Upper Mississippi River Bacteria TMDL
Stakeholder Meeting

June 27, 2012
Elk River City Hall
Upper Town Conference Room
13065 Orono Parkway
Elk River, MN 55330

9:30AM – 12:00PM

9:30 – 9:50  Welcome, Introductions & Project Status Update
Phil Votruba, Barb Peichel, MPCA

9:50 – 10:30 Microbial Source Tracking – “Determining the sources and sinks of fecal bacteria in the environment”
Mike Sadowsky, Director BioTechnology Institute
University of Minnesota

10:30 – 11:00 Microbial Source Tracking Results
Andrea Plevan, EOR

11:00 – 11:10 Break

11:10 – 11:40 "Us vs. Poop: A Bacteria Reduction Demonstration Project"
Tiffany Determan, Water Resources Specialist
Sherburne SWCD

11:40 – 12:00 Next Steps
Barb Peichel, Phil Votruba, MPCA
Upper Mississippi River Bacteria (UMRB)  
Total Maximum Daily Load (TMDL) Project 
Stakeholder Meeting 
June 27, 2012 
Elk River City Hall 
Upper Town Conference Room  
13065 Orono Parkway  
Elk River, MN 55330

<table>
<thead>
<tr>
<th>In Attendance</th>
<th>Representing</th>
<th>Name</th>
<th>Representing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phil Votruba</td>
<td>MN Pollution Control Agency (MPCA)</td>
<td>Rebecca Haug</td>
<td>City of Elk River</td>
</tr>
<tr>
<td>Allison Mueller</td>
<td>MPCA</td>
<td>Joe Jacobs</td>
<td>Wright County SWCD</td>
</tr>
<tr>
<td>Laurel Mezner</td>
<td>MPCA</td>
<td>Jacob Pace</td>
<td>City of Elk River</td>
</tr>
<tr>
<td>Barb Peichel</td>
<td>MPCA</td>
<td>Rick Lestina</td>
<td>City of Maple Grove</td>
</tr>
<tr>
<td>Pat Conrad</td>
<td>EOR</td>
<td>Mike Sadowsky</td>
<td>University of Minnesota</td>
</tr>
<tr>
<td>Andrea Plevan</td>
<td>EOR</td>
<td>Art Persons</td>
<td>MN Department of Health</td>
</tr>
<tr>
<td>Nancy-Jeanne LeFevre</td>
<td>EOR</td>
<td>Pat Spence</td>
<td>Watab Township</td>
</tr>
<tr>
<td>Udat Singh</td>
<td>Mississippi Watershed Management Organization (MWO)</td>
<td>Shelley Marsh</td>
<td>City of Brooklyn Center</td>
</tr>
<tr>
<td>John Hensel</td>
<td>MPCA</td>
<td>Bruce Westby</td>
<td>City of Monticello</td>
</tr>
<tr>
<td>Len Kremer</td>
<td>Bassett Creek WMO</td>
<td>Kameron Kytonen</td>
<td>City of Andover</td>
</tr>
<tr>
<td>Roger Stradal</td>
<td>MN Department of Natural Resources (DNR)</td>
<td>Dale Reed</td>
<td>White Bear Township</td>
</tr>
<tr>
<td>Lark Weller</td>
<td>National Park Service - Mississippi National River and Recreation Area</td>
<td>Dennis Fuchs</td>
<td>Stearns County SWCD</td>
</tr>
<tr>
<td>Sue McGuire</td>
<td>Stearns County</td>
<td>Tony Strande</td>
<td>Clear Lake/Clearwater Sewer Authority</td>
</tr>
<tr>
<td>Kari Oquist</td>
<td>Mississippi WMO</td>
<td>John Caven</td>
<td>City of Hastings</td>
</tr>
<tr>
<td>Greg Aamodt</td>
<td>Carver County</td>
<td>Anna Kerr</td>
<td>MPCA</td>
</tr>
<tr>
<td>Len Linton</td>
<td>City of Ramsey</td>
<td>Linda Loomis</td>
<td>Bassett Creek WMO</td>
</tr>
<tr>
<td>Molly Churchich</td>
<td>Ramsey County</td>
<td>Chuck Keyes</td>
<td>City of Monticello</td>
</tr>
<tr>
<td>Bob Lefebvre</td>
<td>MN Milk Producers Association</td>
<td>Todd Tuominen</td>
<td>City of Champlin</td>
</tr>
<tr>
<td>Paul Hudalla</td>
<td>WSB &amp; Associates, City of Champlin</td>
<td>John Manske</td>
<td>Ramsey County</td>
</tr>
<tr>
<td>Marcey Westrick</td>
<td>MN Board of Water and Soil Resources (BWSR)</td>
<td>James Kirchenbauer</td>
<td>Clear Lake/Clearwater Sewer Authority</td>
</tr>
<tr>
<td>Tina Carstens</td>
<td>Ramsey Washington Metro Watershed District (WD) &amp; Shingle Creek/West Mississippi WMOs</td>
<td>Jamie Schurbon</td>
<td>Anoka Conservation District</td>
</tr>
<tr>
<td>Rich Brasch</td>
<td>Three Rivers Park District</td>
<td>Joel Birr</td>
<td>City of Avon</td>
</tr>
<tr>
<td>Josh Stamper</td>
<td>MN Department of Agriculture</td>
<td>Todd Haas</td>
<td>City of Andover</td>
</tr>
<tr>
<td>Tiffany Determan</td>
<td>Sherburne County Soil and Water Conservation District (SWCD)</td>
<td>Bob Paschke</td>
<td>City of Monticello</td>
</tr>
<tr>
<td>Lois Eberhart</td>
<td>City of Minneapolis</td>
<td>Jeff Schlingmann</td>
<td>Haven Township</td>
</tr>
<tr>
<td>John Erdmann</td>
<td>MPCA</td>
<td>Ryan Anderson</td>
<td>MPCA</td>
</tr>
<tr>
<td>Nicki Blake-Bradley</td>
<td>DNR</td>
<td>Marta Behling</td>
<td>Sherburne County SWCD</td>
</tr>
<tr>
<td>Randy Neprash</td>
<td>MN Cities Stormwater Coalition</td>
<td>Tara Carson</td>
<td>MN Department of Transportation</td>
</tr>
<tr>
<td>Eric Eckman</td>
<td>City of Golden Valley</td>
<td>Andrew Hogg</td>
<td>City of Columbia Heights</td>
</tr>
<tr>
<td>John Middendorf</td>
<td>City of Albertville</td>
<td>Jon Forsell</td>
<td>City of Avon</td>
</tr>
<tr>
<td>Whitney Thesing</td>
<td>Ramsey County</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note that additional stakeholders participated in the meeting via webcast but their names are not included in the above table.*
Welcome, Introductions & Project Status Update - Phil Votruba, Barb Peichel, MPCA

