

Upper Mississippi River Basin Association Water Quality Task Force

September 20-21, 2016
Moline, Illinois

Meeting Summary

Participants

Gregg Good	Illinois EPA
John Olson	Iowa DNR
Mary Skopec *	Iowa DNR
Dana Vanderbosch	Minnesota PCA
Joel Chirhart *	Minnesota PCA
Megan Moore *	Minnesota DNR
Eric Lund *	Minnesota DNR
Mohsen Dkhili	Missouri DNR
Brian Weigel	Wisconsin DNR
Shawn Giblin	Wisconsin DNR
Jim Fischer *	Wisconsin DNR
Andy Bartels *	Wisconsin DNR
Deanne Drake *	Wisconsin DNR
Linda Holst *	USEPA, Region 5
Ed Hammer *	USEPA, Region 5
Meghan Hemken *	USEPA, Region 5
Joel Allen *	USEPA, ORD
Blake Schaeffer *	USEPA, ORD
Kelly Warner	USGS, Illinois Water Science Center
KathiJo Jankowski	USGS, Upper Midwest Environmental Sciences Center
Becky Kreiling	USGS, Upper Midwest Environmental Sciences Center
Jeff Houser *	USGS, Upper Midwest Environmental Sciences Center
Ana María García *	USGS, South Atlantic Water Science Center
John Sloan	National Great Rivers Research and Education Center
Jimmy Parra	Midwest Environmental Advocates/Mississippi River Collaborative
Dave Hokanson	UMRBA
Matt Jacobson	UMRBA

*Joined the meeting by phone.

Call to Order and Introductions

The Water Quality Task Force (WQTF) was called to order at 1:03 p.m. on September 20, 2016 by Chair Brian Weigel. Introductions by all participants followed. Weigel noted the meeting agenda would be modified slightly to include a conversation regarding thermal mixing zones led by Mohsen Dkhili and comments regarding harmful algal bloom (HAB) related research by John Sloan.

Approval of Previous Meeting Summary

Gregg Good moved to approve the summary of the June 1-2, 2016 joint meeting of the Water Quality Executive Committee (WQEC) and the WQTF. Weigel seconded and the motion was approved by voice vote.

Interstate 305(b) and 303(d) Consultation

Minnesota

Dana Vanderbosch said the table included in the meeting packet correctly represents Minnesota's proposed impairment listings for 2014 and 2016. She noted that USEPA had not yet approved the 2014 list and that the 2016 list is currently out for public comment.

Wisconsin

Weigel said the packet materials are also correct in terms of Wisconsin's listings. He highlighted that, in the 2016 listing, total phosphorus impairments will now extend through Reaches 5 and 6. As such, the entire length of the UMR in Wisconsin now has been listed as impaired due to elevated phosphorus levels. Weigel added that Wisconsin's 2016 list had been submitted to USEPA in April, but has not yet been approved.

Iowa

John Olson said Iowa's 2016 impairment listings for the UMR are expected to be the same as those in 2014, except that a PCB-related impairment and an indicator bacteria impairment will likely be added in Reach 7. He explained that the indicator bacteria impairment in Reach 7 would then match Illinois' fecal coliform impairment of the same reach.

Illinois

Good reported that Illinois' draft 2016 impairment list had been transmitted to USEPA in July, but action on the list by USEPA is pending. He noted that previous lists had not been fully approved by USEPA.

Missouri

Dkhili reported that the only changes in Missouri's 2016 impairment list did not affect the UMR. As such, the 2014 and 2016 listings for the UMR will be identical. He added that Missouri's 2016 list has been partially approved by USEPA Region 7 and final approval is pending.

TMDLs on the Mainstem UMR and Major Tributaries

Missouri

Dkhili said Missouri hopes to complete a bacteria TMDL affecting the UMR yet this year. He explained that this TMDL would include both the mainstem UMR in the St. Louis area as well as major tributaries (e.g., Meramec River).

Iowa

John Olson said Iowa DNR is currently focusing on lake eutrophication-related TMDLs, with the intent of completing lake TMDLs statewide by 2022.

On the UMR specifically, Olson explained that Iowa DNR continues to work with ADM on the location-specific slime impairment on Beaver Slough at Clinton, Iowa. He indicated that changes at the ADM facility here appear to have reduced the presence of slime from 10 miles in length to two miles. However, he noted, the TMDL goal is zero presence of the slime, and ADM will continue its spring and fall monitoring program. Kelly Warner asked if the slime has been specifically identified. Olson said it is sewage slime, *Sphaerotilus natans*. Olson explained that ADM has said it is not discharging the slime, but it is apparent that something in ADM's discharge is encouraging the slime's growth. He said the issue was first reported by commercial fishermen in the area whose nets were impacted and the impairment is based on Iowa's narrative standard for aesthetic conditions. Giblin asked if phosphorus appeared to be triggering the slime growth. Olson replied that it is not clear and it is likely several

factors are contributing to the issue. Warner asked if this is observed anywhere else on the UMR in Iowa. Olson said this is the only current instance, though the presence of slime had historically been more prevalent.

