Upper Midwest Environmental
Sciences Center (UMESC)
La Crosse, Wisconsin

Upper Mississippi River Restoration Program Coordinating Committee

Quarterly Meeting

August 9, 2017

Agenda
with
Background
and
Supporting Materials

UPPER MISSISSIPPI RIVER RESTORATION PROGRAM
COORDINATING COMMITTEE

August 8-9, 2017

AGENDA

Tuesday, August 8 Partner Quarterly Pre-Meetings
Stoney Creek Hotel

4:15 – 5:45 p.m. **Corps of Engineers**
4:15 – 5:45 p.m. **Department of the Interior**
4:15 – 5:45 p.m. **States**

Wednesday, August 9 UMRR Coordinating Committee Quarterly Meeting
UMESC

Time	Attachment	Topic	Presenter
8:00 a.m.		**Welcome and Introductions**	***Don Balch**, USACE*
8:05	**A1-9**	**Approval of Minutes of May 24, 2017 Meeting**	
8:10		**Regional Management and Partnership Collaboration**	***Marv Hubbell**, USACE*
		▪ FY 2017 Fiscal Update and Scope of Work	
		▪ FY 2018 Funding Outlook	
		▪ Current and Out-Year Implementation Planning	
		▪ UMRR External Communications Strategy	
9:00		**UMRR Showcase Presentations**	
		▪ LTRM: TBD	***TBD***
		▪ McGregor Habitat Project	***Tom Novak**, USACE*
9:40	**B1-21**	**Habitat Needs Assessment**	***Nate De Jager**, USGS*
10:20		**UMRR Database**	***Kayleigh Thomas**, USACE*
10:40		**Break**	
10:50		**Program Reports**	
		▪ Habitat Restoration	
		– District Reports	***District HREP Managers***
		– HREP Process Improvement	***Marv Hubbell**, USACE*
		– Next Generation of Projects	
	C1-14	▪ Long Term Resource Monitoring and Science	
		– LTRM Highlights	***Jeff Houser**, USGS*
		– USACE LTRM Update	***Karen Hagerty**, USACE*
		– A-Team Report	***Matt Vitello**, MO DoC*
11:50		**Other Business**	
	D1	▪ Future Meeting Schedule	
12:00 noon		**Adjourn**	

[See Attachment D for frequently used acronyms,
UMRR authorization (as amended), and UMRR (EMP) operating approach.]

ATTACHMENT A

<u>Minutes of the May 24, 2017</u>
<u>UMRR Coordinating Committee Quarterly Meeting</u>

(A-1 to A-9)

DRAFT
Minutes of the
Upper Mississippi River Restoration Program
Coordinating Committee

May 24, 2017
Quarterly Meeting

Hampton Inn-Gateway Arch
St. Louis, Missouri

Tim Yager of the U.S. Fish and Wildlife Service, on behalf of Sabrina Chandler, called the meeting to order at 8:00 a.m. on May 24, 2017. Other UMRR Coordinating Committee representatives present were Don Balch (USACE), Mark Gaikowski (USGS), Rob Maher (IL DNR) on behalf of Dan Stephenson, Randy Schultz (IA DNR), Megan Moore (MN DNR), Matt Vitello (MO DoC), Jim Fischer (WI DNR), and Ken Westlake (USEPA) via phone. A complete list of attendees follows these minutes.

Thank You to Kevin Stauffer

Tim Yager announced that Kevin Stauffer is ending his tenure as Minnesota's delegate to the UMRR Coordinating Committee and that Megan Moore is now assuming that role. Yager recognized Stauffer's tremendous contributions to UMRR and the Mississippi River. Hubbell expressed his appreciation for Stauffer's partnership and, in particular, his strategic leadership related to external collaboration and public outreach in the 2015-2025 Strategic Plan. Jim Fischer echoed appreciation to Stauffer and said the Stauffer will be missed by the Committee. Randy Shultz thanked Stauffer for his mentorship and friendship.

Minutes of the February 8, 2017 Meeting

Jim Fischer moved and Randy Shultz second to approve the draft minutes of the February 8, 2017 UMRR Coordinating Committee meeting as prepared. The motion carried unanimously.

Regional Management and Partnership Collaboration

Fiscal Update: FY 2017 Report, FY 2018 President's Budget

Marv Hubbell reported that the FY 2017 Consolidated Act was enacted on May 4, 2017 that included $20 million for UMRR and an additional $25 million for the Corps to allocate to its environmental restoration or compliance programs and projects, including UMRR. It is unknown whether the Corps would allocate any of the additional monies to UMRR. Hubbell said the FY 2018 budget for the federal government has not yet been released.

Assuming that UMRR's FY 2017 funding level remains at $20 million, the internal allocations would be as follows:

- Regional Administration and Programmatic Efforts — $761,000
- Regional Science and Monitoring — $6,714,000
  - Long term resource monitoring — $4,610,000
  - Regional science in support of restoration — $1,000,000
  - Regional science staff support — $129,000
  - Habitat project evaluations — $975,000

- Habitat Restoration — $12,525,000
    - Regional project sequencing — $150,000
    - MVP — $4,005,700
    - MVR — $4,363,000
    - MVS — $4,005,700

Given the high degree of uncertainty surrounding the federal appropriations process and potential cuts to ecosystem funding, Mickelsen asked how the Corps intends to coordinate with partners in developing scopes of work given various high and low budget scenarios. Hubbell and Col. Craig Baumgartner cautioned that they cannot provide advance information about the Administration's budget development and will avoid any assurances about any out-year budget scenarios. But, District staff have developed both three-year and six-year plans assuming up to full federal funding and full capacity to execute. Dennis Hamilton added that the Corps also provides plans based on historical funding levels and ensure flexibility in advancing projects. Hamilton said it is important to continuously reiterate that out-year planning is always subject to appropriations. He said the UMRR's strongest asset is its ability to execute at nearly 100 percent every year. Flexibility in spending and the interagency partnership is critical to execution, and helps UMRR to compete nationally for funding. In response to a question from Fischer, Hubbell said he will provide the UMRR Coordinating Committee with the current six-year plan for UMRR. Mickelsen recalled that UMRR facilitated planning efforts among implementing partners a few years ago when there was also high uncertainty and offered a similar mechanism if that seems appropriate.

[Note: Immediately following the UMRR Coordinating Committee meeting on May 24, the Corps released its FY 2017 work plan that includes an additional $13.17 million for UMRR, bringing its total allocation to $331.7 million. That is the program's full annual authorized amount. The President's budget was also published on May 24 and includes $33.17 million for UMRR.]

2016 UMRR Report to Congress

Hubbell reported that, on May 24, 2017, the Office of the Assistant Secretary of the Army for Civil Works [ASA(CW)] approved the 2016 UMRR Report to Congress. Next steps include printing hard copies of the full report and CDs (which include the full report and brochure) and formal submission of printed materials to the Office of Management and Budget. Hard copies will be made available upon request to Marv Hubbell. Electronic copies of the full report and brochure are available on UMRR's web page.

Hubbell said ASA(CW) staff were very impressed with the final report. He expressed appreciation to Mickelsen, Karen Hagerty, and Jeff Houser for their work in developing the report.

External Communications and Outreach

Hubbell invited individuals interested in being involved in UMRR's *ad hoc* external communications group to contact Angie Freyermuth (angela.m.freyermuth@usace.army.mil). Hagerty reported that the group is working to design a UMRR outreach folder with a two-page fact sheet that best reflect the program's purpose and strategic goals as well as other relevant materials. A longer term initiative is to incorporate UMRR signage at HREP sites and LTRM field stations that could eventually be integrated into the National GeoTourism website.

Marty Atkins and Neal Jackson expressed their interest in participating on the communications group.

In response to a question from Gretchen Benjamin, Hubbell said he will make updated one-page fact sheets for individual states available to partners upon request.

UMRR Showcase Presentations

Ecosystem Metabolism

Molly Sobotka presented research using UMRR long term resource monitoring to examine habitat availability between the main channel and side channels in the Middle Mississippi River during flood events. That area of the river is extensively leveed, disconnecting the main channel to its floodplain and reducing the ability of habitat to serve as refuge and food sources during floods. It is important to understand the effectiveness of wing dams in the main channel to provide such habitat and examine the quality difference with side channel areas. Sobotka noted that a) wing dam habitat is essentially fragmented as any movement between them during floods would be met with harsh conditions and b) connection to the floodplain occurs only during major flood events after the river overtops the levee banks.

Sobotka explained how the monitoring results lead to the conclusions that:

- Open river off-channel habitats are capable of high productivity during low and high water periods
- Connectivity and habitat quantity are threshold factors for getting productivity into the food web
- Highly productive areas are a moving target and it is important that these habitats are available at all river stages

Sobotka said the question remains as to whether food sources "move to the consumers" or the consumers must travel to the food. Sobotka added that disconnected side channels during low water cannot contribute to the riverine ecosystem as well as smaller floodplains where floods are constricted and velocity is too high.

Marty Adkins observed that wing dikes do not seem to offer a viable substitute to off-channel areas and asked whether tributary habitat up-and-down river is sufficient to maintain the aquatic ecosystem or if there needs to be a longer term strategy to restore these areas. Kat McCain discussed UMRR's potential habitat projects in the Middle Mississippi River that would restore side channels areas.

Brian Johnson emphasized an observation by Sobotka that wing dams are reclaiming banklines and therefore reducing habitat refuge options there.

Brad Walker mentioned that the New Madrid floodplain is an area that can offer important habitat during flood events. Sobotka said any inundation events there would offer a great opportunity for research.

Jeff Houser expressed appreciation to Sobotka for her research efforts and presentation. Houser recognized that the logistics required to do this monitoring is very challenging and is very rare. The research lends essential insights about fundamental ecological characteristics. Collecting information in these fine temporal scales compliments the broad spatial extent of UMRR's long term resource monitoring to enable scientific conclusions.

Sobotka said future research could examine whether food sources get "flushed" downriver during flood events or if the food simply transfers to the main channel where it can be accessible. In response to a question from Matt Vitello, Sobotka said research is now focused on the functions of floodplain lakes and how connectivity is affecting a broad range of characteristics.

Ted Shanks Habitat Project

Brian Markert acknowledged that UMRR's habitat projects are not just about the ecological resources, but also about the people living there. It is important to consider what can UMRR do in the project area that makes sense and provides value.

Markert said the Ted Shanks project construction is nearing completion. He explained that the 1993 flood is a primary driver for this project as it resulted in substantial loss of the floodplain forest. The 2,900-acre area located in Pool 24 is challenged with an elevated groundwater table, inability to manage water levels, a decline of forest and lack of regeneration, loss of aquatic habitat diversity, and sedimentation into Deadman's Slough.

Markert showed a suite of photographs and other illustrations of the project features that collectively are intended to:

a) Improve water drainage, management, and supply

b) Improve aquatic habitat

c) Increase bottomland and floodplain forest

d) Restore ecosystem functions by reconnecting the floodplain to the river through levee setbacks

Markert shared statistics of public use that demonstrate the importance of these restoration sites to the local public:

- In 2016-2017, 2,900 waterfowl hunters utilized Ted Shanks
- 91.1 million U.S. residents fished, hunted, or wildlife-watched in 2011 spending $145 billion

Markert concluded that UMRR's ecosystem restoration work helps to conserve, maintain, and restore important resource functions.

In response to a question from Rob Maher, McCain said the Corps conducted pre-monitoring of the site and will implement a 10-year post-project monitoring plan that will evaluate the success in advancing each project objective. This includes forestry and fish.

Habitat Needs Assessment

Marv Hubbell reported that the UMRR held a joint workshop on May 16-18, 2017 of the ecosystem resilience and habitat needs assessment (HNA) II efforts. Hubbell acknowledged that the process of developing the HNA II has been challenging and has resulted in confusion among partners. He said this was visible during the latter portion of the workshop. However, Hubbell said that the discussions are exciting for the program. The long term resource monitoring, collected for 30 years, is lending incredible insights at various spatial scales. The program's restoration experience and knowledge of habitat and ecological processes are being integrated with many scientific investigations to generate an enormous amount of information. While this allows for UMRR's future selection and implementation of habitat projects to be science-driven, determining how that is best done is challenging. Hubbell said that this workshop was the first time that many of the habitat practitioners had seen the science synthesizing multiple ecological components in various maps and models.

Jeff Houser summarized the workshop agenda, including the various presentations and facilitation approach. Houser said the workshop's first day focused mostly on the ecological resilience conceptual models including potential thresholds for shifting between ecological states, key drivers, and semi-quantifiable metrics for measuring resilience. On the second day, various USGS staff gave presentations about the variety of products that could be used to support the HNA II development and results. The latter half of the workshop involved open discussions about how to use the information available. Houser recalled that the discussion about use was complicated. He noted that the resilience metrics are meant to keep the focus on the fundamental ecological principles and a more systemic, larger-spatial scale focus.

Megan Moore applauded the scientists for their presentations. Moore said she was very impressed with the capabilities, and is eager to see how the science can be applied to habitat projects. Jim Fischer acknowledged that he was not at the workshop, but that Wisconsin DNR staff would echo Moore's comments.

Nate De Jager said the workshop's discussion validated the direction and work done so far for the HNA II. De Jager explained that the HNA II's goal is to conduct a broad-scale, system-wide assessment of the UMRS and determine how restoration of various habitats could improve its health and resilience. Work that is being done to support that includes:

1. Developing new data for aquatic and floodplain habitats (ongoing)
2. Developing new models for future scenarios of backwater sedimentation, flooding regime, and floodplain forest succession
3. Integrating resilience concepts into HNA II to assess "current conditions" (ongoing)
4. Identifying habitat types or metrics of ecosystem structure, function, resilience for inclusion in the HNA II (starting)
5. Providing data summaries and scientific interpretation of "current and projected future conditions" using metrics identified in the two previous steps

De Jager detailed the work that has been accomplished in the steps listed above as well as the feedback from the restoration practitioners at the workshop. De Jager offered the proposed next steps as follows:

1. Develop a suite of general resilience metrics for inclusion in the HNA II
2. Identify a series of additional queries or metrics to define general habitat characteristics across the UMRS
3. Complete the aquatic and floodplain data by September 30, 2017
4. Complete modeling work by September 30, 2017
5. Provide data summaries and scientific interpretation of current and projected future conditions using the suite of metrics identified in steps 1-2
6. Complete the HNA II in February 2018

In response to a question from Moore about whether new bathymetric data is necessary, De Jager said that is a common issue throughout riverine systems because of their dynamic nature and with frequent erosion and deposition. He said that updated bathymetric is a system-wide need that is also expensive. Workshop participants identified the bathymetric data as a weakness, but it would require a partnership discussion about the investment balancing other resource needs.

Hubbell provided an overview of the more challenging discussion during the second half of the workshop. Hubbell said that participants struggled with some fundamental ideas, such as how to define desired future condition and even the ultimate purpose of the HNA II's and what it would accomplish. He said participants commented that the HNA II lacks a vision and that communications among partners about the anticipated schedule, ongoing work, and agreed-upon decisions needs to be improved. According to Hubbell, the question remains about how best to move forward. He said the HNA II tri-team chairs will work with the HNA Steering Committee to develop a more detailed scope of work for going forward that includes various reviews and consultations with the District-based river teams.

In response to a question from Marty Adkins, Hubbell explained that Corps policy does not allow for UMRR to specifically design projects solely for the purpose of creating habitat for T&E species. It may be considered by partners when prioritizing projects after the standard process of considering projects based on their ability to advance broader ecological goals and habitat needs. Brian Markert recalled MVD's 2010 statement that called for Districts to bring project proposals forward that would provide context in making policy decisions such as forming projects to benefit T&E species.

Hubbell emphasized the importance of the ecological resilience work and HNA II to provide accountability to Congress and the public that UMRR is accomplishing restoration work in the most effective ways. There is a lot of latitude and flexibility in how that is done.

Hubbell said participants' feedback included support for 1) resilience framework with interest in using the spider diagrams to frame HNA II results, 2) aquatic and floodplain classifications at the appropriate scale for HNA II, and 3) the conceptual idea that the floodplain objectives, essential ecosystem characteristics, resilience metrics, and habitats are intertwined although the actual connection is unclear. In addition, participants sought a roadmap for how to utilize the resilience and HNA data to develop the HNA II report and outcomes.

In response to a question from Marty Adkin's about NRCS's potential data contribution, De Jager noted the challenge in classifying wetlands that are under NRCS easements or otherwise privately controlled. The management of floodplain areas dictates the type and quality of that area.

Fischer expressed appreciation to those working on the ecosystem resilience and HNA II project, noting that partnership challenges are inevitable as we are moving towards a toolbox of science-based to inform management that augments professional judgement.

Habitat Restoration

District Reports

St. Paul District

Marv Hubbell reported that Conway Lake is MVP's highest priority, with a fairly strict schedule to complete plans and specs and award a construction contract this fiscal year. Hubbell emphasized that the construction contract is critical if the UMRR program is to maintain a high level of execution in FY 2017. . Chris Erickson reported that the feasibility report was published for public comment on May 16, 2017. Erickson said the Division was helpful in getting the necessary documents finalized in time.

