Nutrient Monitoring Council

Meeting Minutes

Thursday, Sept 26, 2024
9:30 a.m. – Noon.
Via Zoom

Meeting Summary

Welcome and Water Dashboard Preview

Trevor Sample, Illinois Environmental Protection Agency

Trevor welcomed the group. After reviewing the agenda, he shared information about the NLRS Dashboard Development. The NLRS dashboard will use the Great Lakes to Gulf Virtual Observatory website and will replace the NLRS Biennial Reports, with data updates and an executive summary published annually. The goal is to have dashboards online by the end of 2025.

Continuous Gage Statewide Nutrient Loads

Luis Garcia, United States Geological Survey

Luis highlighted updates from water year 2023, indicating reductions in total phosphorus and nitrate loads and streamflow compared to the 1980-96 baseline. He noted that, compared with the baseline, the 2019-2023 5-year average shows a 33% increase for TP loads, and a 4% decrease for N-N loads, with streamflow 18% higher, influenced by the wet period of 2019-20. Over the last three years, N-N loads average 30% below the baseline, exceeding the 15% interim reduction target, while streamflow decreased 10% and TP loads increased 6% compared to baseline.

HUC 8 Loads and Yields

Jenny Murphy, United States Geological Survey

Jenny presented the average annual nutrient loads and yields across Illinois' HUC 8 watersheds for 2018-2022. Building upon earlier studies, this update included not only nitrate-nitrogen and total phosphorus but also dissolved phosphorus, enhancing the analysis of particulate to total phosphorus ratios at these sites. She detailed the methodological approach used to estimate nutrient loads and yields, involving data collection from multiple sources, quality checks, and the integration of various datasets to ensure comprehensive coverage and accuracy.

The application of the "weighted regressions on time, discharge, and season" (WRTDS) model marked a significant methodological update, now also used for estimating nitrate loads along with total phosphorus, allowing for a dynamic adaptation to changing watershed conditions through its unique windowing and regression techniques. Jenny highlighted the improvements in modeling using WRTDS-K, incorporating Kalman filter post-processing, which refines the estimates by adjusting for temporal variability and extrapolation uncertainties. This sophisticated modeling approach supports the USGS's efforts in updating and scripting the HUC 8 analyses, which promises ease of future updates.

Jenny highlighted geographic trends in nitrate and total phosphorus distribution. She noted higher nitrate loads in the middle and northern parts of the state, with the top five watersheds for nitrate yields being Chicago Des Plaines, Kankakee, Upper Illinois, and Vermilion. Total phosphorus loads are consistently high statewide, with particularly high yields in northeastern Illinois, attributed to

point sources, and further south in the state. The top five watersheds for total phosphorus yields were identified as Chicago, The Sny, Des Plaines, Cahokia-Joachim, and Upper Sangamon.

Jenny's presentation also addressed the role of point sources, stating that about 75% of HUCs have point source contributions of less than 10% of the total riverine load, although some watersheds show a dominant influence of point sources on the nutrient loads. She discussed the trend where watersheds with high initial nitrate yields from the baseline period are now experiencing decreases over time, while the pattern for total phosphorus is less consistent. Additionally, she shared that the statewide balance between increases and decreases in nitrate loads since the baseline is relatively equal. Conversely, more than 3 times the number of HUCs showed increases in total phosphorus compared to decreases. Increasing total phosphorus was widespread across Illinois and the few HUCs with decreasing or stable total phosphorus tended to cluster in the northeastern portion of the state.

Furthermore, Jenny highlighted the performance of priority watersheds, revealing that out of five HUCs designated as non-point source priorities for nitrate, three have shown a decrease in nitrate yield from the baseline to the recent period. Conversely, all three non-point source priority watersheds for total phosphorus showed increases exceeding 5%.

Looking ahead, USGS scientists plan to finalize their analysis by comparing dissolved and particulate phosphate numbers and further analyzing water yields across the three studied periods. This comprehensive analysis will culminate in the release of detailed data on ambient loads and incremental loads for HUC 8, alongside a report detailing the status and trends across Illinois watersheds, providing a crucial foundation for informed watershed management and policy decisions.

Illinois River Basin Study Update

Jim Duncker, United States Geological Survey

Jim reported on the Illinois River Basin's progress in the 10-year study with the Next Generation Water Observing Systems (NGWOS), now in its fifth year. He highlighted the installation of 15 super gages enabling detailed, continuous monitoring of water quality parameters like nutrients and harmful algal blooms. The basin also integrates advanced sampling methods, such as FLAMe campaigns and nutrient-diffusing substrates, to enhance understanding of water conditions and support efforts against algal blooms, backed by real-time data accessible on USGS websites.

New Continuous Water Quality Monitoring on The Emiquon Preserve

Sara Sawicki, Illinois Natural History Survey

Sarah announced a collaboration to monitor water quality at Emiquon Nature Preserve. They are using a buoy from NGRREC that collects weather and water quality data. The buoy has encountered challenges with algae buildup, clogging, and spider webs covering solar panels. They are exploring the impact of wind and other factors on turbidity at Emiquon. Sarah also compares turbidity data from the Emiquon buoy to a site in the Illinois River. They are looking forward to more continuous monitoring to gather further insights.

