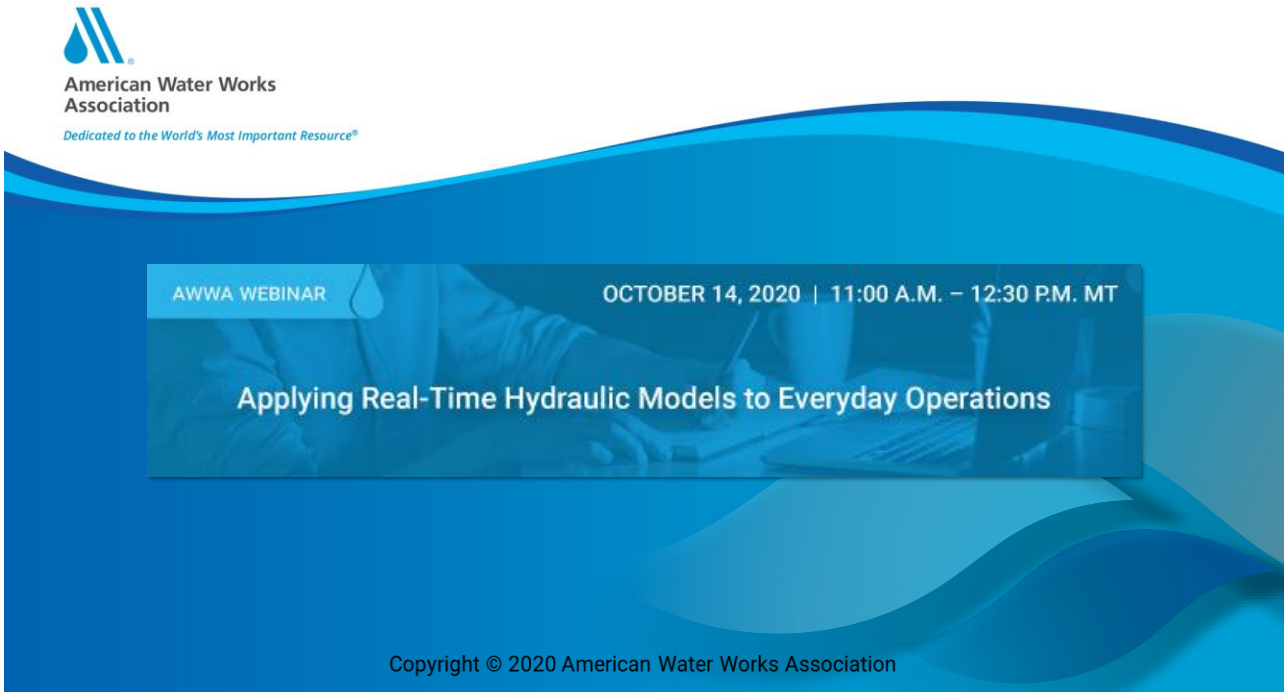

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WEBINAR MODERATOR

Corinne Bertoia
Engineer
American Water Works Association

Corinne Bertoia is an Engineer at the American Water Works Association. Her responsibilities include reviewing and developing technical programs and supporting the Divisions and Committees of the Technical and Education Council. Corinne received her MASc. in Civil Engineering from the University of Toronto in 2018, where her research focused on the removal of NDMA precursors from drinking water biofilters.

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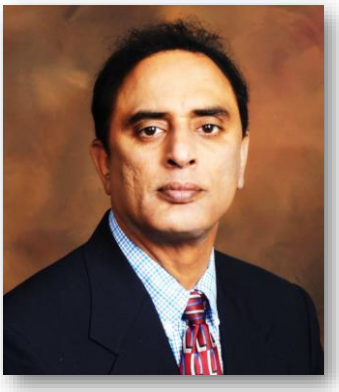

Sri Kamojjala, P.E., D.WRE
Senior Engineer
Las Vegas Valley Water District

Matt Sellers
Product Manager
Sedaru

Tiffany Lufkin
Senior Planning Engineer
South Central Connecticut
Regional Water Authority

7

7

AGENDA

I.	Optimizing Utility Functions with Real-time Hydraulic Models and Sensor Data	Sri Kamojjala, P.E., D.WRE
II.	Introduction to Real-Time Modeling	Matt Sellers
III.	South Central Connecticut Regional Water Authority Application of Real Time Hydraulic Model & Water Loss Tool	Tiffany Lufkin

8

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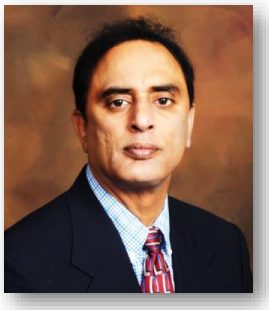
ASK THE EXPERTS



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Las Vegas Valley Water District

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Sedaru

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South Central Connecticut Regional Water Authority

Enter your **question** into the **question pane** on the right-hand side of the screen.

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9

Optimizing Utility Functions with Real-time Hydraulic Models and Sensor Data

Sri Kamojjala
Senior Civil Engineer
Las Vegas Valley Water District

LAS VEGAS VALLEY WATER DISTRICT

10

Acknowledgements

- Bill Turner, Senior Engineering Technician
- LVVWD Operations Department
- LVVWD Infrastructure Management Department

11

Learning Objectives

- Realtime Modeling Technology
  - Data Integration
- Use of Sensors
- Applications

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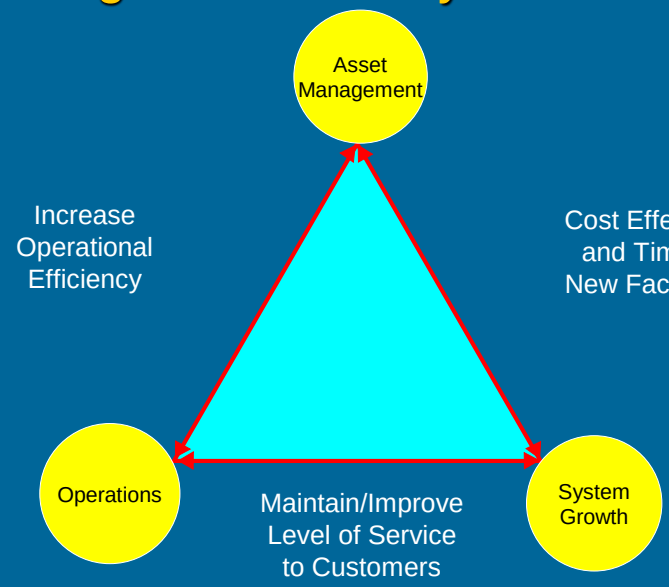
Integration of Utility Functions



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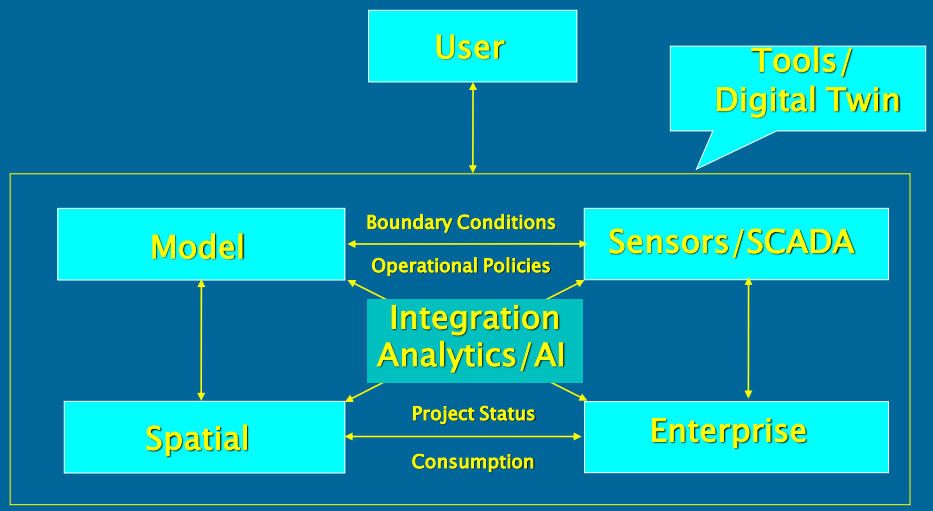
Integration of Data Sources



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Integration Tools

- Streamline and Automate Data Processes
- Enhance Data Accuracy
- Reduce Data Redundancy
- Improve User Efficiency

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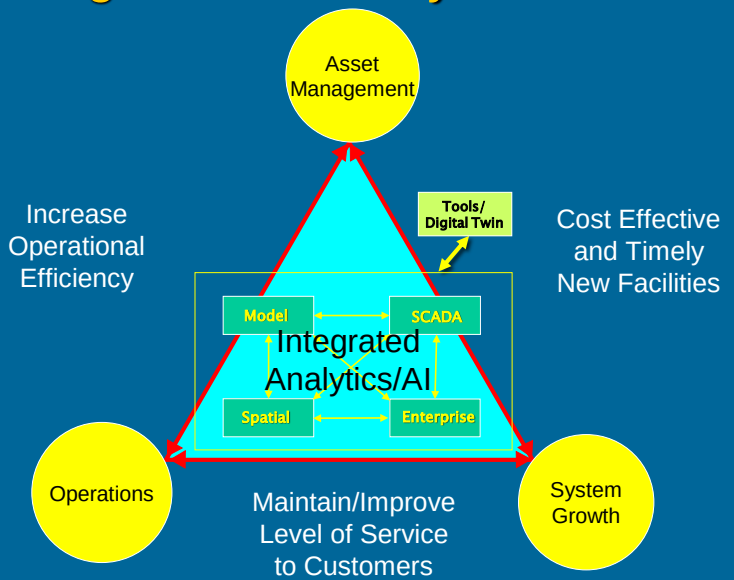
Integration of Utility Functions



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Real-time Models
Integration of SCADA/Sensors with Models

- Get Current System Conditions from SCADA/Sensors
- Run Simulation
- Project System Operation
- Interpolate Between SCADA Locations
- Compare Model Prediction with Sensor/SCADA Data

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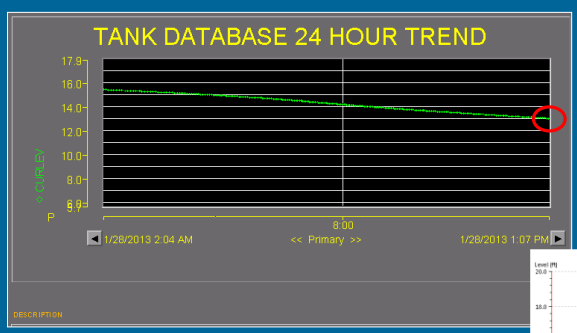
Projecting System Operation



- Reservoir Levels are Pulled from SCADA at any Instant
- System Conditions are Projected Into the Future

