

# Road Salt TMDLs and Road Salt Reduction Strategies in New Hampshire

*OR: Chloride Impairments and The 5 Stages of Grief*

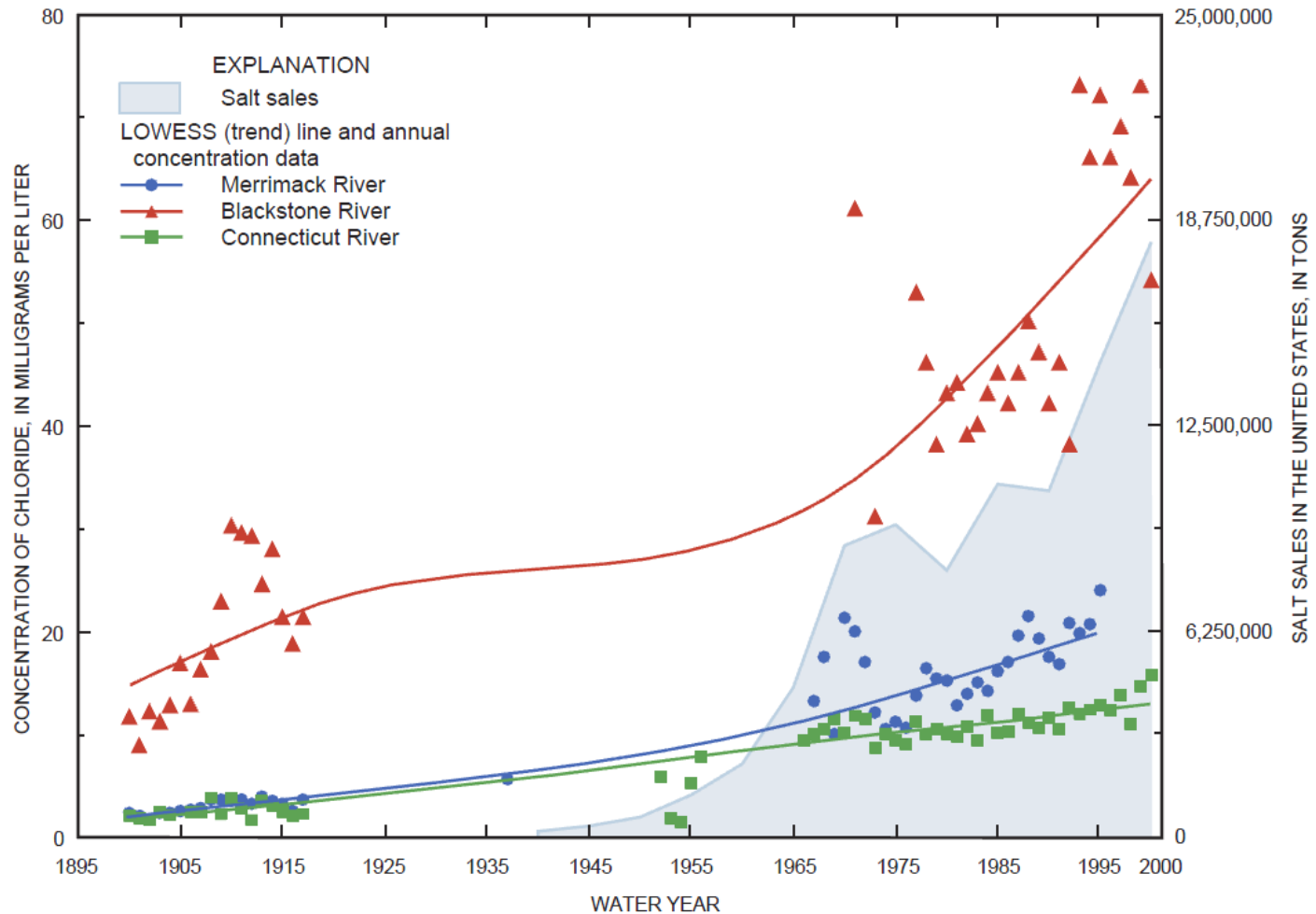
EPA Webinar, January 31, 2013

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# History of US road salt sales and chloride concentrations in New England



**Figure 8.** Trends in annual chloride concentrations in the Merrimack, Blackstone, and Connecticut Rivers from 1900-2000, and annual amount of salt sold for highway de-icing in the United States from 1940-2000 (Annual salt sales data from the Salt Institute, 2001).