Jim Fischer recognized that there are timing challenges for constructing habitat projects at bald eagle habitat areas and asked how that might affect execution capabilities. Tim Yager explained that bald eagles are protected under federal law. Yager said a solution was found at Harper's Slough that allowed for working around the nest. In response to a question from Fischer about whether exceptions would be allowed noting that eagles are acclimating to disturbance, Yager explained that USFWS does not have such flexibility. Aaron Snyder added that the conflicts with bald eagles will become more frequent but that Harper's Slough and future projects can hopefully lead to better plans and coordination for avoiding disturbance. Erickson acknowledged that this is a real issue and that constructing projects takes at least six to eight weeks to build. Harper's Slough is ahead of schedule and the Corps will be able to fully execute on that project. Col. Craig Baumgartner encouraged partners to continue working towards an agreed upon solution. Neal Jackson expressed optimism that there was a successful, active attempt at

Harper's Slough to work through the constraints. Jackson said it triggered great partnership conversation and cooperation.

Hubbell mentioned that it is much easier when any constraints to project implementation are raised early in the planning process. However, he acknowledged that some issues are very hard to predict.

St. Louis District

Brian Markert said MVS continues planning on Rip Rap Landing, Piasa and Eagles Nest Islands, Crains Island, and Harlow Island habitat projects. The District recently held a site visit at Oakwood Bottoms. Markert reported that construction is underway for Ted Shanks, Clarence Cannon, and Pools 25 and 26 Islands.

Rock Island District

Hubbell reported that MVR is finalizing the draft feasibility report for Beaver Island and Keithsburg. The District's construction effort is fairly aggressive with construction ongoing on the Lake Odessa flood damages; Pool 12 Overwintering Stages I, II, and III; Huron Islands Stages I and II; and Rice Lake Stage I.

Kirsten Mickelsen asked if the Corps is considering proposing one of these habitat projects for consideration under Section 1112 of the Water Infrastructure Investment for the Nation (WIIN) Act. Hubbell said Snyder Slough in Pool 11 may be a good candidate.

Long Term Resource Monitoring and Science

FY 2017 3rd Quarter Highlights

Jeff Houser reported that accomplishments of the third quarter of FY 2017 include the publication of:

- Four manuscripts:
    1) Crustacean zooplankton dynamics in a natural riverine lake, Upper Mississippi River
    2) Spatial and temporal relationships between the invasive snail *Bithynia tentaculata* and submersed aquatic vegetation in Pool 8 of the Upper Mississippi River
    3) Long-term fish monitoring in large rivers: utility of "benchmarking" across basins
    4) Widespread and enduring demographic collapse of invasive common carp (*Cyprinus carpio*) in the Upper Mississippi River System
- A technical report of the fish indicators of UMRS ecosystem health
- A fact sheet describing the UMRS topobathy dataset
- A summary of the LTRM sampling highlights in Pools 12 and 13

USACE LTRM Report

Karen Hagerty explained that a similar scope of work process that occurred in FY 17 will occur again in FY 18, with a SOW developed for LTRM base monitoring and a second SOW developed for science in support of restoration and management.

A-Team Report

Shawn Giblin reported that the A-Team's April 26, 2017 meeting focused included a discussion on ecosystem resilience conceptual models and research presentations on standardized HREP fish monitoring protocols, Pettibone Lagoon water quality protocol, Maquoketa River floodplain connectivity study. In addition, the A-Team discussed its future goals and direction. Giblin said Matt Vitello is assuming the chairing position for the next two years.

Other Business

Col. Baumgartner Remarks

Col. Craig Baumgartner recognized that UMRR is the Rock Island District's most strategic effort. Col. Baumgartner stressed the importance of delivering the full obligation authority in FY 2017. He challenged the UMRR Coordinating Committee to be prepared for what may lie ahead in FY 2018. And, he asked the UMRR Coordinating Committee to help establish the necessary conditions to strategically implement the program in FYs 2019 to 2022.

Future Meetings

The upcoming quarterly meetings are as follows:

- **August 2017 — Onalaska/UMESC**
  - UMRBA quarterly meeting —August 8
  - **UMRR Coordinating Committee quarterly meeting — August 9**
- **November 2017 — Twin Cities**
  - UMRBA quarterly meeting — November 7
  - **UMRR Coordinating Committee quarterly meeting — November 8**
- **February 2018 — Quad Cities**
  - UMRBA quarterly meeting — February 6
  - **UMRR Coordinating Committee quarterly meeting — February 7**

With no further business, the meeting adjourned at 11:57 a.m.

UMRR Coordinating Committee Attendance List
May 24, 2017

UMRR Coordinating Committee Members

Don Balch	U.S. Army Corps of Engineers, MVD
Tim Yager	U.S. Fish and Wildlife Service, UMR Refuges [On behalf of Sabrina Chandler]
Mark Gaikowski	U.S. Geological Survey, UMESC
Rob Maher	Illinois Department of Natural Resources [On behalf of Dan Stephenson]
Randy Shultz	Iowa Department of Natural Resources
Kevin Stauffer	Minnesota Department of Natural Resources
Matt Vitello	Missouri Department of Conservation
Jim Fischer	Wisconsin Department of Natural Resources
Ken Westlake	U.S. Environmental Protection Agency, Region 5 [On the phone]
Marty Adkins	Natural Resources Conservation Service

Others In Attendance

Thatch Shepard	U.S. Army Corps of Engineers, MVD
Chris Erickson	U.S. Army Corps of Engineers, MVP
Aaron Snyder	U.S. Army Corps of Engineers, MVP
Col. Craig Baumgartner	U.S. Army Corps of Engineers, MVR
Dennis Hamilton	U.S. Army Corps of Engineers, MVR
Marvin Hubbell	U.S. Army Corps of Engineers, MVR
Karen Hagerty	U.S. Army Corps of Engineers, MVR
Brian Markert	U.S. Army Corps of Engineers, MVS
Kat McCain	U.S. Army Corps of Engineers, MVS
Megan O'Brien	U.S. Army Corps of Engineers, MVS
Deanne Strausser	U.S. Army Corps of Engineers, MVS
Jason Wilson	U.S. Fish and Wildlife Service, UMR Refuges
Neal Jackson	U.S. Fish and Wildlife Service, UMRCC
Kelly Warner	U.S. Geological Survey, Illinois-Iowa Water Science Center
Amy Beussink	U.S. Geological Survey, Missouri Water Science Center
Paul Rydlund	U.S. Geological Survey, Missouri Water Science Center
Jim Stefanor	U.S. Geological Survey, Southwest Region
Nate De Jager	U.S. Geological Survey, UMESC [On the phone]
Jeff Houser	U.S. Geological Survey, UMESC
Kevin Stauffer	Minnesota Department of Natural Resources
Molly Sobotka	Missouri Department of Conservation
Robert Stout	Missouri Department of Natural Resources
Bryan Hopkins	Missouri Department of Natural Resources
John Petty	Wisconsin Department of Agriculture, Trade and Consumer Protections
Shawn Giblin	Wisconsin Department of Natural Resources [On the phone]
Olivia Dorothy	American Rivers
Brad Walker	Missouri Coalition for the Environment
Gretchen Benjamin	The Nature Conservancy
Dave Hokanson	Upper Mississippi River Basin Association
Kirsten Mickelsen	Upper Mississippi River Basin Association

ATTACHMENT B

Summary of the May 16-18, 2017
UMRR Ecosystem Resilience and Habitat Needs Assessment II
Joint Workshop

(B-1 to B-21)

Upper Mississippi River Restoration
Ecosystem Resilience/Habitat Needs Assessment II
Joint Workshop

May 16-18, 2017

Day 1

Welcoming Remarks

Marv Hubbell welcomed participants to the May 16-18, 2017 UMRR Ecosystem Resilience and Habitat Needs Assessment (HNA) II Joint Workshop, providing an overview of the objectives and topics to be addressed. The workshop's objectives were to 1) enhance coordination among the UMRR partnership and 2) solicit feedback on the development and use of models and other products, review and refine management objectives, and develop a plan and schedule to complete the HNA II. Hubbell reviewed the cost, schedule, and main recommendations of the 2000 HNA report, including restoration targets and science information needs. According to Hubbell, the primary purposes of the HNA II are to:

1) Improve current understandings of habitat needs utilizing UMRR's experience and knowledge generated over its 30-year lifetime,
2) Maintain UMRR's national and international leadership role in large river ecosystem rehabilitation, monitoring, and research, and
3) Continue to advance the integration of Upper Mississippi River ecosystem monitoring, research, and rehabilitation.

Hubbell described how the efforts to define the Upper Mississippi's ecological resilience and habitat needs as well as identifying the next suite of restoration projects directly relate to the UMRR's 2015-2025 Strategic Plan. In particular, these efforts are integral for understanding how to achieve the UMRR's vision (that was set in the strategic plan) for a healthier and more resilient Upper Mississippi River ecosystem that sustains the river's multiple uses. The outputs and recommendations will be used to focus UMRR's restoration and scientific research over the next decade or two. Several programmatic planning and strategic documents should be utilized as foundational guides for the ecosystem resilience and HNA II efforts, including the Great River Environmental Action Team (GREAT) reports, the 1981 UMRS Master Plan, 2000 HNA, 2009 UMRS Ecosystem Restoration Objectives report, and the two UMRR LTRM Status and Trends reports as well as the many reports completed by the District-based river teams.

Hubbell explained that the insights from the ecological resilience and HNA II need to blend monitoring data with management needs, and that the question about how to best do that remains somewhat unclear. UMRR also needs to be able to use the outcomes to tell a compelling story to Congress and the Administration about what is needed to restore the ecosystem and how the program partnership intends to do that.

<u>Participant Observations</u>

- The 2000 HNA was qualitative and was developed by river managers with expertise in various geographic areas and disciplines that used maps to define where key habitat gaps existed
  - HNA II can now be quantitative and utilize the extensive monitoring data and experience gained since 2000; UMRR partners should be open minded about what the HNA II can become and what it can provide
  - Props were given to Jason Rohweder and others who developed the GIS for the HNA 2000 and to the partners who thought to include concepts about adaptive management and resilience in the 2000 report

Workshop Overview

Nate De Jager acknowledged that UMRR uses a variety of methods to understand and manage the Upper Mississippi across a range of scales and levels of biological organization. De Jager explained that this workshop will focus on broader scales – e.g., landscape patterns, process, and types. He provided an overview of the planned roadmap for connecting program and management objectives, resilience assessment understandings, and recommendations and outputs of the HNA II as well as with the habitat project identification and sequencing and the geomorphic, chemical, and physical characteristics of within a given habitat project area.

As an example of the HNA II's potential relevance and utility, UMRR partners could examine the existing diversity of aquatic area or floodplain types across the Upper Mississippi and the associated habitat that they provide to ask what is the desired mix of communities and why. At a finer scale, partners may then consider what the desired characteristics should be for side channels within a floodplain or geomorphic reach. And what physical conditions should be restored so that those characteristics are supported. De Jager noted that partners may want to modify, add to, or maintain the existing set of 2009 UMRS reach objectives after considering new data generated from resilience and HNA II.

De Jager listed the workshop's objectives as follows:

1) Provide an update of the ecological resilience assessment
2) Describe new data being developed for use in the HNA II and how it could be used to inform management decisions across multiple scales
3) Facilitate discussions about how the management community might incorporate new information and concepts into setting management goals and objectives at various spatial scales – e.g., across the entire system and at individual project scales

Part 1: The Data – How is the system now? What are the implications for restoring and managing it?

Applying Resilience Concepts

General Overview – Jeff Houser provided an overview of UMRR's effort to-date to define and apply the concepts of ecological resilience to the UMRS. The definition of resilience is defined as "capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks." Houser acknowledged that the Upper Mississippi River ecosystem is a complex, adaptive system that has components that are independent and interact. And, variation and novelty are constantly being added to the system – e.g., invasive species, watershed land use, climate and weather pattern changes, navigation modifications, and responses and adaptations of river geomorphology and native species. Avoiding such change is not the goal. Main concepts of ecological resilience are:

- Small changes in controlling variables can lead to rapid changes in major ecosystem services to rapid changes in major ecosystem services when the system is near a threshold
- There are multiple possible states, instead of one global equilibrium to which an ecosystem can always return.
- There exists nonlinearity (hysteresis), meaning that an ecosystem cannot always return to its original state.
- Controlling variables and other components of the ecosystem can interact resulting in positive or negative feedbacks – e.g., a positive relationship exists between sedimentation and submersed aquatic vegetation.
- Slow variables, such as sedimentation, play a key role.

Houser explained the importance of thinking about multiple spatial scales and how they interact – higher scales may guide or constrain what is occurring at lower scales and lower scales can affect higher scales when synchronized across a larger areas or when the system is close to a threshold.

Houser said the workbook, *The Resilience, Adaptation and Transformation Assessment Framework: From Theory to Application*, is being used as a guide for applying ecosystem resilience concepts to the Upper Mississippi. The workbook contains three main sections: system description, assessing the system, and adaptive governance and management. Thus far the focus has been on the first main section, which includes defining the scope, scale, and a "desirable" future condition, the resilience of what to what, and how the ecosystem functions. The purpose of doing the ecological resilience assessment is to 1) improve the understanding of the UMRS's current ecosystem resilience and the potential for management and restoration actions to affect the resilience of the UMRS, 2) identify potential indicators of ecosystem resilience, and 3) identify areas of uncertainty where additional study is needed to inform management and restoration. Houser acknowledged that there are important social considerations that have not yet been evaluated but are important to keep in mind. He listed the team members involved in the ecological resilience workgroup and who have participated in the discussions.

Conceptual Models – Kristen Bouska explained the resilience working group's effort to identify the main controlling variables that structure the ecosystem so that interactions and feedbacks among controlling variables and major resources can be investigated across and within scales. Bouska said the first major step in the system resilience assessment (described above) is to develop a basic shared understanding of the river ecosystem, including relevant historical changes, valued uses and management concerns, and critical controlling variables. There is currently a manuscript in review that describes the process of developing the system description that can be made available upon request. A timeline was developed to visualize the historical pattern of disturbances that have affected the Upper Mississippi ecosystem, including eras associated with settlement and opening, navigation and floodplain development, and multi-use management.

Information was synthesized into conceptual models for each of the three sub-ecosystem classifications: lotic, lentic, and floodplain. And, the resilience working group identified the basic relationships between the valued ecological component and the main controlling variables – i.e., the resilience of what to what. This required determining the critical ecological components of the system and what are the likely shocks/disturbances that the ecosystem will continue to experience. To answer the question of "resilience of what," the resilience work group identified the valued uses or ecosystem services that the Upper Mississippi provides (e.g., recreation, water quality) and the ecological components that support those uses or services. Conceptual models were developed to describe what is known about the relationships between various ecological components and the key controlling variables as well as what is not known and needs additional research. Bouska explained the conceptual model of lentic backwaters, lotic areas, and floodplains, showing how the external drivers and controlling variables interact with each other and affect the major uses and services.

The second major step is to assess system resilience, including the identification of alternate regimes (states) of the ecosystem such as high turbidity and scarce aquatic vegetation versus clear water and abundance aquatic vegetation and associated thresholds. The objective is to define *specified* resilience (resilience of particular parts of a system to identified disturbances) and *general* resilience (the capacity of the ecosystem to cope with all sorts of disturbances). The conceptual models form the basis for determining specified resilience. The principles for building resilience include maintaining diversity and redundancy, managing connectivity, and managing slow variables and feedbacks.

In response to a question from KathiJo Jankowski, Bouska said that the scale of threshold values depend on the indicator and the question being examined. In response to a question from Chuck Theiling, Bouska said there has not yet been an attempt to link the general resilience indicators to the ecosystem objectives.

Poll 1: Considering the major resources and controlling variables included in the conceptual models, which components are you most interested in better understanding relationships between/among for the HNA II?

Rank	Indicator	General Resilience Class Type	Data Type	Complete
1	Lateral connectivity	Connectivity	Floodplain Areas Layer	No
2	Aquatic area diversity	Diversity	Aquatic Areas Layer	No
3	Depth diversity and distribution	Diversity	Bathymetry Layer	Yes
4	Floodplain vegetation diversity	Diversity	Land Cover Layer	Yes
5	Water surface fluctuations	Connectivity	Gage Data	Yes
6	Aquatic vegetation diversity	Diversity	Land Cover Layer	Yes
7	Sediment accumulation and erosion	Slow Variables and Feedbacks	Field Measurements	Yes
8	Longitudinal connectivity	Connectivity	Gage Data	Yes
9	Fish functional diversity and redundancy	Diversity	LTRM, LTE Fish Data	Yes
10	Core forest area	Connectivity	Land Cover Layer	Yes
11	Watershed land use	Slow Variables and Feedbacks	NLCD Layer	Yes
12	TSS	Slow Variables and Feedbacks	Other non-GIS data	Yes
13	TSS loads	Slow Variables and Feedbacks	Other non- GIS data	Yes
14	Tributary connectivity	Connectivity	Other non- GIS data	Yes
15	Nutrient loads	Slow Variables and Feedbacks	Other non- GIS data	Yes
16	Non-native species	Slow Variables and Feedbacks	Other non- GIS data	Yes

General Resilience

Bouska showed direct links (and thus potential uses of) between the 2008 LTRM status and trends indicators and the various controlling variables in the lentic, lotic, and floodplain conceptual models. The principles for general resilience include:

- *Maintaining diversity and redundancy* by providing options and insurance for responding and adapting to change and disturbances, with indicators such as aquatic area diversity, floodplain and aquatic diversity, and depth diversity and distribution, and fish functional diversity and redundancy
- *Managing connectivity* by providing access to a wide range of conditions and facilitating recolonization after disturbance as well as facilitating the spread of disturbance with indicators such as longitudinal, tributary, and lateral connectivity; core forest area; and water surface elevation fluctuations
- *Managing slow variables and feedbacks* by stabilizing feedbacks coupled with slowly changing variables and maintaining persistent conditions (when slow variables cross critical thresholds, the system may change rapidly) with indicators such as non-native species, sediment accumulation and erosion, watershed land use, and nutrient and total suspended solids loads

Bouska offered ways in which the HNA II effort may utilize the concepts of general resilience and the associated indicators to inform a broad assessment of existing habitat conditions and to prioritize restoration over a large spatial scale. She summarized that general resilience indicators offer insight into what actions might foster resilience at broad scales and suggested sorting the indicators based on their relevance/applicability to the HNA II, showing that maps are a relatively effective and easy way to visualize many indicators at once. Bouska asked whether there are any additional metrics that would be useful to examine in the HNA II and whether any of the general resilience metrics that she described are not thought to be useful.

