

Gaining Traction on Road Salt Reduction



Jamie Carr, Environmental Analyst, MA DCR Division of Water Supply Protection, Wachusett Section

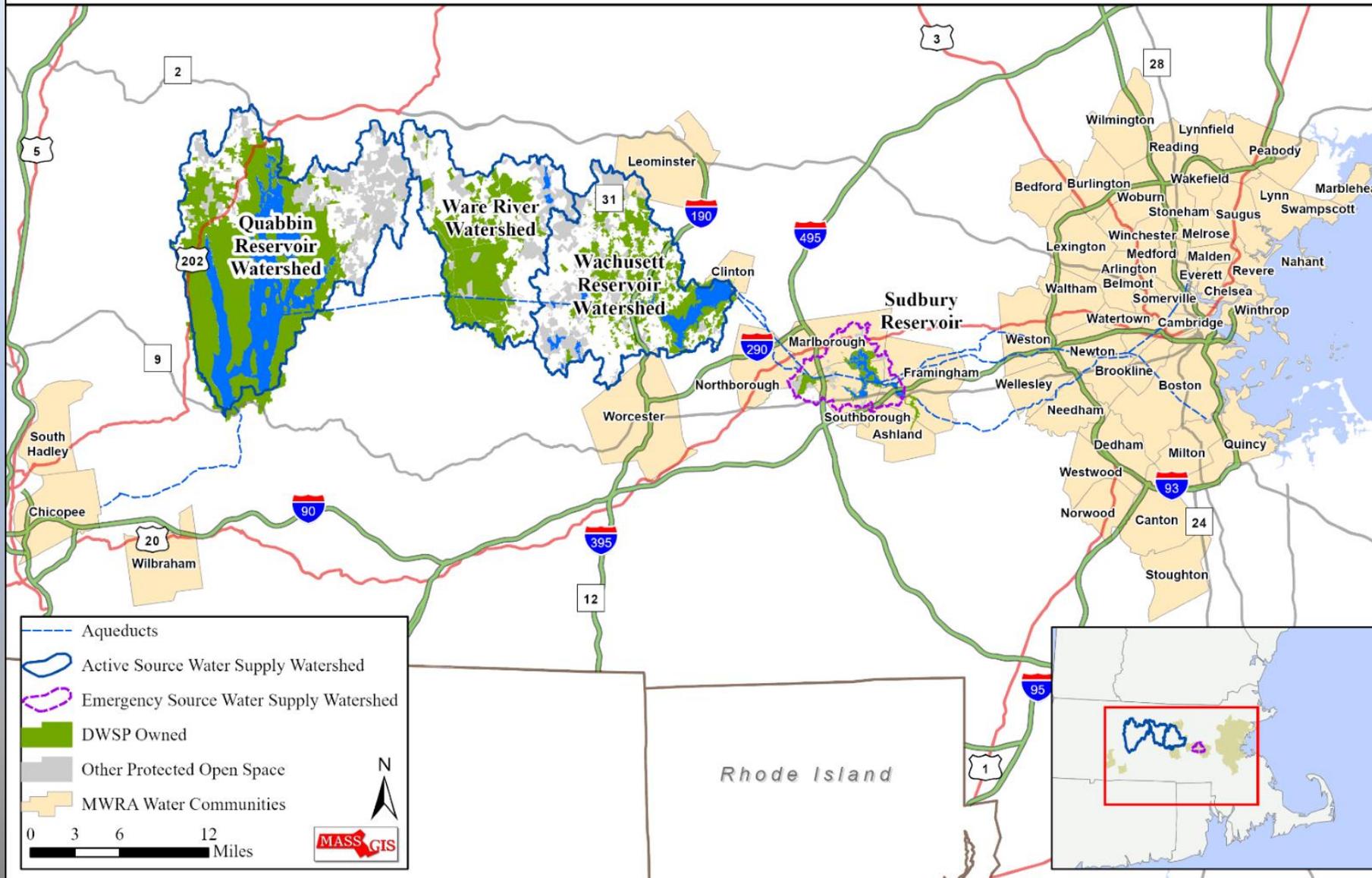
PRESENTATION OUTLINE

- **System Overview**
- **Watershed water quality trends**
- **Gaining Traction on Road Salt Reduction:
how do we protect water quality?**



General Plan of the DCR/MWRA Watershed System

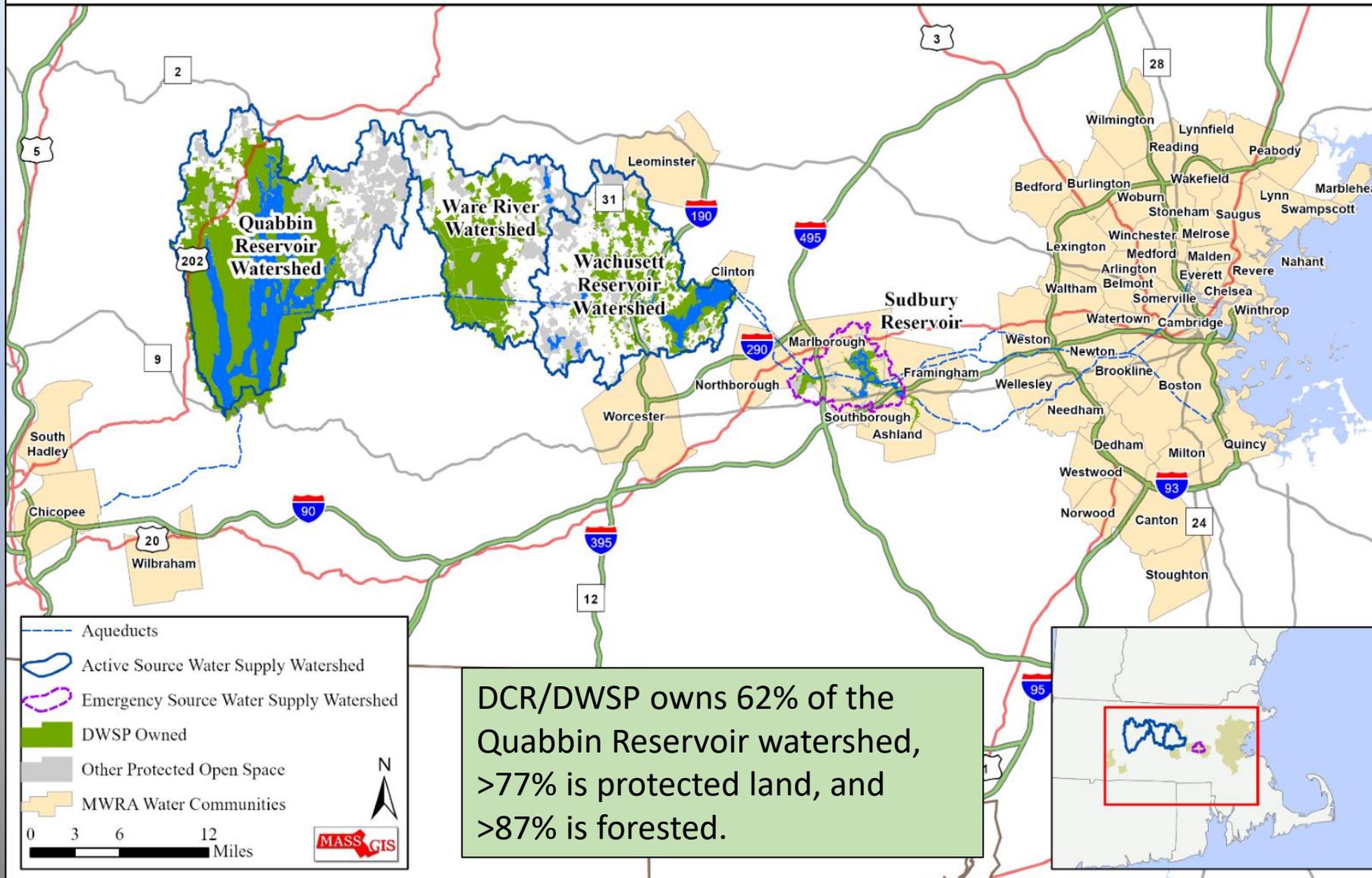
Division of Water Supply Protection - Office of Watershed Management





General Plan of the DCR/MWRA Watershed System

Division of Water Supply Protection - Office of Watershed Management



Legend:

- Aqueducts
- Active Source Water Supply Watershed
- Emergency Source Water Supply Watershed
- DWSP Owned
- Other Protected Open Space
- MWRA Water Communities

