

# Upper Mississippi River Interstate Water Quality Monitoring

**REACHES 8 & 9 PILOT PROJECT** 

June 30, 2022

### Acknowledgements

The Evaluation Report was produced in collaboration with the members of the UMR Interstate Water Quality Monitoring Program Reaches 8-9 Pilot Planning Committee. This includes the following agencies and individuals:

Illinois Environmental Protection Agency: Anna Belyaeva, Gregg Good, Ryan Sparks, Nicole Vidales Iowa Department of Natural Resources: Roger Bruner, Andy Fowler, Melanie Harkness, Daniel Kendall, Randy Schultz, Adam Thiese, Nick Smith

Missouri Department of Natural Resources: John Hoke, Scott Robinett, Robert Voss, Chris Wieberg Missouri Department of Conservation: Molly Sobotka

Upper Mississippi River Basin Association: Lauren Salvato, Kirsten Wallace, Erin Spry

The Reaches 8-9 Planning Committee would like to thank the following groups and individuals for their support during the pilot:

The UMRBA WQ Task Force: Pam Anderson (Minnesota PCA), Kim Laing (Minnesota PCA), Shawn Giblin (Wisconsin DNR), Mike Shupryt (Wisconsin DNR), Ryan Sparks (Illinois EPA), Daniel Kendall (Iowa DNR), and John Hoke (Missouri DNR)

Reaches 0-3 Planning Committee: Joel Chirhart (Minnesota PCA), Andy Bartels (Wisconsin DNR), Jim Fischer (Wisconsin DNR), Jack Barland (Metropolitan Council) Jeffrey Dimick (UW Stevens Point) and Dr. Brian Weigel (Wisconsin DNR)

John Olson (Retired, Iowa DNR)











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## Introduction

#### UMR Interstate Water Quality Monitoring Plan

The Upper Mississippi River Basin Association's (UMRBA's) Upper Mississippi River (UMR) Interstate Water Quality (WQ) Monitoring Plan<sup>1</sup> (herein called the "Monitoring Plan") is a comprehensive assessment of the river in support of four designated uses: aquatic life, recreation, drinking water, and fish consumption (**Figure 1**). UMRBA, through its Water Quality Task Force (WQTF), developed the Monitoring Plan in 2013 to achieve a coordinated, comprehensive Clean Water Act (CWA) focused monitoring approach on the UMR (UMRBA 2014).



**Figure 1:** Illustration of UMR Recommended Monitoring Plan, including constituent networks and designated uses which can be assessed utilizing data from these networks

Following the development of the Monitoring Plan, the states opted to test the effectiveness and feasibility of the plan on a smaller scale. From May 2016 to April 2017, a pilot was conducted in CWA Assessment Reaches 0-3, from the Twin Cities Metro Area, Minnesota to La Crosse, Wisconsin (herein called "Reaches 0-3" and "Reaches 0-3 pilot") (UMRBA, 2019). The Reaches 0-3 pilot focused on the implementation of the probabilistic and fixed site components of the Monitoring Plan. During 2020-2021, the plan was piloted with Iowa, Missouri, and Illinois state agencies in Reaches 8-9. The Monitoring Plan organizes monitoring around the "minimum Clean Water Act assessment reaches" established via an interstate Memorandum of Understanding in 2003.<sup>2</sup> These reaches follow HUC-8 boundaries (**Figure 2**).

<sup>1</sup> 

The UMR Interstate WQ Monitoring Plan was formerly known as the CWA Monitoring Plan

<sup>2</sup> https://umrba.org/sites/default/files/documents/wqmou.pdf



Figure 2: Minimum, Interstate UMR CWA Assessment Reaches

#### **Evaluation Report Purpose**

This Evaluation Report discusses the successes and lessons learned of the Reaches 8-9 pilot from the technical, logistical, budgetary, and personnel perspectives. The report also includes considerations for scaling up monitoring to the entire UMR mainstem.

### Reaches 8-9 Pilot

#### **PROJECT SCOPE**

The geographic extent of the pilot monitoring project is the main stem UMR from the Iowa River confluence (River Mile 434) to the L&D 21 (River Mile 324.9). This includes the UMR assessment reaches 8 and 9 (Table 1). All sampling takes place in the river's main channel and adjacent shoreline throughout the run of the river.