In response to a question from Theiling, Bouska said she is not sure how many indicators resilience or the HNA II effort will need for an accurate assessment of the river's ecological condition and predicted future. There may be a natural break that occurs through discussion.

Participant Observations

- There was some discussion about the need for a reference condition, acknowledging that defining a certain historical condition or time period would be challenging to form some consensus around
  - Previously, UMRR partners working on the 2015-2025 UMRR Strategic Plan and ecological resilience agreed to assess the transition (trends over time) of ecological health – i.e., the UMRR vision statement is for *a healthier* and *more resilient* river ecosystem.
  - The management community needs to wrestle with this question. One suggested approach is to define what a desired condition involves (within a range) and how we might achieve that given resilience indicators and the existing condition as a baseline
- No one indicator should be used alone but rather a group of indicators allows for examining habitat needs through a variety of lenses
  - Example: Simpson's diversity index score alone may not indicate the desired existing condition or trajectory without providing context
  - Example: It was suggested that the proportion of inundation should be placed in context with indicators of impoundment and seasonal variation
- Suggestion to include agriculture in floodplain vegetation diversity index to better understand land use drivers (and potentially private land ownership)
- Maps of existing general resilience indicators could be used to define a baseline (reference) condition at various spatial scales, also providing a means for assessing cumulative restoration over broader spatial scales and for communicating about the river ecosystem's current assessment and restoration work to the public
  - Agreement that maps would be a useful tool for managers, making the indicators and research relevant and accessible
- Concern that the results of the survey (what ecological issues are most important) is reflective of the audience and might be different another day (perhaps influenced by mood or recent events)
- May need to ask the survey question for each floodplain reach
- Suggestions to group similar ecological issues and rank high, medium, and low rather than in order
- The question will become which areas to restore given limited resources; resilience and HNA II should provide or inform the answer
- Re the potential for process-related indicators, if we understand what the processes do, the distribution of "functional process zones" can become meaningful and modeling may inform how resilient X, Y, and Z are under different scenarios
  - How could processes be summarized across a landscape?

- The goals of resilience and HNA II are to inform and prioritize both UMRR's habitat restoration and scientific research
- Suggestion that resilience and HNA indicators be essentially "living" indicators rather than point-in-time with scientific research to validate hypotheses
- Resilience indicators allow for habitat project selection to be more science-driven rather than value-driven
- Managers will need to address whether UMRR should focus on maintaining good habitat or restore degraded areas

Poll 2: Are there any additional indicators that you would want to include in the HNA II?

Yes	No	Indicators
10	0	Focus more on ecosystem structure and function rather than a given biota
7	1	Topographic diversity
4	0	Land ownership
4	0	Forest habitat type analysis similar to guild analysis
3	2	Fetch
3	0	Channel incision – i.e., further disconnection of floodplain
2	1	Land ownership
2	0	Velocity and residency of water is important [Some indicators may be too simplified and need species information to be meaningful]
2	0	Disturbance regimes
2	1	Topographic and benthic diversity
2	0	Forest regeneration
2	0	Forest age class diversity
2	0	Index of hydrologic alteration
1	1	Wind fetch
1	1	All are important! Too hard to rank.

Participant Observations

- Results may reflect personal and agency perspectives, underscoring the need to include a variety of perspectives in the HNA II discussions to reflect a more actuate picture of the diverse suite of habitat needs in the UMRS
- While the issue categories may be similar throughout the UMRS, their values changes north to south and in certain areas – i.e., connectivity may be desired in certain areas or may be a hindrance in other areas
- There may be ways to index multiple indicators to quantify ecological processes and functions in a more holistic way – e.g., combining permanent inundation with seasonal variation and leveed areas
- Suggestion to also consider short-term (daily) water surface evaluation fluctuation in addition to seasonal variation and linking to inundation

Day 2

Part 1: The Data – How is the system now? What are the implications for restoring and managing it? (Continued)

System-Wide Data, Analysis, and Modeling

Nate De Jager provide an overview of the existing data layers that are available and the initial analyses that have been conducted thus far as well as how the data layers and analytical results could be used to inform management and restoration decisions, project selection, and project characteristics. De Jager said there are two major operating assumptions: that system-wide GIS data are needed to estimate "habitat" across the entire Upper Mississippi ecosystem and that such information is lacking. There is not sufficient information on the hydrogeomorphology of aquatic or floodplain portions of the Upper Mississippi although pieces exist (e.g., topobathy, stream gauges, connectivity metrics). Recommendations from the 2000 HNA should be incorporated into the HNA II, such as inclusion of the topobathy layer, enhanced hydrogeomorphic conditions, and a better way to simulate forest succession. In addition, the HNA II needs to be relevant to a broad-range of existing management objectives while also being specific enough to capture aspects of habitat for focal species.

De Jager acknowledged that habitat is typically best defined from the perspectives of specific organizes (e.g., requirements for all life states including movement considerations). But the Upper Mississippi ecosystem contains many species with different life requirements and data and knowledge differs for each organization, making broad characterizations of habitat need difficult. However, there are a handful of drivers that underpin habitat needs for a wide range of organisms that can be modeled and mapped – e.g., connectivity, depth, inundation. These drivers are characterized in the existing reach objectives essential ecosystem characteristics (EECs) framework and are described in more specific detail (linking to project objectives) in the UMRR HREP Design Handbook, and they also provide the framework for the ecological resilience conceptual models.

De Jager discussed UMESC's current work to develop hydrogeomorphic conditions or characteristics in aquatic and floodplain areas including their influence on other processes or physical conditions and they may be influenced through restoration actions. He also explained that similar aquatic area types (e.g., side channels, backwaters) have varying degrees of habitat suitability and that either individual or a combination of metrics can be used to differentiate their suitability. UMESC staff are currently developing modeling approaches to query suitability using specified metrics.

Assessing Existing Conditions

Aquatic Areas – Jim Rogala explained that the 2000 HNA characterized habitat broadly based on geomorphic and constructed features and environmental conditions. The desired goal for the HNA II is to have enhanced aquatic areas that utilize spatial data such as land cover, bathymetry, fetch, and connectivity to provide more meaningful classes, as well as for easier transitions between aquatic areas classes with a range of lotic to lentic and shallow to deep habitats. Rogala explained that the selected approach to defining lentic habitats will use only systemic data and broad habitat classes, minimize number of habitat conditions and ranges considered, and "regions" rather than "metric-defined areas." Regions are individual disconnected polygons and are preferred over metric-defined areas, which are complex and do not capture well habitat suitability for mobile organisms. Rather metric-defined areas are better for single-species, single-descriptor, or smaller scales habitat modeling. Rogala provided an overview of how the enhanced aquatic areas are generated, including the following:

1) Generate aquatic areas databases for 1989 and 2010,

2) Further delineate aquatic area classes using other GIS data layers (create sub-regions within larger regions to reduce variability within regions), and
3) Assign attributes to regions using characteristics that define “habitat.”

Step two includes delineating channels and off-channels in contiguous floodplain shallow areas, segments within side channels, channels within impounded areas, and structured and unstructured main channel borders. Attributes in step three include size, depth, connectivity, vegetative cover, fetch, and structures.

Jason Rohweder provided a more detailed overview of bathymetric data can be used to examine side channels and the main channel in a more meaningful way. For side channels, this includes connectivity to other lotic, lentic, and forested shoreline areas and/or percentage of aquatic vegetation or open water and total shoreline. Rohweder also illustrated how considering various metrics associated with Pool 26 provides a more meaningful context for thinking about habitat availability and needs – e.g., percent of shoreline adjacent to wet forest, percent of perimeter adjacent to channels, percent of side channel aquatic vegetation, percent of shoreline revetted. Rohweder also explained that a topographic position index (TPI) with slope can be used to classify the landscape in both slope position and landform category, including bathymetry. The TPI can be used to determine the presence of scour holes associated with river training structures.

Participant Observations

- Floodplain shallow areas are not classified as terrestrial
- Some delineation is done automatically, but most is entered manually so there is some subjectivity; metrics should provide more meaning within the categories
- Important that this approach allows for less subjectivity with the results more likely to be repeated by others
- Question remains as to how to deal with managed backwaters, perhaps by creating a new class; currently depends on the land cover at the time the data was acquired; groundtruthing some areas may be helpful with the help of resource managers
- Consider how to account connectivity for biota not just water movement
- Systemic depth data is about a decade old
- Recognition that the forest shoreline attribute would not account for erosion over time; while there may be potential to rectify the data and would provide valuable information at a systemic scale, it would be difficult and timely
- The TPI data on river training structures uses the Corps’ navigation chart data; however, the Corps may have more recent data – USGS will work with the Corps to determine the best available data
- Different buffer criteria may be appropriate in various areas through the UMRS; it will be important to document and define the rational
- The depth-diversity metric would be more useful than TPI in a specific backwater late; TPI does not capture depth diversity at a finer scale
- The TPI seems useful for assessing areas between dikes, deep hoses, or ridgetops

LTRM SRS Data – KathiJo Jankowski offered ways to use UMRR’s long term resource monitoring water quality data to better understand and potentially quantify habitat conditions and ecological functions in within various enhanced aquatic areas. While it is fairly obvious that there are differences in ecological conditions between main channel, side channels, and backwaters, there are also substantial variation among backwaters. Connectivity to the main channel is a primary consideration for habitat managers and can be measured through various velocity and physical connection metrics. A suite of such metrics is able to explain about 54 percent of variation among backwater lakes. And per Jankowski's statistical research, it appears that percent channel is the strongest single predictor for connectivity where there appears to be some distinct thresholds. Percent channel is the percent of a backwater's perimeter that is a channel. Physical metrics are able to better explain backwater conditions in the absence of biological factors – e.g., seasonal differences. However, backwaters are much more dynamic and no one indicator will be sufficient. Rather, there will likely need to be a suite of variables to assess habitat conditions among backwaters.

Participant Observations

- All LTRM parameters may be considered in future research; there has not yet been a screening process, but velocity the starting variable for research because of its relationship with connectivity
- Suggestion to examine various flow equations with different parameters, e.g., generate slope across in-flow connections using spatial data
  - Slope calculations may also inform groundwater interactions
  - Suggestion to categorize speeds
  - Habitat managers can help identify inlets and outlets
  - There exist automated ways to calculate distance and path, without needing to know direction (river mile and slope); not sure of usefulness for backwaters
- Suggestion to consider terrestrial land surrounding backwaters – it is an important management consideration partly because that affects sedimentation and other ecological drivers

Tutorial: Modeling and Mapping Aquatic Area Habitat Conditions and Ecological Functions – Rogala explained how various aquatic area classes (e.g., contiguous floodplain lake larger than 10 hectares), categories, or metrics may be visualized in ArcGIS to determine habitat availability and needs. ArcGIS may also illustrate gradients within habitat classes – e.g., percentage of channel regions that are shallow to deep. Rogala said that the data can be summarized at a sub-regional scale – i.e., frequency of occurrence, area.

<u>Polls 3 and 4: What do you see as the greatest utility of the new enhanced aquatic areas data? What do you see as the potential weakness or limitation of the data?</u>

Strengths:

- Planning habitat work
- Ability for more detailed data analysis – better resolution and more standardized approach
- Better spatial relationships of microhabitats
- Determining nutrient processing questions
- Ability to explore geomorphic/biotic relationships
- Ability to query independent of scales
- Better assessments of completed habitat restoration and management
- Ability to quantify differences in quality of backwater conditions

Weaknesses/limitations:

- Does not cover forests
- Unable to capture many aspects of hydrology
- Not able to incorporate changes that occur in channel geometry from sediment deposition or scour
- Scale resolution is not fine enough to support HREP or other project-scale applications

Floodplain Areas – Molly Van Appledorn described the limitations of the 2000 HNA as it pertains to non-aquatic habitat areas – i.e., floodplains. In particular, the 2000 HNA described floodplain areas by land cover and geomorphic positioning but lacked information about the hydrologic retime of floodplains throughout the UMRS. The HNA II aims to better understanding how flood inundation patterns act as a controlling variable and how various patterns affect major resources. There are three main objectives to doing so:

1) Describe ecologically-relevant aspects of surface water inundation across the UMRS
2) Identify and map zones expected to experience similar surface water inundation regimes
3) Characterize how inundation patterns relate to vegetation distribution and soil characteristics

Van Appledorn provided a detailed overview of the UMRS inundation model's structure, outputs, and potential applications. The uses topobathy and land elevation to determine flooding attributes such as frequency, duration, depth, timing, and timing variability. These attributes can be mapped spatially. And, areas that experience similar inundation patterns can be grouped and mapped. Resource managers can use the model to predict affects to vegetation germination, establishment, growth, reproduction, and dispersal. In addition, inundation attributes may be combined with other data layers to create custom management tools and a landscape index – e.g., hydrology, habitat quality, location, and historical context.

Van Appledorn said that modeling has been completed for Pools 3-10, and pre-processing is underway for the remaining pools with the Illinois River scheduled next. The LTRM field teams are currently doing an empirical evaluation of the model. Once the modeling for the entire UMRS pools are complete, work will begin to define inundation process classes and modeling of the ecologically-relevant patterns.

Participant Observations

- Suggestion to examine 10-year increments to identify any trends
- Suggestion to better understand maximum duration and effects of multiple years inundated
- Suggestion to determine the effects of the creation of the 9-foot navigation channel – i.e., how the floodplain forest has changed since the construction of the locks and dams
  - This might require a new topobathy layer and would require many assumptions
  - There have been changes in peaks over time becomes of changes in geomorphology
  - Understanding increased land elevation from loss of floodplain forest would require an associated topobathy layer (the topobathy layer is static)
- Suggestion to better understand the management effects of water level management on floodplain forests using the model
- Will need to consult with foresters about how to reflect different relationships of different tree species to inundation characteristics

- Suggestion to consider how to reflect transition areas between aquatic and floodplain areas (currently there are no plans to reflect those areas in the HNA II)
- There is potential to assess floodplain connectivity in backwaters for forage and nursery areas for fish
  - Brian Ickes has a lot of information about this
  - This information is important to the public

Poll 5 and 6: What do you see as the greatest utility of the new enhanced aquatic areas data? What do you see as the potential weakness or limitation of the data?

Strengths:

- Linking to fisheries year class strength and recruitment
- Ability to assist with HREP planning of reforestation measures
- Identifying which hydrologic variables are most important for plant communities
- Ability to model underwater photo zone depth
- Ecological modeling
- Tremendous amount of forestry applications as well as HREP projects
- Takes into account water levels and changes in water levels
- Ability to identify areas with different probabilities to support or sustain different types of forests

Weaknesses/Limitations:

- Ecological model is limited to single-data inputs
- Lacks a vision to examine hydraulic data (e.g., velocity)
- Variability in the model data and actual results

Approaches for Modeling Future Conditions

Future aquatic habitat conditions – Jim Rogala said the goal of the HNA II is to better understand how future conditions will alter habitat conditions within the entire system and within individual pools as well as within different aquatic area types – e.g., main channels, impounded areas, and contiguous and isolated backwaters. However, predicting long term changes is very difficult. Rogala provided a potential approach for modeling future depth conditions in backwater areas, illustrating the challenges in making predictive assumptions given high variance among backwaters and the many reasons that may explain the variance.

