



Dashboards for Well and Distribution System Monitoring Result in Proactive Well Maintenance and Improved System Operations

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Outline

1. Background Information: Groundwater & Well Hydraulics
2. Well Data Logging
3. Example Well Monitoring Dashboards
4. Distribution System Monitoring
Overview and Example Dashboards
5. Closing Thoughts
6. Q&A

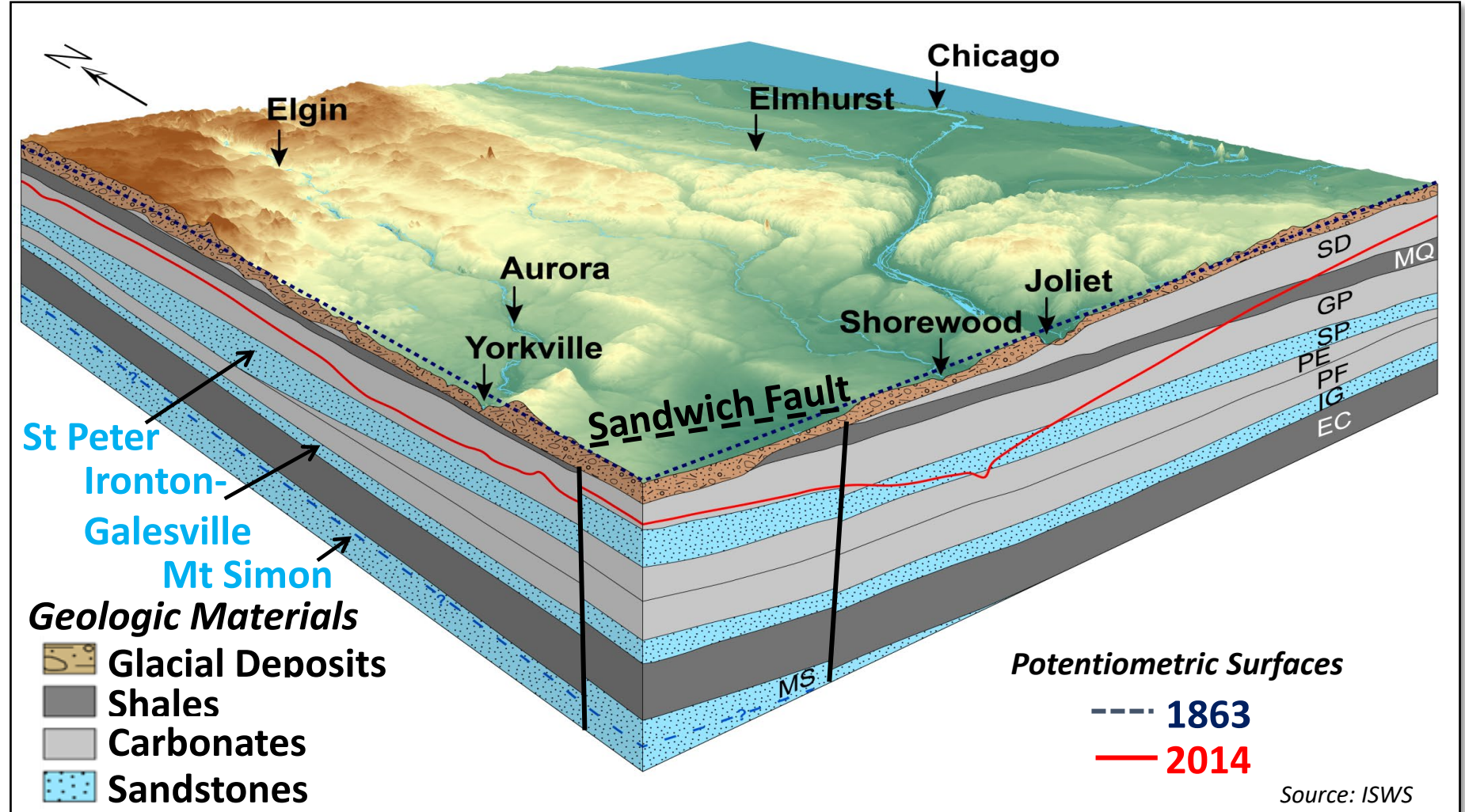
**BACKGROUND INFORMATION:
GROUNDWATER & WELL
HYDRAULICS**

Why Is This Important?



- 💧 Declining Aquifer Levels
- 💧 Continuous Well Performance Monitoring
- 💧 Planned vs. Emergency Rehabilitation
- 💧 Long-Term Supply Planning

