Road Salt Impacts – A Sleeping Giant

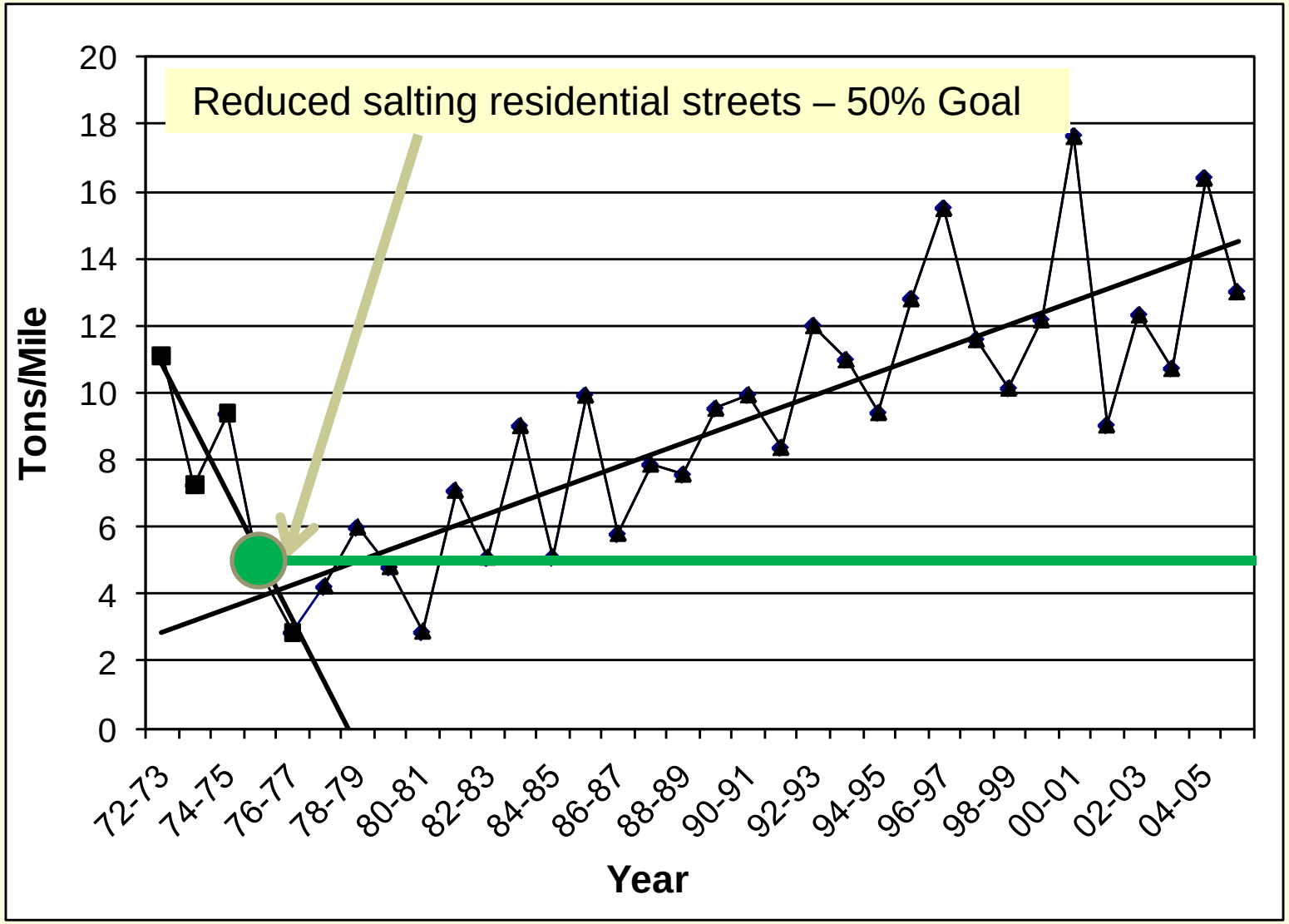
(Sept 23,2014)

