

Fredonia's Water Supply: Understanding Source & Treatment

**Public Information Session
July 9, 2026**

Chautauqua County Health Department

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Shared Interest in Community Health

Prevent Contamination & Illness

- Provide guidance to ensure operators and officials understand the regulations for their facilities.
- Verify that monitoring samples are submitted and that public water supplies are maintained and operated in accordance with health and safety regulations.

Promote Reliable Infrastructure and Community Awareness

- Encourage communities to prepare for their average daily needs and for emergencies.
- Improve capacity for economic growth.
- Encourage a better understanding of public health systems.

Protect Public Health

- Ensure a safe and reliable water supply is available.



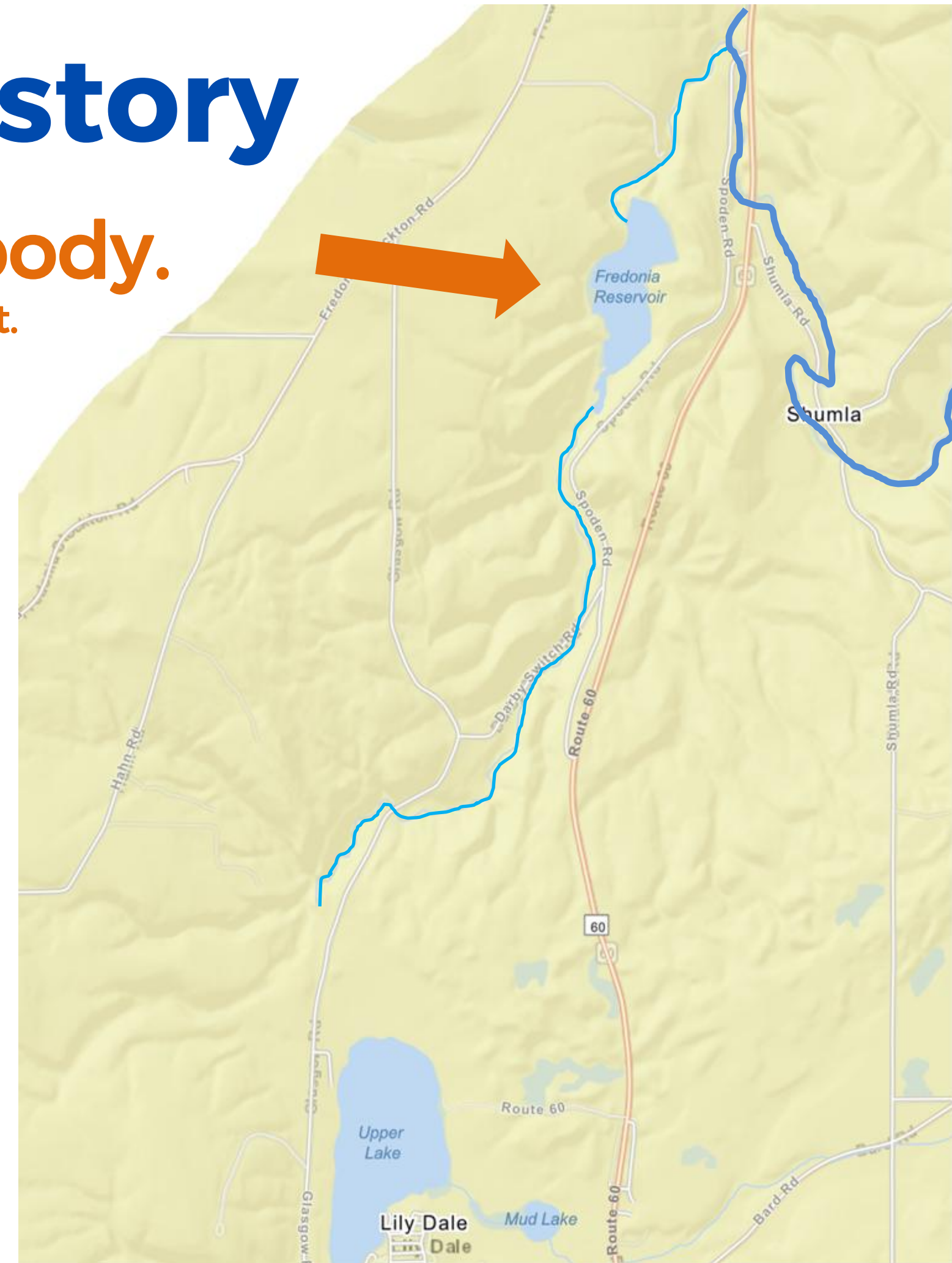
Fredonia Reservoir History

Not a naturally occurring water body.

Damming a creek disrupts the natural flow of water and sediment.

1884 - Small reservoir (*10 Million Gallons*) created by damming an upper branch of Canadaway Creek.

1938 - Dam and spillway built to increase volume (*332 MG*) to supply growing Village.



Fredonia Reservoir Water Sources

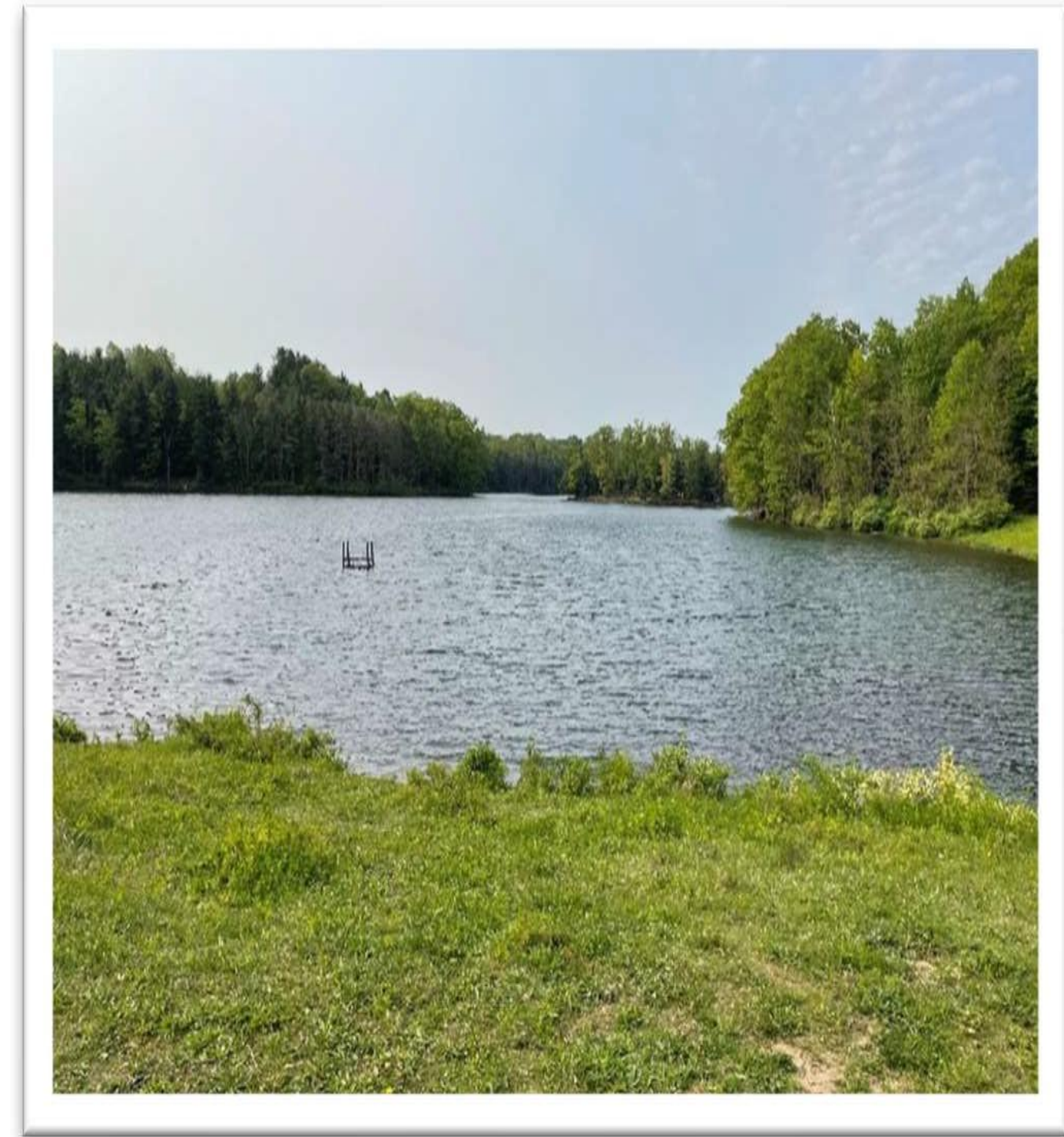
0% from groundwater / springs feeding the Reservoir directly.

1% from rain / snow that falls directly on the Reservoir.

