Alternative Water Source Study

Village Board Update

May 17, 2021

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Senior Project Manager / Principal

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Chief Executive Officer

WATER SUPPLY OBJECTIVES

SUSTAINABLE

REGULATORY COMPLIANT

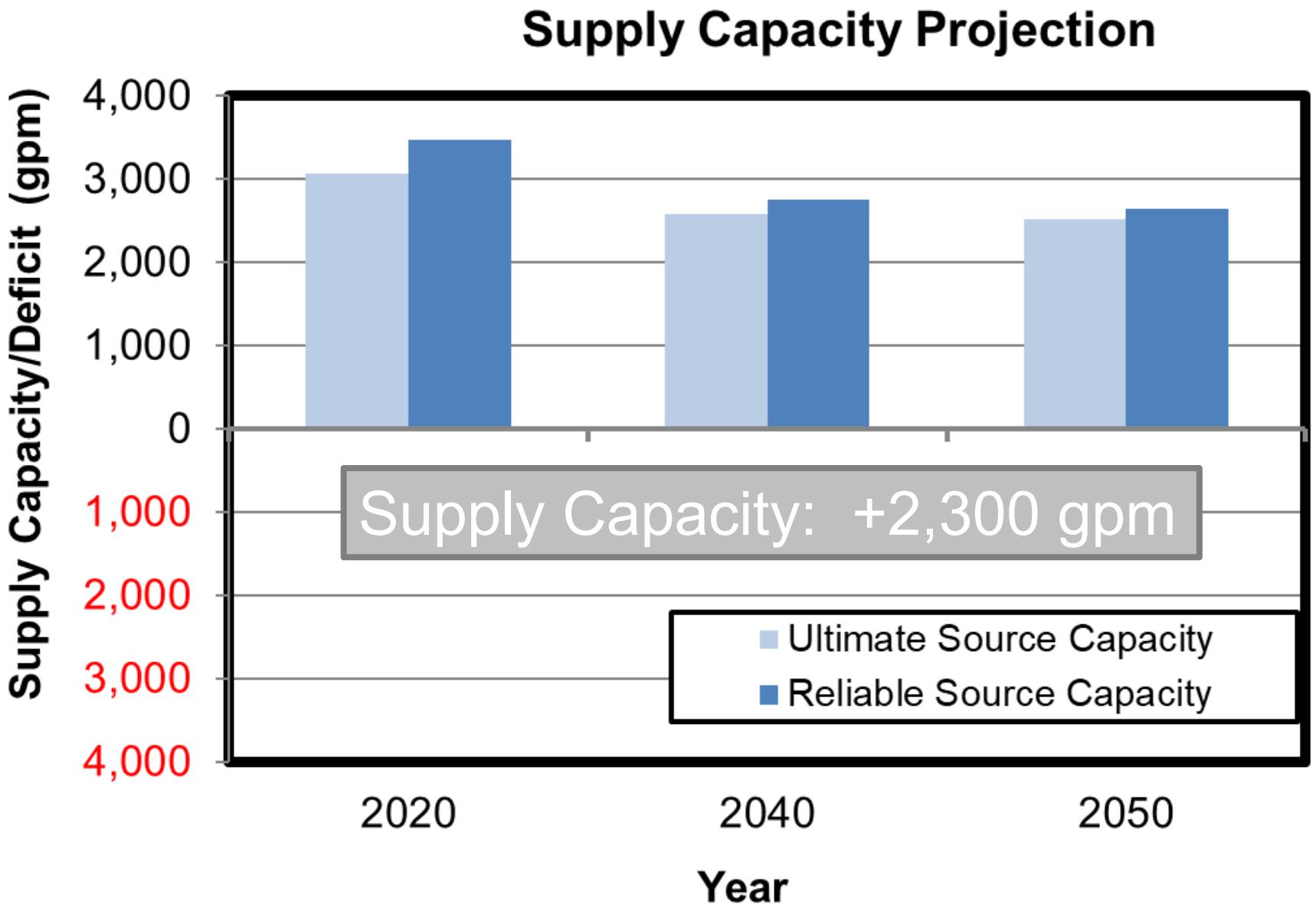
HIGH QUALITY

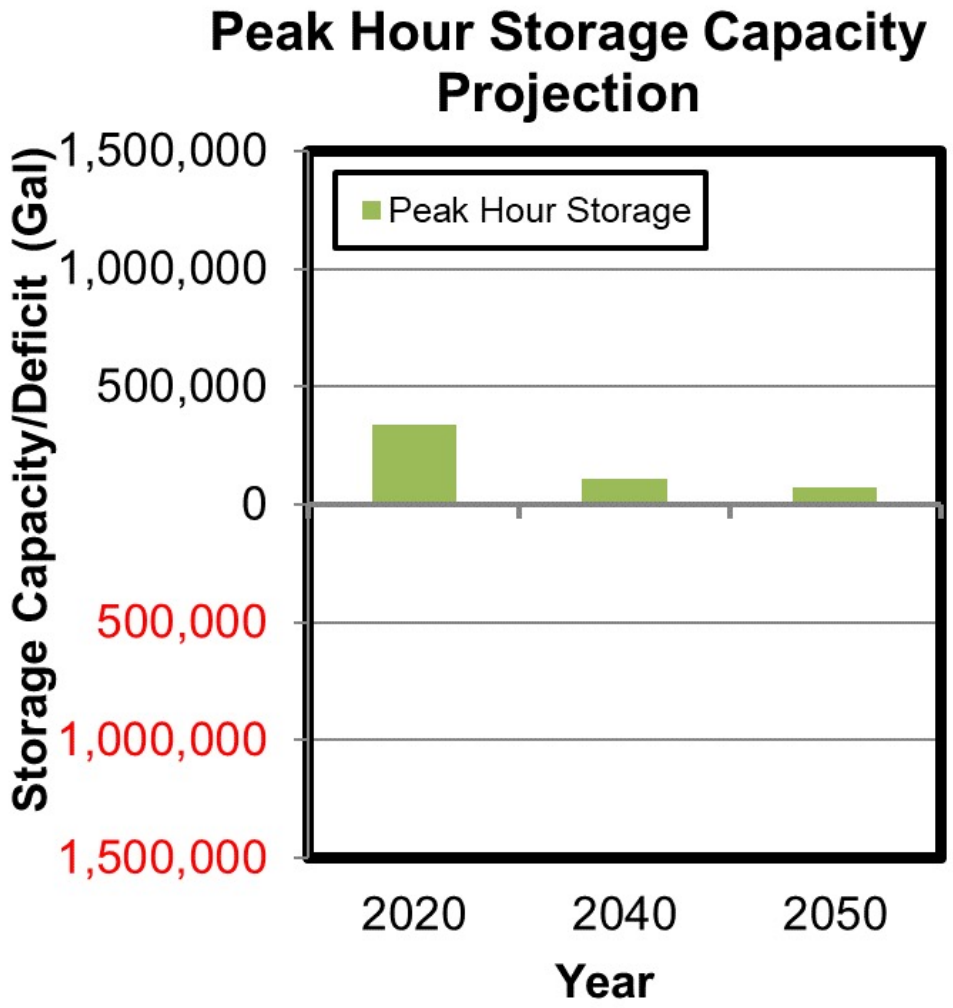
COST EFFECTIVE

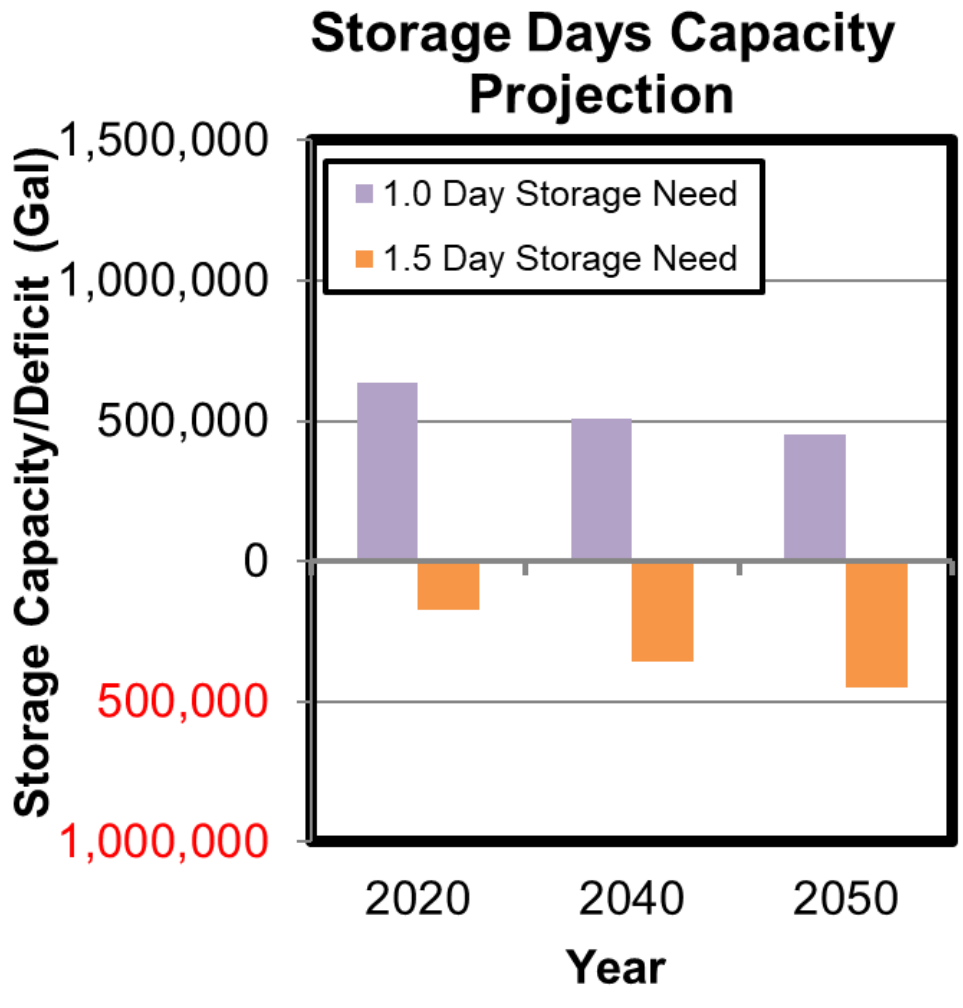
Agenda

1. Review
2. Groundwater Treatment Overview
3. Village’s Existing Groundwater Treatment
4. Proposed Groundwater Treatment Options
    a) Pretreatment
    b) Replacement of Existing System
    c) Treatment of Regeneration Waste
5. Treatment Comparison

REVIEW


Supply Capacity Projection
