



**Converting an Unchlorinated
System to Full Chlorination/
Arsenic/Manganese Treatment**
Beth Mende, PE



AGENDA

- 01** Project Background
- 02** Treatment Process Selection
- 03** Site Constraints
- 04** Summary





01 Project Background



History

- Water Supply:
 - Service Zone A (Wells 2,3 and 4N)
 - Service Zone B (Wells 14 and 16)
- Unchlorinated system
- Total coliform detections in Zone B
 - Risk of violating TCR
- Coliform Investigation
- Required by State to begin chlorinating
- Water quality aesthetic concerns with chlorination
- Groundwater treatment selected to minimize concerns
- DWSRF for project funding

Well Locations

- Service Zone A
 - Well 2, 3 and 4N
- Service Zone B
 - Well 14 and 16



Zone A Raw Water Quality (Wells 2, 3 and 4N)

Parameter	Units	Regulated Limit	Well 2 Results	Well 3 Results	Well 4N Results
Total Dissolved Solids	mg/L	500	182	258	110
pH	specific units	6.0 – 9.0	7.69	7.69	8.18
Hardness	mg/L as CaCO ₃	-	90.9	133	80.7
Iron	mg/L	0.3	0.1	<0.1	0.324
Manganese	mg/L	0.050	0.02	0.069	0.028
Arsenic	mg/L	0.01	0.003	0.005	0.028
Alkalinity	mg/L as CaCO ₃	(none)	65.6	66.7	79.6

Zone B Raw Water Quality (Wells 14 and 16)

Parameter	Units	Regulated Limit	Well 14 Results	Well 16 Results
Total Dissolved Solids	mg/L	500	129	119
pH	specific units	6.0 – 9.0	8.06	8.09
Hardness	mg/L as CaCO ₃	-	86	84
Iron	mg/L	0.3	<0.1	<0.1
Manganese	mg/L	0.050	0.079	0.077
Arsenic	mg/L	0.01	0.009	0.008
Alkalinity	mg/L as CaCO ₃	(none)	100	78

Well Capacities

Source	Service Zone	Capacity (gpm)
Well 2	A	120
Well 3	A	74
Well 4N	A	115
Well 14	B	300
Well 16	B	320



Treatment Process Selection

02



Treatment Alternatives

- Maintain current operations
- Regular, intermittent chlorination to kill bacterial growth
- Constant chlorination to kill of bacterial growth and prevent from returning
- Constant chlorination with sequestrant to mask manganese-related color issues
- Constant chlorination and installation of pyrolusite filters to remove manganese