**99% water
from watershed runoff.**

***A watershed is the area of land that drains into a
body of water. ***

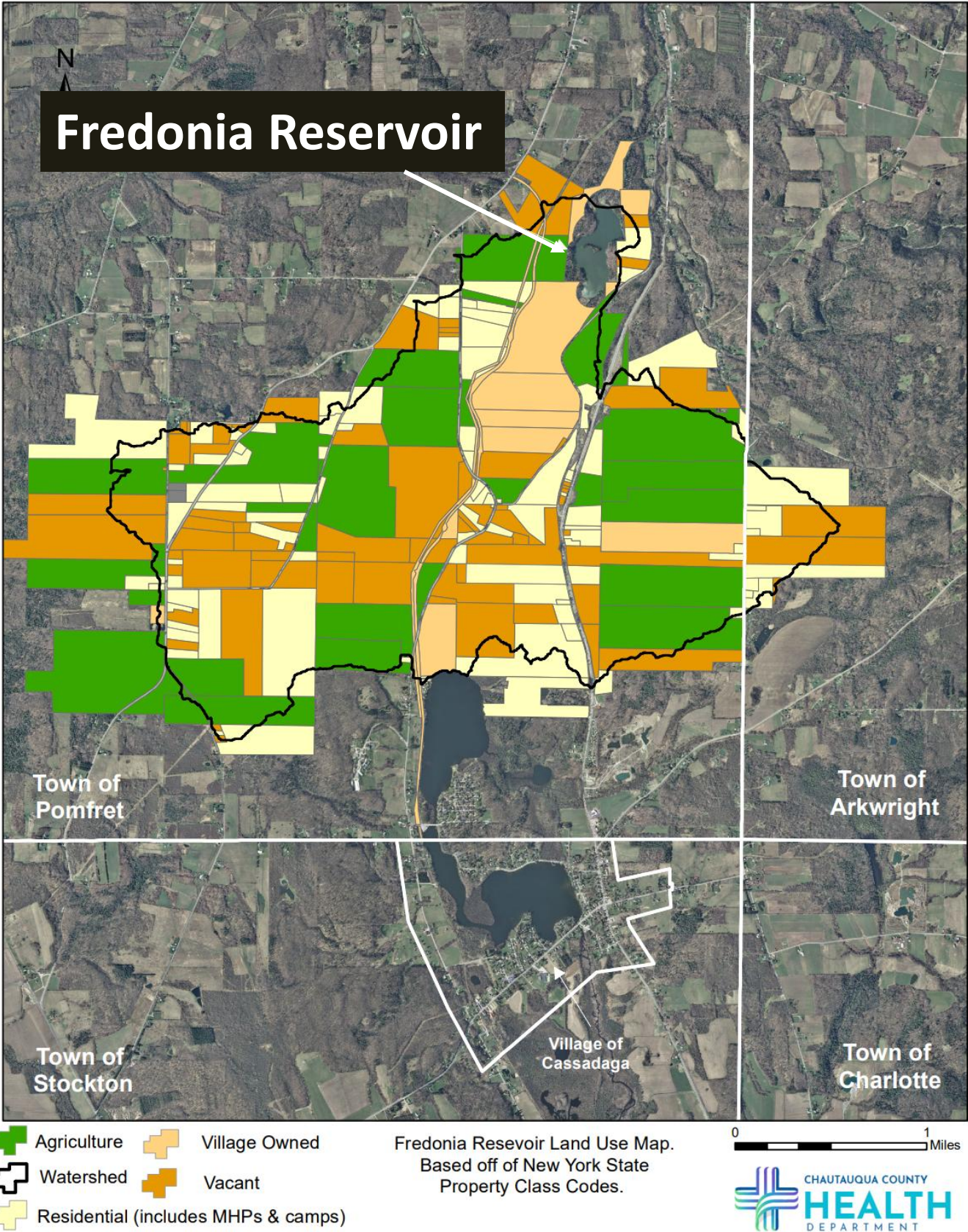
(2008 report from Dr. Mike Wilson SUNY Fredonia Geology)



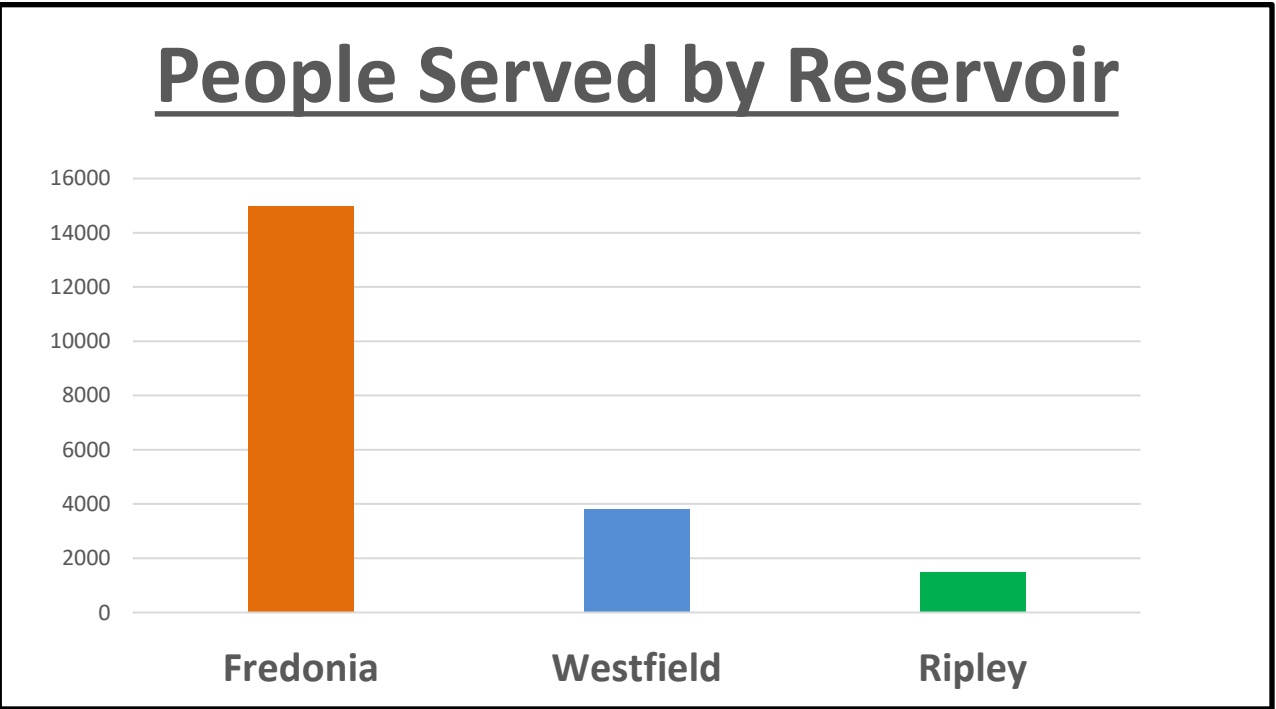
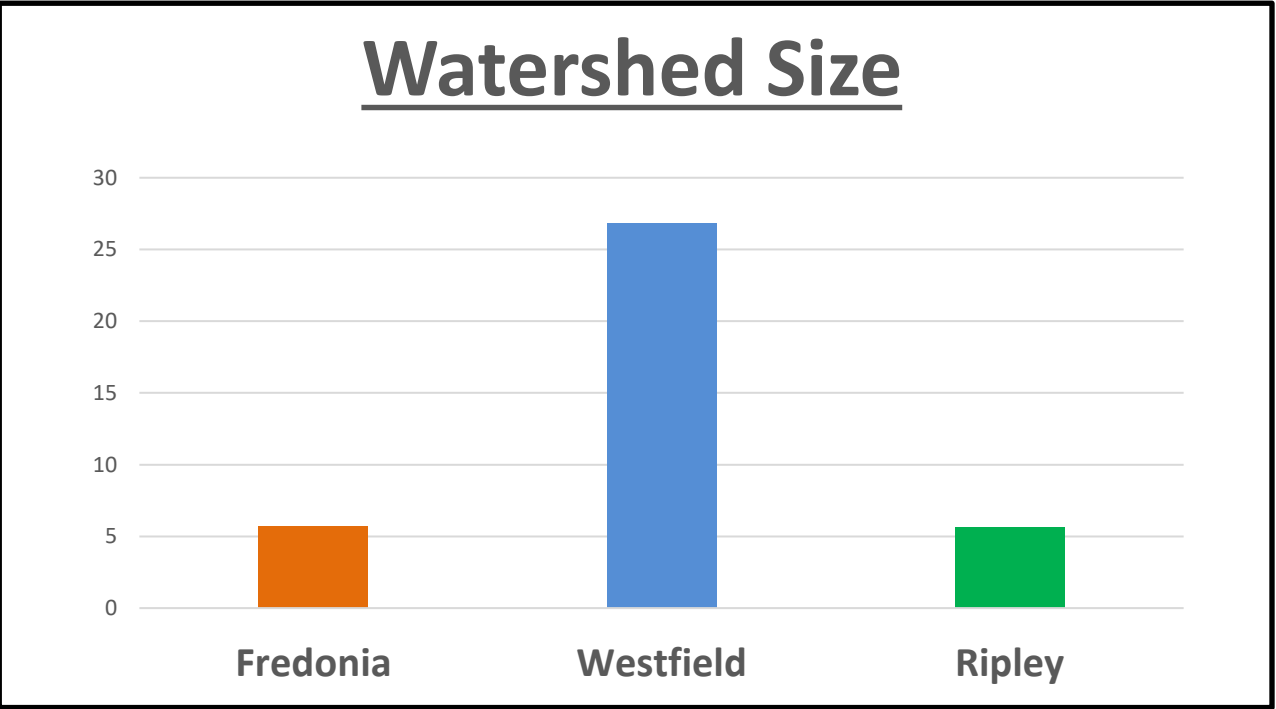
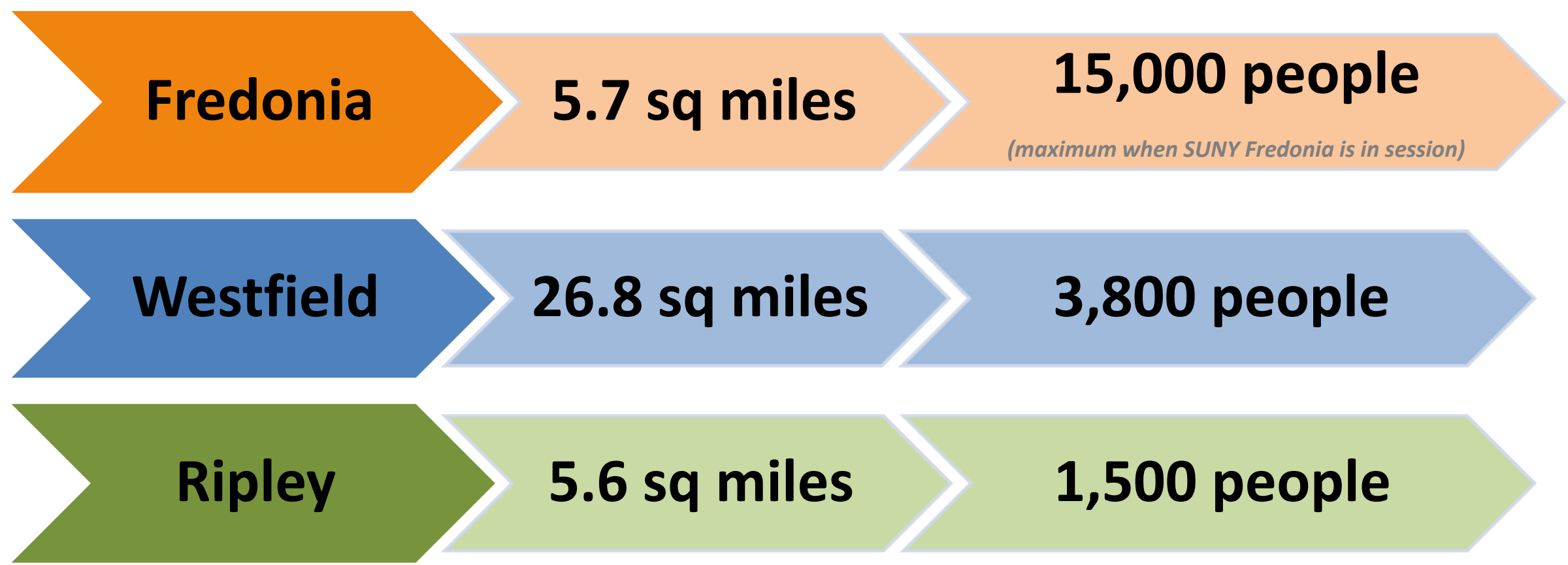
Reservoir Watershed & Runoff