NARPs and NPDES: What We Have Learned and Next Steps

Mila Marshall and Albert Ettinger, Sierra Club IL

Mila discussed the Sierra Club's monitoring of the Nutrient Assessment Reduction Plan (NARP) and National Pollutant Discharge Elimination System (NPDES) process. The Sierra Club has reviewed the first round of NARPs, finding inadequate stakeholder engagement and a lack of necessary conditions in submissions. The Sierra Club developed guidance for operators and created a survey to gather insights on engagement difficulties, however this did not translate to increased stakeholder engagement from operators and contractors. They await clearer definitions of "stakeholder engagement" from the IEPA. Currently, 15 new NARPs have been submitted, with more expected. Albert Ettinger emphasized that many contractors did not collaborate with stakeholders, resulting in insufficient phosphorus discharge targets and plans to reach those targets. Although data collection occurred in some areas, existing practices will remain under the current NARPs. Discussion after the presentation highlighted that point source representatives are not in agreement with this stance and that this is a conversation for another meeting.

NMC Member Updates- No member updates were given.

Meeting Minutes

In attendance: Aubree Basso, American Bottoms Regional Wastewater Treatment ; Erin Bauer, Illinois State Water Survey ; James Bland, Des Plaines River Watershed Group; Chuck Bodden, Northshore Water Reclamation District; Libby Brasel, University of Illinois Extension; Amelia Cheek, Illinois Farm Bureau; Amanda Christenson, University of Illinois Extension; Joan Cox, University of Illinois Extension; Rachel Curry, University of Illinois Extension; Paul Davidson, University of Illinois - Agricultural and Biological Engineering; Chris Davis, Illinois Environmental Protection Agency; Jim Duncker, United States Geological Survey; David Dupre, United States Geological Survey; Albert Ettinger, Sierra Club; Mary Beth Falsey, DuPage County Stormwater Management; Luis Garcia, United States Geological Survey; Laura Gentry, Illinois Corn Growers Association; Nicole Haverback, University of Illinois Extension; Timothy Hodson, United States Geological Survey; Vlad Iordache, Illinois State Water Survey; Brandon Janes, Village of Deerfield; Laura Kammin, National Great Rivers Research and Education Center; Brock Kamrath, United States Geological Survey; Claire Kissane, DuPage County Stormwater Management; Heather Krempa, United States Geological Survey; Corey Lacey, Illinois Soybean Association; Jim Lamer, Illinois Natural History Survey; Jong Lee, NCSA, Univ. of Illinois; Fred Lutzi, Savanna Institute; Rishab Mahajan, Geosyntec; Rick Manner, Urbana and Champaign Sanitary District; Mila Marshall, Sierra Club; Greg McIsaac, University of Illinois; Brian Metzke, Illinois Department of Natural Resources; Shawn Meyer, Waterborne Environmental, Inc.; Tom Minarik, Metropolitan Water Reclamation District of Greater Chicago; Jenny Murphy, United States Geological Survey; Adrienne Nemura, Geosyntec Consultants; Anna Niedzinski, Lake County Stormwater Management Commission; MJ Oviatt, Savanna Institute; Bena Peng, University of Illinois Crop Sciences; Bin Peng, University of Illinois Crop Sciences; Hannah Podzorski, United States Geological Survey; Karoline Qasem, Fehr Graham; Brian Rennecker, Illinois Department of Agriculture; Mike Rousey, City of Woodstock; Amy Russell, United States Geological Survey; Trevor Sample, Illinois Environmental Protection Agency; Sara Sawicki, Illinois Natural History Survey; Lindsey Schafer, United States Geological

Survey; Cindy Skrukrud, Fox River Watershed; Judith Thomas, United States Geological Survey; Amy Underwood, Downers Grove Sanitary District; Helen VanBeck, American Farmland Trust; Justin Vick, Metropolitan Water Reclamation District of Greater Chicago; Zhongjie Yu, U of I Natural Resources & Environmental Science

Welcome and Water Dashboard Preview

Trevor Sample, Illinois Environmental Protection Agency

Trevor Sample with Illinois EPA began by welcoming everyone to the Nutrient Monitoring Council meeting. After reviewing the agenda, he shared information about the NLRS Dashboard Development. The Policy Working Group members were surveyed in 2024 about moving to a dashboard and the majority approved. The Steering Committee, consisting of representatives from Illinois EPA, IDOA, and Illinois Extension, is working on building a dashboard site with the National Great Rivers Research and Education Center and the U of I National Center for Supercomputing Applications. The NLRS dashboard will use the Great Lakes to Gulf Virtual Observatory, Illinois portal platform. This will replace the Biennial Reports previously used for tracking and reporting metrics. Data will be updated annually, and an Executive Summary will be completed each year. Dashboards will allow interactive data reported both temporal and spatially and data will be downloadable by users. The Steering Committee and Facilitation Team are currently in the early stages of development and are using Iowa and Minnesota nutrient dashboards as examples. Previous reporting for NLRS data did not capture implementation data spatially, but instead just reported statewide. Illinois Extension staff will be working with partners to collect data with associated watershed HUCs for interactive maps which include spatial data by HUC 8 and HUC 12 or county and temporal data from 2011-2022. The final NLRS Dashboard will include all data previously reported for Biennial Reports, like resources, outreach and education, land and facility measures, and water. The goal is to have dashboards online by the end of 2025. Performance Benchmark Group and Policy Working Group members will have opportunities for input and review. Once the 2011-2022 data has been posted, work will begin on 2023-2025 data. Trevor ended by sharing the Great Lakes to Gulf website, the Iowa Dashboard, and the Minnesota Dashboard, with links to their water quality and BMP data.

Discussion summary:

- Question (Helen VanBeck): Can you share what the source is for the ag data you're planning to pull into the dashboard?
- Answer (Joan Cox): Sources that we've been using that were published in the biennial report will be in the dashboard as well. It's the State, Federal, and NGO programs. We will also continue to highlight partner programs in some way.
- Answer (Trevor Sample): All the sources you've seen before going to be pretty much the same source that we've used before, just presenting it online instead of in our traditional biennial reports.

