Gaining Traction on Road Salt Reduction

dcr Massachusetts

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

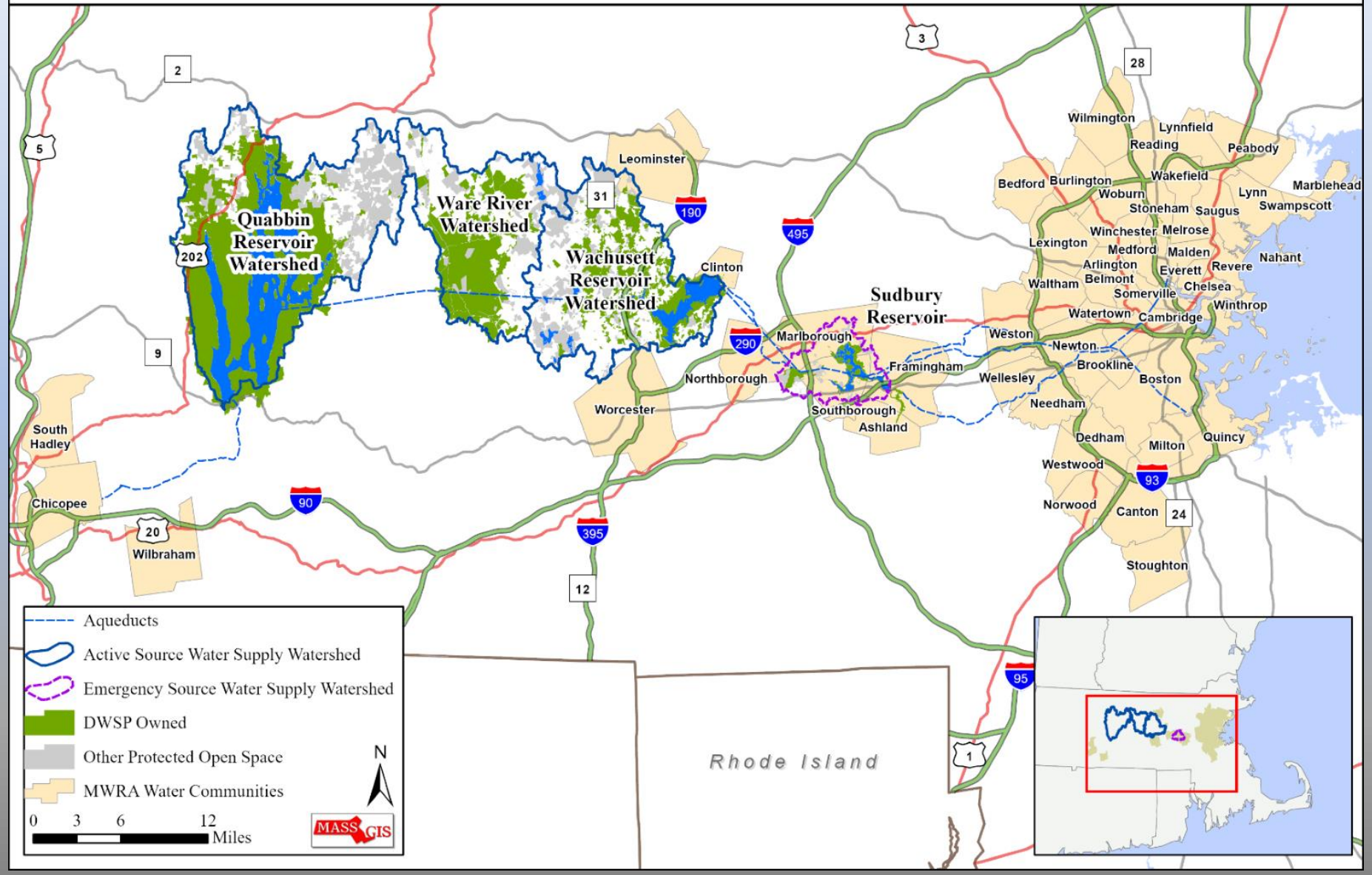
PRESENTATION OUTLINE

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

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Department of Conservation & Recreation

General Plan of the DCR/MWRA Watershed System

Division of Water Supply Protection - Office of Watershed Management



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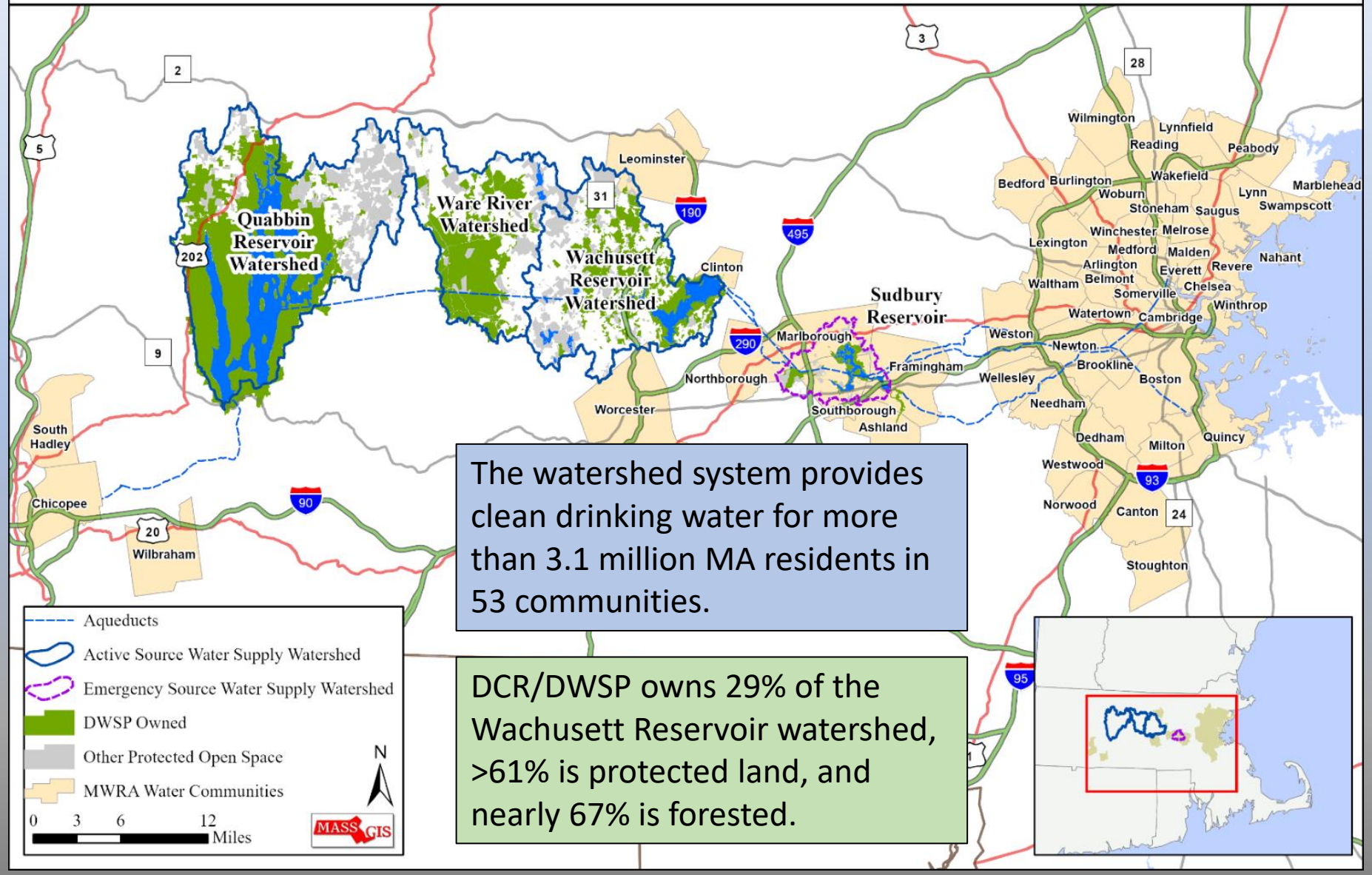

The watershed system provides clean drinking water for more than 3.1 million MA residents in 53 communities.

DCR/DWSP owns 29% of the Wachusett Reservoir watershed, >61% is protected land, and nearly 67% is forested.

