A Preliminary Evaluation of Road Deicing Chemical Concentrations in North Idaho Streams Adjacent to Interstate 90 and Draining Fourth of July Pass

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Coeur d’Alene Lake Tributary WAG
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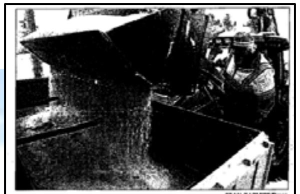
Discussion Topics

- Problem
- Background
- Study Area
- Project Findings
- Aquatic Life
- Conclusions

Problem

- Deicing chemical application is increasing in north Idaho and instream concentrations are unknown.



SEAN GARMIRE/Press

Judd Reed, Idaho Transportation Department foreman, mixes salt and water to make salt brine — a de-icing agent for roadways.

Pass the salt

Transportation officials turn to tried-and-true method to clear roads

By SEAN GARMIRE
Staff writer

COEUR d'ALENE — This winter, North Idaho roads will have a high-salt diet.

Salt brine, long noted for its ability to cut through ice and snow on slippery roadways, is a method that is old enough to be an antique. But Idaho transportation officials say it is not outmoded.

"We've found that salt just does a terrific job," said Barbara Babic, spokeswoman for the Idaho Transportation Department.

Magnesium chloride — an alternative de-icer — was purchased by ITD for years. Last winter, after some comparative testing of the two chemicals, workers found that salt melted the ice as well as any alternative.

"It's significantly cheaper too," Babic said. "We took it for a test run last winter, and really, the benefits in relation to the costs outweigh mag-chloride."

Last winter the state used 3,800 tons of magnesium chloride. At 74 cents a gallon, the daily de-ic... about 1,500 miles of North Id... roads cost $516,000 for the s...

Salt can be purchased in it... form for 12 cents per gallon, ... mixed with water to create b...

Brine is generally applied ... rate of 120 to 300 pounds per ... and averages 17,000 pounds ... every 113 miles.

Last year ITD purchased a ... small facility that mixes the ... water. The brining machine, ... is about the size of a small ca... produces a frothing solution ... is pumped into storage tanks ... and then transported around ... Panhandle.

This winter, consistent sto... have rapidly depleted salt sto... prompting ITD to spend mor... its typical allotment for salt.

see SA...

SPOKESMANREVIEW.COM

Wednesday, March 26, 2008

Slippery situation

Favored deicer getting tougher to find

CdA official pushing for salt brine maker

Meghann M. Cuniff
Staff writer
February 7, 2008

Deicer can be difficult to come by for Tim Martin.

The city of Coeur d'Alene's street superintendent often finds himself battling for magnesium chloride that always seems in short supply.

"When I need it, the city of Spokane needs 40,000 gallons," Martin said. The deicer is used by most cities across the Northwest. "We've had to wait up to two weeks to get material."

Idaho Transportation Department worker Judd Reed talks about the salt brine ...rates in Coeur ...brine is a cheap ...r deicing ...okesman-Review ...a The ...Review)

SPO Kw 2-21-08

Salt, deicer used on passes affecting birds

ASSOCIATED PRESS

STEVENS PASS, Wash. – The harsh winter pummeling Washington's mountain passes isn't easy for the birds either, it seems.

The road salt and deicer used on the state's roadways tend to disorient finches and other small, seed-eating birds that ingest them as they peck for grit. That, in turn, makes them roadkill when they're hit by snowplows and other vehicles.

Heather Murphy, a retired U.S. Forest Service wildlife biologist and consultant for the Wenatchee and Okanogan National Forest, said she noticed the problem while conducting bird studies for a Leavenworth volunteer birding group, the Upper Basin Birders.

Volunteers found three areas of dead finches last weekend on U.S. Highway 2, a half-mile west of the Stevens Pass summit. Murphy said they found fewer than a dozen birds at each site, although greater numbers were reported earlier in the winter.

The problem is unusual but quite severe this year, especially along U.S. 2 near Stevens Pass and Interstate 90 near Snoqualmie Pass, said Dan Stephens, a Wenatchee Valley College biology professor.

The finches are mainly attracted to the grit on and along the highway. In the process of picking up the grit needed to aid their digestion of seeds, they ingest salt and other deicer chemicals used to keep the roads free of ice, he said. The chemicals then cause disorientation and sluggishness.

The state Department of Transportation uses a liquid magnesium salt deicer as well as calcium chloride salt on mountain highways to control buildup of ice and snow.

The Transportation Department is aware of the bird problem, but isn't sure what can be done about it, said Kelly McAllister, a department biologist in Olympia.

McAllister said he's been studying the situation to try to understand why large numbers of birds are on the highway. He believes an unusually large number of finches – mainly the pine siskin, red crossbill, white-winged crossbill and Cassins finch – stayed in the area through the winter because of an abundant crop of pinecones this year. The finches feed on the seeds from the cones, but they need to also ingest small pebbles and grit to help break down the seeds in their gizzards before the seeds pass to their stomachs. The sand on the road is a good source of grit, especially in this particularly snowy year when there are few patches of bare ground to be found at higher elevations, he said. The state will continue to study the problem, McAllister said, but it's unknown what alternatives exist.

Roadside Vegetation

April 25, 2008

February, 2011

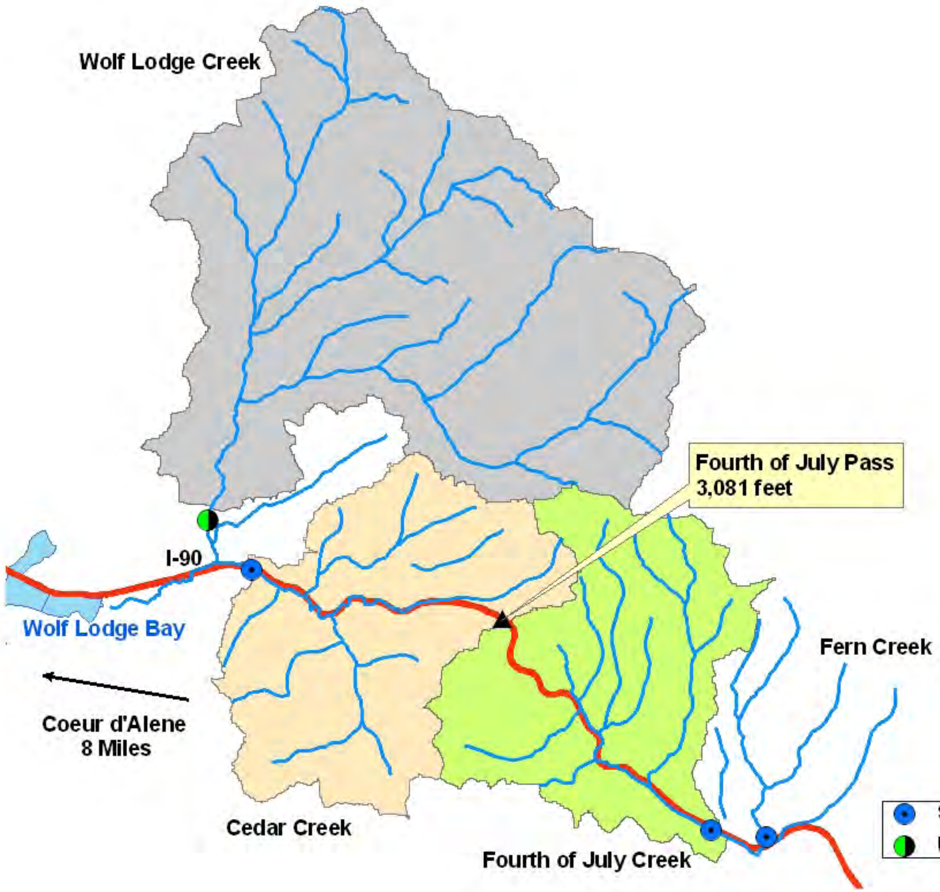
Improving Winter Driving

- 51% of world's salt produced is used for road deicing – annual US 15-20 million tons
- ITD began using NaCl in 2003 and has since expanded use to entire 5 county area
- Current the application rate of NaCl in north Idaho is 150-300 pounds per lane mile
  - Four lane per mile = 600-1,200 lbs/mile
- 30 salting events during a typical winter
- 80 salting events during winter 07/08