Continuous Gage Statewide Nutrient Loads

Luis Garcia, United States Geological Survey

Luis began the presentation by noting its similarity to the one given by Tim Hodson at the 2024 NLRS Conference, with the addition of water year 2023 values. He shared a map of Illinois displaying the locations of USGS Monitoring Stations and mentioned that the baseline value for comparing 5-year rolling averages are computed from averaging statewide loads from 1980-96. Luis also described super gages as continuous monitoring sites used since 2019, measuring streamflow and water

quality, including nitrates and turbidity, with additional measures in a few watersheds. Notably, Big Muddy has a super gage that also measure dissolved oxygen, temperature, specific conductance, and pH, while the Kaskaskia super gage measures additional dissolved phosphate.

Relative to the 1980–96 baseline, water year (WY) 2023 loads for total phosphorus were down by 11%, total nitrate was down 25% and streamflow was down by 30%. The new 5-year average load for total phosphorus was up 33%, total nitrate was down 4% with streamflow up 18% compared with baseline. The 2019-2020 wet year contributed to a higher 5-year rolling average. However, for the last 3 years, total nitrate loads have been below the 15% interim reduction target, averaging 30% below baseline. When considering the last 3 years without the 2019-20 values, stream flows are down 10%. Total phosphorus is still up by 6% averaged over the recent three-year period. Looking ahead to WY 2024, when those 2019 values are no longer included in the average, we may see progress towards meeting the NLRS interim goals.

Luis also presented graphs illustrating the changes in phosphorus load relative to baseline in Illinois' major waterways. In most waterways, streamflow was up, which could account for some of the elevated phosphorus levels. However, Illinois streamflow is approximately 11% above baseline, while phosphorus loads are closer to 20% above baseline. In the latest 5-year average, total phosphorus loads were mostly above baseline, with Green and Vermilion subwatersheds below baseline.

Discussing changes in nitrate relative to baseline, downward trends were observed in several subwatersheds, despite increases in streamflow. While the Big Muddy, Green, Little Wabash, and Rock River subwatersheds still showed loads above baseline, the Embarrass, Illinois, and Vermilion River subwatersheds were lower than baseline in the latest 5-year average. Average streamflow has been mostly above baseline, with one exception this year in the Vermilion River subwatershed.

Luis highlighted the relationship between phosphorus trends and streamflow, noting higher loads in 2019-20 and then a decrease in loads, although not at all sites. Kaskaskia had years of increasing phosphorus loads and decreasing nitrate loads, while some sites had below baseline values like the Vermilion. The Rock River was closely tied to flow, with high nitrate loads in 2019-20 and then a decrease in 2021-23. The Big Muddy showed an increasing trend, which is an interesting observation but does not contribute much nitrate overall.

Discussion summary:

- Question (Karoline Qasem): Do we know why this increase in phosphorus from Kaskaskia?
- Answer (Gregory McIsaac): It may be due in part to navigation channelization leading to channel erosion in the lower section.
- Question (Helen VanBeck): Were the percent changes in stream flows shown on a previous slide? Or can you share where you're pulling those numbers from for each site?
- Answer (Luis): They were on the previous slide. I should add that to the site-specific nitrate and phosphorus load graphs next time.

- Question (Chuck Bodden): Is the USGS willing to take recommendations for additional locations for Next Generation Water Observing Stations? If so, is there a particular contact?
- Answer (Jude Thomas): Jim Duncker

HUC 8 Loads and Yields

Jenny Murphy, United States Geological Survey

Jenny began by acknowledging her colleagues, Hannah, Brock, and Lindsey, for their work behind the scenes that made possible the project of computing the average annual N-N, Total P, and dissolved P loads and yields for 2018-2022. She shared preliminary findings from a project which builds upon two previous iterations of similar work: the original Nutrient Loss Reduction Strategy, which reported average annual nutrient N-N and TP loads and yields for 1997-2011, and an update for 2012-2017. Similar to previous efforts, the work covers point source and non-point source loads and yields. For 2018-2022 loads and yields, they added dissolved phosphorus. This will allow USGS to compute the percent of dissolved particulate phosphorus related to total phosphorus at most of these HUCs. Jenny also explained the workflow and approach for calculating nutrient loads and yields across the Hydrologic Unit Code (HUC) 8 watersheds in Illinois 2018-2022. She talked about the ambient sites used for these computations and the load estimation techniques, then discussed how they computed HUC 8 loads and yields and summarized the results to date.

She provided a map showing the locations of IEPA ambient sites and HUC 8 boundary lines. It's important to note that not all ambient sites are directly linked to the outlets of HUC 8 boundary lines. Therefore, the scientists at USGS applied techniques previously presented in the initial NLRS report and also the 2019 NLRS biennial report to extrapolate information from the Illinois IEPA ambient site locations to the HUC 8 watershed areas. The first step involved gathering water quality data from various sources, including the U.S. Water Quality Portal, legacy data from the STORET Data Warehouse, and the IEPA's most recent samples for the water year 2022. They utilized three different data sources for water quality data. Then they performed several data preparation and quality assurance steps due to the multiple sources. This included harmonizing columns and metadata, standardizing constituent names, and converting units to common units (e.g., reporting nitrate-nitrogen as total nitrogen and total phosphorus as phosphorus). They also addressed missing results and zero concentrations, removed duplicate records, and reviewed qualifiers and non-detects. The dataset contains only discrete water quality samples and sensor data (i.e., high frequency in situ measurements of water quality) were not incorporated into the dataset.

