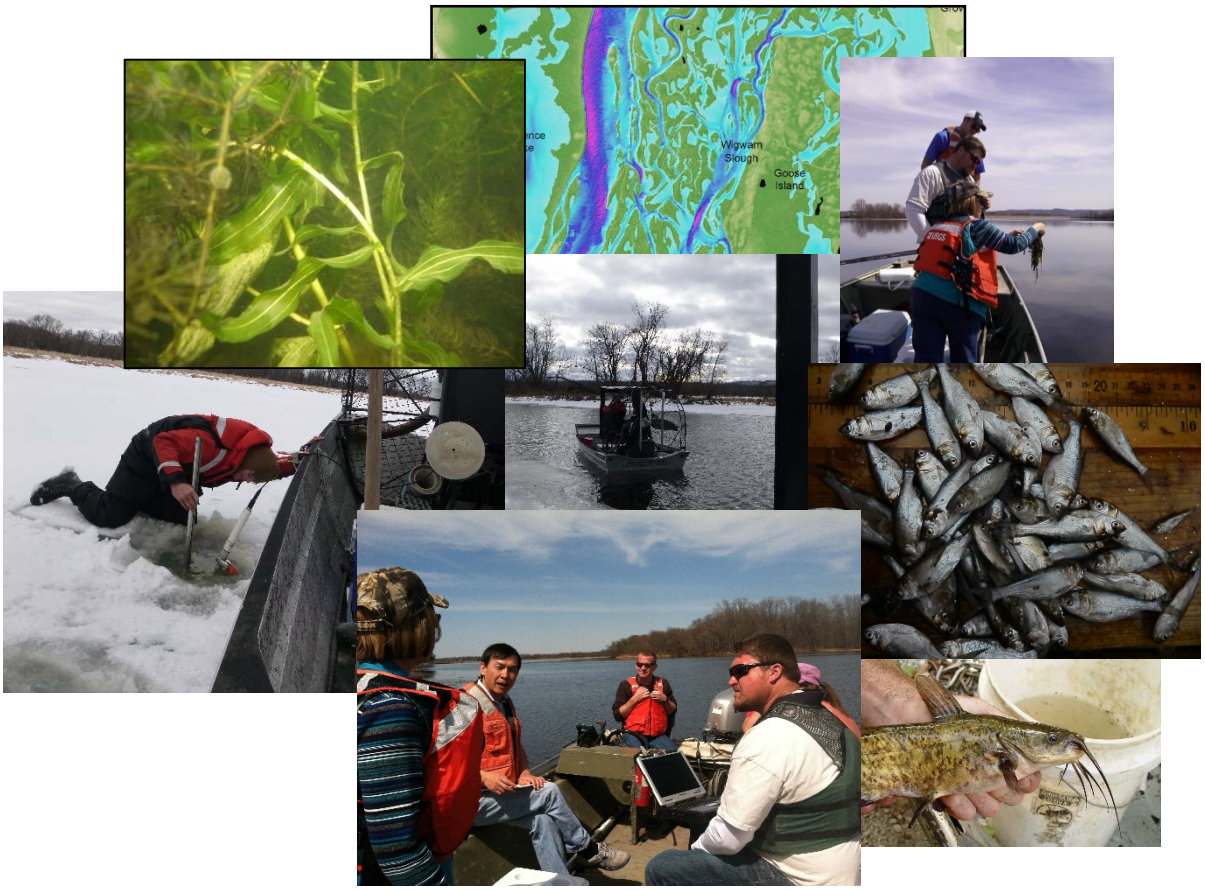
Upper Mississippi River Restoration Program

Long Term Resource Monitoring Element
FY16 SOW



Enhancing Restoration and Advancing Knowledge of the Upper Mississippi River

Addressing the
FY2015–2025 UMRR Strategic Plan

The Upper Mississippi River Restoration (UMRR) Program for the Upper Mississippi River System (UMRS) is first comprehensive program for ecosystem restoration, scientific research, and monitoring on a large river system in the Nation and the world. The UMRS is one of this Nation's unique natural resources. The ecosystem provides habitat to a wide array of fish and wildlife species distributed among a complex assortment of flowing channels, floodplain lakes, backwaters, wetlands, and floodplain forests. With an ecosystem as diverse and complex as the UMRS, many of its processes and their interrelationships are not well known. One way to help understand this multifaceted system is through environmental monitoring. The UMRR Long Term Resource Monitoring (LTRM) data provides the scientific foundation required for sound management actions, effective river restoration projects, and informed environmental policy decisions for the UMRS.

The value of UMRR LTRM's long term data set continues to grow. It serves as a foundation for the restoration of the UMRS by revealing patterns and trends, establishing benchmarks of the current state for comparison to future conditions, serving as an early warning of change, supporting planning and management through the identification of key issues and trends, and evaluating the effectiveness of restoration and management actions on the UMRS.