Participant Observations

- Discussion about potential data sets to estimate sedimentation rates and alluvial fan formation:
  - Arial photographs to detect changes in surface area (also with land cover/land use to show vegetation response)
    - Challenge: Vegetation responds to a lot of different variables.
  - HREP contractors' survey data

  - HREP monitoring
    - Sediment transects are typically done three years pre-project and two- and ten years post-project
    - Suggestion to build specific research questions into monitoring designs
  - New bathymetry
  - Systemic modeling with finer scale resolution analysis at specific areas
- Suggestion to research causes that are resulting in backwater lakes losing sediment or how flooding might impact sediment deposition in backwaters
- Concern expressed about the utility of a model or approach throughout the UMRS, given the range of ecological conditions
  - There is some backwater transect information in Illinois River backwaters that may be useable
- Suggestion to predict connectivity of the main channel and side channels to backwaters and the associated impact of erosional forces
  - May be possible with land cover data
- Suggestion to research alluvial fan formation and how that affects habitat and connectivity
  - Difficult to predict when and where natural levees might breech
- Question/concern about applicability of aquatic area models to the Open River reach

Future floodplain habitat conditions – Nate De Jager said the benefit of modeling future scenarios increasing understandings of unobservable ecological processes and their associated impacts as drivers and provides a common methodology and framework for improving decision making. De Jager explained how a surface water connectivity model can be used to generate annual maps for simulating alternative regimes. Key questions to consider may be:

1) How does the biomass and composition of species across the landscape change over time in response to internal and external drivers?
2) Are there areas within the floodplain that do not support forests over the long term? And, does it depend on flooding regime?
3) How resilient is biomass and composition to disturbances?

Answering these questions may result in a better understanding of the predicted trajectory of forests under different scenarios and what management actions can impact that direction, and whether there is a spatial component to those management actions.

Next steps involve a) completing an inundation model for the entire system and b) running various scenarios through the model to determine how disturbances or management actions may affect future floodplain forest conditions.

Participant Observations

- Suggestion to model future scenarios as though the floodplain forests are not resilient to stressors – a “dooms day” scenario
- Suggestion to model a future scenario with more routine (successive) pool-scale water level management
  - Willows regenerated in response to drawdowns in Pool 24 – in the exposed fringe areas

Part 2: Management Objectives

Defining the Desired Future State of the Ecosystem

2009 Reach Planning Objectives – Jon Hendrickson provided an overview of the purpose, development process, and outcomes of the 2009 Reach Planning Objectives effort with respect to the St. Paul District. The purpose was to identify future restoration projects based on ecosystem objectives that would collectively inform a target future condition that was generally agreed upon by the river management community. These objectives would then be used to define quantitative performance criteria and associated monitoring. A top-down approach was used to defining a vision and ecological goals, objectives, and actions on a system-wide basis that we organized by essential ecosystem characteristics (EECs). Floodplain reach planning teams used that information to define more specific objectives for each geomorphic reach and identify potential project areas. The District-based river teams evaluated those project areas and selected the highest priority ones to recommend to the NESP project management team and subsequently the Navigation and Environmental Coordinating Committee (NECC) for consideration of endorsement. The reach planning teams used their expert knowledge and experience to identify an initial group of project areas. Conceptual models were used to determine a desired reference condition for H&H, biogeochemistry, and geomorphology – finding that water level variation, connectivity, and constituent transport are very important for shaping desired ecological conditions. The models took into consideration the factors limiting natural processes and the distribution and abundance of biota, and were used to select the initial group of projects and recommend a project for a new start. The intent was also to provide the project delivery teams with fairly complete idea of habitat needs and recommendations for management actions. Hendrickson explained how the process unfolded in the Upper Impounded Floodplain Reach, with the Upper Iowa River habitat project selected as the highest priority new start.

Participant Observations

- Reflection: Ongoing UMRR projects were removed from the 2009 list because of concerns that the program would be lost before a transition to NESP was ripe
- The HNA and resilience research as well as larger-scale management objectives offer a great opportunity for relating habitat projects/site-specific restoration to larger ecological and habitat needs
- Question: What is the right process going forward for selecting project areas using the HNA and resilience frameworks?
  - The ultimate decision –making process should be well documented and understood
  - Need to incorporate flexibility in project sequence and implementation
- Question: Is there a group of objectives or measurements at the system-scale that can be used to facilitate dialogue across all floodplain reaches and frame a conceptual desired future condition?
- Suggestion to develop a scorecard to screen metrics
- Resilience can be used to show what habitat projects can attempt to address – e.g., core forest area

Habitat Objectives Worksheet – Sara Schmuecker described the process and outcomes for a partnership reflection on defining management objectives in the HNA II. The purpose was to assess 1) if there is still consensus surrounding the 2009 reach objectives (whether they are still valid, or a full redo is needed) and 2) at which spatial scale habitat needs should be assessed and reported. In response to a request from partners during the initial review request for a more streamlined approach to integrating the five EECs and resilience, Schmuecker developed a cross-walk between the reach objectives and the resilience factors: fundamental drivers, controlling variables, and major resources. Very similar or closely related reach objectives were paired or grouped, consolidating the total number from 34 to 12. Schmuecker detailed the raw results of the worksheet including suggestions for additional objectives. Floodplain reach scale had the most votes for which to summarize habitat needs. One suggestion received was to summarize the reports at the floodplain reach scale and to provide case studies illustrating the utility of higher resolution data at smaller spatial scales. Other comments received include:

- Add a data layer with areas that UMRR is *not* able to construct habitat projects
- Define a clearer message for how the HNA II will help managers plan and select projects
- Habitat suitability index models are still the most prominent unmet information need and are a high priority
- Include a climate change expert to help forecast future conditions
- Apply elements of the Corps' planning process including a trend analysis to form future scenarios and frame outputs in terms of current conditions and future without project
- Integrate other (previous and ongoing) efforts – e.g., the Navigation Study's cumulative effects report, Corps' policy regarding climate change scenarios

Schmuecker emphasized that the approach outlined is just one option and there are other potential ways for assessing objectives. Next steps include discussing how to inventory existing conditions the process for HNA II objective development.

Participant Observations

- Question: Are habitat objectives synonymous with habitat needs?
- There still remains quite a bit of confusion about how the resilience, HNA, and project selection will fit together
- The UMRR vision for "a healthier and more resilient ecosystem" should be a guide in all efforts and decision-making and provide the link among resilience, HNA, and project selection
- Missing inventory of habitat needs – what is UMRR really doing this for (the critters not the processes)

Developing Habitat Objectives – Jeff Janvrin offered a potential framework for integrating historical planning information (e.g., Master Plan, GREAT studies, 2000 HNA, and UMRR Status and Trends reports) with current efforts to assess ecosystem resilience, HNA, and project selection. Using backwater fish community and waterfowl community as examples, Janvrin explained an approach for evaluating habitat needs using specific criteria within each of the five EECs. There is fairly extensive information on habitat criteria including from HEP, AHAG, WHAG, various LTRM research and models, and queries of existing data.

- Suggestion to create a systemic plan first, with subsequent floodplain and geomorphic reach plans that are derived from the systemic plan
- Suggestion to standardize terminology
- It does not necessarily matter if looking through the lens of EECs, resilience, or reach objectives
- Caution against being too specific/detailed/complex in the HNA; rather HNA can provide broad assessment of habitat needs

<u>Facilitated Discussion: Small Group Exercise</u>

Small groups were formed to discuss the following four questions [results discussed on Day 3 below]:

1) What are your group's reactions, concerns, etc. to the worksheet response and the plan for inventorying existing conditions and developing HNA II objectives through connecting resilience, the 5 EECs, status and trends, and reach planning objectives.
2) Based upon this workshop, do you agree that there is a clear linkage between the metrics of resilience, the resilience subsystems, HNA I habitats, controlling variables, indicators of ecosystem health, and the 5 EEC's. If not – what suggestions do you have for improving the linkages?
3) If you agree that the 5 EEC's are interrelated, do you agree that we can use habitat(s) to describe our objectives, as long as we fully recognize the interrelationship with the four other EEC's?
4) What other alternatives for the development of management objectives are available that can be linked to resiliency?

Day 3

Part 3: Assessing Habitat Needs Within The Context of General Resilience and Recently Developed Data Products

<u>Small Group Report-Outs</u>

Group One – This group only addressed the first question, but more so was struggling with the objectives question, "habitat for what" that Jeff Janvrin and who gets to decide. Other comments:

- Next steps and how the process might unfold are unclear
- The HNA II effort should work with the river teams to determine habitat goals (but the HNA II should take the leadership role and provide a single, systemic platform)
  - Unclear of how specific the HNA II should describe habitat outcomes
  - Host a workshop or some venue for the river teams to jointly discuss habitat objectives including the spider diagrams (to tailor objectives to each reach)
    - These discussions should be jointly hosted by the tri-chairs and resilience teams
- The HNA II should integrate the resilience conceptual models and proposed metrics
- Spider diagrams seem useful for organizing ecological goals and objectives
- Need to define the HNA II's end goal and how data, objectives, and previous planning materials will be used to make statements about habitat needs

Group Two –

- Question 1:
  - The HNA II's end product/deliverable and future schedule/process are unclear
  - The habitat objectives worksheet did not seem to add value to the HNA II effort
    - Unsure how results will be useful given that nearly all matrix items were selected
  - Prefer to focus HNA II objectives evaluation at the system-level (in terms of objectives for UMRR) and then project delivery teams would provide more specificity to project areas
- Question 2:
  - Unclear who the audience for the HNA II assessment – Congress, Administration, project delivery teams, scientists or all of the above – and how that affects the end product(s)

    - Some linkages are very clear and some still need to be fleshed out; spider diagrams may help to illustrate the interrelatedness
    - Found value in the flood inundation information
    - The resilience work is much further developed and so is more clearly defined
    - Support framing objectives and habitat needs within the 5 EECs
    - Some work is needed to better link the 2000 HNA outputs regarding desired future conditions/habitats with the current ecosystem resilience analyses
    - UMRR partners need to decide what are the most critical things that the HNA II should address
    - Suggestion to have the river teams identify the greatest habitat need for a given spatial area (reach or pool) and evaluate whether the data from resilience and HNA II inventory confirm that answer
    - A near term effort should be to seek input from the river teams – place habitat needs on a map
- Questions 3 and 4:
    - Agree that the five EECs are interrelated
    - Moving from an ecosystem restoration and management of (structure and function) focus to a habitat-only approach might inadvertently result in "habitat patch" restoration
        - The rational of using the habitat EEC as a proxy should be clearly articulated in the HNA II report
        - Habitat categories should be clearly defined to avoid confusion
        - Need to restore structure and function
    - The HNA II should identify constraints to ecosystem health – e.g., 9-foot navigation channel – and should explain habitat needs in both a constrained and unconstrained context
        - Suggestion to define the optimal condition, using the spider diagram for resilience indicators to determine how much of a certain habitat/process/feature in a given condition
        - Need to determine what habitats need to be retained to be sustainable given existing and future stressors
        - How do we work in a system that is undergoing a transformation to something we determine is undesirable? What should be managed for – i.e., what was or what it might become?
        - Need to provide a clear connection to habitat needs and individual habitat projects

Group Three –

- Question 2: While the group generally supported the linkage, the ways in which historical plans and current work is being integrated is unclear and confusing.
        - The following items need further clarification:
        - The distinction between resilience and HNA II
        - The appropriate spatial scales for various efforts
        - How to address information gaps – prioritize research, etc.
        - Evaluating biological responses/track success
        - Determine how calculate restoration benefits to multiple species in one area – rather than only being able to address fish or wildlife needs; focusing on broader ecosystem functions and processes should help

- Other discussion:
  - Maintain an unbiased approach by only focusing on habitat needs and not considering cost share and other administrative factors
  - Need to determine final product(s) – perhaps a more general, summary type report and a more detailed, technical report
  - Suggestion to define deficient and critical habitat types and then address restoration in those areas, consider how restoration might restore the natural mosaic of habitats
  - Project monitoring needs to scale up into a broader, cumulative assessment
  - Assess a restoration action a few times enough to find that its repeatable (do not need to do more than that)
  - Habitat restoration projects convert habitat types; need a clear statement about the desired habitat and how it should be distributed across larger spatial scales
  - Working to increase carrying capacity for limiting factors to make habitat viable
  - HNA should focus more broadly and on the greatest management priorities

Group Four –

- Question 1: It appears as though the HNA II process is skipping major steps and is too rushed, not allowing for The HNA II to be data driven as was intended. It will be difficult to define future conditions.
- Question 2: The linkages may be there, but they are unclear.
- Question 4: There are important social aspects to consider.
  - There is an opportunity to improve channel maintenance for the benefit of ecosystem health and habitats
  - Suggestion to focus the scope on species' guilds rather than single species
  - Define quantity, quality, and for what
  - Difficult to define reference condition
- Other discussion:
  - The HNA II tri-chairs are planning to have system-wide datasets available in mid-July, but need some further direction about what is included in that

<u>General Discussion</u>

- Suggestion to extend the timeline given that the HNA II such a substantial, important project
  - UMRR is near the end of its queue in terms of available projects; if the HNA and subsequent project selection process is delayed, then will need to advance projects that have not been evaluated through the partnership processes
  - Suggestion that each river team select a project using the resilience conceptual models and HNA II inventory
  - Perhaps the HNA II should focus on defining a future condition and existing inventory
- Suggestion to develop similar terminology to facilitate systemic understandings

- Nate De Jager's suggestion for a Path Forward:
  - Utilize the suite of resilience metrics that partners have already agreed define the essence of the ecosystem across the system
  - Provide some additional value meanings with metrics – whether good or bad
  - Host a workshop for partners to discuss the proposed value metrics/objectives and determine which conditions are acceptable or not, which metrics are most important, and where UMRR should focus restoration – does the partnership want more or less of certain habitat types

  This would facilitate a data-driven process and outcomes, and would provide for a broad scale assessment of habitat availability and recommend areas for which UMRR should focus

  For example, the HNA would have a suite of metrics regarding whether aquatic areas that would indicate whether those habitats are fine or are in trouble; the river teams would be asked to weigh in on the value of whether those areas are in a good state or need to be restored and where

  This type of broad assessment can be completed this year; prefer to have a relatively generic focus because species-specific information is lacking
- Suggestion to further flesh out the spider diagrams as they seem to provide a good simplification of the data that is commonly understood
- While one suggestion was to define some clear separation from resilience and HNA II, focusing the HNA on the most directly applicable resilience concepts; it was a deliberate decision to have overlap between resilience and HNA – need to be focusing restoration on restoring the health and resilience of the whole system
- Need to separate institutional arrangements with HNA II
- Several partners commented that they support De Jager's recommendation
  - It makes sense to stay general, and work on specific habitat in the next HNA
  - Use resilience metrics to provide a common, systemic framework for river teams to work within
- Question remains of how EECs will be incorporated; resilience is not intended to replace EECs
  - The HNA tri-chairs and resilience leads will think through how to integrate all of these pieces better
- Non-profits are eligible to serve as cost-share sponsors and should be included in the discussions; non-profits may have project ideas that can be brought to the table
- Need to articulate difference between habitat needs and objectives; HNA viewed as needing to inform objectives, not define them
- HNA II seen as dovetailing nicely with resilience
- Suggestion for HNA II to show different future condition scenarios
- Suggestion to add resilience concepts to ecosystem and habitat objectives; UMRR's vision should flow seamlessly through these different efforts
- General agreement to implement De Jager's suggested approach

<u>HNA II Project Goals</u>

Megan McGuire shared her thoughts for the HNA II project goals and how the process should unfold, calling for a shared understanding and consensus for the HNA's goals and scope. She offered the following goals:

1) Use new information and cutting-edge science to identify the UMRS's habitat needs
2) Identify the scale of effort required to maintain and enhance the health and resilience of the UMR system
3) Use habitat needs to direct habitat restoration project location and goals, including HREPs and other river management efforts

McGuire offered the *current* habitat needs could be estimated by subtracting the existing condition from some desired future condition and that *future* habitat needs could be estimated by subtracting projected future condition from desired future condition. Habitat condition is the sum of quantity, quality, and distribution and connectivity.

McGuire suggested using habitat needs to develop habitat objectives, and recommended that objectives are defined in ways that are specific, measureable, attainable, relevant, and time-bound (SMART). In addition, she suggested that habitat objectives are formulated as 1) number of acres; 2) created, enhanced, or maintained; and 3) of a specific spatial scale.

McGuire outlined a suggested approach for the HNA II process from here, as follows:

1) Determine HNA II project goals and products
2) Define habitat types for further evaluation – i.e., confirm habitat categories and develop metrics
3) Identify current habitat condition – i.e., quantity, quality, distribution, and connectivity
4) Forecast future habitat condition
5) Identify future condition
6) Calculate habitat needs
7) Identify drivers and stressors that can be influenced to meet habitat objectives
8) Engage the public

McGuire suggested that UMRR move the ecosystem toward a specified historical reference condition, focus on habitat with the greatest rate of loss or degradation and maintaining existing habitat availability (quality and quantity), and identify areas with the greatest return on investment. Her preference is to focus on wildlife needs from a landscape perspective and focus on threatened and species of greatest conservation need.