Forest / Vacant (81.5%)	Plant debris Sediment runoff from erosion
Agricultural (13.1%)	Plant debris Sediment runoff from erosion Fertilizer / pesticide / manure / pathogens
Residential/ Commercial (3%) *includes Campgrounds & Mobile Home Parks	Onsite Wastewater Treatment Systems / Septic Systems (22 permitted systems, #? unknown) Residential runoff (pesticide, fertilizer, heavy metals)
Roadways	Road salt Vehicle fluids (leaky vehicles & accidents) Potential Hazmat accidents

(Percentages based on NYSDEC Lake Classification and Inventory study 2016)

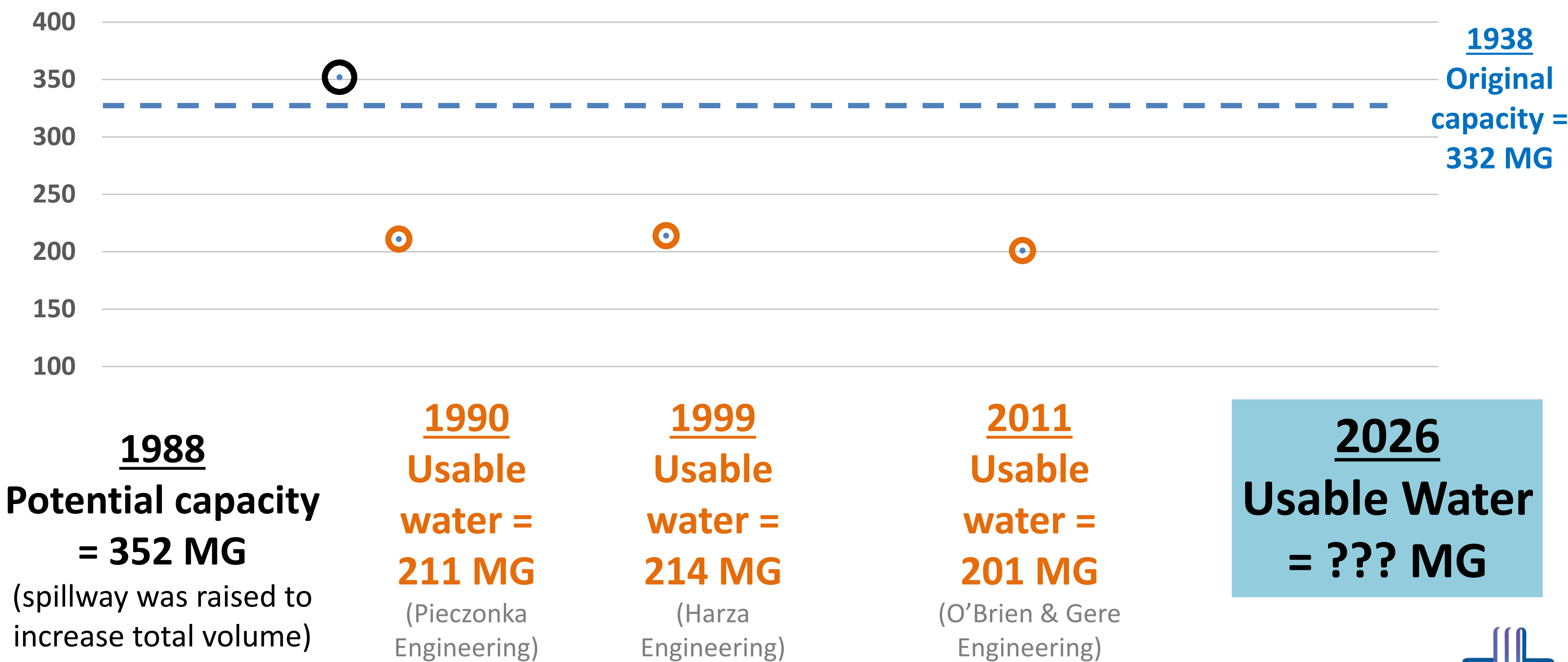


Comparing Reservoir Watershed Sizes

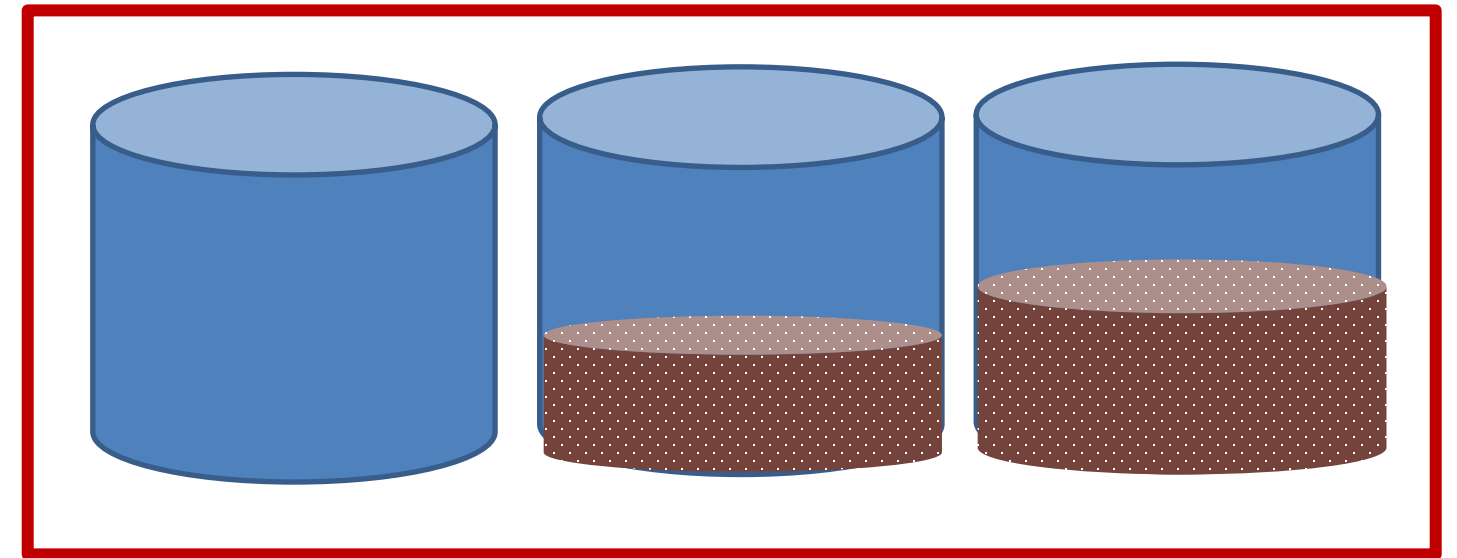
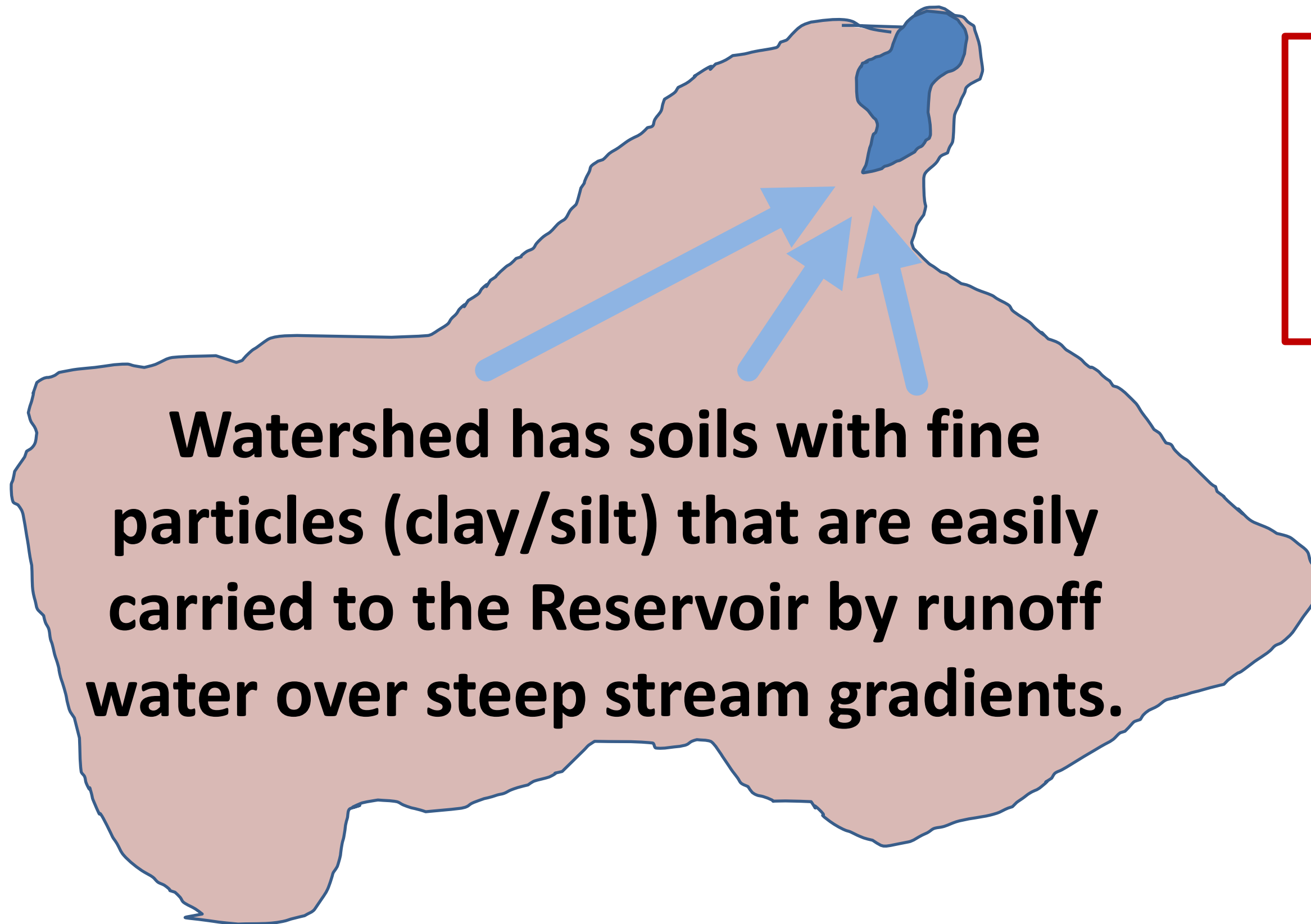


