

Waukesha Softener Salt Optimization Program

2024 Salt Symposium

August 6, 2024



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Water Plant

Agenda

- Project Driver
- Effluent Chloride Concentrations Pre and Post Transition to Lake Michigan
- Chloride Load Estimates by Source
- Achievable Chloride Reductions from Softener Optimizations
- Optimization v. Softener Elimination
- Optimization Program
- Communications with Water Softener Owners
- Challenges, Successes, and the Path Forward of the Program

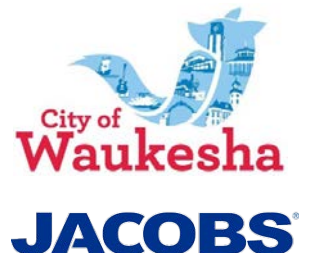
Project Driver

- The City of Waukesha transitioned from groundwater to Lake Michigan water to address a radium issue in the water supply.
- In order to withdraw Lake Michigan water, treated effluent must be returned to the Lake Michigan watershed to achieve a water balance.
- The permit chloride limit will be 400 mg/L three years from the switch to lake water.



WPDES PERMIT

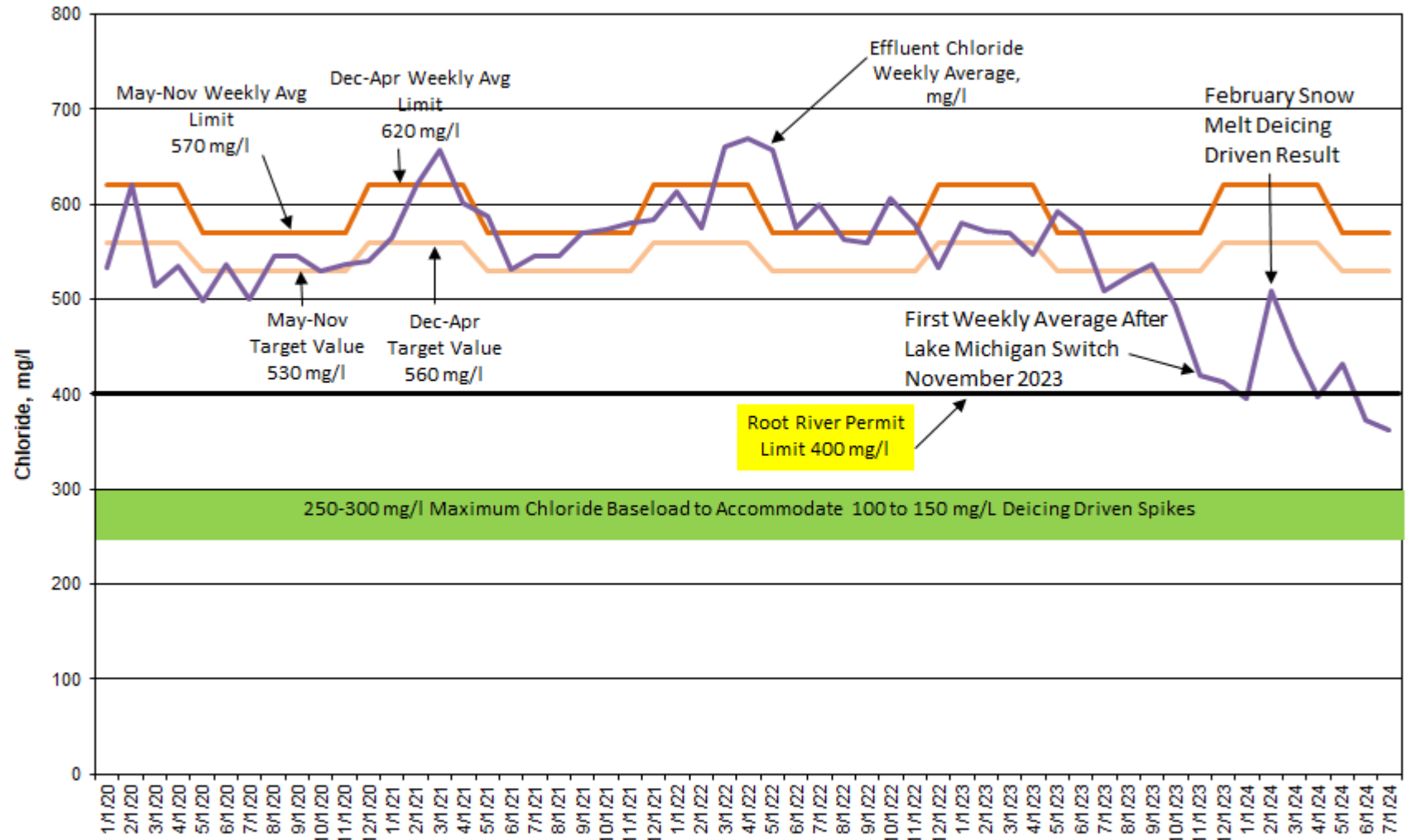
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES
PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE
ELIMINATION SYSTEM