Participant Observations

- Question: Does step four need to occur? See step five as valuable, but will require side boards and quite a bit of collaboration and staff time
  - The 2000 HNA offered that step as an approach, but the HNA II does not need to stick to that
- UMRR's vision should be central to HNA effort and what partners are trying to do through the program
- Spider diagrams and metrics seem to have the most consensus for proceeding forward
- Suggestion for a smaller group to flesh out the process and schedule
- HNA II Steering Committee will explore opportunities for public engagement and outreach?
- There are many challenges to predicting future conditions (can do scenario exercises) and that not may not be the best use of resources
  - Spider diagrams may be used to model future scenarios

- Need to manage expectations about the extent to which future conditions can be defined
- Work is being done to set up a framework for better modeling future conditions

- Need to understand limitations to evaluating current conditions (and reasons for not focusing on some current conditions)
  - Depends on metrics and how the framing the data in question
  - Further thought can be focused on this question
  - Define broad scale trend information
- Questions remain about the appropriate spatial scales for metrics to be meaningful

Next Steps

Marshall Plumley outlined a proposed schedule for developing the HNA II process and timeline going forward. Plumley suggested that the HNA Steering Committee hold a conference call to agree on an approach and schedule, and have the HNA tri-chairs distribute a one-page summary of the approach to partners. Suggestion to incorporate the HNA II project management plan, which outlined many of the project's intended steps.

Plumley outlined questions that remain: what are the HNA II's goals, scale, users, audience, and purpose, and how will the HNA inform the next generation of habitat projects. He offered that it may be helpful to review progress made in achieving the 2000 HNA's recommended desired future condition.

A completed HNA document is scheduled for February 2018, which will require partners to focus on what is really important and to be relatively concise.

Participant Observations

- Communication needs to be improved – with the Steering Committee and river teams – as does commitment to following through with the planned schedule

Upper Mississippi River Restoration Program
Joint Ecosystem Resilience/Habitat Needs Assessment II Joint Meeting

May 16-18, 2017
Attendance List

Andy Barnes	U.S. Army Corps of Engineers
Mark Cornish	U.S. Army Corps of Engineers
Michael Dougherty	U.S. Army Corps of Engineers
Tim Eagan	U.S. Army Corps of Engineers
Kjetil Henderson	U.S. Army Corps of Engineers
Jon Hendrickson	U.S. Army Corps of Engineers
Karen Hagerty	U.S. Army Corps of Engineers
Marvin Hubbell	U.S. Army Corps of Engineers
Brian Johnson	U.S. Army Corps of Engineers
Ray Kopsky	U.S. Army Corps of Engineers
Kat McCain	U.S. Army Corps of Engineers
Megan McGuire	U.S. Army Corps of Engineers
Andy Meier	U.S. Army Corps of Engineers
Davi Michl	U.S. Army Corps of Engineers
Marshall Plumley	U.S. Army Corps of Engineers
Bre Popkin	U.S. Army Corps of Engineers
Chuck Theiling	U.S. Army Corps of Engineers
Jackie Veninger	U.S. Army Corps of Engineers
Kathy Kowal	U.S. Environmental Protection Agency
Neal Jackson	U.S. Fish and Wildlife Service
Kraig McPeek	U.S. Fish and Wildlife Service
Mathew Mangan	U.S. Fish and Wildlife Service
Sara Schmuecker	U.S. Fish and Wildlife Service
Darrik Weissenfluh	U.S. Fish and Wildlife Service
Jason Wilson	U.S. Fish and Wildlife Service
Steve Winter	U.S. Fish and Wildlife Service
Kristen Bouska	U.S. Geological Survey
Nate De Jager	U.S. Geological Survey
Mark Gaikowski	U.S. Geological Survey
Jeff Houser	U.S. Geological Survey
KathiJo Jankowski	U.S. Geological Survey
Jim Rogala	U.S. Geological Survey
Jason Rohweder	U.S. Geological Survey
Molly Van Appledorn	U.S. Geological Survey
Levi Solomon	Illinois Natural History Survey
Narissa McClelland	Illinois Department of Natural Resources
Dave Bierman	Iowa Department of Natural Resources
Mike Griffin	Iowa Department of Natural Resources
Kirk Hansen	Iowa Department of Natural Resources
Dan Dieterman	Minnesota Department of Natural Resources
Megan Moore	Minnesota Department of Natural Resources
Dave Herzog	Missouri Department of Conservation
Shawn Giblin	Wisconsin Department of Natural Resources
Jeff Janvrin	Wisconsin Department of Natural Resources
Gretchen Benjamin	The Nature Conservancy
Doug Blodgett	The Nature Conservancy
Kirsten Mickelsen	Upper Mississippi River Basin Association

ATTACHMENT C

Long Term Resource Monitoring and Science

- **UMRR Science in Support of Restoration and Management Potential Projects for FY 17** *(C-1 to C-3)*
- **FY 2014 UMRR Science Activities in Support of Restoration and Management (7/2017)** *(C-4)*
- **Base Monitoring Scope of Work thru 3rd Quarter of FY 2017 (7/17/2017)** *(C-5 to C-8)*
- **FY 2017 UMRR Science Activities in Support of Restoration and Management (7/17/2017)** *(C-9 to C-14)*

UMRR Science in Support of Restoration and Management
Potential Projects for FY17

The following summaries are for potential UMRR Science in Support of Restoration and Management projects, for funding and implementation as early as FY17, as appropriate. These seven proposed projects resulted from a targeted solicitation for projects and all focus on improving our understanding of resilience and ecosystem health of the UMRS.

Of the seven projects proposed, the first four projects are fully developed and could be funded in 2017, pending endorsement by the UMRR CC. The next three projects (#5-7) require additional work and, if appropriate, could be funded in 2018, pending ongoing discussion of the details of those projects and available funding.

Collectively, this proposed work described below:

1. Improves our understanding of the processes that support biological production in the river and how they are affected by fundamental drivers of the river's health and resilience;
2. Investigates the extent to which water clarity is driven by external drivers (total inputs of suspended material) versus internal biological processes (submersed vegetation and phytoplankton production). Such work informs our understanding of the extent to which internal modifications (e.g., HREPs) can reasonably expected to affect the system as compared to external drivers that affect inputs to the system;
3. Pursues strategic, short-term additions to LTRM data including: 1) Growth, age, recruitment and mortality rates of select UMRS fish species, and 2) more direct measurements of submersed vegetation biomass at select LTRM sampling sites; and,
4. Develops additional information for the development of indicators of ecological health and resilience in support of river restoration and management.

1. Plankton community dynamics of Lake Pepin – the role of crustacean zooplankton

This work expands on previous and on-going work to better understand biological processes that contribute to the base of the food web and supports diverse riverine biota. Specifically, this project expands ongoing work to larger zooplankton (crustaceans) in a set of analyses currently based on phytoplankton and small zooplankton (rotifers). This work completes the overall picture of the plankton community at a set of LTRM sampling sites in Lake Pepin, allows more comprehensive assessment of that plankton community and how it is affected by fundamental drivers of ecosystem health and resilience such as water velocity and residence time, and lays the groundwork for assessing the response of the system to future biological invasions and other stressors.. Other components (phytoplankton and rotifers) of the plankton community have been previously assessed by a combination of LTRM or in kind work by MNDNR.

2. Water Clarity in Pool 8 of the Upper Mississippi River: the contributions of changes in external inputs and changes in internal conditions to long term trends

This work uses the long term base monitoring data in Pool 8 to assess the extent to which the increase in water clarity is associated with changes in external factors (such as decreased TSS inputs from up-river and local tributaries) or internal factors (primarily the increase in vegetation abundance). The results will provide insight into possible feedbacks between vegetation and TSS, will build upon and complement the previous work addressing thresholds in the relationship between vegetation abundance and water clarity previously completed and published by Shawn Giblin (WDNR), and will be a contribution to our broader understanding of the resilience of the UMRS.

3. Developing methods estimating of submersed aquatic vegetation biomass in the Upper Mississippi River to expand capabilities within the UMRR program and improve the utility of the long term vegetation data

LTRM base vegetation monitoring was designed to efficiently provide basic, critical information regarding the distribution of vegetation in select study reaches of the UMRS. The based monitoring data provides an index of abundance but not intended, or designed, to predict vegetation biomass. This work will test a relatively simple method to estimate vegetation biomass in collaboration with the USFWS in their Lake Onalaska wild celery monitoring, and at a subset of LTRM vegetation sampling sites in Pool 4 and 8. Estimates of vegetation biomass may improve our ability to describe and quantify vegetation derived processes such as fish habitat providing, oxygen production, nutrient sequestration and changes in water clarity. This data generated by this project will also be assessed to see the extent to which it may be able to enhance rake scores generated as part of the standard LTRM methods.

4. Using measurements of age, recruitment, growth rates, and mortality to understand population demographics of Smallmouth Buffalo in the Upper Mississippi River System

Interpretation and evaluation of the LTRM fish data can be enhanced with more information regarding vital rates that drive these fish populations over time. This project will use a standard fisheries method to gather information on rates of recruitment, growth, and mortality as well as population age structure for Smallmouth Buffalo in LTRM study reaches of the UMRS. Doing so will provide important information for the Commercial Fish Indicator intended for inclusion in the next Status and Trends Report as well increase our understanding of an important commercial fish species and what aspects of the UMRS contribute to its sustenance. In the past the UMRR has used this approach to determine that sport fish are having trouble overwintering (i.e., indicated by a population of mostly smaller-younger individuals) and whether the creation of HREPS for improved overwinter improves the situation. For example, we will be able to determine whether the growth of Smallmouth Buffalo is higher in relation to the number or type of HREPS in a reach. Additionally, we will be able to see if Smallmouth Buffalo trends are affected by events like extreme droughts, floods, or winter conditions.

5. Developing and applying an approach to better understanding Long-Term Performance of Habitat Rehabilitation and Enhancement Projects for the backwaters of the Illinois River.

This project will conduct an assessment of the long term effects of existing HREPs on the Illinois River. There are two components. First, through interviews with site managers of UMRR HREP sites on the Illinois River they will document the long-term performance of these project in achieving their ecological goals, identify unforeseen challenges to achieving the original projects goals, document changes to management goals/objectives and strategies that have occurred since the project was completed, and identify any potential project improvements (e.g., new construction) that could be implemented to improve the success of these sites. Second, they will devise and implement rapid-monitoring plan for HREP sites that could be implemented in years when funding is available. This rapid-monitoring and assessment plan would be used to create a database of quantifiable ecological indicators relevant to the objectives of HREP projects on the Illinois River. For example, key ecological attributes for most of these HREP sites would be the establishment of aquatic vegetation, use of HREP sites by waterfowl and waterbirds, and indicators of the health of fish communities within these HREP sites.

6. Development of Young of the Year Fish Indicator for Use in the UMRR

Accurate and informative indicators are a key tool for assessing the condition of the UMRS and the effectiveness of management and restoration actions. During the recent development of a suite of Fish Indicators of Ecosystem Health, the abundance of Young of the Year (YOY) was recommended as an indicator to summarize an important component of trends in natural fish reproduction in the UMRS. However, the YOY indicator could not be completed because the A-Team was concerned that the existing length cut-offs used in the development were not accurate, and they suggested these cut-offs needed to be re-evaluated. This project would primarily use the LTRM fisheries data to establish length cut-offs for identifying YOY for select system wide species and apply the methods developed as part of the previous work on Fish Indicators of Ecosystem Health to the assessment of YOY dynamics.

7. Using a snapshot of Age, Growth, Recruitment, and Mortality to improve our understanding of the processes behind the patterns observed in the LTRM fisheries data.

This work represents an expansion of the above assessment vital rates of small mouth buffalo (described above) to a broader group of fishes of the UMRS in order to further improve our interpretation and evaluation of LTRM fish data. Quantifying these rates will provide critical additional parameters to the existing community and population-level data that LTRM currently collects. Importantly, it will enable a better understanding of the processes that produce the patterns that are observed and the inferences that can be made regarding the fishes of the UMRS. For example, insights into the causes of long-term declines in common carp and white bass may be gained by analysis of the rate data collected in this study. Furthermore, unlike catch-per-unit-effort data, the rate data collected here is relatively unaffected by gear efficiency and selectivity issues and may provide more sensitive indicators of how the ecosystem responds to various disturbances as well as restoration efforts and management actions.

UMRR Science in Support of Restoration and Management
FY2014 Scope of Work
July 2017 Status

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Seamless Elevation Data						
2015LB9	Lidar (Tier 2) processing for Pool 1, 2, and Lockport	31-Dec-15		31-Dec-16	no cost acquisition of new LiDAR	Dieck, Hanson
2015LB10	Seamless Elevation processing for Pool 2 and 19	31-Dec-15		31-Dec-16	resolved data quality issues (Pool 19)	Dieck, Hanson
Development of Mussel Vital Rates						
2014MVR1	Brief summary report	30-Sep-15		30-Sep-15	completed, in UMESC review	Newton, Zigler, Davis
2014MVR2	Progress update	30-Sep-16		30-Sep-16		Newton, Zigler, Davis
2014MVR3	Completion report on a vital rates of native mussels at West Newton Chute, UMRS	30-Sep-17				Newton, Zigler, Davis
Effects of Nutrient Concentrations on Zoo- and Phytoplankton						
2014NC1	Counting of phytoplankton samples	13-Mar-15		2-Mar-15		Giblin, Campbell, Houser, Manier
2014NC2	Database completed and analysis completed	13-Mar-16	13-Sep-17		Working With UWL staff. Analysis partally complete.	Giblin, Campbell, Houser, Manier
2014NC3	Full manuscript completed	13-Mar-18				Giblin, Campbell, Houser, Manier
Ecological Shifts Turbid to Clear States						
2014ES1	Literature review and initial analyses competed	13-Mar-15		15-Nov-14		Giblin, Ickes, Langrehr, Bartels
2014ES2	Refined analyses and draft manuscrpt prepared	13-Mar-16		4-Jan-16	reconciling journal review comments	Giblin, Ickes, Langrehr, Bartels
2014ES3	Manuscipt submitted for publication	13-Mar-17		13-Mar-17	accepted by Journal fo Freshwater Ecology	Giblin, Ickes, Langrehr, Bartels
Asian Carps Recruitment Sources (#2)						
2014CRS1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014CRS2	Manuscript	31-Mar-16	30-Aug-16	30-Aug-16	in review at Aquatic Invasions	Phelps, Mccain
Effects of Asian Carps on Native Piscivore Diets (#3)						
2014NPD1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014NPD2	Manuscript	31-Mar-16	30-Oct-16	17-Nov-16	submitted to Environmental Biology of Fishes	Phelps, Mccain
Early Life History of Invasive Carps (#4)						
2014CLH1	Summary letter	31-Jan-15		16-Jan-15		Phelps, Mccain
2014CLH2	Manuscript	31-Mar-16		1-Jan-16	in press	Phelps, Mccain
Fish Indicators of Ecosystem Health						
2015FI1	Preliminary set of species identified for the different assemblages by study reach submitted to A-Team as status update and for review	30-Aug-15	10-Feb-16	16-Feb-16	Post doc hiring delay resulted in project delayed	Anderson, Casper, McCain
2015FI2	Draft recommendation for the best attainable or target for each assemblage by study reach submitted to A-Team for Review	1-Oct-15	10-Feb-16	16-Feb-16	For presentation at 2016 UMRR Science Mtg in La Crosse briefing	Anderson, Casper, McCain
2015FI3	Initial draft Project Report submitted to A-Team for review	1-Dec-15	15-Mar-16	30-Mar-16	Incorporate feedback from 2016 UMRR Science Mtg presentation into La Crosse A-team briefing	Anderson, Casper, McCain
2015FI4	Final draft Project Report submitted to A-Team for review and endorsement at JANUARY meeting	1-Mar-16	15-Dec-16	16-Dec-16	all requested changes were made	Anderson, Casper, McCain
2015FI5	Final draft Project Report submitted to UMRR CC for endorsement at FEBRUARY meeting	15-Jul-16	15-Jan-17	15-Jan-17	on schedule	Anderson, Casper, McCain
2015FI6	Final Report	1-Jun-16	28-Feb-17	13-Apr-17	INHS report http://hdl.handle.net/2142/95874	Anderson, Casper, McCain
Plankton community dynamics in Lake Pepin						
2015LPP1	Phytoplankton processing; species composition, biovolume	30-Dec-15		22-Oct-15		Burdis
2015LPP2	draft manuscript: Plankton community dynamics in Lake Pepin	30-Sep-16	30-Mar-18		delayed due to field station staffing shortages and will also include data from 2015D15	Burdis
Estimating trends in UMRR fish and vegetation levels using state-space models						
2015SST1	Draft completion report: Evaluation of trend estimation methods for LTRM fish and vegetation indices	30-Sep-15	15-Dec-15	29-Jan-16	Project delayed by computing challenges.	Gray
2015SST2	Final completion report: Evaluation of trend estimation methods for LTRM fish and vegetation indices	31-Dec-15	15-Mar-16	27-Mar-16		Gray
2015SST3	Provide trend estimates for fish and vegetation web browser pages	30-Sep-16	31-Dec-16	27-Dec-16		Gray, Schlifer
Predictive Aquative Cover Type Model - Phase 2						
2015AQ1	Develop 2-D hydraulic model of upper Pool 4	30-Sep-15		30-Sep-15		Libbey (MVP H&H)
2015AQ2	Apply model to Pool 4 and resolve discrepancies	31-Dec-15	31-Mar-16	31-Mar-16		Yin, Rogala
2015AQ3	Detailed summary of work for Phases I & II	31-Dec-15	31-Dec-17		Resolving model discrepancy took longer than anticipated. Last extension.	Yin, Rogala, Ingvalson