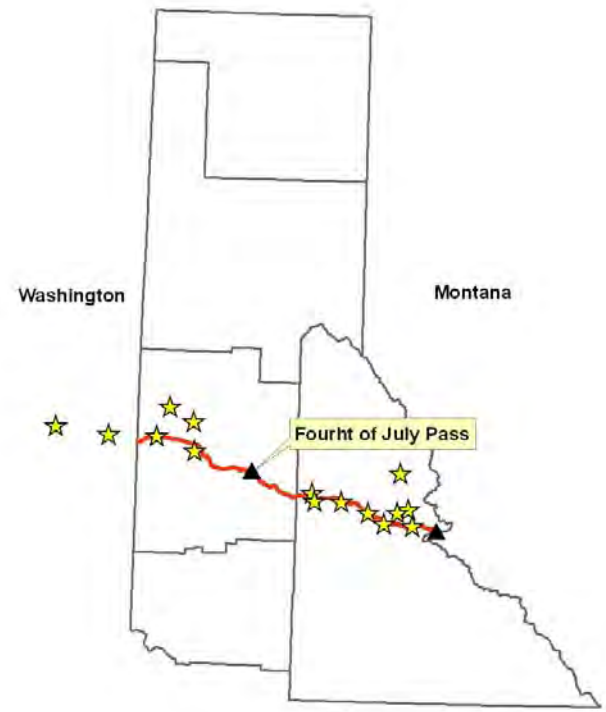
Improving Winter Driving

- Historically traction sand or sand/salt mix was used to improve traction
- Salt is more effective, longer lasting, and less expensive

Study Area



Wolf Lodge Creek
I-90
Wolf Lodge Bay
Coeur d'Alene
8 Miles
Cedar Creek
Fourth of July Pass
3,081 feet
Fern Creek
Fourth of July Creek
Sampling Locations
USGS Gauging Station



Washington
Montana
Fourht of July Pass

Project Scope

1. Determine if road deicing agents are transported to adjacent water bodies,

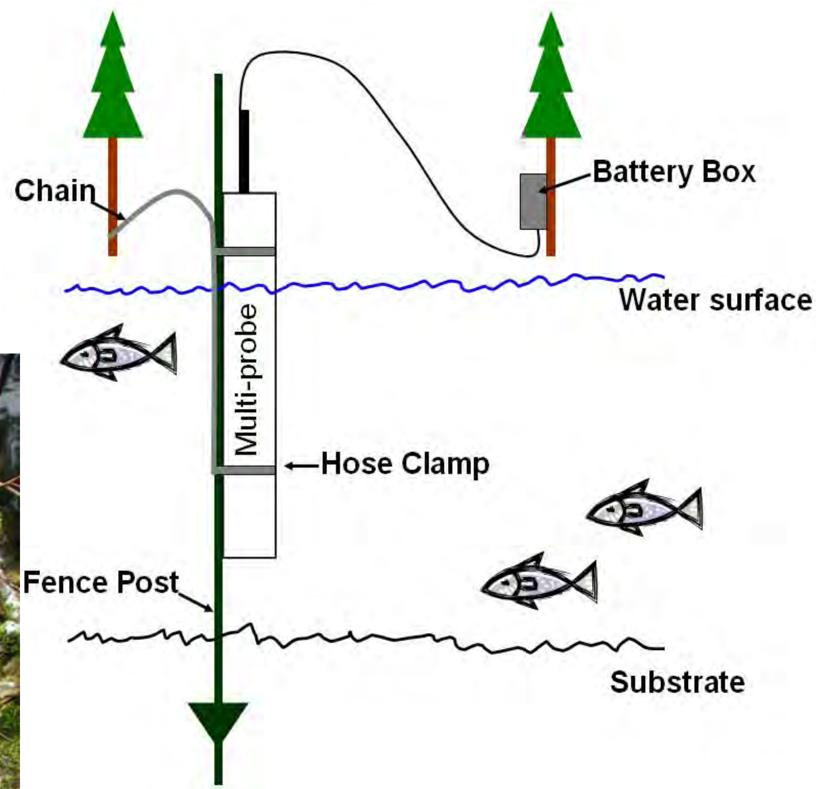
2. And if so what are the instream concentrations?

3. <u>Determine aquatic life tolerances…</u>

Monitoring Equipment

Cedar Creek
2008

Cedar Creek
2010-2011



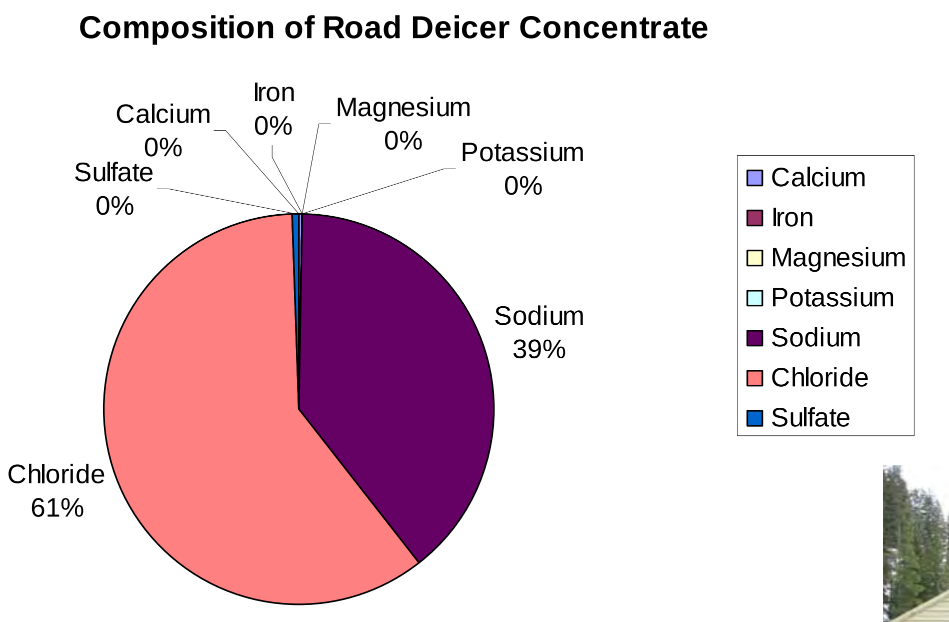
Common Deicing Chemicals

- Sodium Chloride*
- Magnesium Chloride*
- Calcium Chloride*
- Calcium Magnesium Acetate*
- Ammonium Sulfate
- Potassium Acetate
- Potassium Chloride
- Urea