Real-time Models

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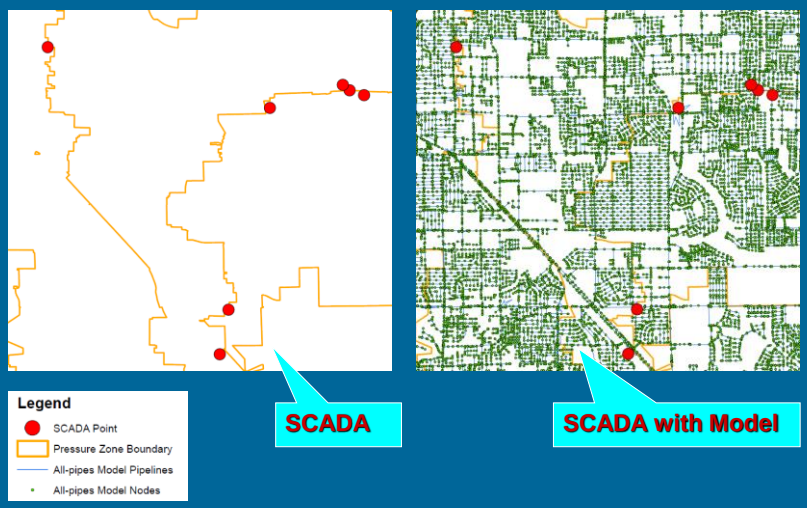
System Monitoring: SCADA vs. Model



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Integration of Models with Sensors/SCADA Benefits

- Gain Understanding of Network Operations in Real Time
  - Simulate the current system performance, future scenarios and past system performance - forensic analysis
- Monitor System for Abnormal Conditions
  - Comparison of planned versus actual
- Emergency Response
  - Develop incident and response runs to determine best action during emergency response
- Develop Operational Plans
- Calibration
- Asset Protection/Management

20

Benefits of Wireless Sensors

- Mobility and Convenience
  - Where and When
- Quick Installation and Lower Cost
- Identification and Notification of Distribution System Conditions
  - Identification of Field Issues
- Confirm SCADA Measurements and Model Results

21

Benefits of Wireless Sensors

- Mobility and Convenience
  - Where and When
- Quick Installation and Lower Cost
- Identification and Notification of Distribution System Conditions
  - Identification of Field Issues
- Confirm SCADA Measurements and Model Results

Ideal for Operational Troubleshooting, Asset Protection and Emergency Response

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Hydraulic Models and Data Integration Intended Use

- Initial Applications
  - Master planning
  - Development review
  - Water quality
- Current/Emerging Applications
  - Real-time operations/energy planning
  - Emergency response
  - Shutdown analysis
  - Asset management

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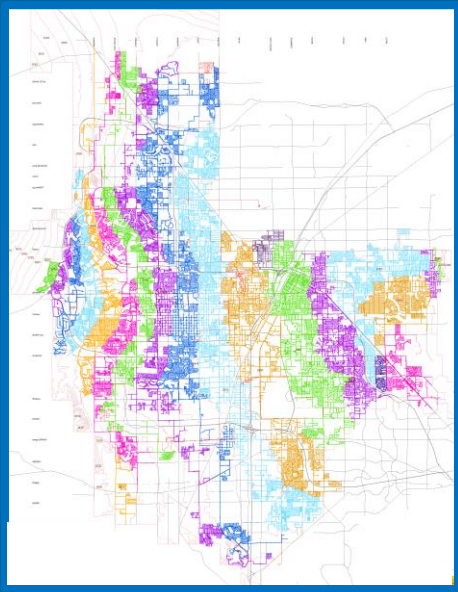
Real-time Operational Planning
Developing Daily Pumping Plans

24

LVVWD Distribution System



- 1.5 Million Service Area Population
- More Than 5,000 Miles of Pipeline
- 24 Active Pressure Zones
- 42 Distribution Reservoirs
- 10 Supply Turnouts
- 68 Groundwater Production Wells
- 53 Pumping Stations
  - 262 Pumping units

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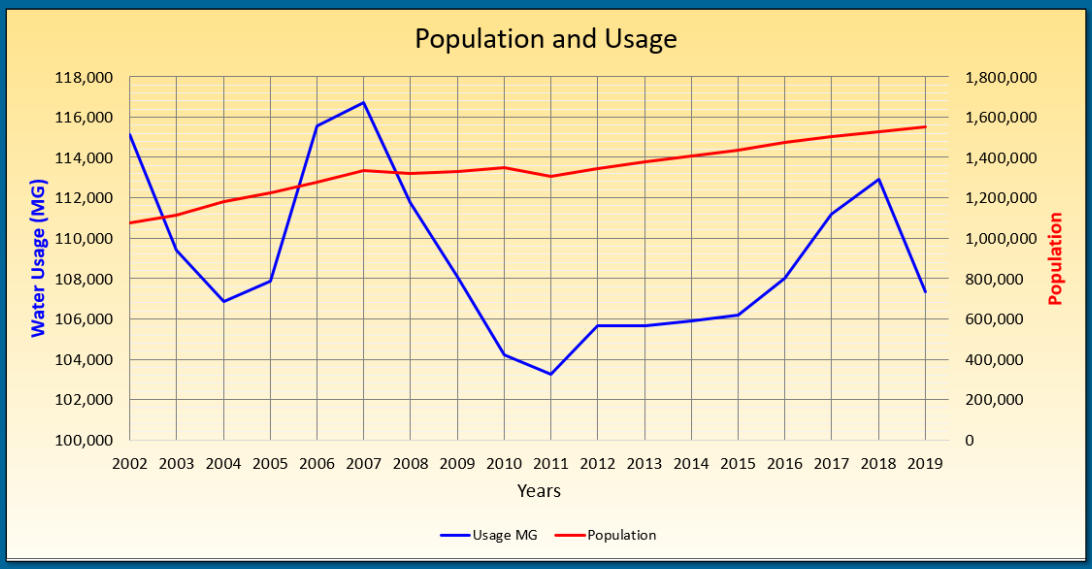
Las Vegas Valley Water District

Population and Usage 2002 to 2019



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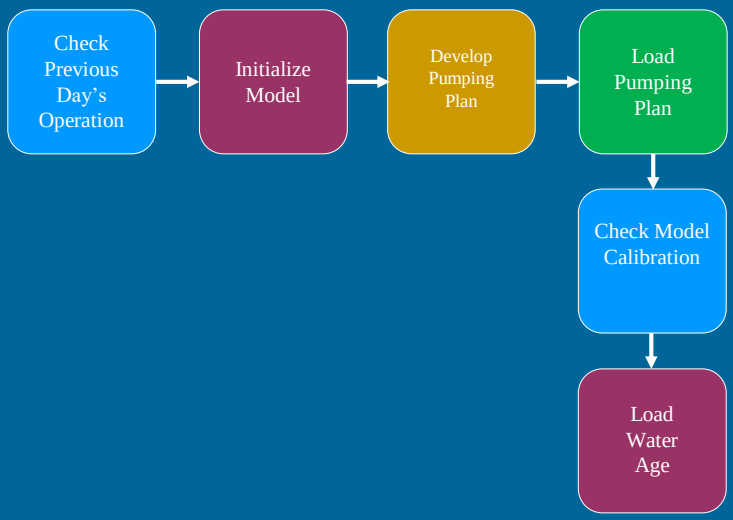
Tools for Daily Plan Development



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Daily Pumping Plan Modeler's Role

- Develop Optimal Pumping Schedule
  - Water quality
  - Energy cost
- Recommend Daily Water and Power Orders
- Transfer the Plan
- Identify Calibration Issues

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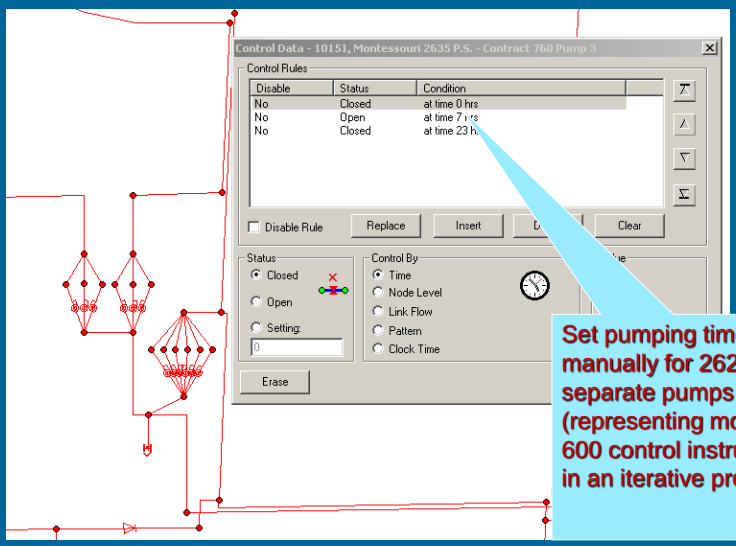
Generating Pumping Schedules (Without Tools)

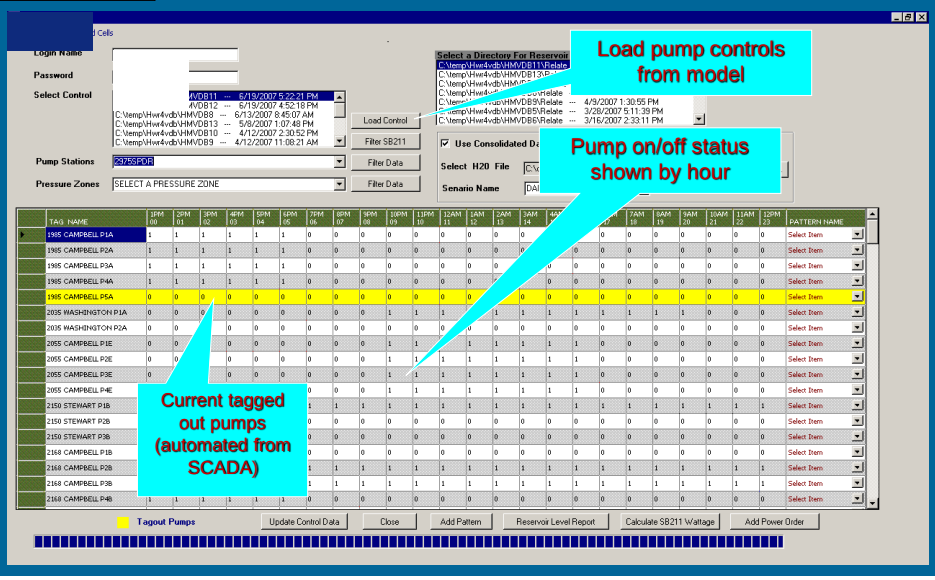


- Schedules Must be Generated Daily by Noon

29

Pumping Plan Tool

Develop operating plan in an EPS Hydraulic Model



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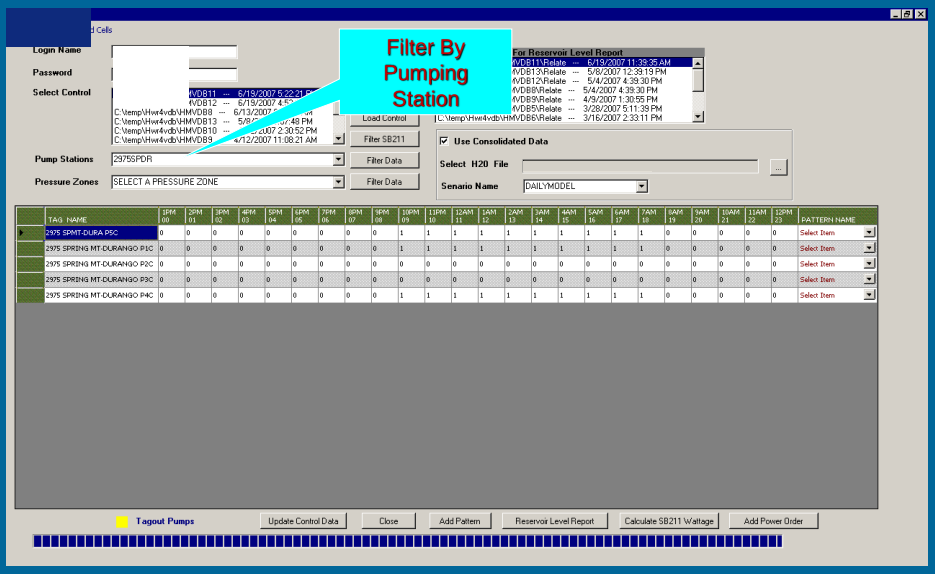
Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool



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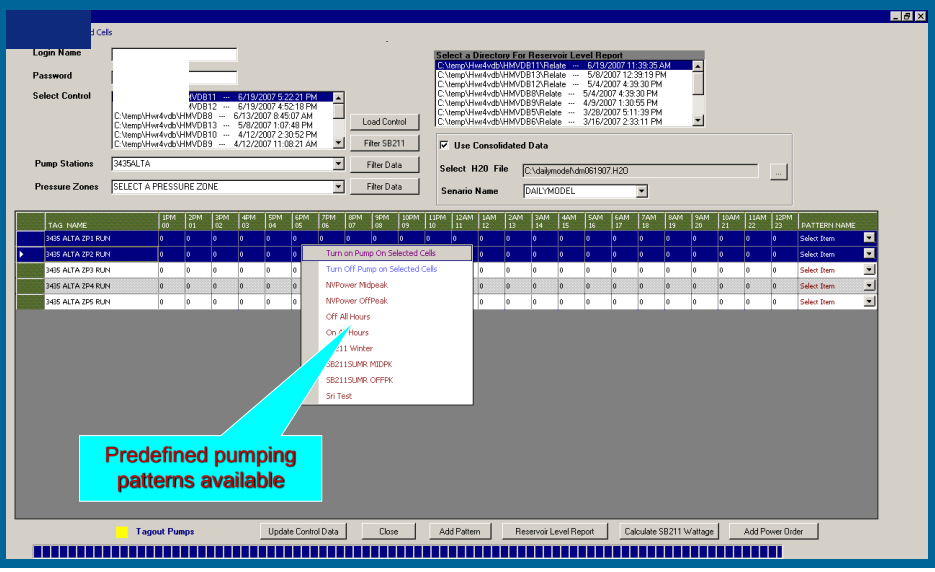
Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool



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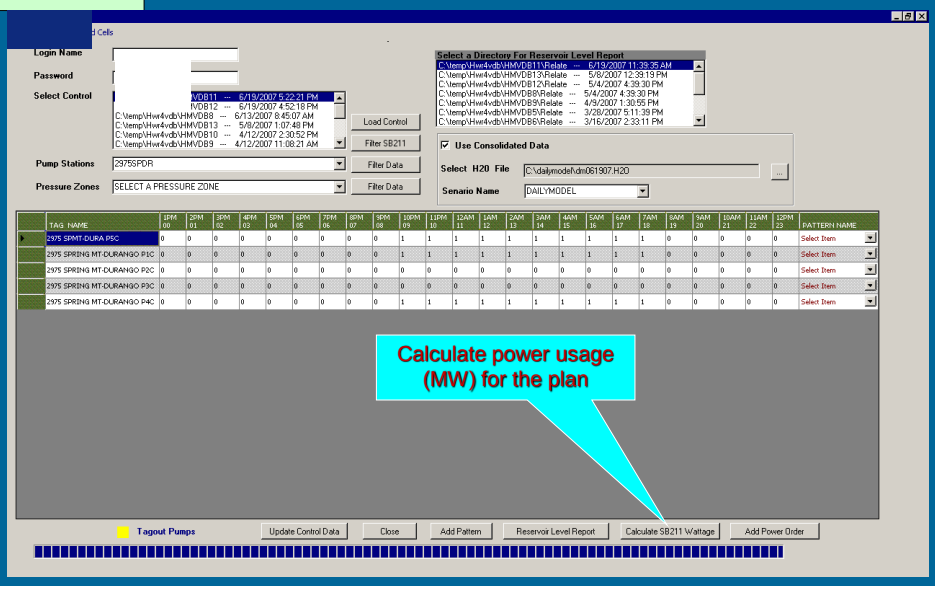
Develop operating plan in an EPS Hydraulic Model

Pumping Plan Tool



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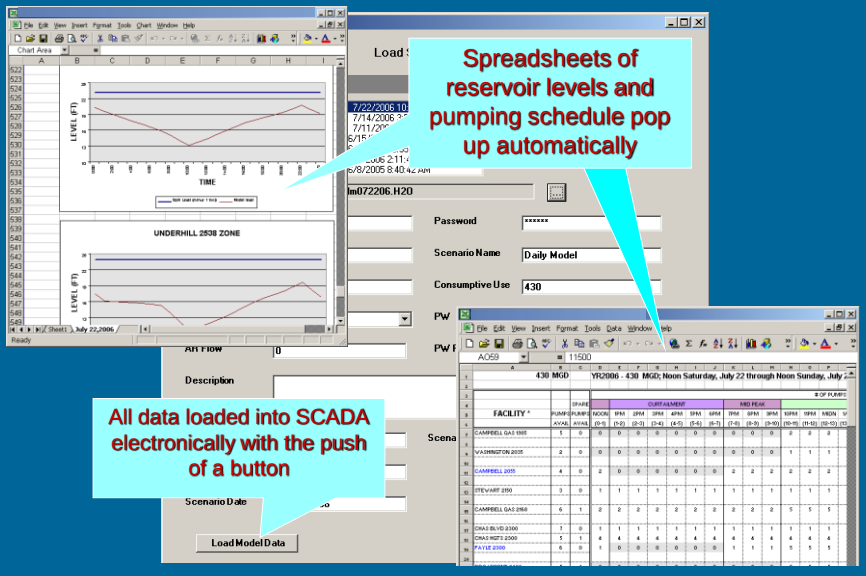
Load pumping plan and generate charts

Load Simulation Data

Loading Simulation Data into EWQMS



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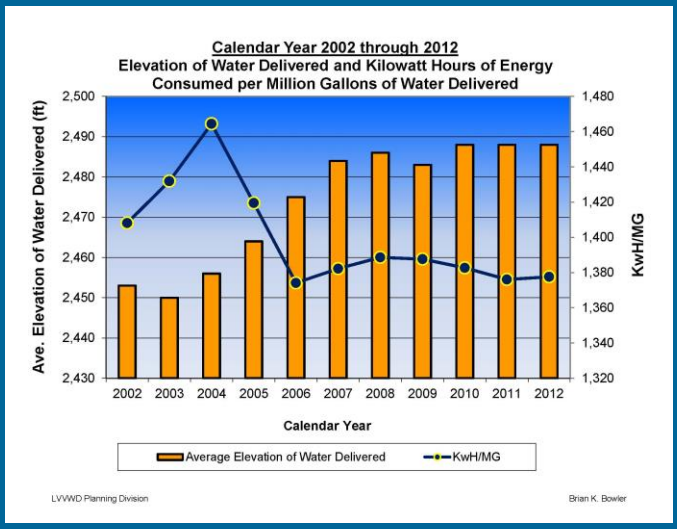
Energy Usage Comparison



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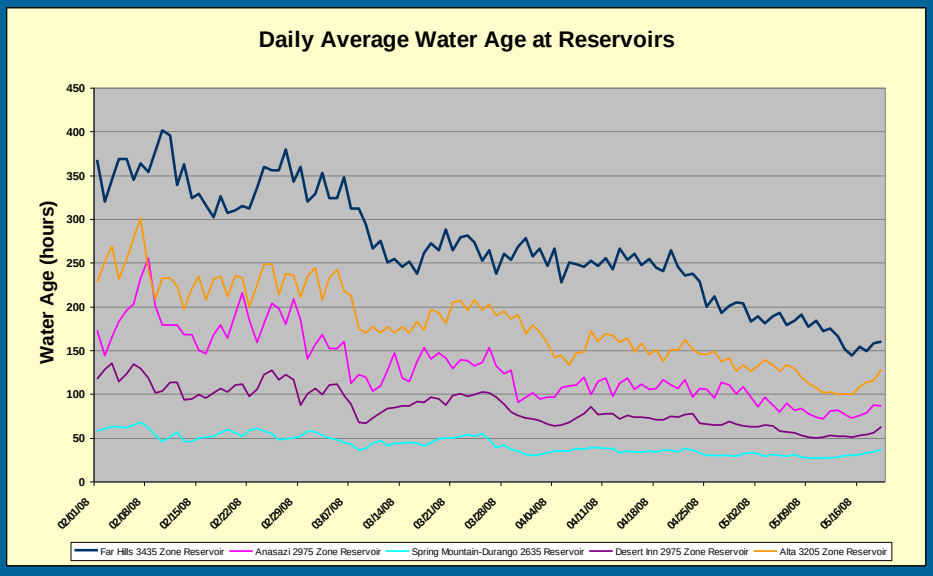
Daily Water Age Report



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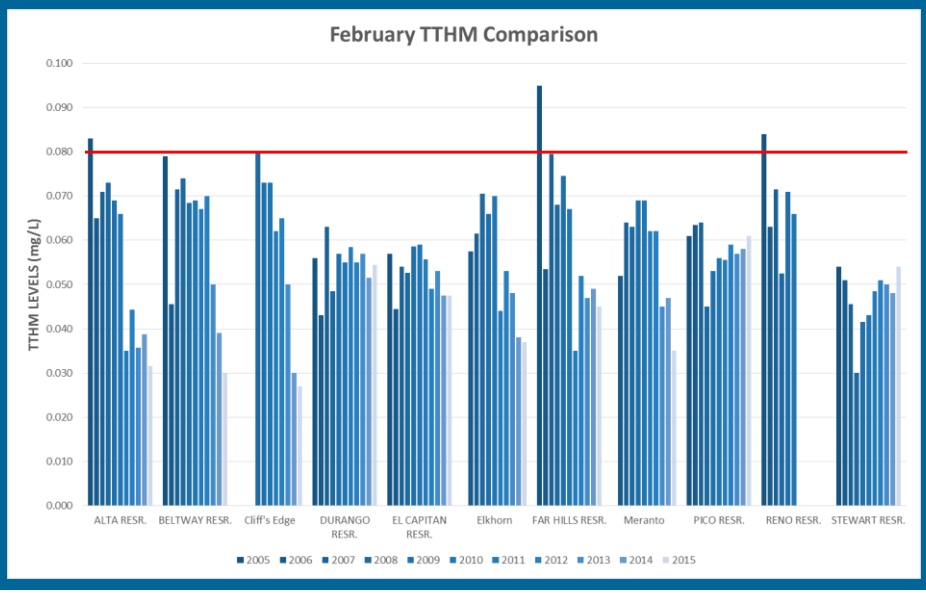
Water Quality Comparison



