

The logo for TYLin, featuring the letters 'TYLin' in a bold, black, serif font. The 'Y' and 'L' are connected, and the 'i' has a dot. The logo is positioned in the upper left corner of the slide, which is partially overlaid by a white diagonal shape.

2023 PNWS-AWWA Section Conference

NITRATE TREATMENT FOR GROUNDWATER WELLS

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Today's Topics

- Background
- Design Basis
- Raw Water Quality
- Pilot Test
- WTP Concept
- Final Remarks



Water Treatment Plant

Background

- Design of water and sanitary infrastructure for a new development in Southern Ontario
- A WTP to treat two groundwater wells which contains higher concentration of nitrates.
- Located adjacent to WWTP and stormwater management pond that also service to this development.



Area Allocated for the WTP

Design Basis

- A phased approach based on the construction of residential development.
- Phase 1A: 400 units
- Phase 1B: 800 units
- Ultimate: 2909 units
- 2,559 Residential units+ 350 Employment units



Monitoring Wells

Design Basis

Item	Unit	400 Units	800 Units	Ultimate
No of Units	#	400	800	2,909
Population	#	1,200	2,400	8,727
Minimum Rate Factor (Minimum Hour)		0.45	0.45	0.5
Maximum Day Factor		2.50	2.25	2.0
Peak Hour Factor		3.75	3.38	3.0
Minimum Hour Demand (MHD)	m ³ /d	205	410	1,658
Average Day Demand (ADD)	m ³ /d	456	912	3,316
Maximum Day Demand (MDD)	m ³ /d	1,140	2,052	6,632
Peak Hour Demand (PHD)	m ³ /d	1,710	3,083	9,948
Equalization Storage (25% of MDD)	m ³	285	513	1,658
Fire Storage per MECP Guidelines		70 L/s for 2 hrs	101 L/s for 2 hrs	180 L/s for 3 hrs
Approved Fire Storage in Class EA				133 L/s for 3 hrs
Proposed Fire Storage	m ³	504	727	1,436
Emergency Storage [25% of (Equalization + Fire Flow)]	m ³	197	310	774
Total Storage (Equalization + Fire + Emergency Storage)	m ³	986	1,550	3,868

1m³/d = 264 GPD
 1m³ = 264 gal

Raw Water Quality

Parameter	Units	MAC/AO/OG	2021		2022		2023	
			TW22	TW19	TW22	TW19	TW22	TW19
pH		6.5 -8.5 (OG)	8.08	7.99	7.97	7.97	7.82	7.73
Alkalinity (Total as CaCO ₃)	mg/L	30-500 (OG)	247	260	236	250	249	245
Hardness (CaCO ₃)	mg/L	80-100	324	320	329	330	338	345
Iron	mg/L	0.3 (AO)	0.379	<0.1	0.042	<0.1	0.021	0.135
Manganese	ug/L	50 (AO)	25.7	3	24.3	2.1	1.38	5.66
Nitrate	mg/L	10 (MAC)	8.83	8.68	9.6	8.64	8.89	9.08
Total Ammonia-N	mg/L	-	0.02	<0.050	<0.01	<0.050	8.89	9.1

MAC - Maximum Acceptable Concentration
 AO - Aesthetic Objective
 OG - Operational Guidance Value

WTP and Well Site 1



Pilot Study

- Commenced in Jan. 2020 - 2 Wk Program
- Installed a 10 GPM pump in the well
- Pump fills (2 times/d) - Two Pressure Tanks
 - Before each fill, well pumps to waste for 2hrs
 - Each time before filling the tanks, the well pumps 1,200 gal of raw water
- Ion Exchange Pilot Designed for 254 gpd