Table 1:	Geographic Extent	of Pilot Monitoring	Program, UMR	Assessment	Reaches 8 a	nd 9
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REACH NUMBER	<b>REACH NAME</b> (Description/8-digit HUC code)	RIVER MILES	SEGMENT LENGTH (miles)
8	Assessment Reach 8 (Flint-Henderson) (Iowa River to Des Moines River/HUC 07080104)	434.0 - 361.4	72.6
9	Assessment Reach 9 (Bear-Wyaconda) (Des Moines River to Lock & Dam 21/ HUC 07110001)	361.4 - 324.9	36.5

#### SAMPLING IMPLEMENTATION

Parameters sampled for the Reaches 8-9 pilot include water chemistry and biological samples. A comprehensive list of the samples collected can be found in the Reaches 8-9 Field Operations Manual and the Reaches 8-9 Condition Assessment (UMRBA 2020, UMRBA 2022).

#### **COMPANION DOCUMENTS**

Other UMRBA WQTF publications that provide additional information on the Monitoring Plan and Reaches 8-9 Pilot include:

**UMR Interstate WQ Monitoring Plan** – An overview of the sampling plan for the UMR in support of the four uses: aquatic life, recreation, drinking water, and fish consumption

https://umrba.org/document/umrba-interstate-wq-clean-water-act-monitoring-strategy-2013-2022-documents

**Reaches 8-9 Pilot Condition Assessment** – A water quality condition assessment based on the data collected in Reaches 8-9 for the four use assessments: aquatic life, recreation, drinking water, and fish consumption

**Field Operations Manual** – Field sampling instructions for the four use assessments for Reaches 0-3 <u>https://umrba.org/</u> <u>document/interstate-wq-monitoring-reaches-0-3-pilot-field-operations-manual</u> and Reaches 8-9 <u>https://umrba.org/</u> <u>document/reaches-8-9-pilot-field-operations-manual</u>

**Provisional Assessment** – Instructions on how to calculate the condition (i.e., good, fair, poor) for the data collected for each probabilistic and fixed site.

https://umrba.org/document/umrba-interstate-wq-clean-water-act-monitoring-strategy-2013-2022-documents

#### **PLANNING COMMITTEE ROLES**

The Reaches 8-9 pilot was coordinated by agency representatives from Missouri, Iowa, and Illinois. Contact information can be found in the **Appendix**. Their specific roles and responsibilities were as follows:

AGENCY/ORGANIZATION	NAME	ROLE					
	Roger Bruner (retired)	Supervisory role for contract, personnel, and budget matters					
	Andy Fowler	Probabilistic sampling, lead database management, aquatic life use assessment analysis					
	Melanie Harkness	Probabilistic sampling					
Iowa Department	Nick Smith	Probabilistic sampling, database management					
of Natural Resources	Daniel Kendall	Fixed sampling, data entry, cyanobacteria toxin data analysis; lead contact for Iowa DNR					
	Randy Schultz	Supervisory role for contract, personnel, and budget matters					
	Adam Thiese	Probabilistic sampling, data entry					
	John Olson	Condition Assessment contractor					
	Anna Belyaeva	Fixed sampling, data entry, aquatic life use assessment analysis					
Illinois Environmental	Gregg Good (retired)	Supervisory role for contract, personnel, and budget matters					
Protection Agency	Ryan Sparks	Lead contact for Illinois EPA					
	Nicole Vidales	Supervisory role for contract, personnel, and budget matters					
	John Hoke	Supervisory role for contract, personnel, and budget matters					
Missouri Department of	Scott Robinett	Laboratory analysis (lead)					
Natural Resources	Robert Voss	Lead contact for Missouri DNR					
	Chris Wieberg	Supervisory role for contract, personnel, and budget matters					
Missouri Department of Conservation	Molly Sobotka	Contractor for fixed and probabilistic sampling					
Unner Mississinni	Lauren Salvato	Project coordinator					
River Basin Association	Kirsten Wallace	Supervisory role for contract, personnel, and budget matters					

Table 2:	Roles	of the	Reaches	8-9	Planning Committee	

#### **MODIFICATIONS TO THE PILOT**

The Monitoring Plan was modified to meet the specific needs of the Reaches 0-3 and Reaches 8-9 pilots. The changes removed redundancies, improved efficiencies, and enhanced feasibility, particularly in consideration of available funding and staff capacity. The reasons for the modifications are described in detail below and organized by *additions* and *deletions*. Additionally, a comparison of the two pilots is provided.

#### Additions

**Per- and Polyfluoroalkyl Substances (PFAS) Monitoring** – The Reaches 8-9 planning committee partnered with USEPA Region 5 laboratory to analyze fixed site and drinking water samples for PFAS. While the parameter is not associated with the Monitoring Plan, there is substantial interest in the contaminant, and the committee wanted to begin collecting baseline data. The WQTF has expressed interest in adding an emerging contaminants monitoring component to the Monitoring Plan and will be scoping a monitoring design in 2022 and 2023.

