ANALYSIS AND REPORTING OF VOLUNTEER-COLLECTED DATA IN THE DEER CREEK WATERSHED, ST. LOUIS COUNTY, MISSOURI

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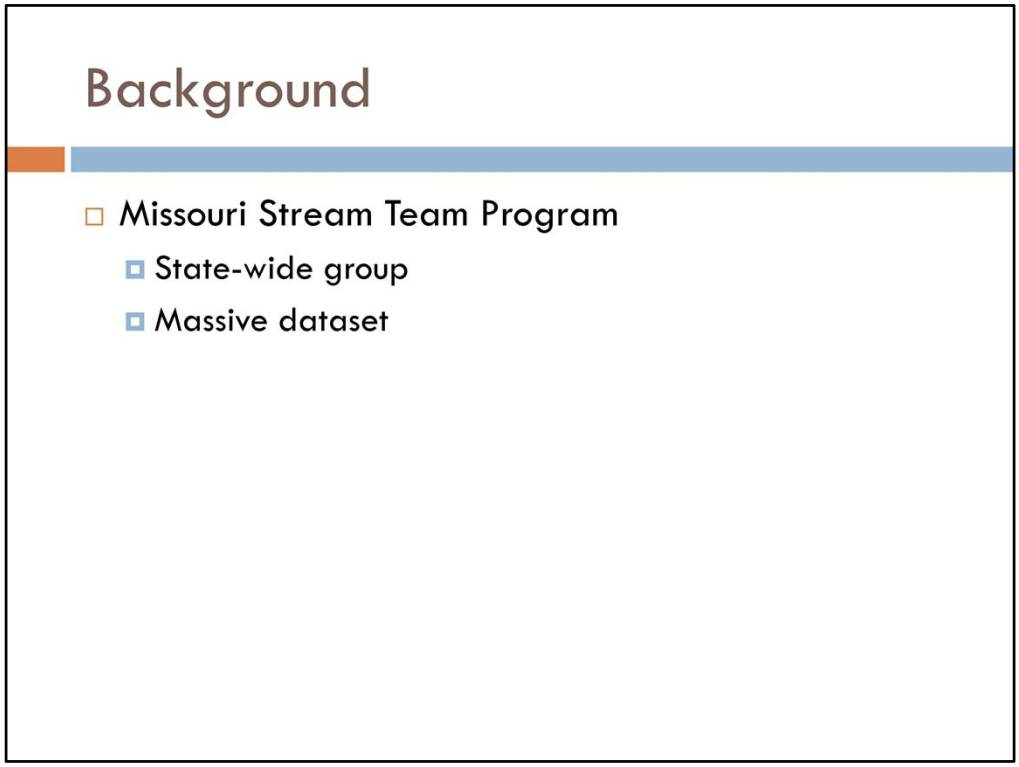


MO ST is a state-wide organization with around 65,000 members/participants in over 4,000 teams. The organization supports teams in activities ranging from litter pickups and public education to habitat improvement and water monitoring. The volume of water monitoring data generated in the past 20 years by the subset of volunteers who have been trained by the ST program is overwhelming, with nearly 1800 monitoring trips reported in 2007 alone.

Missourians love their ST program. One of the few complaints from ST members is that they collect all of this data, but never know if it is being used. The data IS used in many ways by the state government, local governments, drinking water and wastewater operators, grant-seekers, etc., but the process does not involve the volunteers and does not often result in reports or presentations that are accessed by the public.

The Litzsinger Road Ecology Center is a 35-acre site in suburban St. Louis that includes 10 acres of prairie, 15 acres of riparian woodlands, and a half-mile segment of Deer Creek. The mission of our center is to provide place-based education to students in the St. Louis metropolitan region. (Place-based education builds on the concept that in order to appreciate the environment, one must first build a relationship with it. In our schools, most children study rain forests, oceans, tundra, deserts and other ecosystems not found locally. With place-based education, we give the students hands-on experiences with the ecosystems found in their own region.)