Deep Aquifer System Overview in Northeastern Illinois



Well Hydraulics Overview

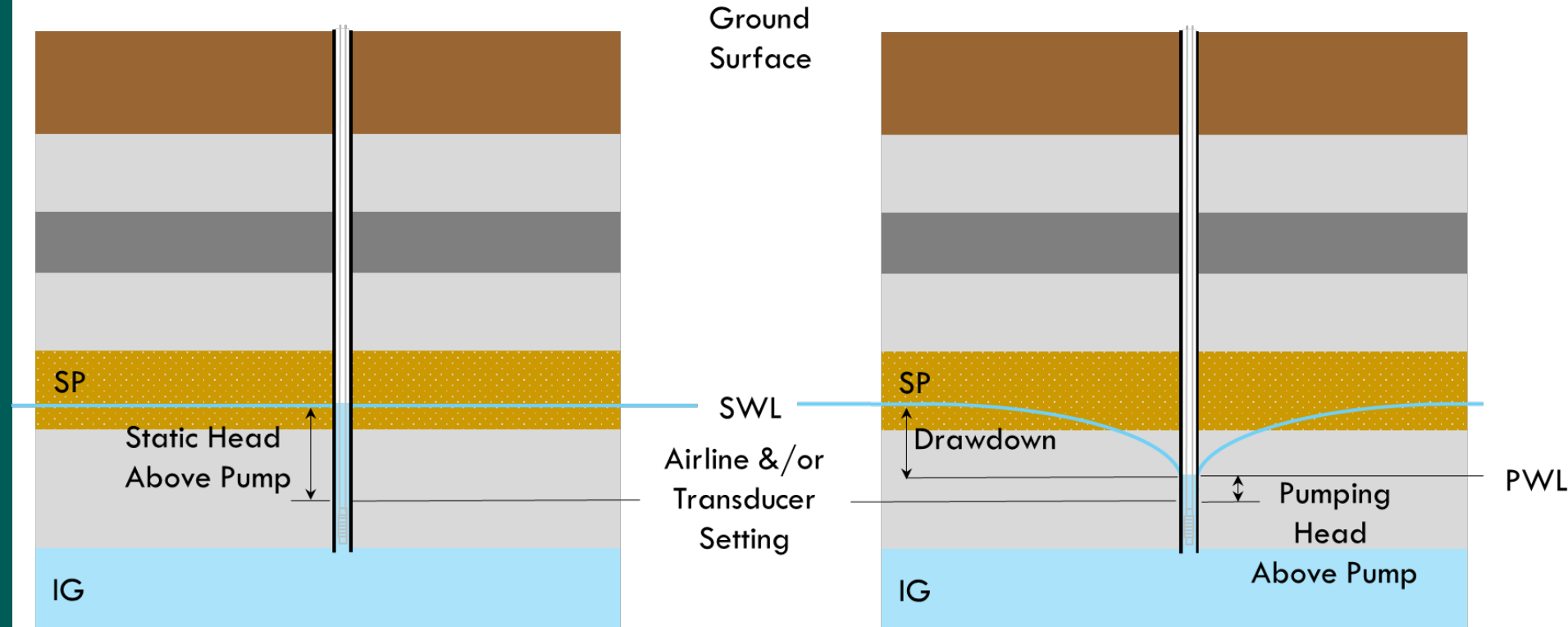
Drawdown =

SWL (ft) – PWL (ft)

Specific Capacity =

$\frac{\text{Pumping Rate (gpm)}}{\text{Drawdown (ft)}}$

Drawdown (ft)



IG = Ironton-Galesville Sandstone Aquifer

PWL = Pumping Water Level

SP = Ancell / St. Peter Sandstone Aquifer

SWL = Static Water Level



WELL DATA LOGGING



Recommended Data

- 💧 Static Water Level
- 💧 Pumping Water Level
- 💧 Pumping Rate

Monthly Well Data Collection & Tracking

Additional Data

- 💧 Amp Draw
- 💧 Current Unbalance
- 💧 Water Quality

Well Data Collection Guidelines



- 💧 Allow Well to run for a period before taking PWL reading (e.g. until PWL stabilizes)
- 💧 Before taking SWL reading (if Well has been running), turn the Well off and allow the level to recover
- 💧 Compare airline vs. level transducer readings (if both available)
- 💧 Compare multiple flow readings, if available (e.g. Well vs. WTP)



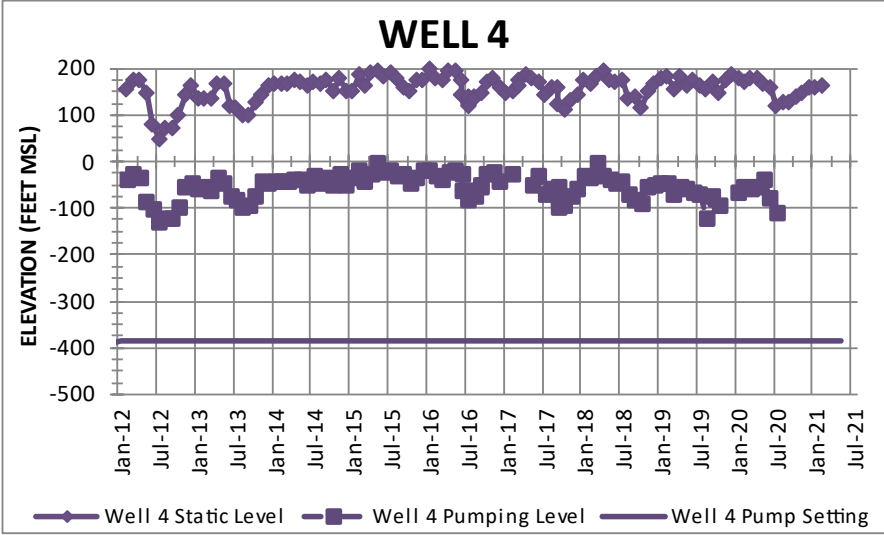
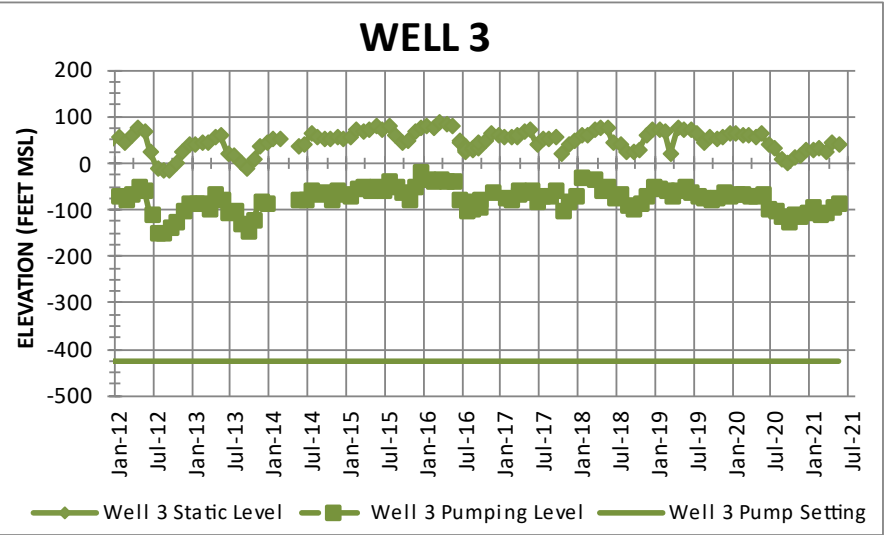
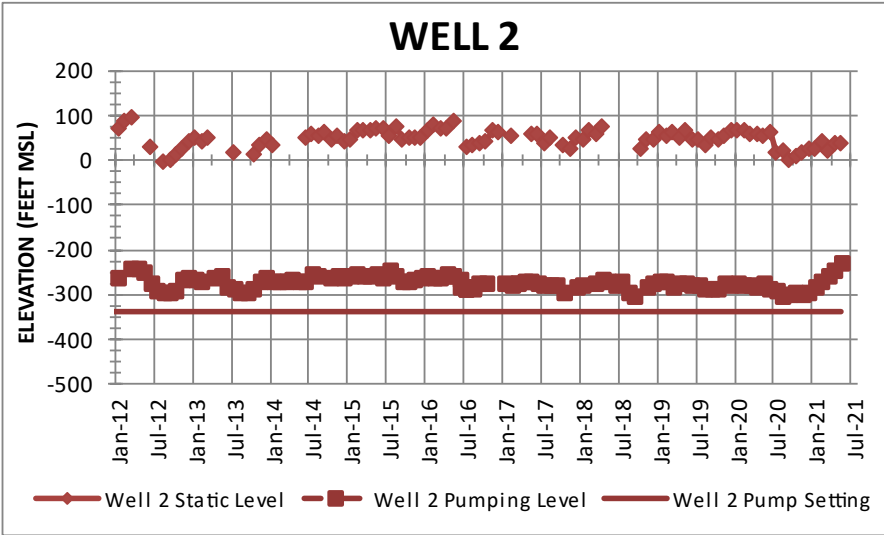
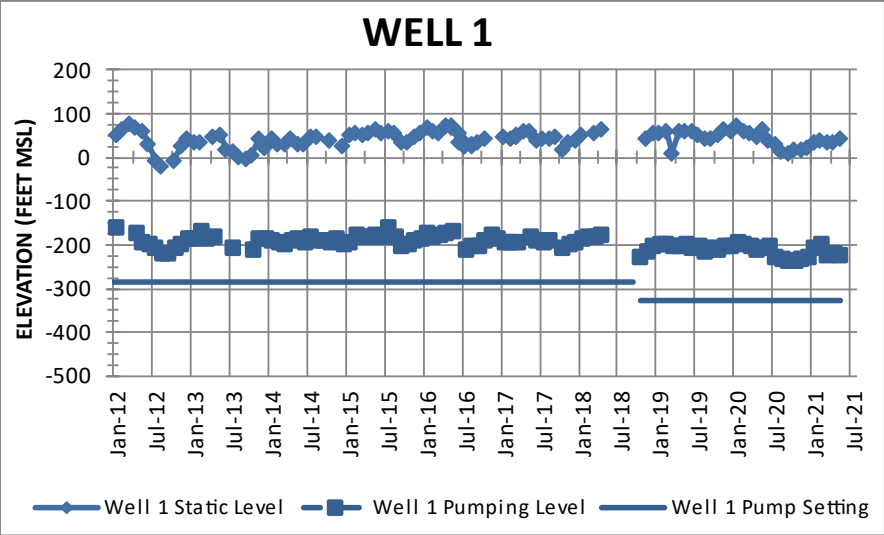
EXAMPLE WELL MONITORING DASHBOARDS