#### Deletions

**Probabilistic Metals Monitoring** – Metals were not sampled at the probabilistic sites because of the limited benefit to collecting metals intensively during the summer growing season. Fixed site sampling was maintained to create a baseline dataset and identify any new metals exceedances. As an addition, the Reaches 8-9 pilot assessed both total metals and dissolved metals.

*Biological Monitoring* – The Reaches 8-9 pilot modified the electrofishing sampling plan to be more in line with the Upper Mississippi River Restoration's Long Term Resource Monitoring (LTRM) fish sampling protocol. Wisconsin DNR staff noted that sampling the full 1,000-meter transect was not feasible and that field staff would take a break after 500 meters. Other concerns involved keeping fish alive and improving sampling efficiency for the field sampling staff. Modifications made to the plan included breaking up the probabilistic sites into 10-200-meter long transects (Figure 3). Five of the 10 candidate subsites were randomly selected to be sampled. If it was infeasible to sample the specified transect because of safety, access, or other reasons, then the remaining five subsites were randomly selected for sampling (UMRBA 2020).

*Index Sites* – Index monitoring was not included in the Reaches 8-9 pilot because of the additional costs to collect data on tributaries on the UMR. Index sites are located on the lower portions of major tributaries, and provide comparison data for calibrating biological indices, identifying stressors, and setting attainable thresholds for chemical, physical, and biological parameters.

*Follow-Up Sampling* – Follow-up sampling and monitoring for secondary indicators (e.g., sediment chemistry) were not included in the Reaches 8-9 pilot.

*Tributary Loading Network* – The tributary loading network was not sampled as part of the Reaches 8-9 pilot. The existence of states' loading measurement networks and presence of United States Geological Survey continuous monitoring stations may limit the need for an additional, separate loading network.



*Figure 3:* General arrangement of probabilistic sample sites (denoted by the orange circle) and the 10-200 meter long mainchannel fish transects (denoted in red circles). Five of the 10 sites are randomly selected to be sampled.

#### **Comparison of the Two Pilots**

#### **Differences:**

- The Reaches 0-3 pilot monitored for aquatic vegetation as part of the aquatic life use assessment. Note that aquatic vegetation monitoring is not part of the Monitoring Plan below CWA Reach 6 (i.e., UMR Pool 13).
- Unlike the Reaches 0-3 pilot, the Reaches 8-9 pilot monitored for cyanobacteria toxins (e.g., microcystin and cylindrospermopsin) in the recreation, fixed, and drinking water use assessments. The Reaches 0-3 planning committee determined that this monitoring would not be particularly effective or helpful given the sporadic and variable occurrence of these toxins.
- Unlike the Reaches 0-3 pilot, the Reaches 8-9 pilot collected fish for fish tissue analyses as part of the fish
  consumption use assessment. The committee deviated from the recommendation to analyze fish tissue of skin-on
  fillets and instead analyzed skin-off fillets to be compatible with state agency programs.
- Due to the presence of public water suppliers (PWS) in Reaches 8-9, the planning committee partnered with PWS to sample for parameters in the drinking water use assessment.
- The Monitoring Plan recommended sampling for either for dissolved organic carbon (DOC) or total organic carbon (TOC). The Reaches 0-3 pilot elected to monitor TOC while the Reaches 8-9 pilot elected to monitor DOC.

#### Similarities:

- The two pilots commonly eliminated probabilistic sampling of metals, index sites, follow-up sampling, and tributary loading network.
- The two pilots commonly utilized an artificial substrate sampler for the macroinvertebrate component of the aquatic life use assessment.

#### **DATA MANAGEMENT AND TOOLS**

A number of tools were developed to improve the implementation of the Reaches 8-9 pilot, as follows:

**ArcGIS Online** – The online mapping tool was used to located fixed and probabilistic sites. Other layers such as boat launches were added to assist field sampling staff. The link can be accessed here: <u>https://umrba.maps.arcgis.com/home/webmap/viewer.html?webmap=9628cf7d690c422685549a94429cdae9</u>

*Microsoft Access Database* – The datasets for both pilot projects were housed in a Microsoft Access database, hosted on an Amazon Webserver, to allow any Reaches 8-9 pilot planning committee members to log in and complete data entry. Note that the webserver is no longer supported, and a copy of the data can be provided by UMRBA staff.