•Approved by Pacific Northwest Snowfighters Association

http://www.wsdot.wa.gov/partners/pns/default.htm

Deicing Chemical

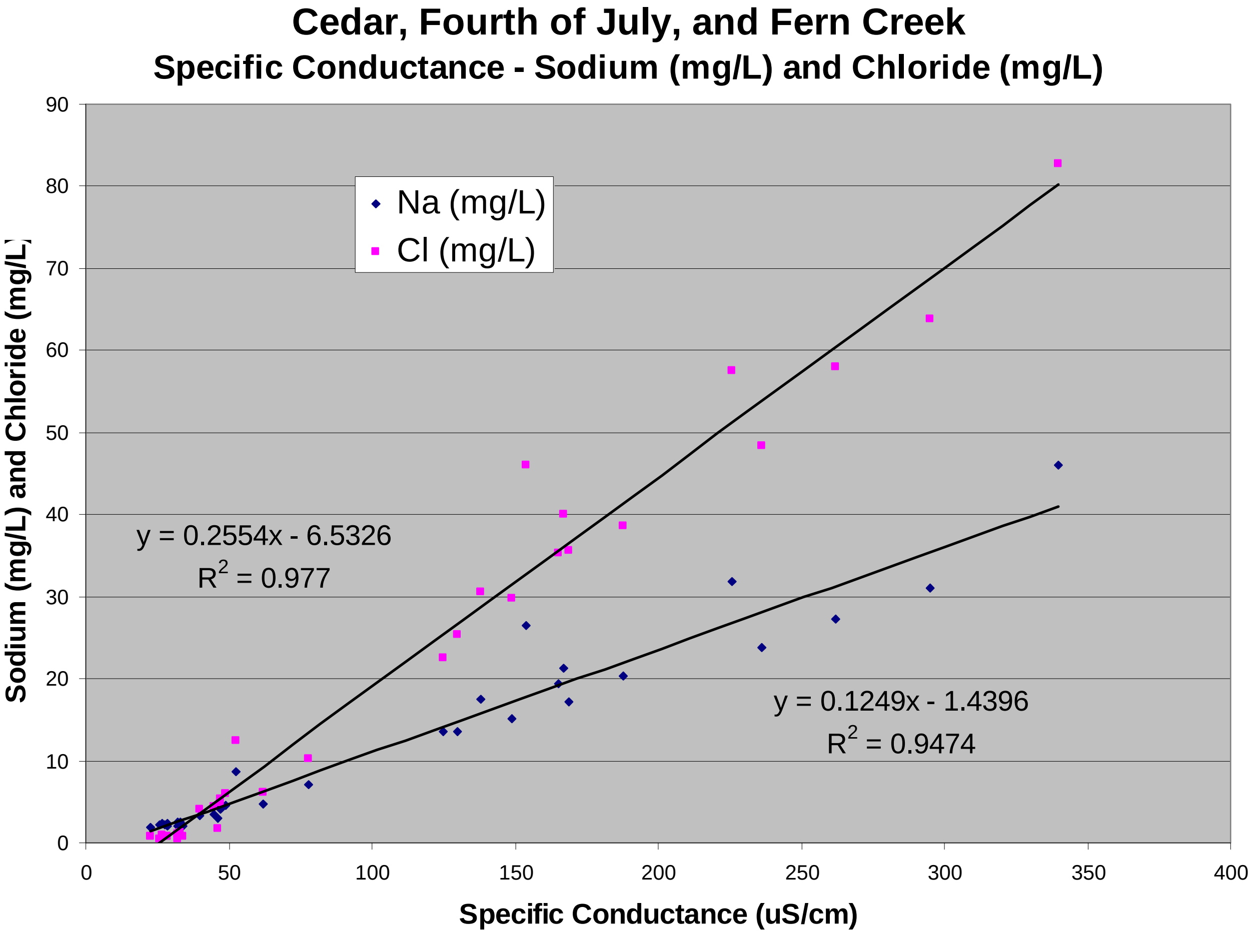


One gram of NaCl contains 0.3933 grams of sodium and 0.6067 grams of chloride or one gram of NaCl is 39% sodium and 61% chloride.

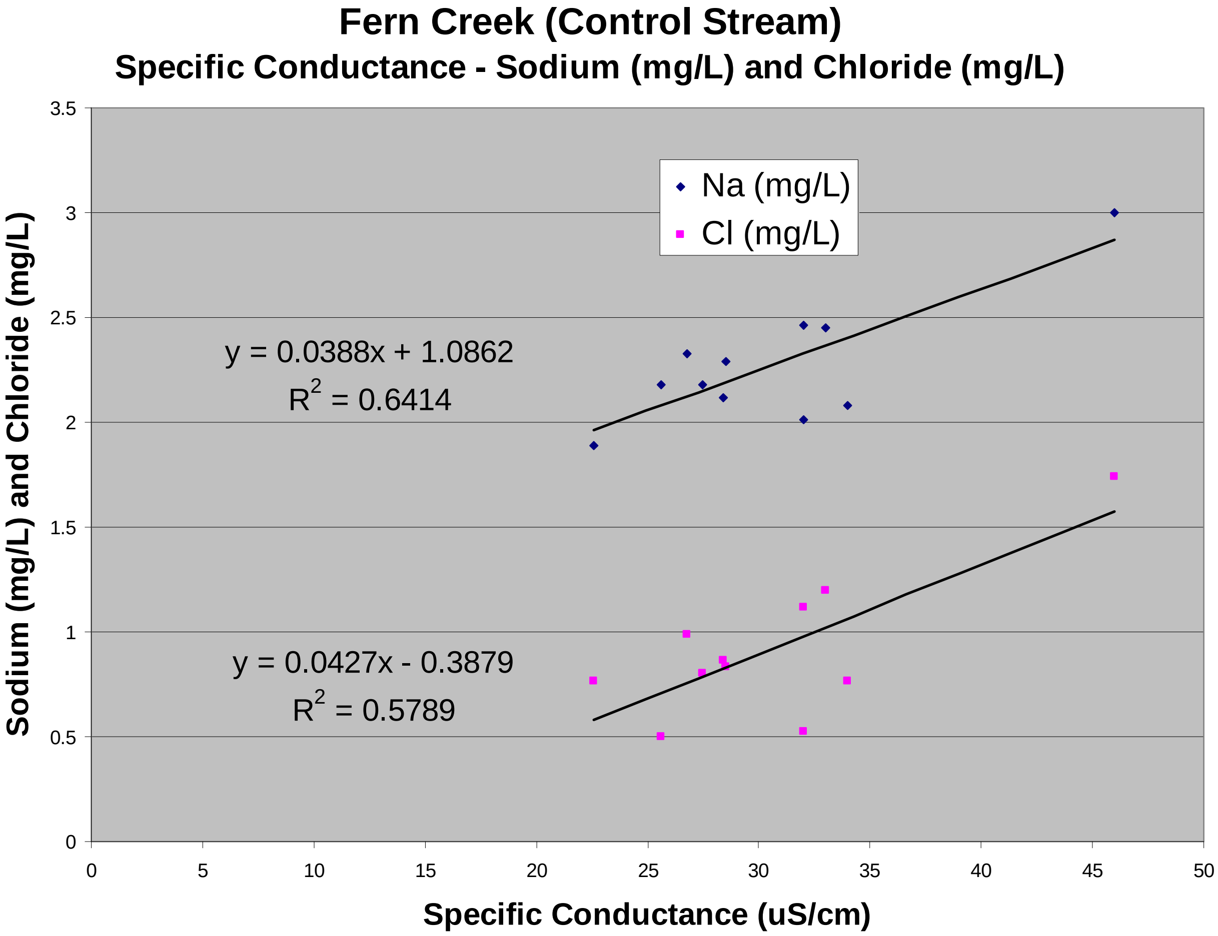
Monitoring and Lab Results

- Streams sampled 11 different occasions
  - February 14 through June 3, 2008
- Streams sampled monthly
  - October 2009 and continuing
- Samples analyzed for Sodium, Chloride, Magnesium and Calcium