- Barb welcomed the group, thanked Elk River for letting us host the meeting here and help from staff with the webcast and meeting logistics. The meeting began with introductions including a brief mention from each attendee of the last time they were at the river.
- Phil began with picture of Mississippi River at Royalton, flooding at Aitkin, and a sewage leak in Fridley which were a few recent Mississippi River news items. He used these to illustrate why we were at the meeting.
- Phil showed a map of the project area and pointed out the subwatersheds with impaired listings (for aquatic recreation due to high *E. coli* bacteria concentrations) and described that those are the areas that will get wasteload/load allocations. It was pointed out that there are breaks in the map and that those are areas where there are either other underway or planned TMDL projects for those reaches or are reaches that are fully supporting (not impaired) for *E. coli*. Another slide showed greater detail on the subwatershed/contributing areas for the impaired reaches.
- Phil also showed a slide of the entire Upper Mississippi and how the project area fits in; it is a subset of 3 watersheds (8-digit Hydrologic Unit Codes (HUCs)). He went through each of the HUCs and showed the impaired reaches, project monitoring locations, contributing areas, etc.
- Phil described how the *E. coli* monitoring data was collected by partners and MPCA and showed a map and list for each of the 3 HUCs. He pointed out a couple specific reaches of interest; like a couple de-listings and a reach where there is an improving trend. Note that this *E. coli* monitoring data will be used to determine the bacteria reductions needed for the TMDL report.
- Phil described that there are 27 reaches (5 mainstem Mississippi River reaches and 22 tributaries) impaired for aquatic recreation due to *E. coli* bacteria concentrations that are in the project area. There are other bacteria impairments in the watershed but these aren’t included as mentioned previously because they are or will be included in other projects.
- Phil described next steps in the TMDL review process (that there will be a draft TMDL this fall/winter for stakeholder review). He also mentioned that we now have included stakeholder representatives from Wastewater Treatment Facilities as our project area is set.
- Phil concluded his opening remarks by thanking people for their involvement, particularly in the refinement of the subwatershed areas. He then summarized the meeting agenda and introduced Mike Sadowsky.