She presented a water quality time series for the Embarrass River, which included data from multiple sources. The symbols indicate that information from this location came from two different site numbers: one from the USGS and another from the IEPA. Most of the data was obtained from the Water Quality Portal, represented by the pink color. The STORET data helped fill in important gaps in the dataset and extend the data further back in time. Additionally, recent IEPA samples allowed them to bring the dataset as close to the present as possible.

In the past two HUC assessments, the "Weighted Regressions on Time, Discharge, and Season" (WRTDS) model was used to estimate total phosphorus riverine loads. While linear interpolation

had traditionally been used by the NLRS for nitrate load estimation. This time they are also using WRTDS for nitrate. WRTDS uses time and stream flow to model the temporal variability of concentration, which is then multiplied by daily streamflow to compute the load. What sets WRTDS apart is its use of weighted regression and windowing to allow the coefficients in the equation to vary over time. There are three windows: half windows for a 1 log cycle for stream flow, 7 years for time, and a half 0.5 seasonal window for a seasonal cycle in the equation. Allowing these coefficients to vary over time enables the model to adapt to changing conditions in the stream and watershed. Additionally, the Kalman filter post-processing procedure has been incorporated into WRTDS, resulting in WRTDS-K. This approach combines regression-based weighting techniques and interpolation techniques. Utilizing a programming language for the USGS workflow allows them to script the process and makes it easier to update the HUC 8 analyses in the future.

The input datasets include water quality data from various sources and stream flow data from the National Water Information system. The workflow involves several steps, including running WRTDS and calculating loads, reviewing the output and residuals to identify potential extrapolation issues, and post-processing steps such as manual review of residual plots and compilation of figures and tables. All this information will soon be available in an online USGS data release, which will include the compiled water dataset used for modeling, the site list, model output, and datasets of the annual and monthly nitrate-nitrite, plus total and dissolved phosphorus loads. This information is used to estimate HUC 8 loads and yields.

Moving from ambient sites to computations of HUC loads and yields, the approach follows the same process used in the last HUC assessment (NLRS, 2019). A schematic shows a HUC 8 outlet, with point sources located in the watershed and a monitoring site. The monitored area includes point sources upstream of the monitoring site. The schematic also shows a downstream point source located below the monitoring site but upstream of the HUC outlet. The approach used accounts for point sources downstream from the monitored area. The first step is to compute the ambient load at the ambient sites. With this information and information about the point sources in the monitored area, the non-point source load and yield for the monitored area can be computed. The assumption is that the non-point yield from the monitored area can be applied to the entire HUC. With additional information about point sources further downstream from the monitoring site, the total for the HUC 8 and the point source and non-point source loads and yields can be computed. For nested watersheds, the process becomes more complicated. It involves looking at the incremental HUC 8 loads and subtracting out the upstream contribution to focus on the contributing point source and non-point source from each HUC individually

She shared the preliminary summary of the 2018-2022 loads and yields. The maps show incremental loads by HUC 8 for nitrate and total phosphorus. The top 5 HUCs for nitrate and phosphorus are listed and outlined in yellow on the maps she shared in her presentation. The units are millions of pounds per year for the average annual load from 2018-22. The HUCs with hash marks did not have observed data available for computation and were estimated based on averaging the surrounding HUC loads and yields. Nitrate loads are higher in the middle and northern portions of the state. The top five watersheds for nitrate loads for this time period were Des Plaines, Lower Rock, Flint-Henderson, Vermilion, and Embarras. Total phosphorus loads are

high across the state, though there may be some tendency for higher loads further south. The top five watersheds for total phosphorus loads were Chicago, Embarras, Des Plaines, Little Wabash, and Lower Kaskaskia.

The yield is calculated by dividing the load by the area of the HUC 8 and provided as the average annual yield for 2018-2022 in pounds per year per acre. Not all HUCs with high loads necessarily have high yields. The map outlines and lists the top five HUCs for yields for nitrate and total phosphorus. The following underlined HUCs also appeared on the top five load list. For nitrate, there are higher yields in the northeast in and around Chicago and the Upper Illinois basin. The top five watersheds for nitrate yields for this time period were Chicago Des Plaines, Kankakee, Upper Illinois, and Vermilion. For total phosphorus there are some high yields in northeastern Illinois, likely due to point sources. There are some high total phosphorus yields further south in the state. The top five watersheds for total phosphorus yields were Chicago, The Sny, Des Plaines, Cahokia-Joachim, and Upper Sangamon.

A box plot shows the incremental yields from both point source and nonpoint sources for nitrate and total phosphorus across all the HUCs. It illustrates that non-point source and total annual yields have similar ranges and distributions, while point source yields are much smaller in comparison for both nutrients. About 75% of the HUCs have point source contributions of less than 10% to the total riverine load, but there are some exceptions where point sources dominate the overall riverine load. Maps shared by Jenny display the yield by HUC broken up by point source and non-point source yields. The largest point sources of nitrate are in the Des Plaines, Upper Fox, and Chicago watersheds, which also have some of the highest overall nitrate yields. These areas also have relatively low non-point source nitrate yields. In the northern and central portions of Illinois, there are relatively large non-point nitrate yields, potentially attributed in part to more cropland and tile drains. Conversely, the southern part of the state has relatively low non-point source nitrate yields, possibly due to fewer tile drains and the presence of large reservoirs that might contribute to denitrification, as previous biennial reports have suggested.

