

Rebuilding Tacoma Water's Hydraulic Model to Embrace SmartWater

Doug Lane, Tacoma Water

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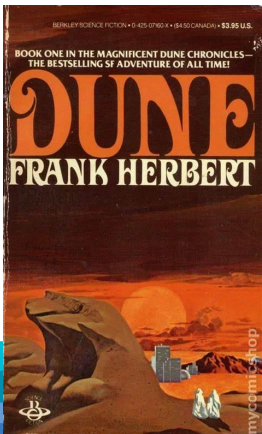
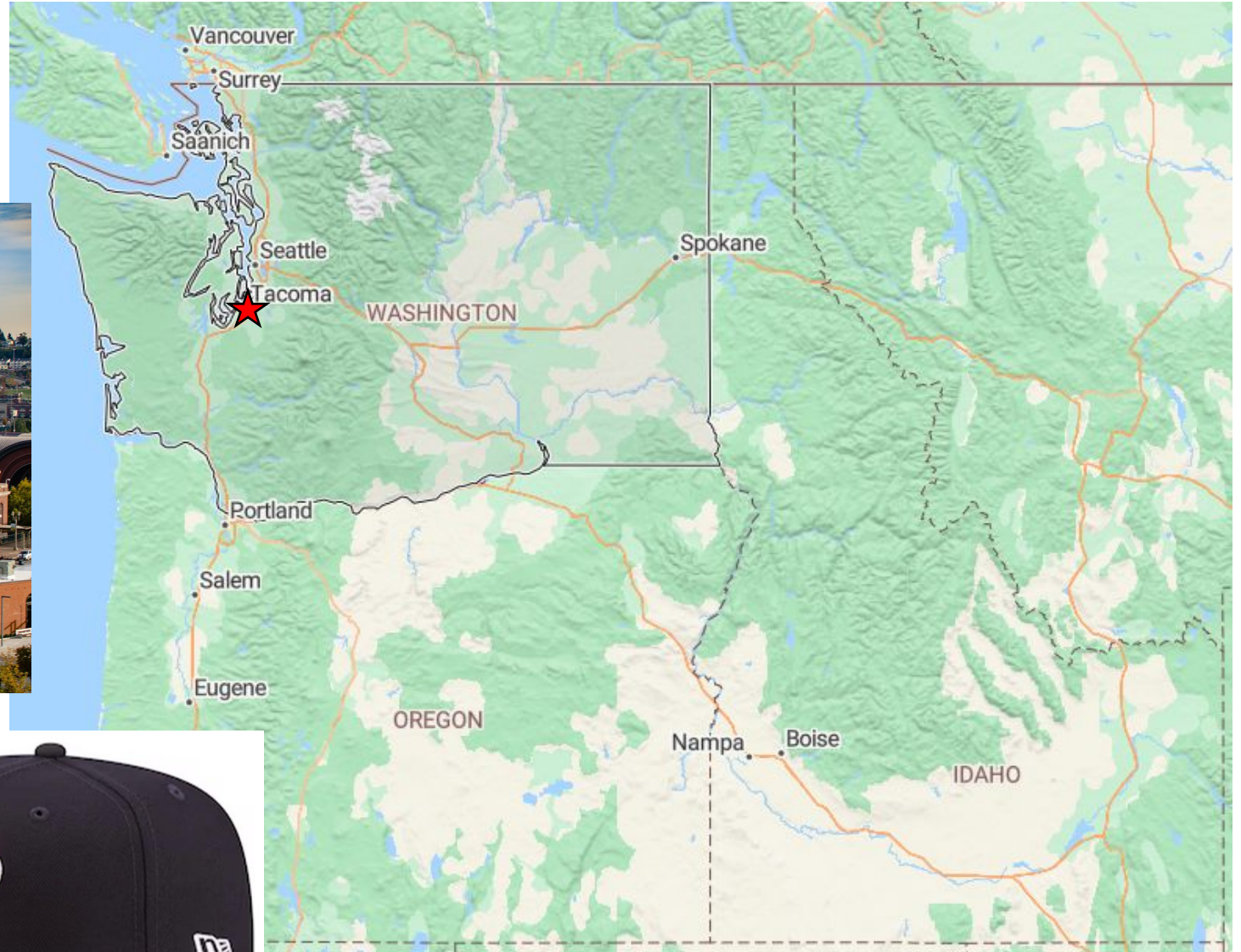
Agenda

- Tacoma Water background
- AMI and Smartwater sensors
- Model rebuild and EPS calibration
- SCADA to model connections
- What's next



Mt. Rainier & 11th St Bridge, looking south from Firefighters' Park in Tacoma

Tacoma



Our water comes
from **FAR AWAY.**

Most of it comes from a place **40 miles** from Tacoma—the **GREEN RIVER WATERSHED**. A bit of our water also comes from wells in our city. From those places, our water flows through pipes. It takes a lot of pipes to get water everywhere it needs to go.



Water flows through
PIPES and TANKS.

The biggest pipes are called **PIPELINES**. Pipelines are so big that a person could walk through them. The smallest pipes are the ones that connect right to your home. These pipes are about one inch around.

Water is stored in
TANKS.