Source :Robinson et al. 2003 USGS WRI Report 03-4012

# Scope of Chloride Problem in NH

- The first state to use salt for regular winter road maintenance (1941-42)
- Salt use has nearly doubled in the past 40 years (to about 190,000 tons/year, or 21.5 tons/lane mile)
- Chloride impairments are on the rise (18 in 2008, 40 in 2010)
- Background levels have increased 100x in some areas

# Road Salt Pollution

- Toxic to fish, invertebrates and other species
  - EPA Acute toxicity (kills fish quickly) = 860 mg Cl/L
  - EPA Chronic toxicity (kills fish slowly) = 230 mg Cl/L
- Contaminates drinking water
  - EPA Secondary Maximum Contaminant Level (MCL) based on taste - 250 mg/L of Na or Cl
  - Associated with high blood pressure - EPA advisory limit 20 mg Na/L
- Destroys vegetation and corrodes vehicles
- No way to remove NaCl once applied
  - Not removed by plants and does not stick to soils
  - Desalinization is EXPENSIVE and impractical (high energy)

# I-93 Expansion



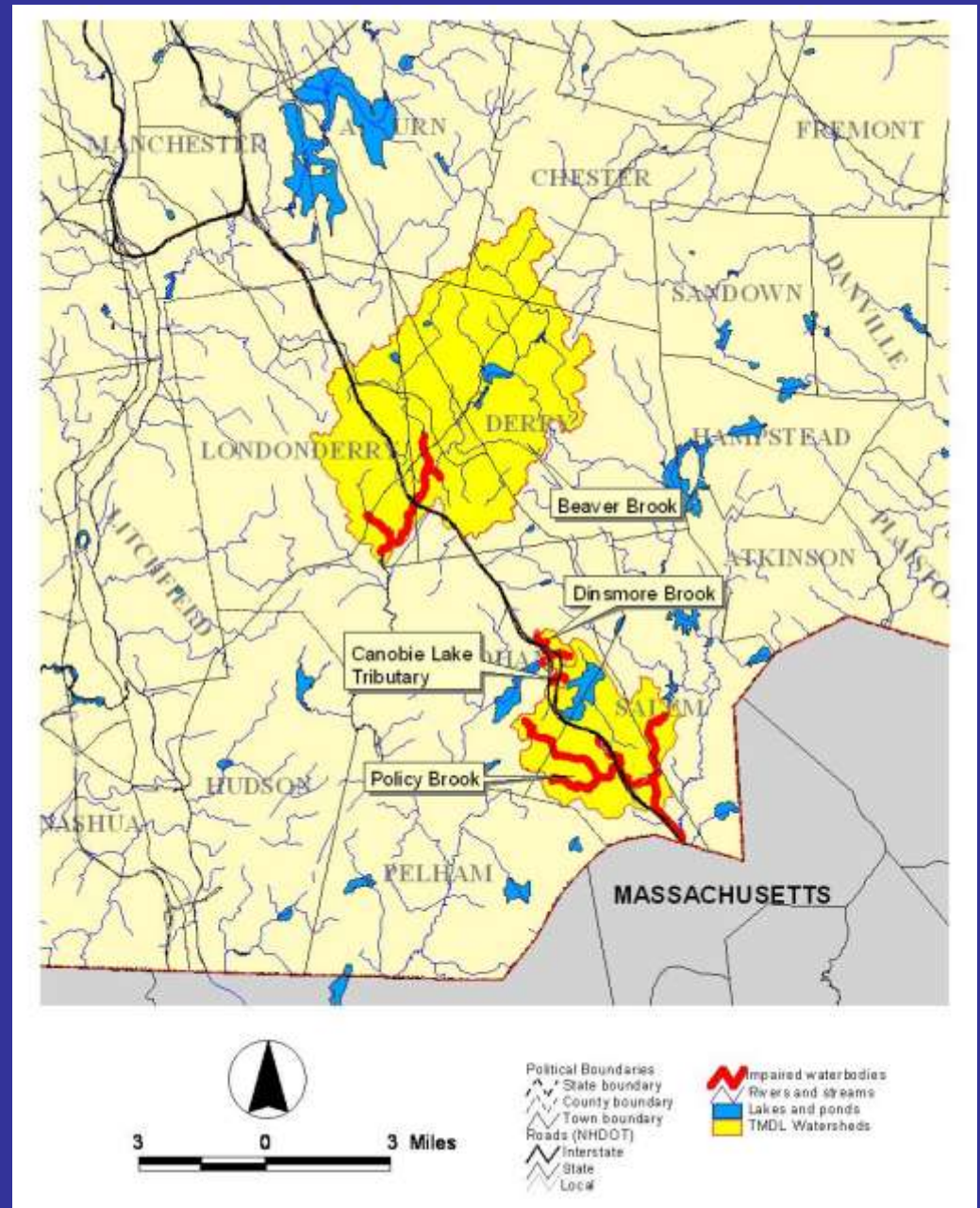
# Water Quality Timeline

- In 2002-2006, monitoring by DES, DOT, and EPA detected violations of the water quality standard for chlorides in 4 watersheds
- In 2006-2007, DES collected data on and prepared TMDLs for road salt for each watershed
- In 2008-2012, DES monitored chlorides to track effects of salt reductions