When examining the sources of total phosphorus, note that Chicago, Des Plaines, and Upper Fox watersheds have significant point source yields. These are likely linked to point source discharges in this heavily urbanized area. Interestingly, the Upper Sangamon River also shows a high total phosphorus point source yield. Previous reports have suggested that the Sanitary District of Decatur treats a large amount of water, not just for homes but also for large industrial processing facilities, which explains the elevated point source total phosphorus yield contribution in this area. Non-point source yields of total phosphorus are elevated further downstate, which is the opposite of what is observed for nitrate, possibly due to differences in topography. The Lower Illinois River Basin has a relatively low point source total phosphorus yield, which, according to other reports, might be serving as a sink in recent years.

USGS scientists are currently analyzing changes over three periods: a baseline period from 1997 to 2011, a middle period from 2012 to 2017, and a recent update from 2018 to 2022 (described above). They are examining the changes between the baseline and recent periods and then looking at the results for the three periods over time. The following information are results from a preliminary analysis. A color-coded map was created to illustrate the direction of change in total

nitrate yields from the baseline to the recent period. USGS scientists provided a buffer around this change, which designates “stable” for any HUC in which the recent nitrate yield was within plus or minus 5% of the baseline nitrate yield. Stable HUCs are shown as white on the map. The other HUCs are shown in red or blue, indicating increase or decrease beyond the plus or minus 5% range, respectively. Statewide, the quantity of HUCs that increased versus decreased in nitrate since baseline is relatively equal. A large proportion of HUCs are demonstrating at least a 5% increase in total phosphorus compared with the baseline. Thirty-two watersheds have increased and 11 have decreased in total phosphorus yield. In northeastern Illinois, it appears many HUCs are showing decreasing total phosphorus yields with some remaining stable, likely related to changes in point sources.

Comparisons were made for the average yields of the three periods by HUC. For visualization purposes, they have been divided into decreasing, increasing, and stable HUCs based on nitrate and phosphorus. It is important to note that sites with decreasing nitrate yields have relatively high starting baseline yields, whereas the scale is much lower for those with increasing nitrate HUCs. There are some differences in these patterns when analyzing the point source over the three periods. More HUCs show decreases in point source yields of nitrate and total phosphorus, with fewer HUCs showing increases and more stable results.

One way to analyze this is by creating a graph that shows the initial yield compared to the change in yield between the baseline and the recent period. If the point falls below zero on the Y-axis, it indicates a decrease in nitrate, while if it's above and green, it shows an increase in nitrate in these HUCs. When looking at these nitrate yield plots, there is a trend where HUCs that initially had high annual yields in the baseline period are experiencing decreases over time. However, this pattern is not as consistent for total phosphorus. While a few HUCs had high baseline annual total phosphorus yields and a significant decrease from the baseline to the recent period, most HUCs experienced increases. This trend is observed for phosphorus when looking at both total yield and non-point sources. On the other hand, when they examine the point sources, they notice significant decreases over time in total phosphorus and larger decreases tended to occur in HUCs with larger baseline point source total phosphorus yields

The Nutrient Loss Reduction Strategy identifies priority watersheds based on non-point sources of phosphorus, non-point sources of nitrate, and point source priorities as per the original 2015 strategy. Jenny presented a graph displaying the annual average yields of the priority watersheds over three time periods. It is evident that out of the 5 HUCs selected as non-point source priority watersheds for nitrate, 3 have shown a decrease in nitrate yield from the baseline to the recent period. In terms of total phosphorus, all 3 non-point source priority watersheds appear to have increased by more than 5%. As for the point source priority watersheds, most of the HUCs have demonstrated some decreases in total phosphorus yield from the baseline to the recent period.

USGS scientist's next steps are to finalize and present the comparison between dissolved and particulate phosphate numbers and analyze water yields across the three time periods. This work will result in the following products: data releases for the ambient loads and for the HUC 8 incremental loads and yields over these three periods, and a report that describes the status and trends for these HUC 8’s across Illinois.

Discussion summary:

- Question (Karoline Qasem): Can you please remind us of what it means when a watershed is listed as a priority watershed.
- Answer (Jenny Murphy): That is from the 2015 nutrient loss reduction strategy report. They were selected using a variety of criteria related to the original HUC 8 assessment produced back then. It allowed the HUCs to be ranked and then selected based on specific criteria, related to how elevated the point source and non-point source loads and interest or priority related to watershed plans, but that might be a question for Trevor.
- Answer (Trevor Sample): It's explained in the original 2015 nutrient strategy document how those were selected. It was just a starting point. The original memo asked us to identify priority watersheds. There are some state and federal cost-share programs that might give a few more points on an application if you are in a priority watershed perhaps, but it doesn't mean funding is automatically directed to them. Some of those watersheds also house the Extension watershed coordinators. So far, the priority watersheds have remained static since 2015.

Illinois River Basin Study Update

Jim Duncker, United States Geological Survey

Jim began by sharing that this is the 5th year of the 10-year Illinois River Basin study with the Next Generation Water Observing Systems (NGWOS) bringing a new approach to monitoring both spatially and temporally within basins. Illinois is one of three integrated water science basins selected. There are focus topics for each basin and with stakeholders' input, the Illinois Basin's primary focus is nutrients and harmful algae. One way to accomplish this is by bringing in new spatial and temporally expanded monitoring using super gages. When the basin study started, they had two super gages, one on the Lower Des Plaines in Joliet and the other in the Lower Illinois at Florence, near the mouth of the basin. USGS now has 15 super gages in the basin. Luis showed some of what's involved with a super gage, but it is continuous monitoring for several parameters that may vary from site to site. The emphasis in the Illinois River Basin is on continuous monitoring of nitrogen and phosphorus. Anyone can access these data on the USGS real-time websites.