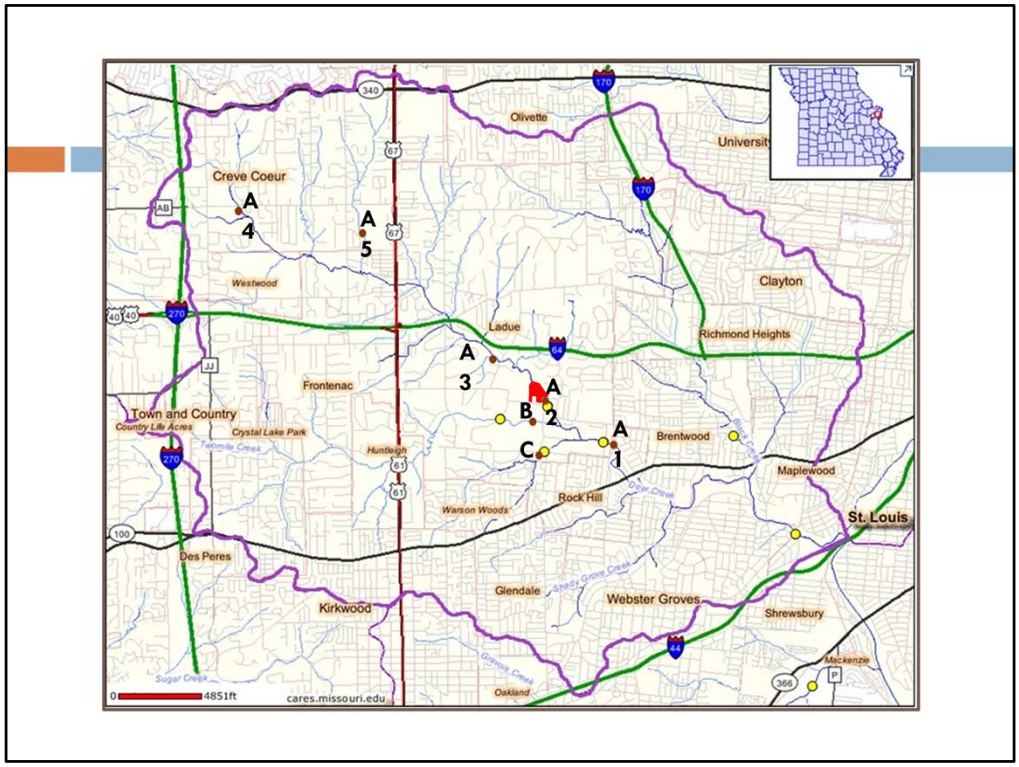
For the majority of our programs, the students are split into groups and are led in their activities by one of our education volunteers. These volunteers have been trained by our staff to work with the students to incorporate exploration of the outdoors with their lesson plan for the visit. We also have horticulture volunteers we help maintain the site with activities such as removing invasive species, collecting seed, and planting native vegetation.

The most recent addition to our volunteer corps is our water quality volunteers. We have developed a group of volunteers that are working on a water monitoring project using the methods and materials provided by the ST program. While many of our staff and volunteers have been trained by the staff of the ST program, others take part with no prior training. Many of our volunteers have an unquenchable thirst for knowledge and may participate in two, or all three of our volunteer groups. Many are retired from fields including teaching, science, and engineering.

