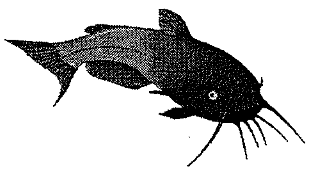
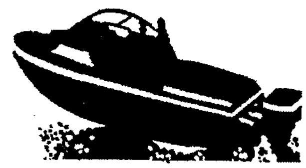
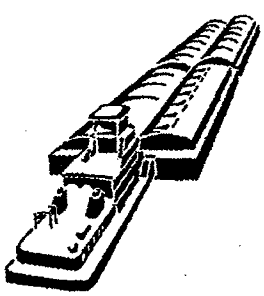
ENV Report 50

Interim Report For The Upper Mississippi River — Illinois Waterway System Navigation Study





Environmental Objectives Planning Workshops



September 2003

Rock Island District
St. Louis District
St. Paul District

US Army Corps
of Engineers®

Upper Mississippi River – Illinois Waterway System Environmental Objectives Planning Workshops

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Interim Report

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Background

The Upper Mississippi River-Illinois Waterway (UMR-IWW) System Navigation Feasibility Study has been restructured to give equal consideration of fish and wildlife resources along with navigation improvement planning. The objectives of this restructured feasibility study are to relieve lock congestion, achieve a sustainable ecosystem, and holistically address ecosystem and floodplain management needs related to navigation. The restructured navigation study will seek to ensure that the rivers and waterway system continues to be an effective transportation system and a nationally treasured ecological resource. The restructured study will: (1) further identify the long-term economic and ecological needs, and potential measures to meet those needs, through collaboration with interested agencies, stakeholders and the public; (2) evaluate various alternative plans to address those needs; (3) present a plan consisting of a set of measures for implementation that will achieve the study objectives; and (4) identify and address issues related to the implementation of the recommended plan.

Navigation System

The study area comprises the Upper Mississippi River and the entire Illinois Waterway and lies within portions of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. It also includes the navigable reaches of four tributary rivers, the Minnesota, St. Croix, Black, and Kaskaskia. The Upper Mississippi River extends 854 miles from the confluence with the Ohio River to Upper St. Anthony Falls Lock in Minneapolis-St. Paul, Minnesota. The Illinois Waterway extends 327 miles from its confluence with the Mississippi River to Lake Michigan via the Illinois River, Des Plaines River, and a series of canals. The total Upper Mississippi River and Illinois Waterway navigation system contains 1,200 miles of nine-foot deep channels, 37 lock and dam sites (43 locks; Figure 1) and thousands of channel training structures.

Much of the UMR-IWW lock and dam system was in place by the 1940s, built and sized for the vessels of that time. Except as noted below, the locks are 600 feet long, although, most modern tow configurations on the UMR-IWW include 15 barges and approach 1,200 feet long. As a result, tows must lock through using a time-consuming two-step process in which the first three rows of barges (9 barges) are locked through first and the last two rows of barges (6 barges) and the towboat are locked through second. The entire process may take 1.5 hours or longer depending on many variables. In contrast, Lock 19 has a 1,200-foot lock and Melvin Price Lock and Dam (Lock 26 replacement) and Lock 27 (Chain-of-Rocks Lock) have both a 1,200-foot and a 600-foot chamber at each site. The lockage process takes an average of 1.0 hours at Lock 19 and 0.6 hours at Locks 26 and 27.

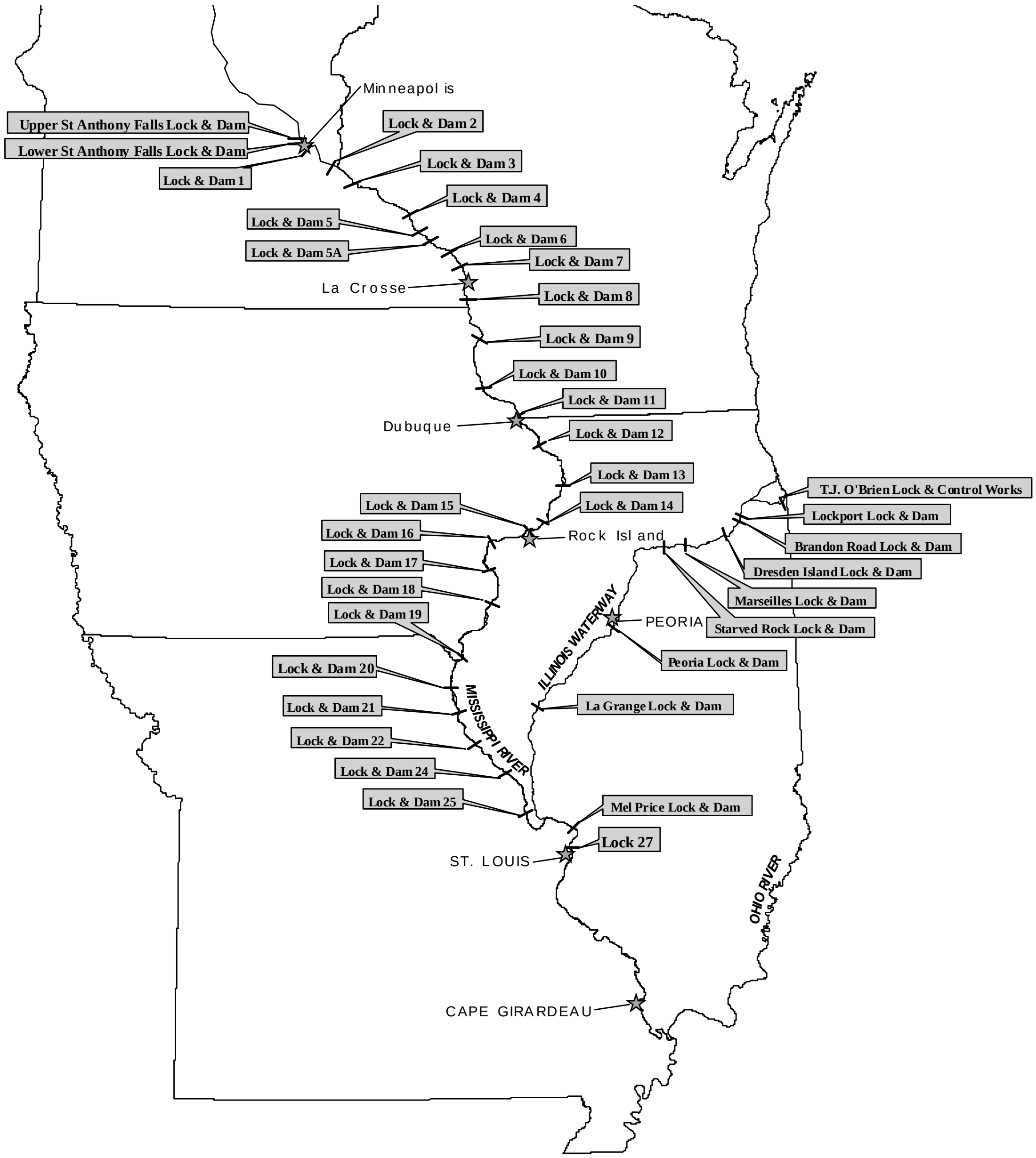

Figure 1. UMR-IWW Locks and Dams.

Ecosystem

The UMR-IWW ecosystem includes the river reaches previously described, as well as the habitats within their floodplain systems. The total acreage of the river-floodplain system exceeds 2.6 million acres of aquatic, wetland, forest, grassland, agricultural, and urban land cover and land use. The Mississippi Flyway is used by more than 40% of the migratory waterfowl traversing the United States. These migratory birds and the threatened and endangered species (T&E Species) in the region are the focus of considerable Federal wildlife management activities along the Upper Mississippi and

Illinois Rivers. For many species in Iowa, Illinois, and Missouri, the most important and abundant habitat is provided by the mainstem river.

Land cover and land use types are disproportionately distributed throughout the river system, and their absolute abundance is dependent on the total area and geomorphology of the reach under consideration (Figure 2). The largest differences occur in the amount and distribution of agriculture and the proportion of open water in the floodplain. Agriculture protected by levees dominates the wide floodplain south of Rock Island, Illinois and in the lower Illinois Waterway. Open water on public lands occupies a greater proportion of the floodplain north of Rock Island. Wetland classes are generally more abundant above Rock Island, wet meadows are fairly evenly distributed, and grasslands are rare throughout the river system. Forest classes generally occupy between 10 to 20 percent of the floodplain in a narrow strip along the river banks throughout the system.

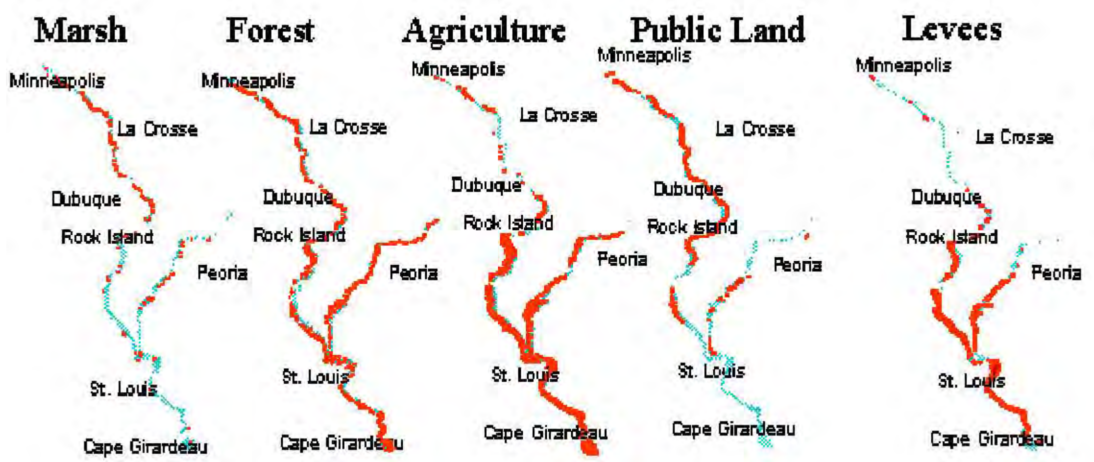

Figure 2. Areas in red show the extent of selected UMR-IWW land cover or land use types.

Section 1103 of the Water Resources Development Act of 1986 recognized the UMR-IWW System as a unique, nationally significant ecosystem and a nationally significant commercial navigation system. The system provides:

1. a means for shippers to transport commodities---130 million tons on the Mississippi River and 44 million tons on the Illinois Waterway in 2000;

2. over 600 plant species providing food and habitat for at least 485 species of birds, mammals, amphibians, reptiles, and fish (including 10 Federally endangered or threatened species and 100 state listed species);

3. more than 226,650 acres managed by 15 units of the U.S. Fish & Wildlife Service National Wildlife and Fish Refuge System;

4. water supply for 22 communities, many farmers and industries;

5. a multi-use recreational resource providing more than 11 million recreational visits each year; and

6. cultural evidence of our Nation's past.

Establishing Goals for the System

The original UMR-IWW Navigation Feasibility Study was narrowly focused on the problem of reducing commercial navigation traffic congestion on the system. Coordination was occurring between economic and environmental interests; however, the work was being accomplished independently. With the new focus of the restructured study including ecological sustainability, it became important for the stakeholders on the system to prepare a common vision for the future of the UMR-IWW. In November 2001, the Economic Coordinating Committee (ECC) and the Navigation Environmental Coordinating Committee (NECC) met jointly to prepare this vision:

> *"To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System"*

The following definition of sustainability was collaboratively developed and agreed to by the group as well:

> *"The balance of economic, ecological, and social conditions so as to meet the current, projected, and future needs of the Upper Mississippi River System without compromising the ability of future generations to meet their needs."*

This definition will serve as the primary goal for integrated and adaptive management of the Upper Mississippi River System.

Planning for future navigation system infrastructure needs; navigation system operation and maintenance; habitat protection, enhancement, and restoration; river recreation; floodplain management; and water quality management will be conducted in the context of a comprehensive set of clear goals and objectives for the desired condition of the UMR-IWW System. Setting these goals and objectives shall be done collaboratively, with participation of the full community of river stakeholders. Development of a set of measurable objectives for integrated and adaptive management of the UMR-IWW System will be challenging. It will require considerable collaboration, making use of conceptual models, predictive models, and visualization tools to comprehend the interconnections between system components to enable the community of stakeholders to actively participate in planning for a sustainable multiple use river-floodplain system. Integrated planning will be an on-going effort to optimize the National economic and environmental benefits achieved from efficient and effective adaptive river management.

Integrated Management

The restructured Feasibility Study will strive to integrate Federal river management activities to achieve sustainability of the System. The Federal activities to be coordinated under the sustainability umbrella include operation and maintenance of the 9-Foot Channel Project, the Environmental Management Program, Environmental Continuing Authorities Programs (CAP; i.e., Sections 204, 206, and 1135), the Water Resources Development Act of 1999 (Public Law 106-53 §459) Comprehensive Plan for the floodplain, U.S. Fish and Wildlife Service Refuge management, and the Illinois River Basin Restoration initiatives (Illinois River Ecosystem Restoration Feasibility Study and Water Resources Development Act of 2000, Public Law 106-541 Section 519, Illinois River Basin Restoration). A conceptual illustration of the floodplain and the areas of responsibility for these various ongoing Federal actions is presented in Figure 3. The restructured Feasibility Study provides the mechanism to define the baseline ecosystem sustainability goals and objectives that may be used across Federal management activities within the spatial limits described in Figure 3. Each individual program can then operationalize within its area of responsibility. The Navigation Feasibility Study will formulate management for sustainability within the limits of the UMR-IWW navigation project. Likewise, the Comprehensive Study will define management for sustainability for projects related to flood damage reduction in the leveed and unleveed UMR-IWW floodplain. The Illinois River Basin Restoration initiatives will address management for sustainability on the Illinois River, floodplain, and throughout the basin. The Environmental Management Program and Environmental CAP (Sections 204, 206, and 1135) can integrate the baseline sustainability goals and continue to operate throughout the river floodplain system. The U.S. Fish and Wildlife Service Refuge Comprehensive Conservation Plans may incorporate the baseline sustainability goals and objectives relevant to UMR-IWW Refuge lands. A schematic of these planning relationships is shown in Figure 4. There are obvious overlaps and gray areas that will need to be further defined during the remainder of the restructured Feasibility Study. The Feasibility Study will evaluate opportunities for better integration of the various Federal programs including new or modified authorities. The Feasibility Study will also attempt to identify non-federal land management initiatives that could be integrated into this effort.

Achieving sustainability of the river system will require close collaboration with Federal, State, and non-governmental organizations. The Feasibility Study Team will continue to work closely with stakeholders to further develop the baseline sustainability goals and objectives. The study will also develop plans to adaptively identify, implement, and evaluate management actions that are most likely to contribute to achieving the established goals and objectives.

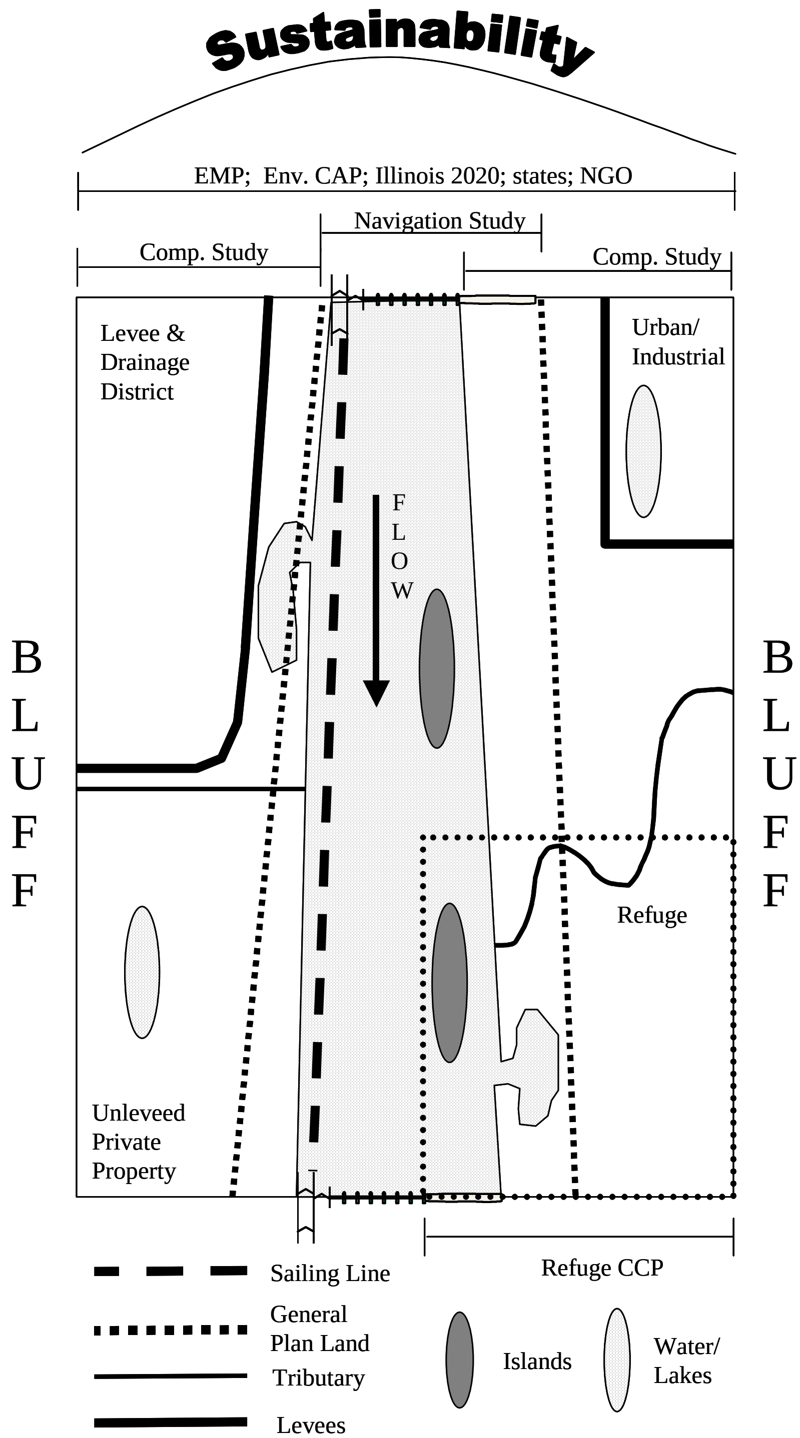

Figure 3. Schematic representation of a river reach illustrating the general types of land uses and ownership and the approximate extent of river management authorities including: the Environmental Management Program, Environmental CAP, States, Non-Governmental Organizations (NGOs), U.S. Fish and Wildlife Service Refuges, the floodplain Comprehensive Study, Illinois River Restoration (Illinois 2020), and the UMR-IWW Navigation Study.

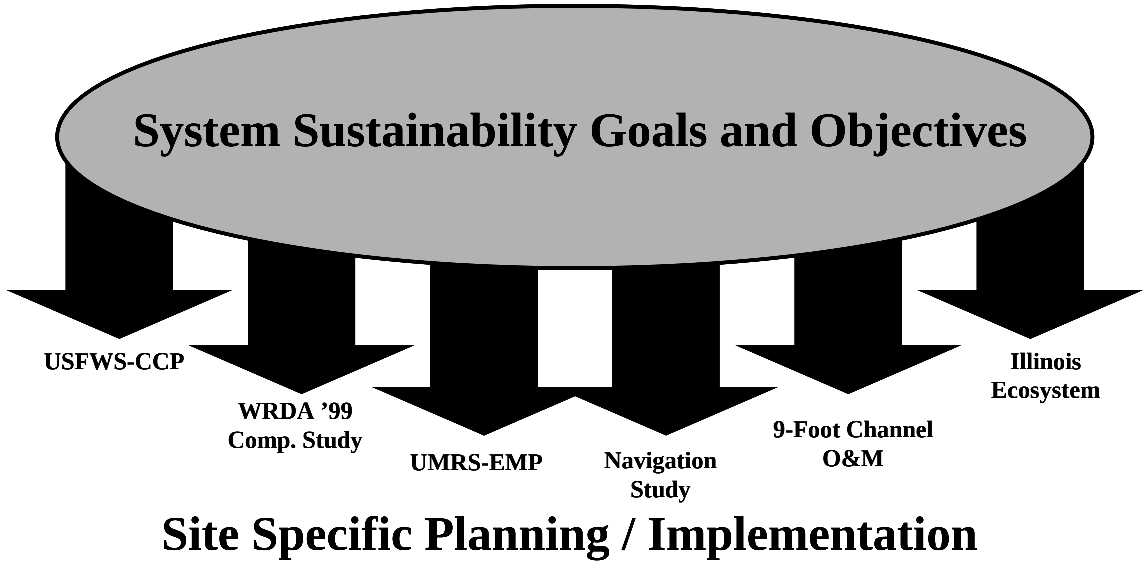

Figure 4. Goals and Objectives for the UMR-IWW System will be established in a comprehensive fashion under the authority of the Restructured Navigation Feasibility Study. Detailed planning and implementation will be assumed under various Federal authorities.

Introduction to the Workshops

Four two-day workshops were held during November 2002, to aid the process of establishing measurable environmental objectives for the Upper Mississippi River-Illinois Waterway (UMR-IWW) System. Workshops were conducted in Peoria, Illinois; St. Louis, Missouri; La Crosse, Wisconsin; and Moline, Illinois.

The workshops were structured to achieve the following main objectives:

1) Identification of UMR-IWW environmental objectives
   Collaboratively review, refine, and add to a database of specific, quantitative, local to regional scale environmental objectives building on previous work from the EMP Habitat Needs Assessment, Mississippi River Environmental Pool Plans, USFWS Comprehensive Conservation Plans, and related study efforts.
2) Identification of UMR-IWW management actions
   Review and identify management actions that are most likely to contribute to achieving the established goals and objectives.
3) Discuss and identify species and population parameters
   Identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.
4) Present and discuss UMR-IWW ecosystem conceptual model
   Present and discuss the utility of developing an UMR-IWW ecosystem conceptual model to gain a better understanding of the linkages between environmental objectives, management actions, and the state of the ecosystem.

Workshop Participants

Participants were invited from a variety of organizations including the U.S. Army Corps of Engineers (USACE), U.S. Forest Service, U.S. Department of Transportation (USDOT) – Maritime Administration, U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), Illinois Department of Natural Resources (DNR), Illinois Department of Water Resources, Illinois Natural History Survey, Illinois State Water Survey, Iowa DNR, Minnesota DNR, Missouri Department of Conservation (MDOC), Missouri DNR, Wisconsin DNR, Audubon Society, Environmental Defense, Iowa Farm Bureau, Izaak Walton League, Midwest Area Rivers Coalition (MARC) 2000, Mississippi River Basin Alliance (MRBA), Mississippi River Revival, Missouri Coalition for the Environment, Sierra Club, Southern Illinois University, The Nature Conservancy, University of Miami, Upper Mississippi, Illinois and Missouri Rivers Association (UMIMRA), Upper Mississippi River Conservation Committee (UMRCC), and Quincy Park District. From the 250 issued invitations, a total of 142 people participated in the interactive workshop process (Table 1). This report presents the contributions (i.e., technical expertise, working knowledge, and considerable energy) of the workshop participants.

A subset of the workshop participants helped prepare and edit individual Workshop Reports. Participants checked that accurate representations were made of the work they had completed during the workshops.

Table 1. Workshop attendance and representation. (Appendix J provides a list of acronyms.)

Date	Location/Reach	Attendance and Representation
Nov. 6-7, 2002	Peoria, Illinois (Illinois Waterway)	**(31)** – USFWS (3); USACE (9); USDOT (1); ILDNR (10); INHS (1); ISWS (1); IDWR (1); MARC 2000 (1); MRBA (1); LTRMP (2); UMIMRA (1).
Nov. 13-14, 02	St. Louis, Missouri (Pool 24 to Ohio River)	**(41)** – USFWS (5); USACE (11); USDOT (1); US Forest Service (1); ILDNR (6); MODOC (5); MODNR (1); MARC 2000 (4); MRBA (1); UMIMRA (1); UMRCC (1); Sierra Club (1); Audubon (1); MO Coalition for the Env. (1); SIU (1).
Nov. 18-19, 02	La Crosse, Wisconsin (Pool 1 to 11)	**(42)** – USFWS (6); USACE (12); WIDNR (5); MNDNR (3); MODNR (1); IADNR (1); Env. Defense (1); Sierra Club (1); Audubon (1); TNC (1); IWL (1); MARC 2000 (4); LTRMP (1); UMESC (3); Mississippi River Revival (1).
Nov. 20-21, 02	Moline, Illinois (Pool 12 to 22)	**(28)** – USFWS (3); USACE (7); USEPA (1); ILDNR (5); IADNR (2); MODNR (1); MODOC (1); Sierra Club (1); MRBA (1); UMRCC (1); Univ. of Miami (1); Audubon (1); IA Farm Bureau (1); UMIMRA (1); Quincy Park District (1).

Most of the participants were present the entire duration of each workshop providing for sustained interactions and the benefits of full attention to the goals and process of the workshop. A more detailed description and listing of participants and invitee information is listed in Appendix A.

Background on the General Workshop Structure

The workshop process was designed to maximize the time and resources available at each of the meetings. To meet the objectives of eliciting information, discussing key issues, and explaining how workshop results would be used, the workshops utilized three components of meeting structure.

The first component was the standard meeting style wherein USACE facilitators provided information to the entire group allowing for questions and discussion.

The second component was key for eliciting information and involved breaking the group into working groups based on a particular criteria such as geography, physical processes, biology, etc. Breaking a large meeting into working groups comprised of 10 or fewer individuals optimized the opportunity for participation and interaction of the greatest number of people and for timely discussion and progression on key issues. The number of working groups varied depending on the number of participants and geographic areas to be covered.

The third component were plenary sessions, which allowed all participants to hear a summary of what was accomplished in the other working groups and to have input into the entire set of results. It also allowed the facilitators and participants to refine the

UMR-IWW Environmental Objective Geographic Information System (GIS) Database as a coordinated team.

Workshop Agenda

The agenda for the workshop shown below was followed loosely, allowing extra time for questions and time in the workgroups as needed. A glossary with definitions of terminology frequently used in the workshops is provided in Appendix K.

DAY 1

9:00	Opening Chuck Theiling and Hank DeHaan
9:10	Introduction to the Workshop Process and Participant Introductions Rebecca Soileau
9:30	UMR-IWW Restructured Navigation Study Overview and Schedule Ken Barr
9:45	Vision, Goals, and Environmental Objectives Chuck Theiling
10:00	Working Definitions of Terminology for this Workshop Nicole McVay
10:10	Overview of GIS Database and Existing Objectives and Management Actions Hank DeHaan
10:30	***Working Groups (I):*** Identify and refine environmental objectives for the Illinois Waterway ecosystem.
12:00	Lunch
1:00	***Working Groups (I):*** Continued work and Report Preparation
3:30	Plenary: Presentation of objectives identified by each working group and input into GIS
5:30	Adjourn

DAY 2

8:00	Plenary: Presentation and discussion of synthesis of results from previous days work
9:00	***Working Groups (II):*** Review and identify management actions that are most likely to contribute towards achieving the established goals and objectives
10:30	Plenary: Group presentations of new and revised management actions.
12:00	Lunch
1:00	Plenary: Overview of regional evaluation data and tools for assessing the efficiency of management action and discussion of species and population parameters. Chuck Theiling
2:30	Plenary: Review of Regional Ecosystem Conceptual Models Hank DeHaan
3:00	Workshop Closing

Reports

Five reports are being produced as a result of the four, two-day workshops. The first four documents are Workshop Proceedings (Appendices F-I), which were distributed to workshop participants for review. These reports include:

1. a summary of the workshop and results,
2. tables of identified UMR-IWW environmental objectives,
3. a table of identified management actions,
4. a narrative on UMR-IWW species and population parameters,
5. working group reports, and
6. the plenary session report.

The fifth document is this integrated report which summarizes the results from the four workshops and is published as part of the Navigation Study's Environmental Report Series. This final integrated report contains a full accounting of the site-specific environmental objectives in the form of an atlas as well as the tabulated system, reach, and pool-wide objectives and management actions. Specifically it includes:

1. a summary of results from all four workshops,
2. tables of all identified UMR-IWW pool-wide and site-specific objectives,
3. atlas maps of UMR-IWW site-specific objectives,
4. a table of all identified managements actions,
5. a narrative on UMR-IWW species and population parameters, and
6. additional detail as to how the workshop results will be used in the Navigation Study.

Workshop Results

Environmental Objectives

Methodology

The primary purpose of the Environmental Planning Workshops was to have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts.

Objectives are incremental quantifiable steps taken toward achieving a goal and thus may be goal specific. They provide a concise description of what we want to achieve, how much we want to achieve, when and where we want to achieve it. Objectives provide the basis for determining management actions, monitoring accomplishments, and evaluating the success of management actions. There may be multiple objectives for each goal. Participants were asked to review, revise if necessary, and supplement the environmental objectives taken from previous work (e.g., UMR-IWW Habitat Needs Assessment, Pool Plans, etc.) that they felt were necessary to achieve the UMR-IWW System Vision:

> *"To seek long term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System."*

The working groups were specifically tasked to apply the "SMART" criteria to each objective making them: (1) Specific, (2) Measurable, (3) Achievable, (4) Results-oriented, and (5) Time-specific. These criteria are further explained below.

1. **Specific.** Objectives should be clearly worded and unambiguous. A clearly worded objective is easy to understand and the meaning is difficult to misinterpret. Specificity results by including WHAT will be done, WHEN and WHERE it will be done, and WHY it will be done. Avoid general phrases like "maintain high-quality habitat," "for the benefit of migratory birds," or "improve the visitor experience," as these phrases are subject to much interpretation.
2. **Measurable.** Objectives should contain a measurable element that can be readily monitored to determine success or failure. Otherwise, you cannot tell if the management actions employed are appropriate, when an objective has been met, or if it should be modified. In evaluating measurability, ask, "What would be monitored to assess progress toward achieving this objective?" For example, you could not determine progress toward "high-quality habitat" or a "high-quality" visitor experience unless you have measurable criteria for "high quality." The nature of the measurable element may vary, as might the difficulty in measuring it. Still, you must have something to indicate progress. While evaluating a water depth objective may only require gauge readings, monitoring a component of vegetative structure may require systematic surveys of vegetation density or composition.
3. **Achievable.** Objectives, no matter how measurable or clearly written, must be achievable. If you cannot resolve constraints on achieving an objective then it must be discarded or rewritten. Don't ask more of the land or wildlife than it can deliver, and use sound professional judgment to develop reasonable expectations of time, staff and funds available to pursue the objective. However, some *apparent* constraints may be surmountable. Consider an objective to reduce contaminants originating in tributaries. Though outside Corps authority, this objective may be achievable through partnerships with other agencies or private stakeholders.

4. **Results-oriented.** Objectives should specify an end result. For example, a habitat objective that is results-oriented will provide a detailed description of the desired habitat conditions expected. When reading a results-oriented objective, it should be possible to envision the result of achieving the objective.
5. **Time-fixed.** Objectives should indicate the time period during which they will be achieved, so as not to be open-ended. Implementation schedules for objectives and/or strategies, perhaps in 5-year increments, can satisfy this attribute.

For the purposes of the workshops, participants were also asked to utilize the following two sets of goals as a framework for setting objectives. These goals were sanctioned in the Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study Interim Report.

During planning for the 1994 Upper Mississippi River Conservation Committee (UMRCC) Ecosystem Management Initiative, resource managers agreed to adopt Grumbine's (1994) ecosystem management goals [Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology* 8(1): 27-38.]:
Goal 1: Maintain viable populations of native species in situ.
Goal 2: Represent all native ecosystem types across their natural range of variation.
Goal 3: Restore and maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.).
Goal 4: Integrate human use and occupancy within these constraints.

The UMRCC expanded the above list of goals in the *A River That Works and a Working River* (2000) document. These goals are:
1. Improve water quality for all uses;
2. Reduce erosion and sediment impacts;
3. Restore natural floodplain;
4. Restore natural hydrology;
5. Increase backwater connectivity with main channel;
6. Increase side channel, island, shoal, and sand bar habitat;
7. Minimize or eliminate dredging impacts;
8. Sever pathways for exotic species introductions/dispersal; and
9. Improve native fish passage at dams.

The process began with participants dividing into work groups based in part on their expertise within reaches of the UMR-IWW (e.g., pools 12-15). The groups were tasked with first setting reach and pool-wide environmental objectives and then reviewing and setting site-specific objectives within the bluff-to-bluff portion of their river section. A combination of worksheets, atlas maps, and group reports were used to capture this information. If groups finished their section and had time remaining, they could extend into adjacent areas.

When setting site-specific objectives, participants were asked to use the data structure outlined in the Framework for Setting Objectives (Figure 5). This hierarchical structure categorizes environmental objectives into four primary ecosystem elements and then breaks these down into more specific parameters, extents, and target ranges. In addition to this information, participants were also asked to consider and note (if possible) the seasonality, frequency of occurrence, target date, and any other comments associated with the objectives they identified. This data framework provided a means to capture and merge objectives from previous study efforts, and those identified by workshop participants, into one standardized database. Additional objectives not found in the framework were also identified and added to the database using the established data structure. For example, it was noted that the Parameter 'Invertebrates' needed to be added under the 'Plants and Animals' Ecosystem Element.

Ecosystem Element	Parameter	Extent	TR	Target Range
Water Quality	Water Clarity	Main Channel	1	Secchi disk transparency 0.3 m
		Backwater Areas	2	Secchi disk transparency 0.7 m
			3	Secchi disk transparency 1.0 m
			4	Secchi disk transparency 1.5 m
			5	Secchi disk transparency >2.0 m
Geomorphology	Backwater Depth	Backwater Areas	1	100% of area <1 m
			2	50% of area 1 - 2 m
			3	50% of area 2 - 3 m
			4	50% of area >3 m
	Water Level	Main Channel	1	0.3 m below project pool at dam
		Backwater Areas	2	0.6 m below project pool at dam
			3	1.0 m below project pool at dam
			4	>1 m below project pool at dam
	Connectivity	Floodplain	1	0% floodplain area inundated during 10 year flood
			2	20% floodplain area inundated during 10 year flood
			3	40% floodplain area inundated during 10 year flood
			4	80% floodplain area inundated during 10 year flood
			5	100% floodplain area inundated during 10 year flood
		Secondary Channel	1	<20% of year
			2	20-40% of year
			3	40-60% of year
			4	60-80% of year
			5	>80% of year
		Longitudinal	1	0% chance of fish passage
			2	20% chance of fish passage
			3	40% chance of fish passage
			4	80% chance of fish passage
			5	100% chance of fish passage

Figure 5. Framework for setting objectives for condition of the UMR-IWW ecosystem.

Ecosystem Element	Parameter	Extent	TR	Target Range
Pattern of Habitats	Aquatic Areas	Main Channel	1	<10% of area
		Secondary Channel	2	10-20% of area
		Tertiary Channel	3	20-40% of area
		Impounded Area	4	40-60% of area
		Contiguous Backwater	5	>60% of area
		Isolated Backwater		
	Terrestrial Areas	Contiguous Floodplain	1	<10% of area
		Isolated Floodplain	2	10-20% of area
		Island	3	20-40% of area
			4	40-60% of area
			5	>60% of area
	Land Cover/Use	Open Water	1	<10% of area
		Submersed Aquatics	2	10-20% of area
		Emergent Aquatics	3	20-40% of area
		Grassland	4	40-60% of area
		Shrub	5	>60% of area
		Forest		
		Agriculture		
		Developed		
Plants and Animals	Plants	Emergent Aquatics	1	<10 plants/m2
		Submersed Aquatics	2	10 - 20 plants/m2
			3	20 - 50 plants/m2
			4	50 - 100 plants/m2
			5	>100 plants/m2
	Fish	Protected Fish Species		CPUE, Length distribution, or kg/ha
		Sport Fish Species		
		Commercial Fish Species		
		Forage Fish Species		
		Exotic Fish Species		
	Birds	Dabbling Ducks	1	0 - 1,000 use days/yr
		Diving Ducks	2	1,000 - 10,000 use days/yr
			3	10,000 - 100,000 use days/yr
			4	>100,000 use days/yr

Figure 5 (continued). Framework for setting objectives for condition of the UMR-IWW ecosystem.

The UMR-IWW environmental objective database is stored as a GIS point coverage. It maintains objective locations and descriptive information (e.g., extent, target range, etc.).

After the work groups completed reviewing and assigning environmental objectives, they came back together into a plenary session to discuss their findings. This allowed workshop participants to hear a summary of what was accomplished in other groups and have input into the entire set of results. Each group provided a brief presentation summarizing the objectives identified in their respective reach and further discussion ensued. Following the presentations, the facilitators used GIS tools to move through the workshop region and have participants refine and add to the UMR-IWW Objective Database (Figure 6). The GIS tool used to capture and refine environmental objective information was developed as an ArcView 3.2a GIS extension. It allowed workshop facilitators and participants to select or create points in the GIS objective database file (by clicking on a location over a base map or photo) and enter descriptive information about the objective (e.g., ecosystem element, extent, target range, etc.). After parameters were entered, the information was saved to the database and the objective point location was displayed with an appropriate icon.

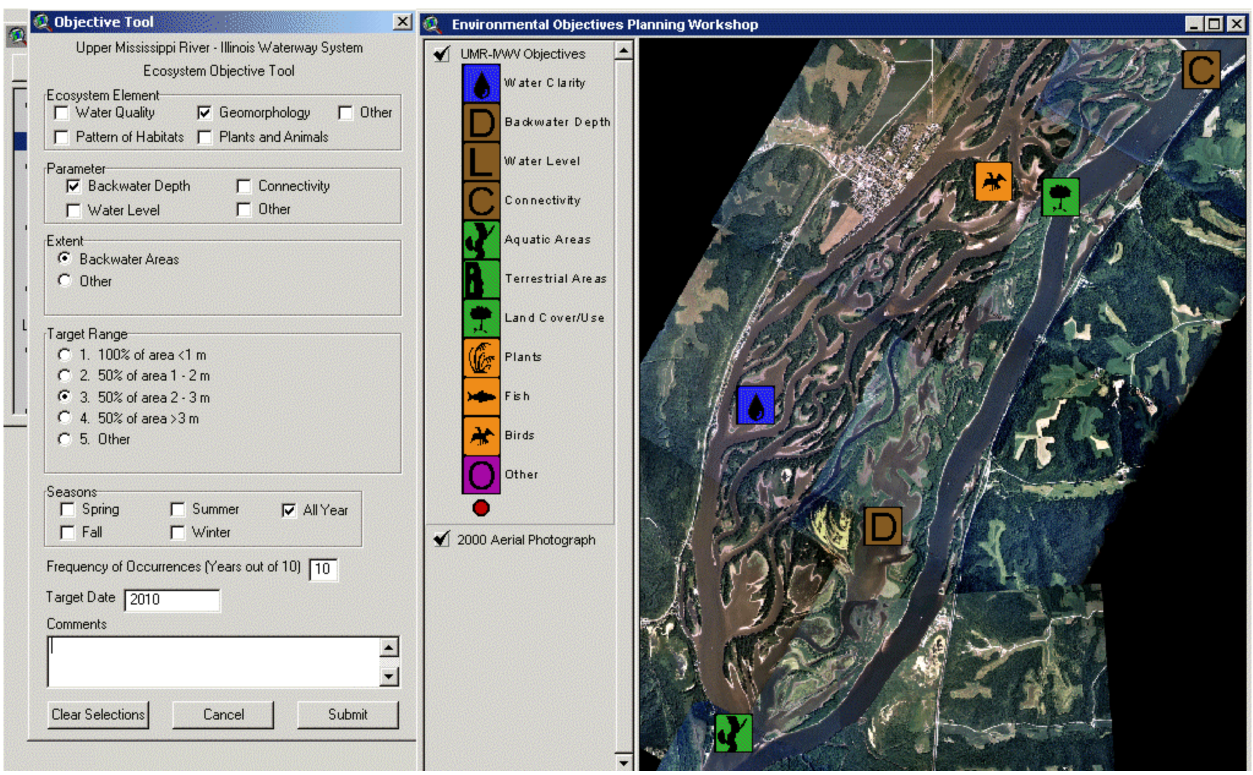

Figure 6. UMR-IWW System Navigation Feasibility Study GIS Objective Tool and Database.

La Crosse Workshop Objectives (Pool 1 to 11)

The environmental objective database developed prior to the La Crosse Workshop included 1,451 site-specific objectives obtained from the UMR-IWW Habitat Needs Assessment and Mississippi River Environmental Pool Plans. Objectives noted by Habitat Rehabilitation and Enhancement Project (HREP) documents were identified during the La Crosse Workshop and later added to the objective database. HREP objectives were added only for projects described as 'under general design' or 'future opportunities'.

Based on comments from the workshop participants and removal of redundant objectives (e.g., two identical depth objectives in the same backwater area), the database was refined to 1,168 objectives (Table 2). Over 240 of these identified objectives were enhanced with additional detailed information (i.e., target ranges, seasonality, and descriptive comments) provided by the participants.

Table 2. Number of site-specific env. objectives identified for Mississippi River Pools 1 - 11.

	Mississippi River Reach												
Objective	Pool 1	Pool 2	Pool 3	Pool 4	Pool 5	Pool 5a	Pool 6	Pool 7	Pool 8	Pool 9	Pool 10	Pool 11	Total
Water Clarity	0	8	6	11	10	7	7	10	25	26	30	20	160
Backwater Depth	0	8	8	12	11	8	10	10	21	25	40	20	173
Water Level	1	3	1	2	1	1	4	2	1	2	1	2	21
Connectivity	1	6	9	8	6	3	7	6	5	4	9	3	67
Aquatic Areas	13	1	1	7	4	3	1	5	1	3	15	18	72
Terrestrial Areas	1	19	7	38	21	6	12	21	37	36	51	40	289
Land Cover/Use	2	55	41	36	36	16	10	25	42	46	26	30	365
Other	1	2	3	1	0	3	2	0	4	0	3	2	21
Total	19	102	76	115	89	47	53	79	136	142	175	135	1168

Land cover/use, terrestrial area, and backwater depth were the most common type of objectives identified for this portion of the river. Emergent and submersed aquatic vegetation made up the largest number of identified land cover objectives and terrestrial area objectives most often referred to island restoration. The 21 environmental objectives identified as 'Other' included objectives related to improving dissolved oxygen levels, controlling invasive species, and restoration of river rapids habitat. Pool 7 had the largest density of identified objectives with an average of more than six per river mile. Appendix B and C provide additional detail on the objectives listed in Table 2. They include atlas maps displaying objective locations and associated tables with descriptive information. An example of the objective database map products is presented in Figure 7.

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- water clarity in secondary channels should have a secchi disk transparency of 1.5m during all seasons by 2010,
- decrease sediment-loading from tributaries,
- actively manage floodplain forests,
- create a more natural hydrograph,
- support Environmental Pool Plans,
- preserve native species/communities,
- complete storm/sanitary drain separation,
- protect mussels – recovering communities,
- reduce erosion, and
- sustain quality habitat through natural processes.

A more complete list of Mississippi River pool-wide objectives gathered at the La Crosse Workshop is located in Appendix D.

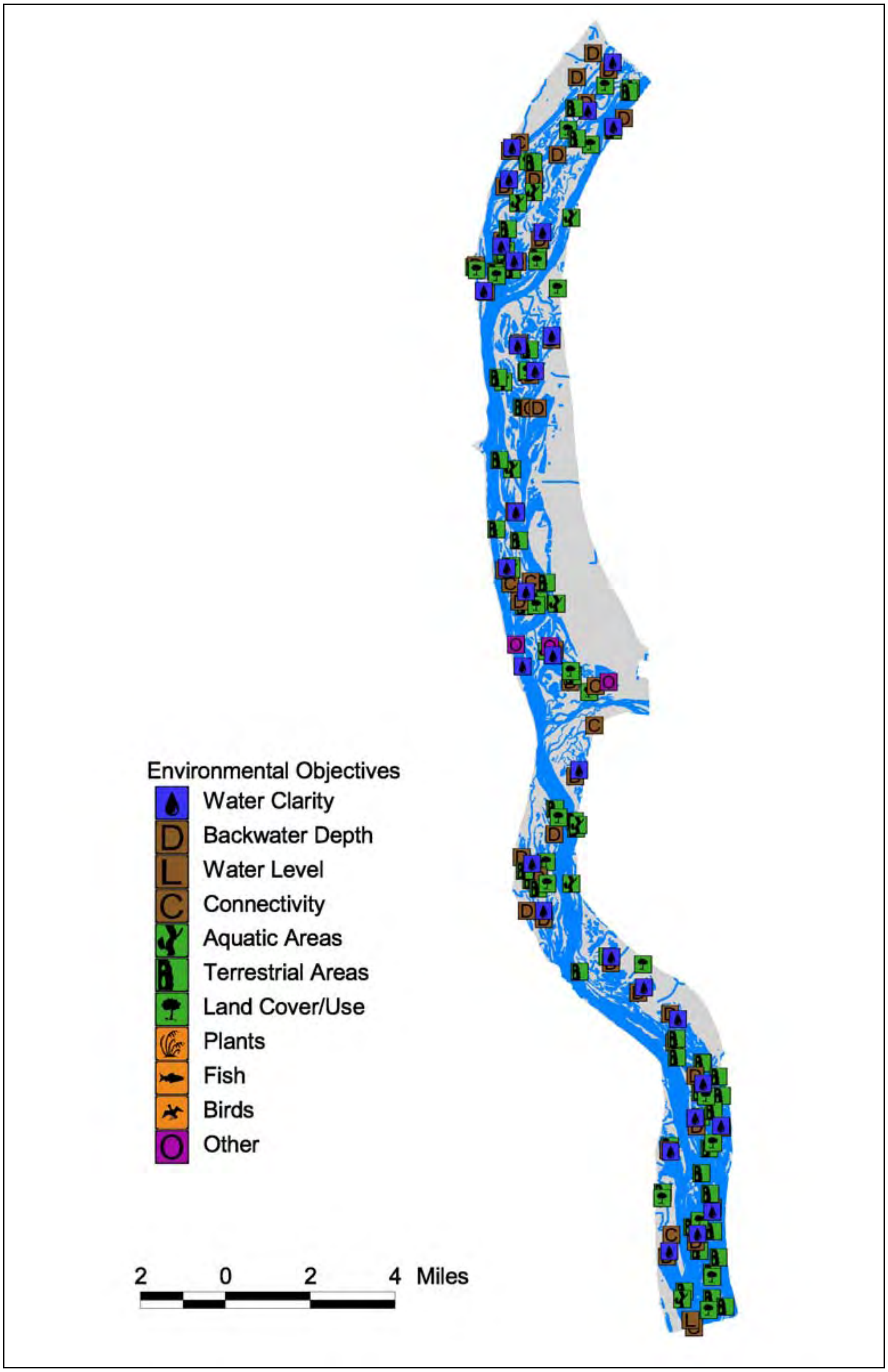

Figure 7. Pool 10 environmental objectives.

Moline Workshop Objectives (Pool 12 to 22)

The environmental objective database developed prior to the Moline Workshop included 374 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment and Mississippi River Environmental Pool Plans. Objectives noted by the Fish and Wildlife Interagency Committee Restoration Priorities and HREP documents were identified during the Moline Workshop and later added to the objective database. HREP objectives were added only for projects described as ‘under general design’ or ‘future opportunities’.

An additional 247 site-specific objectives were identified through the workshop process bringing the total to 621 environmental objectives for the Pool 12-22 reach of the Mississippi River (Table 3). Over 400 of the identified objectives were also enhanced with additional detailed information (i.e., target ranges, seasonality, and descriptive comments) provided by the participants.

Table 3. Number of site-specific env. objectives identified for Mississippi River Pools 12 - 22.

	Mississippi River Reach											
Objective	**Pool 12**	**Pool 13**	**Pool 14**	**Pool 15**	**Pool 16**	**Pool 17**	**Pool 18**	**Pool 19**	**Pool 20**	**Pool 21**	**Pool 22**	**Total**
Water Clarity	14	14	10	0	8	6	8	8	9	9	11	97
Backwater Depth	16	14	12	0	7	7	8	9	6	6	11	96
Water Level	1	1	1	1	1	1	1	1	2	1	1	12
Connectivity	2	2	2	2	2	4	6	2	1	9	10	42
Aquatic Areas	4	9	5	2	11	7	9	6	21	3	19	96
Terrestrial Areas	12	16	6	1	2	1	7	10	3	9	9	76
Land Cover/Use	15	15	11	0	9	12	10	12	18	10	23	135
Fish	1	1	1	1	0	0	1	0	0	0	0	5
Other	0	0	3	3	1	2	0	3	20	14	16	62
Total	65	72	51	10	41	40	50	51	80	61	100	621

Land cover/use, aquatic area, water clarity, and backwater depth were the most common type of objectives identified for this portion of the river. Emergent aquatic and forest vegetation made up the largest number of identified land cover objectives and aquatic area objectives most often referred to secondary channel habitat. The 62 environmental objectives identified as ‘Other’ included objectives related to restoring historic migratory bird habitat, meeting USEPA Total Maximum Daily Load (TMDL) requirements for tributaries, reducing urban stormwater runoff, and targeting land for acquisition. Pool 22 had the largest density of identified objectives with an average of more than four per river mile. Appendix B and C provide additional detail on the objectives listed in Table 3. They include atlas maps displaying objective locations and associated tables with descriptive information.

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- address concerns of 303D (impaired water's list),
- increase connectivity of seasonal river flow so that 20% of the floodplain is inundated during 10-year flood events
- restore or create islands that provide protection from windfetch,
- provide one 1000-acre core habitat block (wetland, grassland and forest) per pool,

- restore 10% of the backwater areas to seasonally maintain a three meter depth with dissolved oxygen concentrations at 5ppm or greater,
- increase emergent plants to 10% of the area for every backwater,
- work to achieve habitat restoration through agricultural programs on the floodplain (e.g., Conservation Reserve Program (CRP), Emergency Wetland Reserve Program (EWRP), Wetland Reserve Program (WRP), etc.),
- eliminate reed canary grass wherever possible,
- allow passage for the 27 migratory fish species during key life cycles and migratory periods, and
- restore the presence of Lake Sturgeon (i.e., a species of concern).

A more complete list of Mississippi River pool-wide objectives gathered at the Moline Workshop is located in Appendix D.

St. Louis Workshop Objectives (Pool 24 to Confluence of Ohio River)
The environmental objective database developed prior to the St. Louis Workshop included 185 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment and Middle Mississippi River Side Channel Rehabilitation and Conservation Initiative. Objectives noted by the Middle Mississippi River Stone Dike Alteration Study and HREP documents were identified during the St. Louis Workshop and later added to the objective database. HREP objectives were added only for projects described as ‘under general design’ or ‘future opportunities’.

An additional 251 site-specific objectives were identified through the workshop process bringing the total to 436 environmental objectives for the Pool 24 to Ohio River reach of the Mississippi River (Table 4). Aquatic area and land cover/use were the most common type of objectives identified for this portion of the river. Aquatic and forest vegetation made up the largest number of identified land cover objectives and aquatic area objectives most often referred to secondary channel habitat.

Table 4. Number of site-specific env. objectives identified for Mississippi River from Pool 24 to the Ohio River.

Objective	Mississippi River Reach Pool 24	Pool 25	Pool 26	Lock 26 to Kaskaskia R.	Kaskaskia R. to Grand Tower	Grand Tower to Ohio R.	Total
Water Clarity	10	19	16	1	1	3	50
Backwater Depth	14	21	18	1	1	3	58
Water Level	1	0	0	0	0	0	1
Connectivity	9	13	4	11	6	12	55
Aquatic Areas	8	17	7	34	15	43	124
Terrestrial Areas	7	3	2	10	3	5	30
Land Cover/Use	13	26	18	18	9	14	98
Fish	0	0	0	0	1	0	1
Other	4	6	4	4	0	1	19
Total	66	105	69	79	36	81	436

Pool 25 had the largest density of identified objectives with an average of more than three per river mile. The 19 environmental objectives identified as ‘Other’ included objectives related to maintaining gravel substrate, improving air quality, and reducing sediment input from tributaries. Appendix B and C provide additional detail on the objectives listed in Table 4. They include atlas maps displaying objective locations and associated tables with descriptive information.

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- restore and maintain 200 foot wide riparian corridors,
- maintain water clarity sufficient to support vegetation to a depth of 1.5m,
- increase floodplain connectivity to mainstem flows by 40%,
- increase quantity of woody debris in side channels,
- reduce the nutrient load by 15%,
- restore historic meanders,
- allow some disturbance regimes to occur on the river,
- allow some non-constrained stretches of the river (e.g., areas with no revetment),
- provide bird nesting areas every 20 miles, and
- provide thermal refuge (e.g., summer and overwintering habitat) for fish every 5-7 miles.

A more complete list of Mississippi River pool-wide objectives gathered at the St. Louis Workshop is located in Appendix D.

Peoria Workshop Objectives (Illinois Waterway)

The environmental objective database developed prior to the Peoria Workshop included 115 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment and Illinois River Ecosystem Restoration – Alton Pool Draft Fact Sheet. Objectives noted by the Fish and Wildlife Interagency Committee Restoration Priorities and HREP documents were identified during the Peoria Workshop and later added to the objective database. HREP objectives were added only for projects described as 'under general design' or 'future opportunities'.

An additional 227 site-specific objectives were identified through the workshop process bringing the total to 342 environmental objectives for the Illinois River (Table 5). Over 80 percent of the objectives were located in the lower three pools of system with land cover/use (i.e., aquatic vegetation) and backwater depth being the most common types identified.

Table 5. Number of site-specific env. objectives identified for the Illinois River.

	Illinois River Pool								
Objective	Lockport	Brandon	Dresden	Marseilles	Starved Rock	Peoria	La Grange	Alton	Total
Water Clarity	0	0	1	4	3	14	22	7	51
Backwater Depth	0	0	1	4	3	15	25	8	56
Connectivity	0	0	1	2	1	3	13	7	27
Aquatic Areas	0	1	2	2	3	9	12	14	43
Terrestrial Areas	0	0	0	3	2	23	3	23	54
Land Cover/Use	0	0	1	5	4	17	29	22	78
Plants	0	0	0	0	0	1	0	0	1
Fish	2	0	0	0	0	0	0	0	2
Birds	0	0	0	0	0	1	0	0	1
Other	0	1	3	1	4	11	2	7	29
Total	2	2	9	21	20	94	106	88	342

The 29 Illinois River objectives identified as 'Other' included objectives related to mussel beds, restoring natural tributary meanders, and reduction of contaminated sediment. Appendix B and C provide additional detail on the objectives listed in Table 5. They include atlas maps displaying objective locations and associated tables with descriptive information.

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- maintain 50% of currently isolated backwaters for exclusion of exotics and protection of high quality habitat;
- increase connectivity to 25% of currently isolated backwaters;
- protect, maintain, and enhance threatened and endangered species habitat and other natural areas;
- recreate the natural hydrograph;
- reduce incidence of summer water level "bumps" to less than 1 year in 3;
- restore aquatic vegetation in backwater areas;
- reduce sedimentation throughout each pool;
- control all exotic species; and
- increase bottomland hardwood forest acreage by 10% and improve diversity.

A more complete list of Illinois River pool-wide objectives gathered at the Peoria Workshop is located in the Environmental Objectives Appendix D.

Comparison of Workshop Environmental Objective Results

A total of 2,567 UMR-IWW environmental objectives were reviewed and developed through the Environmental Objectives Planning Workshops held in November 2002. Land cover/use, terrestrial areas, and backwater depth were the most common type of objectives identified by workshop participants (Table 6 and Figure 8).

Table 6. Number of site-specific env. objectives identified for the UMR-IWW System.

	Mississippi River Reach				
Objective	**La Crosse (Pool 1-11)**	**Moline (Pool 12-22)**	**St. Louis (P. 24-Ohio R.)**	**Peoria (Illinois R.)**	**Total**
Water Clarity	160	97	50	51	358
Backwater Depth	173	96	58	56	383
Water Level	21	12	1	0	34
Connectivity	67	42	55	27	191
Aquatic Areas	72	96	124	43	335
Terrestrial Areas	289	76	30	54	449
Land Cover/Use	365	135	98	78	676
Plants	0	0	0	1	1
Fish	0	5	1	2	8
Birds	0	0	0	1	1
Other	21	62	19	29	131
Total	1,168	621	436	342	2,567

Emergent and submersed aquatic vegetation made up the largest number of identified land cover objectives and terrestrial area objectives most often referred to island restoration. The target range most often identified for backwater depths was 1-2 meters.

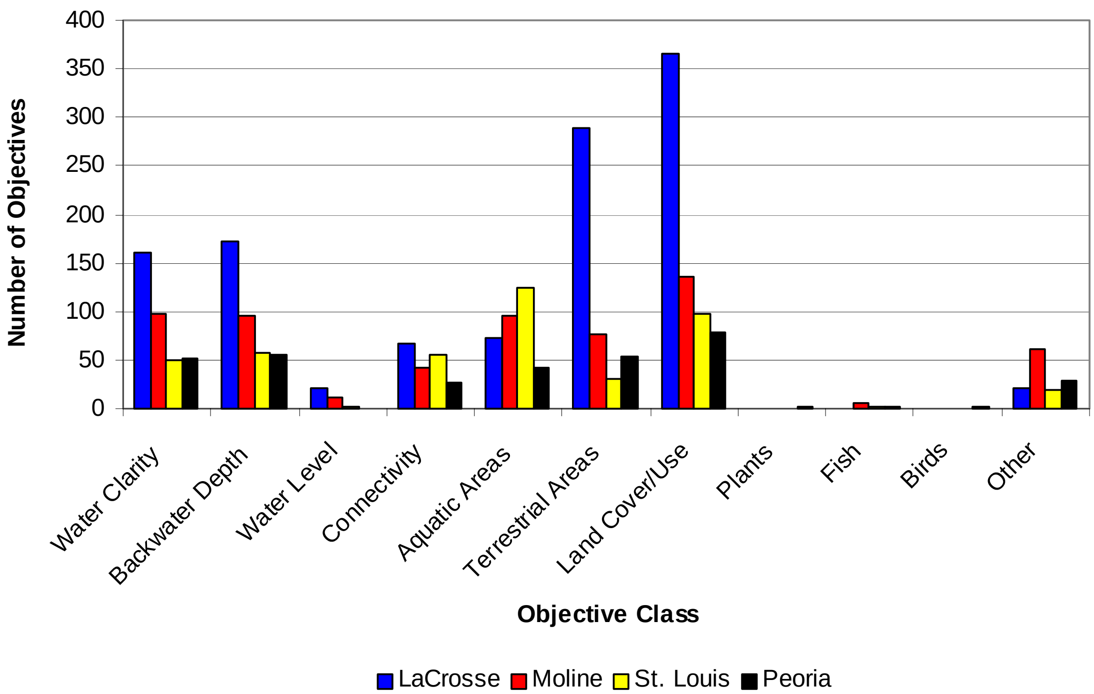

Figure 8. Number of site-specific env. objectives identified for the UMR-IWW System.

A summary of all workshops showed the largest proportion of environmental objectives, 46 percent, were established for the Pools 1 to 11 reach at the La Crosse workshop (Table 6 and Figure 8). In decreasing density of objectives, 24 percent occurred in Pools 12 to 22, 17 percent between Pool 24 and the Ohio River, and 13 percent along the Illinois Waterway. Examining the types of objectives, there were almost twice as many terrestrial area objectives in the La Crosse area, mainly island construction objectives, than in the rest of the system. Similarly, there were more land cover objectives for the La Crosse reach than the rest of the system combined. There were about 50 percent more water clarity and backwater depth objectives in the La Crosse reach than in the Moline reach which was the second highest. The La Crosse reach also had more connectivity objectives than the other reaches that have substantially more levees, but many of the La Crosse objectives were actually for reduced connectivity of impounded area aquatic habitats. The St. Louis and Moline areas had the highest density of aquatic area objectives, most often referring to secondary channel habitats. The largest number of "Other" objectives was noted in the Moline reach and primarily referred to land acquisition and improved water quality. The Peoria reach had the second highest density of "Other" objectives, mainly related to protecting mussel beds and restoring natural tributary meanders in the floodplain.

The differences in the number of workshop identified and reviewed objectives do not necessarily reflect the landscape-level ecological needs of the system. Species objectives (i.e., plants, birds, and fish) are considered extremely important for the system, but were limited in the database because habitat objectives were often set in their place (e.g., restore aquatic areas to improve fish populations). These objectives were also limited due to the difficulty in setting quantitative targets for species. In general, the number of objectives may not directly relate to the spatial extent of their need. For example, although there were fewer water level objectives identified, they may impact a larger area in the UMR-IWW than the terrestrial area objectives. Regional differences in the number of identified objectives may also be related more to existing habitat diversity than ecological need. For example, the number of identified backwater depth objectives may be more proportional to the number of backwater areas in a region, rather than the overall need. Regional geomorphology and response to navigation infrastructure has resulted in more, smaller backwaters in northern river reaches versus fewer larger backwater lakes in southern and Illinois River reaches.

Management Actions

Methodology

The purpose of the Management Actions working groups and plenary session was to review and identify management actions that were most likely to contribute to achieving the established goals and objectives. This was accomplished by reviewing current tables of management actions (*Interim Report for the Restructured Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study – Appendix 5*), tailoring them to the ecosystem elements under consideration, and revising them where necessary. Management Actions are defined as specific actions, tools, techniques or combinations of actions, tools and techniques used to meet defined objectives. Management actions are implemented as specific projects whose detailed planning and design provide the information required to assess the benefits, cost effectiveness, and incremental justification of the project. Issues of funding, staffing, engineering, and partnerships needed to implement the plan will also be assessed during this phase. Table 7 provides an example of the Management Action tables where actions have been reviewed and added. All UMR-IWW management actions compiled and revised during the workshops can be found in Appendix E.

For the purposes of these workshops, Management Actions were: regulatory, operational or structural tools or activities that can be implemented to positively address environmental objectives (e.g. hydraulically dredge a backwater area). Participants reviewed a list of management actions that had been compiled from previous planning efforts to assess their ability to meet the environmental objectives discussed in the workshop. Time was given to ensure all the groups were able to review all of the actions. The reports from each group were presented in a plenary session to provide other participants the opportunity to ask for and receive clarification.

Table 7. Example Management Action Table.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Water Quality			
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)
		2	Stabilize river banks
		3	Pool scale drawdown to consolidate soft sediments
			Pool scale drawdowns to promote emergent vegetation
		4	Minimize dredge disturbance/frequency
		5	Minimize dredge slurry return water
		6	Minimize bankside dredged material placement
		7	Stabilize dredged material
		8	Tributary reservoirs
		9	Speed and wake restrictions - rec. boats
Comments/ Additions			Establish and enforce safety zone for tow boats
			Establish a permit system for tows over 9 foot draft
			Adjust sailing line
			Improve aids to navigation
			Additional mooring buoys
			Restore natural tributary meander areas through delta areas
			Minimize open water dredged material placement
			Tributary sediment traps
			Increase depth in main channel (reduce sediment resuspension)
			Require upper Illinois Waterway to meet EPA general use standards

The results were organized into three sections for each draft workshop report (Appendices F-I): management action tables, plenary report, and working group reports. Results from working group "master" management action tables were compiled into workshop reports, and the workshop reports were further combined to create a final list from all the workshops (Appendix E). Redundancies were removed within individual ecosystem elements or extents, but considerable redundancy among ecosystem elements and extents remains. This attests to the fact that the same management action may achieve multiple objectives.

Results

Each working group prepared a master worksheet to record the group's changes, additions, and deletions to the list of management actions. The changes from all the groups were compiled in worksheets in Draft Workshop Reports (Appendices F-I). In La Crosse, there were 130 new management actions, and 54 comments added (Table 8).

Table 8. Additions, modifications, deletions, and comments made to Management Action worksheets during UMR-IWW Restructured Navigation Study Environmental Objectives Workshops (Nov. 2002).

River Reach	Ecosystem Element or Parameter Added	Management Action Added	Management Action Modified	Management Action Deleted	Comments
La Crosse	1	130	44	10	54
Moline	3	67	22	10	20
St. Louis	3	36	4	7*	54
Peoria	0	41	8	0	23
* The work groups responsible for the Middle Mississippi River (i.e., open river) deleted 20 management actions.					

The La Crosse group modified 44 existing management actions and deleted 10 of the actions listed. In Moline, there were three ecosystem elements, 67 new management actions, and 20 comments added. The Moline group modified 22 existing management actions and deleted 10 of the actions listed. In St. Louis, there were three ecosystem elements or parameters, 36 new management actions, and 54 comments added. The St. Louis group modified four existing management actions and deleted seven of the actions listed. The groups covering the Open River, or Middle Mississippi River reach deleted 20 actions or determined they were not applicable in that river reach. In Peoria, there were 41 management actions added, 8 actions were modified, and 23 additional comments were added. The results from all workshops were merged (Appendix E), and will be combined with the entire management actions database (*Interim Report for the Restructured Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study – Appendix 5*) and updated as a relational database.

There was considerable mixing of management actions, management tools, and objectives in the worksheets completed during the workshops. It was decided not to refine these worksheets any further, but to keep them as references for use in the future. Further refinements will be made in a relational database under development with the advice of an Expert Panel and stakeholders. The *Interim Report* Appendix of Management Actions, which was expanded from 400 to 500 items after including the results of the workshops, will provide the basis of the database.

Species and Population Parameters

Methodology

Recent environmental planning efforts for the Environmental Management Program and other Upper Mississippi River System restoration and maintenance programs have focused on habitats and the impacts of Corps activities on habitats. It has been recognized that planning efforts need to be expanded to include additional functional and structural ecosystem elements.

During the planning stages of the UMR-IWW Environmental Objectives Workshops, organizers were considering objectives for plant and animal species and quickly encountered difficulty in selecting species, guilds, or units of measure for plants and animals. Emergent and submersed aquatic plants, diving ducks, and dabbling ducks were eventually selected for quantitative objectives based on the perception that knowledgeable resource managers could interpret the units of measure selected (Figure 5). Stem density was selected as a relatively standard unit of measure for aquatic plants and use-days during migration periods were selected as relatively standard measures of waterfowl abundance.

Specific objectives for fish were desired, but the selection of guilds, or species, or units of measure quickly complicated the issue. It was decided therefore to seek less specific objectives for fish and only indicate that there is an objective for several general categories of fish determined during earlier phases of the Navigation Study: protected, sport, commercial, forage, and exotic fishes in channel and backwater habitats. With the river community's desire to establish quantitative objectives, developing units of measure is particularly important because of the historical inability or lack of commitment to conduct fish community stock assessments. Discussion of the units of measure and requirements to achieve them is especially important because of the need for measurable objectives and the selection of evaluation tools.

These issues were discussed during plenary sessions at each workshop, with the results to be forwarded to an Expert Panel. A focus group of workshop participants will continue work with the Expert Panel to refine fisheries objectives. The larger list of species such as reptiles, amphibians, other birds, and mammals will be considered during future phases of the adaptive management and assessment process recommended in the 2002 Navigation Study Interim Report.

Results

Workshop participants expressed apprehension about setting species targets. The source of apprehension was that environmental management actions to achieve species targets may be undertaken without knowing or evaluating the impacts on the rest of the ecosystem. Overwhelmingly, the participants expressed a desire for habitat objectives, with the understanding that habitat management will likely result in increased abundance of both targeted and non-targeted species.

Understanding baseline and existing conditions was mentioned several times with the thought that the deviation of existing conditions from the baseline can frame the scope of restoration needs. Most workshop participants recognized the lack of quantitative baseline data for most species, but they encouraged the incorporation of any information available. Being able to relate species presence and abundance with specific habitats (or land cover) might help back-calculate potential species abundance based on available historic land cover. Resource managers repeatedly called for ecological quality metrics, such as the Index for Biotic Integrity for stream fishes that can be used in large rivers and for other faunal groups.

The topic of biological response monitoring to restoration was rather wide-ranging considering the discussions at all of the workshops. There was concern that focusing on a small set of species may not detect community level response, either beneficial or adverse. In St. Louis, habitat evaluation procedures including the Wildlife Habitat Appraisal Guide (WHAG: Missouri Department of Conservation. 1991. Wildlife Habitat Appraisal Guide. Jefferson City, MO.) and Aquatic Habitat Appraisal Guide (AHAG: Mathias, Dean. 1996. Aquatic Habitat Appraisal Guide. USACE Waterways Experiment Station Instruction Report. 68 pp.) were proposed as habitat level models designed for such purposes. They were thought to be more robust than species specific Habitat Evaluation Procedures (HEP: USFWS Division of Ecological Services. 1992. Habitat Evaluation Procedures. USFWS Ecological Service Manual 102. 150 pp.) that may emphasize some habitat variables over others and frequently don't incorporate all habitat variables. Some participants recommended that the fisheries management community work to complete an Index of Biotic Integrity (IBI: Karr, J.R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6(6):21-27.) for large rivers. Another proposed indicator of ecological improvements in the Illinois River is the vigor of fishing tournaments and public use. It was also suggested that fish condition could be another characteristic that might be measured to view the state of the river fishery.

Facilitators posed the question of whether total population assessments were desired. Workshop participants responded no because: 1.) the cost would be prohibitively high considering other priorities, 2.) the precision of the estimate would likely not be very good, 3.) some populations may be affected by factors outside of the UMR-IWW System or may be habitat independent (e.g., overexploitation), and 4.) many species life histories are such that strong or weak year classes can greatly affect population sizes over short time periods. It was recognized that in some instances total population estimates might be required, but these should be done for very specific purposes, not routine surveys.

There was one suggestion to consider conservative species (habitat specialists) needs as an umbrella approach to be able to assess the more general species. Other participants thought that relative abundance of species or guilds obtained from traditional survey techniques would be sufficient to assess community structure and response to restoration. One concern was that expending considerable effort to understand many different species could consume considerable amounts of money and not leave any for actual restoration efforts. In actuality, many measurement techniques will be needed to assess progress toward restoration targets.

In La Crosse, there was a suggestion that physical responses (e.g., current velocity, dissolved oxygen, depth, etc.) to project implementation may be reliable measures of project performance. Their thoughts were that projects should be designed to accommodate the physical needs of target organisms or communities, thus the effectiveness of the project could be evaluated by its ability to achieve desired physical targets. That line of reasoning circumvents the problems of waiting for biological communities to respond, or expending huge amounts of effort to estimate biological responses to projects separate from other influences on the population. Some long-lived species or wide-ranging species responses may be very difficult or impossible to evaluate. The lag time between project implementation, post-project performance evaluations (biological and physical), and reporting results was seen as an important issue to understand.

Aquatic plants, invertebrates, and less mobile species were proposed as the best bioindicators of restoration response because they would be most likely to respond to changes in local habitat conditions. Considering all the issues, participants seemed to agree that species of concern and exotic species should be tracked as indicators of ecosystem condition and that community level assessments should be targeted at specific habitats and project areas.

Several participants espoused the adaptive management philosophy put forth in the UMR-IWW System Navigation Feasibility Study Interim Report. The adaptive management process allows for testable hypotheses (i.e., restoration measures) to be implemented despite uncertainties, and evaluation to refine measures if actions fall short of anticipated results.

Some participants were puzzled why the Corps would venture into species level issues. The Corps has authority for habitat management and other state and Federal agencies have responsibility for species.

The question of why we need precise population estimates was also raised. Facilitators responded that the Planning Guidance for water resources require quantitative estimates of the benefits of restoration projects. The thought was that firm quantitative estimates of population changes related to habitat modification may help provide justification for restoration measures. Such information is also beneficial for developing sound scientific information that can serve as a solid baseline in an adaptive management strategy.

Next Steps

After the Workshops

The workshops were an early step in a planning process to establish environmental alternatives that strive to secure the ecological sustainability of the UMR-IWW. Once environmental objectives are well defined and management actions are identified to achieve them, the next step will be estimating the potential costs and outcomes (i.e., benefits) for the suggested actions. This information will be used to develop alternative plans (made up of multiple combinations of management actions) that seek to address the local, river reach, and system-wide needs of the UMR-IWW ecosystem. These environmental alternative plans will then be integrated with alternative plans for the UMR-IWW Navigation System. Tradeoff analysis will be conducted to identify and compare the environmental, economic, and social benefits of the integrated plans. The results of the alternative analysis, and further collaborative review and input from stakeholders, will be used to develop a recommended plan portrayed in the Final Feasibility Report scheduled for completion in late 2004.

The process of refining environmental objectives, management actions, and resulting Navigation Study alternatives will require further stakeholder involvement. This will include stakeholder input in the development of an objective/management action relational database, management action cost/outcome assessment, alternative development/refinement/sequencing, adaptive management, and the overall plan formulation process. Input from the river community on these topics will occur through upcoming stakeholder meetings (e.g., NECC, ECC, and GLC), public meetings, an alternative formulation briefing, and draft product distribution to stakeholders for review and comment.

Pathways to Implementation

Work completed to date has indicated a potential for inclusion of a wide variety of measures formulated to meet the goals of economic and ecological sustainability. As discussed in the previous section this will be accomplished by evaluating combinations of navigation improvements and environmental restoration measures. Implementation of these measures will require a review and understanding of the Corps of Engineers authorizations and may require additional authorization. The authorization discussion will be refined throughout the formulation process and be fully documented in the Feasibility Study.

The Corps of Engineers will include ecosystem restoration as an equal project purpose in the UMR-IWW Navigation Feasibility Study. This could provide for dual project purposes of navigation and ecosystem restoration and include justified navigation improvements, operation and maintenance for both navigation and the environment, and authorities to provide for ecosystem restoration projects to meet ecosystem restoration goals and objectives. A dual-purpose project will provide better focus and flexibility to adaptively manage the system. The Feasibility Study will provide a full evaluation to compare the implementation effectiveness of existing authorities against a new specific dual-purpose authority.

Maintaining the ecological integrity and sustainability of the UMR-IWW System extends beyond sound environmental stewardship in operation of the navigation project and modification of navigation structures. It includes interdependent basin-wide issues of water quality, sedimentation, habitat protection and restoration, wildlife and fishery management and land management that are within the purview of other Federal agencies, the States, and private organizations. The Federal agencies and the States that manage resources and have regulatory responsibilities on the UMR-IWW will have important roles to play in this new integrated plan. The non-governmental organizations will also have an important role in the advocacy of this new integrated plan. The Feasibility Study will explore opportunities where programs and potential projects can be coordinated and integrated into a comprehensive synergistic plan. Authorities and funding priorities and limits of the USDA, FWS, USGS, DOT and EPA shall be identified and the potential for using cross-cut budgeting among Federal agencies will be considered. The Feasibility Study will not seek new authorities or funding mechanisms for these agencies, however the recognition of the need for these agencies to participate will be highlighted. The Federal agencies and States will be encouraged to review their existing authorities and funding streams to determine if changes are needed to better support the sustainability goals established in this restructured effort.

Managing the UMR-IWW as a multi-purpose resource will require a review of existing institutional arrangements. The existing institutional arrangements consist of varied coordination committees composed of Federal, State, and non-governmental involvement, and their many layers create a challenge to developing a common vision for integrated management of the UMR-IWW System. While acknowledging that considerable progress has been made in the regions management framework over the past decades, there is room for improvement, especially with respect to addressing sustainability level problems and opportunities. Some of the areas commonly identified in need of improvement, include:

- commitment of staff and fiscal resources to collaborative planning and decision-making;
- inter- and intra-agency communication;
- jurisdictional border issues;
- overcoming the legacy of conflict and controversy;
- balance or equity in competing interests;
- development of common vision with consensual buy-in and support;
- acceptance of risk and uncertainty;
- evaluation process;
- public understanding, involvement, and support;
- coordinated partner funding requests and cross-cut budget support;
- integration, alignment, or leveraging of authorities and resources; and
- clear delineation of partners' and stakeholders' responsibilities.

The Feasibility Study will include a review of existing institutional arrangements and identify problems and opportunities for improvement. Using a subgroup of NECC members, this review and evaluation of the UMR-IWW management framework will be accomplished collaboratively with stakeholders. Recommendations for existing and new institutional arrangements developed by this subgroup will be included in the Final Feasibility Report as a means to implement the recommended plan.

Expert Panel

Previous sections of this report presented UMR-IWW environmental goals, objectives, and associated management actions identified and reviewed in a series of stakeholder workshops in November 2002. Future efforts will focus on how to move forward with the established objectives and refinement of management actions most likely to contribute to achieving them. Given the breadth and technical depth of these tasks, it is desirable to invite 'peer review' from technical experts in various disciplines relative to UMR-IWW System ecology. As such, a Technical Expert Review Panel, made up of an interdisciplinary team (Figure 9), will provide support to the process of establishing UMR-IWW environmental sustainability alternatives. This panel will assist in developing a process for defining, evaluating, and refining environmental objectives, management actions, and alternative plans for the river system.

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Figure 9. Expert panel participants.

The Expert Panel will review the UMR-IWW objectives and management actions and assist the study team in the formulation of alternative plans to achieve environmental sustainability. The expert panel will convene monthly between January and April 2003. The following is a list of the primary topics of discussion for these monthly meetings.

January - Review of environmental goals and objectives.
February - Link goals/objectives with management strategies using conceptual models.
March - Develop management strategies and alternatives.
April - Synthesize for input to the Navigation Study Feasibility Report.

Ecosystem Conceptual Model

At the end of the workshop, participants were provided with a brief presentation on the ecosystem conceptual model (Figure 10 and 11) being developed for the UMR-IWW Navigation Study. The model defines the pathways (lines and arrows) of causal influence between specific stressors (ovals) and general (large diamonds) and specific (hexagons) ecological effects. The purpose of the UMR-IWW conceptual model is to identify the linkages and sequencing of identified environmental objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and outcomes resulting from modifications to the system. The conceptual model can contribute to this overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Facilitate dialog and develop a structure for additional input from stakeholders

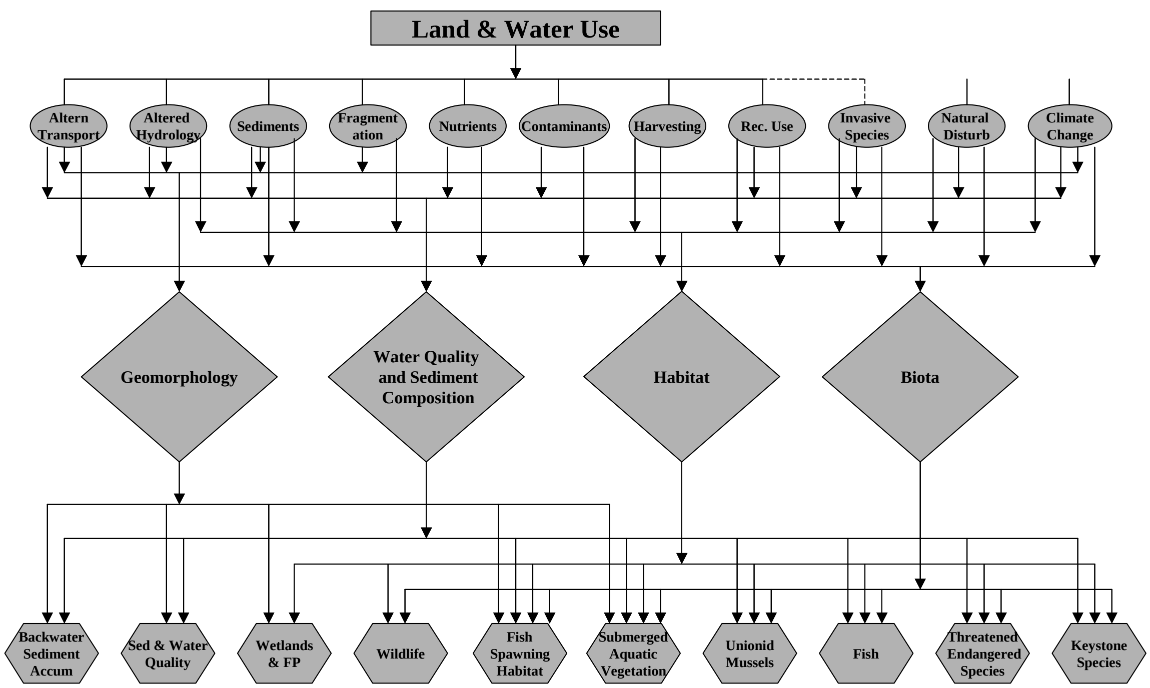

Figure 10. General conceptual model that defines ecological and environmental stressors relevant to the UMR-IWW Navigation Study. The model emphasizes stressors (ovals) specific to the operation and maintenance of the nine-foot navigation channel, but also includes other stressors (both natural and human-induced) that will be considered in the development restoration goals and objectives and implementation of adaptive management. The diamonds designate broader categories of ecological and environmental impacts of the stressors. The hexagons identify more specific effects (endpoints, performance measures).

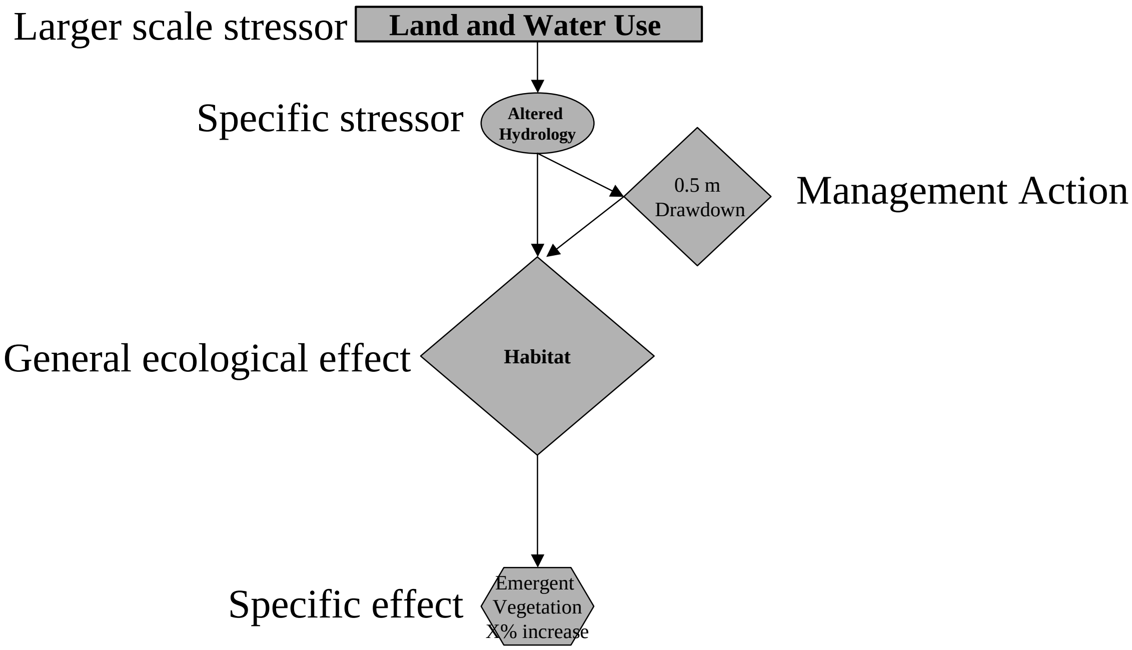

Figure 11. Specific example (derived from the conceptual model outlined in Figure 10) using the conceptual model to assess a management action's potential to address an identified objective of increased emergent vegetation. The specific stressor (oval) is alteration in hydrology and hydraulics associated with commercial navigation and nine-foot channel operations and maintenance. The smaller diamond identifies a management action (i.e., 0.5 m drawdown) that modifies the stressor and leads to a general ecological effect (larger diamond) of habitat change (e.g., increased aquatic vegetation). The specific assessment endpoint or performance measure (hexagon) is the percent increase in emergent vegetation due to the lowered water.

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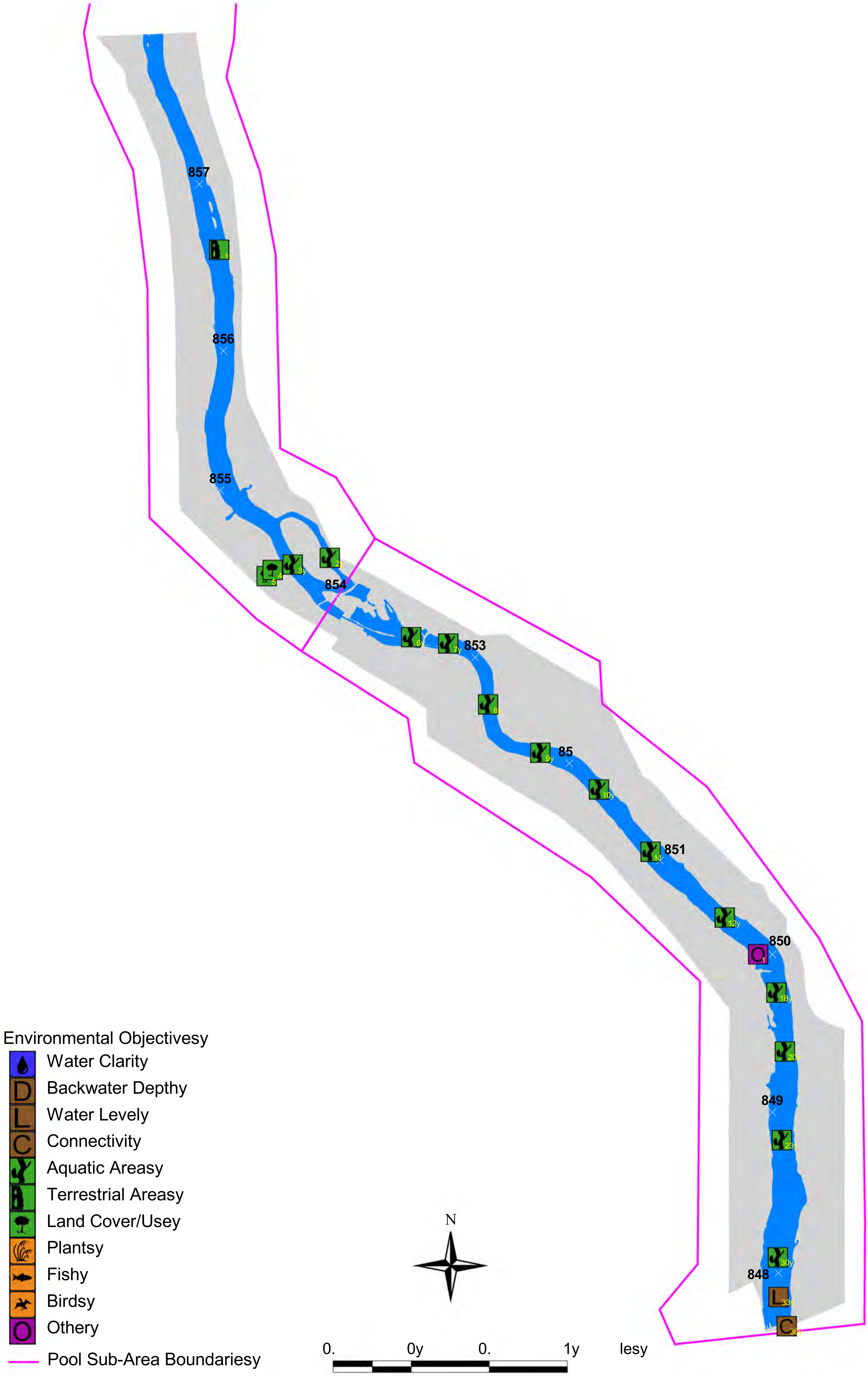
Appendix B. Site-Specific Environmental Objectives - Maps

The following maps display site-specific UMR-IWW environmental objectives identified and reviewed by workshop participants. The maps are organized by UMR-IWW pool/river reach and display icons representing the objectives. Icon numbers are also provided that link the mapped objectives to the tables in Appendix C. These tables contain descriptive information about the objectives.

UMR - IWW Environmental Objectives
Pool 1



UMR - IWW Environmental Objectives
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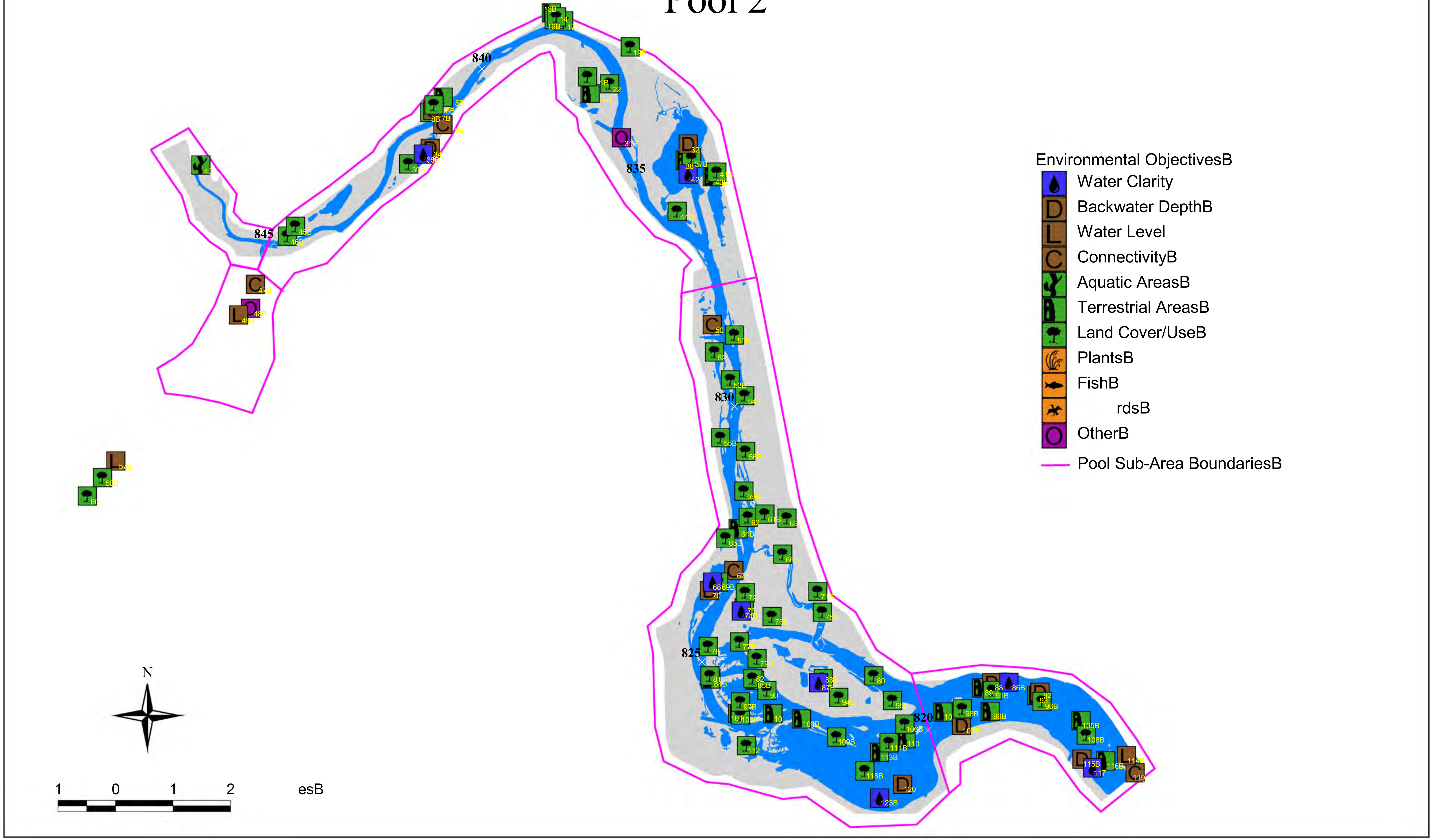

UMR - IWW Environmental Objectives
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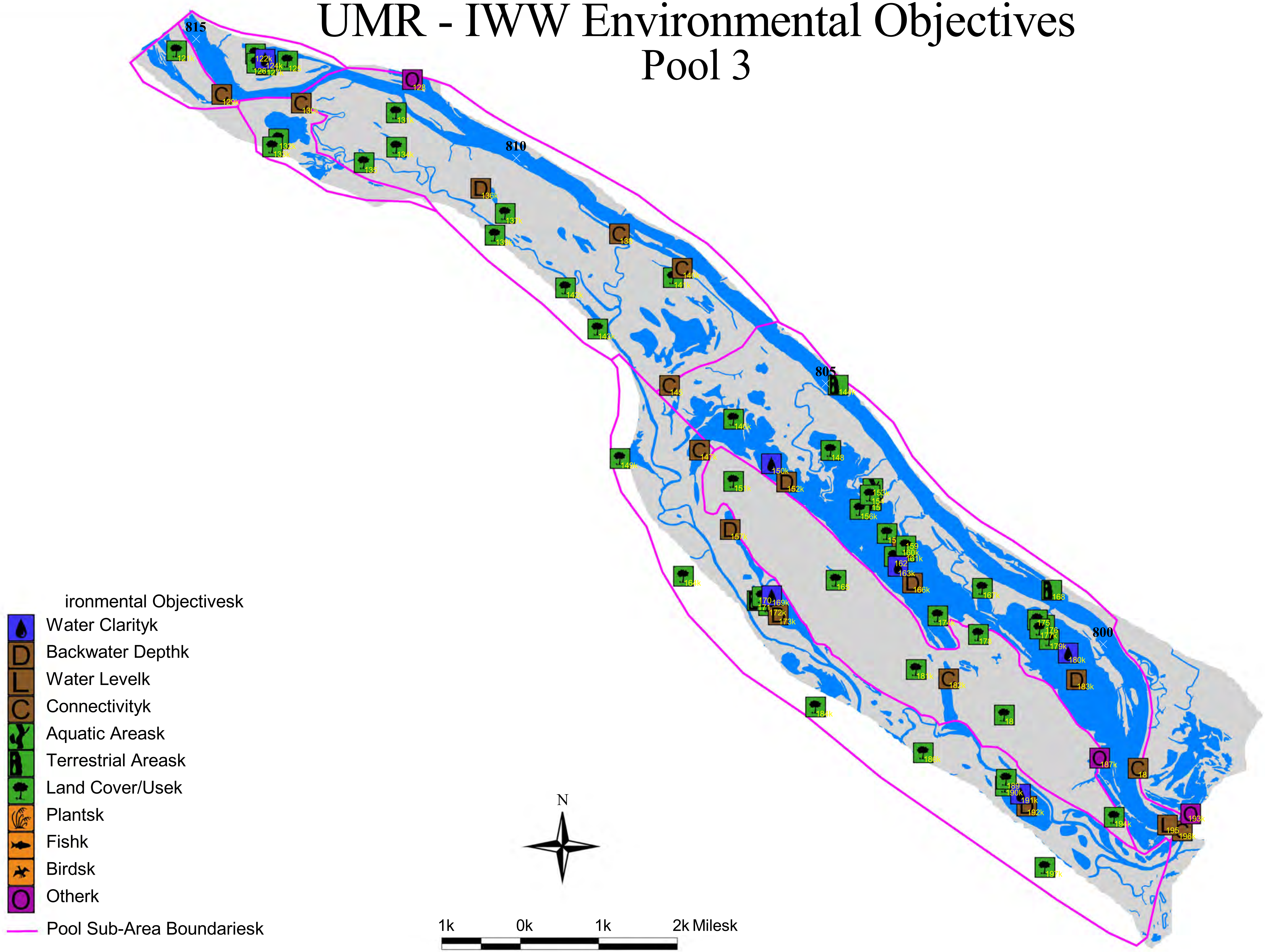
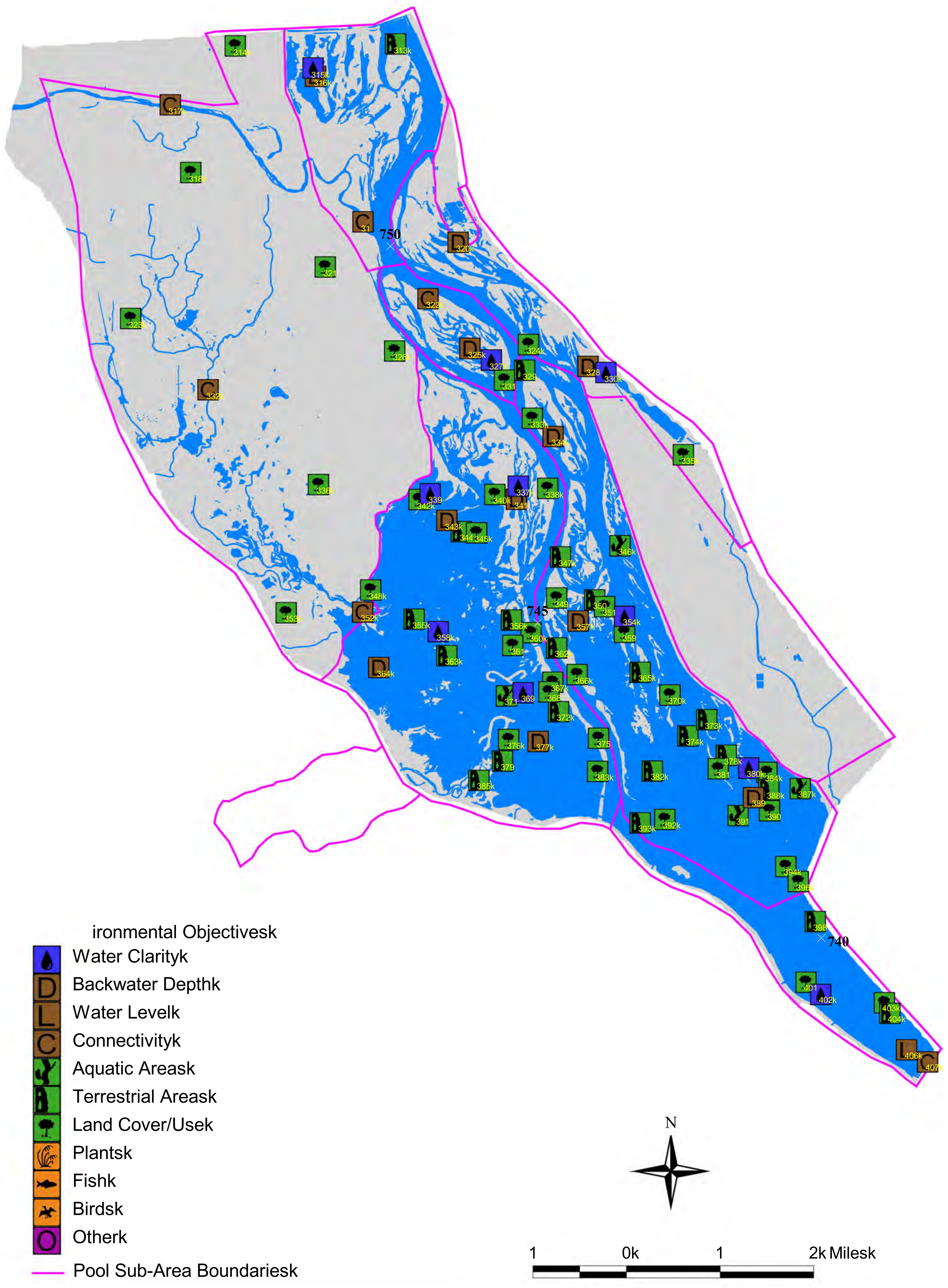


UMR - IWW Environmental Objectives
Pool 4

UMR - IWW Environmental Objectives
Pool 5



UMR - IWW Environmental Objectives
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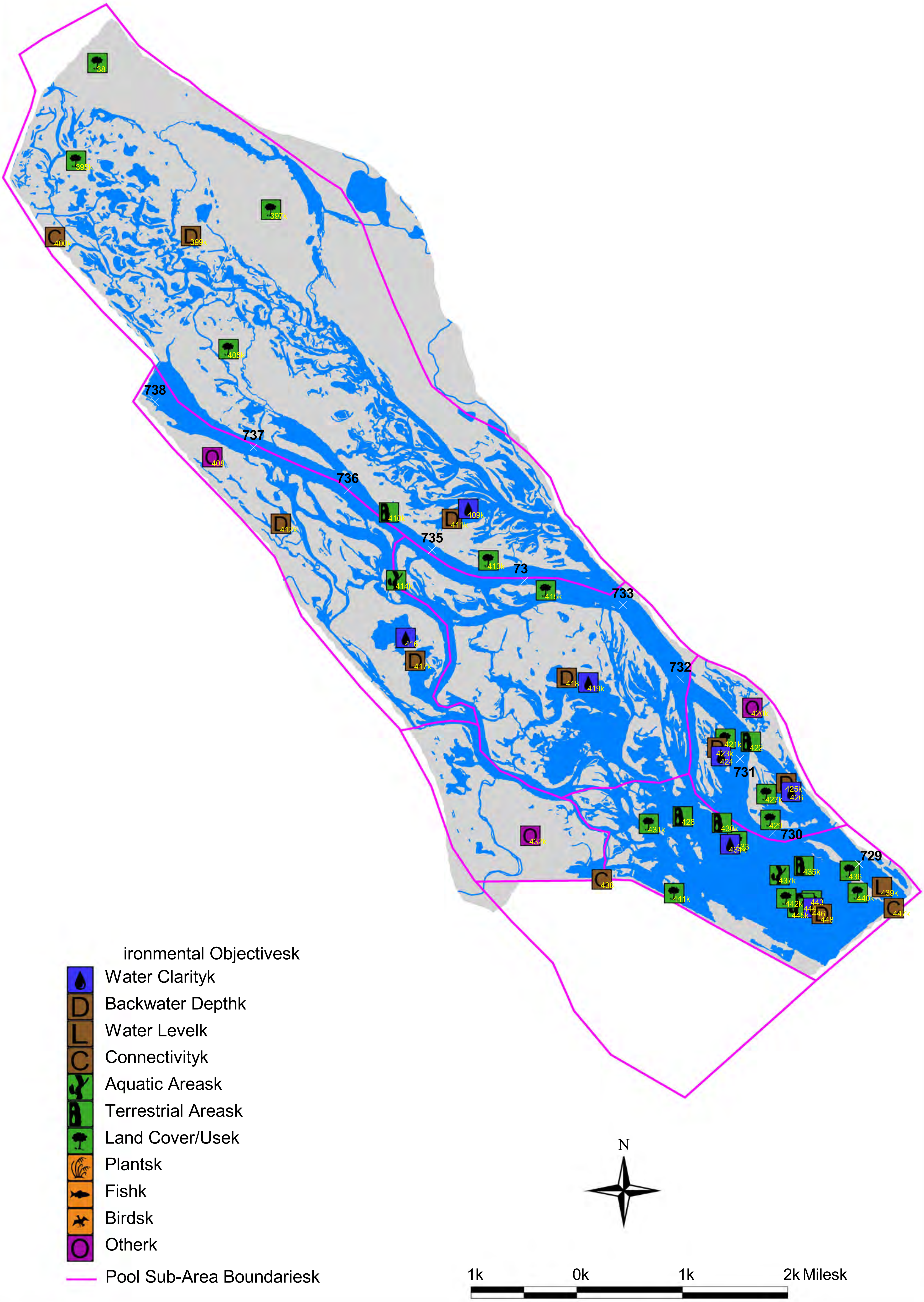

UMR - IWW Environmental Objectives
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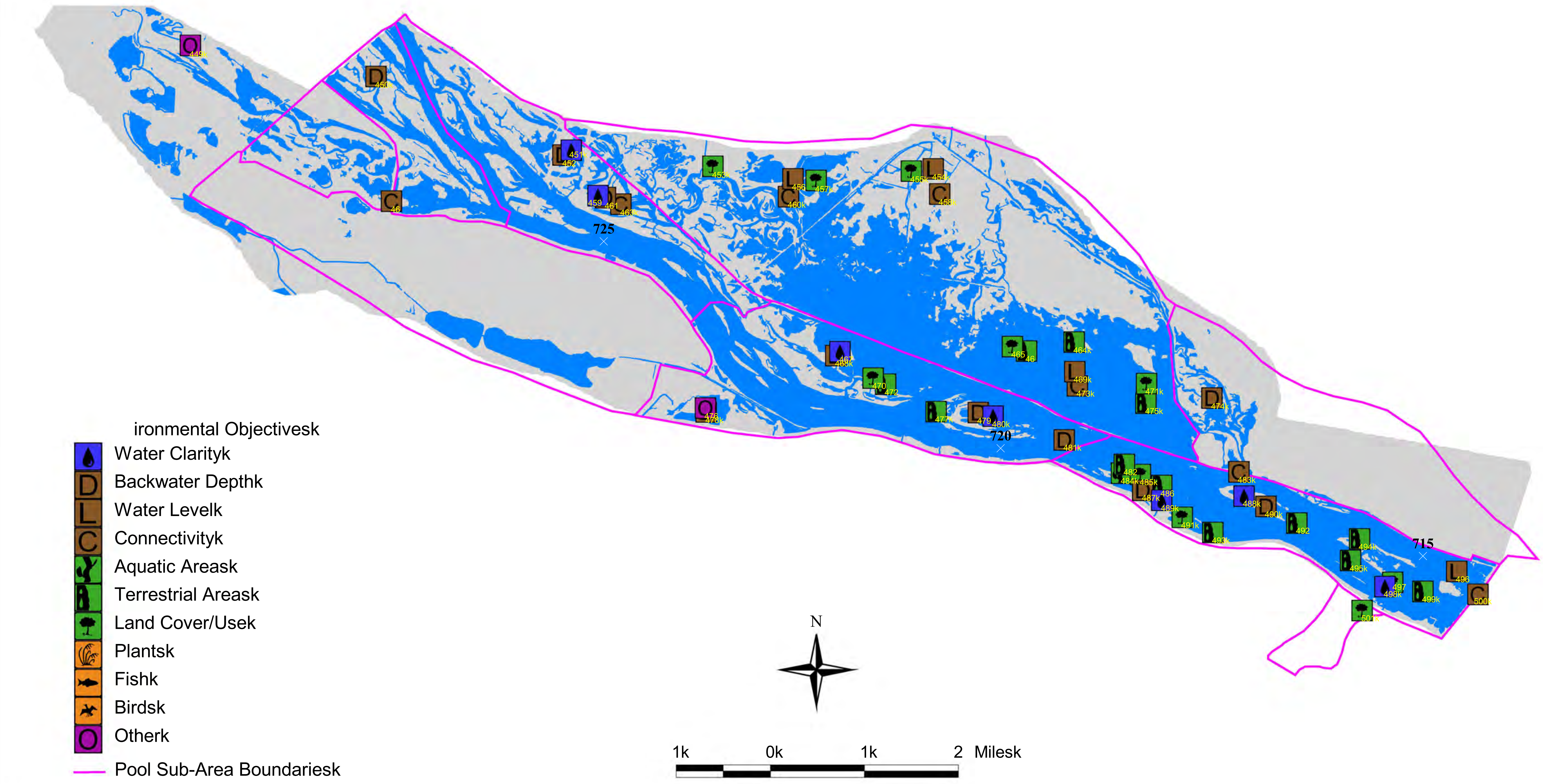

UMR - IWW Environmental Objectives
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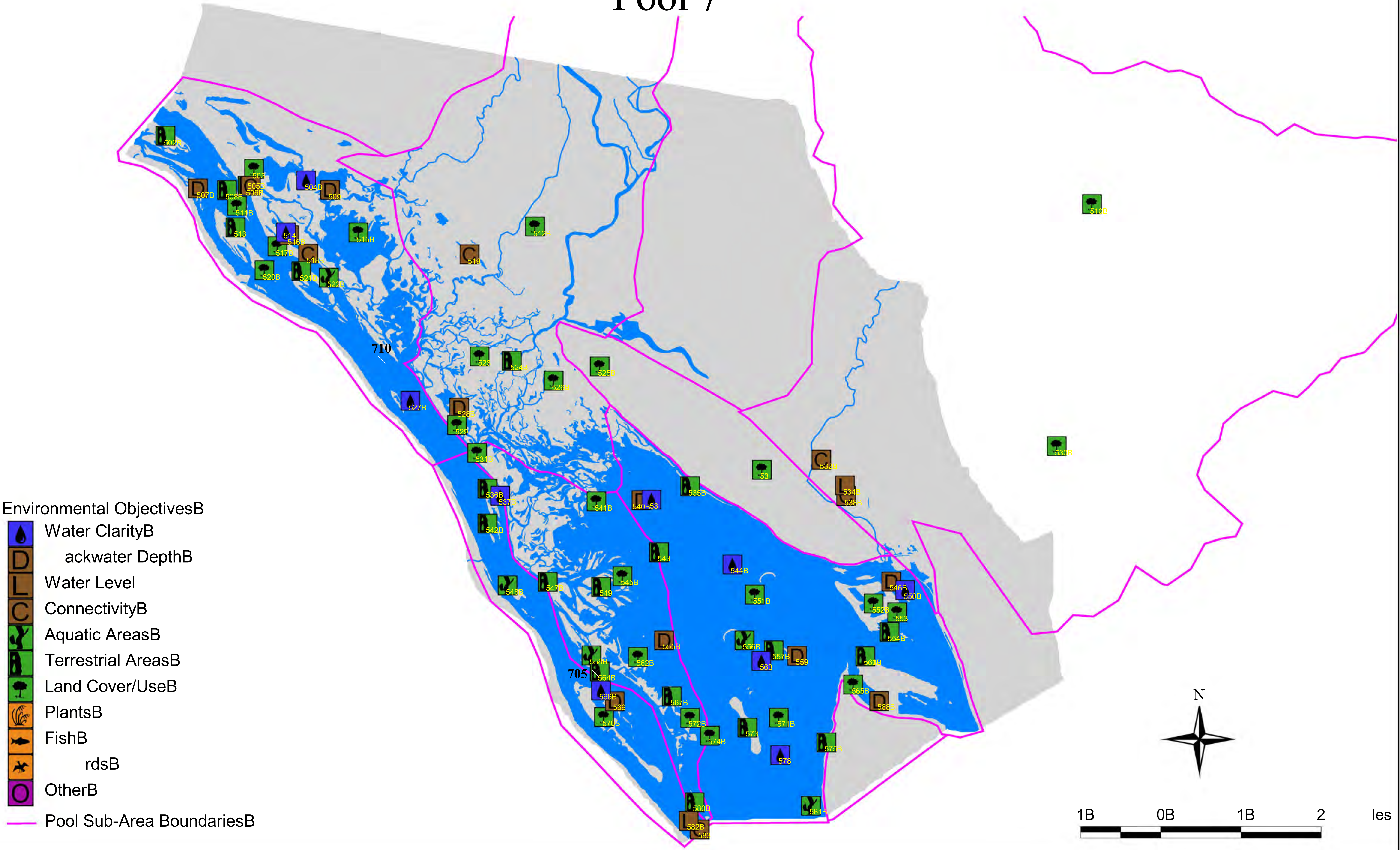

UMR - IWW Environmental Objectives
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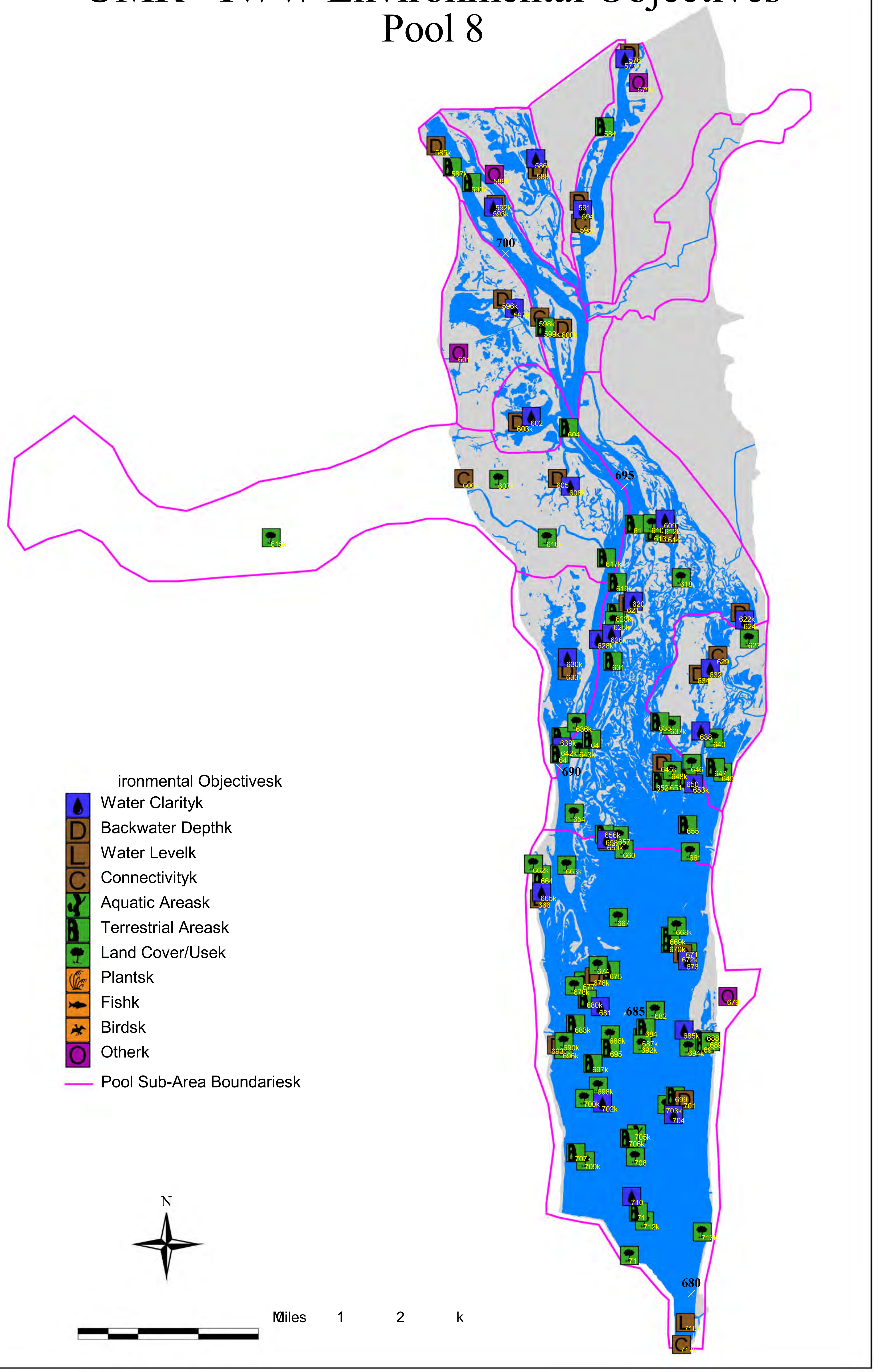
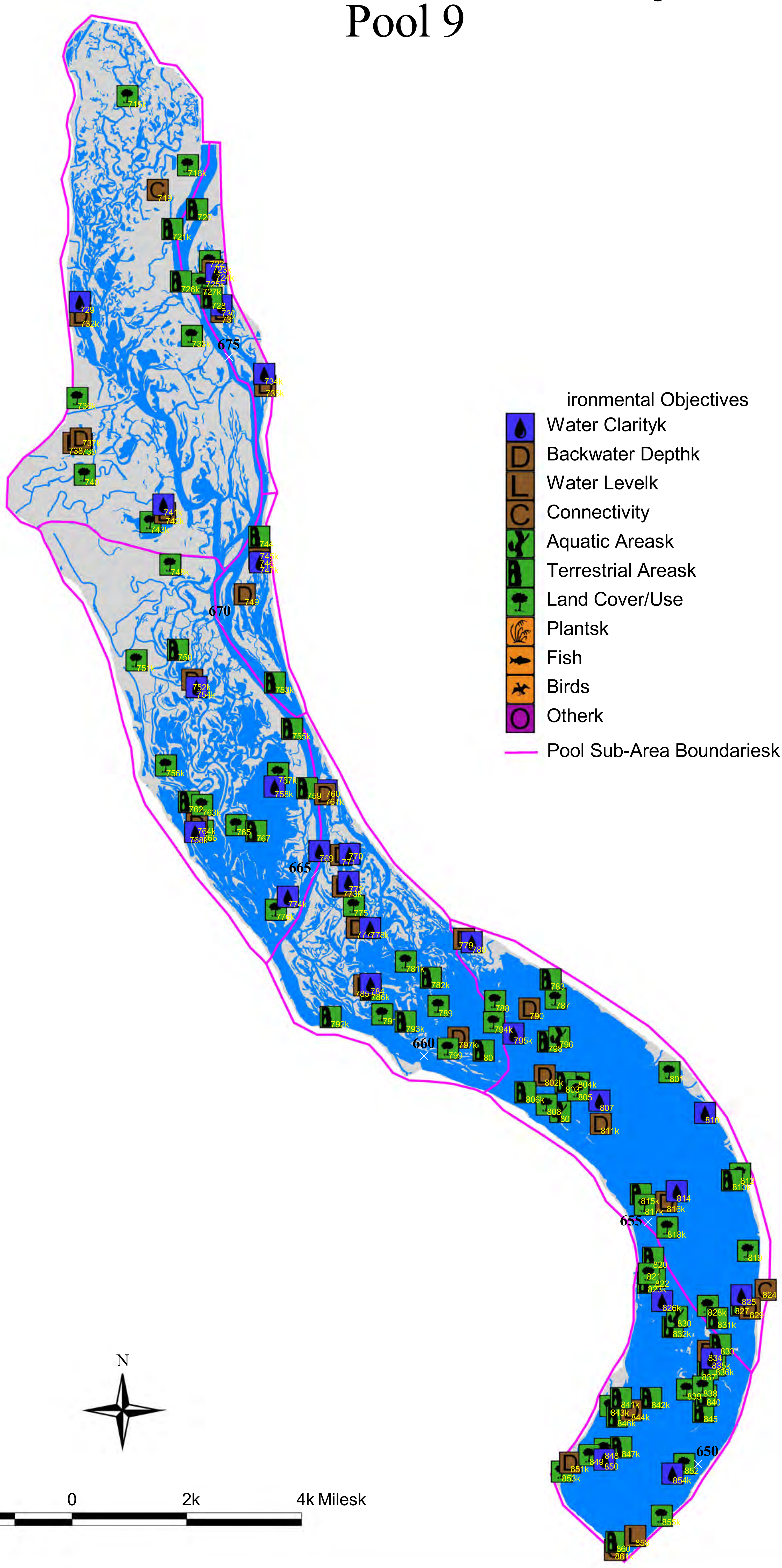
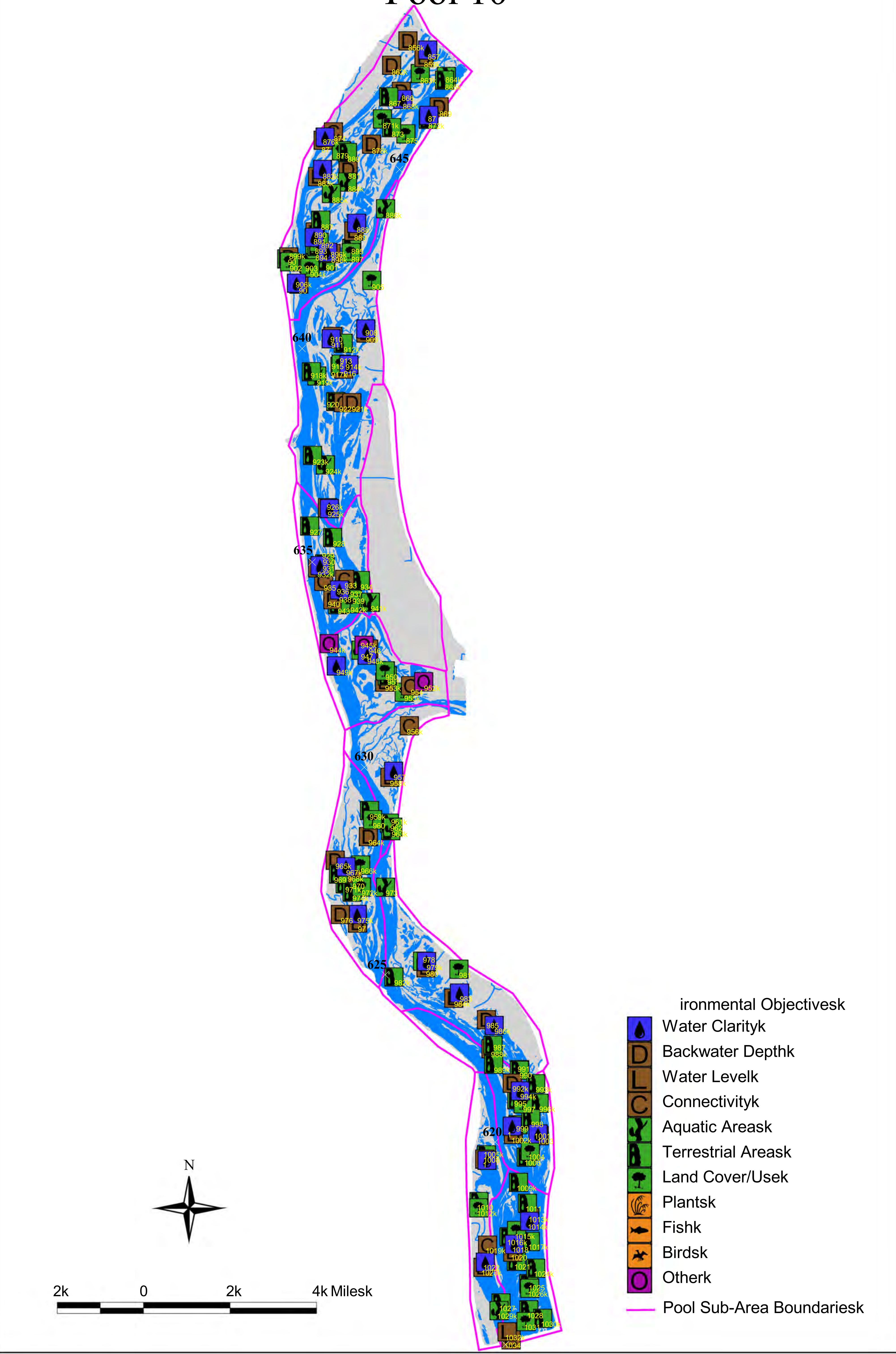