# I-93 TMDL Watersheds

Town	Population
Derry	34,318
Salem	29,640
Londonderry	24,729
Windham	12,993



# Policy Brook





# Water Quality Data from FY07

## Key Facts

Average chloride conc. = 163 mg/L  
Days of WQS violation = 87.7  
Percent of year in violation = 24%  
Total Cl exported = 1,563 tons/yr  
Total salt exported = 2,576 tons/yr

mg Cl/L

1000

800

600

400

200

0

07/01/06

08/01/06

09/01/06

10/02/06

11/02/06

12/03/06

01/03/07

02/03/07

03/06/07

04/06/07

05/07/07

06/07/07

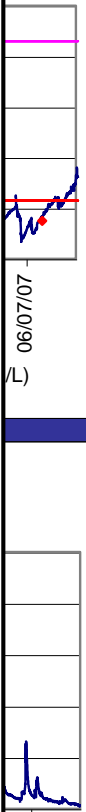
Chronic Standard (230 mg/L)

Date

Acute Standard (860 mg/L)

Date

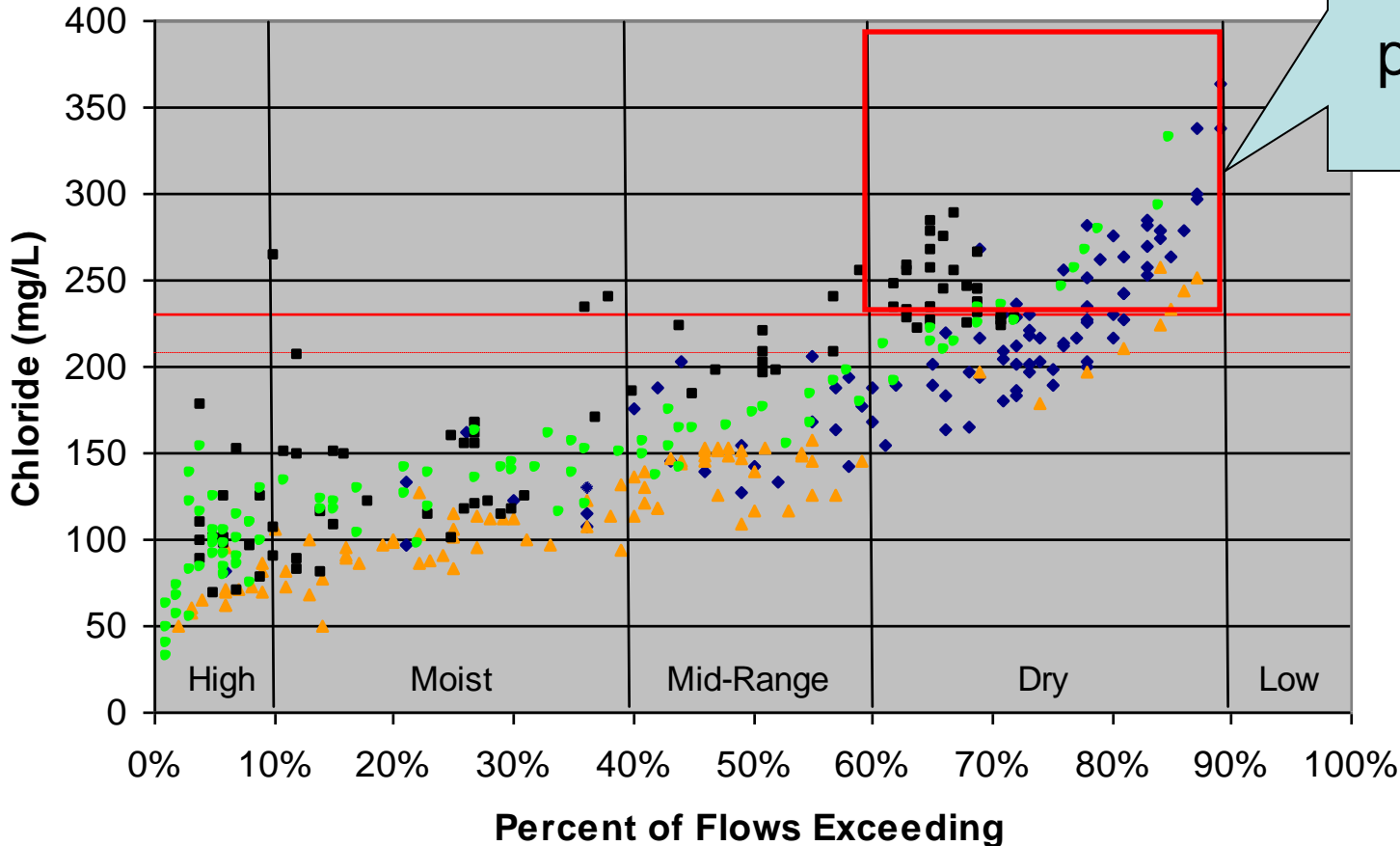
Measurements



06/07/07

# Salty in All Seasons

Daily Average Chloride Concentrations



Key Fact  
WQS violations occur during periods of low stream flow