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FY16 UMRR LTRM (Base Monitoring) Scope of Work

This Scope of Work (SOW) describes tasks in support of the US Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program Long Term Resource Monitoring (LTRM) element, authorized by Congress in the 1986 Water Resources Development Act and reauthorized in the 1999 Water Resources Development Act, to be performed by the USGS-Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, and six state-operated field stations (Illinois, Iowa, Minnesota, Missouri, and Wisconsin). This long term monitoring directly supports Upper Mississippi River System (UMRS) understanding, critical for successful UMRS restoration by the UMRR. This SOW complements those work items in the UMRR Science in Support of Restoration and Management FY16 SOW.

A comprehensive monitoring program consists of environmental monitoring, research, systemic data acquisition, modeling, and information delivery in an effort to provide a solid scientific foundation upon which resource managers and policy makers base management actions and develop environmental policy.

Aquatic Vegetation Component

The objective of the UMRR LTRM Aquatic Vegetation Component is to collect quantitative data on the distribution and abundance of aquatic vegetation in the Upper Mississippi River System (UMRS) and to conduct research related to aquatic vegetation for the purpose of understanding its status, trends, ecological functions, and responses to disturbances and UMRR restoration activities. Aquatic vegetation in the UMRS is desirable because of its many values, most notably as food for migratory waterfowl (Korschgen et al. 1988) and habitat for fish. Monitoring data are collected within three LTRM study reaches in the UMRS (Pools 4, 8, and 13 on the Upper Mississippi River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols.

Methods

For monitoring aquatic vegetation, sampling will be conducted following the LTRM aquatic vegetation standard sampling protocol (Yin et al. 2000). A total of 1,350 sites will be surveyed, including 450 in Pool 4, 450 in Pool 8, and 450 in Pool 13 (Table 1). The presence/absence and abundance of aquatic plant species at each site will be measured and recorded. Pool-wide estimates of abundance and percent frequency of occurrence will be derived by pooling data over all strata.

New Product Descriptions

2016A5: Graphical summary and maps of aquatic vegetation current status and long-term trends.

Maps of where aquatic vegetation was recorded in Pool 4 (Upper Pool 4, Lower Pool 4 and Lake Pepin) during 2015 will be created using the UMRR LTRM vegetation data. Charts of annual species richness and annual frequency of occurrence of aquatic vegetation categories of

submersed aquatic vegetation (SAV), rooted floating, and emergent species, as well as specific species of interest will be produced. These annual vegetation updates are shared in October of 2015 with Mississippi River managers from the states of Minnesota, Wisconsin and Iowa, as well as the US Fish and Wildlife Service, US Army Corps of Engineers, US Geological Survey and the Upper Mississippi River Basin Association. Many river managers are interested in receiving these graphics and charts prior to the waterfowl migration.

Products and Milestones

Tracking number	Products	Staff	Milestones
2016A1	Complete data entry and QA/QC of 2015 data; 1250 observations.		
	a. Data entry completed and submission of data to USGS	Moore, Drake, Vogeler	30 November 2015
	b. Data loaded on level 2 browsers	Schlifer	15 December 2015
	c. QA/QC scripts run and data corrections sent to Field Stations	Sauer, Schlifer	28 December 2015
	d. Field Station QA/QC with corrections to USGS	Moore, Drake, Vogeler	15 January 2016
	e. Corrections made and data moved to public Web Browser	Yin, Sauer, Schlifer, Caucutt	30 January 2016
2016A2	Web-based: Creating surface distribution maps for aquatic plant species in Pools 4, 8, and 13; 2014 data	Yin, Rogala, Schlifer	31 July 2016
2016A3	Wisconsin DNR annual summary report 2015 that combines current year observations from LTRM with previous years' data, for the fish, aquatic vegetation, and water quality components.	Drake, Bartels, Hoof, Kalas	30 Sept 2016
2016A4	Complete aquatic vegetation sampling for Pools 4, 8, and 13 (Table 1)	Yin, Moore, Drake, Vogeler	31 August 2016
2016A5	Graphical summary and maps of aquatic vegetation current status and long-term trends.	Moore	30 Oct. 2015
2014A6	Annual Field Station Data Summary Report Template Development	Hagerty, Popp, Bierman, Chick, Herzog, Casper	30 Sept 2015

Intended for distribution
LTRM Technical Report: Ecological Assessment of High Quality UMRS Floodplain Forests (2007APE12; Chick, Guyon, Battaglia)
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)
LTRM completion report: FY05-07 data--Analysis and support of aquatic vegetation sampling data in Pools 6, 9, 18, and 19 (2008APE4a; Yin)
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)
Manuscript: A statistical model of species occupancy using the LTRM aquatic vegetation data (2013A7; Yin)

Fisheries Component

The objective of the UMRR LTRM Fisheries Component is to collect quantitative data on the distribution and abundance of fish species and communities in the UMRS and to conduct research related to fishes for the purpose of understanding resource status and trends, ecological functions, and response to disturbances and UMRR restoration activities. The UMRS is probably the most biologically productive and economically important large floodplain river system in the United States (Patrick 1998; U.S. Geological Survey 1999), and fish are one of the most important goods and services the UMRS provides to humans (Carlander 1954). Fishes within the UMRS are the subject of commercial and recreational fisheries, both of which contribute substantially to local economies (Fremling et al. 1989). Scientists and fishery managers also recognize fish communities as an integrative index for a complex set of physical and biological conditions on the UMRS.