While not a TMDL-specific report, Olson also offered a brief update on the Des Moines Water Works lawsuit. He reminded the WQTF that the Water Works first filed an intent to sue back in early 2015 and noted that the case has been identified as having two parts and raise two separate questions: 1) is the tile drainage system a discharge subject to the Clean Water Act? and 2) can the Des Moines Water works collect damages from the drainage districts involved? Olson said there is a Iowa state law which makes drainage districts immune from such damage claims, but the federal court has sent this second question back to the state to make a determination. He said action on the state level is expected soon with action at the federal level anticipated in 2017. Dkhili asked whether any monitoring is being conducted at tile drain outfalls in Iowa. Olson responded that monitoring is being done by the Iowa Soybean Association as well as other groups.

Illinois

Good said Illinois did not have a TMDL report this meeting, and the detailed report given at the preceding meeting largely captures TMDL status in the state.

Wisconsin

Weigel noted Wisconsin's work on a TMDL for the Milwaukee River Basin addressing fecal coliform bacteria, phosphorous, and sediment. While it is not in the UMR basin, Weigel noted that this has been a major focus of Wisconsin DNR's recent TMDL efforts. He explained that draft allocations have recently been developed for this TMDL and there is a strong influence from wastewater and storm water in these allocations. Weigel said Wisconsin DNR hopes to submit the TMDL within approximately the next month.

Weigel noted that another large-scale TMDL being developed by Wisconsin DNR is the TMDL for the Wisconsin River, pointing out that the portion of the Wisconsin River Basin addressed by the TMDL covers approximately 9,000 square miles. He said a couple of reservoirs on the river are primarily driving the TMDL and that modeling has been conducted for these. Weigel said one of the challenges in creating the TMDL has been in regard to establishing chlorophyll-a reduction targets. While the models exist to provide draft reductions, an important and difficult step will be to adjust these for local conditions. Jankowski asked which pollutants will have allocation made under the TMDL. Weigel responded that these are being developed for total phosphorus and total suspended solids.

Minnesota

Dana Vanderbosch explained that the majority of Minnesota's TMDLs are developed around individual watersheds and as a result a border water such as the Mississippi River may not fall under a TMDL, at least at the entire basin scale. She said the Lake Pepin TMDL is the one TMDL in Minnesota which directly addresses the interstate UMR. Weigel asked if Vanderbosch had any specific report in regard to the Lake Pepin TMDL. Vanderbosch said she did not but could check with MPCA's Justin Watkins for a detailed update. Dave Hokanson suggested that a dedicated discussion of the Lake Pepin TMDL could be part of an upcoming WQTF meeting.

State Nutrient Reduction Strategy Updates

Wisconsin

Weigel reported that Marcia Willhite is leading an update to Wisconsin's nutrient reduction strategy. He added that, as part of strategy implementation, Wisconsin is considering the best ways to track changes and trends over time, recognizing that these are likely to occur primarily over the long term, rather than in the near term.

Illinois

Good said Amy Walkenbach has taken the lead on the Illinois nutrient loss reduction strategy within Illinois EPA. He explained that multiple subgroups are involved in strategy implementation and that he is chairing the monitoring subgroup. In this context, Good explained, he has been working with USGS and Kelly Warner in particular on the installation of a continuous monitoring network. He said the network currently has eight stations statewide and plans are underway to add a ninth station at Joliet in order to monitor water quality coming from the Chicago area. Separately, Good noted that Illinois EPA is seeking to integrate biological condition information into assessment of long-term changes in water quality.

Good also reported that the Chicago Metropolitan Water Reclamation District (MWRD) has recently installed an Ostara nutrient reduction system at its Stickney Plant. He explained that the process is designed to remove up to 65% of the phosphorus from the effluent stream and convert it into a marketable fertilizer product. Good said systems of this type have been installed elsewhere – such as in Madison, Wisconsin – but that the Chicago MWRD system appears to be the largest of its kind. He also noted that the agriculture sector in Illinois has been working on messages associated with nutrient loss reduction including timing of fertilizer application.

Additionally, Good noted that efforts are ongoing to look at ground water impacts from nutrients, as well as surface water impacts. In particular, he said work is ongoing in places where elevated ground water concentrations of nitrogen have been observed, such as the area of sandy soils near Havana, Illinois. Kelly Warner concurred, adding that the investigation of ground water concentrations will be a key component in understanding the presence, distribution, and impacts of nutrients. Sloan asked whether center point irrigation is commonly used in some of the areas where elevated nitrate levels in ground water are being detected. Warner confirmed that this is commonly the case, and noted that nitrate concentrations up to 40 mg/l have been observed in these areas, with average concentrations around 20 mg/l. She said the potential correlation between irrigation and elevated nitrate levels is being explored in collaboration with the agriculture community, and that these elevated results have driven interest in the issue more broadly. Warner added that some studies have indicated higher nutrient concentrations in surface waters under low flows, and there is a need to understand the role ground water may be playing in these situations.