Example Well Dashboards – Water Levels

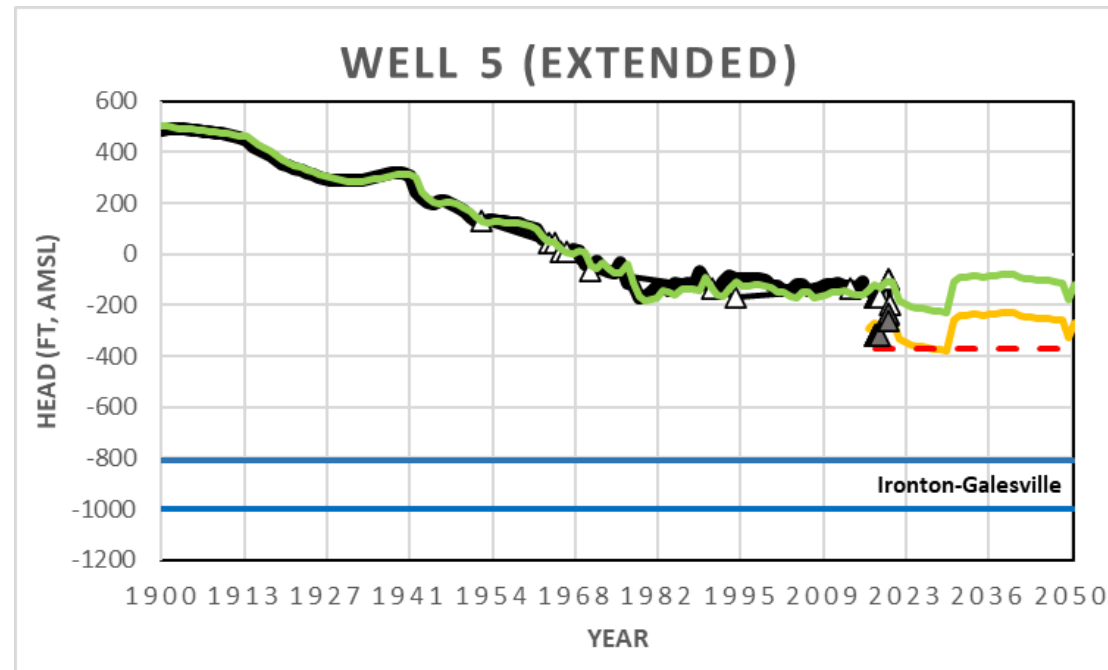
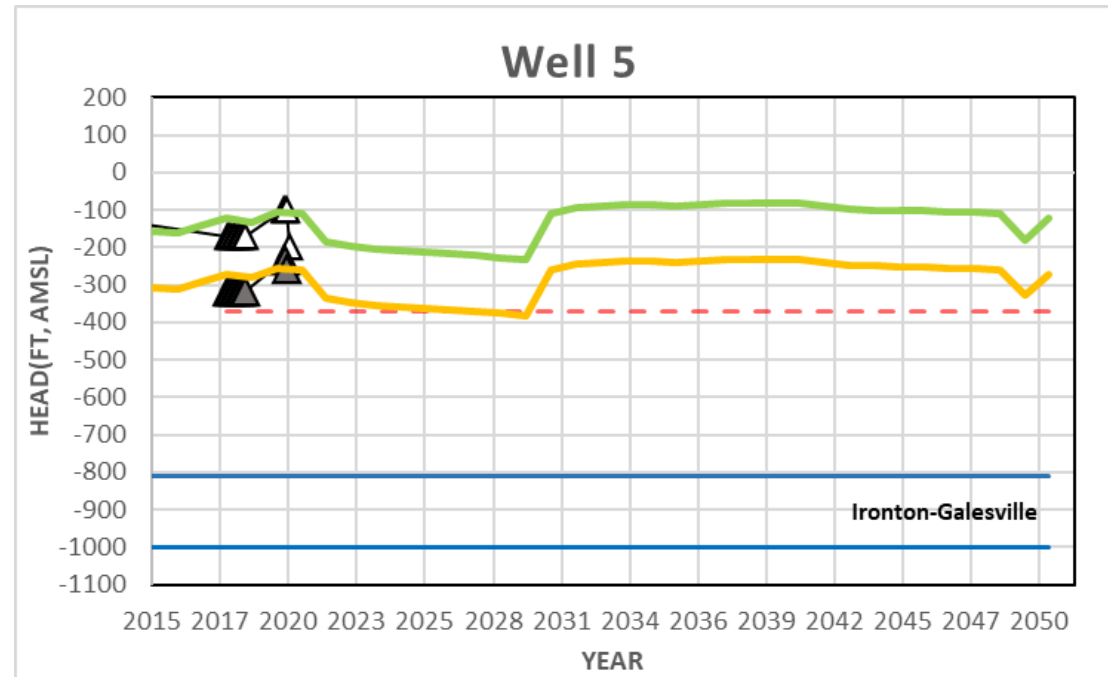
Static Level