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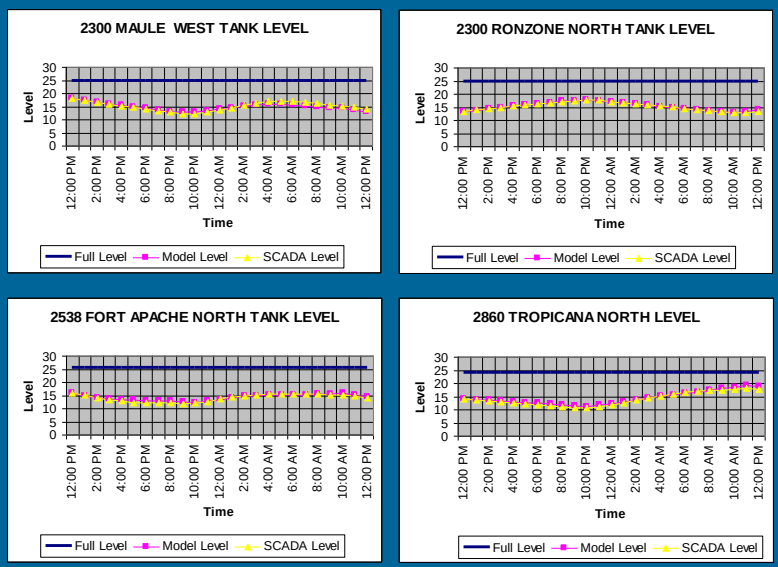
Model Calibration
Reservoir Level Comparison



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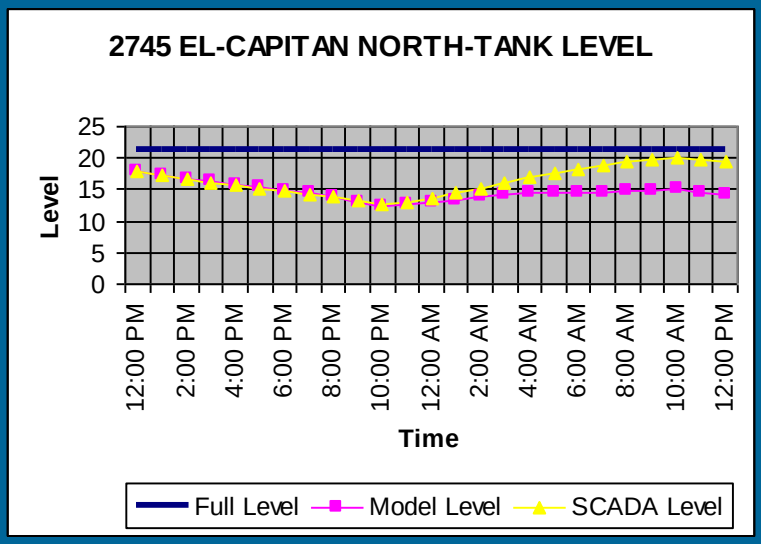
Reservoir Tracking Issue



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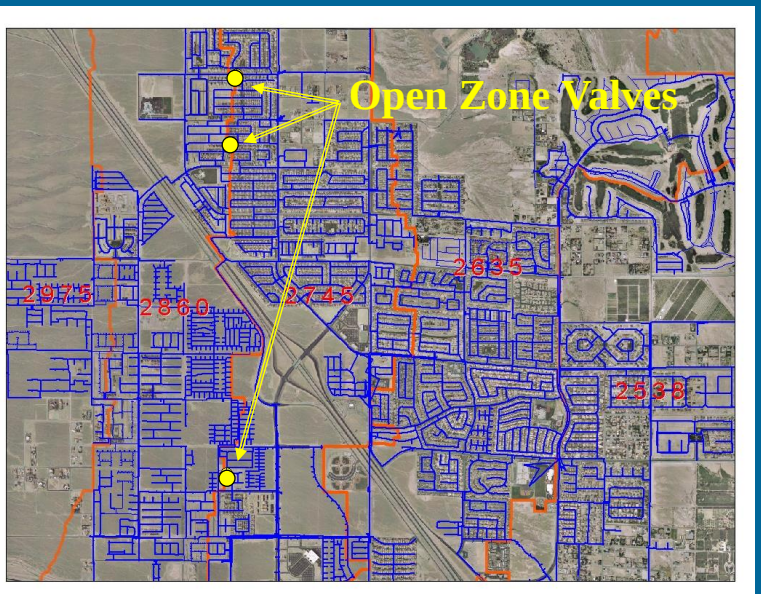
Reservoir Tracking Issue



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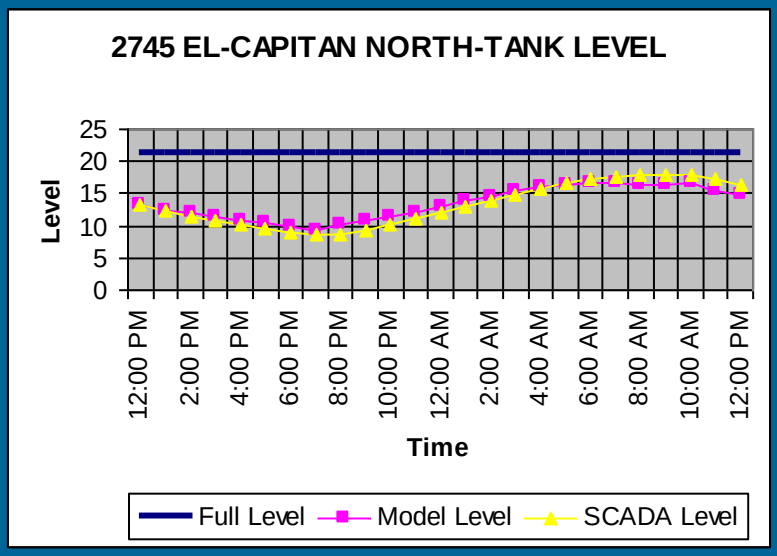
Reservoir Tracking Issue



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Failure Consequences

- Loss of service to critical customers
- Contamination of the distribution system
- Reduction or loss of fire protection
- Flooding and private property damage

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Reservoir 10 Outage

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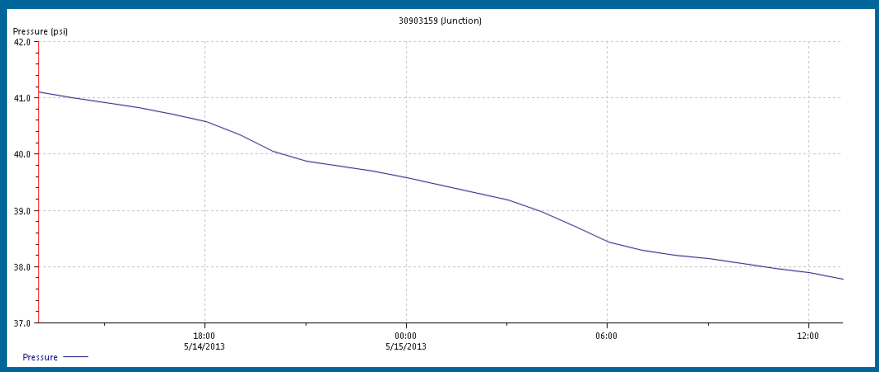
Reservoir 10: Before Outage

PS Discharge Pressure



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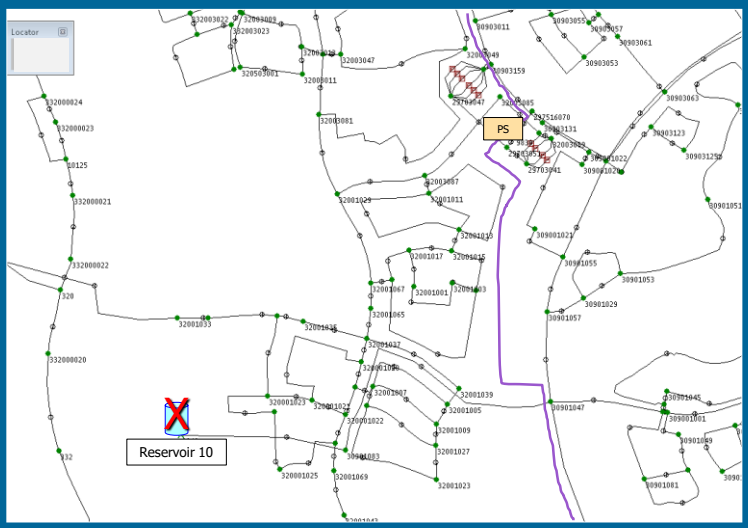
Reservoir 10 Outage



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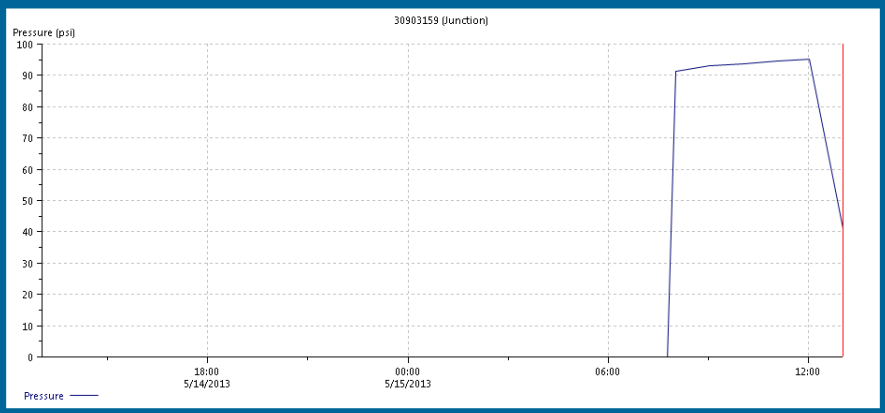
Reservoir 10 Outage

Projected Operation
6 Pumps from 8 AM to 1 PM
PS Discharge Pressure



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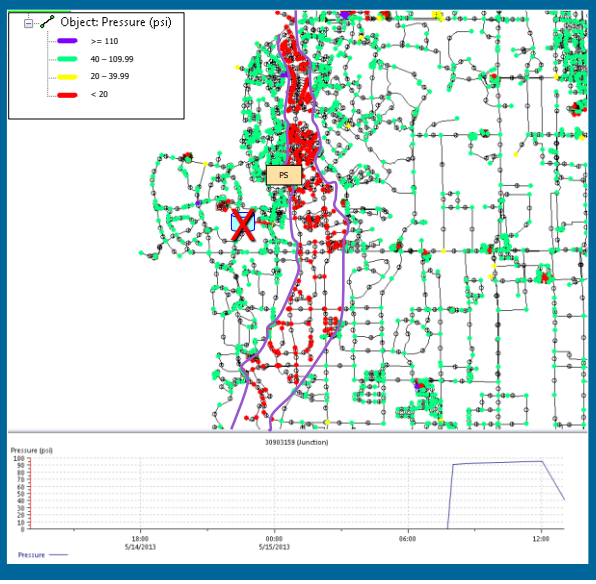
Reservoir 10 Outage