Roger Bannerman
USGS

Reduce Salt Use By 50% - Limited Salt on Residential Streets. Extend to Entire City in 1977

Lake Wingra – 6 sq. mi. Watershed

Salt Use Per Mile of Maintained Street in Madison, Wisconsin



Reasons for Growing Use of Road Salt

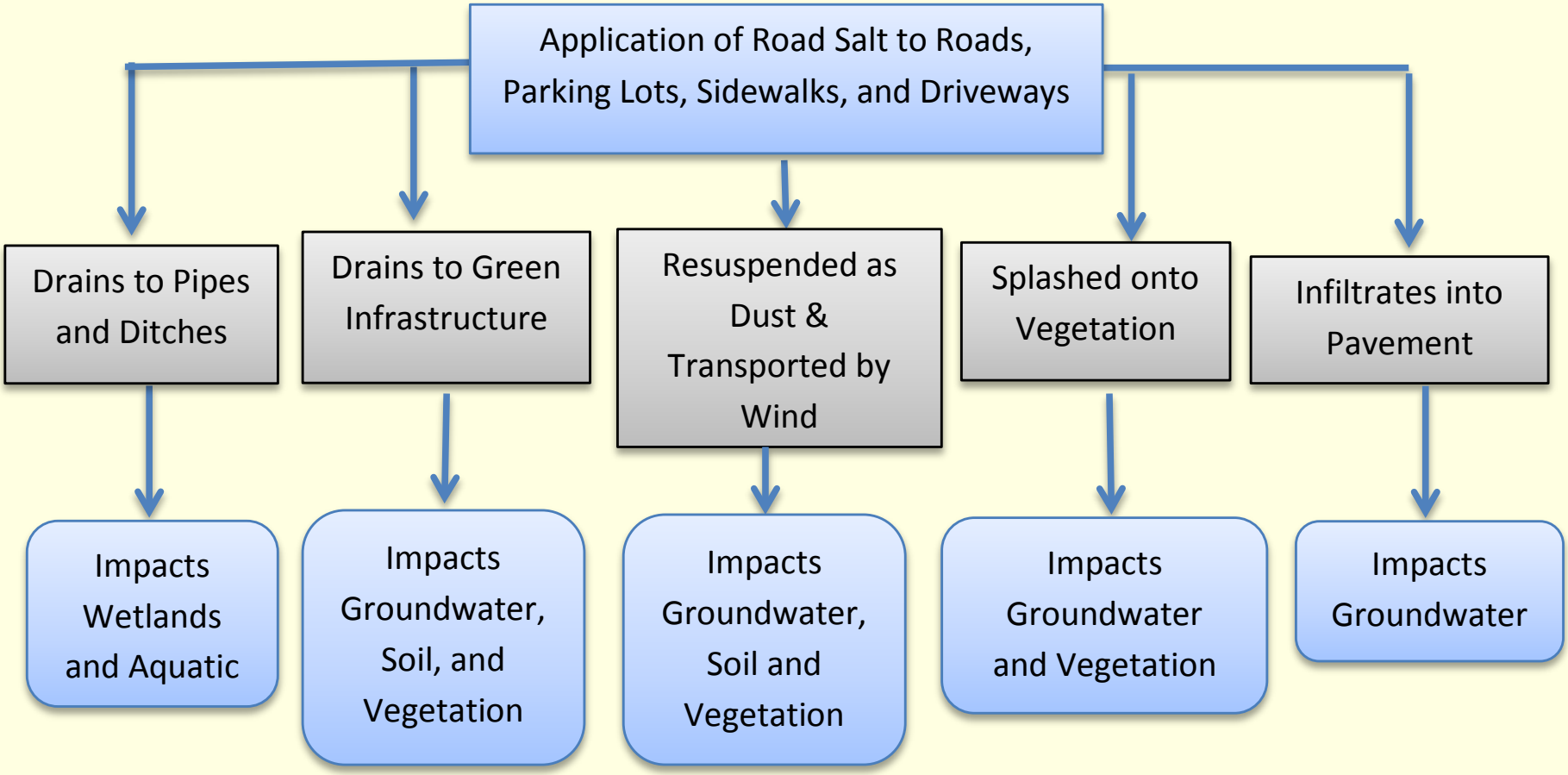
- ***Increase in ice and snow removal events – maybe***