The Commonwealth of Massachusetts
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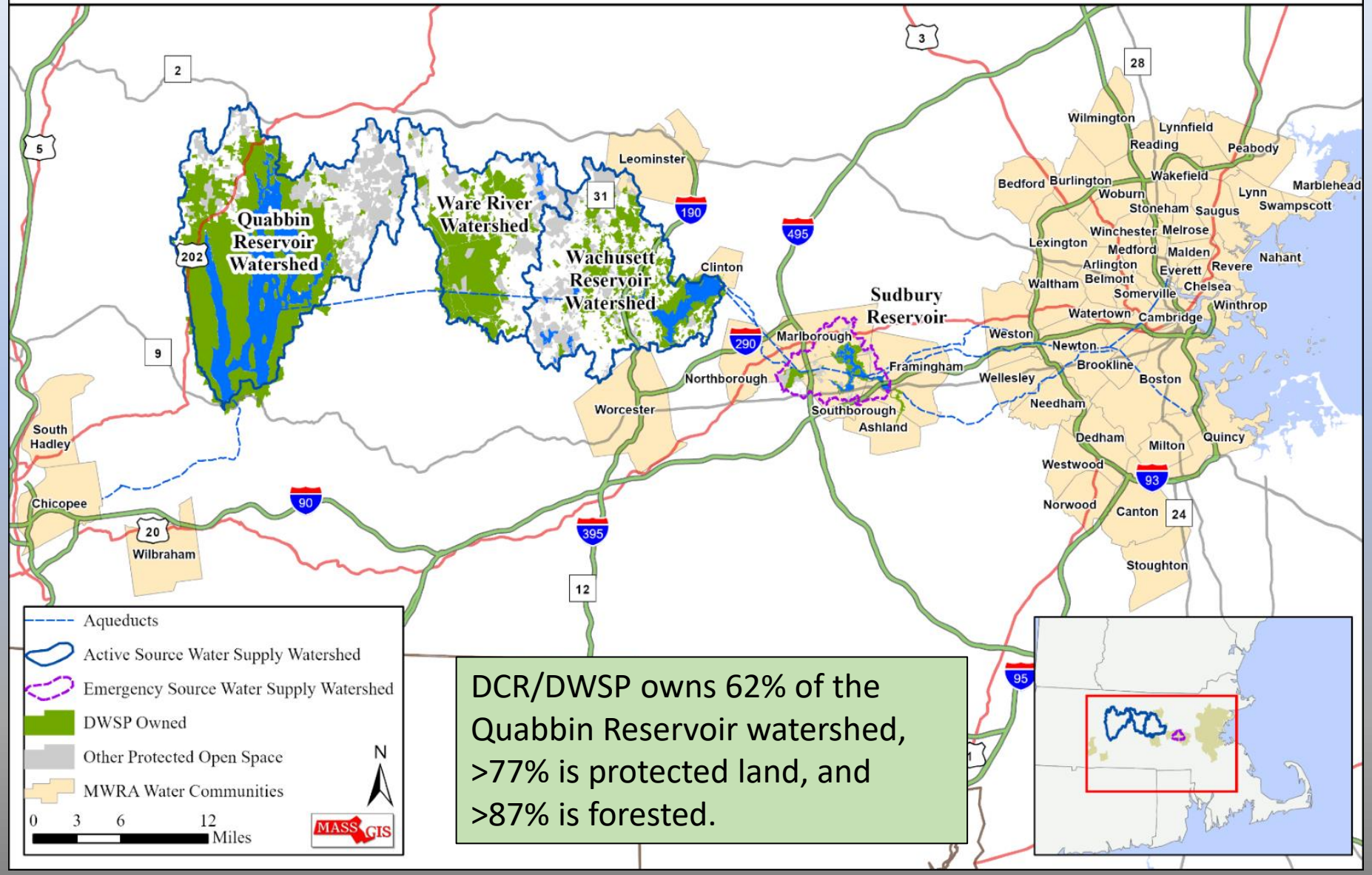
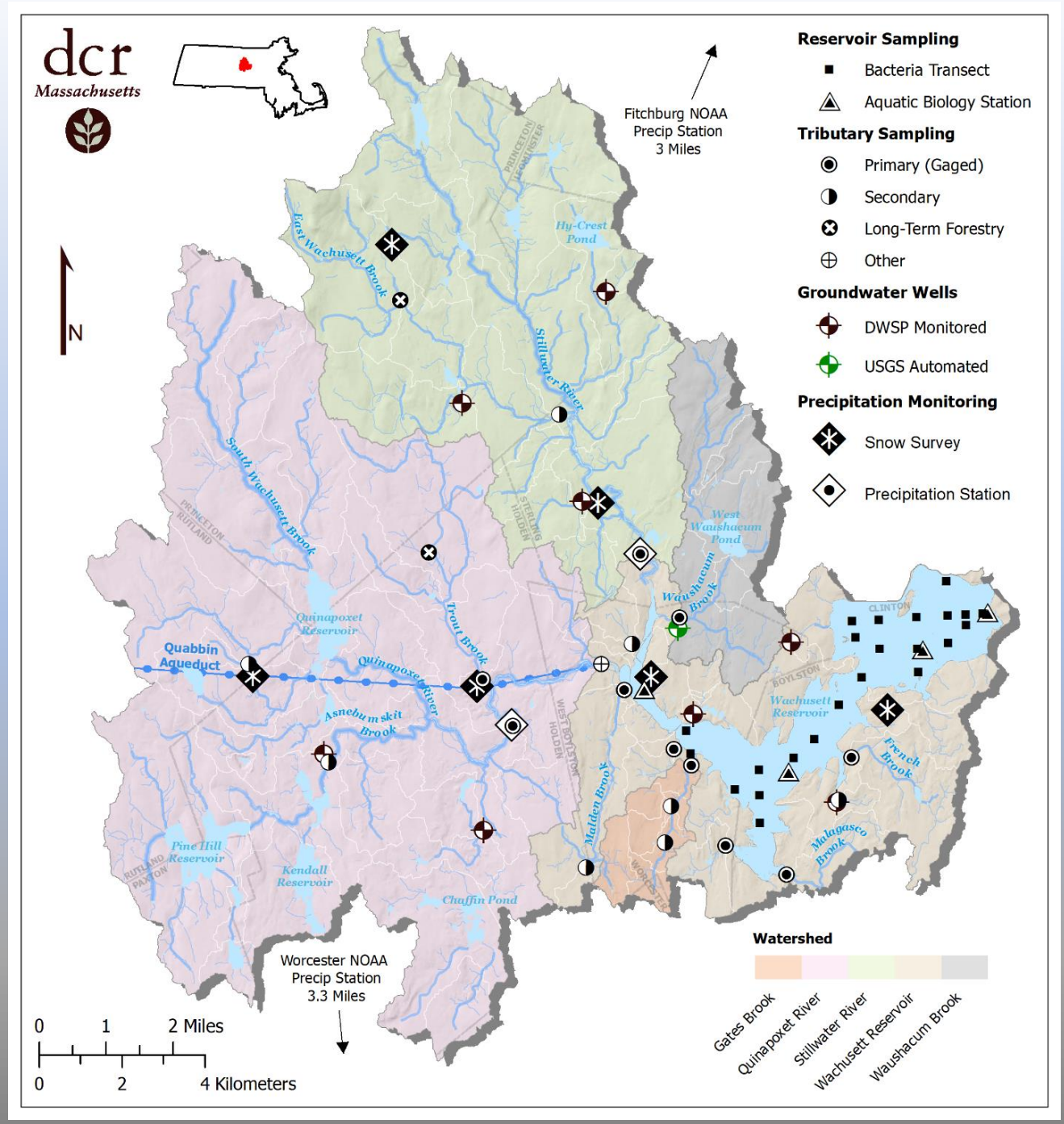


DCR/DWSP owns 62% of the Quabbin Reservoir watershed, >77% is protected land, and >87% is forested.

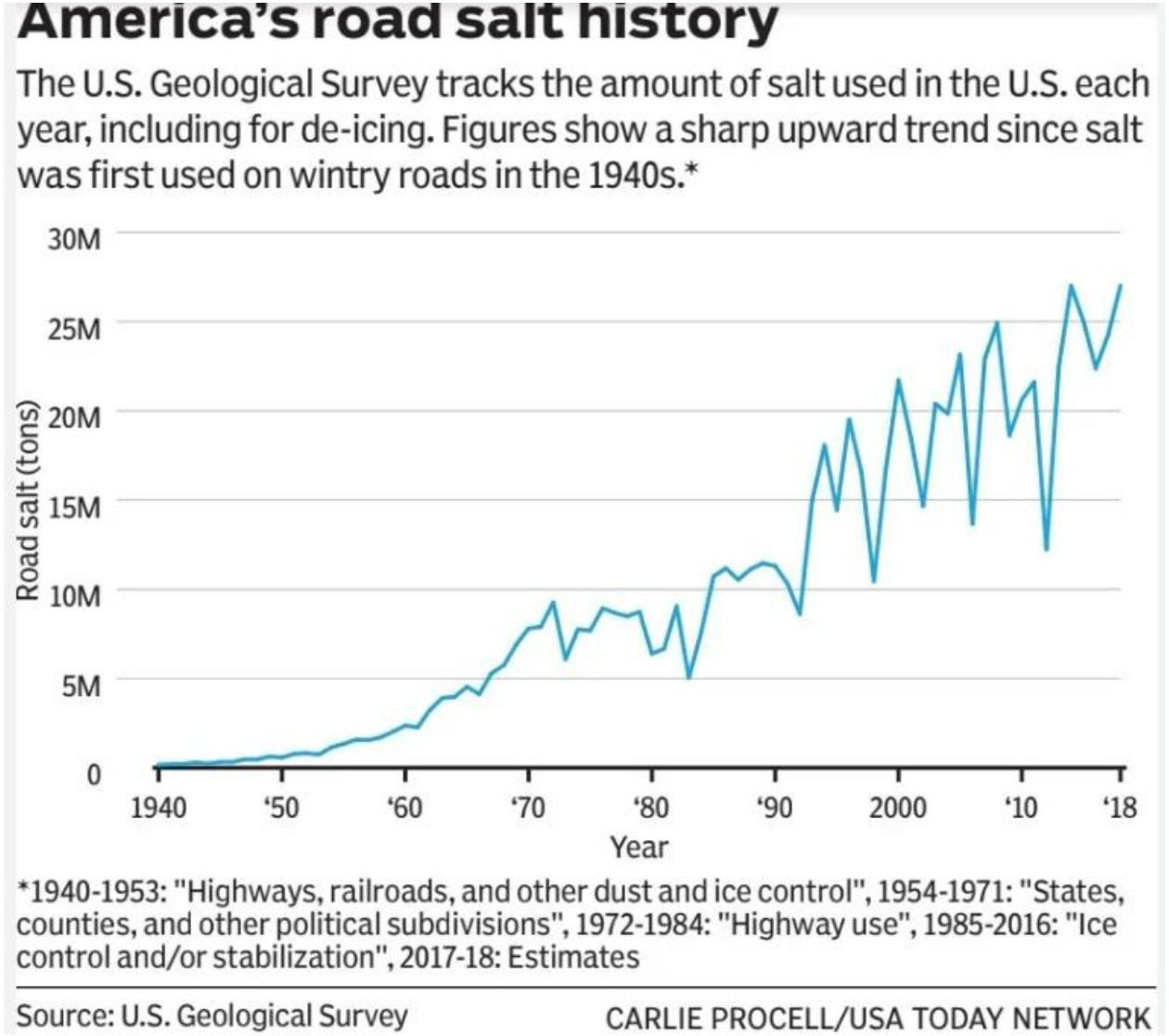
Map of the Wachusett Reservoir watershed with sampling stations

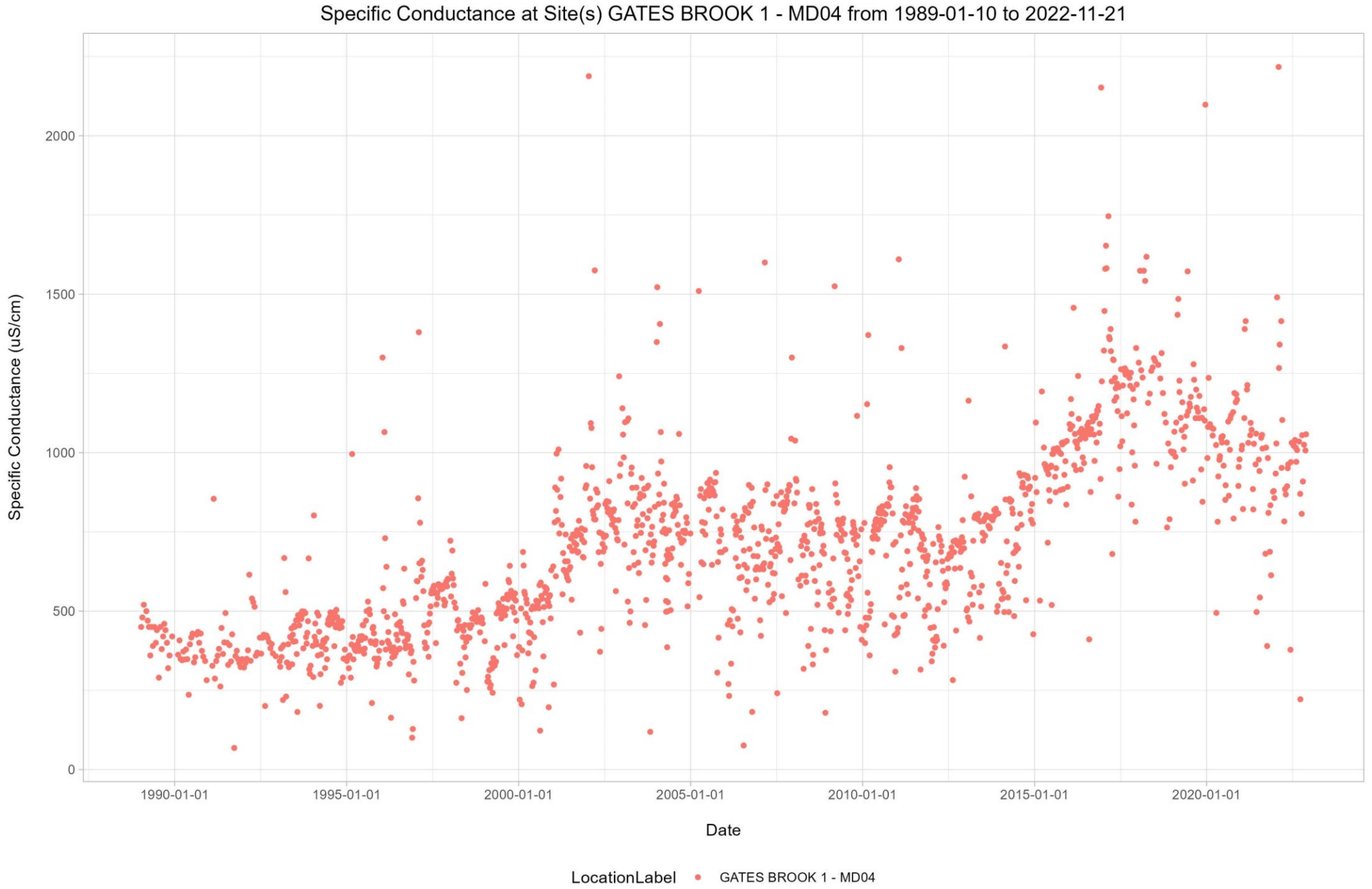
Environmental Analyst David Getman recording a specific conductivity measurement in a watershed tributary