Jim shared a few examples of the super gage data plotted over one year. For the Florance site, nitrogen starts down around 2 to 3 milligrams per liter in the fall increasing to 5 to 6 from late winter through spring, then dropping back down to 2 to 3 milligrams per leader in late summer. This basin has a mix of agriculture and large, dense, urban land cover. For comparison, the Kankakee River near Davis, Indiana, had nitrogen levels down around one to 2 milligrams per liter in the fall, increasing with peaks around 3 to 4 milligrams per liter from late winter through the spring before dropping back down to one to 2 milligrams. Some high spikes in midsummer were due to large runoff events. In contrast, the Chicago area at Joliet does not have much of a seasonal trend, with nitrogen consistent between 4 to 6 milligrams per liter, which is the signature of the urban landscape of the watershed.

They're also doing synoptic sampling at selected HUC 8 tributaries. They're sampling at 6 to 9

locations per tributary basin from the border streams and ditches down to the tributary mouth over one day. Focusing on discrete sampling for nitrogen and phosphorus gives a snapshot of water quality conditions across that basin. They can see what's happening spatially up into those low-order streams. For the past two years, they have tried to time synoptic sampling runs with satellite overpasses. This remote sensing combined with discrete sampling and other forms of monitoring helps to advance our understanding of what's going on in the basin. Synaptic sampling sub-basins include the Upper Fox, Vermilion, Mackinaw, Spoon, Salt, and the Sangamon River. These basins are sampled quarterly with synaptic sampling runs.

Another related issue is sediment source tracking. They're doing source tracking and testing out new techniques in the Indian Creek watershed with a gaging station near Fairbury. This is a significant source of sediment to the Peoria Pool. Initial samples collected in the Starved Rock pool processed and analyzed by Deb Repert at USGS showed some interesting results with releases of Phosphorus under anoxic conditions. They followed up with some discussion with Greg McIsaac, Andrew Margenot, and other USGS researchers which led to this legacy phosphorus reconnaissance level sampling. This past year they expanded to 10 sites across the Illinois River basin. Stream bed sampling with sediment analysis is currently happening to determine a reconnaissance level of legacy phosphorus in those sediment samples. This is an outgrowth from this past year started by some of the discussions in the early part of the study.

They continue to do testbed sensor evaluations for both continuous nitrogen and phosphorus sensors. Technology is changing and improving, and more options are available in the marketplace. Colin Peak leads this test bed effort and is working closely with manufacturers to get a feel for how easy or difficult it is to run different instrumentation and the viability of that instrumentation. This is pushing the instrumentation to remote sites. A lot of this instrumentation is for the wastewater industry, to use it at a remote gaging station with power limitations is challenging. That is the direction they're going and it's leading to some data that lets us better understand the processes in the basin.

Jim shared about the FLAMe Water Quality Sampling Campaigns, FLAMe standing for Fast Limnology Automated Measurement. This is a flow-through setup mounted at the back of the boat. It's a flow-through chamber with a wide suite of instrumentation. They run a trip from Lake Michigan in Chicago down to Alton and it takes about 7 to 8 days. They ran five of these trips last year and collected discrete samples along the river for a wide range of parameters. This gives a snapshot of the river conditions. The super gages provide us continuous time series of how these parameters change at a fixed location. Then they can take that FLAMe data and see changes between super gages. Jim shared an example of nitrate data from a few FLAMe campaigns. They’re still processing these data, but the heat maps for nitrogen and some other parameters are eye-opening and give a more holistic picture of what's happening along the main stem of the waterway. The spatial component of the FLAMe survey enhances our understanding in addition to the fixed time series at the gages.

They're also testing nutrient-diffusing substrates in the Starved Rock Pool. They are deploying an array of different combinations of nutrients to try to determine which nutrients are limiting the algal

growth of toxin-producing species. This gives a sense of what the stream metabolism is doing and what is happening in terms of gross primary productivity. This is also valuable when looking at the driving components of harmful algal blooms. There's quite a bit of discrete sampling with our focus on harmful algal blooms. There is a very distinct break between the difference between harmful blooms and algal blooms in general in the lake setting versus river settings. Our focus is on riverine, and there was a big bloom in 2021 where USGS put a lot of effort into sampling. In the 2021 event, they had a sonde sensor in the water and then discrete sampling. They're getting confirmation of the sonde data and then tying that to satellite imagery, which can be correlated to chlorophyll concentrations. Back in 2021, they thought this was promising and they were doing quite a bit of work with our remote sensing group to expand on this work. They're seeing that while there is a good correlation between satellites and discrete samples, the chlorophyll data is an indicator of biomass and not necessarily a harmful algal. They're still learning a lot about what leads to the formation of a harmful algal bloom and the generation of toxicity. They started utilizing the remote sensing capabilities of USGS at the June 2021 event.

Jim shared a plot this summer of a 2024 event this past September in the Starved of Rock Pool. The photo is a satellite image of Starved Rock where you can see red, indicating chlorophyll a. The interesting thing about this picture is you can see some variability with really high chlorophyll-a biomass in the pool and some of the ponds nearby. If you go upstream, you can see changes in the intensity of the chlorophyll information. Then, off in the upper right-hand corner is the mouth of the Fox River, and you can see that red in the meandering channel of the Fox. This nutrient monitoring group and others around the state have thought the Fox is a source of eutrophic conditions many times of the year and most summers. Jim postulated that maybe it's seeding conditions in the Illinois River. This is a nice confirmation of some of our hypotheses about what it takes to form blooms in the Illinois River. Initially, they thought that warm weather and nutrients lead to a bloom. In 2022 and 2023, they had similar meteorological conditions, and crews ready to go all summer, but they didn't see any significant blooms.

Other Illinois River Basin NGWOS activities were listed, and Jim encouraged anyone to ask him questions about any of the projects related to nutrients and the work of the Nutrient Monitoring Council.