Pumping Level

Pump Setting

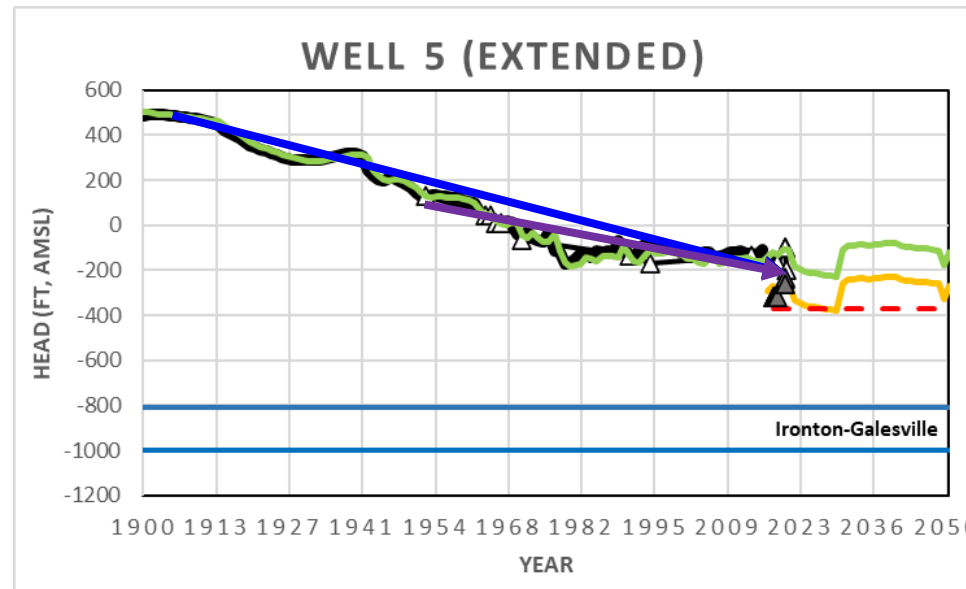
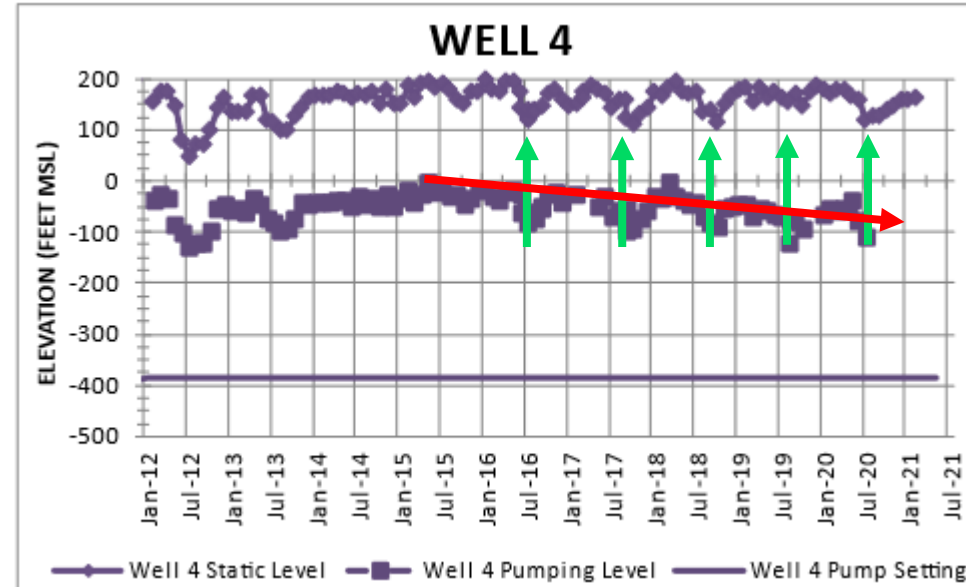


Example Alternate Well Dashboards: Historic Water Levels (Modeled vs. Observed)