# Sources of Salt

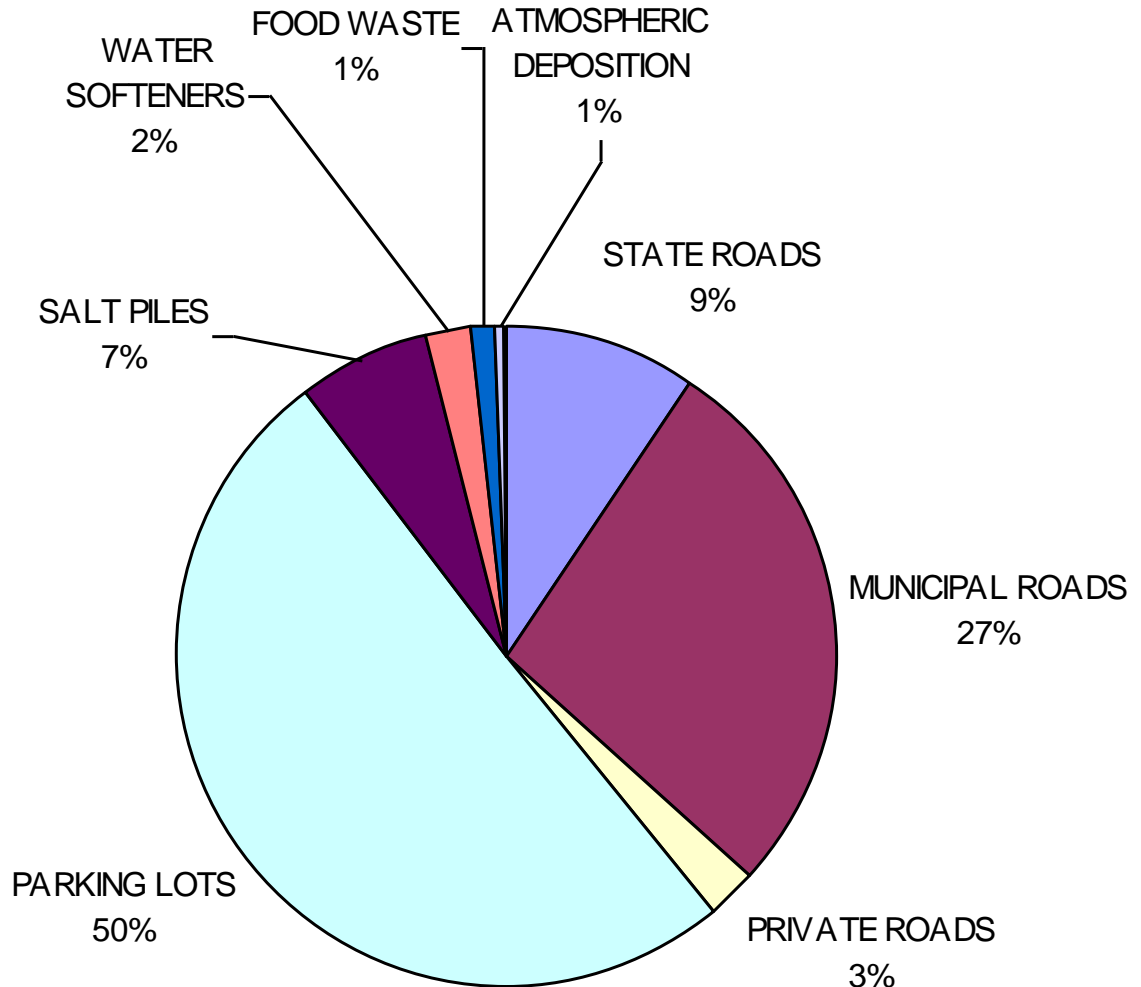
## Key Facts

Total imports:  
4,814 tons/yr

Imports divided by  
drainage area:  
473 tons/sq.mi.

Deicing accounts  
for 89% of total

Salt piles account  
for 7% of total



# Allocation of Loads

- Combine salt imports with percent reduction goal to estimate total allocation
- Calculate DRAFT allocations by sector

Source	FY07 Salt Imports (tons salt/yr)	Allocation of Loads (tons salt/yr)	Percent Reduction
State Roads	456.1	364.7 (10.9 tons/lm/yr)	20.0%
Municipal Roads	1,305.7	1,044.1 (9.0 tons/lm/yr)	20.0%
Private Roads	124.9	99.9 (6.6 tons/lm/yr)	20.0%
Parking Lots	2,426.4	1,940.3 (5.1 tons/ac/yr)	20.0%
Salt Piles	315.2	0	100%
Water Softeners	101.8	101.8	0%
Food Waste	52.3	52.3	0%
Atmospheric Deposition	31.9	31.9	0%
Total	4,814.3	3,635.0	24.5%