- ***"Repeat applications spurred by the public's demand for bare pavement have fueled this increase. Undoubtedly, the public's expectations for clear roadways must be lowered if any salt reduction goal is to be met."*** (1)

- **"Over time, our level of service has probably crept up," Michael Sproul said (DOT). But he said road departments are under pressure from motorists who demand that highways be free of snow and ice.**

1) Road Salt Report – 2008-09
Prepared by Rick Wenta, Kirsti Sorsa, Glenn Hyland, and Tommye Schneider, Public Health
Madison – Dane County
2 February 2010

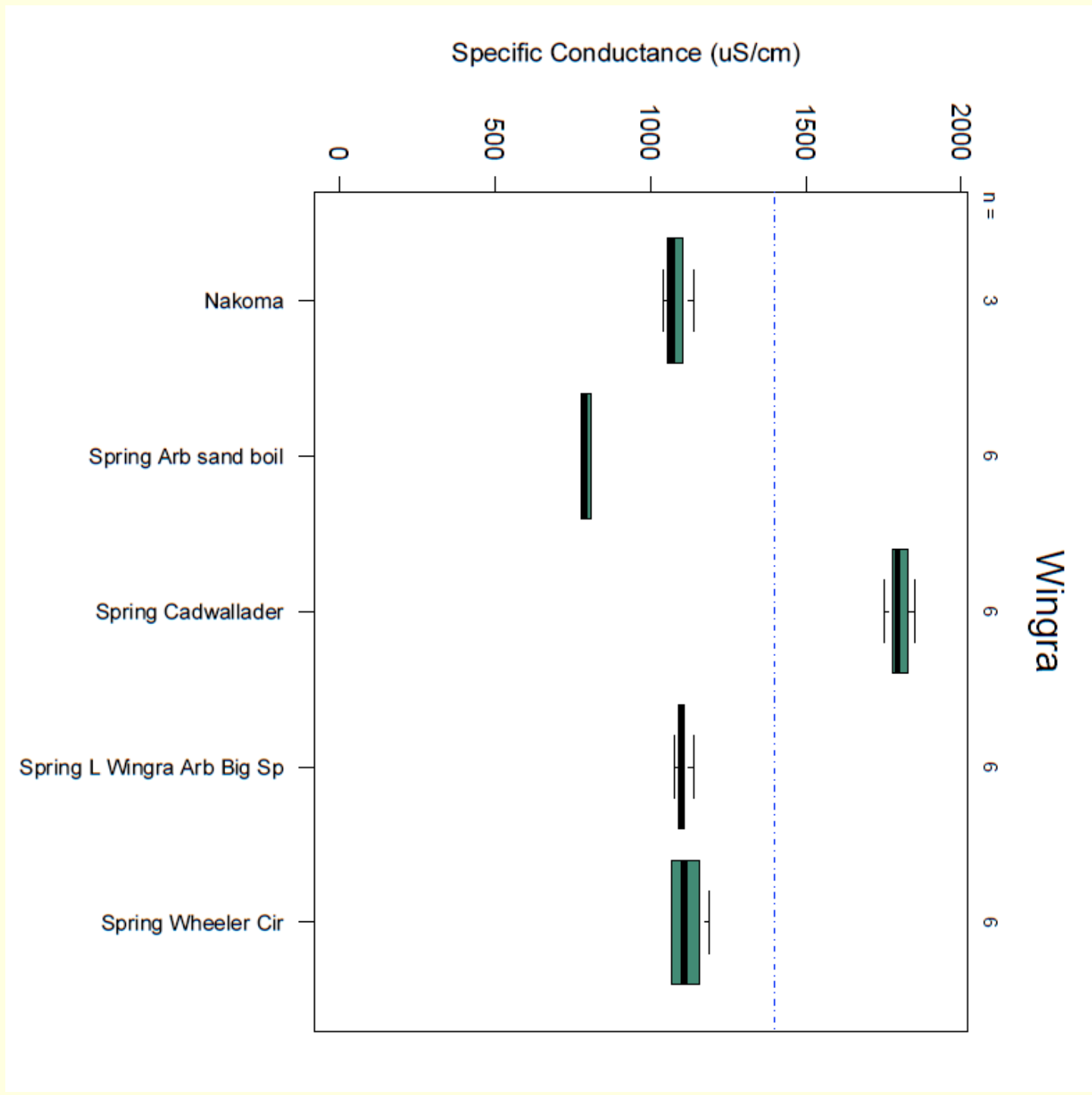
Fate of Road Salt




Lake Wingra
Spring
Monitoring
Sites for
Chloride - WAV

Big Springs:

Chloride – 100 mg/l
PAL – 125 mg/l


Specific Conductance (uS/cm)
0
500
1000
1500
2000
n =
Nakoma
3
Spring Arb sand boil
6
Spring Cadwallader
6
Spring L Wingra Arb Big Sp
6
Spring Wheeler Cir
6
Wingra

Estimates of Chloride Loads to Lake Wingra Using WAV and USGS Data

Annual GW Flow into Lake	Average Concentration of Chloride in Springs	Annual Chloride Load from Springs
39 x10^6 cubic feet	100 mg/l	122 Tons

A **Reasonable** First Step to Reduce Road Salt Use Is to Quantify the Different Sources and Pathways.

Friends of Lake Wingra

Goal for Chloride Concentration in Lake = 40 mg/l

Lake Wingra – 6 sq. mi. Watershed

Estimates of Amount of Salt Applied in an Average Year – 25.6 Events

Source	Lane Miles	Acres	Tons/Year	Contribution
Roads	177	--	1588	**37%**
Homes		67	189	**4%**
Commercial		216	2411	**56%**
ROW Sidewalk		49	145	**3%**
Totals			4333	**100%**

Private Applicators Use Almost the Same Amount of Salt on Parking Lots as the City uses on City Streets

Assumptions: 0.14 tons\acre x 3200 acres x 20 events = 9000 tons

Private applicators working in commercial/business/institutional/Multi-family residential land uses contribute 50 to 60% of Cl load to Lake Wingra each year – Strand and Associates.