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Aquatic Vegetation Component						
2017A1	Complete data entry and QA/QC of 2016 data; 1250 observations.					
	a. Data entry completed and submission of data to USGS	30-Nov-16		30-Nov-16		Lund, Drake, Bales
	b. Data loaded on level 2 browsers	15-Dec-16		15-Dec-16		Schlifer
	c. QA/QC scripts run and data corrections sent to Field Stations	28-Dec-16		28-Dec-16		Sauer, Schlifer
	d. Field Station QA/QC with corrections to USGS	15-Jan-17		15-Jan-17		Lund, Drake, Bales
	e. Corrections made and data moved to public Web Browser	30-Jan-17		30-Jan-17		Yin, Sauer, Schlifer, Caucutt
2017A2	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2016 data	31-Jul-17				Yin, Rogala, Schlifer
2017A3	Wisconsin DNR annual summary report 2016 that combines current year observations from LTRM with previous years' data, for the fish, aquatic vegetation, and water quality components.	30-Sep-17				Drake, Bartels, Hoff, Kalas
2017A4	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	31-Aug-17				Yin, Lund, Drake, Bales
2017A5	Pool 4: Graphical summary and maps of aquatic vegetation current status and long-term trends.	30-Dec-16		21-Oct-16		Lund
2017A6	Pool 8: Graphical summary and maps of aquatic vegetation current status and long-term trends.	30-Dec-16		19-Sep-16		Drake, Weeks
Intended for distribution						
LTRM Technical Report: Ecological Assessment of High Quality UMRS Floodplain Forests (2007APE12; Chick, Guyon, Battaglia) (in final edits with author)						
LTRM Technical Report; Experimental and Comparative Approaches to Determine Factors Supporting or Limiting Submersed Aquatic Vegetation in the Illinois River and its Backwaters (2008APE5, Sass) (in USGS review)						
LTRM completion report: FY05-07 data--Analysis and support of aquatic vegetation sampling data in Pools 6, 9, 18, and 19 (2008APE4a; Yin) (in USGS review)						
Manuscript: Have the recent increases in aquatic vegetation in Pools 5 and 8 been the result of water level management drawdowns, HREPs, or natural fluctuations? (2009APE1a; Yin) (in USGS review)						
Manuscript: A statistical model of species occupancy using the LTRM aquatic vegetation data (2013A7; Yin) (in USGS review)						
Fisheries Component						
2017B1	Complete data entry, QA/QC of 2016 fish data; ~1,590 observations					
	a. Data entry completed and submission of data to USGS	31-Jan-17		31-Jan-17		DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Maxson
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	15-Feb-17		15-Feb-17		Ickes, Schlifer
	c. Field Station QA/QC with corrections to USGS	15-Mar-17		15-Mar-17		DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Maxson
	d. Corrections made and data moved to public Web Browser	30-Mar-17		30-Mar-17		
2017B2	Update Graphical Browser with 2016 data on Public Web Server.	31-May-17		31-May-17		Ickes, Sauer, and Schlifer
2017B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool (Table 1)	31-Oct-17				Ickes, Sauer, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Maxson, Schlifer
2017B4	Summary Letter: Floodplain fisheries sampling	31-Oct-17				West, Sobotka
2017B5	IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2016	30-Jun-17		1-Feb-17		Bowler
2017B6	Sample collection, database increment, Summary letter on Asian carp age and growth: collection of cleithral bones	31-Jan-17		10-Jan-17		Solomon, Maxson, Casper

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
2017B7	Sample collection, database increment, letter summary: Collection and archiving of age and growth structure for selected species in the La Grange Reach of the Illinois River	31-Jan-17		10-Jan-17		Solomon, Maxson, Casper
2017B8(D)	Database increment: Stratified random day electrofishing samples collected in Pools 9–11	30-Sep-17				Bowler
2017B9(D)	Database increment: Stratified random day electrofishing samples collected in Pools 16–18	30-Sep-17				Bowler
2017B10	Summary Letter: Open River Chevron Dike monitoring	31-Oct-17				West
2017B11	Summary Letter: Evaluating the Fish Community in a rare Backwater Habitat in the Middle Mississippi River 2017	30-Sep-17				West
Intended for distribution						
Completion report: LTRM Fisheries Component collection of six darter species from 1989–2004. (2006B13; Ridings) (in USGS review)						
LTRM technical report; Setting quantitative fish management targets for LTRM monitoring (2008APE2; Sass) (in USGS review)						
LTRM Completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish; Chick et al.) (in USGS review)						
Manuscript: Determining environmental history of three sturgeon species in the Upper, Middle, and Lower Mississippi Rivers. (2013B22; Phelps) (in review Journal of Fish Biology)						
Manuscript: Age-0 sturgeon habitat associations in the free flowing portion of the Upper Mississippi River (2012B5; Tripp, Phelps, Herzog) (in review Journal of Fish Biology)						
Manuscript: Population Trends and a Distributional Record of Selected Fish Species from the Illinois River; Levi E. Solomon, Richard M. Pendleton, Robert A. Hrabik, and Andrew F. Casper Completed: Transactions of the Illinois State Academy of Science (2016) Volume 109, pp. 57-61						
LTRM Fact Sheet: Tree map tool for visualizing fish data, with example of native versus non-native fish biomass (2013B16) (in USGS review)						
Water Quality Component						
2017D1	Complete calendar year 2016 fixed-site and SRS water quality sampling	31-Dec-16		31-Dec-16		Jankowski, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka
2017D2	Complete laboratory sample analysis of 2016 fixed site and SRS data; Laboratory data loaded to Oracle data base.	15-Mar-17		15-Mar-17		Yuan, Schlifer
2017D3	1st Quarter of laboratory sample analysis (~12,600)	30-Dec-16		30-Dec-16		Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Cook, Sobotka
2017D4	2nd Quarter of laboratory sample analysis (~12,600)	30-Mar-17		30-Mar-17		Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka
2017D5	3rd Quarter of laboratory sample analysis (~12,600)	29-Jun-17		29-Jun-17		Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka
2017D6	4th Quarter of laboratory sample analysis (~12,600)	28-Sep-17				Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
2017D7	Complete QA/QC of calendar year 2016 fixed-site and SRS data.					
	a. Data loaded on level 2 browsers; QA/QC scripts run; SAS QA/QC programs updated and sent to Field Stations with data.	30-Mar-17		1-Mar-17		Schlifer, Rogala, Jankowski
	b. Field Station QA/QC; USGS QA/QC.	15-Apr-17		23-Mar-17		Jankowski, Rogala, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka
	c. Corrections made and data moved to public Web Browser	30-Apr-17		27-Mar-17		Rogala, Schlifer, Jankowski
2017D8	Complete FY2017 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool	30-Sep-17				Jankowski, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka
2017D9	WEB-based annual Water Quality Component Update w/ 2016 data on Server.	30-May-17		30-May-17		Rogala
2017D10	Final LTRM Completion report: Evaluation of water quality data from automated sampling platforms	30-Sep-17				Soeken-Gittinger, Lubinski, Chick, Houser
2015D11	Operational Support to the UMRR LTRM Element. Serve as in-house Field Station for USGS for consultation and support on various LTRM-wide topics	30-Sep-17				Kalas, Hoff, Bartel, Drake
2015D12	Final report/manuscript: Developing continuous water quality monitoring methods in the UMR	1-Sep-17				Chick, Houser
Intended for distribution						
Completion report: Examining nitrogen and phosphorus ratios N:P in the unimpounded portion of the Upper Mississippi River (2006D9; Hrabik & Crites) (in USGS review)						
LTRM report: Main channel/side channel report for the Open River Reach. (2005D7; Hrabik) (replaced with Sobotka, M. J. and Q. E. Phelps. 2016. A Comparison of Main and Side Channel Physical and Water Quality Metrics and Habitat Complexity in the Middle Mississippi River)						
Manuscript:Contrasts between channels and backwaters in a large, floodplain river: testing our understanding of nutrient cycling, phytoplankton abundance, and suspended solids dynamics (2012D10; Houser) (Freshwater Science. 2016. 35(2):457–473. DOI: 10.1086/686171)						
Completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis) (in USGS review)						
Manuscript: Trends in suspended solids, nitrogen, and phosphorus in select upper Mississippi River tributaries, 1991-2011 (Kreiling and Houser, 2013D14) (Environ Monit Assess. 188: 454. doi:10.1007/s10661-016-5464-3)						
Manuscript: Relationship between the temporal and spatial distribution, abundance, and composition of zooplankton taxa and hydrological and limnological variables in Lake Pepin (2013D17; Burdis) (Burdis, Robert M. & Jodene K. Hirsch. 2017. Crustacean zooplankton dynamics in a natural riverine lake, Upper Mississippi River, Journal of Freshwater Ecology, 32:1, 240-258, DOI: 10.1080/02705060.2017.1279080)						
Manuscript: Nutrients and dissolved oxygen in the UMRS: improving our understanding of winter conditions and their implications for structure and function of the river (2014D12; Houser) (in USGS review)						
Land Cover/Land Use with GIS Support						
2017LC1	Maintenance ArcGIS server	30-Sep-17				Hlavacek, Fox, Rohweder
2017LC2	Aerial Photo scanning	30-Sep-17				Ruhser
2017LC3	USNVC Database Table	30-Sep-17				Hop
2017LC4	Updates on progress for land cover products listed.	New progress reported in the quarterly activities. Percent complete updated 30 Sept 2017.				Robinson
Data Management						
2017M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	30-May-17		30-May-17		Schlifer
2017M2	Load 2016 component sampling data into Oracle tables and make data available on Level 2 browsers for field stations to QA/QC.	30-Jun-17		30-Jun-17		Schlifer

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Quarterly Activities						
2017QR1	Submittal of quarterly activities	30-Jan-17		30-Jan-17		All LTRM staff
2017QR2	Submittal of quarterly activities	13-Apr-17		13-Apr-17		All LTRM staff
2017QR3	Submittal of quarterly activities	13-Jul-17				All LTRM staff
2017QR4	Submittal of quarterly activities	12-Oct-17				All LTRM staff
Equipment Inventory						
2017ER1	Property inventory and tracking	15-Nov-17				LTRM staff as needed

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Developing and Applying Indicators of Ecosystem Resilience to the UMRS						
2017R1	Updates provided at quarterly UMRR CC meeting and A team meetings	Various				Bouska, Houser
2017R2	Submit following manuscript for publication: Bouska, K.B., J.N. Houser, and N. De Jager. Developing a shared understanding of the Upper Mississippi River: the foundation of a resilience assessment.	30-May-17		9-Mar-17	Accepted with revisions by Ecology and Society	Bouska, Houser, De Jager
2017R3	Draft General Resilience of the UMRS manuscript to RWG for review	15-Sep-17				Bouska, Houser
Modelling and mapping current and projected future habitats of the Upper Mississippi River System (HNA-II)						
Aquatic Habitats						
2017AH1	Develop general classification for 2010 and refit 1989-- Key Pools completed	30-Jan-17		21-Sep-16		Janis Rusher
2017AH2	Develop general classification for 2010 and refit 1989-- Rest of system	30-Jul-17				Janis Rusher
2017AH3	Develop enhanced lentic areas--Add Connectivity and depth of backwaters to aquatic areas for Key Pools	30-Jan-17	30-Jun-17		Based on input from the HNA II Workshop, final revisions to programs used to generate the metrics are completed. The program is being run on all pools to create the final shapefiles. (e.g., 17 hours of computer time for Pool 8)	Jim Rogala
2017AH4	Develop enhanced lentic areas--Add Connectivity and depth of backwaters to aquatic areas for rest of system	30-Aug-17				Jim Rogala
2017AH5	Develop enhanced lotic areas--Add Connectivity and depth of side channels, structured MCB to aquatic areas for Key Pools	30-Jan-17	30-May-17		Enhanced lotic area shapefiles and associated metrics completed for all the pools that are ready. Undergoing QA/QC.	Jason Rohweder
2017AH6	Develop enhanced lotic areas--Add Connectivity and depth of side channels, structured MCB to aquatic areas for rest of system	30-Aug-17				Jason Rohweder
2017AH7	Conduct ecological assessment of enhanced aquatic areas--conduct analyses in Key Pools	30-Mar-17	TBD		Lead author has taken a new job with the ACOE in St. Louis. Discussions under way to determine next lead(s)	Allison Anderson, Kristen Bouska, Jeff Houser, Alicia Weeks
2017AH8	Conduct ecological assessment of enhanced aquatic areas--complete draft report	30-Sep-17				Allison Anderson, Kristen Bouska, Jeff Houser, Alicia Weeks
2017AH9	Apply ecological relationships to entire system and incorporate into geodatabase	30-Sep-17				Tim Fox

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Modelling future aquatic habitats						
2017FAH1	Develop Model in Key Pools	30-Mar-17	30-Jul-17		Sedimentation data has been analyzed and methods to determine general associations with backwater characteristics are being developed	Jim Rogala
2017FAH2	Apply Model to entire system	30-Aug-17				Jim Rogala
2017FAH3	Draft report	30-Sep-17				Jim Rogala
Floodplain Habitats						
2017FH1	Develop water surface profiles and flood inundation models for the UMRS	30-Jan-17	31-Jul-17		In progress; delayed due to USCOE gage data availability. Final data received on 7-6-2017.	Molly Van Appledorn
2017FH2	Refine/update levee and lidar data for isolated areas	28-Feb-17	30-Sep-17		These features will be updated once the flood inundation models (tracking number 2017FH1) have been developed	Jason Rohweder
2017FH3	Analyze floodplain vegetation and forestry data	30-Apr-17	TBD		Final analysis completed after flood inundation model competed (See 2017FH1)	Molly Van Appledorn, Nate De Jager
2017FH4	Draft report	30-Sep-17				Molly Van Appledorn, Nate De Jager
2017FH5	Apply ecological relationships to entire system and incorporate into Geodatabase	30-Sep-17				Tim Fox
Modelling future floodplain habitats						
2017FFH1	Format/develop input datasets	30-Mar-17		30-Mar-17	Developed initial communities and ecoregions rasters to use in LANDIS forest succession models.	Jason Rohweder
2017FFH2	Develop flood inundation model extension	30-Mar-17		30-Mar-17		Fox
2017FFH3	Conduct modelling and write draft report	30-Sep-17				Nate De Jager
Geodatabase						
2017GEO1	Develop Geodatabase/compile all lookup tables and data layers	30-Sep-17				Tim Fox
Landscape Pattern Research and Application						
2017L1	Presentations: Habitat Needs Assessment for the UMR (and related conf. calls and such)	30-Sep-17				De Jager
2017L2	Data/Map Set: Reed canarygrass abundance and distribution in the UMR (Pools 3-13) and areas at risk of invasion	30-Sep-17		1-May-17	In USGS review	De Jager, Rohweder, Hoy (UMESC)
On-Going						
2016L3	Draft Manuscript: Review of Landscape Ecology on the UMR	30-Sep-16	30-Sep-17		delayed due to work on the HNA-II	De Jager (UMESC)
2016L4	Draft Manuscript: Reed canarygrass abundance and distribution in the UMR.	30-Sep-16	30-Sep-17		delayed due to work on the HNA-II	Miller & Thomson (UW-L), De Jager Hoy and Rohweder (UMESC)