Fredonia Reservoir Capacity

Million Gallons (MG)



Sedimentation in the Reservoir

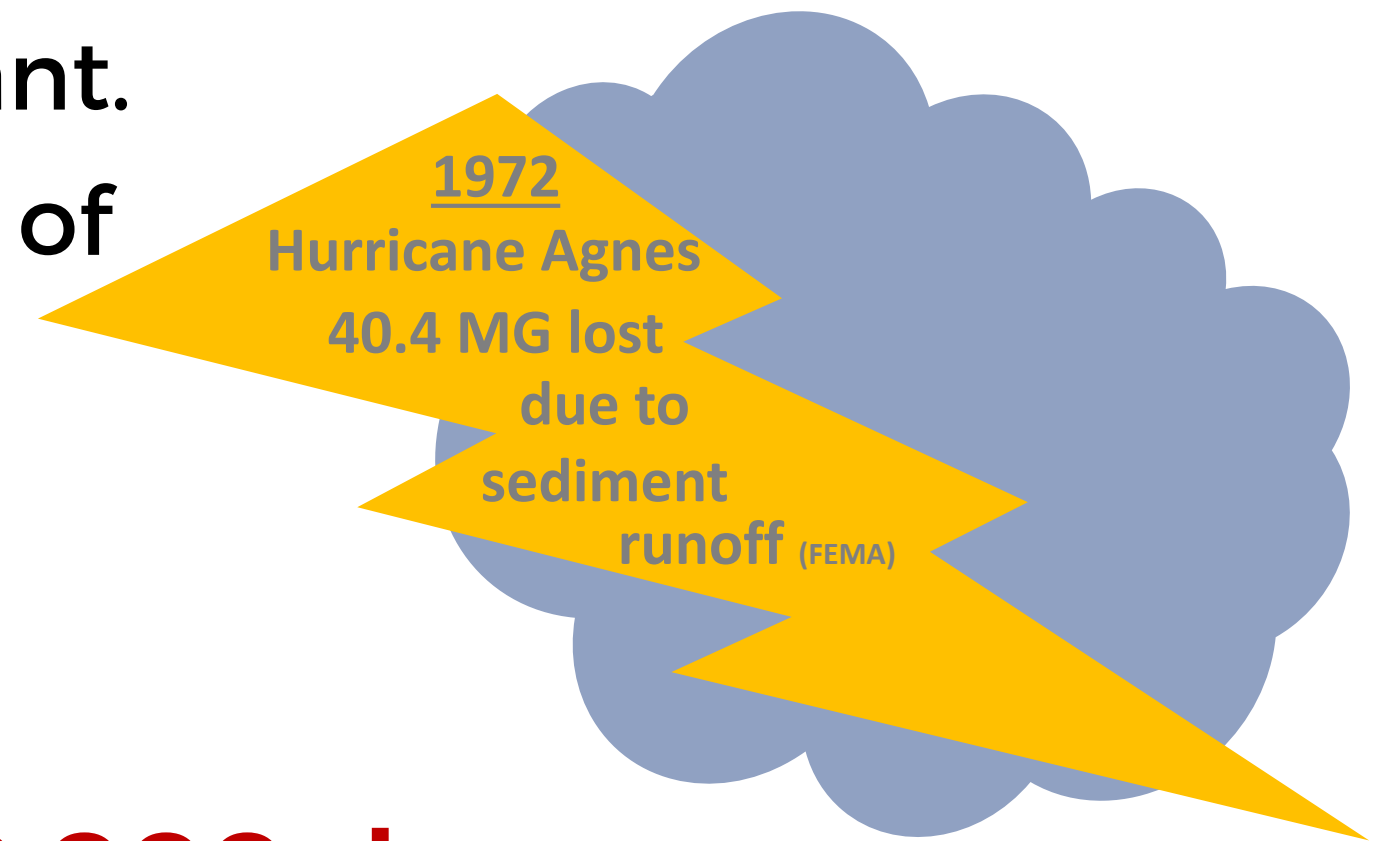


The Reservoir water is calm so fine particles settle out of the water and “fill in” the Reservoir.



Dredging: Important Now & in Future

- Dredging maintains the volume of usable water in the Reservoir.
- Dredging reduces the amount of sediment that can cause turbidity problems at water treatment plant.
- Extreme weather events increase amount of sediment flowing into Reservoir.



2011 O'Brien and Gere estimated
43% of original usable Reservoir volume was lost due to sedimentation.

Roughly 50,000 dump trucks (15 yd³) of soil had been washed into the Reservoir.



Fredonia Reservoir Dredging History

Plans to dredge were in place in 1965, 1972, 1999, & 2001.

2001 - Basic Karpinski engineering report included plans and permit applications to dredge *once per year for 10 years to return Reservoir capacity* as part of NYSDEC required maintenance.

**Despite plans and permits approved by NYSDEC,
the Reservoir has never been dredged.**



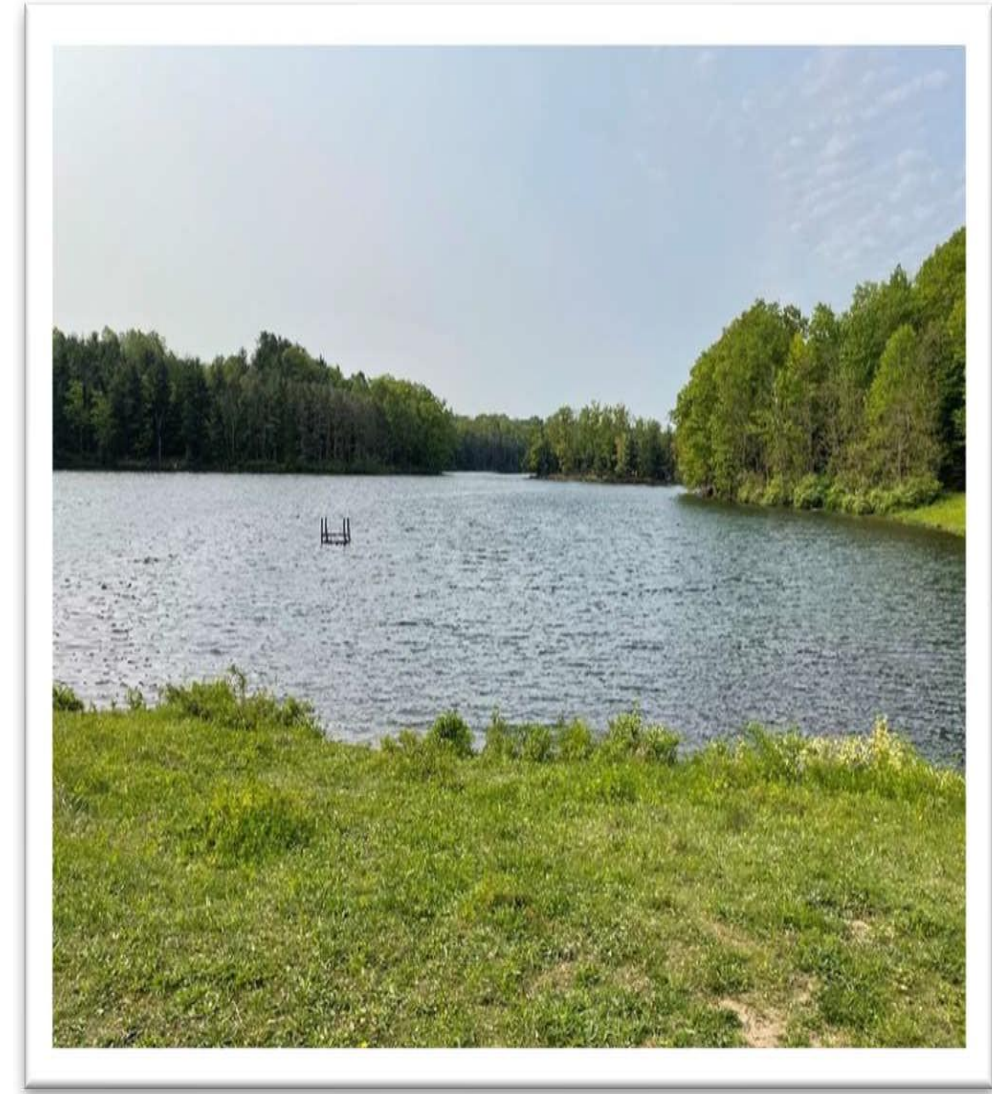
Fredonia Reservoir Water Levels

Reservoir Receives Water

- Rain/snow in watershed runs off to Reservoir.
- Rain/snow falls directly on Reservoir surface.

Usable Reservoir Water Reduced

- Fredonia Water Treatment Plant constantly pulls water to keep up with customer demand and to support water needs for the water treatment plant process.
- Water evaporates from Reservoir surface.

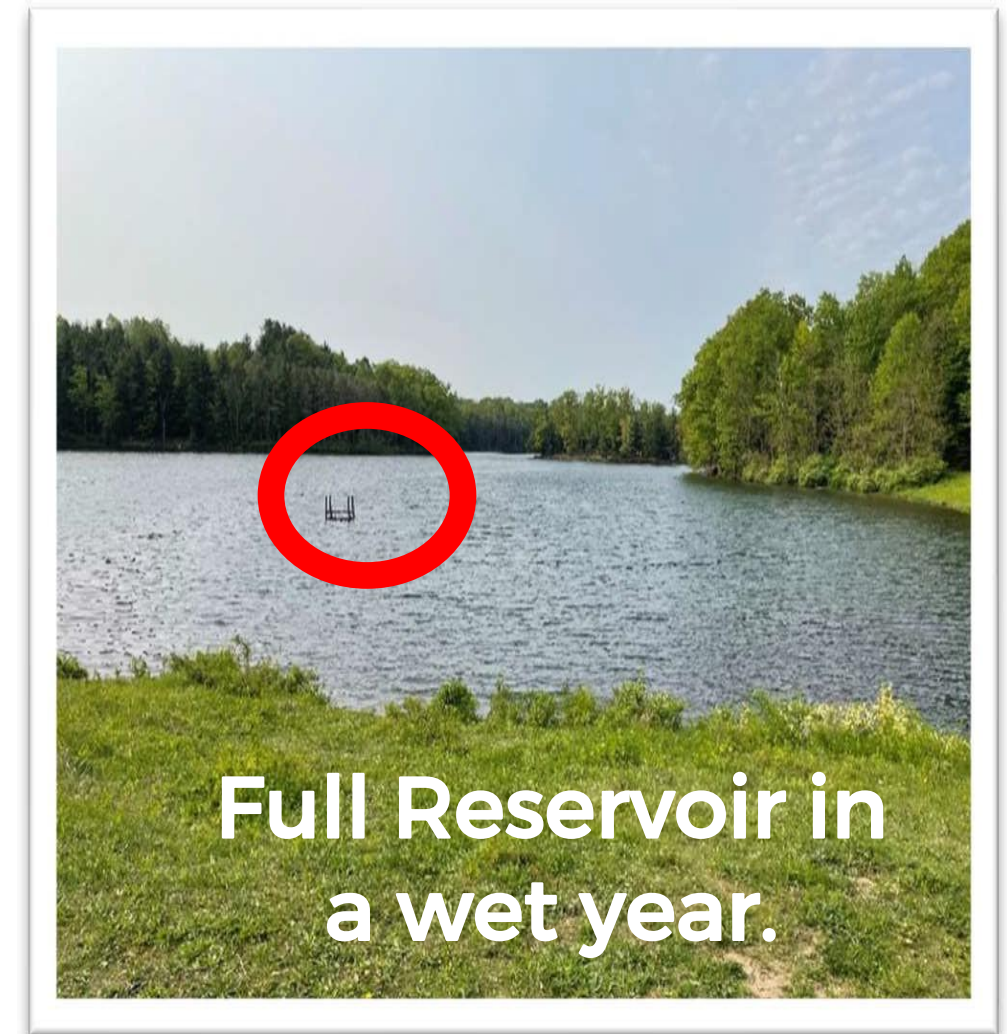


Part 5 NYS Sanitary Code Appendix 5-A section 3.1.1.1:

“The quantity of the source water shall be adequate to meet the maximum projected water demand based on a 1 in 50 year drought or extreme drought of record.”



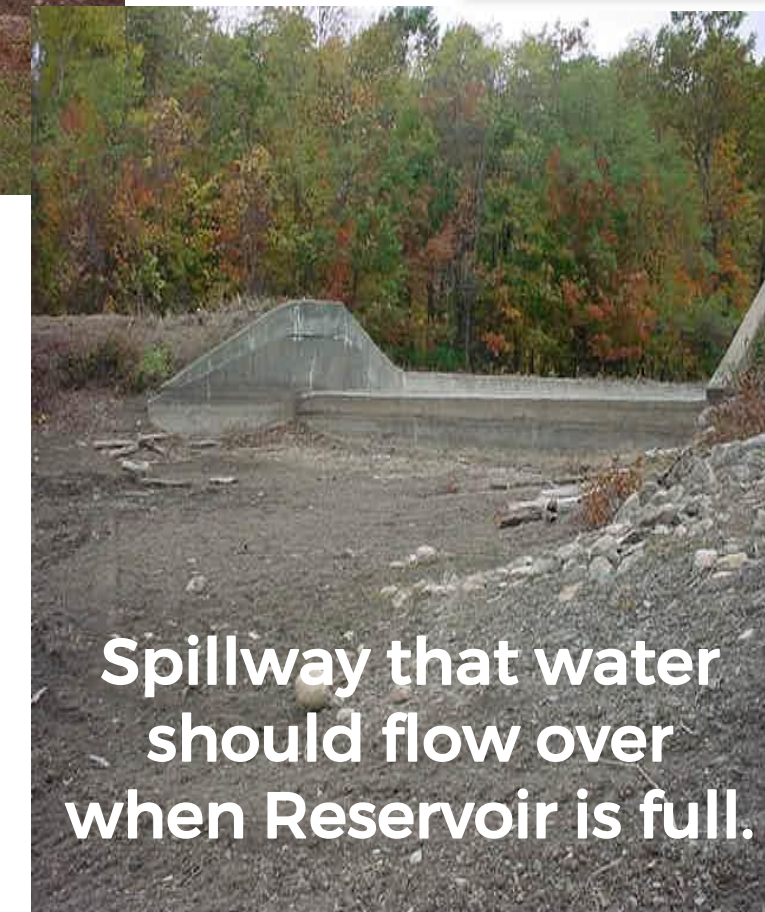
Reservoir Drought History



1991 - Reservoir depleted by 95%

1998 / 1999 - Reservoir depleted by 78%

2007 - Reservoir depleted by 60%



Reservoir Drought Concerns

1991 & 1998 / 1999 – NYSDEC granted emergency permit to pull water from Cassadaga Lakes.

- As part of NYSDEC's 1998 / 1999 emergency permit, Village was mandated to develop a permanent alternative source (*to supplement as needed*).
- Fredonia Reservoir and Cassadaga Lakes are not in the same water system. Future use permits are not guaranteed.

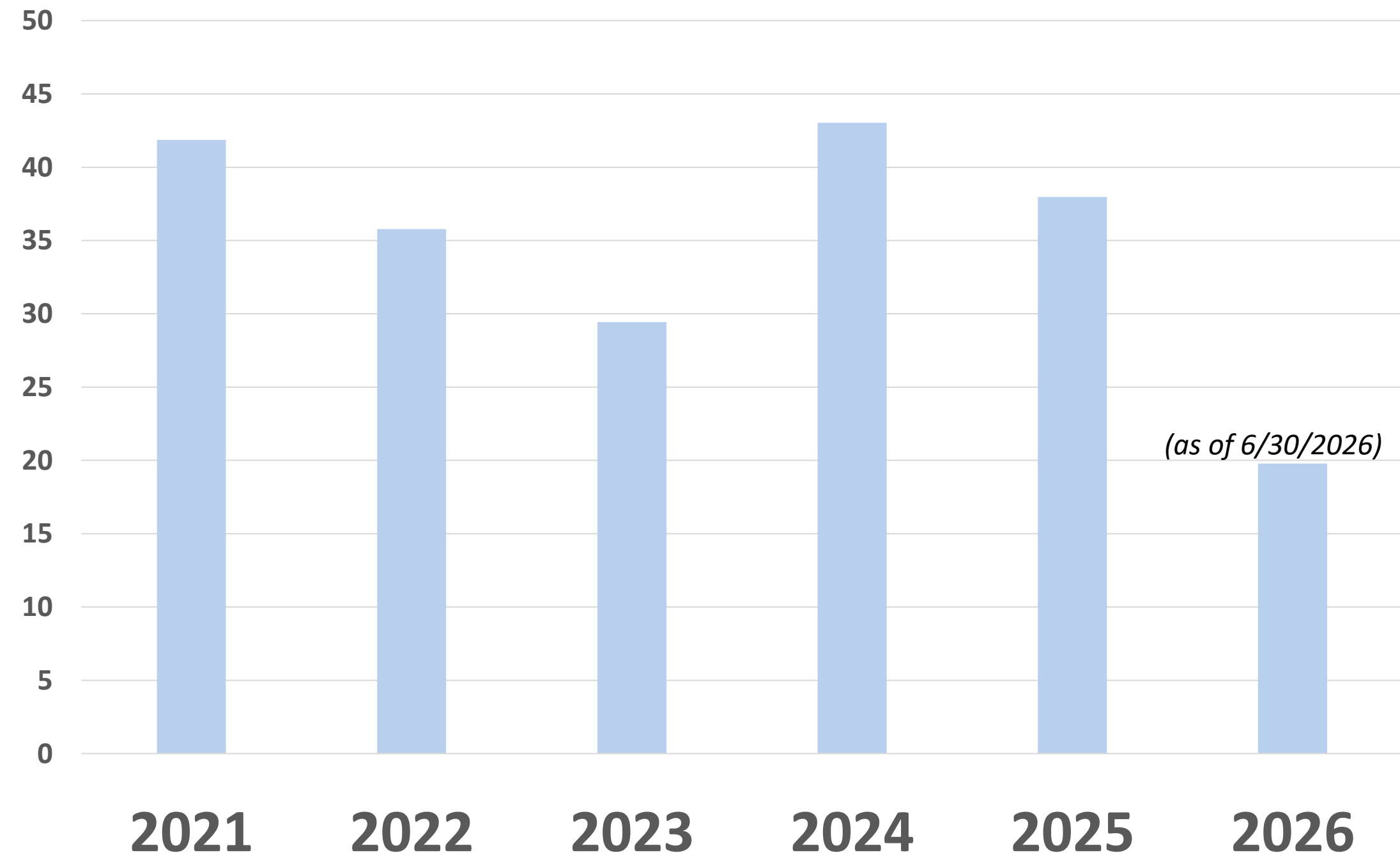


Great Lakes / St. Lawrence Watershed



Recent Annual Precipitation (inches)

**Average annual
precipitation =
45.18 inches**
*(since beginning of
record)*



Reservoir Dam & Spillway

New York State Department Environmental Conservation (NYSDEC) regulates wetlands, water channels, and water bodies.

Reservoir Dam is Class “C” or “High Hazard” Dam (https://extapps.dec.ny.gov/docs/water_pdf/togs315.pdf)

“A dam failure may result in widespread or serious damage to home(s); damage to main highways, industrial or commercial buildings, railroads, and/or important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; or substantial environmental damage; such that the loss of human life or widespread substantial economic loss is likely.”

Reservoir has an Earthen Dam

Built by compacting layers of earth/soil. Soils that don't hold water, or let water move through easily, form the core of the dam. Soils that allow water to seep in/out easily were used on the upstream and downstream sides of the dam.



Reservoir Dam & Spillway

**1980 – Dam inspected by NYSDEC - Deemed “Unsafe, Non-emergency”
Spillway inspected by NYSDEC – Deemed “seriously inadequate”**

(<https://apps.dtic.mil/sti/tr/pdf/ADA090940.pdf>)

2017 - Dam inspected by NYSDEC – Deemed “Unsound – Fair”

(<https://www1.osc.state.ny.us/localgov/dams/damsalldata.cfm>)

2023 – Dam inspected by NYSDEC – Deemed “Unsound – Fair”

- “Condition rating... due to its lack of spillway capacity and inadequate structural stability.”
- “... deficiencies ... are of such a nature that the safety of the dam cannot be assured.”
- “... the dam is expected to perform adequately under normal loading conditions.”