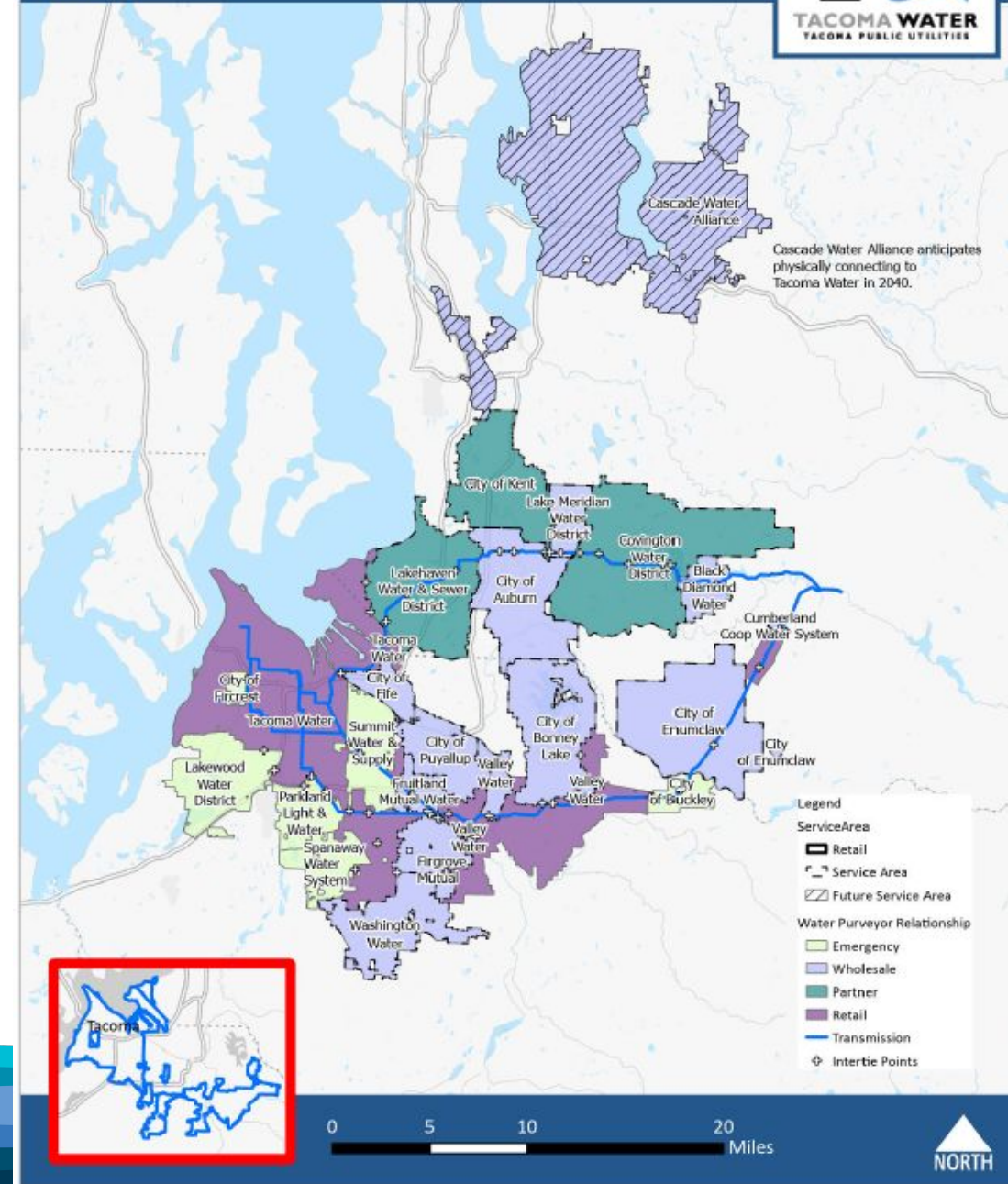
Have you ever walked by a big, tall, round, blue tank up on a hill? Water stays in the tank until you need it. Then it flows through underground pipes into your home.



Tacoma Water

- 360,000 retail population served
- 49 MGD Average Day
 - 34 MGD Retail
 - 13 MGD Regional Partners
 - 2 MGD Wholesale
- 1,400+ miles of main
- 52 pressure zones

Tacoma Water Service Area



Advanced Metering Infrastructure (AMI)

Your benefits over time



Your Control, Choice, and Convenience

Access more usage data anytime to manage your use and costs.



Monthly Billing

Advanced meters will allow a switch to monthly utility bills, which most people prefer.



Easier Move In, Out, and Reconnection

Remote turn on and off of electric service saves you time.



Faster Outage and Leak Detection

Locating and fixing issues helps us restore service to you sooner.



Improved Operational Efficiency

Better information about our systems helps us manage costs.



Automated Meter Reading

More accurate, timely bills based on real-time data.



Enhanced Personal Privacy

No need for regular physical access to read your meter.



Expanded Ways to Save

Providing data about your use increases your ability to save money, water, and energy.



Flexible Payment Options

More options over time include prepay for electric service and custom due dates.