Iowa

Olson said Iowa had recently published its third annual report regarding its nutrient reduction strategy implementation and that it is available on the Iowa State University (ISU) website (<http://www.nutrientstrategy.iastate.edu/>). He reminded the WQTF that Iowa DNR is leading the point source side of the strategy while the Iowa Department of Agriculture and Land Stewardship (IDALS) is heading up the nonpoint side of the strategy. Olson said strategy implementation is moving forward for both point and nonpoint sources, and that an important focus is now on the tracking of this implementation. He highlighted the following actions in particular from the third annual report:

- Installation of continuous water quality monitoring sensors by the University of Iowa (IIHR – Hydroscience & Engineering).
- Iowa DNR review of statewide stream monitoring.
- Initiation of a three-year nutrient reduction strategy (NRS) Measurement Pilot Project, including an evaluation of protocols for improving NRS tracking.
- A conservation practice mapping project conducted by DNR, IDALS, and ISU which has digitized over 9 million acres to map structural practices including terraces, ponds, grassed waterways, and water and sediment control basins.
- Enhanced monitoring of wastewater treatment plant influent and effluent for phosphorus.

Olson noted that funding continues to be an important topic related to strategy implementation. He said Iowa received a \$96 million grant from the department of Housing and Urban Development (HUD) to address flooding, as well as water quality, across the state as part of the “Iowa Watershed Approach.” Additionally, \$9.5 million in federal funds have been provided via USDA NRCS Regional Conservation Partnership Program (RCPP) projects in Iowa. Olson said there is also a push being made for the Iowa legislature to approve dedicating a portion of state sales tax to a previously voter-approved Natural Resources and Outdoor Trust Fund. Regarding dedicated state funds, Giblin asked whether there is any sunset provision built into Minnesota’s Legacy funding mechanism. Vanderbosch replied there is a 25-year renewal period. Dkhili added that Missouri’s sales tax funding of soil and water conservation programs is up for renewal in the upcoming election.

Warner asked how the sensors deployed by IIHR are funded. Olson replied that, to his understanding, a variety of funding sources are being utilized to support these sensors. He added that the sensors do not function year round and need to be removed in the winter to avoid ice damage. Jankowski asked whether the IIHR sensors track more than just nitrogen. Olson responded that they are primarily employed to measure nitrogen, though they may also measure a few ancillary parameters such as temperature. However, he noted, they do not measure phosphorus as the technology for continuous measurement of phosphorus is not as fully developed as that for nitrogen.

Dkhili questioned the focus on nutrient loading, as opposed to concentration, in a number of the states’ nutrient reduction strategies and monitoring approaches. He noted that water quality standards are typically expressed in terms of concentrations and as such that should be the target for water quality programs. Dkhili further observed that concentration and load are related and therefore reducing concentrations will also reduce loads. Warner commented that load is an important consideration in designing best management practices, as they need to be able to perform under various flow conditions. Olson noted that Iowa’s nutrient reduction strategy is very focused on load. Sloan added that load is also important in a Gulf Hypoxia context as it is the load, rather than the concentration, that will impact the extent of the hypoxic zone. Weigel stated that both concentration and load need to be kept in mind, adding that TMDLs are expressed in load, rather than concentration.

Missouri

Dkhili said Missouri is three years into the implementation of its strategy and that in these first three years activities have included:

- Collection of effluent data, both from permittees and via voluntary monitoring
- Development of a nutrient trading framework, which is now being reviewed by the Missouri Clean Water Commission.
- Establishment of edge-of-field monitoring protocols.
- Evaluation of the economic impacts of the nutrient reduction strategy.

Jankowski asked whether ecosystem services are being incorporated into economic evaluations associated with nutrient reduction strategies. Dkhili said he did not think Missouri’s economic evaluation included ecosystem services. Weigel noted that Wisconsin has only considered these so far to a very limited extent.

Dkhili added that Missouri has not yet developed broadly applicable water quality criteria for nutrients in lakes or streams, but that nutrient-related TMDLs are in development for specific watersheds.

Minnesota

Vanderbosch said Minnesota had published its strategy in 2014 and that nonpoint source reduction activities under the strategy are primarily voluntary. She also discussed the buffer initiative championed

by Governor Dayton, which establishes requirements for buffers along all public waterways in the state, with those buffers to be installed by the end of 2017. Vanderbosch said Minnesota DNR has completed the maps underlying the initiative, but how implementation and enforcement specifically proceed is still somewhat to be determined. She noted that Governor Dayton has also recently announced a “Year of Water Action” so it is likely that further initiatives are forthcoming and will likely address nonpoint source/nutrient issues. Vanderbosch added that MPCA is working to better integrate its data into nutrient reduction strategy implementation and in evaluation of the impacts of nutrient reduction actions.

Partnership Updates

Hokanson briefly provided updates on partnerships in which UMRBA is engaged, including the Mississippi River Cities and Towns Initiative (MRCTI) and the Upper Mississippi River Conference (UMR Conference).

Hokanson said MRCTI and UMRBA had jointly authored a letter to the Senate Interior and Environment Committee regarding FY17 appropriations. The letter specifically asked for support of USGS Water Resources Programs, Section 319 Nonpoint Source Management Grants, and Clean Water and Drinking Water State Revolving Loan Funds. Also, UMRBA has collaborated with MRCTI, USFWS, and the Nature Conservancy to update the economic profile for the UMR. Hokanson distributed a brochure including findings from this update, which expanded the counties included to a total of 133 (compared to 60 counties in the previous version) and now identifies an annual total of over \$345 billion in revenue and more than 1 million jobs in river-related sectors. Giblin asked if it would be possible to prepare a more detailed comparison of the results of the two versions of the report. Hokanson said he could do this and share with the WQTF.