0 3 6 12 Miles

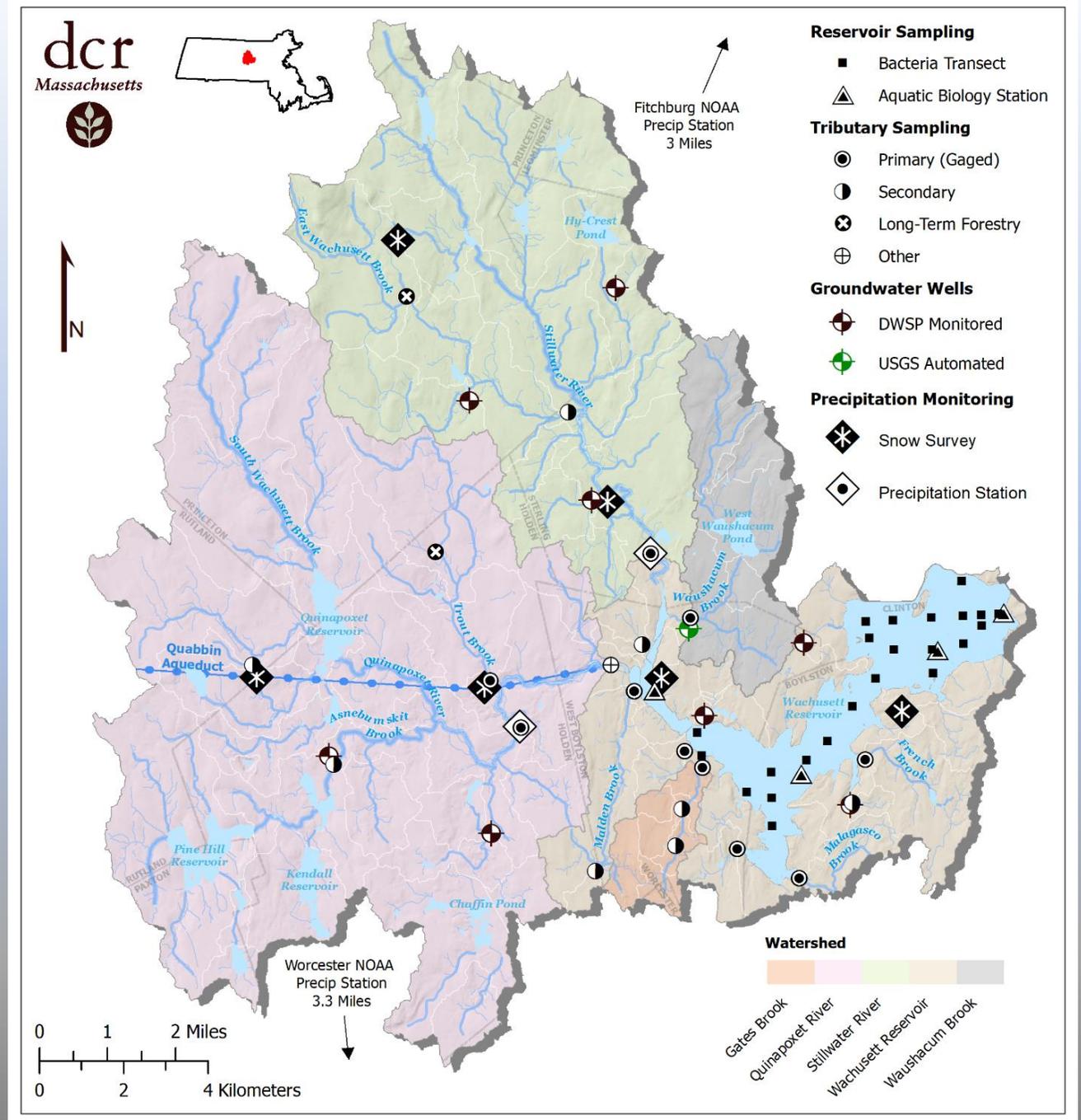
MASS GIS

DCR/DWSP owns 62% of the Quabbin Reservoir watershed, >77% is protected land, and >87% is forested.

Map of the Wachusett Reservoir watershed with sampling stations



Environmental Analyst David Getman recording a specific conductivity measurement in a watershed tributary

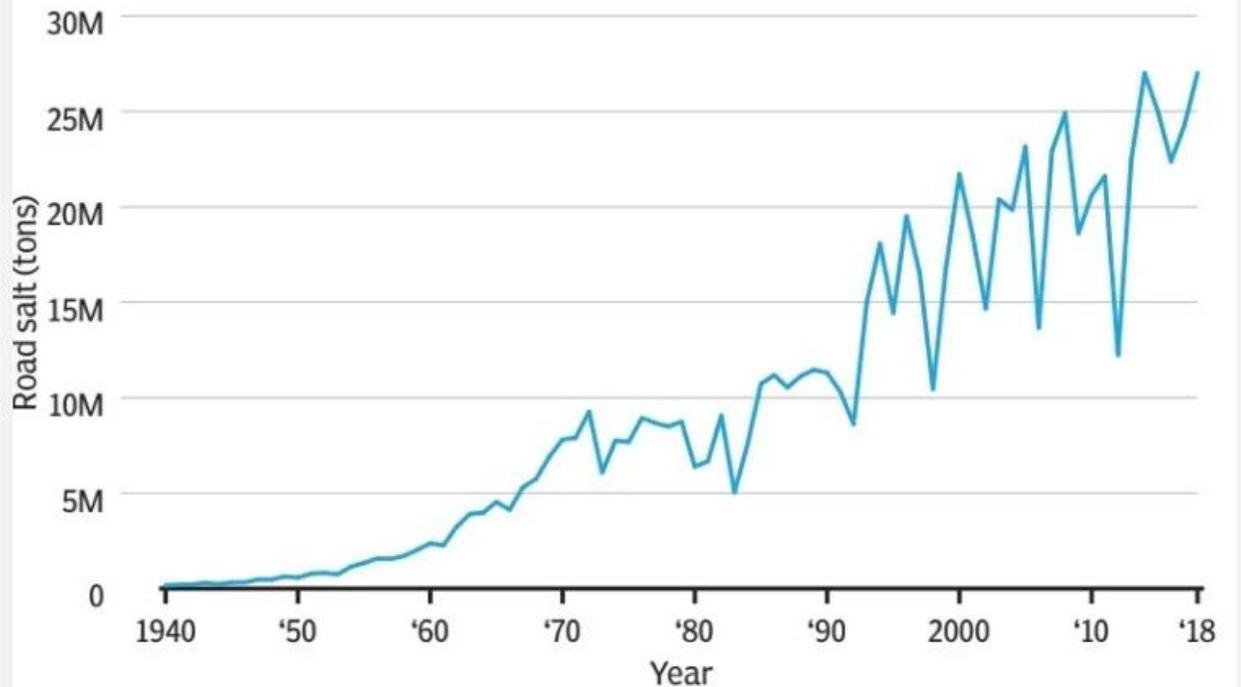


Increases in Road Salt Application Over Time

What are the impacts?

America's road salt history

The U.S. Geological Survey tracks the amount of salt used in the U.S. each year, including for de-icing. Figures show a sharp upward trend since salt was first used on wintry roads in the 1940s.*

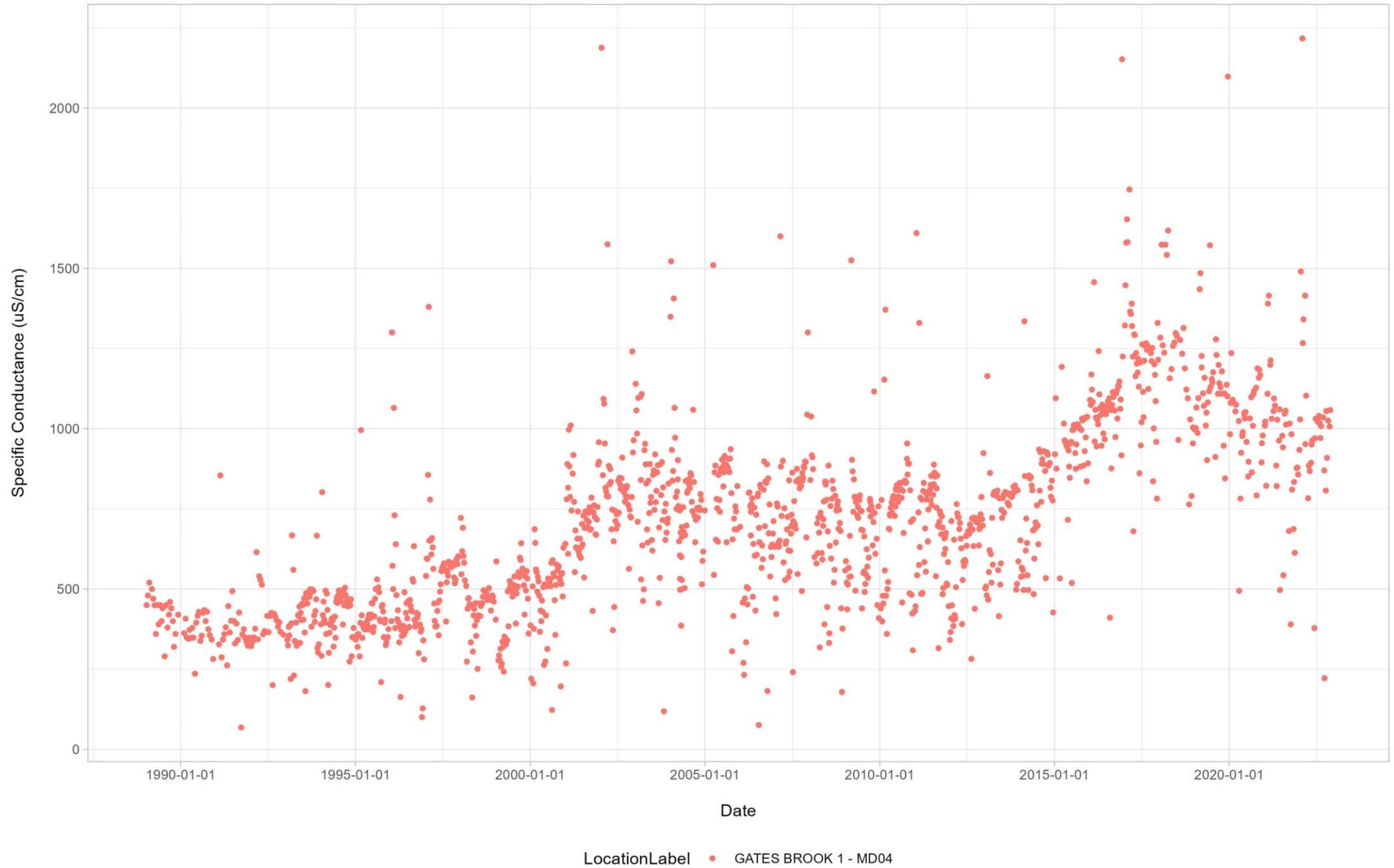


*1940-1953: "Highways, railroads, and other dust and ice control", 1954-1971: "States, counties, and other political subdivisions", 1972-1984: "Highway use", 1985-2016: "Ice control and/or stabilization", 2017-18: Estimates