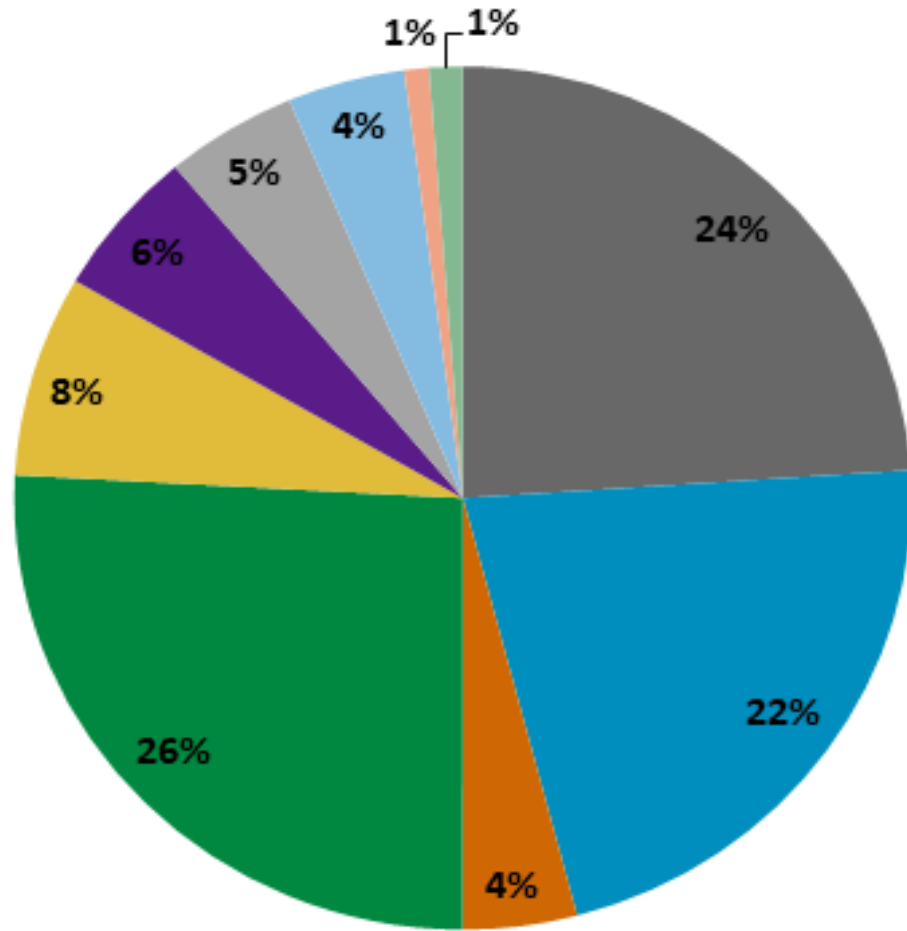
Weekly Average Effluent Chloride Concentration