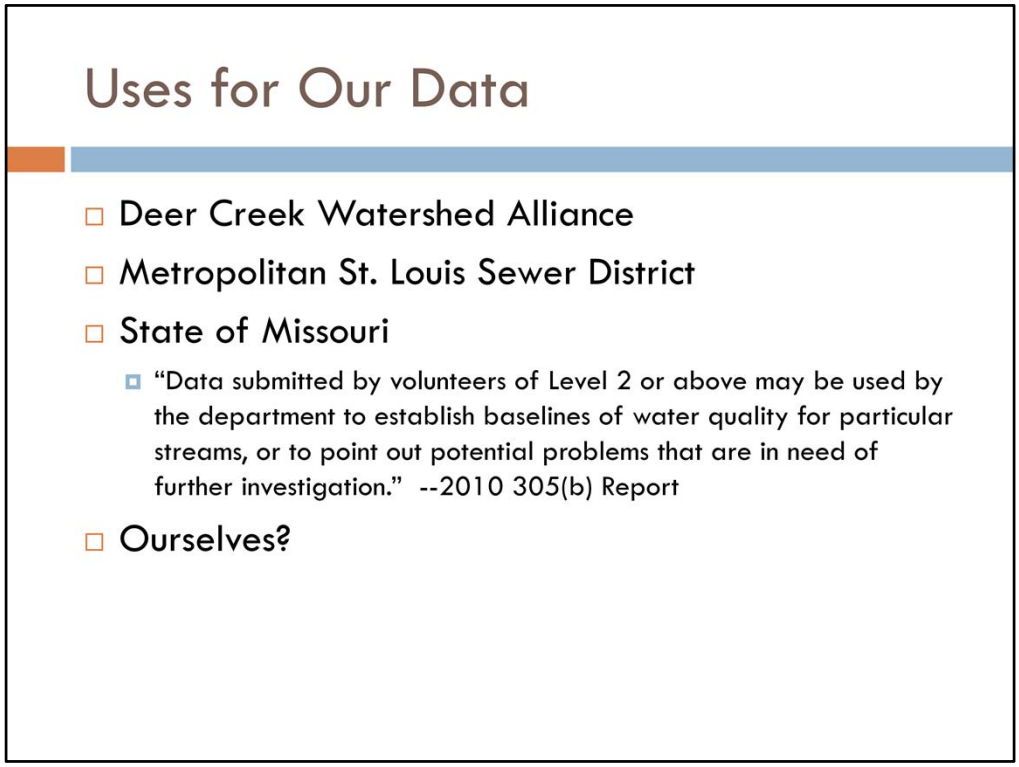
The Project

- Water chemistry monthly at 7 sites (2008)
- Macroinvertebrate surveys twice per year at one site (2005)
- Visual surveys twice per year at 7 sites (2011)

We have been monitoring chemical and physical water quality parameters on a monthly basis since 2008: DO, pH, conductivity, temperature, chloride, nitrate, turbidity, flow. Twice per year we survey the macroinvertebrate population at the LREC site using a kicknet and identifying the invertebrates to the lowest possible taxa (generally class, order, or family). Beginning this past year, we have also been doing a visual survey twice per year.



These are our 7 sites in the Deer Creek watershed. LREC is shown in red, yellow dots are USGS gages, brown dots are our water chemistry monitoring points. Sites A1 to A5 are on Deer Creek with one on an unnamed headwaters tributary. Sites B and C are on two of the major tributaries to Deer Creek: Two-mile Creek and Sebago Creek.

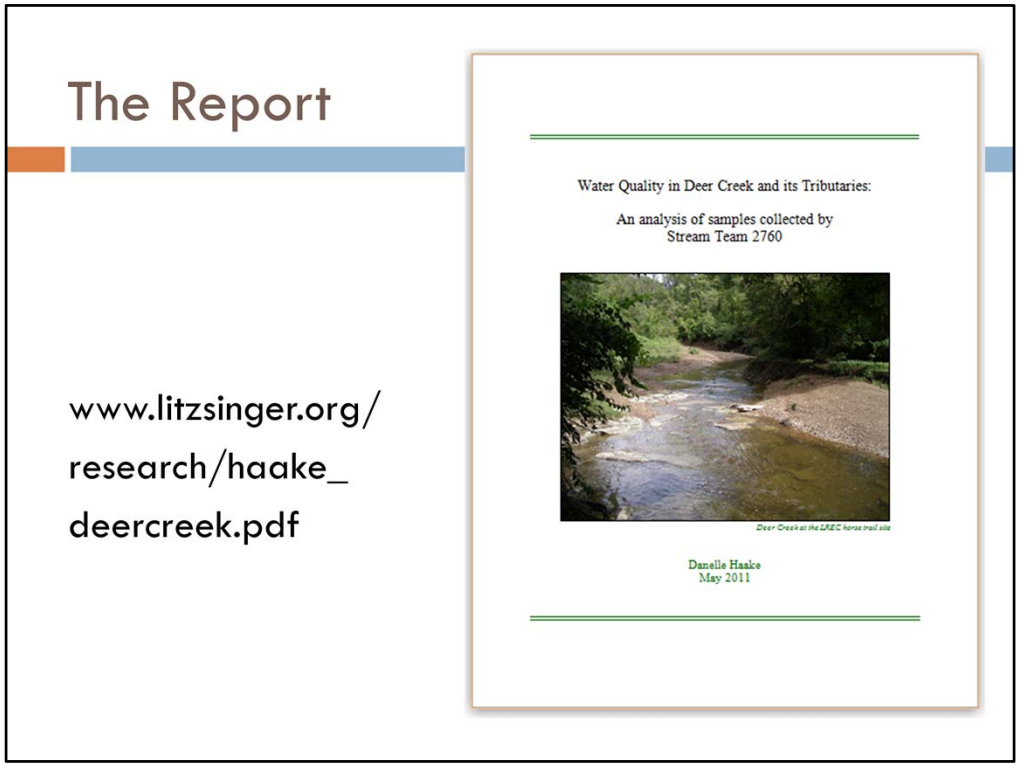


We have a solid baseline of data which is being used by the Deer Creek Watershed Alliance for a 319 grant that is incorporating rain gardens, rain barrels, and other plant-based stormwater BMPs in the watershed.

The data is also beginning to be used, via the ST Program, by MSD to assist with a preliminary assessment for their Stormwater Phase II compliance.

Third, the data is used by the State of Missouri in preparation of the 305b Water Quality Report.