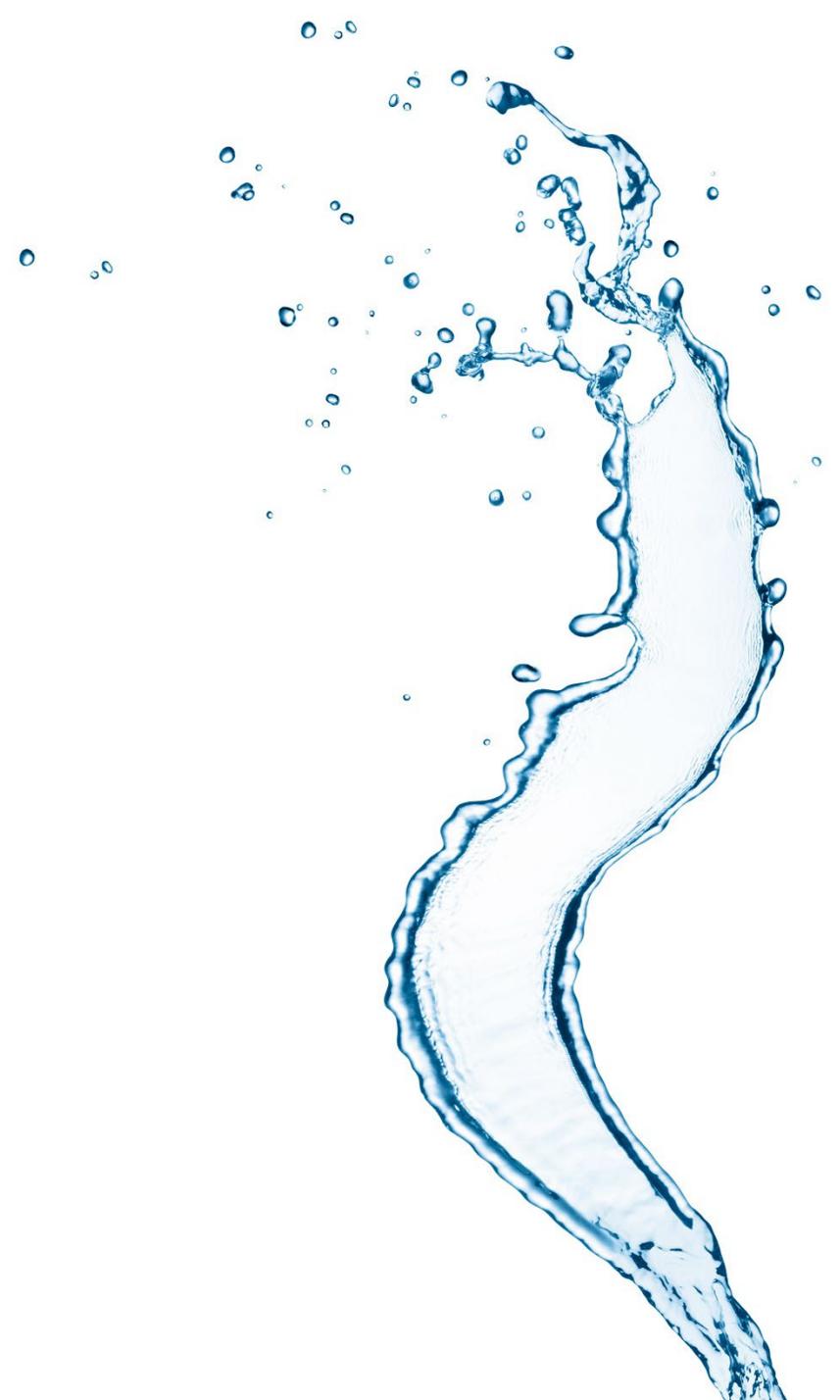
DWSRF Scope

Well Nos. 2,3 and 4N Sites