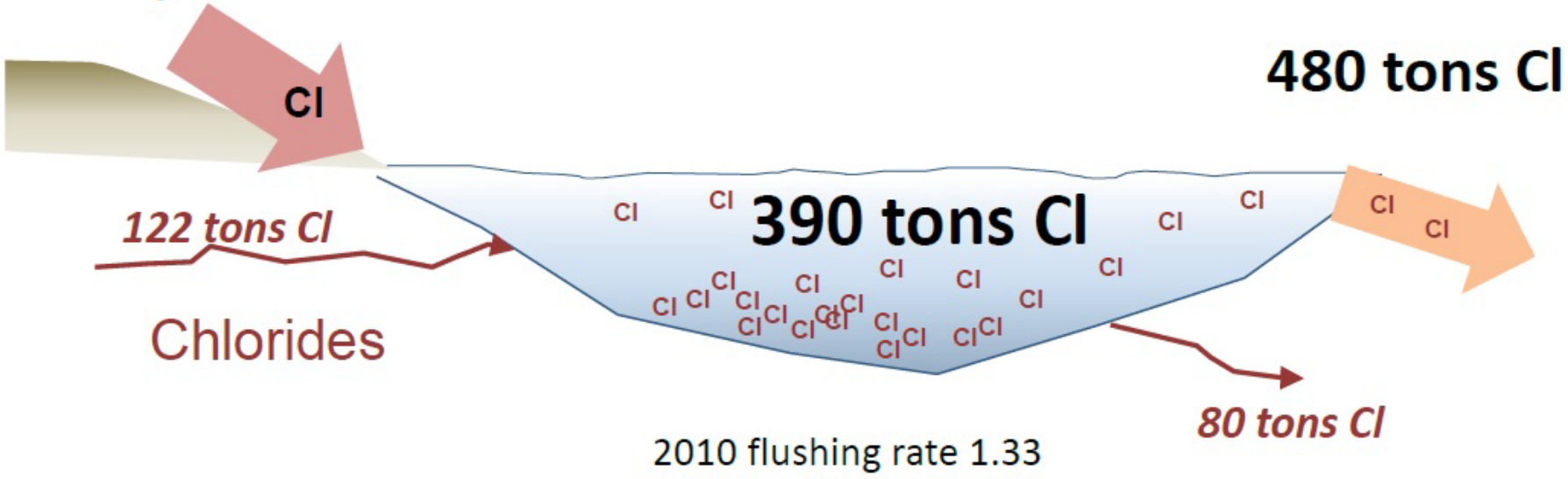
Road Salt

2010

Discrepancy in Delivery

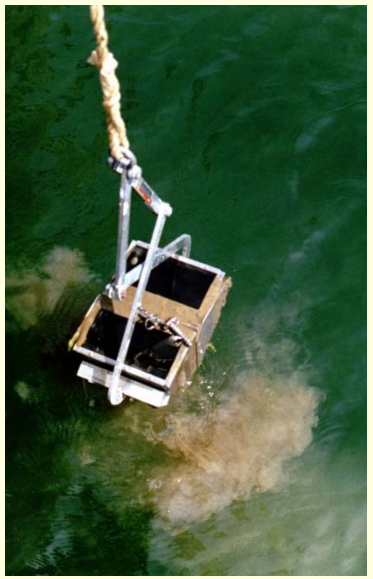
4342 tons salt

2,636 tons Cl

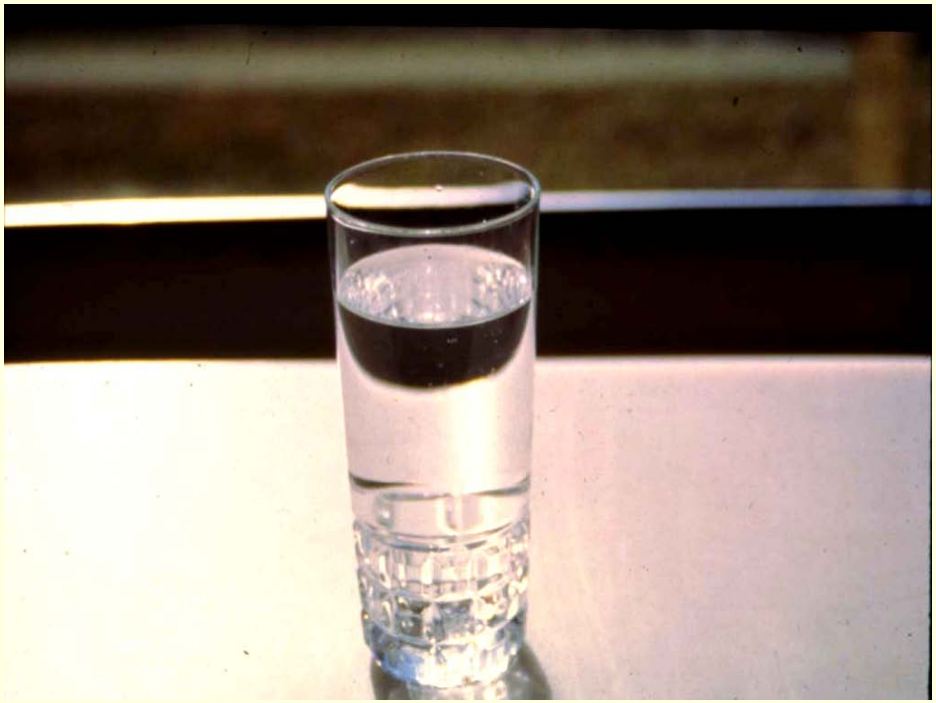


Clearly not all salt is getting to the lake

Where Does All the Chloride Go?



Estimate of 4,000 Tons of Cl in Groundwater Draining to Lake Wingra



“Madison’s groundwater resources continue to show increasing trends in sodium and chloride levels. Groundwater moves slowly, so by the time contamination is a concern, a large volume of water has been affected. Contaminant levels will persist long after remedial action has been taken.”

“In addition to the environmental impacts of increased salt use, taxpayer's pocketbooks will also be affected if new wells are needed to replace those with unsafe chloride levels. The Madison Water Utility estimate for the cost of installing a new municipal well is $3.25 million - a cost that would be born by all of us.” Madison COE

What is a **reasonable** first step to Reduce Road Salt Use Without Compromising Public Safety?

Report of the Salt Use Subcommittee to the Commission on the Environment on Road Salt Use and Recommendations - Completed December 11, 2006

- Expect Recommendations to Reduce Salt Use By About 20 to 30 Percent
- Salt Use Subcommittee Presented Findings to The Commission on the Environment.
- Present Findings to Other City Committees, Such As, Public Works and Water Utility Board.

Alternative De-icing Compounds – Most Have Higher Cost

Type	Temp Down To	Environment Concerns	Phosphorus Content
NaCl – Rock Salt	15 F	Lots	4 ppm
Calcium Chloride	-25 F	Very corrosive	
Magnesium Chloride	5 F	Less Toxic than CaCl, corrosive	13 ppm
Calcium Magnesium Acetate	22 to 25 F	Less Toxic, Bridge Deicing	