Well Water Level Dashboard Observations

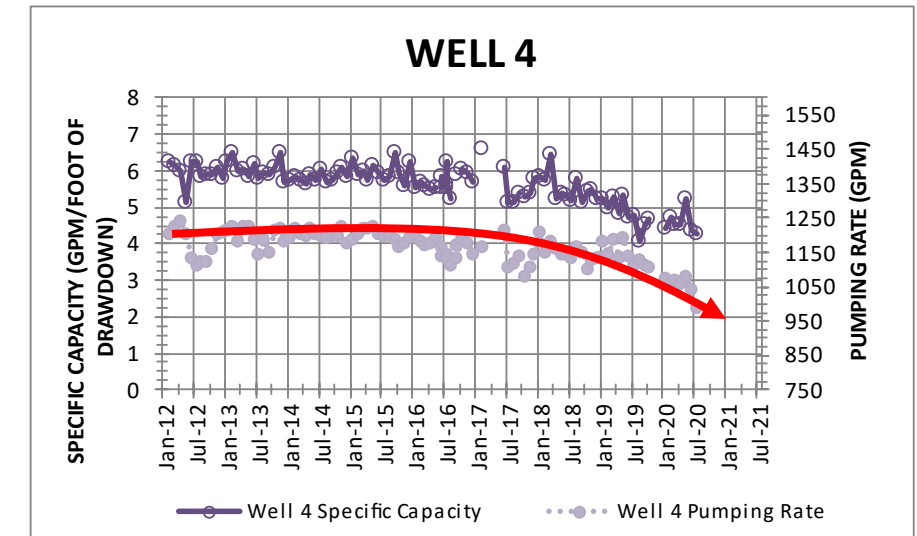
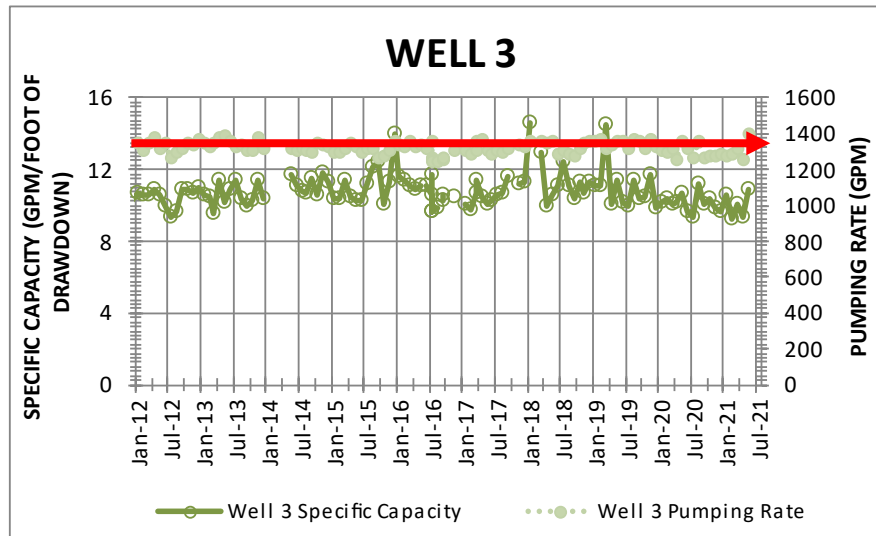
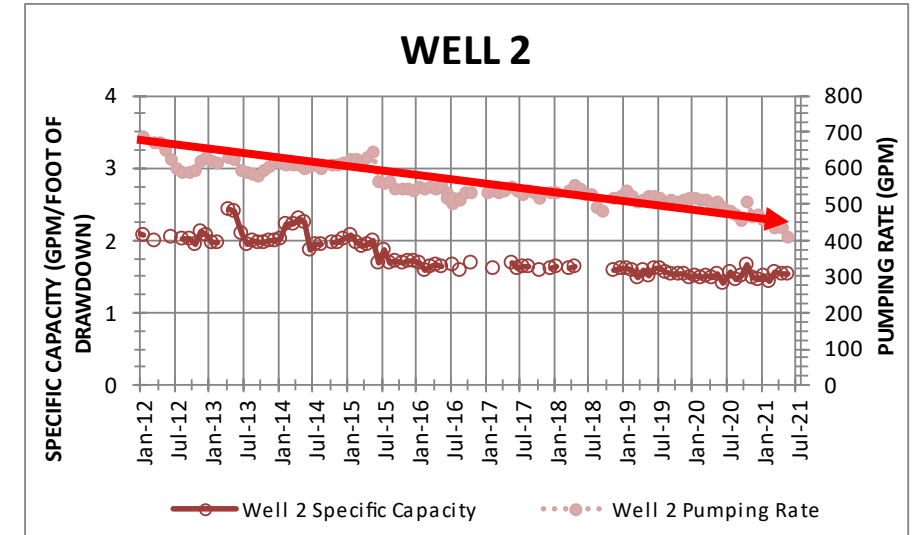
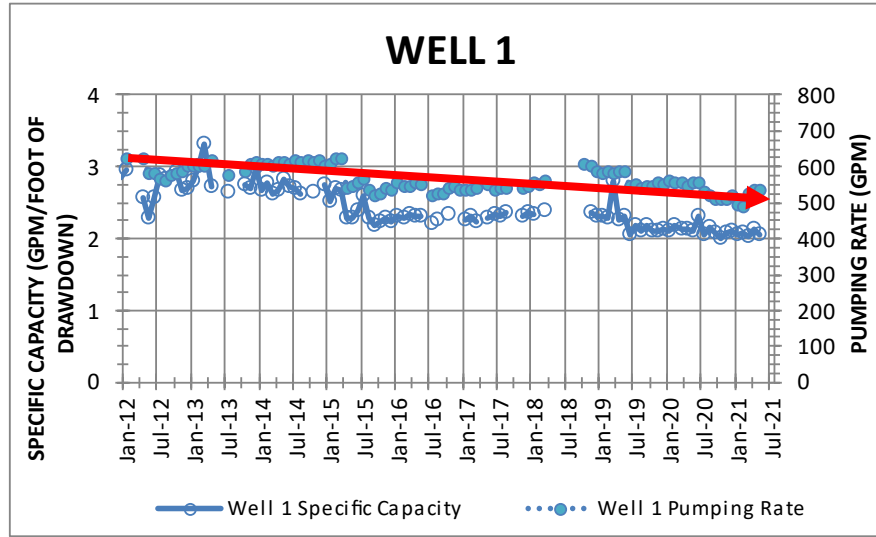
- 💧 Seasonal Variations
- 💧 Long-Term Trends
- 💧 Historical vs. Modeled Levels Comparison
- 💧 System Operations & Planning Related to Well Usage & Rehabilitation (Short-Term & Long-Term)