Data are collected within six LTRM study reaches in the UMRS (Pools 4, 8, 13, and 26 and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Ratcliff et al. 2014).

Methods

For monitoring fish, sampling will be conducted following the LTRM study plan and standard protocols (Ratcliff et al. 2014) as modified in 2002 (Ickes and Burkhardt 2002). Species abundance, size structure, and community composition and structure will be measured over time. Between 250 and 400 samples will be collected in each study area (Table 1). Sample allocation will be based on a stratified random design, where strata include contiguous backwaters, main channel borders, main channel wingdams, impounded areas, and secondary channel borders. Tailwaters in the impounded reaches and tributary mouths in the Open River will be sampled under a fixed site design. Sampling effort will be allocated independently and equally across 3 sampling periods (June 15–July 31; August 1–September 15; September 16–October 31) to minimize risks of annual data loss during flood periods and to characterize seasonal patterns in abundance and habitat use. Pool-wide estimates of abundance will be derived by pooling data over all strata.

New Product Descriptions

2016B4: Floodplain fisheries sampling

Flooding caused random and fixed site fish sampling in the Open River reach of the LTRM to become extremely difficult and in some cases impossible during first period sampling of the 2015 field season. A decision was made to postpone normal LTRM sampling until the flood receded.

While waiting for the flood to recede, Big Rivers and Wetlands Field Station staff undertook a fish project comparing floodplain fish assemblage to the main channel assemblage, from 22 June to 23 July 2015. Data collected from this project will be entered in the LTRM Fish Application as a Special Project. The gear used was electrofishing and if time allowed trawling. Each gear used was equivalent to LTRM fish monitoring procedures. Sites were randomly selected based on availability. For every floodplain random site, there also was a nearby main channel random site.

Data will be used to compare diversity of species, length and weight, juvenile and adult abundance, and habitat usage between the floodplain and main channel during the flood.

2016B10 Open River Chevron Dike Monitoring

Chevron dikes are a relatively new structure designed by the U.S. Army Corps. Of Engineers to aide navigation by concentrating flow and inducing channel scour. They have also been justified for promoting physical habitat and habitat heterogeneity. To date, only a few studies of fish community have occurred for these structures.

Since 1993, river miles 29-80 on the Middle Mississippi have been monitored for fish community structure and water quality for the LTRMP (Ratcliff et al. 2014; Ickes et al. 2014). With this program, several habitats are sampled which include artificially manipulated river structures (i.e. revetment and wing dikes) (Ratcliff et al. 2014; Ickes et al 2014). However, chevrons are not included in the sampling protocol. Chevrons were constructed well after the program sampling methods were established. Also, the Open Rivers and Pool 26 are the only two of six LTRM reaches that have chevrons. The Open Rivers reach has six chevron dikes which occur from river miles 32-36. To date, only sporadic trotlining, electrofishing, and trawling from the Missouri Dept of Conservation and the U.S. Army Corps of Engineers has been done to evaluate these chevrons.

We propose that, when river stage allows, the chevrons are sampled once every LTRM fish monitoring period (June 15-July 31, Aug. 1-Sept. 15, and Sept 16-Oct. 31). Chevron dikes will be electro-fished following LTRM procedures with 15 minute 200 ft. runs. The “island tip” habitat near the chevron may also be electro-fished depending on availability due to river stage. Hoop net sampling based on LTRM procedures will be used to sample the scour hole directly behind the chevron dike.

Monitoring chevrons will give river scientists and managers important data on these relatively new river structures. This information could enable us to compare fish community structure to other chevrons in the Mississippi, compare to other river manipulations (wing dikes), and to other strata in the river system.