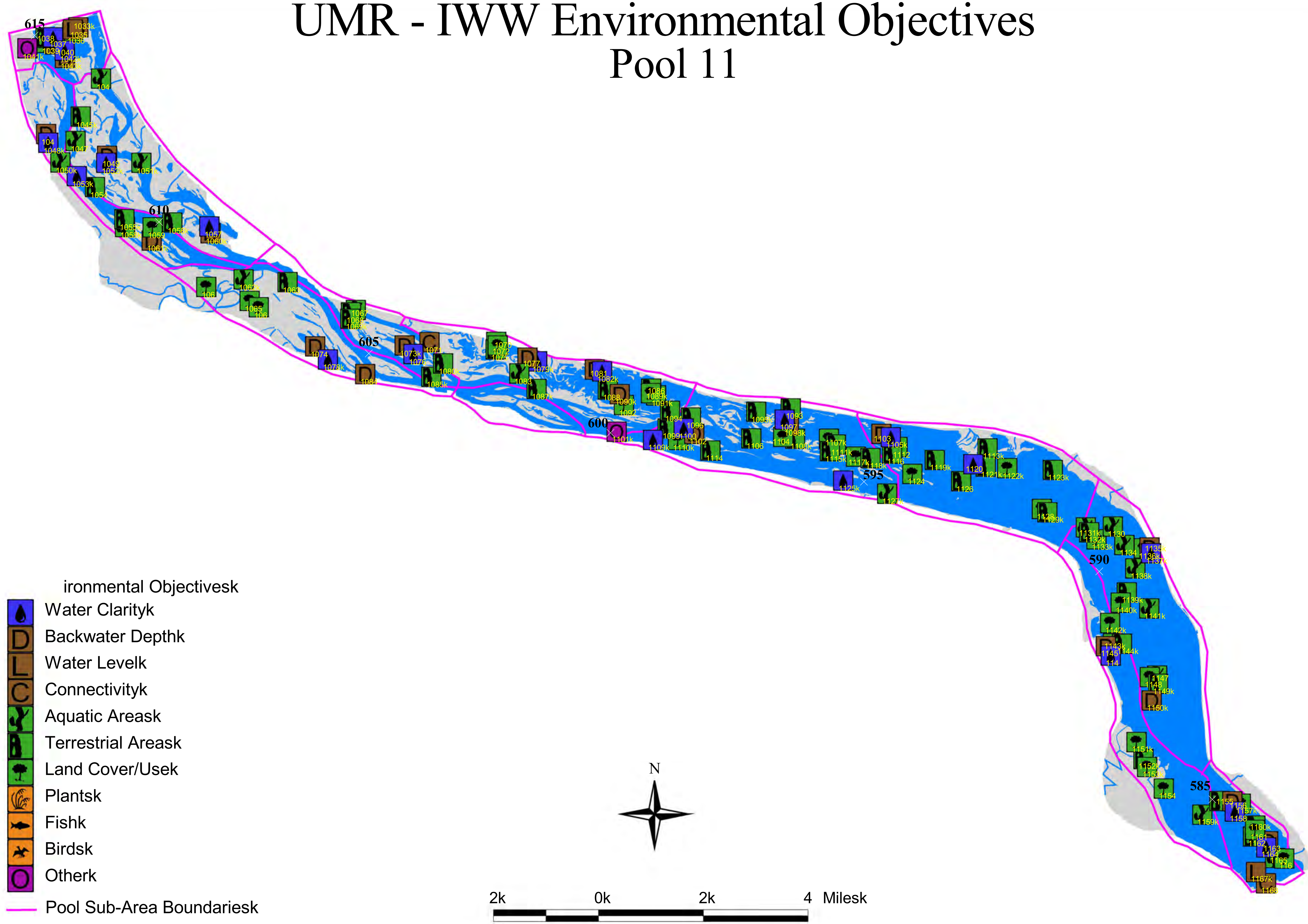
UMR - IWW Environmental Objectives
Pool 9



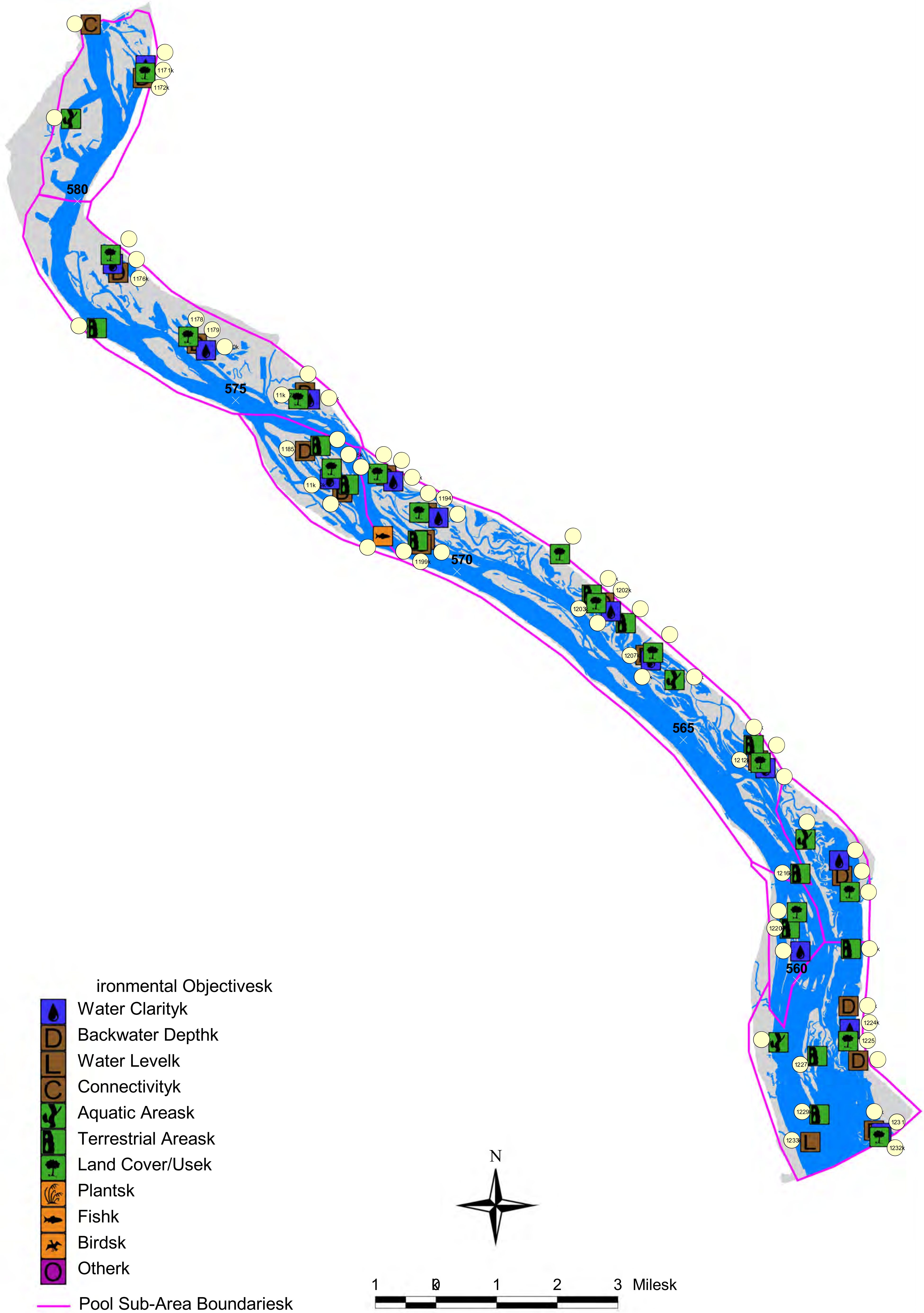
UMR - IWW Environmental Objectives
Pool 10



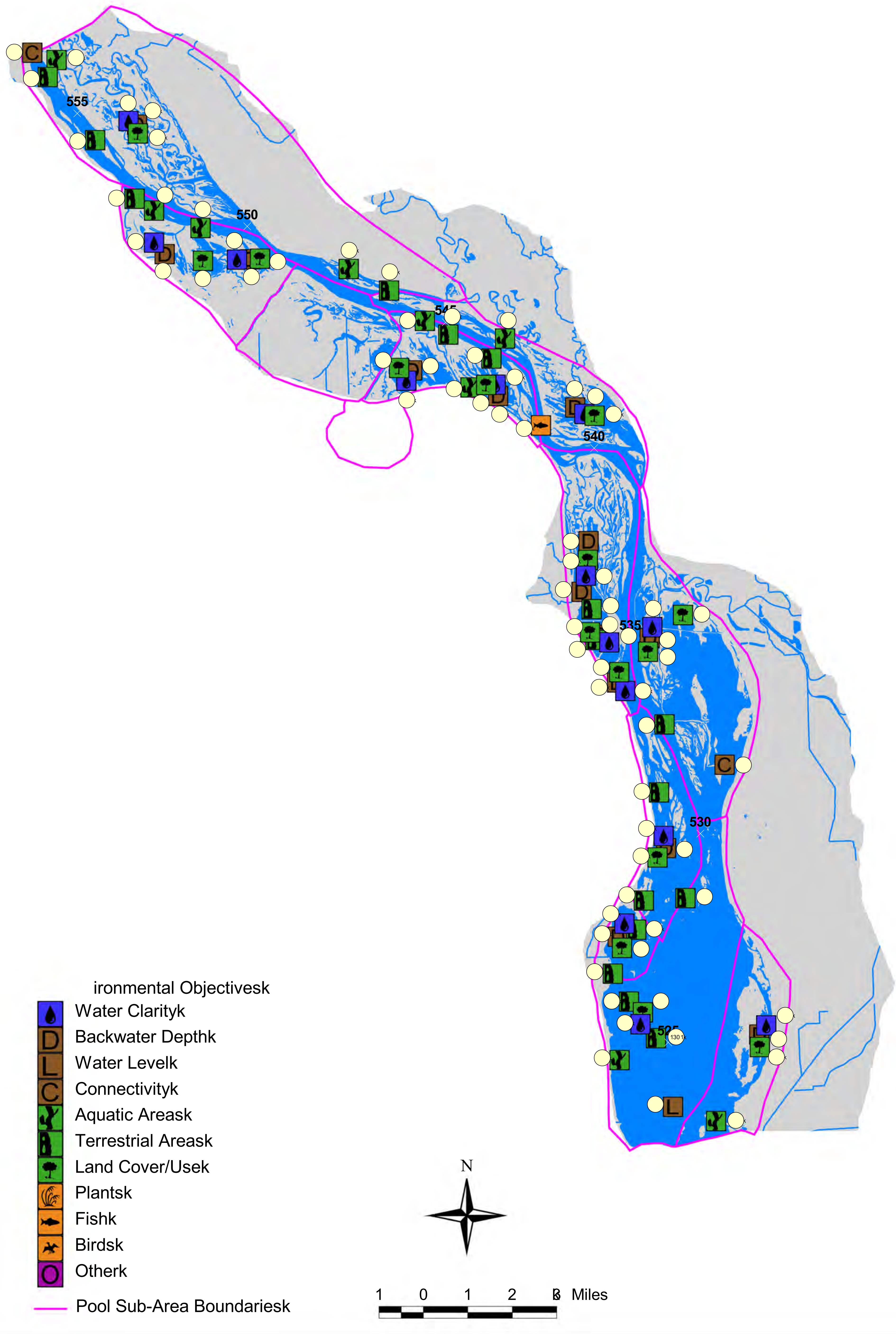
UMR - IWW Environmental Objectives
Pool 11



UMR - IWW Environmental Objectives
Pool 12



UMR - IWW Environmental Objectives
Pool 13



UMR - IWW Environmental Objectives
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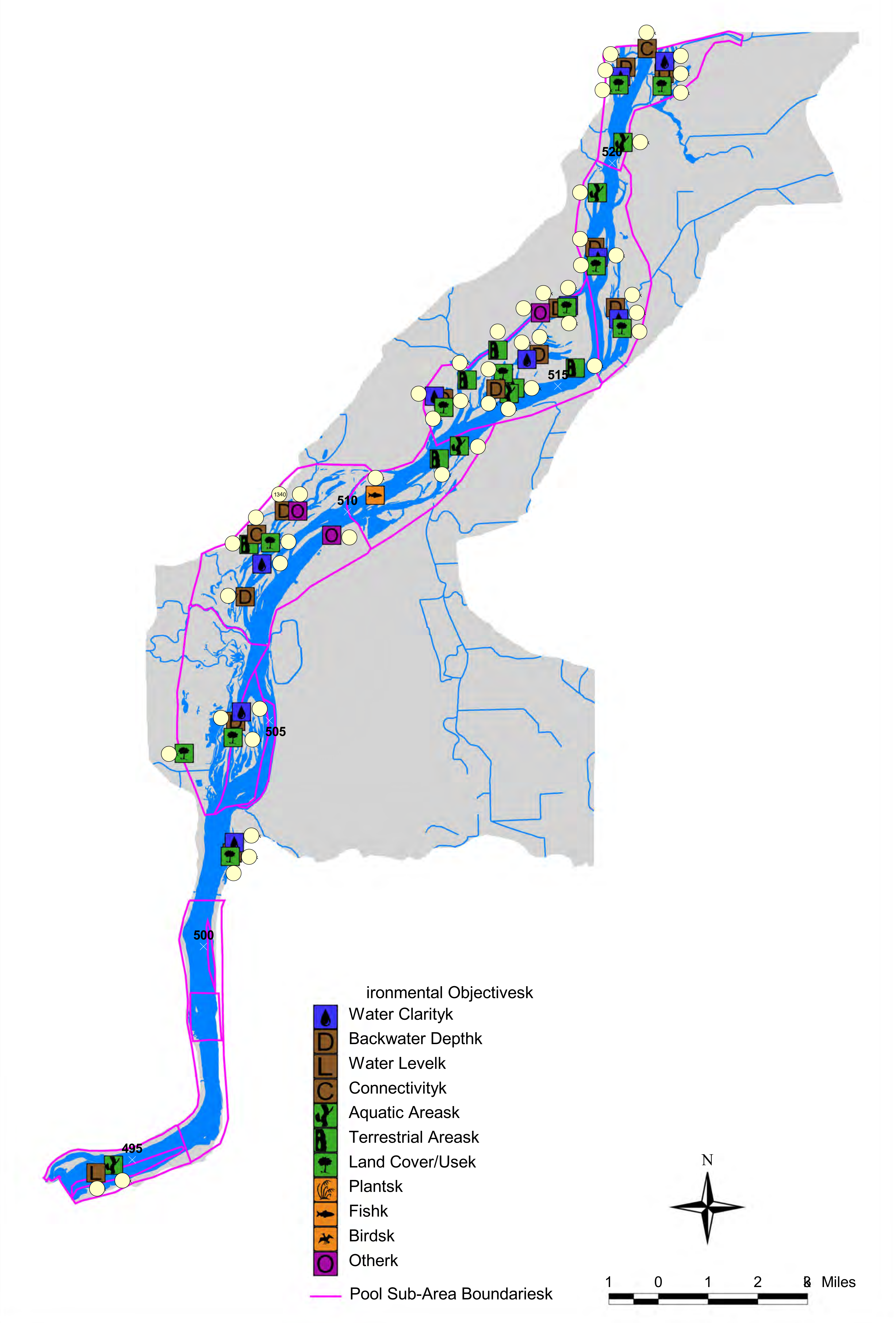
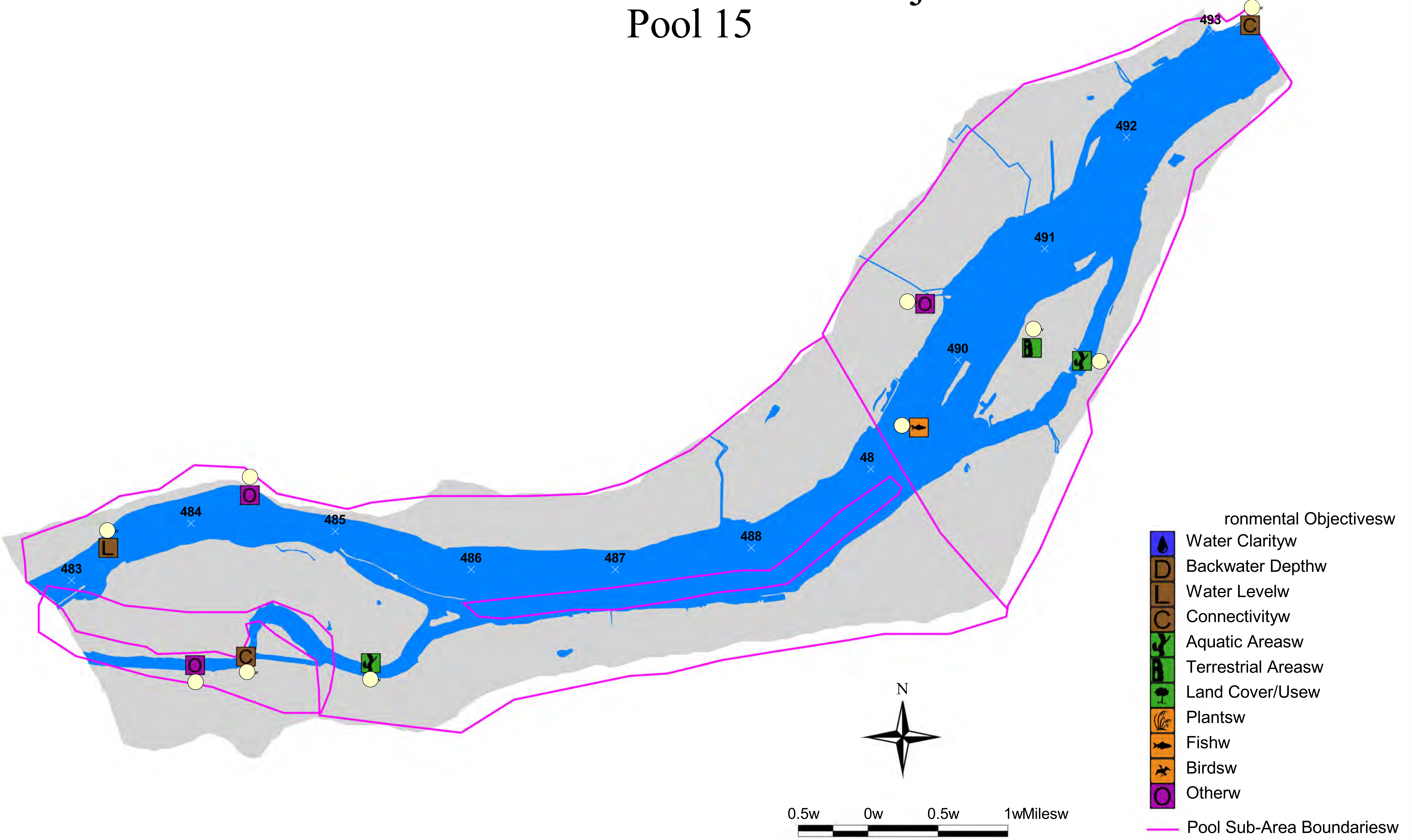


UMR - IWW Environmental Objectives
Pool 15



UMR - IWW Environmental Objectives
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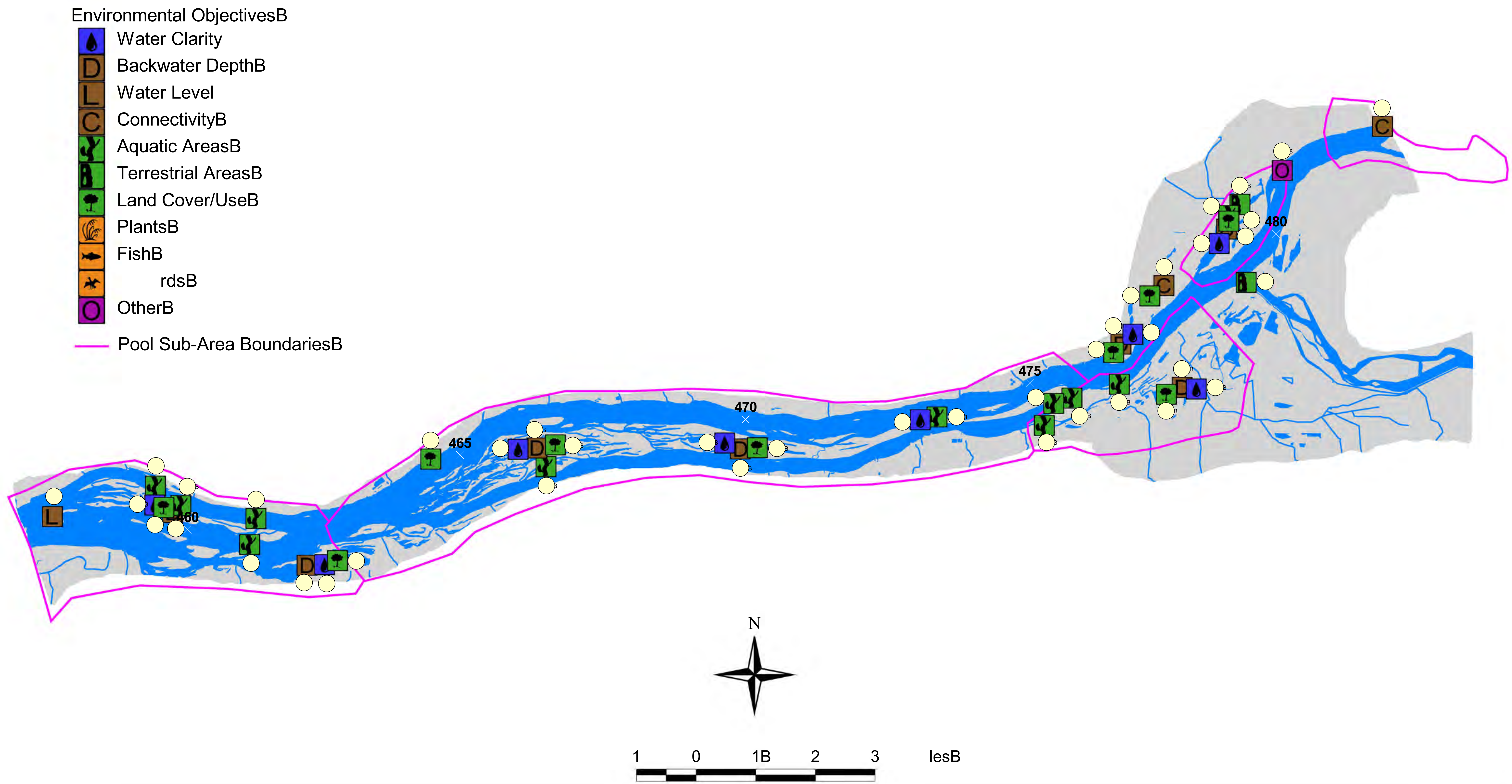
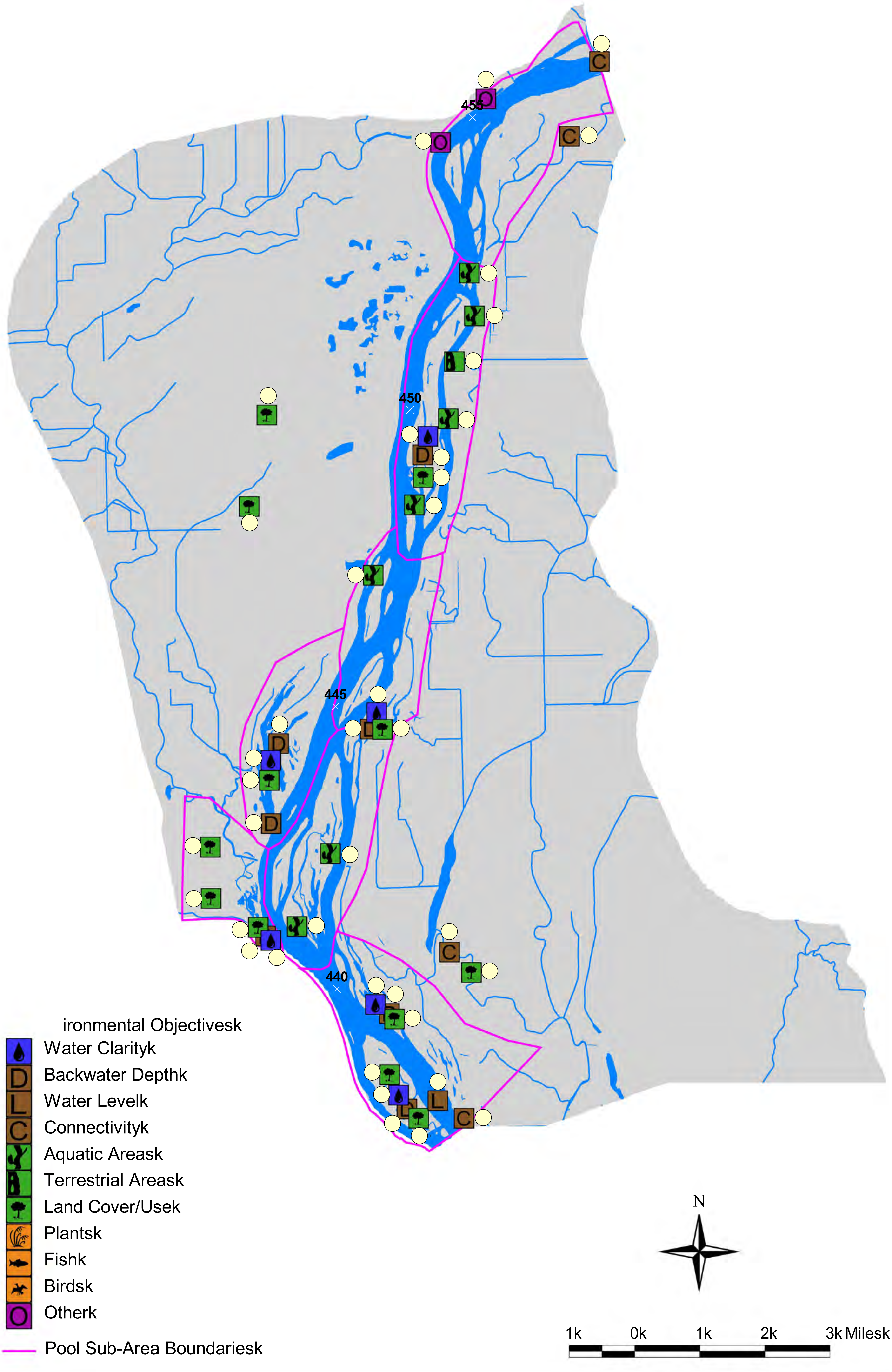
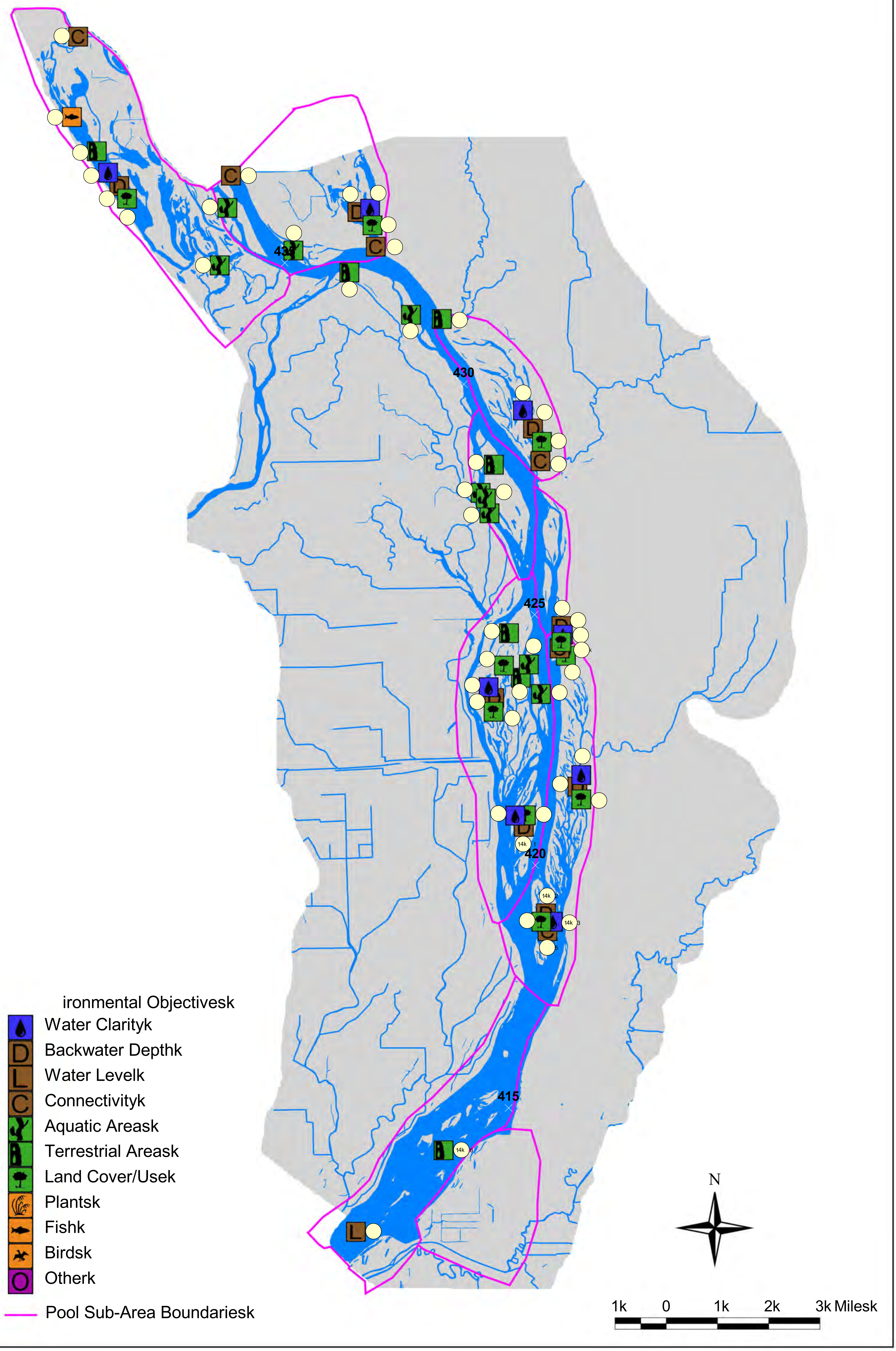


UMR - IWW Environmental Objectives
Pool 17



UMR - IWW Environmental Objectives
Pool 18



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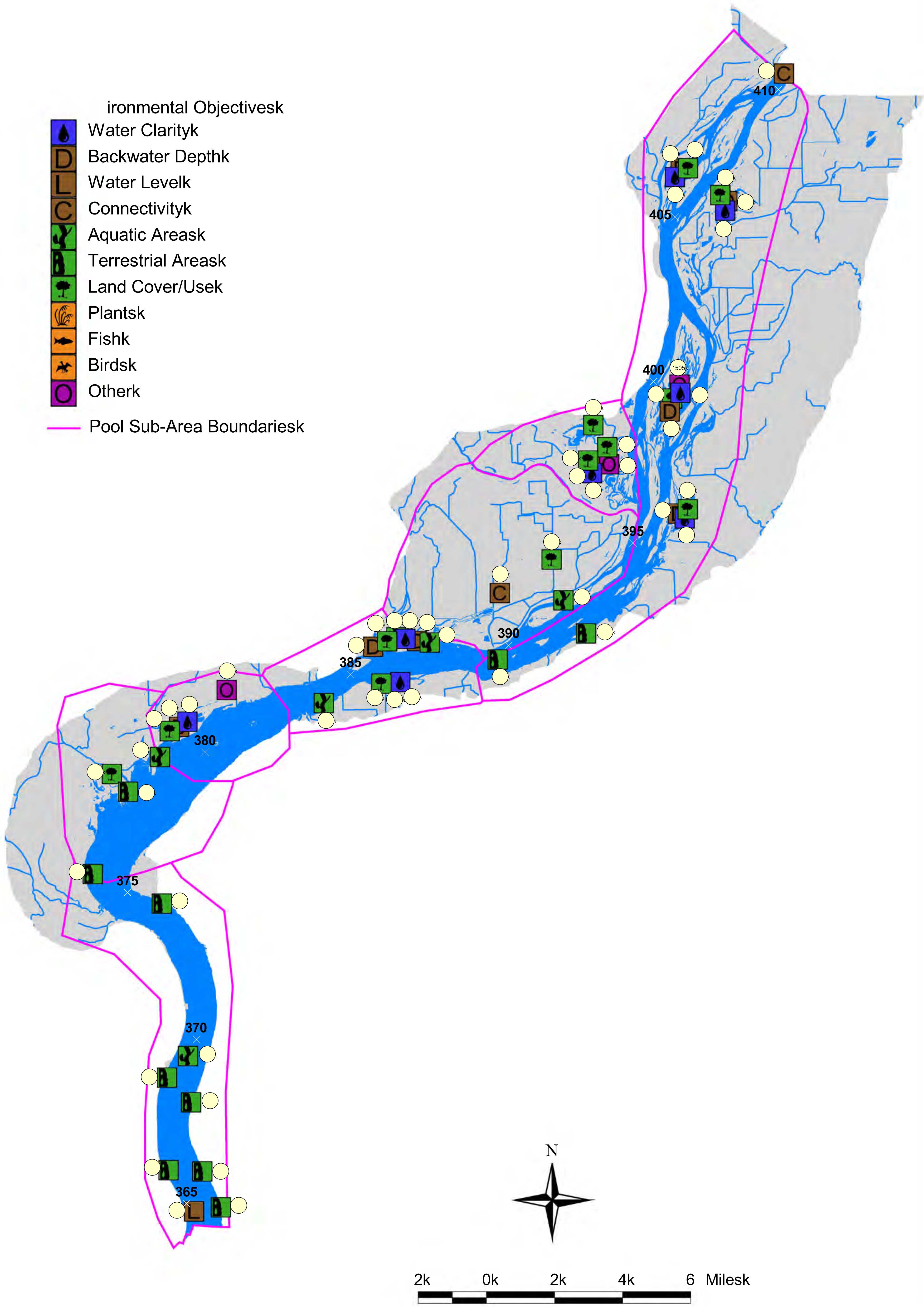

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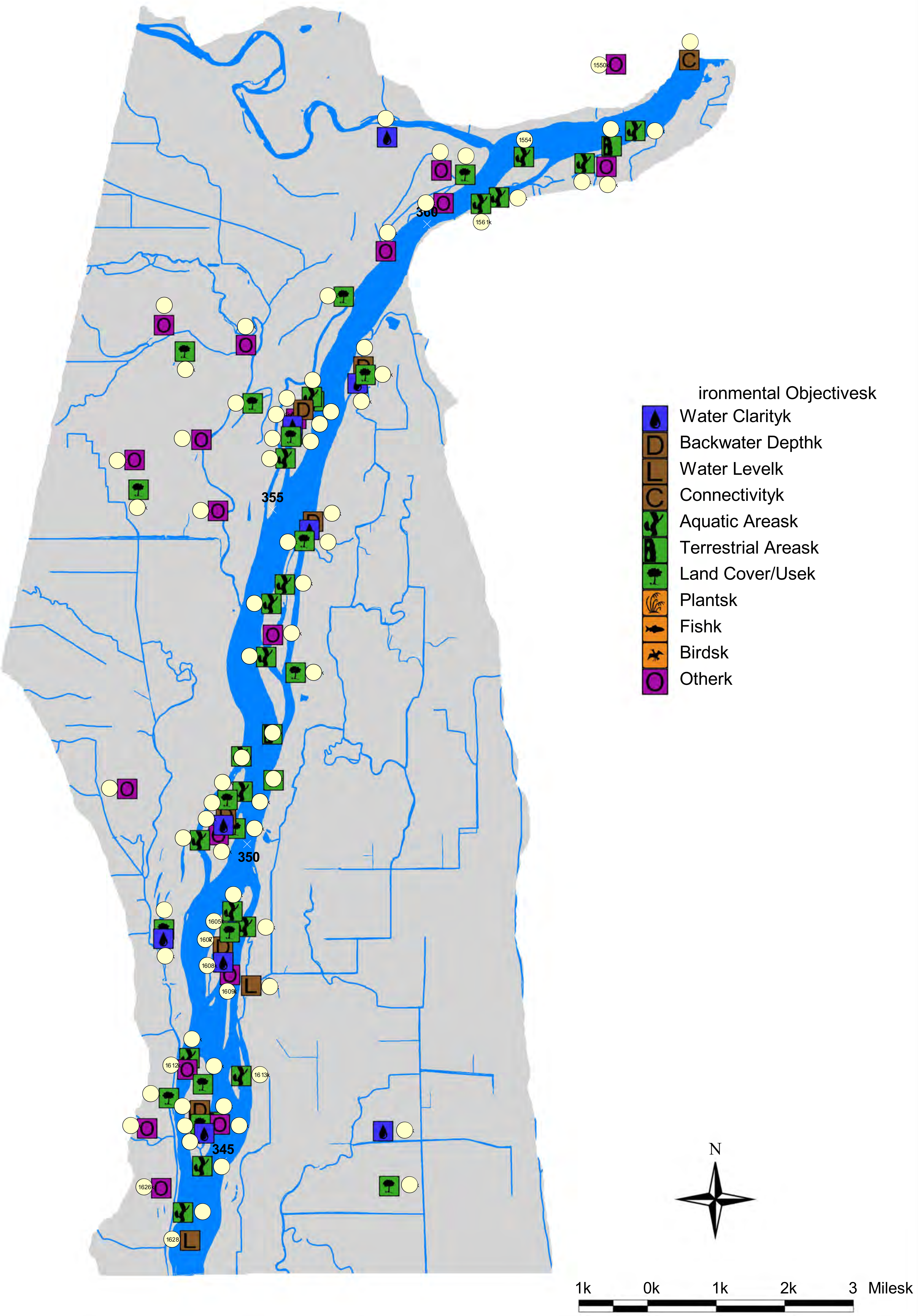

UMR - IWW Environmental Objectives
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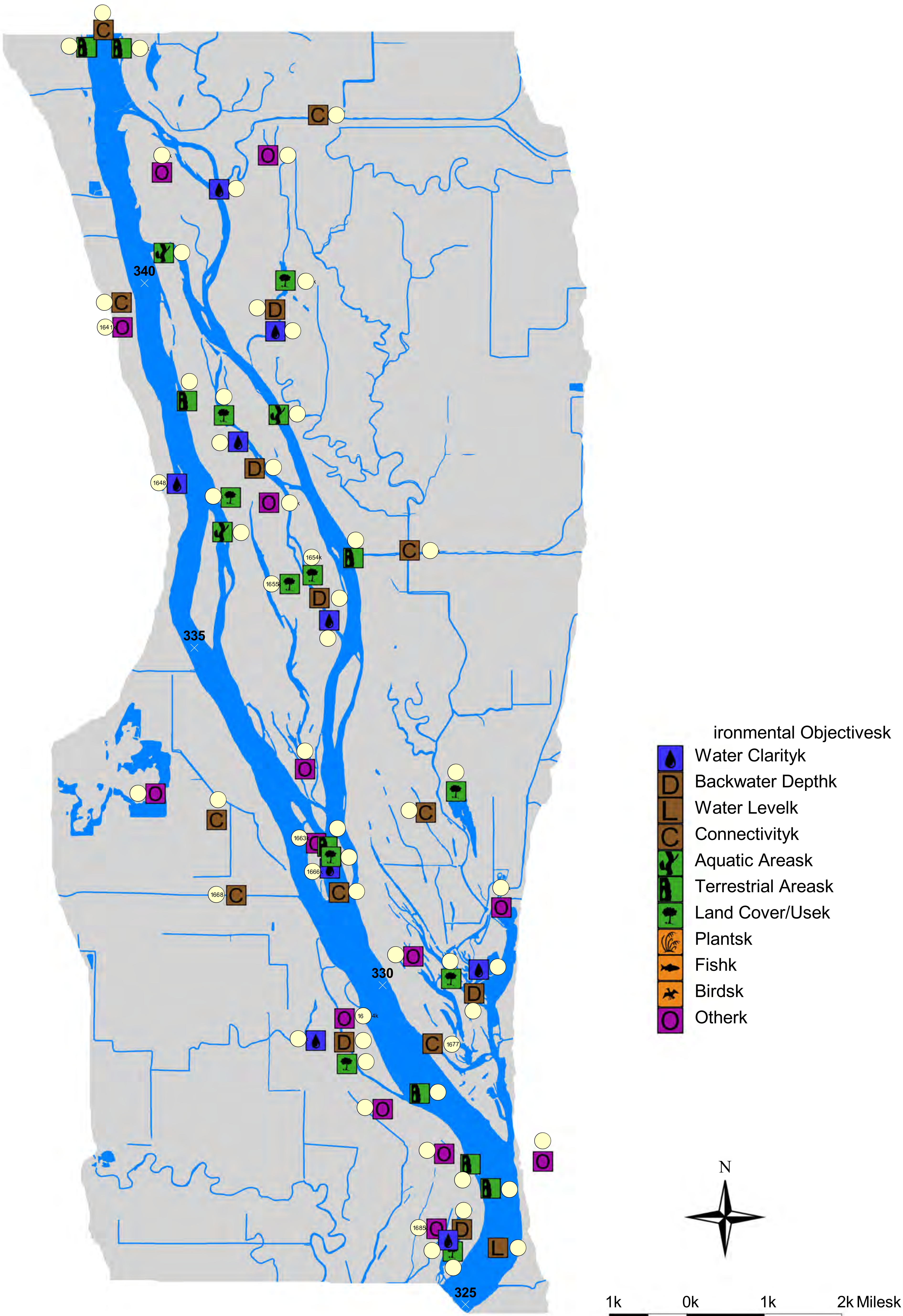

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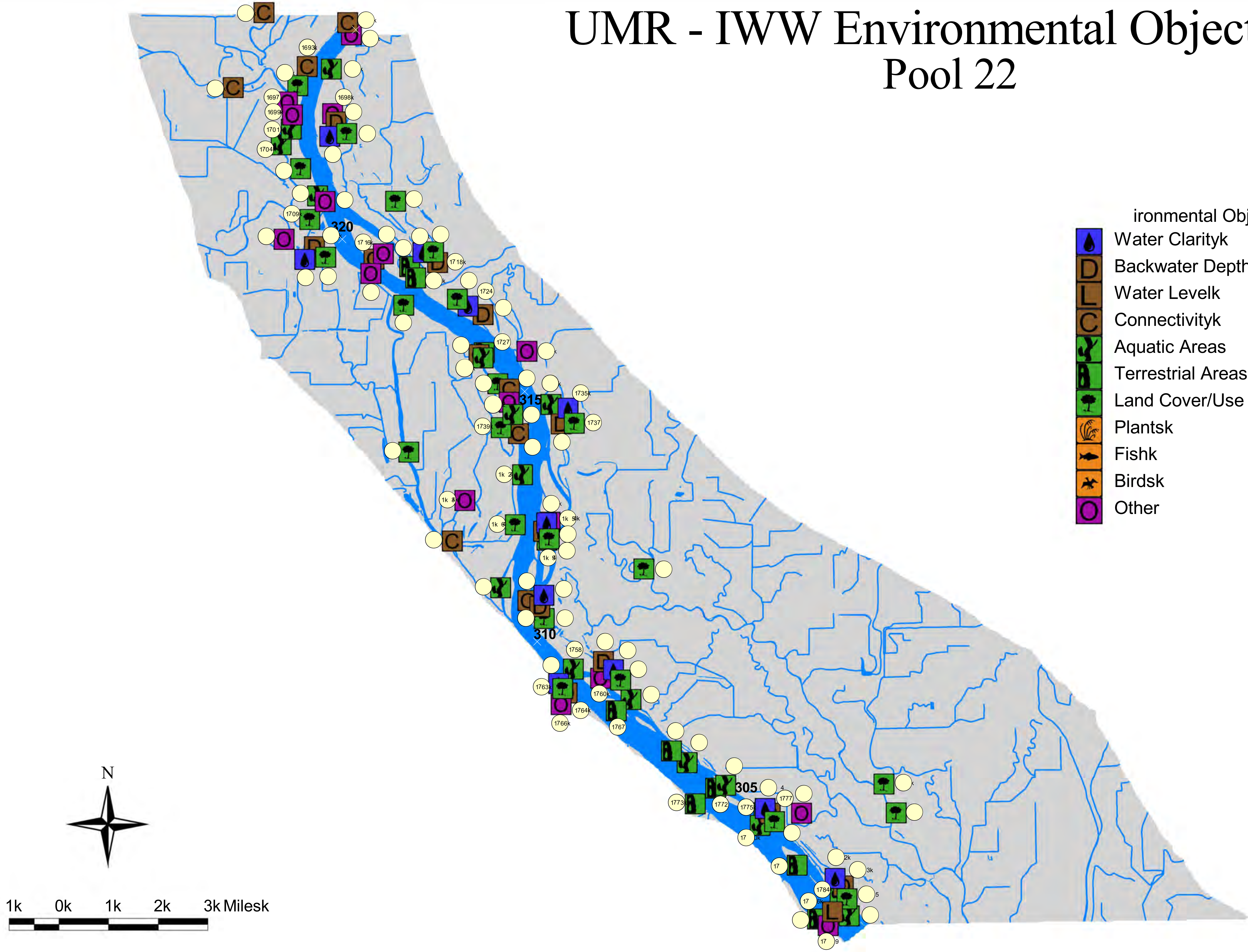

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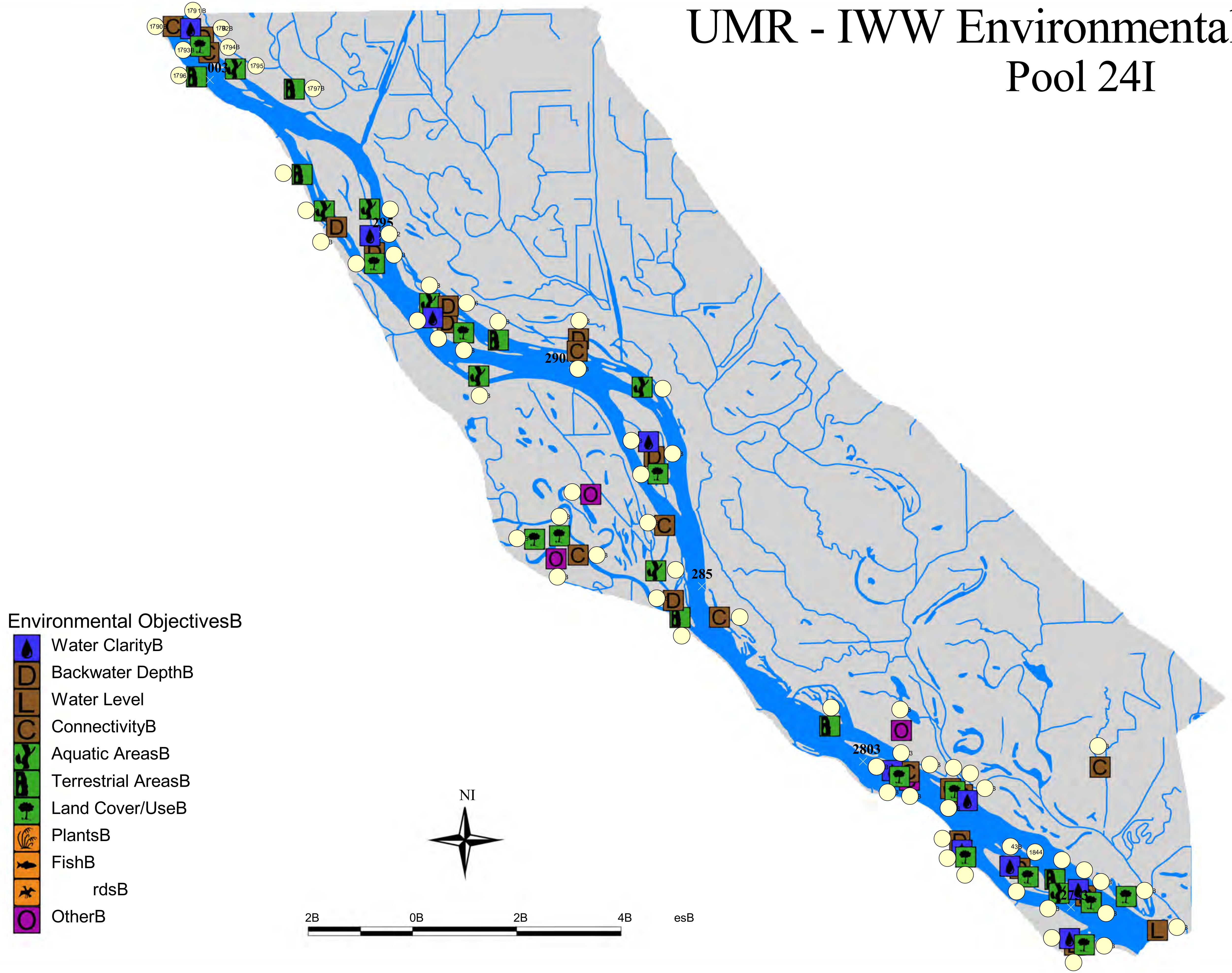

UMR - IW Environmental ObjectivesW
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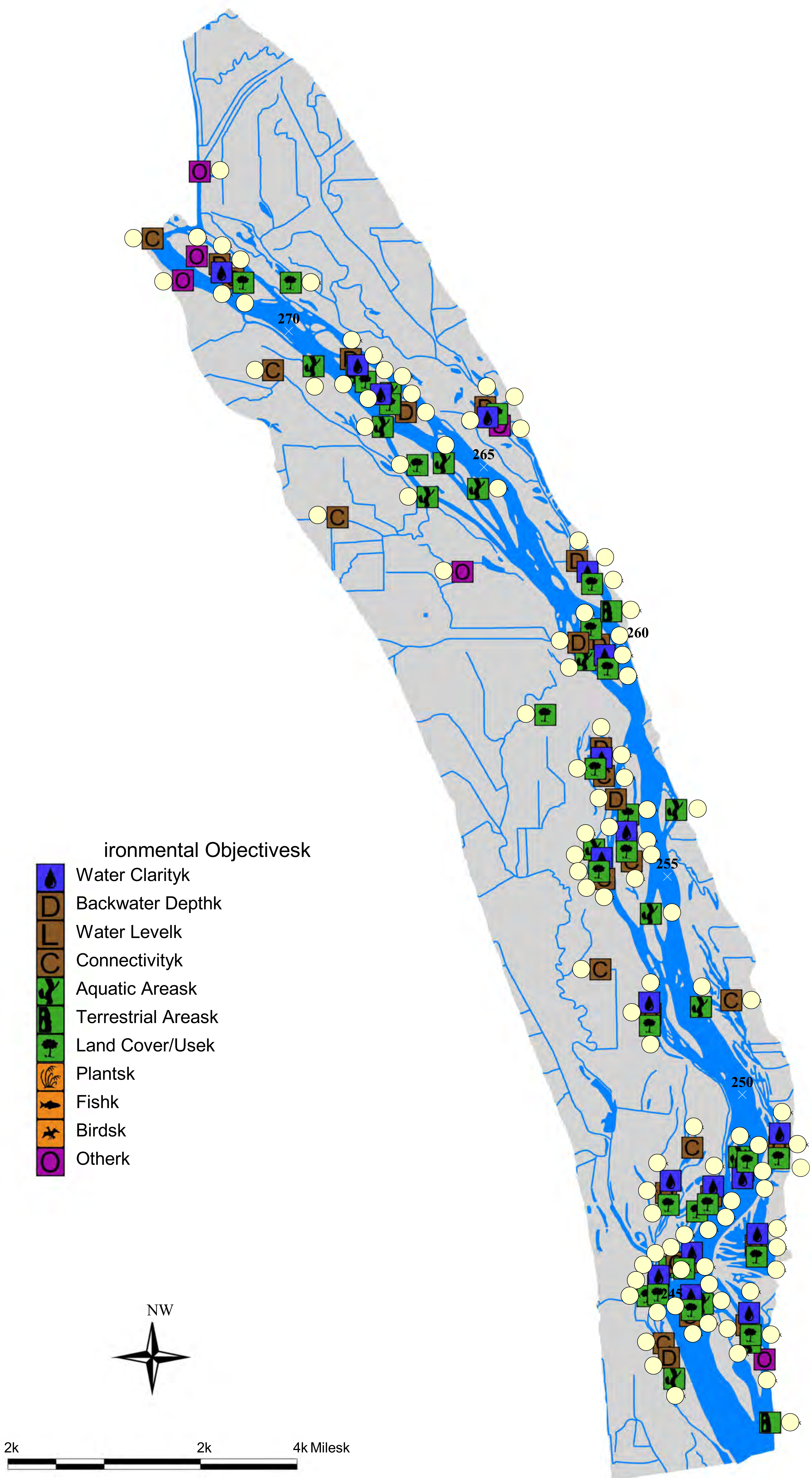
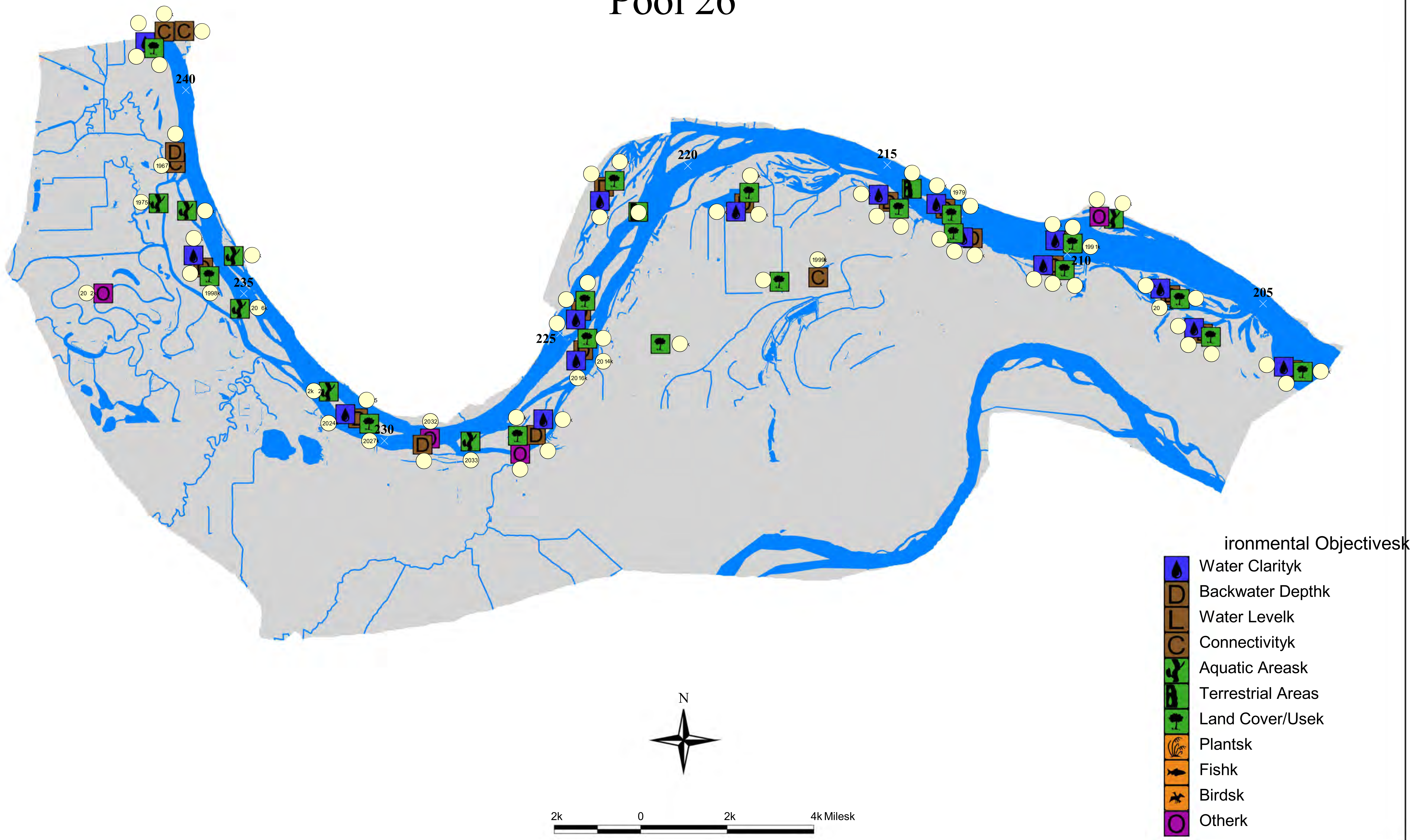
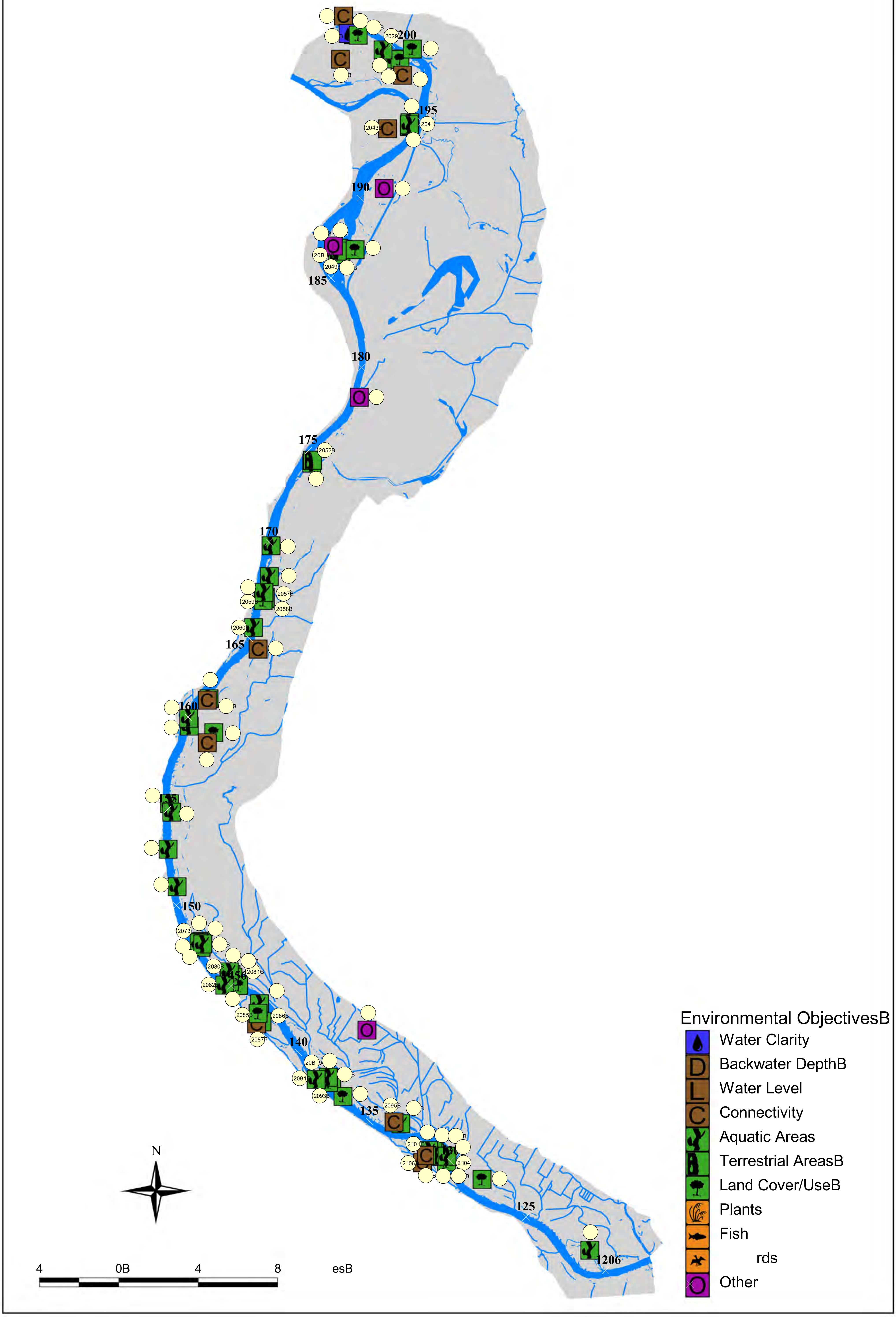
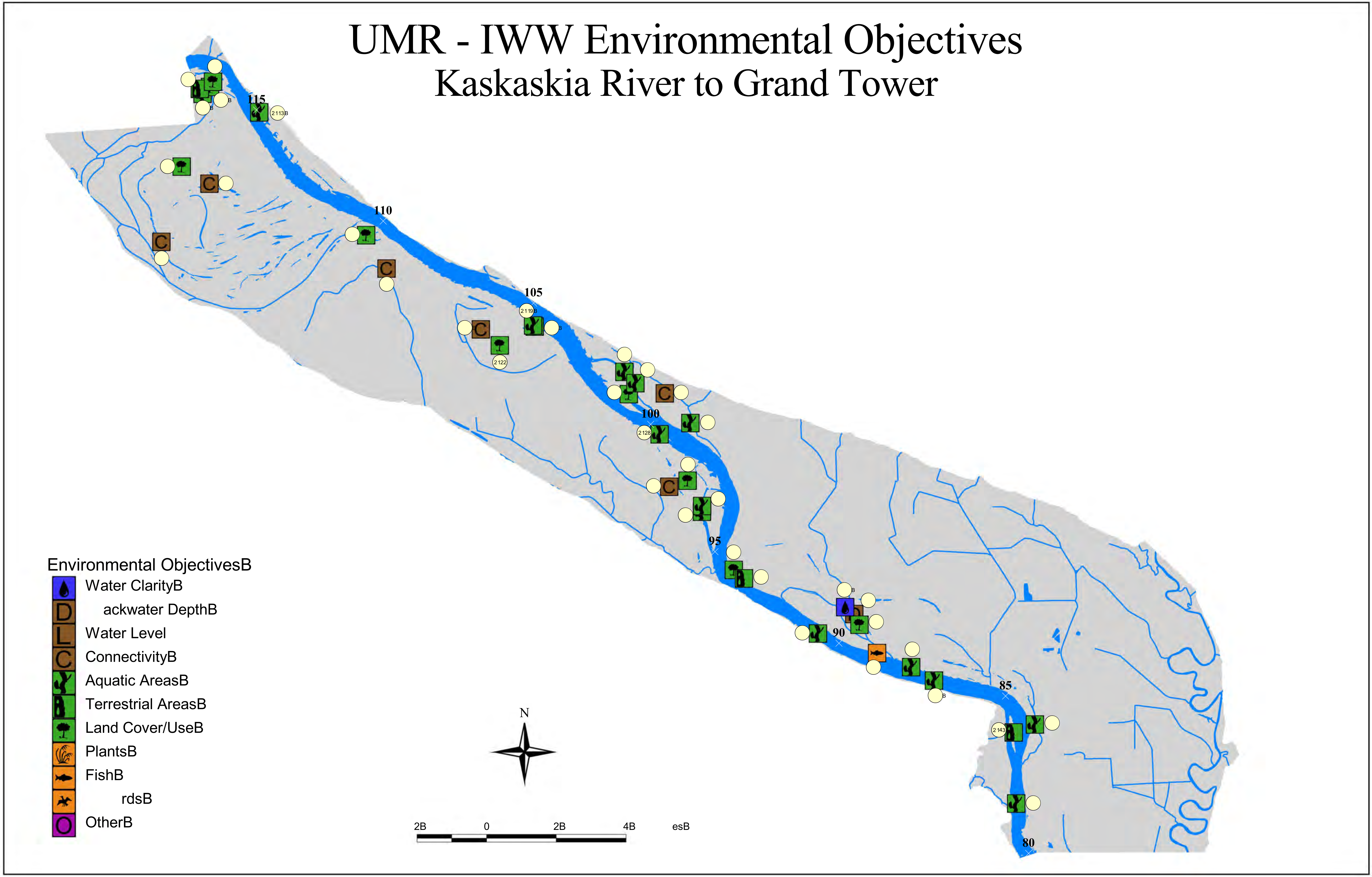


UMR - IWW Environmental Objectives
Pool 26

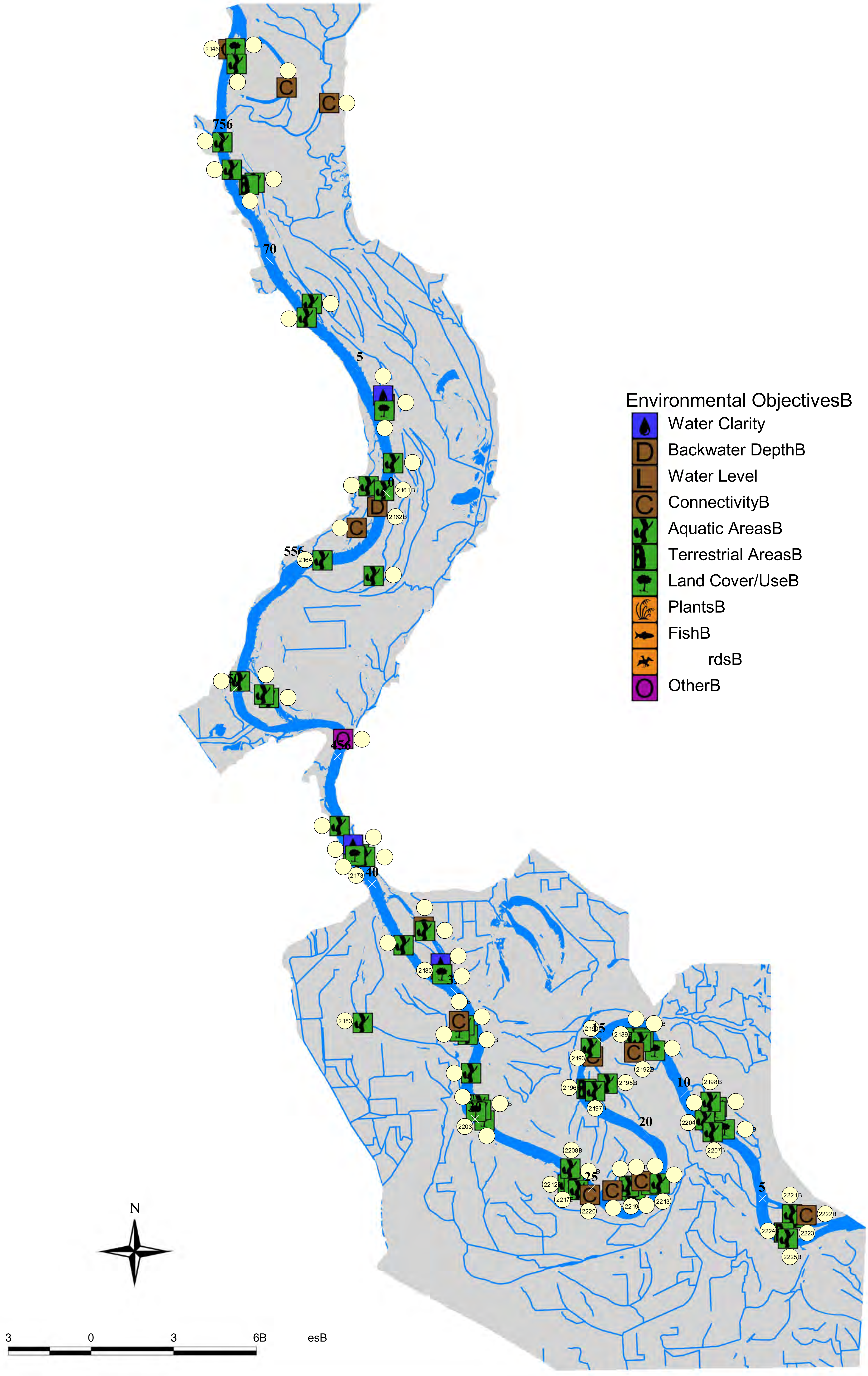


UMR - IWW Environmental Objectives
Lock 26 to Kaskaskia River

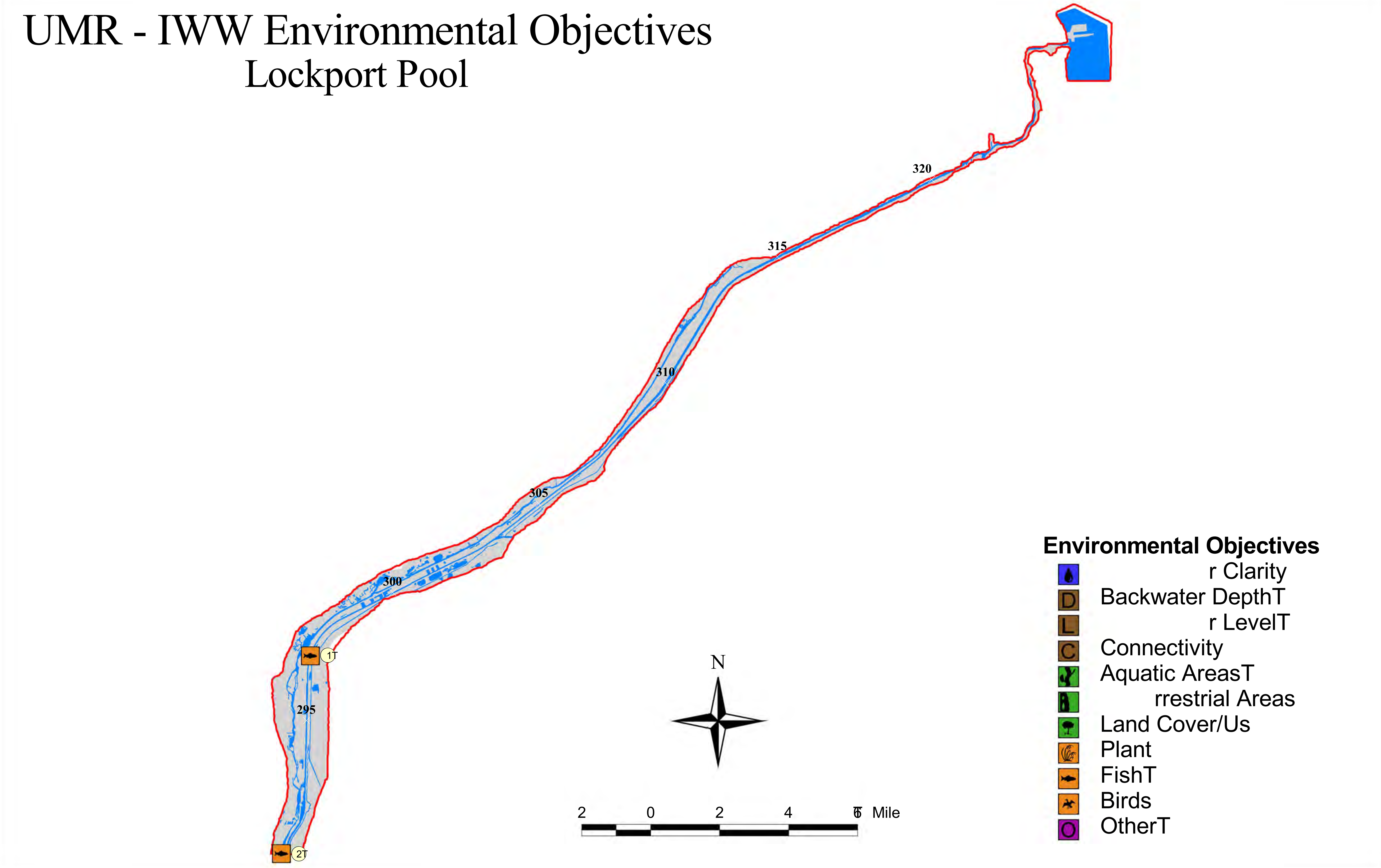



UMR - IWW Environmental Objectives
Kaskaskia River to Grand Tower
115
110
105
100
95
90
85
80
Environmental ObjectivesB
Water ClarityB
ackwater DepthB
Water Level
ConnectivityB
Aquatic AreasB
Terrestrial AreasB
Land Cover/UseB
PlantsB
FishB
rdsB
OtherB
N
2B
0
2B
4B
esB

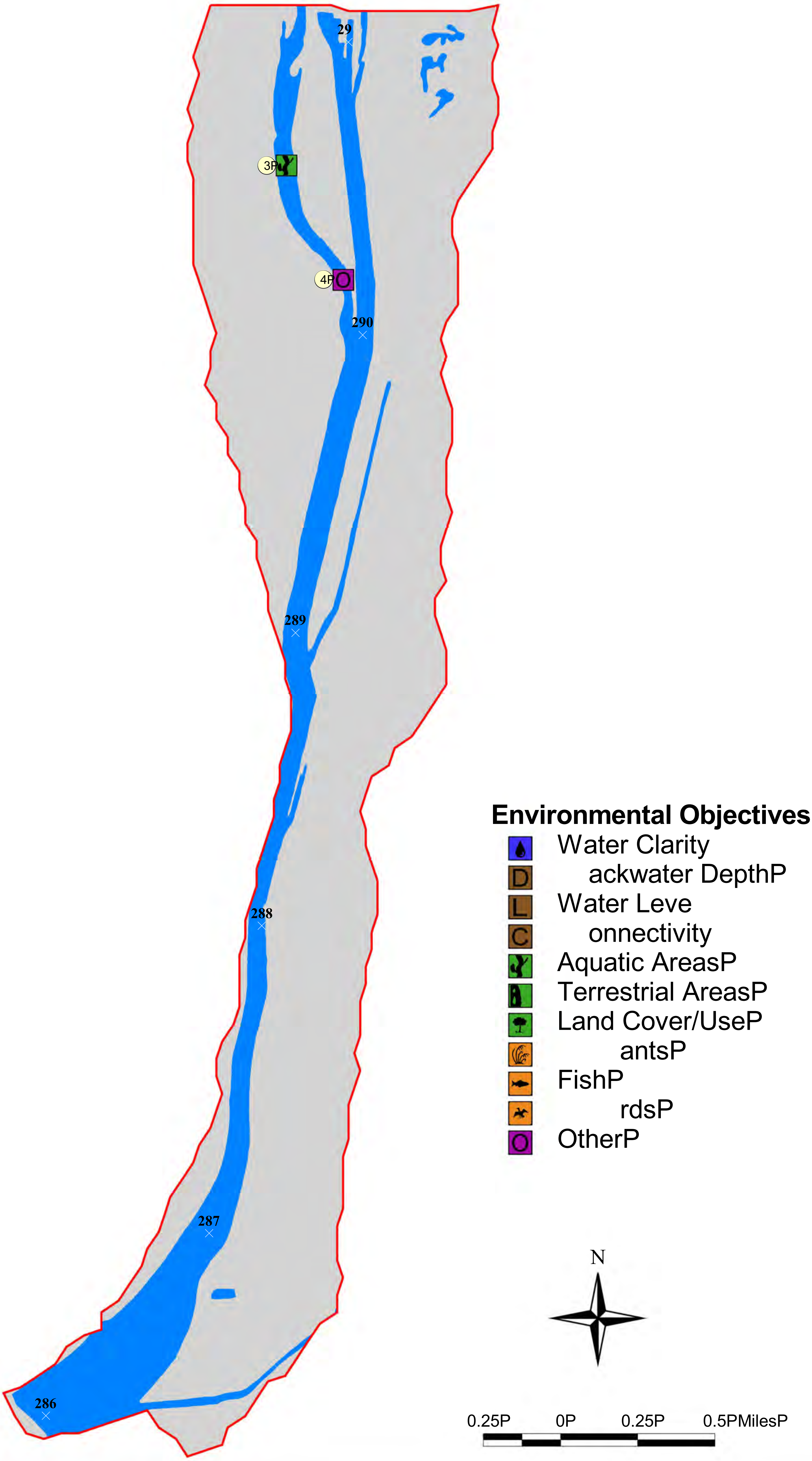
UMR - IWW Environmental Objectives
Grand Tower to Ohio River



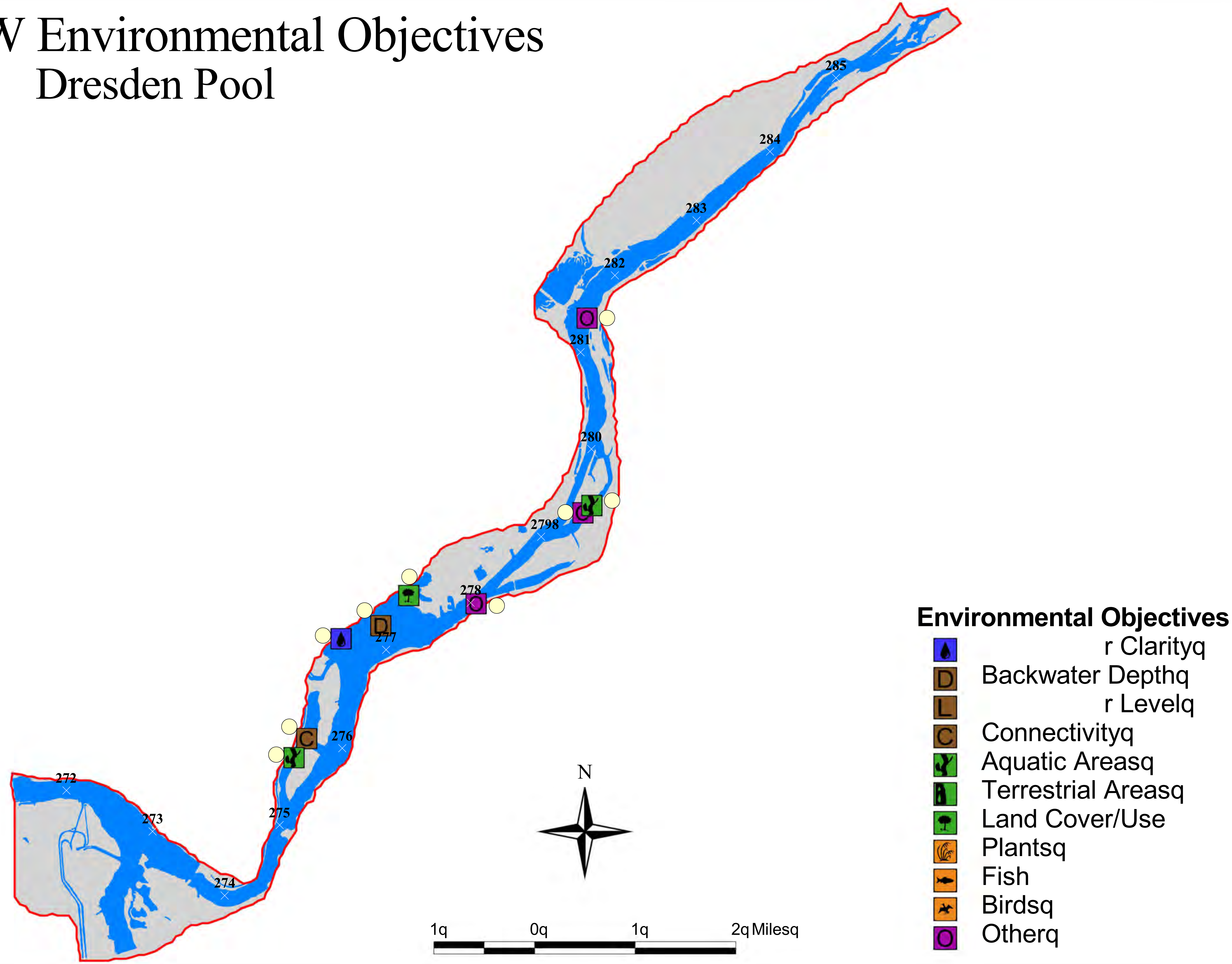
UMR - IWW Environmental Objectives
Lockport Pool



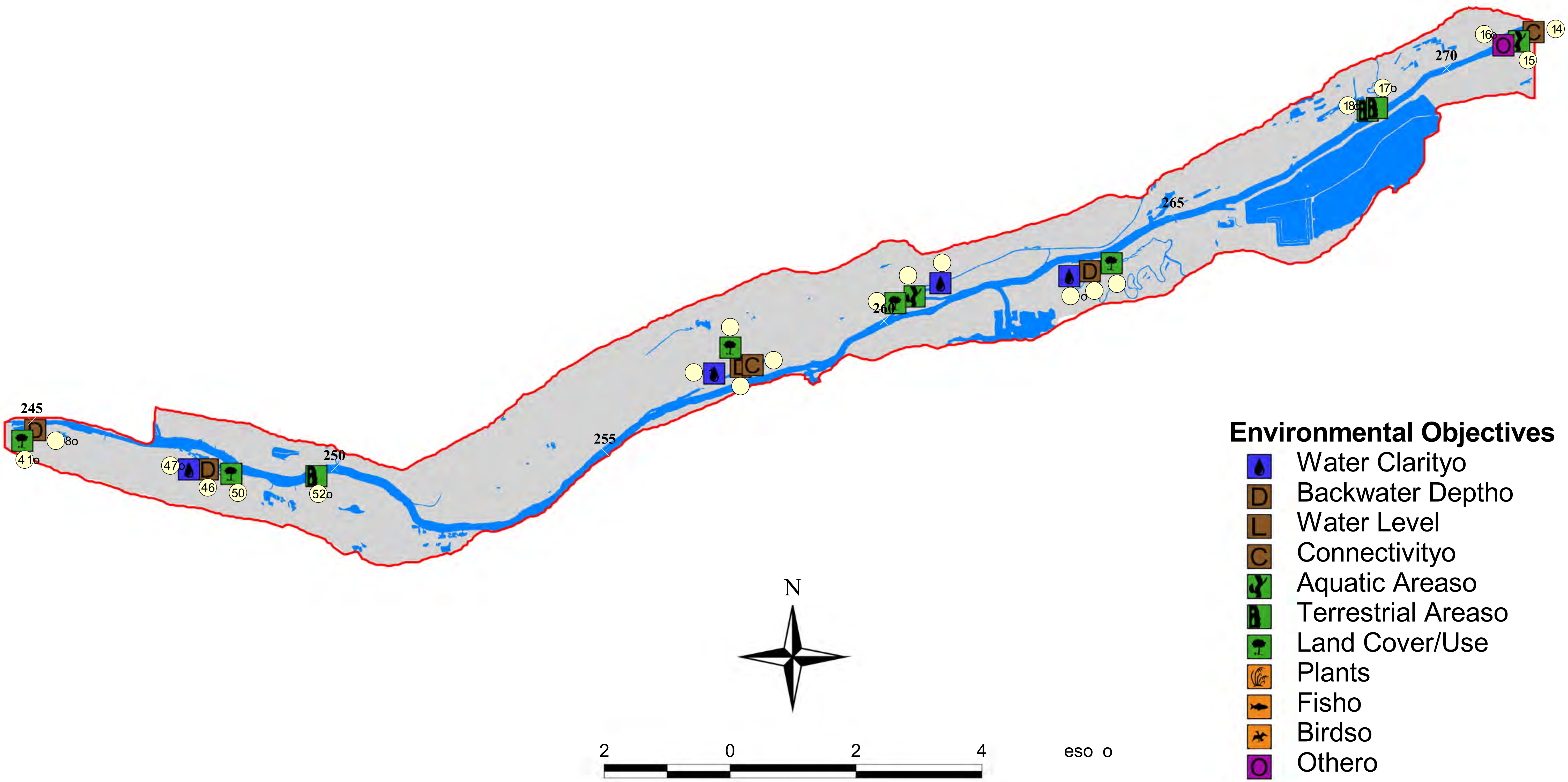
UMR - IWW Environmental Objectives
Brandon Road Pool



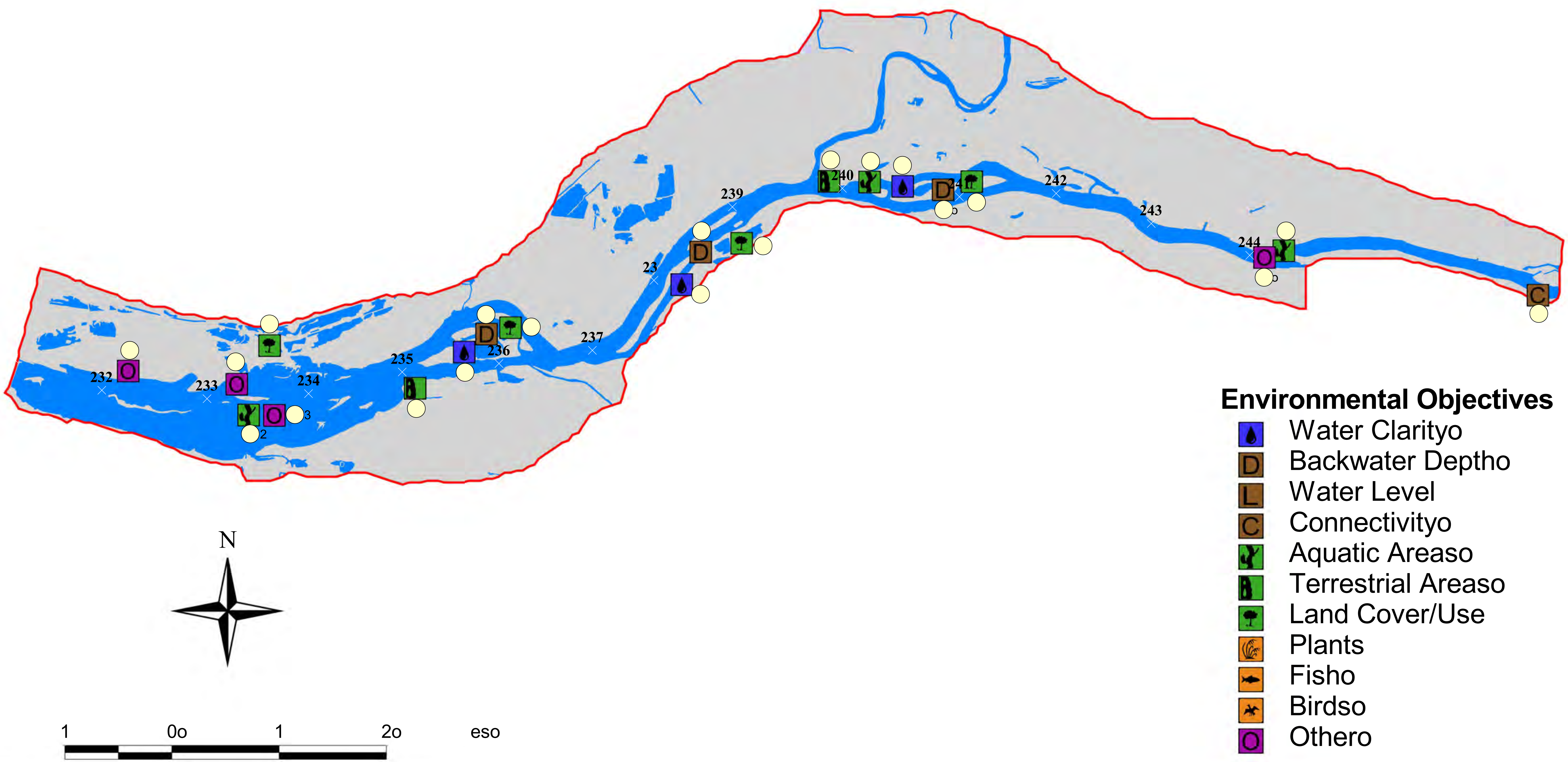
UMR - IWW Environmental Objectives
Dresden Pool



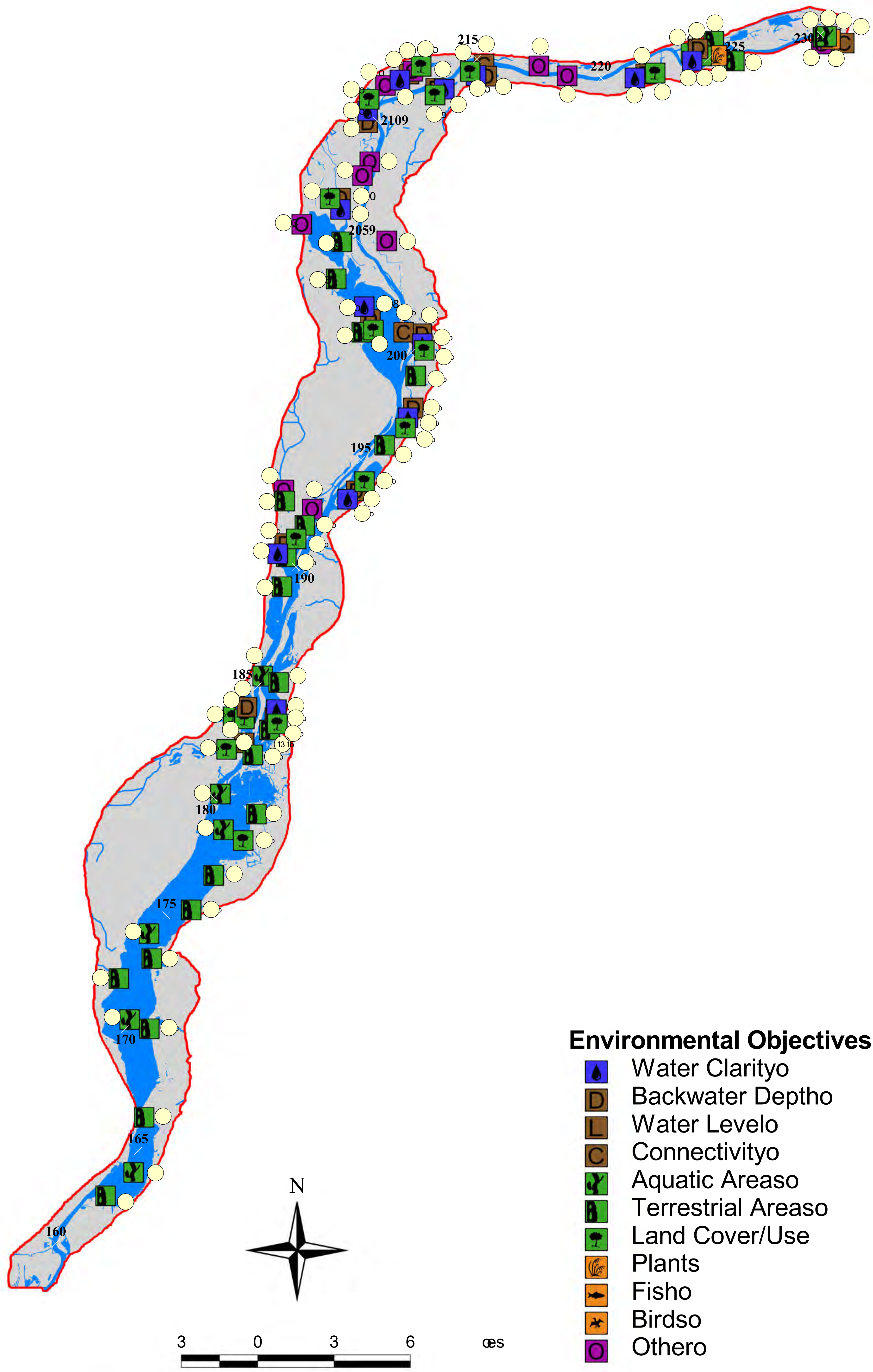
UMR - IWW Environmental Objectives
Marseilles Pool



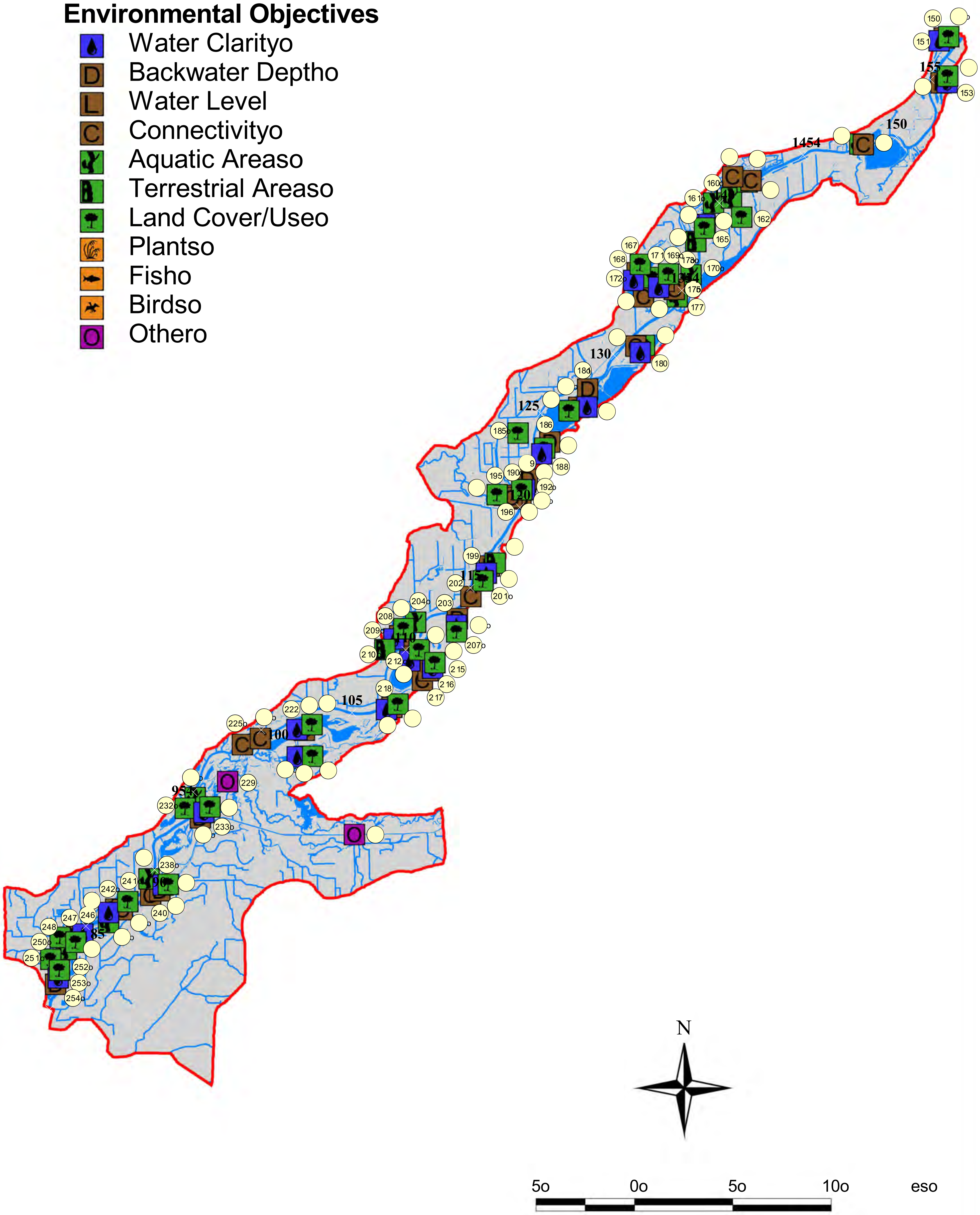
UMR - IWW Environmental Objectives
Starved Rock Pool



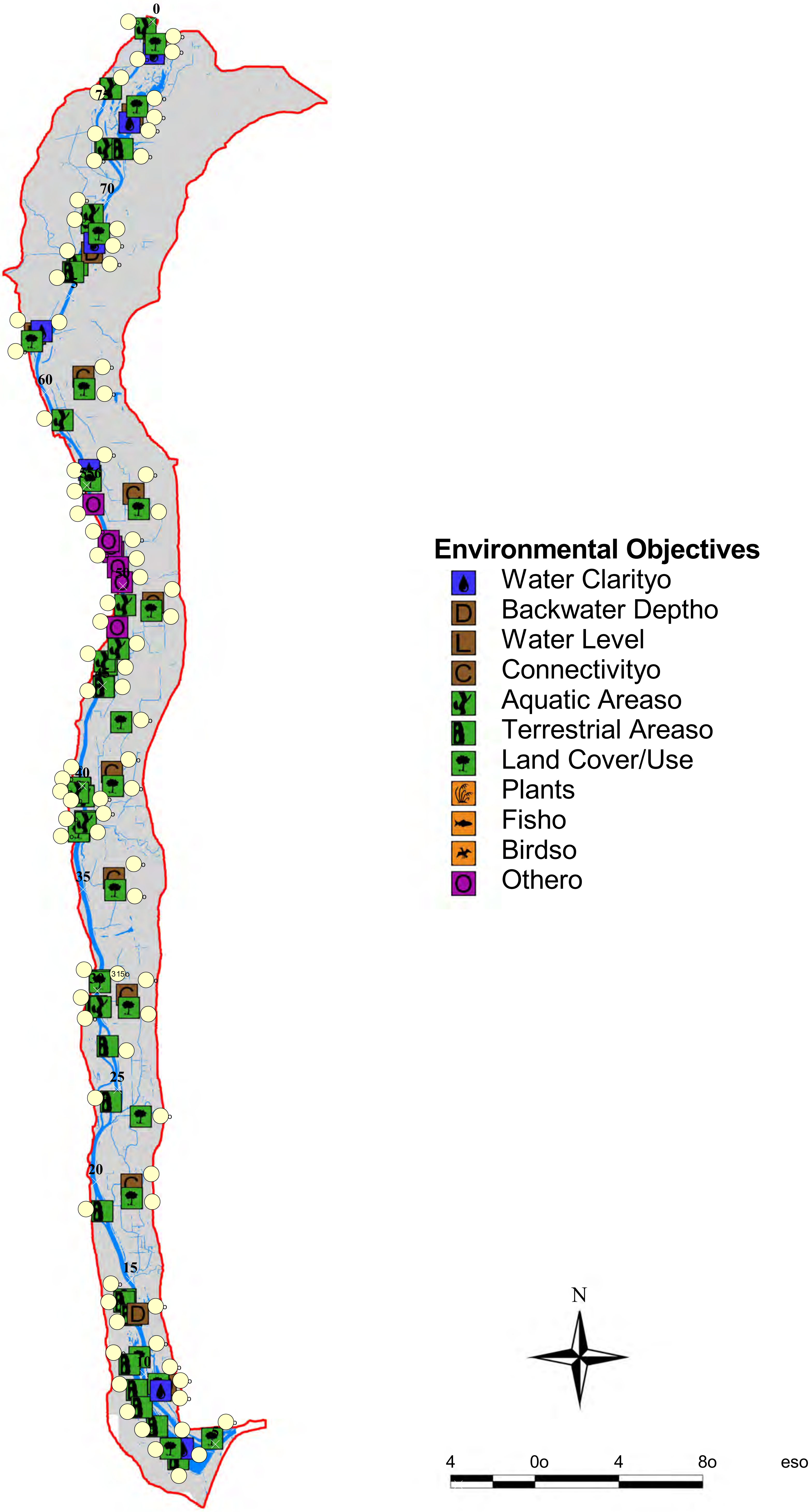
UMR - IWW Environmental Objectives
Peoria Pool



UMR - IWW Environmental Objectives
La Grange Pool



UMR - IWW Environmental Objectives
Alton Pool



Appendix C. Site-Specific Environmental Objectives - Tables

The following tables provide descriptive information for the site-specific UMR-IWW environmental objectives identified and reviewed by workshop participants. The tables are organized by UMR-IWW pool/river reach. The icon numbers in the first column link the descriptive information to the mapped objectives in Appendix B.

Table C1. Site-specific UMR-IWW Environmental Objectives (Pool 1)

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1	Pattern of Habitats	Terrestrial Areas	Island					Island development for riparian corridor RM 858-854
2	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
3	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
4	Pattern of Habitats	Land Cover/Use	Open Water					
5	Pattern of Habitats	Land Cover/Use	Grassland					
6	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
7	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
8	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
9	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
10	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
11	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
12	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
15	Geomorphology	Other				10	2015	Restore Rapids, St. Anthony falls to L&D1
18	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
20	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
23	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
30	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
33	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
36	Geomorphology	Connectivity	Longitudinal					

Table C2. Site-specific UMR-IWW Environmental Objectives (Pool 2).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
13	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
14	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
16	Pattern of Habitats	Land Cover/Use	Open Water					
17	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
19	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
21	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
22	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
24	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
25	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
26	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
27	Geomorphology	Connectivity	Secondary Channel					
28	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
29	Geomorphology	Connectivity	Floodplain					
31	Water Quality	Other						Reduce loading of nitrogen, phosphorus, and endocrine disrupters
32	Geomorphology	Backwater Depth	Backwater Areas					
34	Geomorphology	Backwater Depth	Backwater Areas					
35	Water Quality	Water Clarity	Backwater Areas					
37	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
38	Pattern of Habitats	Terrestrial Areas	Island					
39	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
40	Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffles
41	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
42	Water Quality	Water Clarity	Backwater Areas					
43	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
44	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
45	Pattern of Habitats	Land Cover/Use	Grassland					
46	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
47	Geomorphology	Connectivity	Secondary Channel					

Table C2. Site-specific UMR-IWW Environmental Objectives (Pool 2, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
48	Water Quality	Other						Reduce nitrogen, phosphorus, algae, and sediment
49	Geomorphology	Water Level	Other					Moderate the hydrologic regime of the Minnesota River
50	Geomorphology	Connectivity	Secondary Channel					
51	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
52	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
53	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
54	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
55	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
56	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
57	Geomorphology	Water Level	Backwater Areas					See Long Meadow Lake HREP
58	Pattern of Habitats	Land Cover/Use	Forest					See Long Meadow Lake HREP
59	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
60	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Long Meadow Lake HREP
61	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
62	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
63	Pattern of Habitats	Land Cover/Use	Grassland					
64	Pattern of Habitats	Terrestrial Areas	Island					
65	Pattern of Habitats	Land Cover/Use	Grassland					
66	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
67	Geomorphology	Connectivity	Secondary Channel					
68	Water Quality	Water Clarity	Backwater Areas					
69	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
70	Geomorphology	Backwater Depth	Backwater Areas					
71	Pattern of Habitats	Land Cover/Use	Grassland					
72	Pattern of Habitats	Land Cover/Use	Grassland					
73	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
74	Water Quality	Water Clarity	Backwater Areas					
75	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C2. Site-specific UMR-IWW Environmental Objectives (Pool 2, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
76	Pattern of Habitats	Land Cover/Use	Grassland					
77	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
78	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
79	Pattern of Habitats	Land Cover/Use	Grassland					
80	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
81	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
82	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
83	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
84	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
85	Pattern of Habitats	Terrestrial Areas	Island					
86	Water Quality	Water Clarity	Backwater Areas					
87	Water Quality	Water Clarity	Backwater Areas					
88	Geomorphology	Backwater Depth	Backwater Areas					
89	Pattern of Habitats	Terrestrial Areas	Island					
90	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
91	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
92	Geomorphology	Backwater Depth	Backwater Areas					
93	Pattern of Habitats	Terrestrial Areas	Island					
94	Pattern of Habitats	Land Cover/Use	Grassland					
95	Pattern of Habitats	Land Cover/Use	Grassland					
96	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
97	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
98	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
99	Pattern of Habitats	Terrestrial Areas	Island					
100	Pattern of Habitats	Terrestrial Areas	Island					

Table C2. Site-specific UMR-IWW Environmental Objectives (Pool 2, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
101	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
102	Pattern of Habitats	Terrestrial Areas	Island					
103	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
104	Pattern of Habitats	Terrestrial Areas	Island					
105	Pattern of Habitats	Terrestrial Areas	Island					
106	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
107	Geomorphology	Backwater Depth	Backwater Areas					
108	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
109	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
110	Pattern of Habitats	Terrestrial Areas	Island					
111	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
112	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
113	Pattern of Habitats	Terrestrial Areas	Island					
114	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
115	Geomorphology	Backwater Depth	Backwater Areas					
116	Pattern of Habitats	Terrestrial Areas	Island					
117	Water Quality	Water Clarity	Backwater Areas					
118	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
119	Geomorphology	Connectivity	Longitudinal					
120	Geomorphology	Backwater Depth	Backwater Areas					
123	Water Quality	Water Clarity	Backwater Areas					

Table C3. Site-specific UMR-IWW Environmental Objectives (Pool 3).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
121	Pattern of Habitats	Land Cover/Use	Forest					
122	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
124	Water Quality	Water Clarity	Backwater Areas					
125	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
126	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
127	Pattern of Habitats	Terrestrial Areas	Island					
128	Plants and Animals	Other						Limit northward migration of exotic species
129	Geomorphology	Connectivity	Floodplain					
130	Geomorphology	Connectivity	Floodplain					
131	Pattern of Habitats	Land Cover/Use	Grassland					
132	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
133	Pattern of Habitats	Land Cover/Use	Grassland					
134	Pattern of Habitats	Land Cover/Use	Forest					
135	Pattern of Habitats	Land Cover/Use	Grassland					
136	Geomorphology	Backwater Depth	Backwater Areas					
137	Pattern of Habitats	Land Cover/Use	Forest					
138	Geomorphology	Connectivity	Floodplain					Fish passage structure, fish passage through the slough
139	Pattern of Habitats	Land Cover/Use	Grassland					
140	Geomorphology	Connectivity	Floodplain					
141	Pattern of Habitats	Land Cover/Use	Forest					
142	Pattern of Habitats	Land Cover/Use	Grassland					
143	Pattern of Habitats	Land Cover/Use	Grassland					
144	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
145	Geomorphology	Connectivity	Floodplain					
146	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
147	Geomorphology	Connectivity	Floodplain					

Table C3. Site-specific UMR-IWW Environmental Objectives (Pool 3, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
148	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
149	Pattern of Habitats	Land Cover/Use	Grassland					
150	Water Quality	Water Clarity	Backwater Areas					
151	Pattern of Habitats	Land Cover/Use	Grassland					
152	Geomorphology	Backwater Depth	Backwater Areas					
153	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
154	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
155	Pattern of Habitats	Terrestrial Areas	Island					
156	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
157	Geomorphology	Backwater Depth	Backwater Areas					
158	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
159	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
160	Geomorphology	Backwater Depth	Backwater Areas					
161	Pattern of Habitats	Terrestrial Areas	Island					
162	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
163	Water Quality	Water Clarity	Backwater Areas					
164	Pattern of Habitats	Land Cover/Use	Grassland					
165	Pattern of Habitats	Land Cover/Use	Grassland					
166	Geomorphology	Backwater Depth	Backwater Areas					
167	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
168	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
169	Water Quality	Water Clarity	Backwater Areas					
170	Pattern of Habitats	Land Cover/Use	Grassland					
171	Pattern of Habitats	Terrestrial Areas	Island					
172	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
173	Geomorphology	Backwater Depth	Backwater Areas					
174	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
175	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat

Table C3. Site-specific UMR-IWW Environmental Objectives (Pool 3, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
176	Pattern of Habitats	Terrestrial Areas	Island					
177	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
178	Pattern of Habitats	Land Cover/Use	Grassland					
179	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
180	Water Quality	Water Clarity	Backwater Areas					
181	Pattern of Habitats	Land Cover/Use	Grassland					
182	Geomorphology	Connectivity	Floodplain					
183	Geomorphology	Backwater Depth	Backwater Areas					
184	Pattern of Habitats	Land Cover/Use	Grassland					
185	Pattern of Habitats	Land Cover/Use	Grassland					
186	Pattern of Habitats	Land Cover/Use	Grassland					
187	Water Quality	Other						Reduce thermal loading
188	Geomorphology	Connectivity	Floodplain					For Marsh and Gattnbine Lakes, Gattinbine Sub-Area Complex
189	Pattern of Habitats	Land Cover/Use	Grassland					
190	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
191	Water Quality	Water Clarity	Backwater Areas					
192	Geomorphology	Backwater Depth	Backwater Areas					
193	Plants and Animals	Other						Invasive species control point
194	Pattern of Habitats	Land Cover/Use	Grassland					
195	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
196	Geomorphology	Connectivity	Longitudinal					
197	Pattern of Habitats	Land Cover/Use	Grassland					

Table C4. Site-specific UMR-IWW Environmental Objectives (Pool 4).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
198	Geomorphology	Backwater Depth	Backwater Areas					
199	Geomorphology	Connectivity	Floodplain					
200	Geomorphology	Backwater Depth	Backwater Areas					
201	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
202	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
203	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
204	Pattern of Habitats	Land Cover/Use	Forest					
205	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
206	Pattern of Habitats	Aquatic Areas	Secondary Channel					
207	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
208	Geomorphology	Backwater Depth	Backwater Areas					
209	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
210	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
211	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
212	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
213	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
214	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
215	Geomorphology	Water Level	Backwater Areas					
216	Pattern of Habitats	Terrestrial Areas	Island					
217	Geomorphology	Backwater Depth	Backwater Areas					
218	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
219	Pattern of Habitats	Terrestrial Areas	Island					
220	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
221	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
222	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
223	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity

Table C4. Site-specific UMR-IWW Environmental Objectives (Pool 4, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
224	Pattern of Habitats	Terrestrial Areas	Island					
225	Pattern of Habitats	Terrestrial Areas	Island					
226	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
227	Pattern of Habitats	Terrestrial Areas	Island					
228	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
229	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
230	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
231	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
232	Water Quality	Other						Reduce sediment loading from Minnesota River, Filling upper portion of Lake Pepin
233	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
234	Pattern of Habitats	Terrestrial Areas	Island					
235	Pattern of Habitats	Aquatic Areas	Impounded Area					
236	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
237	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
238	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
239	Geomorphology	Backwater Depth	Backwater Areas					
240	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
241	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
242	Pattern of Habitats	Aquatic Areas	Main Channel					
243	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
244	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
245	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
246	Pattern of Habitats	Aquatic Areas	Secondary Channel					
247	Pattern of Habitats	Terrestrial Areas	Island					

Table C4. Site-specific UMR-IWW Environmental Objectives (Pool 4, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
248	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
249	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
250	Geomorphology	Backwater Depth	Backwater Areas					
251	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
252	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
253	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
254	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
255	Pattern of Habitats	Terrestrial Areas	Island					
256	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
257	Pattern of Habitats	Terrestrial Areas	Island					
258	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
259	Pattern of Habitats	Aquatic Areas	Main Channel					
260	Pattern of Habitats	Land Cover/Use	Forest					
261	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
262	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
263	Geomorphology	Backwater Depth	Backwater Areas					
264	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
265	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
266	Pattern of Habitats	Land Cover/Use	Forest					
267	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
268	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
269	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
270	Pattern of Habitats	Aquatic Areas	Secondary Channel					
271	Pattern of Habitats	Land Cover/Use	Forest					
272	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
273	Geomorphology	Backwater Depth	Backwater Areas					
274	Pattern of Habitats	Terrestrial Areas	Island					
275	Pattern of Habitats	Land Cover/Use	Forest					
276	Pattern of Habitats	Land Cover/Use	Forest					

Table C4. Site-specific UMR-IWW Environmental Objectives (Pool 4, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
277	Pattern of Habitats	Land Cover/Use	Forest					
278	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
279	Pattern of Habitats	Land Cover/Use	Grassland					
280	Pattern of Habitats	Terrestrial Areas	Island					
281	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
282	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
283	Geomorphology	Backwater Depth	Backwater Areas					
284	Pattern of Habitats	Land Cover/Use	Forest					
285	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
286	Geomorphology	Connectivity	Secondary Channel					
287	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
288	Geomorphology	Backwater Depth	Backwater Areas					
289	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
290	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
291	Geomorphology	Backwater Depth	Backwater Areas					
292	Pattern of Habitats	Land Cover/Use	Grassland					
293	Pattern of Habitats	Terrestrial Areas	Island					
294	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
295	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
296	Pattern of Habitats	Land Cover/Use	Forest					
297	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
298	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
299	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
300	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
301	Geomorphology	Backwater Depth	Backwater Areas					
302	Pattern of Habitats	Terrestrial Areas	Island					

Table C4. Site-specific UMR-IWW Environmental Objectives (Pool 4, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
303	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
304	Geomorphology	Connectivity	Floodplain					
305	Geomorphology	Connectivity	Floodplain					
306	Pattern of Habitats	Aquatic Areas	Impounded Area					
307	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
308	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
309	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
310	Pattern of Habitats	Land Cover/Use	Forest					
311	Geomorphology	Connectivity	Longitudinal					
312	Pattern of Habitats	Land Cover/Use	Grassland					

Table C5. Site-specific UMR-IWW Environmental Objectives (Pool 5).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
313	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
314	Pattern of Habitats	Land Cover/Use	Grassland					
315	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
316	Geomorphology	Backwater Depth	Backwater Areas					
317	Geomorphology	Connectivity	Floodplain					
318	Pattern of Habitats	Land Cover/Use	Grassland					
319	Geomorphology	Connectivity	Floodplain					
320	Geomorphology	Backwater Depth	Backwater Areas					
321	Pattern of Habitats	Land Cover/Use	Grassland					
322	Geomorphology	Connectivity	Secondary Channel					
323	Pattern of Habitats	Land Cover/Use	Grassland					
324	Pattern of Habitats	Land Cover/Use	Forest					
325	Geomorphology	Backwater Depth	Backwater Areas					
326	Pattern of Habitats	Land Cover/Use	Grassland					
327	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
328	Geomorphology	Backwater Depth	Backwater Areas					
329	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
330	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
331	Pattern of Habitats	Land Cover/Use	Forest					
332	Geomorphology	Connectivity	Floodplain					
333	Pattern of Habitats	Land Cover/Use	Forest					
334	Geomorphology	Backwater Depth	Backwater Areas					
335	Pattern of Habitats	Land Cover/Use	Grassland					
336	Pattern of Habitats	Land Cover/Use	Grassland					
337	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
338	Pattern of Habitats	Land Cover/Use	Forest					
339	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years

Table C5. Site-specific UMR-IWW Environmental Objectives (Pool 5, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
340	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
341	Geomorphology	Backwater Depth	Backwater Areas					
342	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
343	Geomorphology	Backwater Depth	Backwater Areas					
344	Pattern of Habitats	Terrestrial Areas	Island					
345	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
346	Pattern of Habitats	Aquatic Areas	Secondary Channel					
347	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
348	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
349	Pattern of Habitats	Land Cover/Use	Forest					
350	Pattern of Habitats	Terrestrial Areas	Island					
351	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
352	Geomorphology	Connectivity	Floodplain					
353	Pattern of Habitats	Land Cover/Use	Grassland					
354	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
355	Pattern of Habitats	Terrestrial Areas	Island					
356	Pattern of Habitats	Terrestrial Areas	Island					
357	Geomorphology	Backwater Depth	Backwater Areas					
358	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
359	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
360	Pattern of Habitats	Land Cover/Use	Forest					
361	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
362	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
363	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
364	Geomorphology	Backwater Depth	Backwater Areas					
365	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
366	Pattern of Habitats	Land Cover/Use	Forest					

Table C5. Site-specific UMR-IWW Environmental Objectives (Pool 5, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
367	Pattern of Habitats	Land Cover/Use	Forest					
368	Pattern of Habitats	Land Cover/Use	Grassland					
369	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
370	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
371	Pattern of Habitats	Aquatic Areas	Impounded Area					
372	Pattern of Habitats	Terrestrial Areas	Island					
373	Pattern of Habitats	Terrestrial Areas	Island					
374	Pattern of Habitats	Terrestrial Areas	Island					
375	Pattern of Habitats	Land Cover/Use	Forest					
376	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
377	Geomorphology	Backwater Depth	Backwater Areas					
378	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
379	Pattern of Habitats	Terrestrial Areas	Island					
380	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years, See Spring Lake Islands HREP
381	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
382	Pattern of Habitats	Terrestrial Areas	Island					
383	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
384	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Spring Lake Islands HREP
385	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
387	Pattern of Habitats	Aquatic Areas	Impounded Area					See Spring Lake Islands HREP
388	Pattern of Habitats	Terrestrial Areas	Island					See Spring Lake Islands HREP
389	Geomorphology	Backwater Depth	Backwater Areas					See Spring Lake Islands HREP

Table C5. Site-specific UMR-IWW Environmental Objectives (Pool 5, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
390	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat, See Spring Lake Islands HREP
391	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
392	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
393	Pattern of Habitats	Terrestrial Areas	Island					
394	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat, See Spring Lake Islands HREP
396	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
398	Pattern of Habitats	Terrestrial Areas	Island					
401	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
402	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m				In non-flood years
403	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
404	Pattern of Habitats	Terrestrial Areas	Island					
406	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
407	Geomorphology	Connectivity	Longitudinal					

Table C6. Site-specific UMR-IWW Environmental Objectives (Pool 5a).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
386	Pattern of Habitats	Land Cover/Use	Grassland					
395	Pattern of Habitats	Land Cover/Use	Forest					
397	Pattern of Habitats	Land Cover/Use	Grassland					
399	Geomorphology	Backwater Depth	Backwater Areas					
400	Geomorphology	Connectivity	Floodplain					
405	Pattern of Habitats	Land Cover/Use	Forest					
408	Other	Other						Land Easements or Acquisition
409	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
410	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
411	Geomorphology	Backwater Depth	Backwater Areas					
412	Geomorphology	Backwater Depth	Backwater Areas					
413	Pattern of Habitats	Land Cover/Use	Forest					
414	Pattern of Habitats	Aquatic Areas	Secondary Channel					
415	Pattern of Habitats	Land Cover/Use	Forest					
416	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
417	Geomorphology	Backwater Depth	Backwater Areas					
418	Geomorphology	Backwater Depth	Backwater Areas					
419	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
420	Other	Other						Land Easements or Acquisition
421	Pattern of Habitats	Land Cover/Use	Forest					
422	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
423	Geomorphology	Backwater Depth	Backwater Areas					
424	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
425	Geomorphology	Backwater Depth	Backwater Areas					
426	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
427	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
428	Pattern of Habitats	Terrestrial Areas	Island					

Table C6. Site-specific UMR-IWW Environmental Objectives (Pool 5a, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
429	Pattern of Habitats	Land Cover/Use	Forest					
430	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
431	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
432	Other	Other						Land Easements or Acquisition
433	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
434	Water Quality	Water Clarity	Backwater Areas	Secchi disk				In non-flood years
435	Pattern of Habitats	Terrestrial Areas	Island					
436	Pattern of Habitats	Land Cover/Use	Forest					
437	Pattern of Habitats	Aquatic Areas	Impounded Area					
438	Geomorphology	Connectivity	Floodplain					
439	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
440	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
441	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
442	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
443	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
444	Pattern of Habitats	Terrestrial Areas	Island					
445	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
446	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
447	Geomorphology	Connectivity	Longitudinal					
448	Geomorphology	Backwater Depth	Backwater Areas					

Table C7. Site-specific UMR-IWW Environmental Objectives (Pool 6).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
449	Other	Other						Land Easements or Acquisition
450	Geomorphology	Backwater Depth	Backwater Areas					
451	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
452	Geomorphology	Backwater Depth	Backwater Areas					
453	Pattern of Habitats	Land Cover/Use	Grassland					
454	Geomorphology	Water Level	Backwater Areas					
455	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
456	Geomorphology	Water Level	Backwater Areas					
457	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
458	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
459	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
460	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
461	Geomorphology	Backwater Depth	Backwater Areas					
462	Geomorphology	Connectivity	Floodplain					
463	Geomorphology	Connectivity	Floodplain					
464	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
465	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
466	Pattern of Habitats	Terrestrial Areas	Island					
467	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
468	Geomorphology	Backwater Depth	Backwater Areas					
469	Geomorphology	Water Level	Backwater Areas					
470	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
471	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
472	Pattern of Habitats	Terrestrial Areas	Island					
473	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity

Table C7. Site-specific UMR-IWW Environmental Objectives (Pool 6, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
474	Geomorphology	Backwater Depth	Backwater Areas					
475	Pattern of Habitats	Terrestrial Areas	Island					
476	Other	Other						Land Easements or Acquisition
477	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
478	Geomorphology	Backwater Depth	Backwater Areas					
479	Geomorphology	Backwater Depth	Backwater Areas					
480	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
481	Geomorphology	Backwater Depth	Backwater Areas					
482	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
483	Geomorphology	Connectivity	Floodplain					
484	Pattern of Habitats	Aquatic Areas	Main Channel					
485	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
486	Pattern of Habitats	Terrestrial Areas	Island					
487	Geomorphology	Backwater Depth	Backwater Areas					
488	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
489	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
490	Geomorphology	Backwater Depth	Backwater Areas					
491	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
492	Pattern of Habitats	Terrestrial Areas	Island					
493	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
494	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
495	Pattern of Habitats	Terrestrial Areas	Island					
496	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
497	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C7. Site-specific UMR-IWW Environmental Objectives (Pool 6, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
498	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
499	Pattern of Habitats	Terrestrial Areas	Island					
500	Geomorphology	Connectivity	Longitudinal					
501	Pattern of Habitats	Land Cover/Use	Forest					

Table C8. Site-specific UMR-IWW Environmental Objectives (Pool 7).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
502	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
503	Pattern of Habitats	Land Cover/Use	Forest					
504	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
505	Geomorphology	Connectivity	Floodplain					
506	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
507	Geomorphology	Backwater Depth	Backwater Areas					
508	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
509	Geomorphology	Backwater Depth	Backwater Areas					
510	Pattern of Habitats	Land Cover/Use	Grassland					
511	Pattern of Habitats	Land Cover/Use	Forest					
512	Pattern of Habitats	Land Cover/Use	Forest					
513	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
514	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
515	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
516	Geomorphology	Backwater Depth	Backwater Areas					
517	Pattern of Habitats	Land Cover/Use	Forest					
518	Geomorphology	Connectivity	Floodplain					
519	Geomorphology	Connectivity	Floodplain					
520	Pattern of Habitats	Land Cover/Use	Forest					
521	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
522	Pattern of Habitats	Aquatic Areas	Secondary Channel					
523	Pattern of Habitats	Land Cover/Use	Forest					
524	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
525	Pattern of Habitats	Land Cover/Use	Grassland					
526	Pattern of Habitats	Land Cover/Use	Forest					

Table C8. Site-specific UMR-IWW Environmental Objectives (Pool 7, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
527	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Water quality objective for all main channel habitat, Pools 7-9
528	Geomorphology	Backwater Depth	Backwater Areas					
529	Pattern of Habitats	Land Cover/Use	Forest					
530	Pattern of Habitats	Land Cover/Use	Grassland					
531	Pattern of Habitats	Land Cover/Use	Forest					
532	Geomorphology	Connectivity	Floodplain					
533	Pattern of Habitats	Land Cover/Use	Grassland					
534	Geomorphology	Water Level	Backwater Areas					
535	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
536	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
537	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	All Year	10	2010	Water quality objective for all secondary channel habitat, Pools 7-9
538	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
539	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
540	Geomorphology	Backwater Depth	Backwater Areas					
541	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
542	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
543	Pattern of Habitats	Terrestrial Areas	Island					
544	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
545	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
546	Geomorphology	Backwater Depth	Backwater Areas					
547	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
548	Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table C8. Site-specific UMR-IWW Environmental Objectives (Pool 7, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
549	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
550	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
551	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
552	Pattern of Habitats	Land Cover/Use	Forest					
553	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
554	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
555	Geomorphology	Backwater Depth	Backwater Areas					
556	Pattern of Habitats	Aquatic Areas	Impounded Area					
557	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
558	Pattern of Habitats	Aquatic Areas	Secondary Channel					
559	Geomorphology	Backwater Depth	Backwater Areas					
560	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
561	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
562	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
563	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
564	Pattern of Habitats	Terrestrial Areas	Island					
565	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
566	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Will do better in summer and winter
567	Pattern of Habitats	Terrestrial Areas	Island					
568	Geomorphology	Backwater Depth	Backwater Areas					
569	Geomorphology	Backwater Depth	Other					
570	Pattern of Habitats	Land Cover/Use	Forest					
571	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
572	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table C8. Site-specific UMR-IWW Environmental Objectives (Pool 7, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
573	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
574	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
575	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
578	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
580	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
581	Pattern of Habitats	Aquatic Areas	Impounded Area					
582	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
583	Geomorphology	Connectivity	Longitudinal					