Supply Capacity/Deficit (gpm)
4,000
3,000
2,000
1,000
0
1,000
2,000
3,000
4,000
Supply Capacity: +2,300 gpm
Ultimate Source Capacity
Reliable Source Capacity
2020
2040
2050
Year

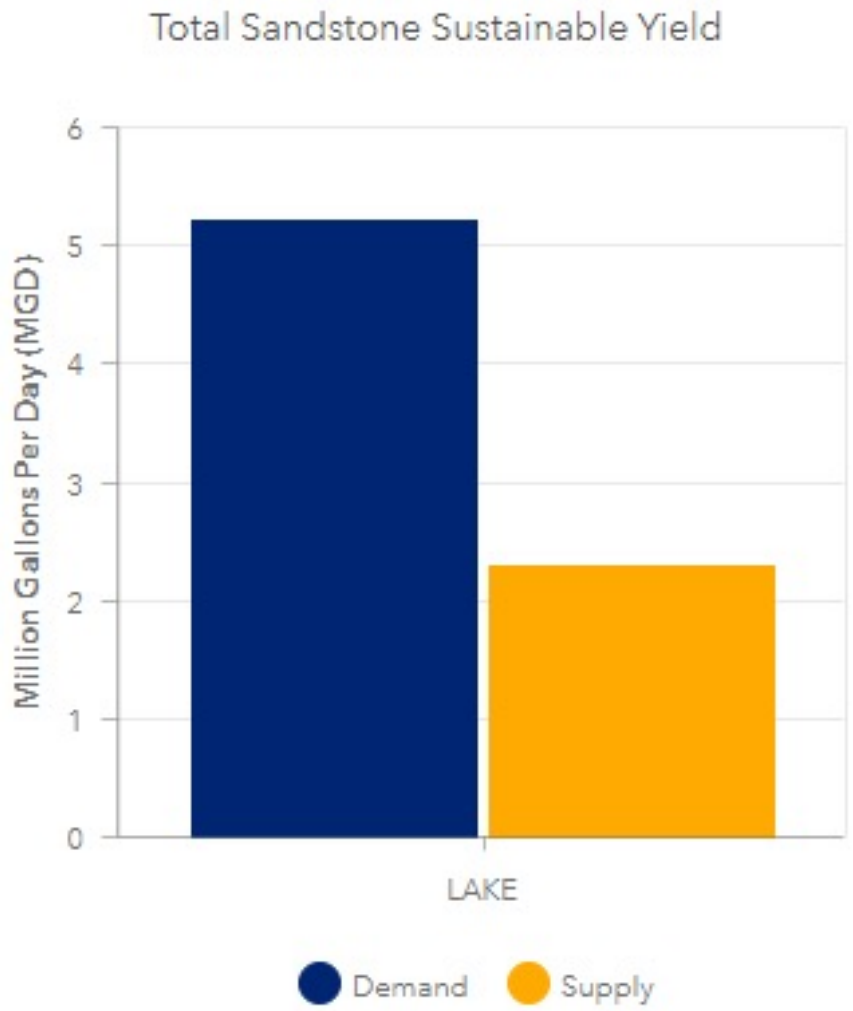


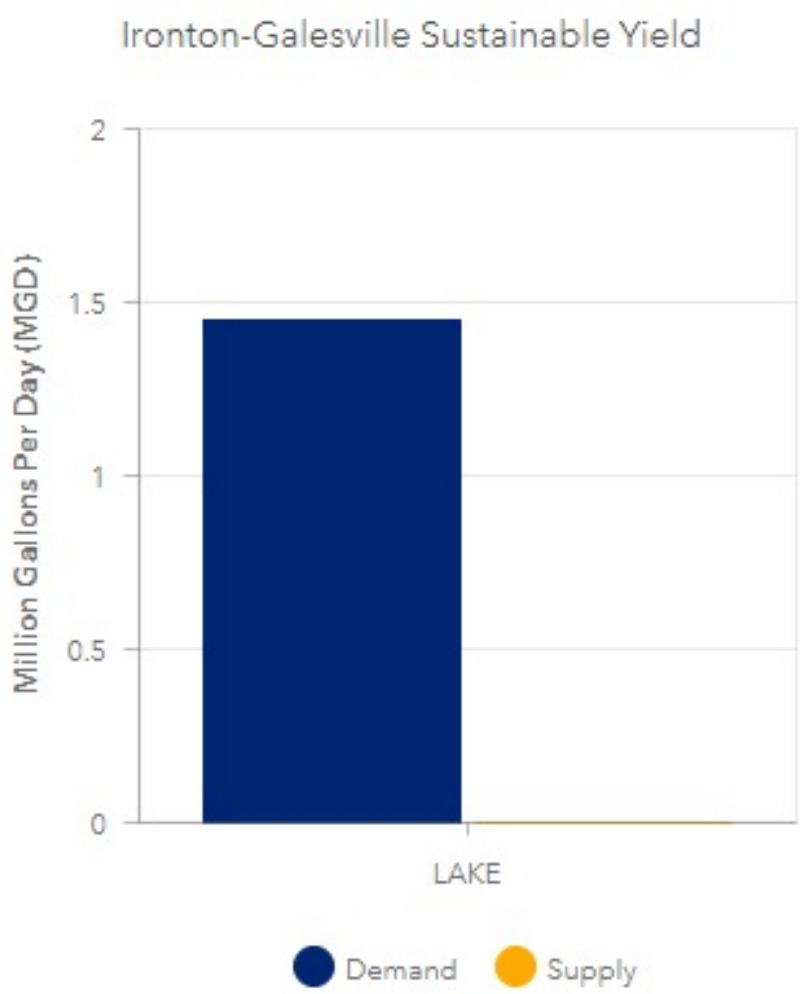


Storage Capacity

Well, CLCJAWA & NWC: +75,000 Gal

NSMJAWA: (450,000) Gal





https://prairie-research.maps.arcgis.com/apps/opsdashboard/index.html#/9825690df3b14da39f03bdfeb69cd33e

Summary and Application – Deep Sandstone Aquifer Sustainability

HISTORIC TRENDS AND CURRENT STATUS

Significant Depletion of the Water in the St. Peter and Ironton-Galesville Aquifers

Slight Recovery in Deep Aquifers Since 1980's Due to Decreased Usage (Increased Regional Usage of Lake Michigan)