Figure 1. Effluent Chloride, 2020-2024 Permit Term

- Prior to Lake Michigan source water, chloride concentration was typically in the 500-600 mg/L, with spikes above 600 mg/L
- Since transition to Lake Michigan, chlorides have been about 360-430 mg/L, with one spike above 500 mg/L



Annualized Chloride Load Sources Ranked by Estimated Contribution to Clean Water Plant Discharge Prior to Lake Water Transition



- Residential Softening
- Commercial & Public Softening
- Industrial Softening
- Infiltration/Inflow (Estimated Annual Average Base load)
- Winter Road Salt via I&I (Annualized Winter - Summer)
- 2022 CWP Vicinity Construction Related Dewatering
- Residential Non-softened Background
- Ferric Chloride at CWP
- Industrial Process
- Hauled Waste

Combined, water softeners were estimated to contribute 50% of the total chlorides.

Significantly higher than originally estimated, suspect cumulative effects of deicing salts elevating “background” concentration of chlorides.

Multi year average is 17.7% higher chlorides in winter thru spring v. summer thru fall. Annualizing as presented here cuts this roughly in half.

Achievable Chloride Reductions from Softener Optimizations

On Groundwater Prior to Switch to Lake Michigan

- In 2017 estimated that softener salt could be reduced by 43% to 58% by optimization while on groundwater.
- Approximately 2,000 of the estimated 16,000 total softeners were optimized prior to switching from groundwater to Lake Michigan source water.
- The average salt/chloride reduction was a little over 50%.
- With softeners contributing 50% of total chlorides, a 50% reduction represented a 25% potential chloride reduction had all softeners been optimized

After Switch to Lake Michigan October 2023

- Adjusting for the lower source water hardness in addition to the other optimization parameters is estimated to provide an average salt/chloride reduction of 80%
- With softeners contributing 50% of total chlorides, this equates to a 40% potential chloride reduction

Optimization v. Softener Elimination

- Considered both
- Reasons optimization was favored:
 - Chloride reduction program was initiated 6 years before the switch to Lake Michigan water. No chloride reduction progress would have been possible from softeners prior to the switch if elimination was selected.
 - Although most customers on Great Lakes water do not soften, and the hardness is below what most customers object to, Lake Michigan water falls in the textbook category of moderately hard and is well above the less than 1 grain/gallon customers with softeners were accustomed to.
 - Optimization gives individuals the freedom to decide whether they want to continue to soften.
 - Optimization does not unnecessarily hurt local water conditioning businesses.

Optimization Approach

- Partnered with Water Quality Association (national organization) and primary water conditioning companies in Waukesha
- Held several meetings discussing project requirements and approach
- While WQA was an eager partner, we pushed them outside their comfort zone and their past programs to maximize salt use reduction
- Despite early pushback, the WQA consulted with softener manufacturers and ultimately endorsed the optimization parameters
- City appropriated \$30 per optimization to share the cost of optimizations with the water conditioning companies

Primary Optimization Parameters

- Salt Dose During Regeneration
 - This accounted for the majority of the greater than 50% average salt reduction prior to the switch to Lake Michigan water
 - Targeted a minimum of 4,000 grains hardness reduction per lb. of salt referred to as “softener salt efficiency”
- Proper Source Water Hardness Setting
 - Test kits determined to be very unreliable
 - Historical practice was to add unnecessary conservativeness to test kit result
 - We provided hardness for each address based on water distribution model
- Reserve Capacity: Eliminate traditional conservativeness
- Turn Off Timer Overrides

Optimization Record Keeping – Developed an App

- Initially developed a 2-page paper form.
- Took that information and created a GPS-based App for use on smart phones, tablets, or laptops.
- Later converted from the GPS-based App to OmniForm.
 - Retained the two GPS functions to identify the optimizer's location and to access the appropriate hardness setting for that location.