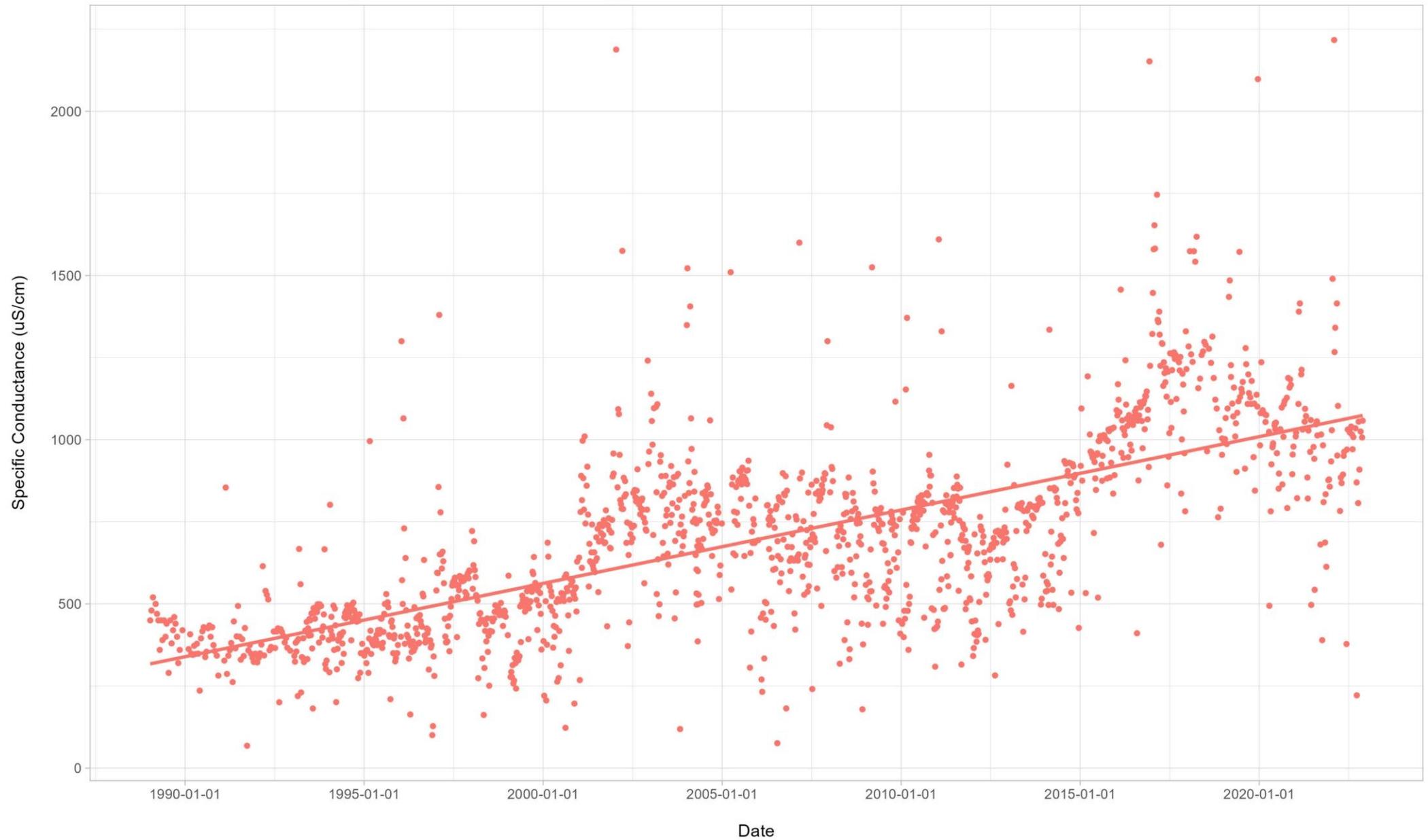
Source: U.S. Geological Survey

CARLIE PROCELL/USA TODAY NETWORK

Specific Conductance at Site(s) GATES BROOK 1 - MD04 from 1989-01-10 to 2022-11-21

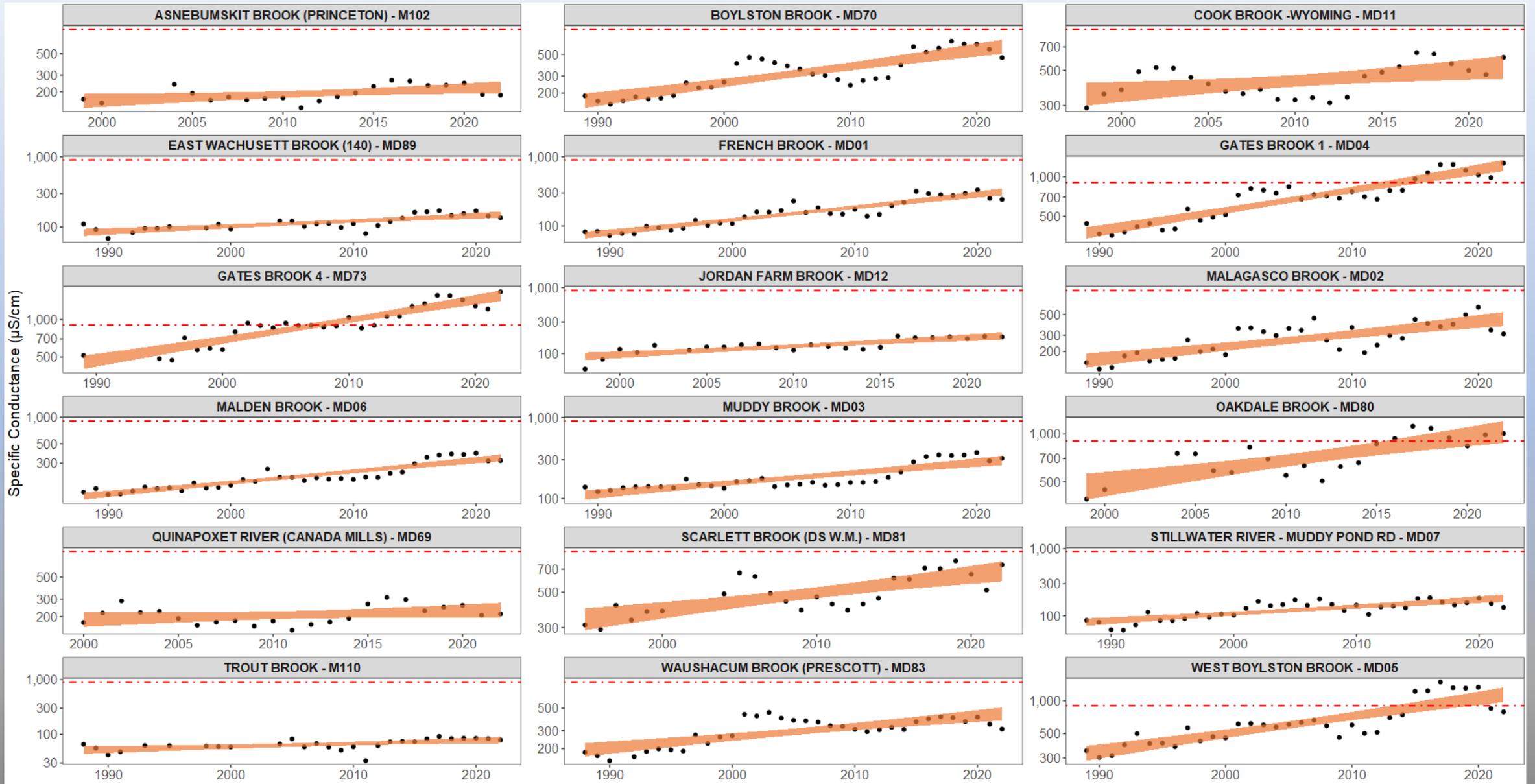


Specific Conductance at Site(s) GATES BROOK 1 - MD04 from 1989-01-10 to 2022-11-21