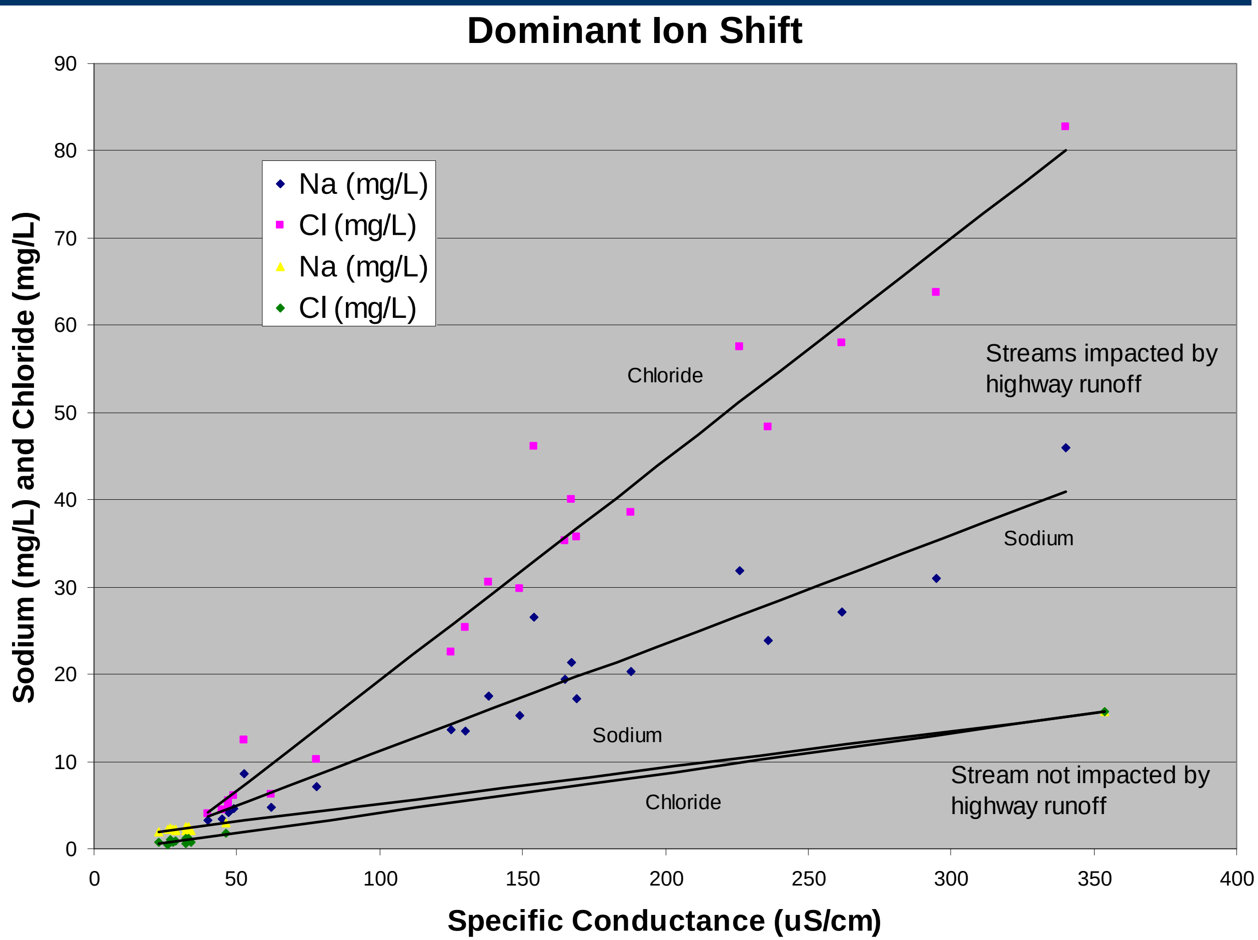
Regression Analysis (2008)



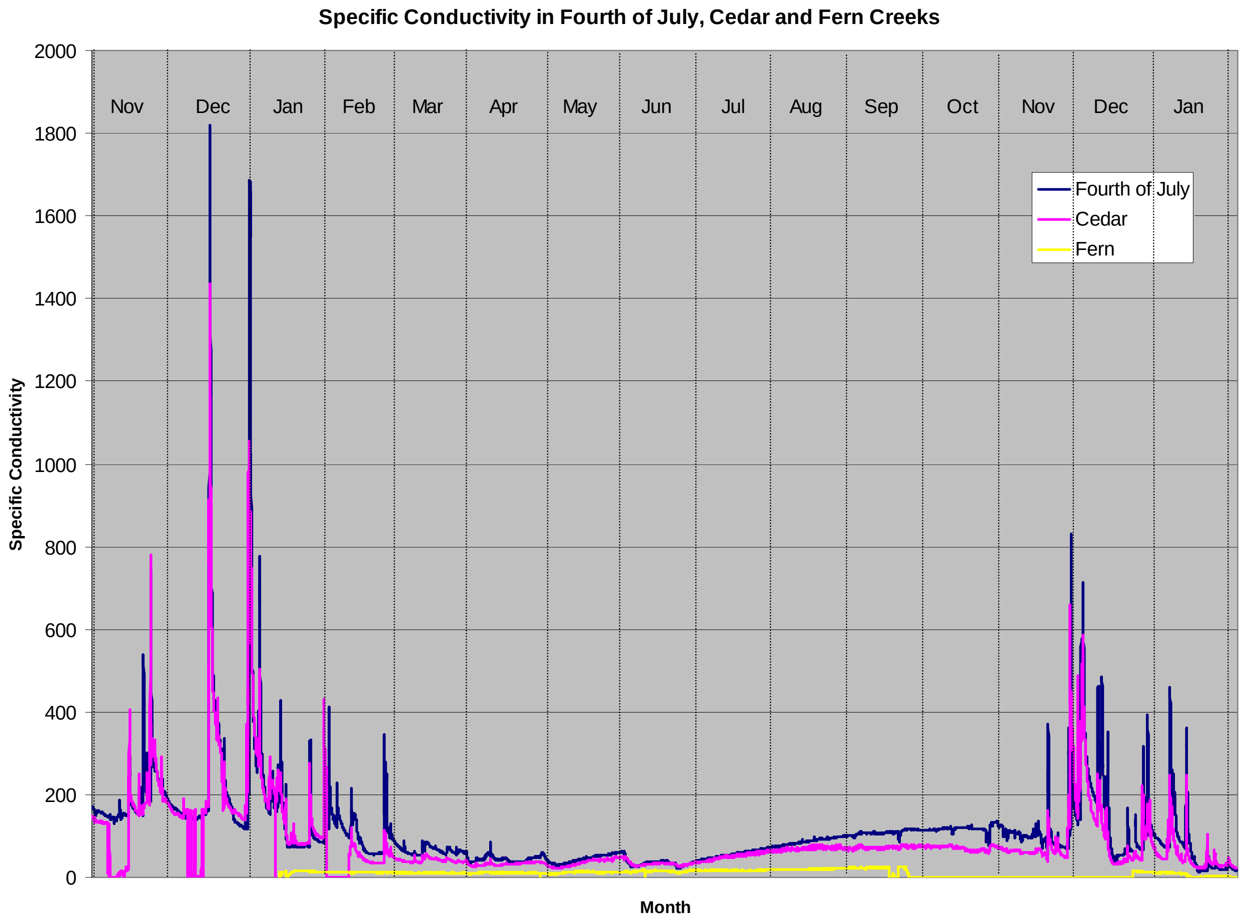
Fern Creek (Control Stream) Regression Analysis