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
576	Geomorphology	Backwater Depth	Backwater Areas					
577	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
579	Other	Other						Land Easements or Acquisition
584	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
585	Geomorphology	Backwater Depth	Backwater Areas					
586	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
587	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
588	Geomorphology	Backwater Depth	Backwater Areas					
589	Other	Other						Land Easements or Acquisition
590	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
591	Geomorphology	Backwater Depth	Backwater Areas					
592	Geomorphology	Backwater Depth	Backwater Areas					
593	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
594	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
595	Geomorphology	Connectivity	Secondary Channel					
596	Geomorphology	Backwater Depth	Backwater Areas					
597	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
598	Geomorphology	Connectivity	Secondary Channel					
599	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
600	Geomorphology	Backwater Depth	Backwater Areas					
601	Other	Other						Land Easements or Acquisition
602	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
603	Geomorphology	Backwater Depth	Backwater Areas					

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
604	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
605	Geomorphology	Backwater Depth	Backwater Areas					
606	Geomorphology	Connectivity	Floodplain					
607	Pattern of Habitats	Land Cover/Use	Grassland					
608	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
609	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
610	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
611	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
612	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
613	Pattern of Habitats	Terrestrial Areas	Island					
614	Geomorphology	Backwater Depth	Backwater Areas					
615	Pattern of Habitats	Land Cover/Use	Grassland					
616	Pattern of Habitats	Land Cover/Use	Forest					
617	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
618	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
619	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
620	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
621	Geomorphology	Backwater Depth	Backwater Areas					
622	Geomorphology	Backwater Depth	Backwater Areas					
623	Pattern of Habitats	Terrestrial Areas	Island					
624	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
625	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
626	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	All Year	10	2010	Water quality objective for all secondary channel habitat, Pools 7-9
627	Pattern of Habitats	Land Cover/Use	Forest					
628	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Water quality objective for all main channel habitat, Pools 7-9
629	Geomorphology	Connectivity	Floodplain					
630	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
631	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
632	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
633	Geomorphology	Backwater Depth	Backwater Areas					
634	Geomorphology	Backwater Depth	Backwater Areas					
635	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
636	Pattern of Habitats	Land Cover/Use	Forest					
637	Pattern of Habitats	Land Cover/Use	Forest					
638	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
639	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
640	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
641	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
642	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
643	Pattern of Habitats	Land Cover/Use	Forest					
644	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
645	Geomorphology	Backwater Depth	Backwater Areas					
646	Pattern of Habitats	Land Cover/Use	Forest					
647	Pattern of Habitats	Terrestrial Areas	Island					

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
648	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
649	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
650	Pattern of Habitats	Terrestrial Areas	Island					
651	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
652	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
653	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
654	Pattern of Habitats	Land Cover/Use	Forest					
655	Pattern of Habitats	Terrestrial Areas	Island					
656	Pattern of Habitats	Terrestrial Areas	Island					
657	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
658	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
659	Geomorphology	Backwater Depth	Backwater Areas					
660	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
661	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
662	Pattern of Habitats	Land Cover/Use	Forest					
663	Pattern of Habitats	Land Cover/Use	Forest					
664	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
665	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
666	Geomorphology	Backwater Depth	Backwater Areas					
667	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
668	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
669	Pattern of Habitats	Terrestrial Areas	Island					
670	Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
671	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
672	Geomorphology	Backwater Depth	Backwater Areas					
673	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
674	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
675	Pattern of Habitats	Terrestrial Areas	Island					
676	Geomorphology	Backwater Depth	Backwater Areas					
677	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
678	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
679	Other	Other						Land Easements or Acquisition
680	Pattern of Habitats	Terrestrial Areas	Island					
681	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
682	Pattern of Habitats	Land Cover/Use	Forest					
683	Pattern of Habitats	Terrestrial Areas	Island					
684	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
685	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
686	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
687	Pattern of Habitats	Terrestrial Areas	Island					
688	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
689	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
690	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
691	Pattern of Habitats	Terrestrial Areas	Island					
692	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
693	Geomorphology	Backwater Depth	Backwater Areas					
694	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
695	Pattern of Habitats	Terrestrial Areas	Island					
696	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
697	Pattern of Habitats	Terrestrial Areas	Island					
698	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
699	Pattern of Habitats	Terrestrial Areas	Island					
700	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
701	Geomorphology	Backwater Depth	Backwater Areas					
702	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
703	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
704	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
705	Pattern of Habitats	Aquatic Areas	Impounded Area					
706	Pattern of Habitats	Terrestrial Areas	Island					
707	Pattern of Habitats	Terrestrial Areas	Island					
708	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
709	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
710	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
711	Pattern of Habitats	Terrestrial Areas	Island					
712	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
713	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
714	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					

Table C9. Site-specific UMR-IWW Environmental Objectives (Pool 8, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
716	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
717	Geomorphology	Connectivity	Longitudinal					

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
715	Pattern of Habitats	Land Cover/Use	Forest					
718	Pattern of Habitats	Land Cover/Use	Forest					
719	Geomorphology	Connectivity	Floodplain					
720	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
721	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
722	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
723	Geomorphology	Backwater Depth	Backwater Areas					
724	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
725	Pattern of Habitats	Land Cover/Use	Forest					
726	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
727	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
728	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
729	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
730	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
731	Geomorphology	Backwater Depth	Backwater Areas					
732	Geomorphology	Backwater Depth	Backwater Areas					
733	Pattern of Habitats	Land Cover/Use	Forest					
734	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
735	Geomorphology	Backwater Depth	Backwater Areas					
736	Pattern of Habitats	Land Cover/Use	Grassland					
737	Geomorphology	Backwater Depth	Backwater Areas					See Pool Slough HREP
738	Geomorphology	Water Level	Backwater Areas					See Pool Slough HREP
739	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Pool Slough HREP
740	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
741	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
742	Geomorphology	Backwater Depth	Backwater Areas					
743	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
744	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
745	Geomorphology	Connectivity	Floodplain					
746	Geomorphology	Backwater Depth	Backwater Areas					
747	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
748	Pattern of Habitats	Land Cover/Use	Forest					
749	Geomorphology	Backwater Depth	Backwater Areas					
750	Pattern of Habitats	Terrestrial Areas	Island					
751	Pattern of Habitats	Land Cover/Use	Forest					
752	Geomorphology	Backwater Depth	Backwater Areas					
753	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
754	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
755	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
756	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Conway Lake HREP
757	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
758	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
759	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
760	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
761	Geomorphology	Backwater Depth	Backwater Areas					
762	Pattern of Habitats	Terrestrial Areas	Island					See Conway Lake HREP
763	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Conway Lake HREP
764	Geomorphology	Backwater Depth	Backwater Areas					See Conway Lake HREP
765	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Conway Lake HREP
766	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Conway Lake HREP
767	Pattern of Habitats	Terrestrial Areas	Island					See Conway Lake HREP

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
768	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
769	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Water quality objective for all main channel habitat, Pools 7-9
770	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
771	Geomorphology	Backwater Depth	Backwater Areas					
772	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
773	Geomorphology	Backwater Depth	Backwater Areas					
774	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	All Year	10	2010	Water quality objective for all secondary channel habitat, Pools 7-9
775	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
776	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
777	Geomorphology	Backwater Depth	Backwater Areas					
778	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
779	Geomorphology	Backwater Depth	Backwater Areas					
780	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
781	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
782	Pattern of Habitats	Terrestrial Areas	Island					
783	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
784	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
785	Geomorphology	Backwater Depth	Backwater Areas					
786	Pattern of Habitats	Terrestrial Areas	Island					

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
787	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
788	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
789	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
790	Geomorphology	Backwater Depth	Backwater Areas					
791	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
792	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
793	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
794	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
795	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
796	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
797	Geomorphology	Backwater Depth	Backwater Areas					
798	Pattern of Habitats	Terrestrial Areas	Island					
799	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
800	Pattern of Habitats	Terrestrial Areas	Island					
801	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
802	Geomorphology	Backwater Depth	Backwater Areas					See Capoli Slough HREP
803	Pattern of Habitats	Terrestrial Areas	Island					See Capoli Slough HREP
804	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics, See Capoli Slough HREP
805	Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat, See Capoli Slough HREP
806	Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Capoli Slough HREP

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
807	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
808	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Capoli Slough HREP
809	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure, See Capoli Slough HREP
810	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
811	Geomorphology	Backwater Depth	Backwater Areas					See Capoli Slough HREP
812	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
813	Pattern of Habitats	Terrestrial Areas	Island					
814	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
815	Pattern of Habitats	Terrestrial Areas	Island					
816	Geomorphology	Backwater Depth	Backwater Areas					
817	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
818	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
819	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
820	Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
821	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Harpers Slough HREP
822	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics, See Harpers Slough HREP
823	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
824	Geomorphology	Connectivity	Floodplain					

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
825	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
826	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
827	Pattern of Habitats	Terrestrial Areas	Island					
828	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
829	Geomorphology	Backwater Depth	Backwater Areas					
830	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure, See Harpers Slough HREP
831	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
832	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
833	Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
834	Geomorphology	Backwater Depth	Backwater Areas					See Harpers Slough HREP
835	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
836	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Harpers Slough HREP
837	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
838	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Harpers Slough HREP
839	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics, See Harpers Slough HREP
840	Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
841	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
842	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
843	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Harpers Slough HREP
844	Geomorphology	Backwater Depth	Backwater Areas					See Harpers Slough HREP

Table C10. Site-specific UMR-IWW Environmental Objectives (Pool 9, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
845	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
846	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
847	Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
848	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics, See Harpers Slough HREP
849	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Harpers Slough HREP
850	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
851	Geomorphology	Backwater Depth	Backwater Areas					See Harpers Slough HREP
852	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					See Harpers Slough HREP
853	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Harpers Slough HREP
854	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
855	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics, See Harpers Slough HREP
858	Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
860	Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
861	Geomorphology	Connectivity	Longitudinal					

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
856	Geomorphology	Backwater Depth	Backwater Areas					
857	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
859	Geomorphology	Backwater Depth	Backwater Areas					
862	Geomorphology	Backwater Depth	Backwater Areas					
863	Pattern of Habitats	Land Cover/Use	Forest					
864	Pattern of Habitats	Aquatic Areas	Secondary Channel					
865	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
866	Geomorphology	Backwater Depth	Backwater Areas					
867	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
868	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
869	Geomorphology	Backwater Depth	Backwater Areas					
870	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
871	Pattern of Habitats	Land Cover/Use	Forest					
872	Pattern of Habitats	Terrestrial Areas	Island					
873	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
874	Geomorphology	Connectivity	Secondary Channel					
875	Pattern of Habitats	Land Cover/Use	Forest					
876	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
877	Geomorphology	Backwater Depth	Backwater Areas					
878	Geomorphology	Backwater Depth	Backwater Areas					
879	Pattern of Habitats	Land Cover/Use	Forest					
880	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
881	Geomorphology	Backwater Depth	Backwater Areas					
882	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
883	Geomorphology	Backwater Depth	Backwater Areas					
884	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
885	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
886	Pattern of Habitats	Aquatic Areas	Secondary Channel					
887	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
888	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
889	Geomorphology	Backwater Depth	Backwater Areas					
890	Geomorphology	Backwater Depth	Backwater Areas					
891	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
892	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
893	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
894	Pattern of Habitats	Terrestrial Areas	Island					
895	Pattern of Habitats	Terrestrial Areas	Island					
896	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
897	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
898	Geomorphology	Backwater Depth	Backwater Areas					
899	Geomorphology	Backwater Depth	Backwater Areas					Sediment trap
900	Pattern of Habitats	Terrestrial Areas	Island					
901	Pattern of Habitats	Terrestrial Areas	Island					
902	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
903	Pattern of Habitats	Terrestrial Areas	Island					
904	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
905	Pattern of Habitats	Land Cover/Use	Forest					
906	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
907	Geomorphology	Backwater Depth	Backwater Areas					
908	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
909	Geomorphology	Backwater Depth	Backwater Areas					

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
910	Geomorphology	Backwater Depth	Backwater Areas					
911	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
912	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
913	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
914	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
915	Pattern of Habitats	Terrestrial Areas	Island					
916	Geomorphology	Backwater Depth	Backwater Areas					
917	Geomorphology	Backwater Depth	Backwater Areas					
918	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
919	Pattern of Habitats	Aquatic Areas	Secondary Channel					
920	Pattern of Habitats	Terrestrial Areas	Island					
921	Geomorphology	Backwater Depth	Backwater Areas					
922	Geomorphology	Connectivity	Floodplain					
923	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
924	Pattern of Habitats	Aquatic Areas	Secondary Channel					
925	Geomorphology	Backwater Depth	Backwater Areas					
926	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
927	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
928	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
929	Pattern of Habitats	Terrestrial Areas	Island					
930	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
931	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
932	Geomorphology	Backwater Depth	Backwater Areas					
933	Geomorphology	Connectivity	Secondary Channel					
934	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
935	Geomorphology	Connectivity	Secondary Channel					

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
936	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
937	Pattern of Habitats	Aquatic Areas	Main Channel					
938	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
939	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
940	Geomorphology	Backwater Depth	Backwater Areas					
941	Pattern of Habitats	Aquatic Areas	Secondary Channel					
942	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
943	Pattern of Habitats	Terrestrial Areas	Island					
944	Water Quality	Other			All Year	10	0	DO objective for all main channel and secondary channel habitat, DO >5 PPM, Pools 10-11
945	Other	Other						Land Easements or Acquisition
946	Geomorphology	Backwater Depth	Backwater Areas					
947	Pattern of Habitats	Aquatic Areas	Tertiary Channel					
948	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
949	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer			Water quality objective for all main channel and secondary channel habitat, Pools 10-11
950	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
951	Pattern of Habitats	Terrestrial Areas	Island					
952	Other	Other						Land Easements or Acquisition
953	Geomorphology	Backwater Depth	Backwater Areas					
954	Geomorphology	Connectivity	Floodplain					

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
955	Pattern of Habitats	Land Cover/Use	Forest					
956	Geomorphology	Connectivity	Floodplain					
957	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
958	Geomorphology	Backwater Depth	Backwater Areas					
959	Pattern of Habitats	Terrestrial Areas	Island					
960	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
961	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
962	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
963	Pattern of Habitats	Terrestrial Areas	Island					
964	Geomorphology	Backwater Depth	Backwater Areas					
965	Geomorphology	Backwater Depth	Backwater Areas					
966	Pattern of Habitats	Land Cover/Use	Forest					
967	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
968	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
969	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
970	Geomorphology	Backwater Depth	Backwater Areas					
971	Pattern of Habitats	Terrestrial Areas	Island					
972	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
973	Pattern of Habitats	Aquatic Areas	Secondary Channel					
974	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
975	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
976	Geomorphology	Backwater Depth	Backwater Areas					
977	Geomorphology	Backwater Depth	Backwater Areas					
978	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
979	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
980	Geomorphology	Backwater Depth	Backwater Areas					

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
981	Pattern of Habitats	Land Cover/Use	Grassland					
982	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
983	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
984	Geomorphology	Backwater Depth	Backwater Areas					
985	Geomorphology	Backwater Depth	Backwater Areas					
986	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
987	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
988	Geomorphology	Connectivity	Secondary Channel					
989	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
990	Pattern of Habitats	Aquatic Areas	Secondary Channel					
991	Pattern of Habitats	Terrestrial Areas	Island					
992	Geomorphology	Backwater Depth	Backwater Areas					
993	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
994	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
995	Pattern of Habitats	Terrestrial Areas	Island					
996	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
997	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
998	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
999	Pattern of Habitats	Terrestrial Areas	Island					
1000	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
1001	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
1002	Geomorphology	Backwater Depth	Backwater Areas					
1003	Geomorphology	Backwater Depth	Backwater Areas					
1004	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1005	Pattern of Habitats	Terrestrial Areas	Island					
1006	Pattern of Habitats	Terrestrial Areas	Island					
1007	Geomorphology	Backwater Depth	Backwater Areas					
1008	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
1009	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1010	Pattern of Habitats	Terrestrial Areas	Island					
1011	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1012	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1013	Geomorphology	Backwater Depth	Backwater Areas					
1014	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
1015	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1016	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1017	Pattern of Habitats	Terrestrial Areas	Island					
1018	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
1019	Geomorphology	Connectivity	Floodplain					
1020	Geomorphology	Backwater Depth	Backwater Areas					
1021	Pattern of Habitats	Terrestrial Areas	Island					
1022	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
1023	Geomorphology	Backwater Depth	Backwater Areas					
1024	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1025	Pattern of Habitats	Terrestrial Areas	Island					
1026	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1027	Pattern of Habitats	Terrestrial Areas	Island					
1028	Pattern of Habitats	Terrestrial Areas	Island					
1029	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration

Table C11. Site-specific UMR-IWW Environmental Objectives (Pool 10, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1030	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1031	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1032	Geomorphology	Water Level	Main Channel	Other	Sum. & Win.	5	2005	Variable drawdown as needed to restore vegetation
1034	Geomorphology	Connectivity	Longitudinal					

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1033	Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
1035	Geomorphology	Water Level	Backwater Areas					
1036	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1037	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
1038	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1039	Pattern of Habitats	Aquatic Areas	Main Channel					
1040	Geomorphology	Backwater Depth	Backwater Areas					
1041	Other	Other						Land Easements or Acquisition
1042	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
1043	Geomorphology	Backwater Depth	Backwater Areas					
1044	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1045	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1046	Geomorphology	Backwater Depth	Backwater Areas					
1047	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1048	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
1049	Geomorphology	Backwater Depth	Backwater Areas					
1050	Pattern of Habitats	Aquatic Areas	Main Channel					
1051	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1052	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	Summer	10	2010	

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1053	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer	10	2010	Water quality objective for all main channel and secondary channel habitat, RM 608-615
1054	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1055	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1056	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1057	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
1058	Pattern of Habitats	Aquatic Areas	Main Channel					
1059	Pattern of Habitats	Land Cover/Use	Forest					
1060	Geomorphology	Backwater Depth	Backwater Areas					
1061	Geomorphology	Backwater Depth	Backwater Areas					
1062	Pattern of Habitats	Aquatic Areas	Impounded Area					
1063	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1064	Pattern of Habitats	Land Cover/Use	Grassland					
1065	Pattern of Habitats	Land Cover/Use	Grassland					
1066	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1067	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1068	Pattern of Habitats	Terrestrial Areas	Island					
1069	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1070	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1071	Geomorphology	Connectivity	Floodplain					
1072	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1073	Geomorphology	Backwater Depth	Backwater Areas					
1074	Geomorphology	Backwater Depth	Backwater Areas					
1075	Pattern of Habitats	Terrestrial Areas	Island					
1076	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1077	Geomorphology	Backwater Depth	Backwater Areas					
1078	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1079	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1080	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1081	Geomorphology	Backwater Depth	Backwater Areas					
1082	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1083	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1084	Geomorphology	Backwater Depth	Backwater Areas					
1085	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1086	Pattern of Habitats	Terrestrial Areas	Island					
1087	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1088	Pattern of Habitats	Terrestrial Areas	Island					
1089	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1090	Geomorphology	Backwater Depth	Backwater Areas					
1091	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1092	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1093	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1094	Pattern of Habitats	Terrestrial Areas	Island					
1095	Pattern of Habitats	Terrestrial Areas	Island					
1096	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1097	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1098	Geomorphology	Backwater Depth	Backwater Areas					

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1099	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1100	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1101	Water Quality	Other			All Year	10	0	DO objective for all main channel and secondary channel habitat, DO >5 PPM, Pools 10-11
1102	Geomorphology	Backwater Depth	Backwater Areas					
1103	Geomorphology	Backwater Depth	Backwater Areas					
1104	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1105	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1106	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1107	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1108	Pattern of Habitats	Terrestrial Areas	Island					
1109	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer			Water quality objective for all main channel and secondary channel habitat, Pools 10-11
1110	Pattern of Habitats	Land Cover/Use	Forest					
1111	Pattern of Habitats	Terrestrial Areas	Island					
1112	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1113	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1114	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1115	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1116	Pattern of Habitats	Terrestrial Areas	Island					
1117	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1118	Pattern of Habitats	Terrestrial Areas	Island					
1119	Pattern of Habitats	Terrestrial Areas	Island					
1120	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1121	Pattern of Habitats	Terrestrial Areas	Island					
1122	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1123	Pattern of Habitats	Terrestrial Areas	Island					
1124	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1125	Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer	10	2025	Water quality objective for all main channel and secondary channel habitat, RM 583-608
1126	Pattern of Habitats	Terrestrial Areas	Island					
1127	Pattern of Habitats	Aquatic Areas	Main Channel					
1128	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1129	Pattern of Habitats	Terrestrial Areas	Island					
1130	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1131	Pattern of Habitats	Aquatic Areas	Impounded Area					
1132	Pattern of Habitats	Terrestrial Areas	Island					
1133	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1134	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1135	Geomorphology	Backwater Depth	Backwater Areas					
1136	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1137	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1138	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1139	Pattern of Habitats	Terrestrial Areas	Island					

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1140	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1141	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1142	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1143	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1144	Pattern of Habitats	Terrestrial Areas	Island					
1145	Geomorphology	Backwater Depth	Backwater Areas					
1146	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1147	Pattern of Habitats	Aquatic Areas	Impounded Area					
1148	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1149	Pattern of Habitats	Terrestrial Areas	Island					
1150	Geomorphology	Backwater Depth	Backwater Areas					
1151	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1152	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1153	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1154	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1155	Pattern of Habitats	Terrestrial Areas	Island					
1156	Geomorphology	Backwater Depth	Backwater Areas					
1157	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1158	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1159	Pattern of Habitats	Aquatic Areas	Impounded Area					
1160	Pattern of Habitats	Terrestrial Areas	Island					
1161	Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
1162	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1163	Geomorphology	Backwater Depth	Backwater Areas					

Table C12. Site-specific UMR-IWW Environmental Objectives (Pool 11, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1164	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
1165	Pattern of Habitats	Aquatic Areas	Impounded Area					
1166	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1167	Geomorphology	Water Level	Main Channel	Other	Sum. & Win.	5	2005	Variable drawdown as needed to restore vegetation
1168	Geomorphology	Connectivity	Longitudinal					

Table C13. Site-specific UMR-IWW Environmental Objectives (Pool 12).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1169	Geomorphology	Connectivity	Longitudinal	40% chance of fish passage	Spr. + Fall	7	2010	See Wilcox study
1170	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1171	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1172	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1173	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points, See Peosta Channel HREP
1174	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1175	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1176	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1177	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation, Catfish Creek, Clean up watershed
1178	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1179	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	10	2010	
1180	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1181	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1182	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1183	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June

Table C13. Site-specific UMR-IWW Environmental Objectives (Pool 12, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1184	Pattern of Habitats	Terrestrial Areas	Island					Increase topographic diversity, Raise 2 m
1185	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1186	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1187	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1188	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2007	See Pool 12 Over wintering HREP
1189	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1190	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1191	Pattern of Habitats	Terrestrial Areas	Island					Increase topographic diversity, Raise 2 m
1192	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1193	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1194	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	See Pool 12 Over wintering HREP
1195	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1196	Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15
1197	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	See Pool 12 Over wintering HREP
1198	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP

Table C13. Site-specific UMR-IWW Environmental Objectives (Pool 12, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1199	Geomorphology	Connectivity	Floodplain	100% inundation during 10 year flood		1	2007	See Pool 12 Over wintering HREP
1200	Pattern of Habitats	Land Cover/Use	Forest					Land acquisition for floodplain and bluff forest habitat, RM 572-564, Red Shouldered hawk and neotropical
1201	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplai					Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP
1202	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2007	See Pool 12 Over wintering HREP
1203	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1204	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1205	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplai					Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP
1206	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1207	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2007	See Pool 12 Over wintering HREP
1208	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1209	Pattern of Habitats	Aquatic Areas	Other				2007	Riffle/Pool and Structure, See Pool 12 Over wintering HREP
1210	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplai				2007	Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP

Table C13. Site-specific UMR-IWW Environmental Objectives (Pool 12, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1211	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	10	2007	See Pool 12 Over wintering HREP
1212	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1213	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1214	Pattern of Habitats	Aquatic Areas	Tertiary Channel				2009	Clean out channel, 100% of area <1 m deep in winter
1215	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1216	Pattern of Habitats	Terrestrial Areas	Island				2006	Increase Topographic Diversity, Raise 2 m
1217	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	9	2014	
1218	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1219	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1220	Pattern of Habitats	Terrestrial Areas	Island				2014	Increase Topographic Diversity, Raise 2 m
1221	Pattern of Habitats	Terrestrial Areas	Island				2010	Island protection
1222	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1223	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	9	2014	
1224	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1225	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1226	Pattern of Habitats	Aquatic Areas	Impounded Area				2010	100% of area <1 m deep in winter
1227	Pattern of Habitats	Terrestrial Areas	Island				2010	Island protection

Table C13. Site-specific UMR-IWW Environmental Objectives (Pool 12, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1228	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1229	Pattern of Habitats	Terrestrial Areas	Island				2010	Island Protection
1230	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1231	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1232	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1233	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation

Table C14. Site-specific UMR-IWW Environmental Objectives (Pool 13).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1234	Geomorphology	Connectivity	Longitudinal	40% chance of fish passage	Spr. + Fall	7	2010	See Wilcox study
1235	Pattern of Habitats	Aquatic Areas	Secondary Channel				2011	50% of area 2-3 m deep in winter
1236	Pattern of Habitats	Terrestrial Areas	Island				2014	Island Protection
1237	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1238	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1239	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1240	Pattern of Habitats	Terrestrial Areas	Island				2014	Island Protection
1241	Pattern of Habitats	Terrestrial Areas	Island				2014	Island Protection
1242	Pattern of Habitats	Aquatic Areas	Main Channel				2015	50% of area 1-2 m deep in spring
1243	Pattern of Habitats	Aquatic Areas	Main Channel				2015	Reduce shoreline erosion
1244	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1245	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1246	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1247	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1248	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1249	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics, See Pleasant Creek HREP
1250	Pattern of Habitats	Aquatic Areas	Secondary Channel				2015	50% of area 2-3 m deep in winter
1251	Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
1252	Pattern of Habitats	Aquatic Areas	Other				2015	Riffle/Pool and Structure

Table C14. Site-specific UMR-IWW Environmental Objectives (Pool 13, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1253	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2015	Increase Topographic Diversity, Raise 2 m, Maintain fish hook entrance
1254	Pattern of Habitats	Aquatic Areas	Secondary Channel				2015	50% of area >3 m deep in winter
1255	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2015	Increase Topographic Diversity, Raise 2 m
1256	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1257	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	Have to maintain
1258	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1259	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1260	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1261	Pattern of Habitats	Aquatic Areas	Tertiary Channel				2015	50% of area >3 m deep in winter
1262	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1263	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	Must have connectivity to the river with a fish hook
1264	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1265	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1266	Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15
1267	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1268	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1269	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June

Table C14. Site-specific UMR-IWW Environmental Objectives (Pool 13, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1270	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1271	Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
1272	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Moist soil unit management
1273	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1274	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1275	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1276	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1277	Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
1278	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1279	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1280	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1281	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1282	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1283	Pattern of Habitats	Terrestrial Areas	Island				2015	Island Protection, Raise 2 m
1284	Geomorphology	Connectivity	Floodplain	100% floodplain area inundated during 10 year flood				Maintain connectivity
1285	Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
1286	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1287	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1288	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1289	Pattern of Habitats	Terrestrial Areas	Island				2015	Island protection, Include rip rap for wave fetch protection, Raise 2 m

Table C14. Site-specific UMR-IWW Environmental Objectives (Pool 13, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1290	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1291	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1292	Pattern of Habitats	Terrestrial Areas	Island				2015	Island protection, Include rip rap for wave fetch protection, Raise 2 m
1293	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	10	2010	
1294	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1295	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1296	Pattern of Habitats	Terrestrial Areas	Island					Create islands
1297	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1298	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1299	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1300	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	Maintain the depths in the HREP
1301	Pattern of Habitats	Terrestrial Areas	Island					Create islands
1302	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1303	Pattern of Habitats	Aquatic Areas	Impounded Area				2014	50% of area >3 m deep in winter
1304	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
1305	Pattern of Habitats	Aquatic Areas	Impounded Area				2014	50% of area >3 m deep in winter

Table C15. Site-specific UMR-IWW Environmental Objectives (Pool 14).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1306	Geomorphology	Connectivity	Longitudinal	80% chance of fish passage	Spr. + Fall	7	2010	
1307	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1308	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1309	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1310	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1311	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1312	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1313	Pattern of Habitats	Aquatic Areas	Main Channel				2020	50% of area >3 m deep in winter
1314	Pattern of Habitats	Aquatic Areas	Secondary Channel				2020	50% of area >3 m deep in winter
1315	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1316	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1317	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1318	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1319	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1320	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1321	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1322	Water Quality	Other						Monitor for pollution type chemicals, ammonia problem in this area
1323	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June

Table C15. Site-specific UMR-IWW Environmental Objectives (Pool 14, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1324	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1325	Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
1326	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1327	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1328	Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
1329	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1330	Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
1331	Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
1332	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
1333	Pattern of Habitats	Aquatic Areas	Secondary Channel					50% of area >3 m deep in winter
1334	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1335	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1336	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1337	Pattern of Habitats	Aquatic Areas	Main Channel				2020	50% of area 1-2 m deep in winter
1338	Pattern of Habitats	Terrestrial Areas	Island					Island Protection, Use 6" channel rock
1339	Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15
1340	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	

Table C15. Site-specific UMR-IWW Environmental Objectives (Pool 14, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1341	Water Quality	Other						Monitoring area, high nitrogen coming out of points sources, factories
1342	Geomorphology	Connectivity	Floodplain					Maintain connectivity
1343	Water Quality	Other						Monitor for water quality, ammonia problem, RM 508-510
1344	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1345	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2020	Increase Topographic Diversity, Raise 2 m
1346	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1347	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1348	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1349	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1350	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1351	Pattern of Habitats	Land Cover/Use	Emergent Aquatics				2010	Increase emergent and submersed aquatics, Maintain or improve
1352	Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
1353	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1354	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1355	Pattern of Habitats	Aquatic Areas	Impounded Area				2005	50% of area >3 m deep in winter
1356	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation

Table C16. Site-specific UMR-IWW Environmental Objectives (Pool 15).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1357	Geomorphology	Connectivity	Longitudinal	80% chance of fish passage	Spring	10	2005	
1358	Water Quality	Other						Water quality monitoring for pollutants
1359	Pattern of Habitats	Terrestrial Areas	Island				2005	Raise 2 m
1360	Pattern of Habitats	Aquatic Areas	Secondary Channel				2005	50% of area >3 m deep in winter
1361	Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15
1362	Water Quality	Other						Water quality monitoring for urban runoff
1363	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
1365	Geomorphology	Connectivity	Secondary Channel	60-80% of year	Winter	10	2005	
1366	Pattern of Habitats	Aquatic Areas	Secondary Channel				2005	50% of area >3 m deep in winter
1367	Water Quality	Other						Water quality monitoring for urban runoff, RM 486-478

Table C17. Site-specific UMR-IWW Environmental Objectives (Pool 16).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1364	Geomorphology	Connectivity	Longitudinal	80% chance of fish passage	Winter	10	2005	
1368	Other	Other						Examine wing dam design and effect on side channel to south
1369	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1370	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	40% of Pool 16 made up of secondary channel habitat
1371	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1372	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1373	Water Quality	Water Clarity	Backwater Areas					
1374	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1375	Geomorphology	Connectivity	Floodplain				2020	Connectivity Nahant Marsh Area
1376	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1377	Water Quality	Water Clarity	Backwater Areas					
1378	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1379	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1380	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1381	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1382	Water Quality	Water Clarity	Backwater Areas					

Table C17. Site-specific UMR-IWW Environmental Objectives (Pool 16, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1383	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1384	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1385	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	40% of Pool 16 made up of secondary channel habitat
1386	Pattern of Habitats	Aquatic Areas	Main Channel					Fleeting impacts, loss of aquatic habitat, RM 470-476
1387	Water Quality	Water Clarity	Main Channel					Resuspended sediment due to fleeting, water quality monitoring required
1388	Pattern of Habitats	Aquatic Areas	Tertiary Channel					
1389	Water Quality	Water Clarity	Backwater Areas					
1390	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1391	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1392	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	All Year	8	2020	Patterson Lake, RM 465.5-466.5
1393	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1394	Water Quality	Water Clarity	Backwater Areas					
1395	Pattern of Habitats	Land Cover/Use	Forest					Loss of riparian corridor, wind erosion of shoreline
1396	Pattern of Habitats	Aquatic Areas	Tertiary Channel					
1397	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	40% of Pool 16 made up of secondary channel habitat
1398	Water Quality	Water Clarity	Backwater Areas					
1399	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure

Table C17. Site-specific UMR-IWW Environmental Objectives (Pool 16, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1400	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1401	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1402	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
1403	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1405	Pattern of Habitats	Aquatic Areas	Impounded Area					
1406	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1407	Water Quality	Water Clarity	Backwater Areas					
1408	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19

Table C18. Site-specific UMR-IWW Environmental Objectives (Pool 17).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1404	Geomorphology	Connectivity	Longitudinal					
1409	Water Quality	Other						Water quality monitoring for urban runoff, monitoring for TMDL
1410	Geomorphology	Connectivity	Secondary Channel					Restore flow to Fourth Slough to improve water quality
1411	Water Quality	Other						Water quality monitoring, outflows from industrial sites
1412	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1413	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1414	Pattern of Habitats	Terrestrial Areas	Other					Restore tributary delta habitat
1415	Pattern of Habitats	Land Cover/Use	Grassland					Protect, restore, maintain sand prairie
1416	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	28% of Pool 17 made up of secondary channel habitat
1417	Water Quality	Water Clarity	Backwater Areas					
1418	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1419	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1420	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	28% of Pool 17 made up of secondary channel habitat
1421	Pattern of Habitats	Land Cover/Use	Agriculture					
1422	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	28% of Pool 17 made up of secondary channel habitat
1423	Water Quality	Water Clarity	Backwater Areas					
1424	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19

Table C18. Site-specific UMR-IWW Environmental Objectives (Pool 17, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1425	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1426	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1427	Water Quality	Water Clarity	Backwater Areas					
1428	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1429	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1430	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1431	Pattern of Habitats	Aquatic Areas	Other					Maintain and restore aquatic habitat
1432	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1433	Pattern of Habitats	Aquatic Areas	Main Channel					
1434	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1435	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1436	Water Quality	Water Clarity	Backwater Areas					

Table C18. Site-specific UMR-IWW Environmental Objectives (Pool 17, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1437	Geomorphology	Connectivity	Floodplain				2020	Restore connectivity to the channel, lake, and ditches to improve water quality and habitat
1439	Pattern of Habitats	Land Cover/Use	Agriculture					
1440	Water Quality	Water Clarity	Backwater Areas					
1441	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1442	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1444	Pattern of Habitats	Land Cover/Use	Forest					
1445	Water Quality	Water Clarity	Backwater Areas					
1446	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
1448	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1449	Geomorphology	Connectivity	Floodplain				2020	Restore connectivity to isolated wetland complex
1450	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19

Table C19. Site-specific UMR-IWW Environmental Objectives (Pool 18).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1438	Geomorphology	Connectivity	Floodplain				2020	See Lake Odessa HREP
1443	Plants and Animals	Fish	Other					Create a natural fish hatchery area, See Lake Odessa HREP
1447	Pattern of Habitats	Terrestrial Areas	Island					See Lake Odessa HREP
1451	Water Quality	Water Clarity	Backwater Areas					
1452	Geomorphology	Connectivity	Longitudinal					
1453	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19, See Lake Odessa HREP
1454	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1455	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
1456	Water Quality	Water Clarity	Backwater Areas					
1457	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1458	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1459	Geomorphology	Connectivity	Floodplain		All Year	10	2005	Restore connectivity to 2 meters of depth
1460	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
1461	Pattern of Habitats	Aquatic Areas	Other					Restore and maintain aquatic habitat
1462	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1463	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat

Table C19. Site-specific UMR-IWW Environmental Objectives (Pool 18, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1464	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1465	Water Quality	Water Clarity	Backwater Areas					
1466	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1467	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1468	Geomorphology	Connectivity	Floodplain				2020	Isolate the backwater area
1469	Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity
1470	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1471	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
1472	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1473	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1474	Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity, See Huron Island HREP
1475	Water Quality	Water Clarity	Backwater Areas					
1476	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1477	Geomorphology	Connectivity	Secondary Channel		All Year	10	2005	Restore flow through area and maintain 2 meter depths
1478	Pattern of Habitats	Land Cover/Use	Grassland	10-20% of area				Restore sand prairie habitat to Yellow Banks Sand Prairie area, RM 415-432
1479	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
1480	Pattern of Habitats	Land Cover/Use	Forest					See Huron Island HREP

Table C19. Site-specific UMR-IWW Environmental Objectives (Pool 18, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1481	Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity, See Huron Island HREP
1482	Water Quality	Water Clarity	Backwater Areas					
1483	Pattern of Habitats	Aquatic Areas	Main Channel					
1484	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19, See Huron Island HREP
1485	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1486	Water Quality	Water Clarity	Backwater Areas					
1487	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1488	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1489	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1490	Water Quality	Water Clarity	Backwater Areas					
1491	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1492	Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
1493	Water Quality	Water Clarity	Backwater Areas					
1494	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19

Table C19. Site-specific UMR-IWW Environmental Objectives (Pool 18, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1495	Geomorphology	Connectivity	Other		All Year	10	2005	Restore flow through backwater area
1496	Pattern of Habitats	Terrestrial Areas	Island					
1497	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation

Table C20. Site-specific UMR-IWW Environmental Objectives (Pool 19).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1498	Geomorphology	Connectivity	Longitudinal					
1499	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1500	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1501	Water Quality	Water Clarity	Backwater Areas					
1502	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1503	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1504	Water Quality	Water Clarity	Backwater Areas					
1505	Other	Other						Target Land for Acquisition
1506	Water Quality	Water Clarity	Backwater Areas					RM 395-402
1507	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2015	Increase emergent and submersed aquatics, RM 395-402, Increase to pool levels identified in HNA, Pools 16-19
1508	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10	2015	RM 395-402
1509	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1510	Pattern of Habitats	Land Cover/Use	Forest				2015	Agriculture and forest, 1500 acres, RM 396-400
1511	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1512	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19

Table C20. Site-specific UMR-IWW Environmental Objectives (Pool 19, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1513	Other	Other						Target Land for Acquisition in Blackhawk bottoms, waterfowl management, neotropical birds
1514	Water Quality	Water Clarity	Backwater Areas					
1515	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1516	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1517	Water Quality	Water Clarity	Backwater Areas					
1518	Pattern of Habitats	Land Cover/Use	Other					Restore plant diversity and habitat
1519	Geomorphology	Connectivity	Floodplain				2020	Levee set back
1520	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	13% of Pool 19 made up of secondary channel habitat
1521	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1522	Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	13% of Pool 19 made up of secondary channel habitat
1523	Water Quality	Water Clarity	Backwater Areas					
1524	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1525	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1526	Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
1527	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1528	Pattern of Habitats	Terrestrial Areas	Island					
1529	Water Quality	Water Clarity	Backwater Areas					
1530	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19

Table C20. Site-specific UMR-IWW Environmental Objectives (Pool 19, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1531	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1532	Water Quality	Other						Water quality monitoring
1533	Pattern of Habitats	Aquatic Areas	Main Channel					
1534	Water Quality	Water Clarity	Backwater Areas					
1535	Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
1536	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1537	Pattern of Habitats	Aquatic Areas	Impounded Area					
1538	Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increase emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
1539	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1540	Pattern of Habitats	Terrestrial Areas	Island				2015	50 acres, barrier islands, Navoo flats, RM 374.5-378
1541	Pattern of Habitats	Terrestrial Areas	Island					
1542	Pattern of Habitats	Aquatic Areas	Impounded Area					
1543	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1544	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1545	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1546	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1547	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1548	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation

Table C21. Site-specific UMR-IWW Environmental Objectives (Pool 20).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1549	Geomorphology	Connectivity	Longitudinal					
1550	Water Quality	Other						Stormwater treatment
1551	Pattern of Habitats	Aquatic Areas	Main Channel					
1552	Water Quality	Water Clarity	Other					Restore or protect riparian buffer of Des Moines River with BMPs to reduce sediment loading to the Mississippi River
1553	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1554	Pattern of Habitats	Aquatic Areas	Main Channel					
1555	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1556	Other	Other						Target Land for Acquisition
1557	Other	Other						Target Land for Acquisition for habitat restoration
1558	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1559	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1560	Other	Other						Remove Abandoned Barges
1561	Pattern of Habitats	Aquatic Areas	Main Channel					
1562	Other	Other						Public Access
1563	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1564	Other	Other						Target Land for Acquisition
1565	Other	Other						Implement the CCP objectives
1566	Pattern of Habitats	Land Cover/Use	Grassland	Other			2010	10-20% of the pool area made up of grassland habitat, Pools 20-22
1567	Geomorphology	Backwater Depth	Backwater Areas					
1568	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1569	Water Quality	Water Clarity	Backwater Areas					
1570	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1571	Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table C21. Site-specific UMR-IWW Environmental Objectives (Pool 20, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1572	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1573	Geomorphology	Backwater Depth	Other					Restore and maintain depth in secondary channel
1574	Other	Other						Target Land for Acquisition
1575	Water Quality	Water Clarity	Backwater Areas					
1576	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1577	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1578	Other	Other						Public Access
1579	Pattern of Habitats	Aquatic Areas	Secondary Channel					Maintain structure to preserve secondary channel
1580	Other	Other						Target Land for Acquisition
1581	Pattern of Habitats	Land Cover/Use	Other					Restore habitat diversity
1582	Other	Other						Target Land for Acquisition
1583	Geomorphology	Backwater Depth	Other					Reconnect blew holes
1584	Water Quality	Water Clarity	Backwater Areas					
1585	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1586	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1587	Pattern of Habitats	Aquatic Areas	Main Channel					
1588	Other	Other						Target Land for Acquisition
1589	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1590	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1591	Pattern of Habitats	Terrestrial Areas	Island					
1592	Pattern of Habitats	Aquatic Areas	Main Channel					
1593	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1594	Other	Other						Target Land for Acquisition
1595	Pattern of Habitats	Aquatic Areas	Main Channel					

Table C21. Site-specific UMR-IWW Environmental Objectives (Pool 20, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1596	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1597	Geomorphology	Backwater Depth	Backwater Areas					
1598	Water Quality	Water Clarity	Backwater Areas					
1599	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1600	Other	Other						Target Land for Acquisition
1601	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1602	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1603	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1604	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
1605	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1606	Water Quality	Water Clarity	Backwater Areas					
1607	Geomorphology	Backwater Depth	Backwater Areas					
1608	Water Quality	Water Clarity	Backwater Areas					
1609	Other	Other						Target Land for Acquisition
1610	Geomorphology	Water Level	Backwater Areas					
1611	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1612	Other	Other						Target Land for Acquisition
1613	Pattern of Habitats	Aquatic Areas	Main Channel					
1614	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1615	Pattern of Habitats	Land Cover/Use	Other					Restore riparian corridor on Buck Run, Maintain ditch
1616	Geomorphology	Backwater Depth	Backwater Areas					
1617	Other	Other						Target Land for Acquisition
1618	Pattern of Habitats	Aquatic Areas	Main Channel					
1619	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1620	Other	Other						Target Land for Acquisition
1621	Plants and Animals	Other						Historic Migratory Bird Habitat

Table C21. Site-specific UMR-IWW Environmental Objectives (Pool 20, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1622	Water Quality	Water Clarity	Backwater Areas					
1623	Water Quality	Water Clarity	Backwater Areas					
1624	Pattern of Habitats	Aquatic Areas	Main Channel					
1625	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					Restore backwater submergent vegetation
1626	Other	Other						Floodplain acquisition
1627	Pattern of Habitats	Aquatic Areas	Impounded Area					
1628	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation

Table C22. Site-specific UMR-IWW Environmental Objectives (Pool 21).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1629	Geomorphology	Connectivity	Longitudinal					
1630	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1631	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1632	Pattern of Habitats	Terrestrial Areas	Island					
1633	Geomorphology	Connectivity	Floodplain					
1634	Other	Other						Target Land for Acquisition
1635	Other	Other						Target Land for Acquisition
1636	Water Quality	Water Clarity	Other					Reduce sediment input from Bear Creek into Canton Chute
1637	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points, See Gardner Division HREP
1638	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1639	Geomorphology	Connectivity	Floodplain					Land acquisition, Restore riparian corridor RM 342-336,
1640	Geomorphology	Backwater Depth	Backwater Areas					
1641	Plants and Animals	Other						Restore Historic Migratory Bird Habitat
1642	Water Quality	Water Clarity	Backwater Areas					
1643	Pattern of Habitats	Terrestrial Areas	Island					Protect islands from erosion
1644	Pattern of Habitats	Aquatic Areas	Secondary Channel					See Gardner Division HREP
1645	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1646	Water Quality	Water Clarity	Backwater Areas					
1647	Geomorphology	Backwater Depth	Backwater Areas					See Gardner Division HREP
1648	Water Quality	Water Clarity	Other					Reduce sediment input from the Wyaconda watershed
1649	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22, See Gardner Division HREP

Table C22. Site-specific UMR-IWW Environmental Objectives (Pool 21, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1650	Other	Other						Implement CCP objectives
1651	Pattern of Habitats	Aquatic Areas	Secondary Channel					See Gardner Division HREP
1652	Geomorphology	Connectivity	Floodplain					
1653	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1654	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1655	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22, See Gardner Division HREP
1656	Geomorphology	Backwater Depth	Backwater Areas					See Gardner Division HREP
1657	Water Quality	Water Clarity	Backwater Areas					
1658	Pattern of Habitats	Other						Investigate backwater habitat restoration
1659	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Wetland restoration
1660	Plants and Animals	Other						Restore Historic Migratory Bird Habitat
1661	Geomorphology	Connectivity	Floodplain					
1662	Geomorphology	Connectivity	Floodplain					
1663	Other	Other						Target Land for Acquisition
1664	Pattern of Habitats	Terrestrial Areas	Island					
1665	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1666	Water Quality	Water Clarity	Backwater Areas					
1667	Geomorphology	Connectivity	Floodplain					
1668	Geomorphology	Connectivity	Floodplain					
1669	Water Quality	Other						Reduce sediment and nutrient input
1670	Other	Other						Land Acquisition
1671	Water Quality	Water Clarity	Backwater Areas					
1672	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C22. Site-specific UMR-IWW Environmental Objectives (Pool 21, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1673	Geomorphology	Backwater Depth	Backwater Areas					
1674	Plants and Animals	Other						Restore Historic Migratory Bird Habitat
1675	Water Quality	Water Clarity	Backwater Areas					
1676	Geomorphology	Backwater Depth	Backwater Areas					
1677	Geomorphology	Connectivity	Other					Close off
1678	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1679	Pattern of Habitats	Terrestrial Areas	Island					Create islands with dredge material
1680	Plants and Animals	Other						Restore Historic Migratory Bird Habitat
1681	Plants and Animals	Other						Restore Historic Migratory Bird Habitat
1682	Water Quality	Other						Reduce urban stormwater runoff
1683	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1684	Pattern of Habitats	Terrestrial Areas	Island					Island protection, Fleeting area
1685	Plants and Animals	Other						Restore Historic Migratory Bird Habitat
1686	Geomorphology	Backwater Depth	Backwater Areas					
1687	Water Quality	Water Clarity	Backwater Areas					
1688	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
1689	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C23. Site-specific UMR-IWW Environmental Objectives (Pool 22).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1690	Geomorphology	Connectivity	Other					Restore tributary channel
1691	Geomorphology	Connectivity	Longitudinal					
1692	Water Quality	Other						Reduce nutrient loading and identify point source
1693	Geomorphology	Connectivity	Secondary Channel					
1694	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1695	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1696	Geomorphology	Connectivity	Floodplain					
1697	Other	Other						Target Land for Acquisition
1698	Other	Other						Target Land for Acquisition
1699	Water Quality	Other						Meet TMDL requirements for tributary input
1700	Geomorphology	Backwater Depth	Backwater Areas					
1701	Pattern of Habitats	Aquatic Areas	Secondary Channel					Place hard points in shallow areas.
1702	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1703	Water Quality	Water Clarity	Backwater Areas					
1704	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1705	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1706	Pattern of Habitats	Aquatic Areas	Secondary Channel					Series of Hard Points.
1707	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1708	Water Quality	Other						Reduce nutrient loading and identify source

Table C23. Site-specific UMR-IWW Environmental Objectives (Pool 22, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1709	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1710	Other	Other						Target Land for Acquisition
1711	Geomorphology	Backwater Depth	Backwater Areas					
1712	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1713	Water Quality	Water Clarity	Backwater Areas					
1714	Other	Other						Target Land for Acquisition
1715	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1716	Geomorphology	Connectivity	Floodplain					Reconnect Slough??
1717	Water Quality	Water Clarity	Backwater Areas					
1718	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1719	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1720	Water Quality	Other						Reduce nutrient loading from point source
1721	Pattern of Habitats	Terrestrial Areas	Island					
1722	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1723	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1724	Water Quality	Water Clarity	Backwater Areas					
1725	Geomorphology	Backwater Depth	Backwater Areas					
1726	Other	Other						Target Land for Acquisition
1727	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1728	Geomorphology	Connectivity	Secondary Channel					
1729	Pattern of Habitats	Aquatic Areas	Main Channel					
1730	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22

Table C23. Site-specific UMR-IWW Environmental Objectives (Pool 22, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1731	Geomorphology	Connectivity	Secondary Channel					
1732	Other	Other						Target Land for Acquisition
1733	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1734	Pattern of Habitats	Aquatic Areas	Isolated Backwater					
1735	Water Quality	Water Clarity	Backwater Areas					
1736	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1737	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1738	Geomorphology	Backwater Depth	Backwater Areas					
1739	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1740	Geomorphology	Connectivity	Secondary Channel					
1741	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1742	Pattern of Habitats	Aquatic Areas	Main Channel					
1743	Other	Other						Target Land for Acquisition
1744	Other	Other						Target Land for Acquisition
1745	Water Quality	Water Clarity	Backwater Areas					
1746	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22, Levee setback, widen riparian corridor
1747	Geomorphology	Backwater Depth	Backwater Areas					
1748	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1749	Pattern of Habitats	Aquatic Areas	Contiguous Backwater					
1750	Geomorphology	Connectivity	Floodplain					
1751	Pattern of Habitats	Land Cover/Use	Other					Restore natural habitat
1752	Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table C23. Site-specific UMR-IWW Environmental Objectives (Pool 22, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1753	Water Quality	Water Clarity	Backwater Areas					
1754	Geomorphology	Connectivity	Secondary Channel					
1755	Geomorphology	Backwater Depth	Backwater Areas					
1756	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1757	Geomorphology	Backwater Depth	Backwater Areas					
1758	Pattern of Habitats	Aquatic Areas	Main Channel					
1759	Water Quality	Water Clarity	Backwater Areas					
1760	Other	Other						Target Land for Acquisition
1761	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1762	Water Quality	Water Clarity	Backwater Areas					
1763	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1764	Geomorphology	Backwater Depth	Backwater Areas					
1765	Pattern of Habitats	Aquatic Areas	Contiguous Backwater					
1766	Water Quality	Other						Reduce nutrient loading at point source location, and reduce urban runoff
1767	Pattern of Habitats	Terrestrial Areas	Island					Island protection, fleeting area
1768	Pattern of Habitats	Terrestrial Areas	Island					Island creation using dredge material
1769	Pattern of Habitats	Aquatic Areas	Main Channel					
1770	Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
1771	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1772	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
1773	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1774	Water Quality	Water Clarity	Backwater Areas					

Table C23. Site-specific UMR-IWW Environmental Objectives (Pool 22, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1775	Pattern of Habitats	Aquatic Areas	Contiguous Backwater					
1776	Pattern of Habitats	Land Cover/Use	Grassland	Other			2010	10-20% of the pool area made up of grassland habitat, Pools 20-22
1777	Geomorphology	Backwater Depth	Backwater Areas					
1778	Other	Other						Target Land for Acquisition
1779	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1780	Pattern of Habitats	Aquatic Areas	Main Channel					
1781	Pattern of Habitats	Terrestrial Areas	Island					
1782	Water Quality	Water Clarity	Backwater Areas					
1783	Geomorphology	Backwater Depth	Backwater Areas					
1784	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1785	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1786	Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
1787	Pattern of Habitats	Aquatic Areas	Main Channel					
1788	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1789	Water Quality	Other						Meet TMDL requirements for tributary

Table C24. Site-specific UMR-IWW Environmental Objectives (Pool 24).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1790	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
1791	Water Quality	Water Clarity	Backwater Areas					
1792	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10		Secondary Channel
1793	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1794	Geomorphology	Connectivity	Other			10		Backwater area connectivity, Isolated on Cottel Island
1795	Pattern of Habitats	Aquatic Areas	Secondary Channel	>60% of area				Notch closing dam
1796	Pattern of Habitats	Terrestrial Areas	Other					Delta
1797	Pattern of Habitats	Terrestrial Areas	Other					Maintain terrestrial area habitat
1798	Pattern of Habitats	Terrestrial Areas	Other					Delta, maintain with no net loss
1799	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1800	Pattern of Habitats	Aquatic Areas	Secondary Channel	>60% of area				
1801	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1802	Water Quality	Water Clarity	Backwater Areas					
1803	Geomorphology	Backwater Depth	Backwater Areas					
1804	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1805	Pattern of Habitats	Aquatic Areas	Secondary Channel					Increase flow
1806	Geomorphology	Backwater Depth	Backwater Areas					
1807	Water Quality	Water Clarity	Backwater Areas					
1808	Geomorphology	Backwater Depth	Backwater Areas					
1809	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1810	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1811	Pattern of Habitats	Terrestrial Areas	Island					
1812	Geomorphology	Connectivity	Floodplain					Increase connectivity to backwater area
1813	Pattern of Habitats	Aquatic Areas	Secondary Channel					Notch two closing structures behind island
1814	Pattern of Habitats	Aquatic Areas	Secondary Channel					Maintain

Table C24. Site-specific UMR-IWW Environmental Objectives (Pool 24, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1815	Water Quality	Water Clarity	Backwater Areas					
1816	Geomorphology	Backwater Depth	Backwater Areas					Implement Shanks HREP
1817	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1818	Pattern of Habitats	Other						Implement proposed project ASAP
1819	Geomorphology	Connectivity	Secondary Channel					See Angle Blackburn Island HREP
1820	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
1821	Pattern of Habitats	Land Cover/Use	Forest					
1822	Geomorphology	Connectivity	Floodplain					
1823	Pattern of Habitats	Other						Reconnect, reforestation, and wet meadow construction. Salt River Bottoms
1824	Pattern of Habitats	Aquatic Areas	Secondary Channel					See Angle Blackburn Island HREP
1825	Geomorphology	Backwater Depth	Backwater Areas					See Angle Blackburn Island HREP
1826	Geomorphology	Connectivity	Other					Connect borrow pit to main channel
1827	Pattern of Habitats	Terrestrial Areas	Other					Delta, maintain, mussel beds
1828	Pattern of Habitats	Terrestrial Areas	Island					
1829	Pattern of Habitats	Other						Implement CCP strategies in this area, FWS, Delair
1830	Geomorphology	Connectivity	Floodplain					Levee setback
1831	Water Quality	Water Clarity	Backwater Areas					
1832	Geomorphology	Connectivity	Other					Connect island ponds to river
1833	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Deepen ponds on island and connect to river
1834	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C24. Site-specific UMR-IWW Environmental Objectives (Pool 24, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1835	Plants and Animals	Other						Mussel bed, protect and maintain area
1836	Geomorphology	Connectivity	Other					Connect island ponds to river
1837	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1838	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Deepen ponds on island and connect to river
1839	Water Quality	Water Clarity	Backwater Areas					
1840	Geomorphology	Backwater Depth	Backwater Areas					
1841	Water Quality	Water Clarity	Backwater Areas					
1842	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1843	Water Quality	Water Clarity	Backwater Areas					
1844	Geomorphology	Backwater Depth	Backwater Areas					Do phase 2 of HREP
1846	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1847	Pattern of Habitats	Terrestrial Areas	Island					
1848	Water Quality	Water Clarity	Backwater Areas					
1849	Pattern of Habitats	Aquatic Areas	Main Channel					Notch closing structure
1850	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Increase depth and reduce sedimentation
1851	Pattern of Habitats	Land Cover/Use	Forest					Increase acreage of bottomland hardwoods. RM 274-275
1852	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1853	Geomorphology	Water Level	Main Channel					Pool-wide water level management
1854	Water Quality	Water Clarity	Backwater Areas					
1855	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1856	Geomorphology	Backwater Depth	Backwater Areas					Clarksville/Dundee Harbor, implement HREP

Table C25. Site-specific UMR-IWW Environmental Objectives (Pool 25).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1845	Geomorphology	Other						Restore natural meanders
1857	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage	Spring			
1858	Other	Other						Acquire remaining portions of Clarksville Island
1859	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Deepen and reconnect backwater sloughs
1860	Water Quality	Water Clarity	Backwater Areas					
1861	Geomorphology	Connectivity	Other					Connect backwater sloughs
1862	Geomorphology	Other						Maintain gravel bar for mussels
1863	Pattern of Habitats	Land Cover/Use	Forest					Reforestation in the vicinity of Pecan Lake
1864	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1865	Geomorphology	Backwater Depth	Backwater Areas					
1866	Water Quality	Water Clarity	Backwater Areas					
1867	Pattern of Habitats	Aquatic Areas	Secondary Channel					Add rock barbs to increase diversity
1868	Geomorphology	Connectivity	Floodplain					Floodplain connectivity, levee setback, wetland restoration
1869	Pattern of Habitats	Aquatic Areas	Secondary Channel					Side channel and backwater restoration
1870	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1871	Pattern of Habitats	Aquatic Areas	Secondary Channel					Side channel and backwater restoration
1872	Water Quality	Water Clarity	Backwater Areas					
1873	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C25. Site-specific UMR-IWW Environmental Objectives (Pool 25, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1874	Geomorphology	Backwater Depth	Backwater Areas					
1875	Geomorphology	Backwater Depth	Backwater Areas					
1876	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1877	Water Quality	Water Clarity	Backwater Areas					
1878	Pattern of Habitats	Other						Area being returned to lakes and forests, RM 263-265
1879	Pattern of Habitats	Aquatic Areas	Main Channel					Remove wing dam to improve aquatic habitat, RM 267.2
1880	Pattern of Habitats	Aquatic Areas	Main Channel					Notch closing structure to improve aquatic habitat
1881	Pattern of Habitats	Land Cover/Use	Forest					Reforestation
1882	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1883	Pattern of Habitats	Aquatic Areas	Secondary Channel					Create scour holes in channel
1884	Geomorphology	Connectivity	Floodplain					Wetland restoration, levee buyout
1885	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1886	Pattern of Habitats	Other						Clarence Cannon Refuge, implement CCP
1887	Water Quality	Water Clarity	Backwater Areas					
1888	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1889	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
1890	Pattern of Habitats	Land Cover/Use	Forest					Increase forest diversity

Table C25. Site-specific UMR-IWW Environmental Objectives (Pool 25, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1891	Geomorphology	Backwater Depth	Other					Create areas of deep (20-40 feet) over wintering habitat in secondary channel
1892	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Reconnect HREP? (ref. Pool 25/26 fact sheets.)
1893	Water Quality	Water Clarity	Backwater Areas					
1894	Pattern of Habitats	Aquatic Areas	Secondary Channel					Deep water over wintering fish habitat (ref. Pool 25/26 fact sheet)
1895	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1896	Pattern of Habitats	Land Cover/Use	Forest					Expand bottomland hardwood forest in area
1897	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1898	Water Quality	Water Clarity	Backwater Areas					
1899	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1900	Geomorphology	Connectivity	Floodplain					
1901	Geomorphology	Backwater Depth	Other					Create areas of deep (20-40 feet) over wintering habitat in secondary channel
1902	Pattern of Habitats	Aquatic Areas	Secondary Channel					Notch or remove structures
1903	Pattern of Habitats	Land Cover/Use	Forest					Increase forest diversity, hard mast trees
1904	Water Quality	Water Clarity	Backwater Areas					
1905	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Ref. 25/26 HREP
1906	Pattern of Habitats	Aquatic Areas	Tertiary Channel	20-40% of area				

Table C25. Site-specific UMR-IWW Environmental Objectives (Pool 25, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1907	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1908	Water Quality	Water Clarity	Backwater Areas					
1909	Geomorphology	Connectivity	Other					Reconnect island backwater areas
1910	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1911	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1912	Geomorphology	Connectivity	Other					Reconnect island backwater areas
1913	Pattern of Habitats	Aquatic Areas	Secondary Channel					Deep water over wintering fish habitat
1914	Geomorphology	Connectivity	Floodplain					Levee setback
1915	Geomorphology	Connectivity	Floodplain					Restore backwater connectivity
1916	Water Quality	Water Clarity	Backwater Areas					
1917	Pattern of Habitats	Aquatic Areas	Main Channel					Multiple round sites, monitor
1918	Geomorphology	Backwater Depth	Backwater Areas					Missouri DOC owns property
1919	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1920	Water Quality	Water Clarity	Backwater Areas					
1921	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1922	Geomorphology	Connectivity	Floodplain					
1923	Pattern of Habitats	Aquatic Areas	Main Channel					
1924	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1925	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics

Table C25. Site-specific UMR-IWW Environmental Objectives (Pool 25, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1926	Pattern of Habitats	Terrestrial Areas	Island				2010	Main channel island creation
1927	Water Quality	Water Clarity	Main Channel					
1928	Water Quality	Water Clarity	Backwater Areas					
1929	Water Quality	Water Clarity	Backwater Areas					
1930	Geomorphology	Backwater Depth	Backwater Areas					Deepen backwater areas
1931	Geomorphology	Backwater Depth	Backwater Areas					
1932	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1933	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1934	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Encourage wetland management of backwater areas
1935	Water Quality	Water Clarity	Backwater Areas					
1936	Geomorphology	Backwater Depth	Backwater Areas					Implement Batchtown HREP
1937	Water Quality	Water Clarity	Backwater Areas					
1938	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1939	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1940	Geomorphology	Connectivity	Secondary Channel					
1941	Pattern of Habitats	Aquatic Areas	Secondary Channel					Notch closing structure
1942	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1943	Water Quality	Water Clarity	Backwater Areas					
1944	Geomorphology	Backwater Depth	Backwater Areas					
1945	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1946	Water Quality	Water Clarity	Backwater Areas					
1947	Pattern of Habitats	Land Cover/Use	Forest					Maintain hardwood forest

Table C25. Site-specific UMR-IWW Environmental Objectives (Pool 25, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1948	Pattern of Habitats	Aquatic Areas	Secondary Channel					Implement Batchtown HREP
1949	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
1950	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1951	Water Quality	Water Clarity	Backwater Areas					
1952	Geomorphology	Connectivity	Other					Reconnect island backwater areas
1953	Geomorphology	Backwater Depth	Backwater Areas					Implement Batchtown HREP
1954	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1955	Pattern of Habitats	Aquatic Areas	Contiguous Backwater					See Batchtown HREP
1956	Geomorphology	Connectivity	Secondary Channel					Restore flow, See Sandy Chute HREP
1957	Geomorphology	Backwater Depth	Backwater Areas					Restore secondary channel depth, See Sandy Chute HREP
1958	Geomorphology	Other						Maintain flow at existing levels, See Batchtown HREP
1959	Pattern of Habitats	Aquatic Areas	Secondary Channel					See Sandy Chute HREP
1960	Pattern of Habitats	Terrestrial Areas	Other					Delta, implement Batchtown HREP

Table C26. Site-specific UMR-IWW Environmental Objectives (Pool 26).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1961	Geomorphology	Connectivity	Other					Reconnect backwater area
1962	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
1963	Water Quality	Water Clarity	Backwater Areas					
1964	Geomorphology	Backwater Depth	Backwater Areas					
1965	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1966	Geomorphology	Backwater Depth	Backwater Areas					Restore side channel depth
1967	Geomorphology	Connectivity	Secondary Channel					
1968	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1969	Geomorphology	Backwater Depth	Backwater Areas					
1970	Pattern of Habitats	Terrestrial Areas	Island					
1971	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1972	Water Quality	Water Clarity	Backwater Areas					
1973	Water Quality	Water Clarity	Backwater Areas					
1974	Geomorphology	Backwater Depth	Backwater Areas					
1975	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1976	Geomorphology	Backwater Depth	Backwater Areas					
1977	Water Quality	Water Clarity	Backwater Areas					
1978	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1979	Geomorphology	Backwater Depth	Backwater Areas					
1980	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1981	Water Quality	Water Clarity	Backwater Areas					
1982	Pattern of Habitats	Terrestrial Areas	Other					Create sandbar habitat
1983	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1984	Geomorphology	Other						Reduce sedimentation from Plasa Creek
1985	Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table C26. Site-specific UMR-IWW Environmental Objectives (Pool 26, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1986	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1987	Water Quality	Water Clarity	Backwater Areas					
1988	Geomorphology	Backwater Depth	Backwater Areas					
1989	Water Quality	Water Clarity	Backwater Areas					
1990	Geomorphology	Backwater Depth	Backwater Areas					
1991	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1992	Water Quality	Water Clarity	Backwater Areas					
1993	Pattern of Habitats	Aquatic Areas	Secondary Channel					
1994	Water Quality	Water Clarity	Backwater Areas					
1995	Geomorphology	Backwater Depth	Backwater Areas					
1996	Geomorphology	Backwater Depth	Backwater Areas					
1997	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1998	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
1999	Geomorphology	Connectivity	Floodplain					
2000	Pattern of Habitats	Land Cover/Use	Forest					Restore floodplain forest and meadow
2001	Water Quality	Water Clarity	Backwater Areas					
2002	Geomorphology	Other						Restore Cuiver River to old channel
2003	Geomorphology	Backwater Depth	Backwater Areas					
2004	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2005	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2006	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2007	Geomorphology	Backwater Depth	Backwater Areas					
2008	Water Quality	Water Clarity	Backwater Areas					
2009	Water Quality	Water Clarity	Backwater Areas					

Table C26. Site-specific UMR-IWW Environmental Objectives (Pool 26, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2010	Geomorphology	Backwater Depth	Backwater Areas					
2011	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2012	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2013	Pattern of Habitats	Land Cover/Use	Forest					Restore floodplain forest and meadow
2014	Geomorphology	Backwater Depth	Backwater Areas					
2016	Water Quality	Water Clarity	Backwater Areas					
2017	Water Quality	Water Clarity	Backwater Areas					
2018	Geomorphology	Backwater Depth	Backwater Areas					
2019	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2020	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2024	Water Quality	Water Clarity	Backwater Areas					
2025	Geomorphology	Backwater Depth	Backwater Areas					
2026	Water Quality	Water Clarity	Backwater Areas					
2027	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2030	Geomorphology	Backwater Depth	Backwater Areas					
2031	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2032	Geomorphology	Other						Restore deep water over wintering habitat in main channel border
2033	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2034	Geomorphology	Backwater Depth	Other					
2038	Geomorphology	Other						Control sediment contribution from Dardenne Creek

Table C27. Site-specific UMR-IWW Environmental Objectives (Dam26 to Kaskaskia River).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2015	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
2021	Water Quality	Water Clarity	Backwater Areas					
2022	Geomorphology	Backwater Depth	Backwater Areas					
2023	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2028	Pattern of Habitats	Land Cover/Use	Forest					Reforestation
2029	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2035	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2036	Geomorphology	Connectivity	Floodplain					
2037	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2039	Geomorphology	Connectivity	Floodplain					Levee setback
2040	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2041	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2042	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
2043	Geomorphology	Connectivity	Floodplain					Levee setback
2044	Pattern of Habitats	Other						Protect the natural habitat from development pressure
2045	Pattern of Habitats	Other						Protect the natural habitat
2046	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
2047	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2048	Pattern of Habitats	Land Cover/Use	Forest					Reforestation
2049	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2050	Pattern of Habitats	Land Cover/Use	Forest					
2051	Other	Other						Monitor air quality in fleeting areas
2052	Pattern of Habitats	Terrestrial Areas	Island					
2053	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2054	Pattern of Habitats	Aquatic Areas	Main Channel					
2055	Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table C27. Site-specific UMR-IWW Environmental Objectives (Dam26 to Kaskaskia River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2056	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 166-168 (see Stone Dike Alteration Study, Cliff Reach)
2057	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2058	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2059	Pattern of Habitats	Land Cover/Use	Forest					
2060	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 163.5-168 (see Stone Dike Alteration Study, Cliff Cave Reach)
2061	Geomorphology	Connectivity	Floodplain					Reconnect Blew Hole
2062	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 161-162 (see Stone Dike Alteration Study, Kimmswick Reach)
2063	Geomorphology	Connectivity	Secondary Channel					
2064	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 156.5-163 (see Stone Dike Alteration Study, Kimmswick Reach)
2065	Pattern of Habitats	Aquatic Areas	Main Channel					
2066	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Isolated wetland restoration, RM 150-165
2067	Geomorphology	Connectivity	Floodplain					
2068	Pattern of Habitats	Aquatic Areas	Main Channel					
2069	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 150-155 (see Stone Dike Alteration Study, Herculaneum Reach)

Table C27. Site-specific UMR-IWW Environmental Objectives (Dam26 to Kaskaskia River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2070	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 150-155 (see Stone Dike Alteration Study, Herculaneum Reach)
2071	Pattern of Habitats	Aquatic Areas	Main Channel					
2072	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2073	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2074	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2075	Pattern of Habitats	Land Cover/Use	Forest					
2076	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 147 (see Stone Dike Alteration Study, Calico/Osborne Reach)
2077	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2078	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 144-146 (see Stone Dike Alteration Study, Calico/Osborne Reach)
2079	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2080	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2081	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2082	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 143-148 (see Stone Dike Alteration Study, Calico/Osborne Reach)
2083	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2084	Pattern of Habitats	Aquatic Areas	Main Channel					
2085	Pattern of Habitats	Land Cover/Use	Forest					Restore bottomland hardwood forest, increase hard mast production

Table C27. Site-specific UMR-IWW Environmental Objectives (Dam26 to Kaskaskia River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2086	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2087	Geomorphology	Connectivity	Secondary Channel					
2088	Other	Other						Restore and enhance additional property-Kidd Lake
2089	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 137-139 (see Stone Dike Alteration Study, Salt Lake Reach)
2090	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2091	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 135-142 (see Stone Dike Alteration Study, Salt Lake Reach)
2092	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2093	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2094	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2095	Geomorphology	Connectivity	Secondary Channel					
2096	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 131-133 (see Stone Dike Alteration Study, Fort Chartres Reach)
2097	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2098	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 130-132 (see Stone Dike Alteration Study, Fort Chartres Reach)
2099	Pattern of Habitats	Land Cover/Use	Forest					
2100	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2101	Geomorphology	Connectivity	Secondary Channel					

Table C27. Site-specific UMR-IWW Environmental Objectives (Dam26 to Kaskaskia River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2102	Pattern of Habitats	Terrestrial Areas	Other					Reestablish right RDB sandbar area, RM 130-131
2103	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 128-133 (see Stone Dike Alteration Study, Fort Chartres Reach)
2104	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2105	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2106	Geomorphology	Connectivity	Secondary Channel					
2107	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Wetland restoration, RM 126-130
2108	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 120-123 (see Stone Dike Alteration Study, St. Genevieve Reach)

Table C28. Site-specific UMR-IWW Environmental Objectives (Kaskaskia River to Grand Tower)

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2109	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2110	Pattern of Habitats	Land Cover/Use	Forest					
2111	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2112	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 116-118 (see Stone Dike Alteration Study, Kasky Reach)
2113	Pattern of Habitats	Aquatic Areas	Main Channel					
2114	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetlands, RM 111-122
2115	Geomorphology	Connectivity	Floodplain					Levee setback, land buyout
2116	Pattern of Habitats	Land Cover/Use	Forest					Restore bottomland hardwood forest
2117	Geomorphology	Connectivity	Secondary Channel					
2118	Geomorphology	Connectivity	Floodplain					Levee setback
2119	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 104 (see Stone Dike Alteration Study, Mile 100 Islands Reach)
2120	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2121	Geomorphology	Connectivity	Floodplain					Levee setback, RM 104-107
2122	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat, Crain
2123	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2124	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 99-103 (see Stone Dike Alteration Study, Mile 100 Islands Reach)
2125	Geomorphology	Connectivity	Secondary Channel					Recreate secondary channel
2126	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2127	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 99 (see Stone Dike Alteration Study, Mile 100 Islands Reach)

Table C28. Site-specific UMR-IWW Environmental Objectives (Kaskaskia River to Grand Tower, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2128	Pattern of Habitats	Aquatic Areas	Main Channel					
2129	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat
2130	Geomorphology	Connectivity	Floodplain					Levee setback
2131	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 95-97 (see Stone Dike Alteration Study, Mile 100 Islands Reach)
2132	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2133	Pattern of Habitats	Land Cover/Use	Forest					Restore bottomland hardwood forest
2134	Pattern of Habitats	Terrestrial Areas	Other					Sandbar isolation for bird habitat
2135	Water Quality	Water Clarity	Backwater Areas					
2136	Geomorphology	Backwater Depth	Backwater Areas					
2137	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2138	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 89-93 (see Stone Dike Alteration Study, Red Rock to Tower Rock Reach)
2139	Plants and Animals	Fish	Other					Encourage backwater habitat formation
2140	Pattern of Habitats	Aquatic Areas	Main Channel					
2141	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 85-89 (see Stone Dike Alteration Study, Red Rock to Tower Rock Reach)
2142	Pattern of Habitats	Aquatic Areas	Secondary Channel					Create islands & secondary channels RM 94-74

Table C28. Site-specific UMR-IWW Environmental Objectives (Kaskaskia River to Grand Tower, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2143	Pattern of Habitats	Terrestrial Areas	Island					Raise the level of island for bird habitat
2144	Pattern of Habitats	Aquatic Areas	Main Channel					Restore and maintain main channel habitat, RM 81-82 (see Stone Dike Alteration Study, Red Rock to Tower Rock Reach)

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2145	Pattern of Habitats	Land Cover/Use	Forest					Remove trees from Cottonwood Island
2146	Geomorphology	Connectivity	Secondary Channel					Maintain side channel
2147	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 77-78 (see Stone Dike Alteration Study, Big Muddy Reach)
2148	Geomorphology	Connectivity	Secondary Channel					Reconnect side channel during low flows
2149	Geomorphology	Connectivity	Floodplain					Reconnect to the Big Muddy River
2150	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 71-78 (see Stone Dike Alteration Study, Big Muddy Reach)
2151	Pattern of Habitats	Aquatic Areas	Main Channel					
2152	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 72-73 (see Stone Dike Alteration Study, Big Muddy Reach)
2153	Pattern of Habitats	Terrestrial Areas	Island					
2154	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 67-68 (see Stone Dike Alteration Study, Trail of Tears Reach)
2155	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 65-70 (see Stone Dike Alteration Study, Trail of Tears Reach)
2156	Water Quality	Water Clarity	Backwater Areas					
2157	Geomorphology	Backwater Depth	Backwater Areas					

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2158	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2159	Pattern of Habitats	Aquatic Areas	Main Channel					
2160	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 57-62 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
2161	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 57-62.5 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
2162	Geomorphology	Backwater Depth	Backwater Areas					Restore deep water over wintering habitat, RM 57-62.5
2163	Geomorphology	Connectivity	Secondary Channel					
2164	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 55.8-56.5 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
2165	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 55-60 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
2166	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 46-53 (see Stone Dike Alteration Study, Cape Reach)
2167	Pattern of Habitats	Aquatic Areas	Secondary Channel					Remove rock dikes at upper end of chute

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2168	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 48-50 (see Stone Dike Alteration Study, Cape Reach)
2169	Pattern of Habitats	Other						Maintain existing gravel substrate
2170	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 40-45 (see Stone Dike Alteration Study, Thebes Reach)
2171	Water Quality	Water Clarity	Backwater Areas					
2172	Pattern of Habitats	Terrestrial Areas	Island					Isolate developing islands, RM 40 42
2173	Pattern of Habitats	Aquatic Areas	Main Channel					
2174	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2175	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 41 (see Stone Dike Alteration Study, Thebes Reach)
2176	Geomorphology	Connectivity	Secondary Channel					
2177	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 35-39 (see Stone Dike Alteration Study, Thebes Reach)
2178	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 35-40 (see Stone Dike Alteration Study, Thebes Reach)
2179	Water Quality	Water Clarity	Backwater Areas					

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2180	Geomorphology	Backwater Depth	Backwater Areas					Restore deep water habitat at lower end, remain isolated habitat
2181	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics
2182	Geomorphology	Connectivity	Secondary Channel					
2183	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2184	Pattern of Habitats	Aquatic Areas	Main Channel					
2185	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Reestablish wetland complex with river connection
2186	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 33 (see Stone Dike Alteration Study, Prices Reach)
2187	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2188	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2189	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 12-13 (see Stone Dike Alteration Study, Thompson Reach)
2190	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 12-19 (see Stone Dike Alteration Study, Thompson Reach)
2191	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2192	Geomorphology	Connectivity	Secondary Channel					Reestablish connection with Sister Chute
2193	Geomorphology	Connectivity	Secondary Channel					Open bottom end of chute and deepen for over wintering habitat

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2194	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 29-34 (see Stone Dike Alteration Study, Prices Reach)
2195	Pattern of Habitats	Aquatic Areas	Secondary Channel					
2196	Pattern of Habitats	Terrestrial Areas	Other					Sandbar on inside of the bend, bird habitat
2197	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 16-18 (see Stone Dike Alteration Study, Thompson Reach)
2198	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 8-10 (see Stone Dike Alteration Study, Cairo Reach)
2199	Pattern of Habitats	Aquatic Areas	Secondary Channel					Increase diversity
2200	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2201	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 29-31 (see Stone Dike Alteration Study, Prices Reach)
2202	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2203	Pattern of Habitats	Land Cover/Use	Other					Strip island of all habitat
2204	Pattern of Habitats	Aquatic Areas	Main Channel					
2205	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2206	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2207	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 5-11 (see Stone Dike Alteration Study, Cairo Reach)

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2208	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 24-28 (see Stone Dike Alteration Study, Dogtooth Reach)
2209	Geomorphology	Connectivity	Secondary Channel					Restore connectivity during high flows
2210	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 20-24 (see Stone Dike Alteration Study, Dogtooth Reach)
2211	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
2212	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2213	Pattern of Habitats	Land Cover/Use	Other					Sand bar
2214	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2215	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 22-24 (see Stone Dike Alteration Study, Dogtooth Reach)
2216	Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
2217	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 25 (see Stone Dike Alteration Study, Dogtooth Reach)
2218	Geomorphology	Connectivity	Secondary Channel					Open up lower end of Browns Chute
2219	Pattern of Habitats	Land Cover/Use	Forest					
2220	Geomorphology	Connectivity	Secondary Channel					Reopen lower end of Buffalo Island Chute

Table C29. Site-specific UMR-IWW Environmental Objectives (Grand Tower to Ohio River, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
2221	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 2-5 (see Stone Dike Alteration Study, Cairo Reach)
2222	Geomorphology	Connectivity	Other					Reestablish tertiary channels, RM 2-5, Angelo Chute
2223	Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
2224	Pattern of Habitats	Terrestrial Areas	Other					Reestablish and maintain gravel bars
2225	Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 0-5 (see Stone Dike Alteration Study, Cairo Reach)

Table C30. Site-specific UMR-IWW Environmental Objectives (Lockport).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
1	Plants and Animals	Fish	Exotic Fish Species					Electronic barrier, or better
2	Plants and Animals	Fish	Other					Fish barrier to reduce entrainment in hydroplant

Table C31. Site-specific UMR-IWW Environmental Objectives (Brandon Road).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
3	Pattern of Habitats	Aquatic Areas	Secondary Channel					RM 290-291, Maintain aquatic and terrestrial habitat
4	Pattern of Habitats	Other						Maintain existing habitats

Table C32. Site-specific UMR-IWW Environmental Objectives (Dresden).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
5	Other	Other						Remove sunken barges and cable
6	Pattern of Habitats	Aquatic Areas	Secondary Channel					Improve habitat quality
7	Other	Other						Removal of contaminated sediments and restore and protect side channel habitats
8	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
9	Water Quality	Other						Improve water quality to general use level from RM 278 to Lake Michigan
10	Geomorphology	Backwater Depth	Backwater Areas					
11	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
12	Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year			Reconnect side channel
13	Pattern of Habitats	Aquatic Areas	Secondary Channel					Improve aquatic habitat and depth diversity

Table C33. Site-specific UMR-IWW Environmental Objectives (Marseilles).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
14	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				Exotic concerns and native concerns (Kankakee River)
15	Pattern of Habitats	Aquatic Areas	Secondary Channel					Maintain and restore secondary channel depth habitat
16	Plants and Animals	Other						Maintain Habitat
17	Pattern of Habitats	Terrestrial Areas	Other					Maintain and protect aquatic and terrestrial delta area
18	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
19	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
20	Geomorphology	Backwater Depth	Backwater Areas					
21	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
22	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
23	Pattern of Habitats	Aquatic Areas	Secondary Channel					Protect and maintain aquatic and terrestrial habitats
24	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
25	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
26	Geomorphology	Connectivity	Secondary Channel					Reconnect side channel
27	Geomorphology	Backwater Depth	Backwater Areas					
31	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
38	Geomorphology	Backwater Depth	Backwater Areas					
41	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore and maintain wetland habitat
46	Geomorphology	Backwater Depth	Backwater Areas					
47	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
50	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
52	Pattern of Habitats	Terrestrial Areas	Island					Protect and maintain island, Johnson Island

Table C34. Site-specific UMR-IWW Environmental Objectives (Starved Rock).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
28	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
29	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
30	Pattern of Habitats	Aquatic Areas	Secondary Channel					
32	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
33	Geomorphology	Backwater Depth	Backwater Areas					
34	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
35	Pattern of Habitats	Aquatic Areas	Secondary Channel					Protect and maintain main and secondary channel habitat
36	Geomorphology	Backwater Depth	Backwater Areas	Other				25% of area >= 2 m
37	Water Quality	Other						Riffle helps improve water quality
39	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
40	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage	All			Fish passage at the tail raceway
42	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
43	Geomorphology	Backwater Depth	Backwater Areas					
45	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetlands from RM231-235 between RR tracks DeeBennet Rd
49	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
55	Other	Other						Protect area, north bank RM 231.5-232.7
58	Plants and Animals	Other						Remove exotic species (i.e. purple loosestrife), RM 231-235
59	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Table C34. Site-specific UMR-IWW Environmental Objectives (Starved Rock, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
62	Pattern of Habitats	Aquatic Areas	Impounded Area					Reduce erosion to sensitive areas, RM 231-233, build islands, control recreational boat access on south side of this reach
63	Other	Other						Remove contaminated sediments from RM 232-235

Table C35. Site-specific UMR-IWW Environmental Objectives (Peoria).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
44	Pattern of Habitats	Aquatic Areas	Other					Protect aquatic habitats on the island
48	Pattern of Habitats	Terrestrial Areas	Island					Protect the island from erosion
51	Plants and Animals	Birds	Other					Protect and maintain habitat on Plum and Leopold Islands
53	Pattern of Habitats	Aquatic Areas	Secondary Channel					Increase depth
54	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
56	Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
57	Other	Other						Abandoned barge removal
60	Geomorphology	Backwater Depth	Backwater Areas					
61	Pattern of Habitats	Aquatic Areas	Isolated Backwater					Protect and enhance aquatic and terrestrial habitats, contaminant clean up
64	Plants and Animals	Plants	Other					Protect and maintain habitat
65	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
66	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
67	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
68	Geomorphology	Connectivity	Secondary Channel					Scours out during high water events, fills in periodically, requires more monitoring
69	Other	Other						WRP land, consider for restoration feasibility
70	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
71	Other	Other						Contaminated sediment removal

Table C35. Site-specific UMR-IWW Environmental Objectives (Peoria, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
72	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
73	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
74	Geomorphology	Backwater Depth	Backwater Areas					
75	Geomorphology	Backwater Depth	Backwater Areas					
76	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
77	Other	Other						HTRW site, Contaminated sediment clean up
78	Geomorphology	Backwater Depth	Backwater Areas					See pool-wide objectives
79	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
80	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
81	Plants and Animals	Other						Protect and enhance habitat (i.e., birds)
82	Geomorphology	Backwater Depth	Backwater Areas					See pool-wide objectives
83	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
84	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
85	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
86	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
87	Geomorphology	Backwater Depth	Backwater Areas					
88	Other	Other						Investigate for restoration opportunities
89	Other	Other						Protect and enhance habitat
90	Geomorphology	Backwater Depth	Backwater Areas					

Table C35. Site-specific UMR-IWW Environmental Objectives (Peoria, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
91	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
92	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
93	Other	Other						Protect and enhance habitat
94	Geomorphology	Other						Maintain levee to maintain water level management until value of connectivity can be assessed
95	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
96	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
97	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
98	Geomorphology	Backwater Depth	Backwater Areas					
99	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
100	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
101	Geomorphology	Connectivity	Other					Disconnect cut
102	Geomorphology	Backwater Depth	Backwater Areas					
103	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
104	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
105	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
106	Geomorphology	Backwater Depth	Backwater Areas					
107	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
108	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)

Table C35. Site-specific UMR-IWW Environmental Objectives (Peoria, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
109	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
110	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
111	Geomorphology	Other						Manage tributary sediments
112	Geomorphology	Backwater Depth	Backwater Areas					
113	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
114	Pattern of Habitats	Terrestrial Areas	Other					Manage and enhance terrestrial habitats
115	Pattern of Habitats	Other						Increase habitat diversity RM 190-195
116	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
117	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
118	Geomorphology	Backwater Depth	Backwater Areas					
119	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
120	Pattern of Habitats	Terrestrial Areas	Island					Island construction
121	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
122	Pattern of Habitats	Aquatic Areas	Other					Increase and maintain habitat diversity per pool-wide objective
123	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
124	Geomorphology	Backwater Depth	Backwater Areas					
125	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
126	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
127	Pattern of Habitats	Land Cover/Use	Forest					
128	Geomorphology	Backwater Depth	Backwater Areas					
129	Pattern of Habitats	Land Cover/Use	Submersed Aquatics					

Table C35. Site-specific UMR-IWW Environmental Objectives (Peoria, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
130	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
131	Pattern of Habitats	Terrestrial Areas	Island					Island construction
132	Geomorphology	Backwater Depth	Backwater Areas					Deepwater embayments for fish
133	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
134	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
135	Pattern of Habitats	Aquatic Areas	Secondary Channel					
136	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
137	Pattern of Habitats	Aquatic Areas	Impounded Area					
138	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Create moist soil management unit
139	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
140	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
141	Pattern of Habitats	Aquatic Areas	Impounded Area					
142	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
143	Pattern of Habitats	Terrestrial Areas	Island					Peoria pool islands, pool-wide objectives
144	Pattern of Habitats	Aquatic Areas	Impounded Area					
145	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
146	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
147	Pattern of Habitats	Aquatic Areas	Impounded Area					
148	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Table C36. Site-specific UMR-IWW Environmental Objectives (La Grange).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
149	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
150	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10	2020	
151	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
152	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
153	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
154	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10	2020	See 2020 plan
155	Pattern of Habitats	Aquatic Areas	Secondary Channel					
156	Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	Maintain secondary channel
157	Geomorphology	Connectivity	Floodplain	0% floodplain area inundated during 10 year flood	All Year	10	2020	Habitat improvement as appropriate, maintain levee
158	Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	Maintain and restore side channel habitat
159	Pattern of Habitats	Aquatic Areas	Secondary Channel					
160	Pattern of Habitats	Aquatic Areas	Secondary Channel					
161	Pattern of Habitats	Aquatic Areas	Secondary Channel					
162	Pattern of Habitats	Land Cover/Use	Submersed Aquatics	>60% of area			2020	Restore submersed and emergent aquatics, RM 134-148, Spring Lake Bottoms, Manage for wetland habitat for waterfowl use, Maintain existing levee
163	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
164	Geomorphology	Backwater Depth	Backwater Areas					
165	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table C36. Site-specific UMR-IWW Environmental Objectives (La Grange, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
166	Pattern of Habitats	Terrestrial Areas	Other					Delta, Copperas Creek, reduce sediment input and delta formation
167	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
168	Geomorphology	Backwater Depth	Backwater Areas	50% of area >3 m			2020	Rice Lake Island, Restore Depths, RM 132-137
169	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
170	Pattern of Habitats	Aquatic Areas	Secondary Channel					
171	Pattern of Habitats	Land Cover/Use	Forest					Restore grassland and forest
172	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
173	Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10		Maintain pool-wide objective for backwater depth
174	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
175	Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	RM 135, Senate Island
176	Geomorphology	Connectivity	Floodplain	100% floodplain area inundated during 10 year flood	All Year	10	2020	Connect gravel pit
177	Pattern of Habitats	Aquatic Areas	Secondary Channel					
178	Pattern of Habitats	Land Cover/Use	Submersed Aquatics	>60% of area			2020	Restore submersed and emergent aquatics
179	Geomorphology	Connectivity	Floodplain	100% floodplain area inundated during 10 year flood			2020	Clear Lake, RM 130-133
180	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
181	Geomorphology	Backwater Depth	Backwater Areas					
182	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
183	Geomorphology	Backwater Depth	Backwater Areas					

Table C36. Site-specific UMR-IWW Environmental Objectives (La Grange, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
184	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
185	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					RM 121-126, Restore and maintain wetland habitat
186	Geomorphology	Backwater Depth	Backwater Areas					
187	Pattern of Habitats	Land Cover/Use	Submersed Aquatics	>60% of area			2020	Restore submersed and emergent aquatics
188	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
189	Geomorphology	Backwater Depth	Backwater Areas	50% of area >3 m				Restore side channel depth, RM 121-122
190	Pattern of Habitats	Aquatic Areas	Secondary Channel					
191	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
192	Geomorphology	Backwater Depth	Backwater Areas					Restore Depth in Coal Dock Cove, using pool-wide backwater depth objective
193	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
194	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland and moist soil habitats
195	Geomorphology	Backwater Depth	Backwater Areas					Restore depth and natural meanders
196	Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	Restore meanders
197	Geomorphology	Backwater Depth	Backwater Areas					Restore depth and natural meanders
198	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
199	Geomorphology	Backwater Depth	Backwater Areas					
200	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives

Table C36. Site-specific UMR-IWW Environmental Objectives (La Grange, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
201	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
202	Geomorphology	Connectivity	Floodplain		Winter			Matanzas Bay, Connectivity for overwintering habitat
203	Geomorphology	Backwater Depth	Backwater Areas					
204	Pattern of Habitats	Aquatic Areas	Main Channel					
205	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
206	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
207	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
208	Geomorphology	Backwater Depth	Backwater Areas					See pool-wide objectives and site management plan
209	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
210	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
211	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
212	Geomorphology	Backwater Depth	Backwater Areas					
213	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
214	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
215	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
216	Geomorphology	Backwater Depth	Backwater Areas					Pool-wide depth objectives in Moscow Lake
217	Geomorphology	Connectivity	Floodplain					Connect backwater area

Table C36. Site-specific UMR-IWW Environmental Objectives (La Grange, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
218	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
219	Geomorphology	Backwater Depth	Backwater Areas					
220	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
221	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
222	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
223	Geomorphology	Backwater Depth	Backwater Areas					Pool-wide depth objective for Stewart lake
224	Geomorphology	Connectivity	Secondary Channel					Restore side channel
225	Geomorphology	Connectivity	Floodplain					Maintain connection of complex to main channel
226	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
227	Geomorphology	Backwater Depth	Backwater Areas					
228	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
229	Geomorphology	Other						Restore natural meanders
230	Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore depth in side channel
231	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
232	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitats
233	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
234	Geomorphology	Backwater Depth	Backwater Areas					
235	Geomorphology	Other						Restore natural meanders
236	Pattern of Habitats	Aquatic Areas	Other					Restore and maintain borrow pit depth

Table C36. Site-specific UMR-IWW Environmental Objectives (La Grange, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
237	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
238	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
239	Geomorphology	Backwater Depth	Backwater Areas					See pool-wide depth objective
240	Geomorphology	Connectivity	Floodplain					Muscooten Bay
241	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
242	Geomorphology	Backwater Depth	Backwater Areas					
243	Geomorphology	Connectivity	Floodplain					Restore and maintain connectivity
244	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
245	Pattern of Habitats	Aquatic Areas	Secondary Channel					Deepen and maintain side channel
246	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
247	Geomorphology	Backwater Depth	Backwater Areas					
248	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitats
249	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
250	Pattern of Habitats	Aquatic Areas	Main Channel					
251	Pattern of Habitats	Land Cover/Use	Other					Promote natural habitat growth
252	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
253	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
254	Geomorphology	Backwater Depth	Backwater Areas					

Table C37. Site-specific UMR-IWW Environmental Objectives (Alton).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
255	Pattern of Habitats	Aquatic Areas	Main Channel					
256	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
257	Geomorphology	Backwater Depth	Backwater Areas					
258	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
259	Pattern of Habitats	Aquatic Areas	Secondary Channel					
260	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
261	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
262	Geomorphology	Backwater Depth	Backwater Areas					
263	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
264	Pattern of Habitats	Aquatic Areas	Secondary Channel					
265	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
266	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
267	Pattern of Habitats	Aquatic Areas	Secondary Channel					
268	Pattern of Habitats	Aquatic Areas	Secondary Channel					
269	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
270	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
271	Geomorphology	Backwater Depth	Backwater Areas					
272	Pattern of Habitats	Terrestrial Areas	Island					
273	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
274	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
275	Geomorphology	Backwater Depth	Backwater Areas					
276	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)

Table C37. Site-specific UMR-IWW Environmental Objectives (Alton, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
277	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
278	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
279	Pattern of Habitats	Aquatic Areas	Secondary Channel					
280	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
281	Geomorphology	Backwater Depth	Backwater Areas					
282	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
283	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
284	Plants and Animals	Other						Mussels
285	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
286	Plants and Animals	Other						Mussel bed, RM 50-54
287	Plants and Animals	Other						Mussels
288	Plants and Animals	Other						Mussels
289	Plants and Animals	Other						Mussels
290	Plants and Animals	Other						Mussels
291	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
292	Pattern of Habitats	Aquatic Areas	Secondary Channel					
293	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
294	Plants and Animals	Other						Mussels
295	Pattern of Habitats	Aquatic Areas	Secondary Channel					
296	Pattern of Habitats	Aquatic Areas	Secondary Channel					
297	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
298	Pattern of Habitats	Land Cover/Use	Forest					
299	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
300	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Large contiguous wetlands for migratory water birds (1000+ acres)
301	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
302	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
303	Pattern of Habitats	Land Cover/Use	Forest					
304	Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table C37. Site-specific UMR-IWW Environmental Objectives (Alton, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
305	Pattern of Habitats	Aquatic Areas	Secondary Channel					
306	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
307	Pattern of Habitats	Aquatic Areas	Secondary Channel					
308	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
309	Pattern of Habitats	Aquatic Areas	Secondary Channel					
310	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
311	Pattern of Habitats	Land Cover/Use	Forest					
312	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
313	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
314	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
315	Pattern of Habitats	Land Cover/Use	Forest					
316	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
317	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
318	Pattern of Habitats	Aquatic Areas	Secondary Channel					
319	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
320	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
321	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
322	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Large contiguous wetland for migratory water birds (1000+ acres)
323	Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
324	Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
325	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
326	Pattern of Habitats	Aquatic Areas	Secondary Channel					
327	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
328	Geomorphology	Backwater Depth	Backwater Areas					Maintain and deepen secondary channel
329	Pattern of Habitats	Terrestrial Areas	Island					Island Protection
330	Pattern of Habitats	Land Cover/Use	Forest					
331	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Table C37. Site-specific UMR-IWW Environmental Objectives (Alton, cont.).

Icon	Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
332	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
333	Geomorphology	Backwater Depth	Backwater Areas					
334	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
335	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
336	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
337	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
338	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat (see pool-wide objectives)
339	Geomorphology	Backwater Depth	Backwater Areas					
340	Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
341	Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increase emergent and submersed aquatics (see pool-wide objectives)
342	Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Appendix D. Pool and System-Wide Environmental Objectives

The following lists display pool and system-wide environmental objectives gathered from the four Environmental Workshops held in November 2002. The objectives are organized by workshop region (i.e., La Crosse, Moline, St. Louis, and Peoria) and are combined and summarized in a UMR-IWW System-wide list. The lists have also been further broken down into objective categories of water quality, geomorphology, pattern of habitats, plants and animals, and other. Please use the key provided below to assist in interpreting the target ranges, frequency of occurrence, and other supporting information that is listed with the environmental objectives.

Key
TR = Target Range
S = Season
FO = Frequency of Occurrence in a 10-year period.
TD = Target Date
P = Pool

La Crosse Workshop (Pools 1-11) Pool-Wide Environmental Objectives

Water Quality

- Decrease sediment loading from tributaries
- Net sedimentation rate of zero
- Secchi disk reading of 1.5m or greater in backwater areas during non-flood conditions (P=4-6)
- Secchi readings in the main channel (TR=1.0m, S=All, FO=10, TD=2010, P=7-9)
- Secchi readings in the secondary channel (TR=1.5m, S=All, FO=10, TD=2010, P=7-9)
- Secchi readings in the impounded areas (TR=>2.0m, S=All, FO=10, TD=2010, P=7-9)
- Secchi readings in the backwater (TR=>2.0m, S=All, FO=10, TD=2010, P=7-9)
- Water clarity in the main channel and secondary channels (TR=1.5m Secchi, S=Summer average, FO=10, TD=2025, P=10-11)
- Water clarity in the contiguous backwaters (TR=1.5m Secchi, S=Summer average, FO=10, TD=2025, P=10-11)
- Sufficient dissolved oxygen to support aquatic life
- Dissolved Oxygen in the main channel and secondary channels (TR>=5ppm, S=All, FO=10, TD=2010)
- Dissolved Oxygen in backwater areas (TR= 75% >5ppm, 100% .3ppm, S=Summer Average, FO=10, TD=2010)
- Velocity in backwater areas (TR=<0/3m/sec, up to bankfull, FO=10, TD=2040)
- Temperature in backwater areas (TR>1°C, S=Winter, FO=10, TD=2030)
- Complete storm/sanitary drain separation (TD=2010,P=1)
- Implement spill detection and warning system (TD=2010, P=1)
- Treat urban storm water (TD=2020)

Geomorphology

- Diversity of depths to address loss of aquatic habitat
- Greater and sufficient depth diversity
- A gradient of depth from 0-3 meters, with backwaters that contain areas at least 2-3 Meters deep in major overwintering areas spaced every two miles (P=7-9)
- Backwater depth (TR=100% water depth >1meter,S=Winter, FO=10, TD=2025, P=10-11)
- 100% of floodplain area inundated during 10-yr flood (FO=1, TD=2000)
- Enhance connectivity or restrict it as appropriate - see "C"s on pool plans (TR=5)
- Enhance connectivity between main channel and backwaters. Key on areas designated with a "C" in the Pool plans, particularly in the upper ends of Pools 5, 5A, and 6 (TR=5, FO=5, P=4-6)
- For longitudinal connectivity, support Pool Plan design as shown as optimal
- Fish passage at all Locks and Dams
- Create a more natural hydrograph
- Seasonal Drawdown (FO=10, TD=2015, P=1-3)
- Conduct drawdowns river-wide during drought conditions (P=4-6)
- Water level variable at the dam (S=Summer, FO=3-7, P=10-11)

La Crosse Workshop (Pools 1-11) Pool-Wide Environmental Objectives (continued)

Geomorphology (cont.)

- Strive for more stable pool tail water levels
- COE shift management to reduce hinge point (to Lock and Dam control)
- Winter months: maintain water levels as high and as level as practical
- Reduce bank erosion

Pattern of Habitats

- Actively manage floodplain forest to support less water-tolerant native floodplain plants - mast tress, prairie, etc.
- 100% of quality natural habitat sustainable through natural processes
- See Pool Plans
- For Aquatic areas refer to pool plans
- Forests are middle age to old
- Submersed vegetation to 2m. As minimum, do pool plan
- Grasslands - Land-use planning
- Actively manage floodplain forest to support less water-tolerant native floodplain plants - mast tress, prairie, etc.

Plants and Animals

- Protect mussels - recovering community
- Plants -Eliminate nuisance exotics. Preserve native species/communities
- Emergent Aquatics (TR=20-50 stems/m2)
- Submersed Aquatics (TR=50 to >100 plants/m2)
- Floating Aquatics (TR=10-20 plants/m2)
- Plants - Overlap is needed between categories (mosaic of plants, i.e. diversity)
- Preserve native fish species
- Enhance bird habitat in traditional areas as well as elsewhere. Give the birds alternative areas to go to

Other

- Need for more public lands
- Environmental Pool Plans were agreed upon to be acceptable and representative of the group's views (P=4-6)
- Clean up trash along riverbanks

Moline Workshop (Pools 12-22) Pool-Wide Environmental Objectives

Water Quality

- Address concerns of 303D (Impaired water's list)
- Secchi disk transparency of 1.0m to occur during the high-water event in spring (FO=5)
- Maintain in compliance with applicable standards

Geomorphology

- Deepen and connect sloughs on islands
- Maintain existing depths of secondary channels
- Maintain aquatic Backwater areas that are already connected to Main Channel. Restore former connections form MC to BW that have been lost since impoundment
- 50% of backwater areas should have a depth >3m (FO=7, TD=2030, P=12-15)
- 10% of Backwater areas should have a depth greater than 3m, with proximity to flow, and a target DO of >=5ppm (S=Winter, FO=10, TD=2020, P=16-19)
- All backwater areas should have a minimum depth of 1-2 meters (TD=2030)
- Water level management to maximize habitat: sediment consolidation, increased water clarity, increase aquatic vegetation. Optimize variety of land cover types. (S=June-Sept, FO=1)
- Water level 0.3m above project Pool (S=All, FO=10, TD=2005)
- Floodplain connectivity for levee districts (TR=20% floodplain area inundated during 10-yr flood, S=All, FO=10, TD=2020, P=16-19)
- 20% of floodplain not isolated by levee inundated during a 10-yr flood event (P=20-22)
- Increase unleveed floodplain at tributary confluences (TR=20% during 10-yr flood, FO=2, TD=2010, P=12-22)
- Allow passage for the 27 migratory species during key life cycles and migratory periods
- Reduce erosion/habitat loss due to barge fleeting
- Upstream islands in particular need to be protected and restored to pre-9-ft project dimensions (location of 6 ft. channel structure would be locations to start)
- Restore islands that provide protection from wind fetch. Many of these islands have been lost due to erosion since impoundment

Pattern of Habitats

- Identify priority secondary channels by 2010
- Maintain all secondary and tertiary channel patters (depths, area, etc) that now exist in all pools
- Secondary Channels (TR=40%, S=Summer, FO=8, TD=2020, P=16)
- Secondary Channels (TR=28%, S=Summer, FO=8, TD=2020, P=17)
- Secondary Channels (TR=26%, S=Summer, FO=8, TD=2020, P=18)
- Secondary Channels (TR=13%, S=Summer, FO=8, TD=2020, P=19)
- Contiguous Backwaters (TR=6%, S=Summer, FO=8, TD=2020, P=16)
- Contiguous Backwaters (TR=7%, S=Summer, FO=8, TD=2020, P=17)

Moline Workshop (Pools 12-22) Pool-Wide Environmental Objectives (continued)

Pattern of Habitats (cont.)

- Contiguous Backwaters (TR=4%, S=Summer, FO=8, TD=2020, P=18)
- Contiguous Backwaters (TR=10%, S=Summer, FO=8, TD=2020, P=19)
- Isolated Backwaters (TR=1%, S=Summer, FO=8, TD=2020, P=16,19)
- Isolated Backwaters (TR=2%, S=Summer, FO=8, TD=2020, P=17,18)
- 5% of all terrestrial floodplain habitats should consist of potholes, lakes, oxbows and similar habitat types
- Maintain continuity patterns of contiguous backwaters as they existed in 1989
- Islands (TR=6000acres, S=Summer, FO=8, TD=2020, P=16)
- Islands (TR=20%, S=Summer, FO=10, TD=2020, P=19)
- Maintain all islands shown on 1989 photography
- All islands in public ownership (P=20)
- Acquire public land (TD=2050, P=19)
- 3000 acres of 1000-acre core block habitat - minimum 1 per pool (30-40 miles) - for area sensitive bird management. (Integrated complex of forest, grassland, and wetland) (TD = 2020)
- Restore and maintain diversity of vegetation cover types that now exist
- 100% increase in Emergent Aquatics from the 1989 aerial photography (S=All, FO=8, TD=2010)
- Increase emergent plants to 10% presence in every backwater
- Backwaters should have 80% coverage of submergent plants in all under 3m depth (see pool plans)
- 100% increase in Submergent Aquatics from the 1989 aerial photography (S=All, FO=8, TD=2010)
- Consolidate cover classes in corridors or contiguous tracts (TR=50-80%)
- Restore and protect aquatic and terrestrial floodplain vegetation (TR=50%)
- 10% of isolated floodplain areas converted to grasslands (TD=2010)
- 10% Shrub coverage in floodplain
- Increase elevation by 2m on 10% of all terrestrial habitats (islands and floodplains) (TD=2030)
- Even-aged forests need to have an age gradation restored through timber management
- Restore and enhance large tracts of bottomland hardwoods for neotropicals
- Restore 200' width riparian corridor on permanent diversion ditches
- Forest - 1000-acre minimum, 25-30 miles apart (TR=10-20% of area, TD=2050)
- Maintain aerial % of Agricultural Use
- Work to achieve habitat restoration through agricultural programs on floodplain (CRP, WRP)

Plants and Animals

- Eliminate reed canary grass wherever possible
- Restore presence of lake sturgeon in all pools. Collected at least 2 times per year
- Restore crystal darter and sand darter populations

Moline Workshop (Pools 12-22) Pool-Wide Environmental Objectives (continued)

Plants and Animals (cont.)

- Asian Carp should have a 0catch/hr effort in all pools
- Neotropical Migrant Birds – See integrated complex in Patterns of Habitat

St. Louis Workshop (Pool 24 to Ohio River) Pool-Wide Objectives

Note: The St. Louis environmental objectives are organized by impounded (Pools 24-26) and unimpounded (Dam 26 to Ohio River) reaches.

Pools 24-26 (Impounded)

Water Quality

- Sufficient water clarity to support vegetation to a depth of 1.5m
- Main Channel Water Clarity (TR=Secchi disk of 1.5m)
- Backwaters Water Clarity (TR=Secchi disk of 1.5m)
- DO, Methyl Mercury, nutrient and fecal coliform reduction from tributaries

Geomorphology

- Create more deep-water habitat
- Greater drawdowns
- Return hydrograph to as natural as possible
- Seasonal drawdowns every 5 or 10 years
- Water level, Main Channel (TR=.6m below project pool at dam, FO= as often as possible)
- Water level, Backwater (TR=.6m below project pool at dam, FO= as often as possible)
- On an opportunistic basis, acquire land from willing sellers to restore floodplain connectivity
- Floodplain connectivity pool-wide 0-10%
- Maintain and increase floodplain connectivity by 40% (before modifications)
- Passage of native fish through navigation dams (TR=100%)
- Hinge point drawdown. This is an opportunity to move from hinge point control

Pattern of Habitats

- Increase quantity of woody debris in side channel of pools
- All islands into public ownership to increase forest diversity
- Increase amount of floodplain wetland habitats in levee districts
- Increase wet marshes 10-20% of existing marshes
- More hard mast producing trees (TR=20%-40%, TD=2050)
- Restore-maintain riparian corridor to provide a broad range of benefits
- Increase nesting areas for terrestrial birds
- Increase forest by 10-20% of existing forest
- Forests (TR=20%-40%, currently=18%, pre-settlement=35%)

Other

- Need to restore streams in floodplain
- Concerns about air quality @ fleeting harbor areas
- Increase air quality - towboat exhaust
- Acquire land necessary to facilitate Environmental Pool Management

St. Louis Workshop (Pool 24 to Ohio River) Pool-Wide Objectives (continued)

<u>Dam 26 – Ohio River (Unimpounded)</u>

Water Quality

- Reduce air and water pollutions
- Minimize clarity impacts due to increased traffic in main channel and fleeting areas
- 15% reduction of nutrient load
- Maintain DO levels on Middle Mississippi

Geomorphology

- Implement stone dike objectives
- Implement dike alteration plan - alter dikes for a mile stretch every ten miles
- Implement side channel plan
- Reconnect river with floodplain in selected locations
- Maintain and increase floodplain connectivity
- Remove all of the levees, restore 100% connectivity, take river to pre-European settlement conditions
- Partial floodplain restoration - 20-30% reconnectivity
- Reconnect tributaries with floodplains to trap some of the nutrients
- Habitat connectivity to main channel
- Address local tributary effects; include deltaic sedimentation, channelization and head cutting. Restore oxbows and other important geomorphic features of the tributaries
- Restore historic meanders. Allow some disturbance regimes to occur on the river. Allow some non-constrained stretches of the river

Pattern of Habitats

- Allow every 5-7 miles of over wintering for fish
- Utilize old or existing quarries for backwater habitat
- Implement side channel plan (Secondary Channels 12-18 feet deep)
- Create new side channels
- Create or engineer new islands and side channels within the Middle Mississippi River
- Maintain and create substrate type diversity; i.e. diversity of sands, gravels, cobbles, etc.
- Preserve and enhance sand bar habitat for aquatics and waterfowl
- Restore small rivulets, oxbows and other tertiary channels adjacent to the main channel
- Utilize existing meander scars and river features located in the floodplain for the creation of new aquatic and waterfowl habitats
- Every 20 miles bird resting areas
- Restore riparian corridor with floodplain, including re-establishing forests and prairies

St. Louis Workshop (Pool 24 to Ohio River) Pool-Wide Objectives (continued)

<u>Dam 26 – Ohio River (Unimpounded) (cont.)</u>

Pattern of Habitats (cont.)

- Increase acreage of bottomland hardwood forests in floodplain as social and economic factors allow
- Restore and maintain riparian corridors (200 ft. wide)
- Preserve and create wetland complexes in adjacent floodplain
- Increase wetland habitat behind levees

Plants and Animals

- Restore river aquatic fisheries environment prior to 1950

Peoria Workshop (Illinois River) Pool-Wide Environmental Objectives

Water Quality

- Improve Secchi Level
- 25% reduction in nutrient loading
- Elimination of secondary use standards for this reach; adhere to general use standards
- Systematic removal of contaminated sediments

Geomorphology

- Reduce sedimentation throughout pool
- Prevent Peoria Pool from sedimenting in
- Need to reduce sediment accumulation in tributary deltas due to erosion off agricultural ground
- Maintain depths of existing backwaters and increase area available for over wintering fish (TR= 5% 3m+, 10% 2-3 M, 25% 1-2 m, 60% < 1 m, S=Winter, TD=2020)
- Improve water depth
- Restore depths and connectivity of tributaries
- Restore backwater depths, throughout backwaters on pool
- Recreate hydrograph
- Reduce incidence of summer water level "bumps" to < 1 year in 3 (FO=7)
- Limit water level fluctuation. Notes -Water levels affected substantially by MWRDGC actions up to 10ft per incidence
- Maintain habitat-protecting levees (e.g. Hennepin /Hopper) until river conditions adequate to allow reconnection
- Maintain 50% of currently isolated backwaters for exclusion of exotics and protection of high quality habitat
- Reconnect 25% of currently isolated backwater areas and historical backwater lakes (fish areas every 10 miles)
- Restore off channel connectivity to all pool. Meredosia to Eldrid are key drainage districts to target for connectivity. No consensus on amounts of floodplain needing to be restored to habitat, but at least 2-3 districts, Nutwood mentioned several times
- Investigate opportunities to improve leveed areas

Pattern of Habitats

- Protection, management, and enhancement of natural areas
- Protect and enhance habitat for threatened and endangered species
- Agree on a reference condition to work towards, probably the best condition was in the 1910's-1920's before the wastewater in the 30's degraded the system
- Avoid conflicts between habitat enhancements and potential or existing fleeting areas
- Restore additional 10% of the floodplain, terrestrial habitats - with a goal of significant contiguous areas (min. 10 ac for wetlands, 100 ac forests, etc.)
- Investigate opportunities to improve leveed areas habitat

Peoria Workshop (Illinois River) Pool-Wide Environmental Objectives (continued)

Pattern of Habitats (cont.)

- Enhance habitat in backwaters
- Maintain/protect existing aquatic plant bed acreage pool-wide
- Promote moist soil development in backwater areas
- Re-establish missing marsh habitat by maintaining the levees
- Improve emergent plant communities and stabilize sediments
- Determine forest habitat needs for migratory songbirds

Plants and Animals

- T&E species and natural areas protection, management, and enhancement
- Control or elimination of exotic and invasive species
- Re-establish aquatic vegetation in areas shown on historic maps in known low spots
- Restore submersed vegetation and off channel connectivity to all pools
- Restore aquatic vegetation in backwaters on pool
- 10% increase in bottomland hardwood forest acreage, improve diversity
- Provide area for mast tree planting (appropriate elevations and soil composition)
- Protect and manage habitat for *Boltonia decurrens*
- Fish screen for water intakes (power plant) and fleeting operations
- Threatened and endangered river redhorse
- Manage fisheries to reduce populations of exotic (destructive) fish species)
- Establish aquatic barriers for exotic fish species
- Red shouldered hawk, brown creeper - protect and enhance
- Increase mussel diversity

Upper Mississippi River-Illinois Waterway System
System-Wide Environmental Objectives

Water Quality

- Achieve USEPA full use standards
- Increase water clarity to support submersed aquatic plant growth at water depths of 4 feet or more by 2010
- Reduce nutrient loads from tributaries by 25 percent
- Reduce mainstem nutrient load by 15 percent
- Reduce mercury and fecal coliform loading from tributaries
- Remove contaminated sediments (IWW, Twin Cities, Quad Cities)
- Reduce stormwater and sewage contamination by 2010
- Maintain dissolved oxygen concentrations >5ppm by 2010
- Maintain water temperature >1 degree C in fish overwintering areas by 2030
- Minimize current in fish overwintering areas (<0.3m/sec) by 2040

Geomorphology

- Restore aquatic habitat diversity every 10 miles in MMR (dike alteration)
- Restore MMR secondary channels
- Create new secondary channels
- Restore physical habitat disturbance (i.e., channel migration) in MMR
- Reduce channel armoring and other constraints
- Maintain existing depth of secondary channels
- Maintain connectivity between contiguous backwater and channel areas
- Restore connections between backwater and channel areas where they have been disconnected by sediment or structures
- Restore or maintain depths >1 m in 50 percent of backwater area
- Restore or maintain depths >3 m in 10 percent of backwater area
- All backwaters should have a minimum depth of 1 – 2 m, with 50 percent greater than 2 m deep and ~5 percent greater than 3 m deep by 2030
- Maintain or restore depth diversity in aquatic habitats
- Provide deepwater fish overwintering areas (e.g., depth range 0 – 3 m every two miles)
- Connect quarries to provide backwater habitat
- Consolidate flocculent backwater sediment
- Restore or maintain substrate diversity
- Reconnect 20 percent of isolated floodplain area by 2020
- Reconnect 40 percent of isolated floodplain area
- Reconnect 20 percent of isolated floodplain area at tributary confluences by 2010
- Reduce sedimentation in tributary deltas
- Restore depth in tributary channels
- Provide for longitudinal fish passage in the mainstem and tributary rivers
- Reduce erosion and habitat loss associated with barge fleeting areas
- Protect islands from erosion
- Reduce bank erosion
- Restore islands eroded since impoundment

Upper Mississippi River-Illinois Waterway System
System-Wide Environmental Objectives
(continued)

Geomorphology (cont.)

- Restore or increase sand bar habitat in the MMR
- Maintain "habitat protecting" levees in restored agricultural areas (i.e., time capsules) until river conditions (e.g., sediment transport, exotic sp., etc) are improved
- Maintain 50 percent of acquired/restored Illinois River backwaters isolated from exotic sp.
- Reconnect 50 percent of acquired/restored Illinois River backwaters to the mainstem
- Provide contiguous backwater habitats every 10 miles on the Illinois River
- Restore natural seasonal river stage variation
- Reduce incidence of unseasonal "bumps" in river stage to less than 1 in three years
- Restore low summertime river stages every 5 – 10 years (i.e., drawdowns) by 2015
- Limit dam mediated water level fluctuations in tailwater and impounded areas (e.g., hinge point regulation, stormflow management @ Lockport, etc.)
- Make dam point control possible at all dams
- Maintain maximum controlled pool stage (or greater if possible) during winter

Pattern of Habitats

- Increase abundance of isolated aquatic areas (5 percent of total floodplain area)
- Restore or maintain large contiguous habitats (forest, grassland, and wetland) every 30 – 40 miles by 2020
- Restore or maintain 1,000 acre or greater contiguous forest patches every 30 miles by 2050
- Achieve 20 – 40 percent forested floodplain area
- Restore habitat corridors (e.g., riparian forests, contiguous prairie, etc.)
- Achieve 200 foot non-agricultural riparian corridor along diversion ditches
- Increase abundance of emergent aquatic plants 100 percent over 1989 abundance by 2010 (20 – 50 stems/m^2)
- Increase abundance of submersed aquatic plants 100 percent over 1989 abundance by 2010 (50 - 100 stems/m^2)
- Achieve 10 percent coverage of submersed aquatic plants in every backwater
- Achieve 80 percent coverage of submersed aquatic plants in shallow backwater areas (<1 m deep)
- Achieve 10 percent coverage of grasslands in the floodplain by 2010
- Achieve 10 percent coverage of scrub shrub in the floodplain by 2010
- Increase marsh habitat management opportunities in leveed areas
- Restore age and species diversity in floodplain forests

Upper Mississippi River-Illinois Waterway System
System-Wide Environmental Objectives
(continued)

Pattern of Habitats (cont.)

- Restore flood intolerant tree species
- Restore or maintain a diverse mosaic of plant communities
- Maintain current areal abundance of crop land
- Protect high quality native habitats
- Increase woody debris in secondary channels
- Restore tributaries and floodplain streams

Plants and Animals

- Restore lake sturgeon river wide documented as their occurrence (sampling, commercial, angling) at least 2 times each year
- Restore crystal darter populations
- Restore sand darter populations
- Restore river redhorse populations
- Restore red-shouldered hawk populations
- Restore brown creeper populations
- Protect existing decurrent false aster populations
- Increase decurrent false aster populations
- Increase mast tree abundance 20 – 40 percent by 2050
- Increase freshwater mussel species diversity
- Increase nesting areas for terrestrial birds
- Protect and enhance habitat for T&E species
- Eliminate Asian carp
- Control or eliminate exotic and invasive species
- Protect and preserve native fishes

Other

- Remove trash from river-floodplain (e.g., sunken or abandoned barges, litter)
- Reduce air pollution in harbors and fleeting areas
- Agree on a reference condition
- Acquire land
- Acquire all islands in public ownership or easements

Appendix E. UMR-IWW Management Actions

The following table provides a summary of management actions that are most likely to contribute to achieving the established UMR-IWW goals and objectives. It was developed by reviewing current tables of management actions (*Interim Report for the Restructured Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study – Appendix 5*), tailoring them to the ecosystem elements under consideration, and revising them where necessary. Management actions without ID numbers were added by Environmental Workshop participants.