These uses are all great, but they do not provide much satisfaction to the volunteers who spend their time collecting all of this data. There is no specific reference to their work in the 305b report – just a mention of an aggregation of ST data that may have been sifted through to note baselines or seek areas for further study. They are unlikely to seek or find much information from the MSD – the search term "Stream Team" only brings up two places on their extensive website and neither is in reference to water quality data…



We wanted to take all of the data that was collected over the first 3 years of our work and hand it back to the volunteers in a meaningful way. It needed to be somewhat in-depth and scientific, because these are well-trained volunteers who get very excited with the natural world and who like details. They do not just want to know what we found; they need to know why our stream is the way it is.

While our volunteers were my primary audience, this information to be useful to the teachers and educators we work with. Finally, while some of our sampling locations are on public property, other sites are on private lands. The homeowners in at least a couple of these locations had expressed an interest in learning more about what we find when we visit their property each month.

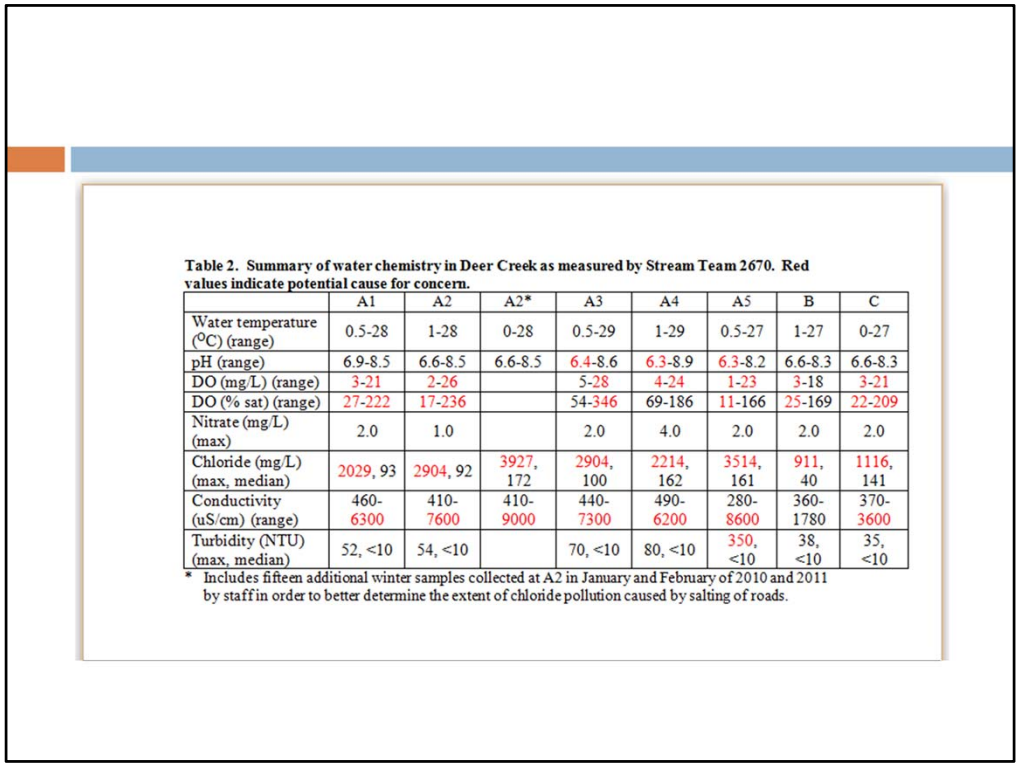