**Google Drive Folder** – A shared folder was set up for the pilot project for the planning committee to access resources, laboratory data, field sampling sheets, and any other information needed.

#### CHALLENGES AND SOLUTIONS

#### Database Management

Google Drive and ArcGIS online maps were utilized by the planning committee members. However, agency restrictions on folder sharing prevented some members from being able to use Google Drive. Common accessibility among implementing agencies to database platforms will likely always be a challenge.

The initial protocol was for field sampling staff to enter data monthly to ensure quality control and data assuredness. A significant amount of work was put into building the ability to copy-and-paste data into the Microsoft Access database for routine data entry by all participating individuals. However, the feature was not routinely utilized. Instead, Iowa DNR staff collected the data in partial year batches for storage and compiled all the data from each partnering agency at the end of the project in Microsoft Excel. In retrospect, the best approach would have been to manipulate the Access database after all data had been analyzed so the equivalent water quality parameters would be merged into a normalized format. The Access database would then serve only for data manipulation and calculation of indices of biotic integrity (IBIs).

Long term storage of data in Access is not recommended. Database management, in general, was significantly more time consuming than anticipated. It is recommended that future monitoring efforts submit data to well-established and maintained databases – e.g., WQX for long term storage. The database developed in this project would be best used as model for temporary storage and manipulation of future monitoring (i.e., how to store/manipulate varied water quality parameter types from different agencies for summaries/analysis and calculations of IBIs).

#### Laboratory Analyses

The Reaches 0-3 pilot committee suggested that future monitoring efforts utilize one laboratory for analyses to avoid challenges with inter-laboratory variability. While multiple laboratories were utilized in the Reaches 8-9 pilot, generally a single laboratory processed samples for a particular component. For example, Rhithron and Associates provided macroinvertebrate identification, Pace Analytical analyzed fish tissue samples, and USEPA Region 5 analyzed the PFAS samples. There were three state laboratories involved in analyses: Iowa DNR (cyanobacteria toxins), Missouri DNR (water chemistry), and Illinois EPA (water chemistry). There were some cases in which the same parameters were analyzed by two laboratories. Illinois EPA's routine fixed site monitoring locations were the same sites utilized for fixed monitoring during the pilot. During December, March, June, and September, Illinois EPA's quarterly sampling was conducted both for its ambient WQ monitoring program and the Reaches 8-9 pilot.

The Quality Assurance/Quality Control process was an extensive effort by the planning committee. For parameters analyzed by two different laboratories, the committee spent considerable time determining the best approaches for resolving differences in detections and non-detections from different laboratories as well as from the same laboratory (e.g., chlorophyll). Because laboratory variation could not be overcome, only samples processed within one laboratory were used in the Reaches 8-9 Pilot Condition Assessment.

In general, a significant portion of the pilot cost was spent on ensuring proper shipment of the samples for consistent laboratory analysis. Problems occurred with samples being lost by FedEx or not arriving at the proper temperature, either because of delays in shipment or because of errors in packaging samples. The technique for packing samples was refined to ensure that samples were not flagged for temperatures. Laboratory coordination and logistics were a larger time commitment than was anticipated. Laboratory staff provided sampling crews with pre-labelled bottles and chain-of-custody forms in monthly sampling kits. Those pre-planning efforts were significant but increased the efficiency of collecting sample in the field.

#### **Field Sampling**

The Field Operations Manual served as a sampling plan but did not go into depth about sampling techniques. The Reaches 8-9 planning committee developed its own field standard operating procedures with guidance provided by the agency analyzing the particular sample. In September 2021, a field training was held for all sampling crews. This helped orient field staff on the samples being collected. A recommendation is to provide formalized coordinated training to ensure consistency in field sampling techniques.

The planning committee aligned sampling among all field crews to occur within the same week to increase efficiency of laboratory analyses.

#### **Drinking Water Use Assessment**

Sampling, as part of the drinking water use assessment, relied on the voluntary participation of public water supplies (PWS). Three PWS participated in the pilot from December 2019 through March 2020. While the Reaches 8-9 planning committee provided information well in advance of the start of pilot implementation, there were challenges with collecting

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samples properly. Samples were collected and sent to Iowa DNR (cyanobacteria toxins), USEPA Region 5 (PFAS), and Missouri DNR (remaining water chemistry). The logistics alone were confusing for PWS without the ability to train in person. Additionally, PFAS is particularly challenging to sample because it is very easy to cross-contaminate samples. When the COVID pandemic began, the Reaches 8-9 pilot was paused and, after it restarted, two of the three PWS were unable to participate due to staffing challenges. The planning committee adapted by combining the drinking water use assessment with fixed site sampling. In other words, field staff added drinking water sampling to the fixed site sampling. However, this meant that samples were not obtained at the PWS intake, and data were not collected on raw and finished samples.