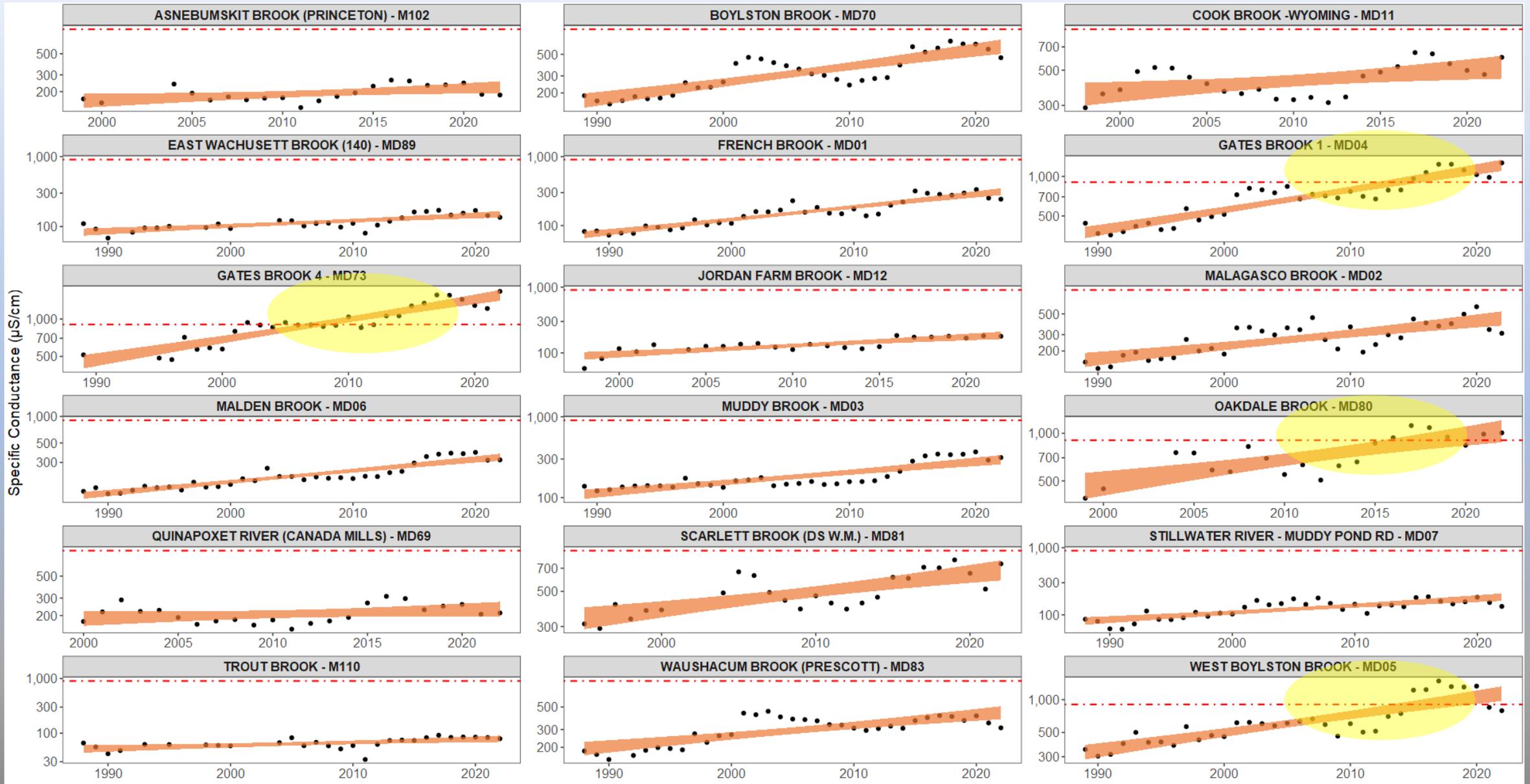
LocationLabel — GATES BROOK 1 - MD04

Annual Median Specific Conductance



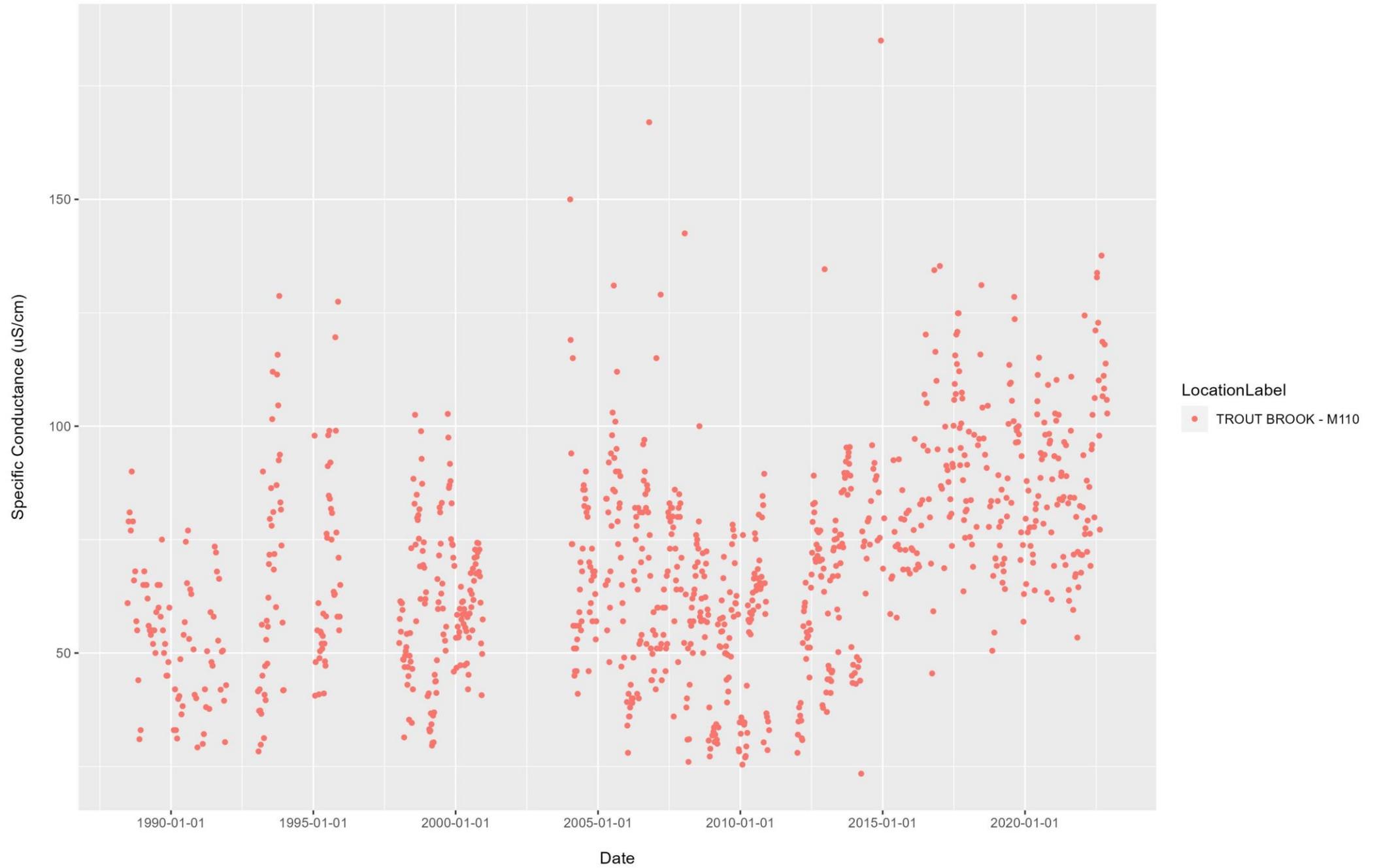
The red dashed line is the MassDEP proxy chronic Cl toxicity threshold of 904 μS/cm.

Annual Median Specific Conductance

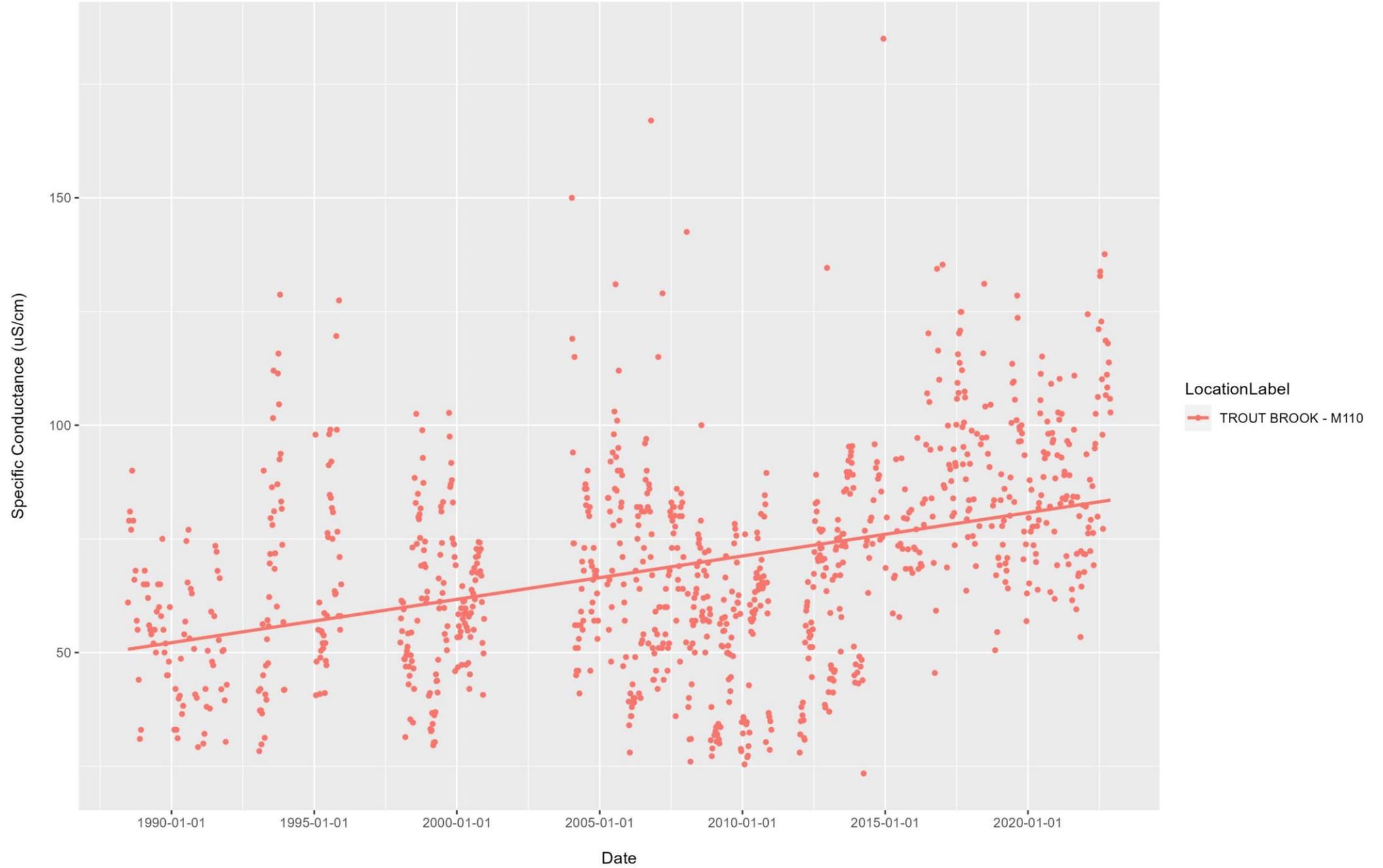


The red dashed line is the MassDEP proxy chronic Cl toxicity threshold of 904 $\mu\text{S}/\text{cm}$.

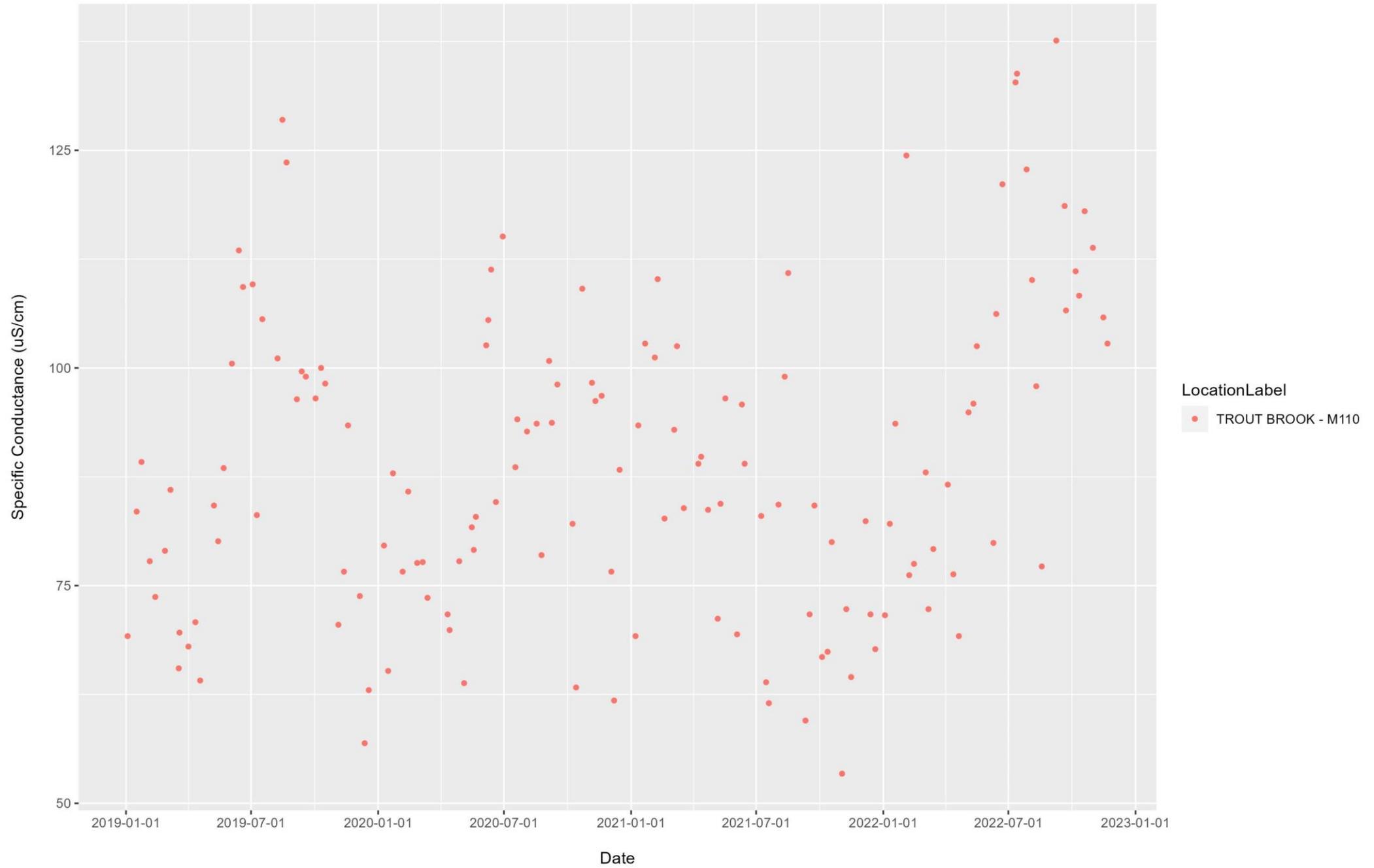
Specific Conductance at Site(s) TROUT BROOK - M110 from 1988-06-23 to 2022-11-21