Current Status – Aquifers Are Adequate for Village's Use

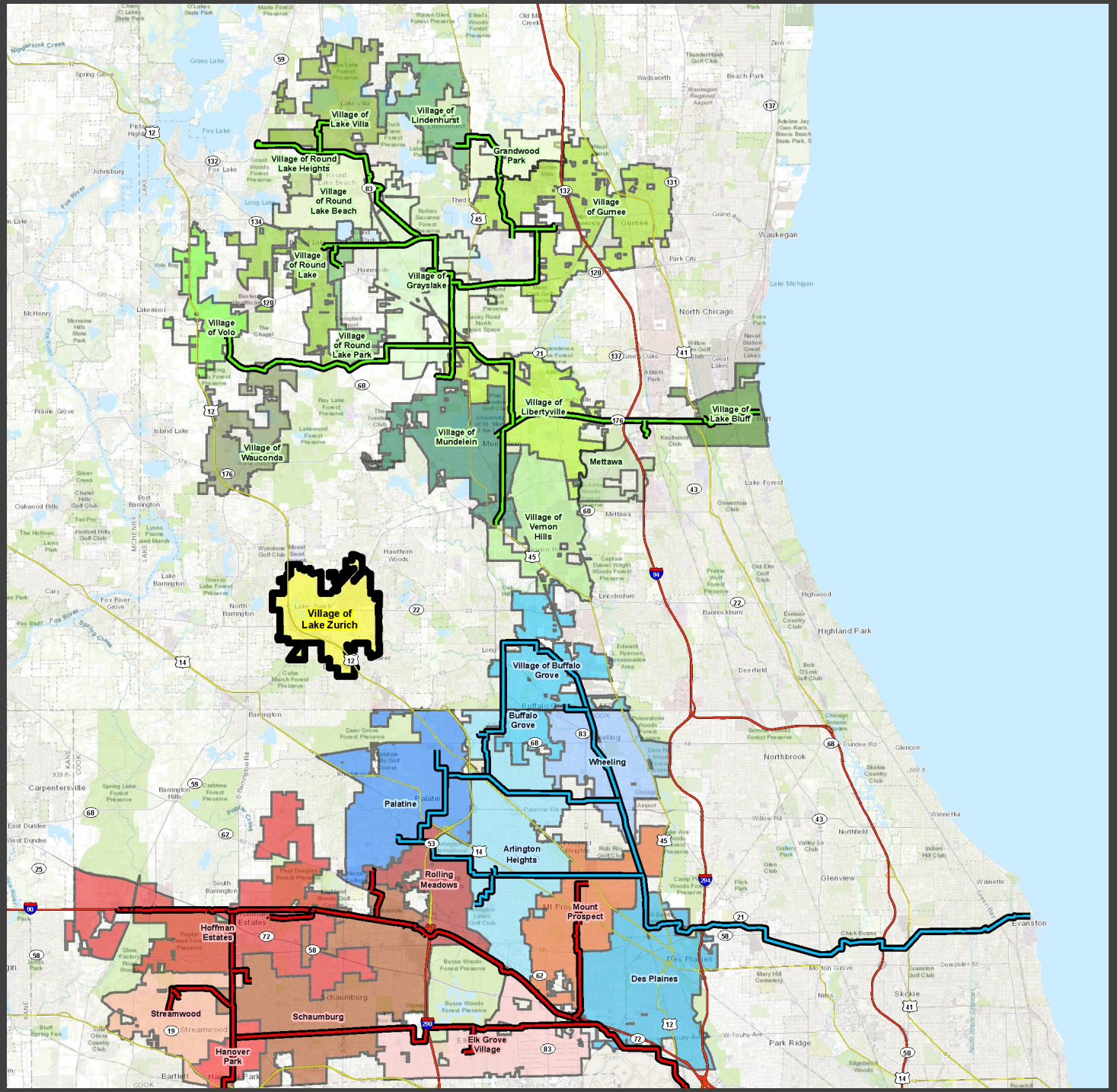
PROJECTED TRENDS

Water Levels in the Deep Sandstone Aquifers are Projected to Decline

Highly Dependent on Regional Development and Usage of the Aquifers

Lake County Demand for Water From Deep Aquifers is Greater Than Replenishing Supply

Implications to Village: Short-Term Sustainability Adequate, but Long-Term (30+ Years) Sustainability a Concern



Lake Michigan (LM) Supplier Options

Legend

Lake Michigan Water Source

- Central Lake County JAWA (From Lake Bluff)
- Northwest Water Commission (From Evanston)
- Northwest Suburban Municipal JAWA (From Chicago)
- CLCJAWA Transmission Main
- NWC Transmission Main
- NSMJAWA Transmission Main

GROUNDWATER TREATMENT OVERVIEW

WHY EVALUATE GROUNDWATER TREATMENT?

- Lake County Public Works Requirement (Radium)
- No Previous Village Water Studies Evaluated Groundwater Treatment Options
  - ❖ Previous Studies Focused on Sustainability of Groundwater Resource
- Helps Fully Evaluate All Viable Water Options for an Informed Final Decision by Village Board
- Additional Details of Lake Michigan Supply Options will be Presented at Future Meeting

Groundwater Treatment Overview

St. Peter & Ironton-Galesville Sandstone

Naturally Occurring
Radium & Barium

Village's Treatment

- Cation Exchange
- Removes Radium, Barium and Hardness (Softens Water)

Radium Removal - Regulations

- USEPA/IEPA – 5.0 pCi/L MCL
- Established in Early 2000's
- Impacted Many CWS' in NE IL

Radium Removal - Technologies

- Best Available Technologies
  - ✓ Cation Exchange
  - ✓ Lime Softening
  - ✓ Membranes (Reverse Osmosis)
- Other
  - ✓ HMO
  - ✓ Radium Selective Media

VILLAGE'S EXISTING GROUNDWATER TREATMENT

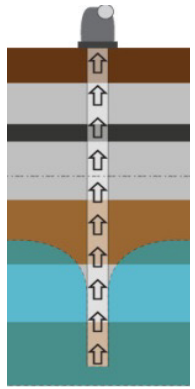
WTP Process Flow Diagram and Radium Mass Balance

Village of Lake Zurich, IL

RAW
Radium Concentration:
Well 7 = 11.3 pCi/L
Well 8 = 10.9 pCi/L
Well 9 = 7.7 pCi/L
Well 10 = 15.8 pCi/L
Well 12 = 9.4 pCi/L

LAKE CO. PW LIMIT (WASTE) = 5 pCi/L

Deep Well

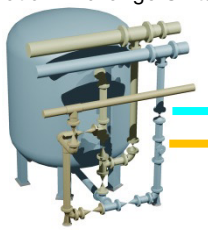


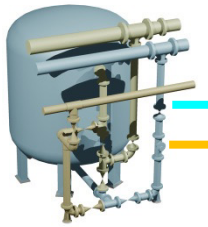
Influent Meter

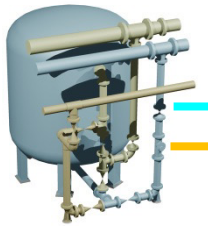
Bypass

Flow Control Valve

Cation Exchange Units





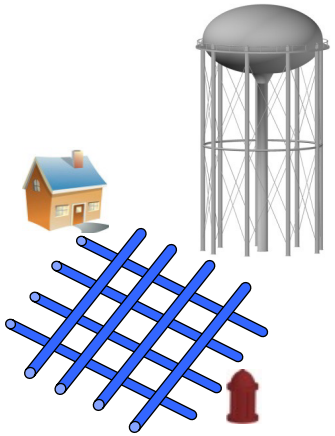


Finished Meter

Cl_2

FINISHED
Radium Concentration:
Well 7 = 2.5 pCi/L
Well 8 = 3.9 pCi/L
Well 9 = 3.2 pCi/L
Well 10 = 4.7 pCi/L
Well 12 = 5.0 pCi/L

MCL = 5.0 pCi/L

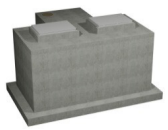


Distribution System

REGENERATION WASTE Radium Concentration:
Well 7 = 484 pCi/L
Well 8 = 314 pCi/L
Well 9 = 242 pCi/L
Well 10 = 567 pCi/L
Well 12 = 243 pCi/L

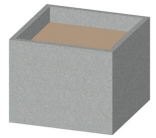
PENDING REGULATORY LIMIT = 600 pCi/L

Brine Tank



Brine Pump

Regeneration Waste Tank



Gravity or Pumped Flow to Sanitary Sewer System

Water Treatment Plant Building Limits

PROPOSED Amendment

Part 622: Handling and Disposal of Water Treatment Residuals

Residual Disposal > 600 pCi/L

1. Prohibits Release into Sanitary Sewer
2. Alternative method
3. Facility authorized to dispose of such material

Worker Safety

- Minimum of 1-2 hours TENORM awareness training if Discharge > 600 pCi/L
- Overall safety and dose exposure improvements
- Radon Measurement Program

Sampling

- Requires Additional Residuals Sampling

Radioactive Placards

- Install placards to notify of radioactivity

Records/Notifications

- Ensures appropriate records are maintained
- Notify Agency prior to residual removal or disposal

Implementation Timeline

- ~1 year (if no changes are made)