Hokanson also noted that UMRBA has participated in the planning group for the upcoming UMR Conference, to be held in Moline on October 13-14, 2016. He reminded the WQTF that the UMR Conference will this year focus on identifying activities to “raise the grade” in the goal areas identified by the 2015 America’s Watershed Initiative Report Card for the Mississippi River Basin.

Harmful Algal Bloom-Related Research

USEPA Office of Research and Development (ORD) Research

Blake Schaeffer and Joel Allen provided an overview of research being conducted by USEPA’s Office of Research and Development (ORD) in regard to harmful algal bloom (HAB) monitoring and prediction. Schaeffer began by reviewing ORD’s HAB research priorities as follows:

- Management strategies to reduce HABs related risk.
- Human health, ecosystem, and socio-economic impacts.
- Causal assessment leading to improved modeling.
- Monitoring protocol, analytical, and assessment methodology development.

Schaeffer then described the application of remote sensing technologies to the detection of algal blooms, noting that ORDs work in this area is currently focused on lakes and reservoirs as dictated by the resolution provided in satellite imagery. He explained that the spatial resolution for satellite imaging is approximately 300 meters with MERIS imagery, which has a revisit cycle of 2-3 days, allowing for the resolution of approximately 6% of 275,000 US lakes. Alternatively, Landsat-8 provides finer resolution (up to 60% of US waters can be resolved) but the revisit cycle for Landsat is longer (8-16 days). In either case, the imagery is not particularly well suited for inland waters and rivers are particularly problematic. However, Schaeffer explained, work is ongoing to look at correlations between cyanobacteria cell counts and chlorophyll-a in the field as compared to what is indicated via satellite imagery, in hopes of making better use of this imagery. He added that surface temperature information

is more readily available and could potentially be used as an indicator of potential bloom activity in rivers and streams.

Schaeffer explained that ORD is also undertaking an effort to look at the extent and duration of HAB events over time in the Great Lakes Basin, as well as the occurrence of these events in relationship to water supply intakes and among different water bodies and regions. Dkhili asked if any of this work allows for the prediction of HAB events. Schaeffer explained that the work he has described so far focuses on detection and does not provide for prediction, but that some of Joel Allen's work does address prediction as well as modeling. As such, he handed the presentation off to Allen, who provided the remainder of ORD's remarks.

Allen opened his remarks by noting that there are many questions to be investigated regarding the occurrence of cyanobacteria as well as the production of cyanotoxins, including:

- What are the biotic and abiotic factors which drive the underlying cyanobacterial ecology and responses to changing environments, particularly cyanotoxin production?
- What is the temporal scale at which these processes occur?
- Are there measurable parameters that can indicate impending blooms and cyanotoxin production?
- What are the unique challenges and opportunities presented by reservoir hydrology in understanding HAB dynamics and management?

Allen explained that, in order to begin answering questions regarding the prediction of HABs, ORD has started by looking at intensive data from a specific set of waterbodies. In particular, he explained that the work he is presenting today is taking place at one reservoir in the Cincinnati area with the intent of focusing HAB predictive approaches on certain key biotic and abiotic factors, as well as examining the impacts of reservoir hydrology. He explained that a number of monitoring approaches have been employed, including chemistry, ELISA, and molecular markers. Allen noted that the reservoir used for the study actually has two different basins with differing biological characteristics.

Based on the Cincinnati reservoir study, Allen said certain parameters – including phycocyanin, temperature, and photosynthetically active radiation (PAR) – appear to be potentially valuable predictors of HAB/toxin occurrence. In particular, he noted, there appears to be a relatively strong correlation between phycocyanin and microcystin. Overall, Allen emphasized, the goal of this work is to identify parameters that are indicative of HABs and algal toxins then develop models to facilitate prediction. Right now, he said, ORD's work is focused on developing those relationships to allow for model creation. He displayed the output of one predictive model (ARIMA) for microcystin occurrence.

Allen provided an additional observation that water quality characteristics can vary greatly at the depth of the intake present in the reservoir. To illustrate this, he displayed a slide showing variations in dissolved oxygen concentrations over time at the intake depth. Lastly, Allen noted that USEPA's Office of Water is working on a source water monitoring guidance related to HABs.

Shawn Giblin asked whether ORD had looked at any correlations between residence time and microcystin levels. Allen replied that this had not been explored to date, but as the study is in the first of four years, this will likely be addressed in a later study year. KathiJo Jankowski asked Allen what he felt was the ideal prediction timeline scale. Allen replied that days to weeks would be a desired prediction timeline. Brian Weigel asked what variables were used as inputs in the previously displayed ARIMA model outputs. Allen said phycocyanin was the only input variable and it provided a strong correlation to a month's worth of observed data for microcystin.

Giblin asked whether there is a particular species of cyanobacteria that is dominant in the study reservoir. Allen replied that this reservoir has an extremely diverse phytoplankton community, perhaps the most diverse of any waterbody in the state. As such, there is not a single dominant species, though anabaena was observed to be most prevalent through June, then declined, with microcystis, cylindrospermopsis, and numerous other species groups present at measurable levels.