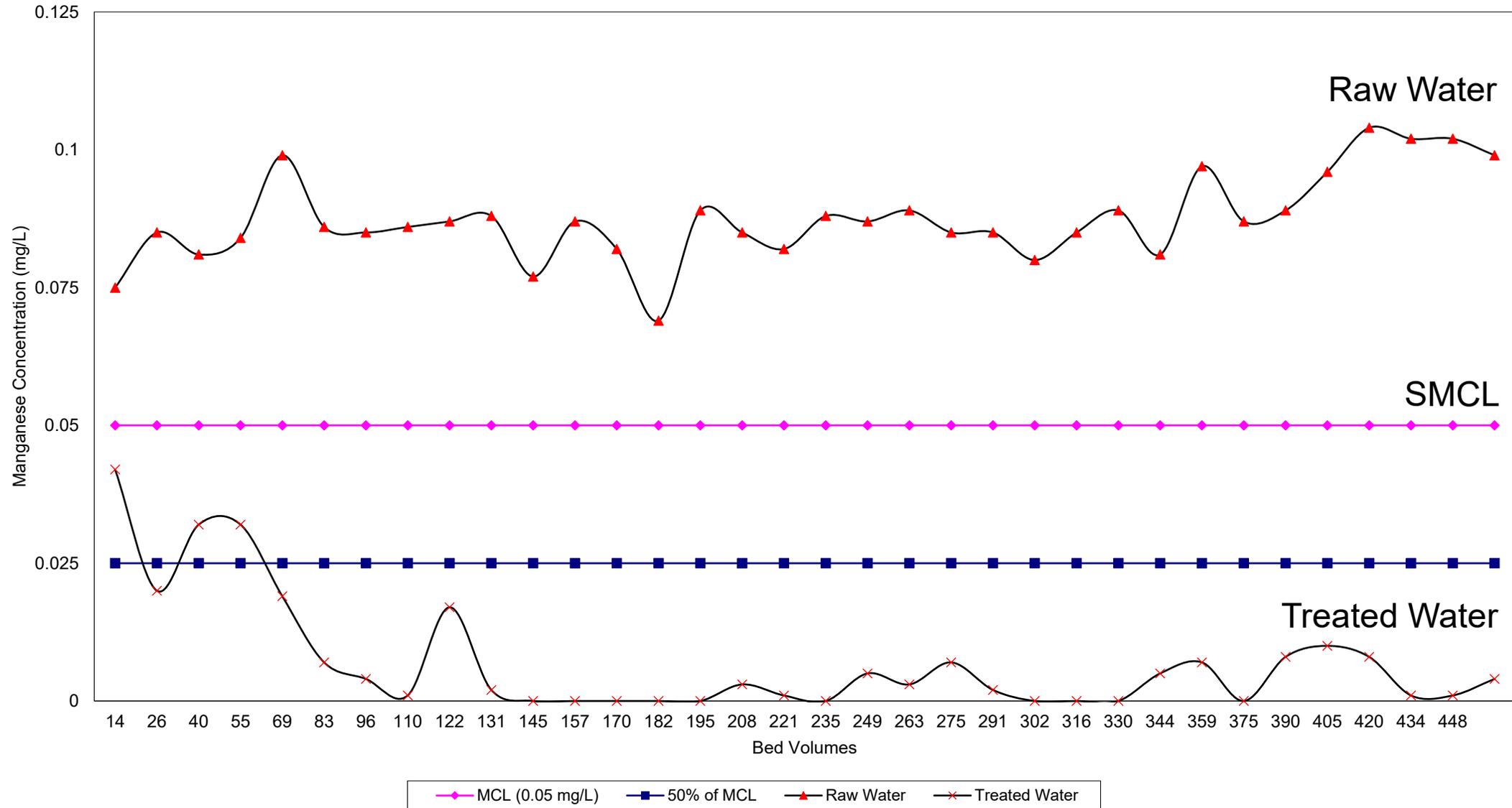
- Chlorination storage, feed and monitoring systems
- Updating Site Telemetry