Discussion summary:

- Question (Albert Ettinger): It is highly unfortunate that we no longer have water quality data from Joslin on Rock River or New Athens on the Lower Kaskaskia. Can those stations be restored?
- Answer (Jim Duncker): I can't comment specifically on them. Can they be restored? We're always open to listening. There are funding choices to be made. The input from this group especially is valuable. We're 5 years into a 10-year study, and we do have the ability to pivot and there may be some flexibility in our funding. We can have that conversation on the side just to see what happened to the monitoring at those sites, and what's needed to restore it
- Comment (Albert Ettinger): Those were both sites that were at the bottom of the Rock and the Kaskaskia, but they were significant in terms of keeping track of what was going on in

those water bodies as well as some significant point sources above them. It was something of a blow when those were lost in 2020.

- Question (Albert Ettinger): Has any work been done following up on the suggestion that rising chloride levels are causing increased water column phosphorus levels?
- Answer (Gregory McIsaac): I hope to do some follow-up analysis when the monthly load values become available from Jenny Murphy's team.
- Question (Rick Manner): RE: FLAMe monitoring, is the intent of floating and testing for 7 days to sample the same water as it flows downstream?
- Answer (Jim Duncker): No, we're able to travel faster than floating with the water. I want to add one of the things that we're looking for in the future is the availability of bringing that survey to some of the other Illinois waterways. I'd love to run it on the Fox or the Rock.

New Continuous Water Quality Monitoring on The Emiquon Preserve

Sara Sawicki, Illinois Natural History Survey

Sarah announced a new collaboration with the Illinois River Biological Station, National Great Rivers Research and Education Center (NGRREC), and The Nature Conservancy (TNC) to monitor water quality at Emiquon Nature Preserve. At Emiquon, they monitor vegetation, fish, and macroinvertebrates. The Emiquon Nature Preserve is located just across the river from Havana, about halfway down the Illinois River. This preserve was once farmland but has been restored to a wetland.

Toby Holda, who conducts vegetation and electrofishing sampling, had many questions about water quality. Luckily, NGRREC has a Great River Ecological Observation Network for scientists, managers, and the public that started in 2013 within the Mississippi River Watershed. For this program, they built 6 buoys designed to sample water quality which were sometimes called the PISCES which stands for Pontoon for In-situ Characterization of Environmental Systems. Most of the original buoys have been retired, but there was one that was still working and not in use. The scientists at the Illinois River Biological Station were able to borrow it with the help of Kathy Jo Jankowski from USGS and NGRREC. There was minimal water quality monitoring until they put in this buoy.

The buoy has a peristaltic pump, data loggers, batteries, solar panels, and a cellular modem. It is free-floating and doesn't need to be connected to anything. Data is transmitted directly to the lab where it can be downloaded and analyzed. A weather transmitter is included which captures wind speed, wind direction, air temperature, barometric pressure, rain, and hail. It has a LI-COR or photosynthetically active radiation sensor. It also includes a YSI Exo-2 sonde sensor that continuously collects dissolved oxygen, algae, dissolved organic matter, turbidity, specific conductance, and temperature. Finally, it has a SUNA to collect nitrate data. Every 15 minutes, it sends weather data and once per hour, it sends water quality data.

They've had a lot of challenges with this buoy so far. This buoy is the only one of its kind that is not in a river and because the water is not moving, the buoy collects living things. The buoy and water quality equipment become dirty and clogged, requiring frequent power washing. The buoy itself is building up algae as well as many of the intake points. They have gone out every five weeks this past

summer but may need to increase frequency. They have tried two different sizes of micron mesh to prevent creatures and things from getting into intake points, but that hasn't worked very well. They also find many spiders, which cover the solar panels with webs. She expressed gratitude to her technicians who cleared the spiders and helped with cleaning maintenance. She asked folks to share any advice or suggestions they have about these issues.

They have some questions about Emiquon and are excited to utilize the buoy to try to answer them. Toby wants to know what the main driver of turbidity at Emiquon could be and how wind affects turbidity. They're trying to determine if turbidity is being affected by wind, invasive species of fish, or some other factor. How might staff affect turbidity when passing in boats? Toby often uses an airboat, and he moves a lot of water. They also wonder how the Emiquon Preserve's water quality compares to the Illinois River main channel.

Sarah shared that they have only had the buoy for a few months, but have some information collected. Between May and August, the most frequent winds came from the southeast, the strongest winds came from east and west and the most frequent wind speeds were between 3-12 miles per hour. Toby plotted the turbidity versus wind speed, and it shows significant polynomial regression, but data is limited. When plotting turbidity by wind direction, they found that the average turbidity of all directions is similar. Variations of turbidity between wind sectors also looked about the same. The concentration of high turbidities shows up for a greater portion of the time when winds were coming from the east and south. Are they affecting turbidity? They are not sure yet. They've only been out for maintenance three times and the second time they had to reset the data transmitter and lost those two weeks of data. They are looking forward to seeing the data after a year or more of continuous monitoring.

Sarah also monitors water quality at a site just outside of Emiquon in the Illinois River and visits at least once per month year-round. For comparison, she looked at turbidity in the Illinois River site compared to the Emiquon buoy for the May-August period. The most common turbidities at Emiquon and the Illinois site are ranging from 30 – 60. However, one big challenge is that these are not in the same unit. The Buoy collects Formazin Nephelometric Unit (FNU) while the Illinois River site collects Nephelometric Turbidity Unit (NTU). They both calibrate at the intensity of scatter light 90 degrees from a beam of light, but for FNU that is an infrared light, and for NTU that is white light. Sarah ended by thanking everyone who helped with this project and encouraged the scientists on the call to share their advice on any of the questions or issues laid out in the presentation.