Products and Milestones

Tracking number	Products	Staff	Milestones
2016B1	Complete data entry, QA/QC of 2015 fish data; ~1,590 observations		
	a. Data entry completed and submission of data to USGS	DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton	31 January 2016
	b. Data loaded on level 2 browsers; QA/QC scripts run and data corrections sent to Field Stations	Ickes, Schlifer	15 February 2016
	c. Field Station QA/QC with corrections to USGS	DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton	15 March 2016

	d. Corrections made and data moved to public Web Browser	Ickes, Sauer, and Schlifer	30 March 2016
2016B2	Update Graphical Browser with 2015 data on Public Web Server.	Ickes, Sauer, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton, Schlifer	31 May 2016
2016B3	Complete fisheries sampling for Pools 4, 8, 13, 26, the Open River Reach, and La Grange Pool (Table 1)	Ickes, DeLain, Bartels, Bowler, Ratcliff, Gittinger, West, Solomon, Pendleton	31 October 2016
2016B4	Summary Letter: Floodplain fisheries sampling	West, Sobotka	31 October 2016
2016B5	IDNR Fisheries Management State Report: Fisheries Monitoring in Pool 13, Upper Mississippi River, 2015	Bowler	30 June 2016
2016B6	Sample collection, database increment, Summary letter on Asian carp age and growth: collection of cleithral bones	Solomon, Pendleton, Casper	31 January 2016
2016B7	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	Solomon, Pendleton, Casper	31 January 2016
2016B8(D)	Database increment: Stratified random day electrofishing samples collected in Pools 9–11	Bowler	30 Sept 2016
2016B9(D)	Database increment: Stratified random day electrofishing samples collected in Pools 16–18	Bowler	30 Sept 2016
2016B10	Summary Letter: Open River Chevron Dike monitoring	West, Sobotka	31 Oct 2016
Intended for distribution			
Completion report: LTRM Fisheries Component collection of six darter species from 1989–2004. (2006B13; Ridings)			
LTRM technical report; Setting quantitative fish management targets for LTRM monitoring (2008APE2; Sass)			
LTRM Completion report, compilation of 3 years of sampling: Fisheries (2009R1Fish; Chick et al.)			
Manuscript: Determining environmental history of three sturgeon species in the Upper, Middle, and Lower Mississippi Rivers. (2013B22; Phelps)			
Manuscript: Age-0 sturgeon habitat associations in the free flowing portion of the Upper Mississippi River (2012B5; Tripp, Phelps, Herzog)			
LTRM Fact Sheet: Tree map tool for visualizing fish data, with example of native versus non-native fish biomass (2013B16)			

Water Quality Component

The objective of the UMRR LTRM's water quality component is to conduct monitoring and research to obtain basic limnological information required to (1) increase understanding of the ecological structure and functioning of the UMRS, (2) document the status and trends of ecological conditions in the UMRS, and (3) contribute to the evaluation of management alternatives and actions in the UMRS. The water quality component focuses on a subset of limnological variables related to habitat quality and ecosystem function that includes physicochemical features, suspended sediment, and major plant nutrients known to be significant to aquatic habitat in this system.

Data are collected within six LTRM study reaches in the UMRS (Pools 4, 8, 13, 26, and Open River Reach on the Upper Mississippi River and La Grange Pool on the Illinois River). Data entry, quality assurance, data summaries, standard analyses, data serving, and report preparation occur under standardized protocols (Soballe and Fischer 2004).

Methods

For monitoring water quality, limnological variables (physicochemical characteristics, suspended solids, chlorophyll a, phytoplankton [archived], and major plant nutrients) will be monitored at both stratified random sites (SRS) and at fixed sampling sites (FSS) according to LTRM protocols.

Fixed site sampling
Fixed site sampling will be conducted as in FY2006 except for modifications made in 2010 for Pools 4 and 8 (Table 1).

Stratified random sampling
Stratified random sampling will be conducted at full effort levels (same as FY2000) for fall, winter, spring, and summer episodes (Table 1).

In situ data collection
For both FSS and SRS in situ data will be collected on physicochemical characteristics per the standard protocols (Soballe and Fischer 2004).

Laboratory analyses
Samples for chemical analysis (nitrogen (total N, nitrate/nitrite N, ammonia N), phosphorus (Total P, SRP), and silica) will be collected at all fixed sites and at approximately 35% of all stratified random sampling locations as specified in the sampling design. Samples for flourometric chlorophyll and suspended solids (total and volatile) will be collected at all SRS and Fixed sites Sampling and laboratory analyses will be performed following LTRM protocols (Soballe and Fischer 2004) and Standard Methods (American Public Health Association 1992).

New Product Descriptions

2016D11: Operational Support to the UMRR LTRM Element

The La Crosse Field station (FS-2) was intentionally co-located at UMESC to serve a role as the LTRM in-house field station and to encourage close interactions between field operations and the LTRM PI's, database administrators, and the water quality and geospatial labs. While FS-2 also benefits from being co-located, providing operational support requires a generous commitment of staff time. Since the program's inception FS-2 has provided support in numerous ways, including procedural development and refinements, e.g. Water Quality Procedures Manual (Soballe and Fischer 2004), LTRM procedures: Aquatic Vegetation Monitoring (Yin et. Al 2000), database management support, and beta testing electronic field data applications and visualization tools to name a few. Similar support functions are still being provided by La Crosse staff.