Screen Shots of The App - User Entries and Multiple-Choice Drop-Down Menus

← Save and Exit Waukesha Softener Optimization Post-diversion

Waukesha Softener Optimization (Post-diversion)

Form Details:

Waukesha Softener Optimization Post-Diversion: Use this form to perform a full optimization.

Optimization date*

Jul 11, 2024

Location / GPS*

Capture GPS

House number*

Street direction

Street name*

Street type*

Apartment number

Optimization conducted by (company)*

Technician/cert number*

Optimization type*

- JacobsOmni

Waukesha Softener Optimization Post-diversion

How many cubic feet of resin? (ft3)*

Initial hardness setting (gpg)*

Initial salt dosage (lbs)*

Initial capacity (grains)*

Value before any adjustments

Initial salt efficiency (grains/lb salt) - Suggested Answer:

NaN

Enter initial salt efficiency (grains/lb salt)*

Initial capacity (gallons) - Suggested Answer:

NaN

Enter initial capacity (gallons)*

Calculate: (initial capacity in grains)/(initial hardness setting in grains per gallon)

Initial reserve capacity (gallons)*

Optimized hardness setting (gpg)*

8 gpg for Waukesha water customers on Lake Michigan water supply

Optimized salt dosage (lbs)*

Use lowest recommended by manufacturer based on valve, salt curve, injector size, etc. Max 1

Optimized capacity without age factor (grains)*

Per manufacturer based on resin volume and type, salt dose, valve, injector, etc.

Advantages of App Include

- Eliminates paper file keeping of thousands of softener optimizations
- Programmed quality control scripts to alert optimizer of issues to address and to help determine whether optimization is approved for payment of the appropriation
- Saving uploads it to a database so information is available to review or query

Evolution of the App

- Number of Data Inputs
 - We initially erred on collecting information we thought may be useful at some point in the program.
 - We received a lot of pushback on how long it took for data entry.
 - We have eliminated all but the most pertinent information.
 - Required information can be entered in approximately 5-7 minutes.
 - Even now we receive some pushback, but we can explain exactly why we need the remaining entries.
 - **In hindsight, minimizing the number of entries to its current bare bones form likely would have resulted in more optimizations.**

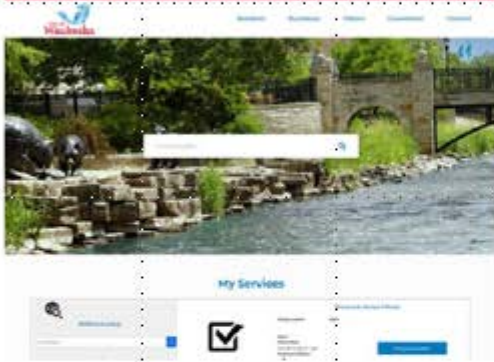
Evolution of the App (continued)

- Automating Calculations
 - We incorrectly assumed optimizers could easily perform calculations such as initial and optimized salt efficiency and softener capacity in grains and gallons.
 - We felt having optimizers do the calculations ensured they were understanding and properly conducting the optimization.
 - Only two water conditioning companies seemed to recognize how to do these calculations without errors and thereby perform large numbers of optimizations.
 - We provided training to companies that submitted optimizations with QC issues. Despite this, most of these companies did not attempt further optimizations.
 - Recently we modified the form to provide “suggested answers” for calculations.
 - **In hindsight, automating the calculations from the start likely would have resulted in more optimizations.**

Communications with Water Softener Owners

Website

waukesha-wi.gov



Social Media

Active as the City on five platforms



E-newsletter

E-mailed weekly on Wednesday



Water Bill Insert

Included in monthly water bill



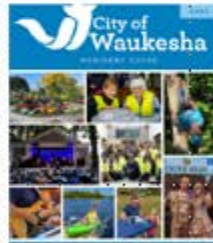
Public Events

Parade Memorial Ceremonies, Walk of Lights, etc.