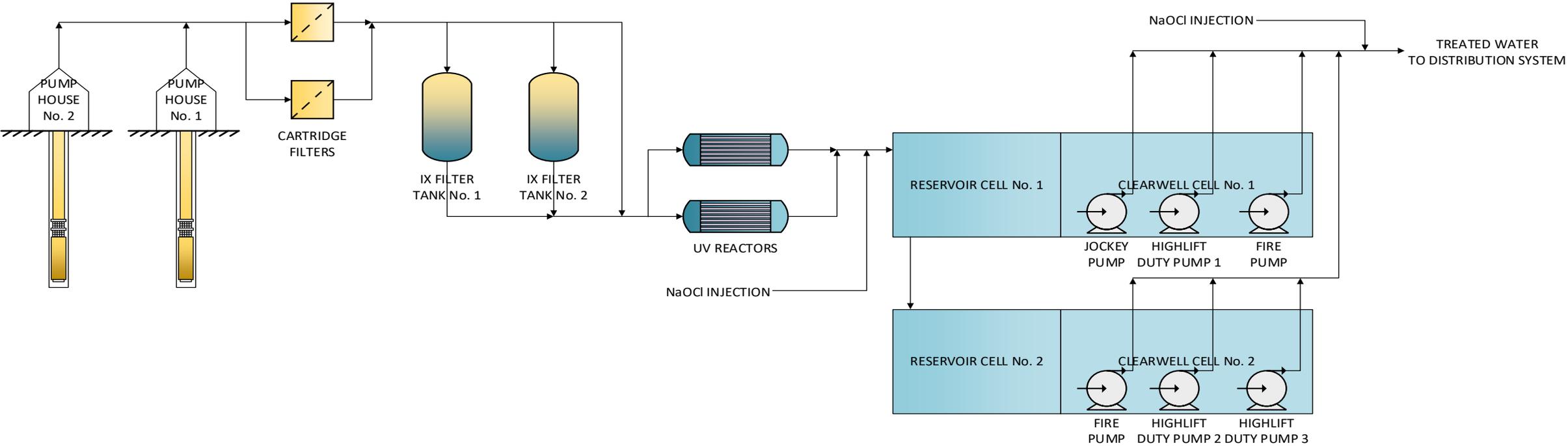


Pilot Study – January 2020

Pilot Study - Outcomes

- The use of a **cartridge filter** is important to ensure that any residual particulate matter, including iron, is picked up prior to the Ion Exchange Filters, such to avoid premature fouling of the filters.
- The trigger for regeneration will be when Nitrate levels hit 2 mg/L in the treated water stream.
- A Brine Consumption of 250 g/L will be used for regeneration, with intermittent deeper regenerations of 750 g/L.
- A Counterflow methodology for regeneration will occur such to reduce the amount of Nitrate Leakage during operation.
- Softening of the raw water resulted in no appreciable difference in regeneration performance, and as such is not recommended for the full-scale system.
- Softening of treated water for the purposes of rinsing in regeneration is recommended
- Scaling from the results of the Pilot Study to the full-scale system based on Media Volume