Beet Juice	- 25 F	Oxygen Demand	108 ppm
Sand	NA	Damage habitat	53 ppm
Corn Steep Residue	NA	Oxygen Demand	2000 ppm


Anti-icing Truck

Efficient Application Recommendations

- Install on-board infrared pavement\air temperature sensors on all vehicles.
- Increase number of vehicles with anti-icing (2 in county now).

- Implement GPS to track trucks.
- Create Task Force to review accuracy of weather forecasting – assistance from WisDOT and others.

Education and Motivation

1. **Create Task Force to develop county-wide:**

   a. Training for Plow Drivers

   b. Advisory alert program for weather and road conditions

2. **Utilize existing outreach channels to:**

   a. **Educate public**

   b. **Reach home owners**

   c. **Educate private applicators**

Fortin Consulting Inc. of Minnesota

Current City of Madison Actions

- Reduced salt content in sand
- Agreed to a demonstration project for using pre-wetting/anti-icing technology (brine)
- Hosted two training courses for private applicators
- Considering a certification program
- Added temperature probes in more vehicles
- New ordinance recently passed with intention to reduce road salt usage

Madison Salt Reduction Ordinance

- Reduce content of sand to 5%
- Consider installing on board temp sensors.
- Regulate private commercial application & require annual compliance reporting
- Conduct extensive monitoring
- Work with USGS to model future levels
- Consider having driver alert program
- Continue annual salt report
- Request Dane Cty do surveys & work with all cities.

Permeable Pavement Reduces Salt Use By 70%

Lots one-hour after plowing, -4*C (11AM on 2/3/07)

Robert Roseen, 2011

We Can Buy Some Time - But in the Longterm Need to Find Alternatives and Adjust Public Expectations

Beet Juice Added to Brine