Example Well Dashboards – Pumping Capacity

💧 Pumping Rate

💧 Specific Capacity





DISTRIBUTION SYSTEM MONITORING OVERVIEW AND EXAMPLE DASHBOARDS

Distribution System Water Quality Monitoring Parameters



💧 Free Chlorine

💧 Phosphate

💧 Iron

💧 *Others*

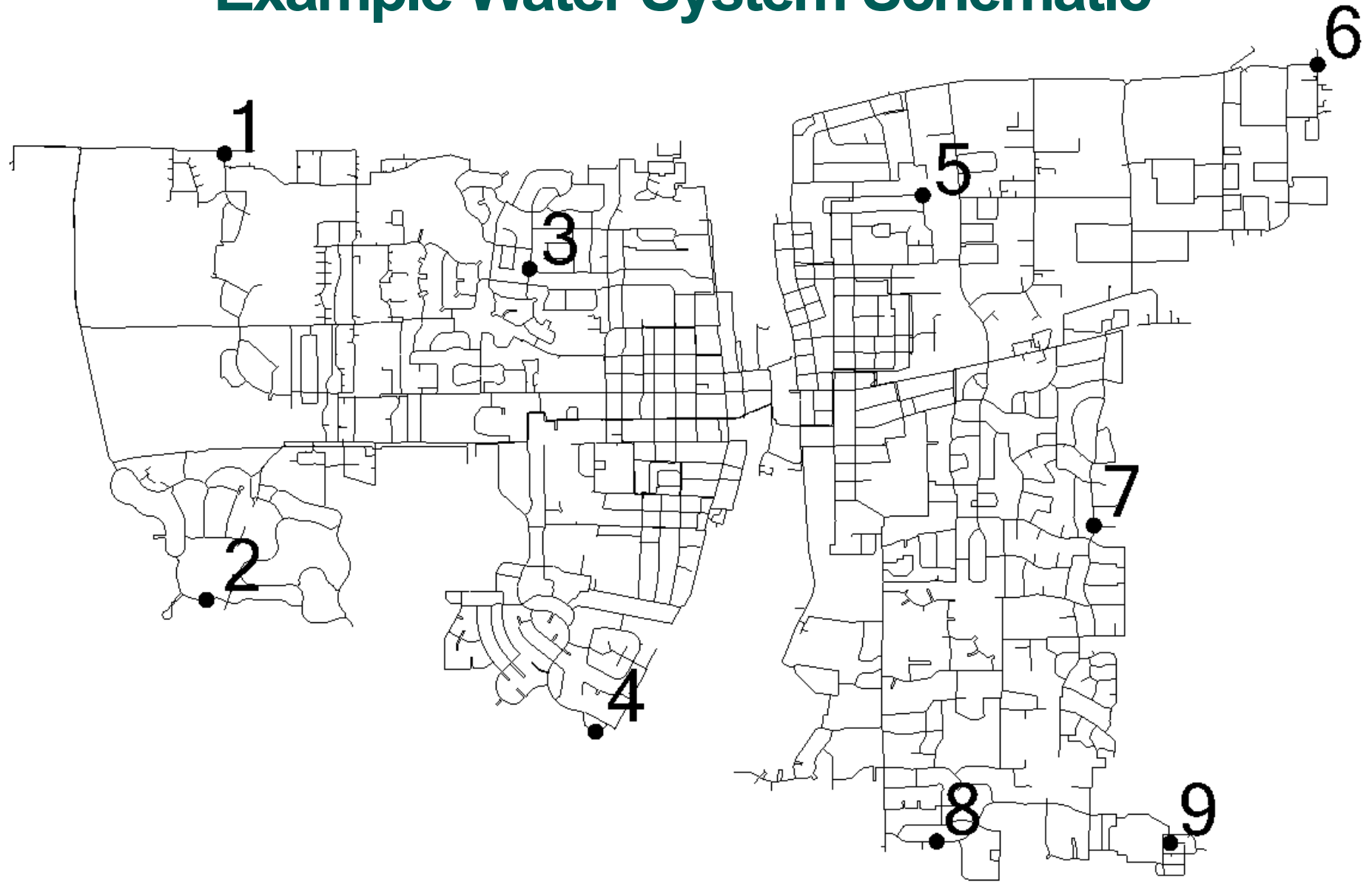
Example Distribution Water Quality Goals/Requirements

Free Chlorine – Minimum free chlorine residual of 0.5 mg/L (or combined chlorine residual of 1.0 mg/L) required in the distribution system per IL law.

Phosphate – Target minimum residual of 1.0 mg/L (not a regulatory requirement – for corrosion control).

Iron – Maximum concentration of 0.3 mg/L per USEPA Secondary Max Contaminant Level (MCL); Target maximum concentration of 0.1 mg/L for taste/odor (not a regulatory requirement)