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Intended for distribution						
Manuscript: De Jager, N.R., Rohweder, J.J. In Review. Changes in aquatic vegetation and floodplain land cover in the Upper Mississippi River System (1989-2000-2010). (2016L1) (Environ Monit Assess (2017) 189:77 DOI 10.1007/s10661-017-5774-0)						
Manuscript: Swanson, W., De Jager, N.R., Strauss, E.A., Thomsen, M. In Review. Effects of flood inundation and invasion by *Phalaris arundinacea* on nitrogen cycling in an Upper Mississippi River floodplain forest. (2016L2) (in USGS Review)						
Manuscript: De Jager, N.R., Swanson, W., Hernandez, D.L., Reich, J., Erickson, R., Strauss, E.A. Effects of flood inundation, invasion by *Phalaris arundinacea* , and nitrogen deposition on extracellular enzyme activity in an Upper Mississippi River floodplain forest. (2015L5) (in USGS Review)						
Manuscript: Van Appledorn, M., De Jager, N.R., Johnson, K. Considerations for improving floodplain research and management by integrating inundation modeling, ecosystem studies, and ecosystem services (2016L5) (delayed due to HNA II)						
Manuscript: Weeks, A.M., De Jager, N.R., Haro, R.J., Sandland, G.J. 2017. Spatial and temporal relationships between the invasive snail *Bithynia tentaculata* and submersed aquatic vegetation in Pool 8 of the UMR. (2016L6) (River Res. Applic. Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/rra.3123)						
Manuscript: Scown, M. W., Thoms, M. C. and De Jager, N. R. The effects of survey technique and vegetation type on measuring floodplain topography from DEMs. Earth Surface Processes and Landforms. (2015L8) (in USGS Review)						
Spatial Patterns of native mussels in the UMRS						
2016MRF1	Draft Completion report: Spatial patterns of native mussels in the UMRS	15-Sep-17				Ries, Newton, De Jager, Zigler
2016MRF2	Final completions report: Spatial patterns of native mussels in the UMRS	15-Nov-17				Ries, Newton, De Jager, Zigler
Pool 4 - Peterson Lake HREP Water Quality Monitoring – Pre and Post-Adaptive Management Evaluation						
2017PL1	Collection of pre-construction winter water quality data	1-Feb-17		1-Feb-17		Burdis, Moore, DeLain, Lund
2017PL2	Collection of pre-construction summer water quality data	1-Aug-17				Burdis, Moore, DeLain, Lund
2017PL3	Collection of post-construction winter water quality data	February 2018 – 2019(?) Dependent on construction date				Burdis, Moore, DeLain, Lund
2017PL4	Collection of post-construction summer water quality data	February 2018 – 2019(?) Dependent on construction date				Burdis, Moore, DeLain, Lund
2017PL5	Summary report: Tabular and graphical summary of water quality data	February 2018 – 2019(?) Dependent on construction date				Burdis, Moore
Pool 12 Overwintering HREP Adaptive Management Fisheries Response Monitoring						
2017P13a	Collect annual increment of pool-wide electrofishing data	1-Nov-16		1-Nov-16		Bierman and Bowler
2017P13b	Collect annual increment of fyke netting data from backwater lakes	15-Nov-16		15-Nov-16		Bierman and Bowler
2017P13c	Perform otolith extraction from bluegills for aging	1-Dec-16		1-Dec-16		Bierman and Bowler
2017P13d	Age determination of bluegills collected in Fall 2014	1-Feb-17		1-Feb-17		Bierman and Bowler
2017P13e	In-house project databases updated	31-Mar-17		31-Mar-17		Bierman and Bowler
2017P13f	Summary report compiled and made available to program partners	30-Sep-17				Bierman and Bowler
Pool 12 Overwintering HREP Adaptive Management Fisheries Response Monitoring – Pre-project Biological Response Monitoring; Crappie Telemetry –Kehough Lake						
2017AM1	Capture fish and affix radio tags to white crappies in study lakes	1-Nov-16		1-Nov-16		Bierman, Hansen, Bowler, Theiling
2017AM2	Location of tagged fish and update in-house project database	Ongoing through FY17				Bierman, Hansen, Bowler, Theiling
2017AM3	Complete tracking portion of study	30-Sep-17				Bierman, Hansen, Bowler, Theiling
2017AM4	Summary report: Analysis of tracking data and quantification of 80% UDs for Stone, Tippy, and Green lakes	30-Sep-17				Bierman, Hansen, Bowler, Theiling

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
2017AM5	Summary report: Analysis of tracking data and quantification of 80% UDs for Kehough lake	30-Sep-18				Bierman, Hansen, Bowler, Theiling
Understanding biological shifts in the UMR due to invasion by *Potamogeton crispus*-Year 2						
2016PC2	Draft Report: Understanding biological shifts in the UMR due to invasion by *Potamogeton crispus*	1-Jun-17		5-May-17	LTRM-2016PC2	Drake, Giblin, Nissen, Kalas
Assessing recent rates of sedimentation in the backwaters of Pools 4, 8, and 13 to support river restoration and the Habitat Needs Assessment						
2017ST1	Reestablishment of horizontal and vertical temporary benchmarks, and a data base for horizontal and vertical benchmarks	30-Mar-17		1-Feb-17	Majority of benchmarks found in Pools 4 and 8. Due to poor ice conditions in winter 2016, Pool 13 work will take place in winter 2017.	Rogala, Moore, Kalas, Bierman
2017ST2	Open-water nearshore surveys completed and a database	31-Jul-17		2-Jan-17		Rogala, Moore, Kalas, Bierman
2017ST3	Over-ice surveys completed and a database	30-Mar-17		30-Mar-17		Rogala, Moore, Kalas, Bierman
2017ST4	Data analysis and completion report on sedimentation rates along transects	30-Sep-17				Rogala, Moore, Kalas, Bierman
Developing and applying trajectory analysis methods for UMRR Status and Trends indicators – Year 2						
2015B16	Draft Manuscript: Fish Trajectory Analysis	30-Sep-16	31-Oct-17		2015B16 and 2016B17 will be submitted to journal concurrently. 2015B16 With Minchin for final review	Ickes, Minchin
2016B17	Draft Manuscript: Developing and applying trajectory analysis methods	31-Oct-17				Ickes, Minchin
Statistical Evaluation						
On-Going						
2016E2	Draft manuscript: How well do trends in LTRM percent frequency of occurrence SAV statistics track trends in true occurrence?	30-Sep-16	30-Sep-17			Gray
Intended for distribution						
Manuscript: Inferring decreases in among- backwater heterogeneity in large rivers using among-backwater variation in limnological variables (2010E1, Rogala, Gray, Houser) (In USGS review)						
Additional Aquatic Vegetation, Fisheries, and Water Quality Research--On-Going Work from previous Fiscal years						
Aquatic Vegetation Component						
2015A7	Data compilation and analysis: Aquatic macrophyte communities and their potential lag time in response to changes in physical and chemical variables	30-Jun-15	30-Dec-17		Eric Lund, new vegetation component specialist will be taking over this project	Lund
2015A8	Draft completion report or manuscript: Aquatic macrophyte communities and their potential lag time response to changes in physical and chemical variables in the LTRM vegetation pools	30-Jun-16	30-Jun-18		Eric Lund, new vegetation component specialist will be taking over this project	Lund
2016A6a	Draft manuscript: Aquatic Plant Response to Large-Scale Island Construction in the Upper Mississippi River.	30-Sep-16	31-Jan-17	8-Jun-17	In USGS review	Drake and Gray

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
2016A7	Draft completion report: How many years did the effects of the 2001-2002 Pool 8 drawdown on arrowheads (*Sagittaria latifolia* and *S. rigida*) last?	30-May-16	30-Aug-17			Yin
Fisheries Component						
2006B6	Draft manuscript: Spatial structure and temporal variation of fish communities in the Upper Mississippi River.	TBD				Chick
2016B14	Draft completion report: Exploring Years with Low Total Catch of Fishes in Pool 26	30-Sep-16	30-Sep-17		Delayed due to moving to new field station Bldg.	Gittinger, Ratcliff, Lubinski, Chick
Water Quality Component						
2015D15	Analysis of Lake Pepin rotifers; data from 2012-2014	30-Jun-15	30-Jun-17	14-Jul-17		Burdis
2015D16	Draft manuscript: Trends in water quality and biota in segments of Pool 4, above and below Lake Pepin	27-Feb-15	30-Dec-17			Burdis
Intended for Distribution						
Manuscript: 2016B12: Ward, D.L., A. F. Casper, T. D. Counihan, J. M. Bayer, I. R. Waite, J. J. Kosovich, C. G. Chapman, E. R. Irwin, J. S. Sauer, B. S. Ickes, and A. J. McKerrow. 2017. Long-Term Fish Monitoring in Large Rivers: Utility of "Benchmarking" across Basins. Fisheries Vol. 42 , Iss. 2. DOI: 10.1080/03632415.2017.1276330						
Manuscript: An Assessment of Long Term Changes in Fish Communities within Large Rivers of the United States Counihan, Ickes, Casper, Sauer 2016B13 (resubmitting to PLOS One; accepted with revisions)						
LTRM Report: Anderson, Alison M.; Casper, Andrew F.; McCain, Kathryn N.S. 2017. Fish Indicators of Ecosystem Health: Upper Mississippi River System INHS Technical Report 2017 (16)						
Manuscript: Gibson-Reinemer, D.K., Chick, J.H., VanMiddlesworth, T.D. et al. 2017. Widespread and enduring demographic collapse of invasive common carp (*Cyprinus carpio*) in the Upper Mississippi River System. Biol Invasions. doi:10.1007/s10530-017-1405-5						
Manuscript:2016D17: Robert M. Burdis & Jodene K. Hirsch (2017) Crustacean zooplankton dynamics in a natural riverine lake, Upper Mississippi River, Journal of Freshwater Ecology, 32:1, 240-258, DOI: 10.1080/02705060.2017.1279080						
USACE UMRR LTRM Technical Support						
2017COE1	Quarterly update submitted to the LTRM Management Team	31-Dec-16		31-Dec-16		McCain, Theiling, Potter
2017COE2	Quarterly update submitted to the LTRM Management Team	30-Mar-17				McCain, Theiling, Potter
2017COE3	Quarterly update submitted to the LTRM Management Team	30-Jun-17				McCain, Theiling, Potter
2017COE4	Quarterly update submitted to the LTRM Management Team	30-Sep-17				McCain, Theiling, Potter
UMRR LTRM Team Meeting						
2017FM1	Meeting date coordination	16-Jan-17		16-Jan-17		All LTRM Staff
2017FM2	Agenda development	10-Feb-17		10-Feb-17		All LTRM Staff, led by UMESC
2017FM3	Meeting logistics	On-Going		Complete		Sauer
20157M4	Meeting participation	Week of March 27, 2017		Complete		All LTRM Staff
A-Team and UMRR-CC Participation On-going						
Estimating backwater sedimentation resulting from alluvial fan formation						
2017SED1	Land cover GIS datasets identifying areas of potential alluvial fan formation	30-Sep-17				Rogala, Hansen, Nelson
2017SED2	Draft contract report summarizing findings and providing recommendations for expanding the project system-wide	31-Dec-17				Rogala, Hansen, Nelson
2017SED3	Final Report	30-Jun-18				Rogala, Hansen, Nelson

Tracking number	Milestone	Original Target Date	Modified Target Date	Date Completed	Comments	Lead
Advancing our understanding of habitat requirements of fish assemblages using multi-species models						
2017FA1	Draft report on period-specific inferences on environmental gradients and species-environment associations by period	15-Feb-18				Bouska, Gray
2017FA2	Final Report	15-Sep-18				Bouska, Gray
Investigation of metabolism, nutrient processing, and fish community in floodplain water bodies of the Middle Mississippi River						
2017MMF1	Fish and water quality databases completed	30-Aug-17				Sobotka
2017MMF2	Draft report completed - will detail differences between the floodplain habitats and the main channel and associations between fish community and water quality attributes with connectivity of the water body to floodwaters or the main channel	30-Dec-17				Sobotka
2017MMF3	Final Report	30-Jun-18				Sobotka
Mapping the thermal landscape of the Upper Mississippi River: A Pilot Study						
2017TL1	Draft report on feasibility and utility of surface water temperature map	30-Dec-17				Jankowski, Robinson, Ruhser
2017TL2	Final report and data distribution	30-Mar-18				Jankowski, Robinson, Ruhser
Evaluation of a System-Wide Floodplain Inundation Model for Ecological Applications						
2017FH6	Site selection and field protocol finalization	31-Mar-17		31-Mar-17		Van Appledorn, Moore, Fischer, Bierman, Chick, Herzog, and Casper
2017FH7	Preparation and deployment of temperature loggers	30-Apr-17		30-Apr-17		Van Appledorn, Moore, Fischer, Bierman, Chick, Herzog, and Casper
2017FH8	Conduct spatially-extensive field sampling effort during high river stage	30-Jun-17		30-Jun-17		Van Appledorn, Moore, Fischer, Bierman, Chick, Herzog, and Casper
2017FH9	Conduct spatially-extensive field sampling effort during moderate to moderately-low river stages	31 August, 2017				Van Appledorn, Moore, Fischer, Bierman, Chick, Herzog, and Casper
2017FH10	Retrieve temperature loggers	30-Sep-17				Van Appledorn, Moore, Fischer, Bierman, Chick, Herzog, and Casper
2017FH11	Post-processing and analysis of logger data and water-edge mapping	31-Oct-17				Van Appledorn
2017FH12	A written summary of validation results will be submitted as a supplement to the Habitat Needs Assessment II that identifies potential sources of UMRS inundation model error, discusses the validity of the model's assumptions, and provides guidance on appropriate model use.	31-Dec-17				Van Appledorn

ATTACHMENT D

Additional Items

QUARTERLY MEETINGS
FUTURE MEETING SCHEDULE

NOVEMBER 2017

St. Paul, Minnesota

November 6	UMRBA WQEC Meeting
November 7	UMRBA Quarterly Meeting
November 8	UMRR Coordinating Committee Quarterly Meeting

FEBRUARY 2018

Moline, Illinois

February 6	UMRBA Quarterly Meeting
February 7	UMRR Coordinating Committee Quarterly Meeting

Acronyms Frequently Used on the Upper Mississippi River System

AAR	After Action Report
A&E	Architecture and Engineering
ACRCC	Asian Carp Regional Coordinating Committee
AFB	Alternative Formulation Briefing
AHAG	Aquatic Habitat Appraisal Guide
AHRI	American Heritage Rivers Initiative
AIS	Aquatic Invasive Species
ALC	American Lands Conservancy
ALDU	Aquatic Life Designated Use(s)
AM	Adaptive Management
ANS	Aquatic Nuisance Species
AP	Advisory Panel
APE	Additional Program Element
ARRA	American Recovery and Reinvestment Act
ASA(CW)	Assistant Secretary of the Army for Civil Works
A-Team	Analysis Team
ATR	Agency Technical Review
AWI	America’s Watershed Initiative
AWO	American Waterways Operators
AWQMN	Ambient Water Quality Monitoring Network
BA	Biological Assessment
BATIC	Build America Transportation Investment Center
BCR	Benefit-Cost Ratio
BMPs	Best Management Practices
BO	Biological Opinion
CAP	Continuing Authorities Program
CAWS	Chicago Area Waterways System
CCC	Commodity Credit Corporation
CCP	Comprehensive Conservation Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CG	Construction General
CIA	Computerized Inventory and Analysis
CMMP	Channel Maintenance Management Plan
COE	Corps of Engineers
COPT	Captain of the Port
CPUE	Catch Per Unit Effort
CRA	Continuing Resolution Authority
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSP	Conservation Security Program
CUA	Cooperative Use Agreement
CWA	Clean Water Act
DALS	Department of Agriculture and Land Stewardship
DED	Department of Economic Development

DEM	Digital Elevation Model
DET	District Ecological Team
DEWS	Drought Early Warning System
DNR	Department of Natural Resources
DO	Dissolved Oxygen
DOA	Department of Agriculture
DOC	Department of Conservation
DOER	Dredging Operations and Environmental Research
DOT	Department of Transportation
DPR	Definite Project Report
DQC	District Quality Control/Quality Assurance
DSS	Decision Support System
EA	Environmental Assessment
ECC	Economics Coordinating Committee
EEC	Essential Ecosystem Characteristic
EIS	Environmental Impact Statement
EMAP	Environmental Monitoring and Assessment Program
EMAP-GRE	Environmental Monitoring and Assessment Program-Great Rivers Ecosystem
EMP	Environmental Management Program [Note: Former name of Upper Mississippi River Restoration Program.]
EMP-CC	Environmental Management Program Coordinating Committee
EO	Executive Order
EPA	Environmental Protection Agency
EPR	External Peer Review
EQIP	Environmental Quality Incentives Program
ER	Engineering Regulation
ERDC	Engineering Research & Development Center
ESA	Endangered Species Act
EWMN	Early Warning Monitoring Network
EWP	Emergency Watershed Protection Program
FACA	Federal Advisory Committee Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FDR	Flood Damage Reduction
FFS	Flow Frequency Study
FONSI	Finding of No Significant Impact
FRM	Flood Risk Management
FRST	Floodplain Restoration System Team
FSA	Farm Services Agency
FTE	Full Time Equivalent
FWCA	Fish & Wildlife Coordination Act
FWIC	Fish and Wildlife Interagency Committee
FWS	Fish and Wildlife Service
FWWG	Fish and Wildlife Work Group
FY	Fiscal Year
GAO	Government Accountability Office
GEIS	Generic Environmental Impact Statement

GI	General Investigations
GIS	Geographic Information System
GLC	Governors Liaison Committee
GLC	Great Lakes Commission
GLMRIS	Great Lakes and Mississippi River Interbasin Study
GPS	Global Positioning System
GREAT	Great River Environmental Action Team
GRP	Geographic Response Plan
HAB	Harmful Algal Bloom
HEL	Highly Erodible Land
HEP	Habitat Evaluation Procedure
HNA	Habitat Needs Assessment
HQUSACE	Headquarters, USACE
H.R.	House of Representatives
HREP	Habitat Rehabilitation and Enhancement Project
HU	Habitat Unit
HUC	Hydrologic Unit Code
IBA	Important Bird Area
IBI	Index of Biological (Biotic) Integrity
IC	Incident Commander
ICS	Incident Command System
ICWP	Interstate Council on Water Policy
IDIQ	Indefinite Delivery/Indefinite Quantity
IEPR	Independent External Peer Review
IIA	Implementation Issues Assessment
ILP	Integrated License Process
IMTS	Inland Marine Transportation System
IRCC	Illinois River Coordinating Council
IRPT	Inland Rivers, Ports & Terminals
IRTC	Implementation Report to Congress
IRWG	Illinois River Work Group
ISA	Inland Sensitivity Atlas
IWR	Institute for Water Resources
IWRM	Integrated Water Resources Management
IWTF	Inland Waterways Trust Fund
IWUB	Inland Waterways Users Board
IWW	Illinois Waterway
L&D	Lock(s) and Dam
LC/LU	Land Cover/Land Use
LDB	Left Descending Bank
LERRD	Lands, Easements, Rights-of-Way, Relocation of Utilities or Other Existing Structures, and Disposal Areas
LiDAR	Light Detection and Ranging
LMR	Lower Mississippi River
LMRCC	Lower Mississippi River Conservation Committee
LOI	Letter of Intent
LTRM	Long Term Resource Monitoring