PROPOSED GROUNDWATER TREATMENT OPTIONS

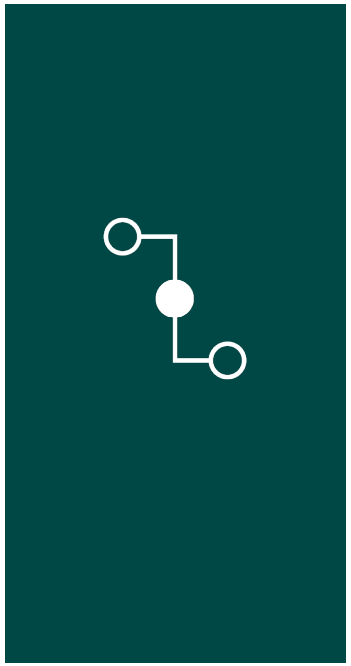
RADIUM TREATMENT OPTIONS

PRETREATMENT

Install pretreatment technology to remove radium prior to ion exchange and continue to soften

TREAT WASTE

Treat the regeneration waste from the existing cation exchange treatment and keep softening

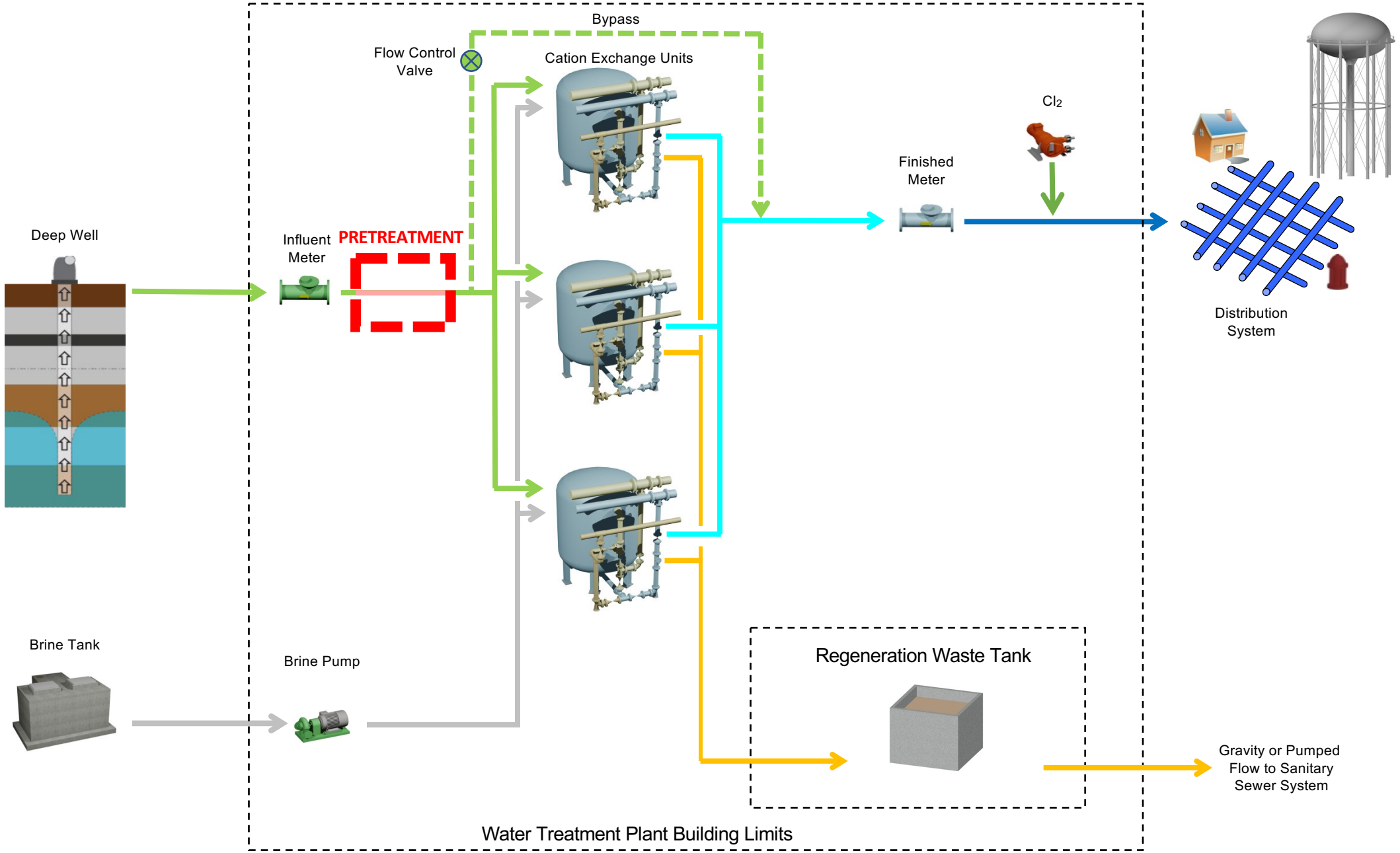


REPLACEMENT

Remove existing cation exchange and softening and replace with different radium removal technology

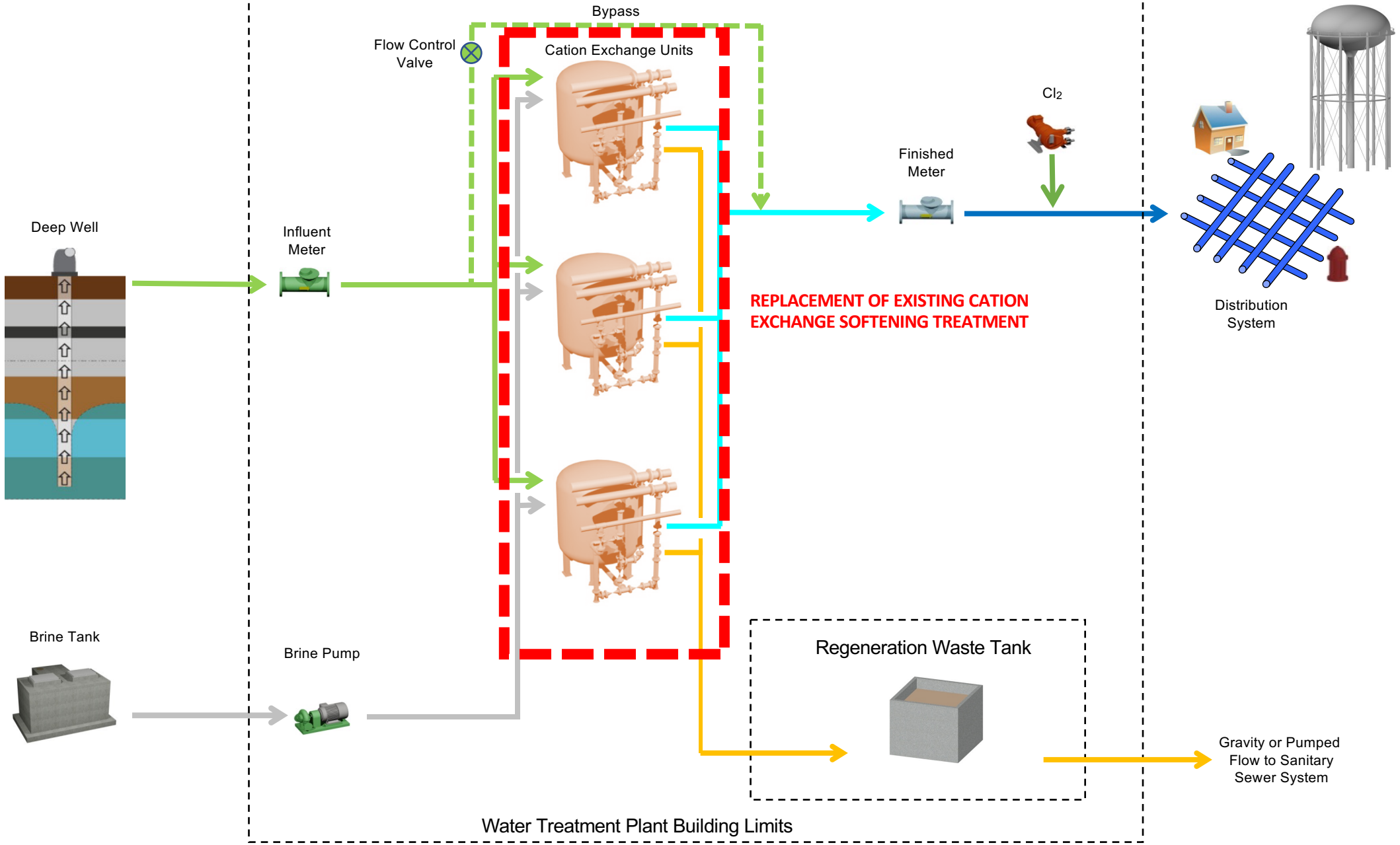
WTP Radium Removal Technology Process Flow Diagram