Table E1. UMR-IWW Management Actions

Ecosystem Element/ Parameter	**Extent**	**ID**	**Management Action**
Water Quality			
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)
(Note: Also include nutrient loading,		2	Stabilize river banks
dissolved oxygen, contaminant		3	Pool scale drawdown to consolidate soft sediments
loading, and carbon input parameters.)			Pool scale drawdowns to promote emergent vegetation
(Note: Also include more/all WQ		4	Minimize dredge disturbance/frequency
parameters, see USACE guidance		5	Minimize dredge slurry return water
110-2-8154.)		6	Minimize bankside dredged material placement
		7	Stabilize dredged material
		8	Tributary reservoirs
		9	Speed and wake restrictions - rec. boats
			Establish and enforce safety zone for tow boats
			Establish a permit system for tows over 9 foot draft
			Adjust sailing line
			Improve aids to navigation
			Additional mooring buoys
			Restore natural tributary areas through delta areas
			Minimize open water dredged material placement
			Sediment traps
			Increase depth in main channel (reduce resuspension)
			Require upper Illinois Waterway to meet EPA general use standards
			Minimize open water placement of dredged material
			Use retention areas for dredged material

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Water Quality (cont.)			
	Main Channel (cont.)		Promote emergent plant growth
			Protect aquatic vegetation (regulatory) - do no harm
			Encourage regulation for BMPs
			Strict runoff and erosion control regulations for new developments
			Temporary mooring facility
			Tow boat speed control to minimize stops
			Modify propulsion system
			Hull redesign
			Wingdams
			Recreation management on the main channel (camping, fires, sanitation, speed, noise)
			Create wetlands to promote biological waste management of storm water.
			Remove levees throughout floodplains (mostly tribs in St. Paul Dist.)
			Industry self help & small scale improvements, nonstructural navigation elements
			Modify tow size/configuration
			Agricultural BMPs
			Restore hydrologic regime of tributaries
			Tributary stream channel stabilization
			Larger, more effective dredged material placement sites for silty material
			Off-shore revetments to reduce sediment resuspension & bank erosion
			Improve channel marking (USCG buoys)
			Install mooring buoys to keep tow away from sensitive areas
			Construct islands to reduce wind waves and sediment resuspension
			Minimize impacts of barge fleeting & mooring
			Side channel closing structures - dredging
			Monitor and minimize nutrient loading
			Control nitrates/chemicals
			Phosphate limits @ sewage treatment plants NTE 1 ppm

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Water Quality (cont.)			
	Main Channel (cont.)		Eliminate phosphorus in lawn fertilizer
			Increase connection, duration, flow to reduce D.O. sags
			Control dissolved oxygen
			Urban storm water treatment
			Urban storm water BMPs
			Reforestation, BMPs
	Backwaters	10	Pool scale drawdown to consolidate soft sediments
		11	Drawdown management units
		12	Drawdown isolated backwaters
		13	Isolate and drawdown contiguous backwaters
		14	Temporarily isolate and drawdown contiguous backwaters
		15	Construct wind breaks
		16	Construct Wave breaks
		17	Remove bottom feeding fishes (carp)
		18	Increase plant density
		19	Increase plant distribution
		20	Reduce algae production
			Construct isolated ephemeral wetlands
	Impounded		Berm and construct moist soil area with water level control
	Secondary channel		Access, speed, and wake restriction on rec. boats
			Increase depth of backwaters
			Plantings to stabilize banks
			Sediment traps
			Create forested riparian corridor
			Land acquisition
			Reduce wind fetch
			Reduce sediment resuspension
			Isolate head of channel

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Water Quality (cont.)			
	Secondary channel (cont.)		Modify flow in channel
			No net loss of backwaters
			Pollution control of all phases (i.e., solids, liquids, gases
			Control dissolved oxygen
			Control nitrates/chemicals
			Stabilize existing islands
			Urban BMPs
			Promote emergent plant growth
			Phosphate limits @ sewage treatment plants NTE 1 ppm
			Off-shore revetments to reduce sediment resuspension & bank erosion
			Winter water level fluctuations - bring in DO water
			Operate pools on "high side"
			Aerators to improve DO
			Divert tribs into backwaters to deliver DO
			Apply BMPs
			Plant vegetation to increase diversity and distribution
			Open springs in isolated backwaters
Geomorphology			
Backwater Depth	Backwater Areas	21	Hydraulic dredging
		22	Mechanical dredging
		23	Consolidate sediment
		24	Divert flow to increase backwater scour
			Increase water levels and hold constant in winter
	Side Channels		Pool-scale drawdown - allow tribs to scour
			Temporarily remove closing structures, build high wing dikes to divert flow into side channels
			Experiment with management actions during scheduled Nav. System closure
			Use structures to maintain BW depth

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Geomorphology (cont.)			
Backwater Depth (cont.)	Side Channels (cont.)		Bank protection to reduce sed input
			Add mooring buoy to reduce sed resuspension
			Mechanical movement of sediment during drawdowns (land based)
			Divert flow of sediment laden water away from backwaters
			Modify drainage district operations
			Construct rock barbs
			Increase meander scour through placement of hard structures - for low flow depth diversity (modify geometry)
			Explosives
			Control sediment by BMPs
			Structures additions or modifications
			Make new side channels
Water Level	Main Channel	25	Pool scale drawdown
	Secondary channel		System-scale or multiple pool drawdowns
			Operate dams to maintain winter water levels at the high end of the operating range
			Hold winter water levels high
			Automate dam operations
			Make frequent gate adjustments to minimize fluctuations
			Use dam point control more - limit hinge point operations
			Hydrographic smoothing (system wide) by dam operation
			Maintain minimum water gradient
			Pool scale increase
			Study water table changes
			Manage tributary and dam flows to mimic natural patterns
			Run of the river tributaries
			Wetland restoration to increase infiltration
			Evaluate and modify mechanisms to deal with watershed influences to eliminate spiking hydrographic cycle (system wide)

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Geomorphology (cont.)			
Water Level (cont.)	Backwater Areas	26	Pool scale drawdown
		27	Drawdown management units
		28	Drawdown isolated backwaters
		29	Isolate and drawdown contiguous backwaters
		30	Temporarily isolate and drawdown contiguous backwaters
			Pool raise within limits of system (winter)
			Rock ramps at spillways and other overflow sections
			Flow diversion to reduce flow, create a head difference
			Install pumps to flood or drawdown isolated backwater areas
			Modify drainage district operations
			Smooth hydrograph by regulatory
			Wetland restoration to increase infiltration
			Moderate hydrologic regime of tributaries - establish objectives for trib hydrology
			De-channelize tributaries
Connectivity	Floodplain	31	Acquire real estate rights, restore water to leveed floodplain areas
		32	Reconfigure, restore flow to secondary channels
		33	Restore flow to isolated backwater areas
		34	Create habitat corridors for floodplain terrestrial wildlife
		35	Restore natural tributary channels through delta areas
		36	Notch levees
		37	Set back levees
		38	Increase water levels
		39	Increase terrestrial area
			Remove levees
			Controlled floodways
			Gated levees - controlled flow into hydrograph
			Rock ramps at spillways and other overflow sections
			Remove bank stabilization structures

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Geomorphology (cont.)			
Connectivity (cont.)	Floodplain (cont.)		Maintain current and historic backwater mouths
			Create moist soil management areas that mimic natural hydrology of river
			Construct islands to increase connectivity
			Connect isolated backwater areas (e.g., sloughs) at downstream end
			Install flow structures (pipes) through earthen dams to connect isolated backwaters
			Create and maintain fishless aquatic areas
			Protect, maintain and create isolated backwaters for amphibian conservation
			Restore lost physical structure
			No government bailouts for repetitive flood damage
			More floodplain zoning
	Secondary Channels	40	Notch closures
		41	Divert flow
		42	Increase water levels
		43	Dredge secondary channels
		44	Remove levees
			Construct islands to restore and create secondary channels
			Set back levee
			Controlled floodway
			Restrict flow to contiguous backwaters
			Construct islands to increase flow
			Restrict flow to secondary channels
			Restore flow (all parameters except clarity) at selected side channels
	Longitudinal	45	Build fishways
		46	Modify gate operations
		47	Modify lock operations
		48	Remove tributary dams
			Modify gate structure

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Geomorphology (cont.)			
Connectivity (cont.)	Longitudinal (cont.)		Lower embankments and spillways
			Modify control structures (such as spot dikes)
			Remove dams (mainstem and tribs)
			More research on fish passage
			Build barriers to restrict exotic species movements
Pattern of Habitats			
Aquatic areas		49	Introduce flow to isolated backwater areas
		50	Restore flow to secondary channels
		51	Restore flow to floodplain areas isolated by levees
		52	Restore natural tributary channels through delta areas
		53	Divert more tributary delta flow into open impounded areas
		54	Create rock and gravel substrate areas
		55	Create shallow rock and gravel riffle areas
		56	Incorporate woody debris into bank protection
		57	Incorporate woody debris into secondary and small channels
		58	Restore flow and geometry of secondary channels
		59	Modify flow distribution from dam gates - tailwater habitat
		60	Grading, vegetation planting
		61	Rock groins, hard points
		62	Anchored woody debris
		63	Off-shore rock revetments
		64	Submerged rock vanes
		65	Notch wing dams to create hydraulic, depth diversity
		66	Notch closing dams to increase side channel flow
		67	Construct temporary structures to divert flow
		68	Use larger rock, make bank revetments irregular
		69	Incorporate woody debris into channel structures
		70	Construct hard points, groins for shoreline stabilization
		71	Construct off-shore revetments

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Pattern of Habitats (cont.)			
Aquatic areas (cont.)		72	Construct seed islands
		73	Construct bendway weirs
		74	Construct chevrons
		75	Modify flow splits between main and off-channel areas
		76	Dredge backwater areas, increase depth
		77	Dredging to restore and create secondary channels
		78	Shore pipe, boosters to reach target sites
		79	Use small dredges to expand placement options
		80	Bend width reductions where possible
			Raise island topography
			Insure over wintering centrarchid areas every 5 miles
			Manage barge fleeting areas
			Control invasive/exotic species
			Create islands to restore secondary channels
			Protect. Maintain and increase isolated backwater areas for amphibian conservation
			Remove beach plan from MVP
			Upland dredged material placement for beneficial use
			Behind levee dredged material placement
			Protect and restore mussel beds and increase diversity
			Restore native submersed and emergent communities
			Buy land/interest
			Restore meanders to tribs
			Reduce flow to isolated backwater areas
			Restrict flow to secondary channels
			Increase shoreline dynamics/complexity
			Pool-wide drawdowns
			Submerged sills into backwaters
			Remove/knock down wingdams to create fish habitat

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Pattern of Habitats (cont.)			
Aquatic areas (cont.)			Break low spots in dam embankments - riffle type aquatic habitat
			Use mgmt actions to reduce/eliminate flow (include islands, dikes, and closures)
			Construct islands
			Water level management
			Increase channel border width
			Notch levees
			Pool-wide to system-wide drawdowns
Terrestrial Areas	Floodplain	81	Place dredged material to create wetland areas
		82	Placement on existing, construct new beaches
		83	Semi-confined channel placement (chevrons)
		84	Unconfined placement in floodplain (for mast trees)
		85	Unconfined placement in floodplain
		86	Beaches
		87	Island construction
		88	On floodplain to raise areas for mast-producing trees
		89	Confined placement in floodplain
		90	Construct hard point in floodplain
		91	Construct islands in impounded areas and backwaters
		92	Seed islands
		93	Chevron islands
		94	Rock islands
		95	Islands with varied top elevation, fine material
		96	Low islands - mud flats and sand bars
	Islands		Protect, restore, and increase grassland, forest, wetland habitats for areas sensitive sp - large habitat blocks for acquisition/easement programs
			Manage barge fleeting areas
			Control exotic/invasive species.
			Behind levee dredged material placement for crop fields

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Pattern of Habitats (cont.)			
Terrestrial Areas (cont.)	Islands (cont.)		Behind levee dredged material placement for beneficial use
			Stabilize eroding ravines
			UMR-wide BMP practices that apply
			Control selected native and exotic species
			Promote diverse moist soil vegetation
			Buy interest
			Create/maintain sand nesting sites for turtles, shorebirds, and water birds for loafing, resting, or basking areas
			Encourage natural land formation - deltas
			Stabilize and protect landforms to protect what exists
			Open barrier islands - create channel, induce delta formation into open BW areas
			Excavate floodplain potholes
			Raise elevation of islands above water level to allow growth of moisture intolerant trees, forbs, and grasses
			Protect Islands, especially in main channel
Land Cover/Use		97	Modify and manage habitats on refuges (see habitat below)
		98	Manage vegetation cover
		99	Manage water levels
		100	Modify habitat structure in floodplain and backwaters
		101	Plant vegetation on dredged material deposits
		102	Plant floodplain trees
		103	Harvest floodplain trees
		104	Plant floodplain prairie
		105	Burn floodplain prairie
		106	Control invasive exotic species
		107	Place dredged material to create wetland areas
		108	Unconfined dredged material placement in floodplain (for mast trees)
		109	Growing season drawdowns

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Pattern of Habitats (cont.)			
Land Cover/Use (cont.)			Acquire real estate interest
			Focus on securing management interest enlarge habitat blocks for area sensitive species.
			Create habitat corridors for floodplain terrestrial wildlife
			Promote alternative agriculture in floodplain
			Regulate future floodplain development
			Remove levees
			Restrict use in the river floodplain (regulate)
			Soil amendment (beneficial use of dredged material)
			Reevaluate existing authorities and policies for beneficial use of dredged material.
			Reconfigure, restore flow to secondary channels
			Notch closures
			Divert flow
			Restore flow to isolated backwater areas
			Dredge secondary channels
			Restore natural tributary channels through delta areas
			Notch levees
			Set back levees
			Increase water levels
			Increase terrestrial area
			Increase water levels
			Reestablish disease resistant elms in floodplain
			Excavate wetland scrapes
			Make moist soil areas every 50 miles
			Maintain selected agricultural levee districts

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Plants and Animals			
Fish		110	Adjust angling, commercial fishing regulations as needed
		111	Modify angler attitudes about exploitation
		112	Enforce fishing regulations
		113	Stock fish
			Conduct biomanipulation of fish and wildlife community (various actions)
			Reintroduce/maintain native fish species stocks
			Modify dredging activities for invertebrate habitat
			Reconnect fish species to habitat to restore life cycles
			Promote commercial utilization of appropriate species
			Close sturgeon fishing season
			Improve angler access
			Improve habitat for fish, provide a diversity of habitats for fish communities (MAs 1 - 109)
			Control invasive exotic species
			More population studies of biological research such as fish, wildlife, birds, herps, invertebrates, and plants
			Use predator control where appropriate
Wildlife		114	Conduct biomanipulation of fish and wildlife community (various actions)
		115	Adjust hunting and trapping regulations as needed
		116	Modify hunter attitudes about exploitation
		117	Enforce hunting regulations
		118	Reintroduce native species
			Intensive management of moist soil areas
			Focus Federal aid on Miss. R
			Increase designated refuge
			Protect increase, and restore habitat for species of conservation concern including neotropical migrants and others
			Increase monitoring and research of nesting neotropical migrant

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Plants and Animals (cont.)			
Wildlife (cont.)			Better management of game sp. (deer) so populations do not negatively impact other biodiversity
			Monitor and test for diseases as needed
			Promote habitat for migratory bird species
			Control invasive exotic species
			Predator management where appropriate or needed
			Voluntary closed areas
			Implement MAs 1 - 109
Exotics		119	Control invasive exotic species
		120	Construct, operate, maintain barrier on Illinois River
		121	Require antibiotic treatment of Great Lakes freighter ballast water
		122	Regulate use of exotic species for fishing bait
		123	Regulate biota transfer by fishing boats
		124	Apply species-specific toxicants
		125	Kill zebra mussels on vessels in lock chambers
		126	Restrict and enforce use of exotic species in aquaculture
			Sever Great Lakes IWW connection
			Promote education
			Promote utilization of exotic biomass
			Develop interagency task force for coordination of control efforts
			Barge cleaning stations (hulls for zebra mussels)
			Public awareness for catch and DO NOT release program
			Increase water temperature using power plant open-cycle cooling water during warm summers to kill zebra mussels
			Implement MAs 1 - 109
			Control exotic introductions through other ports (New Orleans)
T&E		127	Protect, increase populations of threatened, endangered species
			Stabilize nesting islands and maintain vegetation cover (e.g., cormorant colonies in Pool 13)

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Plants and Animals (cont.)			
T&E (cont.)			Promote education
			Evaluate species of concern
			Reintroduce/expand species of concern to avoid listing
			Manage for T&E consideration as a priority where they exist
			Conservation easements to protect bluff lands & grasslands in floodplain and beyond (local, state, NGO, Feds)
			Monitor and test for disease
			Increase, restore, and maintain suitable habitat for T&E species
			Reintroductions based on historic records
			Protect, increase habitat of threatened, endangered species
			Emphasize mgmt of communities, not populations
			Continue to implement UMR Biological Opinion
			Implement recovery plans
			Reintroduction of extirpated species to the area
			Restore populations of T&E species.
			Restore and improve T&E species habitats
Mussels and other invertebrates			Need mussel management plan
			Need mussel component in restoration projects
Biodiversity			Manage for maximum diversity of native species
Watershed Management		128	BMPs
		129	Conservation tillage
		130	Contour farming, terraces
		131	Grassed waterways
		132	Establish perennial cover, crops
		133	Stabilize eroding ravines
		134	Conservation Reserve Program land set-aside
		135	Erosion control structures along intermittent streams
		136	Construct, maintain small impoundments
		137	Restore drained lakes, wetland areas

Table E1. UMR-IWW Management Actions, cont.

Ecosystem Element/ Parameter	Extent	ID	Management Action
Plants and Animals (cont.)			
Watershed Management (cont.)		138	Riparian buffer strips
		139	Restore stream channels, floodplain areas
		140	Urban storm water management practices
		141	Construction site erosion prevention practices
		142	Increase pervious surface in developed areas
			Employ USDA and IDA set-aside programs such as CREP, WRP, etc
			Land acquisitions or easements
			Watershed groups
			Livestock management
			Encourage land trusts and individuals to conserve grasslands, blufflands, open space in perpetuity along the watershed (encourage all means of land conservation)
			Stable hydrologic objectives for tributaries
			Provide sanitary facilities for campers on islands
			Adjust dredging frequency and volume to enable pool scale drawdowns, limit frequency of disturbance, WQ problems, gain cost efficiencies
			Acquire tributary floodplain areas - areas hydrologically affected by Nav. System impoundment
			Look at Galloway Report recommendations
			USDA, EPA, FEMA need to be involved in river management
			Consider system-wide cumulative impacts during evaluations of any project
			Wetland Reserve Program
Environmental Education & Outreach			Environmental education and outreach
			Educational outreach - neotropicals, ecology of river, many things

Appendix F. La Crosse Environmental Workshop Report

The following report summarizes the results of the La Crosse Environmental Workshop that was held November 18-19, 2002. The report includes:

1. a summary of the workshop and results,
2. tables of identified UMR-IWW environmental objectives,
3. a table of identified management actions,
4. a narrative on UMR-IWW species and population parameters,
5. working group reports, and
6. the plenary session report.

Upper Mississippi River – Illinois Waterway System Navigation Feasibility Study

La Crosse Environmental Workshop

November 18-19, 2002
La Crosse, WI

DRAFT REPORT

January 2003

United States Army Corps of Engineers

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EXECUTIVE SUMMARY

Introduction and Workshop Process

The restructured Upper Mississippi River –Illinois Waterway (UMR-IWW) System Navigation Feasibility Study is focused on the authorized Federal navigation projects on the Upper Mississippi River System (UMRS; including the Illinois Waterway; Figure 1) and the ecological and floodplain resources that are affected by these navigation projects. The objectives of this restructured feasibility study are to relieve lock congestion, achieve an environmentally sustainable navigation system, and address ecosystem and floodplain management needs related to navigation in a holistic manner. The restructured navigation study will seek to ensure that the rivers and waterway system will continue to be an effective transportation system and a nationally treasured ecological resource. The restructured study will: (1) further identify the long-term economic and ecological needs, and potential measures to meet those needs, through collaboration with interested agencies, stakeholders and the public; (2) evaluate various alternative plans to address those needs; (3) present a plan consisting of a set of measures for implementation that will achieve the study objectives; and (4) identify and address issues related to the implementation of the recommended plan.

The study area comprises the entire Illinois Waterway and the Upper Mississippi River. The Illinois Waterway extends 327 miles from its confluence with the Mississippi River to Lake Michigan via the Illinois River, Des Plaines River, and a series of canals. The Upper Mississippi River extends 854 miles from the confluence with the Ohio River to Upper St. Anthony Falls Lock in Minneapolis-St. Paul, Minnesota. The study area lies within portions of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The total Illinois Waterway and Mississippi River navigation system contains 1,200 miles of nine-foot deep channels, 37 lock and dam sites (43 locks) and thousands of channel training structures (Figure 1).

Much of the UMRS lock and dam system was in place by the 1940s. Except as noted below, the locks are 600 feet long, although, modern tow configurations include 15 barges and approach 1,200 feet long. As a result, most tows must lock through using a time-consuming two-step process in which the first three rows of barges (9 barges) are locked through first and the last two rows of barges (6 barges) and the towboat are locked through second. The entire process may take 1.5 hours or longer depending on many variables. In contrast, Lock 19 has a 1,200-foot lock and Melvin Price Lock and Dam (Lock 26 replacement) and 27 have both a 1,200-foot and a 600-foot chamber at each site. The lockage process takes an average of 1.0 hours at Lock 19 and 0.6 hours at Locks 26 and 27.

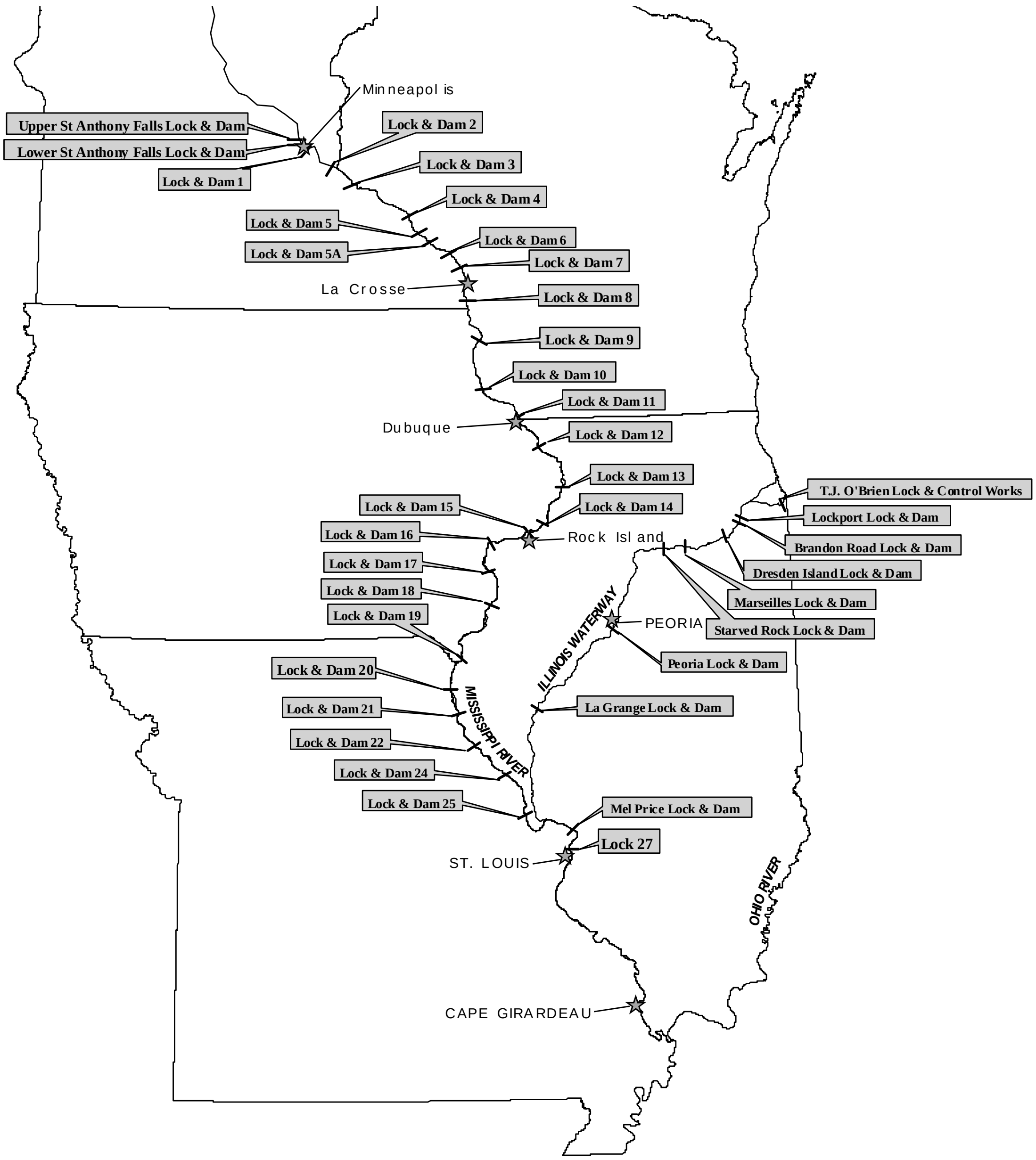

Figure1. UMR-IWW Locks and Dams.

Eight locks on the Upper Mississippi River and 3 Illinois Waterway locks were among 20 locks with the highest average delays in 1987 at the beginning of this study. This remains the case with UMR-IWW facilities highly ranked in the peak monthly delays at locks around the country in 1998. The UMRS had over half (19 of 36) of the most delayed lock sites in the country. Under current conditions, delays to tows are common at a number of locks on the UMRS. In general, delays are greatest at the most downstream 600-foot locks. For the 10-year period 1990-1999, delays per tow average 3.4 hours at Locks 20-25; 2.2 hours at Locks 14-18; 0.9 hour at Locks 8-13; and 0.4 hour for Upper St. Anthony Lock to Lock 7. On the IWW over the same period, delays per tow average 1.8 hours at Peoria and La Grange and 1.1 hours for the other locks.

Ecosystem

The Upper Mississippi River ecosystem includes the river reaches described above, as well as the floodplain habitats that are critically important to large river floodplain systems. The total acreage of the river-floodplain system exceeds 2.6 million acres of aquatic, wetland, forest, grassland, and agricultural habitats. The Mississippi Flyway is used by more than 40% of the migratory waterfowl traversing the United States. These Trust Species and the threatened and endangered species in the region are the focus of considerable Federal wildlife management activities. In the middle and southern portions of the basin the habitat provided by the mainstem rivers represents the most important and abundant habitat in the region for many species.

Habitat types are disproportionately distributed throughout the river system, and their absolute abundance is dependent on the total area of the reach under consideration (Figure 2). The largest differences occur in the amount and distribution of agriculture and the proportion of open water in the floodplain. Agriculture dominates the wide floodplain south of Rock Island, Illinois and open water occupies a greater proportion of the floodplain north of Clinton, Iowa. Wetland classes are generally more abundant in northern river reaches, wet meadows are fairly evenly distributed, and grasslands are rare throughout the river system. Forest classes generally occupy between 10 to 20 percent of the floodplain in a narrow strip along the river banks throughout the system.

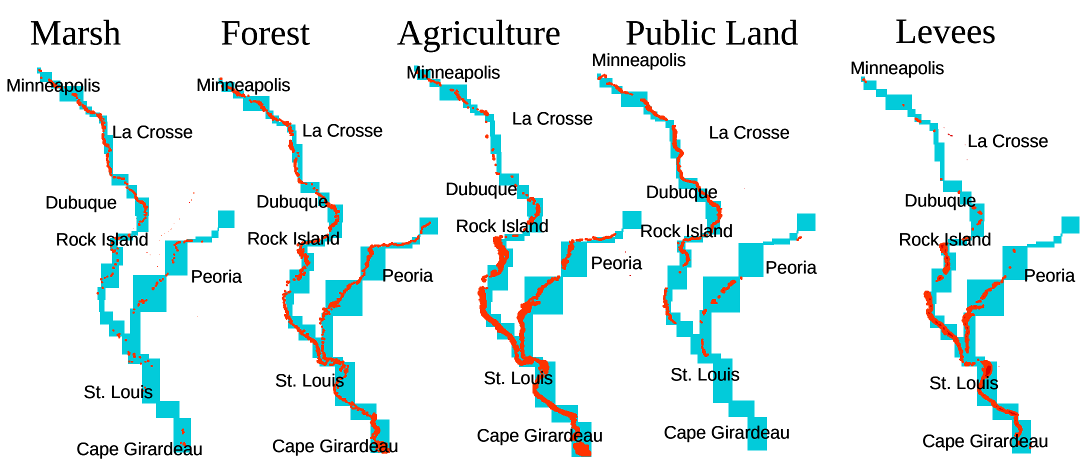

Figure 2. Areas in red show the extent of selected landcover or landuse types on the UMR-IWW.

Section 1103 of the Water Resources Development Act of 1986 (WRDA 86) recognized the Upper Mississippi River system as a unique, nationally significant ecosystem and a nationally significant commercial navigation system. The system provides:

1. A means for shippers to transport million of tons of commodities within the study area---130 million tons on the Mississippi River and 44 million tons on the Illinois Waterway in 2000,

2. Food and habitat for at least 485 species of birds, mammals, amphibians, reptiles, and fish (including 10 Federally endangered or threatened species and 100 state listed species),

3. More than 226,650 acres of national wildlife and fish refuge,

4. Water supply for 22 communities and many farmers, and industries,

5. A multi-use recreational resource providing more than 11 million recreational visits each year,

6. Cultural evidence of our Nation's past.

Establishing Goals for the System

The original UMR-IWW Navigation Feasibility Study was narrowly focused on the problem of reducing commercial navigation traffic congestion on the system. Coordination was occurring between economic and environmental interests;, however, the work was being accomplished independently. With the new focus of the restructured study on sustainability, it became important for the stakeholders of the system to prepare a common vision for the future of the UMRS. In November 2001, the Economic Coordinating Committee (ECC) and the Navigation Environmental Coordinating Committee (NECC) met jointly to prepare this vision:

> *"To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System"*

The following definition of sustainability was collaboratively developed and agreed to by the group as well:

> *"The balance of economic, ecological, and social conditions so as to meet the current, projected, and future needs of the Upper Mississippi River System without compromising the ability of future generations to meet their needs."*

This definition will serve as the primary goal for integrated and adaptive management of the Upper Mississippi River System.

Planning for future navigation system infrastructure needs; navigation system operation and maintenance; habitat protection, enhancement, and restoration; river recreation; floodplain management; and water quality management should be conducted in the context of a set of clear goals and objectives for condition of the UMRS. Setting these goals and objectives should be done collaboratively, with participation of the full community of river stakeholders. Development of a set of measurable objectives for integrated and adaptive management of the UMRS will be challenging. It will require considerable collaborative effort, making use of conceptual models, predictive models, and visualization tools to comprehend the interconnections between system components and to enable the community of stakeholders to actively participate in planning for a

sustainable multiple use river-floodplain system. Integrated planning will be an on-going effort to optimize the National benefits achieved from efficient and effective adaptive river management.

Introduction to the Workshop

Four two-day workshops were held during November 2002, to aid the process of establishing measurable environmental objectives for the Upper Mississippi River-Illinois Waterway System (UMR-IWW). Workshops were conducted in Peoria, Illinois, St. Louis, Missouri, La Crosse, Wisconsin and Moline, Illinois.

The workshops were structured to achieve the following main objectives:

1) <u>Identification of UMR-IWW environmental objectives</u>
   Collaboratively review, refine, and add to a database of specific, quantitative, local to regional scale environmental objectives (for the workshop region) building on previous work from the EMP Habitat Needs Assessment, Pool Plans, USFWS Comprehensive Conservation Plans, and related study efforts.
2) <u>Identification of UMR-IWW management actions</u>
   Review and identify management actions that are most likely to contribute to achieving the established goals and objectives.
3) <u>Discuss and identify species and population parameters</u>
   Identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.
4) <u>Present and discuss UMR-IWW ecosystem conceptual model</u>
   Present and discuss the utility of developing an UMR-IWW ecosystem conceptual model to gain a better understanding of the linkages between environmental objectives, management actions, and the state of the ecosystem.

Participants were invited from a variety of organizations including the U.S. Army Corps of Engineers, U.S. Department of Forestry, U.S. Department of Transportation – Maritime Administration, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, Iowa Department of Natural Resources (DNR), Illinois DNR, Illinois Department of Water Resources, Illinois Natural History Survey, IL State water Survey, Minnesota DNR, Missouri Department of Conservation, Missouri DNR, Wisconsin DNR, Audubon Society, Environmental Defense, Iowa Farm Bureau, Izaak Walton League, MARC 2000, MRBA, Mississippi River Revival, Missouri Coalition for the Environment, Sierra Club, Southern Illinois University, The Nature Conservancy, University of Miami, UMIMRA, UMRCC, and Quincy Park District. There were a total of 142 people who participated in the interactive workshop process. This report presents the results of the enormous amount of effort and energy the participants contributed to the workshops.

Workshop Process

The workshop was organized by the U.S. Army Corps of Engineers (USACE) Rock Island District. A subset of the workshop participants helped review and edit this Workshop Report. Outside review by non-participants will not be part of the process.

No content changes were made by the editors and the participants checked that accurate representations were made of the work they had done during the workshop.

The La Crosse workshop was conducted 18 - 19 November, 2002 at the Fish and Wildlife Service Refuge Office La Crosse, Wisconsin. There were 42 participants, with most present the entire duration of the workshop. These participants, from more than 60 issued invitations, included state and federal wildlife agency personnel, non-governmental agency representatives, and public citizens. Participants and invitees are listed in Appendix A.

The agenda for the workshop (Appendix B) was followed loosely, allowing extra time for questions and time in the workgroups as needed. A record of these plenary discussions is found in Appendix C, while workgroup reports can be found in the appendices related to their topic of discussion.

Background on the General Workshop Structure

The workshop process was designed to maximize the time and resources available at each of the meetings. The workshops utilized three components of meeting structure to meet the objectives of eliciting information, discussing key issues, and informing the participants of developing strategies.

The first component was the standard meeting style wherein a few speakers provided information to the group as a whole allowing for questions and some discussion.

The second component was key for eliciting information and involved breaking the group into working groups based on some criteria such as geography or content. Breaking a large meeting into working groups comprised of 10 or fewer individuals optimized the opportunity for participation of the greatest number of people and for timely discussion and progression on key issues. The number of working groups varied depending on the number of participants and geographic areas to be covered.

The third component were the plenary sessions, which allowed all of the participants to hear a summary of what was accomplished in the other working groups and to have input into the entire set of results. It also allowed the facilitators to refine the GIS database as a coordinated team.

Before getting started with the first task of this workshop, each participant was asked to introduce themselves and to write out and then read aloud answers to an introductory question. This process allowed for expression of individual perspectives without being immediately influenced by previous responses. This process indicated potential areas of common ground and provided a first insight into the diversity of perceived issues present in the group. Answers to the question can be found in Appendix D of this report.

After the Workshops

The workshops were an early step in a planning process to establish environmental alternatives that strive to secure the environmental sustainability of the UMR-IWW. Once the environmental objectives are well defined and management actions are identified to achieve them, the next step will be estimating the potential costs and outcomes (i.e., benefits) for the suggested actions. This information will be used to develop alternative plans (made up of multiple combinations of management actions) that seek to address the local, river reach, and system-wide needs of the UMR-IWW ecosystem. These environmental alternative plans will then be integrated with alternative plans for the UMR-IWW Navigation System. Tradeoff analysis will be conducted to identify and compare the environmental, economic, and social benefits of the integrated plans. The results of the alternative analysis, and further collaborative review and input from stakeholders, will be used to develop a recommended plan portrayed in the Final Feasibility Report scheduled for completion in late 2004.

Formal Report

Five reports will be produced as a result of the four, two-day workshops. The first four reports are Workshop Reports, which will be reviewed by the workshop participants. A final integrated report summarizing the results from the four workshops will be published as part of the Navigation Study's formal documentation process. The final integrated report will contain a full accounting of the site-specific objectives in the form of an atlas as well as the tabulated system, reach, and pool wide objectives and management actions (Table 1). Workshop participants will have an opportunity to review and comment on the integrated Draft Environmental Objectives Planning Workshops Report before its completion in early 2003.

Table 1. UMR-IWW System Navigation Feasibility Study Environmental Objective Workshops reports contents.

- <u>La Crosse Environmental Workshop Report</u>
    - Summary of La Crosse workshop and results
    - Tables of identified Upper Mississippi River pool-wide and site-specific objectives
    - Table of identified management actions
    - Narrative of species and population parameters
    - Working Group Reports
    - Plenary Session Report

- <u>Environmental Objectives Planning Workshops Report</u>
    - Summary of all four workshops
    - Tables of all identified UMR-IWW pool-wide and site-specific objectives
    - Atlas maps of all identified site-specific objectives
    - Table of all identified managements actions
    - Narrative of UMR-IWW species and population parameters

Environmental Objectives

The primary goal of the Environmental Objectives Planning Workshops was to have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts. The La Crosse Workshop was successful in reviewing and identifying both site-specific and pool-wide objectives for the Mississippi River (Pools 1-11) using a combination of breakout groups and a plenary session. Objective atlas maps and worksheets were reviewed and filled out by breakout groups. A plenary session then followed where the information from each group was compiled into the objective database using GIS tools (Figure 3).

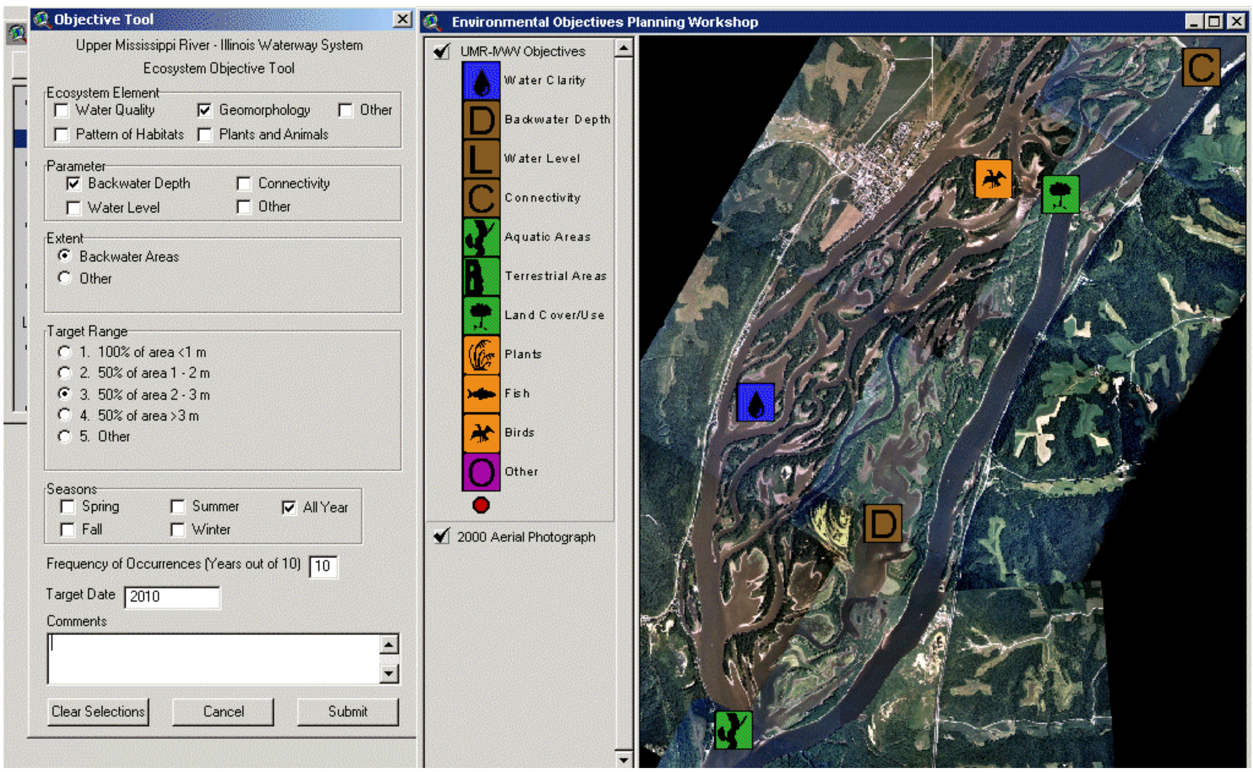

Figure 3. UMR-IWW System Navigation Feasibility Study GIS Objective Tool and Database.

The environmental objective database used at the La Crosse Workshop included 1,451 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment (HNA) and Mississippi River Environmental Pool Plans. An additional data source was identified during the La Crosse Workshop and later added to the objective database. This included objectives noted by the Habitat Rehabilitation and Enhancement Project (HREP) documents. HREP objectives were noted only for projects described as 'under general design' or 'future opportunities'.

Based on comments from the workshop participants and removal of redundant objectives (e.g., two identical depth objectives in the same backwater area), the database was refined to 1,168 objectives (see Table 2). Over 240 of these identified objectives were enhanced with additional detailed information (i.e., target ranges, seasonality, and descriptive comments) provided by the participants. Land cover/use, terrestrial area, and backwater depth were the most common type of objectives identified for this portion of the river. Emergent and submersed aquatic vegetation made up the largest number of identified land cover objectives and terrestrial area objectives most often referred to island restoration. The 21 environmental objectives identified as ‘Other’ included objectives related to improving dissolved oxygen levels, controlling invasive species, and restoration of river rapids habitat. Pool 7 had the largest density of identified objectives with an average of over six per river mile. Appendix E provides additional detail on the objectives listed in Table 2. Maps of all site-specific objectives identified in the workshop will be distributed for review in the integrated Environmental Objectives Planning Workshops Draft Report (in January).

Table 2. Number of site-specific env. objectives identified for the Mississippi River.

	Mississippi River Reach												
Objective	**Pool 1**	**Pool 2**	**Pool 3**	**Pool 4**	**Pool 5**	**Pool 5a**	**Pool 6**	**Pool 7**	**Pool 8**	**Pool 9**	**Pool 10**	**Pool 11**	**Total**
Water Clarity	0	8	6	11	10	7	7	10	25	26	30	20	160
Backwater Depth	0	8	8	12	11	8	10	10	21	25	40	20	173
Water Level	1	3	1	2	1	1	4	2	1	2	1	2	21
Connectivity	1	6	9	8	6	3	7	6	5	4	9	3	67
Aquatic Areas	13	1	1	7	4	3	1	5	1	3	15	18	72
Terrestrial Areas	1	19	7	38	21	6	12	21	37	36	51	40	289
Land Cover/Use	2	55	41	36	36	16	10	25	42	46	26	30	365
Other	1	2	3	1	0	3	2	0	4	0	3	2	21
Total	19	102	76	115	89	47	53	79	136	142	175	135	1168

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- water clarity in secondary channels should have a secchi disk transparency of 1.5m during all seasons by 2010,
- decrease sediment-loading from tributaries,
- actively manage floodplain forests,
- create a more natural hydrograph,
- support Environmental Pool Plans,
- preserve native species/communities,
- complete storm/sanitary drain separation,
- protect mussels – recovering communities,
- reduce erosion, and
- sustain quality habitat through natural processes.

A more complete list of Mississippi River pool-wide objectives gathered at the La Crosse Workshop is located in Appendix E.

Management Actions

The purpose of the Management Actions working groups and plenary session was to review and identify management actions that were most likely to contribute to achieving the established goals and objectives. This was accomplished by reviewing current tables of management actions (see the *Interim Report for the Restructured Upper Mississippi River – Illinois Waterway system Navigation Feasibility Study* pages 251-255), tailoring them to the ecosystem elements under consideration, and revising them where necessary. Management Actions are defined as specific actions, tools, techniques or combinations of actions, tools and techniques used to meet defined objectives. Management actions are implemented as specific projects whose reconnaissance and feasibility studies provide the detail required to assess and develop environmental analyses, funding, staffing, engineering and partnerships needed to implement the plan. Table 3 is an example of the Management Actions Tables where actions have been changed or added. All management actions can be found in Appendix F.

Table 3. Example Management Action Table.

Element/ Parameter	Extent	ID	Management Action	Comments
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to consolidate soft sediments	
		4	Minimize dredge disturbance/frequency	
		5	Minimize dredge slurry return water	
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	
		9	Speed and wake restrictions - ~~rec. boats~~ (all watercraft)	
Comments/ Additions:			Evaluate and modify mechanisms to deal with watershed influences to eliminate spiking hydrographic cycle (system wide)	
			Restore natural tributary areas through delta areas	
			Minimize open water dredged material placement	
			Sediment traps	

Species and Population Parameters

The purpose of this session was to identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts. Below is a summary of the discussion that took place during the plenary session.

Participants at the La Crosse workshops expressed apprehension about setting species targets. The source of apprehension was that environmental management actions to achieve species targets may be undertaken without knowing or evaluating the impacts on the rest of the ecosystem. Overwhelmingly, the participants expressed a desire for habitat objectives (i.e., Pool Plans), with the understanding that habitat management will likely result in increased abundance of both targeted and non-targeted species. Monitoring and understanding existing conditions was mentioned several times with the thought that pre-project conditions should be compared to post-project responses. Environmental monitoring data was also mentioned as valuable to help understand existing conditions and to establish expectations for restoration efforts. Workshop participants thought the catch rate and relative abundance of species in the catch were viable measures of the fish community response to aquatic restoration initiatives. They also thought that physical responses to project implementation may be reliable assessments of project performance.

Several participants espoused the adaptive management philosophy put forth in the UMR-IWW System Navigation Feasibility Study Interim Report. The adaptive management process allows for action despite uncertainties, and evaluation to refine management practices where actions fall short of anticipated results.

Considering all the issues, participants seemed to agree that sensitive and exotic species should be tracked as indicators of ecosystem condition and that community level assessments should be targeted at specific habitats and project areas. The desire for absolute abundance estimates should not be ignored, but should also not be acquired at the expense of other monitoring or restoration efforts.

Conceptual Model

At the end of the workshop, participants were provided with a brief presentation on the ecosystem conceptual model being developed for the UMR-IWW Navigation Study. The purpose of the UMR-IWW conceptual model is to identify the linkages and sequencing of identified environmental objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to this overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Facilitate dialog and develop a structure for additional input from stakeholders

The ecosystem conceptual model presentation can be found in Appendix H. All the PowerPoint slides used during the 2-day workshop are accessible through a FTP site noted in Appendix I.

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Appendix B. Agenda

Day 1

9:00	Opening *Hank DeHaan and Chuck Theiling*
9:10	Introduction to the Workshop Process and Participant Introductions *Rebecca Soileau*
9:30	UMR-IWW Restructured Navigation Feasibility Study Overview and Schedule *Ken Barr*
9:45	Vision, Goals, and Environmental Objectives *Chuck Theiling*
10:00	Working Definitions of Terminology for this Workshop *Nicole McVay*
10:10	Overview of GIS Database and Existing Objectives and Management Actions *Hank DeHaan*
10:30	***Working Groups (I)*:** Identify and refine environmental objectives for the Illinois Waterway ecosystem. .
12:00	Lunch
1:00	***Working Groups (I)*:** Continued work and Report Preparation
3:30	Plenary: Presentation of objectives identified by each working group and input into GIS
5:30	Adjourn

DAY 2

8:00 Plenary: Presentation and discussion of synthesis of results from previous days work

9:00 ***Working Groups (II):*** Review and identify management actions that are most likely to contribute towards achieving the established goals and objectives

10:30 Plenary: Group presentations of new and revised management actions.

12:00 Lunch

1:00 Plenary: Overview of regional evaluation data and tools for assessing the efficiency of management actions both initially and in an adaptive management framework. Discussion of species and population parameters.
Chuck Theiling

2:30 Review of Regional Ecosystem Conceptual Models

3:00 Workshop Closing

Appendix C. Plenary Session Notes

Below are the plenary session notes that were captured by the facilitators during the two-day workshop. Participant names have been removed from all comments except those made by the facilitators.

La Crosse Workshop November 18th – Day 1

Chuck Theiling's Intro (9:08 –9:11)
Chuck Theiling's introduction briefly described what the workshop will accomplish as well as introduced Hank DeHaan, Nicole McVay, Rebecca Soileau and himself.

Participant Introductions (9:11 – 9:32)

See Appendix D for a list of written and verbal responses.

Ken Barr's Talk (9:32- 10:31)
Ken Barr discussed the history of the Navigation Study – its original focus as well as some of the studies that originated from that process. He then went on to discuss the restructured navigation study, describing the vision as well as the new scope of the study. He showed how the two studies differed with respect to the ecological integrity (the original study focused on direct effects of construction or more tow boats on fish, sediment resuspension, mussels, etc; while the restructured study will consider the existing project impacts and establish objectives to have the environment reach a desired state). During his presentation he also displayed the six-step planning process and reminded all workshop participants that the Corps has to follow this process. He concluded the presentation by discussing how the environmental portion of the navigation study will be viewed in an adaptive management framework as well as showing the participants the schedule of the study. At the end of the presentation he told people that they were open to attend NECC/ECC meetings and that the meeting minutes could be found on the web.

Questions

– How is this scope comparative to EMP?

Barr – It is probably pretty similar, maybe a bit narrower. There is a greater opportunity to identify things in an O&M context.

– Are you looking at the incremental difference because of the lock extensions or the difference that might be needed because there is navigation on the river?

Barr – The latter and perhaps broader. Sediment is more from outside of navigation but we may be able to address this.

– Bed degradation in the lower river has affected side channels and wetlands way out on the floodplain. We need to consider this too.

Barr – Those gray lines are fuzzy and we will be looking to see what we can do.

– Will you be looking outside the gray lines?

Barr – There are other agencies and organizations that can use these objectives, but we will be looking to recommend things that focus on navigation effects.

– This navigation study will only look at effects directly related to the dotted lines (changes in navigation). Is the only part of the environmental based on the changed to the navigation system? (Confusion due to dotted line, navigation effects vs. traffic effects)

Barr – No we will look at all actions that we might take to contribute to those objectives somewhere where the navigation system has effects. This is not just traffic, the entire navigation system.

– Is this your response to the federal task force to deal with being out of compliance of NEPA? Have limited resources so what part of the study/mitigation are we focusing on?

Barr – Lots of debates on on-going effects. We are focused more on what are the needs of the system and how can we modify the system to address those needs? We did sidestep mitigation of past effects, but we will have to go through similar steps as we would for mitigation.

– The reason you don't do mitigation is funding?

Barr – We consider there to be three baskets for funding: Mitigation (50% Federal, 50% Fuel tax); 100% Federal (things on federal land, Operations and Maintenance (O&M) as well as Construction General (CG) funds); and Cost sharing with entities who want to restore (private land). We anticipate 3 ways to fund things with changes in authority. Possible dual authority for navigation and environment.

Question on second basket: CG or OM?

Barr - Good question. That is an authority issue.

– Everglades program up here? If you are looking for sustainability you need to look at the entire watershed. So is the Navigation study moving towards "Everglades" type sustainability or is it constrained by the dotted lines?

Barr – When the study was first restructured the Navigation Study was termed a Comprehensive study. Talked it over and it is still a navigation study. It is bigger than the previous study, but still tied to navigation. We know we need to understand the

effects of the tributaries in a watershed context. However the management actions we recommend will be associated with the navigation study.
– There are big differences between the Everglades and the Navigation Study. They never determined if the water supply was cost effective, it was assumed to be necessary. There were also lots of other sponsors. Everything is cost shared among the agencies.

Wege – I was hoping for a more comprehensive plan, but I'm not hearing that here. How are they handling this downstream? Are they setting objectives for recapturing the floodplain?

Response – Downstream they are setting objectives for recapturing the floodplain.

– Eventually we can set objectives for the condition of the river system that ties us to the watershed plan. Then we can work towards obtaining targets. We can set targets for the input of tributaries.

– TMDL projects have a good process for setting targets in the watershed.

– Adaptive Management. Right now we have a 40% funding reduction in EMP-LTRMP (something that is existing). Yet you are promising 3 new baskets. Why was there a cut to EMP?

Barr –It was a 40% cut across the board that effected EMP. In August of 2001 we were told to look at how EMP can address sustainability of the river ecosystem.

– Some of us will be cautious as to what we will get out of this based on past budget outcomes.

– The new funding will show how committed HQ is to this process since Missouri and Everglades did not get the 40% cut.

– Could agriculture areas be part of those cost sharing. What if we need to address these to acquire sustainability? What if agriculture becomes the most important cause for environmental sustainability?

Barr –We know there are private lands where navigation system has an effect. We bought easements to lands – they are on the table for this project. We will probably recommend cost sharing for these. Areas that are FWS or fee title would be easier to justify 100%. However, HQ might say that the 1135 authority already addresses navigation effects.

– We are going to need multiple funds and tools to address sustainability. How are you going to do this? Top 4 priorities because these are systemic or individual tools for different areas? Are you looking for a prioritized list?

Barr – Today and tomorrow we aren't going to be prioritizing, we want to have all the tools in our toolbox. However later we will prioritize. We want to use the most effective tools possible. We understand that St. Louis is different than St. Paul.
– Will you be looking systemically or locally? Draw down may be best systemic tool, but will affect the 1-foot habitat of a mussel.

Barr – You have to deal with the critter in that resolution. There will always be tradeoffs.

– Where the animals live will be overlooked. What you can see from an airplane will be what we do. We never get to plan for the habitat area. Our greatest concern is that what is going to be overlooked is the habitat level – specific areas for specific species.

Soileau – You can state your areas of concern and place them on the maps.

– How big is the 2nd basket and what is the philosophy that we use that basket? The channel is guaranteed for nine feet of depth. Corps manages for 13 feet of depth, but if we really manage for 9 feet of depth it wouldn't cost as much to open backwaters and do drawdowns. Requires a shift in philosophy.

– The tools Hank and Chuck have put together are a remarkable framework to do this- to gather objectives at different scales. Have a nested set of scales for setting objectives. Implementation is also done at different scales. We also need to identify many different management actions at various scales.

– How do you identify what is best for the river once we have this laundry list?

Barr – Reasonable alternatives that can be evaluated at a certain scale that will be good enough for the feasibility study. We will be working through NECC.

– Clarify Tim's question what is the sequence again?

–We have to discuss systemic effects. Will this discussion occur in the Expert panel? Will we have opportunity to participate in this discussion?

Barr – Expert panels will help with the conceptual model. They can help us. At the end of the day the actual management structure will be as important as the site-specific info. It will have to be adaptive.

– Key to this is the adaptive management actions. Corps is so good at not doing this. They are better at designing, building and then walking away. Is the Corps willing to do this… adaptive management?

Barr – The environment at HQ seems to be ripe for this. The proof is in the pudding.

Chuck Theiling's Talk (10:31-10:57)
Chuck began his talk by reviewing many of the reports that have been written concerning the environment of the UMR-IWW. He then went on to discuss how the Corps has structured this study and where in the study these workshops take place. Next he discussed the expert panel, their functions, the individuals who will make up the panel, as well as how they will fit into the entire process. Chuck then discussed goals, objectives and management actions. He displayed the goals from Grumbine that were adopted by the Navigation Study in the interim report as well as the goals listed in the UMRCC report "A River that Works and a Working River." Next he discussed objectives, described them and listed several example objectives. Chuck continued his presentation by giving an overview of the framework for setting objectives. He then continued by showing where the data to create the objectives database came from. He concluded the talk by reiterating exactly where the focus of the navigation study was as well as discussing how other agencies and authorities could use these overarching goals.

Questions

– When can we talk about water quality?

Soileau – In your working group and in the plenary

DeHaan – There is always "other" that can be entered into the database. Just follow the hierarchical structure.

– Who decides what objectives are the priorities? Especially if they oppose each other?

Response – Probably the NECC.

– Make an effort to have decisions be open and transparent because they are very important.

– TMDL – EPA and States to address water quality standards. EPA will have to address the Mississippi sedimentation. This is about ready to be developed. What is the framework for addressing them…water quality standards of the states? Maybe deal with habitat degradation if objective framework doesn't allow for that.

– As we talk about prioritizing the objectives different agencies will prioritize differently. From a large universe of objectives the Corps will have to decide what will be authorized in this project.

Theiling – The study team will start with that deal.

– I spent 2 years getting USDA money for restoring habitat. Confused as to what scale the Corps will develop these objectives on so others can use them.

– How will you determine these management actions? You are using target ranges that are usually used when you are designing a project but no one is doing that here.

Theiling – Set pool-wide values, individual objectives will happen later.

– We have the detail here. It is more a matter of taking the detail of the pool plans and putting them on the map.

DeHaan – The verbiage of the pool plans will be linked to the database.

– Is this the tiered approach that you are talking about?

Theiling – No, this is one step in the process.

– If the consensus is to use the pool plans how do you get the numbers?

– Appendix to the pool plans will be more specific and we will get that to you. You are asking us for recommendations for things that aren't quite done. What time frame do we want to meet this in?

– Endorse the idea of going with the environmental pool plans. This is the template that the refuge will be using for the CCP. To get to the nitty gritty we aren't there yet, but what can we implement in the next 15 years? We need to put the effort in the watershed. If you think of sustainability you have to look at what is going on in the watershed.

Barr – We have some stakeholders here who may not have been in the Pool Plan process. We can all get a common vision as to what we need and why we need it. Take this chance to share with others in your group.

Break (10:57 – 11:15)

<u>Rebecca Soileau's Talk (11:15 – 11:23)</u>
Rebecca Soileau discussed the overall workshop process including a brief agenda. She then discussed the working agreement and had participants agree to abide by it. Finally she defined her role as a facilitator as well as the expected roles of the participants. She then presented the working definitions.

<u>Hank DeHaan's Objectives (11:23-11:35)</u>
Hank discussed the objective database, including where the information came from, and how the database is structured. This included a detailed discussion of the framework for setting objectives. He then gave a brief demonstration of the database in Arc View 3.2.

<u>Questions</u>

– Is the CARR data integrated into this database?

DeHaan – We don't want to put the protected data into this database, but we do have access to it and it will be used during the efforts. We brought an atlas with us for your use.

– What additional info are you trying to glean from us? I can't see us going through all of these hatch marks and identifying depth and time ranges? How did you get this info?

DeHaan – We are looking for stakeholder buy in. Data came from pool plans.

– We can get more info into this database. However, one thing that wasn't captured accurately from the pool plans to this database is that we wanted some areas to be disconnected and this needs to be shown in this group. Also, we can work in some areas where we didn't come to an agreement during the pool plan process. Also, the pool plans represent a stabilized system, but not sustainable. Do we want to take next step to realistic pie in the sky? We had an optimum that we wanted (2m for submersed vegetation) but we settled for more realistic (1.5m). Our pools plans represent stabilized system but not an ultimate system.

Objectives Plenary Session (3:35):

The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary (Pools 10-11)

Brought people up to speed on pool plans. Decided UMRCC addressed common objectives for the pools. Looked at framework and added things in. Added several water quality parameters. Weren't comfortable with backwater depth ranges but couldn't come up with something better. Water levels – "added increase water level for over wintering EMP monitoring". Look at dropping water levels in the winter as well. Connectivity – Pools are inundated 100% at the 10-year flood, so maintain current conditions. Added bank full connectivity parameter. Feel that there is too much connectivity. Too many areas have flow 365 days of the year. 15% is the average for connectivity for Pool 11. Sediment transport may be another parameter. Acquire a more natural sediment regime in the pools, but didn't come up with target ranges. In Plants and Animals we didn't feel that many animals were well represented. Need to modify target use days because these pools already exceed the given range (2 billion use days would be better range).

–35 million use days is maximizing the refuge. Never the less, range is definitely low.

Group 2 Summary (Pools 7-9)

Looked at reach. Started to look at framework. Need to explore reconnecting Root River to floodplain. Questioned ranges of target ranges.
Water levels – draw down is good
Water depth in backwaters –refer to pool plans.
Spent lots of time in pool plans to familiarize everyone in the group
Need to add "Floating Aquatics" in Aquatic Areas
Terrestrial Areas – Land use/cover – concerned about target ranges.
Plants and animals – why more guilds aren't included and also questioned use days.
Overall – this was a good discussion.

Group 3 Summary (Pools 4-6)

Started to talk about pool plans.
Went through ecosystem elements and looked to see what was different from the pool plans

Group 4 Summary (Pools 1-3)

Discussed pool plans, HNA and Cumulative Effects to give everyone a background as to where info came from.
Pools 1-2 are different because they are very urban.
Pool –Reach-Wide Objectives:
Potential contaminant spills – need early warning system.
Need to treat urban storm water runoff
Need to have annual trash clean up along river
More effort to separate storm and sewer in twin cities
MN River conveys lots of sediment, phosphorus and algae… needs to be reduced.
Lot of boating traffic causing bank erosion. Need education and structural means to deal with this.
Fish passage – improve through the dams. However, concerned about movement of exotics.
More trees for a more continuous corridor for riparian habitat.
Rapids by St. Anthony Falls – Lock and Dam 1 floods the area to a considerable depth. There might be an opportunity to open up Dam 1 and let fish migrate up to St. Anthony's fall.

Site Specific Objective Setting for La Crosse (3:30)
Once each group gave their report we then started at St. Anthony Falls and moved down river, allowing all participants to provide input.

Group 4 (Pools 1-3) specific data –

Construct a string of small islands by St. Anthony Falls. Create green corridor. From RM 858 to Upper St. Anthony's Falls.

Shingle Creek, Rice Creek and Coon Creek reduce sediment input.

Pool-wide (1) – Bank protection where needed.

St. Anthony Falls to LD1 – area to restore rapids (see discussion above)

– When will these go from objective to "approved" objectives?

Theiling – These will never become consensus objectives. For projects these will become alternatives and you will have input to this process.

General consensus of Group 4 –Pool plans were very complete.

Pool 2 –
Water Quality objectives for MN River –reduce loading for sediment, nutrients (phosphorus) and algae. Also moderate hydrologic regime of the river, it has become flashier due to agriculture.

Water Quality at water treatment plant at RM 835.7 – upgrade plant to handle increased population. Be able to handle pH, nitrogen, phosphorus, and endocrine disruptors.

– Floodplain development. We can't build any islands because it raises the flood level too much. Need to have better floodplain management.

Pool-wide riparian restoration/improvement

Improve fish passage through LD 2

Pool plans are generally accepted.

Pool 3 –
Water Quality – Prairie Island Nuclear Power Plant – reduce thermal loading.
Pool plans – number of backwaters identified for more depth. Different ranges might work better. Range of 0-6 feet with at least 5% at 6 feet of depth. Who suggested water depth indicators for pool plans? Mentioned that this was cartoonish. Some however need to be deepened for connectivity.

Fish Passage through LD3

How to protect St. Croix River from exotics.

– There is a master plan for St. Croix. May want to consult that. Terry Mohl/Steve Johnson.

Should be including St. Croix because part of authorized navigation project. There are some good habitat areas. There could be some benefit to restore backwater areas.

– Make sure that is goes up to Taylor Falls.

– Put invasive species control point at LD3. Stop zebra mussels from coming up. There is a nuclear power plant there. Maybe put hot water into the lock chamber or something.

Pool 3 – Flood plain forest needs improvement.

Marsh and Gantenbin Lake by lock and dam 3 WI. Want lateral floodplain connectivity for fish.

– Make sure that lots of the "C"s are reduce connectivity – Maybe use "IC" or "RC" for increase or reduce connectivity. Need to go back through the database.

– Connectivity used to mean open areas in the floodplain that had been cut off.

–We just need to be specific in the comments.

– That is why we used the term bank-full.

– Need to key this to a specific flow (1.5-year event) Clarify with Chuck Theiling.

Group 3 (Pools 4-6)

We didn't get any specific data for the 4 pools because we thought the pool plans were adequate.

Water Quality – Minimum of 1.5 meters in backwaters.
0 (zero) sedimentation in BW

Water Level Management
Range from no draw down to open river conditions.
Drought years are an important time for water level management. We thought that adaptive management was a necessary part of water level management.

–Pool plans did not state any specific draw down.

Maintain natural high water levels at the lower end of the pools. Reduce drawn down.

Natural sustainability of habitat type more than plants and animals.

– Lake Pepin will be gone because of MN river watershed. Reduce sediment loading to Lake Pepin from MN River.

– Delta is pretty nice habitat. Filling rate has been estimated at 300 years. Lake Pepin used to extend up to St. Paul. We will want to reduce the rate yet preserve the habitat. What is going on there is good and bad.

– We are assuming that this map accurately depicts the pool plans so we didn't want to waste time on them. Trusted that they were there.

– Pool plans represent stabilized system not restored system. Suggest a reduction in connectivity. 70-100% of flow confined to channel (MC, 2°, 3°) From pools 3-11. Mud flat, sand bar habitat and isolated wetland habitats need to be increased at less than bank-full (1.5 year events). Iowa put in what they thought they could do, not what we wanted to do. In upper pool, pool plans did not depict restoration, just what we thought we could do. So did not depict fisheries in closed areas. Pool plans represent what is necessary for populations to maintain themselves and handle stress, but not be what we ideally want. Understand that this will have to be actively maintained.

Theiling – In the Peoria meeting they said, "Oh, no, not another wish list". They didn't have a restored level verses other levels. Wish I had told them Gretchen's 5 levels.

– We are in a degraded system. Stabilized means that the endangered are still there and restored means that they are in a less threatened state.

– We use pre-settlement conditions as a reference. Set objectives for abundance for life. As far as system-wide, the thing to pay attention to is that we have raised the water surface profile. We have raised the water level tables in the floodplains. This has greatly affected our floodplain forests. We need to actively maintain our forests and increase height for trees.

<u>Group 2 (Pools 7-9)</u>

Not real site specific
Add floating aquatic.
Community changes with depth. Under restored system emergents from floating to submersed based on improved water clarity.
Reiterate need for watershed approach. Landuse planning, USDA tools.

Soileau – EPA would like us to set target ranges for tributaries so they could backtrack up into the watersheds for setting goals for sediment and contaminant loading.

– This is done for pool 2: Dan Engstrom and Alemendinger are the contacts involved in this effort.

Whole reach -Water Clarity in a fully restored system
Target date of 2010, in spring, disk reading of 1-meter in the main channel. Assumed it would be better in other areas. 2-meters in backwater.

– Locations where pool plans reduced connectivity.

– Is there a good study that is reliable for mass balance input of sediment above lock and dam 26 (input versus outflow)?

– Started with Simon and others. Nakato and others updated this for Pools 11-26. Does not include bed materials. As part of Navigation Study we hope to expand on this.

– Will this ultimately include bedload?

– Would like to see this but understand how difficult this will be to do.

– If you don't know where you are on the continuum it is hard to set priorities.

Theiling – We were cautioned in St. Louis that a sediment-starved river is a bad thing too.

– River and sediment go together like Ham and eggs. Conservation in 1930's has greatly reduced problems, but there are still stored sediments in beds and bank lines.

– LA is trying to open up tributaries to allow more sediment movement to help Gulf. Sediment bypass may be helpful to all.

– Someone in WES has developed a good model for estimating bedload movement.

– How can we use sedimentation and scour for habitat management? More recent projects have used these processes. Pool 8 islands phase 2 and 3. How do we manage for these processes that we know are out there?

– Quality of sediment is a big issue as well. There are a lot more nutrients then before.

<u>Group 1 (Pools 10-11)</u>

All things were pool wide
Target ranges
Water Quality –
Clarity Contiguous backwater: Target Range of 4 for summer average
Main Channel and Side Channel: Target Range of 3 for Summer Average
DO have daily minimum .5% 5ppm, 100%>3ppm
Velocity – BW -<or= 0.3 m3/sec during bank-full conditions.
Temperature >1 °C in Winter

More parameters
More extents (MC, SC, Contiguous Backwater, isolated Back Water
Geomorphology – Don't want drawdowns to be the same level or the same way. Need variety. Also look at water levels for winter, both high and low.

– Objectives for DO…Under the most pristine conditions we had swings in DO that went under 5ppm. As site specific planning we can accept areas that go anoxic. We know that several critters need anoxic conditions.

La Crosse Workshop November 19th – Day 2

Managements Actions – Chuck Theiling (8:15 – 9:25)

Chuck began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

Discussion Before Management Actions Working Groups:

– Our task is to identify tools. Are we to rank them now?

Soileau - No, just make sure they are on the list.

– For just our pools that we are assigned to?

Soileau -You can do the entire reach. However, if you know that there is an action that only ties to a specific area please list that in the comments.

– Have you used the crosswalk of management actions from the Pool Plans?

Theiling – No.

– I recommend that you use them.

Theiling - We will.

Soileau – If you have any other sources that would be helpful, please let us know.

Management Action Working Groups (8:25-10:21)

Management Action Plenary (10:21- 11:48)

Page W2-2 Water Quality

Group 1

Lots of discussion about what management actions are and what we are trying to achieve. Wrestled about how much detail we needed. Looked at the UMRCC report.
Water Clarity in the Main Channel -
Maybe island construction in the backwaters that reduce wind fetch so sediment resuspension won't affect the main channel.

Group 2
Redesign barge hulls to make more efficient.

Group 3
We thought that best management practices (BMP’s) were essential to all efforts. We also felt that algae production was related to BMP’s.

Group 4
Also felt that watershed BMP’s were important.

Page W2-3,4 Geomorphology

Group 1
Structures to maintain backwater depth – rock and bio-technical bank protections, islands see the group’s notes.

We could lower backwaters by closing upper end. Don’t need to have permanent structure. It could be a temporary sand plug.

Group 2
All in notes

Group 3
Didn’t understand what #39 meant, so deleted this.

Group 4
Using the power of the river to do work would be better than using diesel engines to perform work.

Agreed that connectivity was an overused word.
For #39 – clarified that to add elevation to islands and floodplains to grow trees.

Page W2-4 Geomorphology and Pattern of Habitats

Group 1
We discussed Lock & Dam as well as dike modifications. We recorded it in our computer notes.

Group 2
All in notes

Group 3
Felt that Item 61 was a duplicate to item 70 so deleted.

Group 4
All in notes.

Page W2-5 Pattern of Habitats

Group 4 (aquatic areas)
Width of bends is narrow so tows might have to wait for another and churn things up in the meantime. It might be good for protection of mussel beds.

Get a brief sentence for each management action describing what will be done and what the expected outcomes will be.

Theiling – Jeff and Jon did this in the UMRCC. We will be looking at this.

Group 1

–There is an advantage to increase width of main channel border areas. In historic times it experienced filling in of training structures. Increasing width will increase quantity and quality of main channel border. Management actions – remove dikes, notch wing dams, remove old dredge islands.

Group 2
All in notes.

Group 3
Confused about number #81 did it mean take area from floodplain?

Group 4
All in notes.

Page W2-6 Pattern of Habitats (cont)

Group 1
All in notes.

Group 2
All in notes.

Group 3
Discussion items of 97-100 that these were covered in other areas.

Group 4
Confused about #90.

Page W2-7 Plants and Animals

Group 1
First thing we did was to include 1-109 as efficient habitat restoration/management.

– These were mostly social and regulatory issues. However, if you don't have the habitat then you won't have the critters so need to address that first.

– We are going to need more than clichés. We are going to need causal mechanisms. We are going to get some hard questions that we are going to have to answer. How much investment are we going to need to develop adequate habitat?

– You are missing the microhabitats in our large overarching fish and population actions.

Soileau – So we need you to add in the microhabitat management actions. This wasn't intended to be exclusive.

– You are managing the forest for a certain species. So if I want a type of bird in the forest I will manage the forest for a certain species.

– We have been setting objectives in a very simple way. We could be using landscape (architecture) that we can be using to address very specific life forms. As we understand things more we will be creating management actions.

Soileau – Was there an explicit outcome for the education? (Under wildlife)

– Promote BMP's

Group 2
All in notes.

Group 3
#114 – What was the thinking on this?

– Adjust predator/prey relationships, commercial harvest. Directly managing biota rather than habitat.

Group 4
We talked about bio-manipulation.
Were concerned about invasive and aggressive exotics.

High water temperatures set zebra mussels back. During the hot summers have power plants do open water cycling to bring the water temperatures higher.

Need a fresh look at what is considered exotics.

There was a discussion about reintroducing mammoths, bison. These are native, but could be harmful.

<u>Page W2- 8 Plants and Animals, T&E</u>

Group 1

136 – May effect downstream by holding sediment back from sediment starved areas. Consider system-wide impacts before implementing any projects.

Group 2
All in notes.

Group 3
Consider changing 134. Distinguish CRP from land set aside programs. Don't limit yourself.

Group 4
All in notes.

– Implement the Galloway report recommendations. USDA, EPA, and FEMA need to be added to this study effort. They are controlling 3/4th of the pie. They control the drainage districts. So far we have not been successful in getting them involved at the local level rather than just the National level.

Theiling – You are right. They are involved in the NECC, and the Federal Task force.

– We need them involved in the local efforts.

– We do seem to get them more involved in the lower river and the Illinois River.

Theiling – The latest farm bill has lots of money for conservation. If we can get the local DC involved we can get some dollars and more importantly the contacts.

– Put together a main stem, multi-state CREP plan using CREP and WHIP dollars for the Mississippi River. Mostly there is a 20% match, but that has been waived in some cases. You should ask your senators for $'s from USDA.

–Hundreds of Millions of dollars are going to IL and MN for the basin. They don't have much of a scientific process to allocate that money. They don't have to show results. If we set some targets for delivery of materials to main stem it might wake some people up. If we had a quantitative model of sediment transport of materials in the system it would help. The USDA money is not being used in the most cost effective way. It is being done in a political manner.

– USDA knows this is a problem. The Corps, with all of it's planning, would be welcome at the USDA.

–We as a group can complain about USDA's culture and how it doesn't deliver conservation on the land efficiently. However, even if the USDA knew exactly which acres they wanted to put conservation treatment on to get the most efficient treatment they still have to have the landowners come through the door because the program is strictly voluntary. What we aren't doing is getting to the landowners themselves (part of nebulous education programs discussed earlier) and fostering an ecological conscience in people. USDA is only half of that bridge.

Theiling – In IL they have more people on the waiting list, so participation is not an issue, thought maybe targeted participation is. Corps is recognizing its role in the watershed.

– Take a look at the Great Reports and the Upper Mississippi River Comprehensive plan.

– What do you think about coming up with point source criteria for the tributaries?

Theiling -This is a golden opportunity to put a dot at each tributary.

Soileau – I spoke with someone in the EPA that would love to have us do this.

Theiling – We could do this regionally.

– We already have estimates of yields from each watershed in the Upper Miss. We can refine those. We can set realistic objectives for loading from tributaries. We should set targets for sediment loading and hydrologic regime of each of the tributaries.

Evaluation Tools and Data Chuck Theiling (11:48 12:00)

Chuck discussed evaluation data such as the LTRMP monitoring data, the state's fisheries sampling, aerial waterfowl censuses, and other data that might be used to evaluate ecological responses to restoration or to help evaluate cause and effect relationships among ecosystem components and stressors. Chuck also discussed evaluation tools such as conceptual and predictive models that have been or will be developed to help predict environmental response to restoration measures. Other tools available to evaluate restoration response include the large variety of sampling techniques used to evaluate plants and animal populations.

Lunch – 12:00 – 1:07

Species and Parameters – Chuck Theiling (1:07 – 2:28)

Chuck discussed some of the problems that were encountered when he was trying to set species target ranges for the objectives. He asked participants to offer suggestions as to the merit of doing this as well as for species and target ranges.

– There is some apprehension about setting species targets. Setting targets is risky. We can make decisions without knowing impacts on the systems. If we implement the habitat from the pool plans you can take the abundance and quality of that. Work on diversifying habitats as best as we can provide at that site – then use measured abundances as a healthy goal. In MN we are concerned about targeting for a specific species.

– Pre and Post project monitoring is important. Biological response for habitat monitoring. What is the biological concentration around the potential project? Need some more focused research from LTRM. See if current populations decline once a new project starts. Also look and that area's habitat (disease, dissolved oxygen, temperature) to ensure response is from project. If you have a great enough separation of sites you are probably not taking fish from one area, but are giving new habitat for larval drift.

–Worked with Carl Korschgen to create a matrix (Phase II Pool 8 island) (before HNA). Looked at a whole range of critters and vegetation classes.

- Look at the area where bluegills are the majority. The contiguous backwater is the main habitat of them. So, try to identify preferred habitat of organisms. Develop a matrix that would be more refined than phase II but take the same approach. Look at LTRM databases and query to find the percentages to determine preferred habitat.

–We don't fund EMP to a decent level so how are we going to get this kind of information? If there are certain ways we want to collect data are there any assurances that this will happen out in the future?

Theiling – This is important to ask in this kind of venue because it is telling the program managers this. Ken Barr and others have stated that they would like the monitoring (cause and effect) to become part of the adaptive management.

– You say money will be available for focused research, but what about baseline monitoring? We need more trend analysis and baseline information.

Theiling – Are you talking more historic baseline or today? Because some areas are better today than they were in history.

– There is a shift in species dominance over time – it takes 50-60 years to see a response to our actions.

Theiling – This brings in baselines. Also justifying existing impacts. Yes they are there, but let's go and find out what is causing certain degradation. So then we can build a predictive model to help us even more.

– We did that in phase II, however this was not focused research. A picture can speak a thousand words. Power analysis showed how low you could go but also how high you should go. We have data to justify the level of monitoring that is needed. If you think these numbers are important give us an idea of where the really good areas are. Maybe in 30-40 years we can fill this database.

Theiling – I appreciate the monitoring you do. Who thinks this needs to be written down? Does the Corps need to make arrangements to get it written down or support the states to write it down?

– In fisheries we have 10 years of data, but many species have longer life spans, so the data won't help. Not going to be able to pull out lots of data because of that.

– I can build my pop can because I have a design. But that is why we have adaptive management on the river because we don't have plans. I think that HREP and LTRM should have been tied together. Stoddard Island shows what EMP and HREP can do together. That is a success story. You will see bits and pieces but one of these days you will see these little cartoons come about. In each project we should have monitoring included.

– What don't you have now? We know that we built the project, Velocity, Temp, and DO improved. What else do you need to know? We are assessing data from our projects. It takes some time to get it published but it is there. We will never get biomass info from LTRM unless we want to spend a lot of money. We shouldn't worry about it because it isn't going to happen. We shouldn't tear apart the entire ecosystem into numbers.

–The real question I have now…are you saying we need this information to justify this program? I say no, there is no way we can do this.

Theiling – No one says you have to; however we may need to, in order to compete with other programs. If we could show that because a project went in we got x bluegills that are worth x $'s do the math and show how the economic benefits are better than the costs. They will see that the recreational benefits will outweigh navigation.

– The authority to use recreation benefits, as part of our environmental benefits, like navigation can, would be a good change.

Theiling – We need to come up with a model to estimate benefits better than everyone else.

– We did come up with Habitat Units (HEP). You are talking about revisiting this. Bottom line is that you should compare this dollar per dollar.

Theiling – No one is asking us or telling us to do this. But this is a good opportunity.

– This is the same problem we had before we developed HEP. But we don't need to do that. We need to show a little cartoon. But if that is not enough then we need to have another discussion. I don't think they went through a HEP analysis in Florida. If we do economic then we start to get into incremental analysis and only get what is cost effective. Adaptive management will be hard for Corps to do.

– It might be able to help us to prioritize.

– We want a sustainable river. Now we are where we get the biggest bang for your buck. If we do this we will overlook the subtle needs of the ecosystem that are essential for restoring sustainability. Something that is essentially critical for the system may cost a lot of money and not get a lot of return. What may be really, really important will be things that take a lot of work. Land acquisition will be very difficult, but we know we need that. Is that a top priority… we need all of the tools. It is all interrelated.

– We shouldn't worry about making the math justifying the expenditures. The justification will be political and social mostly anyway. Monitoring data should be collected to make sure you are making the correct investments. One of the big fallouts of the Everglades is that this Congress isn't going to write a blank check. They are going to want to see a higher level of detail (what project, when built, what outcomes). A lot of members have said, we aren't going to do that again. Come up with a suite of very specific projects with a built in monitoring program.

– If we are talking adaptive management we have to have some monitoring involved. We see response out there. Build in a standard 1% into the cost of the project. We could come up with some very simple monitoring aspects. We may have to get at more subtleties.

Theiling – If you are going to have objectives then you need to have a monitoring - accountability.

– That is why we need to look about the chemical response because the biological response takes time. It takes many years to monitor biological yet the chemical and physical response is almost immediate. Islands in Pool 8 at first didn't show the biological response. However the response took longer than the monitoring.

–Are the pools plans the kind of information that we can package up to Congress? Will this successfully get us $ to congress?

– It won't be enough today. You need to have specific projects. Here are the hypothetical projects that we would implement. Give Congress assurance that you have pegged the cost a little bit. Congress will want to see some thinking behind the numbers.

– What about the UMRCC.

– Some members see this as an unrealistically huge number because Members of Congress don't understand it. Also Congress thinks that the Corps can't handle it.

– Here is what we can handle annually now, here is what we could handle in the future. Show a curve of increasing amounts. It is hard to see the Corps numbers going way up, the members of Congress are having a visceral reaction to this. It would help me to show what you are monitoring for. A matrix of habitats or desired habitat would be a better index for monitoring.

– The HNA query tool could be used. It will generate a number for the bean counters. We could make this a log linear. This is a long process (the UMRCC is a need) that needs to get more money to the Corp, FWS and states.

– Are there some critters that we will monitor that we don't know much about? There is skepticism about what LTRMP is producing.

– There shouldn't be the skepticism because there was an EMP report to Congress that did that. As far as monitoring, we have had these discussions many times over. We monitor what we can with what funds are available. We've monitored both structural and functional. It would be good to fund the LTRM to be close to our objectives; to see if we are getting there (SMART Criteria). Long-term estimate of cost to some target future condition… we have a whole set of objectives with dates and we are required to do some plan formulation within the Navigation Studies. With regard to the size of the dollar figure, I'm not sure. There will be more data and plan formulation behind it.

– Does there come a time when you don't evaluate an HREP project because you know it works?

Theiling– Sure, ideally.

– Achieving ecological integrity is the ultimate goal of the objectives. As for species it becomes too overwhelming to have quantitative objectives for all guilds/species. Are there certain categories that are important (T&E or indicator species). The pool plans don't represent ecological health. Don't think so much about monitoring, but think about original goals and what you are trying to achieve.

–You are trying to get us to a different level in each project report. The problem is that by the time we are done in the entire river there will be new information that will cause us to do this again. So instead we need to show our evolution in our thought process… Look at effects outside the project area and other things have evolved. We cannot develop that level of detail. Let's just do it. We've got plans. We need to get down to work and do something. We need a propaganda person to start telling people that we have been doing a good job. We are beating everyone for dollars spent.

– Comments from John Sullivan – The environmental goals will have to be a multitude of things, we have to use some best judgment and others will have to trust us as we do them. There is a wealth of knowledge in the LTRM database and the Corps needs to mine that data out in the next year. Also use this to identify data gaps and figure out how to address them. The Corps should be financially supporting them in their effort.
We have to validate everything that we have gone before.

– Members of Congress think EMP is a valuable program. What they don't know is that EMP is not provided sufficient resources to implement to pool plans. You do have incredible integrity because you are scientists and that is your biggest tool. We need to get scientists up to the hill.

– What you are saying is that we need to tell Congress that EMP is a prototype and we need to implement the full thing.

– It will be a tough climb. Status and trends did not make good conclusions that common folks can understand.

– It is amazing where we have come in 4 years. We are in an exponential growth in what we believe we can accomplish, what we need, and what we know. This is because of HNA and LTRM. HNA gave us a true picture of what we need to do. Congress asked for HNA report and that is where the numbers came from.

– Perhaps for population or species we should stick with goals rather than developing this fine level of management with detailed objectives that we cannot accomplish. The USFWS has been going to mostly developing habitat rather than focusing on individual species.

– Are there indicator species?

Theiling – If money and time were no objects would you want total species indicators?

–Why?

– Look at sensitive species vs. exotics and see how they each respond to what we do. To look for really rare stuff the sampling effort is really big. Figure out over time if rare things dropped off and exotics boomed. Or vice versa.

– We have been measuring habitats, so if we see something that is desirable and describe what we want we can say this is what we are getting at. We are still able to look at numbers. Look at representative sites and use this.

- We still need to do spatial study (land cover, hydrology, changes in land form). That gets us a long way to look at the physical patterns of the systems. Come to agreement on array of organisms to monitor to come up with condition of the ecosystem. We need information about abundance of life. There is a compilation of non-LTRM data through the UMRCC.

– We need to put this in context that the Congressman can understand.

– The farm bill is a perfect example of how Congress wants feedback.

– We will have to do what we can and keep it real simple. Our 404 dredging study has taken a lot of individual studies. How much detail will we have to do? Do it at every project or make some assumptions.

<u>Conceptual Models Hank DeHaan (2:28 –3:00)</u>

Hank provided participants with some background regarding the conceptual model, as well as an overview of the purposes for having a conceptual model. He then displayed the conceptual model in it's current form as well as a more simplistic diagram that gave an example of how the model might be used to asses the effectiveness of a management action.

<u>Discussion of Conceptual Models</u>

– You want this model upfront to justify the amount of money?

DeHaan – This is upfront to help us identify alternative plans that use several management actions to address several objectives.

– We are still assuming that we want everything, not just the cheap stuff.

– If we know we need all of the tools in the toolbox, why even bother do this model? This will be ruling things out, yet we want this big list. You need to do the same thing to the navigation.

– This might help with sequencing and prioritization.

– You need to have all of your tools available to be able to do this. With channel maintenance you need all of them (might have drought and might have flood). Do a ramp down in funding rather than a ramp down in importance. Your desire to do this by science isn't going to happen. It makes it harder to do adaptive management.

– Adaptive Management is based upon scientific learning. In this case we want to provide good answers to people who ask. We want ongoing adaptive and integrated river management program. This includes the full range of doing things. What combination of things will get us there? One of the best ways of doing this is a conceptual model. "This will be a better set of combinations will be more effective than this other combination" We have to do this as a federal organization. Yes we know that there will not be an even application of management actions in time or space, but this will help us provide scientists credibility to win us Congressional funding.

– We want everything, we don't want anything cut out of this.

Theiling – That is incremental analysis used incorrectly.

DeHaan – This is a tool to justify the site-specific projects and educate congress. This is sequencing, not prioritization. The conceptual model will help to identify how to proceed forward.

– I've never seen that work. You all ways get less than what you need.

– There is a planning process that we are obliged to follow. That does not call for incremental analysis, but it does call for a comparison of alternative plans. You are getting what you want in the most economically and efficient manner.

Theiling – I wish I could say that this program will recommend everything, but it is not going to. But I don't think that the conceptual model is going to be doing this, it will be political. The conceptual model will help evaluate how well management actions address objectives.

– The model doesn't concern me, incremental analysis does.

– How will you validate this?

Theiling – You don't evaluate an entire conceptual model. Some parts will be pulled out as predictive and those may be evaluated.

– What you are doing makes some sense. We have never prioritized this. You have to see what will work best for the system. I am hoping your approach will do this. We have to have some reality that there will be a sequence to do this.

– Did they use a conceptual model and incremental analysis on the Everglades?

- They did use conceptual model but not incremental analysis.

When will output come out – mid December for the workshop, March for the conceptual model. Stuff from Bartell can be given out soon.

Please send us model outcomes as soon as you can.

–Some of the assumptions in the Large River Conference need to be validated for the Mississippi River. Validate and make sure you are looking at the Mississippi river. We can make some errors and run down the wrong path if we take the wrong approach. The model better look at the correct factors. Some of the goals and objectives are not good for this area. Hopefully the expert panel will pick that up. This model should have a funding/implementation level to it. Say we fund one but not all, or fund all but at different levels. We would prefer some money for all tools rather than all money for some tools. Prioritize through adaptive management.

– we went through AEA approach. Look at a file for the AEA stuff.

Appendix D. Participant Introductions

All the participants were asked to write down an answer to the question printed on page 4 of the workshop handout: “What do you hope this workshop will accomplish?” Then all participants introduced themselves to the group and read their answer to the question. The first list below contains the answers that were taken directly from the written forms that were turned in. Not everyone put his or her name on the form. Following the first list is the set of verbal responses that was captured as part of the meeting minutes. The verbal responses are included because they were substantially different than the written responses that had no identification.

WRITTEN RESPONSES

1. - Link Nav Study & Upper Mississippi River Refuge Comprehensive Conservation Plan (15-yr. Outlook) activities.
   - Link objectives to the term sustainability.

2. Kucera -- Determine feasibility of providing consistent application of restoration *and* sustainability objectives on entire reach of upper Mississippi including reach from L/D 26 to Cairo.

3. Anderson -- I hope the environmental side of the river system will be given the same or greater degree of attention to the navigation side.

4. - A better understanding of the potential for habitat protection and habitat restoration as the plans for continued expansion of navigation on the Mississippi River. I’d like to see positive evidence for a hope that a balance can be achieved between navigation needs and the needs for ecological diversity.

5. - Clarify all of the information out there and how to pull it together into a cohesive vision for protecting & restoring biodiversity.

6. - Give us an idea of how Nav study is going to treat the natural resources component.

7. - Identify what can be realistically accomplished.

8. - To further define & refine the environmental objectives & goals.

9. - Consistency between Nav Study and the current St. Paul District’s L/D 2-10 embanking study environmental enhancements.

10. - Establish a plan for the future of the river. Work for common goals.

11. - Continue programmatic planning toward comprehensive river management, with specific progress toward setting quantifiable objectives for habitat patterns & keystone species abundance.

12. - A compilation of realistic goals and objectives for further refinement of systemic needs of the ecosystem. The systemic needs should be general and not supercede detailed analysis and implementation at the systemic level.

13. Cox -- I hope that this workshop will focus on identifying regional differences and try to find ways to achieve better consistency.

14. - More concrete, definable goals for sustainability. How LTRMP, the program I work in, can help.

15. -Learning.

16. - Learn more about how this process will build on previous exercises. How will this process build on planning efforts already done or underway?

17. - Get a good start on getting objectives for condition of the UMRS ecosystem… leading to adaptive and more integrated river management.

18. Benjamin -- Validate past work done by most of the people in this room that represents a course of action to begin adaptive stabilization and eventual restoration of the river's ecosystem.

19. Schlazft --Determine steps needed (policy changes, funding) to implement the pool plans.

20. - Help me gain a better understanding of the navigation study.

21. Pinkard -- Determine if additional study support by Corps CHL is needed.

22. - Environmental pool plans and UMRCC cost estimates used to fulfill first 2 general objectives.

23. - Understand alternative objectives and how they can be accomplished.

24. - Achieve consensus, or identify & discuss areas of difference regarding goals & objectives for the UMR system and river management actions to achieve the goals & objectives.

25. - Identify practical methods to implement river management actions.

26. DeZellar -- Use info from workshops to help in preparing UMRCP & enhancement maintenance study (L/D 2-10).

ADDITIONAL VERBAL RESPONSES

27. Kucera – Pools north of St. Louis are well taken care of. St. Louis to Cairo has suffered the greatest. We are forming a national committee to study sediment input. If you have knowledge, we are looking for scientists.

28. Cox – Learn more about the upper river. Focus on the regional differences and focus on consistency.

29. Barr – Shared understand of the objectives.

30. Janvrin – Worked on Pool Plan.

31. Stefanik – How we can take the work and efforts already done and incorporate it in the Navigation Study.

32. Andersen – I want to see the environmental end of the river gets as much consideration as the navigation.

33. Faber –What new tools can be developed to implement the pool plans. Need to ensure that we have adopted proper scope, and who pays.

34. Hultman –Here to ensure the refuge prospective is taken into account.

35. Otto – Let’s see how some of this stuff will become implemented.

36. Ron Benjamin – I have no preconceived notions.

37. Lubinski –Want to ensure the opportunities where scientists can help with management mission. Where we can help we will. We will support a unified vision.

38. Stravers – Seek a balanced approach where we can find partners to fund this. Need to keep middle river in mind.

39. Brecka – Help out where I can and bring in local knowledge.

40. Tapp – Understand objectives.

41. Driesland – Curious to see how these efforts will fit together.

42. Pinkard – Learn more about the upper Miss. See if the Coastal and Hydraulics lab can offer assistance.

43. Eric Nelson – Hope we don't lose any endangered species on our watch.

44. Wege – Don't have a good idea of the scope. Get to an understanding of these scopes.

45. Croker – I am here to listen.

46. Rhode – Eager to hear the objectives and management actions.

47. Lee Nelson – Listen and hopefully see the beginning of getting things off dead center.

48. McCalvin –Get a feel where TNC might play a role.

49. DeZellar –Practical methods for the management actions. Keeping an eye on the process to make sure objectives and management actions are usable. Keep things consistent between Comp. plan and Navigation study.

50. Johnson – Let's use the Pool plans and the HNA; not reinvent the wheel.

51. Schlagenhaft – Lead to funding and positive changes to implement pool plans. These represent a common vision.

52. Benjamin – Hope this will validate all of the other efforts.

53. Wilcox – Encouraged seeing this group integrate the complete set of pool plans.

54. Nissen – Put this all together in the adaptive management.

55. Duckerschein – See what kinds of integrated objectives. See how our organization can aid in this effort.

56. Gulan –See how this study correlates with COMP study.

57. Powell – See this workshop be another step forward in coming up with an overall plan.

58. Zigler – Learn about the process and help in any way I can.

Appendix E. Environmental Objectives

Purpose:
To have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts.

Background:
Objectives are incremental steps taken toward achieving a goal and thus may be goal specific. They are a concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it. Objectives provide the basis for determining management actions, monitoring accomplishments and evaluating the success of management actions. There may be multiple objectives for a goal. Participants were asked to review, revise if necessary, and supplement the Environmental Objectives taken from previous work (HNA, Pool Plans, etc.) to achieve the Navigation Environmental Coordination Committee (NECC)/Economics Coordinating Committee (ECC) UMR-IWW Navigation System Vision:

"To seek long term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System."

The working groups were specifically tasked to apply the widely known SMART criteria to each objective making them: specific, measurable, achievable, results –oriented, time-specific.

The participants were asked, for the purposes of this workshop, to utilize the following two sets of goals as a framework for setting objectives.

Ecosystem Goals (from Interim Report)
During planning for the 1994 Upper Mississippi River Conservation Committee (UMRCC) Ecosystem Management Initiative, resource managers agreed to adopt Grumbine's (1994) ecosystem management goals (Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology* 8(1): 27-38.):

Goal 1: Maintain viable populations of native species in situ.
Goal 2: Represent all native ecosystem types across their natural range of variation.
Goal 3: Restore and maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.).
Goal 4: Manage over periods long enough to maintain the evolutionary potential of species and ecosystems.
Goal 5: Integrate human use and occupancy within these constraints.

The UMRCC expanded their list of goals in the *A River That Works and a Working River* (2000) document. These goals are:

1. Improve water quality for all uses,
2. Reduce erosion and sediment impacts,
3. Restore natural floodplain,
4. Restore natural hydrology,
5. Increase backwater connectivity with main channel,
6. Increase side channel, island, shoal, and sand bar habitat,
7. Minimize or eliminate dredging impacts,
8. Sever pathways for exotic species introductions/dispersal,
9. Improve native fish passage at dams.

Working Group Process

The process began with participants dividing into four groups based in part on their expertise within four segments of the UMR. The four geographic regions were: Pools 1-3, Pools 4 - 6, Pools 7 - 9, and Pools 10 - 11. Group 1 worked on Pools 10 - 11, Group 2 worked on Pools 7 - 9. Group 3 covered Pools 4 - 6. And Group 4 covered Pools 1 - 3. Working groups were tasked with first setting reach and pool-wide objectives and then reviewing and setting site-specific objectives within their section of the river. If groups finished their section and had time remaining they could extend into the adjacent areas.

When setting site-specific objectives, participants were asked to use the data structure outlined in the Framework for Setting Objectives (Figure E1). This hierarchical structure categorizes environmental objectives into four primary ecosystem elements and then breaks these down into more specific parameters, extents, and target ranges. In addition to this information, participants were also asked to consider and note (if possible) the seasonality, frequency of occurrence, target date, and any other comments associated with the objectives they identified. This data framework provided a means to capture and merge objectives from previous study efforts, and those identified by workshop participants, into one standardized database. Additional objectives not found in the framework were also identified and added to the database using the established data structure (e.g., Invertebrates was added under Plants and Animals

Ecosystem Element	Parameter	Extent	TR	Target Range
Water Quality	Water Clarity	Main Channel	1	Secchi disk transparency 0.3 m
		Backwater Areas	2	Secchi disk transparency 0.7 m
			3	Secchi disk transparency 1.0 m
			4	Secchi disk transparency 1.5 m
			5	Secchi disk transparency >2.0 m
Geomorphology	Backwater Depth	Backwater Areas	1	100% of area <1 m
			2	50% of area 1 - 2 m
			3	50% of area 2 - 3 m
			4	50% of area >3 m
	Water Level	Main Channel	1	0.3 m below project pool at dam
		Backwater Areas	2	0.6 m below project pool at dam
			3	1.0 m below project pool at dam
			4	>1 m below project pool at dam
	Connectivity	Floodplain	1	0% floodplain area inundated during 10 year flood
			2	20% floodplain area inundated during 10 year flood
			3	40% floodplain area inundated during 10 year flood
			4	80% floodplain area inundated during 10 year flood
			5	100% floodplain area inundated during 10 year flood
		Secondary Channel	1	<20% of year
			2	20-40% of year
			3	40-60% of year
			4	60-80% of year
			5	>80% of year
		Longitudinal	1	0% chance of fish passage
			2	20% chance of fish passage
			3	40% chance of fish passage
			4	80% chance of fish passage
			5	100% chance of fish passage

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem.

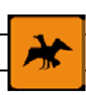
Ecosystem Element	Parameter	Extent	TR	Target Range
Pattern of Habitats	Aquatic Areas	Main Channel	1	<10% of area
		Secondary Channel	2	10-20% of area
		Tertiary Channel	3	20-40% of area
		Impounded Area	4	40-60% of area
		Contiguous Backwater	5	>60% of area
		Isolated Backwater		
	Terrestrial Areas	Contiguous Floodplain	1	<10% of area
		Isolated Floodplain	2	10-20% of area
		Island	3	20-40% of area
			4	40-60% of area
			5	>60% of area
	Land Cover/Use	Open Water	1	<10% of area
		Submersed Aquatics	2	10-20% of area
		Emergent Aquatics	3	20-40% of area
		Grassland	4	40-60% of area
		Shrub	5	>60% of area
		Forest		
		Agriculture		
		Developed		
Plants and Animals	Plants	Emergent Aquatics	1	<10 plants/m2
		Submersed Aquatics	2	10 - 20 plants/m2
			3	20 - 50 plants/m2
			4	50 - 100 plants/m2
			5	>100 plants/m2
	Fish	Protected Fish Species		CPUE, Length distribution, or kg/ha
		Sport Fish Species		
		Commercial Fish Species		
		Forage Fish Species		
		Exotic Fish Species		
	Birds	Dabbling Ducks	1	0 - 1,000 use days/yr
		Diving Ducks	2	1,000 - 10,000 use days/yr
			3	10,000 - 100,000 use days/yr
			4	>100,000 use days/yr

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem, continued.

Results:
The environmental objective information gathered and reviewed at the La Crosse Workshop has been organized into the following four sections. They include a pool-wide objectives table, site-specific objectives table, plenary report, and working group reports.

Pool-wide objectives identified by workshop participants were compiled from comments recorded in the plenary sessions, working group reports, group worksheets, and atlas map notations (Table E1). In cases where management actions were recorded, an objective was created and the management action was listed in the comments section, denoted by "MA".

Site-specific objectives and supporting information identified and reviewed by workshop participants are listed by pool (Table E2) and organized to follow the Framework for Setting Objectives format (Figure E1). These objectives were compiled from previous study efforts, participant comments during the plenary session (with GIS tools), working group reports, group worksheets, atlas map notations. The objectives identified in the workshop were recorded exactly as written. For the final integrated report, site-specific objectives will be standardized, new parameter icons may be created and similar comments will be assimilated into one comment.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

Examples of objectives at various scales were given as guidelines, they included:

- *System* – Restore X acres of secondary channel habitat system wide,
- *Reach* – Increase the amount of marsh habitat by X acres in the Open River Reach of the Mississippi River,
- *Pool* – Return Pool 13 to a more natural hydrologic regime by having a 90 day low water stage X feet below maximum pool elevation during late summer every three years,
- *Local* – Increase the average depth of backwater area X to six feet.

Table E1. Pool-wide Environmental Objectives (Pool 1 – Pool 3 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Other	Tributaries					Decrease sediment loading from tributaries.
Geomorphology							
	Water Level				10	2015	Seasonal Drawdown
	Connectivity	Longitudinal					Fish passage at all Locks and Dams.
	Other						Reduce bank erosion. - MA boat wakes, off-shore revetments
Pattern of Habitats							
	Land Cover/Use	Forest					Actively manage floodplain forest. MA - Create higher elevation floodplain areas to support less water-tolerant native floodplain plants - mast tress, prairie, etc. MA - Plant trees.
Plants and Animals							
Other							
	Other						Need for more public lands.

Table E1. Pool-wide Environmental Objectives (Pool 4 – Pool 6 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Water Clarity	Backwater Areas	>4	Non-flood			Secchi disk reading of 1.5m or greater.
	Sedimentation						Net sedimentation rate of zero
Geomorphology							
	Backwater Depth	Backwater Areas					Diversity of depths to address loss of aquatic habitat. MA - Use pool plans - dredge open water areas with "D" designation for winter fish habitat.
	Water Level	Main Channel and Backwater Areas					Create a more natural hydrograph. MA - Conduct drawdowns riverwide during drought conditions. MA - Strive for more stable pool tail water levels. MA - COE shift management to reduce hinge point (to Lock and Dam control).
	Connectivity	Floodplain	5		5		Enhance connectivity between main channel and backwaters. Key on areas designated with a "C" in the Pool plans, particularly in the upper ends of Pools 5, 5A, and 6. MA - Breach levees on the Zumbro River
		Secondary Channel	5				Enhance connectivity or restrict it as appropriate - see "C"s on pool plans.
		Longitudinal	5				Support Pool Plan design as shown as optimal.
Pattern of Habitats							
	Aquatic Areas						See Pool Plans
	Terrestrial Areas						See Pool Plans
	Land Cover/Use						See Pool Plans
	Other						100% of quality natural habitat sustainable through natural processes.
Plants and Animals							
Other							
	Other						Environmental Pool Plans were agreed upon by Group 3 to be acceptable and representative of the group's views.

Table E1. Pool-wide Environmental Objectives (Pool 7 – Pool 9 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Water Clarity	Main Channel	3	All	10	2010	Will do better in summer and winter. Includes watershed work.
		Secondary Channel	4	All	10	2010	Will do better in summer and winter. Includes watershed work.
		Impounded Areas	5	All	10	2010	Can be achieved with management actions
		Backwater Areas	5	All	10	2010	Already achieved in some backwaters
	Other	All					Sufficient dissolved oxygen to support aquatic life.
Geomorphology							
	Backwater Depth	Backwater Areas	Varies	All			Greater and sufficient depth diversity
	Water Level	Main Channel and Backwater Areas	1-4	Growing Season			See Group 2's working group notes.
	Connectivity	Floodplain					Root River - Not many in Pool 7-9
		Secondary Channel					See Group 2's working group notes.
		Longitudinal					Fish passage at all locks.
Pattern of Habitats							
	Aquatic Areas						Refer to Pool Plans.
	Terrestrial Areas						Forests are middle-age to old.
	Land Cover/Use	Grassland					Land-use planning
		Other					Submersed vegetation to 2m. As minimum, do pool plan.
Plants and Animals							
	Plants						Eliminate nuisance exotics. Preserve native species/communities.
	Plants	Emergent Aquatics	3 (20-50 stems/m2				

Table E1. Pool-wide Environmental Objectives (Pool 7 – Pool 9 Reach cont.).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Plants and Animals (cont.)							
	Plants	Submersed Aquatics	4-5				
	Plants	Other	10-20 plants/m2				
	Plants						Overlap is needed between categories (mosaic of plants, i.e. diversity).
	Fish						Preserve native species.
	Birds						Enhance habitat in traditional areas as well as elsewhere. Give the birds alternative areas to go to.
Other							

Table E1. Pool-wide Environmental Objectives (Pool 10 – Pool 11 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Water Clarity	Main Channel/ Secondary Channel	4	Summer Average	10	2025	
		Other	4	Summer Average	10	2025	
	Other	Main Channel/ Secondary Channel	>5.0ppm	All	10	2010	
		Backwater Areas	75% > 5ppm 100% > 3ppm	Summer Average	10	2010	To be met as daily minimum
	Velocity	Backwater Areas	Average <= 0.3 m/sec	Up to Bankfull	10	2040	To meet during bankfull conditions.
	Temperature	Backwater Areas	>1°C	Winter	10	2030	
Geomorphology							
	Backwater Depth	Backwater Areas	100% water depth >1meter	Winter	10	2025	
	Water Level	At Dam	Variable	Summer	3-7		
Pattern of Habitats							
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 1).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Other	Entire Pool			10	2010	Complete storm/sanitary drain separation.
		Entire Pool			10	2010	Implement spill detection and warning system.
		Entire Pool			10	2020	Treat urban storm water.
Geomorphology							
Pattern of Habitats							
	Land Cover/Use	Forest					Actively manage floodplain forest. MA - Create higher elevation floodplain areas to support less water-tolerant native floodplain plants - mast trees, prairie, etc. MA - Plant trees.
Plants and Animals							
Other							
	Other	Entire Pool			10		Clean up trash along river banks.

Table E1. Pool-wide Environmental Objectives (Pool 2).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Other	Entire Pool					Treat urban storm water
Geomorphology							
Pattern of Habitats							
	Land Cover/Use	Forest					Actively manage floodplain forest. MA - Create higher elevation floodplain areas to support less water-tolerant native floodplain plants - mast trees, prairie, etc. MA - Plant trees.
Plants and Animals							
	Other						Protect mussels - recovering community.
Other							
	Other	Entire Pool			10		Clean up trash along river banks

Table E1. Pool-wide Environmental Objectives (Pool 11).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
	Connectivity	Floodplain	5	flood event	1	2000	
		Other		up to bankfull	10	2050	% chosen as average connectivity in upper sections of pools during bankfull stage.
Pattern of Habitats							
	Land Cover/Use	Forest					Actively manage floodplain forest. MA - Create higher elevation floodplain areas to support less water-tolerant native floodplain plants - mast tress, prairie, etc. MA - Plant trees.
Plants and Animals							
	Other						Protect mussels - recovering community.
Other							
	Environmental Clean Up	Entire Pool			10		Clean up trash along river banks

Table E2. Site-specific Environmental Objectives (Pool 1).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Longitudinal					
Geomorphology	Other				10	2015	Restore Rapids, St. Anthony falls to L&D1
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffle
Pattern of Habitats	Terrestrial Areas	Island					Island development for riparian corridor, RM 858-854
Pattern of Habitats	Land Cover/Use	Open Water					
Pattern of Habitats	Land Cover/Use	Grassland					

Table E2. Site-specific Environmental Objectives (Pool 2).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Other						Reduce loading of nitrogen, phosphorus, and endrocrine disrupters
Water Quality	Other						Reduce nitrogen, phosphorus, algae, and sediment
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 2 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Water Level	Backwater Areas					See Long Meadow Lake HREP
Geomorphology	Water Level	Other					Moderate the hydrologic regime of the Minnesota River
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Other			10	2015	Rapids/Riffles
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					

Table E2. Site-specific Environmental Objectives (Pool 2 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Land Cover/Use	Open Water					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					

Table E2. Site-specific Environmental Objectives (Pool 2 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Long Meadow Lake HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 2 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					

Table E2. Site-specific Environmental Objectives (Pool 2 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					See Long Meadow Lake HREP

Table E2. Site-specific Environmental Objectives (Pool 3).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Other						Reduce thermal loading
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation

Table E2. Site-specific Environmental Objectives (Pool 3 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Fish passage structure, fish passage through the slough
Geomorphology	Connectivity	Floodplain					For Marsh and Gattinbine Lakes, Gattinbine Sub-Area Complex
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 3 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table E2. Site-specific Environmental Objectives (Pool 3 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Plants and Animals	Other						Invasive species control point
Plants and Animals	Other						Limit northward migration of exotic species

Table E2. Site-specific Environmental Objectives (Pool 4).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years

Table E2. Site-specific Environmental Objectives (Pool 4 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Other						Reduce sediment loading from Minnesota River, Filling upper portion of Lake Pepin
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Water Level	Backwater Areas					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity

Table E2. Site-specific Environmental Objectives (Pool 4 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table E2. Site-specific Environmental Objectives (Pool 4 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					

Table E2. Site-specific Environmental Objectives (Pool 4 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table E2. Site-specific Environmental Objectives (Pool 4 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat

Table E2. Site-specific Environmental Objectives (Pool 5).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years

Table E2. Site-specific Environmental Objectives (Pool 5 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years, See Spring Lake Islands HREP
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					See Spring Lake Islands HREP
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table E2. Site-specific Environmental Objectives (Pool 5 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Impounded Area					See Spring Lake Islands HREP
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					See Spring Lake Islands HREP
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Spring Lake Islands HREP

Table E2. Site-specific Environmental Objectives (Pool 5 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					

Table E2. Site-specific Environmental Objectives (Pool 5 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat, See Spring Lake Islands HREP
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat, See Spring Lake Islands HREP

Table E2. Site-specific Environmental Objectives (Pool 5a).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 5a cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					

Table E2. Site-specific Environmental Objectives (Pool 5a cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Other	Other						Land easements or acquisition
Other	Other						Land easements or acquisition
Other	Other						Land easements or acquisition

Table E2. Site-specific Environmental Objectives (Pool 6).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years

Table E2. Site-specific Environmental Objectives (Pool 6 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				In non-flood years
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Water Level	Backwater Areas					
Geomorphology	Water Level	Backwater Areas					
Geomorphology	Water Level	Backwater Areas					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					

Table E2. Site-specific Environmental Objectives (Pool 6 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Other	Other						Land easements or acquisition
Other	Other						Land easements or acquisition

Table E2. Site-specific Environmental Objectives (Pool 7).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	All Year	10	2010	Water quality objective for all secondary channel habitat, Pools 7-9
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Water quality objective for all main channel habitat, Pools 7-9
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Will do better in summer and winter
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Other					

Table E2. Site-specific Environmental Objectives (Pool 7 cont.).

Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Water Level	Backwater Areas					
Connectivity	Floodplain					
Connectivity	Floodplain					
Connectivity	Floodplain					
Connectivity	Floodplain					
Connectivity	Floodplain					Use levee to reduce connectivity
Connectivity	Longitudinal					
Aquatic Areas	Secondary Channel					
Aquatic Areas	Secondary Channel					
Aquatic Areas	Secondary Channel					
Aquatic Areas	Impounded Area					
Aquatic Areas	Impounded Area					
Terrestrial Areas	Island					
Terrestrial Areas	Island					
Terrestrial Areas	Island					
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection
Terrestrial Areas	Island					Island Protection

Table E2. Site-specific Environmental Objectives (Pool 7 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					

Table E2. Site-specific Environmental Objectives (Pool 7 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					

Table E2. Site-specific Environmental Objectives (Pool 8).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Water quality objective for all main channel habitat, Pools 7-9
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	All Year	10	2010	Water quality objective for all secondary channel habitat, Pools 7-9
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas

Table E2. Site-specific Environmental Objectives (Pool 8 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 8 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					

Table E2. Site-specific Environmental Objectives (Pool 8 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table E2. Site-specific Environmental Objectives (Pool 8 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 8 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Other	Other						Land easements or acquisition
Other	Other						Land easements or acquisition
Other	Other						Land easements or acquisition

Table E2. Site-specific Environmental Objectives (Pool 9).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	All Year	10	2010	Water quality objective for all main channel habitat, Pools 7-9
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	All Year	10	2010	Water quality objective for all secondary channel habitat, Pools 7-9
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas

Table E2. Site-specific Environmental Objectives (Pool 9 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	All Year	10	2010	Already achieved in some backwater areas
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 9 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					See Capoli Slough HREP
Geomorphology	Backwater Depth	Backwater Areas					See Capoli Slough HREP
Geomorphology	Backwater Depth	Backwater Areas					See Conway Lake HREP
Geomorphology	Backwater Depth	Backwater Areas					See Harpers Slough HREP
Geomorphology	Backwater Depth	Backwater Areas					See Harpers Slough HREP
Geomorphology	Backwater Depth	Backwater Areas					See Harpers Slough HREP
Geomorphology	Backwater Depth	Backwater Areas					See Pool Slough HREP
Geomorphology	Water Level	Main Channel	Other				Variable drawdown as needed to restore vegetation
Geomorphology	Water Level	Backwater Areas					See Pool Slough HREP
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure, See Capoli Slough HREP
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure, See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					

Table E2. Site-specific Environmental Objectives (Pool 9 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					See Capoli Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Conway Lake HREP
Pattern of Habitats	Terrestrial Areas	Island					See Conway Lake HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Capoli Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP

Table E2. Site-specific Environmental Objectives (Pool 9 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, See Harpers Slough HREP
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Conway Lake HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Conway Lake HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Conway Lake HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					See Pool Slough HREP

Table E2. Site-specific Environmental Objectives (Pool 9 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics, See Capoli Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest

Table E2. Site-specific Environmental Objectives (Pool 9 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Capoli Slough HREP
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Conway Lake HREP
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest, See Harpers Slough HREP
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat
Pattern of Habitats	Land Cover/Use	Other					Sand/Mud Flat, See Capoli Slough HREP

Table E2. Site-specific Environmental Objectives (Pool 10).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer			Water quality objective for all main channel and secondary channel habitat, Pools 10-11
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				

Table E2. Site-specific Environmental Objectives (Pool 10 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m				

Table E2. Site-specific Environmental Objectives (Pool 10 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Other			All Year	10		DO objective for all main channel and secondary channel habitat, DO >5 PPM, Pools 10-11
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 10 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					Sediment trap
Geomorphology	Water Level	Main Channel	Other	Sum. + Win.	5	2005	Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table E2. Site-specific Environmental Objectives (Pool 10 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Tertiary Channel					
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Wetland restoration
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					

Table E2. Site-specific Environmental Objectives (Pool 10 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					

Table E2. Site-specific Environmental Objectives (Pool 10 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Other	Other						Land easements or acquisition
Other	Other						Land easements or acquisition

Table E2. Site-specific Environmental Objectives (Pool 11).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer			Water quality objective for all main channel and secondary channel habitat, Pools 10-11
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer	10	2010	Water quality objective for all main channel and secondary channel habitat, RM 608-615
Water Quality	Water Clarity	Main Channel	Secchi disk transparency 1.0 m	Summer	10	2025	Water quality objective for all main channel and secondary channel habitat, RM 583-608
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	

Table E2. Site-specific Environmental Objectives (Pool 11 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency >2.0 m	Summer	10	2010	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2025	
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.5 m	Summer	10	2010	
Water Quality	Other			All Year	10		DO objective for all main channel and secondary channel habitat, DO >5 PPM, Pools 10-11
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 11 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Water Level	Main Channel	Other	Sum. + Win.	5	2005	Variable drawdown as needed to restore vegetation
Geomorphology	Water Level	Backwater Areas					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Use levee to reduce connectivity
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure

Table E2. Site-specific Environmental Objectives (Pool 11 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
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Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table E2. Site-specific Environmental Objectives (Pool 11 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					

Table E2. Site-specific Environmental Objectives (Pool 11 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Grassland					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Other	Other						Land easements or acquisition

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

Nov 18th, Objectives Plenary Session:
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary (Pools 10-11)

Brought people up to speed on pool plans. Decided UMRCC addressed common objectives for the pools. Looked at framework and added things in. Added several water quality parameters. Weren't comfortable with backwater depth ranges but couldn't come up with something better. Water levels – "added increase water level for over wintering EMP monitoring". Look at dropping water levels in the winter as well. Connectivity – Pools are inundated 100% at the 10-year flood, so maintain current conditions. Added bank full connectivity parameter. Feel that there is too much connectivity. Too many areas have flow 365 days of the year. 15% is the average for connectivity for Pool 11. Sediment transport may be another parameter. Acquire a more natural sediment regime in the pools, but didn't come up with target ranges. In Plants and Animals we didn't feel that many animals were well represented. Need to modify target use days because these pools already exceed the given range (2 billion use days would be better range).

–35 million use days is maximizing the refuge. Never the less, range is definitely low

Group 2 Summary (Pools 7-9)

Looked at reach. Started to look at framework. Need to explore reconnecting Root River to floodplain. Questioned ranges of target ranges.
Water levels – draw down is good
Water depth in backwaters –refer to pool plans.
Spent lots of time in pool plans to familiarize everyone in the group
Need to add "Floating Aquatics" in Aquatic Areas
Terrestrial Areas – Land use/cover – concerned about target ranges.
Plants and animals – why more guilds aren't included and also questioned use days.
Overall – this was a good discussion.

Group 3 Summary (Pools 4-6)

Started to talk about pool plans.
Went through ecosystem elements and looked to see what was different from the pool plans

Group 4 Summary (Pools 1-3)

Discussed pool plans, HNA and Cumulative Effects to give everyone a background as to where info came from.
Pools 1-2 are different because they are very urban.
Pool –Reach-Wide Objectives:
Potential contaminant spills – need early warning system.
Need to treat urban storm water runoff
Need to have annual trash clean up along river
More effort to separate storm and sewer in twin cities
MN River conveys lots of sediment, phosphorus and algae… needs to be reduced.
Lot of boating traffic causing bank erosion. Need education and structural means to deal with this.
Fish passage – improve through the dams. However, concerned about movement of exotics.
More trees for a more continuous corridor for riparian habitat.
Rapids by St. Anthony Falls – Lock and Dam 1 floods the area to a considerable depth. There might be an opportunity to open up Dam 1 and let fish migrate up to St. Anthony's fall.

Site Specific Objective Setting for La Crosse (3:30)
Once each group gave their report we then started at St. Anthony Falls and moved down river, allowing all participants to provide input.

Group 4 (Pools 1-3) specific data –

Construct a string of small islands by St. Anthony Falls. Create green corridor. From RM 858 to Upper St. Anthony's Falls.

Shingle Creek, Rice Creek and Coon Creek reduce sediment input.

Pool-wide (1) – Bank protection where needed.

St. Anthony Falls to LD1 – area to restore rapids (see discussion above)

– When will these go from objective to "approved" objectives?

Theiling – These will never become consensus objectives. For projects these will become alternatives and you will have input to this process.

General consensus of Group 4 –Pool plans were very complete.

Pool 2 –
Water Quality objectives for MN River –reduce loading for sediment, nutrients (phosphorus) and algae. Also moderate hydrologic regime of the river, it has become flashier due to agriculture.

Water Quality at water treatment plant at RM 835.7 – upgrade plant to handle increased population. Be able to handle pH, nitrogen, phosphorus, and endocrine disruptors.

– Floodplain development. We can't build any islands because it raises the flood level too much. Need to have better floodplain management.

Pool-wide riparian restoration/improvement

Improve fish passage through LD 2

Pool plans are generally accepted.

Pool 3 –
Water Quality – Prairie Island Nuclear Power Plant – reduce thermal loading.
Pool plans – number of backwaters identified for more depth. Different ranges might work better. Range of 0-6 feet with at least 5% at 6 feet of depth. Who suggested water depth indicators for pool plans? Mentioned that this was cartoonish. Some however need to be deepened for connectivity.

Fish Passage through LD3

How to protect St. Croix River from exotics.
– There is a master plan for St. Croix. May want to consult that. Terry Mohl/Steve Johnson.

Should be including St. Croix because part of authorized navigation project. There are some good habitat areas. There could be some benefit to restore backwater areas.

– Make sure that is goes up to Taylor Falls.

– Put invasive species control point at LD3. Stop zebra mussels from coming up. There is a nuclear power plant there. Maybe put hot water into the lock chamber or something.

Pool 3 – Flood plain forest needs improvement.

Marsh and Gantenbin Lake by lock and dam 3 WI. Want lateral floodplain connectivity for fish.

– Make sure that lots of the “C”s are reduce connectivity – Maybe use “IC” or “RC” for increase or reduce connectivity. Need to go back through the database.

– Connectivity used to mean open areas in the floodplain that had been cut off.

–We just need to be specific in the comments.

– That is why we used the term bank-full.

– Need to key this to a specific flow (1.5-year event) Clarify with Chuck Theiling.

Group 3 (Pools 4-6)

We didn’t get any specific data for the 4 pools because we thought the pool plans were adequate.

Water Quality – Minimum of 1.5 meters in backwaters.
0 (zero) sedimentation in BW

Water Level Management
Range from no draw down to open river conditions.
Drought years are an important time for water level management. We thought that adaptive management was a necessary part of water level management.

–Pool plans did not state any specific draw down.

Maintain natural high water levels at the lower end of the pools. Reduce drawn down.

Natural sustainability of habitat type more than plants and animals.

– Lake Pepin will be gone because of MN river watershed. Reduce sediment loading to Lake Pepin from MN River.

– Delta is pretty nice habitat. Filling rate has been estimated at 300 years. Lake Pepin used to extend up to St. Paul. We will want to reduce the rate yet preserve the habitat. What is going on there is good and bad.

– We are assuming that this map accurately depicts the pool plans so we didn’t want to waste time on them. Trusted that they were there.

– Pool plans represent stabilized system not restored system. Suggest a reduction in connectivity. 70-100% of flow confined to channel (MC, 2°, 3°) From pools 3-11. Mud flat, sand bar habitat and isolated wetland habitats need to be increased at less than bankfull (1.5 year events). Iowa put in what they thought they could do, not what we wanted to do. In upper pool, pool plans did not depict restoration, just what we thought we could do. So did not depict fisheries in closed areas. Pool plans represent what is necessary for populations to maintain themselves and handle stress, but not be what we ideally want. Understand that this will have to be actively maintained.

Theiling – In the Peoria meeting they said, "Oh, no, not another wish list". They didn't have a restored level verses other levels. Wish I had told them Gretchen's 5 levels.

– We are in a degraded system. Stabilized means that the endangered are still there and restored means that they are in a less threatened state.

– We use pre-settlement conditions as a reference. Set objectives for abundance for life. As far as system-wide, the thing to pay attention to is that we have raised the water surface profile. We have raised the water level tables in the floodplains. This has greatly affected our floodplain forests. We need to actively maintain our forests and increase height for trees.

<u>Group 2 (Pools 7-9)</u>

Not real site specific
Add floating aquatic.
Community changes with depth. Under restored system emergents from floating to submersed based on improved water clarity.
Reiterate need for watershed approach. Landuse planning, USDA tools.

Soileau – EPA would like us to set target ranges for tributaries so they could backtrack up into the watersheds for setting goals for sediment and contaminant loading.

– This is done for pool 2: Dan Engstrom and Alemendinger are the contacts involved in this effort.

Whole reach -Water Clarity in a fully restored system
Target date of 2010, in spring, disk reading of 1-meter in the main channel. Assumed it would be better in other areas. 2-meters in backwater.

– Locations where pool plans reduced connectivity.

– Is there a good study that is reliable for mass balance input of sediment above lock and dam 26 (input versus outflow)?

– Started with Simon and others. Nakato and others updated this for Pools 11-26. Does not include bed materials. As part of Navigation Study we hope to expand on this.

– Will this ultimately include bedload?

– Would like to see this but understand how difficult this will be to do.

– If you don’t know where you are on the continuum it is hard to set priorities.

Theiling – We were cautioned in St. Louis that a sediment-starved river is a bad thing too.

– River and sediment go together like Ham and eggs. Conservation in 1930’s has greatly reduced problems, but there are still stored sediments in beds and bank lines.

– LA is trying to open up tributaries to allow more sediment movement to help Gulf. Sediment bypass may be helpful to all.

– Someone in WES has developed a good model for estimating bedload movement.

– How can we use sedimentation and scour for habitat management? More recent projects have used these processes. Pool 8 islands phase 2 and 3. How do we manage for these processes that we know are out there?

– Quality of sediment is a big issue as well. There are a lot more nutrients then before.

<u>Group 1 (Pools 10-11)</u>

All things were pool wide
Target ranges

Water Quality –
Clarity Contiguous backwater: Target Range of 4 for summer average
Main Channel and Side Channel: Target Range of 3 for Summer Average
DO have daily minimum .5% 5ppm, 100%>3ppm
Velocity – BW -<or= 0.3 m3/sec during bank-full conditions.
Temperature >1 °C in Winter

More parameters
More extents (MC, SC, Contiguous Backwater, isolated Back Water

Geomorphology – Don’t want drawdowns to be the same level or the same way. Need variety. Also look at water levels for winter, both high and low.

– Objectives for DO…Under the most pristine conditions we had swings in DO that went under 5ppm. As site specific planning we can accept areas that go anoxic. We know that several critters need anoxic conditions.