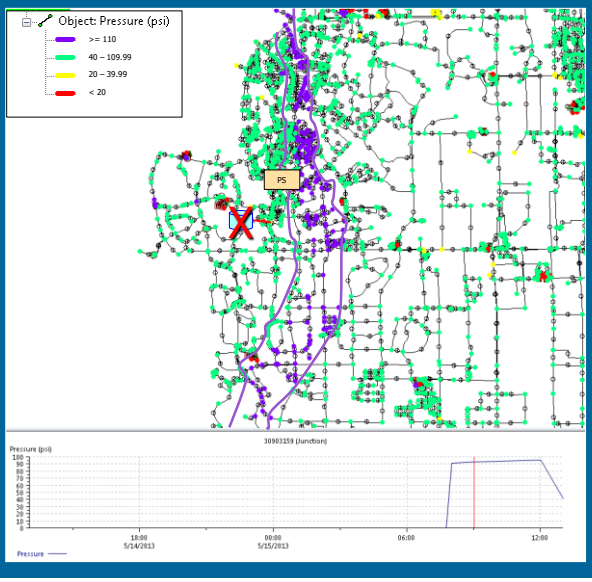
Projected Operation: 6 Pumps from 8 AM to 1 PM
Distribution System Pressures at 1 PM



48

Reservoir 10 Outage

Projected Operation: 6 Pumps from 8 AM to 1 PM
Distribution System Pressures at 9 AM



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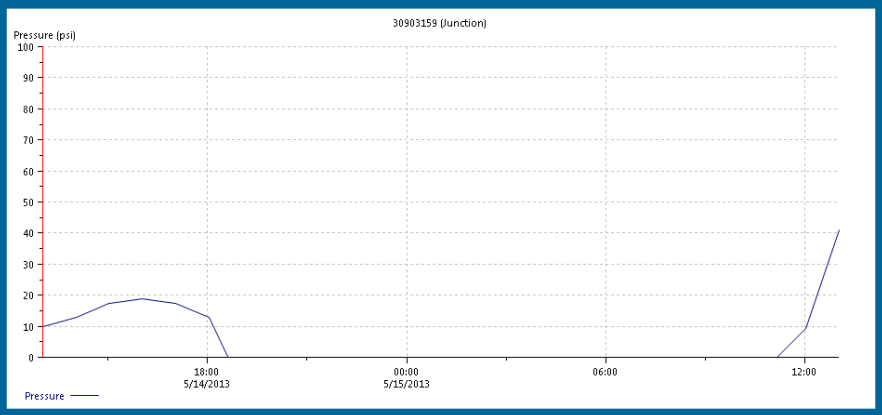
Reservoir 10 Outage

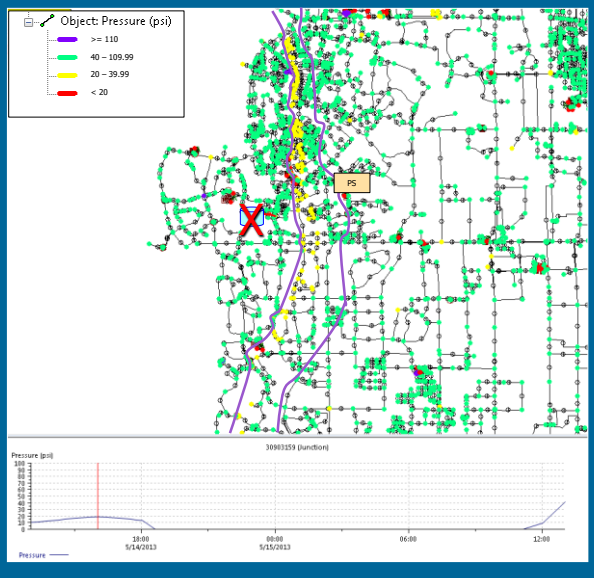
Emergency Response: 1 Pump on 24 Hours
PS Discharge Pressure



50

Reservoir 10 Outage

Emergency Response: 1 Pump on 24 Hours
Distribution System Pressures at 4 PM



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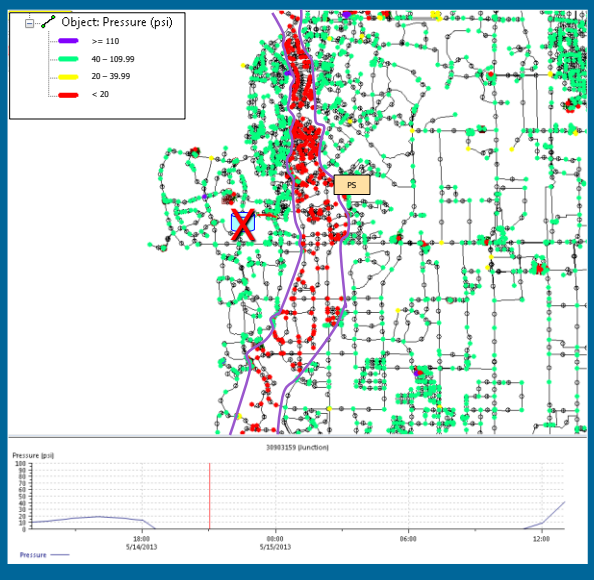
Reservoir 10 Outage

Emergency Response: 1 Pump on 24 Hours
Distribution System Pressures at 9 PM



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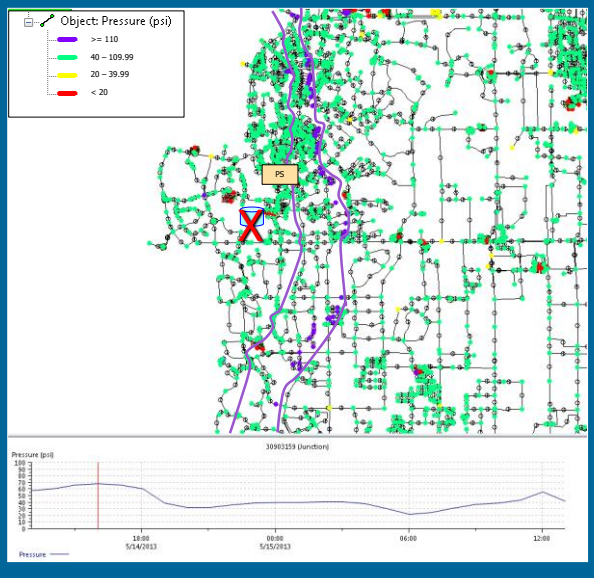
Reservoir 10 Outage

Emergency Response: 3 Pumps on 24 Hours
Distribution System Pressures at 4 PM



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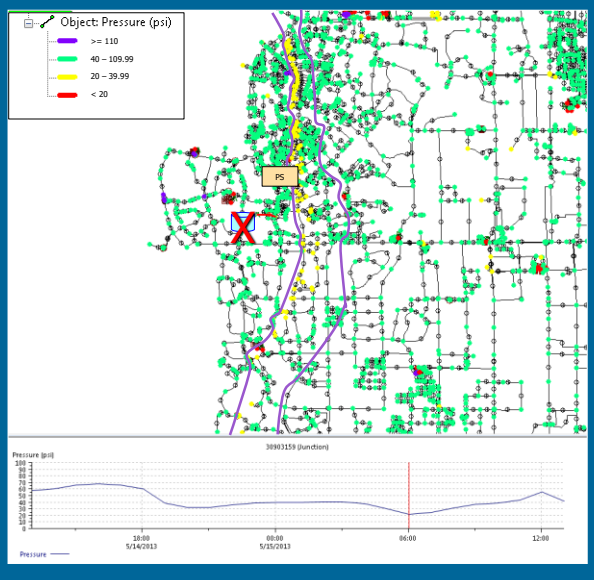
Reservoir 10 Outage

Emergency Response: 3 Pumps on 24 Hours
Distribution System Pressures at 6 AM



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Advantages of a Real-time Model in Emergency Response

- Hydraulic model contains current operating conditions and pumping schedules
  - Minimal setup time
  - Multiple scenarios can be created quickly
  - Fewer modeling errors
  - Facilitates organized response

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Summary

- Real-time Models and Sensor Data Provide Powerful Tools for Infrastructure Planning, Engineering and Management
- Real-time Models are essential for Daily Operational Planning, System Troubleshooting, Asset Protection and Emergency Response
- Data Integration is Key for Realizing Full Benefits
- Look Beyond the Current State of the Technology

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Thank You

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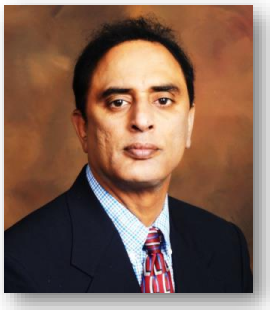
ASK THE EXPERTS



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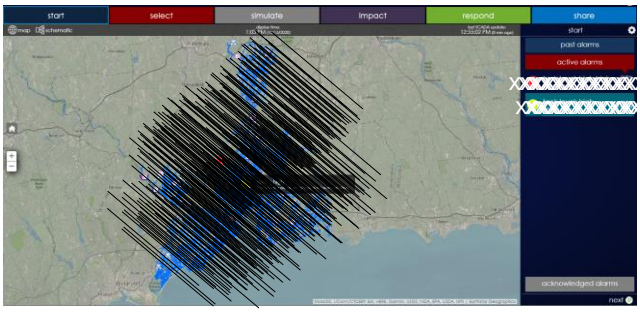
SEDARU

INTRODUCTION TO REAL-TIME MODELING

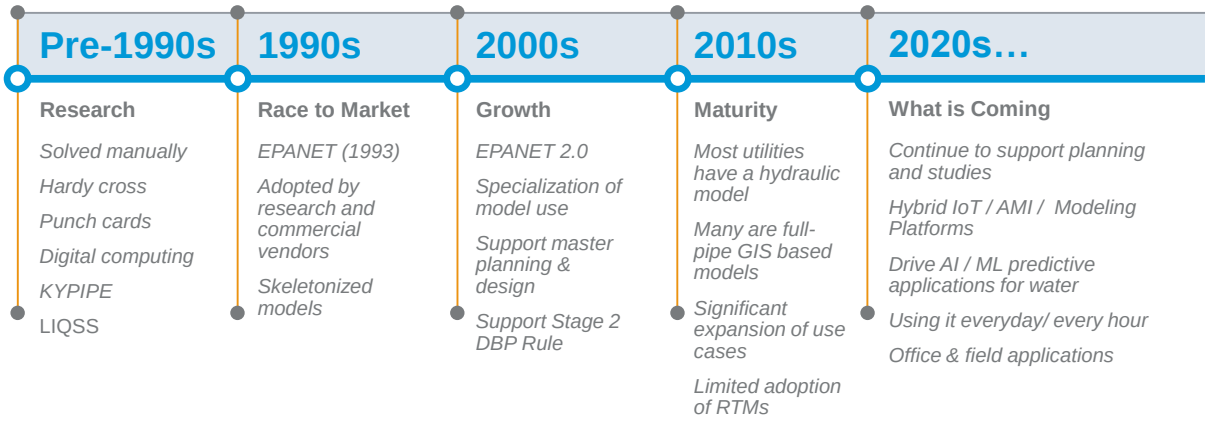
Matt Sellers
Product Manager
Sedaru

LEARNING OBJECTIVES

- Roots of real-time hydraulic modeling
- Requirements for real-time hydraulic modeling
- Key steps for building an accurate real-time model
- Practical use cases