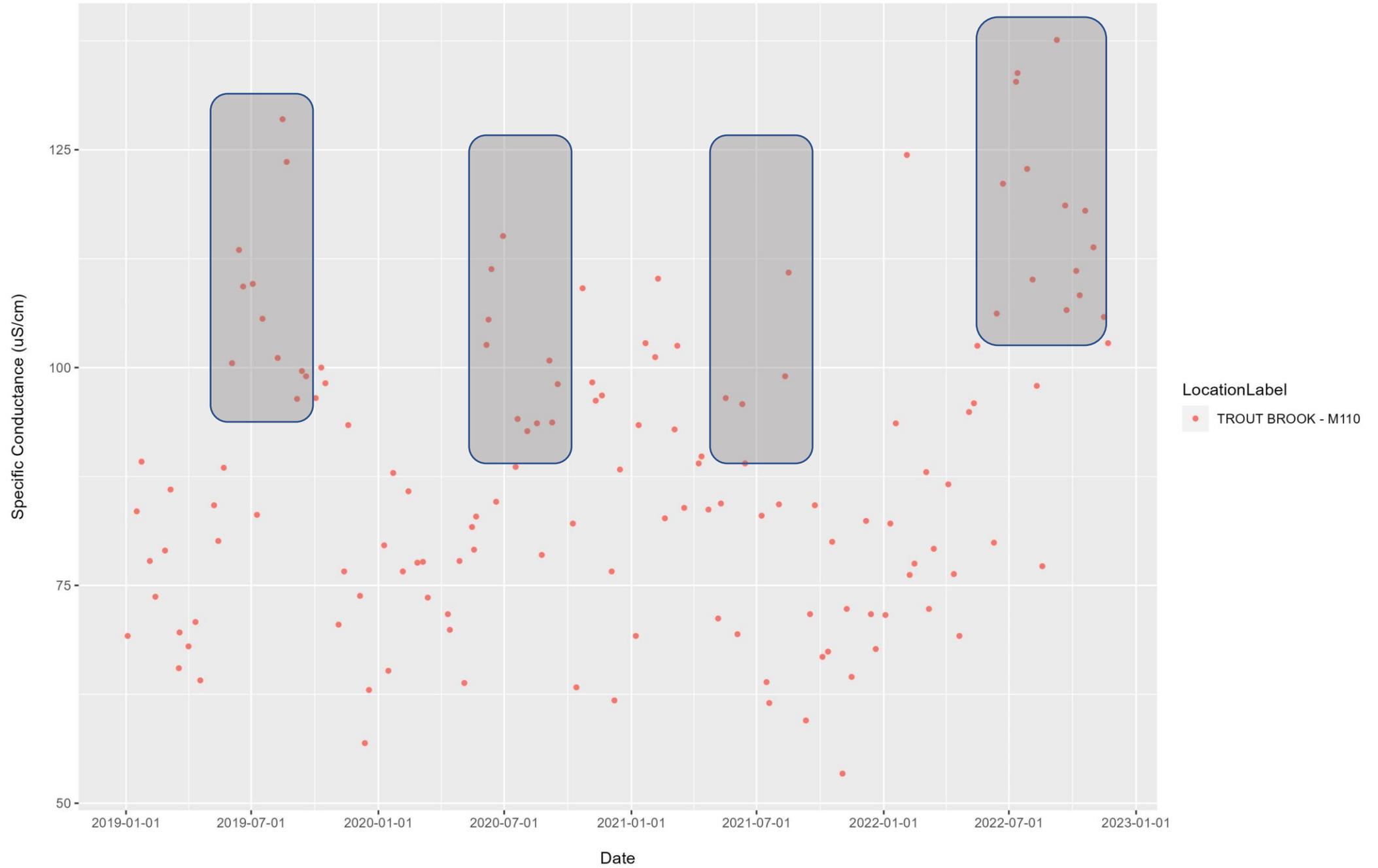
Specific Conductance at Site(s) TROUT BROOK - M110 from 1988-06-23 to 2022-11-21



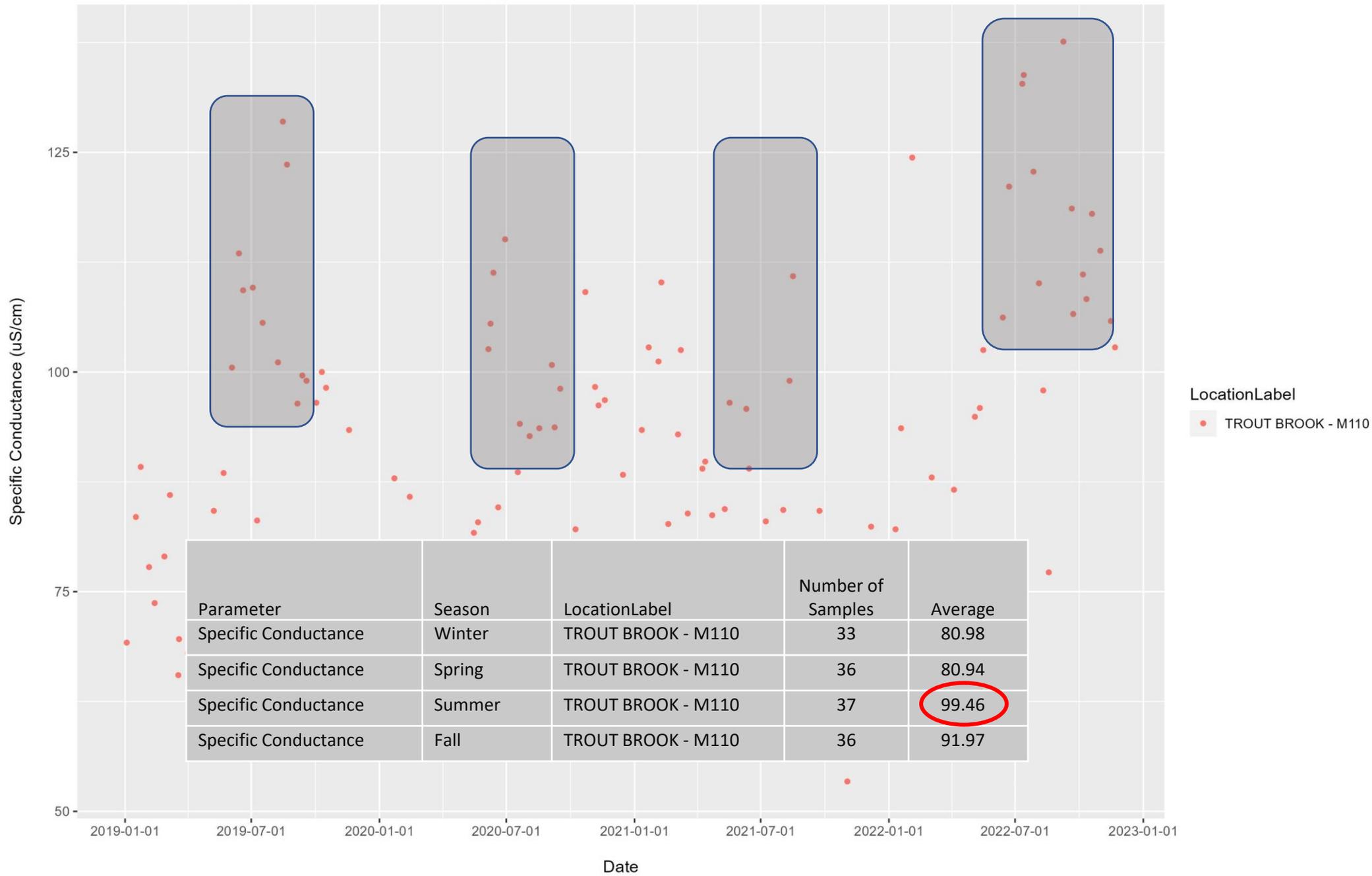
Specific Conductance at Site(s) TROUT BROOK - M110 from 2019-01-03 to 2022-11-21



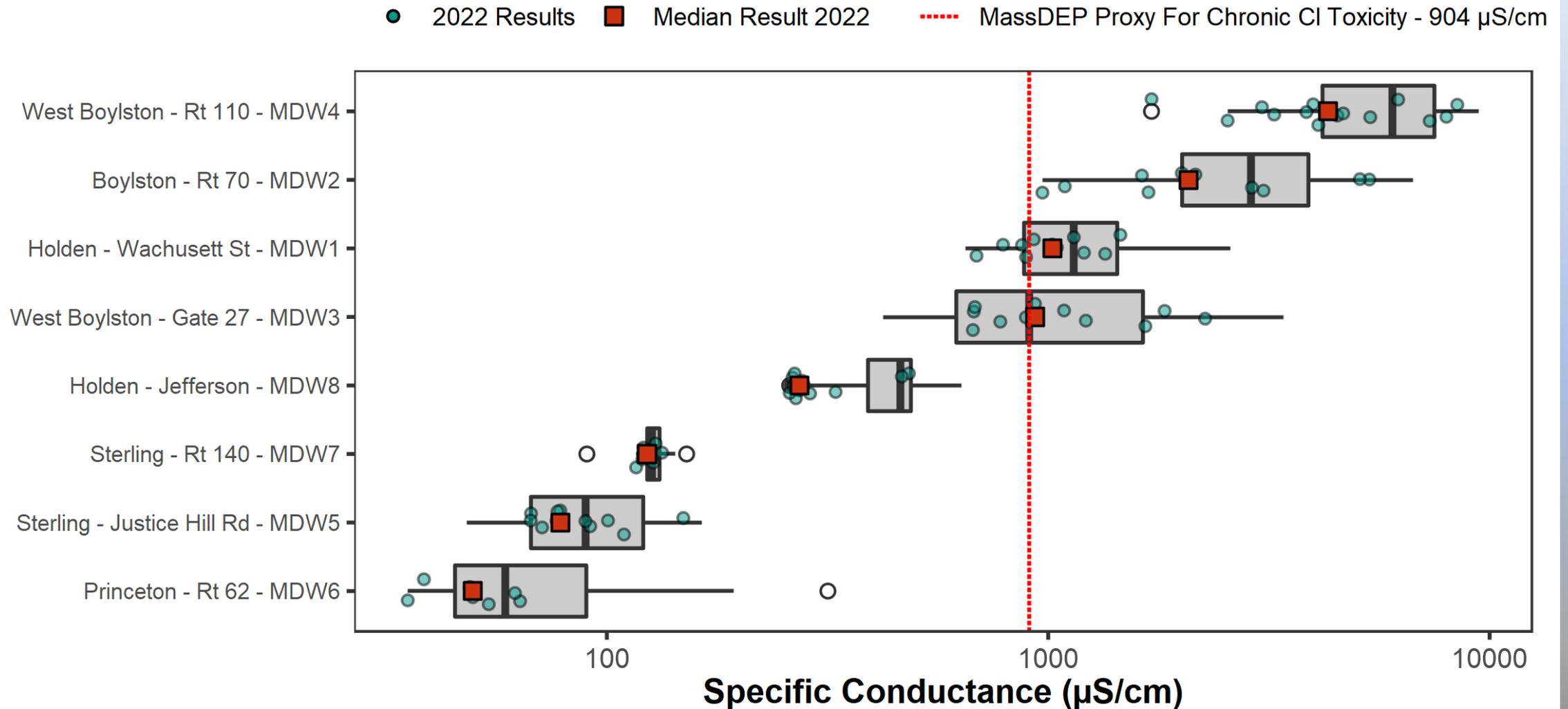
Specific Conductance at Site(s) TROUT BROOK - M110 from 2019-01-03 to 2022-11-21