Future efforts with PWS should include increased resources for sampling – e.g., sampling videos and in-person training. However, it is important to keep in mind that there are a wide variety of staffing capacity and fiscal resources among PWS on the UMR. Voluntary participation may make it challenging to retain participation.

#### IBIs

The results of the Wisconsin Large River IBI utilized for the Reaches 8-9 pilot warrant further investigation. The IBI was selected for use in CWA Reaches 0-11 as part of the dual-assemblage aquatic life use assessment. The results for Reaches 1-3 and 8-9 were grouped around the threshold of 50. Given the vast longitudinal differences in the reaches, the IBI may not be sensitive enough to detect changes in macroinvertebrate communities.

#### **BUDGET, STAFFING, AND PROJECT COSTS**

One purpose of the piloting the UMR Interstate Water Quality Monitoring Plan is to get a better assessment of expenses and staffing needs to implement the Plan as designed – i.e., over a five-year cycle. When estimating expenses for implementing the Monitoring Plan, it will be important to acknowledge the inherent annual variability in staffing and financial resource needs given particular phases – e.g., planning and coordination, sampling, assessment, communication. Additionally, the full-scale estimate will need to consider costs for components of the Monitoring Plan that were reduced or dropped from both pilots. The staffing and expenses involved in the Reaches 8-9 pilot include factors that may both over- and under-estimate the costs of ongoing plan implementation.

#### **Funding Sources**

To fund the Reaches 8-9 pilot, Illinois, Iowa, and Missouri secured financial contributions through their agency water quality programs or through a CWA Section 106 grant. The states each contributed personnel as work-in-kind (WIK) to participate in the Reaches 8-9 planning committee. The states were also able to provide their available capacity to advance particular elements of the pilot – e.g., additional field sampling, chemical analyses, research, writing, or project coordination. Additionally, Missouri DNR contracted with Missouri DoC to implement a specific monitoring task.

#### Personnel and Time Commitment

The Reaches 8-9 pilot was implemented by a team of agency staff from Iowa, Illinois, and Missouri who assumed different roles. Each individual took on pilot work in addition to their other responsibilities. It was not a full-time job for any one individual. The project started in August 2018 with initial planning discussions and the pilot was finalized in June 2022 with final data analysis and assembly of reports (Table 3).

 Table 3: Reaches 8-9 Pilot Timeline (calendar years, divided into quarters). Note that the pilot was paused from April 2020 to September 2020 due to the COVID-19 pandemic.

	2018			2019			2020			2021			2022				
Scoping and Coordination																	
Fixed Site Sampling										Pau	sed						
Probabilistic Site Sampling																	
Data Compilation and Assessment																	
Documentation and Wrap-Up																	

Many individuals were engaged in scoping and executing the pilot. The planning committee members' respective roles, times of engagement, and approximate full time equivalent (FTE) requirement were compiled to estimate total personnel costs (**Table 4**). The estimates of personnel time are an approximation and are likely underestimates. However, the estimates provide a clearer view of the staffing requirements needed to implement the Monitoring Plan. The number of individuals involved and duration of time engaged would likely decline as efficiencies are gained in the process of implementing the Monitoring Plan.