Although a formal arrangement is no longer recognized (i.e., with supplemental funding), continuing logistical support services bring noteworthy value to the LTRM element, and the time commitment should be reflected in the annual SOW.

Most recently the water quality component has provided LTRM-wide support to the WQ component during the transition to new velocity meters (2013), new turbidity meters (2014), and new LDO oxygen sensors and syringe filter replacement (2015). The FS-2 water quality component also prepares the conductivity reference solutions used by all the field stations for calibrating their conductivity probes.

These equipment transition periods required FS-2 to field test and compare instrument performance, troubleshoot issues that arise at other field stations, and develop calibration and maintenance protocols. During these times staff help field stations move through the transition period smoothly by responding to phone calls and emails, providing technical support and equipment troubleshooting.

The La Crosse water quality component also provides in-house training for new Water Quality Specialists from other stations, allowing the new hires to learn field and laboratory operations first-hand. The new staff leaves with hands-on training and step by step protocols for all field and laboratory procedures. Given the proximity to UMESC, La Crosse staff also routinely provides program support by fielding questions from other researchers on varied topics related to LTRM sampling procedures and data.

Products and Milestones

Tracking number	Products	Staff	Milestones
2016D1	Complete calendar year 2015 fixed-site and SRS water quality sampling	Houser, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka	31 December 2015
2016D2	Complete laboratory sample analysis of 2015 fixed site and SRS data; Laboratory data loaded to Oracle data base.	Yuan, Schlifer	15 March 2016
2016D3	1st Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Cook, Sobotka	30 December 2016

2016D4	2nd Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka	30 March 2016
2016D5	3rd Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka	29 June 2016
2016D6	4th Quarter of laboratory sample analysis (~12,600)	Yuan, Manier, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka	28 September 2016
2016D7	Complete QA/QC of calendar year 2015 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.	Schlifer, Rogala, Houser	30 March 2016
	b. Field Station QA/QC; USGS QA/QC.	Houser, Rogala, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka	15 April 2016
	c. Corrections made and data moved to public Web Browser	Rogala, Schlifer, Houser	30 April 2016
2016D8	Complete FY2015 fixed site and SRS sampling for Pools 4, 8, 13, 26, Open River Reach, and La Grange Pool (Table 1)	Houser, Burdis, Kalas, Kueter, L. Gittinger, Kellerhals, Sobotka	30 Sept 2016
2016D9	WEB-based annual Water Quality Component Update w/ 2015 data on Server.	Rogala	30 May 2016
2016D10	Draft Completion report: Evaluation of water quality data from automated sampling platforms	Soeken-Gittinger, Lubinski, Chick, Houser	30 Sept 2016
2016D11	Operational Support to the UMRR LTRM Element. Serve as in-house Field Station for USGS for consultation and support on various LTRM-wide topics	Kalas, Hoff, Bartel, Drake	30 Sept 2016
2015D11	Draft report/manuscript: Developing continuous water quality monitoring methods in the UMR	Chick, Houser	1 Sept 2016
2015D12	Final report/manuscript: Developing continuous water quality monitoring methods in the UMR	Chick, Houser	1 Sept 2017
Intended for distribution			
Completion report: Examining nitrogen and phosphorus ratios N:P in the unimpounded portion of the Upper Mississippi River (2006D9; Hrabik & Crites)			
LTRM report: Main channel/side channel report for the Open River Reach. (2005D7; Hrabik)			
Manuscript: Lateral contrasts in nutrients, chlorophyll, and suspended solids within the Upper Mississippi River System (2012D10; Houser)			
Completion report, compilation of 3 years of sampling: Water Quality (2009R1WQ; Giblin, Burdis)			
Manuscript: Trends in suspended solids, nitrogen, and phosphorus in select upper Mississippi River tributaries, 1991-2011 (Kreiling and Houser, 2013D14)			
Manuscript: Relationship between the temporal and spatial distribution, abundance, and composition of zooplankton taxa and hydrological and limnological variables in Lake Pepin (2013D17; Burdis)			
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)			

Land Cover/Land Use with GIS Support

Although the LTRM will not collect systemic aerial photography data, it will maintain expertise, manage existing data and infrastructure, and provide limited on-demand Geographic Information System (GIS) technical assistance to the UMRR partnership including, but not limited to:

- Aerial image interpretation of selected sites as requested
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- Flight planning and acquisition of aerial imagery
- Change detection and habitat modeling
- Georeferenced aerial photo mosaics (pool wide, Habitat Rehabilitation and Enhancement Projects (HREPs), land acquisition areas)
- Georeference and create metadata for archival map/plat mosaics (Brown Survey, Mississippi River Commission data, Government Land Office data)
- Produce graphics and summary tables for partnership publications, posters, and presentations
- Conversion of ASCII coordinate data from a GPS to a spatial data set
- Conversion of GIS data layers to KMZ (Google Earth) formats for ease of viewing and sharing.
- Maintain, update, and oversee the aerial photo library of over 50,000 print and digital images.
- Maintain, update, and enhance over 20 million acres of land cover/land use and aquatic areas data spanning the late 1800s through the year 2000. This includes improving existing or developing new crosswalks for comparison of existing data sets, cropping data sets to common extents, and ensuring that all data sets are in a common coordinate system.
- Assist in the maintenance and updating of the USGS-Upper Midwest Environmental Sciences Center's (UMESC) web based geospatial data repository.
- Provide geospatial hardware and software technical support to UMESC staff and partners, as needed.
- Continue to assess advances in computer technology (hardware and software) for accurate and efficient GIS data production.
- Develop plan to implement small unmanned aerial systems technology (sUAS) in UMRS resource monitoring (training, certification, sUAS leasing options).

New Product Descriptions

2016LC1 Maintenance ArcGIS server

New data access and delivery methods have enhanced the visualization the UMRR-LTRM spatial data. There is continual upkeep and maintenance of the ArcGIS server that allows for the spatial tools and data to be online. These online tools present LTRM data in an intuitive, universally accessible manner that alleviates the requirement of substantial post-processing by enhancing the usefulness of the data to resource decision makers and the general public.

2016LC2 Aerial Photo scanning

The UMESC has an extensive collection of aerial photography of the Upper Mississippi River System (UMRS). These photos are currently being stored in a secure, yet not climate controlled location. UMESC will scan the systemic photography for the Key Pools (Pools 4, 8, 13, 26, Open River South & La Grange) of the UMRS to ensure their long term usability. Most, if not all, of these photos are unique to UMESC and do not exist elsewhere.

The resulting imagery would be available online and would also be available for georeferencing to make it GIS ready.

2016LC3: Bathymetry footprint

The UMRR has overseen the collection, processing, and serving of bathymetric data since 1989. Pool-wide bathymetric coverages for Pools 4, 7, 8, 9, 10, 13, 21, 26, and La Grange Pool and topobathy data for Pools 3, 4, 5, 7, 8, 9, 13, and 21 of the UMRS are available for download from the UMESC website. Vector data, to the most detailed date information available, would be created and served along with the existing bathymetry data, as well as any new bathymetry data available to indicate the timing of the data collection.

2016LC4: Updates on progress for land cover products

Although the primary focus of this component is to provide technical assistance and maintain existing geodatabases(i.e. including new data as it becomes available or is created such as LCU updates, KMLs, or site-specific orthoimagery; ensuring compliant with newest software), *as time allows* work may occur on the following LTRM projects. As work is accomplished for each project, it will be reported in the quarterly activities. When a project is completed, that will be announced to the partners and reported in the quarterly activities. The percentage completion for each project will be updated in each subsequent scope of work.

- Continue to update the detailed spreadsheet of all LTRM aerial photography currently housed at UMESC, including date, pool location, format (color infrared, natural color, black-and-white), scan status (yes/no, dots per inch), interpreted status, photo scale, and extent of coverage (partial or complete). This document will be served on-line and updated as necessary. (70% complete)
- Complete summaries detailing differences in land cover between 2000 and 2010/11 for the key pools (50% complete)
- Create a Google Earth help page to assist partners and public in using Google Earth to view and query LTRM data being served in the KMZ format. (75% complete)
- Develop KMZ files for 2010/2011 aerial photo positions that include date, time, approximate water level at time of acquisition, and link to closest stream gage. This work will enhance the scope “Geospatial upgrades”. (100% complete, in review)
- Clip HREP boundaries (based on boundaries as defined in HREP web pages for individual projects, or through consultation with the Corps) across years and create a geodatabase for each HREP site. (70% complete)

- Assess automated terrain extraction software (Imagine Photogrammetry Suite) using 3”/pixel imagery or better and compare extracted elevation information to LiDAR-derived digital elevation models. This will help answer the question if using high-resolution aerial imagery can produce digital surface models on par with LiDAR elevation models.
- Assist Nate De Jager with his land cover/land use change assessment project using the systemic 2000 and 2010/2011 LCU products.
- Assess eCognition’s ability to identify and classify floodplain vegetation to the 31-class level. This software has become the standard for automated and semi-automated land cover classification. The software must be ‘trained’ on vegetation class signatures initially but it can use that that training and ancillary datasets to derive land cover classes from digital aerial imagery. We hope to assess is usefulness at distinguishing floodplain land cover classes for future mapping efforts.

Products and Milestones

Tracking number	Products	Staff	Milestones
2016LC1	Maintenance ArcGIS server	Hlavacek, Fox, Rohweder	September 30, 2016
2016LC2	Aerial Photo scanning; year 1 key pools	Ruhser	September 30, 2016
2016LC3	Bathymetry footprint	Stone, Hanson	September 30, 2016
2016LC4	Updates on progress for land cover products listed.	Robinson	New progress reported in the quarterly activities. Percent complete updated 30 Sept 2016.