ROOTS OF REAL-TIME MODELING



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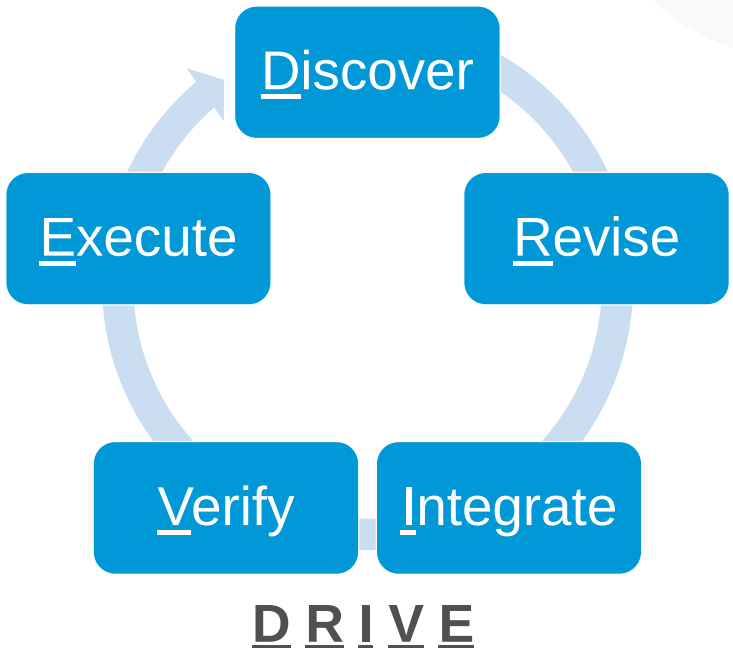
STEPS



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DISCOVER

- State of Your Model

What is the state of your model?

- Recently calibrated?
- EPS or SS?
- Represent GIS?

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DISCOVER

- State of Your Model
- Gather Data

		112	36	28	0.22
	Benoit	107	28	19	0.58
		103	62.6	25	0.09
		109	26	21	0.08
G		106	28	19	0.09
		113	36	29	0.22
		133	43	31	0.33
		107	34	29	0.20

2018

WATER SYSTEM MODEL BUILD AND CALIBRATION

FINAL
JULY 2018

Gather Data

- Gather data
  - pump curves, facility plans, valve details, GIS, demands, etc
- Previous reports
- Interview operations staff

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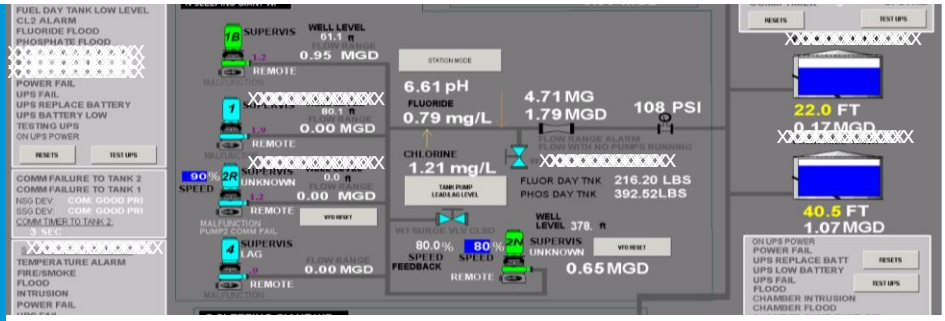
DISCOVER

- State of Your Model
- Gather Data
- Review SCADA



Review SCADA System

- Define boundary conditions
- What SCADA channels are available
- 1:1 match of SCADA to model elements

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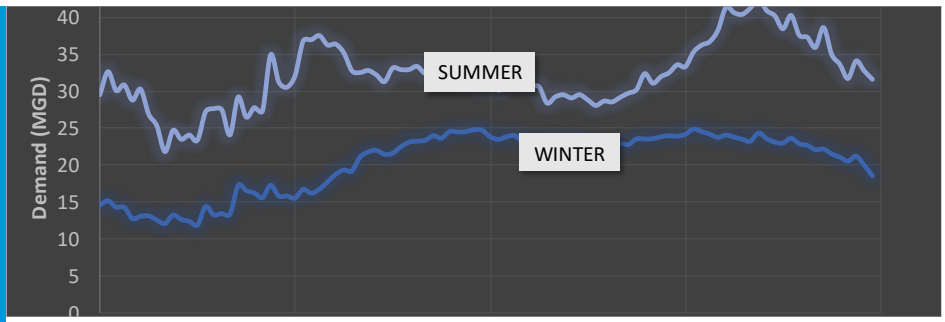
DISCOVER
REVISE

- Demands



Update Demands

- Include large users
- Develop “summer” and “winter” demands
- Use AMI/AMR if available

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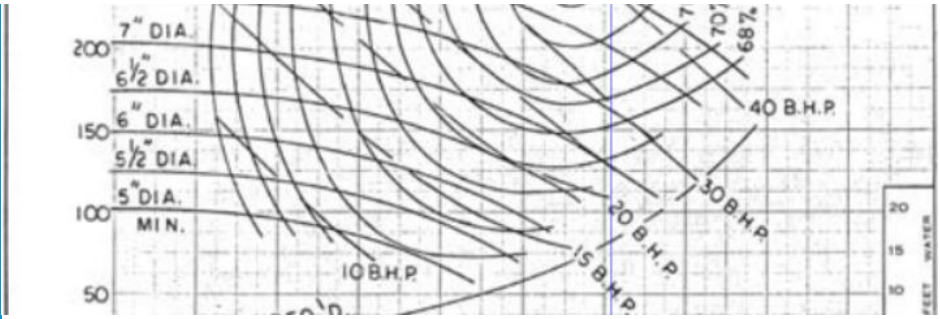
DISCOVER REVISE

- Demands
- **Pump Curves**



Update Pump Curves

- Avoid design point curves
- Pump testing
- SCADA – flow and pressure to indicate operating points
- Manufacturer curves

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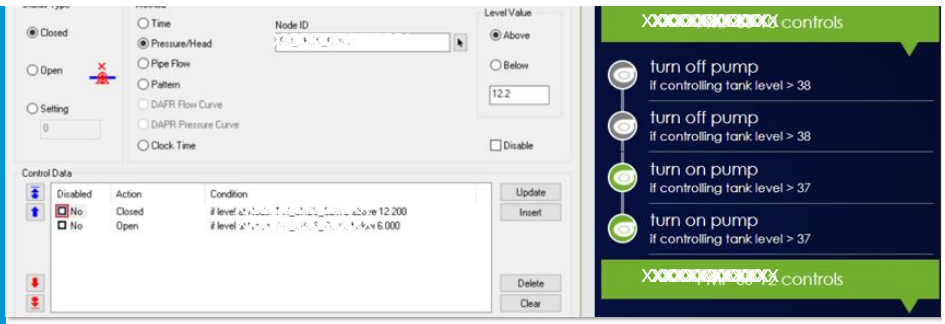
DISCOVER REVISE

- Demands
- Pump Curves
- **Controls**



Update Model Controls

- Try to get close to PLC logic
- Big difference between a PLC and modeling controls
- Create an off control for all pumps

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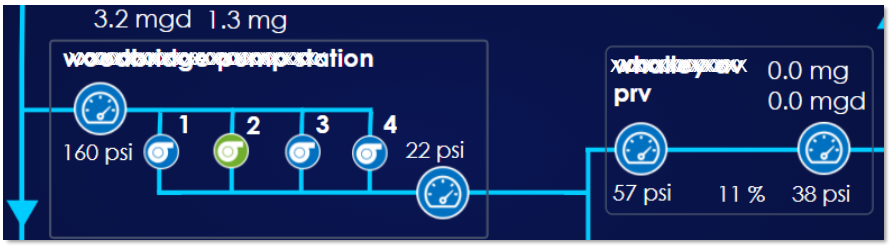
DISCOVER
REVISE
INTEGRATE

- Match SCADA & Connect SCADA



Match & Connect SCADA

- Flow ➔pipes
- Pressure ➔ Junctions
- Pump status ➔ pumps
- Valve settings ➔ valves

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DISCOVER
REVISE
INTEGRATE

- Match SCADA & Connect SCADA
- Document

	SCADAUnit	Unit	ModelID	DecimalDigits	ModelEle
e.Booster1.Run.Status.bit1			BP-CAM-1		Pumps
e.Booster2.Run.Status.bit1			BP-CAM-2		Pumps
e.Booster3.Run.Status.bit1			BP-CAM-3		Pumps
e.Bypass.Flow	gpm	mg	T-CAM-FCV	1	Valves
e.Bypass.Flow	gpm	cfs	T-CAM-FCV	1	Valves
e.Discharge.Flow	cfs	mg	P-15010	1	Pipes
e.Discharge.Flow	cfs	cfs	P-15010	1	Pipes
e.Reservoir.Level	ft	cfs	T-CAM	1	Tanks
e.Reservoir.Level	ft	ft	T-CAM	1	Tanks
e.Reservoir.Level	ft	ft	T-CAM	1	Tanks
e.Reservoir.Level	ft	%	T-CAM	0	Tanks

Document

- Track tags in a table or in RTM software
- Schematic displays
- Update over time

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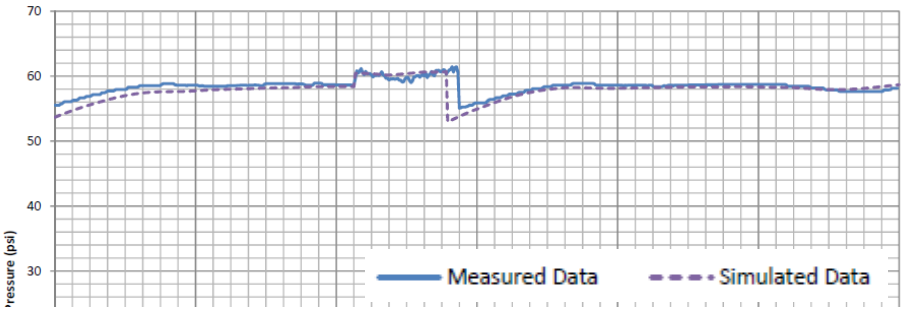
DISCOVER
REVISE
INTEGRATE
VERIFY

- Verify Historical Data



Verify Historical Data

- Validate using several days
- Recent data
- Does not need to be “exceptional”