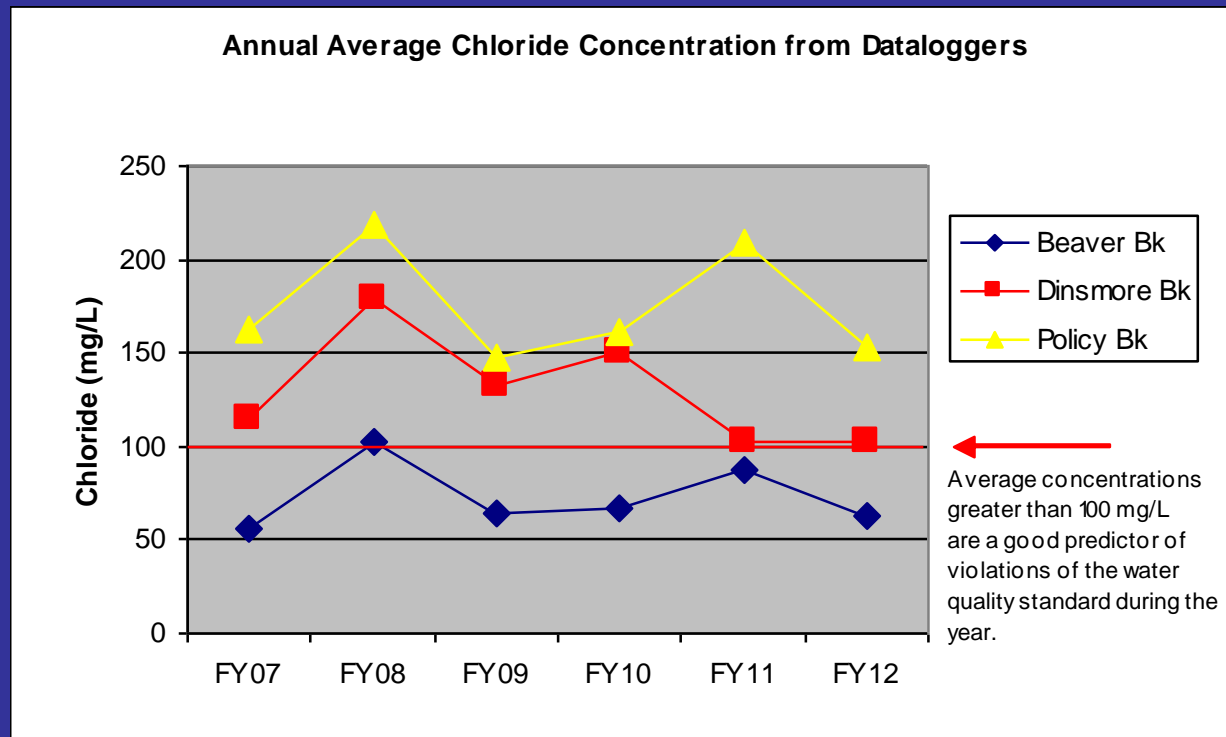
# I-93 Chloride TMDL Implementation Monitoring Plan

- Dataloggers deployed in watersheds year round
- Chloride measured every 15 minutes
- Calibration checks every 6 weeks
- Yearly updates to Winter Severity Index
- Follows an approved QA Project Plan