Reduced Environmental Impact

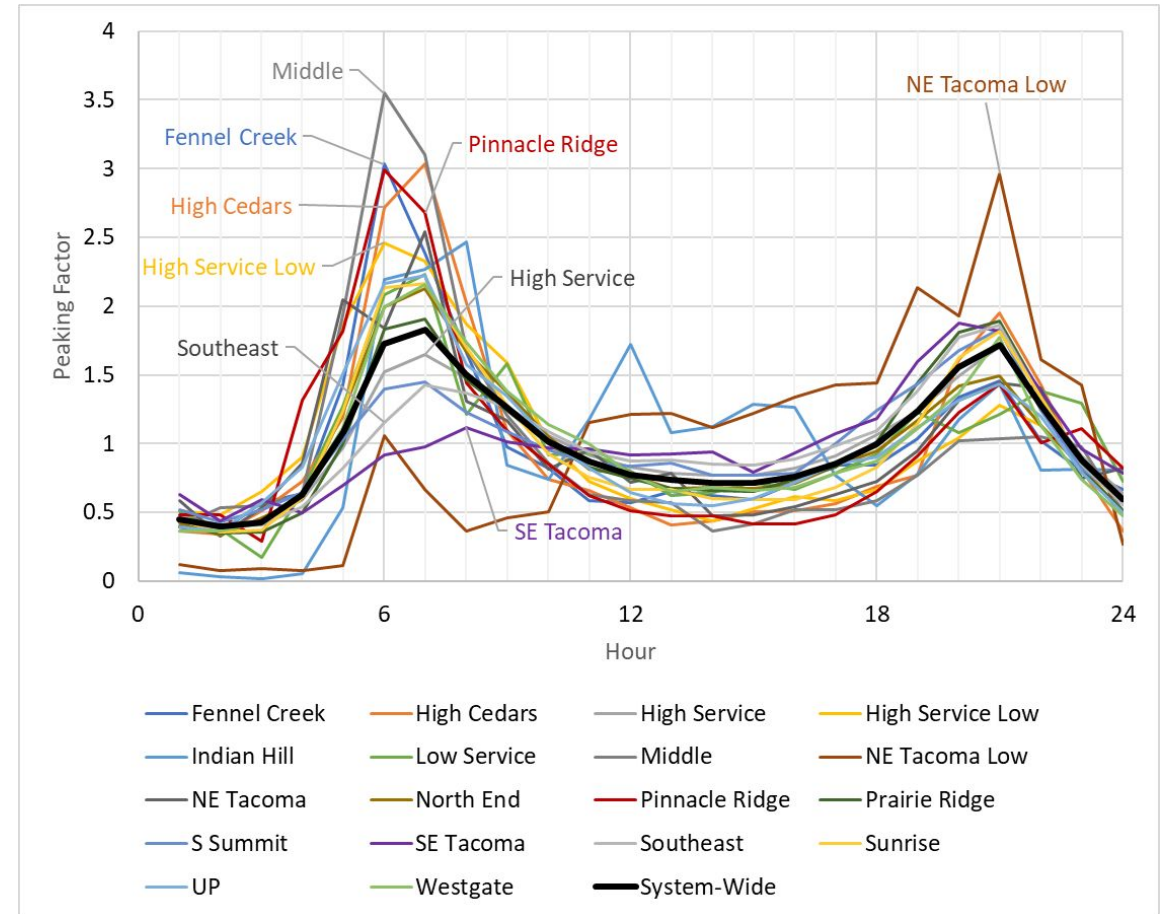
Fewer vehicle miles traveled for meter reading, basic field services, and outage detection lowers our carbon footprint.

Advanced Metering Infrastructure

- Fully deployed (~ 1 year)
- Hourly volumes for every customer
- Customer meter elements in model (Takes minutes to update demands)
- Created 172 diurnal curves

Challenges:

- Data storage & retrieval
- Not all meters have same interval



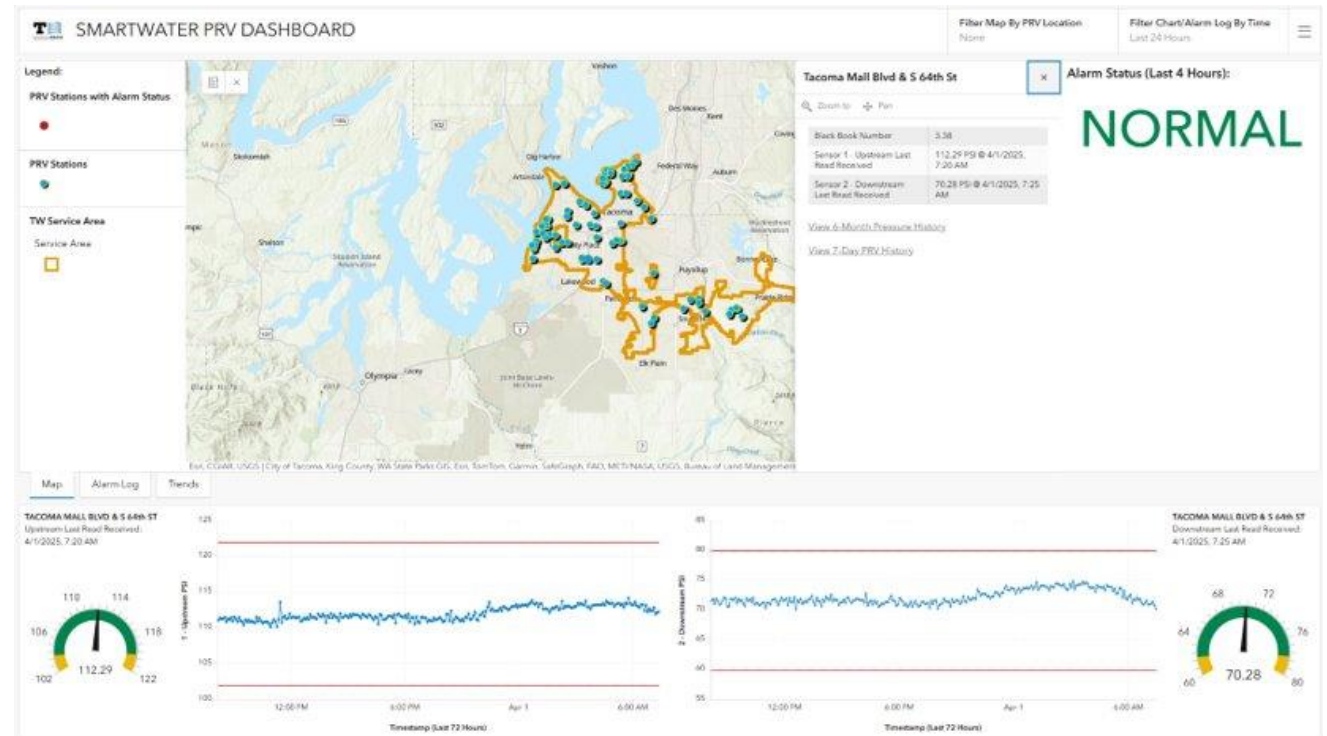
Smartwater Sensors

Distributed devices throughout system, in addition to SCADA

- Flow
- Pressure
- GIS / Tableau Dashboards

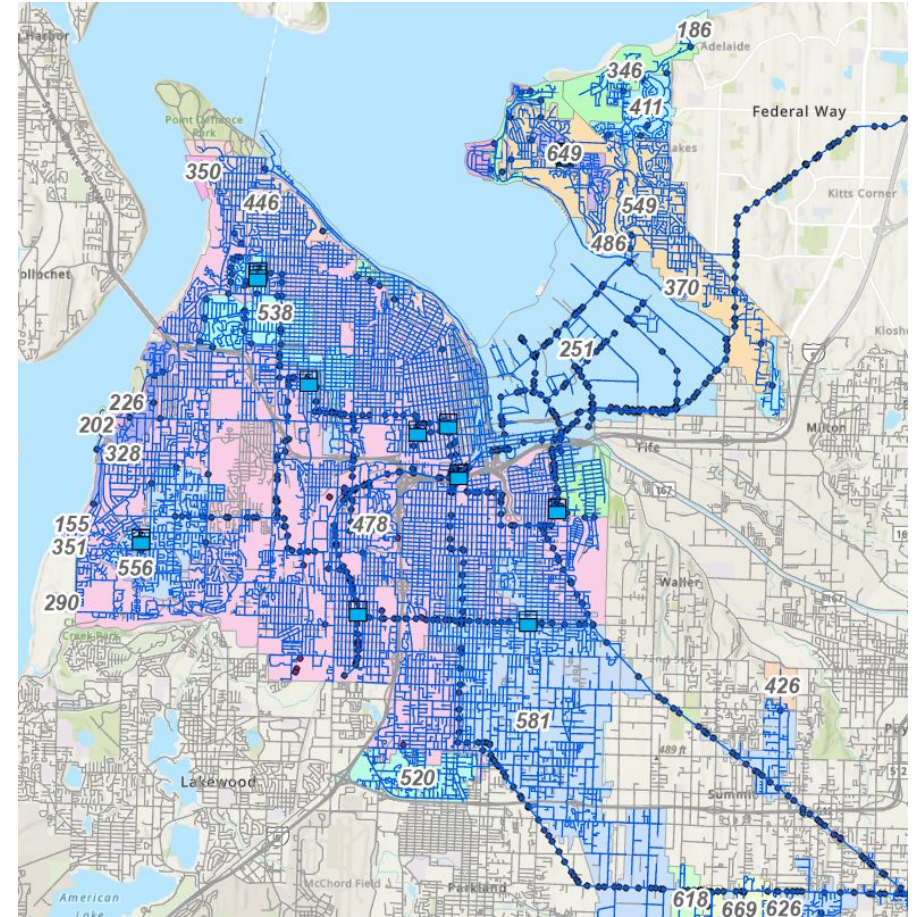
Challenges:

- Data Management
- Low velocities
- Flow meter installation in ROW



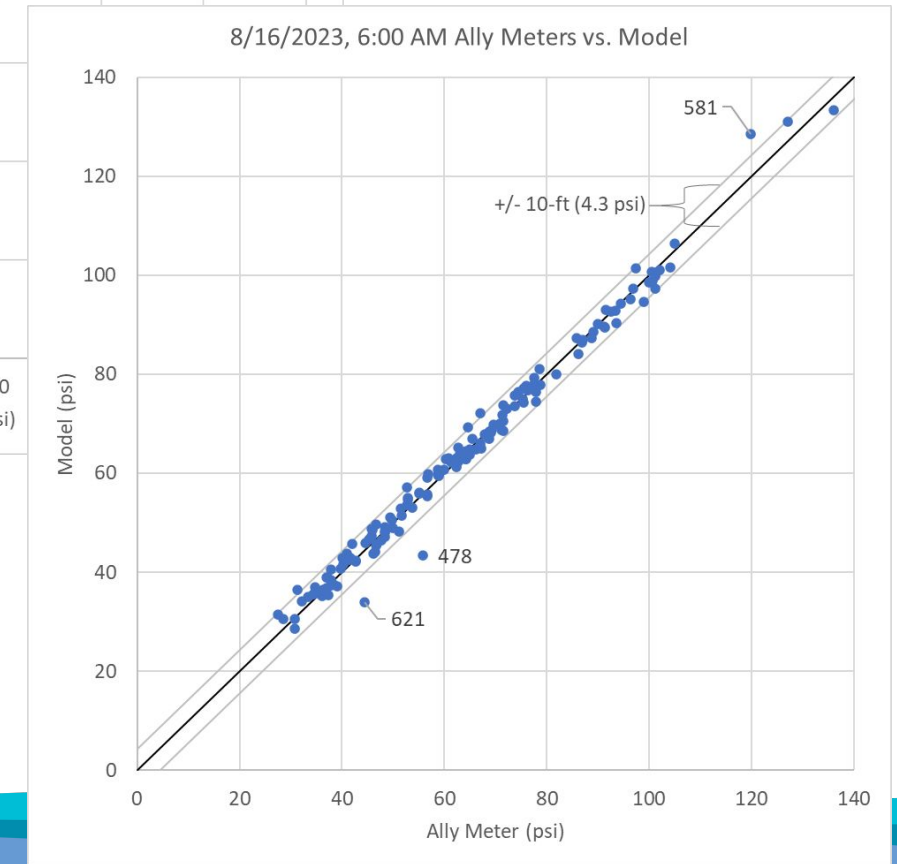
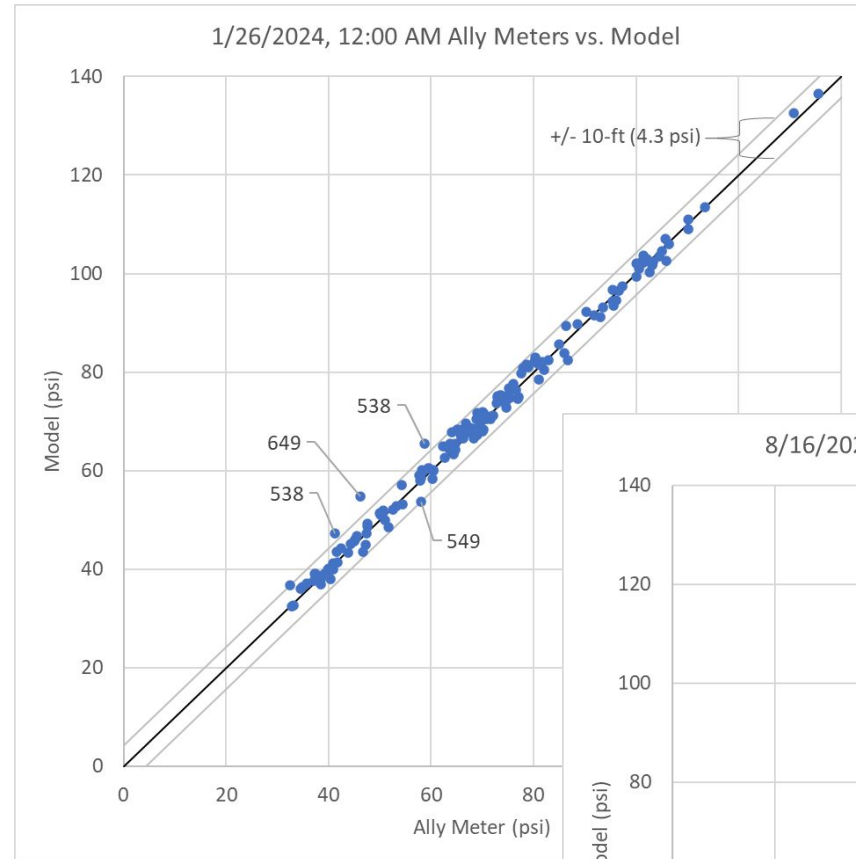
EPS Model Build & Calibration

- Rebuild model (steady state)
- Extract and analyze AMI data
- Build EPS scenarios
- Retrieve SCADA and SmartWater data
- Validate/Calibrate