Gregg Good observed that, in Illinois, many reservoirs are multiple use (drinking water supply, recreation, etc.) and the utilities drawing from them as source water may be relatively small. As such, there is a great need to provide practical, helpful information to the operators of these water systems. He said the recently-published USEPA guidelines for microcystin and cylindrospermopsin have forced operators to be aware of and react to algal toxins, and Illinois EPA is still working to provide these operators with the most helpful tools possible. Allen concurred with Good's observation, noting that once blooms are established, the options for operators are very limited, particularly for small water systems. As such, any tools which can be developed to help these utilities are very important. Weigel observed that key questions for operators are likely to fall into two categories: 1) how do I monitor for/detect the presence of HABs/algal toxins? and 2) what do I do if they are present?

Giblin asked Good whether IL EPA is observing any particular flow-related cues to when an HAB event may be likely to occur. Good said this has not been observed to his knowledge, but rather that there are certain reservoirs which appear to be most commonly impacted by HABs, and that neighboring land use appears to be related to the issues encountered by these reservoirs.

Returning to the earlier discussion of satellite imagery, Jankowski asked Schaeffer what might be expected in terms of the ability to observe blooms on the UMR using satellite imaging. Schaeffer said ORD had not done a spatial analysis on the Mississippi River in particular, but in general the utility is likely to be quite limited, given spatial resolution constraints. Among the satellite data options, he said Landsat-8 is likely to be somewhat more useful, but he explained that the key is not just one pixel width, but that three are typically needed to make a definitive determination of a reading (i.e., not mixing pixel readings). So, for example, if the pixel width is 300 meters, then 900 meters of surface are needed to confirm a reading definitively.

National Great Rivers Research and Education Center and St. Louis University Research

John Sloan provided an overview of a research proposal recently submitted by St. Louis University, the National Great Rivers Research and Education Center (NGRREC), and other partners to utilize remote sensing, water chemistry data, and hydrological modeling to characterize and predict water quality condition in the UMR basin, including conditions leading to HABs. He explained that this proposed research would focus on two UMR sub-basins (the Meramec and the Kaskaskia) and would integrate data from satellites, hand-held and other hyperspectral sensors, ambient water quality monitoring, and other sources.

Sloan noted that end users who supported the proposal included UMRBA and the American Water Company. In the case of American Water, he commented that water suppliers have an interest in conditions leading to taste and odor issues as well as HABs. Sloan said the project proposes work over a period of 3 years with a total budget of \$1.5 million. He added that a decision should be made soon on whether or not the project will receive funding and that he will keep the WQTF updated as to its status.

Summer Hypoxic Conditions and Fish Kills in Pools 7 and 8

Giblin gave a summary of recent fish kill in Pools 7 and 8 attributed to low dissolved oxygen levels. He explained that these hypoxic conditions were likely related to high precipitation and flow events which lead to fluctuating water levels and flushing of organic materials into the river and associated backwaters. He explained that a combination of dead and sediment-covered vegetation and organic

material pushed out of wetlands consumed oxygen creating hypoxic zones in off-channel areas, leading to significant fish kills.

Giblin displayed monitoring results from a marsh area (Brown's Marsh) off of the Black River near La Crosse where the dissolved oxygen concentration was observed to be as low as zero at midday sampling. The fish kill occurring in this area was reported by an angler on June 24 who was concerned it may have been caused by a manure spill. Giblin explained that large fish are the first to die off in a low oxygen event, though in this case fish across size classes were killed, as well as highly tolerant species such as bullhead. Additionally, Giblin noted, the anoxic conditions may have caused phosphorus to be released from sediment contributing to high total phosphorus readings at this site. Giblin also showed data associated with fish kills at Lawrence Lake and Blue Lake (both are Pool 8 backwaters) occurring in late July 2016; as well as at Trempealeau Lakes/Round Lake (Pool 7 backwaters), also in late July.

Jankowski asked how long continuous dissolved oxygen monitors were deployed to assess condition in the locations where kills occurred. Giblin replied that they were deployed for approximately one week and in some cases were moved to various locations within the impacted area.

Overall, Giblin observed that these incidents appear to be associated with variability of flows and, if this continues to be a predominant flow/precipitation pattern in the future, such kills are likely to be a recurring scenario. Olson concurred, noting that kills seem to be most pronounced when a long, dry period is followed by heavy rains – leading to a lot of flushing of organic materials. Weigel asked if it's the magnitude of variation in flow that seems to be the most predictive of the severity of the kill. Giblin replied that this does appear to be the case. Olson agreed, adding that stream size will also determine severity. Giblin added that water quality is also a consideration in kills, as greater sediment loading will lead to greater plant mortality which in turn causes more decay and oxygen depletion. Weigel and Giblin noted that, if these factors are really the drivers of fish kills, they are potentially critical considerations for ecosystem restoration project design and illustrate the importance of lateral connectivity on the river.