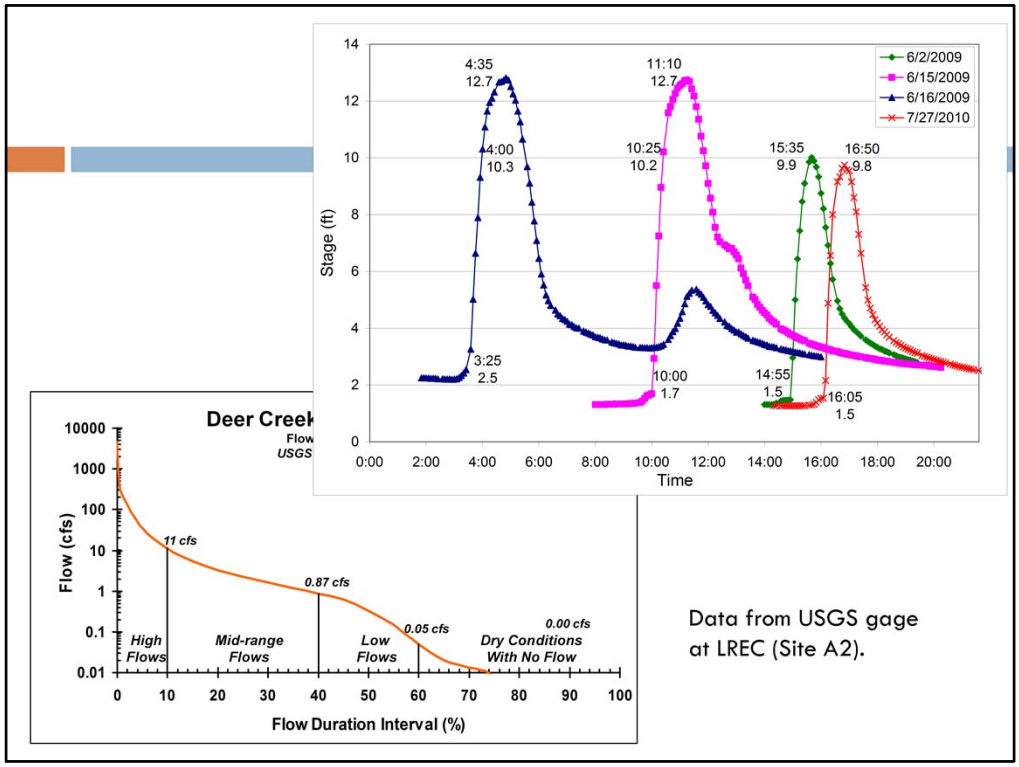
Table 2. Summary of water chemistry in Deer Creek as measured by Stream Team 2670. Red values indicate potential cause for concern.

	A1	A2	A2*	A3	A4	A5	B	C
Water temperature (°C) (range)	0.5-28	1-28	0-28	0.5-29	1-29	0.5-27	1-27	0-27
pH (range)	6.9-8.5	6.6-8.5	6.6-8.5	6.4-8.6	6.3-8.9	6.3-8.2	6.6-8.3	6.6-8.3
DO (mg/L) (range)	3-21	2-26		5-28	4-24	1-23	3-18	3-21
DO (% sat) (range)	27-222	17-236		54-346	69-186	11-166	25-169	22-209
Nitrate (mg/L) (max)	2.0	1.0		2.0	4.0	2.0	2.0	2.0
Chloride (mg/L) (max, median)	2029, 93	2904, 92	3927, 172	2904, 100	2214, 162	3514, 161	911, 40	1116, 141
Conductivity (uS/cm) (range)	460-6300	410-7600	410-9000	440-7300	490-6200	280-8600	360-1780	370-3600
Turbidity (NTU) (max, median)	52, <10	54, <10		70, <10	80, <10	350, <10	38, <10	35, <10

* Includes fifteen additional winter samples collected at A2 in January and February of 2010 and 2011 by staff in order to better determine the extent of chloride pollution caused by salting of roads.

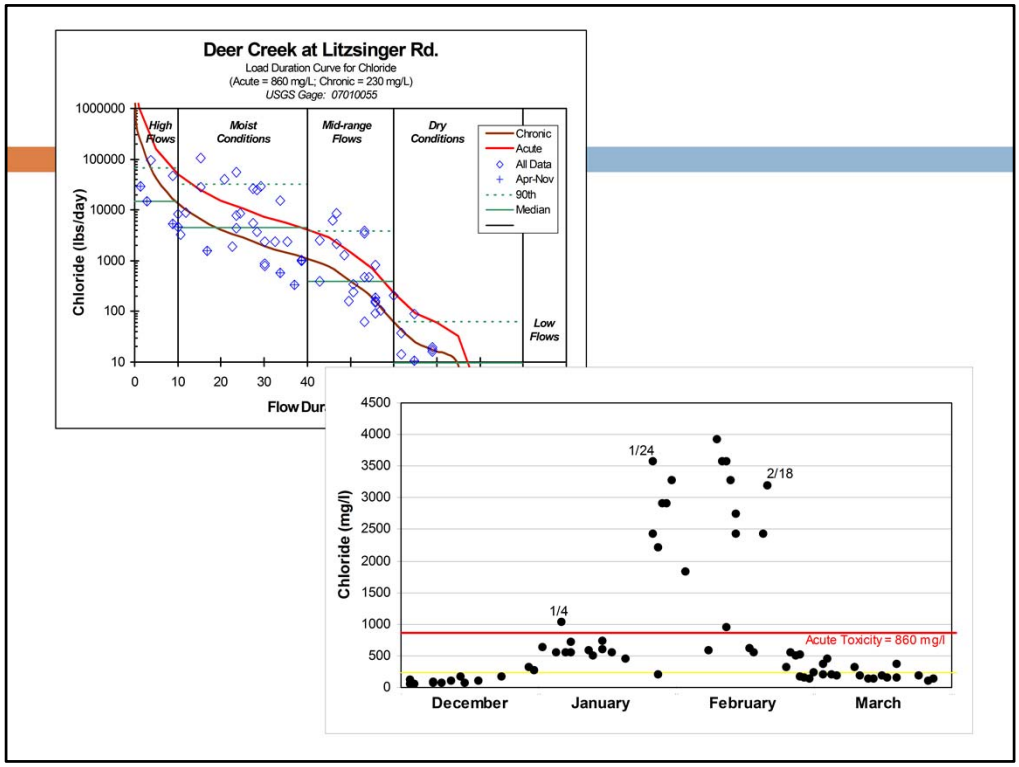
The 21 page report includes a summary, an introduction to the watershed and our rational, a sampling plan and summary of results, analysis and discussion of individual water quality parameters, notations of complications experienced by the team, acknowledgement of the team members, references, and links to USGS data available on-line.