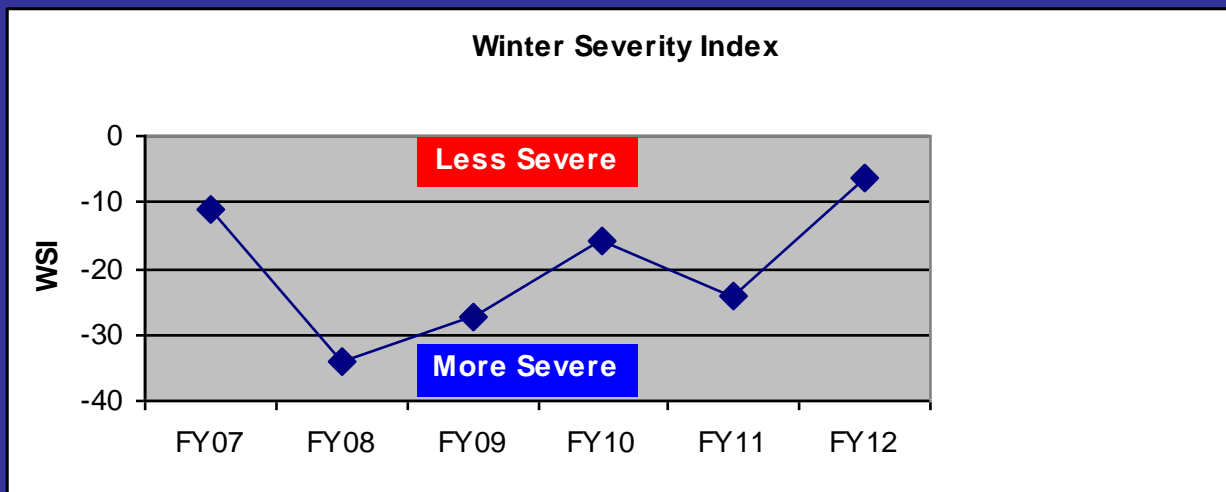


# FY07-FY12 Trend Results

- Annual average chloride concentrations at each station

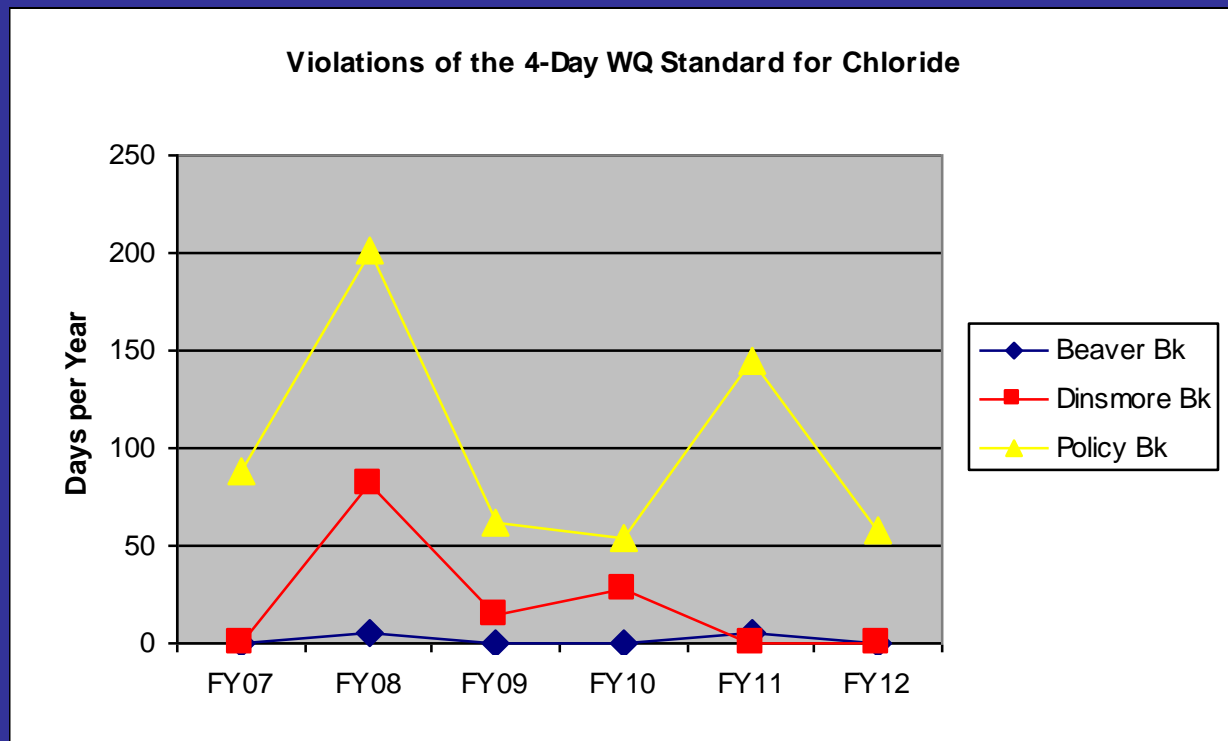


- Winter Severity Index

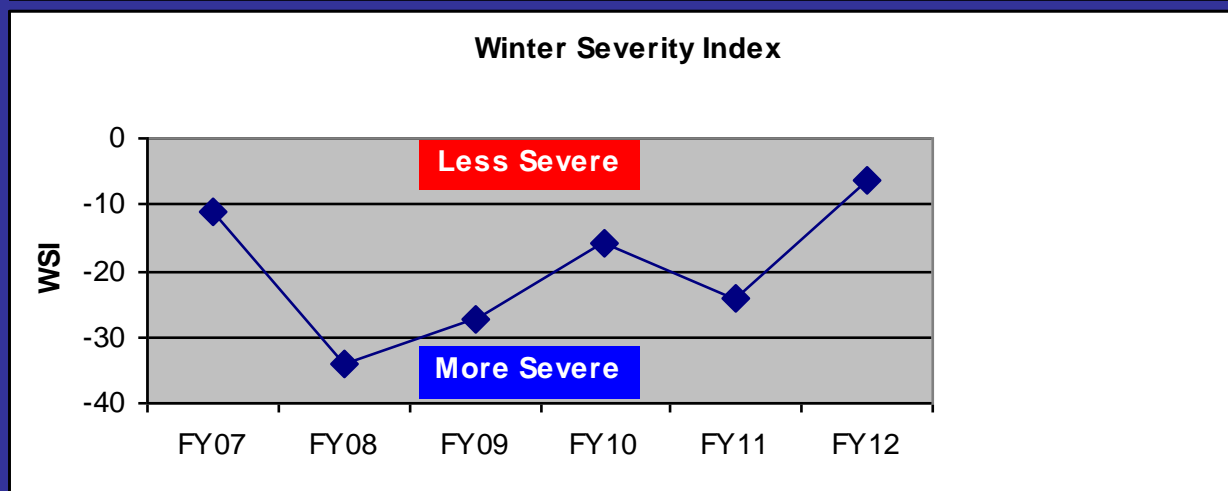


# FY07-FY12 Trend Results

- Number of days per year with violations of the 4-day water quality standard at each station



- Winter Severity Index