#### Table 4: Personnel Commitment to the Pilot – Roles and Estimated Time

PARTICIPANTS		ROLES									
Agency	Name	Conference Call	In-person Meeting	Field Sampling	Data Analysis/ Laboratory	Database Development/ Data Entry	General Research, Writing	Communications and Outreach	Reporting (e.g., Personnel Time, Financial)	Duration Involved (Years)	Total FTE^
Missouri DNR	Dane Boring	•					•			0.5	0.09
	John Hoke	•	•				•	•		2.75	0.01
	Chris Wieberg	•							٠	1	0.01
	Robert Voss	•	•				•	•		3.75	0.01
	Scott Robinett	•			•			•		1	0.02
	Dave Bierman	•								1.25	0.01
	Roger Bruner	•							•	2.75	0.01
	Andy Fowler	•	•	•		•	•	•	•	4	0.10
	Daniel Kendall	•	•	•	•	•	•	•	•	4	0.02
	Randy Schultz	•						•	•	2	0.01
lowa	Amy Buckendahl	•		•	•					2	0.03
DNR	Melanie Harkness	•		•						3.5	0.01
	Adam Thiese	•		•		•	•			3.75	0.04
	Drew Cuckler			•						0.25	0.015
	Chris Mack			•						0.25	0.22
	Nick Smith			•		•				0.25	0.49
	Bennett Soncarty			•						0.25	0.05
	Anna Belyaeva	•	•	•	•	•	•	•	•	3.25	0.07
	Gregg Good	•	•				•	•	٠	3.5	0.01
	Matt Short	•					•			0.5	0.01
Illinois EPA	Logan Shippert			•						1.5	0.03
	Hilary Marler			•						1.75	0.02
	Curtis Clark									0.25	0.05
	Ryan Sparks	•					•			0.5	0.02
	Nicole Vidales	•		•				•	٠	1	0.02
UMRBA	Lauren Salvato	•	•		•	•	•	•	•	4	0.14
	Kirsten Wallace	•						•	•	4	0.002
	Margie Daniels/ Natalie Lenzen						•		•	4	0.007
	Tyler Leske						•			0.25	0.07
TOTAL											1.59

\*During duration involved in project.

^ FTE over project life (approx. 4 years to date). Product of duration x FTE proportion when involved.

#### **Project Costs**

Project costs for the pilot can be broadly classified as either personnel or analytical expenses.

#### **Estimated Personnel Costs**

Personnel costs are extrapolated based on the approximate time allocations described in the preceding section of this report. Assuming the rough estimate is accurate and average annual salary and benefits are \$100,000, then estimated personnel cost for the project can be calculated as follows:

#### **Total FTE Estimated Personnel Costs**

(1.59 Total FTE) x (\$100,000 per FTE) = \$159,000 estimated total project personnel cost

#### **Analytical Costs**

Analytical costs are broadly defined and may include chemistry analysis, and macroinvertebrate identification (**Table 5**). The costs were tracked throughout the duration of the pilot.

The total analytical costs for the pilot are \$132,445.00

Table 5: Actual Versus Estimated Costs for the Reaches 8-9 Pilo
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	ACTUAL COSTS	ESTIMATED COSTS
Chemistry Costs – Missouri DNR	\$44,975.00	\$70,000.00
Chemistry Costs – Iowa DNR	\$12,050.00	\$12,700.00
Macroinvertebrate Identification (Contractor)	\$8,430.00	\$9,000.00
Fish Tissue Analysis (Contractor)	\$6,090.00	\$6,435.00
Field Sampling (Contractor)	\$27,000.00	\$22,145.00
Condition Assessment (Contractor)	\$10,000.00	\$10,000.00
Supplies	\$4,510.00	\$6,940.00
Technology	\$310.00	\$450.00
Shipping	\$19,080.00	\$21,400.00
TOTAL	\$132,445.00	\$159,070.00

#### **Combined Costs and Per Reach Costs**

Using the above estimates of personnel and analytical cost, the estimated **overall project cost for the pilot was approximately \$291,445**. Averaging this cost among the two reaches results in a **per reach cost of approximately \$145,723**.

#### Estimating Costs for the Entire UMR

There are numerous uncertainties and assumptions involved in estimating expenses for the entire UMR. As previously discussed, the pilot was scaled down from the full Monitoring Plan so costs would be greater if those components are implemented. Keeping these limitations in mind, the **estimated cost of one full round of baseline UMR CWA monitoring for the entire UMR would be \$2.04 million** (\$146,000 per reach for 14 reaches).

## Recommendations for Future Monitoring

#### **UMRBA'S ROLE**

UMRBA provided project coordination of the Reaches 8-9 pilot. This involved coordinating logistics, contractual arrangements, reporting, and other activities. UMRBA staff convened monthly meetings of the Reaches 8-9 planning committee to organize implementation, including assigning roles and responsibilities, and identify and resolve implementation issues.

#### LABORATORY ANALYSES

The use of one laboratory for water chemistry analyses is still a reasonable goal for ensuring consistency in laboratory results. The planning committee suggests using a contracted laboratory rather than a state laboratory given capacity constraints. However, using a contracted laboratory will increase the analytical costs.

#### SHIPPING SAMPLES

The cost to ship samples was significant for the Reaches 8-9 pilot (approximately \$19,000). The use of one laboratory to analyze samples will result in high shipping costs. The planning committee recommends negotiating shipping rates to reduce costs.

#### PERMANENT DATA MANAGEMENT SYSTEM

lowa DNR staff built and maintained a Microsoft Access database to house Reaches 0-3 and 8-9 pilot data. Database development took a significant amount of time (approximately three-fold higher than budgeted). The planning committee recommends housing UMR Interstate WQ Monitoring Plan data in an existing database that is routinely maintained and is publicly accessible.