M-35	Marine Highway 35
MAFC	Mid-America Freight Coalition
MARAD	U.S. Maritime Administration
MARC 2000	Midwest Area River Coalition 2000
MICRA	Mississippi Interstate Cooperative Resource Association
MIPR	Military Interdepartmental Purchase Request
MMR	Middle Mississippi River
MMRP	Middle Mississippi River Partnership
MNRG	Midwest Natural Resources Group
MOA	Memorandum of Agreement
MoRAST	Missouri River Association of States and Tribes
MOU	Memorandum of Understanding
MRAPS	Missouri River Authorized Purposes Study
MRBI	Mississippi River Basin (Healthy Watersheds) Initiative
MRC	Mississippi River Commission
MRCTI	Mississippi River Cities and Towns Initiative
MRRC	Mississippi River Research Consortium
MR&T	Mississippi River and Tributaries (project)
MSP	Minimum Sustainable Program
MVD	Mississippi Valley Division
MVP	St. Paul District
MVR	Rock Island District
MVS	St. Louis District
NAS	National Academies of Science
NAWQA	National Water Quality Assessment
NCP	National Contingency Plan
NIDIS	National Integrated Drought Information System (NOAA)
NEBA	Net Environmental Benefit Analysis
NECC	Navigation Environmental Coordination Committee
NED	National Economic Development
NEPA	National Environmental Policy Act
NESP	Navigation and Ecosystem Sustainability Program
NETS	Navigation Economic Technologies Program
NGO	Non-Governmental Organization
NGRREC	National Great Rivers Research and Education Center
NICC	Navigation Interests Coordinating Committee
NPDES	National Pollution Discharge Elimination System
NPS	Non-Point Source
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRDAR	Natural Resources Damage Assessment and Restoration
NRT	National Response Team
NSIP	National Streamflow Information Program
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	Operation and Maintenance

OHWM	Ordinary High Water Mark
OMB	Office of Management and Budget
OMRR&R	Operation, Maintenance, Repair, Rehabilitation, and Replacement
OPA	Oil Pollution Act of 1990
ORSANCO	Ohio River Valley Water Sanitation Commission
OSC	On-Scene Coordinator
OSE	Other Social Effects
OSIT	On Site Inspection Team
P3	Public-Private Partnerships
PA	Programmatic Agreement
PAS	Planning Assistance to States
P&G	Principles and Guidelines
P&R	Principles and Requirements
P&S	Plans and Specifications
P&S	Principles and Standards
PCA	Pollution Control Agency
PCA	Project Cooperation Agreement
PCX	Planning Center of Expertise
PDT	Project Delivery Team
PED	Preliminary Engineering and Design
PgMP	Program Management Plan
PILT	Payments In Lieu of Taxes
PIR	Project Implementation Report
PL	Public Law
PMP	Project Management Plan
PORT	Public Outreach Team
PPA	Project Partnership Agreement
PPT	Program Planning Team
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RCP	Regional Contingency Plan
RCPP	Regional Conservation Partnership Program
RDB	Right Descending Bank
RED	Regional Economic Development
RIFO	Rock Island Field Office
RM	River Mile
RP	Responsible Party
RPT	Reach Planning Team
RRAT	River Resources Action Team
RRCT	River Resources Coordinating Team
RRF	River Resources Forum
RRT	Regional Response Team
RST	Regional Support Team
RTC	Report to Congress
S.	Senate
SAV	Submersed Aquatic Vegetation
SDWA	Safe Drinking Water Act

SEMA	State Emergency Management Agency
SET	System Ecological Team
SONS	Spill of National Significance
SOW	Scope of Work
SRF	State Revolving Fund
SWCD	Soil and Water Conservation District
T&E	Threatened and Endangered
TEUs	twenty-foot equivalent units
TIGER	Transportation Investment Generating Economic Recovery
TLP	Traditional License Process
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSS	Total Suspended Solids
TVA	Tennessee Valley Authority
TWG	Technical Work Group
UMESC	Upper Midwest Environmental Sciences Center
UMIMRA	Upper Mississippi, Illinois, and Missouri Rivers Association
UMR	Upper Mississippi River
UMRBA	Upper Mississippi River Basin Association
UMRBC	Upper Mississippi River Basin Commission
UMRCC	Upper Mississippi River Conservation Committee
UMRCP	Upper Mississippi River Comprehensive Plan
UMR-IWW	Upper Mississippi River-Illinois Waterway
UMRNWFR	Upper Mississippi River National Wildlife and Fish Refuge
UMRR	Upper Mississippi River Restoration Program [Note: Formerly known as Environmental Management Program.]
UMRS	Upper Mississippi River System
UMWA	Upper Mississippi Waterway Association
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VTC	Video Teleconference
WCI	Waterways Council, Inc.
WES	Waterways Experiment Station (replaced by ERDC)
WHAG	Wildlife Habitat Appraisal Guide
WHIP	Wildlife Habitat Incentives Program
WLMTF	Water Level Management Task Force
WQ	Water Quality
WQEC	Water Quality Executive Committee
WQTF	Water Quality Task Force
WQS	Water Quality Standard
WRDA	Water Resources Development Act
WRP	Wetlands Reserve Program
WRRDA	Water Resources Reform and Development Act

Upper Mississippi River Restoration Program Authorization

Section 1103 of the Water Resources Development Act of 1986 (P.L. 99-662) as amended by
Section 405 of the Water Resources Development Act of 1990 (P.L. 101-640),
Section 107 of the Water Resources Development Act of 1992 (P.L. 102-580),
Section 509 of the Water Resources Development Act of 1999 (P.L. 106-53),
Section 2 of the Water Resources Development Technical Corrections of 1999 (P.L. 106-109), and
Section 3177 of the Water Resources Development Act of 2007 (P.L. 110-114).

Additional Cost Sharing Provisions

Section 906(e) of the Water Resources Development Act of 1986 (P.L. 99-662) as amended by
Section 221 of the Water Resources Development Act of 1999 (P.L. 106-53).

SEC. 1103. UPPER MISSISSIPPI RIVER PLAN.

(a)(1) This section may be cited as the "Upper Mississippi River Management Act of 1986".

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system. Congress further recognizes that the system provides a diversity of opportunities and experiences. The system shall be administered and regulated in recognition of its several purposes.

(b) For purposes of this section --

(1) the terms "Upper Mississippi River system" and "system" mean those river reaches having commercial navigation channels on the Mississippi River main stem north of Cairo, Illinois; the Minnesota River, Minnesota; Black River, Wisconsin; Saint Croix River, Minnesota and Wisconsin; Illinois River and Waterway, Illinois; and Kaskaskia River, Illinois;

(2) the term "Master Plan" means the comprehensive master plan for the management of the Upper Mississippi River system, dated January 1, 1982, prepared by the Upper Mississippi River Basin Commission and submitted to Congress pursuant to Public Law 95-502;

(3) the term "GREAT I, GREAT II, and GRRM studies" means the studies entitled "GREAT Environmental Action Team--GREAT I--A Study of the Upper Mississippi River", dated September 1980, "GREAT River Environmental Action Team--GREAT II--A Study of the Upper Mississippi River", dated December 1980, and "GREAT River Resource Management Study", dated September 1982; and

(4) the term "Upper Mississippi River Basin Association" means an association of the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, formed for the purposes of cooperative effort and united assistance in the comprehensive planning for the use, protection, growth, and development of the Upper Mississippi River System.

(c)(1) Congress hereby approves the Master Plan as a guide for future water policy on the Upper Mississippi River system. Such approval shall not constitute authorization of any recommendation contained in the Master Plan.

(2) Section 101 of Public Law 95-502 is amended by striking out the last two sentences of subsection (b), striking out subsection (i), striking out the final sentence of subsection (j), and redesignating subsection "(j)" as subsection "(i)".

(d)(1) The consent of the Congress is hereby given to the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, or any two or more of such States, to enter into negotiations for agreements, not in conflict with any law of the United States, for cooperative effort and mutual assistance in the comprehensive planning for the use, protection, growth, and development of the Upper Mississippi River system, and to establish such agencies, joint or otherwise, or designate an existing multi-State entity, as they may deem desirable for making effective such agreements. To the extent required by Article I, section 10 of the Constitution, such agreements shall become final only after ratification by an Act of Congress.

(2) The Secretary is authorized to enter into cooperative agreements with the Upper Mississippi River Basin Association or any other agency established under paragraph (1) of this subsection to promote and facilitate active State government participation in the river system management, development, and protection.

(3) For the purpose of ensuring the coordinated planning and implementation of programs authorized in subsections (e) and (h)(2) of this section, the Secretary shall enter into an interagency agreement with the Secretary of the Interior to provide for the direct participation of, and transfer of funds to, the Fish and Wildlife Service and any other agency or bureau of the Department of the Interior for the planning, design, implementation, and evaluation of such programs.

(4) The Upper Mississippi River Basin Association or any other agency established under paragraph (1) of this subsection is hereby designated by Congress as the caretaker of the master plan. Any changes to the master plan recommended by the Secretary shall be submitted to such association or agency for review. Such association or agency may make such comments with respect to such recommendations and offer other recommended changes to the master plan as such association or agency deems appropriate and shall transmit such comments and other recommended changes to the Secretary. The Secretary shall transmit such recommendations along with the comments and other recommended changes of such association or agency to the Congress for approval within 90 days of the receipt of such comments or recommended changes.

(e) Program Authority

(1) Authority

(A) In general. The Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, may undertake, as identified in the master plan

(i) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement; and

(ii) implementation of a long-term resource monitoring, computerized data inventory and analysis, and applied research program, including research on water quality issues affecting the Mississippi River (including elevated nutrient levels) and the development of remediation strategies.

(B) Advisory committee. In carrying out subparagraph (A)(i), the Secretary shall establish an independent technical advisory committee to review projects, monitoring plans, and habitat and natural resource needs assessments.

(2) REPORTS. — Not later than December 31, 2004, and not later than December 31 of every sixth year thereafter, the Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, shall submit to Congress a report that —

(A) contains an evaluation of the programs described in paragraph (1);

(B) describes the accomplishments of each of the programs;

(C) provides updates of a systemic habitat needs assessment; and

(D) identifies any needed adjustments in the authorization of the programs.

(3) For purposes of carrying out paragraph (1)(A)(i) of this subsection, there is authorized to be appropriated to the Secretary $22,750,000 for fiscal year 1999 and each fiscal year thereafter.

(4) For purposes of carrying out paragraph (1)(A)(ii) of this subsection, there is authorized to be appropriated to the Secretary $10,420,000 for fiscal year 1999 and each fiscal year thereafter.

(5) Authorization of appropriations.—There is authorized to be appropriated to carry out paragraph (1)(B) $350,000 for each of fiscal years 1999 through 2009.

(6) Transfer of amounts.—For fiscal year 1999 and each fiscal year thereafter, the Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, may transfer not to exceed 20 percent of the amounts appropriated to carry out clause (i) or (ii) of paragraph (1)(A) to the amounts appropriated to carry out the other of those clauses.

(7)(A) Notwithstanding the provisions of subsection (a)(2) of this section, the costs of each project carried out pursuant to paragraph (1)(A)(i) of this subsection shall be allocated between the Secretary and the appropriate non-Federal sponsor in accordance with the provisions of section 906(e) of this Act; except that the costs of operation and maintenance of projects located on Federal lands or lands owned or operated by a State or local government shall be borne by the Federal, State, or local agency that is responsible for management activities for fish and wildlife on such lands and, in the case of any project requiring non-Federal cost sharing, the non-Federal share of the cost of the project shall be 35 percent.

(B) Notwithstanding the provisions of subsection (a)(2) of this section, the cost of implementing the activities authorized by paragraph (1)(A)(ii) of this subsection shall be allocated in accordance with the provisions of section 906 of this Act, as if such activity was required to mitigate losses to fish and wildlife.

(8) None of the funds appropriated pursuant to any authorization contained in this subsection shall be considered to be chargeable to navigation.

(f) (1) The Secretary, in consultation with any agency established under subsection (d)(1) of this section, is authorized to implement a program of recreational projects for the system substantially in accordance with the recommendations of the GREAT I, GREAT II, and GRRM studies and the master plan reports. In addition, the Secretary, in consultation with any such agency, shall, at Federal expense, conduct an assessment of the economic benefits generated by recreational activities in the system. The cost of each such project shall be allocated between the Secretary and the appropriate non-Federal sponsor in accordance with title I of this Act.

(2) For purposes of carrying out the program of recreational projects authorized in paragraph (1) of this subsection, there is authorized to be appropriated to the Secretary not to exceed $500,000 per fiscal year for each of the first 15 fiscal years beginning after the effective date of this section.

(g) The Secretary shall, in his budget request, identify those measures developed by the Secretary, in consultation with the Secretary of Transportation and any agency established under subsection (d)(1) of this section, to be undertaken to increase the capacity of specific locks throughout the system by employing nonstructural measures and making minor structural improvements.

(h)(1) The Secretary, in consultation with any agency established under subsection (d)(1) of this section, shall monitor traffic movements on the system for the purpose of verifying lock capacity, updating traffic projections, and refining the economic evaluation so as to verify the need for future capacity expansion of the system.

(2) Determination.

(A) In general. The Secretary in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, shall determine the need for river rehabilitation and environmental enhancement and protection based on the condition of the environment, project developments, and projected environmental impacts from implementing any proposals resulting from recommendations made under subsection (g) and paragraph (1) of this subsection.

(B) Requirements. The Secretary shall

(i) complete the ongoing habitat needs assessment conducted under this paragraph not later than September 30, 2000; and

(ii) include in each report under subsection (e)(2) the most recent habitat needs assessment conducted under this paragraph.

(3) There is authorized to be appropriated to the Secretary such sums as may be necessary to carry out this subsection.

(i) (1) The Secretary shall, as he determines feasible, dispose of dredged material from the system pursuant to the recommendations of the GREAT I, GREAT II, and GRRM studies.

(2) The Secretary shall establish and request appropriate Federal funding for a program to facilitate productive uses of dredged material. The Secretary shall work with the States which have, within their boundaries, any part of the system to identify potential users of dredged material.

(j) The Secretary is authorized to provide for the engineering, design, and construction of a second lock at locks and dam 26, Mississippi River, Alton, Illinois and Missouri, at a total cost of $220,000,000, with a first Federal cost of $220,000,000. Such second lock shall be constructed at or in the vicinity of the location of the replacement lock authorized by section 102 of Public Law 95-502. Section 102 of this Act shall apply to the project authorized by this subsection.

SEC. 906(e). COST SHARING.

(e) In those cases when the Secretary, as part of any report to Congress, recommends activities to enhance fish and wildlife resources, the first costs of such enhancement shall be a Federal cost when--

(1) such enhancement provides benefits that are determined to be national, including benefits to species that are identified by the National Marine Fisheries Service as of national economic importance, species that are subject to treaties or international convention to which the United States is a party, and anadromous fish;

(2) such enhancement is designed to benefit species that have been listed as threatened or endangered by the Secretary of the Interior under the terms of the Endangered Species Act, as amended (16 U.S.C. 1531, et seq.), or

(3) such activities are located on lands managed as a national wildlife refuge.

When benefits of enhancement do not qualify under the preceding sentence, 25 percent of such first costs of enhancement shall be provided by non-Federal interests under a schedule of reimbursement determined by the Secretary. Not more than 80 percent of the non-Federal share of such first costs may be satisfied through in-kind contributions, including facilities, supplies, and services that are necessary to carry out the enhancement project. The non-Federal share of operation, maintenance, and rehabilitation of activities to enhance fish and wildlife resources shall be 25 percent.

EMP OPERATING APPROACH

2006 marks the 20th anniversary of the Environmental Management Program (EMP). During that time, the Program pioneered many new ideas to help deliver efficient and effective natural resource programs to the Upper Mississippi River System (UMRS). These included the creation of an effective partnership of five states, five federal agencies, and numerous NGOs; a network of six field stations monitoring the natural resources of the UMRS; and the administrative structure to encourage river managers to use both new and proven environmental restoration techniques.

EMP has a history of identifying and dealing with both natural resource and administrative challenges. The next several years represent new opportunities and challenges as Congress considers authorization of the Navigation and Environmental Sustainability Program (NESP), possible integration or merger of EMP with NESP, and changing standards for program management and execution.

We will continue to learn from both the history of EMP and experience of other programs. Charting a course for EMP over the next several years is important to the continued success of the Program. EMP will focus on the key elements of partnership, regional administration and coordination, LTRMP, and HREPs.

The fundamental focus of EMP will not change, however the way we deliver our services must change and adapt. This will include:

- further refinements in regional coordination and management,
- refinement of program goals and objectives,
- increased public outreach efforts,
- development and use of tools such as the regional HREP database and HREP Handbook,
- exploring new delivery mechanisms for contracting,
- continued refinement of the interface between LTRMP and the HREP program components, and
- scientific and management application of LTRMP information and data.

The focus of these efforts must benefit the resources of the UMRS through efficient and effective management.