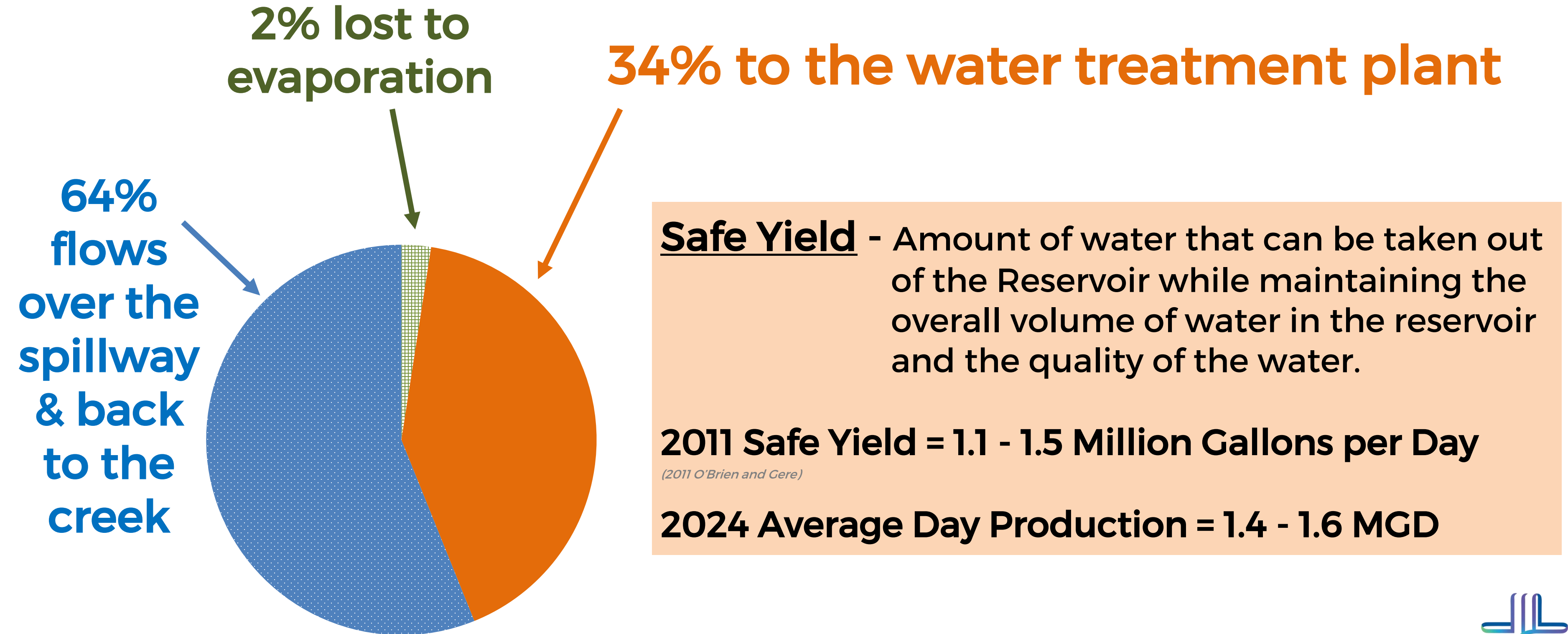


Fredonia Reservoir Summary

- The last estimated measurement of usable water did not meet NYSDOH requirements; current volume is unknown.
- Reservoir will need immediate and long term dredging plan if it remains in operation.
- NYSDEC mandated the Village to find an alternative water source connection in 1999 to prepare for future drought events.
- Concerns about Reservoir capacity, need for regular dredging / maintenance and long term outlook first documented in 1965.
- Dam and spillway must be maintained. The risks of dam failure are reduced if the Reservoir volume is drawn down.



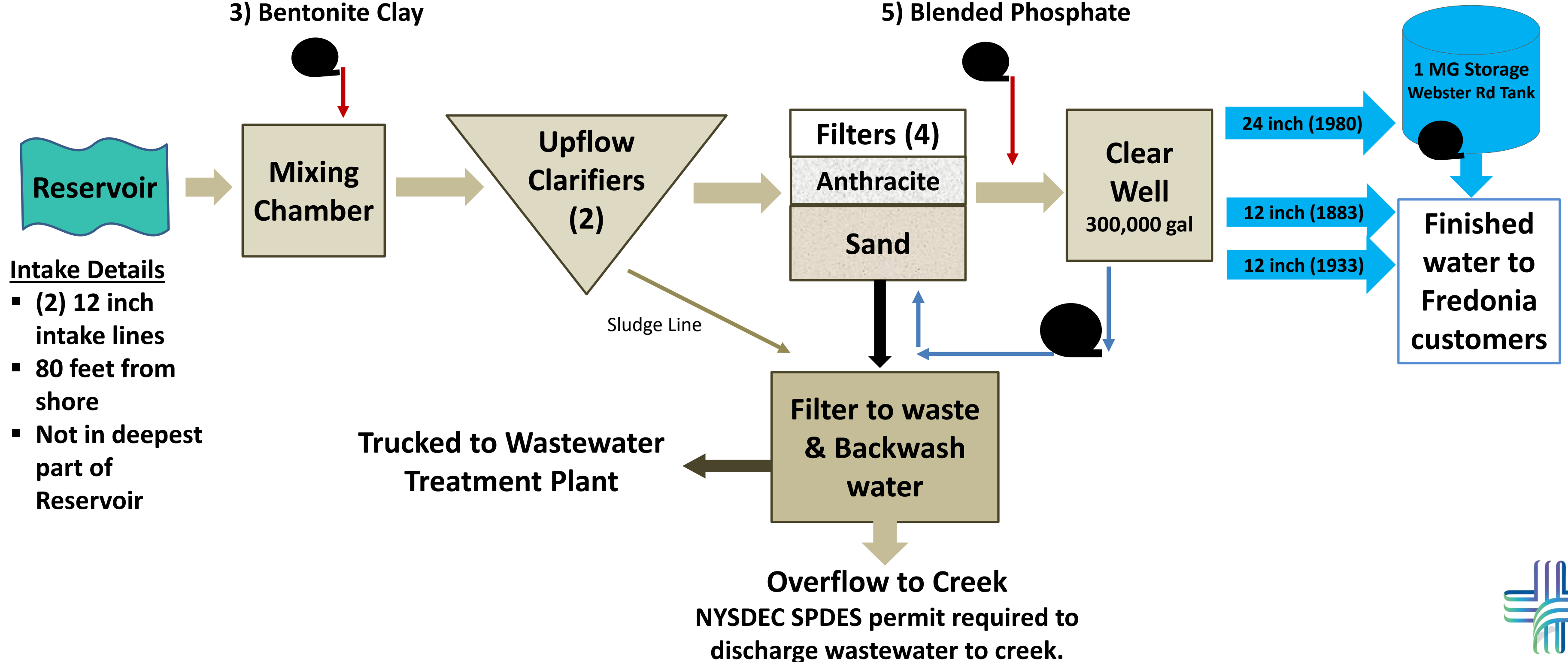
Where Does Reservoir Water Go?



Fredonia Water Treatment Plant (WTP)

- 1) Poly Aluminum Chloride
- 2) Cationic Polymer
- 3) Bentonite Clay

- 4) Sodium Hypochlorite
- 5) Blended Phosphate



WTP Concerns & Deficiencies

- Stream bank erosion & undercutting

- Clarifiers are on the other side of concrete wall.
- Clarifiers hold 250,000 gallons of water which weighs 1,050 tons.



May 23, 2023

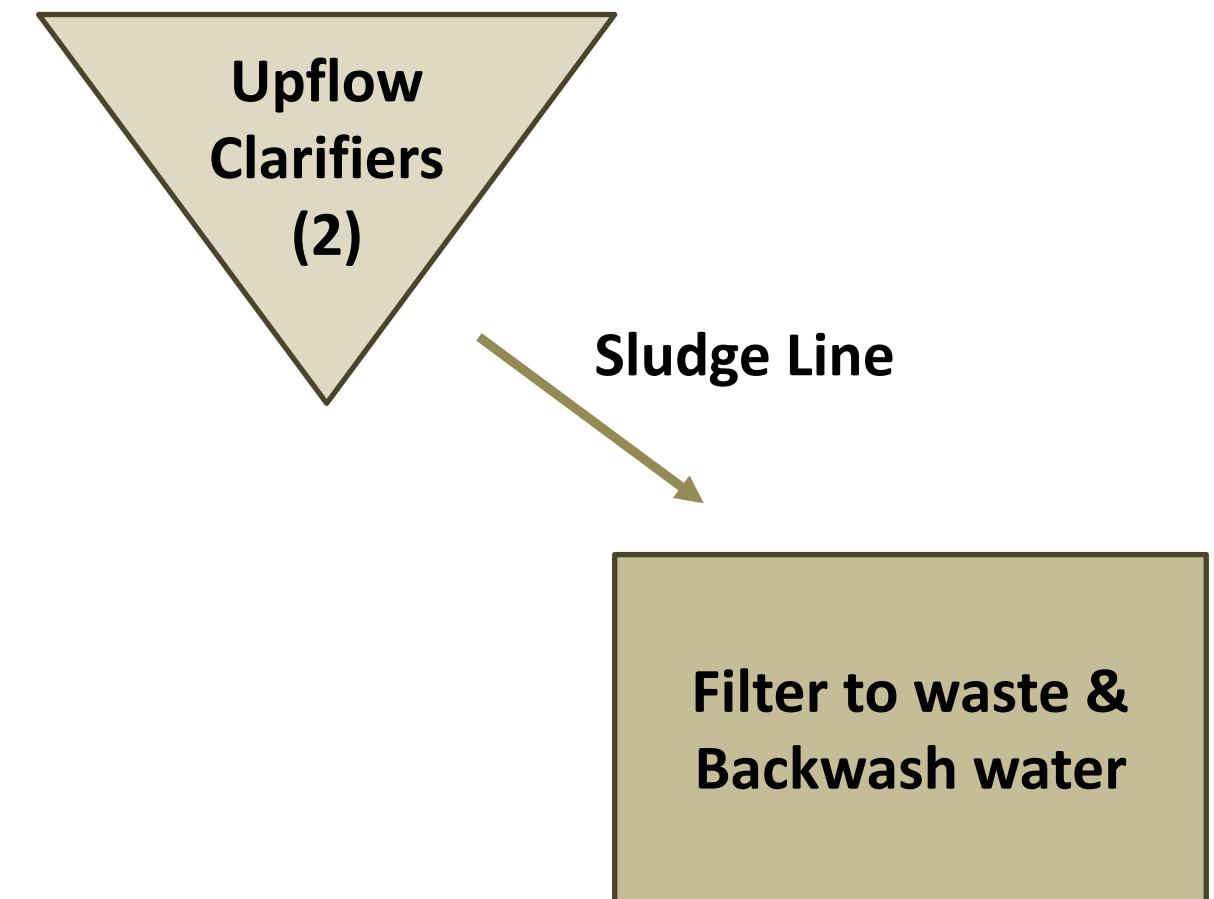


April 24, 2026



WTP Concerns & Deficiencies

- Clarifier sludge line blocked
- Generator present but inadequate
- General condition of the water treatment plant building
 - Cracked walls
 - Limited size / space for upgrades and back-up equipment / parts



WTP Concerns & Deficiencies

Mixing
Chamber

Chemicals needed for treatment are not mixed adequately with incoming water.