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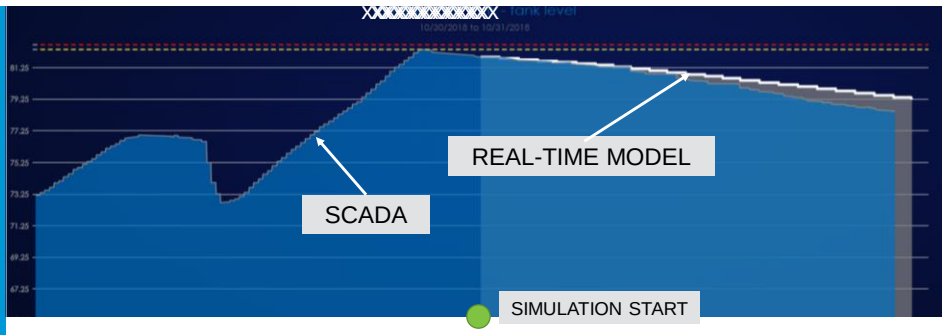
DISCOVER
REVISE
INTEGRATE
VERIFY

- Verify Historical Data
- Verify Live Data



Verify with Live Data

- Validates existing controls against current operations
- Continuously check accuracy

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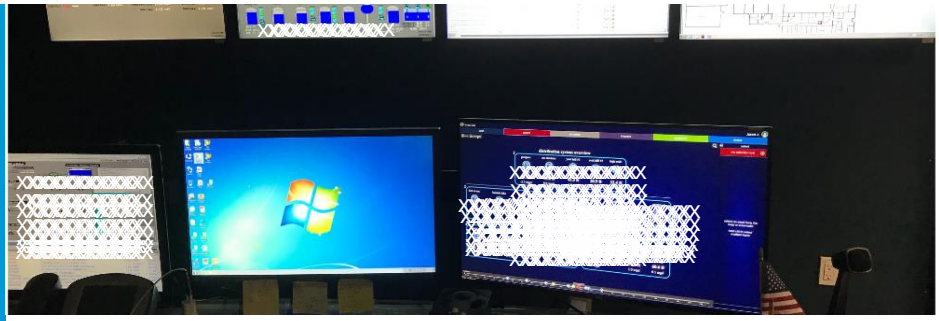
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- **Training**
- Use Cases



Training

- One on One training for operations and engineering
- Create a daily operating SOP
- Train new staff

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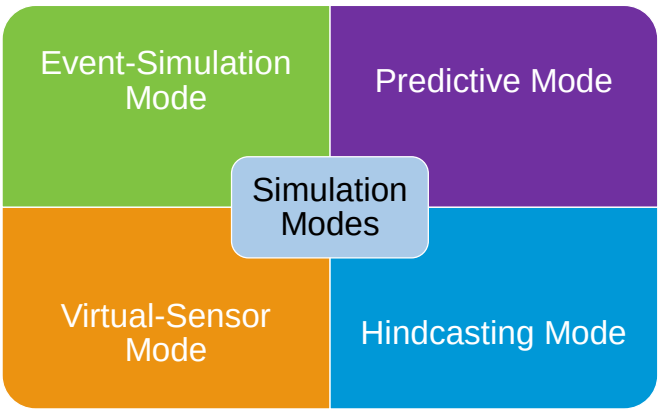
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- **Use Cases**



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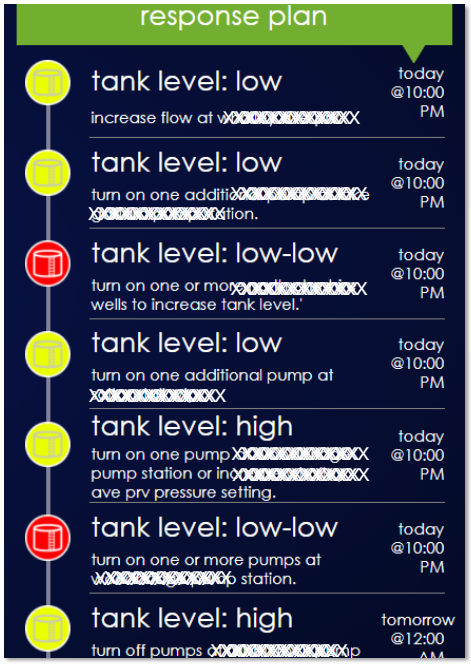
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- Use Cases
  - Daily Operations

Daily Operations

- Run RTM at start of shift
- Evaluate impacts
- Make changes and re-run
- Plan out the day

- **Predictive Mode**
- Event-Simulation Mode
- Hindcasting Mode
- Virtual-Sensor Mode



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DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- Use Cases
  - Daily Operations
  - Evaluate Impacts

Evaluate Impacts

- What-If analysis
- Test impacts system changes

- Predictive Mode
- **Event-Simulation Mode**
- Hindcasting Mode
- Virtual-Sensor Mode

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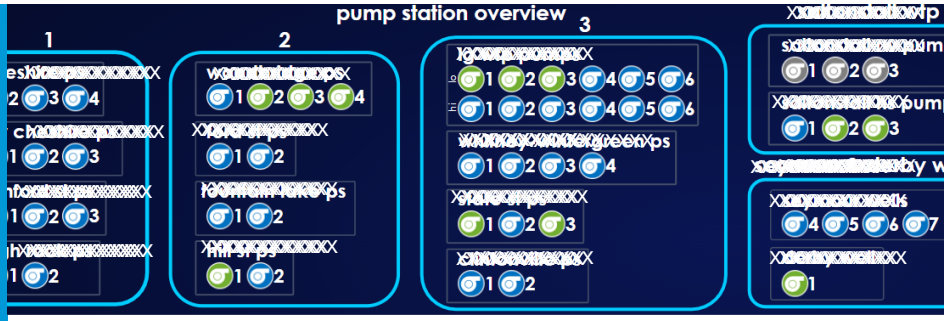
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- Use Cases
  - Daily Operations
  - Evaluate Impacts
  - Knowledgebase



Knowledgebase

- Unlocks all the data a model has to multiple departments
- RTM can support best practices for control rooms

- Predictive Mode
- Event-Simulation Mode
- **Hindcasting Mode**
- Virtual-Sensor Mode

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DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- Use Cases
  - Daily Operations
  - Evaluate Impacts
  - Emergency Response

Emergency Response

- Know real impacts to customers
- Gain confidence in response plan

- Predictive Mode
- **Event-Simulation Mode**
- Hindcasting Mode
- Virtual-Sensor Mode

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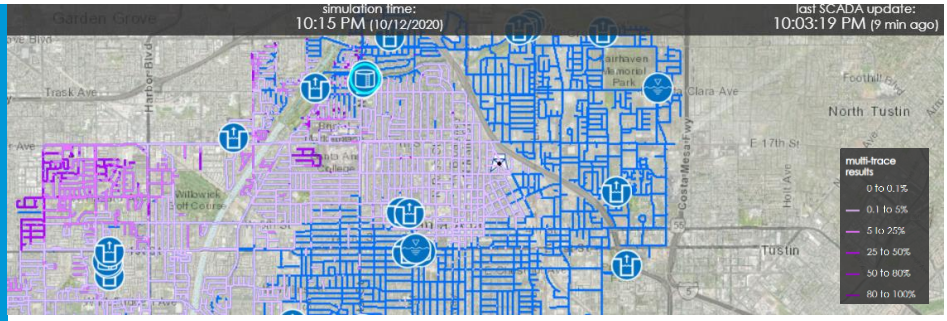
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- **Use Cases**
  - Daily Operations
  - Evaluate Impacts
  - Emergency Response
  - **Water Quality**



Water Quality

- Real-time source tracing
- Correlate complaints with water age and trace results
- Issue targeted work orders based on results

- Predictive Mode
- Event-Simulation Mode
- Hindcasting Mode
- **Virtual-Sensor Mode**

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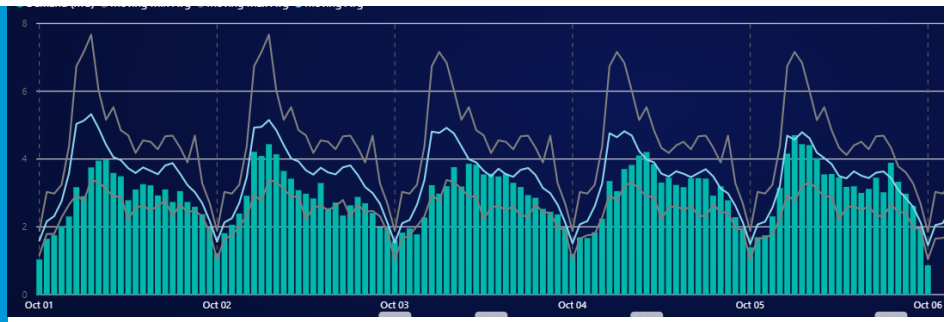
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- **Use Cases**
  - Daily Operations
  - Evaluate Impacts
  - Emergency Response
  - Water Quality
  - **Water Loss**



Water Loss

- Continuously calculate diurnal usage
- Detect anomalous flow
- Night-time flow analysis

- Predictive Mode
- Event-Simulation Mode
- Hindcasting Mode
- **Virtual-Sensor Mode**

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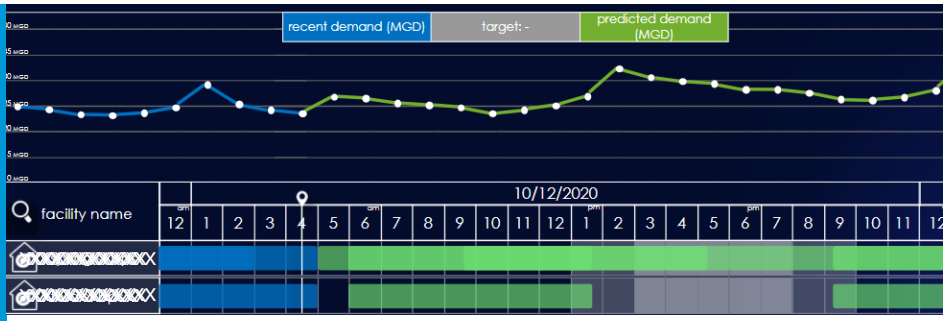
DISCOVER
REVISE
INTEGRATE
VERIFY
EXECUTE

- Training
- Use Cases
  - Daily Operations
  - Evaluate Impacts
  - Emergency Response
  - Water Quality
  - Water Loss
  - Optimization



Optimization

- RTM can support artificial intelligence and machine learning predictive algorithms
- Could be used to train neural networks and validate final recommendations

- **Predictive Mode**
- Event-Simulation Mode
- Hindcasting Mode
- **Virtual-Sensor Mode**

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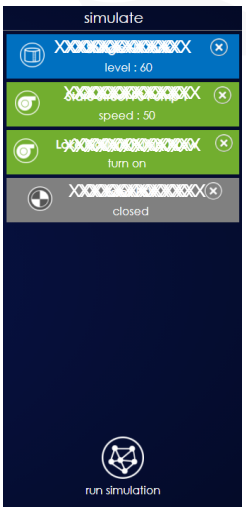
SUMMARY

- Traditional hydraulic modeling steps to improve, update, and validate still apply
- Focus on boundary conditions and model controls
- Industry is just scratching the surface on RTM use cases
- RTMs can provide a virtual data set to support SCADA



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Contact Info

THANK YOU!