Village of Lake Zurich, IL



WTP Radium Removal Technology Process Flow Diagram

Village of Lake Zurich, IL



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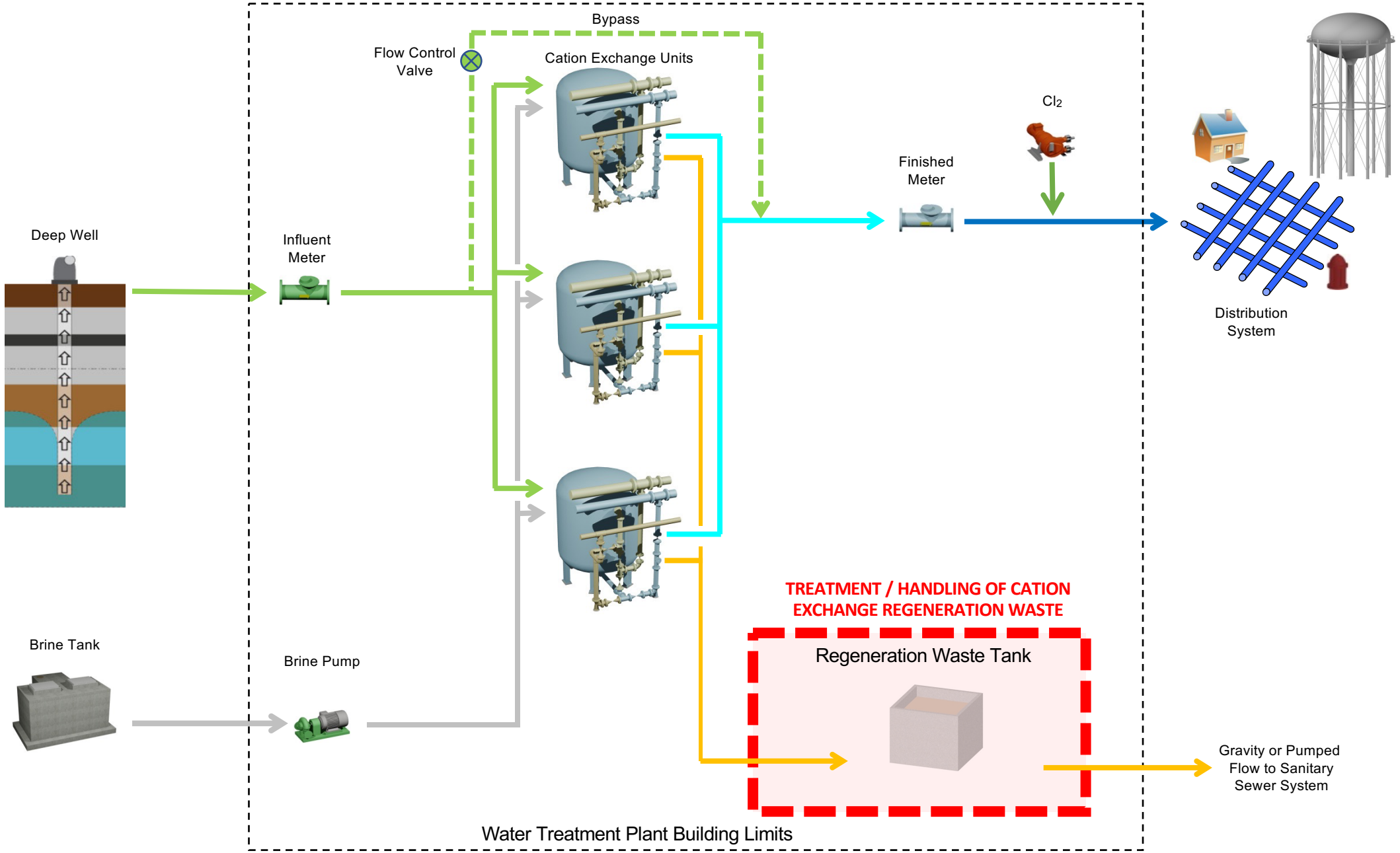
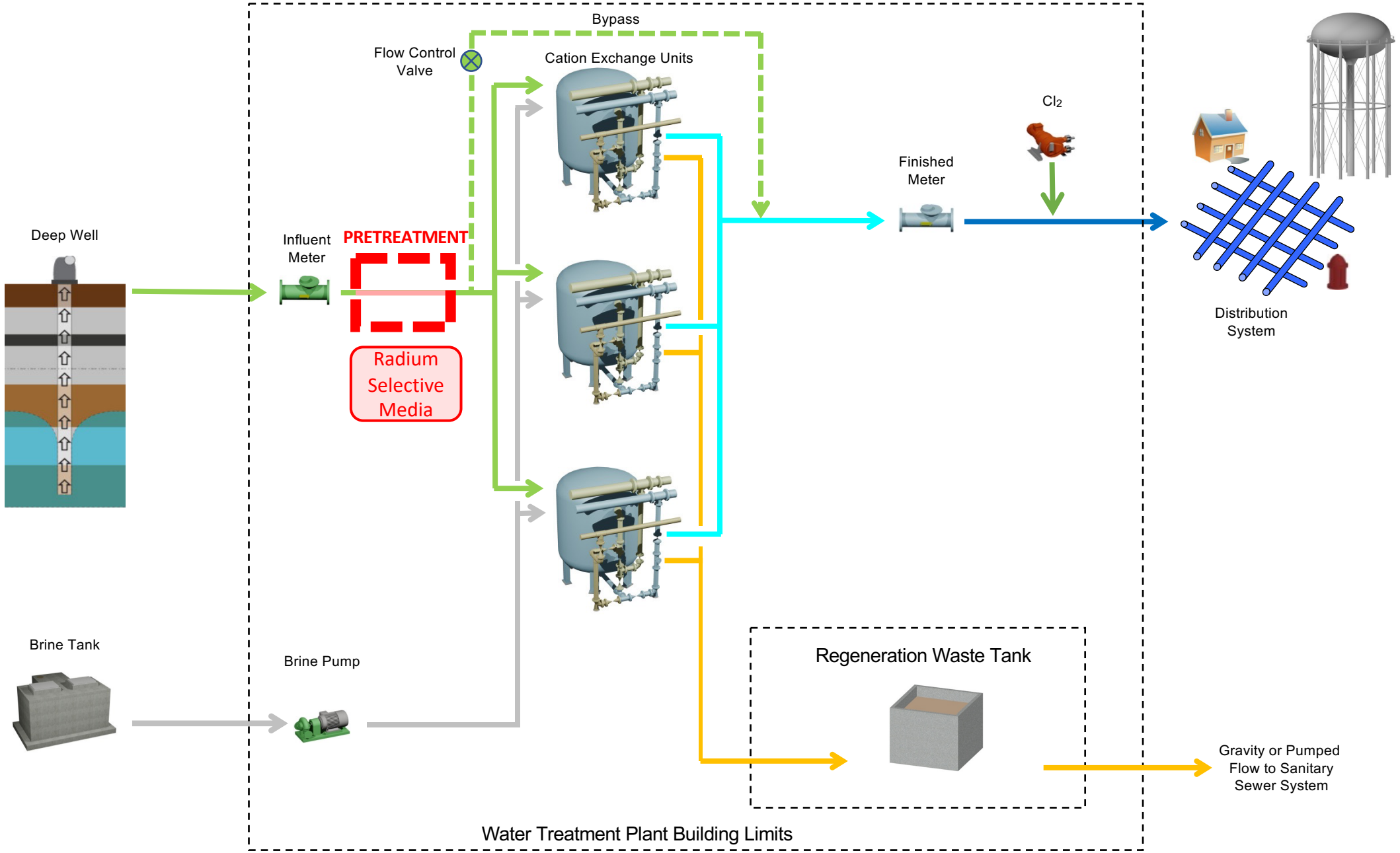