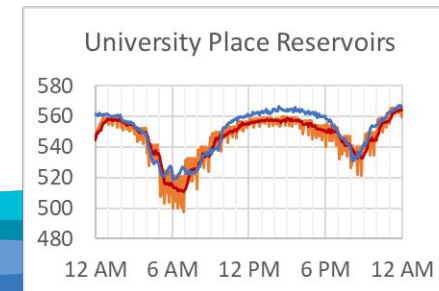
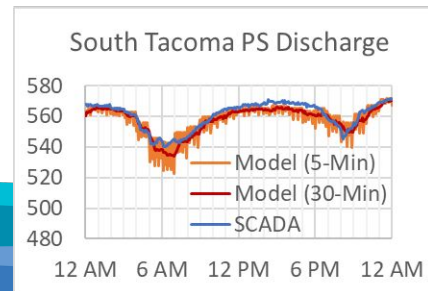
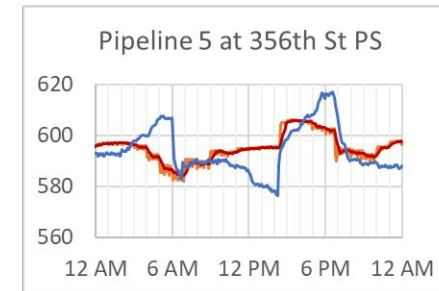
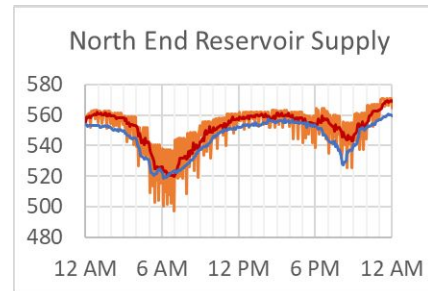
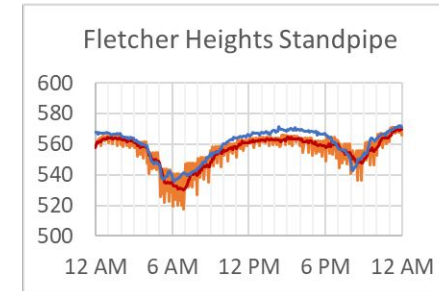
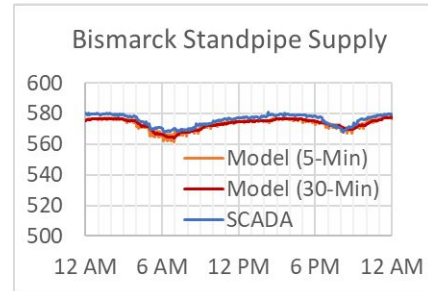
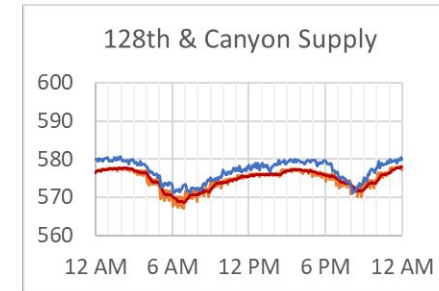
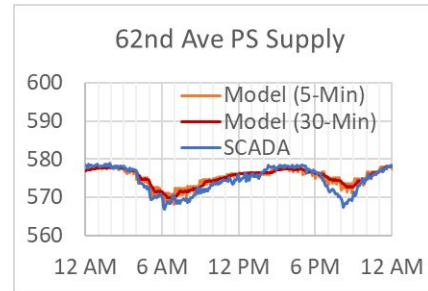
Calibration to Smartwater Devices

- Pressure within tolerance at 94% to 98% of all (160) Ally meters at different evaluated times of day in both scenarios (winter and max day).