Distribution System Monitoring Dashboards – Example Water System Schematic



Distribution System Monitoring Dashboards – Historical Data Table

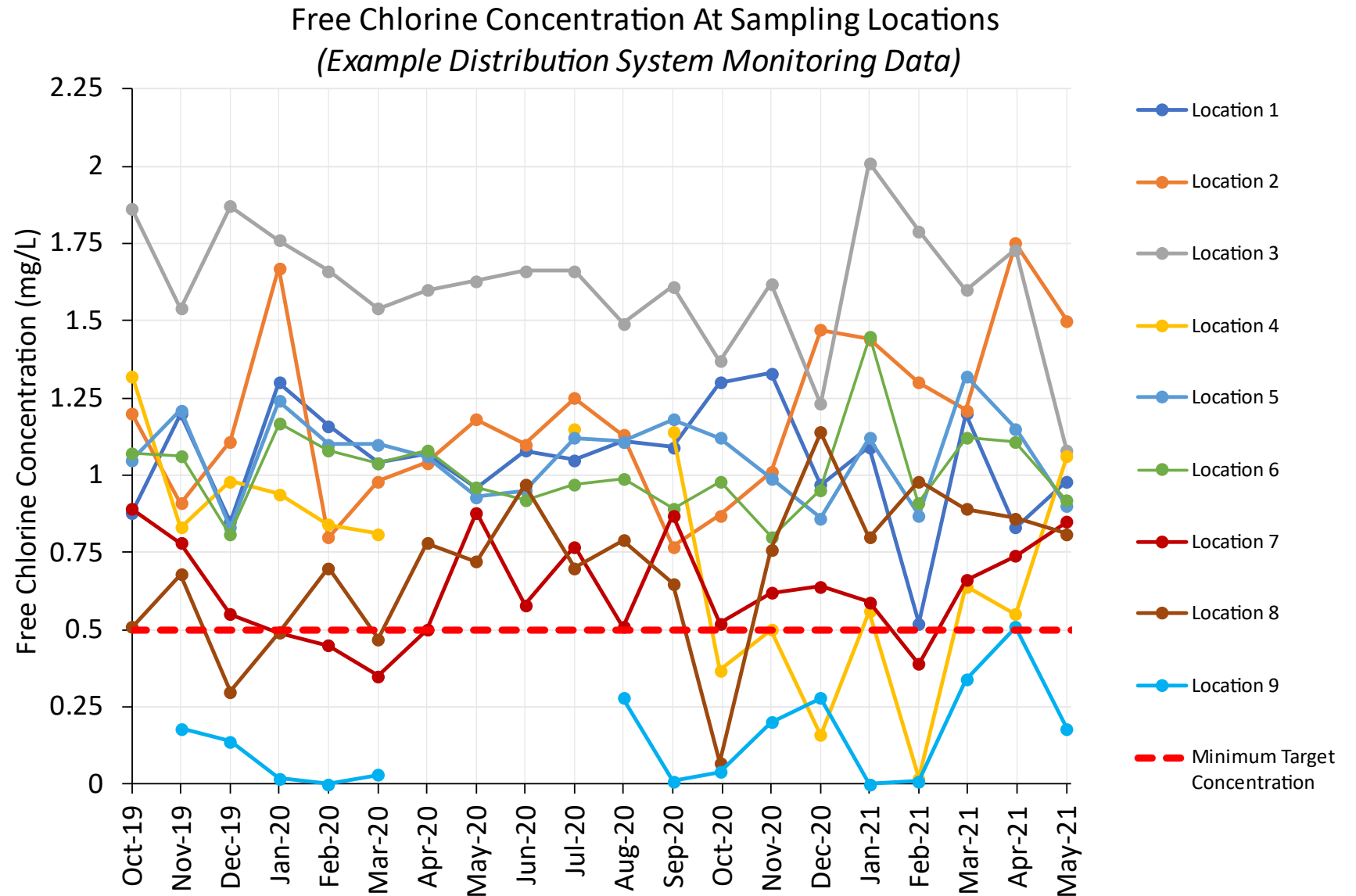
Month	Location 1			Location 2			Location 3			Location 4			Location 5			Location 6			Location 7			Location 8			Location 9		
	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)	Phosphate (mg/L)	Iron (mg/L)	Free Cl (mg/L)
Oct-19	1.25	0.02	0.88	1.01	0.06	1.2	1.75	0	1.86	1.25	0.02	1.32	1.19	0.02	1.05	1.19	0.02	1.07	1.62	0.02	0.89	1.27	0.1	0.51			
Nov-19	1.11	0.02	1.2	0.9	0.02	0.91	1.64	0.01	1.54	1.44	0	0.83	1.25	0.02	1.21	1.23	0.02	1.06	1.59	0.01	0.78	0.89	0.09	0.68	1.52	0.06	0.18
Dec-19	1.08	0.04	0.85	0.96	0.08	1.11	1.68	0.04	1.87	1.63	0	0.98	1.39	0	0.83	1.03	0.01	0.81	1.84	0	0.55	1.05	0.14	0.3	1.23	0.08	0.14
Jan-20	1.25	0.04	1.3	1.11	0.06	1.67	1.83	0.04	1.76	1.38	0	0.94	1.36	0.04	1.24	1.11	0.01	1.17	1.51	0	0.49	0.86	0.11	0.49	1.34	0.06	0.02
Feb-20	0.88	0.04	1.16	1.41	0.05	0.8	1.9	0.01	1.66	1.77	0.01	0.84	1.14	0.02	1.1	1.12	0.03	1.08	1.84	0.01	0.45	1.43	0.15	0.7	1.52	0.34	0
Mar-20	1.04	0.04	1.04	1.4	0.04	0.98	1.85	0.01	1.54	1.33	0.01	0.81	1.06	0.04	1.1	1.09	0	1.04	2.04	0.11	0.35	1.57	0.14	0.47	1.49	0.16	0.03
Apr-20	0.93	0.04	1.07	2.1	0.1	1.04	1.94	0	1.6				1.05	0.03	1.06	1.06	0	1.08	1.87	0.01	0.5	1.81	0.04	0.78			
May-20	0.83	0.02	0.96	1.93	0.05	1.18	1.96	0.01	1.63				0.89	0.02	0.93	0.93	0.02	0.96	1.91	0	0.88	2.03	0.07	0.72			
Jun-20	1.34	0.03	1.08	1.39	0.07	1.1	2.29	0	1.66				1.39	0.03	0.95	1.47	0.02	0.92	1.95	0.03	0.58	1.8	0.08	0.97			
Jul-20	1.58	0.02	1.05	2.16	0.09	1.25	2.29	0	1.66	1.72	0.01	1.15	1.36	0.02	1.12	1.53	0.02	0.97	1.73	0	0.77	2.14	0.07	0.7			
Aug-20	1.7	0.05	1.11	2.03	0.05	1.13	1.93	0.02	1.49				1.56	0.02	1.11	1.6	0.01	0.99	2.14	0.05	0.51	2.19	0.1	0.79	1.36	0.04	0.28
Sep-20	1.58	0.03	1.09	2.15	0.05	0.77	2.04	0	1.61	1.6	0	1.14	1.42	0.01	1.18	1.51	0.02	0.89	2.03	0.01	0.87	2.17	0.09	0.65	1.6	0	0.01
Oct-21	1.33	0.03	1.3	1.21	0.01	0.87	2.5	0	1.37	1.92	0.05	0.37	1.45	0.06	1.12	1.45	0.02	0.98	2.16	0.06	0.52	0.96	0.39	0.07	1.75	0.2	0.04
Nov-21	1.38	0.05	1.33	2.7	0.02	1.01	1.88	0	1.62	1.75	0.59	0.5	1.37	0.03	0.99	1.35	0.02	0.8	1.58	0.06	0.62	1.64	0.14	0.76	1.38	0.33	0.2
Dec-21	1.25	0.05	0.97	1.8	0.05	1.47	2.39	0.04	1.23	1.45	0.76	0.16	1.02	0.04	0.86	1.3	0.04	0.95	1.89	0.01	0.64	1.77	0.12	1.14	3.13	1.88	0.28
Jan-21	1.16	0.06	1.09	1.87	0.04	1.44	2.12	0.02	2.01	1.21	0.21	0.56	1.82	0.03	1.12	1.21	0.04	1.45	1.97	0.08	0.59	2.01	0.04	0.8	1.01	0.53	0
Feb-21	1	0.07	0.52	1.95	0.03	1.3	2.55	0	1.79	1.52	0.4	0.02	1.3	0.05	0.87	1.24	0.04	0.91	2.3	0	0.39	1.74	0.06	0.98	0.97	0.54	0.01
Mar-21	1.47	0.06	1.2	1.76	0.05	1.21	2.28	0.01	1.6	1.79	0.05	0.64	1.35	0.06	1.32	1.24	0.07	1.12	2.2	0.17	0.66	1.81	0.09	0.89	1.41	0.2	0.34
Apr-21	0.11	0.04	0.83	1.5	0.03	1.75	2.52	0.01	1.73	1.96	0.01	0.55	1.26	0.03	1.15	1.25	0.03	1.11	2.34	0.39	0.74	1.63	0.09	0.86	1.66	0.06	0.51
May-21	1.36	0.03	0.98	1.9	0.03	1.5	2.86	0	1.08	1.87	0.02	1.06	1.54	0.03	0.9	1.46	0.05	0.92	1.99	0.03	0.85	1.58	0.04	0.81	1.81	0.06	0.18