Bathymetry Component

The overall goal of the UMRR LTRM's Bathymetry Component is to complete a system-wide GIS coverage of UMRS bathymetry used to quantitatively and qualitatively assess the suitability of essential aquatic habitats. Bathymetric surveys of the UMRS have been completed, and nine pools (Pools 4, 7, 8, 9, 10, 13, 21, 26, and La Grange Pool) were processed into bathymetry coverages and are served in standard formats on the LTRM's website (www.umesc.usgs.gov/aquatic/bathymetry.html). However, with the LiDAR data acquisition completed for the system, the component will now produce topobathy coverages by combining bathymetry and LiDAR data under separate SOWs as funding becomes available. Currently, topobathy has been completed for Pools 3, 4, 5, 7, 8, 9, 13, and 21. From the topobathy coverages, bathymetric coverages at selected discharge conditions will be generated and served in the future. The LTRM will maintain some level of expertise to provide basic assistance with using the existing topobathy and bathymetry data, as described below.

Provide on demand technical assistance related to the bathymetric database to the UMRR partnership including, but not limited to:

- Deliver data in non-standard formats, such as raw point data in GIS or text files.
- Adjust bathymetry data to selected water surface conditions (presently only available at "flat-pool" conditions)
- Calculate summary statistics (e.g., hypsographic curves and volume) for geographical subsets of the data
- Advise partner agencies on data collection methods and locations that meet LTRM need
- Assist in spatial modeling using the bathymetric data

Jim Rogala is principal investigator.

Data Management

The objective of data management for the UMRR LTRM is to provide for data collection, correction, archive, and distribution of a 90 million dollar database that consists of over 2.2 million records located in 195 tables. The 2.2 million data points currently in the system require regular maintenance and upgrading as technologies change. Also, having a publicly accessible database requires a significant level of security. This is accomplished by having the systems Certified and Accredited by a rigorous, formal process by the USGS Security team.

Methods

Data management tasks include, but are not limited to:

- Review daily logs to ensure data and system integrity and apply application updates.
- Develop and maintain field notebook applications to electronically capture data and begin the initial phase of Quality Control/Quality Assurance (QA/QC).
- Administer and maintain the Oracle LTRM database.
- Administer and maintain LTRM hardware, software, and supplies to support LTRM needs.
- Administer, maintain, and update the LTRM public and intranet data browsers to insure access to all LTRM data within USGS security policy.

Product Description

Products and Milestones

Tracking number	Products	Staff	Milestones
2016M1	Update vegetation, fisheries, and water quality component field data entry and correction applications.	Schlifer	30 May 2016
2016M2	Load 2015 component sampling data into Oracle tables and make data available on Level 2 browsers for field stations to QA/QC.	Schlifer	30 June 2016
2016M3	Update Graphical Water Quality SRS Data browser from java applet based to html5 JavaScript plugin free version.	Schlifer	1 Nov. 2015
2016M4	Update Graphical Fisheries Data browser from java applet based to html5 JavaScript plugin free version.	Schlifer	25 Jan. 2016
2016M5	Update Aquatic Vegetation Graphical SRS Data browser from java applet based to html5 JavaScript plugin free version.	Schlifer	1 March 2016
2016M6	Rewrite Fisheries Data Download Query to increase efficiency and performance	Schlifer	1 June 2016

Quarterly Activities

To enhance communication with the UMRR Partnership, LTRM staff at USGS-UMESC and the six state-run field stations will track activities not explicitly listed in this current scope of work. These quarterly activity lists will document activities and accomplishments by Program partners that are not tracked in the milestone table. Activities will include such items as presentations, outreach, technical assistance, data retrieval, and consultation for LTRM Partners including state and federal agencies, NGOs, and academia. These activities demonstrate the value of LTRM data and expert scientific knowledge to clients and customers, and help to identify potential new collaborations that will benefit EMP and river managers. Activity lists will be placed on the web under the A-Team Corner page (http://www.umesc.usgs.gov/ltrmp/ateam.html). This effort addresses a need for increased communication and dissemination of information.

Products and Milestones

Tracking number	Products	Staff	Milestone
2016QR1	Submittal of quarterly activities	All LTRM staff	30 January 2016
2016QR2	Submittal of quarterly activities	All LTRM staff	13 April 2016
2016QR3	Submittal of quarterly activities	All LTRM staff	13 July 2016
2016QR4	Submittal of quarterly activities	All LTRM staff	12 October 2016

Equipment Refreshment

UMRR LTRM field equipment (boats, motors, sampling equipment, etc.) need to be well maintained and replaced when necessary to maintain a safe and functional work environment.