Well Nos. 14 and 16 Site

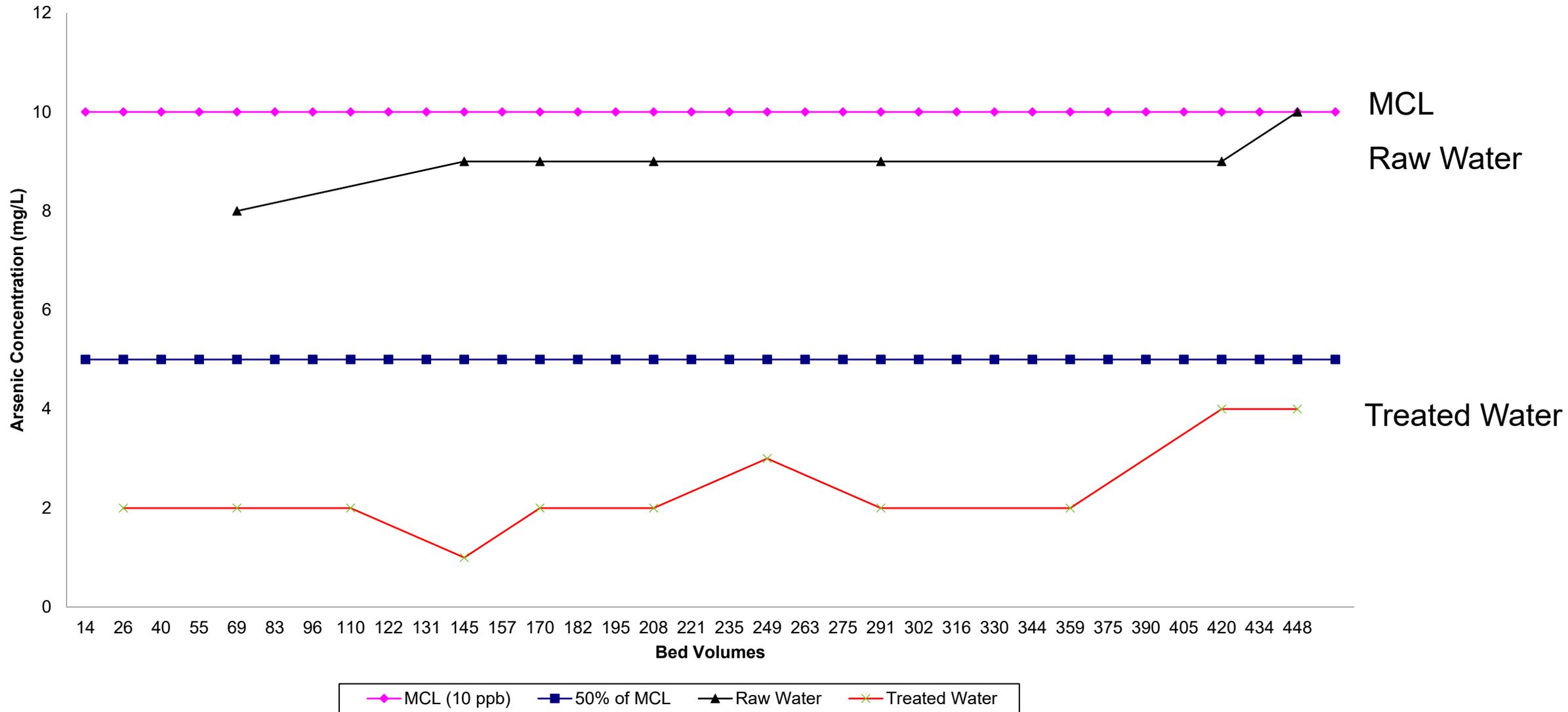
- Chlorination storage, feed and monitoring systems
- Installation of new 620 gpm pyrolusite greensand filter
- Ferric chloride chemical storage and feed system for arsenic removal
- Updating Site Telemetry
- A new building to house the new equipment
- A new sewer line to dispose of the filter backwash waste
- Booster pump replacement