Dominant Ion Shift



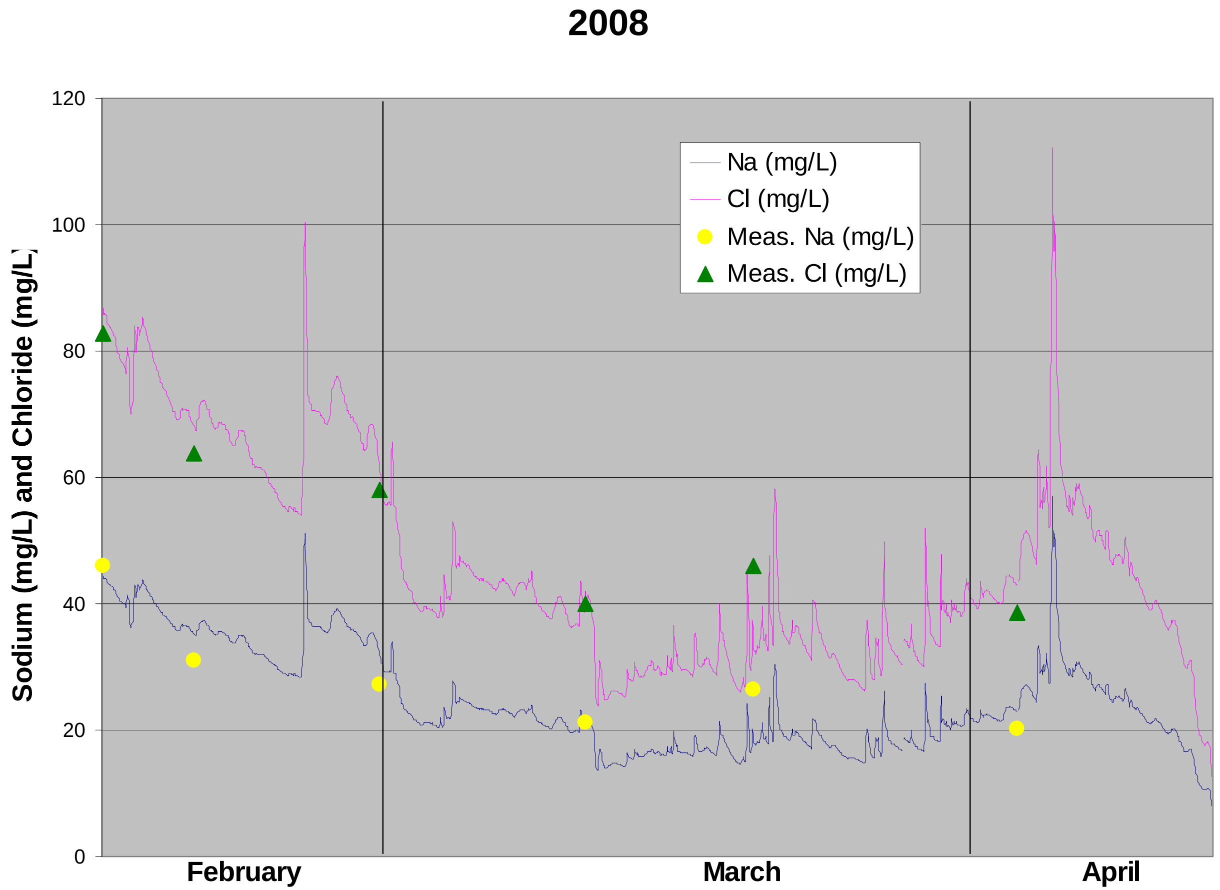
Specific Conductivity 2010-2011



Maximum
1,820

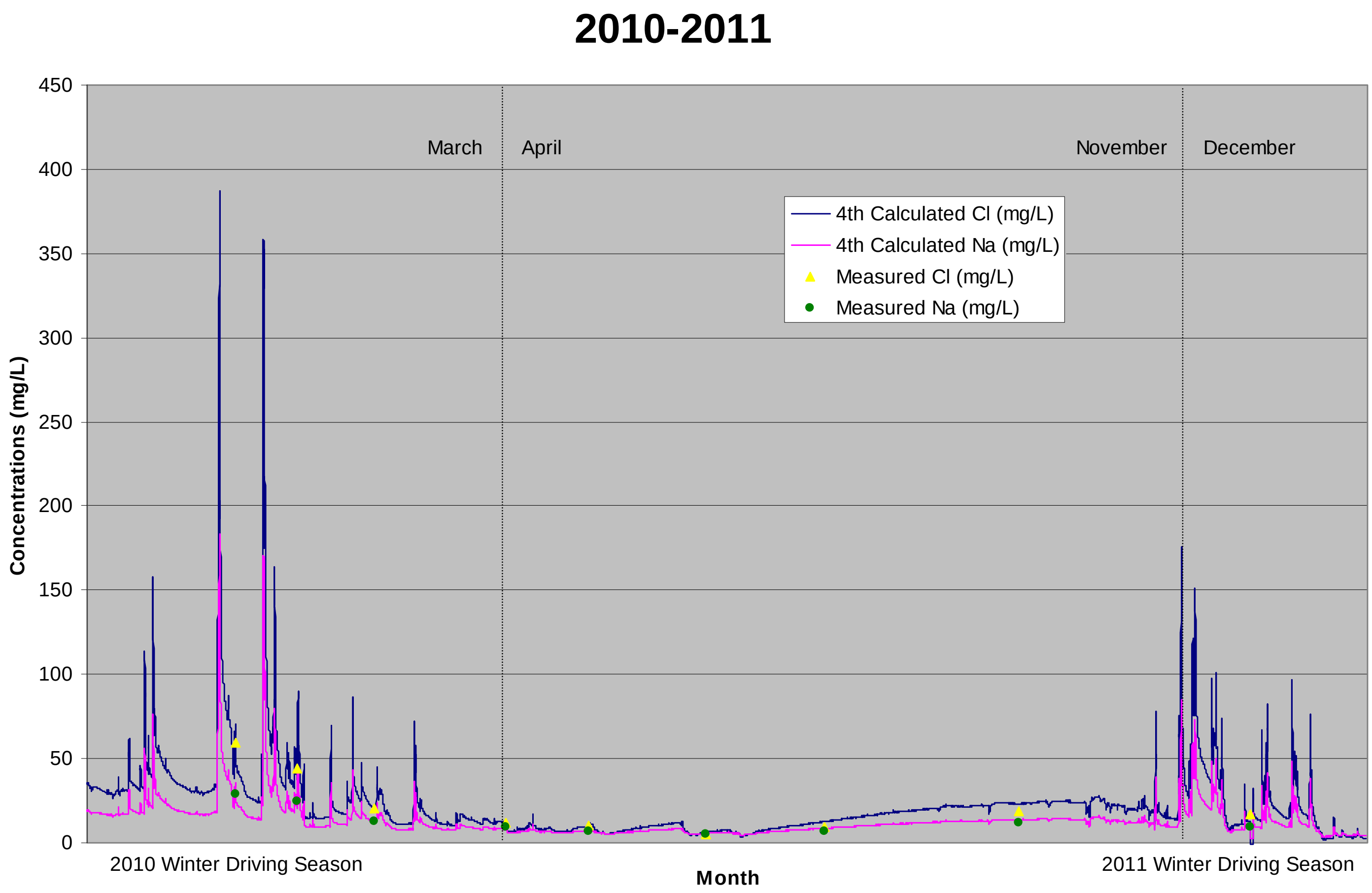
Minimum
<1

Sodium Chloride Concentrations – Fourth of July Creek



Maximum
471 µS/cm
58 mg/L – Na
112 mg/L - Cl

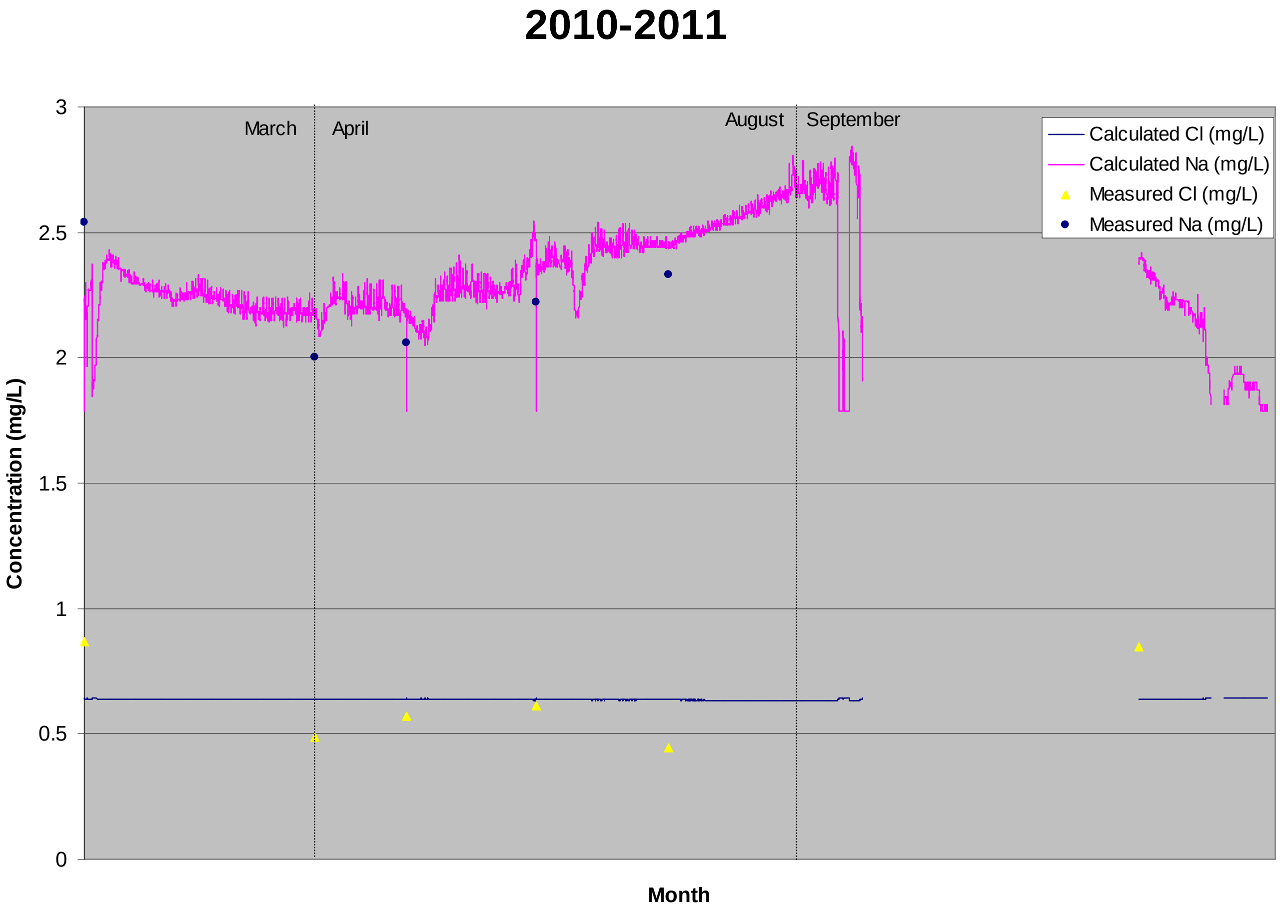
Sodium Chloride Concentrations – Fourth of July Creek



2010 Maximum
1,820 µS/cm
186 mg/L – Na
386 mg/L - Cl

2011 Maximum
827 µS/cm
85 mg/L – Na
175 mg/L - Cl

Sodium Chloride Concentrations – Fern Creek (Control)



2010
Maximum
26.8 µS/cm