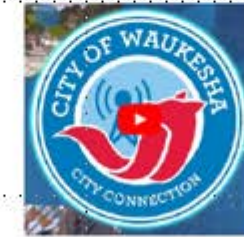
Publications

State of the City, New Resident Guide



City Connection Channel

24/7 City content and public meetings



Communications – Printed Newsletters

DEPARTMENT OF PUBLIC WORKS



Water Softeners –What to Do?

The City of Waukesha is continuing its campaign to reduce chloride discharge as required by the Wisconsin Department of Natural Resources. We appreciate the many residents who have taken steps to reduce their salt use.

We're making progress, but we still need your help to achieve chloride compliance.

Keeping your softener?

Adjusting the hardness to 8 grains per gallon yourself or by your salt delivery driver is a great first step, but your salt use can be further reduced up to 20% by having it fully optimized. Simply adjusting the hardness is not sufficient to meet the city's ordinance. All softeners must be optimized by January 1st, 2025.

We understand that many residents are trying to schedule their optimization. Keep calling your softener company or plumber that is participating in the optimization program to schedule a full optimization.

Softener Removal

If you've bypassed your softener and are happy with your water, we encourage you to remove the softener. Keeping your unused softener can cause water quality issues such as bacteria growth or red water in your plumbing.

Water softeners can be scheduled for pickup at your house by calling Waste Management at 262-369-3080 or the City at 262-524-3600. Water softeners are picked up as large appliances, typically on Tuesdays.

Water softeners may also be brought to the city Drop-Off Center and disposed as a trash item. Normal fees apply.

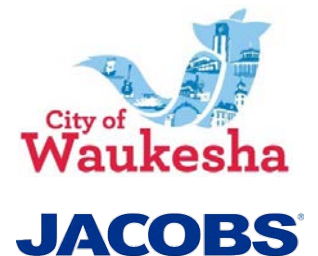
For more information, call 262-524-3628 or visit www.waukesha-wi.gov/watersoftener



Stickers on water softeners certifying optimization.



waukesha-wi.gov/watersoftener



Communications – Social Media & E-Newsletters



Ready, Set, Get OPTIMIZED!

If you are still using your water softener, it must be optimized by January 1, 2025. You can [view a list of approved optimizers here](#).

Call the optimizer that matches your softener brand today to schedule your FULL optimization service call. A full optimization includes adjusting the hardness, salt dosage, and reserve capacity settings.

Softener Optimization
Information

Communications – Online Survey



Softener Survey

If you have not already done so, please complete the softener survey. We have received over 800 surveys so far!

Completing this survey will help the city evaluate progress toward meeting our chloride discharge permit limit.

To access the survey, use this QR code or visit:

waukesha-wi.gov/softenersurvey



Challenges of the Program

- Water conditioning companies optimized only approximately 2,000 of the 16,000 estimated softeners from 2018 through the transition to Lake Michigan water in late 2023, which is only about 12.5% of the softeners.
- 12.5% of a 25% potential total chloride reduction from optimizing all softeners represents only a 3.1% actual chloride reduction.
- Sufficient personnel and competition with normal profitable business tasks were significant barriers mentioned by the water conditioning companies.
- Simplifying the App and automating calculations likely would have increased the number of optimizations, but we don't know how much.

Successes of the Program and the Path Forward

- Public Education resulted in a large percentage of customers either discontinuing use of their softeners or adjusting down their hardness setting after the transition to Lake Michigan. This resulted in an almost immediate 100 mg/L drop in chloride concentration.
- Ongoing optimizations, hardness adjustments by both the water conditioning companies and softener owners, and additional discontinued use of softeners appear to be further reducing chloride concentrations.
- We have three years from the transition to Lake Michigan water until the 400 mg/L limit is in effect. With deicing season chloride spikes of 100 to 150 mg/L, we hope to reduce non-deicing season chlorides to 250 to 300 mg/L to accommodate the deicing-driven spikes.

Questions?



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