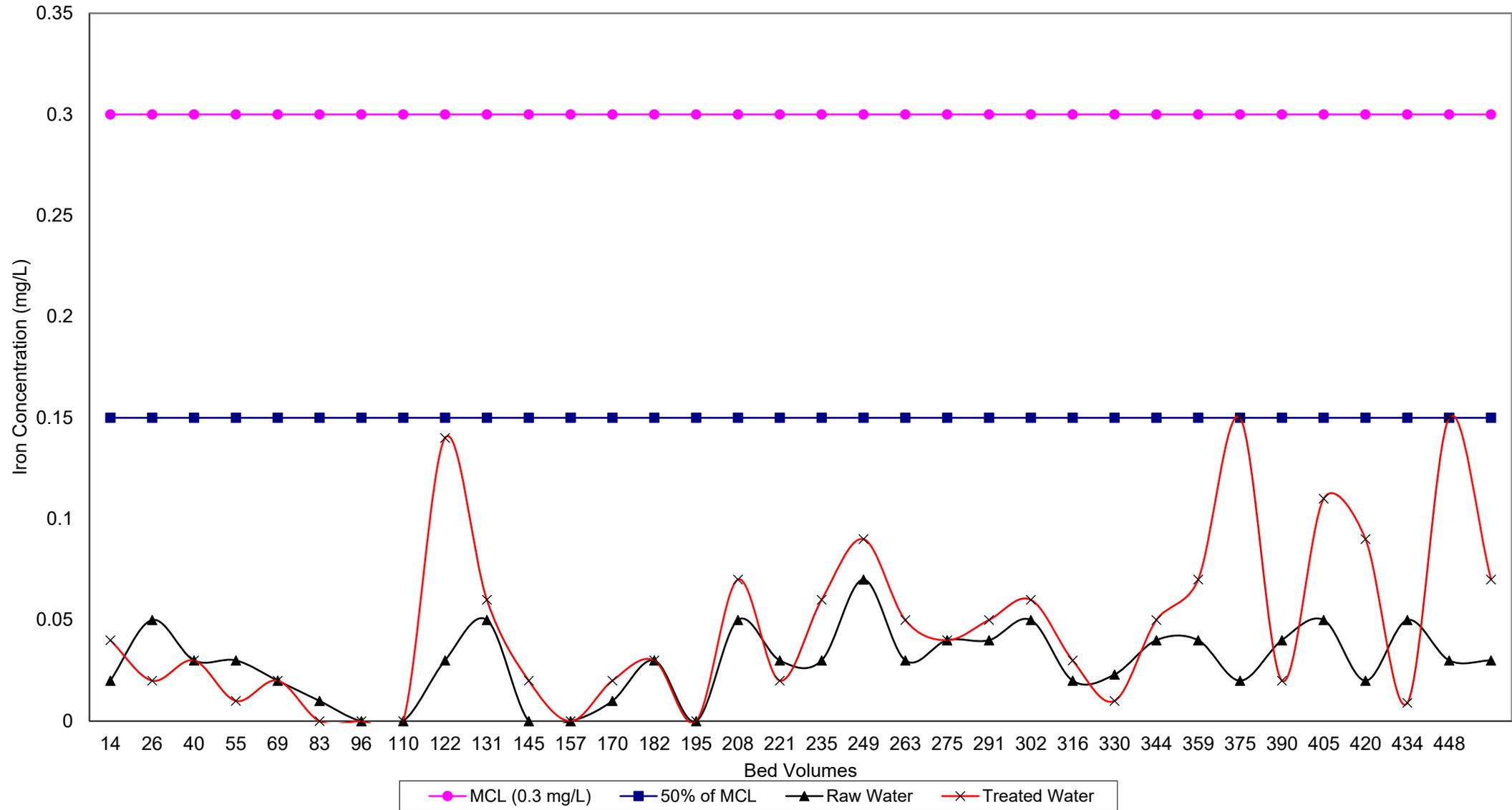
Pilot Testing – Manganese Removal Results