Working Group Reports

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

GROUP 1

Participants List: Elliott Stefanik (recorder), Mike Cox, John Lindell, John Hendrickson, Ron Kucera, Mark Anderson, Don Larson, Jeff Janvrin

UMR Pools 10 and 11

Pool 11 RM 583 to 615
Reach-wide objectives

Jeff J: provides an overview of Pool planning process.
How do these plans differ from UMRCC effort – the plans try to capture specific actions that meet UMRCC objectives for key components of water quality, flood plain habitat, etc. Common themes for all pool plans include backwater restoration, sand bar habitat, island creation, water level management, etc.

Restoration, restoring to aspects after or before dam placement?
The premise is that the navigation system will remain in place. We would like to maximize the river to do the work to create a desired condition that maybe mimics pre-dam condition.
For habitat features, we based habitat features on historical conditions, in some cases 1940 and 50s, in other cases 1970s. We are targeting some condition post-dam before habitat was degraded through sedimentation and erosion. The pool plans did leave a lot of room for further revision. Areas with conflicting goals and objectives need revision (i.e., fish vs. wildlife habitat).
What about sport species vs. diversity?
That is an issue that has been and will continue to be considered.

Pool wide and reach-wide objectives. How do we apply the UMRCC objectives? The pool plans have applied these objectives. But do we need to add any more objectives specific for Pools 10 and 11? Yes, we will want to fine tune these. Discussion held on whether all 9 of these directly apply or not to each Pool. Aspects of each of these would likely apply to at least a part of both Pools.

Approach: Go through the list of parameters and go through or Reach Wide quantitative objectives. Agreed upon.

Lunch Break

Quantitative Objectives

Pool-wide objectives

Water quality
Temp (mainly a winter target for backwater) %area >1C
0-30-60-100% of backwater area

DO – backwater and mainchannel
Summer range, main channel >5ppm; backwater 75% of area that >5 ppm early morning. 100% greater than 3 ppm.
Winter: main channel o.k.; backwater sites areas 100% of area > 1m deep with 5 ppm. 75%of area > 3 ppm.

Velocity,
Example for backwaters;20%, 40, 60 or 80% of area with velocity of 0 ft/sec.

Water Clarity: Sechi Disk or TSS
Backwater
Side-channel
Main-channel suggested, do not exceed TMDL

Geomorphology
Flood plain connectivity gradient (connectivity at low flows, high flows, etc.).
Also, reduced inundation at lower flows. Reduce connectivity at bankfull connectivity.
Percent bankfull connectivity: 10, 20, 30, 40 and 50%
Flood stage connectivity: as listed.

We also discussed adding sediment transport – did not officially "add" this to the list, but it was noted for later discussion.

Backwater depths – leave as is, use a range. But backwater area target area size may be variable.
Water levels – could add a fifth category: to be 1 foot (0.3 m) above pool elevation for winter conditions.

Pattern of Habitats

Leave as written.

Plants and Animals
-include categories for amphibians, reptiles, invertebrates, and a wide range of bird guilds (shore birds, neo-tropical migrants, etc).
-expand target range for waterfowl (use-days probably too low).
-include some form of Diversity measurements as an overall ecosystem element.

Pool 11.

Upper Pool 11: RM 608 to 615

Sechi Disk depth, main and secondary channels, midsummer – 1.0 m. Target date of 2010.
Contiguous backwater, summer average 4m. Target date 2010.
Isolated backwater, summer average 5m. Target date 2010.
Frequency of occurrence: 10%, 20, 30, 50, 70, 80 and 90%.

Mid Pool 11: RM 596 to 608

Sechi Disk depth, main and secondary channels, midsummer – 1.0 m. Target date of 2030.
Contiguous backwater, summer average 4m. Target date 2025.
Isolated backwater, summer average 5m. Target date 2025.
Frequency of occurrence: 10%, 20, 30, 50, 70, 80 and 90%.

Lower Pool 11: 583 to 596

Sechi Disk depth, main and secondary channels, midsummer – 1.0 m. Target date of 2030.
Contiguous backwater, summer average 4m. Target date 2025.
Isolated backwater, summer average 5m. Target date 2025.
Frequency of occurrence: 10%, 20, 30, 50, 70

Dissolved Oxygen, Velocity and Temp
Implement reach-wide goals, with various target year dates (2020 to 2040).
Water level management: target, variable on a 3 to 7 year cycle. (2005 for Pool 11).

Geomorphology and Connectivity
Lateral (bankfull connectivity):
Longitudinal: Fish passage provided 100% of the time.

Ensure stabilization of Island 189.

GROUP 2

Participants List: Jim Nissen, Jeff Gulan, Don Powell, Steve Zigler, Jeff DeZellar, Rick Moore, Barbara Frank, Gretchen Benjamin, John Lindell, Terry Dukerschein, Scott Johnson

Time Keeper: Jeff DeZellar
Recorder: Terry Dukerschein
Facilitator: Gretchen Benjamin
Reporter: Jim Nissen
Master Chart: Jeff Gulan

Target Objectives for Poolwide Scale, Pools 7, 8, 9

Facilitator defined the aquatic areas first for clarification. Main Channel, Backwater, Side Channel (primary, secondary, tertiary), Impounded Area

Target water clarity for Main Channel Water Clarity: Discussed typical seasonal Secchi's and Turbidities first. Spring, Summer, Fall, Winter (flooding) target 1 Meter Secchi) Comments: likely we'll do better in summer and winter. Target date = 2010

Secondary channels, 7,8,9 Water Clarity: 1.5 Meters (#4)

Impounded, Pools 7,8,9 Water Clarity: #5 (2.0 Meters) Comments-management actions needed

Backwaters 7, 8, 9 Water Clarity #5 (2.0 Meters) Comments: Some attainment at some times and places now, but will need more management actions to increase time and area extent.

Target water depth backwaters 7, 8, 9. We want a gradient of depth from 0-3 meters, with backwaters that contain areas at least 2-3 Meters deep in major overwintering areas spaced every two miles. The areas need to big enough so that there is oxygen there throughout diurnal variations. This is a site-specific criteria with a diverse range of depth in each backwater.

Consider **target velocity** as a critical variable for backwaters

Dissolved Oxygen: All areas: Sufficient dissolved oxygen to support aquatic life.

Water Levels, 7, 8, 9. Poolwide main channel drawdowns are the most efficient, and others can be done as needed on a case by case basis. How much to change the water level depends on the pool and the situation—a range of 0.3 to over 1.0 Meter should be considered. Investigate what the absolute minimum depth that we need is to provide for the tows. If boats required more than 9 feet of draft, it's too bad for them if a nine-foot channel and no more is maintained. We would like all options and we want to review how to implement it. Spring, summer, fall, consider the length of the growing season, recreational navigation, mussels, commercial navigation, etc. Winter months: maintain water levels as high and as level as practical.

Lateral Connectivity, Pools 7, 8, 9. Comments: Habitats are getting homogenized over time. We want to restore a matrix of depths and current velocities—repair and maintenance. Work with the river wherever possible. There are different types of connectivity—lateral, longitudinal. Focus on the Root River, work with private parties to acquire land and maintain. Secondary channels like Summer Chute, Raft Channel and Shady Maple are examples of areas already connected to the main channel. It is not always the temporal nature of the connectivity but the level of connectivity (closing structures) that may be of concern. Asian carp are raising new concerns in the area of connectivity.

Longitudinal Connectivity (fish passage, etc.): Lock and Dam 3 was used as an example. If you say 100% , the opportunity for passage is there 100% of the time, but only a small proportion of the target population might get through at any given time. Non-targeted populations (exotics) are also a concern. Other management options not in the 100% category are worth acknowledging as possible ways to improve the situation. We are aiming for 100% of fish passage Spring—fall, the most critical seasons.

Aquatic areas, all pools: Aquatic areas are a crude measure for habitat. We're not comfortable with using criteria associated with such broad categories. We are really looking for diversity of depth, current velocity, and connectivity. Implement the Pool Plans.

Terrestrial Areas: In general, the floodplain forest is middle-old age and we want to maintain a corridor of floodplain forest at least what we have now. A concern in urban areas is loss of connectivity to the blufflands. The forest is aging and we need to increase species diversity within the floodplain forest. We need more islands and we need to look at all management alternatives. Implement the Pool Plans.

Land Cover/Land Use: The floating leaf plant community needs to be added as a category. 0--0.5 Meter emergent, 0.5—1 Meter floaters, 0.5-2 Meters submersed. Minimum: Implement the Pool Plans, but preferable to do better. We have lost a lot of prairies—work with and support the local land trusts for saving grasslands. Encourage and foster Smart Growth. Land Use Planning is needed for all counties—offer information and encourage and foster it at every opportunity. Work with USDA to encourage implement of their full range of programs.

PLANTS AND ANIMALS

Plants: Plants include the floating plant community, please add it at the following category--Floaters: 10-20 plants/square meter. Overlap is needed between categories (mosaic of plants, i.e. diversity). Emergents: 20-50 stems per Meter. Submersed: category 4-5. We feel that using fixed numbers will vary with the area under consideration. These are general estimates. We want no nuisance exotic species. We want to preserve diversity with native species.

Fish: We don't have enough historical, baseline data to tell yet (need two to three lifetimes for most fish, and the current LTRMP database of 10 years only covers one lifespan in many cases). We are just beginning to get trends information and apply community metrics, and we do not have the capability to provide desired numbers at this time. We want no nuisance exotic species. We want to preserve diversity with native species. Balanced length distributions need to be maintained to sustain healthy native fish populations.

Add a category for **invertebrates**. Mussels, fingernail clams, butterflies, aquatic invertebrates, etc.

Birds and wildlife: Use Days for waterfowl, a measure of sustainability (habitat) that ties back to the ability of the area to sustain a particular avian activity such as breeding or migration. Distribute habitat up and down the river or laterally, not all in one place. Enhance habitat in traditional areas as well as elsewhere. Give the birds alternative areas to go to. Missing whole communities of Concern: black terns (need rooted floated aquatics), Neotropical migrants, breeding birds, herps, songbirds, waders, shorebirds, marsh birds, resident birds, mammals.

GROUP 3

Participants: Tim Schlagenhaft, Bob Drieslein, Steve Tapp, Brian Brecka, Catherine McCalvin, Sol Simon, Betsy Croker, Paul Rohde, Eric Nelson, Fred Pinkard, Pat Heglund

UMR Pools 4 - 6

Reach-wide Recommendation:
The group was in general agreement on the goals of the Pool Plans. Other statements by the group go beyond the Pool Plans and were not necessarily arrived by consensus, but were items not included in the Pool Plans.

Water Quality: Add a Parameter: Objective: Net Sedimentation Rate of zero

Water Clarity Goal: Secchi Disk goal of >1.5 meters

Geomorphology: Objective: Restore a more natural hydrologic regime and hydrograph of open-river conditions, as much as practicable

Backwater Depth Target: Utilize Open water areas of Pool Plans, as show as "D" on UMR-IWW Nav Study Map

Drawdown Target: Open River Conditions

Water Levels: Attain more stable water levels at tailwaters.
Operate water levels at the dams, during flood events, depend less on hinge points

Connectivity: Promote Connectivity concept at points where "C" symbols occur on Nav Study Map;
Promote side channel connectivity in upper end of Pools 5, 5A, and 6.
Longitudinal: Optimize fish passage as shown in Pool Plans

Pool 5: In Zumbro River Area, breech levees and have flood event every two years.

Pattern of Habitats: Objective Level: Utilize Pool Plans
100% of quality natural habitat, sustainable through natural processes

Plants and Animals:

GROUP 4

Participant List: Dick Otto, Ron Benjamin, Lee Nelson, Jon Stravers, Dan Wilcox, Kurt Brownwell, Don Hultman, Gary Wege, Scott Faber, Randy Urich, Mike Davis

UMR Pools 1 - 3

DISCUSSION-

POOL 1

Need for pollution/spill detection

Need for additional treatment of storm sewer water

Fish passage at all Locks & Dams

Possibility of restoring rapids

Possibility of seasonal exposure of rapids

Need for more public lands

Finish separation of sanitary and storm sewers

POOL 2

MN River sediment and nutrient clean up needed.

Moderation of hydrologic regime needed

(All Pools) Suggested actions indicated on maps need to be reviewed to see if they make sense ecologically.

Appendix F. Management Actions

Purpose:
To review and identify management actions that are most likely to contribute towards achieving the established goals and objectives.

Background:
For the purposes of these workshops, Management Actions are: regulatory, operational or structural tools or activities that can be implemented to positively address environmental objectives (e.g. hydraulically dredge a backwater area). Participants reviewed a list of management actions that had been compiled from previous planning to assess their ability to meet the objectives that were discussed the previous day Time was given to ensure all the groups were able to review all of the actions. The reports from each group were presented in a plenary session to provide other participants the opportunity to ask for and receive clarification.

Results:
What follows is the management information gathered and reviewed at the La Crosse Workshop. It is organized into three sections: management action tables, plenary report, and working group reports.

Each working group prepared a master worksheet to record the group's changes, additions, and deletions to the list of management actions. The changes from all the groups were compiled in the following worksheets (Table F1). There were 130 new management actions, and 54 comments added. The whole group modified 44 existing management actions and deleted 10 of the actions listed.
These results will be merged with those from other workshops, and the entire management actions database published in the UMR-IWW System Navigation Feasibility Study Interim Report will be updated.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management. The entire plenary report can be found in Appendix C.

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work that was produced for Management Actions. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

Table F1. Management Actions.

Element / Parameter	Extent	ID	Management Action	Comments
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to ~~consolidate soft sediments~~	in localized areas
				Revise: to promote aquatic vegetation (no soft sediment in MVP)
		4	Minimize dredge disturbance/frequency	
		5	Minimize dredge slurry return water	
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	to reduce sediment input
		9	Speed and wake restrictions - rec. boats	add tow boats
Comments/ Additions:				
			Pool scale drawdowns to promote emergent vegetation	
			Protect aquatic vegetation (regulatory) - do no harm	
			Encourage regulation for BMPs	
			Strict runoff and erosion control regulations for new developments	
			Temporary mooring facility	
			Tow boat speed control to minimize stops	
			Modify propulsion system	
			Hull redesign	
			Wingdams	
			Recreation management on the main channel (camping, fires, sanitation, speed, noise)	
			Promote emergent plant growth	
			Create wetlands to promote biological waste management of storm water.	

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality cont.			Remove levees throughout floodplains (mostly tribs in St. Paul Dist.)	
			Phosphate limits @ sewage treatment plants NTE 1 ppm	
			Industry self help & small scale improvements, nonstructural navigation elements	
			Modify tow size/configuration	
			Urban stormwater treatment	
			Eliminate phosphorus in lawn fertilizer	
			Agricultural BMPs	
			Urban stormwater BMPs	
			Restore hydrologic regime of tributaries	
			Tributary stream channel stabilization	
			Larger, more effective dredged material placement sites for silty material	
			Off-shore revetments to reduce sediment resuspension & bank erosion	
			Improve channel marking (USCG buoys)	
			Install mooring buoys to keep tow away from sensitive areas	
			Construct islands to reduce wind waves and sediment resuspension	
			Minimize impacts of barge fleeting & mooring	
	Backwaters	10	Pool scale drawdown to ~~consolidate soft sediments~~	in localized areas
				promote aquatic vegetation
		11	Drawdown management units	

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality cont.		12	Drawdown isolated backwaters	11 - 14 too much detail for MVP
		13	Isolate and drawdown contiguous backwaters	@ specific locations
		14	Temporarily isolate and drawdown contiguous backwaters	13 & 14 are the same
		15	Construct ~~wind breaks~~	islands to serve as wave breaks
		16	~~Construct Wave breaks~~	
		17	Remove bottom feeding fishes (carp)	
		18	~~Increase plant density~~	Delete - these are objectives
		19	~~Increase plant distribution~~	Delete - these are objectives
		20	~~Reduce algae production~~	Delete - these are objectives
Comments/ Additions:				
			Manage recreational boaters- speed & wake restrictions	
			Increase water depths	
			Stabilize existing islands	
			Urban BMPs	
			Promote emergent plant growth	
			Phosphate limits @ sewage treatment plants NTE 1 ppm	
			Off-shore revetments to reduce sediment resuspension & bank erosion	
			Winter water level fluctuations - bring in DO water	
			Operate pools on "high side"	
			Aerators to improve DO	
			Divert tribs into backwaters to deliver DO	
			Apply BMPs	
			Plant vegetation to increase diversity and distribution	
			Open springs in isolated backwaters	

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Geomorphology				
Backwater Depth	Backwater Areas	21	Hydraulic dredging	Include new technologies
		22	Mechanical dredging	
		23	Consolidate sediment	limited value?
				through drawdowns
		24	Divert flow to increase backwater scour	
Comments/ Additions:			Increase water levels and hold constant in winter	
			Pool-scale drawdown - allow tribs to scour	
			Temporarily remove closing structures, build high wing dikes to divert flow into side channels	
			Experiment with management actions during scheduled Nav. System closure	
			Use structures to maintain BW depth	list all structures
			Apply BMPs	
			Bank protection to reduce sed input	
			Add mooring buoy to reduce sed resuspension	
			Mechanical movement of sediment during drawdowns (land based)	
Water Level	Main Channel	25	Pool scale drawdown	
Comments/ Additions:			Manage tributary and dam flows to mimic natural patterns	
			Maintain minimum water gradient	
			Run of the river tributaries	
			Wetland restoration to increase infiltration	
			system-scale or multiple pool drawdowns	
			Hold winter water levels high	
			Use dam point control more - limit hinge point operations	
			Make frequent gate adjustments to minimize fluctuations	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Geomorphology (cont)	Backwater Areas	26	Pool scale drawdown	
		27	Drawdown management units	27 - 30 too much detail?
		28	Drawdown isolated backwaters	specified
		29	Isolate and drawdown contiguous backwaters	
		30	Temporarily isolate and drawdown contiguous backwaters	
Comments/ Additions:			Wetland restoration to increase infiltration	
			Moderate hydrologic regime of tributaries - establish objectives for trib hydrology	
			De-channelize tributaries	
			Rock ramps at spillways and other overflow sections	
			Pool scale flooding - winter	
			Flow diversion to reduce flow, create a head difference	
Connectivity	Floodplain	31	Acquire real estate rights, restore water to leveed floodplain areas	may apply to tributaries
		32	Reconfigure, restore flow to secondary channels	increase or decrease
		33	Restore flow to isolated backwater areas	or limit
		34	Create habitat corridors for floodplain terrestrial wildlife	
	2 extents	35	Restore natural tributary channels through delta areas	
	1. Flood stage	36	Notch levees	
	2, bank full	37	Set back levees	
	All mgmt action apply to both	38	Increase water levels	Raise maximum controlled pool elevation selectively
		39	Increase terrestrial area	Revise: Use dredged material to build islands, plant trees, etc.
Comments/ Additions:			No government bailouts for repetitive flood damage	
			Restore lost physical structure	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Geomorphology (cont)			Remove levees	
Connectivity (cont)			More floodplain zoning	
			Rock ramps at spillways and other overflow sections	
			Deposit sand, cap with fines, plant trees	
			Construct islands to increase connectivity	
	Secondary Channels	40	Notch closures	
		41	Divert flow	gravity or pumps
				increase or decrease
		42	Increase water levels	
		43	Dredge secondary channels	
		44	Remove levees	
Comments/ Additions:			Restrict flow to contiguous backwaters	
			Construct islands to increase flow	
			Restrict flow to secondary channels	
	Longitudinal	45	Build fishways	or lock fish through
		46	Modify gate operations	
		47	Modify lock operations	See notes
		48	Remove tributary dams	
Comments/ Additions:			Lower embankments and spillways	
			Modify control structures (such as spot dikes)	
			Remove dams (mainstem and tribs)	
			More research on fish passage	
			Build barriers to restrict exotic species movements	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats				
Aquatic areas		49	Introduce flow to isolated backwater areas	Modify flow?
		50	Restore flow to secondary channels	
		51	Restore flow to floodplain areas isolated by levees	
		52	Restore natural tributary channels through delta areas	
		53	Divert more tributary delta flow into open impounded areas	
		54	Create rock and gravel substrate areas	
		55	Create shallow rock and gravel riffle areas	
		56	Incorporate woody debris into bank protection	
		57	Incorporate woody debris into 2° and small channels	
		58	Restore flow and geometry of secondary channels	
		59	Modify flow distribution from dam gates - tailwater habitat	
		60	Grading, vegetation planting	
		61	Rock groins, hard points	Construct; duplicates no. 70
			Reduce flow to isolated backwater areas	
			Restrict flow to secondary channels	
		62	Anchored woody debris	
		63	Off-shore rock revetments	Duplicates no. 71
		64	Submerged rock vanes	
		65	Notch wing dams to create hydraulic, depth diversity	
		66	Notch closing dams to increase side channel flow	
		67	Construct temporary structures to divert flow	
		68	Use larger rock, make bank revetments irregular	
		69	Incorporate woody debris into channel structures	
		70	Construct hard points, groins for shoreline stabilization	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont)		71	Construct off-shore revetments	
Aquatic areas (cont)		72	Construct seed islands	
		73	Construct bendway weirs	NA in MVP
		74	Construct chevrons	NA in MVP
		75	Modify flow splits between main and off-channel areas	
		76	Dredge backwater areas, increase depth	
		77	Dredging to restore and create secondary channels	
		78	Shore pipe, boosters to reach target sites	
		79	Use small dredges to expand placement options	
		80	Bend width reductions where possible	What is this? Not enough places for tows to pass as is. Bends are already too narrow
				to reduce bed erosion
Comments/ Additions:			Increase shoreline dynamics/complexity	
			Pool-wide drawdowns	
			Submerged sills into backwaters	
			Remove/knock down wingdams to create fish habitat	
			Break low spots in dam embankments - riffle type aquatic habitat	
			Use mgmt actions to reduce/eliminate flow (include islands, dikes, and closures)	
			Construct islands	
			Water level management	
			Increase channel border width	
			Notch levees	
			Pool-wide to system-wide drawdowns	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont)		81	Place dredged material to create wetland areas	
Terrestrial		82	~~Placement on existing, construct new beaches~~	Revise: maintain existing recreation beaches
		83	Semi-confined channel placement (chevrons)	
		84	~~Unconfined placement in floodplain (for mast trees)~~	Revise: Material placement for habitat restoration in the floodplain
		85	Unconfined placement in floodplain	Delete
		86	~~Beaches~~	Revise: Sandbars (for turtle nesting)
		87	Island construction	
		88	On floodplain to raise areas for mast-producing trees	
		89	Confined placement in floodplain	Delete
		90	Construct hard point in floodplain	
		91	Construct islands in impounded areas and backwaters	Reconstruct natural channel levees
		92	Seed islands	
		93	Chevron islands	
		94	Rock islands	
		95	Islands with varied top elevation, fine material	
		96	Low islands - mud flats and sand bars	
Comments/ Additions:			Create/maintain sand nesting sites for turtles, shorebirds, and water-birds for loafing, resting, or basking areas	
			Encourage natural land formation - deltas	
			Stabilize and protect landforms so we can protect what we have	
			Open barrier islands - create channel, induce delta formation into open BW areas	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont)			Excavate floodplain potholes	
Terrestrial (cont)				Need to do larger scale forest restoration in mid-pool areas
				Smaller scale forest restoration w/dredged material in upper pool areas.
Land Cover/Use		97	Modify and manage habitats on refuges (see habitat below)	
		98	Manage vegetation cover	
		99	Manage water levels	
		100	Modify habitat structure in floodplain and backwaters	
		101	~~Plant vegetation on dredged material deposits~~	Revise: Re-sculpt the site and plant dredged material deposits if necessary
		102	Plant floodplain trees	
		103	~~Harvest~~ floodplain trees	Manage
		104	~~Plant~~ floodplain prairie	Restore
		105	Burn floodplain prairie	
		106	~~Control~~ invasive exotic species	Manage; list examples
		107	Place dredged material to create wetland areas	
		108	Unconfined dredged material placement in floodplain (for mast trees)	Delete unconfined
		109	Growing season drawdowns	
Comments/ Additions:				See computer notes
			Restrict use in the river floodplain (regulate)	
			Manage water levels	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont)				
Land Cover/Use (cont)			Acquire floodplain land from willing sellers (easement or fee), restore habitat	
			Reestablish disease resistant elms in floodplain	
			Excavate wetland scrapes	
Plants and Animals				
Fish		110	Adjust angling, commercial fishing regulations as needed	
		111	~~Modify angler attitudes about exploitation~~	Educate anglers about wise use of the resources
		112	Enforce fishing regulations	
		113	~~Stock fish~~	Delete for MVP - preserve existing genetic diversity
			-	native fish to achieve desired composition
Comments/ Additions:			Improve habitat for fish, provide a diversity of habitats for fish communities (MAs 1 - 109)	
			Control invasive exotic species	
			More population studies of biological research such as fish, wildlife, birds, herps, invertebrates, and plants	
			Use predator control where appropriate	
Wildlife		114	Conduct biomanipulation of fish and wildlife community (various actions)	
		115	Adjust hunting and trapping regulations as needed	
		116	~~Modify hunter attitudes about exploitation~~	Educate anglers about wise use of the resources
		117	Enforce hunting regulations	
		118	Reintroduce native species	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Plants and Animals (cont.)				
Wildlife Comments/ Additions:			Control invasive exotic species	Delete invasive
			Predator management where appropriate or needed	
			Voluntary closed areas	
			Need mussel management plan	
			Need mussel component in restoration projects	
			Implement MAs 1 - 109	
			Management for protection of neotropical migrants and other species of concern	
Exotics		119	~~Control~~ invasive exotic species	Manage
		120	Construct, operate, maintain barrier on Illinois River	
		121	Require antibiotic treatment of Great Lakes freighter ballast water	Concern with the use of term antibiotic, want to be sure that the treatment does not affect other aquatic or terrestrial organisms
		122	Regulate use of exotic species for fishing bait	
		123	Regulate biota transfer by fishing boats	and commercial boats
		124	Apply species-specific toxicants	
		125	Kill zebra mussels on vessels in lock chambers	
		126	Restrict and enforce use of exotic species in aquaculture	
Comments/ Additions:			Increase water temperature using power plant open-cycle cooling water during warm summers to kill zebra mussels	
			Implement MAs 1 - 109	
			Prevent introduction of aquatic and terrestrial species	
Mussels and other invertebrates			Control exotic introductions through other ports (New Orleans)	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Plants and Animals		127	Protect, increase populations of threatened, endangered species	add restore
T&E			Reintroduction of extirpated species to the area	
Comments/ Additions:			Restore populations of T&E species.	
			Restore and improve T&E species habitats	
Best Management Practices				
All			Modify habitat (see below)	
		128	BMPs	
		129	Conservation tillage	
		130	Contour farming, terraces	
		131	Grassed waterways	
		132	Establish perennial cover, crops	
		133	~~Stabilize eroding ravines~~	
		134	~~Conservation Reserve Program land set-aside~~	Don't identify specific programs
		135	Erosion control structures along intermittent streams	
		136	Construct, maintain small impoundments	
		137	Restore drained lakes, wetland areas	
		138	Riparian buffer strips	
		139	Restore stream channels, floodplain areas	
		140	Urban stormwater management practices	
		141	Construction site erosion prevention practices	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Best Management Practices (cont.)		142	Increase pervious surface in developed areas	
Comments/ Additions:			Encourage land trusts and individuals to conserve grasslands, blufflands, open space in perpetuity along the watershed (encourage all means of land conservation)	
			Establish hydrologic objectives for tributaries	
			Provide sanitary facilities for campers on islands	
			Adjust dredging frequency and volume to enable pool scale drawdowns, limit frequency of disturbance, WQ problems, gain cost efficiencies	
			Acquire tributary floodplain areas - areas hydrologically affected by Nav. System impoundment	
			Look at Galloway Report recommendations	
			USDA, EPA, FEMA need to be involved in river management	
			Consider system-wide cumulative impacts during evaluations of any project	
			Wetland Reserve Program	
			Environmental education and outreach	

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management actions. The entire plenary report can be found in Appendix C.

Nov 19th, Management Actions Plenary Session:

The plenary began by asking each group to give a brief overview of what they did, as well as listing their modifications to the list of Management Actions. The Tables of Management Actions were visited section by section with all four groups having an opportunity to give their input on each section before moving to the next.

Managements Actions – Chuck Theiling (8:15 – 9:25)

Chuck began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

Discussion Before Management Actions Working Groups:

– Our task is to identify tools. Are we to rank them now?

Soileau - No, just make sure they are on the list.

– For just our pools that we are assigned to?

Soileau -You can do the entire reach. However, if you know that there is an action that only ties to a specific area please list that in the comments.

– Have you used the crosswalk of management actions from the Pool Plans?

Theiling – No.

– I recommend that you use them.

Theiling - We will.

Soileau – If you have any other sources that would be helpful, please let us know.

Management Action Working Groups (8:25-10:21)

Management Action Plenary (10:21- 11:48)

Page W2-2 Water Quality

Group 1

Lots of discussion about what management actions are and what we are trying to achieve. Wrestled about how much detail we needed. Looked at the UMRCC report.
Water Clarity in the Main Channel -
Maybe island construction in the backwaters that reduce wind fetch so sediment resuspension won't affect the main channel.

Group 2
Redesign barge hulls to make more efficient.

Group 3
We thought that best management practices (BMP's) were essential to all efforts. We also felt that algae production was related to BMP's.

Group 4
Also felt that watershed BMP's were important.

Page W2-3, 4 Geomorphology

Group 1
Structures to maintain backwater depth – rock and bio-technical bank protections, islands see the group's notes.

We could lower backwaters by closing upper end. Don't need to have permanent structure. It could be a temporary sand plug.

Group 2
All in notes

Group 3
Didn't understand what #39 meant, so deleted this.

Group 4
Using the power of the river to do work would be better than using diesel engines to perform work.

Agreed that connectivity was an overused word.
For #39 – clarified that to add elevation to islands and floodplains to grow trees.

Page W2-4 Geomorphology and Pattern of Habitats

Group 1
We discussed Lock & Dam as well as dike modifications. We recorded it in our computer notes.

Group 2
All in notes

Group 3
Felt that Item 61 was a duplicate to item 70 so deleted.

Group 4
All in notes.

Page W2-5 Pattern of Habitats

Group 4 (aquatic areas)
Width of bends is narrow so tows might have to wait for another and churn things up in the meantime. It might be good for protection of mussel beds.

Get a brief sentence for each management action describing what will be done and what the expected outcomes will be.

Theiling – Jeff and Jon did this in the UMRCC. We will be looking at this.

Group 1

–There is an advantage to increase width of main channel border areas. In historic times it experienced filling in of training structures. Increasing width will increase quantity and quality of main channel border. Management actions – remove dikes, notch wing dams, remove old dredge islands.

Group 2
All in notes.

Group 3
Confused about number #81 did it mean take area from floodplain?

Group 4
All in notes.

Page W2-6 Pattern of Habitats (cont)

Group 1
All in notes.

Group 2
All in notes.

Group 3
Discussion items of 97-100 that these were covered in other areas.

Group 4
Confused about #90.

<u>Page W2-7 Plants and Animals</u>

Group 1
First thing we did was to include 1-109 as efficient habitat restoration/management.

– These were mostly social and regulatory issues. However, if you don't have the habitat then you won't have the critters so need to address that first.

– We are going to need more than clichés. We are going to need causal mechanisms. We are going to get some hard questions that we are going to have to answer. How much investment are we going to need to develop adequate habitat?

– You are missing the microhabitats in our large overarching fish and population actions.

Soileau – So we need you to add in the microhabitat management actions. This wasn't intended to be exclusive.

– You are managing the forest for a certain species. So if I want a type of bird in the forest I will manage the forest for a certain species.

– We have been setting objectives in a very simple way. We could be using landscape (architecture) that we can be using to address very specific life forms. As we understand things more we will be creating management actions.

Soileau – Was there an explicit outcome for the education? (Under wildlife)

– Promote BMP's

Group 2
All in notes.

Group 3
#114 – What was the thinking on this?

– Adjust predator/prey relationships, commercial harvest. Directly managing biota rather than habitat.

Group 4
We talked about bio-manipulation.
Were concerned about invasive and aggressive exotics.

High water temperatures set zebra mussels back. During the hot summers have power plants do open water cycling to bring the water temperatures higher.

Need a fresh look at what is considered exotics.

There was a discussion about reintroducing mammoths, bison. These are native, but could be harmful.

<u>Page W2- 8 Plants and Animals, T&E</u>

Group 1

136 – May effect downstream by holding sediment back from sediment starved areas. Consider system-wide impacts before implementing any projects.

Group 2
All in notes.

Group 3
Consider changing 134. Distinguish CRP from land set aside programs. Don't limit yourself.

Group 4
All in notes.

– Implement the Galloway report recommendations. USDA, EPA, and FEMA need to be added to this study effort. They are controlling $3/4^{th}$ of the pie. They control the drainage districts. So far we have not been successful in getting them involved at the local level rather than just the National level.

Theiling – You are right. They are involved in the NECC, and the Federal Task force.

– We need them involved in the local efforts.

– We do seem to get them more involved in the lower river and the Illinois River.

Theiling – The latest farm bill has lots of money for conservation. If we can get the local DC involved we can get some dollars and more importantly the contacts.

– Put together a main stem, multi-state CREP plan using CREP and WHIP dollars for the Mississippi River. Mostly there is a 20% match, but that has been waived in some cases. You should ask your senators for $'s from USDA.

–Hundreds of Millions of dollars are going to IL and MN for the basin. They don't have much of a scientific process to allocate that money. They don't have to show results. If we set some targets for delivery of materials to main stem it might wake some people up. If we had a quantitative model of sediment transport of materials in the system it would help. The USDA money is not being used in the most cost effective way. It is being done in a political manner.

– USDA knows this is a problem. The Corps, with all of it's planning, would be welcome at the USDA.

–We as a group can complain about USDA's culture and how it doesn't deliver conservation on the land efficiently. However, even if the USDA knew exactly which acres they wanted to put conservation treatment on to get the most efficient treatment they still have to have the landowners come through the door because the program is strictly voluntary. What we aren't doing is getting to the landowners themselves (part of nebulous education programs discussed earlier) and fostering an ecological conscience in people. USDA is only half of that bridge.

Theiling – In IL they have more people on the waiting list, so participation is not an issue, thought maybe targeted participation is. Corps is recognizing its role in the watershed.

– Take a look at the Great Reports and the Upper Mississippi River Comprehensive plan.

– What do you think about coming up with point source criteria for the tributaries?

Theiling -This is a golden opportunity to put a dot at each tributary.

Soileau – I spoke with someone in the EPA that would love to have us do this.

Theiling – We could do this regionally.

– We already have estimates of yields from each watershed in the Upper Miss. We can refine those. We can set realistic objectives for loading from tributaries. We should set targets for sediment loading and hydrologic regime of each of the tributaries.

Working Group Reports

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work produced concerning management actions. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

<u>GROUP 1</u>

Participants List: (*Was not listed, assumed to be same as previous day*) Elliott Stefanik (recorder), Mike Cox, John Lindell, John Hendrickson, Ron Kucera, Mark Anderson, Don Larson, Jeff Janvrin

Include all of the management measures identified in the UMRCC report "A preliminary description of habitat objectives…." And the appendix to the report.

Note, see master hand written notes for some items which may have been missed.

Water quality - Main Channel

3 - water level management does not achieve any substantial amount of soft sediment consolidation in pool 4-11 due to the high percentage of sand in the sediments. Soft flocculent sediments are mainly found in very deep areas, which would require run of the river, or even lower drawdowns. However, if water level management is successful at increasing the amount of aquatic vegetation, then it the vegetation may help improve clarity in the summer by trapping sediment. Therefore, water level management can seasonally improve water clarity.

10 – speed and wake restriction for recreation and commercial vessels

8 – add to trap sediment

11 – add mooring buoys to keep barges away from sensitive areas.

12 – Island construction to reduce sediment resuspension in the pool year round benefit

13 – Island construction to promote the growth of vegetation to trap sediment

14 – wind breaks

15 – wave breaks

Water Clarity - Backwater

10 - water level management does not achieve any substantial amount of soft sediment consolidation in pool 4-11 due to the high percentage of sand in the sediments. Soft flocculent sediments are mainly found in very deep areas, which would require run of the river, or even lower drawdowns. However, if water level management is successful at increasing the amount of aquatic vegetation, then it the vegetation may help improve clarity in the summer by trapping sediment. Therefore, water level management can seasonally improve water clarity.

21 – speed and wake restriction for recreation and commercial vessels

22 – add best management practices

23 – add mooring buoys to keep barges away from sensitive areas.

24 – Island construction to reduce sediment resuspension in the pool year round benefit

25 – Island construction to promote the growth of vegetation to trap sediment

26 – Backwater dredging

Backwater Depth

25 – structures to maintain backwater depth
- complete closures
- partial closure
- dikes
- groins
- trib bmp
- flow diversion structures
- bank protection
  - rock
  - bio tech

Islands to concentrate flood flows to promote scour

23 – this will only have a limited affect if there is a dd of > 3 feet, even then, the depth will only be increased by a few inches due to the high sand content of sediments in the majority of areas in pools 4-11. These affects will also only be short term due to re hydration and flocculation of consolidated sediments

Water Level Main Channel and Back Water

for both add the following
- 31 – winter pool drawdown
- 32 – pool scale flooding in the winter

33 – flow reduction into backwater (for example, the closures and partial closures in lansing big lake pool 9, caused a water surface reduction in the upper portion of the project area due to increase in head difference. By letting in less flow, the “glass isn’t as full”.

Connectivity has two different extents (flood and bankfull) the ones presented apply to both

40 – eliminate flow from contiguous backwaters using the following techniques
- complete closures
- partial closure
- dikes
- groins
- trib bmp
- flow diversion structures
- bank protection
  - rock
  - bio tech

41 – construct islands to reduce connectivity in backwaters

Connectivity Secondary Channels

41 – the diversion would be used for increasing and decreasing

45 – construct islands to improve flow conditions in channel (i.e. harpers slough pool 9 and pool 8 islands phase III

Longitudinal

Add - Lock and dam dike modifications
- Lower dike
- Roller gate in spillway
- Tainter gate in spillway
- Additional spillways

Note, fish passage can be several different structures

Patterns of habitat – Aquatic Areas.

Increase the width of the main channel border area by:
- Notching wing dams
- Removal of dredge material disposal sites
- Remove dikes

81 – Add structures to decrease or eliminate flow, i.e.
- complete closures

partial closure
dikes
groins
trib bmp
flow diversion structures
bank protection
    rock
    bio tech
islands

82 – construct islands

83 – water level manage (all options)

61– ADD construct to this explanation

86 – change to sand beaches

84 – remove reference to unconfined

85 – delete

89 – delete (85 and 86 are duplicated by other items)

Land Cover/Use
110 – Uneven forest management

111 – placement of 1-3 feet of fine or fine topped sand dredged material to suppress reed canary grass and plant to forest or prairie

112 – use root pruned method tree planting to reestablish forest in reed canary grass areas

Fish, Wildlife, Exotics, Mussels and other inverts, Shorebirds etc.

add all of the above 1-109 and 119-142. The listed techniques for fish and wildlife only address regulatory or social attitude modifications/education. All of the actions listed above (1-109) have been used in various combinations to improve or restore habitat conditions for all of these. If the habitat is not there, then the animal will not be there and regulatory measures will be unnecessary

Wildlife, add -- Manage for protection of neo tropical migrants or other species of concern

Exotics

128 – prevent the introduction of terrestrial and aquatic species

119 – delete the word invasive

121 – expand to all vessels (recreation and commercial) hull (exterior) and interior

129 – control of exotic introduction through other ports (i.e. New Orleans)

Threatened and Endangered Species

128 – protect, improve, restore and increase habitats for t and e

127 – add restore

add 1-109 and 119-142 as actions needed to improve habitat to improve populations of t and e

Comment on 136 there was concern leaving this in. A more appropriate description of this technique would be to more accurately define these as small sediment retention "ponds"

Add systemwide impact evaluation of all/any project

GROUP 2

Participants List: Jeff DeZellar, Steve Ziger, Don Powell, Jeff Gulan, Terry Dukerschein, Jim Nissen, Gretchen Benjamin, Scot Johnson, Richard Moore

Recorder: Gretchen Benjamin
Facilitator: Rick Moore
Reporter: Jim Nissen
Master scribe: Jeff Gulan

Water Clarity

Pool Scale drawdown to consolidate soft sediment promote growth of emergents – May do more to "consolidate" sediment

Main Channel

9) Recreation management on the main channel, camping, fires, sanitation, speed, noise
10wc) Promote emergent plant growth
11wc) Do no harm to aquatic vegetation (?)
12wc) Encourage appropriate of authorization for BMP
13wc) Create wetlands to promote biological waste management of storm water

14wc) Storm management plan with strict runoff and erosion control
15wc) Implement development regulation for storm water, erosion control,
16wc) Remove levees throughout the floodplains (mostly tributaries in St. Paul District) to allow sediment to settle out on land
17wc) Phosphorus limits at sewage treatment plants should not exceed 1 ppm
18wc) Temporary mooring facilities
19wc) Towboat speed control to minimize stops
20wc) Modify propeller systems to cause fewer disturbances
21wc) Redesign hulls to make them more efficient
22wc) Modify size of the tow
23wc) Wingdams to make channel deeper to minimize tow impact to bottom
24wc) Industry self help and small scale improvements, non-structural navigation elements

Backwaters

20wc) BMP urban and suburban
10wc) Promote emergent plant growth
15) Should be changed to - Construct islands to service wind and wave breaks
13wc) Create wetlands to promote biological waste management of storm water
13 and 14) are the same – Not sure we want isolated dd temporary or permanent
21wc) Manage recreation in the backwaters
22wc) Increase water depths
23wc) Stabilize existing islands
17wc) Phosphorus limits at sewage treatment plants should not exceed 1 ppm

GEO
Backwater
25geo) Increase water levels during the winter

Water Level MC

26wl) Manage flows at dam and trib. flows. Mimic natural flows
27wl) Run of the river – tributaries from hydro facilities, Chip, Black, WI, Cannon, Coon Rapids, etc.
28wl) Minimum water gradient – amend law to say that during a drought the 7Q10 must be met. May have to eliminate 9-foot channel during this time.
29wl) Wetland restoration to increase infiltration

Backwaters

29wl) Wetland restoration to increase infiltration
28wl)
27wl)

26wl)

Connectivity
Floodplain

40con) More floodplain zoning
41con) No money from federal gov't for repetitive flood insurance
42con) Restore lost physical structure in the impounded and other areas.
43con) Remove levees

Secondary Channel

41) Change wording to: Divert flow by gravity or other means

Longitudinal

45) Reword to: Build fish ways or lock fish through
49long) Lower embankments and spillways
50long) Modify control structures, i.e. spot dikes, culverts to allow flow
51long) Remove tributary and main stem dams.
52long) Encourage new methods for fish passage

Aquatic areas

81ph) More shoreline dynamics and complexity
82ph) Pool-wide drawdowns
83ph) Submerged sills into backwater
84ph) Remove or knock down wingdams to create fisheries habitat (substrate diversity).
Take out 73, 74 not appropriate in St. Paul District

Terrestrial

82 – Maintain existing recreation beaches
84 – material placement for habitat restoration in the floodplain (not unconfined)
97ter) Create and maintain sand nesting sites for turtles, shorebirds and water birds for loafing, resting or basking areas
98ter) Encourage natural land formation – deltas,
99ter) Stabilize and protect landforms so we can keep what we have

Land cover / Use

101) Re-sculpt the site and plant dredged material deposits, if necessary
103) Manage floodplain forest
104) Restore or plant vegetation
110lcu) Restrict use in the river floodplain. (regulate)
111lcu) Manage water levels to control reed canary grass

Fish

111) Change wording to: Educate anglers about wise use of the resources
113) Eliminate for St. Paul District – preserve existing genetic diversity
114fi) Improve habitat for fish, provide a diversity of habitats for fish communities
115fi) Control invasive exotic species
116fi) More population studies of biological research such as fish, wildlife, birds, herps, invertebrates, and plants

Wildlife

116fi) More population studies of biological research such as fish, wildlife, birds, herps, invertebrates, and plants
116) Change wording to Educate hunters about wise use of the resources
119wild) Predator management where appropriate or needed

Exotics

121) Concern with the use of term antibiotic. Want to make sure that the treatment does not affect other aquatic and terrestrial organisms.

Threatened and Endangered

128te) Reintroduction of extirpated species to the area
129te) Restore populations of endangered and threatened species

All

143) Encourage land trusts and individuals to conserve grasslands, blufflands, open space, in perpetuity along the watershed (Encourage all means of land conservation.)

<u>GROUP 3</u>

Participant List: (*Was not listed, assumed to be same as previous day*) Tim Schlagenhaft, Bob Drieslein, Steve Tapp, Brian Brecka, Catherine McCalvin, Sol Simon, Betsy Croker, Paul Rohde, Eric Nelson, Fred Pinkard, Pat Heglund

Water Clarity, Main Channel: add: minimize impacts of barge mooring and waiting for lockage; deals with bank erosion and resuspension of sediments.

Backwaters: add watershed BMPs to the list.
Combine 18 and 19: increase plant density and distribution by doing plantings.

Delete 20

These management actions address the objective of having a net sedimentation rate of zero (see above).

Geomorphology: #23 consolidate sediment by drawdown and excavation during drawdowns with land-based equipment

Add: apply watershed BMP

Water level: add reach wide drawdowns
Hold winter water levels higher; maintain control at lock and dam more frequent-less hinge point operation.
Manage gate adjustment to minimize water level fluctuations
Combine main channel and backwater areas methodology

Connectivity: add: Restrict flow into specified backwaters under certain conditions or needs
#33 add "specified" rather than isolated.
38 raise low control pool water levels.
39 delete

Secondary channels: restrict flow to secondary channel where needed.

Longitudinal: construct fish barriers to restrict invasive species

Aquatic Areas:
Add Pool-wide and system-wide drawdowns
Delete item 61 and 63
General Comment: review actions and clarify whether they are an objective of management action

Terrestrial: move item 81 to aquatic areas

Land Cover/Use
Add: Excavate or construct wetlands

Plants and Animals
Delete 114 Is this predator control?
Item 114: conduct predator control

All

Add Wetland Reserve Program
Item 134 remove "set-aside"

Add Environmental Education, Outreach to keep public informed about all programs

GROUP 4

Participants List: Don Hultman, Kurt Brownell, Gary Wege, Ron Benjamin, Dan Wilcox, Lee Nelson, Mike Davis, Randy Urich

Task: Management action development.

Water quality – main channel

- need to educate the public on runoff and disposal issues in urban settings, storm sewer inputs to river, etc. (use BMPs)

- ban phosphorus in lawn fertilizers

- is there a way to influence construction codes which require the use of impervious materials (ie: concrete, asphalt) to instead incorporate new pervious construction materials that aid in runoff/infiltration issues (some effort is being made along these lines locally).

- new technologies in agriculatural drainage

- separate rural sanitary systems from tile systems where they are linked (this is critical where large livestock operations are occurring).

- Tributary stream channel stabilization is important

- Dredge material placement sites that hold fine material need a return water system that filters out all solids (especially significant issue in urban areas where real estate for disposal is difficult to come by); larger and more effective placement sites are needed

- Try to minimize the frequency of dredging

- Rain gardens (Dane Co. in Wisconsin is using these to manage stormwater on site) miniature detention areas – use these as management actions in various locations

Water quality – backwaters

- keep the river levels on the high side of the band during the winter

- we don’t see carp removal as an option

- Ids 18-20 may not fit in the list as management actions – they are actually goals

- Use backwater aeration systems

- Opening up springs to increase flow in backwaters could help water quality

Geomorphology

- Promote use of natural flows to manage geomorphology over hard construction methods; water level mgmt – allow tributary channels to scour

- drawdowns – in St. Paul District, we’ve already investigated the opportunities in the various pools but need to come up with a schematic for implementation (which pools? When?) (Gary Palesh is working on a 10-year plan … so we are getting there).

- Dechannelize the tributaries to moderate the hydrology

- Set objectives for both TMDLs and the hydrologic regime of tributaries

Connectivity

- hydrology changes in tributary delta areas and floodplains are unnatural due to navigation and causing die-off of high quality timber and conversion to lower quality vegetation (marsh and reed canary), so there is a dilemma for the private landowners whose real estate values have been degraded (then the govt comes along and offers to buy up the land at low value)

- elevating floodplain areas with dredged material to improve groundwater/hydrologic conditions for vegetation (i.e. bottomland hardwoods, mast, etc.) – (the downside might be to diminish flood storage capacity, although this would probably be done over smaller areas where impacts would not be that great)

- use of rock ramps at spillway locations and other overflow sections to allow fish passage

- lower embankments; replace portion of railroad embankment at Trempealeau with trestle to allow passage of flood flows

- taking places at risk (from flood damage) out of floodplains is good public policy

- Unsure of what hardpoint in floodplain means?

Patterns of Habitat

- create low areas in embankments to provide better connectivity between backwater sloughs; make use of water control gates in these isolated areas (longitudinal connectivity)

- Ref to ID49 – may also need to eliminate flow

- Need to expand on the definition of ID80 – this may be a significant problem for commercial navigation

- Add openings to long barrier islands to allow sediment laden flows to pass through and build deltas or island width on the backwater side of the island (promotes natural river processes vs. heavy construction methods to achieve the same)

- Reconstruct old channel levees that have eroded away to create riparian habitat and intercept wave energy

- Use of dredged material to increase ridge/swale topography within floodplain and restore mast trees; this could be done on smaller scale in combination of light selective logging in well-established forest stands to improve light conditions for planted trees – or on larger scale in mid-pool areas where forest has already converted over to reed canary or other more mesic herbaceous vegetation

- Add land acquisition as a management action

- There is a need to expand on the definitions of some of the management actions from the spreadsheet – clarifying which are really actions and which are objectives – and possibly linking them to actual outcomes to help define

Plants and animals

- Should there be a barrier on St.Croix River to prevent movement of exotic species? How could this be done without impeding native species?

- Make use of additional voluntary closed areas for waterfowl protection

- Focus more research on disease resistant elm seedlings that could be produced economically and re-established in the floodplain

- Implement a mussel conservation plan, including a list of management actions

- Include control of exotic/invasive plant species as a management action (reed canary, purple loosestrife, buckthorn, etc.)

- Zebra mussels were set back by high water temperatures a couple years ago. Look into taking the opportunity during a hot summer to have local utilities discharge water at higher temps in main channel and reduce zebra mussel populations

All

- develop techniques to provide sanitary facilities for beach/island campers and other rec users

- adjust dredging frequencies to gain cost efficiencies and other benefits

- Add to the BMP list the following – Set objectives for both TMDLs and the hydrologic regime of tributaries

- Get USDA, USGS and FEMA involved in this entire process. We need these people at the field level discussions. MVR says they get some involvement at the RRCT level and on Illinois River, but they is still a need for more involvement.

- Implement the Galloway report recommendations

- River managers need to set some targets for the watershed programs that USDA implements, since these projects are currently being implemented on more of a political basis instead of an organized fashion that meets main stem river ecosystem objectives

- River management agencies could take on more responsibility to educate the public on the importance of watershed protection to the health of the river. The agencies should use their respective interpretive programs to get the word out.

Appendix G. Species and Population Parameters

Purpose: To identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.

Background: Recent environmental planning efforts for the Environmental Management Program and other Upper Mississippi River System restoration and maintenance programs have focused on habitats and the impacts of Corps activities on habitats. It has been recognized that planning needs to be expanded to include additional functional and structural ecosystem elements.

During the planning stages of this workshop, organizers were considering objectives for plant and animal species and quickly encountered difficulty in selecting guilds, species, or units of measure for plants and animals. Emergent and submersed aquatic plants, diving ducks, and dabbling ducks were eventually selected based on the perception that knowledgeable resource managers could interpret the units of measure selected. It was determined that stem density was a relatively standard unit of measure for aquatic plants and that use-days during migration periods were relatively standard measures of waterfowl abundance.

Specific objectives for fish were desired, but the selection of guilds, or species, or units of measure quickly complicated the issue. It was decided therefore to back-off on the specifics for fish objectives and only indicate that there is an objective for several general categories of fish determined during earlier phases of the Navigation Study: protected, sport, commercial, forage, and exotic fishes in channel and backwater habitats. The unit of measure became particularly complicated because of our desire to establish quantitative objectives, but our general inability or lack of commitment to fish community stock assessments. Discussion of the unit of measure is particularly important because of our need for measurable objectives and our selection of evaluation tools.

These issues were discussed during a plenary session at the workshop, with the results to be forwarded to an expert panel. A focus group of workshop participants will continue work with the expert panel to refine fisheries objectives. The larger list of species such as reptiles, amphibians, other birds, and mammals will be considered during future phases of the adaptive management and assessment process recommended in the Navigation Study Interim Report.

Results:
Participants at the La Crosse workshops expressed apprehension about setting species abundance targets. The source of apprehension for some was that environmental management actions to achieve species targets may be undertaken without knowing or evaluating the impacts on the rest of the ecosystem. Stocking fish, for example, may help achieve species targets, but may also result in overpopulation and food or habitat limitations on other species.

Overwhelmingly, the participants expressed a desire for habitat objectives, with the understanding that habitat management will likely result in increased abundance of both targeted and non-targeted species. Environmental Pool Plans were suggested as the preferred mechanism to illustrate habitat objectives. Monitoring and understanding existing conditions was mentioned several times with the thought that pre-project conditions should be compared to post-project environmental responses. Environmental monitoring data was also mentioned as valuable to help understand existing conditions and to establish expectations for restoration efforts. Workshop participants thought the catch rate and relative abundance of species in the catch were viable measures of the fish community response to aquatic restoration initiatives. Participants also suggested that monitoring and project performance assessments should be habitat specific. Funding monitoring and project performance assessments should be a high priority for an adaptive management scheme proposed for UMR-IWW ecosystem management efforts.

Workshop participants thought that physical responses (e.g., current, dissolved oxygen, depth, etc.) to project implementation may be reliable measures of project performance. Their thoughts were that projects should be designed to accommodate the physical needs of target organisms or communities, thus the effectiveness of the project could be evaluated by its ability to achieve desired physical targets. That line of reasoning circumvents the problems of waiting for biological communities to respond, or expending huge amounts of effort to estimate biological responses to projects separate from other influences on the population. Some long-lived species or wide-ranging species responses may be very difficult or impossible to evaluate. The lag time between project implementation, post-project performance evaluations (biological and physical), and reporting results was seen as an important issue to understand.

Several participants espoused the adaptive management philosophy put forth in the UMR-IWW System Navigation Feasibility Study Interim Report and other venues. The adaptive management process allows for action despite uncertainties, and evaluation to refine management practices where actions fall short of anticipated results.

As in Peoria, the question of why species abundance needs to be enumerated was raised in La Crosse. Theiling suggested that the efforts to enumerate species may provide information to estimate economic output from restoration projects. There were concerns that abundance cannot be accurately measured economically, and that the effort and potential impacts of extensive sampling may not be worth the answered obtained. There were also concerns that some of the necessary ecosystem restoration measures might not provide results that appear cost effective in the short-run, but are in fact critical to the well-being of the ecosystem; land acquisition was put forth as and example.

The cost-benefit issues initiated a discussion of what Congress is looking for to support UMR-IWW restoration initiatives. Scott Faber suggested that Congress was not going to write a blank check and that the UMR-IWW environmental management community needs to describe specific hypothetical projects, their outcomes, and costs. He suggested the approach should be one of establishing the need (as done with the HNA) and recommending short-term and long-term efforts to address those needs. Monitoring efforts should be an integral component of any restoration plan.

Considering all the issues, participants seemed to agree that sensitive and exotic species should be tracked as indicators of ecosystem condition and that community level assessments should be targeted at specific habitats and project areas. The desire for absolute abundance estimates should not be ignored, but should also not be acquired at the expense of other monitoring or restoration efforts.

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to the species and population measurements. The entire plenary report can be found in Appendix C.

Species and Population Plenary Session:

– There is some apprehension about setting species targets. Setting targets is risky. We can make decisions without knowing impacts on the systems. If we implement the habitat from the pool plans you can take the abundance and quality of that. Work on diversifying habitats as best as we can provide at that site – then use measured abundances as a healthy goal. In MN we are concerned about targeting for a specific species.

– Pre and Post project monitoring is important. Biological response for habitat monitoring. What is the biological concentration around the potential project? Need some more focused research from LTRM. See if current populations decline once a new project starts. Also look and that area's habitat (disease, dissolved oxygen, temperature) to ensure response is from project. If you have a great enough separation of sites you are probably not taking fish from one area, but are giving new habitat for larval drift.

–Worked with Carl Korschgen to create a matrix (Phase II Pool 8 island) (before HNA). Looked at a whole range of critters and vegetation classes.

- Look at the area where bluegills are the majority. The contiguous backwater is the main habitat of them. So, try to identify preferred habitat of organisms. Develop a matrix that would be more refined than phase II but take the same approach. Look at LTRM databases and query to find the percentages to determine preferred habitat.

–We don't fund EMP to a decent level so how are we going to get this kind of information? If there are certain ways we want to collect data are there any assurances that this will happen out in the future?

Theiling – This is important to ask in this kind of venue because it is telling the program managers this. Ken Barr and others have stated that they would like the monitoring (cause and effect) to become part of the adaptive management.

– You say money will be available for focused research, but what about baseline monitoring? We need more trend analysis and baseline information.

Theiling – Are you talking more historic baseline or today? Because some areas are better today than they were in history.

– There is a shift in species dominance over time – it takes 50-60 years to see a response to our actions.

Theiling – This brings in baselines. Also justifying existing impacts. Yes they are there, but let's go and find out what is causing certain degradation. So then we can build a predictive model to help us even more.

– We did that in phase II, however this was not focused research. A picture can speak a thousand words. Power analysis showed how low you could go but also how high you should go. We have data to justify the level of monitoring that is needed. If you think these numbers are important give us an idea of where the really good areas are. Maybe in 30-40 years we can fill this database.

Theiling – I appreciate the monitoring you do. Who thinks this needs to be written down? Does the Corps need to make arrangements to get it written down or support the states to write it down?

– In fisheries we have 10 years of data, but many species have longer life spans, so the data won't help. Not going to be able to pull out lots of data because of that.

– I can build my pop can because I have a design. But that is why we have adaptive management on the river because we don't have plans. I think that HREP and LTRM should have been tied together. Stoddard Island shows what EMP and HREP can do together. That is a success story. You will see bits and pieces but one of these days you will see these little cartoons come about. In each project we should have monitoring included.

– What don't you have now? We know that we built the project, Velocity, Temp, and DO improved. What else do you need to know? We are assessing data from our projects. It takes some time to get it published but it is there. We will never get biomass info from LTRM unless we want to spend a lot of money. We shouldn't worry about it because it isn't going to happen. We shouldn't tear apart the entire ecosystem into numbers.

–The real question I have now…are you saying we need this information to justify this program? I say no, there is no way we can do this.

Theiling – No one says you have to; however we may need to, in order to compete with other programs. If we could show that because a project went in we got x bluegills that are worth x $'s do the math and show how the economic benefits are better than the costs. They will see that the recreational benefits will outweigh navigation.

– The authority to use recreation benefits, as part of our environmental benefits, like navigation can, would be a good change.

Theiling – We need to come up with a model to estimate benefits better than everyone else.

– We did come up with Habitat Units (HEP). You are talking about revisiting this. Bottom line is that you should compare this dollar per dollar.

Theiling – No one is asking us or telling us to do this. But this is a good opportunity.

– This is the same problem we had before we developed HEP. But we don't need to do that. We need to show a little cartoon. But if that is not enough then we need to have another discussion. I don't think they went through a HEP analysis in Florida. If we do economic then we start to get into incremental analysis and only get what is cost effective. Adaptive management will be hard for Corps to do.

– It might be able to help us to prioritize.

– We want a sustainable river. Now we are where we get the biggest bang for your buck. If we do this we will overlook the subtle needs of the ecosystem that are essential for restoring sustainability. Something that is essentially critical for the system may cost a lot of money and not get a lot of return. What may be really, really important will be things that take a lot of work. Land acquisition will be very difficult, but we know we need that. Is that a top priority… we need all of the tools. It is all interrelated.

– We shouldn't worry about making the math justifying the expenditures. The justification will be political and social mostly anyway. Monitoring data should be collected to make sure you are making the correct investments. One of the big fallouts of the Everglades is that this Congress isn't going to write a blank check. They are going to want to see a higher level of detail (what project, when built, what outcomes). A lot of members have said, we aren't going to do that again. Come up with a suite of very specific projects with a built in monitoring program.

– If we are talking adaptive management we have to have some monitoring involved. We see response out there. Build in a standard 1% into the cost of the project. We could come up with some very simple monitoring aspects. We may have to get at more subtleties.

Theiling – If you are going to have objectives then you need to have a monitoring - accountability.

– That is why we need to look about the chemical response because the biological response takes time. It takes many years to monitor biological yet the chemical and physical response is almost immediate. Islands in Pool 8 at first didn't show the biological response. However the response took longer than the monitoring.

–Are the pools plans the kind of information that we can package up to Congress? Will this successfully get us $ to congress?

– It won't be enough today. You need to have specific projects. Here are the hypothetical projects that we would implement. Give Congress assurance that you have pegged the cost a little bit. Congress will want to see some thinking behind the numbers.

– What about the UMRCC.

– Some members see this as an unrealistically huge number because Members of Congress don't understand it. Also Congress thinks that the Corps can't handle it.

– Here is what we can handle annually now, here is what we could handle in the future. Show a curve of increasing amounts. It is hard to see the Corps numbers going way up, the members of Congress are having a visceral reaction to this. It would help me to show what you are monitoring for. A matrix of habitats or desired habitat would be a better index for monitoring.

– The HNA query tool could be used. It will generate a number for the bean counters. We could make this a log linear. This is a long process (the UMRCC is a need) that needs to get more money to the Corp, FWS and states.

– Are there some critters that we will monitor that we don't know much about? There is skepticism about what LTRMP is producing.

– There shouldn't be the skepticism because there was an EMP report to Congress that did that. As far as monitoring, we have had these discussions many times over. We monitor what we can with what funds are available. We've monitored both structural and functional. It would be good to fund the LTRM to be close to our objectives; to see if we are getting there (SMART Criteria). Long-term estimate of cost to some target future condition… we have a whole set of objectives with dates and we are required to do some plan formulation within the Navigation Studies. With regard to the size of the dollar figure, I'm not sure. There will be more data and plan formulation behind it.

– Does there come a time when you don't evaluate an HREP project because you know it works?

Theiling– Sure, ideally.

– Achieving ecological integrity is the ultimate goal of the objectives. As for species it becomes too overwhelming to have quantitative objectives for all guilds/species. Are there certain categories that are important (T&E or indicator species). The pool plans don't represent ecological health. Don't think so much about monitoring, but think about original goals and what you are trying to achieve.

–You are trying to get us to a different level in each project report. The problem is that by the time we are done in the entire river there will be new information that will cause us to do this again. So instead we need to show our evolution in our thought process… Look at effects outside the project area and other things have evolved. We cannot develop that level of detail. Let's just do it. We've got plans. We need to get down to work and do something. We need a propaganda person to start telling people that we have been doing a good job. We are beating everyone for dollars spent.

– Comments from John Sullivan – The environmental goals will have to be a multitude of things, we have to use some best judgment and others will have to trust us as we do them. There is a wealth of knowledge in the LTRM database and the Corps needs to mine that data out in the next year. Also use this to identify data gaps and figure out how to address them. The Corps should be financially supporting them in their effort.
We have to validate everything that we have gone before.

– Members of Congress think EMP is a valuable program. What they don't know is that EMP is not provided sufficient resources to implement to pool plans. You do have incredible integrity because you are scientists and that is your biggest tool. We need to get scientists up to the hill.

– What you are saying is that we need to tell Congress that EMP is a prototype and we need to implement the full thing.

– It will be a tough climb. Status and trends did not make good conclusions that common folks can understand.

– It is amazing where we have come in 4 years. We are in an exponential growth in what we believe we can accomplish, what we need, and what we know. This is because of HNA and LTRM. HNA gave us a true picture of what we need to do. Congress asked for HNA report and that is where the numbers came from.

– Perhaps for population or species we should stick with goals rather than developing this fine level of management with detailed objectives that we cannot accomplish. The USFWS has been going to mostly developing habitat rather than focusing on individual species.

– Are there indicator species?

Theiling – If money and time were no objects would you want total species indicators?

–Why?

– Look at sensitive species vs. exotics and see how they each respond to what we do. To look for really rare stuff the sampling effort is really big. Figure out over time if rare things dropped off and exotics boomed. Or vice versa.

– We have been measuring habitats, so if we see something that is desirable and describe what we want we can say this is what we are getting at. We are still able to look at numbers. Look at representative sites and use this.

- We still need to do spatial study (land cover, hydrology, changes in land form). That gets us a long way to look at the physical patterns of the systems. Come to agreement on array of organisms to monitor to come up with condition of the ecosystem. We need information about abundance of life. There is a compilation of non-LTRM data through the UMRCC.

– We need to put this in context that the Congressman can understand.

– The farm bill is a perfect example of how Congress wants feedback.

– We will have to do what we can and keep it real simple. Our 404 dredging study has taken a lot of individual studies. How much detail will we have to do? Do it at every project or make some assumptions.

Appendix H. Conceptual Model Presentation

The overall purpose of a conceptual model developed for the UMR-IWW Navigation Study is to identify the linkages and sequencing of identified objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to the overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Develop a structure for additional input from stakeholders

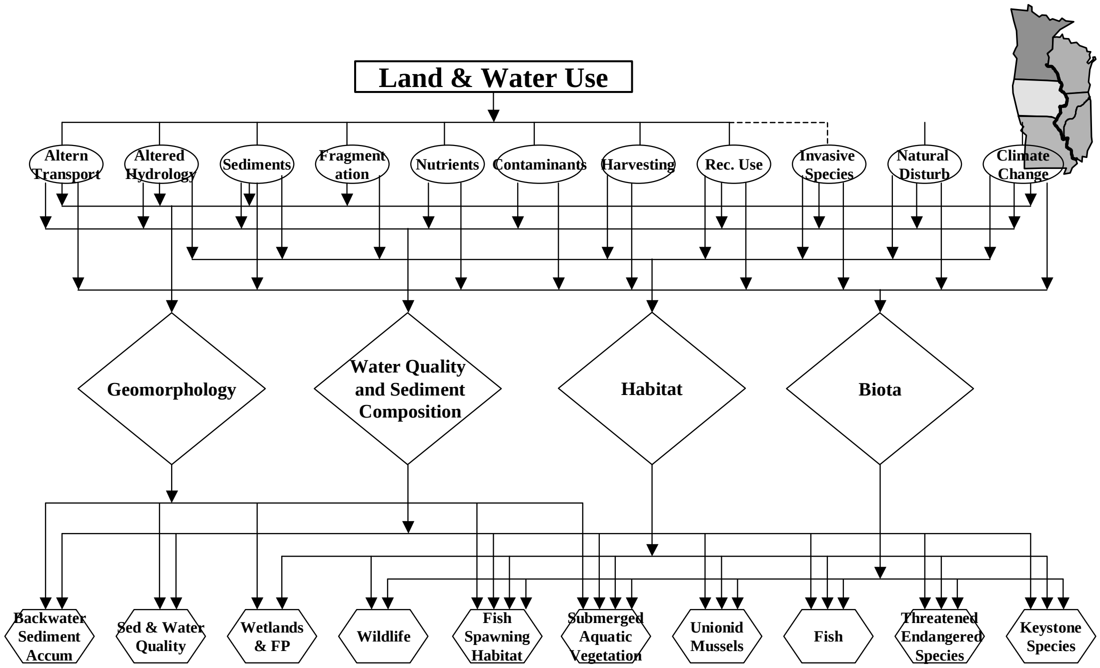
The following slides were used at each of the workshops to present information on the current draft conceptual model.

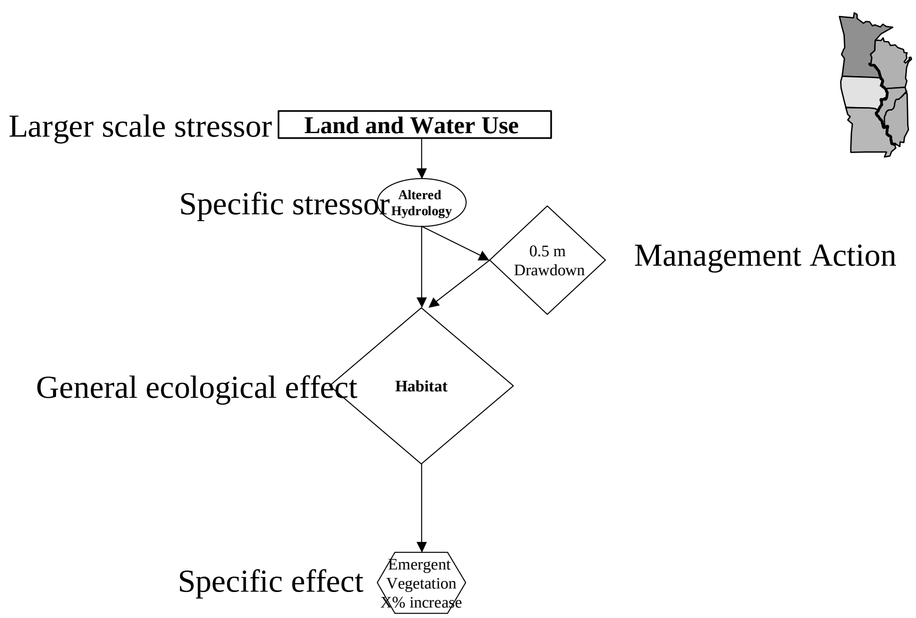
UMR-IWW Ecosystem Conceptual Models

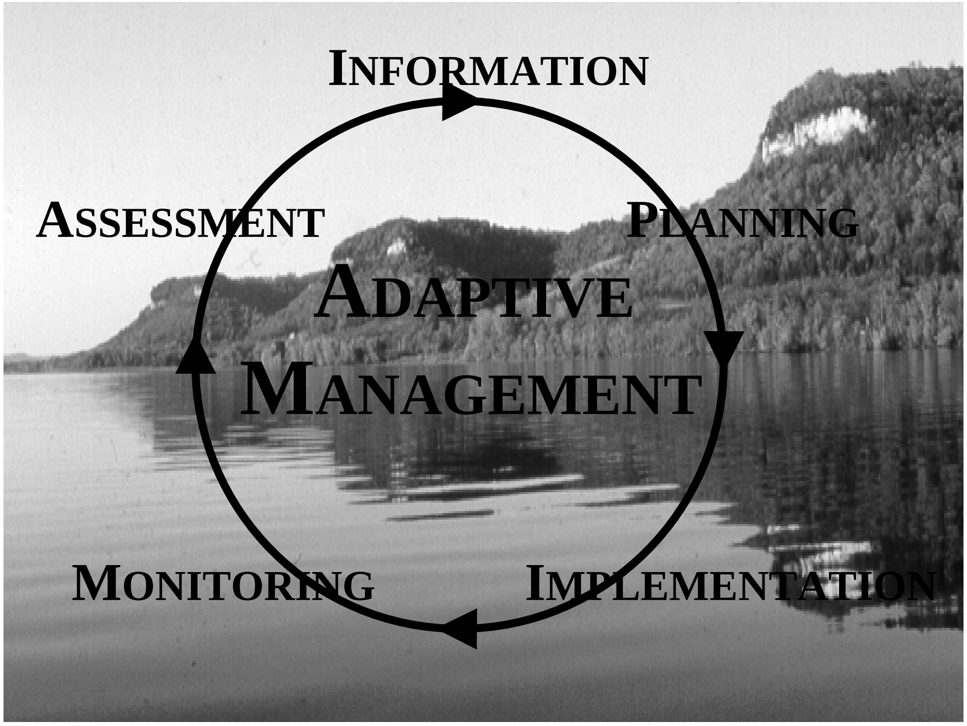
- **Background**
  - – **Conceptual models help to gain a better understanding of the linkages between:**
    - **Environmental Objectives**
    - **Management Actions**
    - **State of the Ecosystem**
- **Task**
  - – **Discuss the utility of developing a UMR-IWW ecosystem conceptual model**

Purposes of a Conceptual Model for the UMR-IWW

- **To visually present a complex system**
- **Creates a framework for additional input**
- **Provides a basis for decision making in relation to the achievement of objectives**
- **Develops a structure for implementing adaptive management and restoration**


Land & Water Use
Altern Transport
Altered Hydrology
Sediments
Fragment ation
Nutrients
Contaminants
Harvesting
Rec. Use
Invasive Species
Natural Disturb
Climate Change
Geomorphology
Water Quality and Sediment Composition
Habitat
Biota
Backwater Sediment Accum
Sed & Water Quality
Wetlands & FP
Wildlife
Fish Spawning Habitat
Submerged Aquatic Vegetation
Unionid Mussels
Fish
Threatened Endangered Species
Keystone Species


Larger scale stressor
Land and Water Use
Specific stressor
Altered Hydrology
0.5 m Drawdown
Management Action
General ecological effect
Habitat
Specific effect
Emergent Vegetation X% increase


INFORMATION
ASSESSMENT
PLANNING
ADAPTIVE
MANAGEMENT
MONITORING
IMPLEMENTATION

Appendix I. Power Point Presentations

This section contains the power point slides used to present background and introductory information throughout the workshops. They are given in the order they were presented on the agenda.

The Power Point Presentations will be included in the final version of the printed workshop reports. You can download them by going to the following FTP site

ftp://ftp.usace.army.mil/Incoming/MVR/NavStudy/**.**

Appendix G. Moline Environmental Workshop Report

The following report summarizes the results of the Moline Environmental Workshop that was held November 20-21, 2002. The report includes:

1. a summary of the workshop and results,
2. tables of identified UMR-IWW environmental objectives,
3. a table of identified management actions,
4. a narrative on UMR-IWW species and population parameters,
5. working group reports, and
6. the plenary session report.

Upper Mississippi River – Illinois Waterway System Navigation Feasibility Study

Moline Environmental Workshop

November 20-21, 2002
Moline, IL

DRAFT REPORT

January 2003

United States Army Corps of Engineers

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EXECUTIVE SUMMARY

Introduction and Workshop Process

The restructured Upper Mississippi River –Illinois Waterway (UMR-IWW) System Navigation Feasibility Study is focused on the authorized Federal navigation projects on the Upper Mississippi River System (UMRS; including the Illinois Waterway; Figure 1) and the ecological and floodplain resources that are affected by these navigation projects. The objectives of this restructured feasibility study are to relieve lock congestion, achieve an environmentally sustainable navigation system, and address ecosystem and floodplain management needs related to navigation in a holistic manner. The restructured navigation study will seek to ensure that the rivers and waterway system will continue to be an effective transportation system and a nationally treasured ecological resource. The restructured study will: (1) further identify the long-term economic and ecological needs, and potential measures to meet those needs, through collaboration with interested agencies, stakeholders and the public; (2) evaluate various alternative plans to address those needs; (3) present a plan consisting of a set of measures for implementation that will achieve the study objectives; and (4) identify and address issues related to the implementation of the recommended plan.

The study area comprises the entire Illinois Waterway and the Upper Mississippi River. The Illinois Waterway extends 327 miles from its confluence with the Mississippi River to Lake Michigan via the Illinois River, Des Plaines River, and a series of canals. The Upper Mississippi River extends 854 miles from the confluence with the Ohio River to Upper St. Anthony Falls Lock in Minneapolis-St. Paul, Minnesota. The study area lies within portions of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The total Illinois Waterway and Mississippi River navigation system contains 1,200 miles of nine-foot deep channels, 37 lock and dam sites (43 locks) and thousands of channel training structures (Figure 1).

Much of the UMRS lock and dam system was in place by the 1940s. Except as noted below, the locks are 600 feet long, although, modern tow configurations include 15 barges and approach 1,200 feet long. As a result, most tows must lock through using a time-consuming two-step process in which the first three rows of barges (9 barges) are locked through first and the last two rows of barges (6 barges) and the tow boat are locked through second. The entire process may take 1.5 hours or longer depending on many variables. In contrast, Lock 19 has a 1,200-foot lock and Melvin Price Lock and Dam (Lock 26 replacement) and 27 have both a 1,200-foot and a 600-foot chamber at each site. The lockage process takes an average of 1.0 hours at Lock 19 and 0.6 hours at Locks 26 and 27.

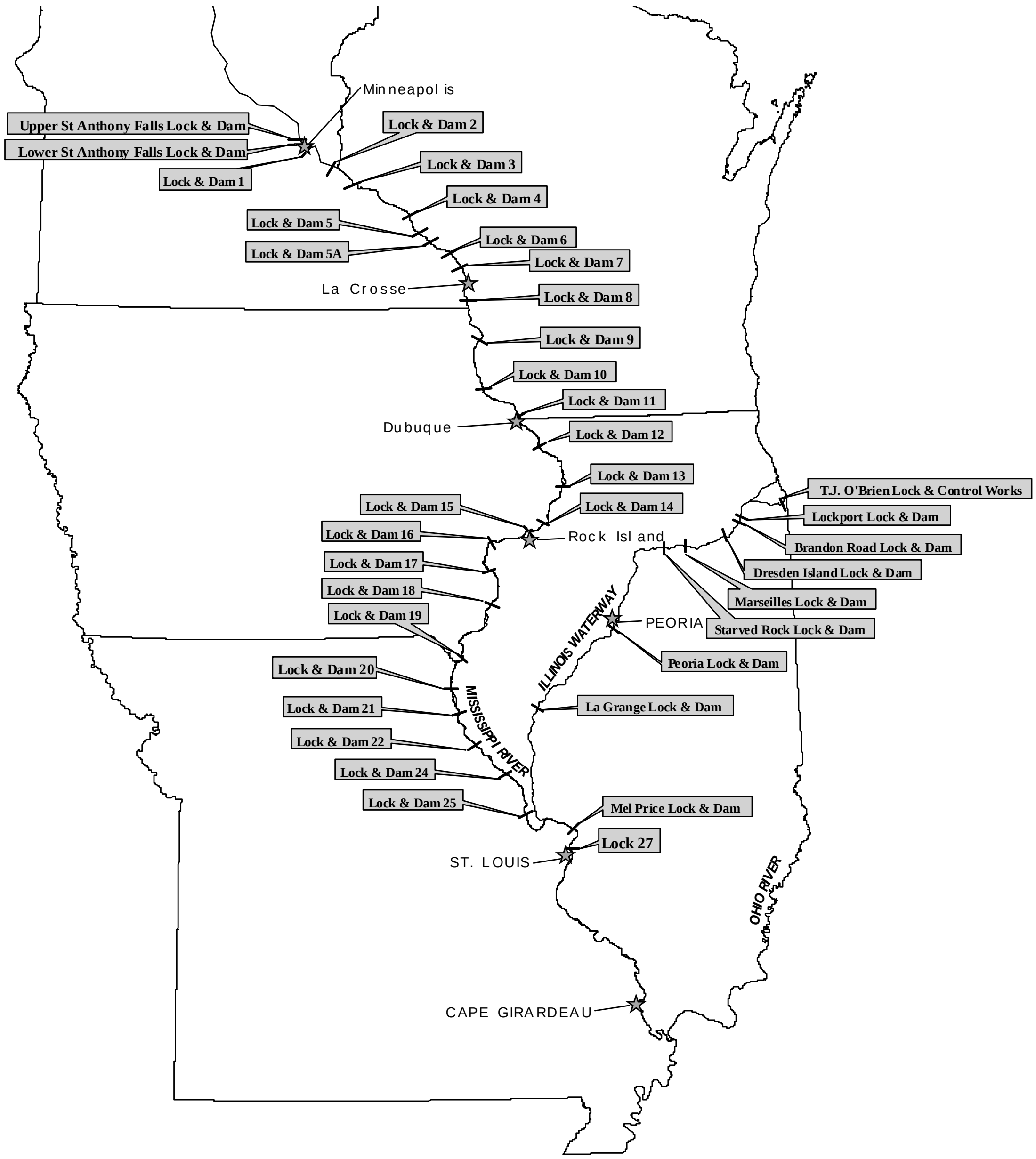

Figure1. UMR-IWW Locks and Dams.

Eight locks on the Upper Mississippi River and 3 Illinois Waterway locks were among 20 locks with the highest average delays in 1987 at the beginning of this study. This remains the case with UMR-IWW facilities highly ranked in the peak monthly delays at locks around the country in 1998. The UMRS had over half (19 of 36) of the most delayed lock sites in the country. Under current conditions, delays to tows are common at a number of locks on the UMRS. In general, delays are greatest at the most downstream 600-foot locks. For the 10-year period 1990-1999, delays per tow average 3.4 hours at Locks 20-25; 2.2 hours at Locks 14-18; 0.9 hour at Locks 8-13; and 0.4 hour for Upper St. Anthony Lock to Lock 7. On the IWW over the same period, delays per tow average 1.8 hours at Peoria and La Grange and 1.1 hours for the other locks.

Ecosystem

The Upper Mississippi River ecosystem includes the river reaches described above, as well as the floodplain habitats that are critically important to large river floodplain systems. The total acreage of the river-floodplain system exceeds 2.6 million acres of aquatic, wetland, forest, grassland, and agricultural habitats. The Mississippi Flyway is used by more than 40% of the migratory waterfowl traversing the United States. These Trust Species and the threatened and endangered species in the region are the focus of considerable Federal wildlife management activities. In the middle and southern portions of the basin the habitat provided by the mainstem rivers represents the most important and abundant habitat in the region for many species.

Habitat types are disproportionately distributed throughout the river system, and their absolute abundance is dependent on the total area of the reach under consideration (Figure 2). The largest differences occur in the amount and distribution of agriculture and the proportion of open water in the floodplain. Agriculture dominates the wide floodplain south of Rock Island, Illinois and open water occupies a greater proportion of the floodplain north of Clinton, Iowa. Wetland classes are generally more abundant in northern river reaches, wet meadows are fairly evenly distributed, and grasslands are rare throughout the river system. Forest classes generally occupy between 10 to 20 percent of the floodplain in a narrow strip along the river banks throughout the system.

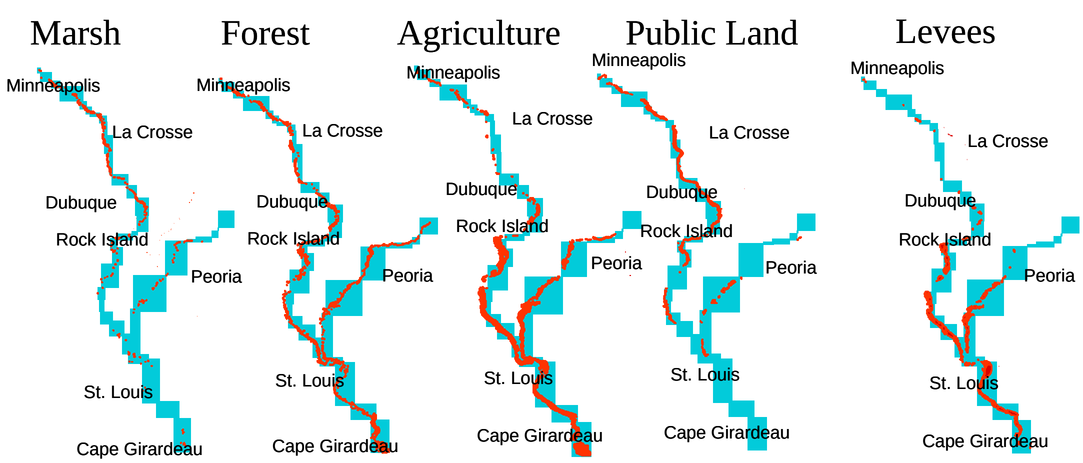

Figure 2. Areas in red show the extent of selected landcover or landuse types on the UMR-IWW.

Section 1103 of the Water Resources Development Act of 1986 (WRDA 86) recognized the Upper Mississippi River system as a unique, nationally significant ecosystem and a nationally significant commercial navigation system. The system provides:

1. A means for shippers to transport million of tons of commodities within the study area---130 million tons on the Mississippi River and 44 million tons on the Illinois Waterway in 2000,

2. Food and habitat for at least 485 species of birds, mammals, amphibians, reptiles, and fish (including 10 Federally endangered or threatened species and 100 state listed species),

3. More than 226,650 acres of national wildlife and fish refuge,

4. Water supply for 22 communities and many farmers, and industries,

5. A multi-use recreational resource providing more than 11 million recreational visits each year,

6. Cultural evidence of our Nation's past.

Establishing Goals for the System

The original UMR-IWW Navigation Feasibility Study was narrowly focused on the problem of reducing commercial navigation traffic congestion on the system. Coordination was occurring between economic and environmental interests;, however, the work was being accomplished independently. With the new focus of the restructured study on sustainability, it became important for the stakeholders of the system to prepare a common vision for the future of the UMRS. In November 2001, the Economic Coordinating Committee (ECC) and the Navigation Environmental Coordinating Committee (NECC) met jointly to prepare this vision:

> *"To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System"*

The following definition of sustainability was collaboratively developed and agreed to by the group as well:

> *"The balance of economic, ecological, and social conditions so as to meet the current, projected, and future needs of the Upper Mississippi River System without compromising the ability of future generations to meet their needs."*

This definition will serve as the primary goal for integrated and adaptive management of the Upper Mississippi River System.

Planning for future navigation system infrastructure needs; navigation system operation and maintenance; habitat protection, enhancement, and restoration; river recreation; floodplain management; and water quality management should be conducted in the context of a set of clear goals and objectives for condition of the UMRS. Setting these goals and objectives should be done collaboratively, with participation of the full community of river stakeholders. Development of a set of measurable objectives for integrated and adaptive management of the UMRS will be challenging. It will require considerable collaborative effort, making use of conceptual models, predictive models, and visualization tools to comprehend the interconnections between system components and to enable the community of stakeholders to actively participate in planning for a

sustainable multiple use river-floodplain system. Integrated planning will be an on-going effort to optimize the National benefits achieved from efficient and effective adaptive river management.

Introduction to the Workshop

Four two-day workshops were held during November 2002, to aid the process of establishing measurable environmental objectives for the Upper Mississippi River-Illinois Waterway System (UMR-IWW). Workshops were conducted in Peoria, Illinois, St. Louis, Missouri, La Crosse, Wisconsin and Moline, Illinois.

The workshops were structured to achieve the following main objectives:

1) <u>Identification of UMR-IWW environmental objectives</u>
   Collaboratively review, refine, and add to a database of specific, quantitative, local to regional scale environmental objectives (for the workshop region) building on previous work from the EMP Habitat Needs Assessment, Pool Plans, USFWS Comprehensive Conservation Plans, and related study efforts.
2) <u>Identification of UMR-IWW management actions</u>
   Review and identify management actions that are most likely to contribute to achieving the established goals and objectives.
3) <u>Discuss and identify species and population parameters</u>
   Identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.
4) <u>Present and discuss UMR-IWW ecosystem conceptual model</u>
   Present and discuss the utility of developing an UMR-IWW ecosystem conceptual model to gain a better understanding of the linkages between environmental objectives, management actions, and the state of the ecosystem.

Participants were invited from a variety of organizations including the U.S. Army Corps of Engineers, U.S. Department of Forestry, U.S. Department of Transportation – Maritime Administration, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, Iowa Department of Natural Resources (DNR), Illinois DNR, Illinois Department of Water Resources, Illinois Natural History Survey, IL State water Survey, Minnesota DNR, Missouri Department of Conservation, Missouri DNR, Wisconsin DNR, Audubon Society, Environmental Defense, Iowa Farm Bureau, Izaak Walton League, MARC 2000, MRBA, Mississippi River Revival, Missouri Coalition for the Environment, Sierra Club, Southern Illinois University, The Nature Conservancy, University of Miami, UMIMRA, UMRCC, and Quincy Park District. There were a total of 142 people who participated in the interactive workshop process. This report presents the results of the enormous amount of effort and energy the participants contributed to the workshops.

Workshop Process

The workshop was organized by the U.S. Army Corps of Engineers (USACE) Rock Island District. A subset of the workshop participants helped review and edit this Workshop Report. Outside review by non-participants will not be part of the process.

No content changes were made by the editors and the participants checked that accurate representations were made of the work they had done during the workshop.

The Moline workshop was conducted 20 - 21 November, 2002 at the Moline Holiday Inn, Moline Illinois. There were 28 participants, with most present the entire duration of the workshop. These participants, from more than 50 issued invitations, included state and federal wildlife agency personnel, non-governmental agency representatives, and public citizens. Participants and invitees are listed in Appendix A.

The agenda for the workshop (Appendix B) was followed loosely, allowing extra time for questions and time in the workgroups as needed. A record of these plenary discussions is found in Appendix C, while workgroup reports can be found in the appendices related to their topic of discussion.

Background on the General Workshop Structure

The workshop process was designed to maximize the time and resources available at each of the meetings. The workshops utilized three components of meeting structure to meet the objectives of eliciting information, discussing key issues, and informing the participants of developing strategies.

The first component was the standard meeting style wherein a few speakers provided information to the group as a whole allowing for questions and some discussion.

The second component was key for eliciting information and involved breaking the group into working groups based on some criteria such as geography or content. Breaking a large meeting into working groups comprised of 10 or fewer individuals optimized the opportunity for participation of the greatest number of people and for timely discussion and progression on key issues. The number of working groups varied depending on the number of participants and geographic areas to be covered.

The third component were the plenary sessions, which allowed all of the participants to hear a summary of what was accomplished in the other working groups and to have input into the entire set of results. It also allowed the facilitators to refine the GIS database as a coordinated team.

Before getting started with the first task of this workshop, each participant was asked to introduce themselves and to write out and then read aloud answers to an introductory question. This process allowed for expression of individual perspectives without being immediately influenced by previous responses. This process indicated potential areas of common ground and provided a first insight into the diversity of perceived issues present in the group. Answers to the question can be found in Appendix D of this report.

After the Workshops

The workshops were an early step in a planning process to establish environmental alternatives that strive to secure the environmental sustainability of the UMR-IWW. Once the environmental objectives are well defined and management actions are identified to achieve them, the next step will be estimating the potential costs and outcomes (i.e., benefits) for the suggested actions. This information will be used to develop alternative plans (made up of multiple combinations of management actions) that seek to address the local, river reach, and system-wide needs of the UMR-IWW ecosystem. These environmental alternative plans will then be integrated with alternative plans for the UMR-IWW Navigation System. Tradeoff analysis will be conducted to identify and compare the environmental, economic, and social benefits of the integrated plans. The results of the alternative analysis, and further collaborative review and input from stakeholders, will be used to develop a recommended plan portrayed in the Final Feasibility Report scheduled for completion in late 2004.

Formal Report

Five reports will be produced as a result of the four, two-day workshops. The first four reports are Workshop Reports, which will be reviewed by the workshop participants. A final integrated report summarizing the results from the four workshops will be published as part of the Navigation Study's formal documentation process. The final integrated report will contain a full accounting of the site-specific objectives in the form of an atlas as well as the tabulated system, reach, and pool wide objectives and management actions (Table 1). Workshop participants will have an opportunity to review and comment on the integrated Draft Environmental Objectives Planning Workshops Report before its completion in early 2003.

Table 1. UMR-IWW System Navigation Feasibility Study Environmental Objective Workshops reports contents.

- Moline Environmental Workshop Report
    - Summary of Moline workshop and results
    - Tables of identified Upper Mississippi River pool-wide and site-specific objectives
    - Table of identified management actions
    - Narrative of species and population parameters
    - Working Group Reports
    - Plenary Session Report

- <u>Environmental Objectives Planning Workshops Report</u>
  - Summary of all four workshops
  - Tables of all identified UMR-IWW pool-wide and site-specific objectives
  - Atlas maps of all identified site-specific objectives
  - Table of all identified managements actions
  - Narrative of UMR-IWW species and population parameters

Environmental Objectives

The primary goal of the Environmental Objectives Planning Workshops was to have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts. The Moline Workshop was successful in reviewing and identifying both site-specific and pool-wide objectives for the Mississippi River (Pools 12-22) using a combination of breakout groups and a plenary session. Objective atlas maps and worksheets were reviewed and filled out by breakout groups. A plenary session then followed where the information from each group was compiled into the objective database using GIS tools (Figure 3).

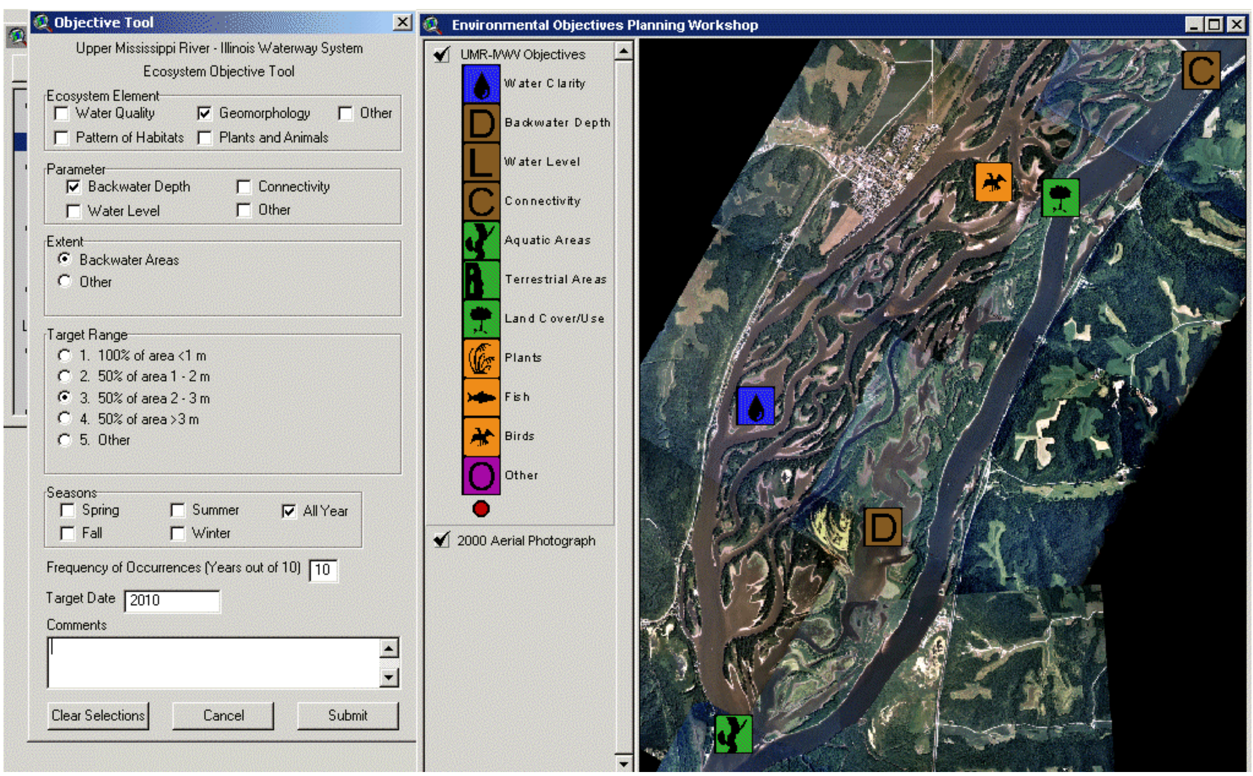

Figure 3. UMR-IWW System Navigation Feasibility Study GIS Objective Tool and Database.

The environmental objective database used at the Moline Workshop included 374 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment (HNA) and Mississippi River Environmental Pool Plans. Two additional data sources were identified during the Moline Workshop and later added to the objective database. They included objectives noted by the Fish and Wildlife Interagency Committee (FWIC) Restoration Priorities and Habitat Rehabilitation and Enhancement Project (HREP) documents. HREP objectives were noted only for projects described as ‘under general design’ or ‘future opportunities’.

An additional 247 site-specific objectives were identified through the workshop process bringing the total to 621 environmental objectives for the Pool 12-22 reach of the Mississippi River (see Table 2). Over 400 of the identified objectives were also enhanced with additional detailed information (i.e., target ranges, seasonality, and descriptive comments) provided by the participants. Land cover/use, aquatic area, water clarity, and backwater depth were the most common type of objectives identified for this portion of the river. Emergent aquatic and forest vegetation made up the largest number of identified land cover objectives and aquatic area objectives most often referred to secondary channel habitat. The 62 environmental objectives identified as ‘Other’ included objectives related to restoring historic migratory bird habitat, meeting TMDL requirements for tributaries, reducing urban stormwater runoff, and targeting land for acquisition. Pool 22 had the largest density of identified objectives with an average of over four per river mile. Appendix E provides additional detail on the objectives listed in Table 2. Maps of all site-specific objectives identified in the workshop will be distributed for review in the integrated Environmental Objectives Planning Workshops Draft Report (in January).

	Mississippi River Reach											
Objective	**Pool 12**	**Pool 13**	**Pool 14**	**Pool 15**	**Pool 16**	**Pool 17**	**Pool 18**	**Pool 19**	**Pool 20**	**Pool 21**	**Pool 22**	**Total**
Water Clarity	14	14	10	0	8	6	8	8	9	9	11	97
Backwater Depth	16	14	12	0	7	7	8	9	6	6	11	96
Water Level	1	1	1	1	1	1	1	1	2	1	1	12
Connectivity	2	2	2	2	2	4	6	2	1	9	10	42
Aquatic Areas	4	9	5	2	11	7	9	6	21	3	19	96
Terrestrial Areas	12	16	6	1	2	1	7	10	3	9	9	76
Land Cover/Use	15	15	11	0	9	12	10	12	18	10	23	135
Fish	1	1	1	1	0	0	1	0	0	0	0	5
Other	0	0	3	3	1	2	0	3	20	14	16	62
Total	65	72	51	10	41	40	50	51	80	61	100	621

Table 2. Number of site-specific env. objectives identified for the Mississippi River.

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- address concerns of 303D (impaired water's list),
- increase connectivity so that 20% of the floodplain is inundated during 10-year flood events
- restore and create islands that provide protection from windfetch,
- restore 10% of the backwater areas so that they are at least three meters deep with proximity to flow and DO >= 5ppm,

- provide one 1000-acre core block habitat (wetland, grassland and forest) per pool,
- increase emergent plants to 10% of the area of every backwater,
- work to achieve habitat restoration through agricultural programs on the floodplain (e.g., CRP, WRP, etc.),
- eliminate reed canary grass wherever possible,
- allow passage for the 27 migratory fish species during key life cycles and migratory periods, and
- restore the presence of Lake sturgeon.

A more complete list of Mississippi River pool-wide objectives gathered at the Moline Workshop is located in Appendix E.

Management Actions

The purpose of the Management Actions working groups and plenary session was to review and identify management actions that were most likely to contribute to achieving the established goals and objectives. This was accomplished by reviewing current tables of management actions (see the *Interim Report for the Restructured Upper Mississippi River – Illinois Waterway system Navigation Feasibility Study* pages 251-255), tailoring them to the ecosystem elements under consideration, and revising them where necessary. Management Actions are defined as specific actions, tools, techniques or combinations of actions, tools and techniques used to meet defined objectives. Management actions are implemented as specific projects whose reconnaissance and feasibility studies provide the detail required to assess and develop environmental analyses, funding, staffing, engineering and partnerships needed to implement the plan. Table 3 is an example of the Management Actions Tables where actions have been changed or added. All management actions can be found in Appendix F.

Table 3. Example Management Action Table.

Element/ Parameter	Extent	ID	Management Action	Comments
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to consolidate soft sediments	
		4	Minimize dredge disturbance/frequency	
		5	Minimize dredge slurry return water	
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	
		9	Speed and wake restrictions - ~~rec. boats~~ (all watercraft)	
Comments/ Additions:			Evaluate and modify mechanisms to deal with watershed influences to eliminate spiking hydrographic cycle (system wide)	
			Restore natural tributary areas through delta areas	
			Minimize open water dredged material placement	
			Sediment traps	

Species and Population Parameters

The purpose of this session was to identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts. Below is a summary of the discussion that took place during the plenary session.

Participants at the Moline workshop suggested that what is really needed, more than species assessments, is a comprehensive ecological assessment of the UMRS to establish an arbitrary baseline of the System's ecological condition. This suggestion was similar to the recommendations for various biological indices recommended at other workshops. Another point considered during the discussion was the spatial scope of investigations. Many species are wide-ranging (e.g., migratory bird or fishes) and may be greatly influenced by factors beyond the UMRS, and within the UMRS resident species may also have differing sized territories that must be considered. There was a suggestion to consider conservative species (habitat specialists) needs as an umbrella approach to be able to assess the more general species. One concern was that expending considerable effort to understand lots of different species could consume considerable amounts of money and not leave any for actual restoration efforts.

Workshop participants did not desire species abundance estimates because: 1.) the precision of the estimate would likely not be very good, 2.) some populations may be effected by factors outside of the UMRS or may be habitat independent (e.g., overexploitation), and 3.) many species life histories are such that strong or weak year classes can greatly affect population sizes of short time periods. It was recognized that in some instances total population estimates are required, but these should be done for very specific purposes not routine surveys. The discussion ended with the statement that in actuality a whole handful of measurement techniques will be needed to assess progress toward restoration targets.

Conceptual Model

At the end of the workshop, participants were provided with a brief presentation on the ecosystem conceptual model being developed for the UMR-IWW Navigation Study. The purpose of the UMR-IWW conceptual model is to identify the linkages and sequencing of identified environmental objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to this overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Facilitate dialog and develop a structure for additional input from stakeholders

The ecosystem conceptual model presentation can be found in Appendix H. All the PowerPoint slides used during the 2-day workshop are accessible through a FTP site noted in Appendix I.

Appendix A. Invitation List with Participants Highlighted

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Appendix B. Agenda

Day 1

9:00	Opening *Hank DeHaan and Chuck Theiling*
9:10	Introduction to the Workshop Process and Participant Introductions *Rebecca Soileau*
9:30	UMR-IWW Restructured Navigation Feasibility Study Overview and Schedule *Ken Barr*
9:45	Vision, Goals, and Environmental Objectives *Chuck Theiling*
10:00	Working Definitions of Terminology for this Workshop *Nicole McVay*
10:10	Overview of GIS Database and Existing Objectives and Management Actions *Hank DeHaan*
10:30	***Working Groups (I)*****:** Identify and refine environmental objectives for the Illinois Waterway ecosystem. .
12:00	Lunch
1:00	***Working Groups (I)*****:** Continued work and Report Preparation
3:30	Plenary: Presentation of objectives identified by each working group and input into GIS
5:30	Adjourn

DAY 2

8:00	Plenary: Presentation and discussion of synthesis of results from previous days work
9:00	***Working Groups (II):*** Review and identify management actions that are most likely to contribute towards achieving the established goals and objectives
10:30	Plenary: Group presentations of new and revised management actions.
12:00	Lunch
1:00	Plenary: Overview of regional evaluation data and tools for assessing the efficiency of management actions both initially and in an adaptive management framework. Discussion of species and population parameters. *Chuck Theiling*
2:30	Review of Regional Ecosystem Conceptual Models
3:00	Workshop Closing

Appendix C. Plenary Session Notes

Below are the plenary session notes that were captured by the facilitators during the two-day workshop. Participant names have been removed from all comments except those made by the facilitators.

Moline Workshop November 20th – Day 1

Opening – Theiling (9:04 –9:10)
Chuck Theiling's introduction briefly described what the workshop will accomplish as well as introduced Hank DeHaan, Nicole McVay, Rebecca Soileau and himself.

Intro of Participants – Soileau (9:10 – 9:30)
Rebecca Soileau asked all participants to turn to page 4 of the Workshop Handbook and write down the answer to the question printed there: "What do you hope this workshop will accomplish?" Participants were given a few minutes to write their answer down. Then all participants verbally answered the question.

See Appendix D for a list of written and verbal responses.

Navigation Study Introduction – Barr (9:30- 10:03)
Ken Barr discussed the history of the Navigation Study – its original focus as well as some of the studies that originated from that process. He then went on to discuss the restructured navigation study, describing the vision as well as the new scope of the study. He showed how the two studies differed with respect to the ecological integrity (the original study focused on direct effects of construction or more tow boats on fish, sediment resuspension, mussels, etc; while the restructured study will consider the existing project impacts and establish objectives to have the environment reach a desired state). During his presentation he also displayed the six-step planning process and reminded all workshop participants that the Corps has to follow this process. He concluded the presentation by discussing how the environmental portion of the navigation study will be viewed in an adaptive management framework as well as showing the participants the schedule of the study. At the end of the presentation he asked people to take this opportunity to ask questions about the overall concerns or questions with the Navigation Study.

Questions

– Will your EIS include just improvements or the whole system?

Barr –The whole system, navigation and environment.

– Will it take the place of the 1975 EIS?

Barr – The federal task force first thought that we should redo this. However the final decision was not to look at past effects but to look at ongoing effects and what we can contribute that will go into the future.

– How much of what we do here will effect the tributaries?

Barr – We are trying to understand these tributaries from where they enter our system (at the mouths). We have to be aware of what is going on in the watersheds. We at first thought this was going to be a completely comprehensive program. Then the Federal task force said that this is still is a navigation project, so focus on what you can do within the confines of the navigation study.

Soileau – If you have objectives that you would like to see at the mouth of the tributaries you can do that, but the authorities will probably come from other areas (EPA, NRCS, etc.)

Environmental Study Overview –Theiling (10:03 -10:20)

Chuck began his talk by reviewing many of the reports that have been written concerning the environment of the UMR-IWW. He then went on to discuss how the Corps has structured this study and where in the study these workshops take place. Next he discussed the expert panel, their functions, the individuals who will make up the panel, as well as how they will fit into the entire process. Chuck then discussed goals, objectives and management actions. He displayed the goals from Grumbine that were adopted by the Navigation Study in the interim report as well as the goals listed in the UMRCC report "A River that Works and a Working River." Next he discussed objectives, described them and listed several example objectives. Chuck continued his presentation by giving an overview of the framework for setting objectives. He then continued by showing where the data to create the objectives database came from. He concluded the talk by reiterating exactly where the focus of the navigation study was as well as discussing how other agencies and authorities could use these overarching goals.

Workshop Process – Soileau (10:20 – 10:30)

Rebecca Soileau discussed the overall workshop process including a brief agenda. She then discussed the working agreement and had participants agree to abide by it. Finally she defined her role as a facilitator as well as the expected roles of the participants. She then presented the working definitions.

10:30 10:46 Break

Objectives - DeHaan (10:46 – 11:10)

Hank DeHaan discussed the objective database, including where the information came from, and how the database is structured. This included a detailed discussion of the framework for setting objectives. He then gave a brief demonstration of the database in Arc View 3.2.

Questions

– How much repetition do you want? For every backwater?

DeHaan – Pool and reach-wide objectives can be used to input targets and ranges for all backwaters, etc.

– For the national heritage data, what are you doing with it?

DeHaan – We do not have this info included in the database because the database will be widely distributed. However, the expert panel and other decision makers will be looking at the information concerning the threatened and endangered species.

– Looking at icon #145 – how many areas does that cover? Do I have to put 3 D's down on the map to cover every backwater in that area?

DeHaan – No, you can write down backwater names or use river mile extents to capture the entire area.

– Are these working groups set in stone? Could we move pool 19 to another group so that Missouri is all in one group and move 15 to the other group with the Iowa Managers?

Soileau - OK – Groups are pools: 12-15, 16-19, 20-22

Objectives Plenary Session (3:22-5:30)
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary (Pools 12-15)
Spent most of our time going over goals for most pools.

Overall
Most backwaters should be 50% 1-3 m deep.
Most should have 10% emergents around them. >3ft at low pool should have 80% submergents.
Dredging in backwater should be used to create topographic diversity

Group 2 Summary (Pools 20-22)
Identified pool and reach specific goals first.
Relied heavily on already prepared pool plans.
Didn't repeat things, but added site specific objectives

Pool Objectives
Restore 20% of floodplain that is not isolated to be flooded during a 10-year event.
Reduce erosion and habitat loss due to barge fleeting.
Examine opportunities for fish passage at all 3 dams, but on a case-by-case basis.

<u>Group 3 Summary (Pools 16-19)</u>
Talked about general objectives that would fit all pools.
Then we went through each pool and figured that the HNA and Pool Plans covered things well.

<u>Site Specific Objective Setting for Moline (3:30)</u>
Once each group gave their report we then started at Pool 12 and moved down river, allowing all participants to provide input.

Pool 12

Reach wide objectives 12 -15
Pool doesn't have much lateral connectivity issues because located between the two bluffs.

Water Quality
Secchi 1 m depth during high water events for 5 out of 10 years. If we can keep it to 1 meter during the floods then it will be good during the rest of the time.

Barr – Did you tie the need for water clarity to the growing season?

– No we did not. We accounted for the difficulty of attaining the goal by giving it a 50/50 implementation target range.

Back Water
1-2 meters minimum, especially during the winter. Achieved by 2030
Increase topographic diversity on all terrestrial islands and shoreline habitats by increasing height.

Increase height by 2 meters on 10% of all islands.

Survey to identify priority areas for erosion. Upstream areas in particular need attention and need to be restored to pre-dam condition.

Use pre-existing islands/bankline as a base to rebuild them.

Restore islands in all pools to provide protection from wind fetch.

Every pool, drawn down 1 out of every 10 years (on a rotational basis).

– How did you come up with 1 out of 10 years?

– Just the seat of our pants.

– How much of a drawdown?

– It would be different by every pool.

– What is the duration of a drawdown?

– From the hydrograph we can’t start before June, so June to September.

– But you don’t need 90 days?

– Minimum is 30 days, 60 are good, but 90 is best.

Barr – Told the economic modelers to model a 60-day shut down.

– If you plan one for 2006 and you cut out navigation you might get 50/50 but if you don’t then you only have a 20%

– If you alternate pools then you would be shutting the system every year. So you might as well do them all at the same time.

Barr – We were talking about shutting them down all at once. A planned shut down is different than an emergency one; there would be less impact.

Maintain what we’ve got.
Achieve some general criteria for designs for entrances of backwaters and minimize sedimentation into those connections.

Restore former connections from Main Channel to backwaters

Maintain existing depths of secondary channels, where possible, use regulatory structures to maintain them as opposed to dredging them.

– Introduce a design change to secondary channel that is a fishhook design that will allow large debris to pass by, but keep water flowing in.

– We discussed that maintenance will have to be done on this system.

Habitat Patterns –
Maintain all secondary and tertiary patterns that exist.

Maintain patterns of contiguous backwaters as they existed (1989 is a good baseline for this).

Maintain all islands and restore island shown on 1989 photography.

Terrestrial Habitat should contain ox bow, potholes… from Pool Plans.

Eliminate Reed Canary Grass where possible.

Need a forest management program to restore age-gradation.

Land Cover
Drawdown is the most important tool to use.

Moist soil – 1 every 25 RM for birds.
Restore lake sturgeon in all pools – Monitoring goal: collect 2 sturgeons each year for monitoring.

– Menominee Slough is good habitat for neo-tropical birds. Manage floodplain forest.

Group 1 did not have any specific objectives for Pool 12.

Pool 13

Pool 14

– Beaver's slough is part the 9-foot channel project. We have to maintain 9-feet through that entire pool.

– Hannover Ridge carries migration traffic.

Pool 15

– Isn't the entire pool on the list for DO objectives?

Group 3 Overall Objectives
In their notes.

Integrated Complex idea (written in notes)

Theiling – This is very similar to what was done in the Peoria workshop.

– We are a little more aggressive because we want forest and prairie as well.

– Wherever there is a leveed area you can put a mark for connectivity. Set back the flank levees on the tributaries to allow for natural meanders.

Pool 16
Beorkrem -At RM 481 – Look at structure of wing dams. They may be causing sedimentation into side channel.
Some discussion that causeway was major issue, wing dams have not been changed since 1903

Pool 17
Down stream of Muscatine – the whole reach is scheduled for aTMDL assessment , locally for industrial pollution and urban runoff.

Fourth Slough – There is an issue of water quality during the summer and winter.

Discussion about protecting agriculture –

– Just because we list connectivity it doesn't mean we are going to connect 100%. That will have to be looked into during other phases of the study. Let's not put an icon on for every area.

Pool 18
Make sure you link both Odessa and Louisa Creek EMP fact sheet to these.

Identified new area at RM 433 Boston Bay, Geomorphology, connectivity, backwater access to backwater is filling in, needs to be restored.

RM 432 - 415 is the Yellow Banks Sand Prairie area on the Illinois Side Habitat, landcover, grassland….Restore Sand Prairie

– Are there targets for water quality and clarity issue for the entire pools?
Pool wide water clarity targets – 1m clarity during the summer MC. Concern for aquatic vegetation.

Moline Workshop November 21st – Day 2

<u>Continuation of Objectives: (8:10-9:30)</u>

Pool 19
Percentages of each pool-wide objective are the total percentage of plan form area. (It is not an increase)

Pool 19 has the least amount of public land so there is a need to buy more public land. The following should be included:
Generalized goal to acquire land where possible.

– Try not to acquire tilled farm land where possible. Try to prioritize to least productive farmland first. Willing land owners are OK, but again try not to acquire really productive land, even if from willing land owners.

–Acquire lands that influences flooding such as FEMA priority buyouts. Reduce pinch points in the floodway.

Group 2

Reach-wide Objectives Pools 20-22
Restore and enhance large tracts of bottomland hardwood forests for neo-tropical birds. (1000 acre min 25-30 miles apart)
Same for grassland.

Meet TMDL's for all major tributaries (those that have designated TMDL's).

Agricultural - maintain aerial percentage of use.

Pool 20 –Pool-wide
Islands – land interest/acquisition of all islands. Acquire 100% fee title or interest of islands.

Restore and protect aquatic vegetation – 50% of the pool area.

Pool 20 Specific Objectives
RM 356 – Gray chute – The Corps has placed rock at the bottom of the island to keep it as one island.

Mississippi – Fox levee district – This has a 5-year levee. Investigate land acquisition for habitat restoration.

Lima Levee setbacks around blew holes (eyebrow crescent setbacks)

Pool 21 –Pool-wide
Water level management to look at potential draw down

Pool 21 Specific Objectives
RM 341 – Set back levees on Bear Creek.

– Please note the reach-wide objectives to restore connectivity to every levee setback levees to all tributaries.

Restore Rock/Ursa Creeks to natural meanders.

Pool 22 – Pool-wide

Pool 22 Specific Objectives

<u>Managements Actions –Theiling (9:43 – 9:51)</u>
Chuck Theiling began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

<u>Management Action Working Groups (9:51-12:35)</u>

<u>Lunch (11:30-12:35)</u>

<u>Management Action Plenary (12:35-1:24)</u>

<u>Page W2-2 Water Quality</u>

Group 1 (Pools 12-15)
All in notes.

Group 3 (16 – 19)
All in notes.
((Group 1) – the smaller the boat the slower you have to go – allows fisherman in the backwaters but not the jet skies)..

Group 2 (20-22)
– You should change # 11 Develop management units for water level regulation.

Page W2-3,4 Geomorphology

Group 1
"Raise the water level" is specified for winter.

Pipes are for backwater areas that are sequestered due to being adjacent to earthen part of dam.

Group 3
All in notes.

Group 2
#39 – Not sure what how this relates to connectivity.

– Use it to connect terrestrial areas.

– When dredging is used to increase floodplain connectivity, use the dredge material to create islands.

Fishless ponds – maybe have shallow enough for winter kill.

Page W2-4 Geomorphology and Pattern of Habitats

Group 1
All in notes.

Group 3
All in notes.

Group 2
All in notes.

Page W2-5 Pattern of Habitats

Group 1
All in notes.
Beach plan – St. Paul has a beach plan – we should have a plan for beach nourishment in the Rock Island District.

Group 3
– There are some liability concerns about beach plans. If we call it a beach then we become liable for them.

Group 2
All in notes.

Page W2-6 Pattern of Habitats (cont)

Group 1
All in notes.

Group 3
All in notes.

Group 2
Educational or policy changes to help with BMP. Find crops that have greater benefit for the floodplain rather than the typical row crops.

Page W2-7 Plants and Animals

Group 1
All in notes.

Group 3
All in notes.

Discussion about physical barrier with the Great Lakes.

– suggested severing the connection to the Great Lakes.

Group 2
All in notes.

Page W2- 8 Plants and Animals, T&E

Group 1
Stabilize nesting islands for Cormorants.

Group 3
All in notes.

Group 2
All in notes.

<u>Evaluation Data and Tools – Theiling (1:25-1:32)</u>
Chuck Theiling discussed evaluation data such as the LTRMP monitoring data, the state's fisheries sampling, aerial waterfowl censuses, and other data that might be used to evaluate ecological responses to restoration or to help evaluate cause and effect relationships among ecosystem components and stressors. Chuck also discussed evaluation tools such as conceptual and predictive models that have been or will be developed to help predict environmental response to restoration measures. Other tools available to evaluate restoration response include the large variety of sampling techniques used to evaluate plants and animal populations.

– HEP's are bad because you are never taking into account that this is an indicator species. So you make 1 Mallard, yet it doesn't see the benefits to all of the other species. They don't take into affect that other species are also benefiting from the single designated species benefit.

– HEP isn't bad, it's how you interpret HEP. All it is supposed to do is to help evaluate a project.

–We need a better definition of the guilds associated with the habitat.

Theiling – HNA does have a species to habitat relationship.

Theiling – I appreciate your comments. Janvrin has a series of tables with the first series islands in Pool 8. It shows how as they continued through the project they created more objectives to take advantage of the HEP models. When we get a large list of objectives it shows how we need to validate models.

<u>Species and Population Parameter – Theiling (1:32 – 2:14)</u>
Chuck Theiling discussed some of the problems that were encountered when he was trying to set species target ranges for the objectives. He asked participants to offer suggestions as to the merit of doing this as well as for species and target ranges.

– The two studies on small mammals are you including academic literature?

Theiling – This is all that I am aware of.

– There are some dredge site surveys.

– Vole study on Stoddard Island that ate all of the trees.
– There are a few on furbearers – Clark, Dahlgren.

– Lake Sturgeon - Protected

– Should we add protected, T&E under reptiles and amphibians?

– What we need is an ecological assessment by species of the Mississippi River by pool. Set 70 traps for reptiles, … have an arbitrary line that values health.

Theiling – Index for rapid Diversity works well in streams. None of them are tailored to a large river.

– Hard part is deciding whether it is impaired or not. On the open the river 80% confidence is darn good – doesn't shoot for 95% confidence.

Theiling – Do that protocol in a good habitat and in a really degraded habitat to develop that range.

– Are you looking pool wide?

Soileau – We are looking for your guidance.

– Habitat size and structure is good for an area dependent bird. Look for a reach or habitat within a good pool, do habitat survey rather than census data. To a certain extent we could approach that with grassland species as well. The Herps, because of low motility, I am reluctant to work on in a pool-scale even in habitat. Focusing on conservative species (habitat specialists) as an umbrella approach to be able to assess the more general species.

– Again, you start put things into a box by saying "I am making this habitat for x species". If you come in as a generalist then we are better.

– I understand your point, but all habitat is not created equal. By capturing habitat for area sensitive species that are habitat specialists you will capture needs for more general species.

– When you start putting a 3rd of your money away to expand the literature then you are only able to do a limited amount. Lots of times they study a wetland or lake to see what they did. In the end they didn't change the habitat because they spent all of the money on research. There are all kinds of studies looking at finite habitat types, but they use up the money in research.

– On grasslands and forest birds I feel there is enough literature out there to assess habitat and come up with estimates of population structure.

– I THINK WE CAN DO BIRDS
– LTRM's community sampling can help to correlate species and community and show changes/improvements as an indicator.

Theiling – If money and time were no object would you want to do total population?

– No, you have noise from every single factor. Your habitat may not suck; it may be some other factor.

– You spend a fortune to make a figure and then the figure changes the next year.

Theiling – If you rely on the habitat basis then other things won't change.

Soileau – It's not important to build habitat for habitats sake, but we need to build them for species. So, what are those species and what targets do we want to try and achieve?

– Controlling the deer population is a problem. If you don't have a count on the deer it is very difficult to have the State help to reduce their numbers. We have been told that we have to have a count.

– If you look at habitat, you can see how areas are effected by an over abundance of deer. However, for some people 1 deer is too much, in other areas a few deer are really nice.

– Can use habitat effects such as eaten branches as an indicator of too high a population. Also can do a count in a square mile for making estimates.

– For some nuisance species it is a good idea to have some more exact population measures.

Theiling – The answer I take is to not count everything on the river but it is ok in specific areas or for specific purposes.

– To do general assessment – IBA – pick some out and do in 2003.

– We have been looking at entrainment. Do you think we need to know stock population counts to see how significant this entrainment is?

– I think it is a percentage.

Theiling – The original study was just percentage. If it is x now, and we increase by x barges, then there will be x more entrained. However now it is a more total effects study, so it becomes more important to know the entire thing. The original navigation study looked at the relative abundance, but the new scope makes absolute numbers more important.

– The abundance is very tricky. Maybe we should focus on the relative abundance of fish (sport vs. forage). Focus on community structure rather than absolute numbers.

– For natural community health, Natural History has been focusing on presence of exotic species as an indicator of health – this has a structural and food element in terrestrial areas.

– In actuality we will probably use a whole handful of measurement techniques to assess our achievement of the objectives. Someone will have to use an array of these techniques.

Conceptual Models Hank DeHaan (2:22 –2:27)

Hank provided participants with some background regarding the conceptual model, as well as an overview of the purposes for having a conceptual model. He then displayed the conceptual model in it's current form as well as a more simplistic diagram that gave an example of how the model might be used to asses the effectiveness of a management action.

Appendix D. Participant Introductions

All the participants were asked to write down an answer to the question printed on page 4 of the workshop handout: “What do you hope this workshop will accomplish?” Then all participants introduced themselves to the group and read their answer to the question. The first list below contains the answers that were taken directly from the written forms that were turned in. Not everyone put their name on the form. Following the first list is the set of verbal responses that was captured as part of the meeting minutes. The verbal responses are included because they were substantially different than the written responses that had no identification.

WRITTEN RESPONSES

1. Brenner – As a person of many hats, my hope is that I can observe what this program is going to accomplish. As a private citizen who cares about the environment, I hope that this study involves the input from the little guy. As a Corps person from operations, dredging, & survey, I hope that this program brings about needed improvements in the navigation system.

2. Larsen – I am new in my job at FB and mostly came to learn from others about the details of the Mississippi River issue. I expect to be working on this issue for a number of years. My role for FB will be to achieve goals of the environment without unduly jeopardizing farmers of causing undue financial hardship.

3. – That a plan will finally be presented and things can be implemented.