Calibration to SCADA Pressures

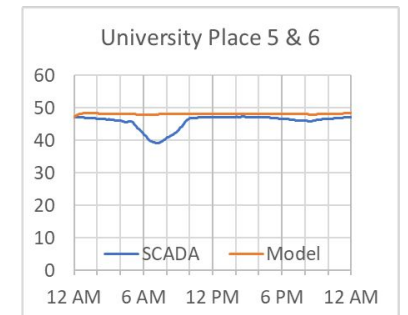
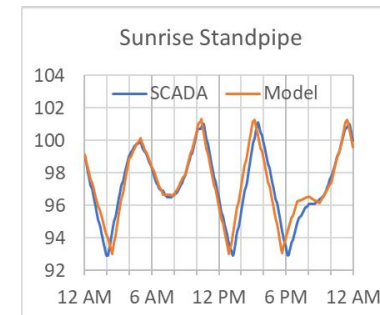
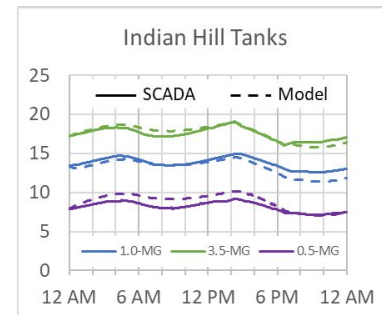
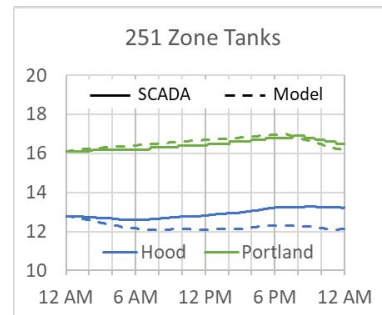
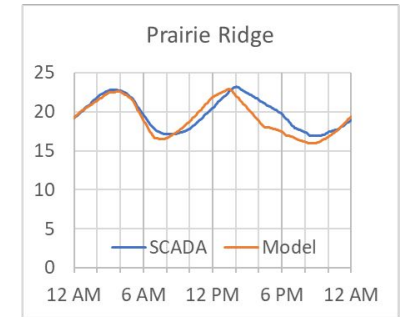
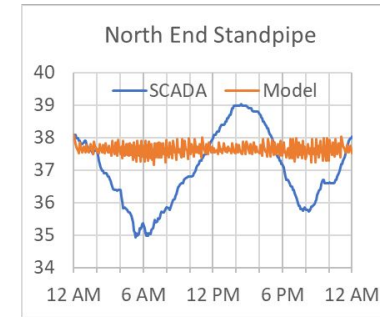
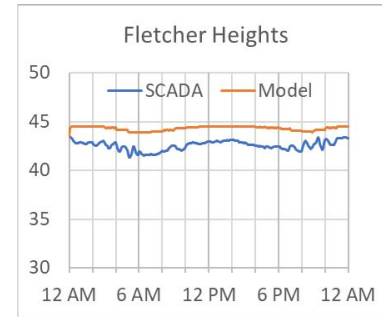
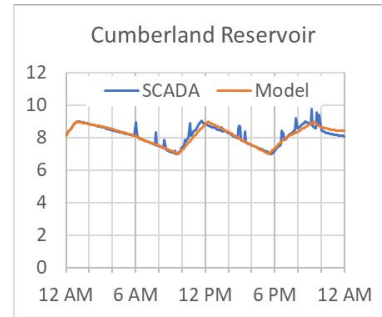
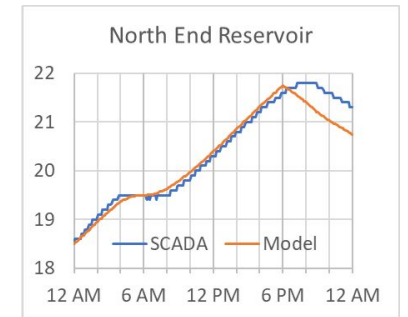
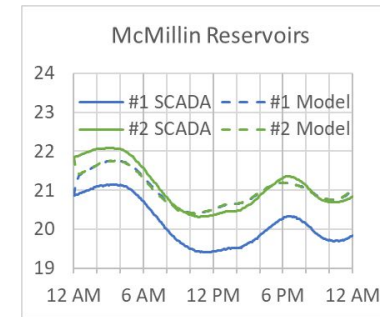
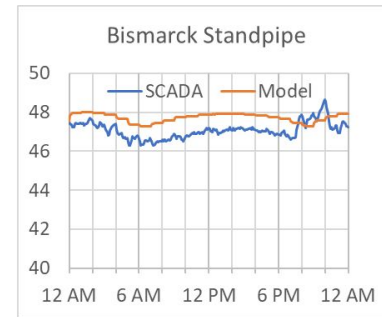
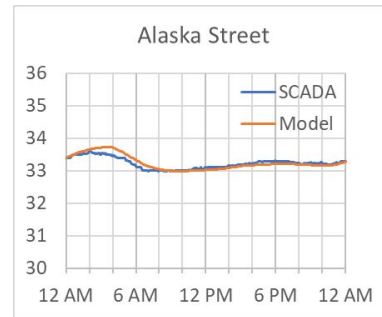
- Good correlation
- Results highlighted transmission system pressure dependency on flow settings
- Impact from wholesale customer pumping? (SCADA difficult to obtain)



Calibration to Tank Levels

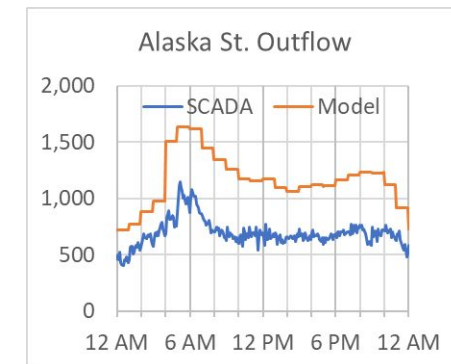
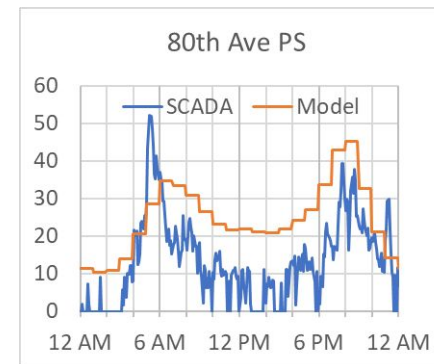
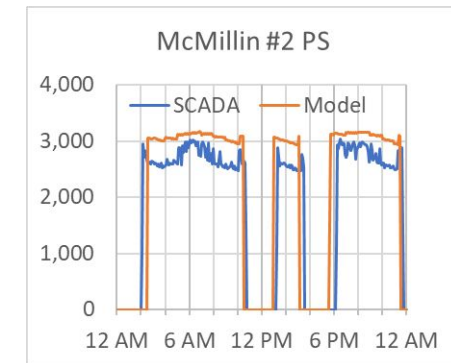
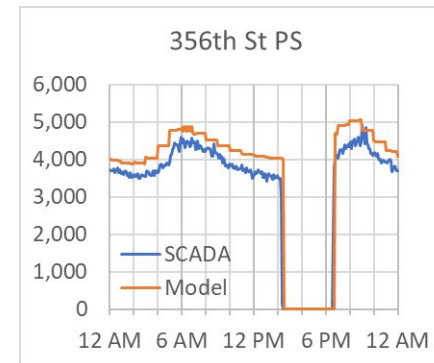
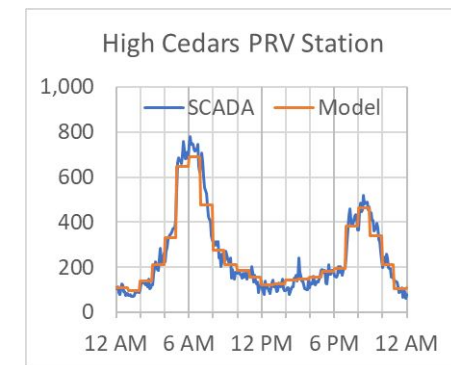
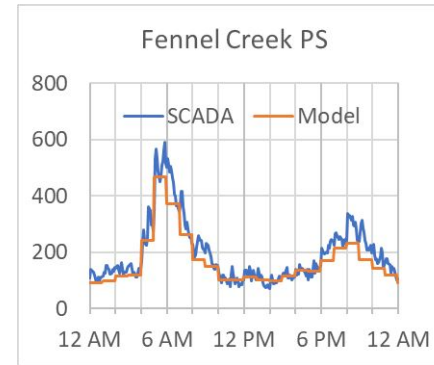
- Reservoir levels track so closely...
- that we can focus on the areas that pop due to larger discrepancies