PRE-TREATMENT

WTP Radium Removal Technology Process Flow Diagram

Village of Lake Zurich, IL



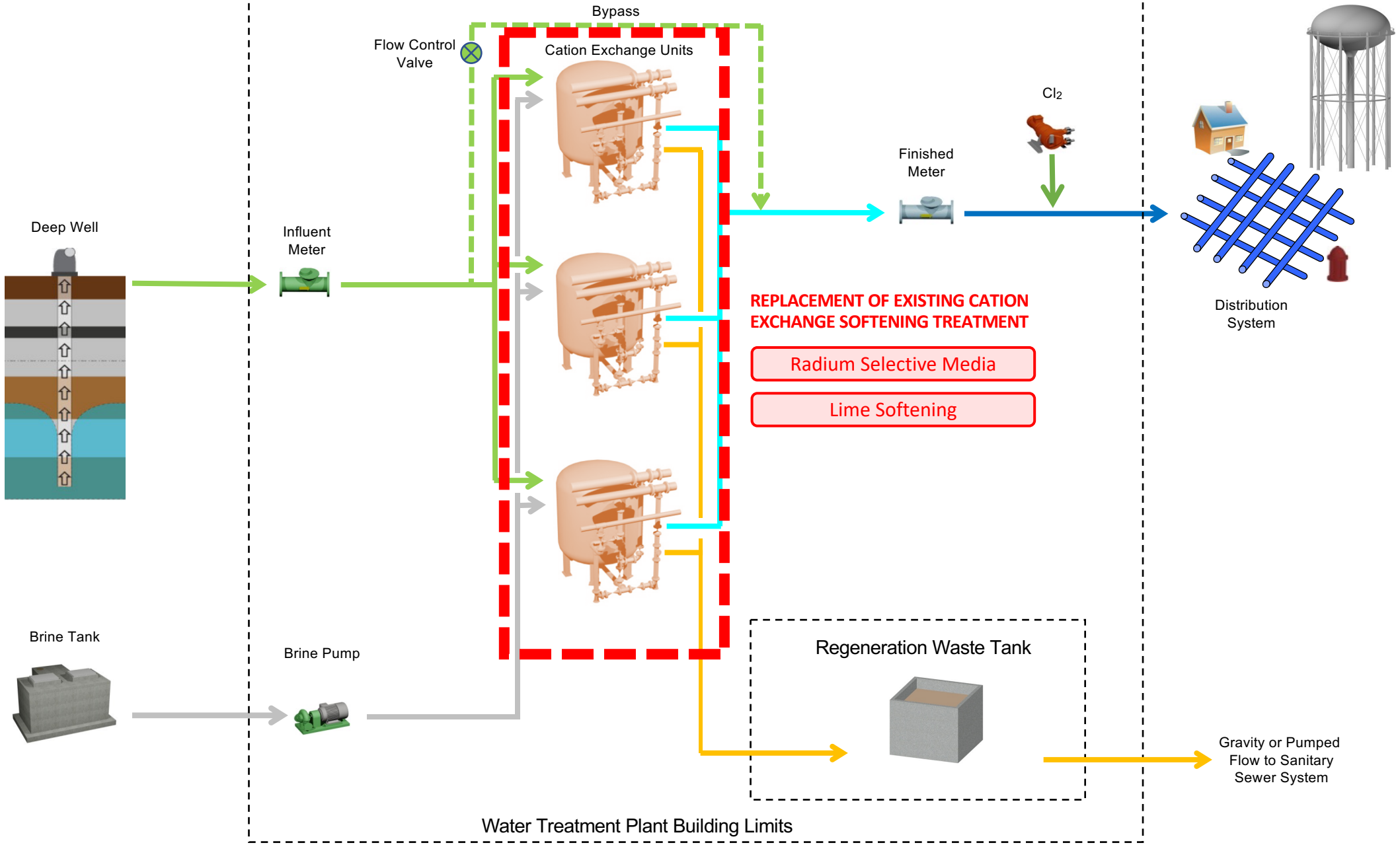
Radium Selective Media (WRT)

- Radium Accumulates on Media (No Liquid Waste)
- No Radium in Waste to Lake County PW
- Requires Leasing Equipment and Periodic Replacement Media (Hazardous Waste)
- Radioactive Material License
- Shortened Media Lifespan Due to Barium Interference
- Not Recommended for Use with Wells 9 & 10 Due to Barium Interference
- Requires Facility Expansions

REPLACEMENT OF EXISTING TREATMENT

WTP Radium Removal Technology Process Flow Diagram

Village of Lake Zurich, IL



Radium Selective Media (WRT)
Additional Considerations

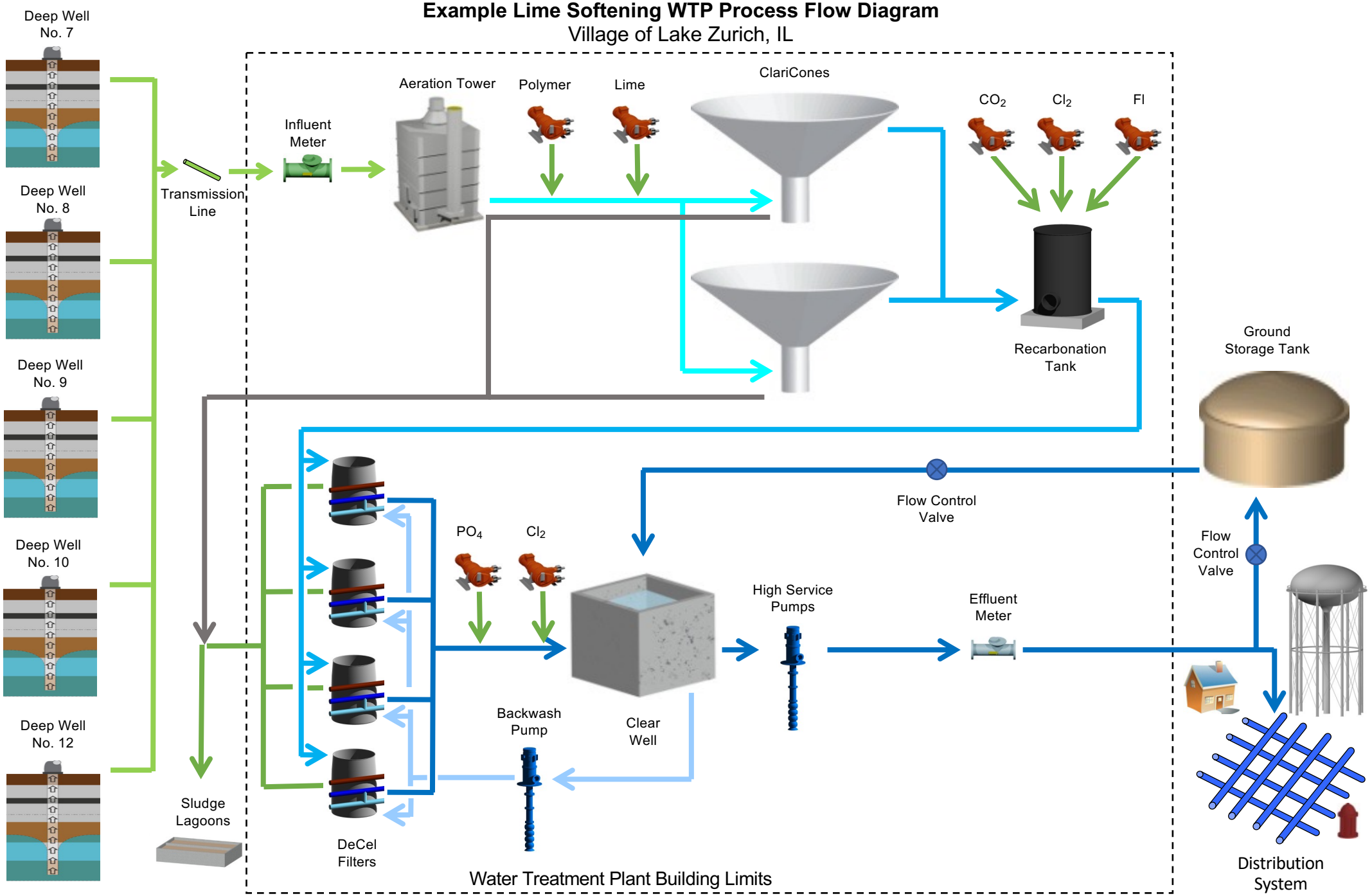
- Replace Ion Exchange Media with Radium Selective Media
- Can Reuse Existing Cation Exchange Tanks (Capital Cost and Construction Schedule Benefits)
- Does Not Soften – Water Quality Impacts
- Significant Permitting Effort Due to Uncertainty with Impacts to Water Distribution Corrosion (Lead and Copper Rule)

Lime Softening

- Most Radium Bound in Lime Sludge and Minimal Radium Discharged to Sanitary
- Lime Sludge Disposal Requirements and Facilitation – Comply with IEMA and IEPA
- One New Centralized Facility – Location?
- Significant Addition of Water Main
- Intensive and Costly Maintenance – Typically Operate 24/7/365
- Class A Operations Required
- Significant Permitting Effort