4. – Bring out ideas that can be used to formulate environmental objective with regards to the UMR-ILWW and how to implement

5. Cox – I hope this workshop will help bring everyone together, working on the same page toward the same goals.

6. Brummett – Provide a forum for input from people not closely involved in the Nav. Study. Also, to place the efforts of field level folks into study records.

7. Schonhoff – Bring together all the pieces of information that have been generated.

8. Bertrand – At least a compilation of the various management objectives for fish and wildlife so that agreement can be reached among all river interests in support of management goals.

9. Landwehr – Better understanding of participants’ objectives and management actions and the role we (H&H) can provide flushing out the details.

10. Carmack – As the sole environmental team member for the Comp Study present today, my hope is that this workshop will do such a through job of identifying environmental objectives and management actions for the whole floodplain that we won't have to repeat this exercise specific to the Comp Study.

11. Neeld – A balance of all the aspects of river system.

12. Gray – My primary goal with this workshop is simply to learn & gain a more thorough understanding of the feasibility & sustainability possibilities & practices for the waterways.

13. Felt – (Why am I here?) To become familiar with this planning process and to result in forest resource management on the ground

14. Clevenstine – Gather enough objectives detail to allow partners to move forward with RNS & application of adaptive management.

15. Anderson – Hope that good, meaningful objectives will be established in the plan and subsequently *met*/*accomplished*, which will lead to a functioning, sustainable river ecosystem.

16. Drew – Better definition of specific environmental goals that all can agree with.

17. – Finalize the documentation of goals & objectives for environmental restoration of Upper Mississippi River System.

ADDITIONAL VERBAL RESPONSES

18. Ed Anderson – I hope we set good, meaningful objectives that are actually met.

19. Eads – I want to see what this is all about.

20. Lundh – I would like to address some of the environmental problems on the river and put some of our financial resources to use.

21. Mankowski – I don't have specific expectations for these workshops.

22. Duvvejonck – I hope that at the end of the day we can say we have goals and objectives done and implemented them.

23. Drew – I hope everyone finds agreement.

24. Heinicke – I am an architect from Quincy, IL.

25. Brenner – As a private person I am concerned about what this will do to the environment. As a Corps person I hope this will bring improvement to the navigation system.

26. Barr – I would like to achieve a shared understanding of the objectives. I am looking forward to learning from you.

27. Larsen – I need to learn a lot from everyone. I hope to encourage restoration of the river that won't cause financial hardship to farmers along the river.

28. Schonhoff – I would like to bring together all the pieces that we have been generating.

29. Haas – I am here as a recreationist.

30. Cox – I hope this workshop helps compile everything and brings everyone onto the same page.

31. Swenson – Hopefully this workshop develops sensible and implement able objectives.

32. Buntin – I am here to listen and learn.

33. Brummett – I hope this process allows those not close to the study to supply their input, especially those who have knowledge of the river.

34. Bertrand – Let's pull together, in one place, the various management objectives.

35. Gray – I would like to gain a better understanding of the feasibility study.

36. Carmack – I am working on the Comprehensive (Comp) Plan –I hope this workshop will do such a thorough job of planning for the entire floodplain, bluff to bluff, that the Comp Plan won't have to redo this.

37. Clevenstine – Gather enough objective detail to allow partners to move on to implementation.

38. Felt – Why am I here? To become familiar with the planning process. See a result in forest management on the ground rather than on paper.

39. Landwehr – Try to get a better understanding as to how Hydrology and Hydraulics can help flush out the details during the study's later steps.

40. Neeld – Hoping there will be a balance between all of the aspects. I live behind the levee and am concerned about my kids and grandkids.
41. Griffin – Get it down on paper as to what we decided. Get the environment up to a somewhat equal level as navigation (look at it the same way as we look at maintenance of the navigation system).

42. Bogenschutz – I am concerned with invasive species and preventing their spread into Iowa.

43. Fenedick – I want to listen to folks who haven't been a part of this. I want to get to a point that we can apply and implement these things rather than talk about them.

44. Whitney – I am very excited about the opportunities to merge this with the Navigation study. Hopefully this will gain the attention of Washington.

45. Lundberg – I am the Project Manager for the Navigation Study. I like to say that I sit in the air traffic control tower and make sure the planes don't run into each other. Sometimes I like to ride on the plane from time to time and this workshop is one of the planes.

46. Dolan – This is my first meeting as a Public Involvement Specialist for the Corps of Engineers.

47. Cox – I represent the Port Louisa Refuge.

Appendix E. Environmental Objectives

Purpose:
To have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts.

Background:
Objectives are incremental steps taken toward achieving a goal and thus may be goal specific. They are a concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it. Objectives provide the basis for determining management actions, monitoring accomplishments and evaluating the success of management actions. There may be multiple objectives for a goal. Participants were asked to review, revise if necessary, and supplement the Environmental Objectives taken from previous work (HNA, Pool Plans, etc.) to achieve the Navigation Environmental Coordination Committee (NECC)/Economics Coordinating Committee (ECC) UMR-IWW Navigation System Vision:

"To seek long term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System."

The working groups were specifically tasked to apply the widely known SMART criteria to each objective making them: specific, measurable, achievable, results –oriented, time-specific.

The participants were asked, for the purposes of this workshop, to utilize the following two sets of goals as a framework for setting objectives.

Ecosystem Goals (from Interim Report)
During planning for the 1994 Upper Mississippi River Conservation Committee (UMRCC) Ecosystem Management Initiative, resource managers agreed to adopt Grumbine's (1994) ecosystem management goals (Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology* 8(1): 27-38.):

Goal 1: Maintain viable populations of native species in situ.
Goal 2: Represent all native ecosystem types across their natural range of variation.
Goal 3: Restore and maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.).
Goal 4: Manage over periods long enough to maintain the evolutionary potential of species and ecosystems.
Goal 5: Integrate human use and occupancy within these constraints.

The UMRCC expanded their list of goals in the *A River That Works and a Working River* (2000) document. These goals are:

1. Improve water quality for all uses,
2. Reduce erosion and sediment impacts,
3. Restore natural floodplain,
4. Restore natural hydrology,
5. Increase backwater connectivity with main channel,
6. Increase side channel, island, shoal, and sand bar habitat,
7. Minimize or eliminate dredging impacts,
8. Sever pathways for exotic species introductions/dispersal,
9. Improve native fish passage at dams.

Working Group Process

The process began with participants dividing into three groups based in part on their expertise within three segments of the UMR. Group 1 worked on Pools 12 - 15, Group 2 worked on Pools 20 – 22, and Group 3 covered Pools 16 - 19. Working groups were tasked with first setting reach and pool-wide objectives and then reviewing and setting site-specific objectives within their section of the river. If groups finished their section and had time remaining they could extend into the adjacent areas.

When setting site-specific objectives, participants were asked to use the data structure outlined in the Framework for Setting Objectives (Figure E1). This hierarchical structure categorizes environmental objectives into four primary ecosystem elements and then breaks these down into more specific parameters, extents, and target ranges. In addition to this information, participants were also asked to consider and note (if possible) the seasonality, frequency of occurrence, target date, and any other comments associated with the objectives they identified. This data framework provided a means to capture and merge objectives from previous study efforts, and those identified by workshop participants, into one standardized database. Additional objectives not found in the framework were also identified and added to the database using the established data structure (e.g., Invertebrates was added under Plants and Animals

Ecosystem Element	Parameter	Extent	TR	Target Range
Water Quality	Water Clarity	Main Channel	1	Secchi disk transparency 0.3 m
		Backwater Areas	2	Secchi disk transparency 0.7 m
			3	Secchi disk transparency 1.0 m
			4	Secchi disk transparency 1.5 m
			5	Secchi disk transparency >2.0 m
Geomorphology	Backwater Depth	Backwater Areas	1	100% of area <1 m
			2	50% of area 1 - 2 m
			3	50% of area 2 - 3 m
			4	50% of area >3 m
	Water Level	Main Channel	1	0.3 m below project pool at dam
		Backwater Areas	2	0.6 m below project pool at dam
			3	1.0 m below project pool at dam
			4	>1 m below project pool at dam
	Connectivity	Floodplain	1	0% floodplain area inundated during 10 year flood
			2	20% floodplain area inundated during 10 year flood
			3	40% floodplain area inundated during 10 year flood
			4	80% floodplain area inundated during 10 year flood
			5	100% floodplain area inundated during 10 year flood
		Secondary Channel	1	<20% of year
			2	20-40% of year
			3	40-60% of year
			4	60-80% of year
			5	>80% of year
		Longitudinal	1	0% chance of fish passage
			2	20% chance of fish passage
			3	40% chance of fish passage
			4	80% chance of fish passage
			5	100% chance of fish passage

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem.

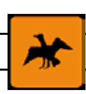
Ecosystem Element	Parameter	Extent	TR	Target Range
Pattern of Habitats	Aquatic Areas	Main Channel	1	<10% of area
		Secondary Channel	2	10-20% of area
		Tertiary Channel	3	20-40% of area
		Impounded Area	4	40-60% of area
		Contiguous Backwater	5	>60% of area
		Isolated Backwater		
	Terrestrial Areas	Contiguous Floodplain	1	<10% of area
		Isolated Floodplain	2	10-20% of area
		Island	3	20-40% of area
			4	40-60% of area
			5	>60% of area
	Land Cover/Use	Open Water	1	<10% of area
		Submersed Aquatics	2	10-20% of area
		Emergent Aquatics	3	20-40% of area
		Grassland	4	40-60% of area
		Shrub	5	>60% of area
		Forest		
		Agriculture		
		Developed		
Plants and Animals	Plants	Emergent Aquatics	1	<10 plants/m2
		Submersed Aquatics	2	10 - 20 plants/m2
			3	20 - 50 plants/m2
			4	50 - 100 plants/m2
			5	>100 plants/m2
	Fish	Protected Fish Species		CPUE, Length distribution, or kg/ha
		Sport Fish Species		
		Commercial Fish Species		
		Forage Fish Species		
		Exotic Fish Species		
	Birds	Dabbling Ducks	1	0 - 1,000 use days/yr
		Diving Ducks	2	1,000 - 10,000 use days/yr
			3	10,000 - 100,000 use days/yr
			4	>100,000 use days/yr

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem, continued.

Results:

The environmental objective information gathered and reviewed at the Moline Workshop has been organized into the following four sections. They include a pool-wide objectives table, site-specific objectives table, plenary report, and working group reports.

Pool-wide objectives identified by workshop participants were compiled from comments recorded in the plenary sessions, working group reports, group worksheets, and atlas map notations (Table E1). In cases where management actions were recorded, an objective was created and the management action was listed in the comments section, denoted by "MA".

Site-specific objectives and supporting information identified and reviewed by workshop participants are listed by pool (Table E2) and organized to follow the Framework for Setting Objectives format (Figure E1). These objectives were compiled from previous study efforts, participant comments during the plenary session (with GIS tools), working group reports, group worksheets, atlas map notations. The objectives identified in the workshop were recorded exactly as written. For the final integrated report, site-specific objectives will be standardized, new parameter icons may be created and similar comments will be assimilated into one comment.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

Examples of objectives at various scales were given as guidelines, they included:

- *System* – Restore X acres of secondary channel habitat system wide,
- *Reach* – Increase the amount of marsh habitat by X acres in the Open River Reach of the Mississippi River,
- *Pool* – Return Pool 13 to a more natural hydrologic regime by having a 90 day low water stage X feet below maximum pool elevation during late summer every three years,
- *Local* – Increase the average depth of backwater area X to six feet.

Table E1. Pool-wide Environmental Objectives (Pool 12 – Pool 22 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Other						Address concerns of 303D (Impaired water's list)
Geomorphology							
	Connectivity	Floodplain	2	All	10	2010	Increase unleveed floodplain at tributary confluences.
		Longitudinal					Allow passage for the 27 migratory species during key life cycles and migratory periods.
Pattern of Habitats							
	Other	Wetland, grassland, and forest		All	10	2020	3000 acres of 1000 acre core block habitat - minimum 1 per pool (30-40 miles) - for area sensitive bird management.
Plants and Animals							
	Birds	Neotropical Migrants					See Integrated Complex idea.
Other							
	Other						Reduce Habitat loss in barge fleeting areas.

Table E1. Pool-wide Environmental Objectives (Pool 12 – Pool 15 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Water Clarity		3	Spring	5		Occur during high water event. MA - Should include work on small watersheds entering pools. Tributary restoration is emphasized as critical to improving WQ on floodplain main stem river. MA - Restoring depth in BWs is part of WQ improvement.
Geomorphology							
	Backwater Depth	Backwater Areas	4	All	7	2030	Specific locations might vary due to local circumstances. Critical all seasons of year, but winter is most important. Restoring depth in BW is part of WQ improvement.
		Backwater Areas	Minimum of 1-2 meters	All		2030	Some locations will need to be deeper.
		Backwater Areas					Maintain secondary channels to maintain existing depths. MA Use regulatory structures to maintain where possible as opposed to dredging.
	Water Level			June-September	1		To maximize habitat: sediment consolidation, increased water clarity, increase aquatic vegetation. Optimize variety of land cover types.
	Connectivity	Secondary Channel					Maintain aquatic Backwater areas that are already connected to Main Channel. Restore former connections form MC to BW that have been lost since impoundment. MA - Designs for a all BW/SC entrances should be made to decrease obstructions and sedimentation (fish hook design).
	Bank Stabilization						Upstream islands in particular need to be protected and restored to pre-9-ft project dimensions (location of 6 ft. channel structure would be locations to start. Restore islands that provide protection from wind fetch. Many of these island have been lost due to erosion since impoundment. MA - conduct survey to ID priority locations that are eroding. MA - Authority revision needed to allow O&M remedy.

Table E1. Pool-wide Environmental Objectives (Pool 12 – Pool 15 Reach cont.).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Pattern of Habitats							
	Aquatic Areas	Secondary and Tertiary Channels					Maintain all secondary and tertiary channel patters (depths, area, etc) that now exist in all pools.
		Secondary Channels				2010	Identify priority secondary channels by 2010.
		Contiguous Backwaters					Maintain continuity patterns as they existed in 1989.
	Terrestrial Areas	Isolated Floodplain	5%	All			5% of all terrestrial floodplain habitats should consist of potholes, lakes, oxbows and similar habitat types.
		Islands and floodplain	Increase elevation by 2m on 10% of all terrestrial habitats	All		2030	Increased topographic diversity is needed on Island/terrestrial habitats in all pools. Generally this is an increase in elevation. MA - Use material form channel dredging and backwater dredging to increase elevation on terrestrial habitats.
		Islands					Maintain all islands shown on 1989 photography.
	Land Cover/Use						Restore and maintain diversity of vegetation cover types that now exist.
		Submergent	80%				Backwaters should have 80% coverage of submergent plants in all under 3m depth (see pool plans).
		Emergent					Create moist soil units for migratory birds on average of every 25 river miles.
		Emergent	10%				Increase emergent plants to 10% presence in every backwater.
		Forest					Even-aged forests need to have an age gradation restore through timber management.
		Shrub	10%				
		Agriculture					Work to achieve habitat restoration through agricultural programs on floodplain (CRP, WRP).
Plants and Animals							
	Plants	Other					Eliminate reed canary grass wherever possible.
	Fish	Protected Fish Species					Restore presence of lake sturgeon in all pools. Collected at least 2 times per year.
		Protected Fish Species					Restore crystal darter and sand darter populations
		Exotic Fish Species	0/hr catch	All			Asian Carp
Other							

Table E1. Pool-wide Environmental Objectives (Pool 16 – Pool 19 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
	Backwater Depth	Backwater Area	10% >3m	Winter	10	2020	depth >10 ft, proximity to flow, DO >=5ppm
	Water Level		0.3m above project Pool	All	10	2005	Water level management is both ways.
	Connectivity	Floodplain	2	All	10	2020	Goal is for levee districts.
Pattern of Habitats							
	Land Cover/Use	Submersed Aquatics	100% increase of 1989	All	8	2010	Reference is HNA
		Emergent Aquatics	100% increase of 1989	All	8	2010	Reference is HNA
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 20 – Pool 22 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Other						Maintain in compliance with applicable standards.
Geomorphology							
	Connectivity	Floodplain	20%	10 yr flood event			20% of floodplain not isolated by levee inundated during a 10-yr flood event.
		Longitudinal		Spawning			Allow fish passing during key stages of life cycle.
	Other						Reduce erosion/habitat loss due to barge fleeting.
Pattern of Habitats							
	Terrestrial Areas	Floodplain					Restore and enhance large tracts of bottomland hardwoods for neotropicals
		Floodplain					Consolidate cover classes in corridors or contiguous tracts.
		Floodplain	50-80%				Restore tributary riparian corridors on floodplain
		Floodplain					Restore 200' width riparian corridor on permanent diversion ditches
	Land Cover/Use	Grassland	2			2010	10% of isolated areas converted to grasslands.
		Forest	2			2050	1000 acre minimum, 25-30 miles apart.
		Agriculture				2002	Maintain aerial % of Ag. Use.
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 12).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
Plants and Animals							
	Exotic Fish Species	Entire	0/hr catch	All			Asian Carp
Other							

Table E1. Pool-wide Environmental Objectives (Pool 16).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
	Aquatic Areas	Secondary Channel	40%	Summer	8	2025	Reference is HNA
		Contiguous Backwater	6%	Summer	8	2025	Reference is HNA
		Isolated Backwater	1%	Summer	8	2025	Reference is HNA
	Terrestrial Areas	Island	6000 acres	Summer	8	2025	Reference is HNA
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 17).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
	Aquatic Areas	Secondary Channel	28%	Summer	8	2025	Reference is HNA
		Contiguous Backwater	7%	Summer	8	2025	Reference is HNA
		Isolated Backwater	2%	Summer	8	2025	Reference is HNA
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 18).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
	Aquatic Areas	Secondary Channel	26%	Summer	8	2025	Reference is HNA
		Contiguous Backwater	4%	Summer	8	2025	Reference is HNA
		Isolated Backwater	2%	Summer	8	2025	Reference is HNA
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 19).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
	Aquatic Areas	Secondary Channel	13%	Summer	8	2025	Reference is HNA
		Contiguous Backwater	10%	Summer	8	2025	Reference is HNA
		Isolated Backwater	1%	Summer	8	2025	Reference is HNA
	Terrestrial	Island	20%	All	10	2025	
	Land Cover/Use	Other		All	10	2050	Acquire public land
Plants and Animals							
Other							

Table E1. Reach-wide Environmental Objectives (Pool 20).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
	Backwater Depth	Backwater Areas					Deepen and connect sloughs on islands
Pattern of Habitats							
Plants and Animals							
Other							
	Other	Islands	100%				Need for greater amount of public lands.
		Floodplain	50%				Restore and protect aquatic and terrestrial floodplain vegetation.

Table E1. Reach-wide Environmental Objectives (Pool 21).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
	Water Level						Pool draw down
Pattern of Habitats							
Plants and Animals							
Other							

Table E2. Site-specific Environmental Objectives (Pool 12).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	

Table E2. Site-specific Environmental Objectives (Pool 12 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2007	See Pool 12 Over wintering HREP
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	See Pool 12 Over wintering HREP
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	See Pool 12 Over wintering HREP
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2007	See Pool 12 Over wintering HREP
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2007	See Pool 12 Over wintering HREP
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	9	2014	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	9	2014	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	10	2007	See Pool 12 Over wintering HREP
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain	100% inundation during 10 year flood		1	2007	See Pool 12 Over wintering HREP
Geomorphology	Connectivity	Longitudinal	40% chance of fish passage	Spr. + Fall	7	2010	See Wilcox study
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points, See Peosta Channel HREP
Pattern of Habitats	Aquatic Areas	Tertiary Channel				2009	Clean out channel, 100% of area <1 m deep in winter
Pattern of Habitats	Aquatic Areas	Impounded Area				2010	100% of area <1 m deep in winter
Pattern of Habitats	Aquatic Areas	Other				2007	Riffle/Pool and Structure, See Pool 12 Over wintering HREP
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP

Table E2. Site-specific Environmental Objectives (Pool 12 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2007	Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Increase Topographic Diversity, Raise 2 m, See Pool 12 Over wintering HREP
Pattern of Habitats	Terrestrial Areas	Island				2010	Island Protection
Pattern of Habitats	Terrestrial Areas	Island				2010	Island Protection
Pattern of Habitats	Terrestrial Areas	Island				2010	Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2006	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2014	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation, Catfish Creek, Clean up watershed
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 12 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Forest					Land acquisition for floodplain and bluff forest habitat, RM 572-564, Red Shouldered hawk and neotropical
Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15

Table E2. Site-specific Environmental Objectives (Pool 13).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	Winter	10	2010	

Table E2. Site-specific Environmental Objectives (Pool 13 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	Have to maintain
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	Maintain the depths in the HREP
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	Must have connectivity to the river with a fish hook
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain	100% inundation during 10 year flood				Maintain connectivity,
Geomorphology	Connectivity	Longitudinal	40% chance of fish passage	Spr. + Fall	7	2010	See Wilcox study
Pattern of Habitats	Aquatic Areas	Main Channel				2015	Reduce shoreline erosion
Pattern of Habitats	Aquatic Areas	Main Channel				2015	50% of area 1-2 m deep in spring
Pattern of Habitats	Aquatic Areas	Secondary Channel				2011	50% of area 2-3 m deep in winter
Pattern of Habitats	Aquatic Areas	Secondary Channel				2015	50% of area 2-3 m deep in winter
Pattern of Habitats	Aquatic Areas	Secondary Channel				2015	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Tertiary Channel				2015	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Impounded Area				2014	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Impounded Area				2014	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Other				2015	Riffle/Pool and Structure
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2015	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2015	Increase Topographic Diversity, Raise 2 m, Maintain fish hook entrance
Pattern of Habitats	Terrestrial Areas	Island					Create islands

Table E2. Site-specific Environmental Objectives (Pool 13 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Island					Create islands
Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2015	Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2014	Island Protection
Pattern of Habitats	Terrestrial Areas	Island				2014	Island Protection
Pattern of Habitats	Terrestrial Areas	Island				2014	Island Protection
Pattern of Habitats	Terrestrial Areas	Island				2015	Island Protection, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2015	Island protection, Include rip rap for wave fetch protection, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2015	Island protection, Include rip rap for wave fetch protection, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Moist soil unit management
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 13 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics, See Pleasant Creek HREP
Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15

Table E2. Site-specific Environmental Objectives (Pool 14).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June

Table E2. Site-specific Environmental Objectives (Pool 14 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Water Clarity	Backwater Areas	Secchi disk transparency 1.0 m	Spring	5		During high water events, April-June
Water Quality	Other						Monitor for pollution type chemicals, ammonia problem in this area
Water Quality	Other						Monitoring area, high nitrogen coming out of points sources, factories
Water Quality	Other						Monitor for water quality, ammonia problem, RM 508-510
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2010	

Table E2. Site-specific Environmental Objectives (Pool 14 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain					Maintain connectivity
Geomorphology	Connectivity	Longitudinal	80% chance of fish passage	Spr. + Fall	7	2010	
Pattern of Habitats	Aquatic Areas	Main Channel				2020	50% of area 1-2 m deep in winter
Pattern of Habitats	Aquatic Areas	Main Channel				2020	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Secondary Channel				2020	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Secondary Channel				2020	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Impounded Area				2005	50% of area >3 m deep in winter
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain				2020	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, Use 6" channel rock
Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Terrestrial Areas	Island				2020	Increase Topographic Diversity, Raise 2 m
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 14 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics				2010	Increased emergent and submersed aquatics, Maintain or improve
Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15

Table E2. Site-specific Environmental Objectives (Pool 15).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Other						Water quality monitoring for pollutants
Water Quality	Other						Water quality monitoring for urban runoff
Water Quality	Other						Water quality monitoring for urban runoff, RM 486-478

Table E2. Site-specific Environmental Objectives (Pool 15 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Secondary Channel	60-80% of year	Winter	10	2005	
Geomorphology	Connectivity	Longitudinal	80% chance of fish passage	Spring	10	2005	
Pattern of Habitats	Aquatic Areas	Secondary Channel				2005	50% of area >3 m deep in winter
Pattern of Habitats	Aquatic Areas	Secondary Channel				2005	50% of area >3 m deep in winter
Pattern of Habitats	Terrestrial Areas	Island				2005	Raise 2 m
Plants and Animals	Fish	Protected Fish Species					Restore Lake Sturgeon, Pools 12-15

Table E2. Site-specific Environmental Objectives (Pool 16).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel					Resuspended sediment due to fleeting, water quality monitoring required
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	All Year	8	2020	Patterson Lake, RM 465.5-466.5
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19

Table E2. Site-specific Environmental Objectives (Pool 16 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain				2020	Connectivity Nahant Marsh Area
Geomorphology	Connectivity	Longitudinal	80% chance of fish passage	Winter	10	2005	
Pattern of Habitats	Aquatic Areas	Main Channel					Fleeting impacts, loss of aquatic habitat, RM 470-476
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	40% of Pool 16 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	40% of Pool 16 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	40% of Pool 16 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Tertiary Channel					
Pattern of Habitats	Aquatic Areas	Tertiary Channel					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Table E2. Site-specific Environmental Objectives (Pool 16 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Forest					Loss of riparian corridor, wind erosion of shoreline
Other	Other						Examine wing dam design and effect on side channel to south

Table E2. Site-specific Environmental Objectives (Pool 17).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Other						Water quality monitoring, outflows from industrial sites
Water Quality	Other						Water quality monitoring for urban runoff, monitoring for TMDL
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain				2020	Restore connectivity to isolated wetland complex
Geomorphology	Connectivity	Floodplain				2020	Restore connectivity to the channel, lake, and ditches to improve water quality and habitat

Table E2. Site-specific Environmental Objectives (Pool 17 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Connectivity	Secondary Channel					Restore flow to Fourth Slough to improve water quality
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	28% of Pool 17 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	28% of Pool 17 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	28% of Pool 17 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Maintain and restore aquatic habitat
Pattern of Habitats	Terrestrial Areas	Other					Restore tributary delta habitat
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19

Table E2. Site-specific Environmental Objectives (Pool 17 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Grassland					Protect, restore, maintain sand prairie
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Agriculture					
Pattern of Habitats	Land Cover/Use	Agriculture					

Table E2. Site-specific Environmental Objectives (Pool 18).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	

Table E2. Site-specific Environmental Objectives (Pool 18 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas	50% of area 1 - 2 m	Winter	10	2020	
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19, See Huron Island HREP
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19, See Lake Odessa HREP
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain				2020	Isolate the backwater area complex
Geomorphology	Connectivity	Floodplain				2020	See Lake Odessa HREP
Geomorphology	Connectivity	Floodplain		All Year	10	2005	Restore connectivity to 2 meters of depth
Geomorphology	Connectivity	Secondary Channel		All Year	10	2005	Restore flow through area and maintain 2 meter depths
Geomorphology	Connectivity	Longitudinal					
Geomorphology	Connectivity	Other		All Year	10	2005	Restore flow through backwater area
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat

Table E2. Site-specific Environmental Objectives (Pool 18 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	26% of Pool 18 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Aquatic Areas	Other					Restore and maintain aquatic habitat
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					See Lake Odessa HREP
Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity
Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity, See Huron Island HREP
Pattern of Habitats	Terrestrial Areas	Island					Increase Topographic Diversity, See Huron Island HREP
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19

Table E2. Site-specific Environmental Objectives (Pool 18 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Grassland	10-20% of area				Restore sand prairie habitat to Yellow Banks Sand Prairie area, RM 415-432
Pattern of Habitats	Land Cover/Use	Forest					See Huron Island HREP
Plants and Animals	Fish	Other					Create a natural fish hatchery area, See Lake Odessa HREP

Table E2. Site-specific Environmental Objectives (Pool19).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					RM 395-402
Water Quality	Other						Water quality monitoring
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10	2015	RM 395-402
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19

Table E2. Site-specific Environmental Objectives (Pool19 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Backwater Depth	Backwater Areas	Other	Winter	10	2020	10% of backwater areas in the pool are deeper than 3 m, Pools 16-19
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain				2020	Levee set back
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	13% of Pool 19 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel	Other			2025	13% of Pool 19 made up of secondary channel habitat
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Other					Riffle/Pool and Structure
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island				2015	50 acres, barrier islands, Navoo flats, RM 374.5-378

Table E2. Site-specific Environmental Objectives (Pool19 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19

Table E2. Site-specific Environmental Objectives (Pool19 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2010	Increased emergent and submersed aquatics, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Emergent Aquatics	Other			2015	Increased emergent and submersed aquatics, RM 395-402, Increase to pool levels identified in HNA, Pools 16-19
Pattern of Habitats	Land Cover/Use	Forest				2015	Agriculture and forest, 1500 acres, RM 396-400
Pattern of Habitats	Land Cover/Use	Other					Restore plant diversity and habitat
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition, Acquisition of land in Blackhawk bottoms, waterfowl management, neotropical birds etc..., RM 396-399

Table E2. Site-specific Environmental Objectives (Pool 20).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 20 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Other					Restore or protect riparian buffer of Des Moines River with BMPs to reduce sediment loading to the Mississippi River
Water Quality	Other						Stormwater treatment
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Other					Reconnect blew holes
Geomorphology	Backwater Depth	Other					Restore and maintain depth in secondary channel
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Water Level	Backwater Areas					
Geomorphology	Connectivity	Longitudinal					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					

Table E2. Site-specific Environmental Objectives (Pool 20 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Maintain structure to preserve secondary channel
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					Restore backwater submergent vegetation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland	Other			2010	10-20% of the pool area made up of grassland habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22

Table E2. Site-specific Environmental Objectives (Pool 20 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Other					Restore habitat diversity
Pattern of Habitats	Land Cover/Use	Other					Restore riparian corridor on Buck Run, Maintain ditch
Plants and Animals	Other						Historic Migratory Bird Habitat
Other	Other						Public Access
Other	Other						Public Access
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition

Table E2. Site-specific Environmental Objectives (Pool 20 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Other	Other						Target Land for Acquisition, Acquire for habitat restoration
Other	Other						Remove Abandoned Barges
Other	Other						Implement the CCP objectives

Table E2. Site-specific Environmental Objectives (Pool 21).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Other					Reduce sediment input from Bear Creek into Canton Chute
Water Quality	Water Clarity	Other					Reduce sediment input from the Wyaconda watershed
Water Quality	Other						Reduce sediment and nutrient input
Water Quality	Other						Reduce urban storm water runoff
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					See Gardner Division HREP
Geomorphology	Backwater Depth	Backwater Areas					See Gardner Division HREP
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation

Table E2. Site-specific Environmental Objectives (Pool 21 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Land acquisition, Restore riparian corridor RM 342-336,
Geomorphology	Connectivity	Longitudinal					
Geomorphology	Connectivity	Other					Close off
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points, See Gardner Division HREP
Pattern of Habitats	Aquatic Areas	Secondary Channel					See Gardner Division HREP
Pattern of Habitats	Aquatic Areas	Secondary Channel					See Gardner Division HREP
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, Fleeting area
Pattern of Habitats	Terrestrial Areas	Island					Create islands with dredge material
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Wetland restoration
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 21 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22, See Gardner Division HREP
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22, See Gardner Division HREP
Pattern of Habitats	Other						Investigate backwater habitat restoration
Plants and Animals	Other						Restore Historic Migratory Bird Habitat
Plants and Animals	Other						Restore Historic Migratory Bird Habitat
Plants and Animals	Other						Restore Historic Migratory Bird Habitat
Plants and Animals	Other						Restore Historic Migratory Bird Habitat
Plants and Animals	Other						Restore Historic Migratory Bird Habitat
Plants and Animals	Other						Restore Historic Migratory Bird Habitat
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Target Land for Acquisition
Other	Other						Implement CCP objectives

Table E2. Site-specific Environmental Objectives (Pool 22).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Other						Meet TMDL requirements for tributary input
Water Quality	Other						Meet TMDL requirements for tributary input
Water Quality	Other						Reduce nutrient loading from point source
Water Quality	Other						Reduce nutrient loading and identify point source
Water Quality	Other						Reduce nutrient loading and identify point source
Water Quality	Other						Reduce nutrient loading at point source location, and reduce urban runoff
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 22 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Water Level	Main Channel					Variable drawdown as needed to restore vegetation
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Reconnect Slough??
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal					
Geomorphology	Connectivity	Other					Restore tributary channel
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Place hard points in shallow areas.

Table E2. Site-specific Environmental Objectives (Pool 22 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Series of Hard Points.
Pattern of Habitats	Aquatic Areas	Contiguous Backwater					
Pattern of Habitats	Aquatic Areas	Contiguous Backwater					
Pattern of Habitats	Aquatic Areas	Contiguous Backwater					
Pattern of Habitats	Aquatic Areas	Isolated Backwater					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection, fleeting area
Pattern of Habitats	Terrestrial Areas	Island					Island creation using dredge material
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 22 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Grassland	Other			2010	10-20% of the pool area made up of grassland habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22
Pattern of Habitats	Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22

Table E2. Site-specific Environmental Objectives (Pool 22 cont.).

Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Land Cover/Use	Forest	Other			2050	10-20% of the pool area made up of forest habitat, Pools 20-22, Levee setback, widen riparian corridor
Land Cover/Use	Other					Restore natural habitat
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition
Other						Target Land for Acquisition

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

Nov 20th, Objectives Plenary Session:
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary (Pools 12-15)
Spent most of our time going over goals for most pools.

Overall
Most backwaters should be 50% 1-3 m deep.
Most should have 10% emergents around them. >3ft at low pool should have 80% submergents.
Dredging in backwater should be used to create topographic diversity

Group 2 Summary (Pools 20-22)
Identified pool and reach specific goals first.
Relied heavily on already prepared pool plans.
Didn't repeat things, but added site specific objectives

Pool Objectives
Restore 20% of floodplain that is not isolated to be flooded during a 10-year event.
Reduce erosion and habitat loss due to barge fleeting.
Examine opportunities for fish passage at all 3 dams, but on a case-by-case basis.

Group 3 Summary (Pools 16-19)
Talked about general objectives that would fit all pools.
Then we went through each pool and figured that the HNA and Pool Plans covered things well.

Site Specific Objective Setting for Moline (3:30)
Once each group gave their report we then started at Pool 12 and moved down river, allowing all participants to provide input.

Pool 12

Reach Wide Objectives Pools 12 -15
Pool doesn't have much lateral connectivity issues because located between the two bluffs.

Water Quality
Secchi 1 m depth during high water events for 5 out of 10 years. If we can keep it to 1 meter during the floods then it will be good during the rest of the time.

Barr – Did you tie the need for water clarity to the growing season?

– No we did not. We accounted for the difficulty of attaining the goal by giving it a 50/50 implementation target range.

Back Water
1-2 meters minimum, especially during the winter. Achieved by 2030
Increase topographic diversity on all terrestrial islands and shoreline habitats by increasing height.

Increase height by 2 meters on 10% of all islands.

Survey to identify priority areas for erosion. Upstream areas in particular need attention and need to be restored to pre-dam condition.

Use pre-existing islands/bankline as a base to rebuild them.

Restore islands in all pools to provide protection from wind fetch.

Every pool, drawn down 1 out of every 10 years (on a rotational basis).

– How did you come up with 1 out of 10 years?
– Just the seat of our pants.

– How much of a drawdown?

– It would be different by every pool.

– What is the duration of a drawdown?

– From the hydrograph we can't start before June, so June to September.

– But you don't need 90 days?

– Minimum is 30 days, 60 are good, but 90 is best.

Barr – Told the economic modelers to model a 60-day shut down.

– If you plan one for 2006 and you cut out navigation you might get 50/50 but if you don't then you only have a 20%

– If you alternate pools then you would be shutting the system every year. So you might as well do them all at the same time.

Barr – We were talking about shutting them down all at once. A planned shut down is different than an emergency one; there would be less impact.

Maintain what we've got.
Achieve some general criteria for designs for entrances of backwaters and minimize sedimentation into those connections.

Restore former connections from Main Channel to backwaters

Maintain existing depths of secondary channels, where possible, use regulatory structures to maintain them as opposed to dredging them.

– Introduce a design change to secondary channel that is a fishhook design that will allow large debris to pass by, but keep water flowing in.

– We discussed that maintenance will have to be done on this system.

Habitat Patterns –
Maintain all secondary and tertiary patterns that exist.

Maintain patterns of contiguous backwaters as they existed (1989 is a good baseline for this).

Maintain all islands and restore island shown on 1989 photography.

Terrestrial Habitat should contain ox bow, potholes… from Pool Plans.

Eliminate Reed Canary Grass where possible.

Need a forest management program to restore age-gradation.

Land Cover
Drawdown is the most important tool to use.

Moist soil – 1 every 25 RM for birds.
Restore lake sturgeon in all pools – Monitoring goal: collect 2 sturgeons each year for monitoring.

– Menominee Slough is good habitat for neo-tropical birds. Manage floodplain forest.

Group 1 did not have any specific objectives for Pool 12.

Pool 13

Pool 14

– Beaver's slough is part the 9-foot channel project. We have to maintain 9-feet through that entire pool.

– Hannover Ridge carries migration traffic.

Pool 15

– Isn't the entire pool on the list for DO objectives?

Group 3 Overall Objectives
In their notes.

Integrated Complex idea (written in notes)

Theiling – This is very similar to what was done in the Peoria workshop.

– We are a little more aggressive because we want forest and prairie as well.

– Wherever there is a leveed area you can put a mark for connectivity. Set back the flank levees on the tributaries to allow for natural meanders.

Pool 16
-At RM 481 – Look at structure of wing dams. They may be causing sedimentation into side channel.
Some discussion that causeway was major issue, wing dams have not been changed since 1903

Pool 17
Down stream of Muscatine – the whole reach is scheduled for a TMDL assessment , locally for industrial pollution and urban runoff.

Fourth Slough – There is an issue of water quality during the summer and winter.

Discussion about protecting agriculture –

– Just because we list connectivity it doesn't mean we are going to connect 100%. That will have to be looked into during other phases of the study. Let's not put an icon on for every area.

Pool 18
Make sure you link both Odessa and Louisa Creek EMP fact sheet to these.

Identified new area at RM 433 Boston Bay, Geomorphology, connectivity, backwater access to backwater is filling in, needs to be restored.

RM 432 - 415 is the Yellow Banks Sand Prairie area on the Illinois Side Habitat, landcover, grassland….Restore Sand Prairie

– Are there targets for water quality and clarity issue for the entire pools?
Pool wide water clarity targets – 1m clarity during the summer MC. Concern for aquatic vegetation.

<u>November 21st Continuation of Objectives: (8:10-9:30)</u>

Pool 19
Percentages of each pool-wide objective are the total percentage of plan form area. (It is not an increase)

Pool 19 has the least amount of public land so there is a need to buy more public land. The following should be included:
Generalized goal to acquire land where possible.

– Try not to acquire tilled farm land where possible. Try to prioritize to least productive farmland first. Willing land owners are OK, but again try not to acquire really productive land, even if from willing land owners.

–Acquire lands that influences flooding such as FEMA priority buyouts. Reduce pinch points in the floodway.

Group 2

Reach-wide Objectives Pools 20-22
Restore and enhance large tracts of bottomland hardwood forests for neo-tropical birds. (1000 acre min 25-30 miles apart)
Same for grassland.

Meet TMDL's for all major tributaries (those that have designated TMDL's).

Agricultural - maintain aerial percentage of use.

Pool 20 –Pool-wide
Islands – land interest/acquisition of all islands. Acquire 100% fee title or interest of islands.

Restore and protect aquatic vegetation – 50% of the pool area.

Pool 20 Specific Objectives
RM 356 – Gray chute – The Corps has placed rock at the bottom of the island to keep it as one island.

Mississippi – Fox levee district – This has a 5-year levee. Investigate land acquisition for habitat restoration.

Lima Levee setbacks around blew holes (eyebrow crescent setbacks)

Pool 21 –Pool-wide
Water level management to look at potential draw down

Pool 21 Specific Objectives
RM 341 – Set back levees on Bear Creek.

– Please note the reach-wide objectives to restore connectivity to every levee setback levees to all tributaries.

Restore Rock/Ursa Creeks to natural meanders.

Pool 22 – Pool-wide

Pool 22 Specific Objectives

Working Group Reports

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

GROUP 1

Participants List: Ed Anderson, Ralph Eads, Kenny Brenner, Joe Lundh, Mike Griffin, Cynthia Drew, Jon Duyvejonck

UMR Pools 12 - 15

Pool-wide objectives 12-15

Many of these objectives are described in draft pool plan documents and should be incorporated into the pool-wide objectives.

Water Quality – Secchi disk of 1 meter in 5 of 10 years (for all pools 12 – 15) during spring (April-June) high water event. This should include work on small watersheds entering pools (e.g. catfish creek, Galena River, Menominee R.) Tributary restoration is emphasized as critical to improving WQ on floodplain mainstem river. Restoring depth in BWs is part of WQ improvement. Without depth WQ improvement will be limited.

Mike G. expressed concern about identifying specific objectives for some species in that it might

Backwater objectives should be TR 4 for all pools in general. Specific locations might vary due to local circumstances. Critical all seasons of year, but winter is most important. Try for 7 of 10 years to meet this TR.

All BWs should be 1-2 m minimum, especially during winter. Try to achieve all BW depth objectives by 2030. Some locations will need to be deeper.

Increased topographic diversity is needed on Island/terrestrial habitats in all pools. Generally this is an increase in elevation. Pool-wide objective is to increase elevation by 2 meters on 10% of all terrestrial habitats (pools 12-15) by year 2030.

Geomorphology

Bank stabilization – conduct survey to ID priority locations that are eroding. Lots of discussion about implementation. Authority revision needed to allow navigation O&M to remedy. Upstream islands in particular need to be protected and restored to pre-9 ft project dimensions (location of 6 ft. channel structure would be locations to start. Restore islands that provide protection from wind fetch. Many of these islands have been lost due to erosion since impoundment.

Objective – Use material from channel dredging and backwater dredging to increase elevation on terrestrial habitats. This will provide increased habitat diversity for both terrestrial and aquatic species.

Water level regulation – Draw pools down 1 of every 10 years to maximize habitat (sediment consolidation, increased water clarity, increase aquatic vegetation,) Optimum window for this is June to September.

Connectivity – Maintain aquatic BW areas that area already connected to MC. Designs for all BW/SC entrances should be made to decrease obstructions and sedimentation (fish hook design). Review existing rock structures to determine which ones can be modified to channel more water from MC into BWs. Restore former connections from MC to BW habitats that have been lost since impoundment.

Secondary channels – Maintain secondary channels to maintain existing depths. Use regulatory structures to maintain where possible as opposed to dredging.

Longitudinal connectivity –

Latitudinal connectivity –

Habitat Patterns

Maintain all secondary and tertiary channel patterns (depths, area, etc) that now exist in all pools. Identify priority SCs by year 2010.

Contiguous BWs – maintain continuity patterns as they existed in 1989. See connectivity under Geomorphology)

Islands – Maintain all islands shown on 1989 photography.

Isolated floodplain habitat (lakes, pot holes) These have filled very quickly. 5% of all terrestrial floodplain habitats should consist of potholes, lakes, ox bows, and similar habitat types.

Terrestrial land cover – Restore and maintain diversity of vegetation cover types that now exist. Restore land cover diversity has been lost. Reed canary grass is invading open areas and preventing reestablishment of some vegetation types. Eliminate reed canary grass wherever possible. Even-aged forests need to have a age gradation restored through timber management.

Diversity of land cover uses – Optimize use of water pool drawdowns to optimize the variety of land cover types. Achieve 10% of land cover in shrubs (see draft pool plan for more specifics.)

Agriculture – work to achieve habitat restoration through agricultural programs on floodplain (CRP, WRP,)

Developed –

Moist soil units – create MSUs for migratory birds on average of every 25 river miles

Plants & Animals – increase emergent plants to 10% presence in every back water. All BWs should have 80% coverage of submergent plants in all under 3m depth (see draft pool plans for more specifics)

Fish – restore presence of lake sturgeon in all pools. As monitoring objective, it should be collected at least 2x per year. Crystal darter and sand darter populations should be restored. For sport and commercial fish goals see pool plans. Achieve 0 catch of Asian carp spp. In monitoring efforts.

Birds - see pool plans for specifics. Songbirds …….

<u>Specific G&Os for Pools 12 - 15</u>

Pool 12

Icon 1 – Reference Wilcox for this

Icon 2 – same as No 1.

Icon 3 – same as pool wide objective

Icon 4 – same as pool

Icon 5 – same as pool

Icon 6 –

Icon 9 – Catfish Cr. Improve watershed quality

Icon 10 – Frentiss L.

Icon 14 – good candidate for restoration/deepening

Icon 19 – change objective to increase connectivity

Icon 20 – 25 for each location where topographic increase is recommended, there should also be an elevation increase associated with BW deepening

Icon 26 –

Icon 34 – stabilize bankline, but do not encroach into water where there is a stump field which is good centrarchid habitat.

Icon 37 and 39 – include comment for 34 above.

Pool 13 G&Os

Icon 44 – island erosion a problem.

Icon 46 – major island loss occurring here

Icon 48 – important walleye spawning area

Icon 52 – 6 ft. channel wing dam is helping habitat here

Icon – 54- Good example of SC mouth configuration. Very important to maintain because of large BW area it serves

Browns Lake – It would benefit from increase foot print of dredged channel

Icon 64 – needs increase connectivity between SC and main channel

Icon 77 – Include with rip-rap protection and raise in elevation

Icon 78 – Manage sediment from Elk river so it does not enter Gomer's Lake

Icon 79 – Place rock

Icon 81 – Create new islands

Icon 82 – Maintain existing Potter's marsh

Icon 83 – Create new islands

Pool 14 G&Os

Icon 90 – Maintain existing channels

Icon 96 – Restoration challenge because of heavy industrial effluent in Beaver Slough

Icon 110 - location of 6 ft. channel project structure

Icon 112 – maintain connectivity

Icon 115 – Princeton WMA

Icon 117 – Dredging appears to be only solution

Pool 15 G&O

Icon 120 – Dynamite island maintain add 2 ft of sand to elevation

Icon 124 – maintain secondary channel

Add: WQ improvement action and monitoring to Alcoa location

GROUP 2

Participants List: Al Fenedick, Ken Brummett, Charlene Carmack, Bob Clevenstine, Dru Buntin, Kevin Landwehr, Kathryn Gray, and Mark Heinicke. Joined in afternoon by Mark Beorkrem.

UMR Pools 20-22

Discussion:

Began in **Pool 22**. However, Pool-wide objectives apply to all three pools.

Existing Database is missing behind levee objectives.

Objective to create/re-establish large blocks of bottomland forest. Currently none present from Delaire Division to Bay Island. Ag interests will want to protect number of acres in production. Potentially seek marginal blocks of Ag land for restoration. The current stands are fragmented, desirable to consolidate these areas. This ties to Opportunity 3 in the Pool Plan. Would need to have incentives to encourage participation by local landowners. What is the desired block size? Thousand acre blocks is initial estimate. Need to consider distance between stands and potential for developing corridors.

Is there the potential to provide passage past Bay Island pump station (without affecting level of protection) to provide connectivity to interior aquatic areas? Perception is that there is very little depth available in these areas. Not discussed further.

Desire to provide large blocks of grassed areas within levee districts. Potentially through a Conservation Reserve type program. Goal of 10% of isolated area converted to grasslands.

Refuge manager would like to see 20% of floodplain inundated during the 10-year flood. Relates to Opportunity 6 in Pool Plan. Group clarified goal as 20% of the isolated areas.

Objective for 50-80% of tributary riparian corridors restored between delta and bluff. Use Conservation Reserve type programs to obtain. May require flank levees to be set back. Potentially provide minimum of 200' wide corridor for remnant and permanent diversion channels.

Location of Bay Island land acquisition icon is in wrong locations.

Should expand definition of "land acquisition" to include methods other than fee title (easements, conservation reserve programs, etc.).

Need to expand water quality objectives beyond water clarity. Potentially focus on industrial, municipal, and pump station discharges for actions. Need to verify that these point sources are the problem. What is objective? Ensure they are in compliance? Reduce loading? Feeling is both. Should tributaries be included in terms of TMDL standards? Yes, including flows captured by levee districts.

Need icons defined for DO and Nutrient Loading.

Desire to restore historical alignment to tributary deltas. Implementation would require land acquisition and modification to existing levees.

Water quality problems in isolated backwaters.

Pool 21.

Pool-wide objectives for Pool 22 are applicable to Pool 21.

Sedimentation problem in Quincy Bay. Perception is that existing cut-through is major source of sediments. Dredging of deep channels and reduction in sediment loading would provide water quality and habitat benefits, as well as recreational opportunities. Problem has been evaluated previously under EMP. Successful restoration of Quincy Bay may require setback of the Indian Grave levee to reconnect upstream end of backwater complex and Bear Creek outlet to UMR.

Potential to reconnect portion of floodplain in Union Township DD (between RM 335 to 332). Portion of area behind levee is state park located in old gravel quarry.

Suggestion to coordinate with Tri-State Port authority to avoid sensitive areas.

Miscellaneous objectives: Reduce sediment input from Wyaconda River Watershed; Management of City of Quincy storm water runoff; Desire to improve aquatic plant production in Goose Lake within Indian Grave DD; Opportunity acquisition of lands along the unprotected Missouri bank between the Wyaconda confluence and Canton, MO; land/interest acquisition on privately owned islands.

Need to stabilize island erosion (e.g., Long Island). Need icon for bank stabilization.

Pool 20.

Pool-wide objectives for Pool 22 are applicable to Pool 20.

Need for greater amount of public lands. Desire Acquisition of islands (goal of 100%) and other floodplain lands (goal of 50% of floodplain).

Would like to acquire 25% of Hunt-Lima Lake isolated areas. Desire to be able to periodically isolate for aquatic vegetation management. This area was an important aquatic vegetation area prior to formation of the drainage district.

General need for off-channel fish refuge. Setback of the Hunt-Lima levee would also support this need. Scour holes from historical levee failures on landward side of levee may have suitable depths. Also deepen and connect sloughs on islands in conjunction with land acquisition above.

Mississippi and Fox Drainage District incurs frequent flood damages. Recollection of group member is that the levee doesn't afford a major level of protection. This is a potential candidate for buy-out and reconnection to floodplain.

Concern for water quality impacts of Keokuk municipal discharges (both treated and storm water).

Concern for sediment loading from Des Moines River. Need for NRCS type measures below Red Rock where farmers are typically farming right up to bank line with no buffer strips.

System Wide.

Fish passage at all dams. What is desirability considering potential to facilitate movement by invasives? Perception is that the invasives have already made it passed dams, so fish passage should be pursued. Goal is to allow passage for the 27 migratory species during key life cycle and migratory periods.

Reduce habitat loss in barge fleeting areas.

GROUP 3

Participants: Mike Cox Recorder, Tom Cox, Rick Nelson Facilitator, Steve Felt, Bill Bertrand, Jon Stravers, Anne Mankowski, Mindy Larsen, Bernie Schonoff, Allen Haas, Kim Bogenschutz Reporter, Gary Swenson

UMR Pools 16 - 19

Pool wide objectives, Pool 16

Bill started our by reviewing the HNA processes, showing the geomorphic conditions. This is existing information that should be incorporated into this effort:

Patterns of habitats, add secondary channels to equal 40% of open areas during the summer, frequency of 8 out of 10 years target date of 2025.

Contiguous backwaters and separate backwaters, contig = 6% - isolated = 1%, with same info as above.

Patterns of habitats, islands to a total of 6,000 acres, with same info as above

Start looking into Pool plans to see what was pool wide plans were included there:

Bank stabilized
WLM
Mussel habitat management
Data collection and monitoring

Discussion of plans and any gaps? None noted, except that it is fairly generic in scope. What about adding a note to consider feasibility of increasing connectivity in the floodplain through extending into levee areas. Discussion of how to determine target ranges instead of using what was figured in the HNA...decided on 20% of leveed area.

* Discussions of needing a program similar to IL2020 along the UMR. We need 1000 acres blocks each of contiguous forest, grassland, and wetland complexes every about 30 miles for area-sensitive bird conservation. (To provide nesting habitat adequate for migratory area-sensitive birds - reduce non-natural fragmentation and promote native vegetation species to attain composition and structure that is suitable for area-sensitive

birds. Habitat complexes need to have a core area of about 1000 acres that approximates a square or round shape - additional habitat can build on core.)
NOTE: The above wording was modified 11/21/02

We also need 1000 block of marsh for migratory waterfowls every 40 miles (similar to what the Illinois workshop discussed).

We also need so many acres of over wintering habitat every 10 miles.

Discussion of how to place this information into the ecosystem elements (e.g., patterns of habitat, but is the forest contiguous floodplain or land cover land use? Also discussed what is reasonable and reachable. Yes, we could incorporated existing stuff as well as accruing new stuff.

So, we have agreed to incorporate a minimum of 3-1,000 acre blocks in include one for forest one for grassland and one for marsh area, to cover the 3 types of area-sensitive migrants (forest, grass, wetland, and waterfowl).

Pool wide objective for aquatic veg. HNA says that there are 6 different types of veg categories in the list for Pool 16, totaling 2,300 acres of aquatic veg. The goal would be to identify this under Patterns of Habitat, but what is the percentage of area (what area, is it the entire pool? or the aquatic area, or what? Rebecca said that we could make the target range anything that we wanted to. So we agreed to increase the acreage by 100%, with all seasons (because of submergent perennials). This could be done by 2010, because of no acquisition required.

Include over wintering habitat, as a new extent under backwater depth under backwater areas, with a target range of 10% >3m.

Water quality is a reach wide issue (some areas of UMR have been named on the 303d list (impaired water list, that EPA says must be cleaned up. And, if the areas are not impaired they must be monitored and maintained.

Birds were discussed, but only dabbling and diving ducks were include (neotropical migrants e.g., were not mentioned were not mentioned in the extents.). We discussed riparian corridors as well as the blocks of 1,000 acre tracts. Look at the Milan bottoms area, about the largest forested area in this part of the UMR that is not fragmented. Other discussion showed that these blocks should be within about every 30 miles. So, add another extent of neotropical migrant nesting areas of at least 1,000 un-fragmented forested areas (we could break this down further but don't have the time).
NOTE: this was covered under the habitat extent in greater detail.

We then went through the atlases by pool to see if there were any obvious gaps in any area, so we can see if we need to add any icons here.

Any HREP proposals (or any other stuff) not included (we just found out that they had not been incorporated yet) should be included, and we don't have to go into every icon to insert the detail.

Specifics to Pool 16:

Patterson Lake: RM 465.5-466.5, add an icon.

Specifics to Pool 17:

Secondary channels would increase to 28%
Isolated backwaters is also different.

Protect, maintain and expand Muscatine Island sand prairie habitat (RM 443-455). We could not get a precise figure of the expansion.

Specifics to Pool 18:

Aquatic areas to change as recommended in HREP

RM 420-418, Benton Island, inland connectivity to isolated backwater, all season, open access to the area.

NOTE: reach-wide plan to include expansion of floodplain along tributaries (for example, setback flank levees to increase meander and delta).

RM 433, Boston (sturgeon bay) reconnect backwater.

RM 424.2, secondary channel, behind snipe island, just above Big River State Forest campground.

RM 432-415 restore sand prairie along Yellow Banks (up on bluff, east of highway) NOTE: This could be incorporated into the migratory habitat (1,000 acre blocks).

Is there any potential for more flooding at the refuge at Keithsburg? It is not holding water as much as is was in the past.

Specifics to Pool 19:

Aquatic areas to change as recommended in HREP

Pool wide objective is to continue to expand and protect island complexes (a 20% increase, no objection to keeping this number.

Pool wide objective is to avoid acquiring productive farm land (tillable/ cultivated) wherever possible.

Pool wide objective to reduce pinch points within the floodway (e.g. levees close to the river).

NOTE: These last 2 pool objectives should be included for entire Reach objectives.

Specific island creation at Nauvoo flats, RM 374.5-378. Concern about maintaining the existing eddy in the backwater area.
Blackhawk

Acquisition of Land in Blackhawk Bottoms, the state owns about 500 acres, the proposal includes buying some/all of the delta for waterfowl management/neotropical birds (note that there is a budget shortfall for both the corps and state).

Specific work at Burlington Islands (backwater habitat management and restoration and dredging openings) at RM 402-395. Note that you can have more than one icon for the same area.

We should add more public land acquisition for Pool 19.

Appendix F. Management Actions

Purpose:
To review and identify management actions that are most likely to contribute towards achieving the established goals and objectives.

Background:
For the purposes of these workshops, Management Actions are: regulatory, operational or structural tools or activities that can be implemented to positively address environmental objectives (e.g. hydraulically dredge a backwater area). Participants reviewed a list of management actions that had been compiled from previous planning to assess their ability to meet the objectives that were discussed the previous day Time was given to ensure all the groups were able to review all of the actions. The reports from each group were presented in a plenary session to provide other participants the opportunity to ask for and receive clarification.

Results:
What follows is the management information gathered and reviewed at the Moline Workshop. It is organized into three sections: management action tables, plenary report, and working group reports.

Each working group prepared a master worksheet to record the group's changes, additions, and deletions to the list of management actions. The changes from all the groups were compiled in the following worksheets (Table F1). There were three ecosystem elements, 67 new management actions, and 20 comments added. The whole group modified 22 existing management actions and deleted 10 of the actions listed. These results will be merged with those from other workshops, and the entire management actions database published in the UMR-IWW System Navigation Feasibility Study Interim Report will be updated.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management. The entire plenary report can be found in Appendix C.

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work that was produced for Management Actions. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

Table F1. Management Actions.

Element/ Parameter	Extent	ID	Management Action	Comments
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to consolidate soft sediments	
		4	Minimize dredge disturbance/frequency	Recommend cutterhead use
		5	Minimize dredge slurry return water	Maximize behind levee placement
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	
		9	Speed and wake restrictions - rec. boats	add tow boats
Comments/ Additions:			Establish and enforce safety zone for tow boats	
			Establish a permit system for tows over 9 foot draft	
			Adjust sailing line	
Nutrient loading			Monitor and minimize nutrient loading	
DO			Restore flow (all parameters except clarity) at selected side channels	
Contaminant loading				
			Improver aids to navigation	
			Additional mooring buoys	
	Backwaters	10	Pool scale drawdown to consolidate soft sediments	
		11	~~Drawdown management units~~	Revise: Develop management units for water level management
		12	Drawdown isolated backwaters	
		13	~~Isolate and drawdown contiguous backwaters~~	Redundant to no. 14
		14	Temporarily isolate and drawdown contiguous backwaters	
		15	Construct wind breaks	add: barrier islands
				add: build to fit site
		16	Construct Wave breaks	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Water Quality (cont)		17	~~Remove~~ bottom feeding fishes (carp)	Replace: control
		18	Increase plant density	
		19	Increase plant distribution	
		20	Reduce algae production	
Comments/ Additions:			Construct isolated ephemeral wetlands	
			Berm and construct moist soil area with water level control	
			Access, speed, and wake restriction on rec. boats	
	Impounded		Reduce wind fetch	
			Reduce sediment resuspension	
	Secondary channel		Isolate head of channel	
			Modify flow in channel	
Geomorphology				
Backwater Depth	Backwater Areas	21	Hydraulic dredging	include new technologies
		22	Mechanical dredging	include new technologies
		23	Consolidate sediment	
		24	Divert flow to increase backwater scour	
Comments/ Additions:			Divert flow of sediment laden water away from backwaters	Change upstream inlet to berms and fishhook design
			Modify drainage district operations	
	Side channel		Include 21-24	
			Construct rock barbs	
Water Level	Main Channel	25	Pool scale ~~drawdown~~	revise: water level management
Comments/ Additions:	Secondary channel		Operate dams to maintain winter water levels at the high end of the operating range	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Geomorphology (cont)			Automate dam operations	
Water Level (cont)			Possibly change hinge point to dam point control	
	Backwater Areas	26	Pool scale ~~drawdown~~	revise: water level management
		27	Drawdown management units	
		28	Drawdown isolated backwaters	
		29	~~Isolate and drawdown contiguous backwaters~~	
		30	Temporarily isolate and drawdown contiguous backwaters	
Comments/ Additions:			Pool raise within limits of system (winter)	desirable for some management objectives
			Install pumps to flood or drawdown isolated backwater areas	
			Modify drainage district operations	
Connectivity	Floodplain	31	Acquire real estate rights, restore water to leveed floodplain areas	
		32	Reconfigure, restore flow to secondary channels	add: "historic" secondary…
		33	Restore flow to isolated backwater areas	
		34	Create habitat corridors for floodplain terrestrial wildlife	
		35	Restore natural tributary channels through delta areas	
		36	Notch levees	Revise: notch/remove selected levees
		37	Set back levees	
		38	Increase water levels	
		39	~~Increase terrestrial area~~	
Comments/ Additions:			Recreate moist soil management areas that mimic natural hydrology of river	
			Connect from the bottom isolated backwater areas (e.g., sloughs)	
			Install flow structures (pipes) through earthen dams to connect to isolated backwaters	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Geomorphology (cont)			Create and maintain fishless aquatic areas	
			Protect, maintain and create isolated backwaters for amphibian conservation	
	Secondary Channels	40	Notch closures	Should be programmatic
				Modify and/or remove as practical
Connectivity (cont)		41	Divert flow	
		42	Increase water levels	
		43	Dredge secondary channels	add: isolate, restrict
		44	~~Remove~~ levees	Revise: alter/modify selected
Comments/ Additions:				May or may not involve removal or setback or notching, etc..
			Construct islands to restore and create secondary channels	
	Longitudinal	45	Build fishways	
		46	Modify gate operations	
		47	Modify lock operations	ties in with raising pool or drawdowns
				e.g., trickle gate or valve flow at Lock 14
		48	Remove tributary dams	
Comments/ Additions:			Modify gate structure	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Geomorphology (cont)				
Island elevation	Islands		Raise elevation of islands above water level to allow growth of moisture intolerant trees, forbs, and grasses	
Pattern of Habitats				
Aquatic areas		49	Introduce flow to isolated backwater areas	
		50	Restore flow to secondary channels	
		51	Restore flow to floodplain areas isolated by levees	
		52	Restore natural tributary channels through delta areas	
		53	Divert more tributary delta flow into open impounded areas	
		54	Create rock and gravel substrate areas	
		55	Create shallow rock and gravel riffle areas	
		56	Incorporate woody debris into bank protection	
		57	Incorporate woody debris into 2° and small channels	
		58	Restore flow and geometry of secondary channels	
		59	Modify flow distribution from dam gates - tail water habitat	
		60	Grading, vegetation planting	
		61	Rock groins, hard points	Delete
				Should be done in numerous places
		62	Anchored woody debris	
		63	Off-shore rock revetments	
		64	Submerged rock vanes	
		65	Notch wing dams to create hydraulic, depth diversity	
		66	Notch closing dams to increase side channel flow	
		67	Construct ~~temporary~~ structures to divert flow	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont)		68	Use larger rock, make bank revetments irregular	
Aquatic areas (cont)		69	Incorporate woody debris into channel structures	
		70	Construct hard points, groins for shoreline stabilization	
		71	Construct off-shore revetments	
		72	Construct seed islands	
		73	Construct bendway weirs	
		74	Construct chevrons	
		75	Modify flow splits between main and off-channel areas	
		76	Dredge backwater areas, increase depth	
		77	Dredging to restore and create secondary channels	
		78	Shore pipe, boosters to ~~reach target sites~~	replace: minimize bankline/open water placement
		79	Use small dredges to expand placement options	
		80	Bend width reductions where ~~possible~~	replace: appropriate
Comments/ Additions:			Raise island topography	
			Make moist soil areas every 50 miles	
			Insure over wintering centrarchid areas every 5 miles	
			Manage barge fleeting areas	
			Control invasive/exotic species	
			Create islands to restore secondary channels	
			Protect. Maintain and increase isolated backwater areas for amphibian conservation	
			Remove beach plan from MVP	
Terrestrial		81	Place dredged material to create wetland areas	
		82	Placement on existing, construct new beaches	
		83	Semi-confined channel placement (chevrons)	

Table F1. Management Actions (cont.).

		84	~~Unconfined placement in floodplain (for mast trees)~~	
Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Pattern of Habitats (cont)		85	Unconfined placement in floodplain	Raise elevation for topographic diversity (mast trees)
Terrestrial (cont)		86	~~- Beaches~~	Need a beach plan for MVR
		87	~~- Island construction~~	Don't delete
		88	~~- On floodplain to raise areas for mast-producing trees~~	add: and other moisture intolerant spp.
		89	~~Confined placement in floodplain~~	
		90	Construct hard point in floodplain	
		91	Construct islands in impounded areas and backwaters	
		92	Seed islands	
		93	Chevron islands	
		94	Rock islands	
		95	Islands with varied top elevation, fine material	
		96	Low islands - mud flats and sand bars	for shorebird habitat
Comments/ Additions:			Protect, restore, and increase grassland, forest, wetland habitats for areas sensitive sp - large habitat blocks for acquisition/easement programs	
			Manage barge fleeting areas	
			Control exotic/invasive spp.	
Land Cover/Use		97	Modify and manage habitats on refuges (see habitat below)	
		98	Manage vegetation cover	
		99	Manage water levels	

Table F1. Management Actions (cont.).

		100	Modify habitat structure in floodplain and backwaters	
		101	Plant vegetation on dredged material deposits	
Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Pattern of Habitats (cont)		102	Plant floodplain trees	102-103 Establish and manage floodplain forest
		103	Harvest floodplain trees	
		104	Plant floodplain prairie	1042-105 Establish and manage floodplain prairie
		105	Burn floodplain prairie	
		106	Control invasive exotic species	
		107	Place dredged material to create wetland areas	
		108	Unconfined dredged material placement in floodplain (for mast trees)	Use fine material to cap or form ridges
				Revise: Vary topography in floodplain (for mast trees)
		109	Growing season drawdowns	
Comments/ Additions:			Pump into moist soil areas	
			Acquire real estate interest	
			Promote alternative agriculture n floodplain	
			Regulate future floodplain development	
			Soil amendment (beneficial use of dredged material	
			Reevaluate existing authorities and policies for beneficial use of dredged material.	
			Focus on securing management interest in large habitat blocks for area sensitive spp.	
Plants and Animals				
Fish		110	Adjust angling, commercial fishing regulations as needed	
		111	~~Modify angler attitudes about exploitation~~	revise: Promote angler education
		112	Enforce fishing regulations	

Table F1. Management Actions (cont.).

		113	Stock fish	Revise: Stock native fish species where appropriate
Comments/ Additions:			Adjust introduced flow into over winter areas	
Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Plants and Animals (cont)			Monitor and test for diseases as needed	
Fish (cont)			Reintroduce extirpated sp.	
Wildlife		114	Conduct bio-manipulation of fish and wildlife community (various actions)	
		115	Adjust hunting and trapping regulations as needed	
		116	~~Modify hunter attitudes about exploitation~~	revise: Promote hunter education
		117	Enforce hunting regulations	
		118	Reintroduce native species	Concerns about reintroducing large predators
Comments/ Additions:			Intensive management of moist soil areas	
			Focus Federal aid on Miss. R	
			Increase designated refuge	
			Protect increase, and restore habitat for species of conservation concern including neotropical migrants and others	
			Increase monitoring and research of nesting neotropical migrant	
			Better management of game sp. (deer) so populations do not negatively impact other biodiversity	
			Monitor and test for diseases as needed	
Exotics		119	Control invasive exotic species	
		120	Construct, operate, maintain barrier on Illinois River	
		121	Require ~~antibiotic~~ treatment of Great Lakes freighter ballast water	

Table F1. Management Actions (cont.).

		122	Regulate use of exotic species for fishing bait	
		123	Regulate biota transfer by fishing boats	and commercial boats
		124	Apply species-specific toxicants	integrated pest management strategies
Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Plants and Animals (cont)		125	Kill zebra mussels on vessels in lock chambers	
Exotics (cont)		126	Restrict and enforce use of exotic species in aquaculture	
Comments/ Additions:			Sever Great Lakes IWW connection	
			Promote education	
			Promote utilization of exotic biomass	
			Develop interagency task force for coordination of control efforts	
T&E		127	Protect, increase, restore populations of threatened, endangered species	
Comments/ Additions:			Stabilize nesting islands and maintain vegetation cover (e.g., cormorant colonies in Pool 13)	Will extend longevity of nesting islands
			Promote education	
			Evaluate species of concern	
			Reintroduce/expand species of concern to avoid listing	
			Manage for T&E consideration as a priority where they exist	
			Conservation easements to protect blufflands & grasslands in floodplain and beyond (local, state, NGO, Feds)	
			Monitor and test for disease	
Biodiversity			Manage for maximum diversity of native species	

Table F1. Management Actions (cont.).

Best Management Practices				
All			Modify habitat (see below)	
		128	BMPs	
		129	Conservation tillage	
Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Best Management Practices (cont)		130	Contour farming, terraces	
		131	Grassed waterways	
		132	Establish perennial cover, crops	
		133	~~Stabilize eroding ravines~~	
		134	Conservation Reserve Program land set-aside	and other USDA progs.
		135	Erosion control structures along intermittent streams	
		136	Construct, maintain small impoundments	for sediment reduction
		137	Restore drained lakes, wetland areas	
		138	Riparian buffer strips	
		139	Restore stream channels, floodplain areas	
		140	Urban stormwater management practices	
		141	Construction site erosion prevention practices	
		142	Increase pervious surface in developed areas	
Comments/ Additions:				Update list as needed
			Environmental education and outreach	

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management actions. The entire plenary report can be found in Appendix C.

Nov 21st, Management Actions Plenary Session:

The plenary began by asking each group to give a brief overview of what they did, as well as listing their modifications to the list of Management Actions. The Tables of Management Actions were visited section by section with all four groups having an opportunity to give their input on each section before moving to the next.

Managements Actions –Theiling (9:43 – 9:51)

Chuck Theiling began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

Management Action Working Groups (9:51-12:35)

Lunch (11:30-12:35)

Management Action Plenary (12:35-1:24)

Page W2-2 Water Quality

Group 1 (Pools 12-15)

All in notes.

Group 3 (16 – 19)

All in notes.

((Group 1) – the smaller the boat the slower you have to go – allows fisherman in the backwaters but not the jet skies)..

Group 2 (20-22)

– You should change # 11 Develop management units for water level regulation.

Page W2-3,4 Geomorphology

Group 1

“Raise the water level” is specified for winter.

Pipes are for backwater areas that are sequestered due to being adjacent to earthen part of dam.

Group 3
All in notes.

Group 2
#39 – Not sure what how this relates to connectivity.

– Use it to connect terrestrial areas.

– When dredging is used to increase floodplain connectivity, use the dredge material to create islands.

Fishless ponds – maybe have shallow enough for winter kill.

<u>Page W2-4 Geomorphology and Pattern of Habitats</u>

Group 1
All in notes.

Group 3
All in notes.

Group 2
All in notes.

<u>Page W2-5 Pattern of Habitats</u>

Group 1
All in notes.
Beach plan – St. Paul has a beach plan – we should have a plan for beach nourishment in the Rock Island District.

Group 3
– There are some liability concerns about beach plans. If we call it a beach then we become liable for them.

Group 2
All in notes.

<u>Page W2-6 Pattern of Habitats (cont)</u>

Group 1
All in notes.

Group 3
All in notes.

Group 2
Educational or policy changes to help with BMP. Find crops that have greater benefit for the floodplain rather than the typical row crops.

Page W2-7 Plants and Animals

Group 1
All in notes.

Group 3
All in notes.

Discussion about physical barrier with the Great Lakes.

– suggested severing the connection to the Great Lakes.

Group 2
All in notes.

Page W2- 8 Plants and Animals, T&E

Group 1
Stabilize nesting islands for Cormorants.

Group 3
All in notes.

Group 2
All in notes.

Working Group Reports

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work produced concerning management actions. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

GROUP 1

Participants List: Ed Anderson, Ralph Eads, Kenny Brenner, Joe Lundh, Mike Griffin, Cynthia Drew, Jon Duyvejonck

Management Actions – Pool 12 - 15

See draft Pool plans for additional specific comments on management actions

Beaches – RID needs to complete a beach management plan as a prerequisite to beach management actions

Traffic effects – increase attention to safety zone in channel shoaling locations. Boats that ignore these zones sometime exacerbate dredging and disposal problems. Overloaded barges create negative natural resource effects. Coast Guard needs to increase its attention to overloaded barges. Investigate use of permits for barges loaded over 9ft. All barges loaded over 9ft. should be required to have a permit. The locations of all overloaded barges would be known in the event of a situation where overloaded barges could create adverse effects.

Erosion – examine potential for restricting recreational boat traffic to reduce shoreline erosion.

Add: construction of ephemeral pools/wetlands should be added to BW actions

Add to BW actions 10 -20: construction of berms to divert sediment around BW deepening actions. This will prolong the life of deepened habitats.

Under 15 add: barrier islands as a tool to reduce wind fetch

Action 24: Divert flow…This action should include attention to design considerations (i.e. fish hook design) which will help reduce sediment input into backwaters.

Action 26: Raising the pool is a desirable action for some management objectives: improve wintering fish survival. Investigate use of pumps to manage backwater locations

Add: Wherever possible investigate the potential for using the head potential upstream of dams to route water (pipes?) to downstream areas (backwaters) in need of fresh water. For example L/D 9 Harper's Slough

Connectivity

Dredge/connect backwaters at the lower entrances

40 – Notch closures - these actions should be considered as O&M actions that can be repeated periodically without having to repeat planning justification. Many small management actions are not being performed because planning and engineering costs are too high. Programmatic justification should be examined so these actions can be implemented.

44 – Remove levees - change to "modify"

46 – Modify gate operations – Examine potential for running water through auxiliary gate valves to elevate dissolved oxygen.

Pattern of habitats – Add construction of "terrestrial islands" on floodplain that can provide refuge to animals during floods, promote topographic and vegetation diversity (mast trees and other moisture intolerant species).

Add: construct fish over-wintering habitat every 5 river miles.

86 – Prepare a reach wide beach management plan as a prerequisite to beach management actions. Identify locations where beaches are appropriate and desirable.

97-109 Add: cap dredged material sand placements with fine sediments

Add: stabilize and manage vegetation on existing islands where cormorant colonies are present to minimize island and vegetation loss from cormorant use.

Under wildlife Add: intensive management of moist soil units

GROUP 2

Participants List: Al Fenedick, Ken Brummett, Charlene Carmack, Bob Clevenstine, Dru Buntin, Kevin Landwehr, Kathryn Gray, and Mark Heinicke.

Pools 20-22

List Additions:

1. Water Quality
    a. Water Clarity
        1. Main Channel
            a. Adjust Sailing Line in sensitive areas.
            b. Commercial tow speed restrictions – Expand ID No. 9 to include.
            c. Recommend using cutterhead dredges – Comment to ID No. 4
            d. Maximize behind levee placement – Comment to ID No. 5
        2. Backwaters
            a. 13 is largely redundant with 14
            b. Change 17 to "Management of bottom feeding fishes"
            c. Access, Speed, and Wake restrictions on Rec Craft
        3. Impounded Areas
            a. Island Creation to reduce fetch lengths
            b. Increased plant density
        4. Secondary Channels
            a. Isolate at head of Side Channel
            b. Modify Flow through regulating structure
    b. Nutrient Loading
            a. BMPs in Watershed
            b. Restore flow to selected remnant channels
    c. DO
            a. Restore flow to selected side channels
    d. Contaminant Loading

2. Geomorphology
    a. Backwater Depth
        1. Backwater Areas
            a. Control structures to control flow of water and sediment.
            b. Modify DD operations.
    b. Side Channel Depths
            a. Construct rock barbs.
            b. IDs 21 through 24
    c. Water Level
        1. Main Channel/Secondary Channel
            a. Pool raise during winter
            b. Convert hinge point to dam control
            c. Reduced fluctuations at wicket dams
            d. Automate dam gate controls

            e. Reduced Surging from Chicago Stormwater Management
        2. Backwater Areas
            a. IDs 29 and 30 are redundant
            b. Modify drainage district operations
    d. Connectivity
        1. Floodplain
            a. Change 32 to “Reconfigure, restore flow to historical secondary channels”
            b. Remove 39.
            c. Create and maintain fish-less ponds
        2. Secondary Channels
            a. Isolate/restrict Secondary channels
            b. Change 44. “Remove/Modify levees”
        3. Longitudinal
            a. Modified Gate Structure – other gate types more conducive to fish passage?

3. Pattern of Habitats
    a. Aquatic Areas
        a. Add “or permanent” to ID 67
        b. Modify 78 to “Minimize bankline/open-water placement”
        c. Modify 80 to “Bend width reductions where appropriate”
    b. Terrestrial
        a. IDs 84, 85, and 88 are redundant – Reduce to 85 with comment to “increase topographic diversity”
        b. Remove 86
        c. Remove 87, redundant with 91-96
    c. Land Cover/Use
        a. Add ID 31 to this section
        b. Promote alternative agriculture on floodplain
        c. Regulation of flood plain development
        d. Modify 108 to be consistent with 85 above.
        e. Soil amendment with dredged material – beneficial use of dredged Materials
        f. Change “Harvest” in 103 to “Manage”
4. Plants and Animals
    a. Fish
        a. Focus federal aid for acquisition of aquatic habitat
        b. “Promote angler education” instead of 111
        c. Change 113 to “Stock native fish species where appropriate”
    b. Wildlife
        a. “Promote hunter education” instead of 116
        b. Focus federal aid for UMR land acquisition

c. Increase designated refuge

c. Exotics

a. Change 120 to "…maintain lethal barrier…"
b. Sever Lake Michigan Connection to IWW
c. Promote education
d. Promote utilization of exotic biomass

d. T&E

a. Promote education
b. Evaluate species of concern
c. Reintroduce/expand species of concern to avoid listing

5. All

GROUP 3

Participant List: Mike Cox Recorder, Bill Bertrand, John Stravers, Anne Mankowski, Mindy Larsen, Alan Haas, Bernie Schonoff, Gary Swenson

Pools 16-19
Management actions:

Discussion about adding biodiversity to the element/parameter, and where to add this element. We added this after plants and animals, and included management action of manage max amount of diversity of native species.

This group is starting on the last page...

Working on **BMPs** ... discussing other CRP both USDA and state EPA. Added environmental education and outreach.

T&E. Added 2 items (see master list) Question of how to include upland habitat into protection of T&E. (adding conservation easements?). Upriver snobs are concerned about bluff habitat. Add another management action (Use conservation easements to protect bluff lands and adjacent grasslands). It is thought that this would help local and state agencies and NGOs to create nature habitats. An example would be the Illinois designated mussel sanctuaries to protect sensitive areas for mussel habitat. The corps has a designation for natural areas but never use this option.

Exotics: Question about invasive vs. exotic, and added a slash between invasive/exotic (there area invasive species that are native, but take over areas) from item 119. Also reworded some other items. Included both recreational and commercial vessels in most applicable items.

Wildlife: Concern about introduction of large species (no predators allowed that may kill off livestock). It is thought that this is not really a very big issue as adequate habitat is needed before added populations are introduced. Protect increase and restore habitat for species of concern.

Fish and inverts: (inverts added to element). Added mussel stuff to many items as applicable. Talk of largemouth bass virus and should this be included as management action. Added monitoring and regional coordination for diseases that may impact populations. **NOTE: this was also added to Wildlife and T&E)**

Land Cover Land Use: Merged some items.

Terrestrial: See master sheet (combined many items) added management of barge fleeting areas to reduce impacts to sensitive areas (**NOTE: this was also added to aquatic**).

Aquatic: Add the need to maintain and increase tributary backwaters for amphibian habitat (non-fish habitat).

Connectivity: Much discussion about removing tributary dams (this conflicts with sediment reduction management actions). Added remove to notch closures. Add remove to notch levees. Added isolate backwaters to increase flow.

Appendix G. Species and Population Parameters

Purpose: To identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.

Background: Recent environmental planning efforts for the Environmental Management Program and other Upper Mississippi River System restoration and maintenance programs have focused on habitats and the impacts of Corps activities on habitats. It has been recognized that planning needs to be expanded to include additional functional and structural ecosystem elements.

During the planning stages of this workshop, organizers were considering objectives for plant and animal species and quickly encountered difficulty in selecting guilds, species, or units of measure for plants and animals. Emergent and submersed aquatic plants, diving ducks, and dabbling ducks were eventually selected based on the perception that knowledgeable resource managers could interpret the units of measure selected. It was determined that stem density was a relatively standard unit of measure for aquatic plants and that use-days during migration periods were relatively standard measures of waterfowl abundance.

Specific objectives for fish were desired, but the selection of guilds, or species, or units of measure quickly complicated the issue. It was decided therefore to back-off on the specifics for fish objectives and only indicate that there is an objective for several general categories of fish determined during earlier phases of the Navigation Study: protected, sport, commercial, forage, and exotic fishes in channel and backwater habitats. The unit of measure became particularly complicated because of our desire to establish quantitative objectives, but our general inability or lack of commitment to fish community stock assessments. Discussion of the unit of measure is particularly important because of our need for measurable objectives and our selection of evaluation tools.

These issues were discussed during a plenary session at the workshop, with the results to be forwarded to an expert panel. A focus group of workshop participants will continue work with the expert panel to refine fisheries objectives. The larger list of species such as reptiles, amphibians, other birds, and mammals will be considered during future phases of the adaptive management and assessment process recommended in the Navigation Study Interim Report.

Results: Participants at the Moline workshop suggested that what is really needed, more than species assessments, is a comprehensive ecological assessment of the UMRS to establish an arbitrary baseline of the System's ecological condition. This suggestion was similar to the recommendations for various biological indices recommended at other workshops. As at previous workshops, the availability of rapid bio-assessment techniques for streams was mentioned, but most of these have not been adapted to large river ecosystems yet. One participant suggested the most difficult task is determining whether conditions are impaired when sampling capabilities are imperfect. It was suggested that even achieving 80 percent confidence in sampling results would be about as good as could be expected and that most results are much less reliable.

Another point considered during the discussion was the spatial scope of investigations. Many species are wide-ranging (e.g., migratory bird or fishes) and may be greatly influenced by factors beyond the UMRS. Resident species also have differing sized territories that must be considered. Some bird species territories are area dependent, meaning the must have large blocks of relatively homogeneous habitat. For these species, large-scale habitat surveys may be appropriate measures of habitat availability. For smaller, less mobile species small habitat patches may be sufficient to support healthy populations. This latter group requires more detailed assessments/surveys in smaller areas. A final suggestion was to consider conservative species (habitat specialists) needs as an umbrella approach to be able to assess the more general species. One concern was that expending considerable effort to understand lots of different species could consume considerable amounts of money and not leave any for actual restoration efforts. There was consensus that there is probably enough information on birds to complete some sort of assessment protocol. The Long Term Resource Monitoring Program fisheries database should provide information to evaluate opportunities to assess fish populations.

Facilitators posed the question of whether total population assessments would be desired if time or money were not a factor. Workshop participants responded no because: 1.) the precision of the estimate would likely not be very good, 2.) some populations may be effected by factors outside of the UMRS or may be habitat independent (e.g., overexploitation), and 3.) many species life histories are such that strong or week year classes can greatly affect population sizes of short time periods. The discussion continued with some specific examples of controlling deer populations, estimating fish entrainment in tow boat propellers, and endangered, exotic, or nuisance species. It was recognized that in some instances total population estimates are required, but these should be done for very specific purposes not routine surveys. Relative abundance of species or guilds obtained from traditional survey techniques should be sufficient to assess community structure.

The discussion ended with the statement that in actuality a whole handful of measurement techniques will be needed to assess progress toward restoration targets.

Note: The following comments were submitted after the workshop by Bill Bertrand – Illinois Department of Natural Resources and have not been reviewed or discussed by the other workshop participants.

Submitted (post-workshop) by Bill Bertrand – Illinois Department of Natural Resources

I feel I would be remiss if I did not submit some suggestions for fish target species and units of measurement in assessing objectives for environmental sustainability. I've spent a good part of 30 years trying to determine just what measures are best used to indicate improvement, relative stability, or decline for populations of river sport species and entire communities. I will still not claim to have definitive answers, but I can argue justification for selection of certain measures over others.

*Regarding spatial coverage, I believe that you can work with the geomorphic reaches rather than pools, just so long as you keep in mind that management actions will be applied on a pool-by-pool basis. Still you can apply reach standards for a target species to pool management to assess the success of the actions taken within that pool.

*As I stated at the workshop, gaining population estimates seems fruitless in most cases. A great deal of time and resources are spent in the effort, and the populations can change so rapidly for the relatively short-lived fish. Many river fish only live 5 years or less, with drastic drops in abundance of fish older than 5. In this situation a single strong or weak year class can dramatically change population numbers. Population estimates can work for longer-lived species, as shown by the Quad Cities Nuclear Power Station studies on drum, and might work for catfish, sturgeon or paddlefish. Since it is precisely the population numbers of PROTECTED and EXOTIC species that everyone is concerned about, perhaps population estimates should be reserved as measures to assess these groups of fish, although population structure might work just as well. For example, if a protected species can be shown to have fairly stable reproduction success i.e. consistent strong year classes produced and fish of all ages and sizes present in expected distribution, then you could assume a healthy population, without trying to estimate exact numbers present.

*As a PROTECTED species target I would support lake sturgeon and suggest that a very specific capture program be designed using tied-down trammel nets in deep holes in late fall or winter. The nets should fish the bottom of the holes (the reason for the tie-down) and preliminary surveys may be necessary to identify specific sites in use. Rob Maher of IDNR can provide further details on fishing gear, method and timing. In pursuit of PROTECTED minnows or darters, seining or trawling in appropriate habitat should work. Stratified random sampling will get you completely zilch, if you are pursuing these species whose low abundance results in their protected status.

*For the SPORT fish group, target largemouth bass, walleye and sauger in combination, and channel catfish. Summer or fall backwater electrofishing catch per hour of largemouth bass 15" or longer can be the unit of measure, with a reach-specific target numbers. I suggest 10 per hour for reaches 4, 5 and 6, and 5 per hour in reaches 7 and 8 (don't use largemouth as target species in reaches 9 and 10). For walleye and sauger combined, use late fall electrofishing in tailwaters with target catches of number of fish per hour 14" and over. For sauger and walleye catch combined I suggest a target of 40 fish per hour, 14" and over, for reaches 6 and 7 – no suggestions for 4, 5, or 8 and should not use sauger/walleye for 9 and 10. I think the only appropriate target SPORT species for reaches 9 and 10 are the catfish species – blue, channel, and flathead -- and would suggest large hoop nets in May as a means of obtaining useable numbers. Rob Maher could probably provide some target numbers. Channel catfish catch could also be used in reaches 4 through 8, but I have no recommended target number per net day.

*I support using a COMMERCIAL group with target species of buffalo (sp), catfish (sp), and freshwater drum. Units of measure should be the annual commercial catch poundage of each, stated as catch per geomorphic reach.

*FORAGE target species must include emerald shiner and gizzard shad, and could include river shiner as well, or sunfish (sp) as more specific to backwaters where bluegill and orangespots can provide much of the forage. I have compared our electrofishing catches of emerald shiner and gizzard shad to our minnow seining catches for reaches 4 through 7 (328 seine hauls and 90 hours electrofishing, 1998-2001) and feel that summer electrofishing could provide a reliable benchmark for emerald shiner and gizzard shad, which are apt to be collected in all river habitats. From our 1986-2001 database, I would suggest target numbers of 50 per hour emerald shiner and 100 per hour gizzard shad for all reaches, and 100 per hour small sunfish (4" or smaller bluegill, pumpkinseed, orangespotted, rock bass, warmouth, green sunfish) in backwater habitat of reaches 4 through 8.

*EXOTIC species to be tracked are the grass carp, silver carp, bighead carp, and white perch. I do not know the most efficient method of collection of these species and would have to rely upon LTRM to provide that, as well as target numbers or other measures.

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to the species and population measurements. The entire plenary report can be found in Appendix C.

Species and Population Plenary Session:

– The two studies on small mammals are you including academic literature?

Theiling – This is all that I am aware of.

– There are some dredge site surveys.

– Vole study on Stoddard Island that ate all of the trees.
– There are a few on furbearers – Clark, Dahlgren.

– Lake Sturgeon - Protected

– Should we add protected, T&E under reptiles and amphibians?

– What we need is an ecological assessment by species of the Mississippi River by pool. Set 70 traps for reptiles, … have an arbitrary line that values health.

Theiling – Index for rapid Diversity works well in streams. None of them are tailored to a large river.

– Hard part is deciding whether it is impaired or not. On the open the river 80% confidence is darn good – doesn't shoot for 95% confidence.

Theiling – Do that protocol in a good habitat and in a really degraded habitat to develop that range.

– Are you looking pool wide?

Soileau – We are looking for your guidance.

– Habitat size and structure is good for an area dependent bird. Look for a reach or habitat within a good pool, do habitat survey rather than census data. To a certain extent we could approach that with grassland species as well. The Herps, because of low motility, I am reluctant to work on in a pool-scale even in habitat. Focusing on conservative species (habitat specialists) as an umbrella approach to be able to assess the more general species.

– Again, you start put things into a box by saying "I am making this habitat for x species". If you come in as a generalist then we are better.

– I understand your point, but all habitat is not created equal. By capturing habitat for area sensitive species that are habitat specialists you will capture needs for more general species.

– When you start putting a 3rd of your money away to expand the literature then you are only able to do a limited amount. Lots of times they study a wetland or lake to see what they did. In the end they didn't change the habitat because they spent all of the money on research. There are all kinds of studies looking at finite habitat types, but they use up the money in research.

– On grasslands and forest birds I feel there is enough literature out there to assess habitat and come up with estimates of population structure.

– I THINK WE CAN DO BIRDS
– LTRM's community sampling can help to correlate species and community and show changes/improvements as an indicator.

Theiling – If money and time were no object would you want to do total population?

– No, you have noise from every single factor. Your habitat may not suck; it may be some other factor.

– You spend a fortune to make a figure and then the figure changes the next year.

Theiling – If you rely on the habitat basis then other things won't change.

Soileau – It's not important to build habitat for habitats sake, but we need to build them for species. So, what are those species and what targets do we want to try and achieve?

– Controlling the deer population is a problem. If you don't have a count on the deer it is very difficult to have the State help to reduce their numbers. We have been told that we have to have a count.

– If you look at habitat, you can see how areas are effected by an over abundance of deer. However, for some people 1 deer is too much, in other areas a few deer are really nice.

– Can use habitat effects such as eaten branches as an indicator of too high a population. Also can do a count in a square mile for making estimates.

– For some nuisance species it is a good idea to have some more exact population measures.

Theiling – The answer I take is to not count everything on the river but it is ok in specific areas or for specific purposes.

– To do general assessment – IBA – pick some out and do in 2003.

– We have been looking at entrainment. Do you think we need to know stock population counts to see how significant this entrainment is?

– I think it is a percentage.

Theiling – The original study was just percentage. If it is x now, and we increase by x barges, then there will be x more entrained. However now it is a more total effects study, so it becomes more important to know the entire thing. The original navigation study looked at the relative abundance, but the new scope makes absolute numbers more important.

– The abundance is very tricky. Maybe we should focus on the relative abundance of fish (sport vs. forage). Focus on community structure rather than absolute numbers.

– For natural community health, Natural History has been focusing on presence of exotic species as an indicator of health – this has a structural and food element in terrestrial areas.

– In actuality we will probably use a whole handful of measurement techniques to assess our achievement of the objectives. Someone will have to use an array of these techniques.

Working Group Report

The following table was generated by a member of one of the working groups, as requested in the read-ahead materials, and presented at the workshop as part of the plenary discussion.

Table G1. Species and Population Parameters

Ecosystem Element/ Parameter	Extent (Guild/Group)	Target Species 1 / Units of Measurement / Target Range	Target Species 2 / Units of Measurement / Target Range	Target Species 3 / Units of Measurement / Target Range	Potential Units of Measurement
Plants and Animals					
Plants	Forest 80%	See UMRCC Forest Management Plan Hard Mast 7%	Soft Mast 75%	Other (cottonwood, ash, elm) 12%	Acreage
	Shrub 10%	button bush 20%	dogwood 10%	grape 20% sand bar willow 30% false indigo 10%	Importance value
	Grassland 10%	Phlaris 40%	prairie cord grass 10%	warm season grass&forbs 50%	Basal area
	Wet Meadow 10 %	carex 15% phragmites 10%	bidens amoranthus 25% nettles 10%		Stem Density
	Marsh 20%	3 square (?) 40% arrowhead 35%	6% typha sparganium 7% pickerelweed 7%	nymphaea lotus 10% 25% soft stem bullrush 12%	Biomass
	Submersed 35%	vallisneria 35% sago pondweed 20% coontail 20%	elodea water stargrass 10% 10% pondweed 10%	najas potamogeton crispus 2% 7%	Diversity index
	Algae 3%				

Table G1. Species and Population Parameters

Ecosystem Element/ Parameter	Extent (Guild/Group)	Target Species 1 / Units of Measurement / Target Range	Target Species 2 / Units of Measurement / Target Range	Target Species 3 / Units of Measurement / Target Range	Potential Units of Measurement
Plants (cont)	Moist soil management areas	polygonum 40% bidens 20% ananthus 10%	3 square barnyard grass 35%		
Invertebrates	Benthic invertebrates	mayflies 200/m2	fingernailclams		Relative abundance
	Epiphytic invertebrates		400/m2		Biomass
	Epilithic invertebrates	caddisfly 700/m2			Density
	Necktonic invertbrates	daphnia 600/l	rotifer		
	Freshwater mussels	Higgin's eye 20 in 10 15 min. dives	threeridge		
	Flying invertebrates	mosquito 1000/camper/24hr	50/m2		
	Arboreal invertebrates				
	Grassland invertebrates	grasshopper 10/sweep	cricket 20/tree/night		

Table G1. Species and Population Parameters

Ecosystem Element/ Parameter	Guild/Group	Target Species	Target Species	Target Species	Units of Measurement
Fish	Protected	lake sturgeon 2/yr	crystal darter presence/absence	western sand darter	Relative abundance
	Sport	walleye 60/hr during fall tailwater electrofishing	largemouth bass 90/hr backwater electrofishing PSD 40 - 60	bluegill 25/net night PSD = 25	Biomass
	Commercial	smallmouth buffalo >250,000 lbs/yr in Iowa waters	channel catfish >400,000lbs/yr in Iowa waters	freshwater drum >100,000lbs/yr in Iowa waters	Density
	Forage	emerald shiner 1,200/seine haul	river shiner	gizzard shad	Population structure
	Exotic	Asian carp 0	ruff 0 (or did Griff mean rough fish)	white perch 0	Proportional Stock Index (PSI)
					Population size
Reptiles	Aquatic reptiles	snapping turtle >12,000lbs/yr in Iowa	map turtle	softshell turtle >2,000lbs/yr in Iowa	Density
	Terrestrial reptiles	black rat snake	fox snake	copper belly water snake Blanding's turtle	Population size
Amphibians	Aquatic amphibians	leopard frog	tiger salamander	mudpuppy	Density
	Terrestrial amphibians	tree frog	race runner	wood frog (?)	Population size
	Arboreal amphibians				
Birds	Waterbirds	great blue heron 200/colony colonies every 20 miles	snipe, rails fall point count	sandhill crane 3 nesting pair	Nesting Success
	Forest birds	redstar point count	red shoulder hawk 4nests/pool	prothonatary warbler point count	Use Days
	Grassland birds	upland sandpiper	woodcock	bobolink	Number of Colonies
					Number of Active Nests

Table G1. Species and Population Parameters

Ecosystem Element/ Parameter	Guild/Group	Target Species	Target Species	Target Species	Units of Measurement
Mammals	Small mammals	microtus 4/trap night	lecopus	squirrel	Density
	Large mammals	deer	raccoon	beaver	Population size

Table G1. Species and Population Parameters

Appendix H. Conceptual Model Presentation

The overall purpose of a conceptual model developed for the UMR-IWW Navigation Study is to identify the linkages and sequencing of identified objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to the overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Develop a structure for additional input from stakeholders

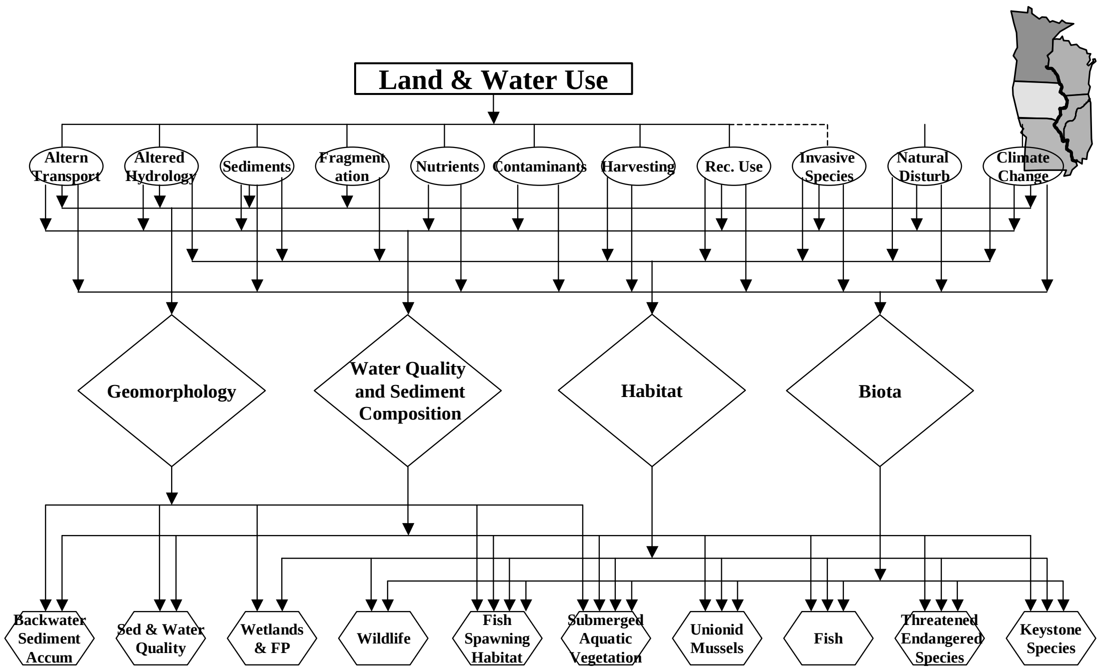
The following slides were used at each of the workshops to present information on the current draft conceptual model.

UMR-IWW Ecosystem Conceptual Models

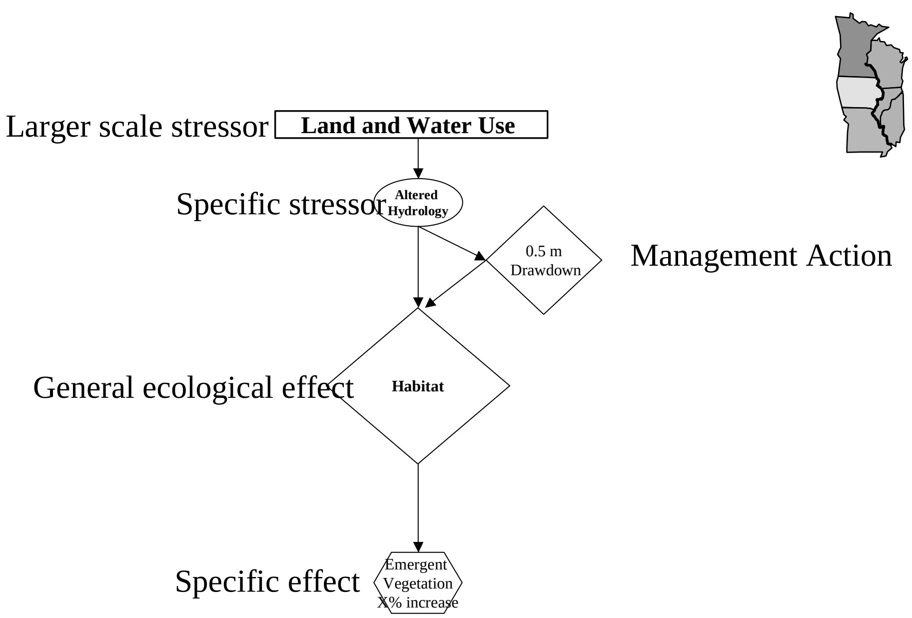
- Background
  - – Conceptual models help to gain a better understanding of the linkages between:
    - Environmental Objectives
    - Management Actions
    - State of the Ecosystem
- Task
  - – Discuss the utility of developing a UMR-IWW ecosystem conceptual model

Purposes of a Conceptual Model for the UMR-IWW

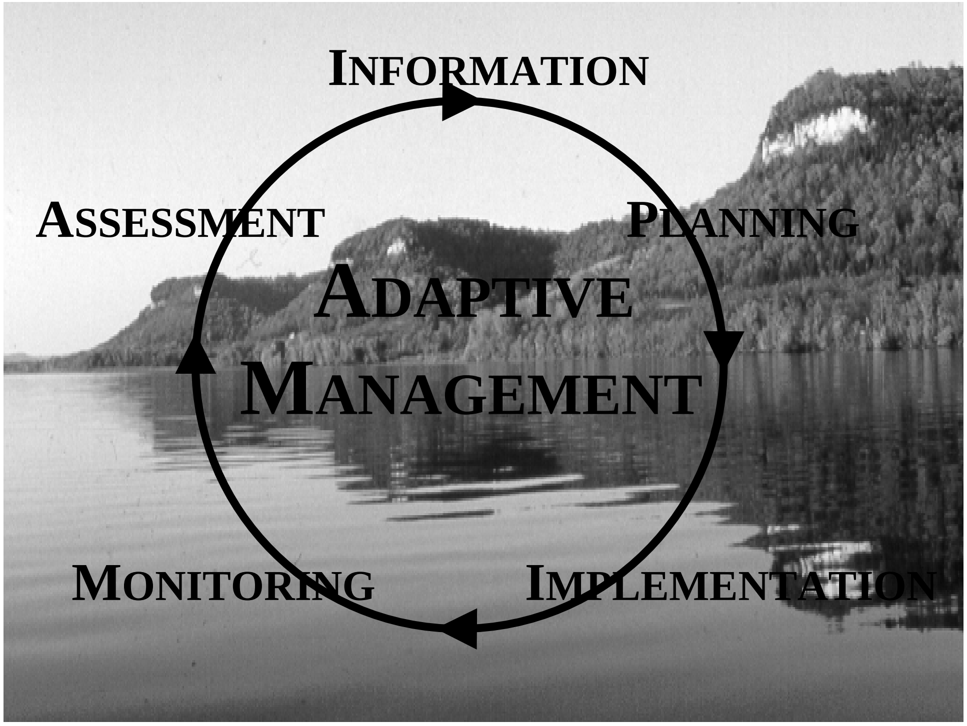
- To visually present a complex system
- Creates a framework for additional input
- Provides a basis for decision making in relation to the achievement of objectives
- Develops a structure for implementing adaptive management and restoration



Land & Water Use
Altern Transport
Altered Hydrology
Sediments
Fragment ation
Nutrients
Contaminants
Harvesting
Rec. Use
Invasive Species
Natural Disturb
Climate Change
Geomorphology
Water Quality and Sediment Composition
Habitat
Biota
Backwater Sediment Accum
Sed & Water Quality
Wetlands & FP
Wildlife
Fish Spawning Habitat
Submerged Aquatic Vegetation
Unionid Mussels
Fish
Threatened Endangered Species
Keystone Species



Larger scale stressor
Land and Water Use
Specific stressor
Altered Hydrology
0.5 m Drawdown
Management Action
General ecological effect
Habitat
Specific effect
Emergent Vegetation X% increase


INFORMATION
ASSESSMENT
PLANNING
ADAPTIVE
MANAGEMENT
MONITORING
IMPLEMENTATION

Appendix I. Power Point Presentations

This section contains the power point slides used to present background and introductory information throughout the workshops. They are given in the order they were presented on the agenda.

The Power Point Presentations will be included in the final version of the printed workshop reports. You can download them by going to the following FTP site

ftp://ftp.usace.army.mil/Incoming/MVR/NavStudy/**.**

Appendix H. St. Louis Environmental Workshop Report

The following report summarizes the results of the St. Louis Environmental Workshop that was held November 13-14, 2002. The report includes:

1. a summary of the workshop and results,
2. tables of identified UMR-IWW environmental objectives,
3. a table of identified management actions,
4. a narrative on UMR-IWW species and population parameters,
5. working group reports, and
6. the plenary session report.

Upper Mississippi River – Illinois Waterway System Navigation Feasibility Study

St. Louis Environmental Workshop

November 13-14, 2002
St. Louis, MO

DRAFT REPORT

United States Army Corps of Engineers

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EXECUTIVE SUMMARY

Introduction and Workshop Process

The restructured Upper Mississippi River –Illinois Waterway (UMR-IWW) System Navigation Feasibility Study is focused on the authorized Federal navigation projects on the Upper Mississippi River System (UMRS; including the Illinois Waterway; Figure 1) and the ecological and floodplain resources that are affected by these navigation projects. The objectives of this restructured feasibility study are to relieve lock congestion, achieve an environmentally sustainable navigation system, and address ecosystem and floodplain management needs related to navigation in a holistic manner. The restructured navigation study will seek to ensure that the rivers and waterway system will continue to be an effective transportation system and a nationally treasured ecological resource. The restructured study will: (1) further identify the long-term economic and ecological needs, and potential measures to meet those needs, through collaboration with interested agencies, stakeholders and the public; (2) evaluate various alternative plans to address those needs; (3) present a plan consisting of a set of measures for implementation that will achieve the study objectives; and (4) identify and address issues related to the implementation of the recommended plan.

The study area comprises the entire Illinois Waterway and the Upper Mississippi River. The Illinois Waterway extends 327 miles from its confluence with the Mississippi River to Lake Michigan via the Illinois River, Des Plaines River, and a series of canals. The Upper Mississippi River extends 854 miles from the confluence with the Ohio River to Upper St. Anthony Falls Lock in Minneapolis-St. Paul, Minnesota. The study area lies within portions of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The total Illinois Waterway and Mississippi River navigation system contains 1,200 miles of nine-foot deep channels, 37 lock and dam sites (43 locks) and thousands of channel training structures (Figure 1).

Much of the UMRS lock and dam system was in place by the 1940s. Except as noted below, the locks are 600 feet long, although, modern tow configurations include 15 barges and approach 1,200 feet long. As a result, most tows must lock through using a time-consuming two-step process in which the first three rows of barges (9 barges) are locked through first and the last two rows of barges (6 barges) and the tow boat are locked through second. The entire process may take 1.5 hours or longer depending on many variables. In contrast, Lock 19 has a 1,200-foot lock and Melvin Price Lock and Dam (Lock 26 replacement) and 27 have both a 1,200-foot and a 600-foot chamber at each site. The lockage process takes an average of 1.0 hours at Lock 19 and 0.6 hours at Locks 26 and 27.

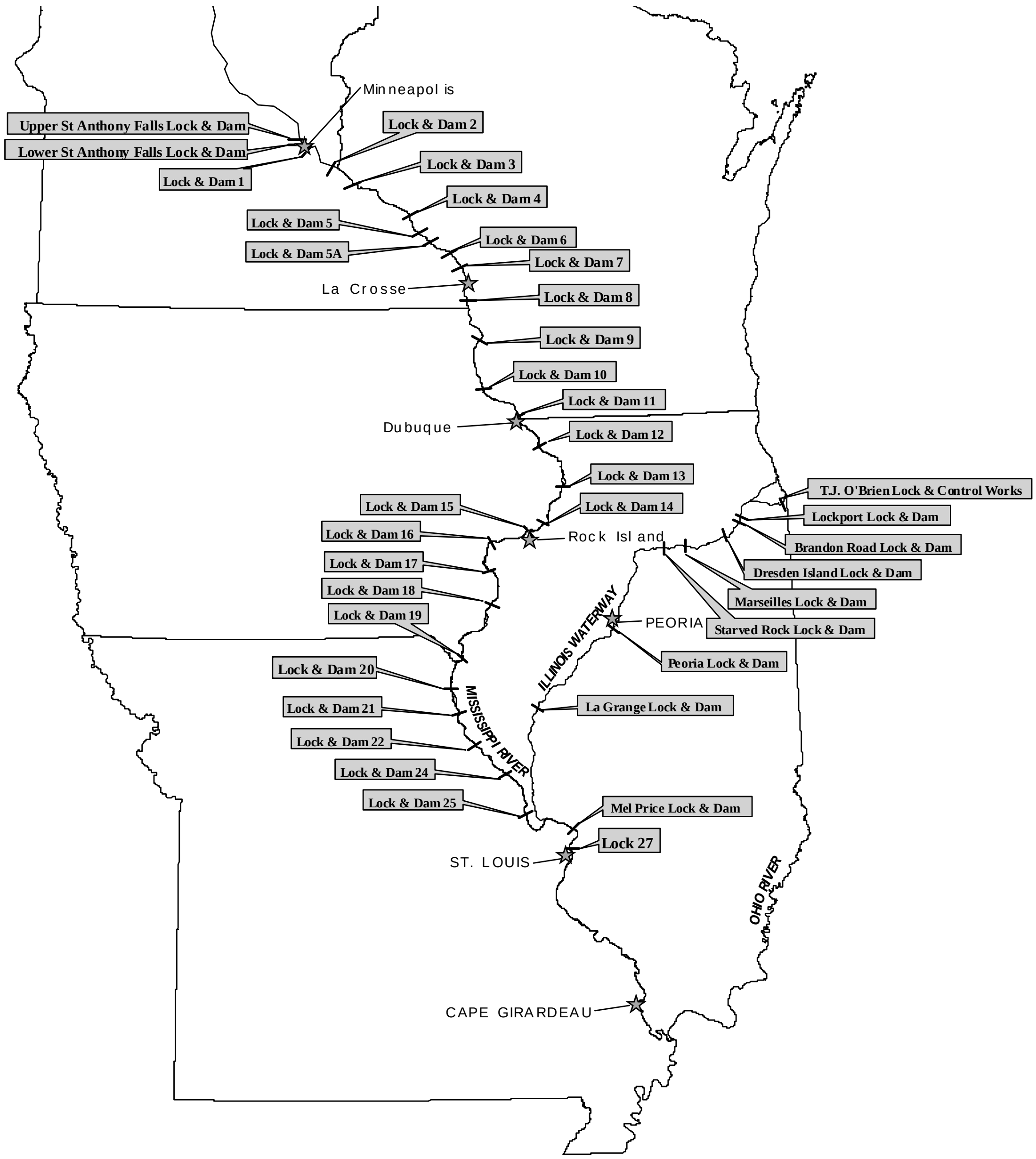

Figure1. UMR-IWW Locks and Dams.

Eight locks on the Upper Mississippi River and 3 Illinois Waterway locks were among 20 locks with the highest average delays in 1987 at the beginning of this study. This remains the case with UMR-IWW facilities highly ranked in the peak monthly delays at locks around the country in 1998. The UMRS had over half (19 of 36) of the most delayed lock sites in the country. Under current conditions, delays to tows are common at a number of locks on the UMRS. In general, delays are greatest at the most downstream 600-foot locks. For the 10-year period 1990-1999, delays per tow average 3.4 hours at Locks 20-25; 2.2 hours at Locks 14-18; 0.9 hour at Locks 8-13; and 0.4 hour for Upper St. Anthony Lock to Lock 7. On the IWW over the same period, delays per tow average 1.8 hours at Peoria and La Grange and 1.1 hours for the other locks.

Ecosystem

The Upper Mississippi River ecosystem includes the river reaches described above, as well as the floodplain habitats that are critically important to large river floodplain systems. The total acreage of the river-floodplain system exceeds 2.6 million acres of aquatic, wetland, forest, grassland, and agricultural habitats. The Mississippi Flyway is used by more than 40% of the migratory waterfowl traversing the United States. These Trust Species and the threatened and endangered species in the region are the focus of considerable Federal wildlife management activities. In the middle and southern portions of the basin the habitat provided by the mainstem rivers represents the most important and abundant habitat in the region for many species.

Habitat types are disproportionately distributed throughout the river system, and their absolute abundance is dependent on the total area of the reach under consideration (Figure 2). The largest differences occur in the amount and distribution of agriculture and the proportion of open water in the floodplain. Agriculture dominates the wide floodplain south of Rock Island, Illinois and open water occupies a greater proportion of the floodplain north of Clinton, Iowa. Wetland classes are generally more abundant in northern river reaches, wet meadows are fairly evenly distributed, and grasslands are rare throughout the river system. Forest classes generally occupy between 10 to 20 percent of the floodplain in a narrow strip along the river banks throughout the system.

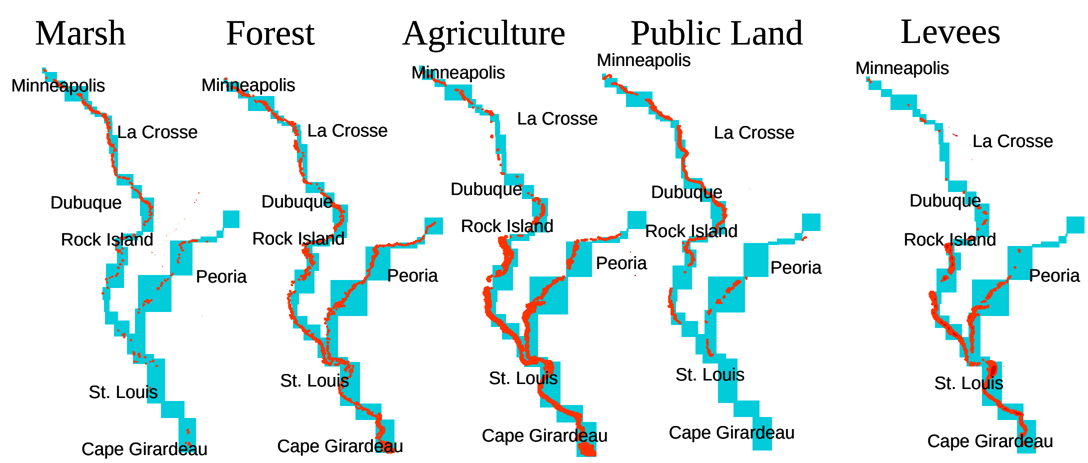

Figure 2. Areas in red show the extent of selected landcover or landuse types on the UMR-IWW.

Section 1103 of the Water Resources Development Act of 1986 (WRDA 86) recognized the Upper Mississippi River system as a unique, nationally significant ecosystem and a nationally significant commercial navigation system. The system provides:

1. A means for shippers to transport million of tons of commodities within the study area---130 million tons on the Mississippi River and 44 million tons on the Illinois Waterway in 2000,

2. Food and habitat for at least 485 species of birds, mammals, amphibians, reptiles, and fish (including 10 Federally endangered or threatened species and 100 state listed species),

3. More than 226,650 acres of national wildlife and fish refuge,

4. Water supply for 22 communities and many farmers, and industries,

5. A multi-use recreational resource providing more than 11 million recreational visits each year,

6. Cultural evidence of our Nation's past.

Establishing Goals for the System

The original UMR-IWW Navigation Feasibility Study was narrowly focused on the problem of reducing commercial navigation traffic congestion on the system. Coordination was occurring between economic and environmental interests;, however, the work was being accomplished independently. With the new focus of the restructured study on sustainability, it became important for the stakeholders of the system to prepare a common vision for the future of the UMRS. In November 2001, the Economic Coordinating Committee (ECC) and the Navigation Environmental Coordinating Committee (NECC) met jointly to prepare this vision:

> *"To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System"*

The following definition of sustainability was collaboratively developed and agreed to by the group as well:

> *"The balance of economic, ecological, and social conditions so as to meet the current, projected, and future needs of the Upper Mississippi River System without compromising the ability of future generations to meet their needs."*

This definition will serve as the primary goal for integrated and adaptive management of the Upper Mississippi River System.

Planning for future navigation system infrastructure needs; navigation system operation and maintenance; habitat protection, enhancement, and restoration; river recreation; floodplain management; and water quality management should be conducted in the context of a set of clear goals and objectives for the desired condition of the UMRS. Setting these goals and objectives should be done collaboratively, with participation of the full community of river stakeholders. Development of a set of measurable objectives for integrated and adaptive management of the UMRS will be challenging. It will require considerable collaborative effort, making use of conceptual models, predictive models, and visualization tools to comprehend the interconnections between system components and to enable the community of stakeholders to actively participate in planning for a sustainable multiple use river-floodplain system. Integrated planning will be an on-going effort to optimize the National benefits achieved from efficient and effective adaptive river management.

Introduction to the Workshop

Four two-day workshops were held during November 2002, to aid the process of establishing measurable environmental objectives for the Upper Mississippi River-Illinois Waterway System (UMR-IWW). Workshops were conducted in Peoria, Illinois, St. Louis, Missouri, La Crosse, Wisconsin and Moline, Illinois.

The workshops were structured to achieve the following main objectives:

1) <u>Identification of UMR-IWW environmental objectives</u>
   Collaboratively review, refine, and add to a database of specific, quantitative, local to regional scale environmental objectives (for the workshop region) building on previous work from the EMP Habitat Needs Assessment, Pool Plans, USFWS Comprehensive Conservation Plans, and related study efforts.
2) <u>Identification of UMR-IWW management actions</u>
   Review and identify management actions that are most likely to contribute to achieving the established goals and objectives.
3) <u>Discuss and identify species and population parameters</u>
   Identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.
4) <u>Present and discuss UMR-IWW ecosystem conceptual model</u>
   Present and discuss the utility of developing an UMR-IWW ecosystem conceptual model to gain a better understanding of the linkages between environmental objectives, management actions, and the state of the ecosystem.

Participants were invited from a variety of organizations including the U.S. Army Corps of Engineers, U.S. Department of Forestry, U.S. Department of Transportation – Maritime Administration, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, Iowa Department of Natural Resources (DNR), Illinois DNR, Illinois Department of Water Resources, Illinois Natural History Survey, IL State water Survey, Minnesota DNR, Missouri Department of Conservation, Missouri DNR, Wisconsin DNR, Audubon Society, Environmental Defense, Iowa Farm Bureau, Izaak Walton League, MARC 2000, MRBA, Mississippi River Revival, Missouri Coalition for the Environment, Sierra Club, Southern Illinois University, The Nature Conservancy, University of Miami, UMIMRA, UMRCC, and Quincy Park District. There were a total of 142 people who participated in the interactive workshop process. This report presents the results of the enormous amount of effort and energy the participants contributed to the workshops.

Workshop Process

The workshop was organized by the U.S. Army Corps of Engineers (USACE) Rock Island District. A subset of the workshop participants helped review and edit this Workshop Report. Outside review by non-participants will not be part of the process. No content changes were made by the editors and the participants checked that accurate representations were made of the work they had done during the workshop.

The St. Louis workshop was conducted 13 - 14 November, 2002 at the Spazio Westport Comfort Inn, St. Louis, Missouri. There were 41 participants, with most present the entire duration of the workshop. These participants, from more than 80 issued invitations, included state and federal wildlife agency personnel, non-governmental agency representatives, and public citizens. Participants and invitees are listed in Appendix A.

The agenda for the workshop (Appendix B) was followed loosely, allowing extra time for questions and time in the workgroups as needed. A record of these plenary discussions is found in Appendix C, while workgroup reports can be found in the appendices related to their topic of discussion.

Background on the General Workshop Structure

The workshop process was designed to maximize the time and resources available at each of the meetings. The workshops utilized three components of meeting structure to meet the objectives of eliciting information, discussing key issues, and informing the participants of developing strategies.

The first component was the standard meeting style wherein a few speakers provided information to the group as a whole allowing for questions and some discussion.

The second component was key for eliciting information and involved breaking the group into working groups based on some criteria such as geography or content. Breaking a large meeting into working groups comprised of 10 or fewer individuals optimized the opportunity for participation of the greatest number of people and for timely discussion and progression on key issues. The number of working groups varied depending on the number of participants and geographic areas to be covered.

The third component were the plenary sessions, which allowed all of the participants to hear a summary of what was accomplished in the other working groups and to have input into the entire set of results. It also allowed the facilitators to refine the GIS database as a coordinated team.

Before getting started with the first task of this workshop, each participant was asked to introduce themselves and to write out and then read aloud answers to an introductory question. This process allowed for expression of individual perspectives without being immediately influenced by previous responses. This process indicated potential areas of common ground and provided a first insight into the diversity of perceived issues present in the group. Answers to the question can be found in Appendix D of this report.

After the Workshops

The workshops were an early step in a planning process to establish environmental alternatives that strive to secure the environmental sustainability of the UMR-IWW. Once the environmental objectives are well defined and management actions are identified to achieve them, the next step will be estimating the potential costs and outcomes (i.e., benefits) for the suggested actions. This information will be used to develop alternative plans (made up of multiple combinations of management actions) that seek to address the local, river reach, and system-wide needs of the UMR-IWW ecosystem. These environmental alternative plans will then be integrated with alternative plans for the UMR-IWW Navigation System. Tradeoff analysis will be conducted to identify and compare the environmental, economic, and social benefits of the integrated plans. The results of the alternative analysis, and further collaborative review and input from stakeholders, will be used to develop a recommended plan portrayed in the Final Feasibility Report scheduled for completion in late 2004.

Formal Report

Five reports will be produced as a result of the four, two-day workshops. The first four reports are Workshop Reports, which will be reviewed by the workshop participants. A final integrated report summarizing the results from the four workshops will be published as part of the Navigation Study's formal documentation process. The final integrated report will contain a full accounting of the site-specific objectives in the form of an atlas as well as the tabulated system, reach, and pool wide objectives and management actions (Table 1). Workshop participants will have an opportunity to review and comment on the integrated Draft Environmental Objectives Planning Workshops Report before its completion in early 2003.

Table 1. UMR-IWW System Navigation Feasibility Study Environmental Objective Workshops reports contents.

- <u>St. Louis Environmental Workshop Report</u>
    - Summary of St. Louis workshop and results
    - Tables of identified Upper Mississippi River pool-wide and site-specific objectives
    - Table of identified management actions
    - Narrative of species and population parameters
    - Working Group Reports
    - Plenary Session Report

- Environmental Objectives Planning Workshops Report
    - Summary of all four workshops
    - Tables of all identified UMR-IWW pool-wide and site-specific objectives
    - Atlas maps of all identified site-specific objectives
    - Table of all identified managements actions
    - Narrative of UMR-IWW species and population parameters

Environmental Objectives

The primary goal of the Environmental Objectives Planning Workshops was to have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts. The St. Louis Workshop was successful in reviewing and identifying both site-specific and pool-wide objectives for the Mississippi River (Pool 24 to the Ohio River) using a combination of working groups and plenary sessions. Objective atlas maps and worksheets were reviewed and filled out by working groups. A plenary session then followed where the information from each group was compiled into the objective database using GIS tools (Figure 3).

