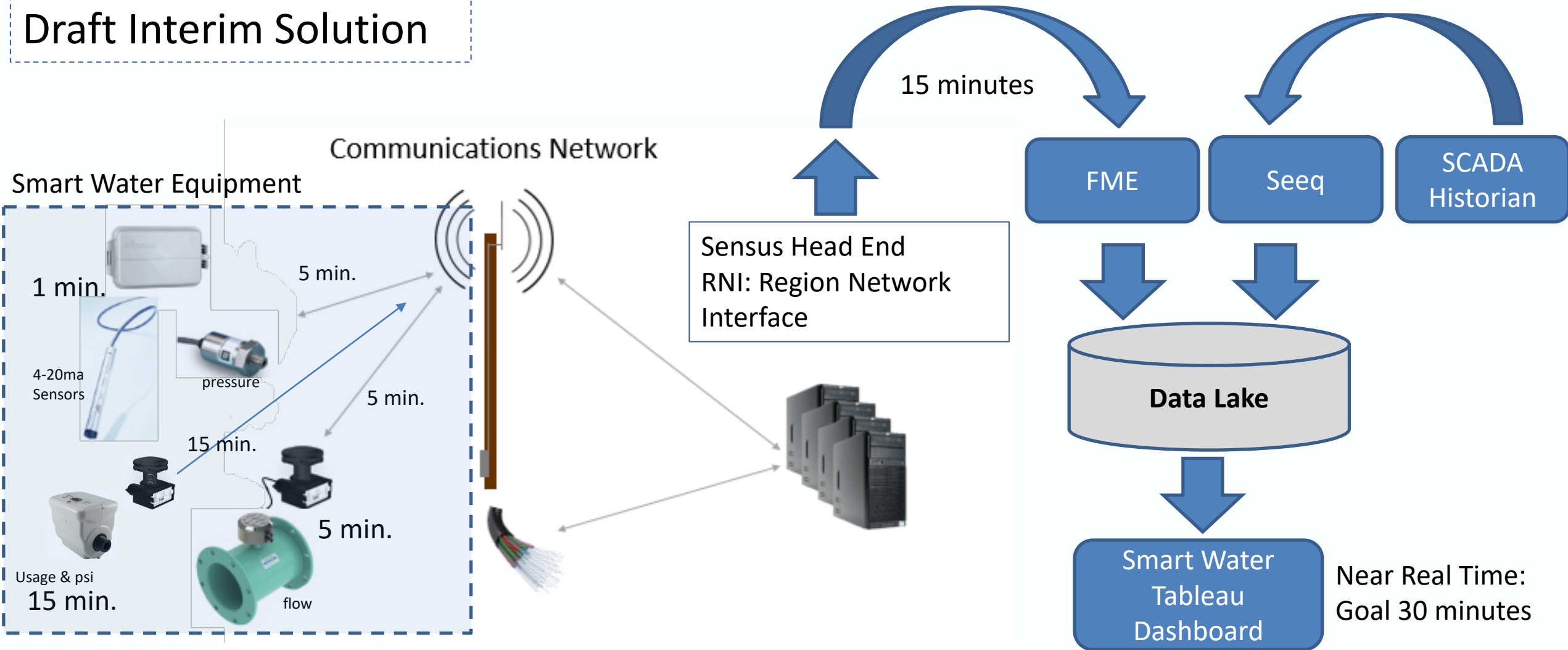
**Test different scenarios**



**Predict outcomes**

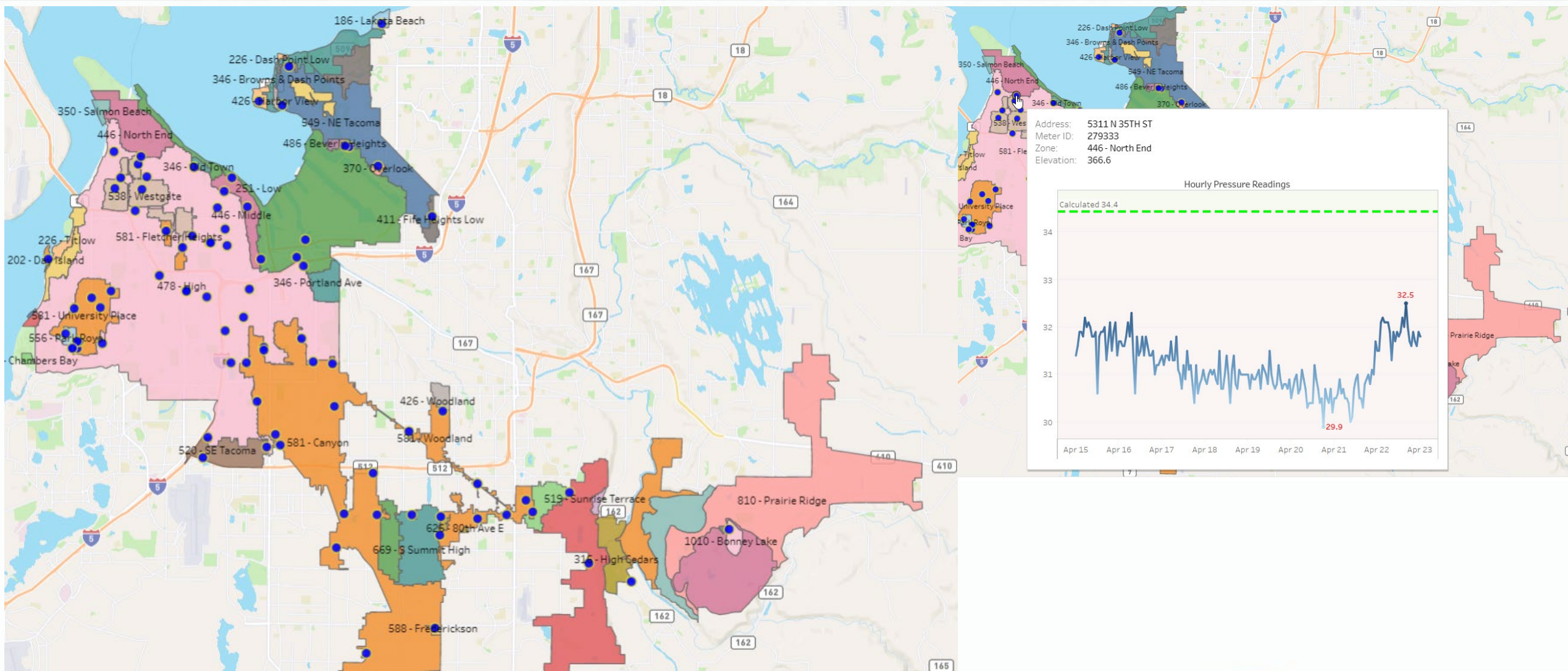
# LEVERAGING FLEXNET NETWORK FOR NEAR REAL TIME AWARENESS

## Draft Interim Solution

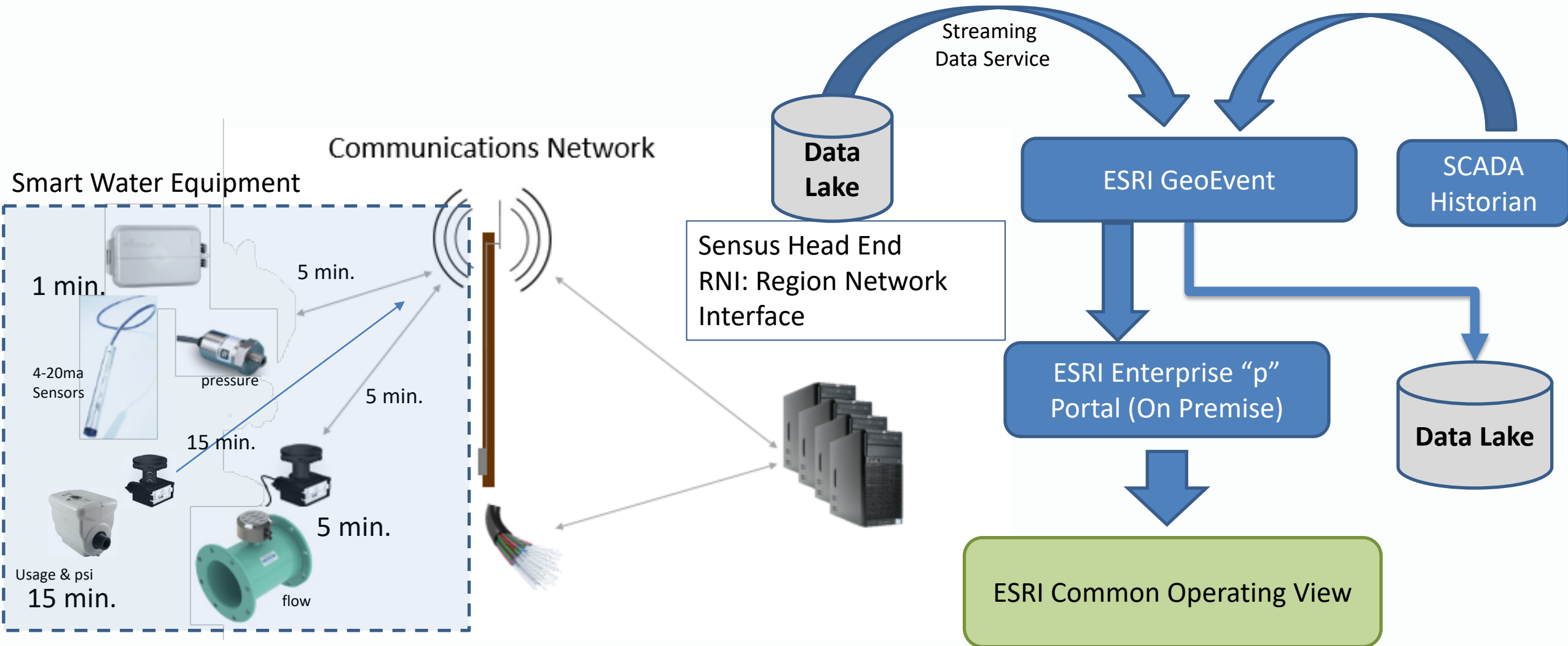


- 1-15 minute sample rate
- 5-15 minute transmission rate