Determining Sources and Sinks of Fecal Bacteria in the Environment – Michael Sadowsky, University of Minnesota (UMN)

- Mike began by describing the technical approaches for determining sources and sinks of fecal coliform. The focus was mostly on how the current indicator organisms (*E. coli* and Enterococci) used in water and beach monitoring to indicate fecal contamination is changing.
- He described that there is an environmental cleansing of fecal coliform if the fecal loads are small and that there is die off of fecal bacteria (through ultraviolet radiation and nutrient starvation). However, fecal bacteria (given enough numbers and selection pressure) can figure out ways to survive.
- Molecular technologies are now available to differentiate between bacteria types. This technique, called Microbial Source Tracking (MST), can be used to distinguish the origins of non-point fecal contamination using microbiological, genotypic, phenotypic and chemical analysis. There are generally two approaches; library dependent and library independent.
- Library dependent refers to collecting fecal samples from certain animals to create a library of sources and then comparing this DNA to the DNA in water/beach samples (known as DNA Fingerprinting). Limitations to this method are that the library may not be large enough to capture unknowns, may not be representative, and are specific to small geographic areas.
- One library-independent method uses specific PCR (polymerase chain reaction) primers for specific host sources (i.e. geese). People are now using PCR for *Bacteroides* and *Enterococcus*. For this method, assays for Bacteroides can be specific (i.e. human vs. bovine fecal contamination), quantitative, and not
geographically dependent, but it does require training and the equipment/process can be expensive. Also, large numbers of samples are recommended.

- Note that the best tool for learning about bacteria sources is your eyes – you have to look around at the conditions and potential sources.
- In addition to *E. coli* being present in warm-blooded animals and being present in water, it can survive and grow in soils, beach sand, and algae.
- Another new technique is called metagenomics, the study of the totality of genetic material recovered directly from environmental samples. This is an important analysis because the majority of microorganisms remain uncultured or non-culturable. For this method, DNA is extracted and sequenced for all microbes in the water sample. Then the DNA sequences from the river samples can be compared with data sets of feces from known animals. It is like bar-coding all the microbes. Mike is using this technique on the Mississippi River Metagenome project. This is the next generation sequencing technique for fecal bacteria.
- For more information, check out http://www.ecolirep.umn.edu/ or Mike’s book, *The Fecal Bacteria*. Also note that the Environmental Protection Agency has a report entitled *Using Microbial Source Tracking to Support TMDL Development and Implementation*.

**Questions**

Q: Where does *E. coli* on *cladophora* (algae) come from?
A: *E. coli* cling onto it and grow.

Q: What are the places in the environment where bacteria are growing and becoming mobilized? What can you say about survival rates?
A: It depends on matrix that you are looking at. It varies with environmental factors. Bacteria are typically starved for carbon and nitrogen. They freeze out in the winter.

Q: What would be the percent contribution of background versus active recent loading?
A: It varies considerably. In a reed canary grass area it was 20% and that was the highest Mike has seen. It is usually more like 5% (that is what we found in the Seven Mile Creek Watershed study).

Q: Would fall application (injection) of manure be a good Best Management Practice since bacteria would die over winter?
A: Yes.

Q: Why is there variability?
A: Temperature, moisture, etc. Bacteria die within days without moisture.

Q: What is best time of day to sample?
A: Early morning like 10 a.m., especially for beach sites.

Q: What about characterization based on land use. Where are we in that science?
A: Mike did not know.

Q: Can this be applied to our project?
A: That will be discussed in the next presentation.

**Microbial Source Tracking Results - Andrea Plevan, EOR**

- Andrea described the study that was done for this Upper Mississippi River Bacteria TMDL project. EOR collected the water samples and that Mike Sadowsky (UMN) coordinated the lab analysis work. This was considered a pilot study to try this type of microbial source tracking method to help us understand more about the possible sources of bacteria to help inform project implementation efforts.
Water samples were collected from 19 monitoring sites which included 5 mainstem Mississippi River sites and 11 tributaries (e.g. Little Two River, Two River, Spunk Creek, Watab River, Johnson Creek, Interstate Valley Creek, Pleasant Creek, County Ditch 17, Shingle Creek, Bassett Creek, and Unnamed Creek), and 3 stormwater outlet sites. These sites were chosen based on known high E. coli concentrations, a variety of land uses and geographic areas. Some samples were collected during when there was high flow from rain events in the rivers/creeks and some during low flow events. Note that this was a very small sample size.