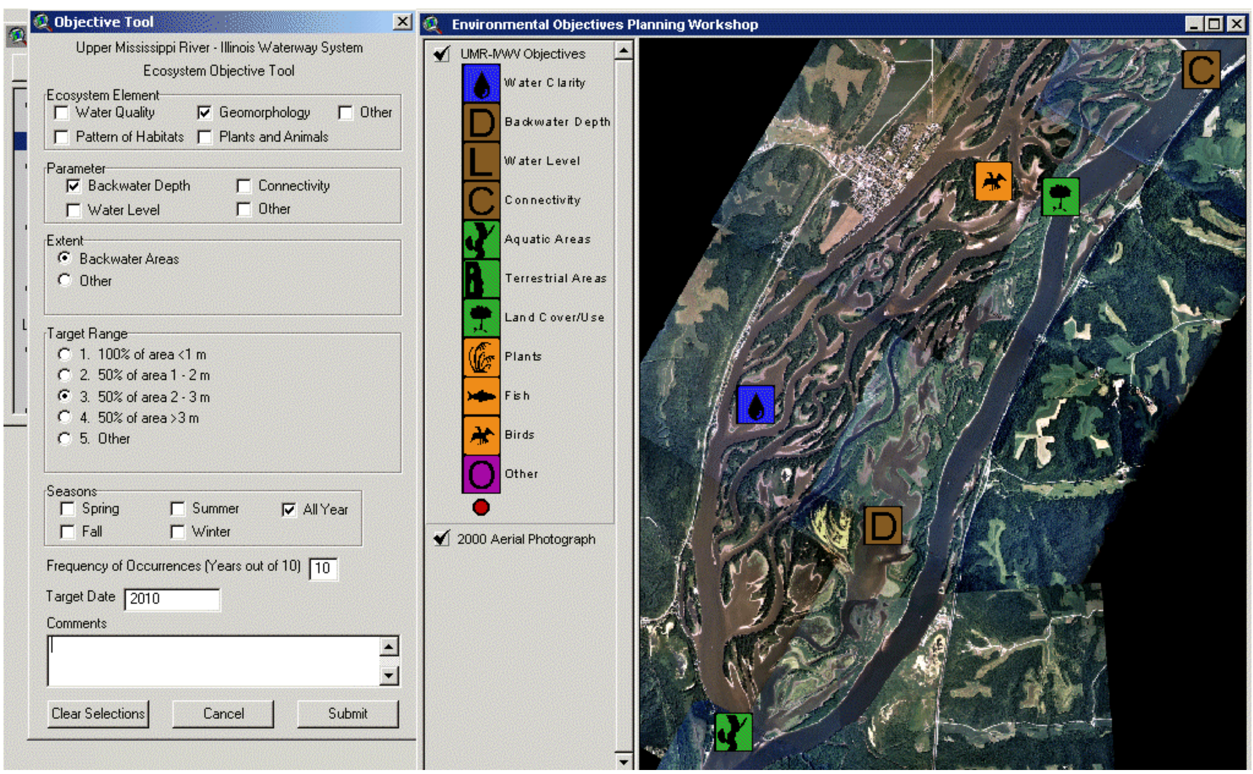

Figure 3. UMR-IWW System Navigation Feasibility Study GIS Objective Tool and Database.

The environmental objective database used at the St. Louis Workshop included 185 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment (HNA) and Middle Mississippi River Side Channel Rehabilitation and Conservation Project. Two additional data sources were identified during the St. Louis

Workshop and later added to the objective database. They included objectives noted by the Middle Mississippi River Stone Dike Alteration Study and Habitat Rehabilitation and Enhancement Project (HREP) documents. HREP objectives were noted only for projects described as ‘under general design’ or ‘future opportunities’.

An additional 251 site-specific objectives were identified through the workshop process bringing the total to 436 environmental objectives for the Pool 24 to Ohio River reach of the Mississippi River (Table 2). Aquatic area and land cover/use were the most common type of objectives identified for this portion of the river. Pool 25 had the largest density of identified objectives with an average of over three per river mile. The 19 environmental objectives identified as ‘Other’ included objectives related to maintaining gravel substrate, improving air quality, and reducing sediment input from tributaries. Appendix E provides additional detail on the objectives listed in Table 2. Maps of all site-specific objectives identified in the workshop will be distributed for review in the integrated Environmental Objectives Planning Workshops Draft Report (in January).

Table 2. Number of site-specific env. objectives identified for the Mississippi River.

Objective	Mississippi River Reach						Total
	Pool 24	Pool 25	Pool 26	Lock 26 to Kaskaskia R.	Kaskaskia R. to Grand Tower	Grand Tower to Ohio R.	
Water Clarity	10	19	16	1	1	3	50
Backwater Depth	14	21	18	1	1	3	58
Water Level	1	0	0	0	0	0	1
Connectivity	9	13	4	11	6	12	55
Aquatic Areas	8	17	7	34	15	43	124
Terrestrial Areas	7	3	2	10	3	5	30
Land Cover/Use	13	26	18	18	9	14	98
Fish	0	0	0	0	1	0	1
Other	4	6	4	4	0	1	19
Total	66	105	69	79	36	81	436

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- Restore and maintain riparian corridors (200 ft. wide),
- Water clarity sufficient to support vegetation to a depth of 1.5m,
- Maintain and increase floodplain connectivity by 40%,
- Increase quantity of woody debris in side channel of pools,
- 15% reduction of nutrient load,
- Restore historic meanders,
- Allow some disturbance regimes to occur on the river,
- Allow some non-constrained stretches of the river,
- Provide bird nesting areas every 20 miles and
- Provide overwintering habitat for fish every 5-7 miles.

A more complete list of Mississippi River pool-wide objectives gathered at the St. Louis Workshop is located in Appendix E.

Management Actions

The purpose of the Management Actions working groups and plenary session was to review and identify management actions that were most likely to contribute to achieving the established goals and objectives. This was accomplished by reviewing current tables of management actions (see the *Interim Report for the Restructured Upper Mississippi River – Illinois Waterway system Navigation Feasibility Study* pages 251-255), tailoring them to the ecosystem elements under consideration, and revising them where necessary. Management Actions are defined as specific actions, tools, techniques or combinations of actions, tools and techniques used to meet defined objectives. Management actions are implemented as specific projects whose reconnaissance and feasibility studies provide the detail required to assess and develop environmental analyses, funding, staffing, engineering and partnerships needed to implement the plan. Table 3 is an example of the Management Actions Tables where actions have been changed or added. All management actions can be found in Appendix F.

Table 3. Example Management Action Table.

Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to consolidate soft sediments	
		4	Minimize dredge disturbance/frequency	
		5	Minimize dredge slurry return water	
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	
		9	Speed and wake restrictions - ~~rec. boats~~ (all watercraft)	
Comments/ Additions:			Evaluate and modify mechanisms to deal with watershed influences to eliminate spiking hydrographic cycle (system wide)	
			Restore natural tributary areas through delta areas	
			Minimize open water dredged material placement	
			Sediment traps	

Species and Population Parameters

The purpose of this session was to identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts. Below is a summary of the discussion that took place during the plenary session.

There is a long-term commercial fish catch database maintained by the Upper Mississippi River conservation Committee (UMRCC) that can be helpful in evaluating species populations on the UMRS. States maintain similar records individually. There is also an ongoing effort to establish a baseline demographic for fishes in the Middle Mississippi River reach. The Audubon Society has launched an initiative to establish and survey "Important Bird Areas" along the UMRS. They also conduct an annual Christmas Bird Count and Breeding Bird Surveys to track bird species presence and trends. These databases do not provide abundance estimates, but they have helped evaluate species distribution for many years.

There was concern that focusing on a small set of species may not detect community level response, either beneficial or adverse. Habitat evaluation procedures like the Wildlife Habitat Appraisal Guide (WHAG) and Aquatic Habitat Appraisal Guide (AHAG) were proposed as habitat level models designed for such purposes. They were thought to be more robust than species specific Habitat Evaluation Procedures (HEP) that may emphasize some habitat variable over others and frequently don't incorporate all habitat variables.

Some responded with the observation that AHAG results are poor indicators of actual project performance in terms of fish use of restored habitats. Some participants recommended that the fisheries management community work to complete an Index of Biotic Integrity (IBI) for large rivers.

Some participants were puzzled why the Corps would venture into species level issues anyway. The Corps has authority for habitat management and other state and Federal agencies have responsibility for species.

Invertebrates and less mobile species were proposed as the best indicators of restoration response because they would be most impacted by changes in local habitat conditions. Exotic, threatened, and endangered species could also be indicators of community level responses. A more detailed discussion can be found in Appendix G.

Conceptual Model

At the end of the workshop, participants were provided with a brief presentation on the ecosystem conceptual model being developed for the UMR-IWW Navigation Study. The purpose of the UMR-IWW conceptual model is to identify the linkages and sequencing of identified environmental objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to this overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Facilitate dialog and develop a structure for additional input from stakeholders

The ecosystem conceptual model presentation can be found in Appendix H. All the PowerPoint slides used during the 2-day workshop are displayed in Appendix I.

Appendix A. Invitation List with Participants Highlighted

Name	Affiliation	Address	Phone	E-mail
Reid Adams	Souther IL Univ - Zoology	Department of Zoology Southern Illinois University Carbondale, IL 62901	618.453.4113	adamsr@siu.edu
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Appendix B. Agenda

Day 1

9:00	Opening *Hank DeHaan and Chuck Theiling*
9:10	Introduction to the Workshop Process and Participant Introductions *Rebecca Soileau*
9:30	UMR-IWW Restructured Navigation Feasibility Study Overview and Schedule *Ken Barr*
9:45	Vision, Goals, and Environmental Objectives *Chuck Theiling*
10:00	Working Definitions of Terminology for this Workshop *Nicole McVay*
10:10	Overview of GIS Database and Existing Objectives and Management Actions *Hank DeHaan*
10:30	***Working Groups (I)*****:** Identify and refine environmental objectives for the Illinois Waterway ecosystem. .
12:00	Lunch
1:00	***Working Groups (I)*****:** Continued work and Report Preparation
3:30	Plenary: Presentation of objectives identified by each working group and input into GIS
5:30	Adjourn

DAY 2

8:00	Plenary: Presentation and discussion of synthesis of results from previous days work
9:00	***Working Groups (II):*** Review and identify management actions that are most likely to contribute towards achieving the established goals and objectives
10:30	Plenary: Group presentations of new and revised management actions.
12:00	Lunch
1:00	Plenary: Overview of regional evaluation data and tools for assessing the efficiency of management actions both initially and in an adaptive management framework. Discussion of species and population parameters. *Chuck Theiling*
2:30	Review of Regional Ecosystem Conceptual Models
3:00	Workshop Closing

Appendix C. Plenary Session Notes

Below are the plenary session notes that were captured by the facilitators during the two-day workshop. Participant names have been removed from all comments except those made by the facilitators.

St. Louis Workshop November 13th – Day 1

Chuck Theiling's Intro (9:05 –9:13)

Chuck Theiling's introduction briefly described what the workshop will accomplish as well as introduced Hank DeHaan, Nicole McVay, Rebecca Soileau and himself.

Questions:

– The lower river is very different from the upper river. How can you standardize when the regions are so different?

Theiling – We want the planning process to be standardized, not the management actions.

– Species level is fine but we should be looking at community level interactions. We need to be looking at things more holistically.

Theiling – We found in Peoria that this whole species level idea is a can of worms.

Participant Introductions (9:13 – 9:35)

See Section 6.

Ken Barr's Talk (9:35- 9:57)

Ken Barr discussed the history of the Navigation Study – its original focus as well as some of the studies that originated from that process. He then went on to discuss the restructured navigation study, describing the vision as well as the new scope of the study. He showed how the two studies differed with respect to the ecological integrity (the original study focused on direct effects of construction or more tow boats on fish, sediment resuspension, mussels, etc; while the restructured study will consider the existing project impacts and establish objectives to have the environment reach a desired state). During his presentation he also displayed the six-step planning process and reminded all workshop participants that the Corps has to follow this process. He concluded the presentation by discussing how the environmental portion of the navigation study will be viewed in an adaptive management framework as well as showing the participants the schedule of the study. At the end of the presentation he told people that they were open to attend NECC/ECC meetings and that the meeting minutes could be found on the web.

Questions (9:57- 10:18)

– How do we focus on the area impacted by Navigation Project? The entire floodplain is indirectly affected by navigation system through the maintenance of the levees, so the whole area affected is actually bluff-to-bluff.

Barr – We are assuming that the navigation system is there. If some objectives are 2-3 miles away near from the river and near the slope of the bluff we probably won't be able to bite that off in this study.

– What will be needed to restore the river is not solely related to navigation. Some needs are related to the watershed. Will the final report separate out those cause and effects and make recommendations regarding this? Congress may only want to fund $'s for restoration from navigation effects. What do we see as our final product? I want to see entire restoration, not just the navigation effects restoration.

Barr – It's not important to know that environmental loss is based on 93% watershed, 7% navigation. What is important is to know what tools we have to change and help these circumstances. We are more interested in cause and effects to be able to look forward and know what we can do better. However, we have to understand that if we dig out an area, runoff may fill it up again in 5 years. We need to understand this. However, we will not be addressing uplands. This study will not make specific recommendations for watersheds.

– This is a major shortcoming of this study. The Corps is the only organization that can do this. If you don't do this no one else can.

Barr – We aren't planning for the entire basin. A whole bunch of folks are doing things in the area that we have chosen to bite off.

– Similar to the navigation study, the UMR Comprehensive Plan won't be looking at the whole universe. We are going to focus primarily on the floodplain area. We cannot make this study the big "CP" of integrated river management. Legislatively, this study has to tie-back to its primary purpose of flood damage reduction. However, this workshop is a first step toward a broader view of the river system. Nothing is stopping either of these studies from making recommendations to Congress for follow-up study investigations.
– Sedimentation within the basin is consistent. We are not doing anything to address sedimentation within the basin, yet it is the greatest impact on navigation and habitat.

Barr – We can do a better job to quantify that. Knox and Nakato were able to give some pretty good insights on how land practices have changed since the 50's. We will not be seeking authority for major basin efforts with this study. We know that sediment is the problem.

– You have to go for some new authority. Somehow we need to convert 3.5 million acres of cropland to trees to help slow erosion. If we don't get it converted it won't matter what we do.

Barr – Some states have done that.

– This is our opportunity to do this on the right scale.

Barr – There are going to be things in the floodplain that will have to be cost shared. There will be regional stakeholder issues that will have to be tackled.

Soileau – These concerns and issues should be noted in the small groups so we can carry them forward from this meeting. All of the info captured here can be utilized in other studies.

Barr – The scope of this study has been developed and focused since Aug 2001.

Theiling –Congress has recognized sedimentation through NRCS programs. IL River Ecosystem Program (IL 2020) will be a model to let a state work in stream channel. This can address the legacy sediment in the stream.

– It is absolutely foolish to come up with recommendations for sustainability if this is not wrapped up as a complete project with no real focus. This is our opportunity to be like Florida.

Barr – Tell this to the Federal taskforce. There is an opportunity to look at crosscut type of issues.

– I thought that this was going to be a cross-agency program.

– Is there any restriction to attaching an addendum to look at things outside the Navigation Effects?

Barr – No, we can. We are told to look at EMP alternatives and possibly other authorities.

– Then I recommend we do that.

– Please don't use acronyms.

Barr – Sorry – EMP – Environmental Management Program.

<u>Chuck Theiling's Talk (10:18-10:37)</u>

Chuck began his talk by reviewing many of the reports that have been written concerning the environment of the UMR-IWW. He then went on to discuss how the Corps has structured this study and where in the study these workshops take place. Next he discussed the expert panel, their functions, the individuals who will make up the panel, as well as how they will fit into the entire process. Chuck then discussed goals, objectives and management actions. He displayed the goals from Grumbine that were adopted by the Navigation Study in the interim report as well as the goals listed in the UMRCC report "A River that Works and a Working River." Next he discussed objectives, described them and listed several example objectives. The following questions had to deal with objectives:

Mid-Talk Questions (10:24 – 10:34)

– When you get to the end of the objectives, how will we know that this feeds into sustainability? The river process can be restored to get at sustainability – this isn't a one-point objective.

Theiling –We want to look for big picture answer but we know we work from project to project.

– We need to restore natural processes.

Theiling – Management actions tomorrow will help us identify how to do this– drawdowns are a good example. Divert flow into backwater to clean them up.

Soileau – The format for setting objectives is to start at the System then set the reach and pool scales.

Barr – Joyce has a great question. We will be using conceptual models that look at processes. They will look at how these objectives will help to restore processes. The conceptual model is a tool to examine how the pattern of habitat can lead to sustainability.

– We have not had a management authority ever, only a navigation authority. The solution that has to come out of the navigation study is an authority revision and adaptive management with monitoring of the system.

– Objectives need to be realistic. What about conflicts with maintenance and with the navigation system?

Theiling – We don't want our ideas to be constrained. We will look at costs and benefits later. There is more site specific planning to be done later.

Chuck Theiling's talk continued (10:34 – 10:42)

Chuck continued his presentation by giving an overview of the framework for setting objectives. He then continued by showing where the data to create the objectives database came from. He concluded the talk by reiterating exactly where the focus of the navigation study was as well as discussing how other agencies and authorities could use these overarching goals.

Break

Rebecca Soileau's Talk (10:50 – 10:57)
Rebecca Soileau discussed the overall workshop process including a brief agenda. She then discussed the working agreement and had participants agree to abide by it. Finally she defined her role as a facilitator as well as the expected roles of the participants. She then presented the working definitions.

Hank DeHaan's Objectives (10:58)-(11:14)
Hank discussed the objective database, including where the information came from, and how the database is structured. This included a detailed discussion of the framework for setting objectives. He then gave a brief demonstration of the database in Arc View 3.2.

Questions (11:14 – 11:27)
– Please discuss the Target Date Issue that we talked about in Peoria.

DaHaan – Instead of identifying a specific date, list a decade. So 2010 means target for implementation within the next 10 years.

– What will you consider to be the baseline year?

Theiling – We don't know when any project will be implemented. So if you say 2020 we will interpret that to mean you want the objective met in 20 years. We will do the math once the Navigation Study is a go.

– If we are "restoring" the ecosystem, what is the reference condition assumed?

Theiling– Different parts of the river have different reference conditions. We proposed 1940 for pooled river reaches of Miss. For IL River – post diversion. Middle Miss – degradation occurred in 1800's for steamboat impacts. Middle Miss is about as good as it has been in a long time.

– 1800's is the best time.

Barr – We are not constrained with our baseline. (*They are best used*) only as insights (*into desired conditions*).

– When do we discuss how to implement? One action may affect other objectives. Batch Town example.

Theiling – We will look at management actions tomorrow. There are many examples of Management actions for Batch Town. However we don't want to be site specific.
– How is reference condition used in the planning process? What does this mean in terms of your planning process?

Theiling – We won't be using it in the planning process. However, people have it in their minds.

– How do we resolve this?

Theiling – We don't work it today. That is what the representatives will do in further meetings.

– We have a lack of information. There is a discrepancy between Corps and agencies as to what the Middle Miss looked like in the 1800's. We need to look at river processes that are similar to what will occur.

Barr – We recognized that this is a heavily managed system. The environment will have to be highly managed. These baselines are not what will be used to set up further authorities.

Soileau – We don't have perfect knowledge. We bring you together to get the best working knowledge that we can. This is an Adaptive Management process as well.

– Will monitoring be more intensive then with EMP? I want us to do more monitoring, we should front load this with science.

Theiling – I hope so. We need to do cause and effect studies with the management actions as well.

Objectives Plenary Session (3:10):
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary

Pools start at 24
Overall Objectives –
1) Increase acreage of bottomland hardwood forests in floodplain as social and economic factors allow.
2) Restore and maintain riparian corridors (200 ft. wide).
3) Increase wetland habitat behind levees.
4) Maintain and increase floodplain connectivity, spillway, opportunistic flooding.
5) Water level management – hinge point drawdown. This is an opportunity to move from hinge point to endpoint control.
6) Fish Passage – Latitudinal and longitudinal connectivity.

Group 2 Summary
Our main thought is that a lot of this has been done
Lower River Objectives–

1) Implement side channel plan.
2) Implement stone dike objectives.
3) Reduce air and water pollutions.
4) Reconnect river with floodplain in selected locations.

Pools Objectives
More hard mast producing trees.
Create more deep-water habitat.
More dredging in pools and private boat docks to allow greater drawdowns.

<u>Group 3 Summary</u>
Open River
Remove all of the levees, restore 100% connectivity, take river to pre-European settlement conditions.
Partial flood plain restoration– 20-30% reconnectivity
Restore historic meanders.
Allow every 5-7 miles of over wintering for fish.
Every 20 miles bird resting areas.
Habitat connectivity in Main Channel.
Founder effect
Rob talking too fast see his computer notes.
1950's may be a good baseline – fisheries and shrimp
Use old and existing quarries for deepwater habitat.
Create new side channels

– We went through side channel plan. Maybe you don't want to clear them all out.
– The final determination would be made later.
– Reconnectivity might not be the best thing in all cases.

<u>Group 4 Summary</u>
Buy the Sny
Deconstruct Batchtown
Pool Objectives
Return hydrograph to as natural as possible
150 in an opportunistic basis acquire land of willing sellers to restore floodplain connectivity.
Pool 26 – Restore 40% of floodplain to pre-historic conditions. Including agricultural programs.
Problems with setting objectives for specific pools – we have a limited understanding of pool resources so it is hard to set objectives. What particular times do some species need access to backwaters? Bank stabilization is good, but limits habitats. SO when does it start to have an impact?
Water Quality – DO, methyl Hg, nutrients, and fecal coliform reduction from tributaries.
Water Clarity - sufficient to support vegetation to a depth of 1.5m.
Increase quantity of woody debris in side channel of pools.
Need to restore streams in the floodplain.

Concerns about air quality.
All islands into public ownership.

Site Specific Objective Setting for St. Louis (3:30)
Once each group gave their report we then started at Pool 24 and moved down river, allowing all participants to provide input.

Pool wide – Water control for aquatic areas.

Pool 25
– Should we add in mussel info?

–Yes.

– Mussel beds will be put in Natural Heritage database. So we will get our info from there, not put on this map.

Pool 24 – 25 island plans? Talk to Ken Barr. EMP Fact Sheet

Group 1 has detailed notes for most numbered objectives. We will not put the info in the database now; rather gather data from their notes later.

Pool 26
#62 – covered in island fact sheet

Pool 26 – Kaskaskia
RM –128-130 Reconnect wetlands on both side of the levee.

Kaskaskia – Grand Tower
RM 112 – There is an old side channel that needs to be reconnected.
Crains Island Levee RM104 - talk about set back and levee raises.

– Route 3 runs through Liberty Chute near Rockwood Islands RM 102

– How will all of this shake out?

Theiling – Once we are to the project level we will do reconnaissance do see if there is a federal interest. We will calculate Costs and Benefits with 65% engineering. This goes through for final funding. Then it will go through final engineering and construction.

Grand Tower to Ohio River
– Are you going to do anything in the ox bow area?

RM 20 – 31 We are in the process of establishing riparian corridor and forest.

- Regional Objective – Come up with and implement a plan to deal with exotics.

St. Louis Workshop November 14th – Day 2

Opening (9:06)

Managements Actions – Chuck Theiling (9:08 – 9:10)
Chuck began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

Discussion Before Management Actions Working Groups:

– "Reduce Algae" Isn't this an objective?

Theiling – Yes.

Soileau – You can go ahead and convert these to management actions.

– If we don't see a management action that is directly linked to an objective identified yesterday we can go ahead and add it on.

Soileau – Yes, absolutely.

– Are we inserting an element of realism to the management actions or are we waiting for later?

Soileau – You can clarify them, but don't say "your off your rocker". We are trying to capture all ideas. What may not be applicable now, may be later.

Theiling – 5-8 years ago people would have thought environmental pool management was impossible.

– If we don't like dredges we tend to get more rock in the river. So, if we cross off minimize dredge disturbance will that be interpreted to add more rock in the river?

Soileau – We will have many actions to address any of these concerns, so there may be another way to meet those needs. Make sure you put any concerns in your notes.

Management Action Working Groups (9:20-11:05)

Management Action Plenary (11:10)

Group 1 Report (Pools) (*Numbers in parentheses are the group the speaker belonged to.)*
People in our group wanted to do this in a site-specific manner. To implement them, you cannot do it over the entire reach; you have to be in a specific area to do a specific action.

Pools
Water Quality (Main Channel)

(1)Dissolved O2, Nitrates and Chemicals.

(1) – For speed restrictions we discussed advisories.

(1)– Should we remove increase Channel depth because we didn't think it would help water quality due to sediment characteristics?

(4) – Many of these applied to other categories and were located there, but we included them here as well. Talked a lot about restoring natural hydrograph. Especially how induced drawdowns don't follow the natural drawdowns.

– Reconfigure tow facilities and scheduling to minimize sediment resuspensions

Water Quality (Back Water)

(1) All in report
(4) Re-emphasize drawdown

Geomorphology (Back Water Depth)

(1) All in report
(4) All in report

Water Level (Main Channel and BackWater)

(1) All in report
(4) All in report

Connectivity (Floodplain)

(1) - #35 was unclear as to what it was

(4) – Year round pool management – Spring Flood – Summer Drawdown – Late Fall, winter rise again.

(1) – How do you apply a natural hydrograph to a locked river? The locks have created a different environmental system so what values are you trying to achieve by introduction a pre-impoundment natural hydrograph to a locked river.

– We can't do anything to the spring flood. We can simulate the rise and fall of the river with management of dam operations. We are trying to draw down in the summer but then let them come back up to pool levels in fall. However, the fall rise is the question mark; we may need to buy more real estate.

– So you need to be careful using the word 'natural'. This system was actually built to mitigate against this.

– Not the amplitude of the natural hydrograph, the shape of it.

– I understand, I think that we need to be careful of language.

Theiling – There are functional aspects that we are trying recreate. Sediment consolidation: this can happen at almost any time. Holding waters high allows connectivity to off channel areas for fish over-wintering. Some things are time dependant, others aren't.

– Some people understand that these need to be acted within certain confines but the general public may not.

– Would this be dependant upon natural conditions?

– Yes, you don't want it to be the same every year. River won't allow you to do it every year, i.e. drought years. Chris is right we do have to be careful with the language we use.

Connectivity (Secondary Channel)

(4) All in report
(1) All in report

Connectivity (Longitudinal)

(4) All in report
(1) All in report

Patterns of Habitat (Aquatic Areas)

(1) All in report
(4) All in report

Patterns of Habitat (Terrestrial)

(4) All in report
(1) All in report

Patterns of Habitat (Land Cover/Use)

(1) All in report

Plants and Animals

(1) All in report
(4) All in report

<u>Open River</u>

Water Quality – Water Clarity (Main Channel)

(2) – We made no judgments. All things were good and should be laid out before the site manager.

(2) – Assuming #8 meant sediment traps and that it could be used in the middle river.

(3) Our plan of attack was to go through the list and discuss and eliminate items.

(3) Water clarity wasn't as much an issue as stratification and anoxic conditions. Water is clearer than historic levels due to Missouri Dams. Better route to increase turbidity in some areas. #2 Feel that some banks are too stabilized, would like to restore some natural meander.

Water Quality – Water Clarity (BW)

(2) – Number 17 brought about a bit of discussion based on feasibility. Additional management actions were Increasing licensing, and Rhodam (?)

(3) Added side channels to the backwater category.

– Dissolved Oxygen (DO) – side channels become isolated in the summer months, stratification occurs and anoxic conditions develop. Increasing connectivity and flow would help. Notching structures and dredging would help.

Nutrients are also an issue. Being isolated in side channels leads to eutrophication and DO issues. Carbon inputs and woody structures could be debated – reforestation would be desirable.

– BMP was also added here.

(2) – How can destabilizing a riverbank improve the water clarity?

(3)– Middle Miss was a very turbid river. Fish communities evolved and adapted to these kinds of situations. This changed when mainstem dams went in on the Missouri. There has been a shift in fish populations – non-sight fish populations are down. Return of these fish would be beneficial. Stabilizing the banks keeps turbidity and sediment out of the river.

(2)– Seems counter intuitive

(3)– We, a society, like to see clean flowing water. However the Middle Miss was not that kind of river.

(2)– So, if we decrease BMPs and let the sediment flow into the river, would that be good?

(3)- No, the sediment has to come from the right places (from the channel or the Missouri River).

– Good to think outside of the box

(2)– We are talking about different areas of the river. Sediment coming from upland impacts the entire system, but sediment from the river is better.

– Stabilizing the bank does keep trees from falling in river, but it does eliminate flat scoured area habitat and structure from fallen trees.

Geomorphology Page 2-3

(2) Look at water level tables and water usage and see how that is affecting Main Channel water levels.

(3) – Hydrograph in the Middle Miss is similar to historic, but more flashy. If you could implement set backs and notching you may be able to bring down the peak a little bit.

(3) – Dig new channels for backwater depth and backwater areas

(2) In floodplain – add structures into levees to allow water flow

(4)– Is there any problem with channel bed degradation (down cutting) in the main channel?

(3)– Don’t really know.

Geomorphology Page 2-4

(2) All in notes

(3) There is a lock at Kaskaskia and maybe something could be done there.

<u>Pattern of Habitats – Aquatic Areas</u>

(2) – From #54-55 – Could open areas to increase flows, which would expose gravel already there. #80 Thought that was more of an objective. Didn’t really know any management actions. Considered that we could put in nursery areas for small fish. Need a chance to develop techniques (selective notching and floodplain connectivity or using large stone to limit size of fish that can access side channels.

(4) Question on connectivity and degradation. Down-cutting may have caused isolation of secondary channels and backwater.

– Some areas are degrading and some are aggrading

(2) – There was degradation early after channelization, but is has stabilized.

(3) Some areas that have been over-engineered can be looked at.

(3) Didn’t really understand #80.

Lunch – 12:15 – 1:05

<u>Pattern of Habitats – Terrestrial Areas</u>

(3) All in notes

(2) Not clear on #81.

<u>Patterns of Habitats – Land Cover/Use</u>

(3) - #103 don’t see many areas where that was possible except for wetlands and timber stand improvement

(4)– What about the setting back floodplain trees for succession?

(3)– We did mention timber stand improvement.

(2)– To reestablish pine oak you need to have some type of reforesting

(3)– Yes, but you need to have a seed bank and we don't seem to have one.
#109 – Gated levees since the middle river doesn't have dams.

(2) All in notes

<u>Plants and Animals</u>

Fish

(2) All in notes

(3) – Don't have the same fisherman base. Actually need to improve angler access to get people on the river and that would change attitudes.

Wildlife

(2) All in notes
(3) All in notes

Exotics

(2) All in notes

(3) – Use some bacteria or something to control exotics

(3) 121 took out antibiotic treatment.

Threatened and Endangered

(3) Management currently seems to be population based. Should take a more holistic approach by managing for systems and goals. Outreach and education and outreach on the ecology of the river.

(3) - #134 Utilized to "all USDA programs"

2) – All mussel recommendations should be implemented.

<u>Ken Dalrymple's Presentation (1:22-1:40)</u>
(*We are*) trying to solve symptoms that were caused elsewhere (Ken (*Barr's presentation*) put us in a box limiting our (*effective working*) area).

(*I*) looked at land use in the watershed being an issue, considered the first 4 goals of UMRCC, and came up with a thought process to address this.

On the sides of most tributaries are levees. Take the floodplain levee and knock holes in it. Close the main outlet of the tributaries to the river. Make the tributaries flow through the floodplain. Maybe make it flow through the floodplain 10 miles downstream before it reaches on outlet to the river. Reconnected the floodplain without reconnecting them to the main river. (*By routing the tributaries through more of the floodplain*) all of the nutrients and sediment wouldn't reach the main river.

– Would you do a pilot channel or let it find it's own course?

Dalrymple – Let it find it's own coarse. Hoping it would be a braided course.

– In your opinion you would have to have the levee system in place. Could you do what you want without the levees in place?

Dalrymple – Need the levees to help this.

– Is there any value in a levee district in the reduction of sediments?

Theiling – Not aware that anyone has quantified this, but it is a valid point.

– This seems like a pretty large scale, can you do this on a smaller scale.

Dalrymple – I am still trying to work in the box that has been defined. If we could work outside the box I would like to do this in the upland

– You need to be concerned with the sediment budget of the river. You will have to somehow calculate what that will do to the river. You may have the same situations as you have downstream of the dam (head cutting/ down grading).

– Other folks have put that idea forth. This has been brought out in EMP. This points out deficiencies. We can't get a conversation going between NRCS and other folks on the other side of the levee. We have to get outside and over the levee and get them to the meetings. It's the bureaucracy that is preventing us. If we want to define ecosystem sustainability we need to work with authorities in the watershed.

Theiling – There is even infighting in the Natural Resource Agencies as to what to do – connect or keep isolated.

– I would like the idea better if the levee was removed to allow access to the area.

– What I am seeing is a filtering system. At what point does the filtering get choked and what do we do about that?

Theiling – This would have to be maintained O&M.

<u>Evaluation Tools and Data & Species (1:40 2:22) Chuck Theiling</u>

Chuck discussed some of the problems that were encountered when he was trying to set species target ranges for the objectives. He asked participants to offer suggestions as to the merit of doing this as well as for species and target ranges.

– Report of harvest for commercial fish. This is relatively easy to measure.

– Maximize natural species diversity.

Theiling – We don't have good records so it's hard to determine a historic baseline.

– Audubon has launched "Important Bird Areas". They will be looking at the Mississippi River. Surveying State-by-State and identifying restoration areas and long term monitoring to determine if restoration works.

Theiling – Christmas Bird Counts and Breeding Bird Surveys are other ideas.

– Trying to establish a baseline of demographic for fish in the Middle Miss. We are looking at age structure and survival mortality to determine how system is doing.

– How do you take the species and link them up to the functions you are trying to restore? How will you know if you have achieved your objectives? Keystone species – they are there because public wants them but may not have ecological importance. Will you pick a species and use that to monitor success?

Theiling – That is the way we have done things. We are posing this question to you. The DNR has responsibility to their constituent.

– Had difficulty achieving population estimates.

– Illinois River Sauger examples.

- Link to WHAG or AHAG. Can't do intensive biological surveys on every single site.

Theiling– Like the idea of Good, Medium and Bad habitats. Doing it on closed systems is a good idea and on different habitats

– Questions with AHAG. Only study on AHAG said there was no relation between reality and model outcomes.

– What are the biologists doing to assess the restored areas in the Everglades? Do they have a monitoring methodology we can draw on?

Theiling – It's going to take more than 7 people on 300 miles of river to monitor whole populations.

Theiling – Illinois River is a Natural Experiment. Clean Water Act and water treatment has really helped to improve the river. They don't need assessments to tell if it works. They can tell if it works. If bass experts are coming then it is good enough for them for most biologists.

– David Thompson hired commercial fisherman to do the sampling in the 1930's-1950's. Is that an option?

– Are you implying that Sport species… are native species?

– Yes. However, could use these techniques on exotics as well.

– Why doesn't relative abundance work?

– Christmas tree effect. (If you put a Christmas tree in a farm pond. If you sample near it you will find a lot of individuals. There aren't more individuals in the pond, only more structure, so they are concentrated there).

– But you are looking for trends over several years with relative abundance.

Theiling – In low water years get more catch per unit efforts because of concentration

– Use mussels as indicators because they require host fish? They don't move around as much as fish.

– Puzzled why the Corps would venture into the species issue. Invertebrates would be a good indicator of system health. Mammals and Birds are getting into so many more factors that you would have more questions about your data.

Theiling – But what about the Natural Resource Agencies at all?

– That's our job. But we still look at habitat.

– What about IBI – Index of Biologic Integrity? What happened to Big River IBI?

– Looked at Rock Island 404 -???

– Merging all of the datasets that are out there?

– Open river is being analyzed but are a long ways away from specific information.

Theiling – If money and time were no issue would you want to do total fish estimates.

– Yes, that's the only way to answer some of these questions.

– Kill off large stretches to get biomass estimates but general public wouldn’t accept and would have to do it again and again to see changes in trends.

– What about bioacoustics

– This is the tool of the future, but right now you can’t differentiate species. However developing some kind of Matrix like the IBI is a really good idea.

– Is this going to be put to the expert panel?

Theiling – Yes

– MO is going to try to do estimates on Shovel Nose Sturgeons. Maybe those results will help. Estimate of Flathead Cat. Most of the retrieval was in pool 22. So find something that doesn’t move much

– Our Flatheads and Paddlefish are moving quit a bit.

– We can’t neglect community level analysis (IBI)

Conceptual Models Hank DeHaan (2:22 –2:27)

Hank provided participants with some background regarding the conceptual model, as well as an overview of the purposes for having a conceptual model. He then displayed the conceptual model in it’s current form as well as a more simplistic diagram that gave an example of how the model might be used to asses the effectiveness of a management action.

Closing Comments from Participants

– 2nd lock at Mel Price gave us the EMP. However downriver absorbed the environmental impact while the funding has mostly gone upriver. In this reach of the river we need to be aware that a big part of the Navigation improvements will be focused downstream of Rock Island and it will be a big travesty if most of the money goes up river. Doubt that Pool 8 will see more than 1 barge if there is a change to Lock 25. Money shouldn’t be unequally distributed along the river.

– Assumed FWS had a standardization to count T&E progress. If that were set up that would be a good way to count species. You have to look at whole system then all things should be standardized. FWS needs to take the lead on this since they know how to count.

Theiling – Different critters are counted differently.
– When we do status reports we look at all data. We don’t have a standardized way to count species.

Appendix D. Participant Introductions

All the participants were asked to write down an answer to the question printed on page 4 of the workshop handout: “What do you hope this workshop will accomplish?” Then all participants introduced themselves to the group and read their answer to the question. The first list below contains the answers that were taken directly from the written forms that were turned in. Not everyone put their name on the form. Following the first list is the set of verbal responses that was captured as part of the meeting minutes. The verbal responses are included because they were substantially different than the written responses that had no identification.

WRITTEN RESPONSES

1. Hughey -- Consensus on approach on identifying the environmental alternatives.
   - Learn what actions are being proposed and how engineering can assist in implementation.

2. - Completion of all aspects of planning for UMR/IWW
   - Completion of all aspects of flora/fauna planning
   - Initiation of restoration actions per pool of mid-river

3. - Clarify the needs for Pools 24, 25, 26, and the open river

4. Favilla -- A planning process that continually encompasses the water quality indicators for species & river health and makes specific methods & implementation available to fulfill these goals.

5. Christoff -- Get “All” working from the same sheet of music; this will require by-in-by those who say, “We’ve done this—the RTW-WR report, the Jeff-Jon Cost report, etc. Nothing else is needed.” To some extent this is true, but it doesn’t fit the COE humongous planning process.

6. - Clarify system goals & objectives in a manner consistent with other NAV project planning efforts.

7. - Put all uses of river resources into perspective and to begin honest dialogue on future conditions. Not really expecting anything less than that.

8. - A plan for ecosystem (ecological) sustainability of the UMR with emphasis on restoration of habitat and natural river processes in Pools 24, 25, 26 & the open river.

9. - Results in a functioning, sustainable ecosystem that can coexist with navigation.

10. Brummett -- I hope the workshop gives resource managers who are not closely involved in planning and implementing restoration or enhancement measures a chance to provide in put in

this process. The more ideas, the better product. The outcome of this study is too important for just a few people to set its course.

11. - First to understand the specific objectives & goals of this study. Will this plan accomplish these goals? What will be the effect on the navigation channel? How do we (navigation) collaborate with the environmental process?

12. - Arrive at a consensus on natural resource goals & objectives for the UMRS.

13. Westphall -- I hope the workshop will enable us to review existing work that's been done on ecosystem objectives, fill in any gaps and to come to consensus on what needs to be done & how to get it approved & implemented.

14. - Better define/refine environmental issues/needs along the river so that they become a public and politically supported component of the study.

15. - Cooperation among different users of the river
- Set of clear objectives on how to manage the resources.

16. - Improve coordination between Corps & resource managers & set realistic expectations in the minds of each for ecosystem enhancement.

17. - Exchange information, discuss conceptual ideas about ecosystem function, agree about what the river should look like and how it may function, and lay framework for implementing and evaluating conceptual ideas.

18. - For everybody to become familiar with the planning process as related to environmental "mitigation" projects on the UMR, especially the open river.

19. Corgiat -- To bring more attention to the management wants & <u>needs</u> of the middle upper Mississippi River.

20. Major -- Establish measurable and obtainable management goals for Pools 24, 25, & 26, as well as the open river that allow for the best ecosystem goals integrated with commercial river navigation.

21. Krumwiede -- The development of an "action plan" which is accepted by all participants which will allow the COE and other interested parties to begin restoration and improved management of the middle Mississippi River with limited red tape.

22. Widowski -- Listen and assist in setting direction for improvement of ecological conditions in the river and its floodplain in partnership with many of the interested river stakeholders.

23. - Defining goals and objectives for restoring the Mississippi River, much like what has already been accomplished through various UMRCC documents.

24. Collins -- Develop a plan to restore natural functions of Mississippi & Illinois Rivers and their floodplains, including management plan focusing on restoration/preservation of native species diversity.

25. - Have input to the planning process

26. - Clearly identify and quantify environmental goals for the river and begin to formulate practical alternatives.

27. - I hope that this workshop will clearly define a rational plan that will provide environmental sustainability on the Upper Mississippi and Illinois Waterways. This plan must be economically justified on a cost/benefit basis. It must also be integrated into the infrastructure modernization that will emanate from the NAV Study.

28. Atwood -- Would be nice to hope that this effort will end all future efforts in this regard.

29. - That this step will continue a process that started over 3 decades ago in the St. Louis District. The Environmental River Engineering Program has proven that government agencies can work together to cooperatively plan and ***implement*** projects that will continue to improve the riverine environment. Lastly, I hope we concentrate on ***doing*** things that will improve the environment and not just talk about what is wrong.

30. Barr -- Shared understanding of environmental objectives. Learn from all of you.

31. - To determine compatibility of UMR-IWW sustainability objectives effort with ongoing UMRCP needs for the same.

32. Gates -- To explore extent to which UMR-IWW treatment of measures might also address UMRCP plans development needs.

33. Cox -- Hope it gives me a better understanding of this portion of the UMR, hope to focus on striving for greater consistency but showing need for differences in different parts of the river.

34. - I hope to learn how we can all work together—transportation, recreation, ag issue, etc.

35. - The compilation of a complete and comprehensive listing of all the environmental concerns in the reaches of the river system to be discussed here.

36. Bunselmeyer, Farmer & UMIMRA Director --
- A balanced approach to river management
- Fair treatment of stakeholders
- Realization that navigation interests create jobs and opportunities that are far reaching in the country's economy
- Recognizing that foreign countries are speeding ahead with navigation interests because they see the tremendous potential present
- Realizing that both sides of the issue cannot have exactly what they want.

I realize these goals may not be what will be accomplished today, but thought must be given to these goals, before environmental goals can be reached.

ADDITIONAL VERBAL RESPONSES

37. Graham -- Here to learn.

38. Bradshaw – Here to learn.

39. Goodwin – Here to learn more about environments.

40. Wells? – Practical alternatives.

41. Wilson? - Told to be here.

42. Maher – to represent fish.

43. Busse – To get something accomplished.

44. Johnson – Need for pools and open river.

45. Stroud – Let’s start doing something instead of talking.

46. Davinroy – Make sure Butch won’t do anything too crazy. Want to tell the biologists that “If you dream it we can build it”.

47. Berndt – Learn.

48. Erickson – It is past time to get this thing moving. Tired of talk and accusations.

49. Laux – If they build it, they will come.

50. Duyvejonck –Time to put G&O down on paper and start doing.

51. Magera – Meetings about expectations. Afterward it’s living up to expectations.

52. Adams – See what people have to say about what to do on Lower River.

53. Brown – Monitor Butch.

54. Hrabik – Hope we call can agree what the river should look like. Agree on how it should function. Lay the framework for evaluating what we lay out here.

55. Ellis – Step in the process that will have public and private support.

56. Hughey – Worried about Nav Channel. Collaboration is the by word. Room for environmental and economic objectives.

Appendix E. Environmental Objectives

Purpose:
To have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts.

Background:
Objectives are incremental steps taken toward achieving a goal and thus may be goal specific. They are a concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it. Objectives provide the basis for determining management actions, monitoring accomplishments and evaluating the success of management actions. There may be multiple objectives for a goal. Participants were asked to review, revise if necessary, and supplement the Environmental Objectives taken from previous work (HNA, Pool Plans, etc.) to achieve the Navigation Environmental Coordination Committee (NECC)/Economics Coordinating Committee (ECC) UMR-IWW Navigation System Vision:

"To seek long term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System."

The working groups were specifically tasked to apply the widely known SMART criteria to each objective making them: specific, measurable, achievable, results –oriented, time-specific.

The participants were asked, for the purposes of this workshop, to utilize the following two sets of goals as a framework for setting objectives.

Ecosystem Goals (from Interim Report)
During planning for the 1994 Upper Mississippi River Conservation Committee (UMRCC) Ecosystem Management Initiative, resource managers agreed to adopt Grumbine's (1994) ecosystem management goals (Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology* 8(1): 27-38.):

Goal 1: Maintain viable populations of native species in situ.
Goal 2: Represent all native ecosystem types across their natural range of variation.
Goal 3: Restore and maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.).
Goal 4: Manage over periods long enough to maintain the evolutionary potential of species and ecosystems.
Goal 5: Integrate human use and occupancy within these constraints.

The UMRCC expanded their list of goals in the *A River That Works and a Working River* (2000) document. These goals are:

1. Improve water quality for all uses,
2. Reduce erosion and sediment impacts,
3. Restore natural floodplain,
4. Restore natural hydrology,
5. Increase backwater connectivity with main channel,
6. Increase side channel, island, shoal, and sand bar habitat,
7. Minimize or eliminate dredging impacts,
8. Sever pathways for exotic species introductions/dispersal,
9. Improve native fish passage at dams.

Working Group Process
The process began with participants dividing into four groups based in part on their expertise within two segments of the UMR. The two geographic regions were: the pool areas from Pool 24 to Pool 26 and the open river to the confluence of the Ohio River. Group 1 worked on the Pools starting upstream at Pool 24, Group 4 also covered the pools but started downstream at Pool 26 and worked up. Group 2 covered the open river from the upstream end down and Group 3 covered the open river working upstream from the downstream end. Working groups were tasked with first setting reach and pool-wide objectives and then reviewing and setting site-specific objectives within their section of the river. If groups finished their section and had time remaining they could extend into the adjacent areas.

When setting site-specific objectives, participants were asked to use the data structure outlined in the Framework for Setting Objectives (Figure E1). This hierarchical structure categorizes environmental objectives into four primary ecosystem elements and then breaks these down into more specific parameters, extents, and target ranges. In addition to this information, participants were also asked to consider and note (if possible) the seasonality, frequency of occurrence, target date, and any other comments associated with the objectives they identified. This data framework provided a means to capture and merge objectives from previous study efforts, and those identified by workshop participants, into one standardized database. Additional objectives not found in the framework were also identified and added to the database using the established data structure (e.g., Invertebrates was added under Plants and Animals

Ecosystem Element	Parameter	Extent	TR	Target Range
Water Quality	Water Clarity	Main Channel	1	Secchi disk transparency 0.3 m
		Backwater Areas	2	Secchi disk transparency 0.7 m
			3	Secchi disk transparency 1.0 m
			4	Secchi disk transparency 1.5 m
			5	Secchi disk transparency >2.0 m
Geomorphology	Backwater Depth	Backwater Areas	1	100% of area <1 m
			2	50% of area 1 - 2 m
			3	50% of area 2 - 3 m
			4	50% of area >3 m
	Water Level	Main Channel	1	0.3 m below project pool at dam
		Backwater Areas	2	0.6 m below project pool at dam
			3	1.0 m below project pool at dam
			4	>1 m below project pool at dam
	Connectivity	Floodplain	1	0% floodplain area inundated during 10 year flood
			2	20% floodplain area inundated during 10 year flood
			3	40% floodplain area inundated during 10 year flood
			4	80% floodplain area inundated during 10 year flood
			5	100% floodplain area inundated during 10 year flood
		Secondary Channel	1	<20% of year
			2	20-40% of year
			3	40-60% of year
			4	60-80% of year
			5	>80% of year
		Longitudinal	1	0% chance of fish passage
			2	20% chance of fish passage
			3	40% chance of fish passage
			4	80% chance of fish passage
			5	100% chance of fish passage

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem.

Ecosystem Element	Parameter	Extent	TR	Target Range
Pattern of Habitats	Aquatic Areas	Main Channel	1	<10% of area
		Secondary Channel	2	10-20% of area
		Tertiary Channel	3	20-40% of area
		Impounded Area	4	40-60% of area
		Contiguous Backwater	5	>60% of area
		Isolated Backwater		
	Terrestrial Areas	Contiguous Floodplain	1	<10% of area
		Isolated Floodplain	2	10-20% of area
		Island	3	20-40% of area
			4	40-60% of area
			5	>60% of area
	Land Cover/Use	Open Water	1	<10% of area
		Submersed Aquatics	2	10-20% of area
		Emergent Aquatics	3	20-40% of area
		Grassland	4	40-60% of area
		Shrub	5	>60% of area
		Forest		
		Agriculture		
		Developed		
Plants and Animals	Plants	Emergent Aquatics	1	<10 plants/m2
		Submersed Aquatics	2	10 - 20 plants/m2
			3	20 - 50 plants/m2
			4	50 - 100 plants/m2
			5	>100 plants/m2
	Fish	Protected Fish Species		CPUE, Length distribution, or kg/ha
		Sport Fish Species		
		Commercial Fish Species		
		Forage Fish Species		
		Exotic Fish Species		
	Birds	Dabbling Ducks	1	0 - 1,000 use days/yr
		Diving Ducks	2	1,000 - 10,000 use days/yr
			3	10,000 - 100,000 use days/yr
			4	>100,000 use days/yr

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem, continued.

Results:

The environmental objective information gathered and reviewed at the St. Louis Workshop has been organized into the following four sections. They include a pool-wide objectives table, site-specific objectives table, plenary report, and working group reports.

Pool-wide objectives identified by workshop participants were compiled from comments recorded in the plenary sessions, working group reports, group worksheets, and atlas map notations (Table E1). In cases where management actions were recorded, an objective was created and the management action was listed in the comments section, denoted by "MA".

Site-specific objectives and supporting information identified and reviewed by workshop participants are listed by pool (Table E2) and organized to follow the Framework for Setting Objectives format (Figure E1). These objectives were compiled from previous study efforts, participant comments during the plenary session (with GIS tools), working group reports, group worksheets, atlas map notations. The objectives identified in the workshop were recorded exactly as written. For the final integrated report, site-specific objectives will be standardized, new parameter icons may be created and similar comments will be assimilated into one comment.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

Examples of objectives at various scales were given as guidelines, they included:

- *System* – Restore X acres of secondary channel habitat system wide,
- *Reach* – Increase the amount of marsh habitat by X acres in the Open River Reach of the Mississippi River,
- *Pool* – Return Pool 13 to a more natural hydrologic regime by having a 90 day low water stage X feet below maximum pool elevation during late summer every three years,
- *Local* – Increase the average depth of backwater area X to six feet.

Table E1. Pool-wide Environmental Objectives (Pool 24 – Ohio River Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
	Water Level	Main Channel					Hinge point drawdown. This is an opportunity to move from hinge point control.
	Connectivity	Floodplain					Maintain and increase floodplain connectivity. Install spillway to allow for opportunistic flooding
		Longitudinal					Fish Passage - Latitudinal and longitudinal connectivity
Pattern of Habitats							
	Emergent Aquatics						Increase wetland habitat behind levees
	Land Cover / Use	Forest					Increase acreage of bottomland hardwood forests in floodplain as social and economic factors allow
							Restore and maintain riparian corridors (200 ft. wide)
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 24 – Pool 26 Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Water Clarity						Sufficient to support vegetation to a depth of 1.5m.
	Other						DO, Methyl Mercury, nutrient and fecal coliform reduction from tributaries.
Geomorphology							
	Water Level	Main Channel					Greater Drawdowns MA - More dredging in pools and private boat docks to allow greater drawdowns.
							Return hydrograph to as natural as possible.
							Seasonal drawdowns every 5 or 10 years.
		Backwater Areas					Create more deep-water habitat.
	Connectivity	Floodplain					On an opportunistic basis, acquire land from willing sellers to restore floodplain connectivity.
							Connectivity pool-wide 0-10%
							Maintain and increase floodplain connectivity by 40% (before modifications)
		Longitudinal	100%				Passage of native fish through navigation dams.
Pattern of Habitats							
	Aquatic Areas	Secondary Channels					Increase quantity of woody debris in side channel of pools.
	Terrestrial Areas	Island					All islands into public ownership to increase forest diversity.

Table E1. Pool-wide Environmental Objectives (Pool 24 – Pool 26 Reach cont.).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Pattern of Habitats (cont)							
	Land Cover/Use	Emergent Aquatics	2	All	10		Increase wet marshes 10-20% of existing marshes
							Increase amount of floodplain wetland habitats in levee districts
		Forest	2 or 3	All	10	2050	More hard mast producing trees.
							Increase forest by 10-20% of existing forest.
							Restore-maintain riparian corridor to provide a broad range of benefits.
	Other						Increase nesting areas for terrestrial birds.
Plants and Animals							
Other							Need to restore streams in floodplain.
							Concerns about air quality at fleeting harbor areas.

Table E1. Pool-wide Environmental Objectives (Dam 26 to Ohio River Reach).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality	Water Clarity						Reduce air and water pollutions
	Water Clarity						Minimize clarity impacts due to increased traffic in main channel and fleeting areas.
	Other						15% reduction of nutrient load
							Maintain DO levels on Middle Miss

Table E1. Pool-wide Environmental Objectives (Dam 26 to Ohio River Reach cont.).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Geomorphology							
	Water Level						
	Connectivity	Floodplain					Reconnect river with floodplain in selected locations. MA - Put structure in levee that is large enough to allow us to manage connectivity.
			100%				Remove all of the levees, restore 100% connectivity, take river to pre-European settlement conditions.
			20-30%				Partial flood plain restoration - 20-30% reconnectivity.
							Reconnect tributaries with floodplains to trap some of the nutrients.
	Other						Restore historic meanders. Allow some disturbance regimes to occur on the river. Allow some non-constrained stretches of the river.
							Habitat connectivity to main channel
							Address local tributary effects, include deltaic sedimentation, channelization and head cutting. Restore oxbows and other important geomorphic features of the tributaries.
							Implement stone dike objectives
Pattern of Habitats							Allow every 5-7 miles of over wintering for fish
	Aquatic Areas	Main Channel					Utilize old or existing quarries for backwater habitat.
		Secondary Channel	12-18 feet deep				Implement side channel plan

Table E1. Pool-wide Environmental Objectives (Dam 26 to Ohio River Reach cont.).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Pattern of Habitats (cont)	Aquatic Areas (cont)						Create new side channels
							Restore small rivulets, oxbows, and other tertiary channels adjacent to the main channel.
							Utilize existing meander scars and river features located in the floodplain for the creation of new aquatic and waterfowl habitats.
	Terrestrial Areas						Preserve and enhance sand bar habitat for aquatics and waterfowl.
	Land Cover/Use		1000 acres per site				Every 20 miles bird resting areas.
							Restore riparian corridor with floodplain, including re-establishing forests and prairies.
							Preserve and create wetland complexes in adjacent floodplain.
	Other						Maintain and create substrate type diversity; i.e. diversity of sands, gravels, cobbles, etc.
Plants and Animals							
	Fish						Restore river aquatic fisheries environment prior to 1950.
Other							Create or engineer new islands and side channels within the Middle Mississippi River.

Table E1. Pool-wide Environmental Objectives (Pool 24).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
	Connectivity						
	Connectivity						
	Backwater Depth						
	Water Level						
Pattern of Habitats							
	Land Cover/ Use	Forrest	3(20-40%)				Currently 18% Timber, 35% pre-settlement.
Plants and Animals							
Other							

Table E1. Pool-wide Environmental Objectives (Pool 25).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Clarity	Main Channel	4				
	Clarity	Back Water	4				
Geomorphology							
	Backwater Depth						

Table E1. Pool-wide Environmental Objectives (Pool 25 cont.).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Geomorphology (cont.)							
	Water Level	Main Channel	3				Should do every year that it's possible (won't happen every year)
	Water Level	Back Water	3				Should do every year that it's possible (won't happen every year)
	Connectivity	Longitudinal	5				
Pattern of Habitats							
	Aquatic Areas	Secondary Channel					More Woody Structure in side channels
Plants and Animals							
	Plants						
Other							Increase air quality - tow boat exhaust
				All			Acquire land necessary to facilitate Environmental Pool Management

Table E1. Pool-wide Environmental Objectives (Pool 26).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
	Clarity	Main Channel	4				
	Clarity	Back Water	4				
Geomorphology							
	Backwater Depth						
	Water Level	Main Channel	3				Should do every year that it's possible (won't happen every year)
	Water Level	Back Water	3				Should do every year that it's possible (won't happen every year)
	Connectivity	Longitudinal	5				
Pattern of Habitats							
	Aquatic Areas	Secondary Channel					More Woody Structure in side channels
Plants and Animals							
	Plants						
Other							Increase air quality - tow boat exhaust

Table E1. Reach-wide Environmental Objectives (Dam 26 to Kaskaskia River).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
	Aquatic Areas	Main Channel					Implement dike alteration plan - alter dikes for a mile stretch every ten miles.
		Secondary Channel					Implement side channel plan
Plants and Animals							
Other							

Table E1. Reach-wide Environmental Objectives (Kaskaskia to Grand Tower).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
Plants and Animals							

Table E1. Reach-wide Environmental Objectives (Grand Tower to Ohio River).

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency of Occurrence	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
Plants and Animals							
Other							

Table E2. Site-specific Environmental Objectives (Pool 24).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Deepen ponds on island and connect to river
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Deepen ponds on island and connect to river
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Increase depth and reduce sedimentation
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10		Secondary Channel
Geomorphology	Backwater Depth	Backwater Areas					Do phase 2 of HREP
Geomorphology	Backwater Depth	Backwater Areas					Clarksville/Dundee Harbor, implement HREP
Geomorphology	Backwater Depth	Backwater Areas					Implement Shanks HREP
Geomorphology	Backwater Depth	Backwater Areas					See Angle Blackburn Island HREP
Geomorphology	Water Level	Main Channel					Pool-wide water level management
Geomorphology	Connectivity	Floodplain					

Table E2. Site-specific Environmental Objectives (Pool 24 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Connectivity	Floodplain					Increase connectivity to backwater area
Geomorphology	Connectivity	Floodplain					Levee setback
Geomorphology	Connectivity	Secondary Channel					See Angle Blackburn Island HREP
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
Geomorphology	Connectivity	Other					Connect island ponds to river
Geomorphology	Connectivity	Other					Connect island ponds to river
Geomorphology	Connectivity	Other					Connect borrow pit to main channel
Geomorphology	Connectivity	Other			10		Backwater area connectivity, isolated on Cottel Island
Pattern of Habitats	Aquatic Areas	Main Channel					Notch closing structure
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel	>60% of area				
Pattern of Habitats	Aquatic Areas	Secondary Channel	>60% of area				Notch closing dam
Pattern of Habitats	Aquatic Areas	Secondary Channel					Notch two closing structures behind island
Pattern of Habitats	Aquatic Areas	Secondary Channel					Increase flow
Pattern of Habitats	Aquatic Areas	Secondary Channel					Maintain
Pattern of Habitats	Aquatic Areas	Secondary Channel					See Angle Blackburn Island HREP
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Other					Delta
Pattern of Habitats	Terrestrial Areas	Other					Delta, maintain with no net loss
Pattern of Habitats	Terrestrial Areas	Other					Delta, maintain, mussel beds
Pattern of Habitats	Terrestrial Areas	Other					Maintain terrestrial area habitat
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (Pool 24 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					Increase acreage of bottomland hardwoods, RM 274-275
Pattern of Habitats	Other						Implement proposed project ASAP
Pattern of Habitats	Other						Reconnect, reforestation, and wet meadow construction, Salt River Bottoms
Pattern of Habitats	Other						Implement CCP strategies in this area, FWS, Delair
Plants and Animals	Other						Mussel bed, Higgin's eye, reintroduction area

Table E2. Site-specific Environmental Objectives (Pool 25).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Main Channel					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				

Table E2. Site-specific Environmental Objectives (Pool 25 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Deepen and reconnect backwater sloughs
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Reconnect HREP? (Ref. Pool 25/26 fact sheets.)
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m				Ref. 25/26 HREP
Geomorphology	Backwater Depth	Backwater Areas					Missouri DOC owns property
Geomorphology	Backwater Depth	Backwater Areas					Implement Batchtown HREP
Geomorphology	Backwater Depth	Backwater Areas					Implement Batchtown HREP
Geomorphology	Backwater Depth	Backwater Areas					Deepen backwater areas
Geomorphology	Backwater Depth	Backwater Areas					Restore secondary channel depth, See Sandy Chute HREP
Geomorphology	Backwater Depth	Other					Create areas of deep (20-40 feet) over wintering habitat in secondary channel
Geomorphology	Backwater Depth	Other					Create areas of deep (20-40 feet) over wintering habitat in secondary channel
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Floodplain connectivity, levee setback, wetland restoration
Geomorphology	Connectivity	Floodplain					Wetland restoration, levee buyout
Geomorphology	Connectivity	Floodplain					Restore backwater connectivity
Geomorphology	Connectivity	Floodplain					Levee setback
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					Restore flow, See Sandy Chute HREP
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage	Spring			

Table E2. Site-specific Environmental Objectives (Pool 25 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Connectivity	Other					Connect backwater sloughs
Geomorphology	Connectivity	Other					Reconnect island backwater areas
Geomorphology	Connectivity	Other					Reconnect island backwater areas
Geomorphology	Connectivity	Other					Reconnect island backwater areas
Geomorphology	Other						Maintain gravel bar for mussels
Geomorphology	Other						Restore natural meanders
Geomorphology	Other						Maintain flow at existing levels, See Batchtown HREP
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					Multiple round sites, monitor
Pattern of Habitats	Aquatic Areas	Main Channel					Remove wing dam to improve aquatic habitat, RM 267.2
Pattern of Habitats	Aquatic Areas	Main Channel					Notch closing structure to improve aquatic habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Add rock barbs to increase diversity
Pattern of Habitats	Aquatic Areas	Secondary Channel					Create scour holes in channel
Pattern of Habitats	Aquatic Areas	Secondary Channel					Deep water over wintering fish habitat (ref. Pool 25/26 fact sheet)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Deep water over wintering fish habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel					Notch or remove structures
Pattern of Habitats	Aquatic Areas	Secondary Channel					Notch closing structure
Pattern of Habitats	Aquatic Areas	Secondary Channel					Implement Batchtown HREP
Pattern of Habitats	Aquatic Areas	Secondary Channel					See Sandy Chute HREP

Table E2. Site-specific Environmental Objectives (Pool 25 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Side channel and backwater restoration
Pattern of Habitats	Aquatic Areas	Secondary Channel					Side channel and backwater restoration
Pattern of Habitats	Aquatic Areas	Tertiary Channel	20-40% of area				
Pattern of Habitats	Aquatic Areas	Contiguous Backwater					See Batchtown HREP
Pattern of Habitats	Terrestrial Areas	Island				2010	Main channel island creation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, implement Batchtown HREP
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Encourage wetland management of backwater areas
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 25 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 25 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Forest					Reforestation in the vicinity of Pecan Lake
Pattern of Habitats	Land Cover/Use	Forest					Increase forest diversity
Pattern of Habitats	Land Cover/Use	Forest					Increase forest diversity, hard mast trees
Pattern of Habitats	Land Cover/Use	Forest					Expand bottomland hardwood forest in area
Pattern of Habitats	Land Cover/Use	Forest					Reforestation
Pattern of Habitats	Land Cover/Use	Forest					Maintain hardwood forest
Pattern of Habitats	Other						Area being returned to lakes and forests, RM 263-265
Pattern of Habitats	Other						Clarence Cannon Refuge, implement CCP
Other	Other						Acquire remaining portions of Clarksville Island

Table E2. Site-specific Environmental Objectives (Pool 26).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Pool 26 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					Restore side channel depth
Geomorphology	Backwater Depth	Other					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
Geomorphology	Connectivity	Other					Reconnect backwater area
Geomorphology	Other						Restore Cuiver River to old channel
Geomorphology	Other						Restore deep water over wintering habitat in main channel border
Geomorphology	Other						Reduce sediment contribution from Dardenne Creek
Geomorphology	Other						Reduce sediment contribution from Plasa Creek
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics

Table E2. Site-specific Environmental Objectives (Pool 26 cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Forest					Restore floodplain forest and meadow
Pattern of Habitats	Land Cover/Use	Forest					Restore floodplain forest and meadow
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Other					Create sandbar habitat

Table E2. Site-specific Environmental Objectives (Lock 26 to Kaskaskia River).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					
Geomorphology	Connectivity	Floodplain					Levee setback
Geomorphology	Connectivity	Floodplain					Levee setback
Geomorphology	Connectivity	Floodplain					Reconnect Blew Hole
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 163.5-168 (see Stone Dike Alteration Study, Cliff Cave Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 156.5-163 (see Stone Dike Alteration Study, Kimmswick Reach)

Table E2. Site-specific Environmental Objectives (Lock 26 to Kaskaskia River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 150-155 (see Stone Dike Alteration Study, Herculaneum Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 143-148 (see Stone Dike Alteration Study, Calico/Osborne Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 135-142 (see Stone Dike Alteration Study, Salt Lake Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 128-133 (see Stone Dike Alteration Study, Fort Chartres Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points

Table E2. Site-specific Environmental Objectives (Lock 26 to Kaskaskia River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 166-168 (see Stone Dike Alteration Study, Cliff Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 161-162 (see Stone Dike Alteration Study, Kimmswick Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 150-155 (see Stone Dike Alteration Study, Herculaneum Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 147 (see Stone Dike Alteration Study, Calico/Osborne Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 144-146 (see Stone Dike Alteration Study, Calico/Osborne Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 137-139 (see Stone Dike Alteration Study, Salt Lake Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 131-133 (see Stone Dike Alteration Study, Fort Chartres Reach)

Table E2. Site-specific Environmental Objectives (Lock 26 to Kaskaskia River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 130-132 (see Stone Dike Alteration Study, Fort Chartres Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 120-123 (see Stone Dike Alteration Study, St. Genevieve Reach)
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Reestablish RDB sandbar area, RM 130-131
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Isolated wetland restoration, RM 150-165
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Wetland restoration, RM 126-130
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics
Pattern of Habitats	Land Cover/Use	Forest					

Table E2. Site-specific Environmental Objectives (Lock 26 to Kaskaskia River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					Reforestation
Pattern of Habitats	Land Cover/Use	Forest					Reforestation
Pattern of Habitats	Land Cover/Use	Forest					Restore bottomland hardwood forest, increase hard mast production
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Other						Protect the natural habitat
Pattern of Habitats	Other						Protect the natural habitat from development pressure
Other	Other						Monitor air quality in fleeting areas
Other	Other						Restore and enhance additional property-Kidd Lake

Table E2. Site-specific Environmental Objectives (Kaskaskia to Grand Tower).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Connectivity	Floodplain					Levee setback
Geomorphology	Connectivity	Floodplain					Levee setback
Geomorphology	Connectivity	Floodplain					Levee setback, land buyout
Geomorphology	Connectivity	Floodplain					Levee setback, RM 104-107
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					Recreate secondary channel

Table E2. Site-specific Environmental Objectives (Kaskaskia to Grand Tower cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 89-93 (see Stone Dike Alteration Study, Red Rock to Tower Rock Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 85-89 (see Stone Dike Alteration Study, Red Rock to Tower Rock Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Restore and maintain main channel habitat, RM 81-82 (see Stone Dike Alteration Study, Red Rock to Tower Rock Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Create islands & secondary channels RM 94-74
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 116-118 (see Stone Dike Alteration Study, Kasky Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 104 (see Stone Dike Alteration Study, Mile 100 Islands Reach)

Table E2. Site-specific Environmental Objectives (Kaskaskia to Grand Tower cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 99-103 (see Stone Dike Alteration Study, Mile 100 Islands Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 99 (see Stone Dike Alteration Study, Mile 100 Islands Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 95-97 (see Stone Dike Alteration Study, Mile 100 Islands Reach)
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Island					Raise the level of island for Least Tern Habitat
Pattern of Habitats	Terrestrial Areas	Other					Sandbar isolation for Least Turn Habitat
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat, RM 111-122
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat, Crain Islands
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					Restore bottomland hardwood forest
Pattern of Habitats	Land Cover/Use	Forest					Restore bottomland hardwood forest
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Plants and Animals	Fish	Other					Encourage backwater habitat formation

Table E2. Site-specific Environmental Objectives (Grand Tower to Ohio River).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Water Quality	Water Clarity	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					Restore deep water over wintering habitat, RM 57-62.5
Geomorphology	Backwater Depth	Backwater Areas					Restore deep water habitat at lower end, remain isolated habitat
Geomorphology	Connectivity	Floodplain					Reconnect to the Big Muddy River
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					
Geomorphology	Connectivity	Secondary Channel					Maintain side channel
Geomorphology	Connectivity	Secondary Channel					Reconnect side channel during low flows
Geomorphology	Connectivity	Secondary Channel					Reopen lower of Buffalo Island Chute
Geomorphology	Connectivity	Secondary Channel					Restore connectivity during high flows
Geomorphology	Connectivity	Secondary Channel					Open up lower end of Browns Chute
Geomorphology	Connectivity	Secondary Channel					Open bottom end of chute and deepen for over wintering habitat
Geomorphology	Connectivity	Secondary Channel					Reestablish connection with Sister Chute
Geomorphology	Connectivity	Other					Reestablish tertiary channels, RM 2-5, Angelo Chute
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					

Table E2. Site-specific Environmental Objectives (Grand Tower to Ohio River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 71-78 (see Stone Dike Alteration Study, Big Muddy Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 65-70 (see Stone Dike Alteration Study, Trail of Tears Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 57-62.5 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 55.8-56.5 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 46-53 (see Stone Dike Alteration Study, Cape Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 40-45 (see Stone Dike Alteration Study, Thebes Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 35-40 (see Stone Dike Alteration Study, Thebes Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 29-34 (see Stone Dike Alteration Study, Prices Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 24-28 (see Stone Dike Alteration Study, Dogtooth Reach)

Table E2. Site-specific Environmental Objectives (Grand Tower to Ohio River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 20-24 (see Stone Dike Alteration Study, Dogtooth Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 12-19 (see Stone Dike Alteration Study, Thompson Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 5-11 (see Stone Dike Alteration Study, Cairo Reach)
Pattern of Habitats	Aquatic Areas	Main Channel					Dike modification to improve aquatic habitat, RM 0-5 (see Stone Dike Alteration Study, Cairo Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Hard points
Pattern of Habitats	Aquatic Areas	Secondary Channel					Increase diversity
Pattern of Habitats	Aquatic Areas	Secondary Channel					Remove rock dikes at upper end of chute
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 77-78 (see Stone Dike Alteration Study, Big Muddy Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 72-73 (see Stone Dike Alteration Study, Big Muddy Reach)

Table E2. Site-specific Environmental Objectives (Grand Tower to Ohio River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 67-68 (see Stone Dike Alteration Study, Trail of Tears Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 57-62 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 55-60 (see Stone Dike Alteration Study, Schenimann/Picayune Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 48-50 (see Stone Dike Alteration Study, Cape Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 41 (see Stone Dike Alteration Study, Thebes Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 35-39 (see Stone Dike Alteration Study, Thebes Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 33 (see Stone Dike Alteration Study, Prices Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 29-31 (see Stone Dike Alteration Study, Prices Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 25 (see Stone Dike Alteration Study, Dogtooth Reach)

Table E2. Site-specific Environmental Objectives (Grand Tower to Ohio River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 22-24 (see Stone Dike Alteration Study, Dogtooth Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 16-18 (see Stone Dike Alteration Study, Thompson Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 12-13 (see Stone Dike Alteration Study, Thompson Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 8-10 (see Stone Dike Alteration Study, Cairo Reach)
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore and maintain secondary channel habitat, RM 2-5 (see Stone Dike Alteration Study, Cairo Reach)
Pattern of Habitats	Terrestrial Areas	Contiguous Floodplain					Ridge swale
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Isolate developing islands, RM 40-42
Pattern of Habitats	Terrestrial Areas	Other					Sandbar on inside of the bend, Least Tern Habitat
Pattern of Habitats	Terrestrial Areas	Other					Reestablish and maintain gravel bars
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Reestablish wetland complex with river connection
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (Grand Tower to Ohio River cont.).

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					Remove trees from Cottonwood Island
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Sand bar
Pattern of Habitats	Land Cover/Use	Other					Strip island of all habitat
Pattern of Habitats	Other						Maintain existing gravel substrate

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

<u>Nov 13th, Objectives Plenary Session:</u>
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

<u>Group 1 Summary</u>

Pools start at 24
Overall Objectives –
1) Increase acreage of bottomland hardwood forests in floodplain as social and economic factors allow.
2) Restore and maintain riparian corridors (200 ft. wide).
3) Increase wetland habitat behind levees.
4) Maintain and increase floodplain connectivity, spillway, opportunistic flooding.
5) Water level management – hinge point drawdown. This is an opportunity to move from hinge point to endpoint control.
6) Fish Passage – Latitudinal and longitudinal connectivity.

<u>Group 2 Summary</u>
Our main thought is that a lot of this has been done
Lower River Objectives–
1) Implement side channel plan.
2) Implement stone dike objectives.
3) Reduce air and water pollutions.
4) Reconnect river with floodplain in selected locations.

Pools Objectives
More hard mast producing trees.
Create more deep-water habitat.
More dredging in pools and private boat docks to allow greater drawdowns.

<u>Group 3 Summary</u>
Open River
Remove all of the levees, restore 100% connectivity, take river to pre-European settlement conditions.
Partial flood plain restoration– 20-30% reconnectivity
Restore historic meanders.
Allow every 5-7 miles of over wintering for fish.

Every 20 miles bird resting areas.
Habitat connectivity in Main Channel.
Founder effect
Rob talking too fast see his computer notes.
1950's may be a good baseline – fisheries and shrimp
Use old and existing quarries for deepwater habitat.
Create new side channels

– We went through side channel plan. Maybe you don't want to clear them all out.
– The final determination would be made later.
– Reconnectivity might not be the best thing in all cases.

<u>Group 4 Summary</u>
Buy the Sny
Deconstruct Batchtown
Pool Objectives
Return hydrograph to as natural as possible
150 in an opportunistic basis acquire land of willing sellers to restore floodplain connectivity.
Pool 26 – Restore 40% of floodplain to pre-historic conditions. Including agricultural programs.
Problems with setting objectives for specific pools – we have a limited understanding of pool resources so it is hard to set objectives. What particular times do some species need access to backwaters? Bank stabilization is good, but limits habitats. SO when does it start to have an impact?
Water Quality – DO, methyl Hg, Nutrients, and fecal coliform reduction from tributaries.
Water Clarity - sufficient to support vegetation to a depth of 1.5m.
Increase quantity of woody debris in side channel of pools.
Need to restore streams in the floodplain.
Concerns about air quality.
All islands into public ownership.

<u>Site Specific Objective Setting for St. Louis (3:30)</u>
Once each group gave their report we then started at Pool 24 and moved down river, allowing all participants to provide input.

Pool wide – Water control for aquatic areas.

Pool 25
– Should we add in mussel info?

–Yes.

– Mussel beds will be put in Natural Heritage database. So we will get our info from there, not put on this map.

Pool 24 – 25 island plans? Talk to Ken Barr. EMP Fact Sheet

Group 1 has detailed notes for most numbered objectives. We will not put the info in the database now; rather gather data from their notes later.

Pool 26
#62 – covered in island fact sheet

Pool 26 – Kaskaskia
RM –128-130 Reconnect wetlands on both side of the levee.

Kaskaskia – Grand Tower
RM 112 – There is an old side channel that needs to be reconnected.
Crains Island Levee RM104 - talk about set back and levee raises.

– Route 3 runs through Liberty Chute near Rockwood Islands RM 102

– How will all of this shake out?

Theiling – Once we are to the project level we will do reconnaissance do see if there is a federal interest. We will calculate Costs and Benefits with 65% engineering. This goes through for final funding. Then it will go through final engineering and construction.

Grand Tower to Ohio River
– Are you going to do anything in the ox bow area?

RM 20 – 31 We are in the process of establishing riparian corridor and forest.

- Regional Objective – Come up with and implement a plan to deal with exotics.

Working Group Reports

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

GROUP 1

Participants List: Mike Cox, Willis Graham, Ken Barr (MVR); Scott Bunselmeyer (UMIMRA); Phil Bradshaw (IL Soybean Board); Dave Gates (MVS); Dave Ellis (USFWS); Ken Brummett (MODOC); Tim Krumwiede (IDNR); Tom Wilson (IDNR); Chris Brescia (MARC 2000)

Ken = facilitator
Tim = timekeeper (flip chart)
Mike = recorder
Willis = reporter

Working on Pools starting at the upper end

Discussed how to do what when

Pool wide objectives

Lower pools have been slighted as far as pooled areas go

1. Need large blocks of BHF in floodplain in large blocks ~~for neo-tropical migrants~~. Therefore if lower portion of pools have larger portions of BHF, then we need to concentrate on upper ends of pools.

    How much detail do we need here?
    How much percentage of increase?
    How much priority on gov land vs. private land?
    Going into too much detail for pool wide goals and objectives…
    Need to get private incentives for habitat enhancement
    This is for migrants plus heron rookeries and such

If we now have 13% forest in the pools how much do we want to increase (i.e., double the size, up to 26%). Chris asked if we knew how much social impact this land change would have on society (land acquisition) and did we know if this would achieve our objectives and is enough marginal ground available for this effort? We are prepared to do this later in the process.

2. Restore-maintain riparian corridor to provide a broad base range of benefits.

This corridor is really thin/ absent in many places (levee is right to the rivers edge – what about adding some corridor along land-side of levee (wherever, minimum 200' width).

Need mature corridor and mixed group of trees for bird migration

What type of success has been seen? MODOC said that they have seen/done this type of plantings on both sides of the levees

Scott has seen failures due to high water…group said that site selection is very important, and also site modification (raising or making ridges) can be done. Find acceptable ways to retire cropland of farm ground. Ken said that MVR has determined that BHF is very monotypic, but that minor raising can help

How much wetland marshes and other habitat are there in Pools and do we want to maintain what is there or increase the percentage?

What is a wet marsh and what is its value?

3. Increase amount of acres of floodplain wetland habitats in levee districts.

We need to identify that we would be focusing on marginal ground, and identify what is marginal ground (i.e., much of "marginal" would be left idle anyhow if some government incentives would be eliminated (some farmers use some cropland just because of the incentives).

Ken showed pie charts of percentage of marsh habitat along river system, and showed that LU/LC has changed a lot (but we don't need to alter all the land)

4. Maintain and Increase floodplain connectivity by 40%. (before modifications). This is too broad a statement, having too many plusses and minuses.

Need to identify what connectivity is… (water contact with the river at normal river flows)

IDNR questioning land use survey maps for accuracy.

Many of us are concerned that there is too much focus on breaching levees, with much loss to crop land.

On the IWW there are many pumping processes for levee management, but in the MMR there is much more gravity flow for drainage, and when the levee districts (LD) hold drainage water until the river is the right level for drainage, the LD opens the gates and many fish swim up the flow into the LD. Ken B. pointed out that timing is everything and most times this is not as much of a positive effect as appears.

Other connectivity options include setback levees and WL management and fish passages at the dams.

Chris B. asked that if we set an objective to not breach any levees, how could we still increase connectivity. Ken B. explained that there are areas already within the floodplain that could be better connected (i.e., during low flows for spawning in backwaters).

5. Water level management including seasonal drawdowns (every 5 or 10 years). And fish passages.

Going to site specific objectives, and we can go back to the pool wide stuff later: we are reviewing each icon (through expertise by Ken Brummett) and seeing if we need to add/change anything.

1& 3 Cotter Island maintain slough on island and increase depth of side channel at least 6' (10'?) for over wintering habitat.

How deep should a side channel be? It must (further discussion)
Add connectivity to slough 100%
Notch wing dams in area within secondary channel.

#2 restore rip corridor along right bank RM 299.5 to 300.2

NOTE: need to consider removing structure altogether to increase flow and get the river to self-scour back water areas instead of paying to mechanically manage the area. This is a good idea but there may be adverse impacts and modeling may help to identify this.

#4 creek delta work to deepen areas

#7 is ok as is. Chris is wondering how it has been self-maintaining, and could we use this method for future projects. All agree.

#8 shallow side channel – increase flow and depth

#9 back water depth

NOTE: how are determinations made to make or not make a project? It depends on the area, the hydrography and the potential for success.

RM 293, need to add rip corridor around the wet area behind the levee on the Illinois side.

#10 island –

NOTE: notch dikes as necessary to increase flow and scour

RM 291.8, take out/ notch structures (NOTE: modeling needed to ensure that there are no adverse impacts to the nav channel or the secondary channel **<u>bank (increased flow may increase erosion).</u>**

#12 secondary channel, needs no work as it is in great shape (maintain)

NOTE: we should be adding existing projects (e.g., HREP at Ted Shanks) to this list (**<u>F icon added for this area</u>**

#13 HREP, implement fact sheet

Salt River Bottoms **<u>new icon</u>** – IDNR is working to acquire this and implement wet Meadow restoration.

#14 secondary channel implement HREP Ted Shanks (see EMP fact sheet)

#15 trib delta, maintain mussel bed.

#17, RM 280, Crieghter (sic) Island, need to deepen channel. And increase connectivity in area
<u>New icon RM 280</u>: implement CCP strategy at Delair Division (Mark Twain refuges)

#18 Cashe Island (same as #17)

#19 notch dike

#20 Fars Island, continue to maintain project (incl. Monitoring)

#21 reference pool plan #1 (increase BHF larger blocks) behind levee

#22 deepen increase depth and reduce sedimentation

#23 Need to implement HREP project in vicinity (see EMP fact sheet)

Dundee harbor, good backwater that needs maintaining

<u>New icon</u> at dam (fish passage)

POOL wide objectives for Pool 24 – what benefits are there for the environment if we were to stop navigation for 1-2 months? There are benefits to trees and some veg but disadvantages to submergent vegetation.

Perhaps changing Pool24 to dam point instead of hinge point would help (but there are drawbacks to that as well)

Talk about drawdowns stopping lotuses but some are coming back now in backwater areas.

Pool 25:

Pool wide objectives – see reach wide objectives and include in this pool

18% is timbered now (35% pre-settlement) so therefore place at 20-40% TR.

New icon – RM 273 Clarksville – maintain gravel bar for mussels behind guide wall.

New icon – RM 271 increase BHF (there may be local opposition, we need to institute local incentives for implementation.

NOTE: do we need to improve HQ? The feeling was yes, but anywhere below LD15 it is difficult to maintain good HQ…and increase would increase aquatic vegetation. How much degradation has been seen in recent years? It has improved in the backwaters somewhat.

NOTE: exotics are a problem but some have improved (zebra mussels are gone right now)

#25 secondary channel add groins (stub dikes) in back channel to increase diversity.

#26, 27, 28 are covered, need backwater and side channel restoration include habitat on the islands.

RM 263-265 existing IDNR project to deepen and add backwater lakes and add habitat (Rust Land Trust. Need to maintain

New icon NOTE RM 269-264 on Missouri side, need habitat restoration

New icon RM 267-263, opportunities for enhancement for all secondary channels (eliminate one structure, add groins for scour).

New icon RM 263 Clarence Cannon Refuge, maintain HREP project. (see EMP fact sheet)

#31 OK

#32 maintain existing HREP project (no fact sheet made yet) deepen and reconnect (see EMP fact sheet

#33

#34-35 deepen and connect (MO state property)

#36, notch or remove structures (model before removal)

#37 maintain existing HREP project

Note: running out of time, we decide to stop working with the existing numbers, and look at rest if pool to see if any gaps remain (accept existing numbers)

#38 deepen and reconnect

Pools 25-26 HREPs implement

#41 Norton Woods, increase backwater depth (MO DOC owns this land)

NOTE see multiple hard points at RM 250-251 on nav chart (maintain)

#43 Stag Island, main channel island creation (using dredged material)

#44 maintain existing wetland areas behind levee

#45 implement and maintain Batchtown HREP (see DPR report)

#46 backwater depth Jim Crow island (deepen and reconnect)

#47 channel behind Jim Crow island

#48 find incentives for local enhancement

#50, 51- 52 Batchtown

<u>GROUP 2</u>

Participants List:

Tyler Harris – Missouri Coalition for the environment
Mike Wells – Missouri DNR
Bob Goodwin – MARAD
Steve Widowski – Shawnee National Forest
John Magera – USFWS Middle Mississippi River NWR
Ken Dalrymple – Corps of Engineers
Don Erickson – Corps
Dave Busse – Corps

Dave Busse will be reporter
John Magela is keeping master sheet
Tyler Harris is recording notes

Lock 26 – Kaskaskia Reach

Side channel document covers every side channel

If we address all of this we will achieve beyond goals

Most of current issues on reach are aquatic areas
Aquatic diversity and increased depth of side channel
Side channel plan is in GIS database
Note highest priorities for side channel plan restoration

Herculaneum reach and dike alteration plan – high priority room for additions to dike alteration in this reach – how to incorporate dike alteration specifically in plan

Dike alteration will in some cases achieve goals

How do we determine specific location of dike alteration?
Every mile, ten miles, etc.

Lots of planning of dike alteration – already have conditions now – gravel bar survey in progress

Accomplish side channel plan and dike alteration plan we have aquatic habitat addressed in reach

Add to Objectives map:
Implement side channel plan
Implement dike alteration plan

Alter dikes for a mile stretch every ten miles – without holistic view different projects can counteract environmental gains

Get best bang for buck and

Specify amount of public land for reach

Need to bring members of group up to speed on other studies – side channel and dike alteration plans, etc.

What can we achieve?
Work together to develop consolidated vision
States, NGOs fed agencies

What can be done to improve environment in realistic fashion

Focus on things we can do and will provide real environmental benefits

MO River fish and wildlife mitigation project going forward

Miss issues caught in planning morass

Started program of notching dikes in 1970s – created islands and side channels

Now trying to get safe and manageable nav channel that is environmentally sustainable

IMPLEMENT SIDE CHANNEL AND STONE DIKE ALTERATION PLANS – ADD DATA FROM THESE PLANS TO GIS DATABASE FOR NAV STUDY ENVIRONMENTAL PROJECTS

Side channel project\t document does not have standing – frustrating but also useful aspect NGO's and state of IL have been using document for their own planning and trying to implement aspects

No significant opposition has been noted

Levee degradation, controlled floodways difficult to implement

Associate objectives with actions

Create island situations
Backwater with sinuosity
Depends on location of notch and flows
Create vegetated island can be done
Creating sandbar is more difficult

For this process – give objectives like 10 % of dike alterations create sandbars, 30 percent create vegetated islands 60 % backwater creation

Dike alteration is already in database
USFWS supports acquiring 200,000 acres of bottomland hardwood forest but will not specify locations

Nav study does not cover Kaskaskia River

IL is moving toward management for Kaskaskia similar to Illinois 2020

Water quality should in clued nutrient concentration issues in whole river reach.

Lower nutrient load by 20-25% would help, 50% would be great, and realistic will be 10-15%

Maintain DO levels on Middle miss

Set goal as 15% reduction of nutrient load

Reforestation with cottonwood, sycamore and green ash to stabilize banks Thompson Bend

River needs to be reconnected to floodplain – need to consider taking levees down

Put structure in levee that is large enough to allow us to manage connectivity

Already have large enough gates in some areas to make this system work

Horseshoe Lake and Kaskaskia Island

Kaskaskia Island would make a good example

Corps is currently working on Miller city controlled floodway
Reconnect floodplain and get various benefits – bald cypress, bottomland oaks
East Cape Girardeau already has some restoration work in progress
Good location fro mainline levee setback

Reconnecting floodplain is possible in some areas – controlled floodways, gates possible, levee setbacks

Landowners retain right to harvest timber, hunting rights, - have corps buy permanent easement

Implement deal that easements or setbacks must be implemented to upgrade levees

Currently will not jeopardize one levee system with another

80 % floodplain connectivity in St. Charles floodplain and Columbia Bottoms

Protect Mosenthine and Choteau Islands from development pressure

Side channel

Air quality issues – minimize impacts of additional traffic

Water clarity impacts in main channel and fleeting areas due to increased traffic – minimize clarity impacts

Reconnect tributaries with floodplains to trap some of the nutrients.

Manage river to maximize native biodiversity

Management of ecosystem in open river is really dependent on ownership. Want to have ecosystem management equal in priority to management of river for navigation.

Historical record of Mid MS – project died on vine
Initial findings considered invalid by management
Good story never got completed
Put together project historical geomorphic mapping of MMR
Address through the context of Biological opinion
Restoration plan for MMR must include all habitats
Example – reach formerly with 8 Islands that endured from 1840 –1950 now have 2 Islands combining several, easy to restore since river naturally created Islands
Better to spend money in areas where Islands were self-sustaining
GLO mapping starts in 1817 to current
Previous effort based on travel journals
Maps from French surveying – descriptions sometimes do not coincide with drawing
Water level effects morphology of map – Islands, etc.
Surveying that includes water level gives good indication of real river appearance
This is valuable exercise for restoration efforts
Understand some of the structural or physical systems that were lost or modified – physical features and microhabitats.

Problems with MMR include hard headed members of Congress JoAnn Emerson

Supports side channel effort if does not take land from non-willing sellers
Likes American Land Trust method of land swapping

Is it possible to allow river to meander
Nav might require only 60% of water – if you have ability to set back levee you can divert 40% of water to natural meandering process

Politically impossible to remove levees protecting productive farmland

Better land in MMR area likely reduced participation in buyouts after 93 flood

<u>GROUP 3</u>

Participants: Rob Davinroy, Mark Beorkrem, Jerry Stroud, Brian Johnson, Dave Benrmdt, Dan Erickson, Joyce Collins, Eric Laux, Ken Brummett, Gary Christoff, Bob Hrabik

Baseline Condition For Pools 1940--(Just after LD implementation)
Baseline Condition Middle Mississippi River---debatable

Priority Concern. Although sustainability is focused from bluff to bluff, we need an appendix in final report that describes sedimentation issues occurring throughout the basin and how they effect ecosystem sustainability.

Starting at Mile 0.0.

Reach Objectives..

Remove all the levees, restore 100 percent floodplain conductivity, bluff to bluff, take river to prior European settlement condition.

As an interim basis, partial floodplain restoration, restore 20 to 30 percent of floodplain conductivity, bluff.

Restore some measure of historic meandering tendencies of river. Allow some disturbance regimes to occur on the river. Allow some non-constraint stretches of the river.

Allow every 5 to 7 miles of over-wintering fish habitat. Depths would be 12 to 18 feet.

Allow every 20 miles for waterfowl resting habitat. Target 1000 acres minimum per site.

Restore aquatic habitat conductivity within the main channel. Founder effect, bathymetric diversity, aquatic habitat connection. More natural bathymetry, more aquatic connection. In the channel crossings, establish more connectivity. Regional objective to achieve this would be to possibly increase dredging with dike removal.

Restore river aquatic fisheries environment prior to 1950. Under this baseline condition, reach objective would be to possibly replace rock structures with wood structures or other similar measures to regain fisheries diversity and abundance. Investigate historical water quality effects.

Restore riparian corridor within floodplain, including re-establishing forests and prairies.

Restore small rivulets, oxbows, and other tertiary channels adjacent to the main channel.

Create or engineer new islands and side channels within Middle Mississippi River.

Maintain and create substrate type diversity, i.e. diversity of sands, gravels, cobbles, etc.

Address local tributary effects, include deltaic sedimentation, channelization and headcutting. Restore oxbows and other important geomorphic features of the tributaries.

Preserve and enhance sand bar habitat for aquatics and waterfowl.

Utilize existing meander scars and river features located in the floodplain for the creation of new aquatic and waterfowl habitats.

Preserve and create wetland complexes in adjacent floodplain.

Utilize old or existing quaries for backwater habitat.

GROUP 4

Participant List: Bob Hughey, Butch Atwood, Don Huffman, Karen Westphall-chart recorder, Reid Adams, Rob Maher, Dean Corgiat, Danny Brown, Deck Major, Christine Favilla, Jon Duyvejonck - recorder

Pool 26

Pool-wide objectives for Pool 26

There are no pool plans for 26 now. There seems to be agreement that goals and objectives identified in existing documents (HNA, UMRCC) are appropriate for Pool 26

Restoring natural hydrograph (water level regulation) is uppermost priority for management actions. How much should this drawdown be? Probably no more than 1 meter. It would be beneficial to drawdown every year, if conditions permitted. This must be linked with increased floodplain connectivity to be effective; objective of 40% of pre-development floodplain acreage over the next 100(?) years. Fish must have more access to floodplain, but biologists are unsure how much is needed for sustainable populations. This is a long term objective that should be achieved as opportunity presents. Secondary channels restoration objectives is a problem because we don't know what historical conditions were. Need to increase opportunities for agricultural programs (wrp, crp) as part of this objective; these objectives will need to be achieved opportunistically.

Want 100% passage of native fishes through navigation dams.

Understanding of natural resources status is minimal. This lack of information with respect to the status of fish and wildlife resources presents a problem for specifying site-specific objectives.

Information need: When do fish species need access to BWs?

Bank stabilization? Want to stop erosion, but also want habitat diversity. Too much bank stabilization decreases diversity.

Water quality objectives in addition to just increasing water clarity are needed (i.e. more D.O. in specific locations, reduce methyl mercury contamination in sediment, reduce nutrient input from tribs, reduce fecal coliform from treatment plant outfalls). Want clarity sufficient to support aquatic veg in BW down to 1.5m in depth (TR 3-4). How will this affect navigation channel?

Don't know where mussel beds are, and their status. Therefore it is difficult to establish specific objectives for mussels

Increase quantity of woody debris in side-channels throughout pool

Pool-wide there needs to be increased focus on floodplain tributaries and stream restoration objectives as well.

Air quality needs improvement (emissions from waiting tows) What is the alternative to this?

Facilitate necessary changes in land use to achieve objectives

All islands in river should be in public ownership and cabins should be eliminated

Increase bottomland hardwood acreage in all pools.

Specific Locations

76. Backwater depth - At a minimum, wish to maintain existing conditions. Existing connectivity is OK. Maintain no more than 25%of area >3m. Too much depth is counter-productive.

RM 222- Upstream of MO-Miss. confluence is an important natural resource area that needs management attention.

53. Across from this location is a BW that needs reconnection with main channel.

78. Create deep water habitat for paddlefish, sturgeon, blue catfish

65.

74. OK agree

Piasa Creek – watershed needs improvement

Pool 25

General pool wide objectives (restore floodplain connectivity) are the same as Pool 26.

Batchtown –

Appendix F. Management Actions

Purpose:
To review and identify management actions that are most likely to contribute towards achieving the established goals and objectives.

Background:
For the purposes of these workshops, Management Actions are: regulatory, operational or structural tools or activities that can be implemented to positively address environmental objectives (e.g. hydraulically dredge a backwater area). Participants reviewed a list of management actions that had been compiled from previous planning to assess their ability to meet the objectives that were discussed the previous day Time was given to ensure all the groups were able to review all of the actions. The reports from each group were presented in a plenary session to provide other participants the opportunity to ask for and receive clarification.

Results:
What follows is the management information gathered and reviewed at the St. Louis Workshop. It is organized into three sections: management action tables, plenary report, and working group reports.

Each working group prepared a master worksheet to record the group's changes, additions, and deletions to the list of management actions. The changes from all the groups were compiled in the following worksheets (Table F1). There were three ecosystem elements or parameters, 36 new management actions, and 54 comments added. The whole group modified four existing management actions and deleted seven of the actions listed. The groups covering the Open River, or Middle Mississippi River reach deleted 20 actions or determined they were not applicable in that river reach.
These results will be merged with those from other workshops, and the entire management actions database published in the UMR-IWW System Navigation Feasibility Study Interim Report will be updated.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management. The entire plenary report can be found in Appendix C.

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work that was produced for Management Actions. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

Table F1. Management Actions.

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	Better upland controls
General comment: sedimentation and clarity historically		2	Stabilize river banks	Find alternative to rock - woody structure
				Site specific case-by-case
				Include vegetation stabilization
		3	Pool scale drawdown to consolidate soft sediments	Within navigation limitations
				Not applicable in MMR
		4	Minimize dredge disturbance/frequency	More use of cutterhear, less dust pan
				Trades off: rock work
		5	Minimize dredge ~~slurry~~ return water (SEMO port)	Place out of channel - behind levees
				Place out of floodplain
		6	Minimize bankside dredged material placement	Place out of channel - behind levees
				Not applicable in MMR
		7	Stabilize dredged material	
		8	Tributary reservoirs (sediment trap)	
		9	Speed and wake restrictions - rec. boats and tow boats	In backwaters too
Dissolved oxygen			Increase connection, duration, flow to reduce D.O. sags	

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality cont.			Side channel closing structures - dredging	
Nutrients				
Carbon inputs			Reforestation, BMPs	
Woody				
Comments/ Additions:				Issue resource alerts to towing industry
				No. 9 deleted by group 2
			Control dissolved oxygen	
			Conrol nitrates/chemicals	
			Minimize open water placement of dredged material	
			Increase channel depth	
			Use retention areas for dredged material	
	Backwaters/side channels	10	Pool scale drawdown to consolidate soft sediments	Not applicable in MMR
		11	Drawdown management units	Deleted by one group
		12	Drawdown isolated backwaters	Periodically
				Deleted by one group
		13	~~Isolate and drawdown contiguous backwaters~~	Isolate backwaters (revised)
		14	Temporarily isolate and drawdown contiguous backwaters	
		15	Construct wind breaks	Use something other than rock
				Not applicable in MMR

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality cont.		16	Construct Wave breaks	Use something other than rock
				Not applicable in MMR
		17	Remove bottom feeding fishes (carp)	Inovative operations
				Deleted by one group
		18	Increase plant density	Objective?
		19	Increase plant distribution	Objective?
		20	Reduce algae production by water level management and connectivity	
Comments/ Additions:				
			Control dissolved oxygen	
			Conrol nitrates/chemicals	
			Plantings to stabilize banks	
			Sediment traps	
			Create forested riparian corridor	
			Land acquisition	
Geomorphology				
Backwater Depth	Backwater Areas	21	Hydraulic dredging	
		22	Mechanical dredging	
		23	Consolidate sediment	Objective?
		24	Divert flow to increase backwater scour	Model to insure effectivness
Comments/ Additions:			Explosives	
			Control sediment by BMPs	
			Structures additions or modifications	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Geomorphology (cont)				
Side Channels			Hydraulic dredging	backhoe new backwaters, excavation is cheaper than dredging, dredging is 1/10th cost of rock
			Mechanical dredging	
			Divert flow to increase backwater scour	hard points
			Make new side channels	
			Channel bed degradation, side channel development	
Water Level	Main Channel	25	Pool scale drawdown	Not applicable in MMR
Comments/ Additions:			Pool scale increase	
			Study water table changes	
	Backwater Areas	26	Pool scale drawdown / increase	
		27	Drawdown management units	No. 27&28 delete drawdown, add stop-log systems, water level control structures.
		28	Drawdown isolated backwaters	

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Geomorphology (cont)		29	~~Isolate and drawdown contiguous backwaters~~	
		30	Temporarily isolate and drawdown contiguous backwaters	delete drawdown.
Comments/ Additions:				
Connectivity	Floodplain	31	Acquire real estate rights, ~~restore water to leveed floodplain areas~~	Site specific
				Eliminate reference to specific area
		32	Reconfigure, restore flow to ~~secondary~~ remnant channels	
		33	Restore flow to isolated backwater areas	Site specific
		34	Create habitat corridors for floodplain terrestrial wildlife	
		35	Restore natural tributary channels through delta areas	Questionable for St. Louis reach
		36	Notch levees	
		37	Set back levees	
		38	~~Increase water levels~~	
		39	~~Increase terrestrial area~~	If you reconnect you descrease terrestrial area - more water, less land
Comments/ Additions:			Remove levees	
			Controlled floodways	
			Remove bank stabilization structures	
			Gated levees - controled flow into hydrograph	
	Secondary Channels	40	Notch closures	
		41	Divert flow from main channel	Where practical
		42	Increase water flows ~~levels~~	Delete for MMR
		43	Dredge secondary channels	

Table F1. Management Actions (cont.).

Element / Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Geomorphology (cont)		44	Remove levees	Where practical
Comments/ Additions:			Set back levee	
			Controlled floodway	
	Longitudinal	45	Build fishways	
		46	Modify gate operations	
		47	Modify lock operations	
		48	Remove tributary dams	Where practical
Comments/ Additions:				No. 45 - 48 not applicable in MMR
Pattern of Habitats				
Aquatic areas		49	Introduce flow to isolated backwater areas	
		50	Restore flow to secondary channels	
		51	Restore flow to floodplain areas isolated by levees	Where practical
		52	Restore natural tributary channels through delta areas/floodplain	
		53	Divert more tributary delta flow into open impounded areas	Deleted in MMR groups
		54	Create or protect rock, cobble, and gravel substrate areas	
		55	Create or protect shallow rock, cobble, and gravel riffle areas	
		56	Incorporate woody debris into bank protection	
		57	Incorporate woody debris into 2° and small channels	

Table F1. Management Actions (cont.).

Element / Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont.)		58	Restore flow and geometry of secondary channels	Modify, notch, etc structures
Aquatic areas (cont)		59	Modify flow distribution from dam gates - tailwater habitat	Deleted in MMR group
		60	Grading, vegetation planting	
		61	~~Rock groins, hard points~~	
		62	Anchored woody debris	
		63	Off-shore rock revetments	
		64	Submerged rock vanes	
		65	Notch wing dams to create hydraulic, depth diversity	
		66	Notch closing dams to increase side channel flow	Where practical
		67	Construct temporary structures to divert flow	
		68	Use larger rock, make bank revetments irregular	
		69	Incorporate woody debris into channel structures	
		70	Construct hard points, groins for shoreline stabilization	Same as 61?
		71	Construct off-shore revetments	Same as 63?
		72	Construct seed islands	
		73	Construct bendway weirs	
		74	Construct chevrons	
		75	Modify flow splits between main and off-channel areas	
		76	Dredge backwater areas, increase depth	
		77	Dredging to restore and create secondary channels	
		78	Shore pipe, boosters to reach target sites	
		79	Use ~~small~~ dredges to expand placement options	Different dredges and technology
		80	Bend width reductions where possible	Objective?
				Deleted by one group

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont.)				
Comments/ Additions:			Buy land/interest	
			Restore meanders to tribs	
Terrestrial		81	Place dredged material to create wetland areas	
		82	Placement on existing, construct new beaches	
		83	Semi-confined channel placement (chevrons)	
		84	~~Unconfined placement in floodplain (for mast trees)~~	
		85	~~Unconfined~~ placement in floodplain	See 84
		86	~~Beaches~~	Not applicable in MMR
		87	Island construction	
		88	On floodplain to raise areas for mast-producing trees	See 84
		89	Confined placement of dredged material in floodplain	
		90	Construct hard point in floodplain	
		91	Construct islands in impounded areas and backwaters	Not applicable in MMR
		92	Seed islands	Not applicable in MMR
		93	Chevron islands	
		94	Rock islands	See 87
		95	Islands with varied top elevation, fine material	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Pattern of Habitats (cont)				
Terrestrial (cont)		96	Low islands - mud flats and sand bars	
Comments/ Additions:			Buy interest	
Land Cover/Use		97	Modify and manage habitats on refuges (see habitat below)	
		98	Manage vegetation cover	
		99	Manage water levels	
		100	Modify habitat structure in floodplain and backwaters	
		101	Plant vegetation on dredged material deposits	
		102	Plant floodplain trees	
		103	Harvest floodplain trees	TSI - wetland development
		104	Plant floodplain prairie	
		105	Burn floodplain prairie	
		106	Control invasive exotic species	Plants too
		107	Place dredged material to create wetland areas	
		108	~~Unconfined~~ dredged material placement in floodplain (for mast trees)	
		109	Growing season drawdowns	gated levees etc.
Comments/ Additions:			Add items 31 - 44 also	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Plants and Animals				
Fish		110	Adjust angling, commercial fishing regulations as needed	
		111	Modify angler attitudes about expoitation	
		112	Enforce fishing regulations	
		113	Stock fish	Native species only
Comments/ Additions:			Close sturgeon fishing season	
			Improve angler access	
Wildlife		114	Conduct biomanipulation of fish and wildlife community (various actions)	Bioengineered - control of exotics/problem species
		115	Adjust hunting and trapping regulations as needed	
		116	~~Modify hunter attitudes about expoitation~~	Deleted in MMR group
		117	Enforce hunting regulations	
		118	Reintroduce native species	
Comments/ Additions:			Environmental education/outreach programs	Neotropical birds
Exotics		119	Control/eliminate invasive exotic species	Objective?
				Biocontrol
				in Inland waterway system and Great Lakes

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Plants and Animals (cont.)		120	Construct, operate, maintain barrier on Illinois River	
		121	Require antibiotic treatment of Great Lakes freighter ballast water	Delete - too prescriptive
		122	Regulate use of exotic species for fishing bait	
		123	Regulate biota transfer by fishing boats	
		124	Apply species-specific toxicants	
		125	Kill zebra mussels on vessels in lock chambers	Delete - "in lock chambers"
		126	Restrict and enforce use of exotic species in aquaculture	Regulate
Comments/ Additions:			Start catch-and-DON'T-release programs	
			Sever Great Lakes connections	
			Kill Reeds canary grass and purple loosestrife	
T&E		127	Protect, increase populations of threatened, endangered species	Supplemental stocking programs
			Protect, increase habitat of threatened, endangered species	
Comments/ Additions:			Emphasize mgmt of communities, not populations	Holistic approach
			Continue to implement UMR Biological Opinion	
			Implement recovery plans	

Table F1. Management Actions (cont.).

Element/ Parameter	Extent	ID	Management Action	Comments
Best Management Practices				
All			Modify habitat (see below)	
		128	BMPs	
		129	Conservation tillage	
		130	Contour farming, terraces	
		131	Grassed waterways	
		132	Establish perennial cover, crops	
		133	~~Stabilize eroding ravines~~	
		134	Conservation Reserve Program land set-aside	Use all USDA programs
		135	Erosion control structures along intermittent streams	
		136	Construct, maintain small impoundments	
		137	Restore drained lakes, wetland areas	
		138	Riparian buffer strips	
		139	Restore stream channels, floodplain areas	
		140	Urban stormwater management practices	
		141	Construction site erosion prevention practices	
		142	Increase pervious surface in developed areas	
Comments/ Additions:				
			Educational outreach - neotropicals, ecology of river, many things	

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management actions. The entire plenary report can be found in Appendix C.

Nov 14th, Management Actions Plenary Session:

The plenary began by asking each group to give a brief overview of what they did, as well as listing their modifications to the list of Management Actions. The Tables of Management Actions were visited section by section with all four groups having an opportunity to give their input on each section before moving to the next.

Managements Actions – Chuck Theiling (9:08 – 9:10)

Chuck began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

Discussion Before Management Actions Working Groups:

– "Reduce Algae" Isn't this an objective?

Theiling – Yes.

Soileau – You can go ahead and convert these to management actions.

– If we don't see a management action that is directly linked to an objective identified yesterday we can go ahead and add it on.

Soileau – Yes, absolutely.

– Are we inserting an element of realism to the management actions or are we waiting for later?

Soileau – You can clarify them, but don't say "your off your rocker". We are trying to capture all ideas. What may not be applicable now, may be later.

Theiling – 5-8 years ago people would have thought environmental pool management was impossible.

– If we don't like dredges we tend to get more rock in the river. So, if we cross off minimize dredge disturbance will that be interpreted to add more rock in the river?

Soileau – We will have many actions to address any of these concerns, so there may be another way to meet those needs. Make sure you put any concerns in your notes.

Management Action Working Groups (9:20-11:05)

Management Action Plenary (11:10)

Group 1 Report (Pools) (*Numbers in parentheses are the group the speaker belonged to.)*
People in our group wanted to do this in a site-specific manner. To implement them, you cannot do it over the entire reach; you have to be in a specific area to do a specific action.

Pools
Water Quality (Main Channel)

(1)Dissolved O2, Nitrates and Chemicals.

(1) – For speed restrictions we discussed advisories.

(1)– Should we remove increase Channel depth because we didn't think it would help water quality due to sediment characteristics?

(4) – Many of these applied to other categories and were located there, but we included them here as well. Talked a lot about restoring natural hydrograph. Especially how induced drawdowns don't follow the natural drawdowns.

– Reconfigure tow facilities and scheduling to minimize sediment resuspensions

Water Quality (Back Water)

(1) All in report
(4) Re-emphasize drawdown

Geomorphology (Back Water Depth)

(1) All in report
(4) All in report

Water Level (Main Channel and BackWater)

(1) All in report
(4) All in report

Connectivity (Floodplain)

(1) - #35 was unclear as to what it was

(4) – Year round pool management – Spring Flood – Summer Drawdown – Late Fall, winter rise again.

(1) – How do you apply a natural hydrograph to a locked river? The locks have created a different environmental system so what values are you trying to achieve by introduction a pre-impoundment natural hydrograph to a locked river.

– We can't do anything to the spring flood. We can simulate the rise and fall of the river with management of dam operations. We are trying to draw down in the summer but then let them come back up to pool levels in fall. However, the fall rise is the question mark; we may need to buy more real estate.

– So you need to be careful using the word 'natural'. This system was actually built to mitigate against this.

– Not the amplitude of the natural hydrograph, the shape of it.

– I understand, I think that we need to be careful of language.

Theiling – There are functional aspects that we are trying recreate. Sediment consolidation: this can happen at almost any time. Holding waters high allows connectivity to off channel areas for fish over-wintering. Some things are time dependant, others aren't.

– Some people understand that these need to be acted within certain confines but the general public may not.

– Would this be dependant upon natural conditions?

– Yes, you don't want it to be the same every year. River won't allow you to do it every year, i.e. drought years. Chris is right we do have to be careful with the language we use.

Connectivity (Secondary Channel)

(4) All in report
(1) All in report

Connectivity (Longitudinal)

(4) All in report
(1) All in report

Patterns of Habitat (Aquatic Areas)

(1) All in report
(4) All in report

Patterns of Habitat (Terrestrial)

(4) All in report
(1) All in report

Patterns of Habitat (Land Cover/Use)

(1) All in report

Plants and Animals

(1) All in report
(4) All in report

<u>Open River</u>

Water Quality – Water Clarity (Main Channel)

(2) – We made no judgments. All things were good and should be laid out before the site manager.

(2) – Assuming #8 meant sediment traps and that it could be used in the middle river.

(3) Our plan of attack was to go through the list and discuss and eliminate items.

(3) Water clarity wasn't as much an issue as stratification and anoxic conditions. Water is clearer than historic levels due to Missouri Dams. Better route to increase turbidity in some areas. #2 Feel that some banks are too stabilized, would like to restore some natural meander.

Water Quality – Water Clarity (BW)

(2) – Number 17 brought about a bit of discussion based on feasibility. Additional management actions were Increasing licensing, and Rhodam (?)

(3) Added side channels to the backwater category.

– Dissolved Oxygen (DO) – side channels become isolated in the summer months, stratification occurs and anoxic conditions develop. Increasing connectivity and flow would help. Notching structures and dredging would help.

Nutrients are also an issue. Being isolated in side channels leads to eutrophication and DO issues. Carbon inputs and woody structures could be debated – reforestation would be desirable.

– BMP was also added here.

(2) – How can destabilizing a riverbank improve the water clarity?

(3)– Middle Miss was a very turbid river. Fish communities evolved and adapted to these kinds of situations. This changed when mainstem dams went in on the Missouri. There has been a shift in fish populations – non-sight fish populations are down. Return of these fish would be beneficial. Stabilizing the banks keeps turbidity and sediment out of the river.

(2)– Seems counter intuitive

(3)– We, a society, like to see clean flowing water. However the Middle Miss was not that kind of river.

(2)– So, if we decrease BMPs and let the sediment flow into the river, would that be good?

(3)- No, the sediment has to come from the right places (from the channel or the Missouri River).

– Good to think outside of the box

(2)– We are talking about different areas of the river. Sediment coming from upland impacts the entire system, but sediment from the river is better.

– Stabilizing the bank does keep trees from falling in river, but it does eliminate flat scoured area habitat and structure from fallen trees.

Geomorphology Page 2-3

(2) Look at water level tables and water usage and see how that is affecting Main Channel water levels.

(3) – Hydrograph in the Middle Miss is similar to historic, but more flashy. If you could implement set backs and notching you may be able to bring down the peak a little bit.

(3) – Dig new channels for backwater depth and backwater areas

(2) In floodplain – add structures into levees to allow water flow

(4)– Is there any problem with channel bed degradation (down cutting) in the main channel?

(3)– Don't really know.

Geomorphology Page 2-4

(2) All in notes

(3) There is a lock at Kaskaskia and maybe something could be done there.

<u>Pattern of Habitats – Aquatic Areas</u>

(2) – From #54-55 – Could open areas to increase flows which would expose gravel already there. #80 Thought that was more of an objective. Didn't really know any management actions. Considered that we could put in nursery areas for small fish. Need a chance to develop techniques (selective notching and floodplain connectivity or using large stone to limit size of fish that can access side channels.

(4) Question on connectivity and degradation. Down-cutting may have caused isolation of secondary channels and backwater.

– Some areas are degrading and some are aggrading

(2) – There was degradation early after channelization, but is has stabilized.

(3) Some areas that have been over-engineered can be looked at.

(3) Didn't really understand #80.

Lunch – 12:15 – 1:05

<u>Pattern of Habitats – Terrestrial Areas</u>

(3) All in notes

(2) Not clear on #81.

<u>Patterns of Habitats – Land Cover/Use</u>

(3) - #103 don't see many areas where that was possible except for wetlands and timber stand improvement

(4)– What about the setting back floodplain trees for succession?

(3)– We did mention timber stand improvement.

(2)– To reestablish pine oak you need to have some type of reforesting

(3)– Yes, but you need to have a seed bank and we don't seem to have one.
#109 – Gated levees since the middle river doesn't have dams.

(2) All in notes

Plants and Animals

Fish

(2) All in notes

(3) – Don't have the same fisherman base. Actually need to improve angler access to get people on the river and that would change attitudes.

Wildlife

(2) All in notes
(3) All in notes

Exotics

(2) All in notes

(3) – Use some bacteria or something to control exotics

(3) 121 took out antibiotic treatment.

Threatened and Endangered

(3) Management currently seems to be population based. Should take a more holistic approach by managing for systems and goals. Outreach and education and outreach on the ecology of the river.

(3) - #134 Utilized to "all USDA programs"

2) – All mussel recommendations should be implemented.

Working Group Reports

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work produced concerning management actions. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

GROUP 1

Participants List: Mike Cox, Willis Graham, Ken Barr (MVR); Scott Bunselmeyer (UMIMRA); Phil Bradshaw (IL Soybean Board); Dave Gates (MVS); Ken Brummett (MODOC); Tim Krumwiede (IDNR); Tom Wilson (IDNR); Chris Brescia (MARC 2000)

Water Quality (HQ)

Ken would like to see alternatives to rock for bank placement (MVS has been using this for about 15 years. The advantage to using woody structures is an increase of carbon matter. There was some small discussion about large stone vs. small stone and how MVR is hesitant to use the larger stone (because of increased cost and structural integrity of the structure).

Drawdowns are OK as long as navigation is not impacted.

Dredging should not impact water quality, but the placement (especially open water placement) could impact HQ). The question is placement and MVS should be looking toward placing material upland instead of open water. Investigate upland placement. MVP and MVR have beneficial use stockpile sites and MVS should be doing this.

UMIMRA asked about contaminants and would the levee district be responsible for the contaminants. The bedload sand is clean and there are no problems.

Many of the management actions under HQ may better fit under geomorphology. However, lower dredging depth may help to reduce the HQ impacts.

Minimize slurry and bank placement would be place the material upland.

Tributary reservoirs would help, we should work on local incentives and CAP authorities. What about TMDL that some have heard about? Ken spoke about how some states have made new guidelines to reduce nutrient loading to help the hypoxia situation in the Gulf. Discussion about local farm testing and state requirements showed that this is ongoing.

Add towboats to the rec. speed and wake restrictions. How should tows change their way of transporting? Notices of sensitive areas could be broadcast so tows could avoid these areas (i.e., issue resource alerts to the industry).

How do we get the rec areas to understand and comply with the resource alerts (advertising, no wake buoys?). How can you identify whether it's the towing or the rec causing the problem?

Backwaters HQ

Discussion of meaning of some of the listed actions (what is isolation of contiguous backwaters?(damming up connection to allow isolated pumping down of backwater)).

Use alternatives to rock for wave breaks, as possible.

Question of removing bottom feeding fish (they can increase turbidity while feeding and reduce vegetation. But the management action is unrealistic as written. Maybe keep it for isolated areas.

Algae is not a HQ problem in this area, only sometimes in backwaters. Change wording to "introduce flow in isolated backwaters to reduce algae production." Still water promoted growth. Discussion about West Nile virus and stagnant water problems.

Geomorphology, backwater depth, backwater areas.

Add explosives to dredging methods (case by case basis of course)

Diversion of flow can cause more problems that it benefits, so add modeling to determine which methods would work in certain areas.

Sediment reduction is very important and should be initiated wherever possible.

Water Level Management Main Channel and Backwater Areas

Discussion of benefits of this technology (adds veg in lower portion of pools).

Discussion of dam vs. hinge point drawdowns, plusses and minuses.

Add "Increase pool levels during winter to assist over wintering habitat for backwaters".
This is being done in some areas successfully

Connectivity

We do not condone 100% floodplain reconnection (this should be considered on a site-by-site basis)

Concerns about riparian corridor along the leveed land…would this create crop damage and would additional moisture be required (yea and no, but most levee districts would be less opposed to riparian corridors rather than aquatic habitats placed along the levee).

Interest in adding incentives or voluntary actions to modify levee districts (notching or setting back).

Why do environmental projects use existing levees, when the levee districts get no benefits from the system already (e.g., Oakwood Bottoms – if it was flooded in 1993, there was already a plan in place to build new levees to protect the 5,000 acres of oak forest, but the existing levee is doing that now). Ken B. spoke about controlled flooding as opposed to controlled flood reduction. The controlled flooding would allow nutrient transfer of carbon and such back to the river, plus add fish habitat.

<u>GROUP 2</u>

Participants List:

Tyler Harris – Missouri Coalition for the environment
Mike Wells – Missouri DNR
Bob Goodwin – MARAD
Steve Widowski – Shawnee National Forest
John Magera – USFWS Middle Mississippi River NWR
Ken Dalrymple – Corps of Engineers
Don Erickson – Corps
Dave Busse - Corps

Dave Busse – facilitator/keeping master list
Tyler Harris – typing

Pg. W2-7
113A – limit or ban sturgeon fishing – sturgeon got hammered the last two years during commercial season - FWS says “close the season” – include paddle fish – paddle fish removed from closed season

Water Clarity – not that much of a problem in open river main channel

1- what are BMPs and who decides what they are and who implements – nutrient loading involved in clarity – some think it is meaningless – river manages its own sediment load – decided it is an objective
2- could be good or bad – leave it on the list but note including vegetative stabilization
3- not applicable to open river
4- OK

5- Reduce amount of water – will not work for dustpan or cutter head – Caterpillar working on new system for IL river that addresses this – leave it in as option
6- Minimize impacts of bank side dredged material on water quality is an objective – how is it done? Do not place in wetlands – want to use dredged material to create sandbar or Island. Find a way to filter out fine sediment. Use retention areas for bank-side placement of dredged material
7- Combine 6 and 7 – scratch 6 and accept seven – contain dredge material, plant grasses on top of material to stabilize
8- Sediment traps – clarify this as sediment trap
9- How can this be enforced? Is it appropriate? Rec. boats create more wave action on side channel – take it out – unenforceable

Backwaters

10- not applicable
11- includes make a management unit and draw it down
12- ok
13- ok
14- ok
15- ok
16- ok
17- focus heavily on this – this is an action that will be difficult to employ – will encounter much resistance from some fisherman – carp more of a problem than catfish – possibly issue additional commercial licenses restricted to exotic bottom fish
18- this is an objective – plant to help stabilize banks and during low water times plant on caving banks and areas of high erosion –this is an objective
19- objective
20- objective

ADD
– plantings to stabilize banks
- in cooperation with NRCS put in sediment
Create forested riparian corridor –
Land acquisition and easement interest in ag. lands adjacent to river

What impact does flooding inundation of ag. lands have on water clarity – if riparian zone is forested there is little impact, if farmed right to banks it causes major problem – acquire fee title or long term restrictive easement on lands farmed right up to banks – work with land owners

Millions of tons of sediment pass daily – accretion of islands inconsequential

BACKWATER DEPTH

Backwater areas

21- ok

22- ok
23- objective – not clear on meaning of this
24- increase flow during high water

ADD

- structure additions or modifications or removal

water level

whole section does not apply

if channel has incised in open river is that addressed here – affects water table which affects wetlands – studies show channel is incised – is there a trend toward further incision – middle miss is not continuing to incise – problem on lower miss – study showing historic stream elevation – Dr. Pinter shows stage elevation lowered as time goes on – mid bank flow has shown no change – high flow shows increasing stage – lower river loss of sinuosity causing continued incision – no shortening of MMR – gained length since mid 1800's – no cutoffs in MMR – it is not meandering – bottom of river lower than 100 years ago but not continuously degrading – has impact on isolating backwaters and wetlands/water table – monitor water table – lots of irrigation lowering the water table due to shallow wells – how do we separate this from

ADD

- study water table changes

25- na
26- na
27- ok
28- ok
29- ok
30- ok

ADD

- study water table changes

CONNECTIVITY

Floodplain

31- OK acquire real estate rights
32- OK
33- OK
34- OK
35- OK
36- OK
37- OK
38- N/A
39- N/A

ADD

- remove levees
- controlled floodways

- remove bank stabilization structures to allow natural meandering and reestablish ridge and swale system

Secondary Channels

40- OK
41- Divert main channel flow into secondary channels
42- N/A
43- OK
44- OK

ADD

- setback levees
- controlled floodways
- see #31

Pinched area at Chester – is this a candidate for controlled floodway? – could be done but landowners will probably prefer setback to protect remaining land

45- N/A
46- N/A
47- N/A
48- N/A

AQUATIC AREAS

49- ok
50- OK
51- Ok
52- Ok
53- N/A – pool
54- Objective? Action = add rock and cobble
55- Objective? Action = add rock and cobble

River bed is made of gravel and cobble with sand on top, after high flow sand accumulates

56- ok
57- ok
58- objective introduced flow might produce straight flow – use round points and varied notches to manage geometry and sinuosity in side channel – can use woody structures or varied wood dikes at wide spacing – Corps is using woody debris already
59- N/A
60- Ok
61- Ok
62- Ok
63- Ok

64- Ok
65- Ok
66- Ok
67- Ok
68- Ok – provides special habitat for catfish and greater surface for bugs
69- ok
70- Dupe of 61
71- Dupe of 63
72- Ok
73- Ok bendway weir carves a little off bank and moves it downstream
74- Ok
75- Ok
76- Ok
77- Ok
78- Ok will not work with dustpan dredging
79- Ok
80- Want them bigger if possible – real problem with navigation – this is an objective

ADD

- create areas connected with MS – backwater areas – restricted access for large bottom feeding fish – use fence or grating – to increase aquatic vegetation need to restrict large bottom feeding fish since they stir up bottom – want larval fish to access for nursery – works until major flood – large fish will invade with flood waters **screen/grate/rock restriction on fish size** – small fish have access to river
- see #31 – buy land

TERRESTRIAL

81- how will this work? Leave it in but unsure
82- dangerous to public recreation – only appropriate in backwater areas at best
83- ok
84- OK ridge and swale come back in naturally when river is connected to floodplain
85- Not without a specific purpose – see 84
86- N/A in MMR
87- Ok – are there areas that will give immediate benefit for least terns – better to create sandbar habitat behind a chevron
88- Dupe of 84
89- Ok
90- Would create a scour hole behind it – create a blue hole – will add ponding areas – uses rivers energy
91- N/A
92- Used by St. Paul – creating small Island that will grow – need protection in MMR for Island to stay – N/A See 87
93- See 87
94- See 87

95- See 87
96- See 87

ADD

- #31
- All of items under connectivity floodplain

Setback levees will allow natural ridge and swale to redevelop – will create terrestrial habitat desired

Succession of bottomland hardwood forest is dependent on river meandering behavior – need to allow the river to meander to create natural disturbance cycle that governs floodplain forest habitat

LAND COVER USE

All OK

FISH

110- OK
111 – change to: initiate environmental education program
112 – OK
113- include pallid sturgeon

WILDLIFE

114- OK
115- OK
116- N/a
117- OK
118- OK

- Add 111
-

119- Objective
120- Ok
121- Ok
122- Ok
123- Ok
124- Ok
125- Ok
126- Ok

ADD

- KILL REEDS canary grass or purple loosetrife

Useless to discuss fish and wildlife issues when all we have control over is habitat – being forced to create habitat for endangered species when knowledge of habitat is not available

NURSERY IDEA IS INTERESTING – NEEDS FURTHER DEVELOPMENT OF TECHNIQUES

Need to increased the number of bendway weirs in open river
Remove all bendway weirs in open river

Looked at this as an expert system – manager would have objective or action that he would refer to this system for options.
We made no value judgment on the management options (except for beaches in main channel – too dangerous)

Reference Pool recommendations concerning mussels and mussel bed surveys.