2.85 mg/L – Na
0.64 mg/L - Cl

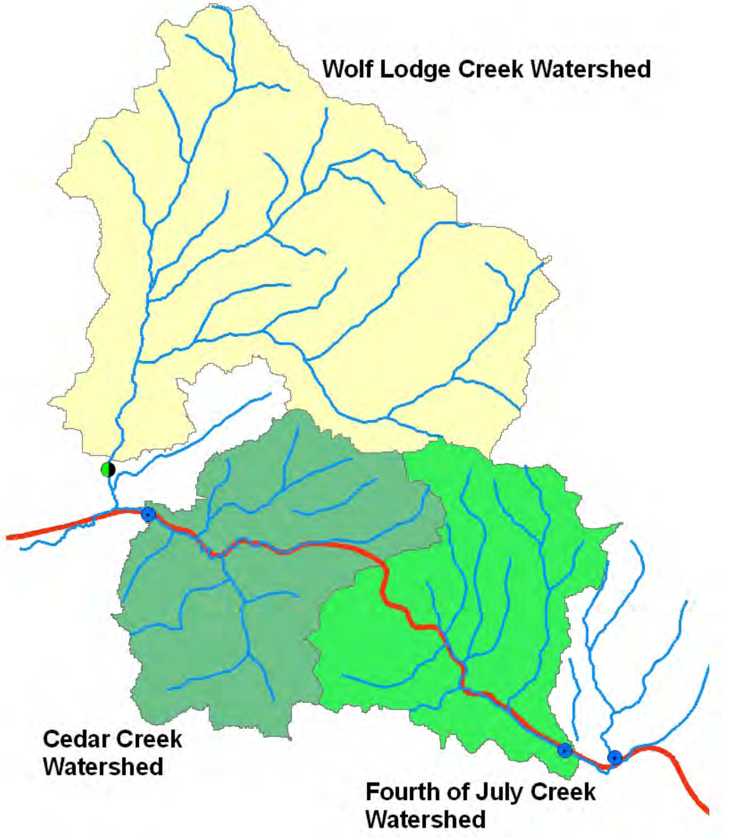
Instream Sodium Chloride Loads

Steps

1. Develop regression equations
2. Apply regression equations to continuously monitored specific conductivity
3. Estimate stream flow
4. Calculate load

Instream Sodium Chloride Loads

- Estimated stream flow
  - Measured stream discharge during 5 visits
  - Applied drainage area ratio to USGS gauging station 12415350
  - Nine years of discharge data 1986-1995



Drainage-Area Ration Equation used to estimate ungauged streams:

Y = (A1/A2)X

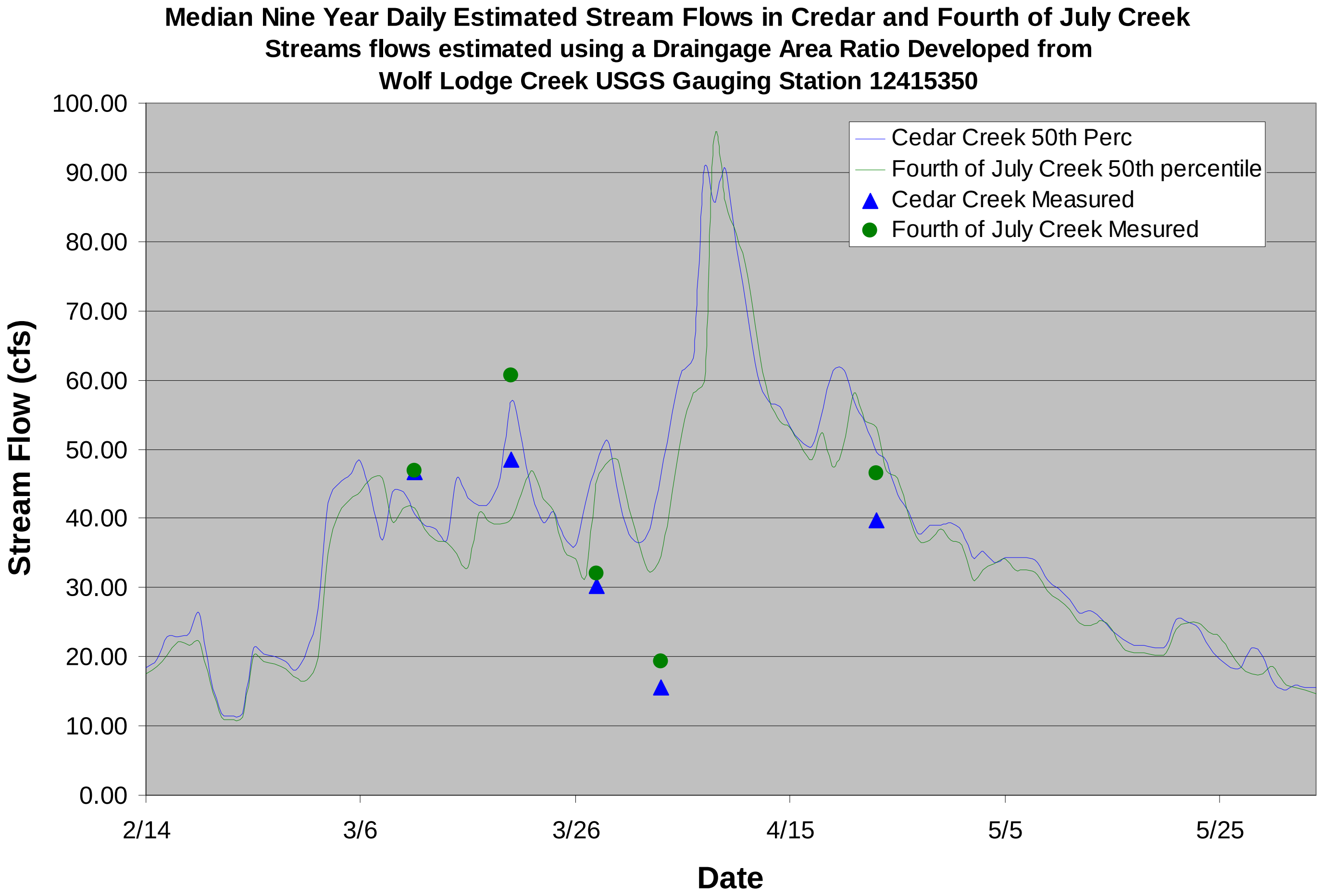
Y = Estimated stream flow from ungauged stream

A1 = Drainage area in square miles from site of interest

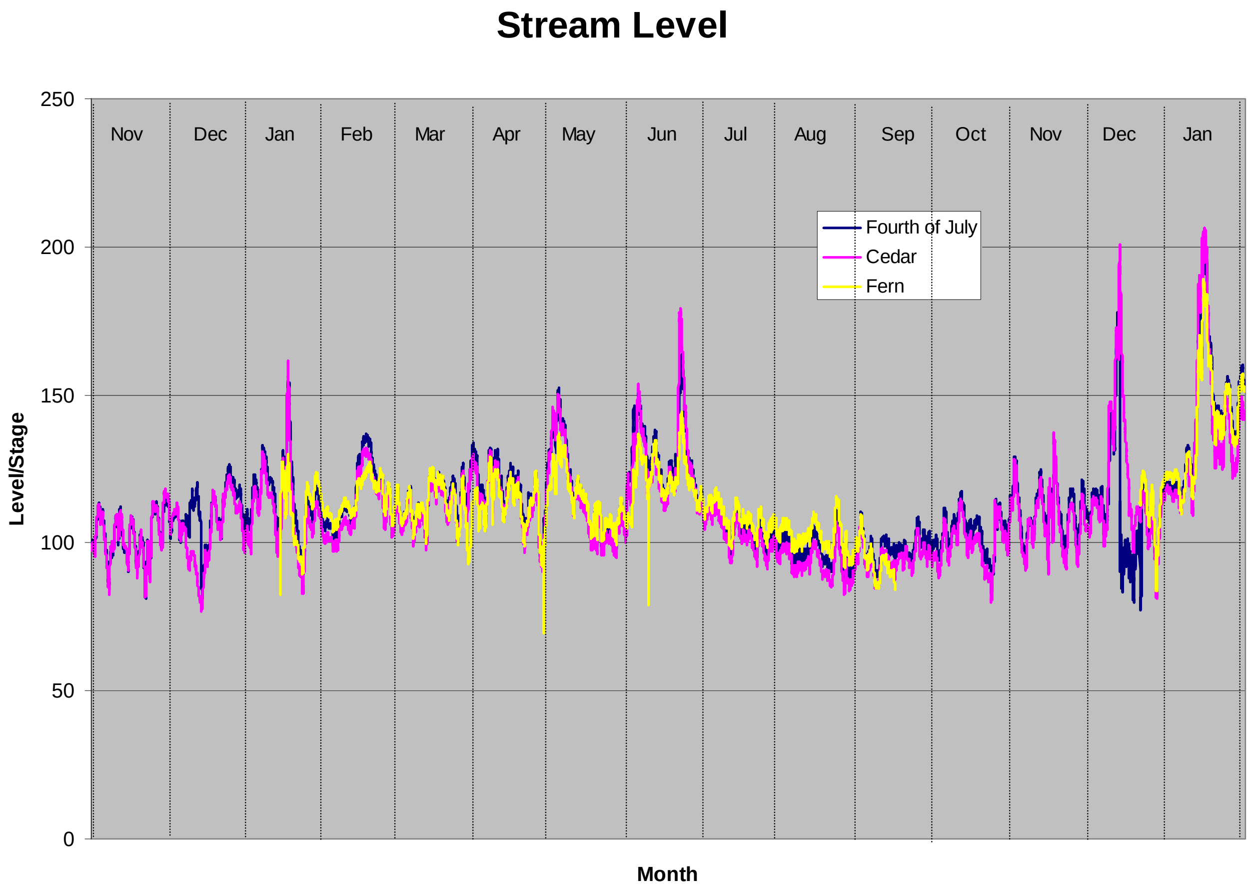
A2 = Drainage area in square miles from gauged stream