Samples were analyzed for Bacteroides, which are anaerobic bacteria abundant in human and animal feces. PCR primers were used to determine if sources could be attributed to cattle, swine, or human/pets. Note that this methodology only determines what might be present as a source at the time of water sampling (so there could be other sources, but they were not present at that time) and we do not have primers for all animals. Also note that the human/pet primer can’t separate out humans from pets.

We consider the results semi-quantitative so what we want to note is which sites had high, medium, or low results. For the cattle primer, Johnson Creek had really high results. The St. Anthony stormsewer (St. Paul) had high results for cattle (note that this subwatershed drains the State Fairgrounds and the UMN St. Paul campus). For the swine primer, only Johnson Creek had a positive result. For the humans/pets primer, two sites had really high results. A number of other sites showed positive results for humans/pets. Pleasant Creek was only site that had showed positive results for humans/pets during low flow.

Note that with this level of microbial source tracking analysis, we are able to get a big picture look at patterns such as at what sites are the primers for cattle, swine, and humans/pets present, what sites have high or low results, and what is the land use and monitoring site type.

Of note was that the analysis found urban sites (e.g. County Ditch 17, Shingle Creek, and Brooklyn Center 65th Ave. stormwater outfall, St. Anthony Park stormwater outfall, Mississippi River at Lower St. Anthony Falls, and Mississippi River after the confluence with the Minnesota River) that showed positive results from cattle.

Stormsewer outfalls all showed positive results for the humans/pets primer.

Q: What do you make of the fact that the UMN site was very high for humans/pets during one sampling event, but not the other?
A: It was a small sample size so it makes it difficult to know the reason, but both samples showed positive results for humans/pets.

Q: Why are human/pets combined?
A: Because the DNA in bacteroides is very similar for humans and pets and there are not separate primers.

Q: Where was the UMN site?
A: The outlet is near the Stone Arch Bridge and the watershed drains the St. Paul campus and part of the St. Paul.

Q: Why weren’t ducks and geese included?
A: At the time of sampling, UMN was not able to use duck and geese primers.

Q: Have you tried to correlate sample times into it?
A: No.

Q: What’s going on with cattle in the urban area? Could it be from compost?
A: That could be possible. Good composting practices would kill bacteria but the compost folks get from the St. Paul campus may not have been thoroughly processed.

Q: How long can bacteroides survive?
A: It can survive about 30 days in manure.
Q: Are you going to hold off on the TMDL until we get better answers or move forward with the source assessment approach we have?
A: The TMDL equation will use the *E. coli* monitoring data and river/stream flow conditions that has been conducted (and was discussed in more detail at the last stakeholder meeting) to determine the allowable load and reductions needed to meet water quality standards. We are still going to do a TMDL and regulated entities will get assigned allocations. Note that the results of this pilot MST effort with UMN are just one of the tools we are using to help us target implementation actions. It’s not very different from what we do on other studies in that we move forward with the best available information that we have.

Q: How do hobby horse farms relate to these results? Could that be the cattle sources too?
A: No – it is cow specific marker.

**Evaluation of Best Management Practices Targeting Low and Base Flow Bacteria Reduction Strategies in an Agricultural Setting - Tiffany Determan, Water Resources Specialist, Sherburne SWCD**

- A lot of attention is being focused on Johnson Creek so hopefully this presentation will address some of the questions. Note that this project is actually not complete yet so the presentation will focus on the background, goals, and monitoring design. The primary objective of this project is to measure change in bacteria concentrations before and after BMP implementation. The three main drivers behind this project was the National Park Service interest in improving water quality in the Mississippi National River and Recreational Area, 2009 EOR report showing monitoring needs and high bacteria concentrations in some tributaries to the Mississippi River, and the Elk River Watershed was finalizing a TMDL on an upstream reach of the river but there was not monitoring data past Lake Orono so there was no way to validate the potential contributions to the Mississippi River.

- Reducing bacteria from agricultural/rural practices during low flows could include implementing practices such as upgrading failing septic system treatment systems (SSTS) and managing riparian grazing differently. We were looking for a project to implement buffer strips on high priority lands and our goal was to include up to three different sites and then measure the change in bacteria concentrations pre and post Best Management Practice (BMP) implementation and provide education.