# FY07-FY12 Trend Results

- Continued sampling supports the hypothesis from Trowbridge et al. (2010) that annual average chloride concentrations greater than 100 mg/L are a good predictor of violations of the 4-day average water quality quality standard.

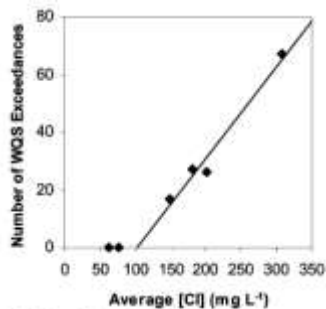
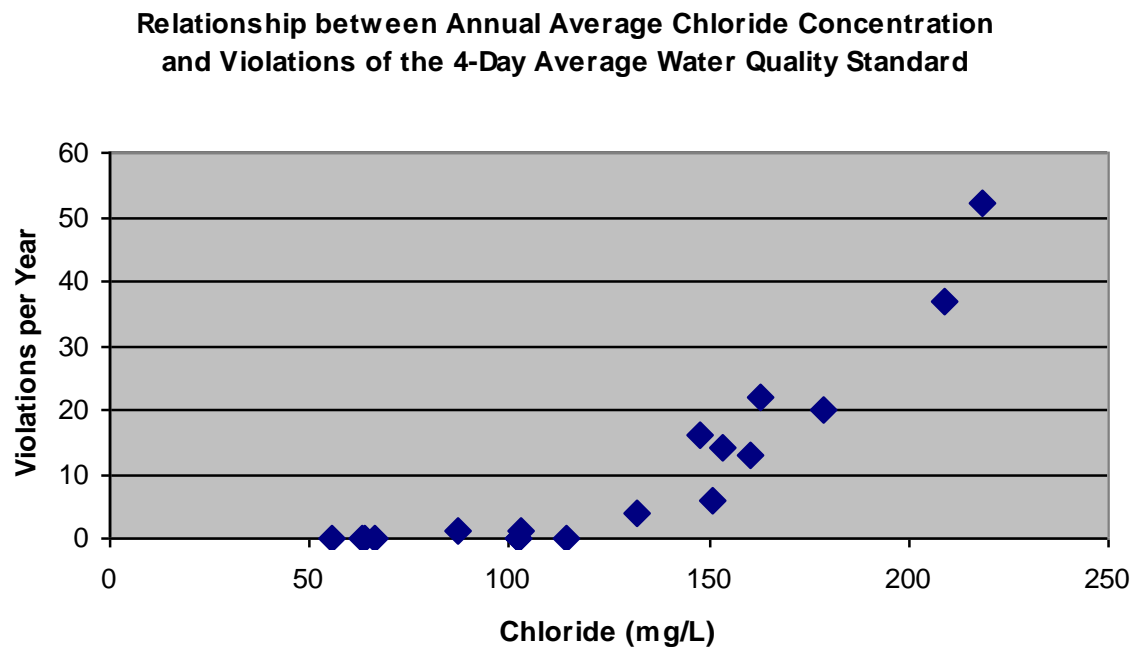
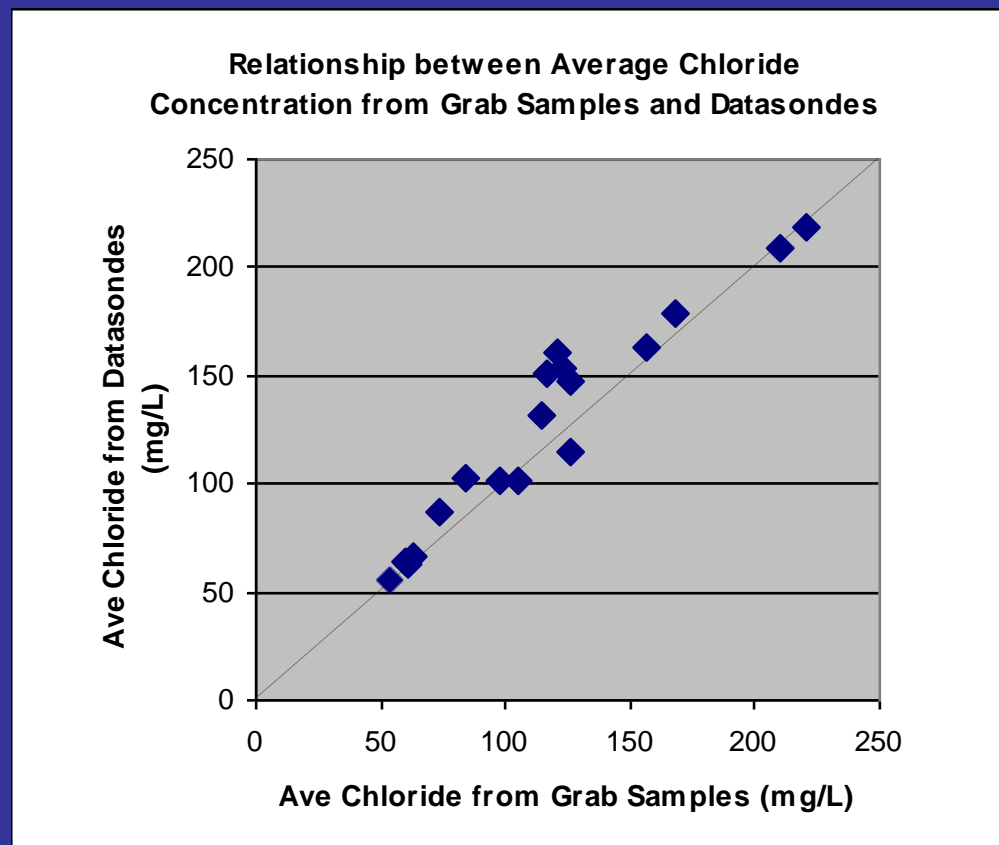


