

## Remaining Q's from Chlorides Webcast

**Emily Campbell: Can we have discussion about the applicability of utilizing retention basins to collect salt-laden runoff and then collection of water from bottom of basin for treatment/disposal?**

*BJ:* In general, the topic is definitely ripe for further investigation and testing. As I touched on briefly near the end of the talk, it was a small part of the overall project but we did investigate the potential of using ponds as chloride collectors for diversion/disposal through a model application to the study pond using observed inflow chloride loading time series. We assumed that water would be diverted from the pond bottom when it exceeded 230 mg/L, and withdrawn at a rate of 1 L/s (other scenarios involving lower rates were also simulated). We found that the withdrawal volumes would have to be pretty substantial to remove even small amounts of chloride (8% reduction for the given scenario). However, I did not mention this, but we found that the model (CE-QUAL-W2) was not able to accurately simulate the intensity and duration of stratification even with some substantial tweaking of diffusion and other parameters. So it's possible that a more accurate model might show slightly higher reductions.

**Aaron: Could you discuss how you dealt with ice accumulation with your continuous monitoring. What other issues did you run into for monitoring equipment? Solutions?**

*BJ:* One solution for the storm pipes was using Massa Sonic Distance sensors mounted to the top of the pipe to measure water level (rather than using a submerged device), which at least prevented damage. We also switched to using Onset HOBO conductivity probes since they were a little more robust and less drift-prone than the other sensors we were using (Sensorex). Otherwise, it just required a lot of baby-sitting. I made lots of trips out to the sites anytime we anticipated snowmelt or freezing in order to break up ice or clear snow away from the weirs and at the storm drain outfalls. A rock pick worked wonders for breaking up ice and digging small channels in the thick ice for snowmelt to drain through (helps to make sure snowmelt has a place to go). Sometimes we had to remove equipment in anticipation of longer, deep freeze periods, which contributed to some data gaps. Batteries also required more frequent changing during cold periods. The Campbell data loggers (venerable CR-10X's) held up really well during almost 3 years of continuous deployment.

**Pat Noble: Did you calculate the amounts of chloride being carried off adhered to vehicles, or other ways it could be removed without being retained?**

*BJ:* We did not try to estimate other fluxes of chloride, even though removal by wind or vehicles is likely not negligible (as suggested by some previous studies). I also forgot to mention that our road salt input calculations included only the amounts applied by city, county, and state road maintenance, and did not include estimates of private or commercial application.

**Midori Patterson: Did you notice any effects of the vegetation health in the ditch, given the high rates of Cl retention? Many of our clients reject the ideas of bioretention and infiltration BMPs along**

**roadsides because they fear that the salts will kill the plants and have effects on soil permeability / infiltration effectiveness.**

*BJ:* We did not look at effects on roadside vegetation at either the highway ditch (swale) or curb-and-gutter sites, and anecdotally I can't remember seeing any damaged vegetation. I suspect that whatever is growing in the ditch is pretty well adapted or tolerant of salty soils. There is a professor at UMN, Dr. Emilie Snell-Rood (<https://cbs.umn.edu/snell-rood-lab/home>), who has just begun a project investigating this issue with respect to highway ditches and chloride impacts to vegetation and insects, who might have more insight (or will at some point in the future).

**Deana Simmons: What methods were used for diversion in your study?**

*BJ:* I should have emphasized that the diversions were just an analytical exercise – we did not actually test or implement any diversions or capture. It was a way to look at the data we had collected, and investigate the maximum benefit of implementing some kind of diversion (whatever that would be) at the street or pond level. In the talk, I gave the example of diverting 0.2 inches of surface runoff per year at the 3 monitored sites (ditch, curb-and-gutter roadway, pond inlet).