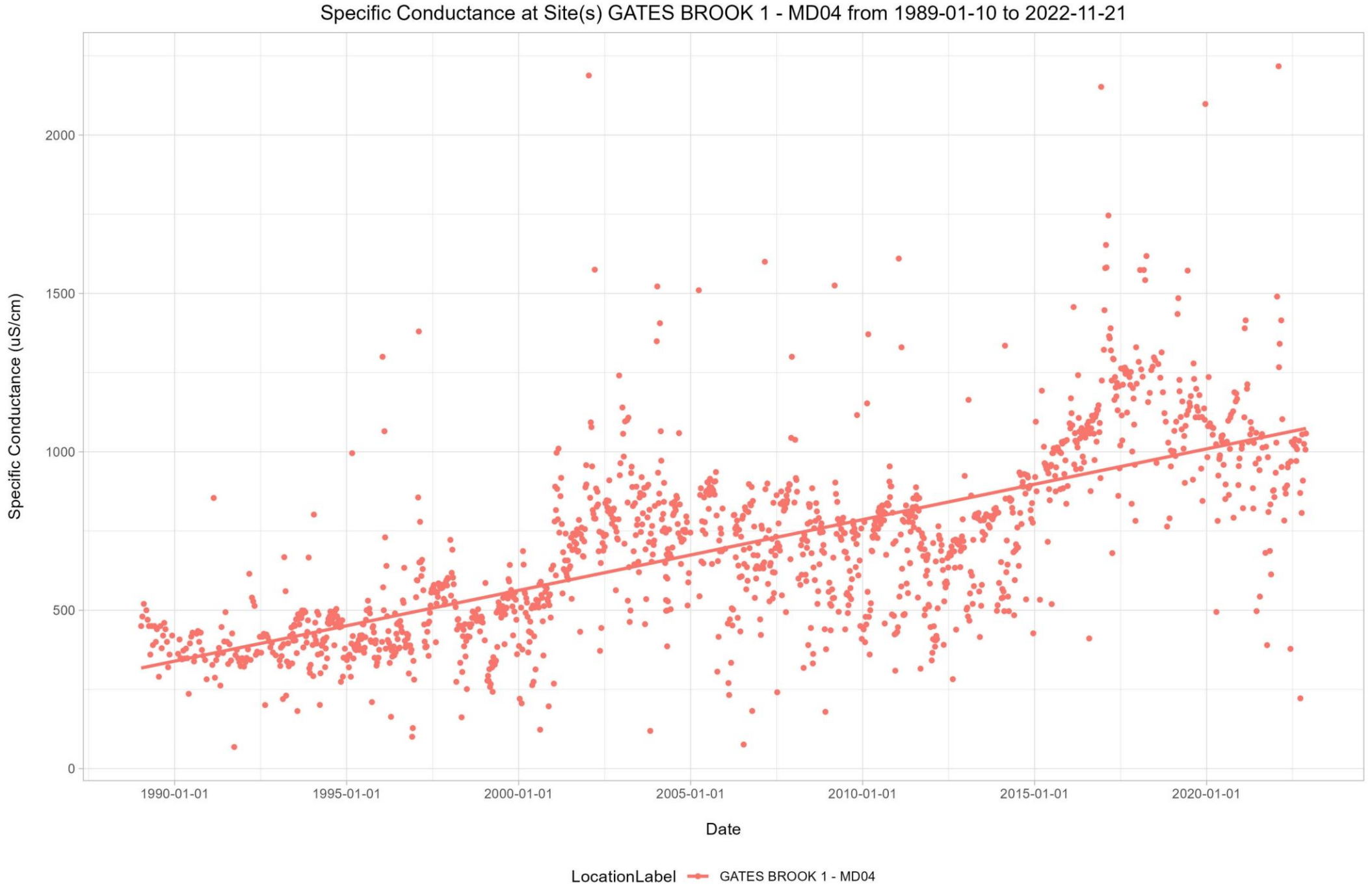


Increases in Road Salt Application Over Time

What are the impacts?




Specific Conductance at Site(s) GATES BROOK 1 - MD04 from 1989-01-10 to 2022-11-21
Specific Conductance (uS/cm)
2000
1500
1000
500
0
1990-01-01
1995-01-01
2000-01-01
2005-01-01
2010-01-01
2015-01-01
2020-01-01
Date
LocationLabel
GATES BROOK 1 - MD04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1500
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1995-01-01
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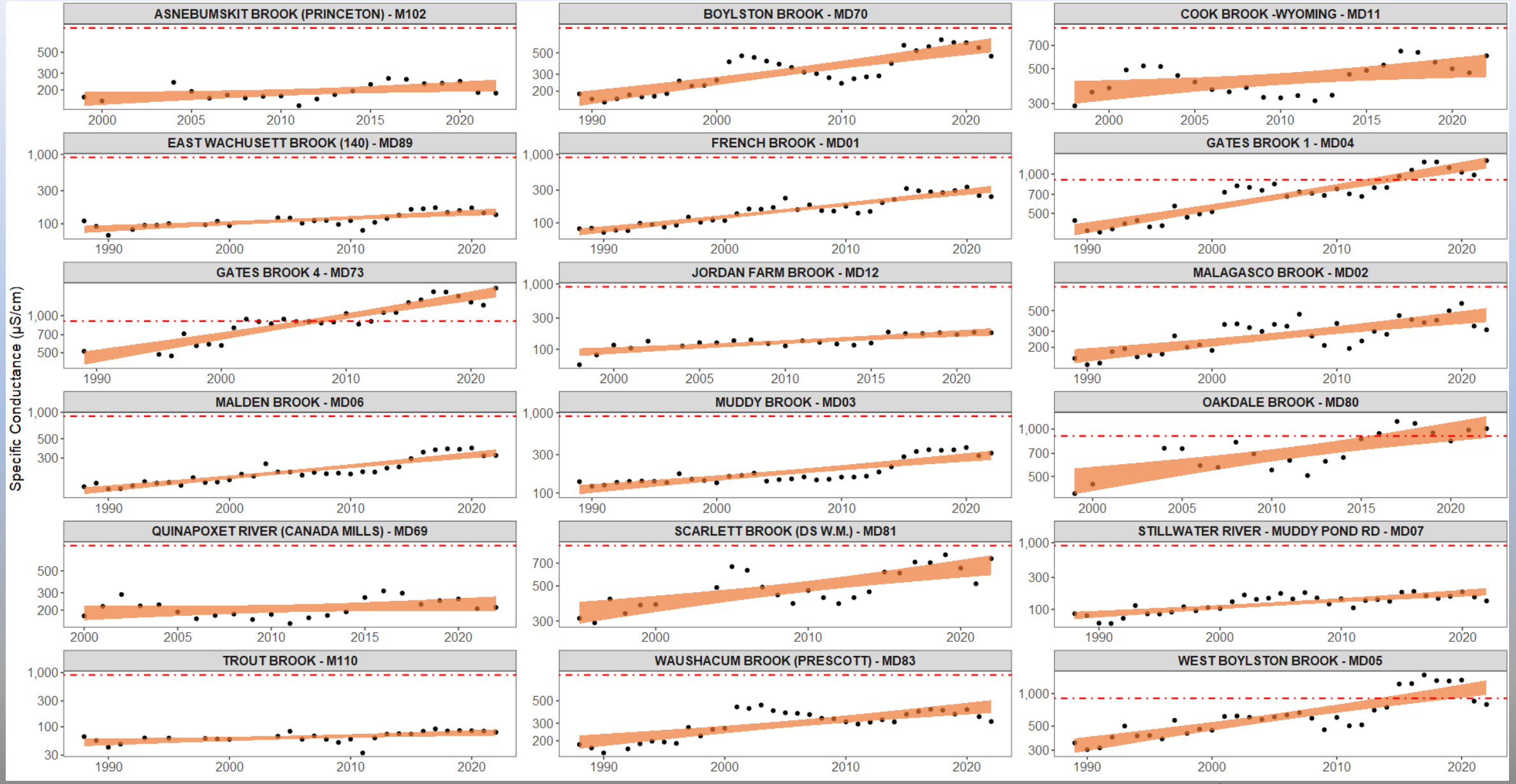
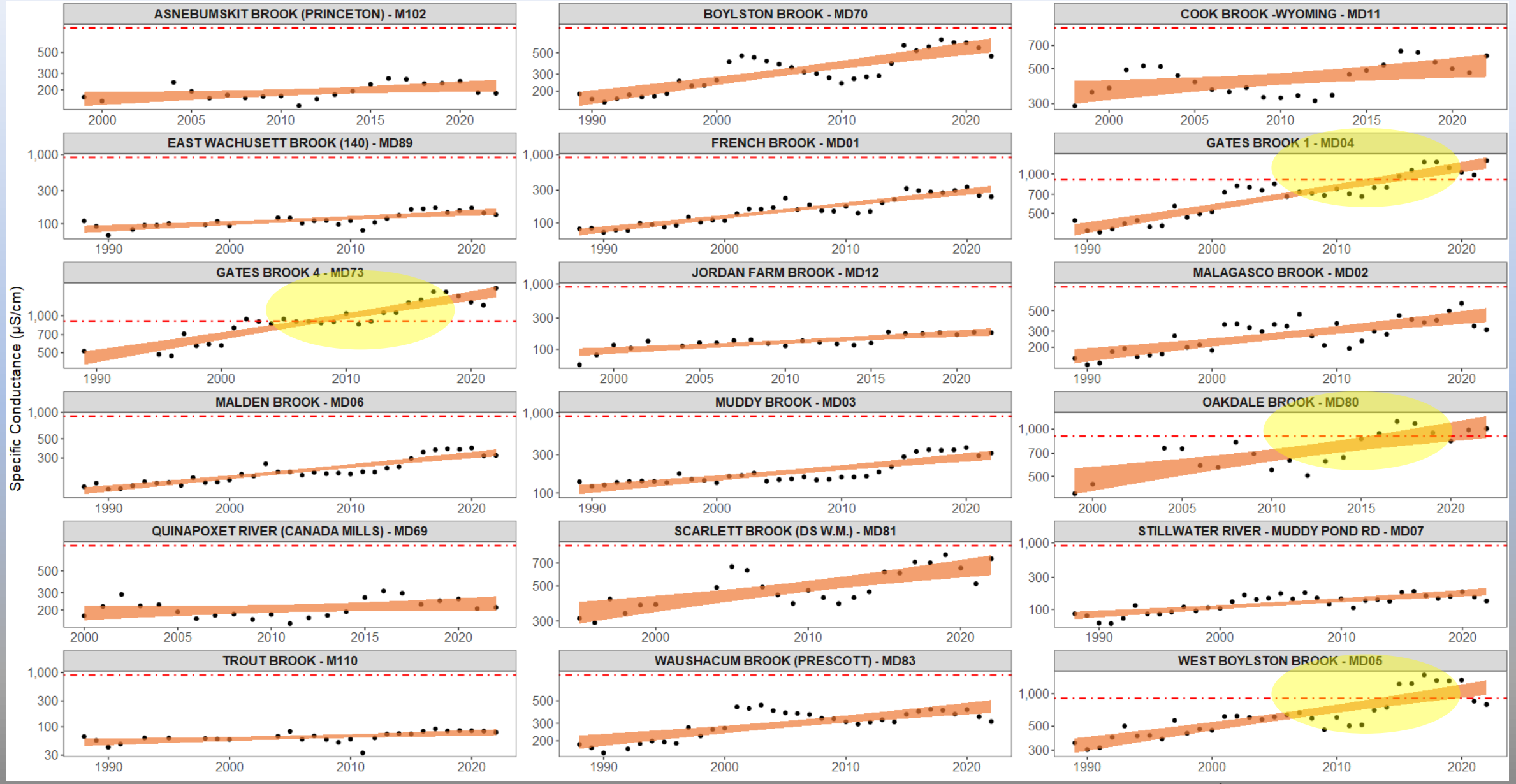
2005-01-01
2010-01-01
2015-01-01
2020-01-01
Date
LocationLabel
GATES BROOK 1 - MD04