Harmful Algal Blooms (HABs) on the UMR

Recent Events and Agency Updates

Hokanson observed that HAB events appeared to be relatively infrequent on the UMR this year, presumably due to high flows. Giblin said one dog death due to HAB exposure had been reported at Trempealeau, but that this type of report is hard to corroborate. Warner agreed that confirming such cases can be difficult, particularly when there may be an extra charge to the pet owner to have the specific cause of death further diagnosed. Vanderbosch concurred, saying it can be both challenging and expensive to have a diagnosis confirmed. Additionally, even timely sampling to confirm the presence of the HAB in the waterbody can be difficult in some cases. Giblin and Warner observed that it may be helpful if there is funding available to support the cause of death investigation. Vanderbosch said such a funding mechanism did exist at one time in Minnesota, but is no longer available.

UMR HAB Work Group

Hokanson reported that the UMR HAB Work Group had completed the initial *Upper Mississippi River Harmful Algal Bloom Response Resource Manual*, which has been posted to UMRBA's website. He said the work group had chosen to take the approach of resource manual, rather than a policy document, at this time. Jimmy Parra asked if a press release or other effort was made to inform the public of the existence of the manual. Hokanson replied that, while the public is welcome to access the manual, it is designed with agencies as a primary audience and as such there was not a specific public outreach effort made regarding the manual.

Matt Jacobson then demonstrated a map-based viewer being developed to accompany the manual. He noted that it currently focuses on jurisdictions relevant to HAB events, but could be modified or expanded as the WQTF and HAB Work Group see fit. Giblin and Weigel noted that such a viewer could be used to track bloom events on the UMR.

Hokanson reported that, in a conference call the preceding week, the HAB Work Group had determined it would like to continue meeting via conference call in the upcoming year. Work group members suggested three conference calls be held – before season (early 2017), during season (summer 2017), and post-season (late 2017).

Thermal Mixing Determination on the UMR

Dkhili provided a brief presentation in regard to the issue of how temperature limits are determined for power plant discharges on the UMR. He noted that states' water quality standards typically address the amplitude, duration, and frequency of temperature impacts due to discharges, and there appears to be variation in how the UMR states address this. Dkhili then reviewed the approaches taken by each of the five states. He offered the following summary observations regarding the states' approaches:

- There is overall, general consistency in the application of mixing zones.
- Similar changes in temperature (ΔT) are allowed.
- There are differing approaches to setting a maximum monthly temperature for each month of the year.
- Thermal mixing zone areas are not set.
- Mixing zone models are scarcely used among the states.

Weigel asked if Dkhili is seeking a more consistent approach among states or simply looking for input to aid Missouri's program. Dkhili replied that at minimum he wanted to share current information and it is up to the WQTF if they would like to pursue the subject further or develop a more consistent approach. Weigel suggested a helpful next step would be for staff in Wisconsin and Missouri to discuss and compare their approaches in detail, and then return the issue to the WQTF for additional action if needed.

The meeting adjourned for the day at 5:12 p.m. and reconvened at 8:02 a.m. on September 21, 2016.

Wrap Up of Day 1 Discussions

Thermal Mixing

Reflecting on the preceding day's discussions regarding thermal mixing, Olson asked Dkhili how Missouri determines compliance with temperature requirements. Dkhili replied that daily readings are taken by the discharging plant, so that daily data does exist – with the caveat that the location of the measurement may vary somewhat among plants. Vanderbosch said the approach is similar in Minnesota, where readings are typically taken at the end of the pipe with the assumption being that if temperature requirements are met at the end of the pipe, they will certainly be met $\frac{1}{4}$ mile downstream at the limit of the mixing zone. Weigel said Wisconsin also takes a similar approach and that continuous monitoring technology for this purpose is available and affordable.

Potential Future Meeting Topics

Hokanson said he had noted from the previous day's discussion strong interest in the Lake Pepin TMDL, Minnesota's buffer initiative, and the UMR Economic Profile. As such, he would keep these in mind as potential future WQTF meeting topics.

Other Agency Updates

As the first day's agenda had not allowed for a full roundtable discussion among those present, Weigel asked if any participants had general updates they wished to share with the group. Warner noted that Kevin Richards is now supervising both the Illinois and Iowa Water Science Centers, in keeping with USGS' plan to tie together the missions of these two centers. Gregg Good reported that Sanjay Sofat has taken the Bureau of Water Director position at Illinois EPA and will also serve on the WQEC. Weigel said Susan Sylvester has taken a new position in Wisconsin DNR and as such Wisconsin will need to name a new representative to the WQEC. Vanderbosch said Kim Laing has been hired to lead MPCA's Southern Biological Monitoring Unit, filling the position left open by Dan Helwig's retirement. She said Laing may participate in future UMR water quality discussions.

Long-Term Decreases in Phosphorus and Suspended Solids, but Not Nitrogen, in Six UMR Tributaries, 1991-2014

Becky Kreiling presented the results of work she had completed in collaboration with Jeff Houser to examine long term trends in total suspended solids, nitrogen, and phosphorus in six tributaries to the UMR. She noted that the data analyzed in this study came from the Long Term Resource Monitoring (LTRM) element of the USACE Upper Mississippi River Restoration (UMRR) Program.

Kreiling explained that each of the six tributaries (Black, Cannon, Chippewa, Cuivre, Maquoketa, and Wapsipinicon Rivers) was sampled at or near their confluence with the UMR during the period of 1991-2014. The monitoring frequency varied somewhat depending on year and season, and samples were taken at 0.2 m depth and analyzed for TSS, TP, TN, SRP, and NO_x according to standard methods. Discharge data was also available from gaging stations upstream of sample sites.