Upflow
Clarifiers
(2)

Existing clarifiers are too small to properly remove organic material and other solids.

Excess organic matter contributes to:

- High levels of disinfection by-products.
- High turbidity of the water, which disrupts disinfection process.

Plant material
washes into the
Reservoir.

Plants & Algae grow
in the Reservoir.



WTP Concerns & Deficiencies

- Complexity of disinfection process
- Switching from primary to secondary chemical feed pumps is not automated
- Lack of redundancy
 - Plant has to operate 24 / 7 / 365 days of the year to meet system demand.
 - Difficult to near impossible to schedule time for the WTP to stop operating to allow repairs.
 - Reservoir dredging creates turbid water that will get pulled into WTP and complicate treatment process.



**Water
Treatment
Plant must
be staffed
and well
monitored
24 / 7.**



Fredonia WTP Summary

- Streambank stabilization needed to prevent structural damage to WTP building.
- WTP requires significant equipment upgrades to provide redundancy.
- Continued routine maintenance and upgrades would be required to maintain the WTP for future use.
- WTP must continue to operate and be staffed 24 / 7 unless significantly more storage is added to hold finished water and more automation is added to the WTP process.



Finished Water Storage in Fredonia

$$\begin{array}{l} \text{NYSDOH} \\ \text{Required} \\ \text{Storage} \\ \text{Capacity} \end{array} = \begin{array}{l} \text{Minimum} \\ \text{Average} \\ \text{Day's Use} \\ \text{(1.4 Million} \\ \text{Gallons / Day)} \end{array} + \begin{array}{l} \text{Fire Response Demands} \\ \text{(typical hydrants = 500 - 1,500 gpm;} \\ \text{Fredonia hydrants release more} \\ \text{because the pressure in the water} \\ \text{lines is so high.} \end{array}$$

Fredonia's Current Storage Capacity = 1.0 MG



Distribution System & Main Breaks

Fredonia's Gravity Fed System

Challenges

- Elevation change causes north part of the system to be 140-150 psi (normal working pressure should be 60-80 psi).
- Distribution system doesn't have a way to reduce / regulate the pressure.
- High pressure makes old lines more susceptible to breaks.
- High pressure causes problems for home appliances with waterlines (washing machines, dishwashers, etc.).
- Water from the Webster Rd water tank must be pumped out to reach high elevation customers; this means lower elevation customers receive excessive high pressure.

Benefit

- Limited number of pumps needed to move water in system.



Fredonia Boil Water Orders

Date issued	Date lifted	Reason for Fredonia Boil Water Order	Customers on BWO
3/27/2026	3/31/2026	Turbidity from reservoir was too high for the treatment plant to successfully treat so the water coming out of the plant had turbidity that exceeded the maximum contaminant level	All
1/30/2026	2/3/2026	Large break on Temple and Central. More than 5 service connections or 1% of the total served by the Village were impacted	All
12/16/2025	12/18/2025	Disinfection system failure	All
9/19/2025	9/21/2025	2 Failing bacteria samples in the distribution system	All
7/8/2025	7/15/2025	Treatment disruption - chemical overfeed	All
2/3/2025	2/7/2025	Treatment equipment failure - chlorine feed pump	All
4/17/2024	4/21/2024	High turbidity due to clearwell cleaning	All
2/8/2024	2/11/2024	Treatment disruption - chlorination	All
6/7/2023	6/11/2023	Disruption at treatment plant - clear well inspection stirred up sediment on bottom causing water with high turbidity to enter the distribution system	All
2/26/2023	2/26/2023	Treatment disruption chlorinator failure	All
9/10/2020	9/30/2020	High turbidity leaving treatment plant due to algae bloom and filter media change out	All
6/5/2020	6/7/2020	Water main break	Partial
10/21/2017	10/24/2017	Water main break BWO and Conserve Order	All

Color Key

- BWO due to failing bacteria samples indicating public health hazard.
- BWO due to failure of treatment processes/inadequately treated water.
- Precautionary BWO due to water main breaks.



Dunkirk & NCCWD Boil Water Orders

Date issued	Date lifted	Reason for Boil Water Order	Customers on BWO
<u>City of Dunkirk (and customers)</u>			
8/31/2021	9/4/2021	Boil and Conserve, Major water main break in 20 in main on Lakeshore Dr.	All
3/29/2018	3/31/2018	Major water main break near plant contractor hit the 30 in water main	All
<u>North Chaut. Co. Water District (NCCWD) Established October 2018</u>			
9/9/2024	9/16/2024	Major water main leak partial system	Partial
7/17/2023	7/21/2023	Several water main breaks only part of the system	Partial
8/31/2021	9/4/2021	Major water main break (in City of Dunkirk) Boil and Conserve Order	All
6/30/2021	7/3/2021	Water main leak	Partial
10/9/2020	10/14/2020	Main break in Van Buren Bay	Partial
1/14/2020	1/17/2020	Main leak/repairs serving Industrial Park	Partial
12/27/2019	12/31/2019	~14 homes due to leak	Partial
8/1/2019	8/4/2019	Brocton/Portland water leak	Partial

Color Key

- BWO due to failing bacteria samples indicating public health hazard.
- BWO due to failure of treatment processes/inadequately treated water.
- Precautionary BWO due to water main breaks.



Vineyard Drive Interconnect Cannot Prevent BWO

Connection was not designed to supply the whole Village.

- Line from Dunkirk to the pump station is not big enough.
- Opening the line for extended time would leave some Dunkirk customers without any water.
- Station pumps cannot lift water to highest point / elevation in Fredonia's system.
- By the time we know a BWO is required, some contaminated water is already in the water mains; connection would have to be opened before we know a BWO is needed.
- Opening line would likely result in BWO or a do not drink order due because there is no information on how water will mix / interact.



Current Connections with Pomfret's NCCWD

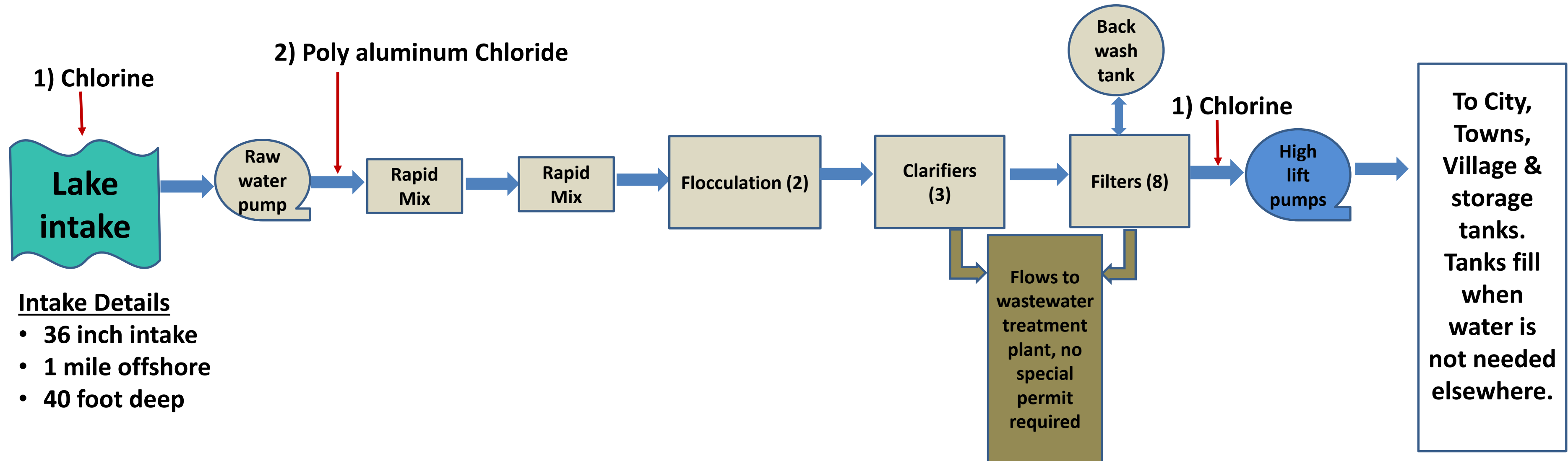
Water Lines Cannot Prevent BWO

**** Fredonia water pressure is so high that water from Pomfret lines cannot enter Fredonia's lines as long as the Fredonia WTP is producing water and filling Fredonia's lines. ****

- Shutoff valves at the Fredonia WTP are very old and have not been exercised regularly so it is not clear if / how well they will be re-opened once they are shut off.
- Opening line would likely result in BWO or a don not drink order because you are blending two different waters and there is no information on how they will interact.
- By the time a BWO is required, some contaminated water is already in the water mains; connection would have to be opened before we know a BWO is needed.



Dunkirk Water Treatment Plant



Key Treatment Differences

Fredonia – 5 chemicals in treatment

- Cannot use pretreatment oxidation to remove organics which cause disinfection by-products; would exceed disinfection by-products.
- Has up-flow clarifiers
- Filter media – anthracite and sand
 - Cannot remove disinfection by-product precursors.
- Routine samples collected for HAB toxin testing by NYS lab.
- Water is corrosive to pipes so a blended phosphate solution is added to help keep lead and copper levels within regulatory limits as water moves through distribution system.

Dunkirk – 2 chemicals

- Uses pretreatment oxidation to remove organics including disinfection by-product precursors.
- Has sedimentation basins
- Filter media – Granular Activated Carbon (GAC) and gravel absorbs / removes organics including:
 - Disinfection byproducts and precursors.
 - Polyfluorinated chemicals – PFOS, PFOA, PFNA.
 - Gasoline and oils.
- Water is not corrosive, so no additional treatment needed to preserve distribution lines.