Annual Median Specific Conductance



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

Annual Median Specific Conductance



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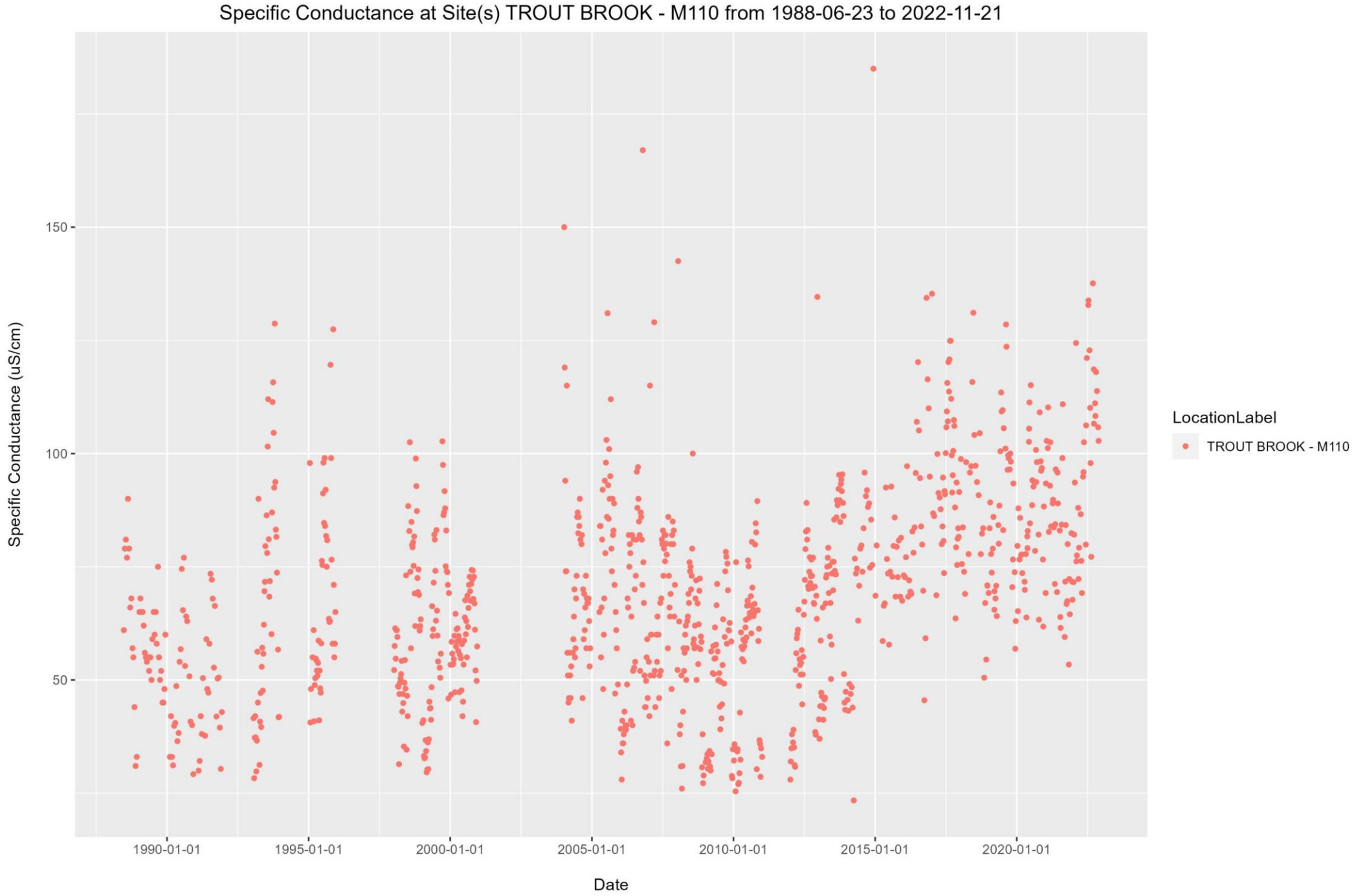
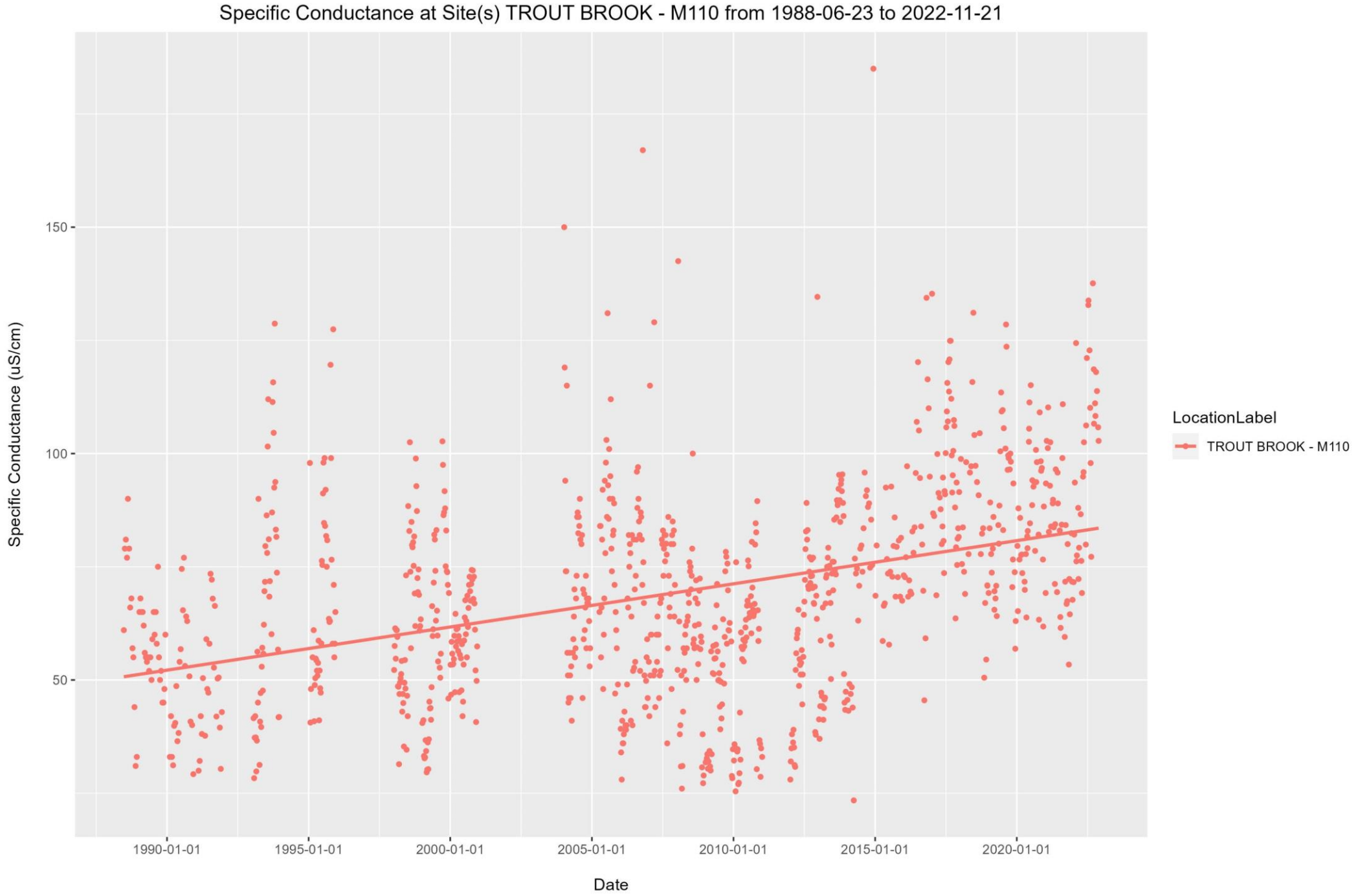