Specific Conductance at Site(s) TROUT BROOK - M110 from 2019-01-03 to 2022-11-21



Chloride contamination apparent in groundwater



Boxplot statistics from years 2019 - 2022
Hollow points are outliers from the entire period of record

EXPANDING DCR EFFORTS TO REDUCE ROAD SALT:

How do we protect
drinking water quality?

- **Improve data collection**
- **Model impact of reducing inputs**
- **Training and Public Outreach**
- **Provide a salt reduction grant program to assist Wachusett watershed communities**
- **Upgrade our own practices**

Improve Data Collection

- Gather information on annual salt use by DCR, towns, and MassDOT
- In some cases, follow the \$: most towns and organizations can find out readily how much was spent to purchase salt
- Best estimate is that 18,000 tons of salt is applied in the watershed on an annual basis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
SALT APPLICATIONS																	acres		
lane miles	in watershed			9.9	23.9	0.0	0.0	2.9	28.0	28.9		2.7		96.3		290			
M (from DOT)	in watershed			24.3	159.0	9.7	96.4	46.7	86.7	85.9		10.0				775		518.7	
M (from DOT)	in watershed			11.0	42.0	3.6	17.9	13.4	20.0	17.3		6.4				160		131.6	
LANE MILES	in watershed			45.2	224.9	13.3	116.2	63.0	134.7	132.1		19.1		96.3				748.5	
(town)	total			130		50	136		112										
																364		acres of parking lots	
(inches)	# of			38.14%	81.67%	19.49%	81.96%	23.68%	56.97%	84.57%	84.57%	WOCR	100.00%	100.00%	100.00%	100.00%			
total	winter	DOT		total	total	total	total	total	total	plain salt	MgCl2	LEOM	plain salt	MgCl2 (gallons)	(watershed)	DOT	(tons)		
snowfall	storms	index		BOYLSTON	HOLDEN	PAXTON	PRINCETON	RUTLAND	STERLING	W BOYLSTON	W BOYLSTON	CLINT	DWSP	MA DOT	MA DOT	parking lots	events	TOTAL*	
60	37	19			2376									4093		1,638	49	7672	
133	36	25			2700									4093		3,640	56	9938	
66	30	18			2502									4093		1,638	41	7774	
55	30	13			2424	1500								4093		1,820	34	8185	
93	43	24			2672	1925	2200							4093		3,276	50	11730	
97	38	17			2606	1600	2200							4093		3,094	52	11430	
56.5	33	17			2621	1000	2200							4093		2,366	40	10598	
72	35	27			2350	1050	2200							4093		2,366	42	10386	
5	26	7			2399	1100	2200							4093		1,274	20	9344	
5	40	26			3550	1800	2200							4093		2,548	29	11694	
	50	30			2705	3703	1650	2200		1900				4093		2,912	41	14268	
					2705		1500	2200		1900				3387			43	7597	
		6			2705		1400	2200		1900				1907			17	6097	
					2705	3,712	1820	2200		1800	3666	1536		4129				15775	
					2705	3,685	1575	2409		1400	2300	1300		3435				13600	
					2100	3,953	2170	1985	4000	1900			35	2372				10516	
					2100	2,949	1675	2650		1100				1686	9215		35	8021	
					2100	3,768	1800	2300	3631.34	5112.06	2979.65			1808.26	11445.81		23	14215	
					2100	4,408	1785.18	2800	3291.07	3376	3200			1456.39	8947.93		25	13909	
50				2,705	4,408	2,170	2,600	4,000	5,112	3,666	1,536		35	4,129	11,446	4,368	63	33,193	
26				2,100	2,040	1,000	1,800	3,291	1,100	2,300	1,300		35	1,456	8,948	1,274	17	16,396	
37				2,436	3,007	1,584	2,276	3,641	2,265	3,036	1,418	700	35	3,522	9,870	2,522	39	24,326	
				929	2,456	309	1,866	862	1,291	2,568	1,199	700	35	3,522		2,522		18,258	

WHAT DOES 18,000 TONS LOOK LIKE?

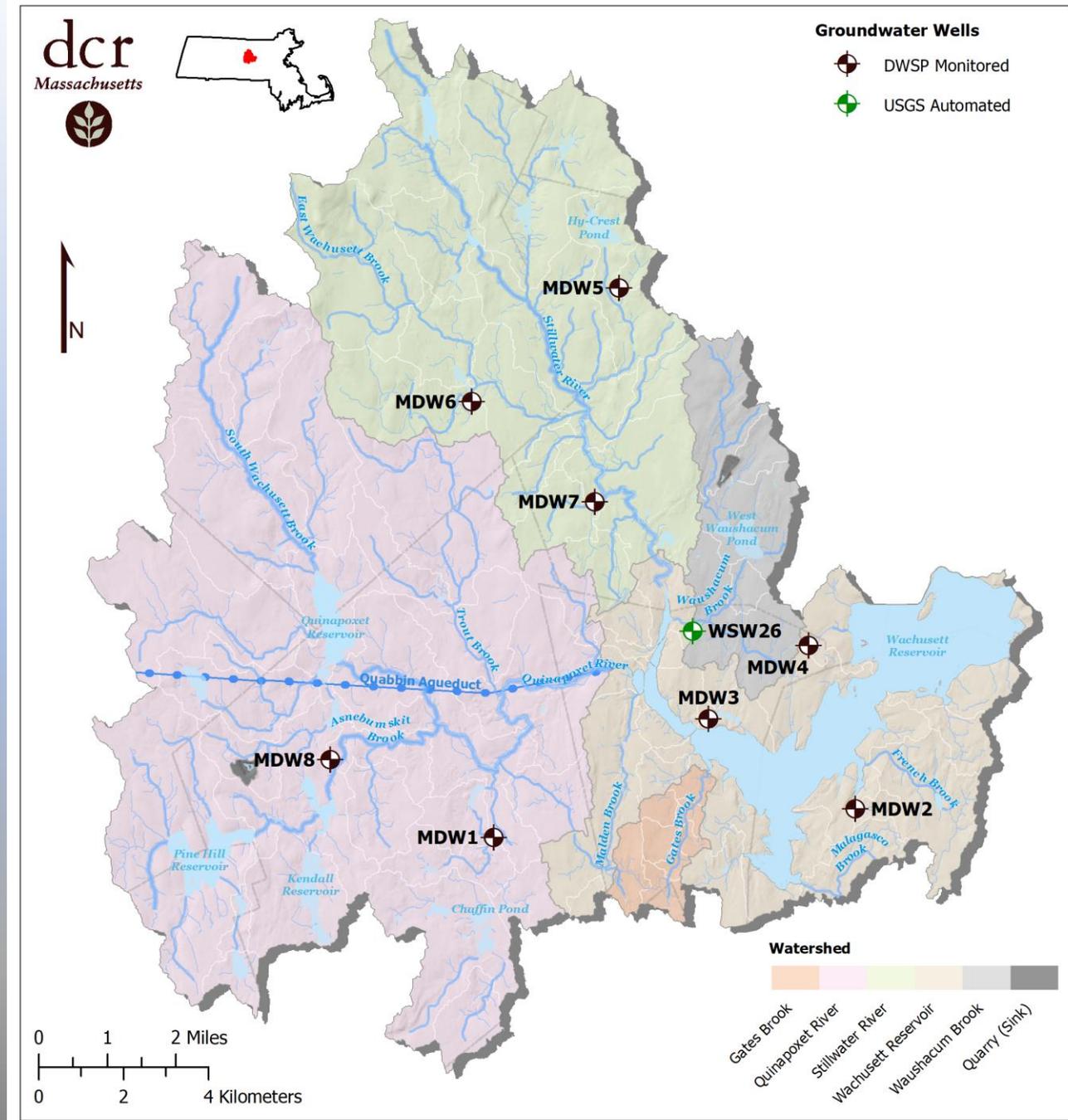


3,000 African elephants (average weight 6 tons)