Field Station	Equipment	Component
La Crosse	Ruggedized laptop	Water Quality
La Crosse	Outboard motor	Aquatic Vegetation
Lake City	GPS/Depth	Water Quality
Lake City	GPS/Depth	Aquatic Vegetation
Lake City	GPS/Depth	Fisheries
Lake City	Conductivity/DO/Temperature Meter	Fisheries
Lake City	Airboat with trailer	Aquatic vegetation & Water Quality
Bellevue	Ruggedized laptop	Fisheries
Bellevue	Cond/DO/Temp meter	Fisheries
Bellevue	17-18 aluminum tunnel boat	Aquatic Vegetation
Bellevue	Trailer for tunnel boat	Aquatic Vegetation
Bellevue	Hydrolab Minisonde 10-meter cable	Water Quality
Bellevue	Peristaltic pump	Water Quality
Bellevue	Propane Power Ice Auger	Water Quality
Big Rivers	Generator	Fisheries
Big Rivers	Conductivity/DO/Temperature meter	Fisheries
NGRREC	Net Boat Trailer	Fisheries
NGRREC	150 hp shock boat motor	Fisheries
NGRREC	Generator	Fisheries
NGRREC	Conductivity/DO/Temperature meter	Fisheries
IRBS	Towing Vehicle	Water Quality
IRBS	Conductivity/DO/Temperature meter	Fisheries

Tracking number	Products	Staff	Milestone
2016ER1	Property inventory and tracking	LTRM staff as needed	15 Nov 2016

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Table 1. Sampling effort within the UMRR Long Term Resource Monitoring Program element and data collected by each component.

Component	Study Area						Summary of data collected[1]
	4	8	13	26	La Grange	Open River	
Aquatic Vegetation	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	450 stratified random sample sites over growing season.	—[2]	—[2]	—[2]	Species, abundance, frequency, distribution, depth, substrate, detritus
Fisheries	~242 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~262 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~300 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~272 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~390 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	~247 samples; 3 periods: June 15–Oct. 30, 6 sampling gears. Mix of stratified random and fixed sites.	Species; catch-per-effort; length; subsample for weight, age, & diet; secchi; water depth, temperature, velocity, conductivity; vegetation density; substrate; dissolved oxygen
Water Quality	135 stratified random sites sampled in each episode (winter, spring, summer, and fall); 14 fixed sites[3]	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 19 fixed sites[3]	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 12 fixed sites[3]	121 stratified random sites sampled in each episode (winter, spring, summer, and fall); 11 fixed sites[3]	135 stratified random sites sampled in each episode (winter, spring, summer, and fall); 11 fixed sites[3]	150 stratified random sites sampled in each episode (winter, spring, summer, and fall); 9 fixed sites[3]	Suspended solids, major plant nutrients, chlorophyll a, silica, pH, secchi, temperature, dissolved oxygen, turbidity, conductivity, vegetation type & density, wave height, depth, current velocity, depth of snow/ice, substrate, phaeophytin, phytoplankton (archived),
Land Cover/Land Use	Land Cover/Land Use digital aerial photography was acquired in 2010-2011 and processed in subsequent years. Systemic land cover data for the Upper Mississippi River System is collected approximately every 10 years. To date, systemic land cover has been mapped three times through the UMRR Long Term Resource Monitoring element, in 1989, 2000, and 2010/2011.						

[1]A full list and explanation of data collected by each component is available through the UMRR LTRM data web site at http://www.umesc.usgs.gov/data_library/other/ltrmp_monitoring.html.
[2]Aquatic vegetation is not sampled in Pool 26 and La Grange because previous sampling revealed very low abundance, or in Open River due to a lack of suitable habitat.
[3]Frequency of fixed site sampling is bi-weekly in April, May, and June, and monthly in all other months, with no sampling in December and February (i.e., winter sampling in January only)

Product Definitions

Draft: A draft that has been submitted to the UMRR LTRM's USGS Science Leader or his designee which is ready for review by USGS, USACE, A-Team, or blind review, as needed. This step begins the process of formal USGS peer-review unless the Science Leader deems the product needs more work by the author(s).

Final draft: A document that the authors have edited based on review comments and has been submitted to the LTRM's USGS Science Leader or his designee.

Intended for Distribution: Indicates a final printed version or Web-based report is awaiting distribution and USGS final approval. For other products (i.e., manuscripts) this indicates submission to a journal. *Staff time is still expended at this stage of the report process.*

Summary Letter: A summary letter is a communication to Corps management and associated staff that provides quick information regarding progress on a project or product. They are often based on preliminary data and analyses, and represent interim information. Summary letters are reviewed internally by UMESC, but do not go through USGS peer review. Thus, they are not citable and should not be widely distributed. Summary letters are used only when a more complete and peer reviewed product is expected after more work on a specific project.

Leveraged Product: A product produced by LTRM staff and others outside of LTRM; may include funding from non-sources.

Donated Product: A product produced by others, without including the LTRM staff and without investment of UMRR funds.