Specific Conductance at Site(s) TROUT BROOK - M110 from 1988-06-23 to 2022-11-21
Specific Conductance (uS/cm)
150
100
50
1990-01-01
1995-01-01
2000-01-01
2005-01-01
2010-01-01
2015-01-01
2020-01-01
Date
LocationLabel
TROUT BROOK - M110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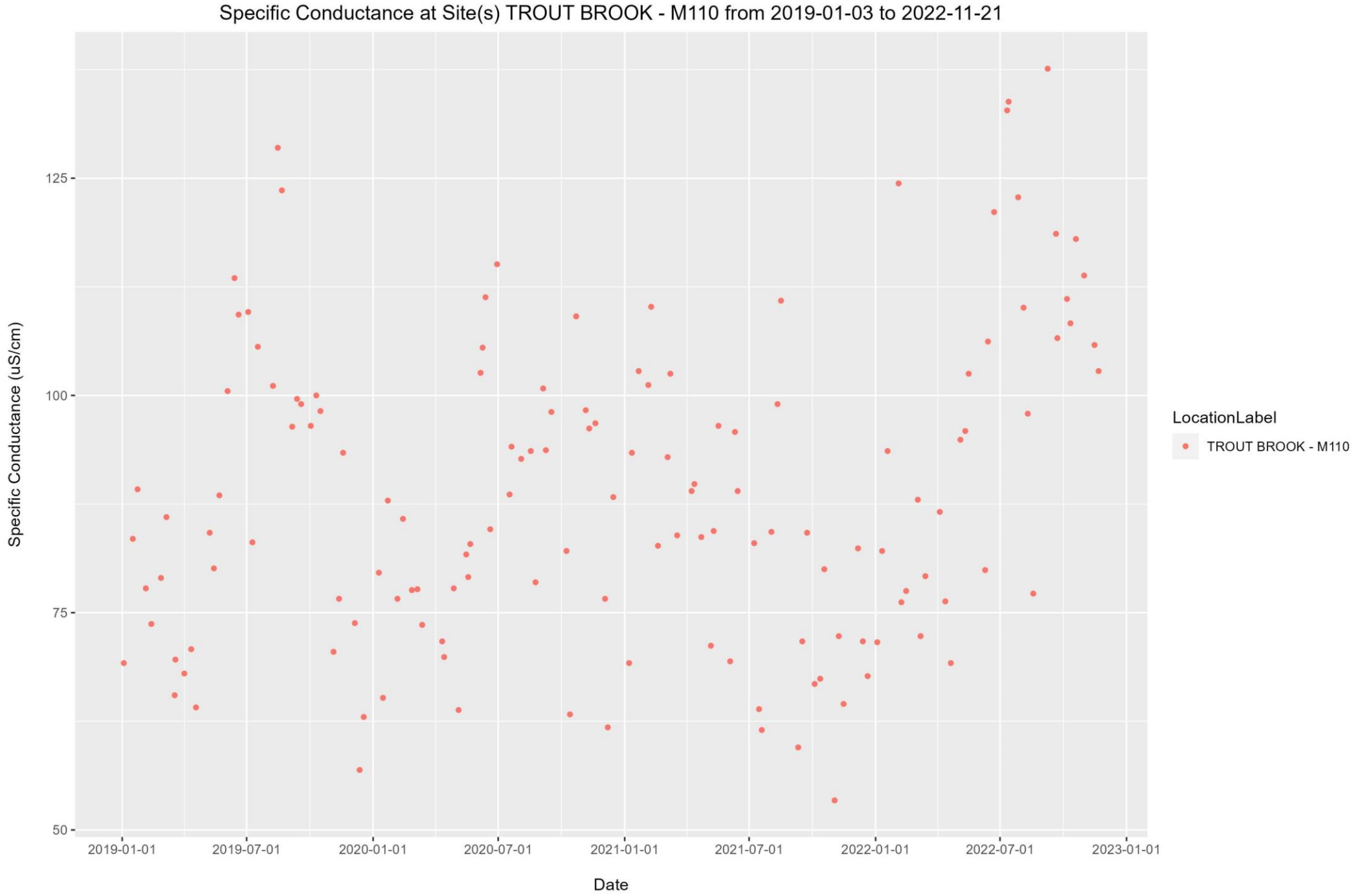
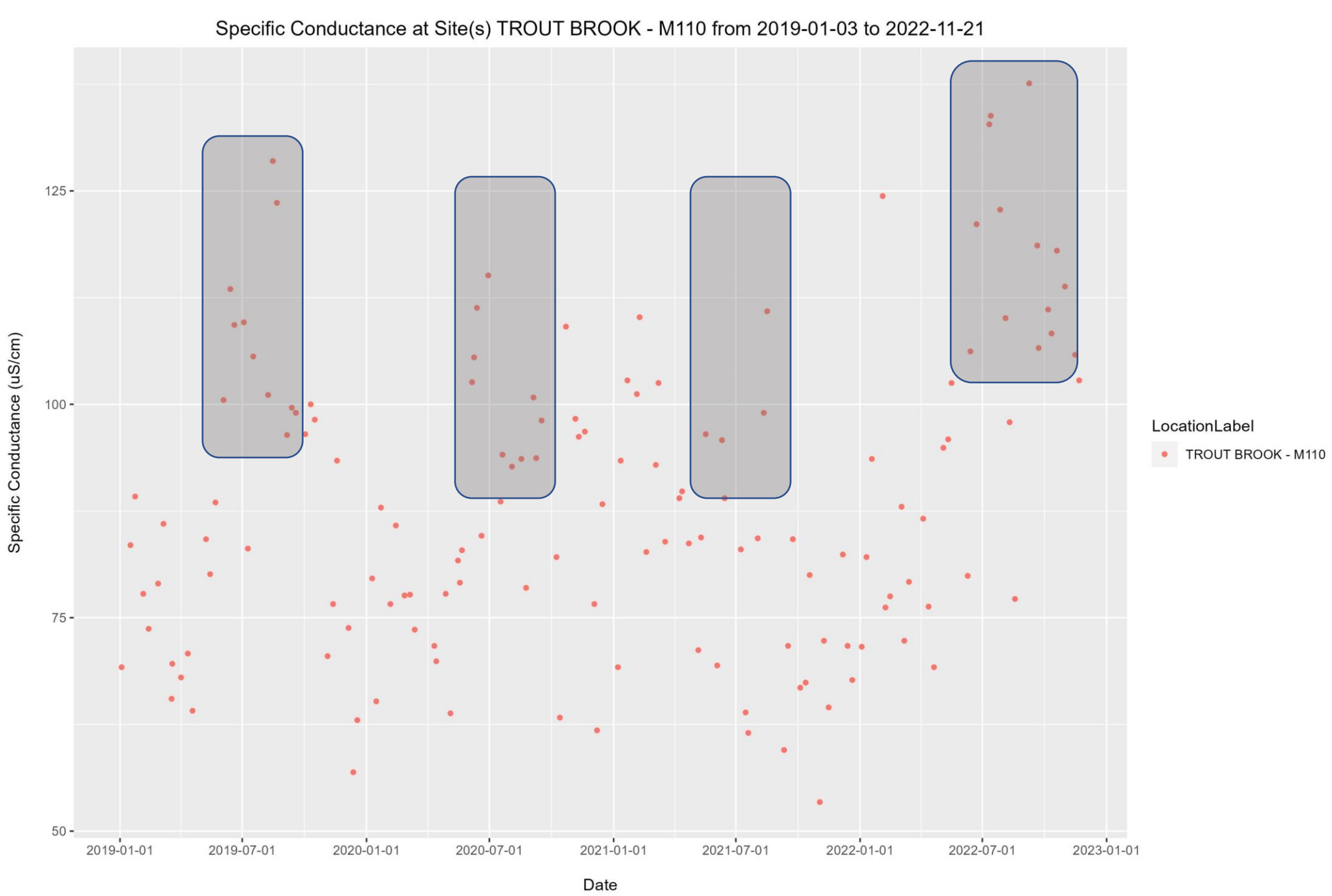
Date
LocationLabel
TROUT BROOK - M110


Specific Conductance at Site(s) TROUT BROOK - M110 from 2019-01-03 to 2022-11-21
Specific Conductance (uS/cm)
125
100
75
50
2019-01-01
2019-07-01
2020-01-01
2020-07-01
2021-01-01
2021-07-01
2022-01-01
2022-07-01
2023-01-01
Date
LocationLabel
TROUT BROOK - M110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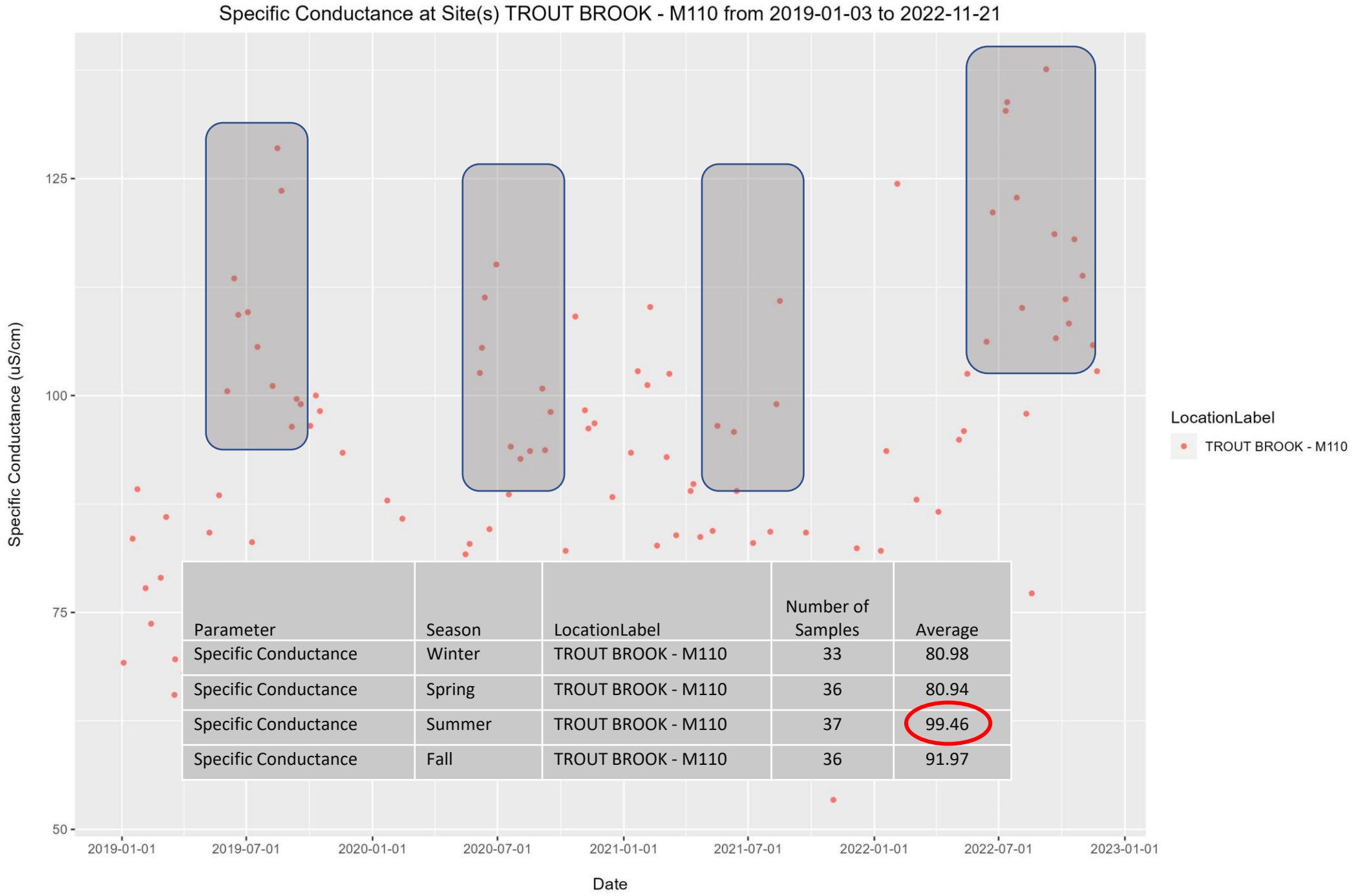
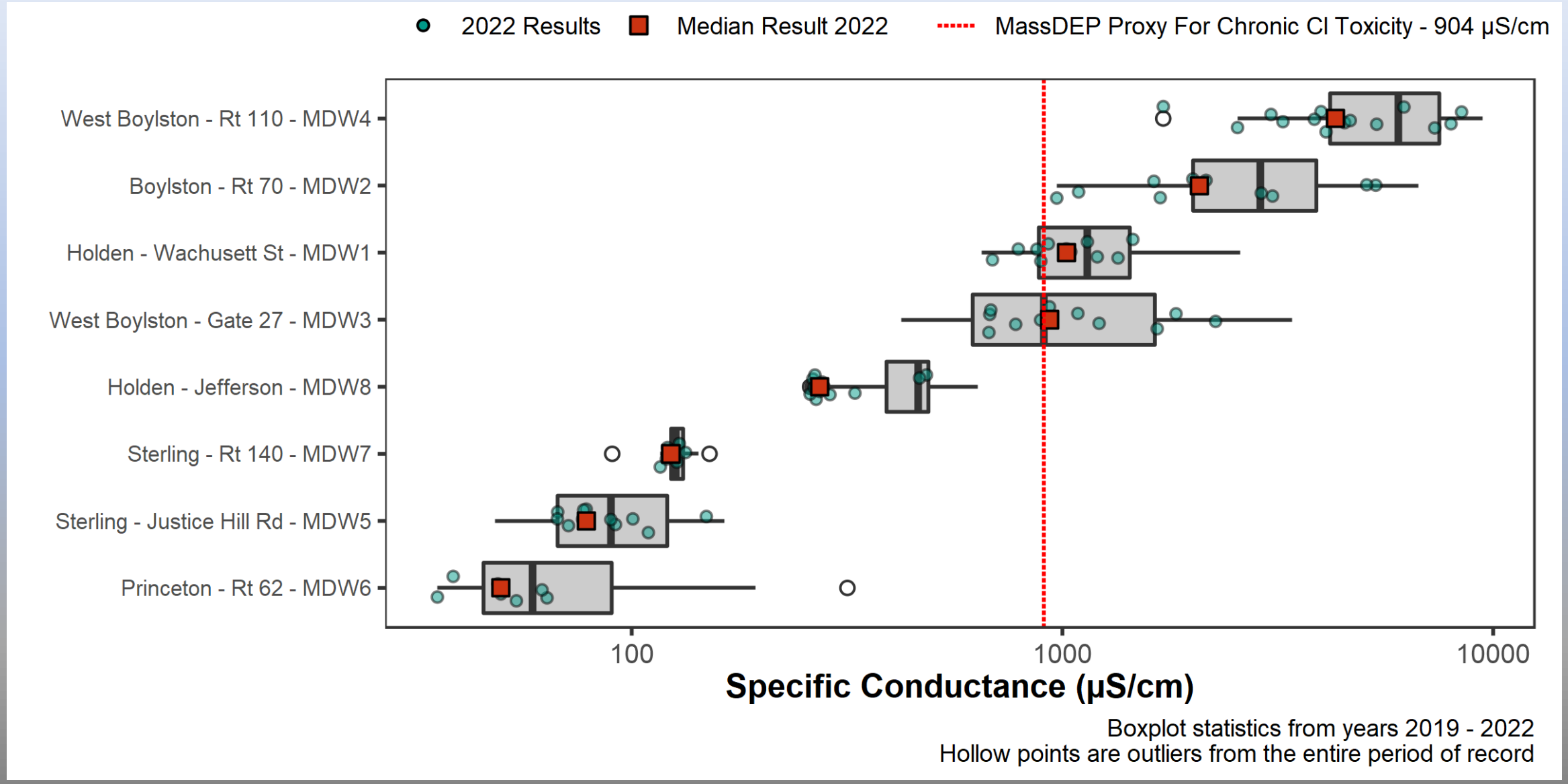
TROUT BROOK - M110