#### **EMERGING CONTAMINANTS**

The Reaches 8-9 pilot benefited from partnering with USEPA Region 5 to analyze PFAS samples. The planning committee and the UMRBA WQTF are interested in scoping an emerging contaminants monitoring plan for the UMR in 2022-2023.

#### **CONTRACTORS AND STATE AGENCY CAPACITY**

The Reaches 8-9 pilot relied on contractors to carry out certain aspects of the work. For example, Missouri DNR contracted with Missouri DOC to conduct all field sampling for Reach 9. A contractor provided writing services for the Reaches 8-9 Pilot Condition Assessment. State agencies have varying abilities to participate in the pilot, and full-scale monitoring will require all five UMRBA member states secure additional personnel to provide the necessary capacity.

#### **PWS PARTICIPATION AND ENGAGEMENT**

Half of the PWS in Reaches 8-9 participated in the drinking water use assessment prior to the COVID pandemic, and only one PWS was able to participate afterward. There were challenges associated with training PWS operators, ensuring correct sampling protocols, and maintaining participation. The COVID pandemic further strained PWS ability to participate in the Reaches 8-9 pilot. The planning committee recommends reassessing the ability to maintain PWS participation for the entirety of the sampling period. The variety of capacities (e.g., personnel and budget) of the PWS along the UMR should be considered and factored into requests to participate in sampling.

#### **COMPATIBILITY WITH OTHER MONITORING PROGRAMS**

The Reaches 8-9 planning committee modified fish sampling transects to incorporate the Upper Mississippi River Restoration program's LTRM design. The primary reasons were to increase fish survivability and reduce field sampling crew fatigue. The Reaches 0-3 pilot confirmed that splitting up transects to the same electrofishing distance as the original design provided a reliable IBI.

The UMR Interstate Water Quality Monitoring Plan was designed using the USEPA's Environmental Monitoring and Assessment Great Rivers Ecosystem (EMAP-GRE) program. However, the planning committee recommends that further consideration be given to utilizing existing monitoring programs on the river, such as the Upper Mississippi River Restoration's LTRM methods, to leverage the data and methods.

#### **CLIMATE CHANGE AND RIVER CONDITIONS**

The Reaches 0-3 pilot sampling occurred during a high-water year on the UMR and the Reaches 8-9 pilot during a lowwater year. Sampling more frequently as envisioned in the UMR Interstate WQ Monitoring Plan would, over time, provide water quality assessments over a range of discharge conditions and increase confidence in the results.

## Next Steps

#### **RESOLVE OUTSTANDING QUESTIONS**

Before implementing the full scale UMR Interstate WQ Monitoring Plan there are a few outstanding questions that would need to be addressed. Total suspended solid (TSS) thresholds are utilized as a supplementary indicator of the aquatic life use assessment. The TSS thresholds in the Provisional Assessment were developed for stretches of the UMR above L&D 13 (UMRBA, 2017; Giblin, 2017). The UMRBA WQTF is in the early stages of considering TSS thresholds that are applicable to the southern impounded area of the UMR and plans to develop research questions.

The WQTF has debated adopting UMRR LTRM design as part of the UMR Interstate WQ Monitoring Plan. The discussion has raised several questions that warrant additional explanation, including:

- Can the LTRM design meet CWA needs?
- Does the Great Rivers Fish IBI meet CWA needs for sections of the river to which it is applicable? Does each method provide the sensitivity to IBI condition gradients?

The Open River IBIs for both macroinvertebrates and fish have not yet been tested. Both IBIs were developed for the Missouri River Basin. While the Missouri River and Open River (i.e., the unlocked portion of the river) have some similarities, it may be appropriate to test the IBIs before moving to full scale monitoring.

#### **REVISION OF UMR INTERSTATE WQ MONITORING PLAN DOCUMENTS**

The UMR Interstate WQ Monitoring Plan should be revised to incorporate the insights gained from the two pilot projects. There are aspects of the Monitoring Plan that both pilot projects did not implement (e.g., follow-up sampling) that may suggest their removal from the overall monitoring design. The Provisional Assessment should be revised, and the Field Operations Manual would benefit from routine updates.

#### **SCALING UP AND FUNDING**

The Reaches 0-3 and 8-9 pilots recommended full scale implementation of the UMR Interstate Water Quality Monitoring Plan. The UMRBA WQTF will continue to work with the Water Quality Executive Committee and the UMRBA Board to prepare for implementation and to secure the necessary resources.