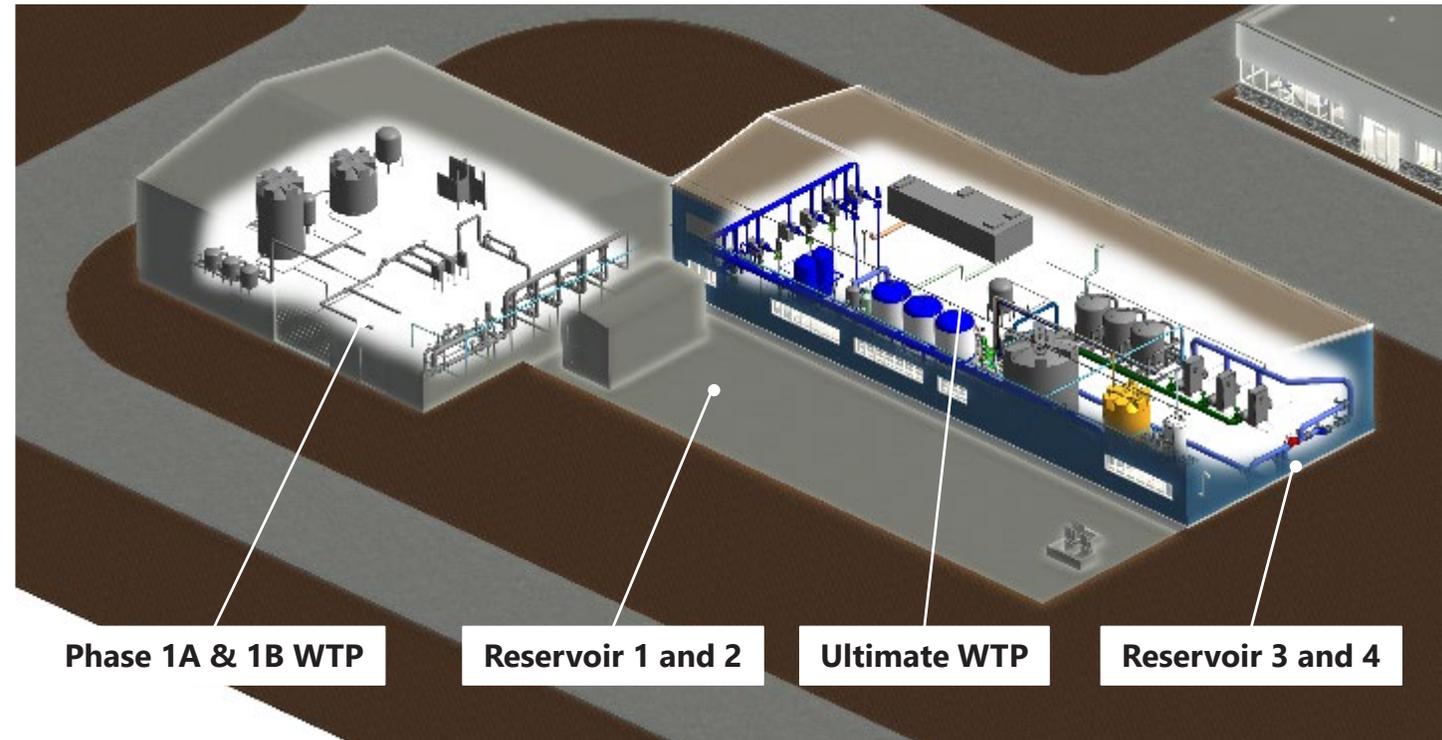
Water Treatment Plant - PFD



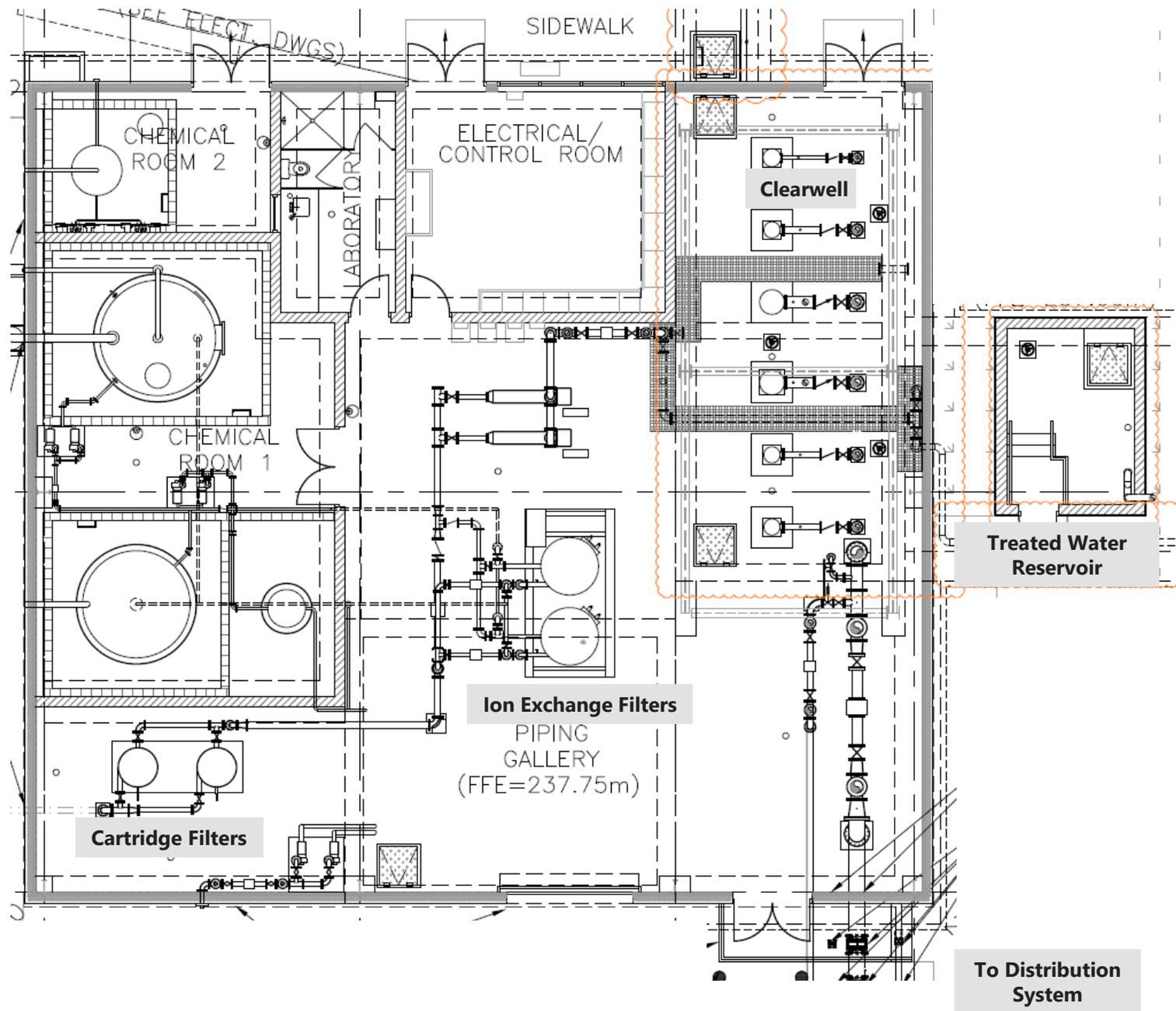
Process Flow Diagram of WTP

WTP Concept

- **Phase 1A**
 - 2 groundwater wells with 2 LLP
 - 1 Reservoir
 - 2 cartridge filter
 - 2 ion exchange filters
 - 2 UV reactors
 - 2 fire pumps, 3 HLP, 1 jockey pump
- **Phase 1B**
 - 1 additional cartridge filter
 - 1 additional Reservoir
 - 2 additional ion exchange filters
 - 1 additional UV reactor
 - Replacement of jockey pump with HLP
- **Ultimate**
 - Second WTP building on 2 new reservoirs
 - Duplicate equipment Phase 1A and Phase 1B