On this slide, you can see an example of how the data was summarized and color coded to point out specific areas that might be cause for concern. There are no statistics in this, just a notation of numbers that are either outside the range considered acceptable by Missouri WQS or numbers that the MDC biologists with the ST program might look at and say, "Hmmm, that doesn't look right for this region."



These are two graphics included to help the readers understand the hydrology of the LREC site. The upper graphic shows the hydrograph following four individual storm events. The two largest events occurred within a 24-hour period in 2009. On 6/15, flow started at <1 cfs and was at 4,500 cfs, rising by about 11 feet, just about 1 hour later. Flow dropped back to 32 cfs, then up to over 4,500 cfs again the following morning and back down to 37 cfs by midnight. This flashy hydrograph is fairly typical of urban and suburban areas.

The lower graphic is a flow duration curve developed for the LREC site based on more than two years worth of sub-hourly stream flow data. This is useful to show that, roughly 25% of the time, there is no detectable flow. However, there are still substantial pools and water moving in the gravel stream bed under these conditions.

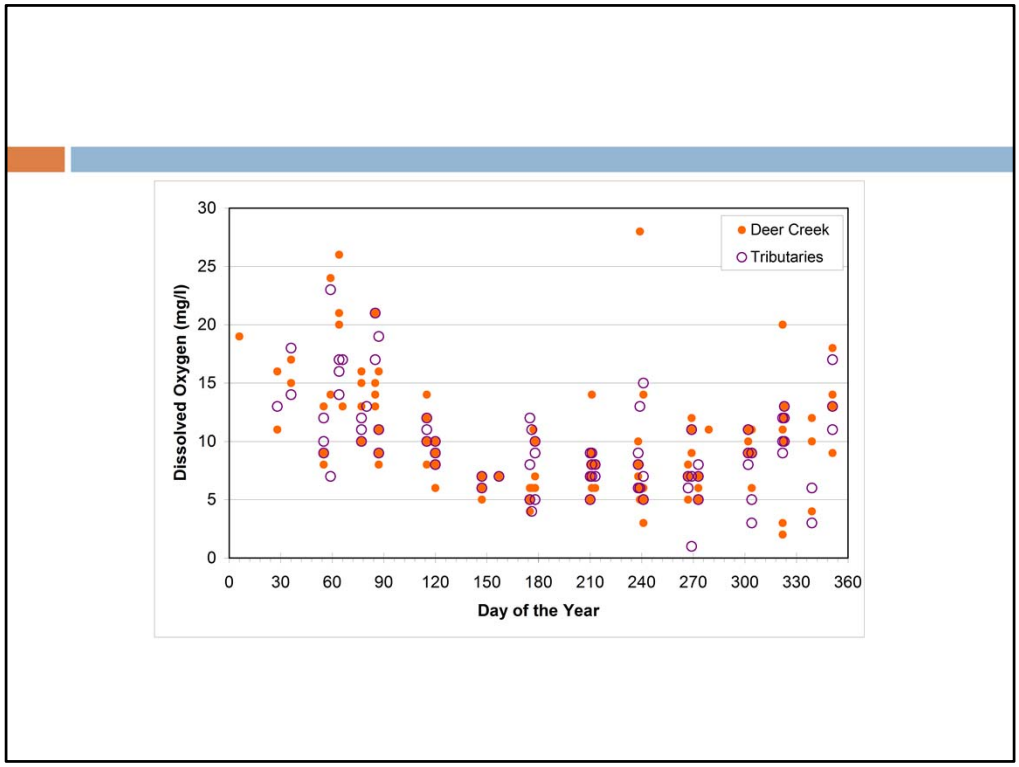


By combining the flow duration curve with the chemical data, in this case chloride data, and the state standards of 860mg/l for acute toxicity and 230mg/l for chronic toxicity, we can develop what is called a load duration curve. From this, we are able to see both the flow conditions under which chloride is present at amounts greater than that allowed by standards. It also gives us a sense of the tremendous load of chloride being put into our stream, primarily in the form of road salt.