Parameter	Season	LocationLabel	Number of Samples	Average
Specific Conductance	Winter	TROUT BROOK - M110	33	80.98
Specific Conductance	Spring	TROUT BROOK - M110	36	80.94
Specific Conductance	Summer	TROUT BROOK - M110	37	99.46
Specific Conductance	Fall	TROUT BROOK - M110	36	91.97

Chloride contamination apparent in groundwater



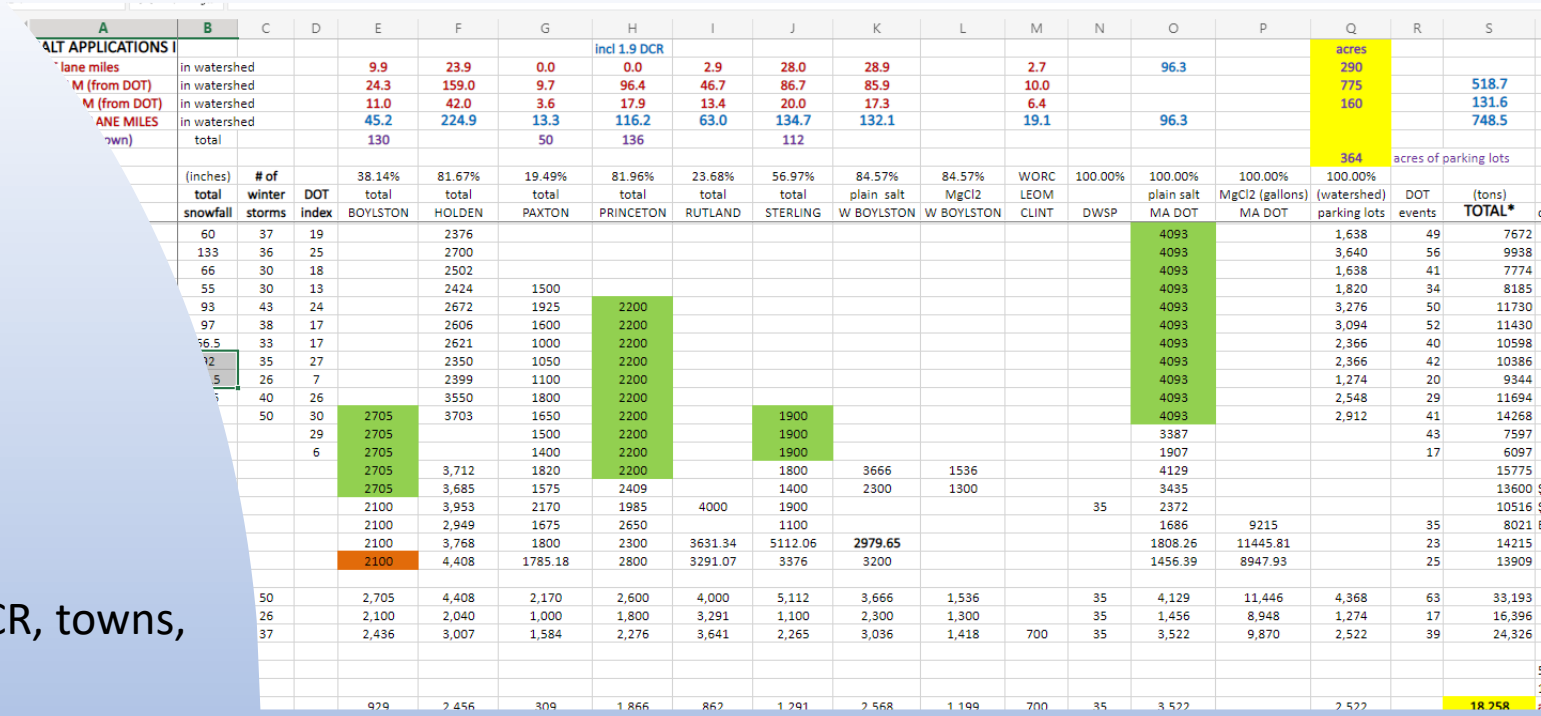
EXPANDING DCR EFFORTS TO REDUCE ROAD SALT:

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**

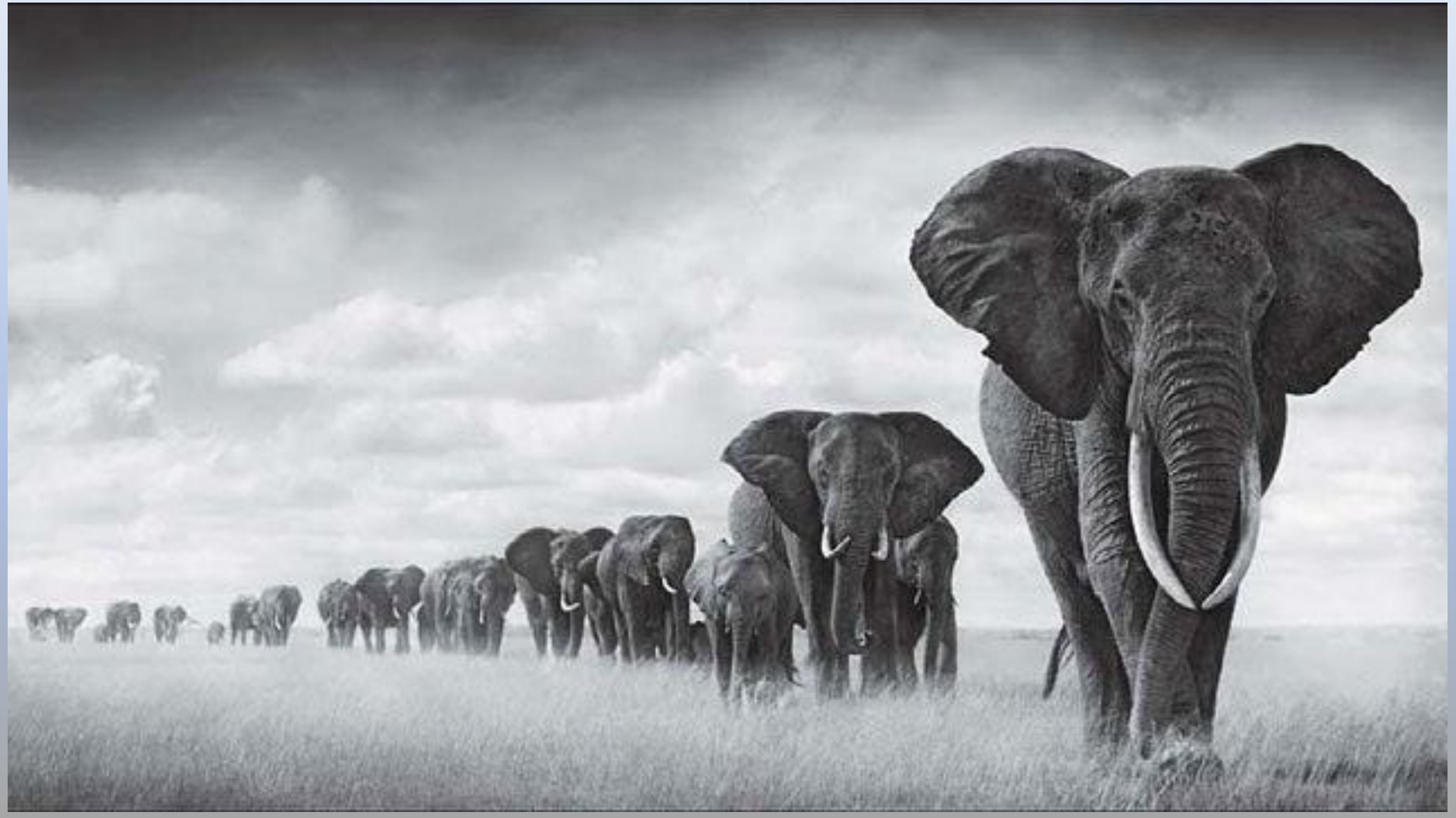
Improve Data Collection

- 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
ALT APPLICATIONS I							incl 1.9 DCR									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
ANE MILES	in watershed			45.2	224.9	13.3	116.2	63.0	134.7	132.1		19.1		96.3				748.5
own)	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%	WORC	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
	2	35	27		2350	1050	2200							4093		2,366	42	10386
	5	26	7		2399	1100	2200							4093		1,274	20	9344
		40	26		3550	1800	2200							4093		2,548	29	11694
		50	30	2705	3703	1650	2200		1900					4093		2,912	41	14268
			29	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?