Discussion Summary:

- Question (Gregory McIsaac): Does water from the Illinois River flow into Emiquon?
- Answer (Sara Sawicki): The Emiquon has a control structure between itself and the river. At one point there the river flooded into Emiquon, but since then they have controlled the water.
- Comment (Jim Lamer): They very rarely will flow in water, and they are very strategic about timing it when they don't have any larva in the area. They've only flowed water in a couple of times for a very short window, but often it's not connected, and any water that leaves Emiquon is often done through pumping. Thee breaches happened in 2013 and 2015.

- Comment (Brian Rennecker): Emiquon is protected by a federal levy.
- Question (Jim Duncker): Will you leave the buoy out over the winter?
- Answer (Sara Sawicki): Good question. I'm not sure. If it doesn't freeze over, I think it would be a good to keep it in.
- Question (Erin Bauer): Have you investigated what kind of paint is on the buoy and how long ago it was painted? There are paints that it can reduce the accumulation.
- Answer (Sara Sawicki): I don't think we're allowed to mess with that because we are only borrowing the buoy, but I can ask.
- Comment (Erin Bauer): I have idea regarding something else you might want to study. Sarah, you should call me at the Illinois State Water Survey.

NARPs and NPDES: What We Have Learned and Next Steps

Mila Marshall and Albert Ettinger, Sierra Club IL

Mila explained that the Sierra Club is monitoring the Nutrient Assessment Reduction Plan (NARP) and the National Pollutant Discharge Elimination System (NPDES) processes. NARPs are part of the NPDES permits, required for major wastewater treatment plants or those discharging into impaired waters, aiming to lower phosphorus discharge to 0.05 milligrams per liter by 2030.

The Sierra Club tracks NPDES permits in Illinois and has shared insights from the first cycle of NARPs, which resulted in around 30 documents now available on the IEPA website. After reviewing these, the Sierra Club offered some feedback. Mila focuses on stakeholder engagement, while legal counsel Albert Ettinger provides additional comments.

Despite guidance that operators should engage stakeholders, many did not To improve engagement, the Sierra Club created resources for operators, including guidance on best practices and stakeholder reporting templates. They also created a survey to learn about the tensions and opportunities around this process to help support operators in meaningful stakeholder engagement. They have urged the IEPA to define "stakeholder engagement" clearly and are waiting for their feedback. NARPs are due at the end of the year and Sierra Club would also like to understand how long they'll have to provide comments, the process if they do not agree with the conditions of the NARP, and what that means for the distribution of the NPDES Permit.

Currently, there are about 15 new NARPs submitted, with more potentially coming. The process, including timelines and decisions on rejected NARPs, is still being developed by the Bureau of Water. The Sierra Club is preparing to comment on the next round of NARPs which are due at the end of the year. Mila then handed the presentation to Albert Ettinger.

Albert reiterated the definition of NARPs and shared the NPDES permit language. Facilities and contractors were supposed to work with stakeholders to develop implementation plans, but the Sierra Club believes this did not occur. NARPs were meant to establish targets for acceptable phosphorus levels and identify necessary reductions. While several NARPs were submitted, most contractors failed to meet the conditions. The task was challenging, especially during the COVID

pandemic, but there is still a lack of defined targets and plans. Although some valuable data collection occurred in areas like Mattoon, Charleston, and DuPage, these efforts did not answer the key questions. As it stands, the first round of NARPs allow dischargers to maintain their existing practices.

Discussion summary:

- Question (Alana Bartolai): How does Sierra club define stakeholder?
- Answer (Mila Marshall): There is a diversity of ways to engage stakeholders. When we think about meaningful stakeholder engagement, it is communicating with the public about what is going on, possibly even that the plan is being developed. We specifically suggested using the resources that we developed to help assist consultants. That includes education on the Clean Water Act, the basics of nutrients, our simple NARP guidance tool as well as the stakeholder best engagement practices which we have provided to IEPA. We made recommendations on how to identify stakeholders, what types of resources would be most appropriate, and encouraged the network to keep Sierra Club in the loop for public meetings. Mila shared the Sierra Club IL Chapter Best Practices for NARP Stakeholder Engagement document.
- Answer (Albert Ettinger): We know who the stakeholders are and in many cases they are nonpoint sources, because if we're going to draft an implementation plan that's going to have to include more than the point sources. It's the community, NGO's, and other point sources in the watershed.
- Question (Karoline): Albert, could you please clarify how you envision community input shaping the scientific methodologies behind setting phosphorus reduction targets?
- Answer (Albert): The thought was that the community input would mainly about the implementation and that's where we thought that the community would be particularly necessary. If you lower the point sources in some cases, then less non-point reduction is necessary, or vice versa. The hope of the TMDL program was that we would come up with plans that would restore impaired waters through a reduction in both point sources and non-point sources when necessary.
- Comment (Rick Manner): The NARP process has been a long, complicated discussion. What you had in today's presentation was one perspective on NARPs and it's basically a summary of comments that were provided to IEPA. Point sources disagree a lot regarding almost every aspect of what was said, the claim of lack of stakeholder engagement, etc. in particular. We don't need to have this discussion now; I just need to point out that is not the total of the NARP status or where they're headed. That is a discussion for other meetings.
- Question (Karoline): Given the limited data and the unique dynamics of each watershed, is it realistic to think we can develop and enforce separate phosphorus targets that will be both effective and scientifically sound? – This was not answered.

Member Updates – None.

Joan thanked everyone for coming and adjourned the meeting at 11:45 AM.