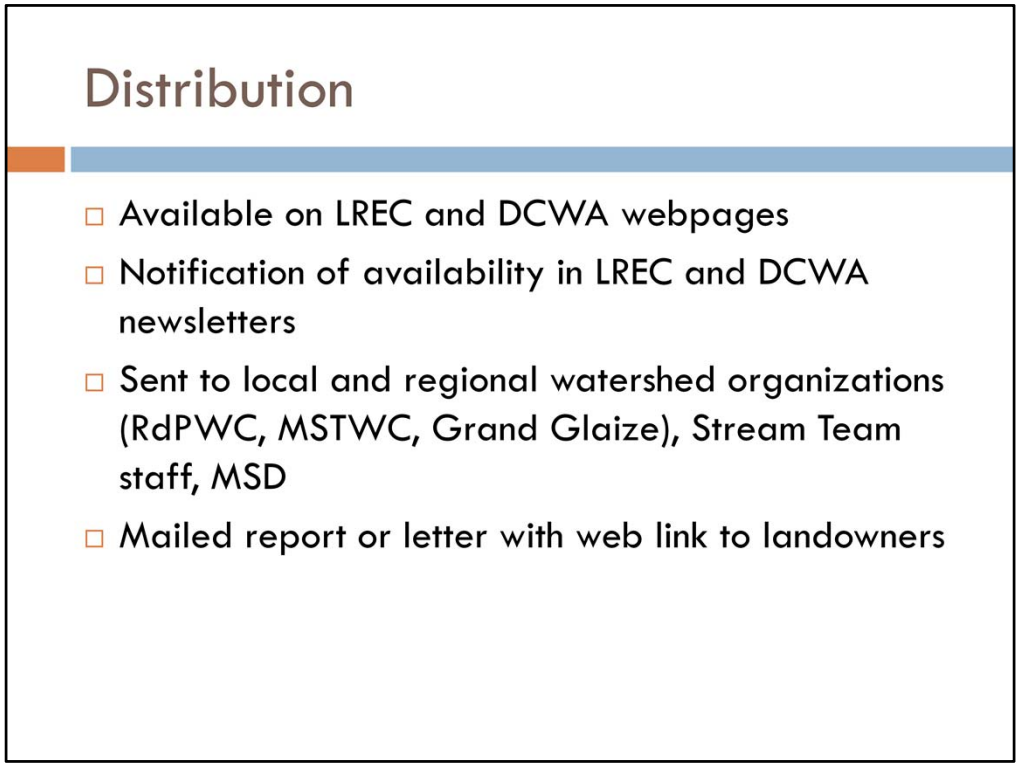
The second figure shows the seasonal component as well. In the St. Louis area, we sometimes have ice, sleet, or snowfall in December, but our major winter storms generally hit in January and February. In the three years of data collection that provided the information for this figure, that was the case. You can see concentrations remaining below the chronic limit through much of December. Then there is a slight rise into the zone above the chronic level but below the concentration considered acutely toxic. In these three years, chloride concentrations were at or above 2000 and up to nearly 4000mg/l for much of a three week period. Finally, once March hits, the concentration drops again to levels at or below the chronic toxicity threshold.

It may seem unnecessary to have multiple graphs to represent this one pollutant, but this was done for two reasons: (1) The two images are at different ends of the spectrum as far as complexity. While the second can be interpreted readily by a majority or my target audience, the first takes a bit more thought and effort on the part of the lay reader to understand. I wanted to inform them, but also to challenge the interpretation skills of those who had the interest and ability. (2) Chloride is one chemical that not only shows a

consistent pattern with a direct link to human activities, but it is also something that the public can exert some degree of local and/or personal control over. I was willing to put the extra time and effort into this issue that has such a clear cause when so many of our other pollution issues are more fuzzy.



Thus far, the graphs have been based on the data collected at the LREC site – Site A2. This graph, on the other hand, includes all seven sites. There was no visible trend when looking at each site individually and, as seen here, no trend when looking at the data collected from Deer Creek in comparison to the tributary streams. This was fairly typical for the majority of the parameters tested. In this case, though, there is a seasonal trend to the dissolved oxygen concentration, with higher concentrations in the winter and lower concentrations in the summer and fall, including a number of samples that were less than 5 mg/l.