FIGURE 4. Relationship between annual average chloride concentrations in mg Cl L<sup>-1</sup> and the number of exceedances of the chronic water quality standard during a year in the six study watersheds. The line is the regression of the four points with documented exceedances (number of exceedances =  $0.317 * [Cl] - 32.37$ ,  $n = 4$ ,  $r^2 = 0.96$ ,  $p < 0.05$ ).



# FY07-FY12 Trend Results

- Continued sampling supports the hypothesis that monthly grab samples can reasonably predict annual average chloride concentrations.





# Salt Reduction Strategies

How do you break through?



# Chloride Impairments and the Five Stages of Grief



# Denial

There's no salt problem! We're saving lives here.



# Anger

I'm not putting  
drivers in danger  
just to save a fish!



# Bargaining

Please God, if you make these tree huggers go away  
I'll never take out another mail box...



# Depression

It's too much. I can't  
control the weather  
...and the voters  
... and the guy in the  
penny loafers doing 75  
in his Porsche during a  
blizzard...





# Acceptance

I have to use less salt.



# Acceptance +

I CAN use less salt and still  
keep the roads safe.



# Audiences



**DOT**



**Towns**

**Parking Lots**



# BMPs



**Anti-icing (mostly DOT)**



**Pre-wetting salt**



**Calibration**



**Training**



# Early BMPs



Underbody Plow



Calibrated Spreader

# Classroom Training



# Hands-on Training





# Salt Accounting

www.roadsalt.unh.edu/Salt/

The screenshot shows a web browser window titled "Salt Management System - Mozilla Firefox". The address bar displays "www.roadsalt.unh.edu/Salt/". The page header includes the NHDES logo and the text "Salt Management System" and "New Hampshire Salt Management System". Navigation links for "Home", "About", "Help", and "Sign In" are visible in the top right.

The main content area features two primary action cards:

- Track Annual Salt Usage:** Represented by a calendar icon with the number "30". Below the icon, it lists "Record annual salt use" and "Report on annual salt use".
- Log Book:** Represented by a clipboard icon with a pencil. Below the icon, it lists "Store and track clients", "Record client services", and "Track total annual services".

To the right of these cards are two green buttons: "Get Started" and "Sign In".

At the bottom of the page, a footer contains the text: "SALT MANAGEMENT SYSTEM 1.0.0 - COPYRIGHT © 2010 MPOWER TECHNOLOGIES, INC. - PRIVACY POLICY". The Windows taskbar at the very bottom shows the Start button, system tray icons, and several open application windows including "Inbox - Micro...", "Windows...", "Salt Manage...", and "20130117 EP...". The system clock shows "3:53 PM".

# MS4 Permit Requirements

Draft EPA permit requires towns to manage private salt application

## Proposed NH Legislation

HB 523 would create a voluntary certification program for salt applicators and provide limited liability

# Messaging



# More Messaging



Doug Heath, USEPA, Boston, MA

Concept: Barbara McMillan

TMDLs that have been approved and the underlying data reports:

<http://des.nh.gov/organization/divisions/water/wmb/tmdl/categories/publications.htm>