Red = Above/Below Regulatory Requirement/Target

Yellow = Above/Below Target Level (not regulatory)

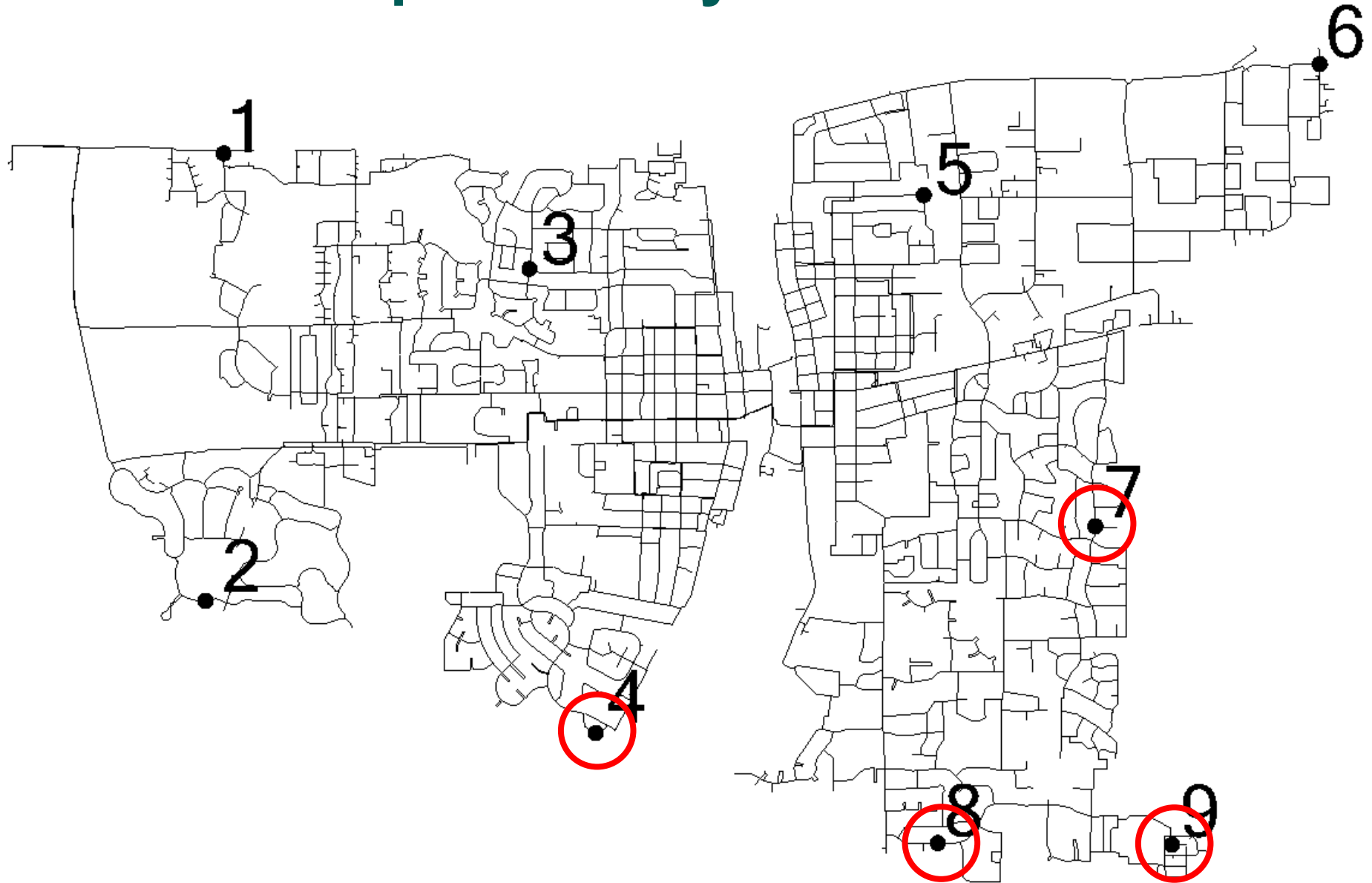
Example Water Quality Dashboard – Free Chlorine

Minimum Free Chlorine Distribution System Residual of 0.5 mg/L



Distribution System Monitoring Dashboards – Example Water System Schematic

Historical
Low to
Marginal
Chlorine
Residual



Distribution System Water Quality Monitoring Results



Planning Resource/Guidance for:

- 💧 Chemical Dosage Adjustments at Supply Points/Treatment Plants
- 💧 Modified System Operations (e.g. Earlier or More Frequent Flushing)
- 💧 Potential System Improvements (e.g. auto-flushers, remote chemical dosing stations, etc.)
- 💧 *And more...*



CLOSING THOUGHTS

Well and Distribution System Monitoring Summary



- 💧 Regular (monthly) monitoring and/or sampling of key parameters
- 💧 Simple dashboard tools can be utilized to track data and observe trends
- 💧 Resulting data can aid short-term in making system adjustments and longer term in capital planning



QUESTIONS?

THANK YOU!



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