Pilot Testing – Arsenic Removal Results



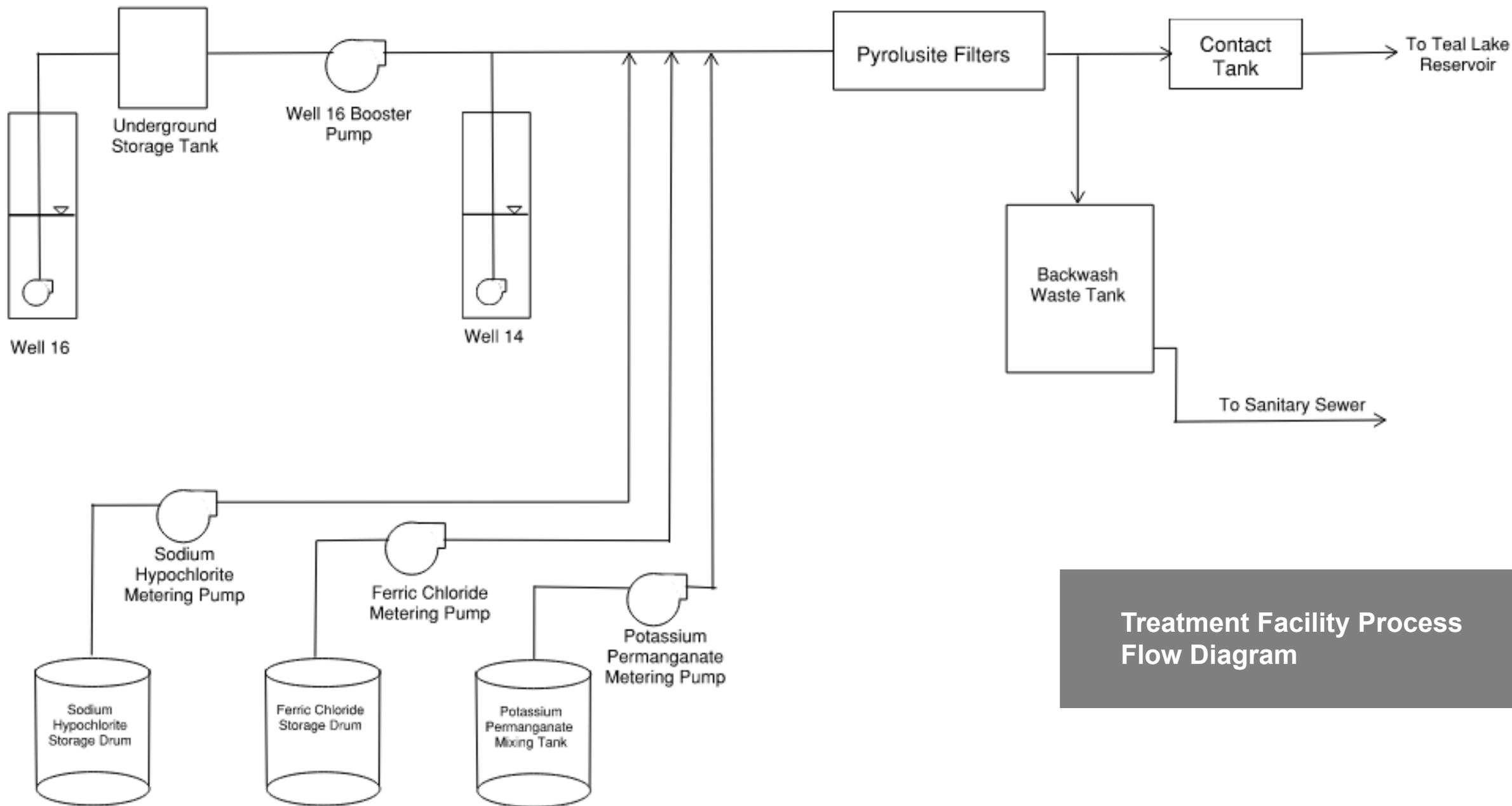
Pilot Testing – Iron Removal Results





Pilot Testing Summary

- Week of testing
- Chlorine demand averaged 0.67 mg/L
- pH was reduced from 8.4 in the feed water to just below 7.5 to prevent silica coating
- Ferric chloride was added for arsenic removal
- Supported a reduction in:
 - Manganese concentrations of 0.087 mg/L to below 0.007 mg/L
 - Arsenic concentrations of 9 $\mu\text{g/L}$ to below 2 $\mu\text{g/L}$



Treatment Facility Process Flow Diagram



Treatment

- Bulk Sodium Hypochlorite chemical feed system for disinfection and arsenic and manganese oxidation
- Pyrolusite oxidation/filtration for removal of arsenic and manganese
- Bulk potassium permanganate chemical feed and storage system to prevent silica coating of filter media
- Bulk ferric chloride and feed system to aid in arsenic removal

Backwash Disposal

- Waste source is backwash waste
- Waste sent to sanitary sewer
 - Storage tank to prevent overwhelming sewer on Mt. Constance Way
 - Air gap provided
- 10,000 gallons
- Will provide 24 hours of storage