Well Pump House



Well Pump House



Water Treatment Plant



Cartridge Filters



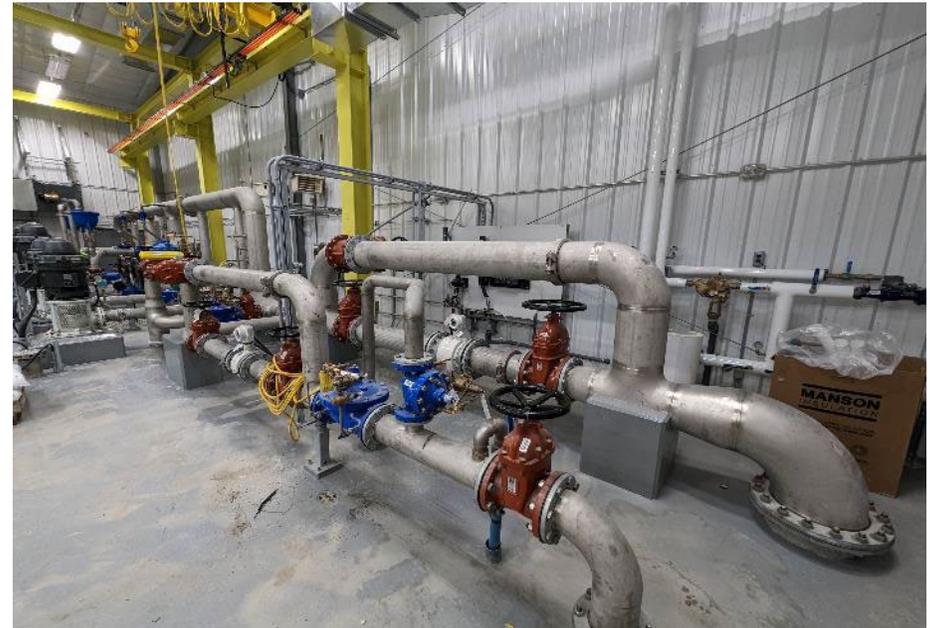
Ion Exchange



UV System



High Lift Pumps



Water Distribution Lines

Final Remarks

- One Test well and four monitoring wells and water samples analyzed
- Pilot test for nitrate treatment
- Construction of second well, pump houses and water treatment plant (Phase 1A)
- Construction of Phase 1B underway
- Construction of Ultimate WTP in 2024



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Questions?

Thank You

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