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Website: Sedaru.com
LinkedIn: https://www.linkedin.com/company/sedaru/

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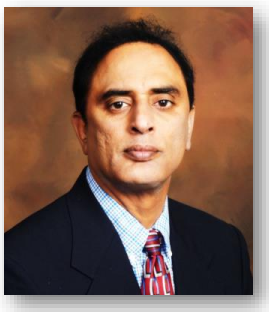
ASK THE EXPERTS



Sri Kamojjala, P.E., D.WRE
Las Vegas Valley Water District

Matt Sellers
Sedaru

Tiffany Lufkin
South Central Connecticut Regional Water Authority

Enter your **question** into the **question pane** on the right-hand side of the screen.

Please specify to whom you are addressing the question.

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South Central Connecticut Regional Water Authority

Application of Real Time Hydraulic Model & Water Loss Tool

Tiffany Lufkin, P.E.
Senior Planning Engineer

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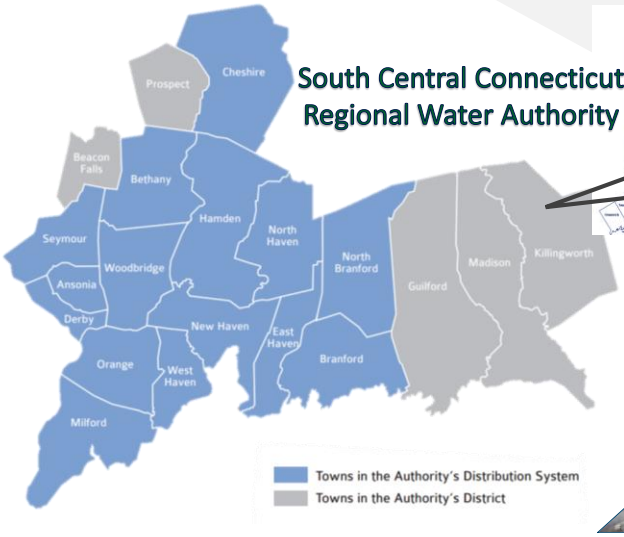
About Us



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Our Journey

Implementation of Smart Operations

Real-time Model

- Visioning
- Baseline data requirements
  - Secure communication of SCADA information
  - Documentation of set points & operating rules
  - Updated & calibrated hydraulic model
  - Energy rates and structures
- Staff Training & Buy-in

Water Loss Tool

- Advanced application of newly available AMI data (hourly reads)
- Mapping of relationships between SCADA & consumption data
- Discovery of legacy data errors

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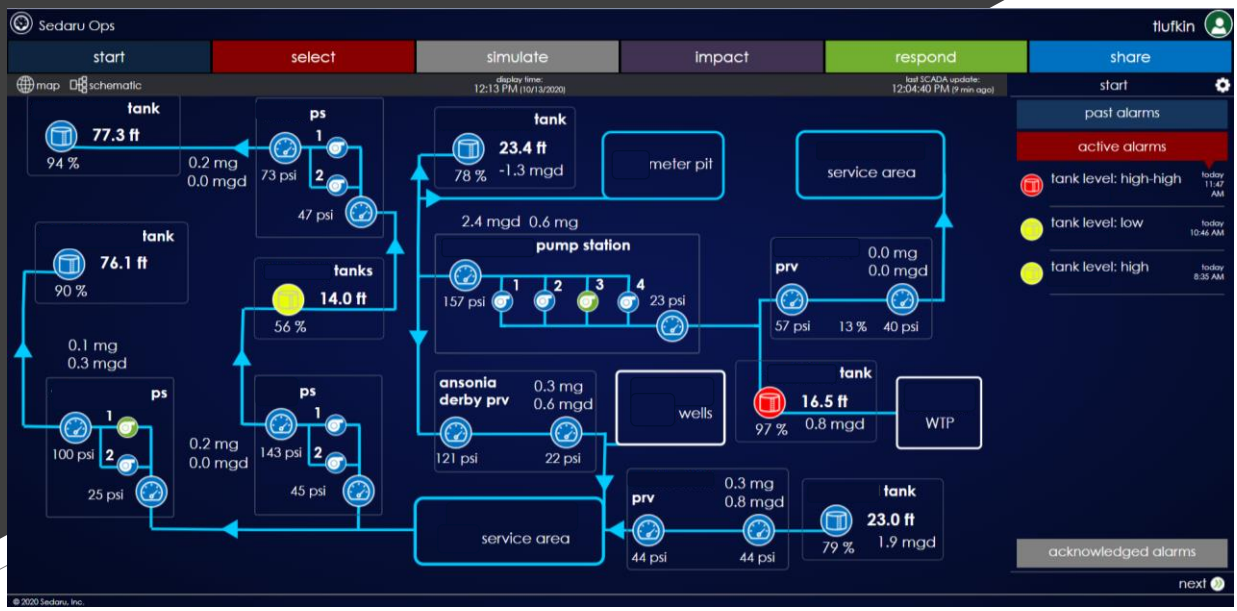
Ops Screens – Mimic SCADA



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Simplified Modelling

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Water Loss Tool

Pulling powerful data together

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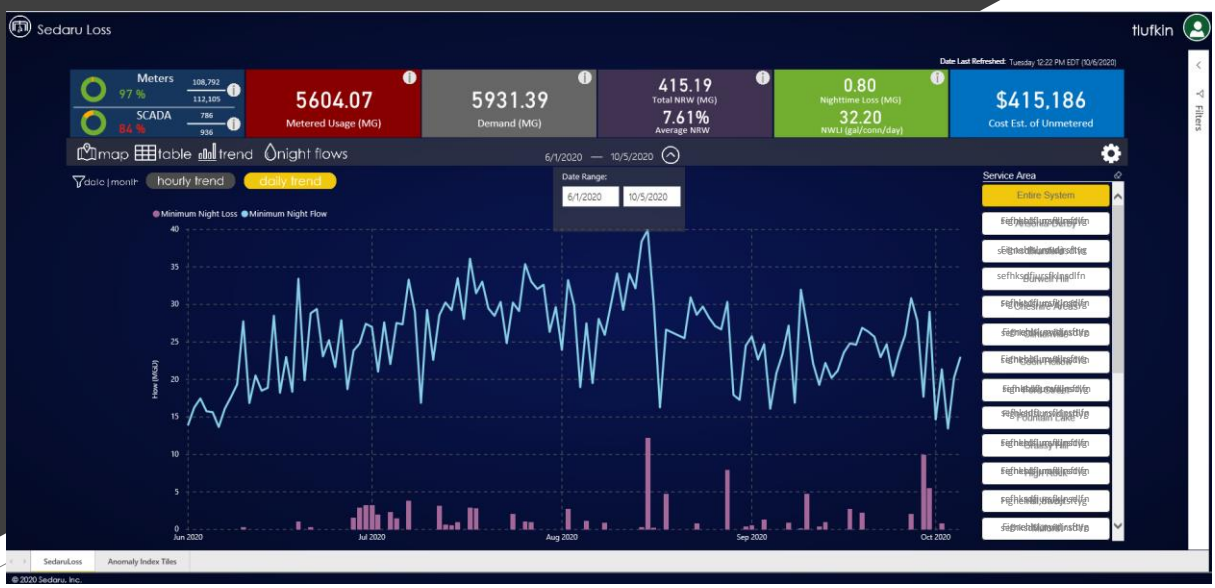
Water Loss – Night Flows



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Water Loss – Night Flows Detail

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Water Loss – SCADA Trend

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Water Loss – AMI Trend

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Water Loss – Unmetered Trend

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Looking Forward

Future Applications & Vision

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Looking Forward

Comprehensive Non-Revenue Water Control Planning

- Metrics and reporting
- Tailoring the leak survey
- Other water loss initiatives
- AWWA Water Balance
  - Apparent Losses
  - Real Losses
- Drought considerations

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Thank You

Tiffany Lufkin, P.E.
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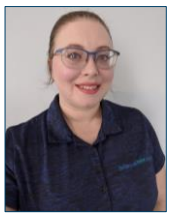
www.rwater.com



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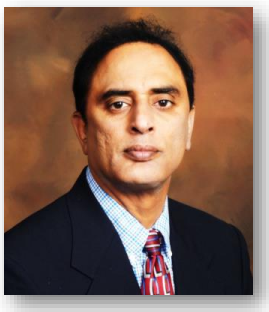
ASK THE EXPERTS



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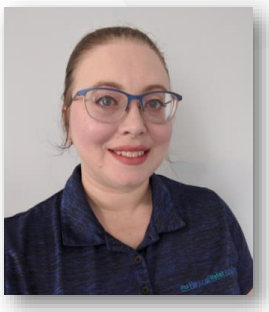

Tiffany Lufkin
South Central Connecticut Regional Water Authority

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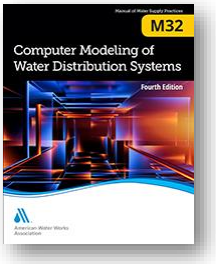
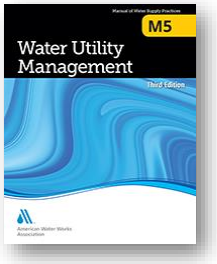
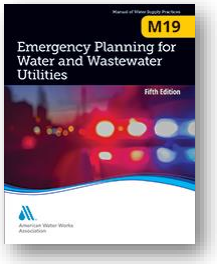
ADDITIONAL RESOURCES



M32 Computer Modeling of Water Distribution Systems
AWWA catalog no: 30032-4E



M5 Water Utility Management
AWWA catalog no: 30005-3E



M19 Emergency Planning for Water and Wastewater Utilities
AWWA catalog no: 30019-5E

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UPCOMING WEBINARS

Oct 15 - FREE Webinar: Innovation Roadmap for Utilities

Oct 16 - Getting the Lead Out: Legal Issues in EPA's Lead & Copper Rule: An AWWA Legal Community Virtual Roundtable Dialogue

Oct 20 - New AWWA Water Audit Software

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- Until next time, keep the water safe and secure.

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PRESENTER BIOGRAPHY INFORMATION

Mr. Sellers serves as Sedaru's Product Manager for real-time modeling and data integrated solutions, maximizing IoT data including SCADA, AMI, pressure/flow sensors with traditional hydraulic modeling EPANet-based files. Mr. Sellers has been deploying water system models driven by real-time sensor/IoT data for nearly a decade.

Mr. Kamojjala has been with Las Vegas Valley Water District and manages their real-time modeling efforts. He holds a MS degree in civil engineering and an MS degree in computer science from the University of Louisville.

Tiffany Lufkin is the Senior Planning Engineer at South Central Connecticut Regional Water Authority. She has been with the company for twelve years, since graduating from Worcester Polytechnic Institute with a Bachelor's in Civil Engineering in 2008.

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