While the data is interesting, the point of this presentation is less what we found and more what we did with it. The report has been posted on the LREC webpage and, more recently, the DCWA page as well – as you may recall, they are the ones who are leading the 319 grant. Besides just posting the report, notifications of its availability went out to the 250 readers of the LREC e-Newsletter and the 700 subscribers to the DCWA mailing list. E-mails were sent to members of other local and statewide water organizations. Finally, a letter which included the web link or a paper copy of the report was sent by mail to landowners at the sites.

Feedback

- Volunteers
- Water Organizations
- ST Staff

There was a good amount of feedback from 11 readers, ranging from LREC volunteers, former staff, watershed organizations, and various state-level govt employees: the greatest reaction came from the MDC and DNR ST staff. Most of their feedback was something like "Wow, great report" or "I'm passing this on to my co-workers."

One person asked about getting help setting up this kind of analysis in their watershed on their ST data. Another reader, a retired environmental engineer who volunteers at LREC, raised questions about DO saturation and about the influence of SSOs in the watershed – these thoughts and comments will be helpful in the next iteration of the report after we collect a couple more years of data.

So What?

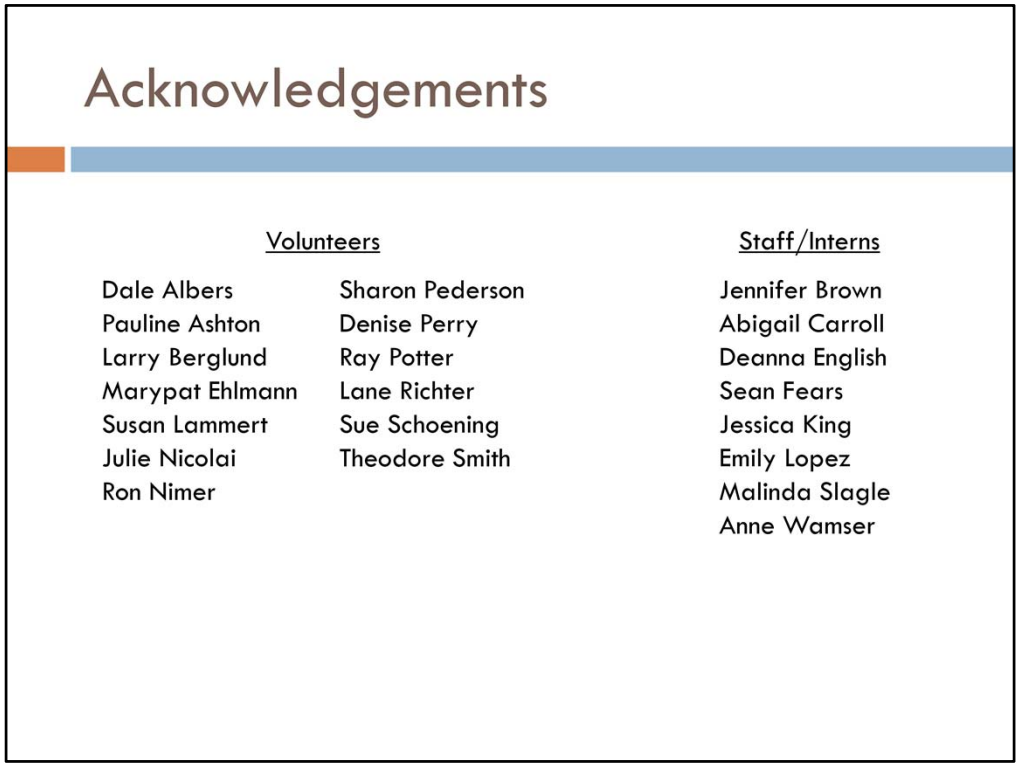
- Who is listening?
- Next steps?
- Suggestions?

Initially, the report was sent to the LREC staff, LREC ST, and state ST staff. Later, the report was posted on-line and the link sent to the LREC volunteer community as a whole. There have been 223 downloads of the LREC report from our website as of April 10 – this does not account for any downloads from the Deer Creek Watershed Alliance page. This tells us that, even though they may not be writing back to us about it, people are interested…

Beyond the messages I have received, my co-author, Chris Riggert with MDC ST, says that the report did make the rounds in several Divisions in the MDC. We are looking at ways to highlight the report to other watershed Associations as an example of what can be done with data their volunteers are collecting.

In the near future, we are looking to add a link to the report on the ST website and from there getting it to the Facebook ST group.

As for the project, we have been continuing to collect data. Although there is no date set for a follow-up report, I would anticipate a follow-up with this new data to come out in a couple of years.



Finally, I would like to acknowledge the LREC staff and volunteers who helped collect data over the past several years. None of these individuals has been on every monitoring excursion – some only made it a couple of times, others about half the time. But the project would not have been nearly successful without the interest of each and every one of them!