Example Lime Softening WTP Process Flow Diagram

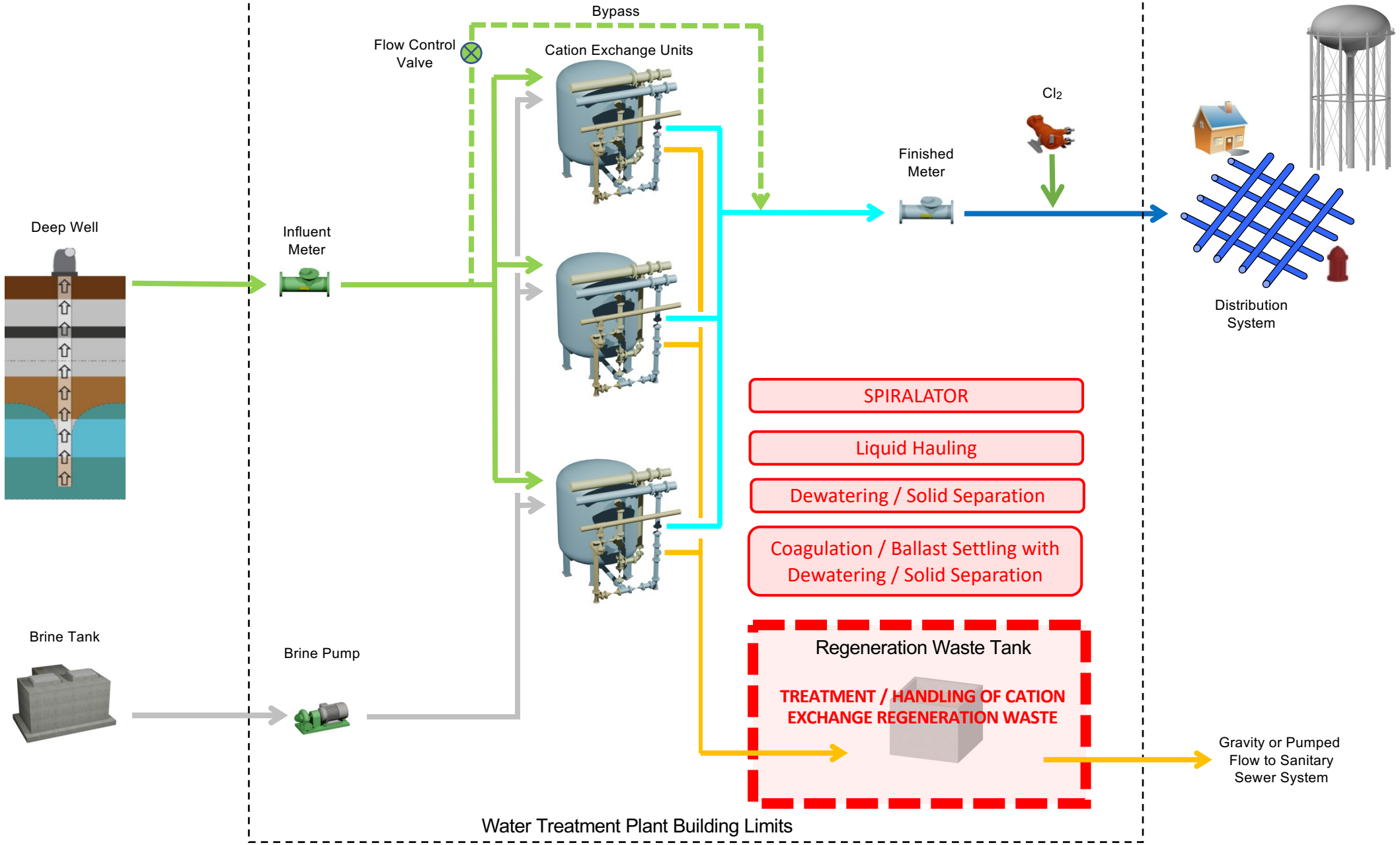
Village of Lake Zurich, IL

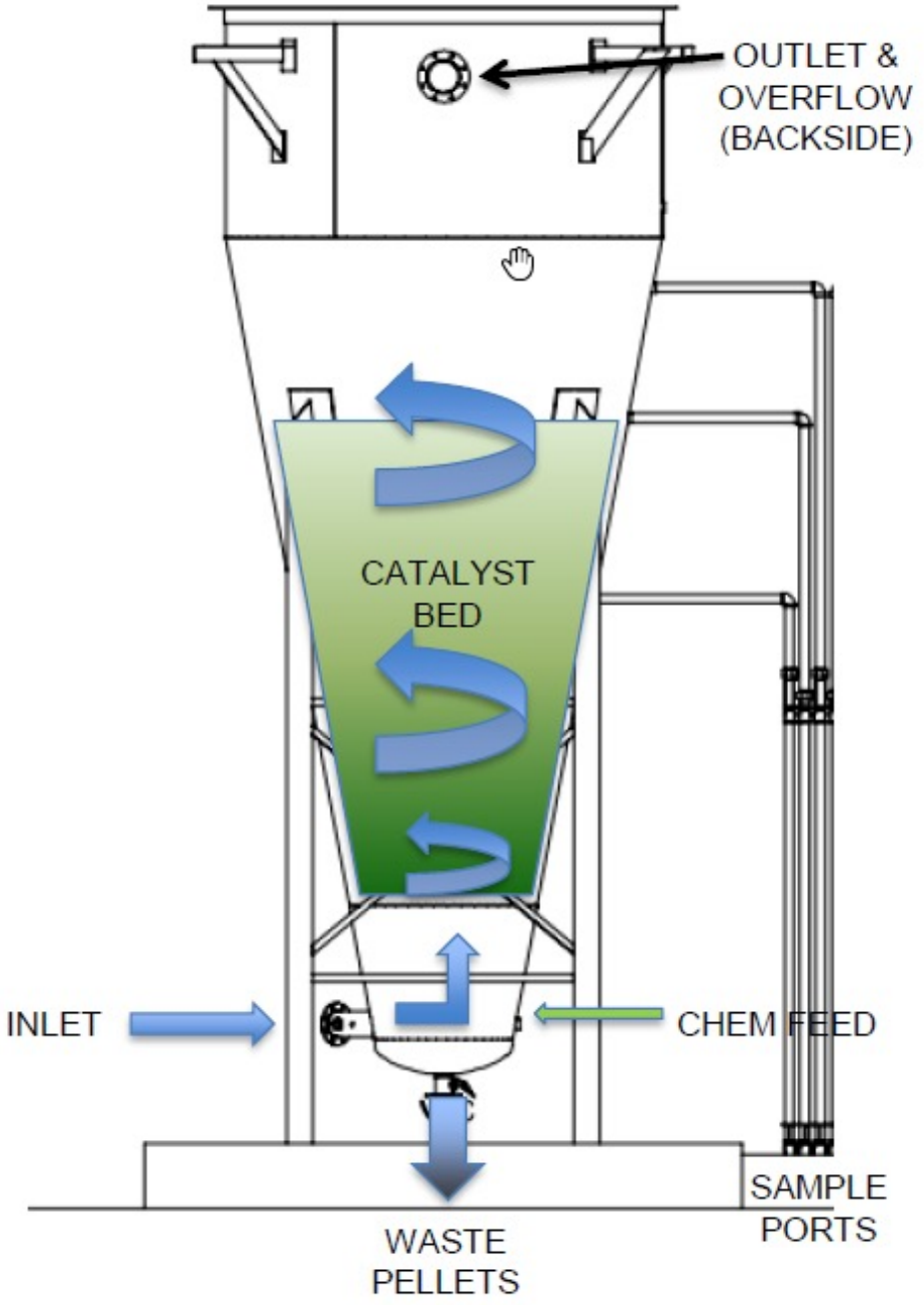


TREATMENT / HANDLING OF REGENERATION WASTE

WTP Radium Removal Technology Process Flow Diagram

Village of Lake Zurich, IL





WesTech SPIRALATOR

- Ballasted media (sand) with chemical precipitation and settling
- Equipment may require building expansion
- Media – requires waste disposal and frequent media replenishment
- Unproven – No Full-Scale Installations
- High effort with pilot and positive results not guaranteed