- We looked at the literature review that EOR did as part of the Upper Mississippi River Bacteria TMDL project showing what the reduction ranges are for various BMPs. An example is that 22-35% decrease in bacteria concentration with the elimination of livestock access to riparian models. Elk River staff developed selection criteria such as finding sites that have cattle access to the stream, landowners would allow staff access, and landowners would be willing to let us use the site for education.

- No interested parties were found in the Elk River Watershed so project staff decided to conduct the project at Johnson Creek instead of Elk River. Bacteria concentrations in Johnson Creek are very high. The project site is 1 mile upstream of an *E. coli* sampling location for the UMRB TMDL project. It is a dairy operation with about 50 cattle and Johnson Creek runs through the site. There is no place to store manure so it is stockpiled and applied during the winter to fields. The streambanks were completely denuded of vegetation before the project and was basically acting as an extension of the feedlot. The first step was fencing to exclude cattle from the stream. Then we re-established 4.5 acres of vegetation along the streambank and are installing a cattle crossing this year when water levels subside. We will also be installing a manure storage system for liquids, a slab for solids, a settling basin, and vegetative treatment area. The total cost for the project is over $200,000 with $50,000 being provided by the landowner.

- *E. coli* monitoring at the site will be conducted once per week upstream and downstream of the site. Pre-project the data shows that the downstream site has higher bacteria concentrations than the upstream site. Now that there is fencing and some vegetation growing in the riparian zone they have some preliminary data but it is inconclusive at this time. The next steps for the project are to continue implementation of BMPs and monitoring the results.

Q: How typical was this farming operation in terms of spreading the cost for manure management across the County?
A: Again, the operation has about 50 cattle but this is not an uncommon problem. The county environmental services staff has been working on this site since 2001 but it takes a long time for developing relationships, obtaining funding, and implementing these activities.

**Next Steps - Barb Peichel and Phil Votrubka, MPCA**

- Barb concluded with a summary of the next steps for the Upper Mississippi River Bacteria TMDL project.
- The TMDL report section on probable bacteria sources is being drafted and will identify relative bacteria production (for the entire project area by watershed Hydrologic Unit Code (HUC) 10 level) and relative bacteria delivery (only for subwatersheds that contain river/stream *E. coli* impairments). For example, in certain watersheds more *E. coli* is produced from livestock than humans and pets and in other watersheds, the opposite is true. The source categories will be humans, dogs, horse, cattle, goat, hog, sheep, deer, geese, duck, and raccoons. Also, we will be able to say for example that more *E. coli* is produced in the Middle Sauk River Watershed than the Two River Watershed. This information will be used to identify primary sources of bacteria in the project area and help us develop target areas and practices for implementation. Stakeholders will review this approach and findings as part of the Draft TMDL (which will likely be available in winter 2012).
- The Draft TMDL report for each impaired river or stream reach will include the total allowable loads for *E. coli* in order for these reaches to meet water quality standards. These loads will be split up into permitted (wasteload allocation) and non-permitted (load allocation) loads. We will be having a Municipal Separate Storm Sewer System (MS4) meeting in addition to an overall stakeholder group to discuss allocations. Allocations will be made by flow regime (high, moist, mid, dry, low).
- The Implementation Plan for the UMRB TMDL project will also be drafted in the next year. The goal of implementation is to eliminate bacteria sources, reduce bacteria loads to be managed by BMPs, and limit the delivery of bacteria to surface waters. We will be seeking input on the Implementation Plan since you are the ones that will be using it. Potential implementation efforts will be discussed at the next few stakeholder meetings.
- Based on monitoring data that shows high bacteria concentrations for a creek in Lilydale, the Cities of Mendota Heights and Lilydale are looking into further investigation the city of Mendota heights did some further investigation and found a problem that they are now addressing
- Presentations and meeting notes will be made available on our project website for the Upper Mississippi River Bacteria TMDL project at [http://www.pca.state.mn.us/ktqha48](http://www.pca.state.mn.us/ktqha48). Note that Mike Sadowsky’s presentation will not be posted on the MPCA website due to copyrighted material.
- The City of Elk River has recorded this meeting which is available for viewing at [http://elkriver-mn.pegcentral.com/player.php?video=bf43c5aa9ea4e0a6d5b6a3ac893be72b](http://elkriver-mn.pegcentral.com/player.php?video=bf43c5aa9ea4e0a6d5b6a3ac893be72b).