2025 Treated Water Quality

Detected Contaminant		Fredonia	Dunkirk	Regulatory Limit (MCL, unless labeled)
MICROBIOLOGICAL CONTAMINANTS * exceedance in red	Turbidity: Highest finished water result at treatment plant	0.916 NTU	0.154 NTU	Value must be <1.0 NTU
	Turbidity: How often were samples below the maximum contaminant level	79.75% were <0.3 NTU (number represents worst month)	100% <0.3 NTU	≥95% of samples must be <0.3
	Distribution Turbidity (Max)	0.24 NTU	0.19 NTU	>5 NTU
INORGANIC CONTAMINANTS	Lead (<i>samples collected from lead pipe locations</i>)	6.1 ug/L Range = ND - 10.0	9.7 ug/L Range = ND - 14.5	Action Level = 15 ug/L
	Copper	0.254 mg/L Range = 0.016 - 0.523	0.0561 mg/L Range = 0.003 - 0.127	Action Level - 1.3 ug/L
	Barium	0.0459 mg/L	0.022 mg/L	2 mg/L
	Nickel	0.5 ug/L	0.6 ug/L	N/A
	Nitrate	0.203 mg/L	0.099 mg/L	10 mg/L
	Fluoride	Not Detected	0.11 mg/L	N/A
	Arsenic	1.6 ug/L	0.5 ug/L	10 ug/L
SECONDARY INORGANIC CONTAMINANTS	Manganese	0.023 mg/L	Analysis not required due to historically low values.	0.3 mg/L
	Iron	0.020 mg/L		0.3 mg/L
	Sodium	9.4 mg/L		Based on dietary restriction
	Chloride	16.3 mg/L		250 mg/L
	Sulfate	13.7 mg/L		250 mg/L
STAGE 2 DISINFECTION BYPRODUCTS: Fredonia must sample 4x / quarter due to continuously higher levels. Dunkirk samples 2x / quarter.	Haloacetic Acids	Average = 27.62 ug/L Range = 6.9 - 57.0	Average = 11.8 Range = 5.9 - 25.6	60 ug/L
	Total Trihalomethanes	Average = 44.28 ug/L Range = 11.2 - 79.7	Average = 31.85 Range = 17.4 - 60.7	80 ug/L

Emerging Contaminants

PFOS, PFOA, PFNA (poly and perfluorinated alkylated substances)

Initial testing performed once per quarter for 1 year.

- If detected, testing continues quarterly.
- If not detected, testing occurs once every 18 months.

Fredonia

- ❖ No existing treatment process to address future contaminants if necessary.
- ❖ Not able to add activated carbon. “Filter bed depth is insufficient to absorb organics with activated carbon” (*O’Brien & Gere 2013*).
- ❖ No available space at WTP to add treatment options.

Dunkirk

- ❖ Activated Carbon already exists in current process to address future contaminants.
- ❖ Has space at WTP to expand treatment options if needed.



Additional Water Quality Concerns

Microplastic Pollution

- No existing regulations to monitor public water supplies for microplastics.
- Sampling, testing and treatment must be standardized; difficult process because there are many different types and sizes.
- Microplastics are spread throughout the environment in water runoff to streams, rivers, lakes and oceans.
- Microplastics are spread throughout the environment in the air on wind currents.
- Found in water ways around the world, in protected wild areas, in sea ice, and at the Antarctic Tundra.
- Microplastics in our diet:
 - Bottled water
 - Beer
 - Sea salt
 - Fish and Wildlife



Additional Water Quality Concerns

Microplastics Not Under Unregulated Contaminant Monitoring Rule (UCMR)

- No approved sampling method.
- No approved testing method.
- Strategies to remove microplastics from water, or treat water containing microplastics, are still being developed and reviewed.
- Information on health effects is not known.
- Risk/benefit analysis must be completed to determine level of health risk and cost of treatment to address health risk.



Additional Water Quality Concerns

Blue-green Algae and Harmful Algal Blooms (HABs)

(Blue-green Algae is the common name for Cyanobacteria)

- Native organism, present for over 3 billion years.
- Growing concern in Chautauqua County and around the world.
- HABs are more likely in warm water that has a lot of nutrients.
- HABs may produce cyanotoxins which are harmful to human and animal health.



Chautauqua Lake



Findley Lake

Toxin Testing in Public Water Supplies

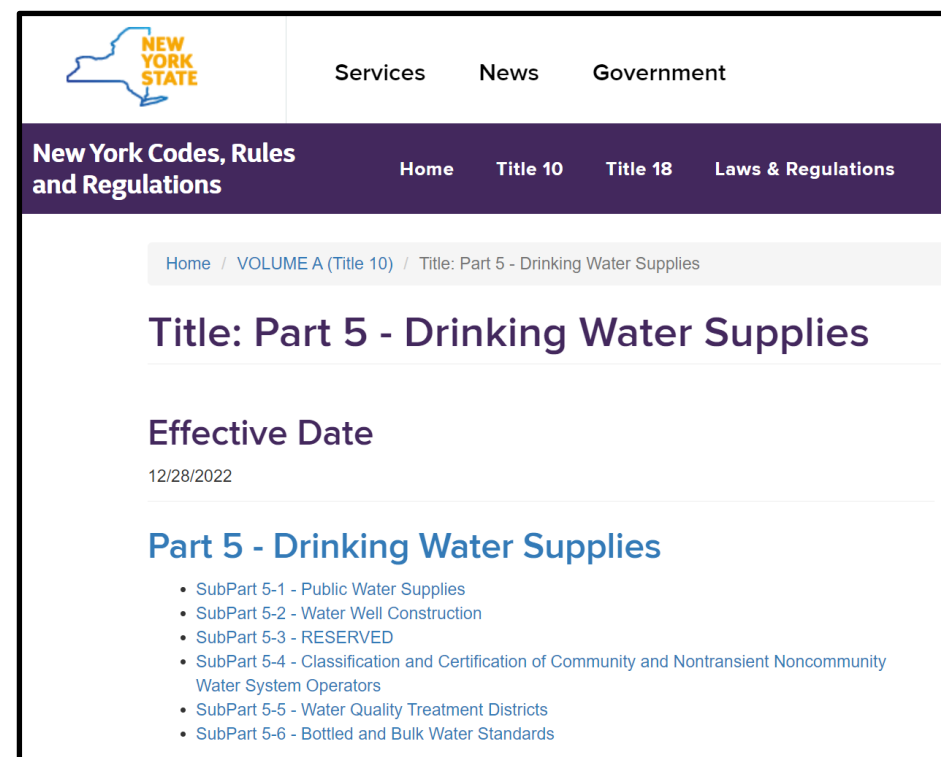
- **Fredonia staff complete visual inspections of the Reservoir to look for** evidence of blue-green algal growth.
- **Dunkirk does not require routine testing.** Lake Erie's Eastern basin has less potential for HABs compared to the Western basin near Cleveland / Toledo. Dunkirk's intake pipe is 40 feet deep.



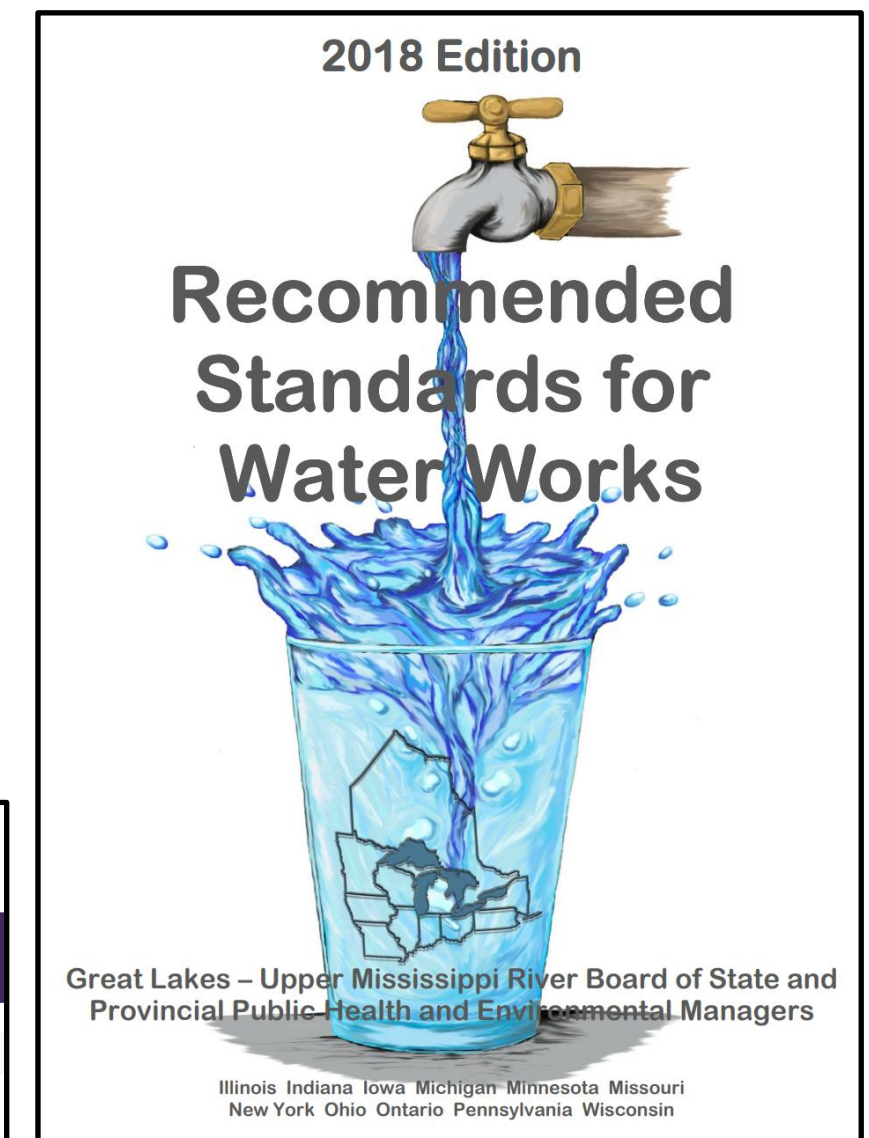
Role of Chautauqua County Health Department (CCHD)

Enforce NYSDOH and federal regulations that define source water requirements, water treatment plant structural requirements, and sampling requirements.

- Title 10. Department Of Health
Chapter I. State Sanitary Code Part
5. Drinking Water Supplies Subpart
5-1. Public Water Systems
- Recommended Standards for Water
Works “Ten State Standards”



<https://regs.health.ny.gov/volume-title-10/content/part-5-drinking-water-supplies>



https://www.health.ny.gov/environmental/water/drinking/regulations/docs/2018_recommended_standards.pdf



CCHD Enforcement & Support

Village is in Compliance with the Corrective Action Plan

- November 2025 CCHD issues consent order with clear goals and objectives.
- CCHD continues to assist Village to determine which deficiencies must be prioritized for safety or could be resolved quickly. Some deficiencies require larger investment (time and finances) and are not needed in the short term as long as Fredonia complies with the existing corrective action plan.
- CCHD works with the Village and LaBella to consider how new equipment purchases will factor into connection with NCCWD. The recently added chlorination system can be repurposed as a booster station when Fredonia connects to NCCWD.



Chautauqua County Health Department will continue to work with Village officials, water operators, and DPW staff in the interest of protecting public health in the community.

Thank you Fredonia water customers for taking time to learn about your water system and the work that goes into maintaining it.

Thank you Fredonia water operators and DPW staff for protecting public health in your community.

Thank you Town of Pomfret for providing space and access for this event.