### References

- Giblin, Shawn. 2017. Identifying and quantifying environmental thresholds for ecological shifts in a large semi-regulated river. Journal of Freshwater Ecology, 32:1, 433-453, 20 p.
- UMRBA. 2014. Upper Mississippi River Clean Water Act Monitoring Strategy 2013-2022: Recommended Monitoring Plan. Upper Mississippi River Basin Association. 23 p. Web: <u>http://umrba.org/wq/cwa-monitoring-plan-2-14.pdf</u>.
- UMRBA. 2017. Provisional Methodology for Clean Water Act Assessment of the Upper Mississippi River. Upper Mississippi River Basin Association. 28 p. Web: <u>http://www.umrba.org/wq/provisional-umr-cwa-assessment-</u> <u>methodology-updated-july2017.pdf</u>.
- UMRBA. 2019. Minnesota-Wisconsin Area Pilot Project Water Quality Condition Assessment. Upper Mississippi River Basin Association.
- UMRBA. 2020. Reaches 8-9 Field Operations Manual. Upper Mississippi River Basin Association. <u>https://umrba.org/</u> <u>document/reaches-8-9-pilot-field-operations-manual</u>.
- UMRBA. 2022. Upper Mississippi River Interstate Water Quality Monitoring Plan: Clean Water Act Reaches 8 & 9 Pilot Project Condition Assessment. Upper Mississippi River Basin Association. <u>https://umrba.org/document/reaches-</u> <u>8-9-pilot-condition-assessment</u>.

## Appendix

### **REACHES 8-9 PLANNING COMMITTEE MEMBERS, ROLES, AND**

#### **CONTACT INFORMATION**

AGENCY/ ORGANIZATION	NAME	ROLE	CONTACT INFORMATION		
	Roger Bruner	Supervisory role for contract, personnel, and budget matters	Retired		
	Andy Fowler	Probabilistic sampling, lead database management, aquatic life use assessment analysis	andy.fowler@dnr.iowa.gov (563) 263-5062		
	Melanie Harkness	Probabilistic sampling	Melanie.Harkness@dnr.iowa.gov (563) 263-5062		
lowa Department of Natural	Nick Smith	Probabilistic sampling, data entry	Nick.smith@dnr.iowa.gov (563) 263-5062		
Resources	Daniel Kendall	Fixed sampling, data entry, cyanobacteria toxin data analysis; lead contact for lowa DNR	Daniel.kendall@dnr.iowa.gov (515) 491-2226		
	Randy Schultz	Supervisory role for contract, personnel, and budget matters	Randy.Schultz@dnr.iowa.gov (515) 725-8447		
	Adam Thiese	Probabilistic sampling, data entry	Adam.Thiese@dnr.iowa.gov (563) 263-5062		
	John Olson	Condition assessment contractor	Jolson_dnr@hotmail.com (515) 229-6290		
	Anna Belyaeva	Fixed sampling, data entry, aquatic life use assessment analysis	No longer with Illinois EPA		
Illinois Environmental	Gregg Good	Supervisory role for contract, personnel, and budget matters	Retired		
Protection Agency	Ryan Sparks	Lead contact for Illinois EPA	ryan.sparks@illinois.gov (217) 294-2585		
	Nicole Vidales	Supervisory role for contract, personnel, and budget matters	Nicole.vidales@illinois.gov (217) 557-8746		

(continued)

AGENCY/ ORGANIZATION	NAME	ROLE	CONTACT INFORMATION		
	John Hoke	Supervisory role for contract, personnel, and budget matters	john.hoke@dnr.mo.gov (573) 526-1446		
Missouri Department	Scott Robinett Laboratory analysis (lead)		scott.robinett@dnr.mo.gov (573) 522-3384		
of Natural Resources	Robert Voss	Lead contact for Missouri DNR	robert.voss@dnr.mo.gov (573) 522-4505		
	Chris Wieberg	Supervisory role for contract, personnel, and budget matters	chris.wieberg@dnr.mo.gov (573) 522-9912		
Missouri Department of Conservation	Molly Sobotka	Contractor for fixed and probabilistic sampling	molly.sobotka@mdc.mo.gov (573) 290-5858 x 4483		
Upper Mississippi	Lauren Salvato	Project coordinator	Isalvato@umrba.org (952) 208-1166		
River Basin Association	Kirsten Wallace	Supervisory role for contract, personnel, and budget matters	kwallace@umrba.org (651) 403-3983		