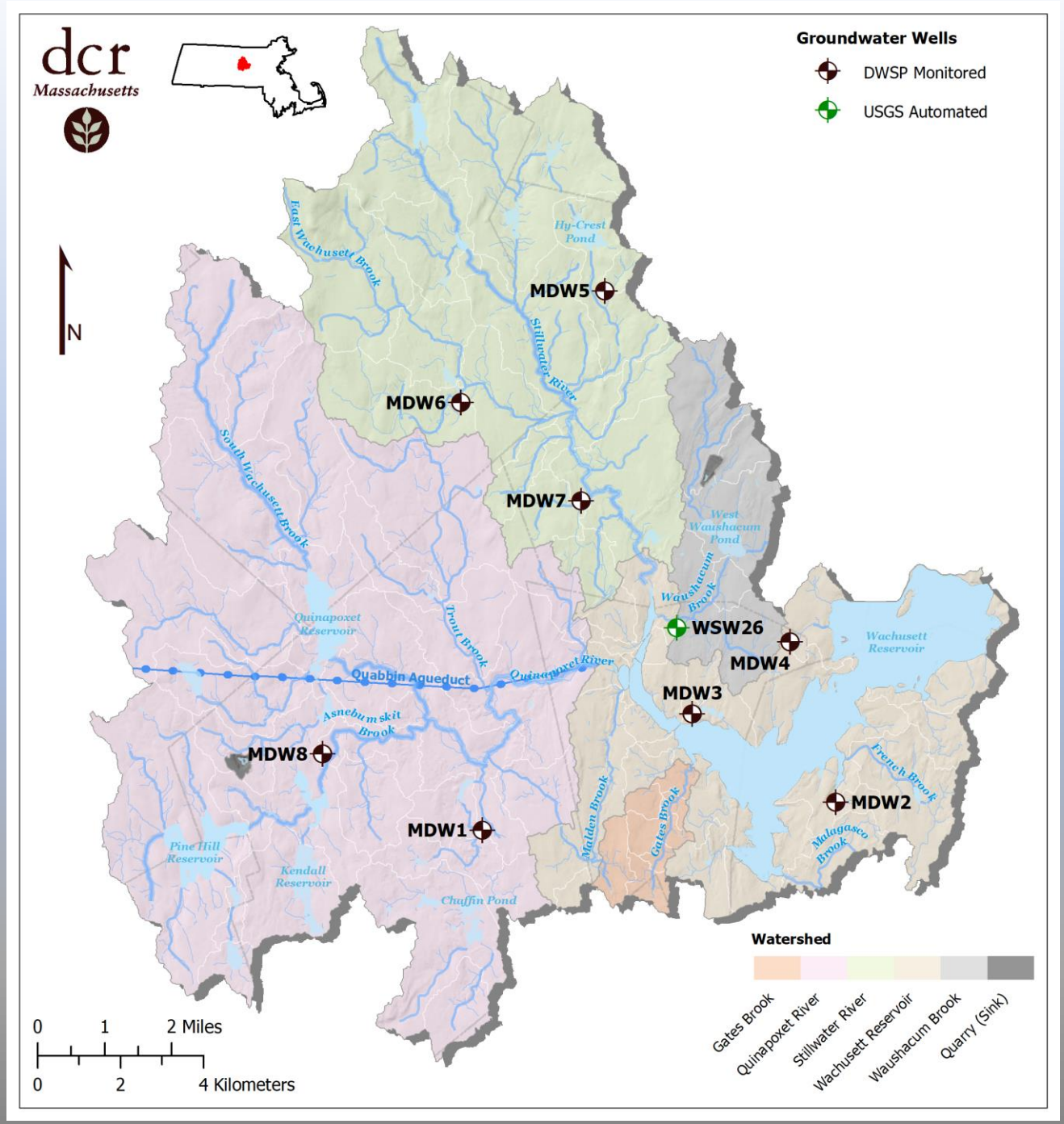


3,000 African elephants (average weight 6 tons)

Improve Data Collection

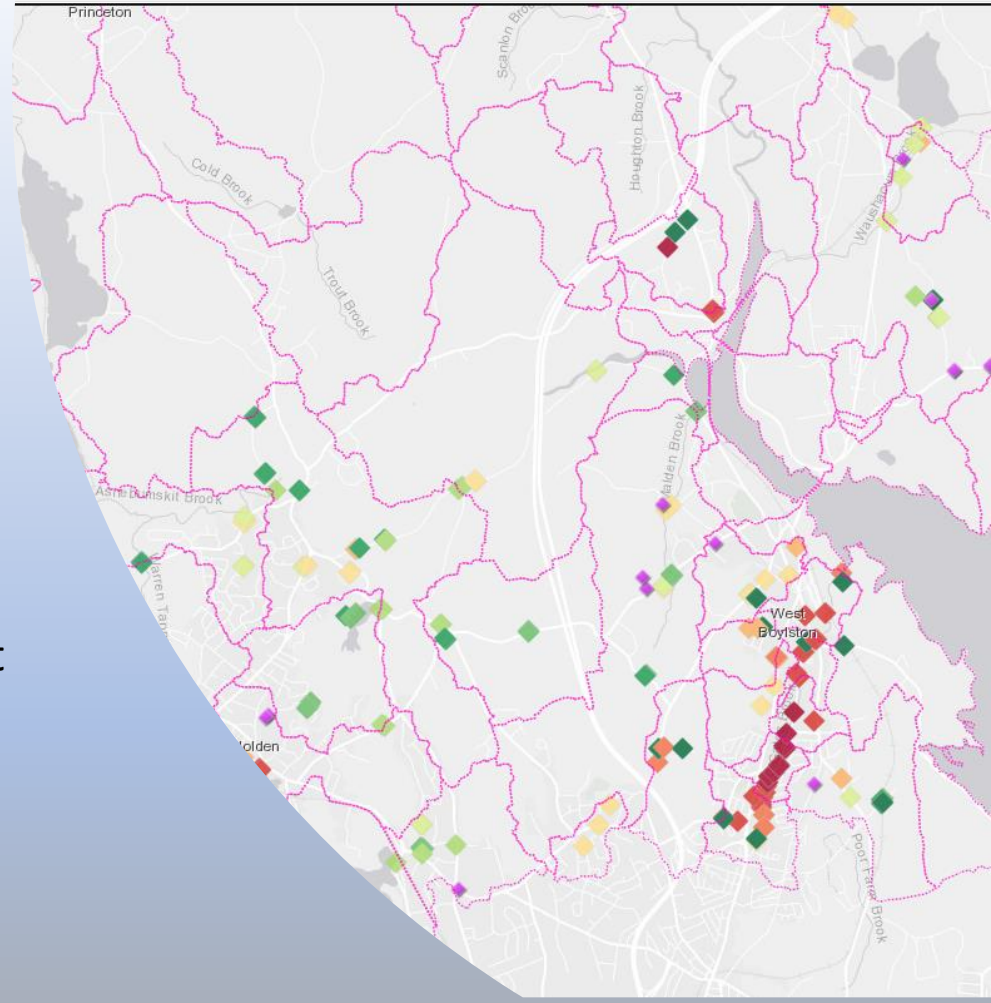
WATWEL Groundwater Monitoring Project (2019-present):

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

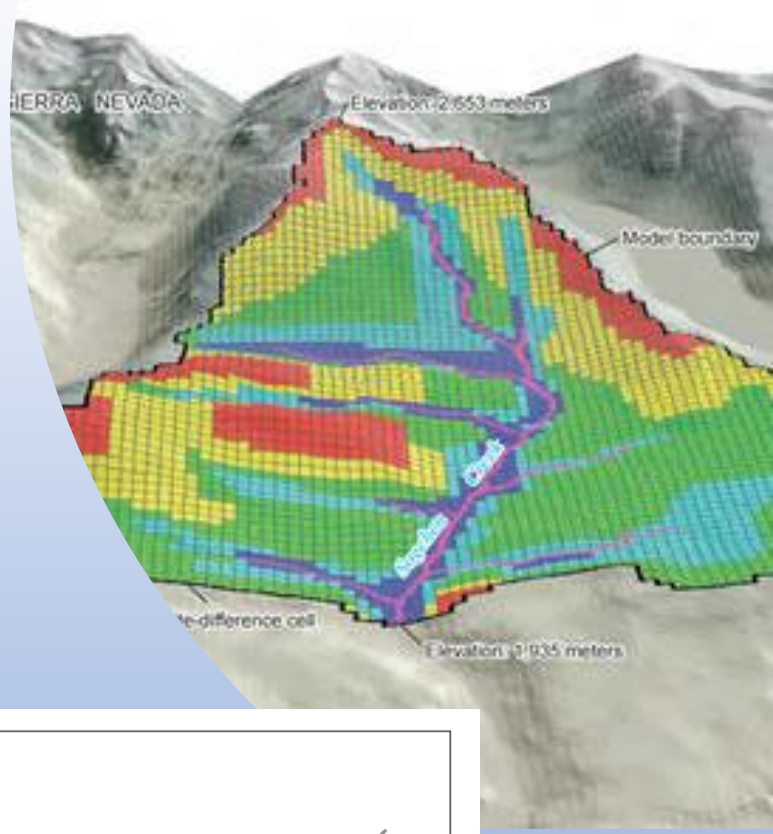


Improve Data Collection

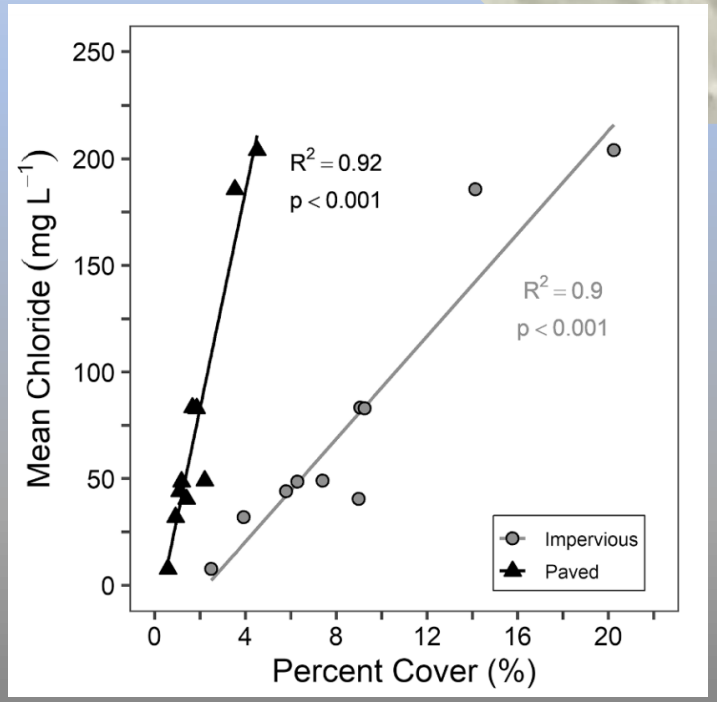
- Conductivity “Blitz” in 2022 and 2023
- Goal: Improve spatial understanding of chloride concentrations throughout the watershed so that hot spots can be identified, and salt reduction measures can be geographically targeted.