Kreiling also summarized the land use characteristics in each of the basins, noting that there was variation in the dominant land uses (i.e., agriculture, forest) among the watersheds, with the Chippewa having the greatest forest use and lowest agriculture use, while the Wapsipinicon had the greatest agriculture use and lowest forest use. She also displayed a graph illustrating that there had been some variation in land area devoted to corn and soybeans in the watersheds over time. Additionally, she noted that soil erosion rates in the tributary basins had also fluctuated during the study period.

Kreiling next described the process of calculating flow-normalized values for each of the study parameters, using methods developed by Hirsch, et al. 2010. She then displayed flow-normalized results for the parameters in each of the tributaries, as well as trends in Conservation Reserve Program (CRP) lands and use of conservation tillage in each of the tributary watersheds. Also noted was an increase in the percentage of agricultural lands with tile drainage in Minnesota – from 18% in 1992 to 33% in 2012.

Kreiling offered the following overall conclusions from this analysis:

- A general decrease in TSS and P and no change in N in the monitored tributaries.
- Trends in agreement with other recent studies of other rivers in the basin.
- Land use best management practices potentially reduced P and TSS run-off.
- More work is needed to target and reduce N leaching and run-off in land use.

She closed by noting that the data included in the study only goes up to 2014, so there may be value in a future study that incorporates more recent data.

Weigel asked why it appeared that soluble reactive phosphorus (SRP) levels were going up in some tributaries during the study period, even though total phosphorus (TP) concentrations declined. Kreiling replied that a possible explanation for this is that conservation practices effectively address

phosphorus which is bound to the soil, but are less effective on the soluble component. She added that the SRP form is also more biologically available than bound forms. Warner observed that the basins where SRP increased have a greater proportion of agricultural use, so this phenomenon is likely related to agricultural production in those watersheds.

Olson asked whether Kreiling felt there was sufficient data available from LTRM on the tributaries to support the type of analysis she presented. Kreiling replied that only fixed station LTRM data were used in the study, but that this provided for sufficient frequency and duration of monitoring to support the analyses.

Weigel asked if any information is available regarding when the use of anhydrous ammonia became prevalent in the study areas. Kreiling replied that this is difficult to determine from available data sets, though it has likely been commonly used for quite some time. Other WQTF members concurred regarding the difficulty of obtaining fertilizer use data.

Giblin commented that he was struck by the increase in tile drainage in Minnesota. Olson said increases in corn prices have triggered large scale installation of tile drainage. Vanderbosch concurred, adding that in some cases installation may also be happening to get tile in the ground ahead of any potential future regulation. Warner observed that, in some cases, seed companies may specify the need for drainage in the use of their product. Good commented that in many cases tile drainage will indeed result in higher yields and the investment will be rapidly paid for – as such, there is a strong incentive to install tile drainage systems. Kreiling noted it is quite challenging to get data on the extent of tile drainage installation. In this study, only data from 1992 and 2012 in Minnesota could be found.

Good asked whether LTRM measures suspended sediment (SS) or only total suspended solids (TSS). Kreiling said LTRM collects only TSS. Giblin explained that TSS has been the preferred parameter because it is relatively easy to collect and measure, and SS can be calculated from TSS.

Weigel thanked Kreiling for her presentation, noting that this type of information is valuable in expanding the group's water quality focus from just the mainstem to include tributaries and their watersheds.

Regional Effects of Agricultural Conservation Practices on Nutrient Transport in the UMR Basin

Ana María García presented regarding the outcomes of a recent collaborative USDA-USGS modeling-based study to examine the regional impacts of conservation practices in the Upper Mississippi River Basin. She explained that the study arose due to a shared interest between USDA and USGS in assessing the efficacy of agricultural conservation practices.

García said the approach taken in this study was to utilize the Spatially Referenced Regressions On Watershed Attributes (SPARROW) model to perform an empirical test of conservation practices. She explained that the SPARROW model is designed to use existing water quality data to make linkages between water quality and watershed attributes.

In this study, García said the challenge was to develop a conservation variable as part of the model, in addition to other variables that impact land-to-water delivery of nutrients. In order to do this, data on conservation practices from the USDA-NRCS Conservation Effects Assessment Project (CEAP) was compiled to create an index of conservation intensity, which was then used to derive a conservation variable for the model. The model was then run to predict likely reductions in nitrogen and phosphorus associated with the implementation of conservation practices.

For nitrogen, the modeled reduction (19%) was very close to that found in the CEAP study (20%). However, for phosphorus, the modeled reduction (6%) was much less than that in CEAP (30%). García

said this discrepancy with regard to phosphorus may highlight a gap in our understanding of the relationship between conservation practices and stream phosphorus loads. She also noted that time lags between the implementation of practices and water quality outcomes may be affecting the model outputs.

Overall, García said the results do provide some empirical evidence of regional-scale environmental benefits from conservation practices. However, she said the results should be considered just an initial finding that would benefit from application in other geographic areas and from a further examination of the effects of time lags.