Improve Data Collection

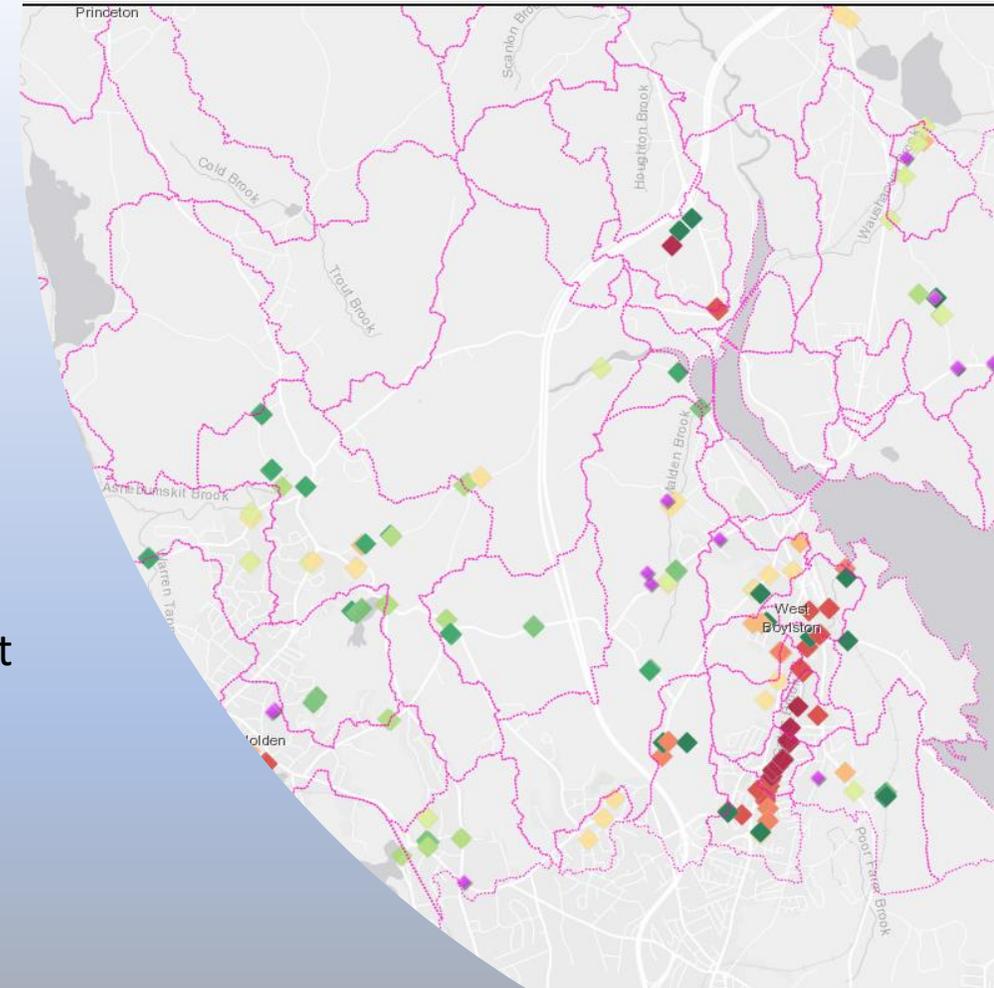
WATWEL Groundwater Monitoring Project (2019-present):

- Monthly chloride sampling at 7 former USGS monitoring wells on DWSP property



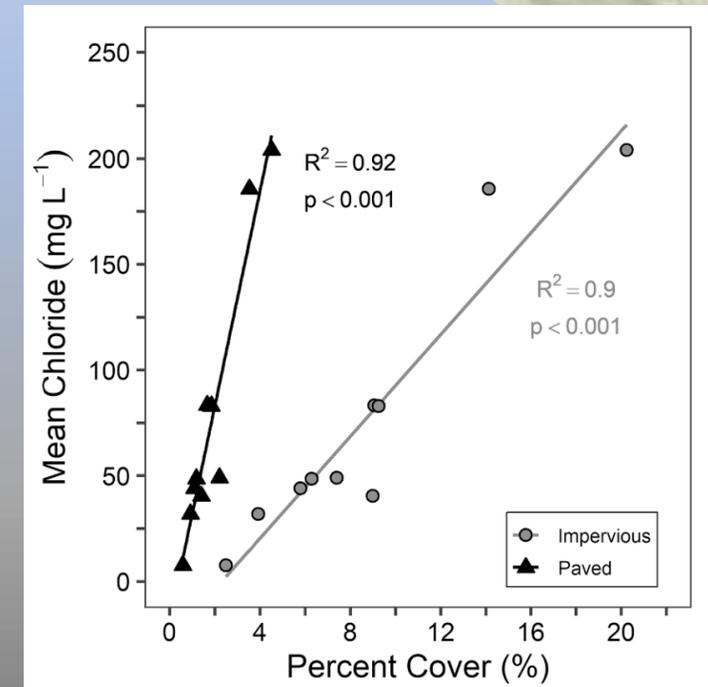
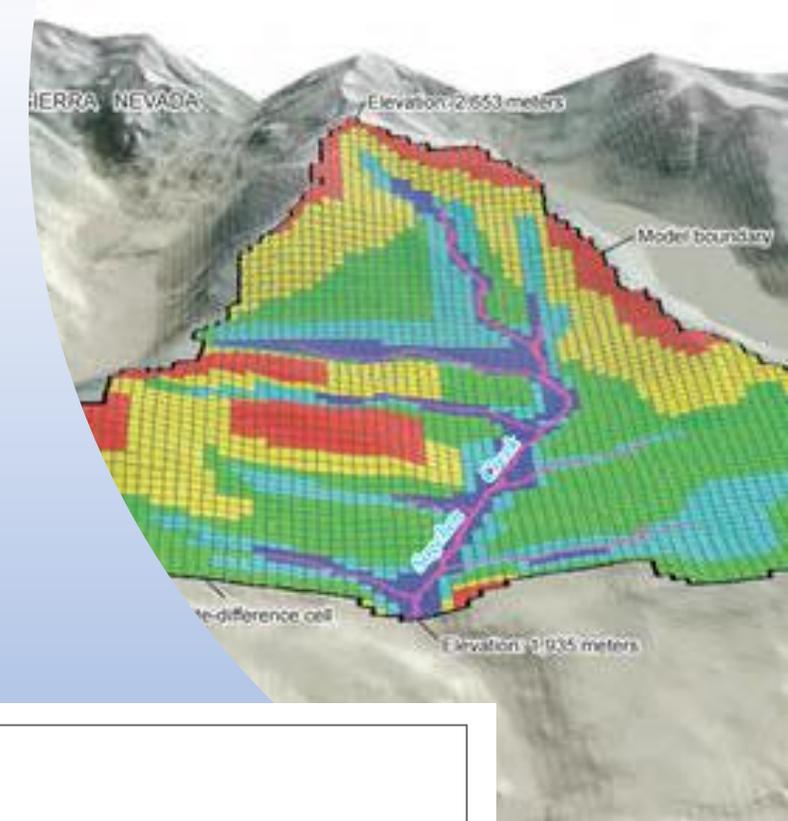
Improve Data Collection

- Conductivity “Blitz” in 2022 and 2023
- Goal: Improve spatial understanding of chloride concentrations throughout the watershed so that hot spots can be identified, and salt reduction measures can be geographically targeted.



Modelling Efforts

- Partner with researchers at Umass to better understand the origin and fate of chlorides in the watershed.
- Soper et al. 2021. Long-term analysis of road salt loading and transport in a rural drinking water reservoir watershed. Journal of Hydrology: “... measurable water quality improvements will only be realized with a sustained long-term decrease in the amount of road salt applied.”
- Salt is a legacy problem: salt in the water today may have been put down on the road 10 or more years ago.
- Establishing the relationships between impervious and paved surfaces has led to refining our land acquisition program.



Training

- DCR and MWRA have cooperated to provide no cost Baystate Roads (UMASS Transportation Center) training on Snow and Ice Operations in 2019, 2021, and 2022, 2023 and 2024 to introduce pre-treatment, anti-icing, and the use of salt brine to town public works employees
- Salt Spreader Calibration Training in November 2023



Training

- Pre-treatment of bare pavement BEFORE a storm prevents snow and ice from binding to pavement which makes it easier to plow and uses less salt overall
- Application of salt brine to roads before storm events is the best approach.
- MA DOT District 3 has achieved a ~40% reduction in the amount of salt applied as compared to 10 years ago
- The town of Sterling achieved a 52% reduction in salt applications in the winter of 2022-23 as compared to the previous winter



“We are now pre-treating always due to the training you provided”

Public Outreach

- Production of a salt use reduction educational video by Interpretive Services for this winter season: **“The Importance of Road Salt Reduction”** on MassDCR YouTube channel
- Reducing salt does not mean reducing public safety!
- Changing public expectations is a necessary component of long-term success.

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SALT SMARTER NOT HARDER
WAYS TO REDUCE SALT USE

THE PROBLEM WITH ROAD SALT
When salt is put down on a road, it doesn't go away. It washes into waterways or seeps into the ground, contaminating reservoirs and underground wells. Salt put down on the road today can be found in drinking water up to a decade later!

DCR SALT REDUCTION GRANTS
DCR awarded over **\$165,000** to Wachusett watershed towns through a matching grant program to lower road salt use and help with new equipment costs.

MORE SALT DOESN'T MELT ICE FASTER
More isn't better. A 12 oz. coffee mug full of rock salt is enough to treat a 20 foot driveway. Make sure there is space between the grains.

SAVE MONEY AND SWEEP UP EXTRA
Sweep up any leftover salt to use in the next storm.

USE BRINE
Make a brine solution and use a sprayer to pretreat pavement. Liquid can melt ice faster than granular salt and it sticks instead of scatters. Lower salt concentrations are less damaging to fish, wildlife and drinking water.

STAY HOME DURING A STORM
This option, if possible, allows snow removal crews time and space to make the roads safer for you today and your drinking water ten years from now.

DID YOU KNOW? ABOUT 30% OF SALT IS WASTED
Salt Smarter, Not Harder to:
• Remain safe on the roads.
• Save money.
• Reduce the harm to our water, wildlife, and the environment.

For more information, watch the Road Salt Reduction video
youtu.be/5mte_kBge0Y

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Road Salt Friend or Foe?

DCR Division of Water Supply

The Importance of Road Salt Reduction

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MAKE YOUR OWN SALT BRINE

Salt Brine is a liquid that prevents snow and ice from freezing to hard surfaces, making it easier to shovel or plow. It is a low cost and more environmentally friendly alternative to solid salt. Salt brine uses less salt and works better than solid salt in most situations.

STEP 1: PREP
Measure out 1 gallon of warm water in a bucket, cooking pot, or pump sprayer container. Measure out 2.3 pounds of clean rock salt (Sodium Chloride, the same material as table salt). Warm water is ideal to dissolve salt.
Examples:
For a one gallon pump sprayer:
1 gallon of water and 2.3 pounds of salt.
For a four gallon pump sprayer:
4 gallons of water and 9.2 pounds of salt.

STEP 2: MIX
Add the salt to the water and stir the solution with a wooden spoon or spatula until the salt is fully dissolved. You can use a hand drill and a paint mixer if you want to make it dissolve faster. Use safety glasses while mixing. If the salt has dirt or rocks mix it in a bucket before pouring the liquid into a pump sprayer.

STEP 3: SPRAY
Apply the liquid brine on paved surfaces using a portable pump sprayer, which are available at home improvement stores. Spray lines on the pavement about 6 inches apart to pre-wet the surface BEFORE expected precipitation. This will prevent snow and ice from sticking so it can be shoveled or plowed away cleanly.

THINGS TO NOTE:
Brine is best for snow and ice but if a storm is forecast to start with rain, the rain may wash the salt brine away before it can be effective. In extremely cold temperatures below 10°F liquid brine could freeze and may not be prudent to apply. During a snowstorm, shovel or plow the surface as clear as possible and then reapply the brine right after. Only use as much brine as needed to make separate lines or thinly cover the paved surface. Overapplication does not boost effectiveness and adds harmful salt into the environment.