Max Day (8/16/2023) Reservoir Levels (feet)



Calibrated Flows

- Closed-zone flows track demands tightly
- Pumps feeding reservoirs track closely with adjustments
- Model based on precise local AMI could diagnose calibration needs or low flow gaps at SCADA meters (more confidence in model than in SCADA)



SCADA Connections

- Model elements connected to real-world data (e.g. Flow, tank levels, pump status, etc)
- Model connected to smartwater devices
- SCADA (major facilities): Excel import/export

Challenges:

- Smartwater devices not "live" (~4 hour lag)
- SCADA Cybersecurity: Firewalls, limited access, and many stakeholders. Excel import/export

Properties - SCADA Element - SW1...

SW100130PR

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Property Search

<General>

ID	660249
Label	SW100130PR
Notes	1-upstream
GIS-IDs	<Collection: 0 items>
Hyperlinks	<Collection: 0 items>

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X (ft)	1,168,606.21
Y (ft)	694,818.03

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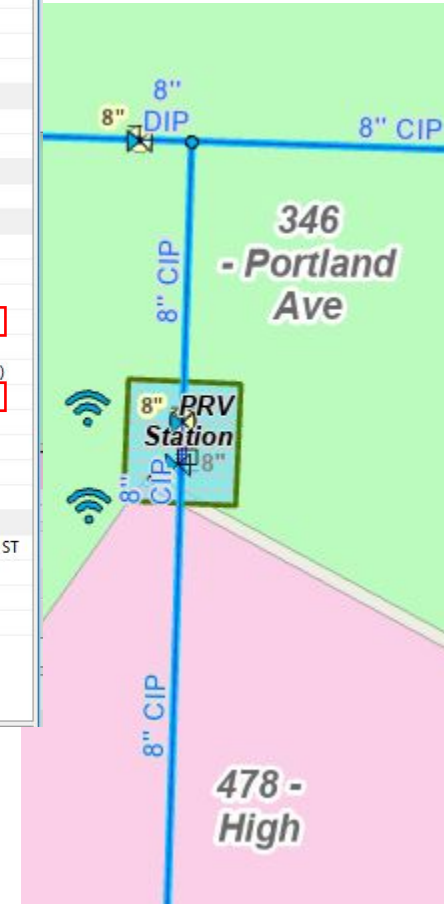
Is Active?	True
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<SCADA>

Model Element	CV-00409
Model Element Type	PRV
Field	Pressure (From/Suction)
Model Element Value	101.79 psi
Real-time Signal	<None>
Historical Signal	120005549 (SW US Pressure)
Historical Signal Value	100.31 psi
Signal Quality (Historic)	Uncertain
Difference	1.48
Difference (Relative) (%)	1.5
Active Alarm(s)	<None>

<User Defined>


Location	E ROOSEVELT AVE & E 38th ST
Read Interval	5
Flexnet ID	120005549
Device ID	BE0_120005549



Future

- Tighter network of Smartwater sensors
- Continued focus on "Big Data" and how to use it
- Discussing easier access to SCADA data

Challenges:

- Model use through common operating platform would require numerous pre-loaded scenarios due to system complexity
 - Staff resources to maintain software and devices
 - Low velocities limit potential flow meter locations
- 

Summary

- AMI and field sensors a huge win for calibration
- Historical data either directly (Smartwater) or indirectly (SCADA via Excel) imported to model
- Challenges:
 - Cybersecurity (appropriately) creates friction in data transfer
 - Modeling staff still “gatekeep” due to lack of simpler interface
 - Software staff support and expense can be an issue
- Worth it, but expect it to take a decade



Acknowledgements

- Scott Dewirst – leadership and sponsorship
- Tacoma's 300 crew – smartwater sensor installation
- Dan Martin, Corey Bedient, Scott Jonas – AMI management and Smartwater implementation
- Dan Reisinger – Management & delegating the opportunity