Liquid Hauling

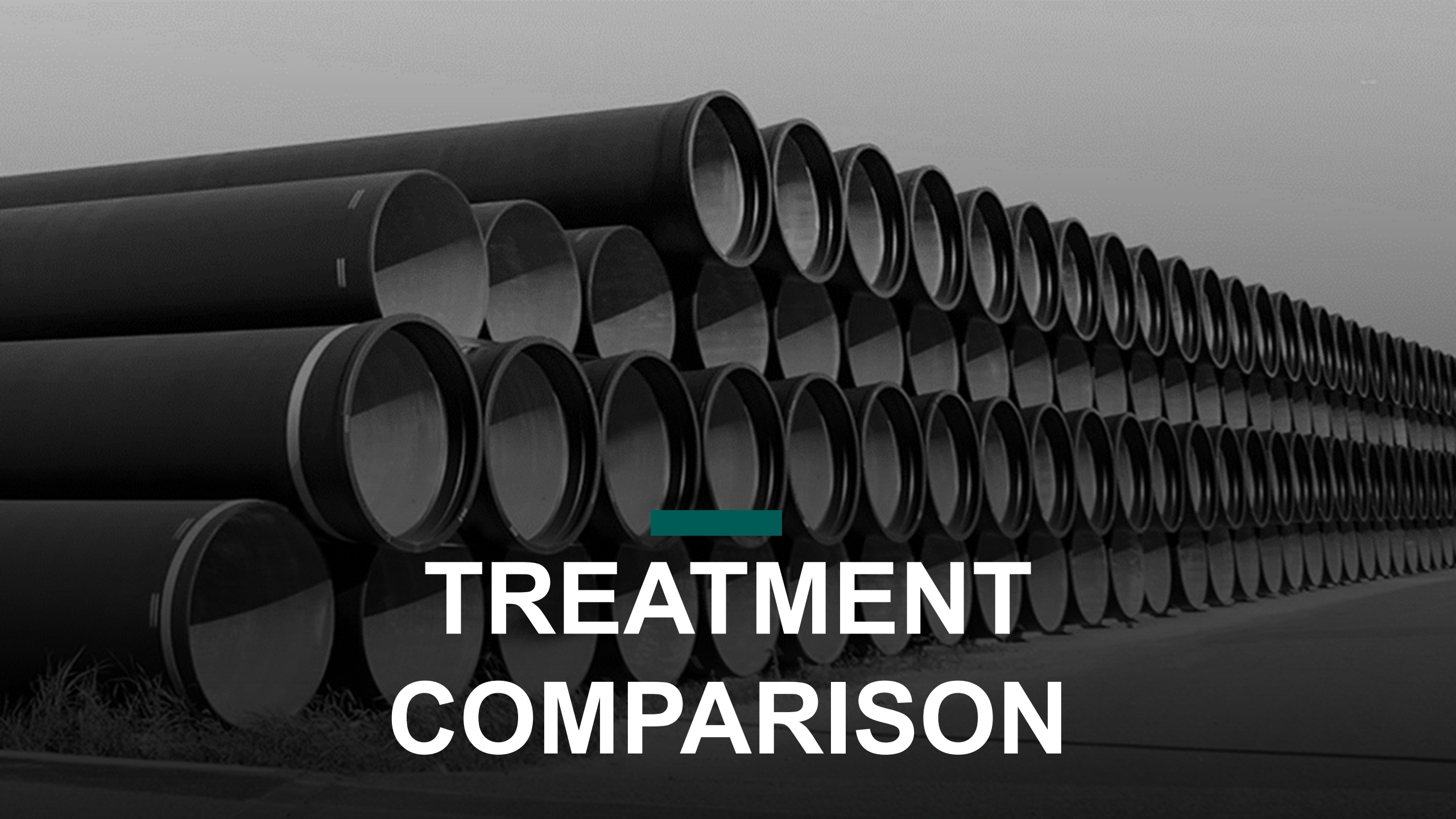
- Pump Waste from Holding Tanks at WTPs, Haul and Dump Elsewhere
- Eliminates Waste Discharge to Sanitary
- Expensive and Costs Could be Highly Volatile
- Increase Size of Waste Holding Tanks
- May Not be Viable – Depends on Ability to Find a Hauler to Handle High Radium Waste – No Market for Radium Waste and Waste Treatment is Difficult

Dewatering / Solid Separation

- Chemically Precipitate and Dewater Solids with Radium
- Dispose of solids at landfill; unable to land apply
- Need to research/select/design the appropriate dewatering technology
- Unproven for this application
- Significant testing effort to confirm it will adequately remove radium
- O&M Intensive (Labor, Chemicals, Equipment Maintenance)

Village of Gilberts' Solid Separation Design

- Uses Chemical Coagulation and Plate Settling
- Designed for Barium, but Radium Removal Similar
- Waste Disposal Costs
- Gilberts' Facility 1/3 size of Typical Lake Zurich WTP (Space and Scaling Considerations)
- Requires Engineered Design and Significant Testing
- O&M Intensive (Labor, Chemicals, Equipment Maintenance)
- Unproven (Only One Installation)



TREATMENT COMPARISON

Decision Component	Pretreatment	Replacement		Treatment/Handling of Waste			
	WRT Radium Selective Media	WRT Radium Selective Media	Lime Softening	WesTech SPIRALATOR	Liquid Hauling	Solid Separation and Settling	Gilberts Solid Separation Design
Project Costs							
Capital Cost	$$	$	$$$	$$$	$$$	$$$	$$$
Annual O&M Cost	$$	$$	$$$	$$	$$$	$$	$$
Total Present Worth Cost	$$$	$$	$$$	$$$	$$$	$$$	$$$
Water Quality							
Anticipated Change to Finished Water Quality	↔	↓	↑	↔	↔	↔	↔
Operation and Maintenance							
O&M Responsibility	1	1	3	3	1	3	3
Risk							
Implementation Difficulty (Short Term Risk/Permitting)	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Long Term Risk/Reliability/Regulatory Concerns	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓
Timing							
Piloting/Testing/Corrosion Control Study	2	3	3	2	NONE	3	3
Schedule of Implementation	2	2	3	3	2	3	3

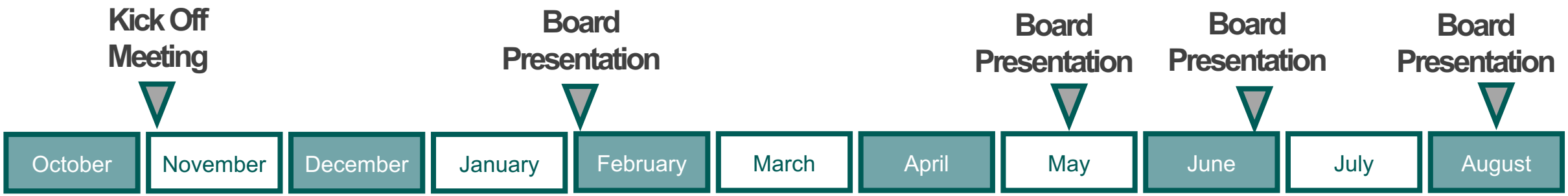
MATRIX RANKING CRITERIA

- Project Costs
  - Capital (implementation) Costs
  - Annual O&M Costs
  - Total Project Costs
- Anticipated Finished Water Quality
- Implementation Difficulty (Short Term Risk)
- Operation & Maintenance
- Long Term Risk and Reliability
- Expendability / Partners
- Control

DESCRIPTION			PROJECT COSTS																		
			Capital Cost		Annual O&M Cost		Total Cost		Anticipated Finished Water Quality		Implementation Difficulty (Short Term Risk)		Operation & Maintenance		Long Term Risk and Reliability		Expandability/Partners		Control		
Ranking Criteria			Capital (implementation) Costs?		Annual O&M Costs		Total Project Costs (implementation and O&M)		What is quality and variability of the finished water for this alternative?		Difficult in implementing this alternative (magnitude of improvements, schedule, permitting)?		Does this alternative require significant O&M responsibility or O&M required for improvements outside of the Village?		Does the alternative provide for the most reliable, long term solution.		Does this alternative provide for either LZ water supply growth and/or partnering with other communities to offset the cost of improvements?		For this alternative, does the Village maintain complete control of their water source?		
Highest			1 - Highest Cost						1 - Finished water quality is variable and/or reduced from present standard.		1 - This alternative is the most difficult and has the highest risk to implement.		1 - This alternative has the highest anticipated O&M responsibility and costs		1 - This alternative is the only a short term solution with potential long term risk and consequences.		1 - This alternative has the least opportunity to allow expansion of the water system or partner with other communities.		1 - The Village does not retain significant control of water system		
Lowest			5 - Lowest Cost						5 - Finished water quality is more consistent and/higher than present standard.		5 - This alternative is the least difficult and has the lowest risk to implement.		5 - This alternative has the least anticpated O&M responsibility and costs		5 - This alternative provides for a long term (exceeding 50 year) solutin with least and most manageable long term risks		5 - This alternative has the most opportunity to allow expansion of the water system or partner with other communities.		5 - The Village maintains complete control		
			Weight	0%	Weight	0%	Weight	0%	Weight	0%	Weight	0%	Weight	0%	Weight	0%	Weight	0%	Weight	0%	
Alternative	**Source**	**Supply Agency(s)**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Value**	**Weighted Value**	**Weighted Total Value**
PRETREATMENT																					
LAKE ZURICH GROUNDWATER - **WRT RADIUM SELECTIVE MEDIA**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REPLACEMENT OF EXISTING CATION EXCHANGE SOFTENING TREATMENT																					
LAKE ZURICH GROUNDWATER **- WRT RADIUM SELECTIVE MEDIA**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAKE ZURICH GROUNDWATER - **LIME SOFTENING**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TREATMENT/HANDLING OF CATION EXCHANGE REGENERATION WASTE																					
LAKE ZURICH GROUNDWATER - **WESTECH SPIRALATOR**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAKE ZURICH GROUNDWATER **- LIQUID HAULING**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAKE ZURICH GROUNDWATER - **SOLID SEPARATION AND SETTLING**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAKE ZURICH GROUNDWATER - **GILBERTS SOLID SEPARATION DESIGN**	Lake Zurich Groundwater	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Next Steps

PROJECT SCHEDULE



Background & Demand Projections

Site Visits, Inventory & Demands

Groundwater System Evaluation

Analysis

Cost Est.

Lake Michigan Supplier Evaluation

Meetings & Analysis

Cost Est.

Comparison Matrix Development

Matrix

Summary, Report & Final Presentation

Final Report

Questions or Comments?

THANK YOU

We value your time and appreciate the opportunity to present this evening.

Engineering Enterprises, Inc.

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