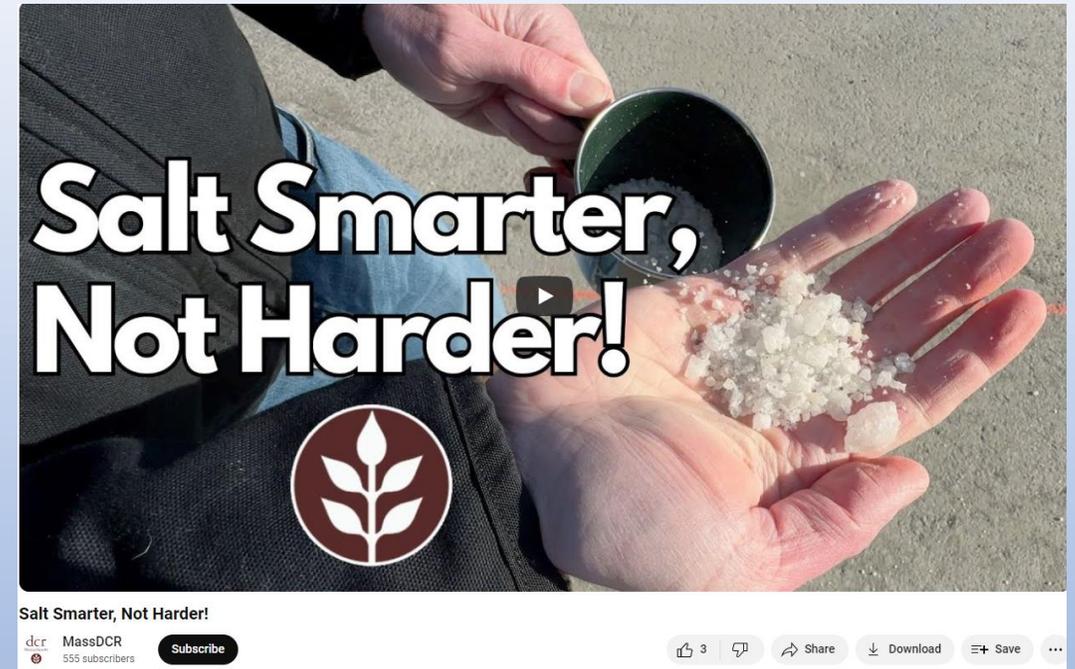
Scan QR code for more information:
mass.gov/info-details/dcr-watershed-system-salt-reduction

DCR Division of Water Supply Protection
180 Beaman Street, West Boylston

Try Brine

Public Outreach

- New focus on social media videos that can be released on the day of a snow storm- good success in January 2024
- Four new videos have gotten good views



Public Outreach

- Success of videos has resulted in mainstream news coverage

What's the best way to melt that ice coating your driveway? Here's what you need to know.

By [Shannon Larson](#) Globe Staff, Updated January 17, 2024, 5:04 p.m.



Icy conditions on Old Colony Avenue in Boston in February 2022. JONATHAN WIGGS/GLOBE STAFF



Wachusett Reservoir (Spectrum News 1/Andrew Boucher)

NEWS

Reservoir water quality impacted by an increase of salt on roadways

High salt levels from roads pose threat to Wachusett Reservoir watershed



Henry Schwan

Worcester Telegram & Gazette

[View Comments](#)



STERLING – It's not your grandpa's snow-and-ice-removal world anymore. Times have changed. Look no further than Sterling for proof.

Work crews in the Central Massachusetts town of 8,000 use high-tech flexible plow blades to get snow and ice off the streets. The blades fit the contours of the road that allow more snow and slush to be scraped off. Less muck left behind means less salt is needed to treat the roads.

Salt Reduction Grant Program

- Launched in FY21, dedicated funding in DWSP budget to administer a 50/50 matching grant of up to \$20,000 per town per year to facilitate adoption of salt reduction technologies in Wachusett watershed towns
- Total grant distribution of \$170,000 over four years has been awarded to the towns of Holden, West Boylston, Princeton, Sterling, and Paxton.
- FY24 resulted in three matching grants being awarded.
- Town purchases have included improved salt storage, flexible plow blades, ground speed controllers, and a salt brine generator.



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Division of Water Supply Protection – Office of Watershed Management

Wachusett Reservoir Watershed Salt Use Reduction Grants

Why Salt Use on Roads is an Issue for Wachusett Reservoir

The Department of Conservation and Recreation - Division of Water Supply Protection (DCR/DWSP) routinely monitors the water quality of the groundwater, streams, and rivers that flow into the Wachusett Reservoir. DCR/DWSP has documented significant increases in the markers that indicate the amount of salt in the reservoir. Elevated measurements that in the past had been linked to winter storms are now occurring during the summer as well. These consistently high levels of salt can impact drinking water treatment and distribution. Once introduced into an ecosystem, salt is very difficult and costly to remove. DCR/DWSP is committed to finding ways to reduce salt use in the Wachusett Reservoir watershed.



How to Reduce Salt Use and Keep Roads Safe

DCR/DWSP is working with Departments of Public Works, Highway Departments, and MassDOT to come up with creative solutions to the problem of salt contamination. Strategies from the Baystate Roads program at the UMass Transportation Center include pre-treatment of roads with liquid solutions that minimizes the use of salt on town roads, provides for clear and safe road surfaces, and is cost-effective.

Wachusett Reservoir Watershed Salt Use Reduction Grants for Fiscal Year 2023

The Wachusett Reservoir watershed encompasses seven towns: Boylston, West Boylston, Sterling, Holden, Princeton, Paxton, and Rutland. These communities' road maintenance activities all have an impact on the reservoir's water quality, which is the drinking water supply for over 3 million people. Private wells throughout the region depend on the watershed's groundwater. DCR/DWSP recognizes that implementing a new road salt use regimen requires investment in equipment that may not be within a town's budget. Following the success of a targeted grant program in Fiscal Years 2021 and 2022, another round of grants – utilizing funds approved by the Water Supply Protection Trust in the DCR/DWSP budget – has been set up in Fiscal Year 2023 to help these seven towns up-grade their equipment to use the latest salt use reduction strategies.

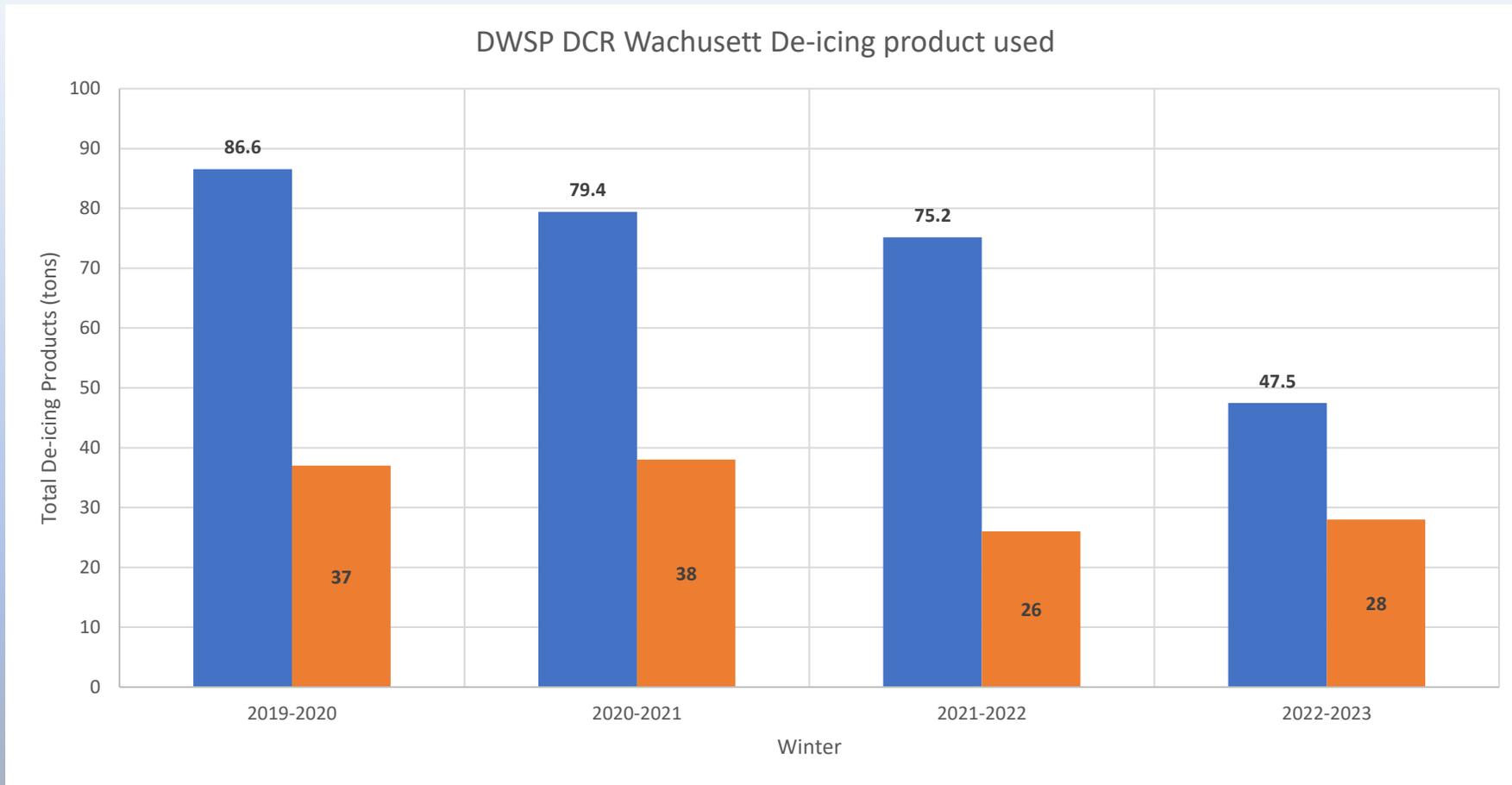


New salt storage building in
Princeton

Upgrade DCR DWSP Winter Operations

- Pre-treatment with granular salt
- Moving towards best practice: using salt brine
- Purchased equipment to apply brine
- Replace and upgrade our salt shed
- Provide training for staff





The amount used in 2022-2023 was about 37% less than the previous winter in 2021-2022 (despite a few more treatments), which saved more than 27 tons of salt.

The amount used this past winter was 45% less than was used in 2019-2020, which means 39 fewer tons of product was used!

Thank You!

Jamie Carr, MA DCR Division of Water Supply Protection

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