Weigel thanked García for her presentation and observed that the results of the study are in many ways counter to conventional thinking regarding conservation practices – that traditional conservation practices are more effective on phosphorus and less effective for nitrogen. García agreed that the results are not necessarily what has been traditionally assumed – but that other researchers are beginning to see similar results, indicating that there are still gaps in our understanding of the efficacy of conservation practices in regard to nitrogen and phosphorus. She added that the calculation of the conservation variable as dictated by the data available regarding conservation practices – in which the main signal is conservation tillage. As such, there may be other practices on the landscape that are not being captured fully in the conservation variable.

García said it will important to continue bringing more data into the model and to apply it in other settings to address some of the current uncertainties regarding its outputs. She said one next step will be to apply the approach in the Chesapeake Bay watershed, bringing in both spatial and trend analyses.

Minnesota-Wisconsin Pilot Monitoring Update

Macroinvertebrates

Giblin gave an update on macroinvertebrate monitoring conducted by Wisconsin DNR under the pilot. He said that only about 50% of the macroinvertebrate samplers deployed by Wisconsin DNR for the pilot were recovered, with the extreme high flows likely causing the loss of samplers. Giblin suggested that in any future monitoring, one option might be to check with USCG to see if samplers could be tied to navigation buoys to aid recovery.

Joel Chirhart said he expects the recovery percentage for Minnesota PCA-deployed samplers to be similar to that reported by Giblin. He noted that this is a much lower recovery percentage than in the recent methods comparison study in the same section of the river. In that case, less than 5% of the samplers were lost. Chirhart added that MPCA would make one more attempt to recover samplers yet this season, likely within the next week.

Weigel asked whether the samplers that were recovered were well colonized. Chirhart replied that good colonization has been observed in samplers with the exception of those placed in Lake Pepin, which is not surprising. Vanderbosch asked if any photos of the macroinvertebrate sampling were taken, and colonized samplers in particular, as she is interested in any photos that may be available. Giblin said Wisconsin DNR may have some photos to share. He added that Wisconsin DNR will be shipping their macroinvertebrate samples to the lab next week. Chirhart said Minnesota PCA will also be submitting samples next week, with both agencies using the same laboratory for analysis (Rhithron Lab in Missoula, Montana). He added that results should then be available some time in December.

Chemistry

Regarding chemistry sampling, Giblin said fixed site sampling will continue through April 2017 and another split sampling event will take place on October 3rd. He also suggested there would be value in developing a shared spreadsheet/data format to facilitate sharing of water chemistry data among

participating agencies. Lastly, Giblin suggested that the water chemistry group should hold its own conference call in the next weeks to discuss the flow of data among agencies.

Fish

Andy Bartels comments on fish sampling, saying that high flows presented challenging conditions for Wisconsin DNR, but that sampling was completed as scheduled and a good diversity of fish were collected. Weigel asked whether the species spread observed is pretty typical. Bartels replied that it was, though a lack of darters may push down GRFIN scores somewhat. Gregg Good asked whether a dominance in biomass from common carp is fairly typical. Bartels replied that this typical and has been the case for several decades. He added that the fish data from Wisconsin DNR sampling has been entered and is awaiting quality assurance review.

Vanderbosch said there has been concern regarding the representativeness of fish sampling results given the high flow, but Minnesota PCA chose to go ahead and complete sampling as scheduled and may do some repeat sampling next year as needed.

Vegetation

Eric Lund said all vegetation sampling was completed as scheduled, and high flow did not appear to affect vegetation to the degree it impacted other biological sampling. However, some low transparency tube readings were observed in the measurements that accompanied the vegetation sampling. Deanne Drake added that the primary effect of high flows on vegetation sampling was on sample site placement, since this is determined by depth. As such, the sampling sites were often closer to shore than is typical. Additionally, she added, there was some scour of vegetation beds by the increased flows.

Next Steps

Hokanson noted that as monitoring is completed and results received, the project will move into a phase of data analysis, assessment, and project evaluation. He shared proposed outlines for two anticipated reports emerging from the pilot: 1) a water quality condition assessment (utilizing the provisional UMR CWA assessment) and 2) a project evaluation, looking at the success of the pilot project in terms of costs, logistics, outcomes, etc. Vanderbosch said the timing of results analysis and assessment this winter may be a bit challenging given other demands on Minnesota PCA staff.

Vanderbosch asked if the intent of the UMR CWA monitoring plan is repeat sampling every five years. Hokanson said this is the intent of the plan, but its implementation is dependent on resources being available to the states to conduct monitoring. Giblin suggested that perhaps the most viable mechanism of future implementation elsewhere on the UMR is to utilize UMRR LTRM field station infrastructure. In terms of funding via USEPA, Ed Hammer said the CWA Section 106 program is currently the only mechanism that could support future monitoring of this type.

Next Meeting

Hokanson said the next meeting of the WQTF would likely take place in February 2017 in the Quad Cities. He indicated he would be in communication with the WQTF to schedule this. In the meantime, the WQEC and the UMRBA would be meeting jointly in St. Paul to discuss 2017 priorities. Also, the Minnesota-Wisconsin pilot group will be working on project reports so that drafts should be available by the time of the next WQTF meeting.

With no further business, the meeting adjourned at 12:03 p.m.