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

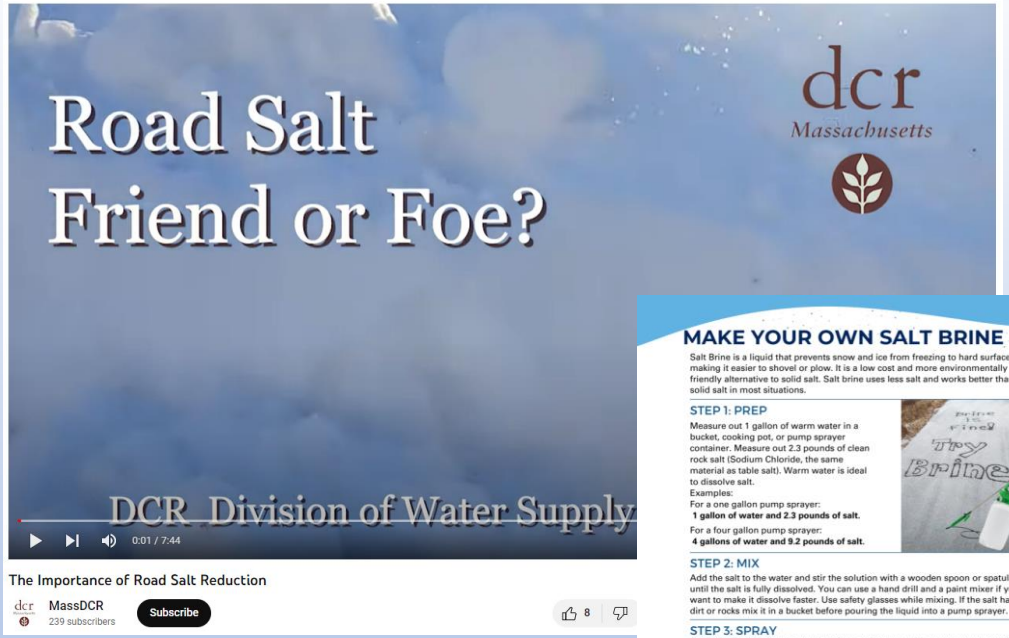
Training

- 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"

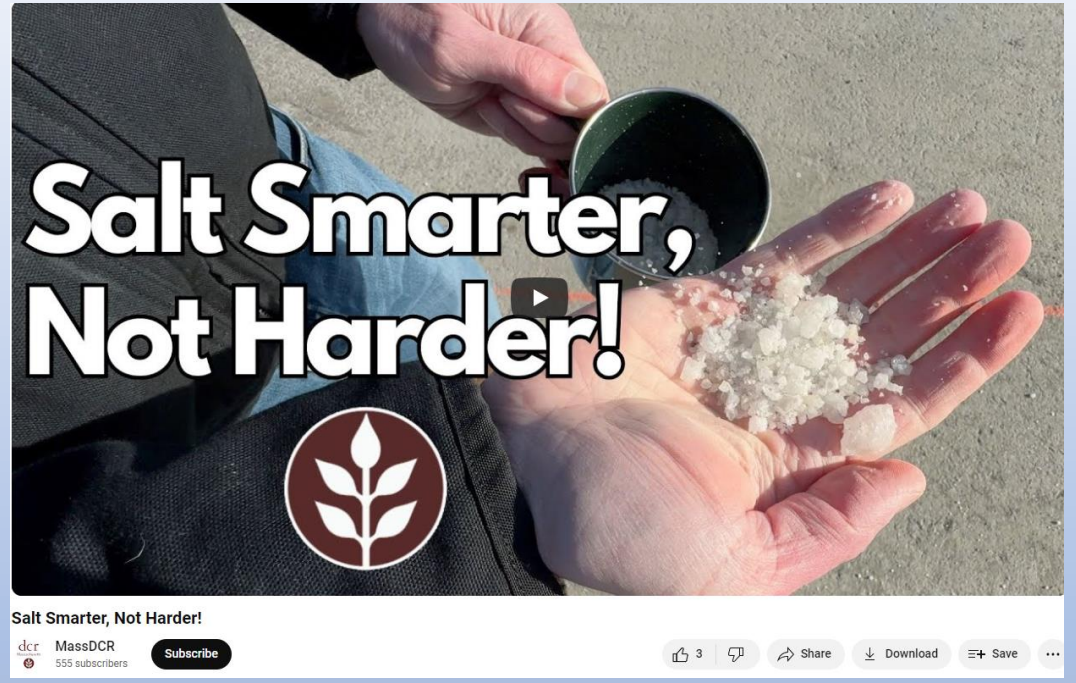
Public Outreach

- 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.



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

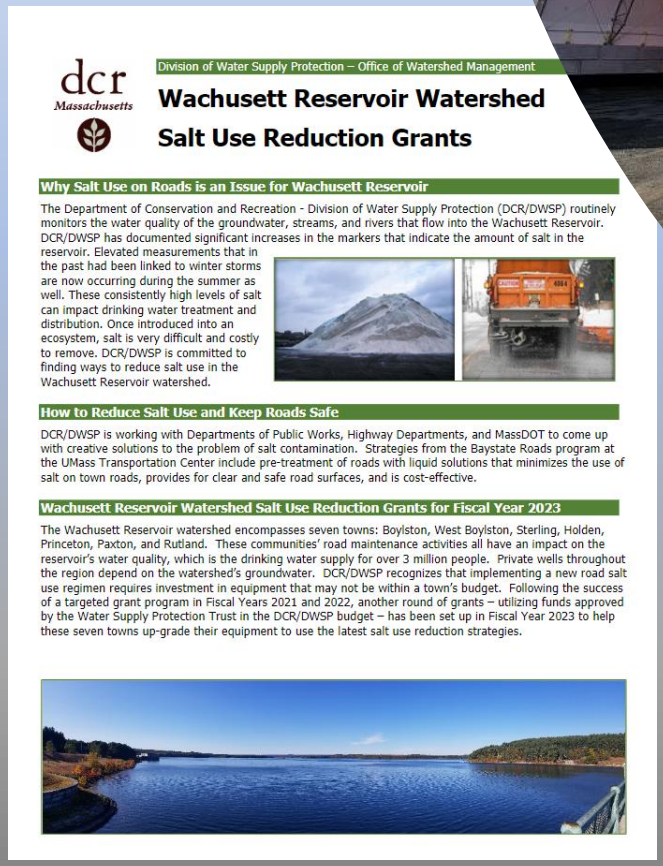
Henry Schwan
Worcester Telegram & Gazette
View Comments

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.



dcr Massachusetts

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.

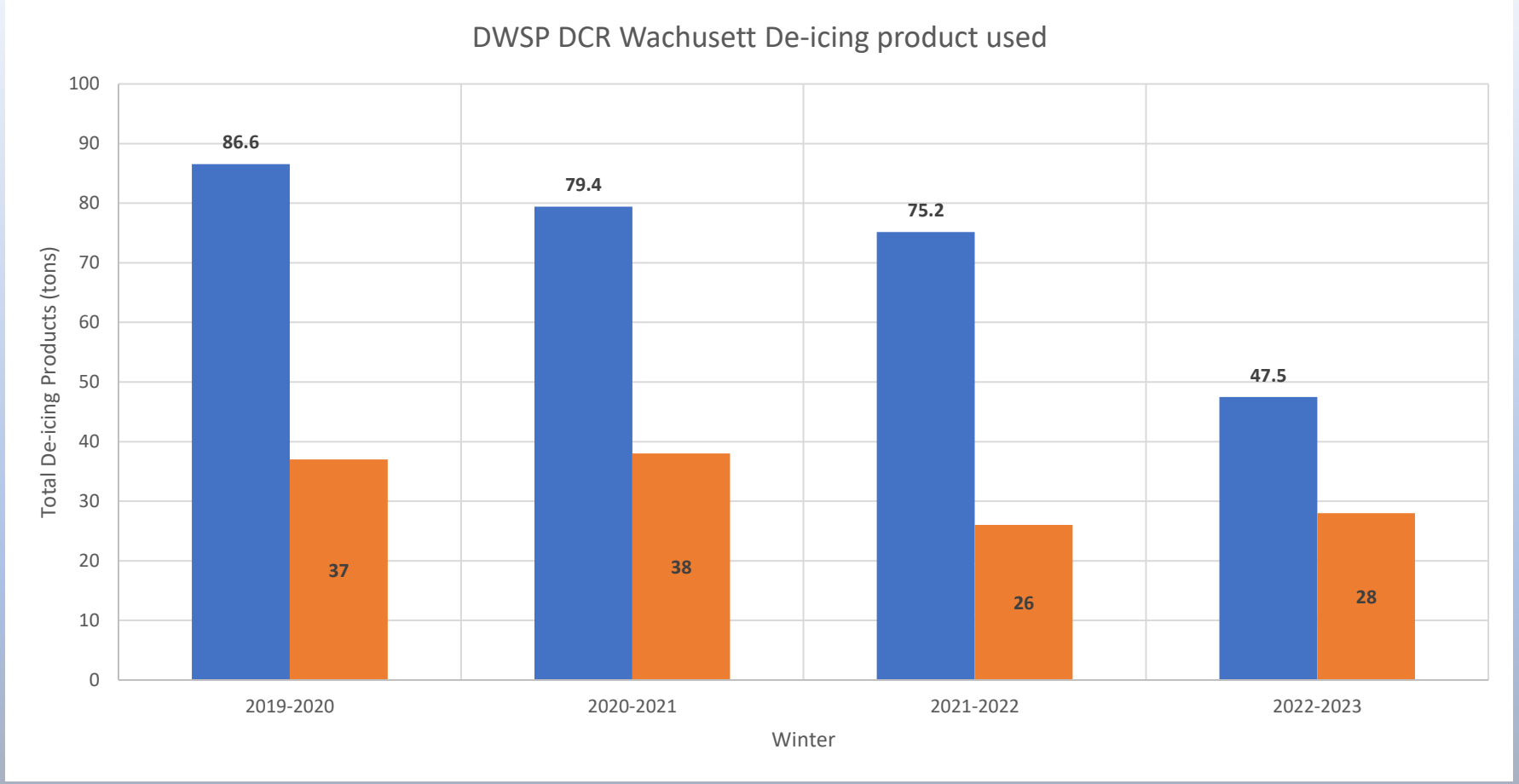
Wachusett Reservoir Watershed Salt Use Reduction Grants for Fiscal Year 2023

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

jamie.carr@mass.gov

dcr
Massachusetts