# DRAFT TABLEAU DASHBOARD



# FUTURE STATE – TO INVESTIGATE



- 1-15 minute sample rate
- 5-15 minute transmission rate

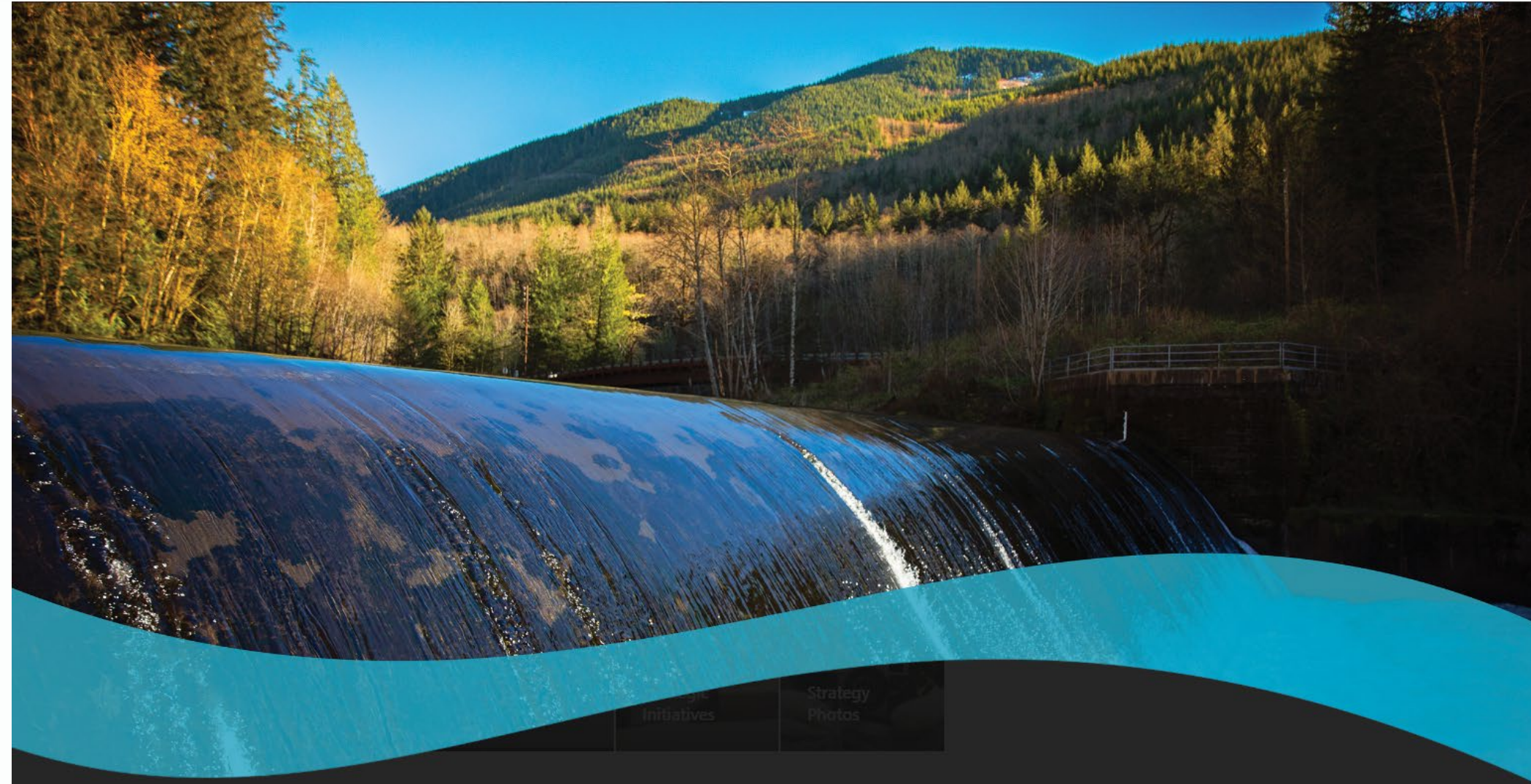
# NEXT STEPS ON THE JOURNEY

1. Continue installing sensors at strategic sites throughout the distribution system
2. Pilot GeoEvent architecture with AMI sensors from Sensus Headend (RNI)
3. Evaluate ESRI pilot as possible platform for Common Operation View

## Keys to success

- Start simple, add complexity as understanding matures
- Don't be afraid to fail; fail small and quickly
- Expand access to the sensor data to more staff
- Consistent progress is better than no progress
- Refresh the roadmap vision as technology changes

# QUESTIONS?



Initiatives

Strategy  
Photos