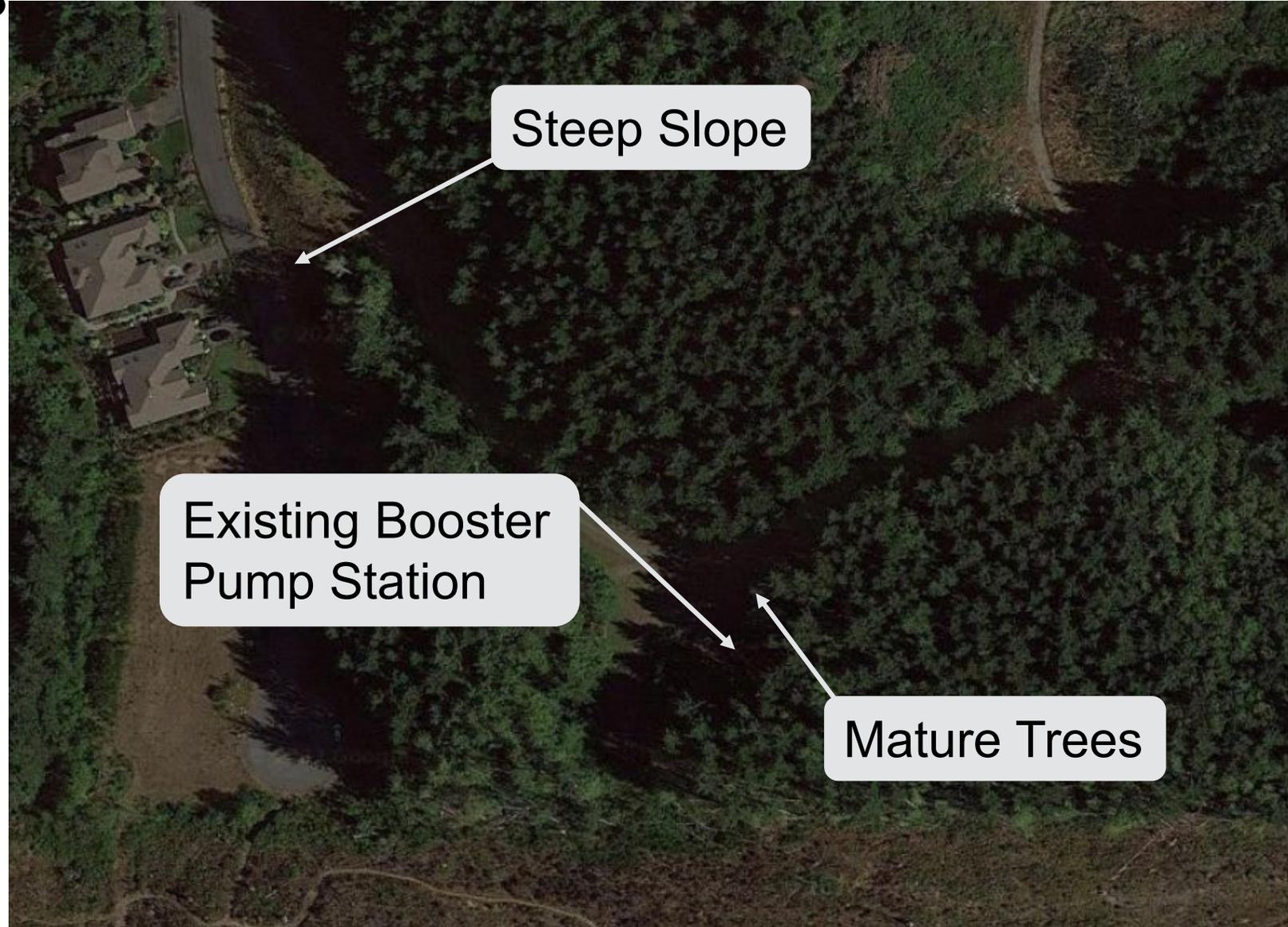


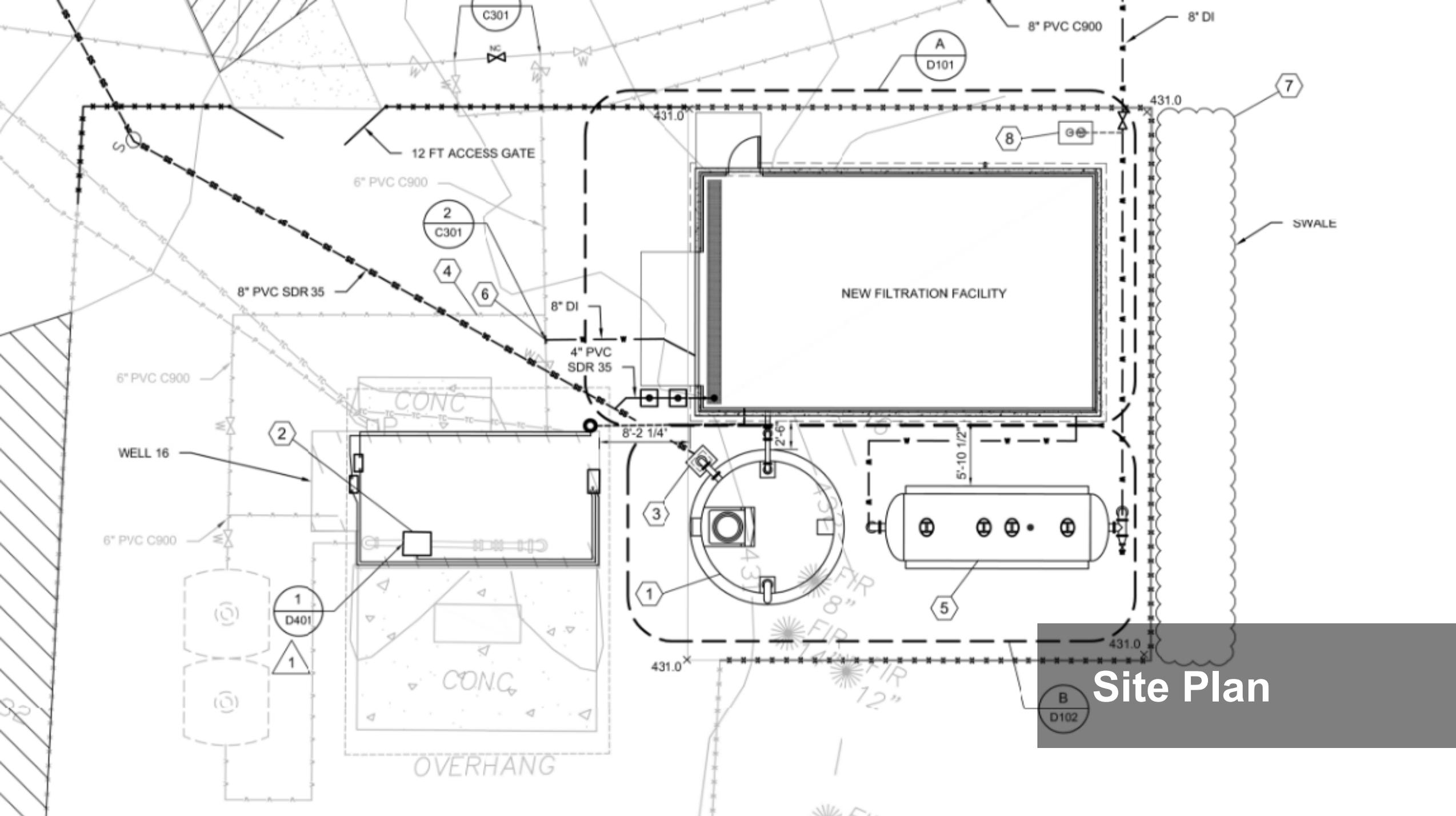
Project Constraints

03

Project Constraints and Drivers

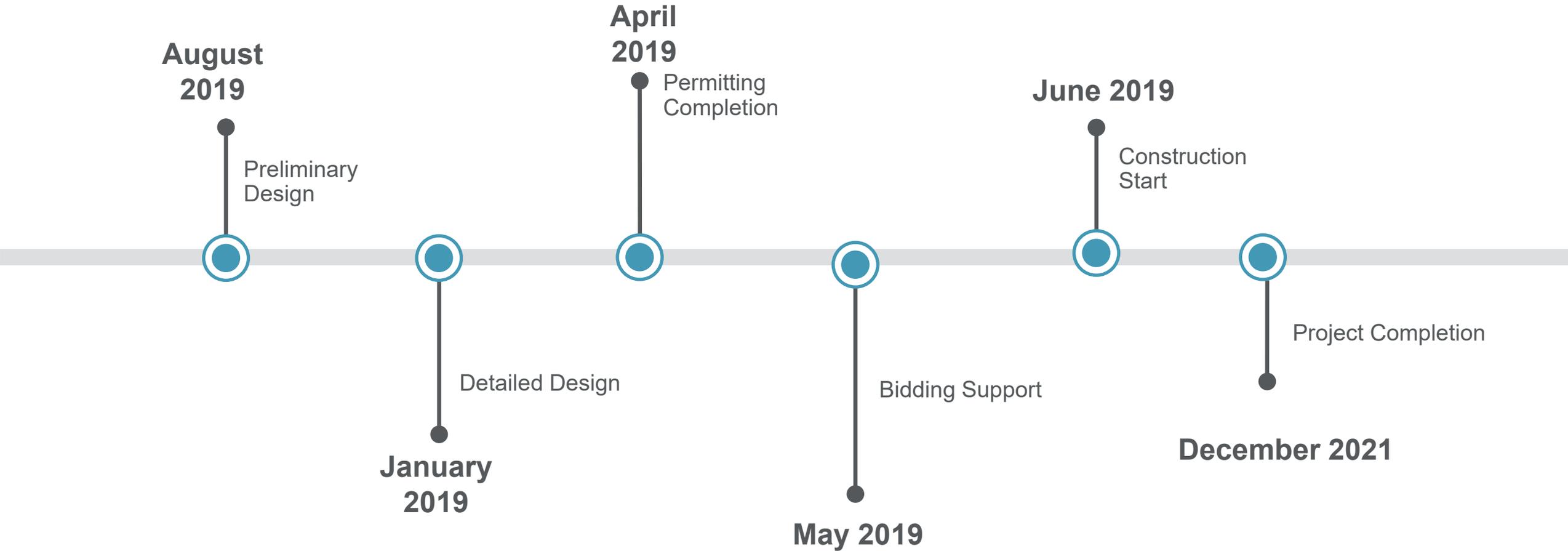
- Limited facility records
- Maximizing benefits to the community
- Site challenges
- Limited time-frame
- Primary water supply
- Public health





Site Plan

Project Schedule





Project Summary

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Summary and Current Status

- System has been operational since December 2021
- Successful elimination of coliform issues
- No colored water complaints
- Greatly reduced customers arsenic exposure

Acknowledgments

Olympic Water and Sewer, Inc.

- Greg Rae, Water Operations Manager
- Diana Smeland, President

HDR

Beth Mende, PE | (425) 468-1532 | Elizabeth.Mende@hdrinc.com

*thank
you*