X = Recorded stream flow in cubic feet per second recorded at gauging station

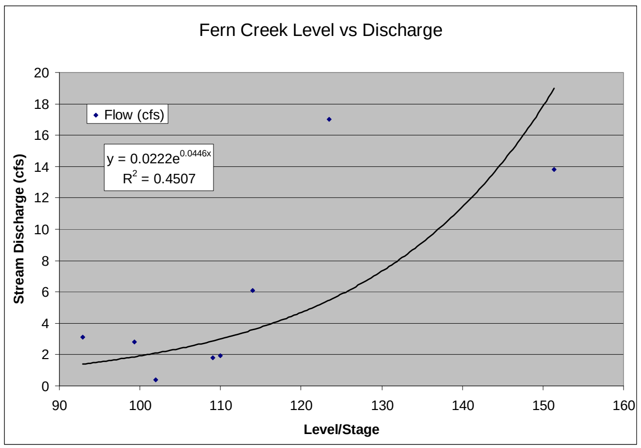
Estimating Stream Flows

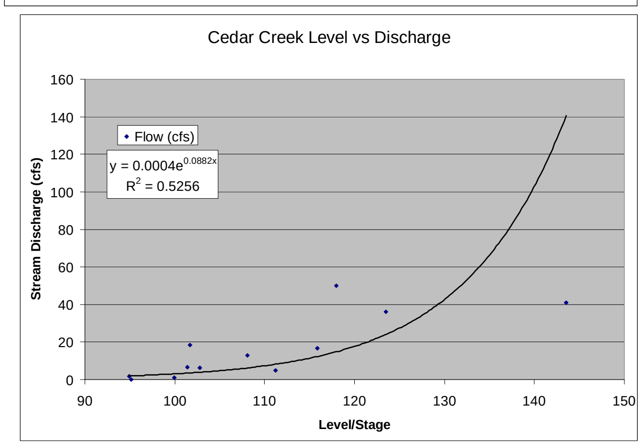


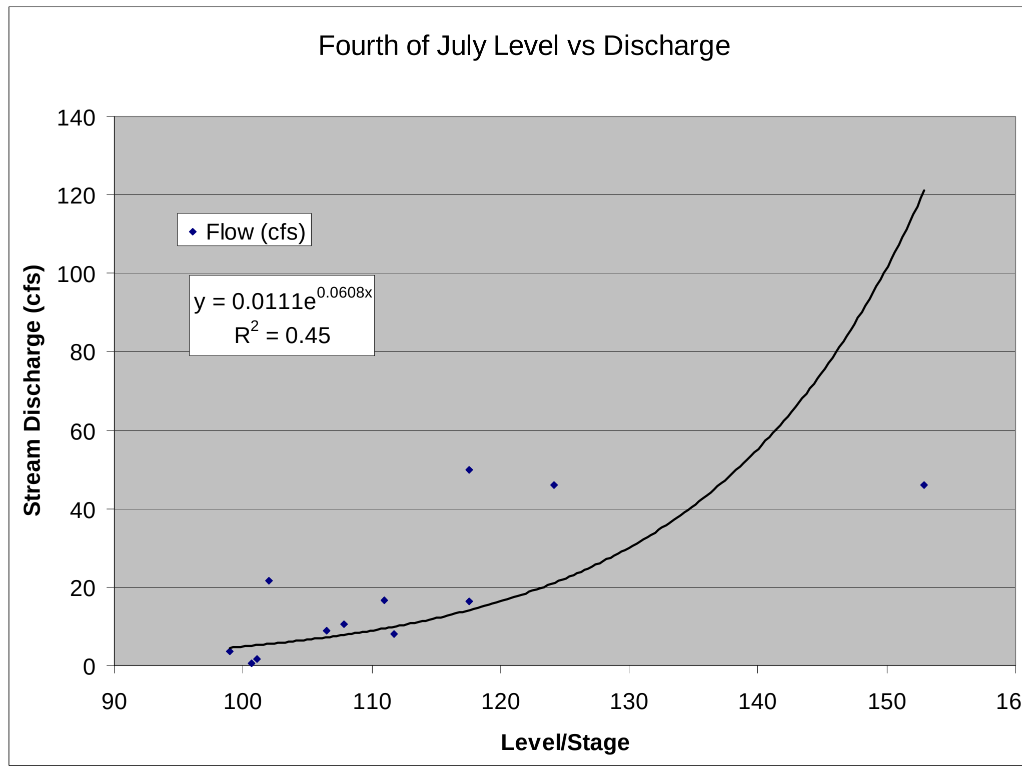
Stream Level/Stage



Level/Stage vs Discharge (cfs)







Instream Loads (2008)

Pounds per day = (stream flow (cfs)) (concentration (mg/L))(5.396)

Minus background load = Pounds per day attributable to road salt

Stream	Total Load (tons)	Background Load (tons)	Road Salt Load (tons)
Cedar Creek	363	108	255
Fourth of July Creek	402	97	305

Application Rate

Application rate = 150-300 pounds per lane mile

4 lanes per mile

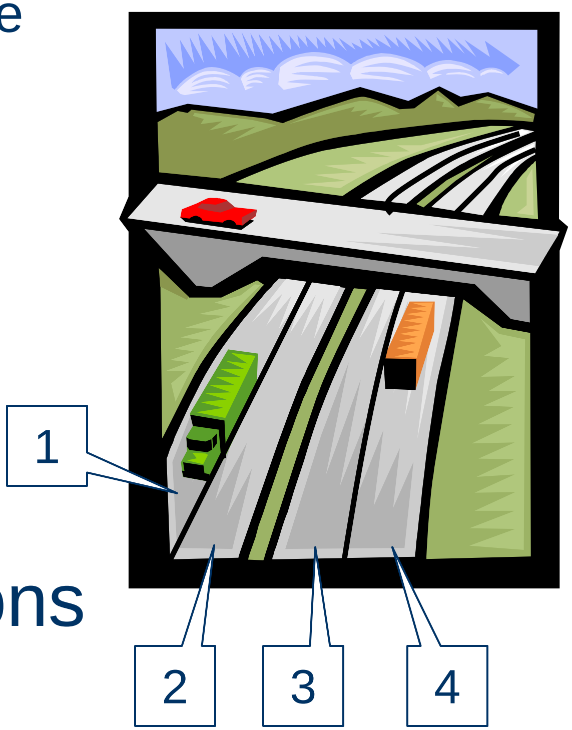
80 application events in winter 07/08

4.3 miles of I-90 draining Cedar Creek

4.7 miles of I-90 draining Fourth of July Creek

Cedar Creek = 103-206 tons

Fourth of July Creek = 113-225 tons



Aquatic Life

Species	NaCl (mg/L)	Cl (mg/L)	Response Type	Response
Blue gill	14,100	8,553	1 day LC50	Acute survival
	9,627 – 12,964	5,840 – 7,864	4 days LC50	Acute survival
	20,000	12,132	6 hours LC45	Acute survival
Brook trout	50,000	30,330	15 minutes LC50	Acute survival
Rainbow trout	11,112	6,743	4 day LC50	Acute survival
	20,000	12,312	6 hour LC40	Acute survival
Rainbow trout egg embryo	2,400	1,456	7 to 10 day LC50	Sub-chronic Survival
Rainbow trout embryo/Alvin	2,630	1,595	7 to 10 day LC50	Sub-chronic Survival
Caddisfly	5,526 – 7,014	4,039 – 4,255	4 days LC30	Acute survival
Chironomid	9,995	6,063	12 hours LC50	Acute survival
	5,192 – 6,637	3,795 – 4,026	4 days LC50	Acute survival
Diatom	2,430	1,474	7 to 10 day EC50	Sub-chronic Survival

(EC, 2001; USEPA, 1988; Nagpal et al., 2003, Hart et al., 1991)

EC50 – the concentration that caused an effect in 50% of the test population indicated the level of acute toxicity.

LC50 – the concentration which caused death in 50% of the tested population.

Highest estimated Chloride concentration = 386 mg/L

MN Cl standard
Acute = 860 mg/L
Chronic = 230 mg/L

Other Impacts

- Interaction with other compounds altering natural stream chemistry
- Decreased soil permeability
- Ground water contamination
- Altered lake stratification and turnover
- Riparian vegetation degradation

Conclusion

- Road salt is transported to adjacent waters
- Specific conductivity and NaCl concentrations recede after the winter driving season
- Measured and estimated instream concentrations do not exceed researched aquatic life toxicity thresholds
- Cumulative impacts from continued use is to be determined

Questions

Final 2008 Deicer Report

http://www.deq.idaho.gov/about/regions/panhandle_bag/deicer_report.pdf

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