<u>GROUP 3</u>

Participant List: Dave Berndt, Mark Beorkrem, Jerry Stroud, Dan McGuiness, Gary Christoff, Eric Laux, Joyce Collins, Brian Johnson, Lynn Muench, Bob Hrabik

MANAGEMENT ACTIONS:

Water Quality:

Water Clarity is less of a concern in lower Upper Miss than in pooled portions of the river due to the decrease in sediment movement from Mo River system.

Stabilization is a two edged sword for Open River portion of the river. Ecosystem needs more sediment in this reach to DECREASE water quality to facilitate biological needs of aquatic species. Systemic and site specific management of banks to facilitate erosion is preferred to bank armoring. This is in conflict with current program of bank stabilization.

Eliminate Pool Scale Drawdown from Open river management actions.

Remove dredge spoils from floodplain with the caveat that system needs sediment

Dissolved Oxygen add as a Water Quality Parameter

DO Management Actions:

Break up stratification in side channels and backwaters through increase of flows/connectivity particularly low water periods

Notch, move, install or remove dikes or closing structures

Dredge openings

Nutrients – dissolved or solid

BMP's on upland areas

See DO Management actions through moving nutrients through the system

Carbon Input:

Increase woody debris and proper mix of carbon inputs

Restore riparian corridors

Water Clarity - BACKWATERS:

Remove pool scale drawdowns

Geomorphology – Backwater Depth:

Eliminate Consolidate sediment

Dredging is one tenth the cost of rock structure for achieving backwater depth even factoring in re-dredging required every ten-twenty years and returns biological response very quickly.

Physical Excavation to create more water areas ie: side-channels, backwaters

Water Level remove Pool Scale Drawdown as a management action

Levee setbacks, notches, pumping, log control structures etc. add as a management action that can affect water levels

BMP practices for stormwater management

Reforestation of floodplains

Geomorphology -Connectivity – placement of water level control structures to manage flows

Remove #39 Increase Terrestrial areas

Pattern of Habitats – Aquatic Areas

Eliminate #53 & #59 as a management action

#52 add floodplain after delta areas

add Restore meanders to tributary

#84/85 specific as dredge material

Terrestrial – eliminate #86 Beaches

Pattern of habitats: Land Cover Use

#103 change to Timber Stand Management to create wetlands, expand diversity of forest cover, land cover

#106 clarify as plant material

Gated isolated habitat drawdowns

Plants and Animals: Fish

Add Improve angler access and angling opportunities

#113 add "native fish" to the sentence

Add Conduct bio-manipulation and bioengineering of fish

Plants and Animals: Wildlife

#114 add bioengineering

Plants and animals: Exotics

#119 control and eliminate invasive exotic species
#121 Change to Regulate Great lakes ballast water
#125 change to Kill Zebra Mussels (no lock chambers on open river)
Add Utilize Bio-controls

Plants and Animals: T&E

Add Require Implementation of recovery plans
Continue to implement UMR biological opinion
Take a community approach to management of threatened or endangered species
Supplemental stockings of desired species

Plants and Animals: All

Add Increase education about the importance of the river corridors for neo-tropical migratory birds and other purposed

Add Increase education on the importance of riverine corridors for plant and animal species

GROUP 4

Participants List: Bob Hughey, Butch Atwood, Don Huffman, Karen Westphall-chart recorder, Reid Adams, Rob Maher, Dean Corgiat, Danny Brown, Deck Major, Christine Favilla, Jon Duyvejonck - recorder

Management actions:

Water Quality

1. Watershed BMP- amend to include restoration of tributary mouths. Channelized tribs on floodplain could be restored to allow sediment deposition on floodplain before it empties into the main river.

2. Stabilizing River Banks – Need to consider all methods of bank stabilization (i.e. bio-technical, including no stabilization in some locations). Need to experiment with different methods to determine best for a given locations.

Add: restoring a natural hydrograph through pool drawdown would help achieve this. However some drawdowns are poorly timed and do not coincide with natural hydrograph.

4. Minimize dredging- Is it preferable to build regulating works to dredging? Consider beneficial uses where possible. Placing material in farm fields.

8. tributary reservoirs should be considered under BMPs. Traditional large reservoirs in uplands are not desirable in some states. Concern for fish passage through these is a concern.

Add: Modify barge loading/fleeting actions/scheduling to minimize sediment resuspension from tows.

17. remove exotic carp, not all bottom feeding fish

Add: Increase mussel populations to help water clarity

Reiterate importance of natural hydrograph to help BW clarity

Geomorphology

Water Level –

BMP practices in watershed would affect level in river

Apply to all parameters under Geomorphology: Year-round environmental pool level management is needed; not just spring/summer draw-downs. This includes winter draw-downs/raises. This applies to both main channel and backwaters, floodplains,

42. Increase water levels seasonally

40. In addition to notching, include removal of structures

44. remove levees or notch

45. Consider natural fish passage-ways (i.e. at LD 25) to promote fish passage

Add: Barging/transporting fish around dams

Pattern of Habitats

61. include rock gabions

add: Consider application of bendway weirs in pooled section of river

Terrestrial

Increase transition zones (succession, habitat gradations) from aquatic to terrestrial to uplands. Create vegetation gradients from the floodplain to uplands. Need travel corridors from aquatic/wetland habitats to upland habitats.

Promote forest succession

<u>Plants and Animals</u>

Fish

Continue fish monitoring

Add: encourage commercial markets for Asian carp species

Mussels

Regulate commercial mussel harvest. Reintroduce native species. Raise public awareness of mussel values. Collect baseline mussel data.

Exotics

Change item 126 by striking words “in aquaculture”.

T&E

Add item Reintroduce T&E species.

143. Reconfigure loading/fleeting to improve air quality.

144. Increase mooring facilities near locks and at other locations (near river mouths) to reduce tow generated air emissions

Appendix G. Species and Population Parameters

Purpose: To identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.

Background: Recent environmental planning efforts for the Environmental Management Program and other Upper Mississippi River System restoration and maintenance programs have focused on habitats and the impacts of Corps activities on habitats. It has been recognized that planning needs to be expanded to include additional functional and structural ecosystem elements.

During the planning stages of this workshop, organizers were considering objectives for plant and animal species and quickly encountered difficulty in selecting guilds, species, or units of measure for plants and animals. Emergent and submersed aquatic plants, diving ducks, and dabbling ducks were eventually selected based on the perception that knowledgeable resource managers could interpret the units of measure selected. It was determined that stem density was a relatively standard unit of measure for aquatic plants and that use-days during migration periods were relatively standard measures of waterfowl abundance.

Specific objectives for fish were desired, but the selection of guilds, or species, or units of measure quickly complicated the issue. It was decided therefore to back-off on the specifics for fish objectives and only indicate that there is an objective for several general categories of fish determined during earlier phases of the Navigation Study: protected, sport, commercial, forage, and exotic fishes in channel and backwater habitats. The unit of measure became particularly complicated because of our desire to establish quantitative objectives, but our general inability or lack of commitment to fish community stock assessments. Discussion of the unit of measure is particularly important because of our need for measurable objectives and our selection of evaluation tools.

These issues were discussed during a plenary session at the workshop, with the results to be forwarded to an expert panel. A focus group of workshop participants will continue work with the expert panel to refine fisheries objectives. The larger list of species such as reptiles, amphibians, other birds, and mammals will be considered during future phases of the adaptive management and assessment process recommended in the Navigation Study Interim Report.

Results:
One workshop participant reminded the group that there is a long-term commercial fish catch database maintained by the Upper Mississippi River conservation Committee (UMRCC) that can be helpful in evaluation species populations on the UMRS. States also maintain similar records individually. While not providing absolute abundance estimates, the database is a good barometer of change over time in the commercial fishery. These databases have been very helpful in tracking exotic species.

Another workshop participant informed the group that there is an ongoing effort to establish a baseline demographic for fishes in the Middle Mississippi River reach.

The group was informed that the Audubon Society has launched an initiative to establish and survey “Important Bird Areas” along the UMRS. Audubon will be surveying state-by-state to identify restoration areas and to conduct long term monitoring. It was added that Audubon’s Christmas Bird Count and Breeding Bird Surveys were also valuable tools to track bird species presence and trends. These databases also do not provide abundance estimates, but they have helped evaluate species distribution for many years.

It was asked how species would be linked to the habitat variables that are typically modified as part of river restoration projects. The thought was that this was important to be able to evaluate whether project objectives had been achieved. There was concern that focusing on a small set of species may not detect community level response, either beneficial or adverse. Habitat evaluation procedures like the Wildlife Habitat Appraisal Guide (WHAG) and Aquatic Habitat Appraisal Guide (AHAG) developed by the Corps were proposed as community level evaluation tools. Species specific Habitat Evaluation Procedures (HEP) are of limited value because they sometimes emphasize some habitat variable over others and frequently don’t incorporate all habitat variables.

Some responded to the HEP discussion with the real-world observation that AHAG results are poor indicators of actual project performance in terms of fish use of restored habitats. Previous AHAG model results showed poor agreement with sampling results from restored areas. It was recommended that the fisheries management community work to complete an Index of Biotic Integrity (IBI) for large rivers. Development of an IBI would require significant validation to ensure its utility throughout the UMRS.

Refuge managers were puzzled why the Corps would venture into species level issues anyway. The Corps, they said, has authority for habitat management and other state and Federal agencies have responsibility for species.

Invertebrates and less mobile species were recommended as the best indicators of restoration response because they would be most impacted by changes in local habitat conditions. Mammals and birds with large ranges are typically impacted by conditions over large special areas and do not necessarily respond only to changes in local habitat conditions.

As occurred at other workshops, participants recommended tracking exotic, threatened, and endangered species as indicators of community level responses. One participant thought freshwater mussels may be good indicators because they reflect local water quality conditions and, potentially, could be used as indicators of fish species presence.

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to the species and population measurements. The entire plenary report can be found in Appendix C.

<u>Species and Population Plenary Session:</u>

– Report of harvest for commercial fish. This is relatively easy to measure.

– Maximize natural species diversity.

Theiling – We don't have good records so it's hard to determine a historic baseline.

– Audubon has launched "Important Bird Areas". They will be looking at the Mississippi River. Surveying State-by-State and identifying restoration areas and long term monitoring to determine if restoration works.

Theiling – Christmas Bird Counts and Breeding Bird Surveys are other ideas.

– Trying to establish a baseline of demographic for fish in the Middle Miss. We are looking at age structure and survival mortality to determine how system is doing.

– How do you take the species and link them up to the functions you are trying to restore? How will you know if you have achieved your objectives? Keystone species – they are there because public wants them but may not have ecological importance. Will you pick a species and use that to monitor success?

Theiling – That is the way we have done things. We are posing this question to you. The DNR has responsibility to their constituent.

– Had difficulty achieving population estimates.

– Illinois River Sauger examples.

- Link to WHAG or AHAG. Can't do intensive biological surveys on every single site.

Theiling– Like the idea of Good, Medium and Bad habitats. Doing it on closed systems is a good idea and on different habitats

– Questions with AHAG. Only study on AHAG said there was no relation between reality and model outcomes.

– What are the biologists doing to assess the restored areas in the Everglades? Do they have a monitoring methodology we can draw on?

Theiling – It's going to take more than 7 people on 300 miles of river to monitor whole populations.

Theiling – Illinois River is a Natural Experiment. Clean Water Act and water treatment has really helped to improve the river. They don't need assessments to tell if it works. They can tell if it works. If bass experts are coming then it is good enough for them for most biologists.

– David Thompson hired commercial fisherman to do the sampling in the 1930's-1950's. Is that an option?

– Are you implying that Sport species… are native species?

– Yes. However, could use these techniques on exotics as well.

– Why doesn't relative abundance work?

– Christmas tree effect. (If you put a Christmas tree in a farm pond. If you sample near it you will find a lot of individuals. There aren't more individuals in the pond, only more structure, so they are concentrated there).

– But you are looking for trends over several years with relative abundance.

Theiling – In low water years get more catch per unit efforts because of concentration

– Use mussels as indicators because they require host fish? They don't move around as much as fish.

– Puzzled why the Corps would venture into the species issue. Invertebrates would be a good indicator of system health. Mammals and Birds are getting into so many more factors that you would have more questions about your data.

Theiling – But what about the Natural Resource Agencies at all?

– That's our job. But we still look at habitat.

– What about IBI – Index of Biologic Integrity? What happened to Big River IBI?

– Looked at Rock Island 404 -???

– Merging all of the datasets that are out there?

– Open river is being analyzed but are a long ways away from specific information.

Theiling – If money and time were no issue would you want to do total fish estimates.

– Yes, that's the only way to answer some of these questions.

– Kill off large stretches to get biomass estimates but general public wouldn't accept and would have to do it again and again to see changes in trends.

– What about bioacoustics

– This is the tool of the future, but right now you can't differentiate species. However developing some kind of Matrix like the IBI is a really good idea.

– Is this going to be put to the expert panel?

Theiling – Yes

– MO is going to try to do estimates on Shovel Nose Sturgeons. Maybe those results will help. Estimate of Flathead Cat. Most of the retrieval was in pool 22. So find something that doesn't move much

– Our Flatheads and Paddlefish are moving quit a bit.

– We can't neglect community level analysis (IBI)

Appendix H. Conceptual Model Presentation

The overall purpose of a conceptual model developed for the UMR-IWW Navigation Study is to identify the linkages and sequencing of identified objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to the overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Develop a structure for additional input from stakeholders

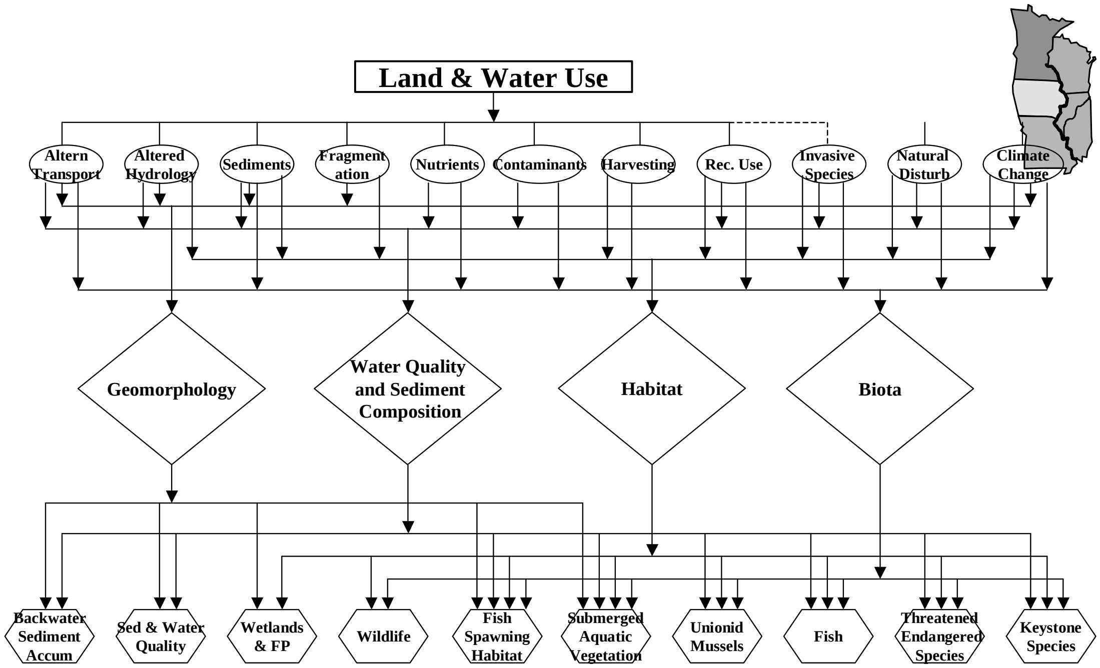
The following slides were used at each of the workshops to present information on the current draft conceptual model.

UMR-IWW Ecosystem Conceptual Models

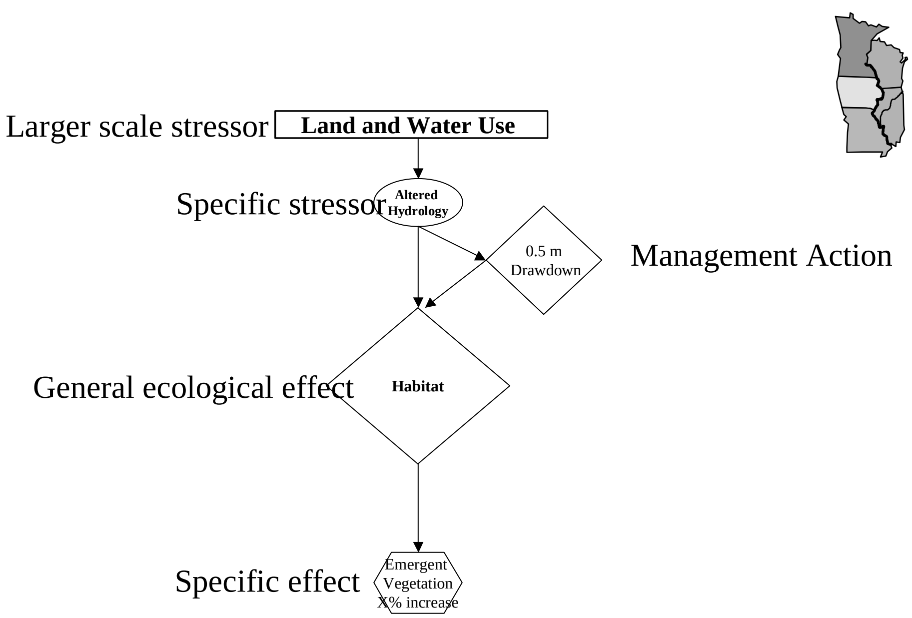
- **Background**
  - Conceptual models help to gain a better understanding of the linkages between:
    - Environmental Objectives
    - Management Actions
    - State of the Ecosystem
- **Task**
  - Discuss the utility of developing a UMR-IWW ecosystem conceptual model

Purposes of a Conceptual Model for the UMR-IWW

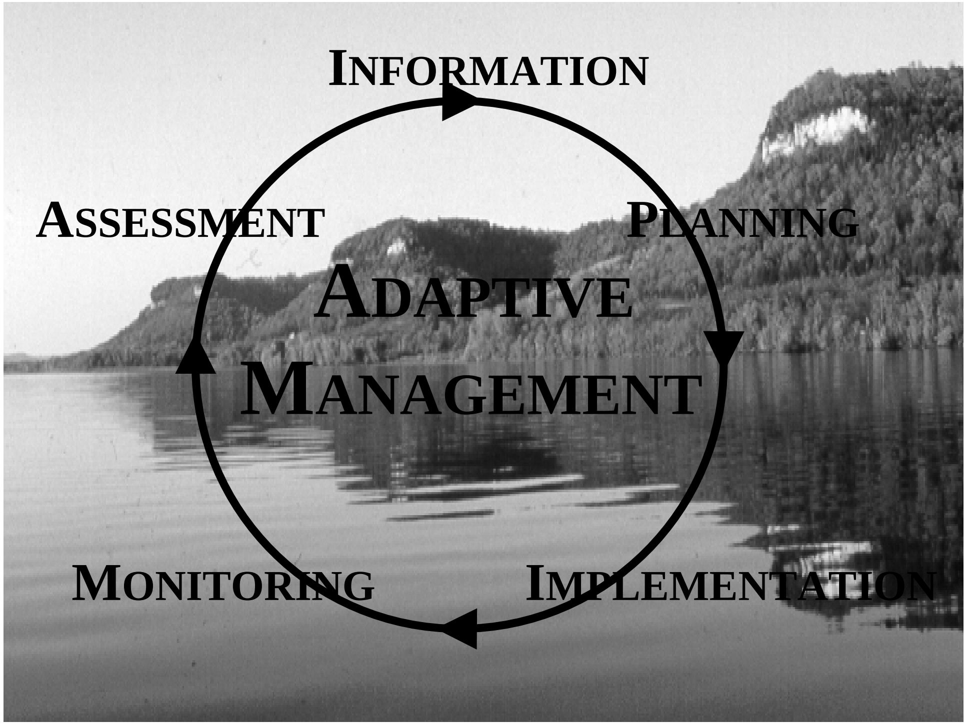
- To visually present a complex system
- Creates a framework for additional input
- Provides a basis for decision making in relation to the achievement of objectives
- Develops a structure for implementing adaptive management and restoration



Land & Water Use
Altern Transport
Altered Hydrology
Sediments
Fragment ation
Nutrients
Contaminants
Harvesting
Rec. Use
Invasive Species
Natural Disturb
Climate Change
Geomorphology
Water Quality and Sediment Composition
Habitat
Biota
Backwater Sediment Accum
Sed & Water Quality
Wetlands & FP
Wildlife
Fish Spawning Habitat
Submerged Aquatic Vegetation
Unionid Mussels
Fish
Threatened Endangered Species
Keystone Species



Larger scale stressor
Land and Water Use
Specific stressor
Altered Hydrology
0.5 m Drawdown
Management Action
General ecological effect
Habitat
Specific effect
Emergent Vegetation X% increase


INFORMATION
ASSESSMENT
PLANNING
ADAPTIVE
MANAGEMENT
MONITORING
IMPLEMENTATION

Appendix I. Power Point Presentations

This section contains the power point slides used to present background and introductory information throughout the workshops. They are given in the order they were presented on the agenda.

The Power Point Presentations will be included in the final version of the printed workshop reports. You can download them by going to the following FTP site

ftp://ftp.usace.army.mil/Incoming/MVR/NavStudy/**.**

Appendix I. Peoria Environmental Workshop Report

The following report summarizes the results of the Peoria Environmental Workshop that was held November 6-7, 2002. The report includes:

1. a summary of the workshop and results,
2. tables of identified UMR-IWW environmental objectives,
3. a table of identified management actions,
4. a narrative on UMR-IWW species and population parameters,
5. working group reports, and
6. the plenary session report.

Upper Mississippi River – Illinois Waterway System Navigation Feasibility Study

Peoria Environmental Workshop

November 6-7, 2002
Peoria, IL

DRAFT REPORT

United States Army Corps of Engineers

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EXECUTIVE SUMMARY

Introduction and Workshop Process

The restructured Upper Mississippi River –Illinois Waterway (UMR-IWW) System Navigation Feasibility Study is focused on the authorized Federal navigation projects on the Upper Mississippi River System (UMRS; including the Illinois Waterway; Figure 1) and the ecological and floodplain resources that are affected by these navigation projects. The objectives of this restructured feasibility study are to relieve lock congestion, achieve an environmentally sustainable navigation system, and address ecosystem and floodplain management needs related to navigation in a holistic manner. The restructured navigation study will seek to ensure that the rivers and waterway system will continue to be an effective transportation system and a nationally treasured ecological resource. The restructured study will: (1) further identify the long-term economic and ecological needs, and potential measures to meet those needs, through collaboration with interested agencies, stakeholders and the public; (2) evaluate various alternative plans to address those needs; (3) present a plan consisting of a set of measures for implementation that will achieve the study objectives; and (4) identify and address issues related to the implementation of the recommended plan.

The study area comprises the entire Illinois Waterway and the Upper Mississippi River. The Illinois Waterway extends 327 miles from its confluence with the Mississippi River to Lake Michigan via the Illinois River, Des Plaines River, and a series of canals. The Upper Mississippi River extends 854 miles from the confluence with the Ohio River to Upper St. Anthony Falls Lock in Minneapolis-St. Paul, Minnesota. The study area lies within portions of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The total Illinois Waterway and Mississippi River navigation system contains 1,200 miles of nine-foot deep channels, 37 lock and dam sites (43 locks) and thousands of channel training structures (Figure 1).

Much of the UMRS lock and dam system was in place by the 1940s. Except as noted below, the locks are 600 feet long, although, modern tow configurations include 15 barges and approach 1,200 feet long. As a result, most tows must lock through using a time-consuming two-step process in which the first three rows of barges (9 barges) are locked through first and the last two rows of barges (6 barges) and the tow boat are locked through second. The entire process may take 1.5 hours or longer depending on many variables. In contrast, Lock 19 has a 1,200-foot lock and Melvin Price Lock and Dam (Lock 26 replacement) and 27 have both a 1,200-foot and a 600-foot chamber at each site. The lockage process takes an average of 1.0 hours at Lock 19 and 0.6 hours at Locks 26 and 27.

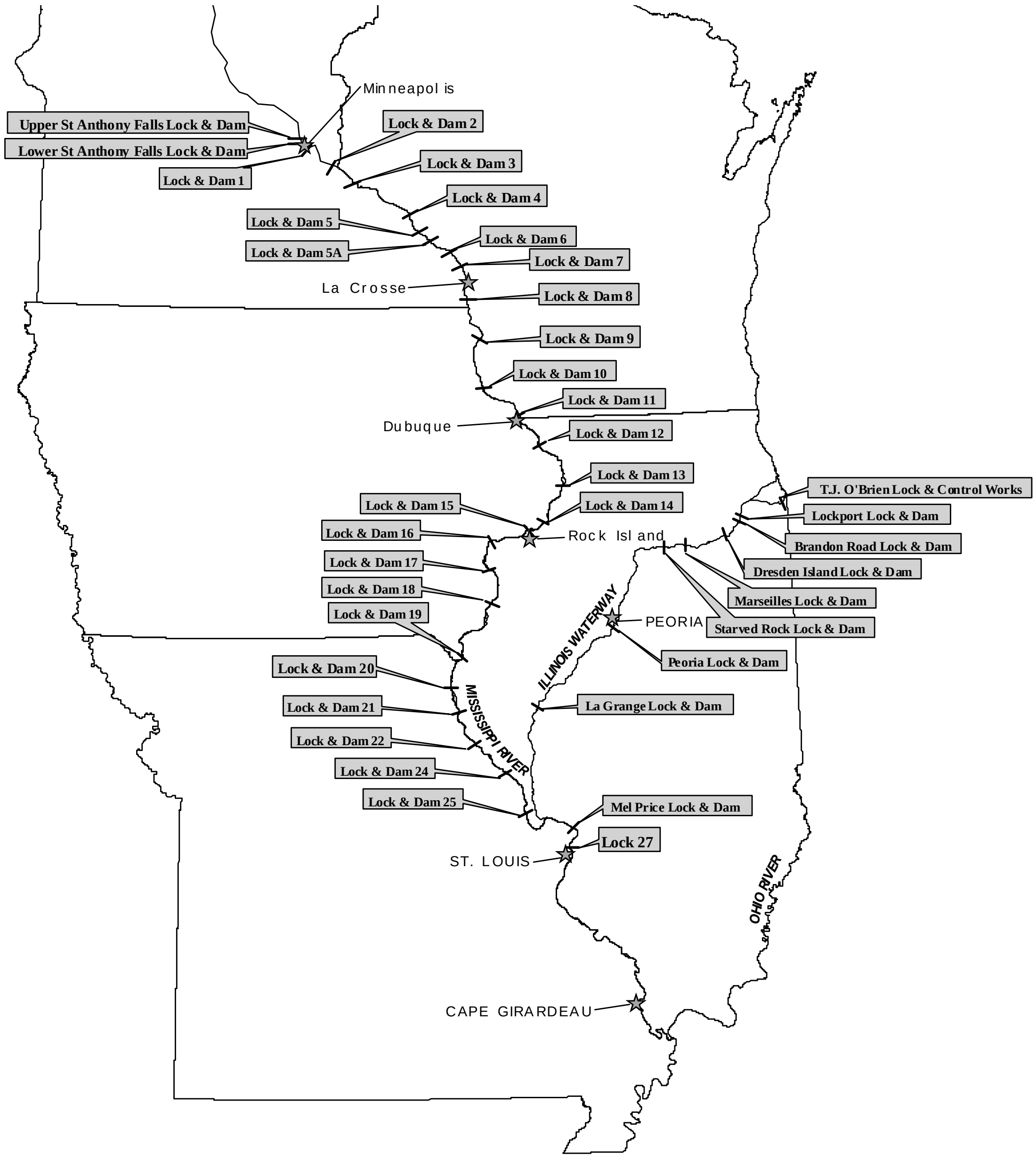

Figure1. UMR-IWW Locks and Dams.

Eight locks on the Upper Mississippi River and 3 Illinois Waterway locks were among 20 locks with the highest average delays in 1987 at the beginning of this study. This remains the case with UMR-IWW facilities highly ranked in the peak monthly delays at locks around the country in 1998. The UMRS had over half (19 of 36) of the most delayed lock sites in the country. Under current conditions, delays to tows are common at a number of locks on the UMRS. In general, delays are greatest at the most downstream 600-foot locks. For the 10-year period 1990-1999, delays per tow average 3.4 hours at Locks 20-25; 2.2 hours at Locks 14-18; 0.9 hour at Locks 8-13; and 0.4 hour for Upper St. Anthony Lock to Lock 7. On the IWW over the same period, delays per tow average 1.8 hours at Peoria and La Grange and 1.1 hours for the other locks.

Ecosystem

The Upper Mississippi River ecosystem includes the river reaches described above, as well as the floodplain habitats that are critically important to large river floodplain systems. The total acreage of the river-floodplain system exceeds 2.6 million acres of aquatic, wetland, forest, grassland, and agricultural habitats. The Mississippi Flyway is used by more than 40% of the migratory waterfowl traversing the United States. These Trust Species and the threatened and endangered species in the region are the focus of considerable Federal wildlife management activities. In the middle and southern portions of the basin the habitat provided by the mainstem rivers represents the most important and abundant habitat in the region for many species.

Habitat types are disproportionately distributed throughout the river system, and their absolute abundance is dependent on the total area of the reach under consideration (Figure 2). The largest differences occur in the amount and distribution of agriculture and the proportion of open water in the floodplain. Agriculture dominates the wide floodplain south of Rock Island, Illinois and open water occupies a greater proportion of the floodplain north of Clinton, Iowa. Wetland classes are generally more abundant in northern river reaches, wet meadows are fairly evenly distributed, and grasslands are rare throughout the river system. Forest classes generally occupy between 10 to 20 percent of the floodplain in a narrow strip along the river banks throughout the system.

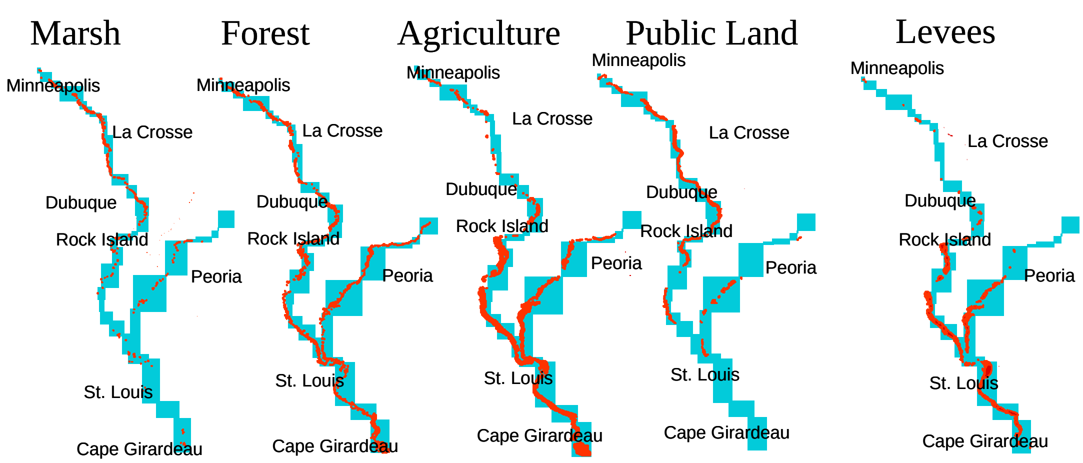

Figure 2. Areas in red show the extent of selected landcover or landuse types on the UMR-IWW.

Section 1103 of the Water Resources Development Act of 1986 (WRDA 86) recognized the Upper Mississippi River system as a unique, nationally significant ecosystem and a nationally significant commercial navigation system. The system provides:

1. A means for shippers to transport million of tons of commodities within the study area---130 million tons on the Mississippi River and 44 million tons on the Illinois Waterway in 2000,

2. Food and habitat for at least 485 species of birds, mammals, amphibians, reptiles, and fish (including 10 Federally endangered or threatened species and 100 state listed species),

3. More than 226,650 acres of national wildlife and fish refuge,

4. Water supply for 22 communities and many farmers, and industries,

5. A multi-use recreational resource providing more than 11 million recreational visits each year,

6. Cultural evidence of our Nation's past.

Establishing Goals for the System

The original feasibility study was narrowly focused on the problem of reducing commercial navigation traffic congestion on the system. Coordination was occurring between economic and environmental interests, however, the work was being accomplished independently. With the new focus of the restructured study on sustainability, it became important for the stakeholders of the system to prepare a common vision for the future of the UMRS. In November 2001, the Economic Coordinating Committee (ECC) and the Navigation Environmental Coordinating Committee (NECC) met jointly to prepare this vision:

> *"To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System"*

The following definition of sustainability was collaboratively developed and agreed to by the group as well:

> *"The balance of economic, ecological, and social conditions so as to meet the current, projected, and future needs of the Upper Mississippi River System without compromising the ability of future generations to meet their needs."*

This definition will serve as the primary goal for integrated and adaptive management of the Upper Mississippi River System.

Planning for future navigation system infrastructure needs; navigation system operation and maintenance; habitat protection, enhancement, and restoration; river recreation; floodplain management; and water quality management should be conducted in the context of a set of clear goals and objectives for condition of the UMRS. Setting these goals and objectives should be done collaboratively, with participation of the full community of river stakeholders. Development of a set of measurable objectives for integrated and adaptive management of the UMRS will be challenging. It will require considerable collaborative effort, making use of conceptual models, predictive models, and visualization tools to comprehend the interconnections between system components and to enable the community of stakeholders to actively participate in planning for a

sustainable multiple use river-floodplain system. Integrated planning will be an on-going effort to optimize the National benefits achieved from efficient and effective adaptive river management.

Introduction to the Workshop

Four two-day workshops were held during November, 2002, to aid the process of establishing measurable environmental objectives for the Upper Mississippi River-Illinois Waterway System (UMR-IWW). Workshops were conducted in Peoria, Illinois, St. Louis, Missouri, La Crosse, Wisconsin and Moline, Illinois.

The workshops were structured to achieve the following main objectives:

1) <u>Identification of UMR-IWW environmental objectives</u>
   Collaboratively review, refine, and add to a database of specific, quantitative, local to regional scale environmental objectives (for the workshop region) building on previous work from the EMP Habitat Needs Assessment, Pool Plans, USFWS Comprehensive Conservation Plans, and related study efforts.
2) <u>Identification of UMR-IWW management actions</u>
   Review and identify management actions that are most likely to contribute to achieving the established goals and objectives.
3) <u>Discuss and identify species and population parameters</u>
   Identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.
4) <u>Present and discuss UMR-IWW ecosystem conceptual model</u>
   Present and discuss the utility of developing an UMR-IWW ecosystem conceptual model to gain a better understanding of the linkages between environmental objectives, management actions, and the state of the ecosystem.

Participants at the Peoria Workshop were invited from a variety of organizations including the U.S. Army Corps of Engineers, U.S. Department of Transportation – Maritime Administration, U.S. Fish and Wildlife Service, U.S. Geological Survey, Illinois Department of Natural Resources, Illinois Department of Water Resources, Illinois Natural History Survey, MARC 2000, MRBA, UMIMRA. There were 31 people who participated in this 2-day interactive process. This report presents the results of the enormous amount of effort and energy the participants contributed to the workshops.

Workshop Process

The workshop was organized by the U.S. Army Corps of Engineers (USACE) Rock Island District. A subset of the workshop participants helped review and edit this Workshop Report. Outside review by non-participants will not be part of the process. No content changes were made by the editors and the participants checked that accurate representations were made of the work they had done during the workshop.

The Illinois River workshop was conducted 6 - 7 November 2002 at the Tri-County Regional Planning Commission, Peoria, Illinois. There were 31 participants, with most present the entire duration of the workshop. These participants, from more than 50 issued invitations, included state and federal wildlife agency personnel, non-governmental agency representatives, and public citizens. Participants and invitees are listed in Appendix A.

The agenda for the workshop (Appendix B) was followed loosely, allowing extra time for questions and time in the workgroups as needed. A record of these plenary discussions is found in Appendix C, while workgroup reports can be found in the appendices related to their topic of discussion.

Background on the General Workshop Structure

The workshop process was designed to maximize the time and resources available at each of the meetings. The workshops utilized three components of meeting structure to meet the objectives of eliciting information, discussing key issues, and informing the participants of developing strategies.

The first component was the standard meeting style wherein a few speakers provide information to the group as a whole allowing for questions and some discussion.

The second component was key for eliciting information and involved breaking the group into working groups based on some criteria such as geography or content. Breaking a large meeting into working groups comprised of 10 or fewer individuals optimized the opportunity for participation of the greatest number of people and for timely discussion and progression on key issues. The number of working groups varied depending on the number of participants and geographic areas to be covered.

The third component were the plenary sessions, which allowed all of the participants to hear a summary of what was accomplished in the other working groups and to have input into the entire set of results. It also allowed us to refine the GIS database as a coordinated team.

Before getting started with the first task of this workshop, each participant was asked to introduce themselves and to write out and then read aloud answers to an introductory question. This process allowed for expression of individual perspectives without being immediately influenced by previous responses. This process indicated potential areas of common ground and provided a first insight into the diversity of perceived issues present in the group. Answers to the question can be found in Appendix D of this report.

After the Workshops

The workshops are an early step in a planning process to establish environmental alternatives that strive to secure the environmental sustainability of the UMR-IWW. Once the environmental objectives are well defined and management actions are identified to achieve them, the next step will be estimating the potential costs and outcomes (i.e., benefits) for the suggested actions. This information will be used to develop alternative plans (made up of multiple combinations of management actions) that seek to address the local, river reach, and system-wide needs of the UMR-IWW ecosystem. These environmental alternative plans will then be integrated with alternative plans for the UMR-IWW Navigation System. Tradeoff analysis will be conducted to identify and compare the environmental, economic, and social benefits of the integrated plans. The results of the alternative analysis, and further collaborative review and input from stakeholders, will be used to develop a recommended plan portrayed in the Final Feasibility Report scheduled for completion in late 2004.

Formal Report

Five reports will be produced as a result of the four, two-day workshops. The first four reports are Workshop Reports, which will be reviewed by the workshop participants. A final integrated report summarizing the results from the four workshops will be published as part of the Navigation Study's formal documentation process. The final integrated report will contain a full accounting of the site-specific objectives in the form of an atlas as well as the tabulated system, reach, and pool wide objectives and management actions (Table 1). Workshop participants will have an opportunity to review and comment on the integrated Draft Environmental Objectives Planning Workshops Report before its completion in early 2003.

Table1. UMR-IWW System Navigation Feasibility Study Environmental Objective Workshops reports contents.

- <u>Peoria Environmental Workshop Report</u>
    - Summary of Illinois River workshop and results
    - Tables of identified Illinois River pool-wide and site-specific objectives
    - Table of identified management actions
    - Narrative of species and population parameters
    - Working Group Reports
    - Plenary Session Report

- <u>Environmental Objectives Planning Workshops Report</u>
    - Summary of all four workshops
    - Tables of all identified UMR-IWW pool-wide and site-specific objectives
    - Atlas maps of all identified site-specific objectives
    - Table of all identified managements actions
    - Narrative of UMR-IWW species and population parameters

Environmental Objectives

The primary goal of the Environmental Objectives Planning Workshops was to have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts. The Peoria Workshop was successful in reviewing and identifying both site-specific and pool-wide objectives for the Illinois River using a combination of working groups and plenary sessions. Objective atlas maps and worksheets were reviewed and filled out by breakout groups. A plenary session then followed where the information from each group was compiled into the objective database using GIS tools (Figure 3).

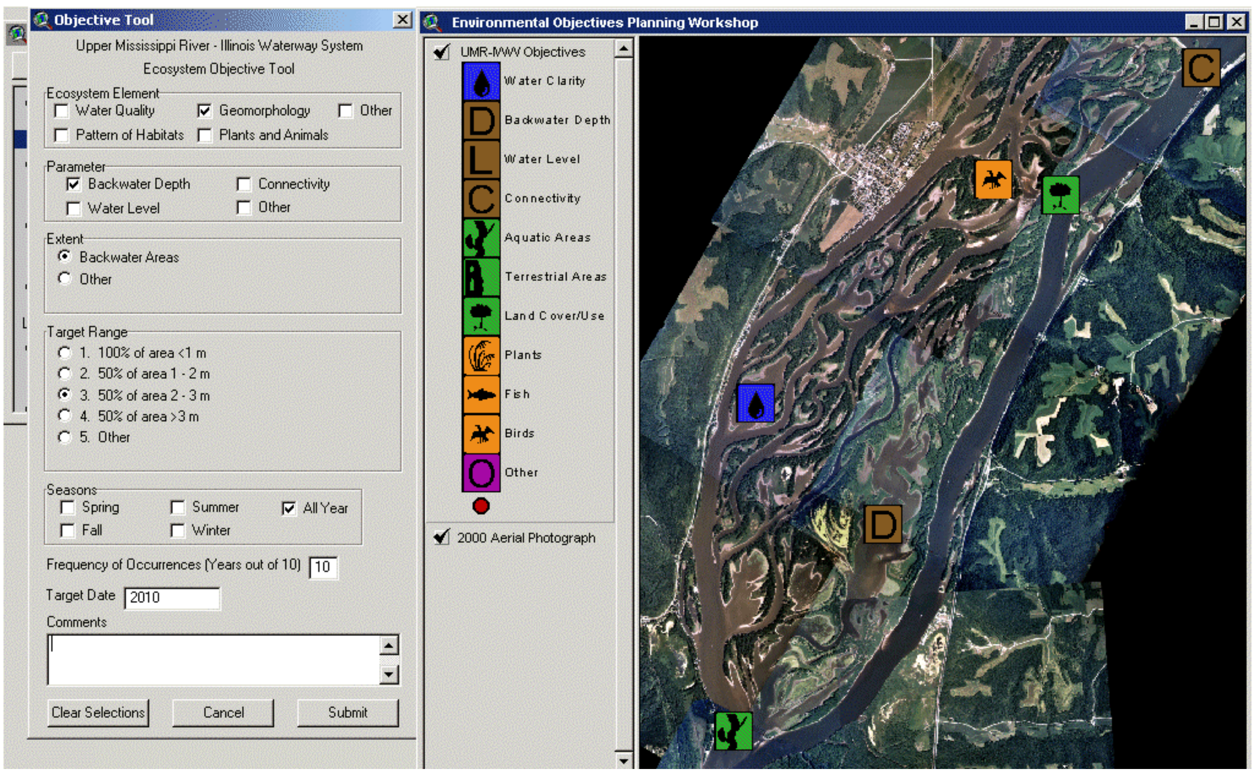

Figure 3. UMR-IWW System Navigation Feasibility Study GIS Objective Tool and Database.

The environmental objective database used at the Peoria Workshop included 115 site-specific objectives obtained from the Upper Mississippi River System Habitat Needs Assessment (HNA) and Illinois River Ecosystem Restoration – Alton Pool Draft Fact Sheet. Two additional data sources were identified during the Peoria Workshop and later added to the objective database. They included objectives noted by the Fish and Wildlife Interagency Committee (FWIC) Restoration Priorities and Habitat Rehabilitation and Enhancement Project (HREP) documents. HREP objectives were noted only for projects described as 'under general design' or 'future opportunities'.

An additional 227 site-specific objectives were identified through the workshop process bringing the total to 342 environmental objectives for the Illinois River (Table 2). Over 80% of the objectives were located in the lower three pools of system with land cover/use and backwater depth being the most common types identified. The 29 Illinois River objectives identified as 'Other' included objectives related to mussel beds, restoring natural tributary meanders, and reduction of contaminated sediment. Appendix E provides additional detail on the objectives listed in Table 2. Maps of all site-specific objectives identified in the workshops will be distributed for review in the integrated Environmental Objectives Planning Workshops Draft Report (in January).

Table 2. Number of site-specific environmental objectives identified for the Illinois River.

	Illinois River Pool								
Objective	**Lockport**	**Brandon**	**Dresden**	**Marseilles**	**Starved Rock**	**Peoria**	**La Grange**	**Alton**	**Total**
Water Clarity	0	0	1	4	3	14	22	7	51
Backwater Depth	0	0	1	4	3	15	25	8	56
Connectivity	0	0	1	2	1	3	13	7	27
Aquatic Areas	0	1	2	2	3	9	12	14	43
Terrestrial Areas	0	0	0	3	2	23	3	23	54
Land Cover/Use	0	0	1	5	4	17	29	22	78
Plants	0	0	0	0	0	1	0	0	1
Fish	2	0	0	0	0	0	0	0	2
Birds	0	0	0	0	0	1	0	0	1
Other	0	1	3	1	4	11	2	7	29
Total	2	2	9	21	20	94	106	88	342

Quantitative target ranges for objectives were usually not identified at specific locations. Rather, they were noted with the pool-wide objectives. Some examples of the pool-wide environmental objectives identified by workshop participants include:

- Maintain 50% of currently isolated backwaters for exclusion of exotics and protection of high quality habitat.
- Increase connectivity to 25% of currently isolated backwaters.
- Protect, maintain, and enhance threatened and endangered species habitat and other natural areas.
- Recreate the natural hydrograph.
- Reduce incidence of summer water level "bumps" to less than 1 year in 3.
- Restore aquatic vegetation in backwater areas.
- Reduce sedimentation throughout each pool.
- Control all exotic species.
- Increase bottomland hardwood forest acreage by 10% and improve diversity.

A more complete list of Illinois River pool-wide objectives gathered at the Peoria Workshop is located in the Environmental Objectives Appendix E.

Management Actions

The purpose of the Management Actions breakout groups and plenary session was to review and identify management actions that were most likely to contribute to achieving the established goals and objectives. This will be accomplished by reviewing current tables of management actions (see the *Interim Report for the Restructured Upper Mississippi River – Illinois Waterway system Navigation Feasibility Study* pages 251-255), tailoring them to the ecosystem elements under consideration, and revising them where necessary. Management Actions are defined as specific actions, tools, techniques or combinations of actions, tools and techniques used to meet defined objectives. Management actions are implemented as specific projects whose reconnaissance and feasibility studies provide the detail required to assess and develop environmental analyses, funding, staffing, engineering and partnerships needed to implement the plan. Table 3 is an example of the Management Actions Tables where actions have been changed or added. All management actions can be found in Appendix F.

Table 3. Example Management Action Table.

Element/ Parameter	**Extent**	**ID**	**Management Action**	**Comments**
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to consolidate soft sediments	
		4	Minimize dredge disturbance/frequency	
		5	Minimize dredge slurry return water	
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	
		9	Speed and wake restrictions - ~~rec. boats~~ (all watercraft)	
Comments/ Additions:			Evaluate and modify mechanisms to deal with watershed influences to eliminate spiking hydrographic cycle (system wide)	
			Restore natural tributary areas through delta areas	
			Minimize open water dredged material placement	
			Sediment traps	

Species and Population Parameters

Workshop facilitators posed the question of whether it was necessary to estimate the total abundance of fish, wildlife, or plants in the Illinois River. The simple answer was no because total population abundance estimates require a very considerable amount of sampling effort and estimates have considerable error associated with them. A better method to measure population response to environmental change is to sample relative abundance in various habitats to detect population change in response to environmental change. Another indicator of ecological improvements in the Illinois River is the vigor of the fishing tournaments and public use. It was also suggested that fish condition is another characteristic that might be measured to view of the condition of the river fishery.

The question of why we need precise population estimates was raised. The response was that USACE Division and Headquarters reviewers look for quantitative estimates of the benefits of restoration projects. The thought is that firm quantitative estimates of population changes may provide justification for restoration measures. A more detailed discussion can be found in Appendix G.

Conceptual Model

At the end of the workshop, participants were provided with a brief presentation on the ecosystem conceptual model being developed for the UMR-IWW Navigation Study. The purpose of the UMR-IWW conceptual model is to identify the linkages and sequencing of identified environmental objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to this overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Facilitate dialog and develop a structure for additional input from stakeholders

The ecosystem conceptual model presentation can be found in Appendix H. All the PowerPoint slides used during the 2-day workshop are displayed in Appendix I.

Appendix A. Invitation List with Participants Highlighted

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Appendix B. Agenda

Day 1

9:00	Opening *Hank DeHaan and Chuck Theiling*
9:10	Introduction to the Workshop Process and Participant Introductions *Rebecca Soileau*
9:30	UMR-IWW Restructured Navigation Feasibility Study Overview and Schedule *Ken Barr*
9:45	Vision, Goals, and Environmental Objectives *Chuck Theiling*
10:00	Working Definitions of Terminology for this Workshop *Nicole McVay*
10:10	Overview of GIS Database and Existing Objectives and Management Actions *Hank DeHaan*
10:30	***Working Groups (I)*:** Identify and refine environmental objectives for the Illinois Waterway ecosystem. .
12:00	Lunch
1:00	***Working Groups (I)*:** Continued work and Report Preparation
3:30	Plenary: Presentation of objectives identified by each working group and input into GIS
5:30	Adjourn

DAY 2

8:00	Plenary: Presentation and discussion of synthesis of results from previous days work
9:00	***Working Groups (II):*** Review and identify management actions that are most likely to contribute towards achieving the established goals and objectives
10:30	Plenary: Group presentations of new and revised management actions.
12:00	Lunch
1:00	Plenary: Overview of regional evaluation data and tools for assessing the efficiency of management actions both initially and in an adaptive management framework. Discussion of species and population parameters. *Chuck Theiling*
2:30	Review of Regional Ecosystem Conceptual Models
3:00	Workshop Closing

Appendix C. Plenary Session Notes

Peoria Workshop November 6th – Day 1

ChuckTheiling's Intro (9:10 –9:15)
Chuck Theiling's introduction briefly described what the workshop will accomplish as well as introduced Hank DeHaan, Nicole McVay, Rebecca Soileau and himself.

Participant Introductions (9:15 – 9:37)
See Section 6.

Ken Barr's Talk (9:37)- (9:53)
Ken Barr discussed the history of the Navigation Study – its original focus as well as some of the studies that originated from that process. He then went on to discuss the restructured navigation study, describing the vision as well as the new scope of the study. He showed how the two studies differed with respect to the ecological integrity (the original study focused on direct effects of construction or more tow boats on fish, sediment resuspension, mussels, etc; while the restructured study will consider the existing project impacts and establish objectives to have the environment reach a desired state). During his presentation he also displayed the six-step planning process and reminded all workshop participants that the Corps has to follow this process. He concluded the presentation by discussing how the environmental portion of the navigation study will be viewed in an adaptive management framework as well as showing the participants the schedule of the study. At the end of the presentation he told people that they were open to attend NECC/ECC meetings and that the meeting minutes could be found on the web.

Questions:
Where we are focused in the Environment? Or define the ecosystem with respect to the navigation system (implies no watershed context).

Barr – We are looking to the Navigation system itself. Objectives are focused on the floodplain (toe-of-bluff to toe-of bluff). Management actions will be implemented in regards to this study within the navigation system. It is being debated as to where navigation effects stop.

Does the term sustainability imply self-sustaining or will it include some input to maintain?

Barr - Sustainability cannot be thought of, on this highly maintained system, as self-sustaining. Operations and management will be part of this. Monitoring and performance evaluation will help determine the maintenance needs and influence new construction.

How does this effort mesh with efforts to modify authorities?

Barr – We might modify the navigation authority for dual purpose.

How does the Navigation Feasibility study mesh with CMP, CCP, and 519 efforts on the UMR-IWW.

Barr – We need to set objectives in the floodplain today. These objectives will be available for the other studies. However, they still will be different than what objectives are being looked at in the Illinois River 2020 and Comp plans.

Theiling – The navigation study gives us an opportunity to plan for EMP and other restoration efforts that for which we weren't previously able to do large scale planning. Partners didn't want us to spend scarce resources on planning, so they did it on their own through the Pool Plans.

<u>Chuck Theiling's Talk (10:00-10:20)</u>

Chuck began his talk by reviewing many of the reports that have been written concerning the environment of the UMR-IWW. He then went on to discuss how the Corps has structured this study and where in the study these workshops take place. Next he discussed the expert panel, their functions, the individuals who will make up the panel, as well as how they will fit into the entire process. Chuck then discussed goals, objectives and management actions. He displayed the goals from Grumbine that were adopted by the Navigation Study in the interim report as well as the goals listed in the UMRCC report "A River that Works and a Working River." Next he discussed objectives, described them and listed several example objectives. The following questions had to deal with objectives:

<u>Mid-talk Questions – 10:12-10:16</u>

Looking at Chuck's example objectives, are these sustainable? Are we setting objectives that are desirable or that are sustainable?

Theiling – Not without a lot of work.

We need to put sideboards on what is desirable vs. what is sustainable.

Treat this as the same thing as the Navigation system.

Theiling – Today get what is desirable and let later analysis determine what is achievable.

So focus today on what is desirable?

If we come to consensus, will it be funded? Or should funding be considered?

RESPONSE: Not today.

Barr - The objectives stay out there. We will keep chipping away at them. We will work at cost effective ways to achieve them. Will we ever complete the list? Probably not, but we will keep trying.

If biologists turn in what they want and the engineers build it, it may be more than a dollar per dollar cost for environmental measures than navigation.

Why are there Pelican's on IL River?

<u>Chuck Theiling's talk continued (10:16 – 10:20)</u>
Chuck continued his presentation by giving an overview of the framework for setting objectives. He then continued by showing where the data to create the objectives database came from. He concluded the talk by reiterating exactly where the focus of the navigation study was as well as discussing how other agencies and authorities could use these overarching goals.

Break

<u>Rebecca Soileau's Talk (10:40 – 10:53)</u>
Rebecca Soileau discussed the overall workshop process including a brief agenda. She then discussed the working agreement and had participants agree to abide by it. Finally she defined her role as a facilitator as well as the expected roles of the participants. After that, Nicole McVay presented the working definitions.

<u>Questions:</u>

What is the nature of the "Report" from the workgroups?

Soileau – This is a record or minutes rather than a consensus report.

How do we deal with gaps in data?

Theiling -We can write down comments about gaps in plenary sessions. Others can fill in later.

Barr – Please let us know if there are other reports and documents that we are unaware of.

<u>Hank DeHaan's Objectives Talk (10:55)-(11:32)</u>
Hank discussed the objective database, including where the information came from, and how the database is structured. This included a detailed discussion of the framework for setting objectives. He then gave a brief demonstration of the database in Arc View 3.2.

Questions:
Is the target date related to the implementation schedule or a range of time for the objective to be accomplished? We need a systematic way to use target dates so that the data from this workshop meshes with that from the other workshops.

Is setting target dates a form of prioritization (ranking)?

RESPONSE: It might be seen that way but we are not attempting to prioritize today.

DeHaan – Please go with 10-year increments.

Theiling – Some objectives will apply to a whole pool/reach so that will be a good point to have a range. From today, when would you like to see this objective achieved? We need to be realistic. What is achievable in the process? This is to give us an idea of expectations. We can do calculation from implementation date later.

Final Decision Baseline will be 2000, so 2020 means in the next 20 years.

Theiling – This is not a final answer, not a final cut. We can tweak this after the workshop and make it better. We can sort through your input from the comments. We aren't bean counters, but it is a part of our system.

What do we do about moist soil plants?

DeHaan – Put it in "other".

How do you define the area of an objective?

DeHaan - In the comments field.

What about conflicting ideas, can we capture both?

All – YES

Soileau and Theiling – For pool wide objectives write them down today and they will be captured in a second database.

Are current conditions in the database?

Theiling – Photos and other information such as the first iteration Natural Resources Inventory are available

1991 for IL river (FWIC HREP Database) needs to be added in. Existing Conditions**.**

Theiling – Those are supposed to be wrapped into the Pool Plans.

Lot of existing knowledge. I was hoping that this would be in the database.

Don't remember about the Illinois.

Steve, Wayne and Dan were involved in this process. I think Jodi Millar was involved. Gail Carmody was the project manager for the first Natural Resources inventory.

Is the Endangered Species database included in the base data? Biological Conservation Database

Theiling –It is not in here because we can't bring it out to public meetings because it is privileged information. Can only use it when there are people who are privy to that info.

Objectives Plenary Session:
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary (Alton and LaGrange) – We focused on Pool wide objectives. We tried to figure what we are trying to restore to. We decided that 1910 would be the reference condition because it is post diversion but before pollutants caused significant problems.

Alton Pool-wide Objectives
Recreate Natural Hydrograph
Decrease flooding to limit catastrophic costs and help with connectivity
Reduce sediment input from the watershed
Restore submersed vegetation

We Added icons to the map. We did some data-mining and created a new icon in Geomorphology E (erosion). We noted that there is gap for wetland complex or habitat from Godar-Diamond Island to Meredosia. There was a joint venture staff in Vicksburg – they recommended a bird resting area every 25 miles. So we located 2 areas for that. We identified more icons for connectivity (drainage ditches). We did not get into LaGrange Pool; we decided that the icons on map were good enough. We didn't want to mess with what has already been done. One suggestion is to move icons off of map to ease up clutter. We did have some questions as to where data came from.

Group 2 Summary (LaGrange to Peoria Pool)

LaGrange and Peoria Pools Reach Objectives

10% additional flood plain
Maintain depths in existing areas. 5m depth in backwater (5%) by 2020
Maintain habitat-protecting levees until ready for reconnection

Summer water level bump less than `1 in 3 years
Reduce sedimentation
Fleeting areas
Dredged material for Mast Trees
Moist soil in BW
Habitat for T&E
Backwater Diversity
Create island, windbreaks

We added data to existing database and added new information

Group 3 Summary (Lockport To LaGrange Pools)

Entire River Objectives
Protect, manage and enhance habitat for T&E
Regulate and develop environmentally friendly fleeting areas
Foresters should evaluate for Mast Tree and floodplain forest in each area.

Lockport Pool-wide Objectives
Aquatic Barriers for Exotic Species
25% reduction of nutrient loading
Secondary standards
Improve water clarity
Database WRDGC should be referenced
SWS study by Tom Butts (1990) Water quality
Systemic removal of sediment
Removal of sunken barges if not serving habitat purpose

Brandon Road Pool-wide Objectives
25% reduction of nutrient loading
Secondary use
No net loss at mouth of Des Plaines RM290-291
Fish by-pass

Dresden Pool-wide Objectives
Removing abandoned barges
Fish passage
Maintain and protect aquatic plant beds

Marseilles Pool-wide Objectives
Protected and maintain floodplain forest. Increase by 20% in 20 years
Increase diversity of floodplain forest.

Starved Rock Pool-wide Objectives
Reach Objective Marseilles and Starved Rock Pools - Threaten and endangered river red horse.

Peoria Pool-wide Objectives
Control exotic species (Purple Loosestrife)
Protect and enhance T&E (bald eagle, river red horse, Decurrent False Aster)

<u>Site Specific Objective Setting for IWW</u>
Once each group gave their report we then started at the upper end of Lockport Pool and moved down river, allowing all participants to provide input.

Discussion of Lockport Pool
There are concerns about the Exotic Barrier. We need something more permanent like an earthen dam.

Brandon Road Pool
Confluence of Des Plains from RM 290-291. There is a backwater complex that is good. We want to protect existing pool riffle complex. Wetland habitat is good too. Protect!

<u>Discussion of Runoff:</u> There is nothing that this project can to within the floodplain.
There is nothing to do to address suspended sediment.
Look at bank stabilization and tow resuspension.
River wide – Reduction in sediment loads from all tributaries.

Dresden Pool
Statewide water quality standards differ above and below bridge at RM 278. Improve water quality so it is all general use.

Barrier vs. Fish Passage: If you try to impede exotic fish then you limit native species.

DuPage River Bay (RM277)– Peter Hall had a scheme.

Discussion of TARP – I have heard something about using gravel pits for regulating reservoirs? TARP acts to capture as much combined sewer overflow (CSO) as possible. All of the flows captured by the TARP are eventually treated. The new reservoirs are designed to first prevent basement flooding, but will also capture other CSO flows as well, depending on how they are operate.

Marseilles Pool
RM 271 – Mussel bed found behind Dresden Island. Hasn't been reported. Heidi Dunn did the work.

Starved Rock Pool
RM 232-235 – Possibly high content of PCB's

Peoria Pool
RM 224.5 Huse Lake is a Superfund site

Clark Island is a very interesting area. During certain hydrographs the main flow goes from MC to back channel and scours it out, while sometime it silts in. This is a very interesting area, self-sustaining. However, it does need to be monitored.

Can we get CRP and CREP system wide?
They have some GIS databases.
USGS is supposed to keep records, but doesn't.

The Corps will gather database info from T&E. However, we will need to mask T&E data before show data to non-privy people.

Islands in 190-195 are good site to put Mast Trees.

RM 182 – There are small embayments that have very small watersheds. This would be a good place for fisheries.

RM177 – Put low-level impoundment to create moist soil units. Already pumping water in that area.

Comment from reviewer: Need fisheries areas every 10 miles and waterbird areas every 25 miles.

Peoria Workshop November 7th – Day 2

<u>Opening Discussion (8:12 – 10:00)</u>

Ken Barr said materials regarding the objective setting workshops would be sent out by the next NECC meeting Dec 10th.

Discussion about what is going to be handed out to all participants: rollup charts, all atlases, and minutes.

Discussion about what is going to be done for Nav Study.

In the final report I thought all engineering and associated costs would be included for each specific objective.

I thought there was going to be a fact sheet for each one.

Discussion focused on how costs would be determined without significant engineering planning being done for each site-specific objective.

Theiling -- I'm not speaking as part of the management team; however, here's what I think real world answer will be: locks cost this much so environment will get the same.

For every dollar you spend on navigation you need to spend a dollar on environmental improvements. Never thought they would spend $8 billion on the Everglades

Theiling -- Instead of looking at Swan Lake or Chautauqua (infrastructure) we need to look at large scale drawdowns.

Yesterday was just a wish list; this didn't get us any closer to defining what needs to be done.

Yes it did, this wish list isn't what anyone expects to happen. We will already have conceptual fact sheets, prioritization, we will be able to justify to Congress what we will do with the money.
I was disenchanted –I wanted to get into more detail. But when I thought about it and realized that we don't have a pool plan for the IL River I thought what we are doing is OK.

IL River Ecosystem Program is considering the entire basin rather than main stem (Like the pool plans are). IL 2020 will be done by mid-Dec.

How did UMRCC come up with the $45 billion? Was there any engineering done?

Theiling -- They figured that "Islands cost about this much" and they spoke with St. Paul to find out how much a drawdown costs.

We are dealing with a project authorized for Navigation. We need to have an authority for environmental stewardship. Need to have that language in the final Navigation Study report.

Theiling -- There are a whole bunch of authorities being shaken up. Talk with your representatives.

You are right, this is only a navigation study, we are fortunate to be able to add the environment. In 2004-2005 this will be a mixture of navigation and environment authorities discussed. This process today is critical for NGO's to understand your wish list so they will know how to negotiate and bargain. The final process will be trade-offs and bargaining. This will all start to play out in 2004.

You need the O&M to follow up. Don't create areas if you aren't going to take care of it.

If you create areas to post 1930's it took 50 years for them to fill in, so you won't have to maintain every year. But they will fill in.

Theiling -- Many things are routine. We could dredge out offshore revetments as needed. We need to have a cyclical O&M program established. Work downstream then start back up.

Return to Objective Setting
LaGrange Pool

Whole floodplain from Peoria to Bartonville needs to be maintained, protected and enhanced. (Pool-wide)

Does anyone have a general concept as to how much sediment input needs to be reduced before we can remove protective levees?

Some small management levees are there to maintain water levels for moist soil plants. Until Carp populations are controlled we need to keep the selected large agricultural levees in place for the marshland habitats. We need a method to control invasive species to protect habitat.

How does this benefit fisheries?

It would be preferable to have this open, but in order to protect this habitat we cannot. These leveed-off agricultural areas are 100-year-old time capsules. Would like to develop them so as to be able to reconnect these.

Comment added from report review: Management levees generally are low-level berms and most are effective only below flood stage. Only the one at Chautauqua 2-3 ft above flood stage in the south pool for moist-soil plant management and higher in the north pool for fishery and stable water management. Both were flooded in 2002 and the south pool is flooded every year. Waterfowl management areas are inundated every year and usually more than cone. Banner Marsh is behind a 50-year ag levee and like Spunky Bottoms and Hennepin has both fishing and water bird habitat. So, there is a major difference in elevation between ag levees (most have never been overtopped) and low-level management levees. A lot of people think management levees or berms are all ag levees. That's not the case. Consequently, most of the 183,000 acres not leveed for agriculture in the floodplain flood most years and are surface.
So, in the next 50 years how can we manage these for clear water – aquatic habitats and work with wildlife, fisheries and spawning areas?

We need to work with areas that are still connected to the river. Maintain, protect and enhance these. This is the most important concept we need to hold onto (keep time capsules until ready.) Pekin Lake is an area that we are developing for fisheries.

Comment added from report review : We can have connectivity through surface and subsurface means. Elimination of pumping within levees allows clear water to accumulate in the district through subsurface connectivity and rainfall.

We need to keep fisheries in mind for IL 2020 and other programs. This is an area that NGO's are curious about. Amount of acreage that needs to be reconnected for IL 2020 (other environmental plans).

Spunky Bottom. We will find out soon if this will happen. TNC has models as to how much sedimentation would go in. Emiquon, ISWS. TNC is going through steps to reconnect to the main channel.

SWS has sediment budgets. Big point 1/3 behind levees, 1/3 connected floodplains, 1/3 backwater. We don't need to be building more leveed areas or reconnecting other areas until we have a better handle on things. Keep areas as they are and continue to improve them as they stand.

Are we worried that the silver, big head or European carp will up root plants?

European carp is hard on plants, but the other two you wouldn't think would have that big effect on vegetation. However, I spoke with people in Europe and theses fish have virtually destroyed other species.

So, what de we do about this?

Theiling -- We manage for conditions that favor native fish rather than invaders.

We could develop some kind of bug to kill off invaders but not native species.

System-wide Objective – Control of exotic species: Manage fisheries to reduce populations of destructive exotic and invasive species.

Great lakes are introducing more invasives, the South is stocking everything and we are limiting habitat. We are shooting ourselves in our foot.

These Exotic species are an impediment to management of the river

50% of currently isolated backwaters for the exclusion of exotic and maintenance of quality habitat. Increase connectivity to 25% of currently isolated backwaters and improve them. Need fisheries over winter areas every 10 miles just like we need bird resting every 25 miles.

Look at the whole river and designate which areas have highest priorities for different guilds.

I reject the idea that fisheries are bad for birds, and bird areas are bad for fish.

Connected vs. disconnected. Need to look at current and historic areas to see areas that were connected and no longer are.

Theiling -- I want to reiterate that we need to look at river systemically.

Do you think we should reconnect backwaters now or after the health of the river is restored?

Now. Areas where there is a marginal levee that have routine breaks can be reconnected.

At RM 137.5 we have a delta area. This is Copperas Creek Delta. A lot of sedimentation.

Gave overview of Rice Lake EMP.

I want to dredge out Big Lake for fisheries (Paddlefish).

Low height of levee, won't prevent annual spring flood, but will help to disconnect during mid-summer bump.

Need to include EMP planning database into this information.

Management action for this area. Take dredged material and place it on the island before planting mast trees.

Some tributaries have watershed plans. We need be examine plans to see what locals want in these areas.

Mantanzas Bay is one of our deepest backwater areas. It might be a good area for over wintering fish.

Moscow Lake is a good candidate for over wintering fish RM 111.

Sangamon River – Restore meander (in general) on both North and South. Would be in Corps interest because of sedimentation problems at the mouth of the river.

The extra length of the proposed lock and dam at LaGrange would cut into the existing wetlands.

Originally considering 2 new locks, one at Peoria and LaGrange, but nothing with the dams. However there has been some talk about moving from wickets to more permanent dams. Would it benefit water level management?

It might be nice to be able to manage more than a foot and a half.
Would this help up at the upper half of the pool?

No there is not a big effect in upper pool.

Barge industry won't like the dams because they can pass over wickets.

At low flows there is a dramatic water level fluctuation.

Comment from Reviewer: Additional tainter gates would likely not provide the level of water level control required to eliminate the "bumps" discussed here.

At low flows there is a possibility to improve management conditions. You could put in another tainter gates, but the flow and watershed effect are more significant.

Theiling -- These things are being looked at carefully in the Illinois River Study.

Alton Pool
Pool wide – Investigate opportunities to improve leveed areas.

Mention levee setbacks to allow for floodplain habitat and increase flood conveyance

From Meridosia to Beardstown – They did some commercial musseling and found 20 beds. Rob Maher and Dean ? did the work.

1-2 foot contour maps will help determine levee setbacks.

Theiling -- Have Woermann and earlier but not modern contour maps.
Comment from Reviewer: We have 2 ft contour COE maps from ~1980.

10:00 Break

<u>10:14 – 10:30 Chuck Theiling's Managements Actions Talk</u>
Chuck began this section by discussing why it is important for management actions to be identified, as well as defining what a management action is. Next he discussed how the current list of management actions was created. Finally he and Rebecca projected the management action worksheet and discussed how to work during the breakout sessions.

<u>Discussion During Management actions Breakouts:</u>

Should additional backwaters be isolated?

Some people want to increase connectivity others decrease connectivity. What do we do?

Theiling - These are a list of potential management actions. They will be determined more in feasibility phase of the study.

I would like to see no-net loss of contiguous backwaters.

This is a really contentious issue; it will have to be determined site by site.

12:00 Break for lunch

<u>1:00 Hank DeHaan's Discussion on how data collected will be evaluated throughout the Nav Study Process.</u>
Identify Objectives, then Identify Management Actions (MA). Cost estimates will come when putting MA on the ground and see how well it addresses the objectives in the pool. Identifying MA, estimating Cost for MA, and evaluating how well it addresses the objectives in that area.

Anticipating 2000-3000 specific objectives. Expecting to do specific costs for all of these in a year is unreasonable.

<u>Management Actions Plenary Session (1:05-1:45)</u>
Water Quality MC
Management action in addressing water quality regulations (3)

Water Quality BW
#13 needs to be cleared up. How much isolation? This is something that needs a Target range. (each group spent about 30 min on this). Group 2 – No net loss of existing contiguous backwater. For #20, needs a target range or remove.

There is a concern that temporary isolation would lead to permanent isolation. Duck hunters would prefer to keep the "temporary" levees in place.

Geomorphology BWD, BWA
Slight discussion of consolidated sediments. Consolidation is the result. Management Action is a draw down. Need to qualify "for consolidation of sediments"

Geomorph, Connect, Floodplain
Want clarification of #38, #42. Almost have to raise pool to raise floodplains. Then you might raise ground water levels. Maybe increase depth. Really more of an objective than an action.

Patterns of Habitats Landcover/use
#107, #108 Use material (e.g. Dredged material). This way you aren't limiting to only dredged material.

<u>1:47-1:57 Chuck Theiling's Intro to Species</u>
Chuck discussed some of the problems that were encountered when he was trying to set species target ranges for the objectives. He asked participants to offer suggestions as to the merit of doing this as well as for species and target ranges.

<u>Species Plenary Session (2:00 –2:45)</u>
Look at survival strategy. If you tie this back to an ecologically sustainable system it is important to look at survival strategies of animals. Species of Fish on large river system – part of their strategy when it floods is to migrate out into the temporary expansion of habitat. Fish exploit expansion of habitat and turn that into a peak of production. For species that can do this they have a significant increase in biomass the next year. By levying off the floodplain we have limited that process. Another example with mammal (swamp rabbit) – Historically flood plain animal. They are gone now because when it floods the little bit of habitat they have gets flood because inward side of levee is bare and because of agriculture and they have no escape habitat so they have been eliminated. We need to consider allowing animals to move in and out of floodplain. None of these measurements really allow us to address this.

Theiling – I appreciate these comments, but how do we measure this?

You cannot sample large river systems with the precision necessary to answer the questions you are asking. You need to sample habitat types in a pool with the same proportional effort as you have habitat types. Get a relative change from year to year. This is still subjective due to staff and equipment. You can get stuff on a relative basis, but not any precision. "The river is continually improving". Fishing tournaments on the Illinois are becoming world class. The only reason they are here is because the fish are here. (Who studied)? Spring Valley to Starved Rock Lock and Dam estimated 1mill fish. Confidence limits were really high.

Theiling -If money and equipment weren't an issue would a full survey of the populations be worth doing?

No

Saugers Example – Originally stocked fish were 75%-85% of tournament young of the year. Now they are 1% of tournament.

Theiling – Stoddard Bay – Jeff Janvrin – Catch per unit effort of Blue gill was phenomenal. Is it important to differentiate between river-wide vs. habitat restoration?

Depends on where – Backwater area – hard to quantify success. It is hard to determine cause and effect. However, go to hunting area (where ingress and egress are limited) and data from .5 ft – 6ft. may be valuable. So where there is no or limited connectivity this type of data may be valuable.

Theiling –So, in an open system – it doesn't matter how you sample because results are foggy and in a closed system doesn't matter how as long as it is sampled some before and after. In an open system you can get general trends.

Lots have to do with general conditions in any year, time and place.

Diversity – Not applicable to the large river system.

LTRM can give some year class strength. This might be another indices.

You need to look carefully at species you select. Consider well-being (proportion of length vs. weight) of the fish, year class strength. OR Get good trend information by looking at YCS (year class strength) by looking at well being (mass/length) by YC and by species. Give good idea of health of population over river.

Theiling – Is there any usefulness in having different measurements for different guilds?

Right now we use only one set because there isn't anything else.

Is it possible, instead of trying to come up with pool/reach number, to make targets for specific projects? Can you use local indices of improvement to evaluate management actions rather than extrapolation to the whole river?

Why do we need precise numbers?

For benefit/cost analysis.

We can't do this

Theiling – Washington has asked us to do that. How many bass will be grown in Swan lake, how many will be caught and how does that relate to the number of minnows and licenses bought for fishing.

Discreet measurements of habitat that are updated yearly. Combine with relative abundance survey to get long-term trends. Take series of transects to measure habitat values that could go back to year after year to see how management affects habitat, abundance, diversity, biomass.

Theiling – The problems is response times. What Mike talked about with Suagers came at the costs of Billions of dollars in waste treatment facilities. You have to "take it on faith". The cost of measuring a decrease in sediment load will be very high yet the changes will be very slow. Need to wait to see benefits.

Do you want to spend lots of money to document this or just take it on faith?

When we create a borrow hole can you make estimates of how many fish use it? If create a habitat asset can you give an estimate of how many fish it can support? EG – How many more fish could over winter in the reconnected backwater?

Yes

Creel Surveys- Daytime is very difficult. Night fisherman is hard.

Ask people, do survey of fishermen. If we do this, ask where will you be staying, and how long. In this way you could get a very intensive Creel survey.

A very intensive Creel survey was done on ILWW.

The units need to be run past a biologist and an ecologist. They have different views to look at things.

For forage fish, maybe use birds as an index.

Rock Island District used larger rocks this year at an additional $4/ton. Now we are requiring a fishery biologist to say how many more fish are in the larger crevices and will it be cost effective. Concrete cost/benefit. We have to remember to focus on trend analysis and not get caught up on statistical sampling. Agree to make a whole bunch of assumptions, put a $ on it and move on.

That is what we are continuously doing on EMP. Most recently Habitat Units (HU) (relationship between quality and quantity).

Diesel engine example. New engine was being created when there was a low demand for it. But then once it was created the demand was there. OR Bean counters want to see you go through some process to arrive at your numbers. In a few years the assumptions will change. You've got to figure out a way that is reasonable and logical. You may not use it, but when conditions are right you may use it.

As long as you have the narrative, even if it isn't statistically sound.

Just go through the process.

Theiling – People are looking for the navigation study to break new ground to put dollars on this.

You can have your numbers but they will have to be based on subjective data. Otherwise you will study yourself to death.

Hank DeHaan's – Conceptual Model Talk 2:47-2:51

Hank provided participants with some background regarding the conceptual model, as well as an overview of the purposes for having a conceptual model. He then displayed the conceptual model in it's current form as well as a more simplistic diagram that gave an example of how the model might be used to asses the effectiveness of a management action.

Closed at 2:51

Appendix D. Participant Introductions

All the participants were asked to write down an answer to the question printed on page 4 of the workshop handout: “What do you hope this workshop will accomplish?” Then all participants introduced themselves to the group and read their answer to the question. Below is an attempt to capture some of those verbal answers. Answers that are underlined are taken directly from the written forms.

1. Havera – I would like to see reasonable multidisciplinary objectives for all animals.
2. <u>Schwar – I hope this workshop will define a clear and comprehensive picture of the desired environmental state of the IL River and set the stage for developing objective and measurable criteria for defining progress toward that goal.</u>
3. Davinroy – I hope we can all leave here holding hands and singing Cum By Yah.
4. Marlin- I hope we can restore habitat and figure out a way to maintain it.
5. <u>Carmack – As the sole UMRCP Corps team representative present, I hope that this workshop will do such a thorough job of establishing goals and objectives, if not management actions. For the bank-to –bluff floodplain that we won’t all have to go through a duplication of these exercises specifically for the UMRCP. Follow-up contact, conference calls, etc. will probably still be required, however.</u>
6. Simone – I am here to provide input about the natural community.
7. Bitner – I represent Threatened & Endangered concerns and other natural resource concerns.
8. <u>Graham – Positive solutions for all the questions/problems being posed here, and to move forward with implementation of these suggestions in a timely manner</u>
9. Zerbonia – I would like to see environmental actions that will complement lock extensions.
10. Barr – I am here to answer question, and increase my understanding of actions.
11. Slowikowski – How will we get there? How will this mesh with ILL 519.
12. Cruz – I want to ensure that this process uses sound science and statistics, as well as good, measurable criteria.
13. Beorkrem – I would like to see goals and procedures developed for the environment as well as a balance between Navigation and the Environment.
14. Sallee – I have been through this process several times. I am looking for a baseline we can all agree with.
15. Herndon - I have concerns about fish species in my district.
16. Wefer – I would like to see restoration needs of wetland communities and floodplain forest quantified better.
17. Ahrens –I am a farmer and own a house on the IL River.
18. Timmons – I want to ensure that trees are included in the overall project. I want to see an increase in bottomland forest. They can compliment other site-specific projects.
19. Laux – I want to see the Ecological and Navigation systems coexist.
20. <u>Kelly – Provide a generalized picture of where river management will head over the next 5-10 years, thereby providing my discipline with an idea of where opportunities for projects will present themselves in the future.</u>
21. O’Hara – I will provide input where I can.

22. Cochran – I am hoping can survive another meeting. I am hoping to be a part of it.
23. Mick – I want to see how Navigation work and Restoration work will coexist.
24. Kaufeld – I want to make sure this is an ecologically sustainable project
<u>25. Help improve navigation on the Illinois in an environmentally friendly way.</u>
<u>26. Give a better understanding of the direction we seem to be heading and the area to focus on (How much detail of what?)</u>
27. Conclude objective setting and begin implementation of adaptive management.

Appendix E. Environmental Objectives

Purpose:
To have participants collaboratively review, refine, and add to a database of specific, quantitative, and local to regional scale UMR-IWW environmental objectives obtained from previous study efforts.

Background:
Objectives are incremental steps taken toward achieving a goal and thus may be goal specific. They are a concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it. Objectives provide the basis for determining management actions, monitoring accomplishments and evaluating the success of management actions. There may be multiple objectives for a goal. Participants were asked to review, revise if necessary, and supplement the Environmental Objectives taken from previous work (HNA, Pool Plans, etc.) to achieve the Navigation Environmental Coordination Committee (NECC)/Economics Coordinating Committee (ECC) UMR-IWW Navigation System Vision:

"To seek long term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System."

The working groups were specifically tasked to apply the widely known SMART criteria to each objective making them: specific, measurable, achievable, results –oriented, time-specific.

The participants were asked, for the purposes of this workshop, to utilize the following two sets of goals as a framework for setting objectives.

Ecosystem Goals (from Interim Report)
During planning for the 1994 Upper Mississippi River Conservation Committee (UMRCC) Ecosystem Management Initiative, resource managers agreed to adopt Grumbine's (1994) ecosystem management goals (Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology* 8(1): 27-38.):

Goal 1: Maintain viable populations of native species in situ.
Goal 2: Represent all native ecosystem types across their natural range of variation.
Goal 3: Restore and maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.).
Goal 4: Manage over periods long enough to maintain the evolutionary potential of species and ecosystems.
Goal 5: Integrate human use and occupancy within these constraints.

The UMRCC expanded their list of goals in the *A River That Works and a Working River* (2000) document. These goals are:

1. Improve water quality for all uses,
2. Reduce erosion and sediment impacts,
3. Restore natural floodplain,
4. Restore natural hydrology,
5. Increase backwater connectivity with main channel,
6. Increase side channel, island, shoal, and sand bar habitat,
7. Minimize or eliminate dredging impacts,
8. Sever pathways for exotic species introductions/dispersal,
9. Improve native fish passage at dams.

Working Group Process

The process began with participants dividing into three groups based in part on their expertise within the three segments of the IWW. The three geographic regions were: Alton Pool, La Grange and Peoria Pool, and Lockport Pool to Starved Rock Pool. Working groups were tasked with first setting reach and pool-wide objectives and then reviewing and setting site-specific objectives within their section of the river. If groups finished their section and had time remaining they could extend into the adjacent areas.

When setting site-specific objectives, participants were asked to use the data structure outlined in the Framework for Setting Objectives (Figure E1). This hierarchical structure categorizes environmental objectives into four primary ecosystem elements and then breaks these down into more specific parameters, extents, and target ranges. In addition to this information, participants were also asked to consider and note (if possible) the seasonality, frequency of occurrence, target date, and any other comments associated with the objectives they identified. This data framework provided a means to capture and merge objectives from previous study efforts, and those identified by workshop participants, into one standardized database. Additional objectives not found in the framework were also identified and added to the database using the established data structure (e.g., Invertebrates was added under Plants and Animals

Ecosystem Element	Parameter	Extent	TR	Target Range
Water Quality	Water Clarity	Main Channel	1	Secchi disk transparency 0.3 m
		Backwater Areas	2	Secchi disk transparency 0.7 m
			3	Secchi disk transparency 1.0 m
			4	Secchi disk transparency 1.5 m
			5	Secchi disk transparency >2.0 m
Geomorphology	Backwater Depth	Backwater Areas	1	100% of area <1 m
			2	50% of area 1 - 2 m
			3	50% of area 2 - 3 m
			4	50% of area >3 m
	Water Level	Main Channel	1	0.3 m below project pool at dam
		Backwater Areas	2	0.6 m below project pool at dam
			3	1.0 m below project pool at dam
			4	>1 m below project pool at dam
	Connectivity	Floodplain	1	0% floodplain area inundated during 10 year flood
			2	20% floodplain area inundated during 10 year flood
			3	40% floodplain area inundated during 10 year flood
			4	80% floodplain area inundated during 10 year flood
			5	100% floodplain area inundated during 10 year flood
		Secondary Channel	1	<20% of year
			2	20-40% of year
			3	40-60% of year
			4	60-80% of year
			5	>80% of year
		Longitudinal	1	0% chance of fish passage
			2	20% chance of fish passage
			3	40% chance of fish passage
			4	80% chance of fish passage
			5	100% chance of fish passage

Figure E1. Framework for Setting Objectives for Condition of the UMR-IWW Ecosystem

Ecosystem Element	Parameter	Extent	TR	Target Range
Pattern of Habitats	Aquatic Areas	Main Channel	1	<10% of area
		Secondary Channel	2	10-20% of area
		Tertiary Channel	3	20-40% of area
		Impounded Area	4	40-60% of area
		Contiguous Backwater	5	>60% of area
		Isolated Backwater		
	Terrestrial Areas	Contiguous Floodplain	1	<10% of area
		Isolated Floodplain	2	10-20% of area
		Island	3	20-40% of area
			4	40-60% of area
			5	>60% of area
	Land Cover/Use	Open Water	1	<10% of area
		Submersed Aquatics	2	10-20% of area
		Emergent Aquatics	3	20-40% of area
		Grassland	4	40-60% of area
		Shrub	5	>60% of area
		Forest		
		Agriculture		
		Developed		
Plants and Animals	Plants	Emergent Aquatics	1	<10 plants/m2
		Submersed Aquatics	2	10 - 20 plants/m2
			3	20 - 50 plants/m2
			4	50 - 100 plants/m2
			5	>100 plants/m2
	Fish	Protected Fish Species		CPUE, Length distribution, or kg/ha
		Sport Fish Species		
		Commercial Fish Species		
		Forage Fish Species		
		Exotic Fish Species		
	Birds	Dabbling Ducks	1	0 - 1,000 use days/yr
		Diving Ducks	2	1,000 - 10,000 use days/yr
			3	10,000 - 100,000 use days/yr
			4	>100,000 use days/yr

Figure E1. Continued

Results:
The environmental objective information gathered and reviewed at the Peoria Workshop has been organized into the following four sections. They include a pool-wide objectives table, site-specific objectives table, plenary report, and the working group reports.

Pool-wide objectives identified by workshop participants were compiled from comments recorded in the plenary sessions, working group reports, group worksheets, and atlas map notations (Table E1). In cases where management actions were recorded, an objective was created and the management action was listed in the comments section, denoted by "MA".

Site-specific objectives and supporting information identified and reviewed by workshop participants are listed by pool (Table E2) and organized to follow the Framework for Setting Objectives format (Figure E1). These objectives were compiled from previous study efforts, participant comments during the plenary session (with GIS tools), working group reports, group worksheets, atlas map notations. The objectives identified in the workshop were recorded exactly as written. For the integrated final site-specific objectives will standardized, new parameter icons may be created, and similar comments will be assimilated into one comment.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps.

Examples of objectives at various scales were given as guidelines, they included:

- *System* – Restore X acres of secondary channel habitat system wide,
- *Reach* – Increase the amount of marsh habitat by X acres in the Open River Reach of the Mississippi River,
- *Pool* – Return Pool 13 to a more natural hydrologic regime by having a 90 day low water stage three feet below maximum pool elevation during late summer every three years,
- *Local* – Increase the average depth of backwater area X to six feet.

Table E1. Pool-wide Environmental Objectives (System-wide)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
Geomorphology							
	Connectivity	Isolated Backwaters	50% of current	all			Maintain 50% of currently isolated backwaters for exclusion of exotics and protection of high quality habitat
	Connectivity	Isolated Backwaters	25% of current				Increase connectivity of 25% of currently isolated backwaters
Pattern of Habitats							
	Land Cover / Use	Forest					Determine forest habitat needs for migratory songbirds. MA - Forester should examine entire IL River reach for mast tree needs and floodplain forest needs from diversity and depth of forest and habitat needs for migratory songbirds, need for increasing acreage, utilize CREP/IL2020
	Land Cover / Use	Other					Protection, management, and enhancement of natural areas
	Aquatic Areas	Main Channel					Regulate and develop environmentally friendly fleeting operations
Plants and Animals							
	Fish	Exotic Fish Species					Manage fisheries to reduce populations of destructive exotic and invasive species
	Other	All					T&E species and natural areas protection, management, and enhancement
	Other	Exotic/ Invasive Species					Control or elimination of exotic and invasive species

Table E1. Pool-wide Environmental Objectives (Lockport Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
	Water Clarity						Improve Secchi Level.
	Water Clarity						Water Clarity affected by resuspension of sediments by barges through navigation season
	Other						25% reduction in nutrient loading
	Other						Elimination of secondary use standards for this reach; adhere to general use standards.
	Other						Systematic removal of contaminated sediments
Geomorphology							
	Water Level	Other					Limit water level fluctuation. Notes -Water levels affected substantially by MWRDGC actions up to 10ft per incidence.
Pattern of Habitats							
Plants and Animals							
	Other						Establish aquatic barriers for exotic species
Other							
	Other						Removal of sunken and abandoned barges (if not serving habitat purposes) and related materials.

Table E1. Pool-wide Environmental Objectives (Brandon Road Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
	Other						25% reduction in nutrient loading
	Other						Elimination of secondary use standards for this reach; adhere to general use standards.
Geomorphology							
Pattern of Habitats							
Plants and Animals							
	Fish						Fish screen for water intakes (power plant) and fleeting operations
Other							
	Other						Removal of sunken and abandoned barges (if not serving habitat purposes) and related materials.

Table E1. Pool-wide Environmental Objectives (Dresden Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
	Land Use/Cover	Submersed Aquatics					Maintain/protect existing aquatic plant bed acreage pool-wide
Plants and Animals							
Other							
	Other						Removal of sunken and abandoned barges (if not serving habitat purposes) and related materials.

Table E1. Pool-wide Environmental Objectives (Marseilles Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
	Other						Systematic removal of contaminated sediments
Geomorphology							
	Water Depth						Improve water depth
	Water Level						Water Level fluctuations need to be controlled
Pattern of Habitats							
	Land use/cover	Forest	increase 10%				10% increase in bottomland hardwood forest acreage, improve diversity
Plants and Animals							
	Fish	Protected					Threatened and endangered river redhorse

Table E1. Pool-wide Environmental Objectives (Starved Rock Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
Geomorphology							
Pattern of Habitats							
Plants and Animals							
	Fish	Protected					Threatened and endangered river redhorse

Table E1. Pool-wide Environmental Objectives (Peoria Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
Geomorphology							
	Backwater Depth						Prevent Peoria Pool from sedimenting in. MA -Moist soil unit at Woodford State Wildlife Unit. MA -Peoria Lake to Henry - backwaters, islands, moist soil as appropriate.
	Water Level	Backwater Areas	5% 3m+, 10% 2-3 M 25% 1-2 m, 60% < 1 m	Winter		2020	Maintain depths of existing backwaters and increase area available for over wintering fish (3m+) in backwaters by 5% by 2020 and 10% 2-3 M , 25% 1-2 m, 60% less than 1m
	Water Level	Other		Summer	7		Reduce incidence of summer water level "bumps" to < 1 year in 3
	Connectivity	Floodplain					Maintain habitat-protecting levees (e.g. Hennepin /Hopper) until river conditions adequate to allow reconnection
	Connectivity	Other	50%				Maintain 50% of existing backwaters for exclusion of exotic species (Maintain dis-connectivity) (e.g. Hennepin /Hopper)
	Connectivity	Other	25%				Reconnect 25% of currently isolated backwater areas and historical backwater latkes (fish areas every 10 miles).
	Other						Reduce sedimentation throughout pool.
Pattern of Habitats							
	Aquatic Areas	Main Channel		All			Avoid conflicts between habitat enhancements and potential or existing fleeting areas.
	Aquatic Areas	Impounded Areas/Backwaters					Enhance habitat in backwaters. MA - Create islands, windbreaks and wavebreaks.

Table E1. Pool-wide Environmental Objectives (Peoria Pool cont.)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats (cont)							
	Terrestrial Area	Contiguous Floodplain					Restore additional 10% of Peoria Pool (bluff to bluff) to floodplain, terrestrial habitats - with a goal of significant contiguous areas (min. 10 ac for wetlands, 100 ac forests, etc.).
	Land Cover/Use	Emergent Aquatics					Promote moist soil development in backwater areas.
	Other						Protect and enhance habitat for threatened and endangered species.
Plants and Animals							
	Plants	Other					Provide area for mast tree planting (appropriate elevations and soil composition). MA - As much as possible use environmental dredge material.
	Plants	Other					Protect and manage habitat
	Fish	Exotic Fish species					Manage fisheries to reduce populations of exotic (destructive) fish species).
	Birds	Other					Red-shouldered hawk, brown creeper - protect and enhance.
	Other						Increase mussel diversity.
	Other						Control all exotic species

Table E1. Pool-wide Environmental Objectives (La Grange Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
Geomorphology							
	Water Level	Back Water Area	5% 3m+, 10% 2-3 M 25% 1-2 m, 60% < 1 m	Winter		2020	Maintain depths of existing backwaters and increase area available for over wintering fish (3m+) in backwaters by 5% by 2020 and 10% 2-3 M, 25% 1-2 m, 60% less than 1m
	Water Level	Other		Summer	7		Reduce incidence of summer water level "bumps" to less than 1 year in 3
	Connectivity	Floodplain					Maintain habitat-protecting levees (e.g. Emiquon) until river conditions adequate to allow reconnection
	Connectivity	Other	50%				Maintain 50% of existing backwaters for exclusion of exotic species (Maintain dis-connectivity)
	Connectivity	Other	25%				Reconnect 25% of currently isolated backwater areas and historical backwater latkes (fish areas every 10 miles).
		Other					Reduce sedimentation throughout pool.
Pattern of Habitats							
	Aquatic Areas	Main Channel		All			Avoid conflicts between habitat enhancements and potential or existing fleeting areas.
	Terrestrial Area	Contiguous Floodplain					Restore additional 10% of Upper La Grange floodplain (bluff to bluff) to floodplain, terrestrial habitats - with a goal of significant contiguous areas (min. 10 ac for wetlands, 100 ac forests, etc.).
	Land Cover/Use	Emergent Aquatics					Promote moist soil development in backwater areas.

Table E1. Pool-wide Environmental Objectives (La Grange Pool cont.)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Plants and Animals							
	Plants	Other					Provide area for mast tree planting (appropriate elevations and soil composition). MA - As much as possible use environmental dredge material.
	Fish	Exotic Fish species					Manage fisheries to reduce populations of exotic (destructive) fish species).
	Other						Increase mussel diversity.
	Other						Protect and enhance habitat for threatened and endangered species.

Table E1. Pool-wide Environmental Objectives (Alton Pool)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Water Quality							
Geomorphology							
	Connectivity	Floodplain & Secondary					Restore off channel connectivity to all pool. Meredosia to Eldrid are key drainage districts to target for connectivity. No consensus on amounts of floodplain needing to be restored to habitat, but at least 2-3 districts, Nutwood and Harwell mentioned several times.
							Reduce scouring and increase nutrient input to floodplain during flood. MA- During flood fighting, lots of sandbagging now occurs, it probably would make more sense to have designed spillway in levees. Flood in a controlled manner
	Connectivity						Investigate opportunities to improve leveed areas

Table E1. Pool-wide Environmental Objectives (Alton Pool cont.)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
	Connectivity	Other					Need to reduce sediment accumulation in tributary deltas due to erosion off ag. ground. It has increased tremendously since 1976. There may be places where delta is preventing fish migration into tributaries, creating islands in the delta, or moist soil units at or near mouths of tributaries, and restore depths and connectivity of tributaries.
	Backwater Depth	Backwater Areas					Restore backwater depths, aquatic vegetation, throughout backwaters on pool.
	Water Level	Other					Improve emergent plant communities and stabilize sediments. MA -Drawdown MA - Some aquaculture opportunities in some areas has limited potential.
		Other					Recreate hydrograph
Pattern of Habitats							
	Terrestrial areas	Isolated Floodplain					Investigate opportunities to improve leveed areas
	Terrestrial areas	Contiguous Floodplain					There is a need for additional floodplain habitat in the gap between Two Rivers and Meredosia. It is a wide floodplain with a levee protecting lots of it. Nutwood and Hartwood Districts may be marginal and available for acquisition and habitat. The levee districts are lower than the pool so at low water conditions can reconnect. Money paid to those levee districts from flooding during pool construction.
	Land Cover/ Use	Emergent Aquatics					Re-establish missing marsh habitat by maintaining the levees, MA -Turn the pumps off and allow subsurface water to infiltrate behind the levee. A natural seed base exists and these plants will return. Hennepin Drainage District, and Spunky Bottoms are examples of where this has occurred.

Table E1. Pool-wide Environmental Objectives (Alton Pool cont.)

Ecosystem Element	Parameter	Extent	TR/ Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats (Cont)							
	Land Cover/ Use	Other					Agree on a reference condition to work towards, probably the best condition was in the 1910's-1920's before the wastewater in the 30's degraded the system.
Plants and Animals							
	Plants	Aquatics					For example on Pool 20 put an icon on Lima Lake for aquatic vegetation establishment, now have landowners interested in doing aquatic re-establishment. We should put aquatic veg. Re-est. on maps in known low spots.
	Plants	Submersed aquatics					Restore submersed vegetation and off channel connectivity to all pools,
	Plants	Aquatics					Restore aquatic vegetation in backwaters on pool.

Table E2. Site-specific Environmental Objectives (Lockport Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Plants and Animals	Fish	Exotic Fish Species					Electronic Barrier, or better
Plants and Animals	Fish	Other					Fish barrier to reduce entrainment in hydroplant

Table E2. Site-specific Environmental Objectives (Brandon Road Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Pattern of Habitats	Aquatic Areas	Secondary Channel					RM 290-291, Maintain aquatic and terrestrial habitat
Pattern of Habitats	Other						Maintain existing habitats

Table E2. Site-specific Environmental Objectives (Dresden Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Other						Improve water quality to general use level from RM 278 to Lake Michigan
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year			Reconnect side channel
Pattern of Habitats	Aquatic Areas	Secondary Channel					Improve habitat quality
Pattern of Habitats	Aquatic Areas	Secondary Channel					Improve aquatic habitat and depth diversity
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Other	Other						Removal of contaminated sediments and restore and protect side channel habitats
Other	Other						Remove sunk barges and cable

Table E2. Site-specific Environmental Objectives (Marseilles)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				Exotic concerns and native concerns (Kankakee River)
Geomorphology	Connectivity	Secondary Channel					Reconnect side channel
Pattern of Habitats	Aquatic Areas	Secondary Channel					Maintain and restore secondary channel depth habitat
Pattern of Habitats	Aquatic Areas	Secondary Channel					Protect and maintain aquatic and terrestrial habitats
Pattern of Habitats	Terrestrial Areas	Island					Protect and maintain island, Johnson Island
Pattern of Habitats	Terrestrial Areas	Other					Delta
Pattern of Habitats	Terrestrial Areas	Other					Maintain and protect aquatic and terrestrial delta area
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore and maintain wetland habitat, Heron rookery
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Plants and Animals	Other						Mussel bed exists here

Table E2. Site-specific Environmental Objectives (Starved Rock Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Other						Riffle helps improve water quality
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas	Other				25% of area >= 2 m
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage	All Year			Fish passage at the tail raceway
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Protect and maintain main and secondary channel habitat threatened and endangered species, or species of concern
Pattern of Habitats	Aquatic Areas	Impounded Area					Reduce erosion to sensitive areas, RM 231-233, build islands, control recreational boat access on south side of this reach
Pattern of Habitats	Terrestrial Areas	Other					Delta
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetlands from RM231-235 between RR tracks DeeBennet Rd
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (Starved Rock Pool cont.)

Plants and Animals	Other						Remove exotic species (i.e. purple loosestrife), RM 231-235
Other	Other						Remove contaminated sediments from RM 232-235
Other	Other						Protection of Indian village site, north bank RM 231.5-232.7

Table E2. Site-specific Environmental Objectives (Peoria Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Peoria Pool cont.)

Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					Deepwater embayments for fish
Geomorphology	Backwater Depth	Backwater Areas					Pool wide objectives
Geomorphology	Backwater Depth	Backwater Areas					Peoria pool-wide objective
Geomorphology	Connectivity	Secondary Channel					Scours out during high water events, fills in periodically, requires more monitoring
Geomorphology	Connectivity	Longitudinal	100% chance of fish passage				
Geomorphology	Connectivity	Other					Disconnect cut
Geomorphology	Other						Maintain levee to maintain water level management until value of connectivity can be assessed
Geomorphology	Other						Manage tributary sediments
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Increase depth
Pattern of Habitats	Aquatic Areas	Isolated Backwater					Protect and enhance aquatic and terrestrial habitats, contaminant clean up
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Impounded Area					
Pattern of Habitats	Aquatic Areas	Other					Protect aquatic habitats on the island
Pattern of Habitats	Aquatic Areas	Other					Increase and maintain habitat diversity per pool-wide objective
Pattern of Habitats	Terrestrial Areas	Island					Protect the island from erosion
Pattern of Habitats	Terrestrial Areas	Island					Island Construction
Pattern of Habitats	Terrestrial Areas	Island					Island construction
Pattern of Habitats	Terrestrial Areas	Island					Peoria pool islands, pool-wide objectives

TableE2. Site-specific Environmental Objectives (Peoria Pool cont.)

Pattern of Habitats	Terrestrial Areas	Other					Manage and enhance terrestrial habitats
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Table E2. Site-specific Environmental Objectives (Peoria Pool cont.)

Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Create moist soil management unit
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (Peoria Pool cont.)

Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Other						Increase habitat diversity RM 190-195
Plants and Animals	Plants	Other					TE species (Boltonia)
Plants and Animals	Birds	Other					TE species protection and management, Plum and Leopold Islands
Plants and Animals	Other						Protect and enhance TE species habitat (i.e., birds)
Other	Other						Abandoned barge removal
Other	Other						Contaminated sediment removal
Other	Other						HTRW site, Contaminated sediment clean up
Other	Other						WRP land, consider for restoration feasibility
Other	Other						Investigate for restoration opportunities
Other	Other						Protect and enhance TE species habitat (Boltonia)
Other	Other						Protect and enhance TE species habitat

Table E2. Site-specific Environmental Objectives (La Grange Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives

Table E2. Site-specific Environmental Objectives (La Grange Pool cont.)

Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					See pool-wide depth objectives
Geomorphology	Backwater Depth	Backwater Areas					See pool-wide objectives and site management plan

Table E2. Site-specific Environmental Objectives (La Grange Pool)

Geomorphology	Backwater Depth	Backwater Areas					Pool-wide depth objectives in Moscow Lake
Geomorphology	Backwater Depth	Backwater Areas					Pool-wide depth objective for Stewart lake
Geomorphology	Backwater Depth	Backwater Areas					Restore Depth in Coal Dock Cove, using pool-wide backwater depth objective
Geomorphology	Backwater Depth	Backwater Areas					Restore depth and natural meanders
Geomorphology	Backwater Depth	Backwater Areas					Restore depth and natural meanders
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10	2020	See 2020 plan
Geomorphology	Backwater Depth	Backwater Areas	50% of area >3 m				Restore side channel depth, RM 121-122
Geomorphology	Backwater Depth	Backwater Areas	50% of area >3 m			2020	Rice Lake Island, Restore Depths, RM 132-137
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10		Maintain pool-wide objective for backwater depth
Geomorphology	Backwater Depth	Backwater Areas	50% of area 2 - 3 m	All Year	10	2020	
Geomorphology	Connectivity	Floodplain					Restore and maintain connectivity
Geomorphology	Connectivity	Floodplain					Muscooten Bay
Geomorphology	Connectivity	Floodplain					Maintain connection of complex to main channel
Geomorphology	Connectivity	Floodplain					Connect backwater area
Geomorphology	Connectivity	Floodplain		Winter			Matanzas Bay, Connectivity for overwintering habitat
Geomorphology	Connectivity	Floodplain	100% floodplain area inundated during 10 year flood			2020	Clear Lake, RM 130-133

Table E2. Site-specific Environmental Objectives (La Grange Pool)

Geomorphology	Connectivity	Floodplain	100% floodplain area inundated during 10 year flood	All Year	10	2020	Connect gravel pit
Geomorphology	Connectivity	Floodplain	0% floodplain area inundated during 10 year flood	All Year	10	2020	Habitat improvement as appropriate, maintain levee
Geomorphology	Connectivity	Secondary Channel					Restore side channel
Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	Maintain and restore side channel habitat
Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	Maintain secondary channel
Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	Restore meanders
Geomorphology	Connectivity	Secondary Channel	>80% of year	All Year	10	2020	RM 135, Senate Island
Geomorphology	Other						Restore natural meanders
Geomorphology	Other						Restore natural meanders
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					Deepen and maintain side channel
Pattern of Habitats	Aquatic Areas	Secondary Channel					Restore depth in side channel
Pattern of Habitats	Aquatic Areas	Other					Restore and maintain borrow pit depth
Pattern of Habitats	Terrestrial Areas	Other					Delta, Copperas Cr., reduce sed.
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation

Table E2. Site-specific Environmental Objectives (La Grange Pool)

Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Submersed Aquatics	>60% of area			2020	Restore submersed and emergent aquatics
Pattern of Habitats	Land Cover/Use	Submersed Aquatics	>60% of area			2020	Restore submersed and emergent aquatics
Pattern of Habitats	Land Cover/Use	Submersed Aquatics	>60% of area			2020	Restore submersed and emergent aquatics, RM 134-148, Spring Lake Bottoms, Manage for wetland habitat for waterfowl use, Maintain existing levee
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitats
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitats
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland and moist soil habitats
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					RM 121-126, Restore and maintain wetland habitat
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (La Grange Pool)

Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (La Grange Pool)

Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Forest					Restore grassland and forest
Pattern of Habitats	Land Cover/Use	Other					Promote natural habitat growth

Table E2. Site-specific Environmental Objectives (Alton Pool)

Ecosystem Element	Parameter	Extent	Target Range	Season	Frequency	Target Date	Comments
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Water Quality	Water Clarity	Backwater Areas					See pool-wide objectives
Geomorphology	Backwater Depth	Backwater Areas					

Table E2. Site-specific Environmental Objectives (Alton Pool cont.)

Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					
Geomorphology	Backwater Depth	Backwater Areas					Maintain and deepen secondary channel
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Geomorphology	Connectivity	Floodplain		All Year	20		Gravity structures
Pattern of Habitats	Aquatic Areas	Main Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Aquatic Areas	Secondary Channel					
Pattern of Habitats	Terrestrial Areas	Island					
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection

Table E2. Site-specific Environmental Objectives (Alton Pool cont.)

Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Island					Island Protection
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Terrestrial Areas	Other					Delta, reduce sediment input and delta formation
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Large contiguous wetlands for migratory water birds (1000+ acres)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Large contiguous wetlands for migratory water birds (1000+ acres)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Restore wetland habitat (see pool-wide objectives)

Table E2. Site-specific Environmental Objectives (Alton Pool cont.)

Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Emergent Aquatics					Increased emergent and submersed aquatics (see pool-wide objectives)
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Forest					
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Pattern of Habitats	Land Cover/Use	Other					Restore habitat as possible
Plants and Animals	Other						Mussels
Plants and Animals	Other						Mussels
Plants and Animals	Other						Mussels
Plants and Animals	Other						Mussels
Plants and Animals	Other						Mussels
Plants and Animals	Other						Mussels
Plants and Animals	Other						Mussel bed, RM 50-54

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to environmental objectives. The entire plenary report can be found in Appendix C.

Nov 6th, Objectives Plenary Session:
The plenary began by asking each group to give a brief overview of what they did, as well as listing their reach and pool-wide objectives.

Group 1 Summary (Alton and LaGrange) – We focused on Pool wide objectives. We tried to figure what we are trying to restore to. We decided that 1910 would be the reference condition because it is post diversion but before pollutants caused significant problems.

Alton Pool-wide Objectives
Recreate Natural Hydrograph
Decrease flooding to limit catastrophic costs and help with connectivity
Reduce sediment input from the watershed
Restore submersed vegetation

We added icons to the map. We did some data-mining and created a new icon in Geomorphology E (erosion). We noted that there is gap for wetland complex or habitat from Godar-Diamond Island to Meredosia. There was a joint venture staff in Vicksburg – they recommended a bird resting area every 25 miles. So we located 2 areas for that. We identified more icons for connectivity (drainage ditches). We did not get into LaGrange Pool; we decided that the icons on map were good enough. We didn't want to mess with what has already been done. One suggestion is to move icons off of map to ease up clutter. We did have some questions as to where data came from.

Group 2 Summary (LaGrange to Peoria Pool)

LaGrange and Peoria Pools Reach Objectives

10% additional flood plain
Maintain depths in existing areas. 5m depth in backwater (5%) by 2020
Maintain habitat-protecting levees until ready for reconnection
Summer water level bump less than `1 in 3 years
Reduce sedimentation
Fleeting areas
Dredged material for Mast Trees
Moist soil in BW
Habitat for T&E
Backwater Diversity

Create island, windbreaks

We added data to existing database and added new information

<u>Group 3 Summary (Lockport To LaGrange Pools)</u>

Entire River Objectives
Protect, manage and enhance habitat for T&E
Regulate and develop environmentally friendly fleeting areas
Foresters should evaluate for Mast Tree and floodplain forest in each area.

Lockport Pool-wide Objectives
Aquatic Barriers for Exotic Species
25% reduction of nutrient loading
Secondary standards
Improve water clarity
Database WRDGC should be referenced
SWS study by Tom Butts (1990) Water quality
Systemic removal of sediment
Removal of sunken barges if not serving habitat purpose

Brandon Road Pool-wide Objectives
25% reduction of nutrient loading
Secondary use
No net loss at mouth of Des Plaines RM290-291
Fish by-pass

Dresden Pool-wide Objectives
Removing abandoned barges
Fish passage
Maintain and protect aquatic plant beds

Marseilles Pool-wide Objectives
Protected and maintain floodplain forest. Increase by 20% in 20 years
Increase diversity of floodplain forest.

Starved Rock Pool-wide Objectives
Reach Objective Marseilles and Starved Rock Pools - Threaten and endangered river red horse.

Peoria Pool-wide Objectives
Control exotic species (Purple Loosestrife)
Protect and enhance T&E (bald eagle, river red horse, Decurrent False Aster)

Site Specific Objective Setting for IWW

Once each group gave their report we then started at the upper end of Lockport Pool and moved down river, allowing all participants to provide input.

Discussion of Lockport Pool
There are concerns about the Exotic Barrier. We need something more permanent like an earthen dam.

Brandon Road Pool
Confluence of Des Plains from RM 290-291. There is a backwater complex that is good. We want to protect existing pool riffle complex. Wetland habitat is good too. Protect!

Discussion of Runoff: There is nothing that this project can to within the floodplain.
There is nothing to do to address suspended sediment.
Look at bank stabilization and tow resuspension.
River wide – Reduction in sediment loads from all tributaries.

Dresden Pool
Statewide water quality standards differ above and below bridge at RM 278. Improve water quality so it is all general use.

Barrier vs. Fish Passage: If you try to impede exotic fish then you limit native species.

Du Page River Bay (RM277)– Peter Hall had a scheme.

Discussion of TARP – I have heard something about using gravel pits for regulating reservoirs? TARP acts to capture as much combined sewer overflow (CSO) as possible. All of the flows captured by the TARP are eventually treated. The new reservoirs are designed to first prevent basement flooding, but will also capture other CSO flows as well, depending on how they are operate.

Marseilles Pool
RM 271 – Mussel bed found behind Dresden Island. Hasn't been reported. Heidi Dunn did the work.

Starved Rock Pool
RM 232-235 – Possibly high content of PCB's

Peoria Pool
RM 224.5 Huse Lake is a Superfund site. Endangered Boltonia in RM225 (South of Vermillion River West of Hwy 39)

Clark Island is a very interesting area. During certain hydrographs the main flow goes from MC to back channel and scours it out, while sometime it silts in. This is a very interesting area, self-sustaining. However, it does need to be monitored.

Can we get CRP and CREP system wide?
They have some GIS databases.
USGS is supposed to keep records, but doesn't.

The Corps will gather database info from T&E. However, we will need to mask T&E data before show data to non-privy people.

Islands in 190-195 are good site to put Mast Trees.

RM 182 – There are small embayments that have very small watersheds. This would be a good place for fisheries.

RM177 – Put low-level impoundment to create moist soil units. Already pumping water in that area.

Comment from reviewer: Need fisheries areas every 10 miles and waterbird areas every 25 miles.

<u>Nov 7th, Objectives Plenary Session:</u>

LaGrange Pool

Whole floodplain from Peoria to Bartonville needs to be maintained, protected and enhanced. (Pool-wide)

Does anyone have a general concept as to how much sediment input needs to be reduced before we can remove protective levees?

Some small management levees are there to maintain water levels for moist soil plants. Until Carp populations are controlled we need to keep the selected large agricultural levees in place for the marshland habitats. We need a method to control invasive species to protect habitat.

How does this benefit fisheries?

It would be preferable to have this open, but in order to protect this habitat we cannot. These leveed-off agricultural areas are 100-year-old time capsules. Would like to develop them so as to be able to reconnect these.

Comment added from report review: Management levees generally are low-level berms and most are effective only below flood stage. Only the one at Chautauqua 2-3 ft above flood stage in the south pool for moist-soil plant management and higher in the north pool for fishery and stable water management. Both were flooded in 2002 and the south pool is flooded every year. Waterfowl management areas are inundated every year and usually more than cone. Banner Marsh is behind a 50-year ag levee and like Spunky Bottoms and Hennepin has both fishing and water bird habitat. So, there is a major difference in elevation between ag levees (most have never been overtopped) and low-level management levees. A lot of people think management levees or berms are all ag levees. That's not the case. Consequently, most of the 183,000 acres not leveed for agriculture in the floodplain flood most years and are surface.
So, in the next 50 years how can we manage these for clear water – aquatic habitats and work with wildlife, fisheries and spawning areas?

We need to work with areas that are still connected to the river. Maintain, protect and enhance these. This is the most important concept we need to hold onto (keep time capsules until ready.) Pekin Lake is an area that we are developing for fisheries.

Comment added from report review : We can have connectivity through surface and subsurface means. Elimination of pumping within levees allows clear water to accumulate in the district through subsurface connectivity and rainfall.
We need to keep fisheries in mind for IL 2020 and other programs. This is an area that NGO's are curious about. Amount of acreage that needs to be reconnected for IL 2020 (other environmental plans).

Spunky Bottom. We will find out soon if this will happen. TNC has models as to how much sedimentation would go in. Emiquon, ISWS. TNC is going through steps to reconnect to the main channel.

SWS has sediment budgets. Big point 1/3 behind levees, 1/3 connected floodplains, 1/3 backwater. We don't need to be building more leveed areas or reconnecting other areas until we have a better handle on things. Keep areas as they are and continue to improve them as they stand.

Are we worried that the silver, big head or European carp will up root plants?

European carp is hard on plants, but the other two you wouldn't think would have that big effect on vegetation. However, I spoke with people in Europe and theses fish have virtually destroyed other species.

So, what de we do about this?

Theiling -- We manage for conditions that favor native fish rather than invaders.

We could develop some kind of bug to kill off invaders but not native species.

System-wide Objective – Control of exotic species: Manage fisheries to reduce populations of destructive exotic and invasive species.

Great lakes are introducing more invasives, the South is stocking everything and we are limiting habitat. We are shooting ourselves in our foot.

These Exotic species are an impediment to management of the river

50% of currently isolated backwaters for the exclusion of exotic and maintenance of quality habitat. Increase connectivity to 25% of currently isolated backwaters and improve them. Need fisheries over winter areas every 10 miles just like we need bird resting every 25 miles.

Look at the whole river and designate which areas have highest priorities for different guilds.

I reject the idea that fisheries are bad for birds, and bird areas are bad for fish.

Connected vs. disconnected. Need to look at current and historic areas to see areas that were connected and no longer are.

Theiling -- I want to reiterate that we need to look at river systemically.

Do you think we should reconnect backwaters now or after the health of the river is restored?

Now. Areas where there is a marginal levee that have routine breaks can be reconnected.

At RM 137.5 we have a delta area. This is Copperas Creek Delta. A lot of sedimentation.

Gave overview of Rice Lake EMP.

I want to dredge out Big Lake for fisheries (Paddlefish).

Low height of levee, won't prevent annual spring flood, but will help to disconnect during mid-summer bump.

Need to include EMP planning database into this information.

Management action for this area. Take dredged material and place it on the island before planting mast trees.

Some tributaries have watershed plans. We need be examine plans to see what locals want in these areas.

Mantanzas Bay is one of our deepest backwater areas. It might be a good area for over wintering fish.

Moscow Lake is a good candidate for over wintering fish RM 111.

Sangamon River – Restore meander (in general) on both North and South. Would be in Corps interest because of sedimentation problems at the mouth of the river.

The extra length of the proposed lock and dam at LaGrange would cut into the existing wetlands.

Originally considering 2 new locks, one at Peoria and LaGrange, but nothing with the dams. However there has been some talk about moving from wickets to more permanent dams. Would it benefit water level management?

It might be nice to be able to manage more than a foot and a half.
Would this help up at the upper half of the pool?

No there is not a big effect in upper pool.

Barge industry won't like the dams because they can pass over wickets.

At low flows there is a dramatic water level fluctuation.
Comment from Reviewer: Additional tainter gates would likely not provide the level of water level control required to eliminate the "bumps" discussed here.

At low flows there is a possibility to improve management conditions. You could put in another tainter gates, but the flow and watershed effect are more significant.

Theiling -- These things are being looked at carefully in the Illinois River Study.

Alton Pool
Pool wide – Investigate opportunities to improve leveed areas.

Mention levee setbacks to allow for floodplain habitat and increase flood conveyance

From Meridosia to Beardstown – They did some commercial musseling and found 20 beds. Rob Maher and Dean ? did the work.

1-2 foot contour maps will help determine levee setbacks.

Theiling -- Have Woermann and earlier but not modern contour maps.
Comment from Reviewer: We have 2 ft contour COE maps from ~1980.

Working Group Reports

The working group reports were prepared by the recorder in each group as a record of the discussion. They contain a subset of the pool-wide and site-specific objective information generated by the groups. The group reports are not inclusive of all the objective descriptions because much of the groups' data generation was also recorded on master worksheets and maps

GROUP 1

Bottom end of Illinois River, Alton Pool – Pool 26

Participants --- Ross Adams, Steve Havera, Michael Cochran, Rob Davinroy, Eric Laux, Mike Cox , Bob Clevenstine, Stan Ebersohl, Tim Kelley, Jon Kauffeld - Recorder

Pool-Wide Objectives

Gap from Two Rivers to Meredosia, need for additional floodplain habitat, wide floodplain, levee protects lots of floodplain, Nutwood and Hartwood Districts may be marginal and available for acquisition and habitat. At low water conditions can reconnect, levee districts lower than the pool. Money paid to those levee districts from flooding during pool construction.

Example – pool 20, put an icon on Lima Lake for aquatic vegetation establishment, now have landowners interested in doing aquatic re-establishment. If we have ideas where we know low spots are, we should put aquatic vegetation reestablishment on the maps.

Restore submersed vegetation and off channel connectivity to all pool, Meredosia to Eldrid are key drainage districts to target for connectivity. No consensus on amounts of floodplain needing to be restored to habitat, but at least 2-3 districts, Nutwood and Hartwell mentioned several times.

All the tributaries have a delta on them from sediment coming from hills. Have increased tremendously since 1976. All tribs have erosion off ag ground, Need to reduce sediment accumulation. There may be places where delta is preventing fish migration into tributaries, creating islands in the delta, or moist soil units at or near mouths of tributaries, and restore depths and connectivity of tributaries.

Restore backwater depths, aquatic vegetation, throughout backwaters on pool.

During flood fighting, lots of sandbagging now occurs, it probably would make more sense to have designed spillways in levees. If they could be flooded in a controlled manner to reduce scouring it would benefit river flood control efforts and allow nutrient input on farmland.

Pattern of habitat on pool wide reach – would be nice to agree on a reference condition, on the Illinois River probably best habitat condition was in the 1910-1920's. Habitat declining at the time dams were put in. Chuck Theiling suggests 1900-1905. Wetlands still had submergent and emergent plants. Wastewater in the 30's degraded system. Illinois Natural History survey data exists, plant surveys, fish sampling, etc. back to turn of the century.

Water level management – drawdowns to improve emergent plant communities, stabilize sediments should be done. There is an increase of interest among landowners to manage floodplain lands for waterfowl hunting. Rice was a common plant in Nutwood and Eldred years ago. Discussion on whether or not is was wild rice or domestic rice. (Review comment from ILNHS states, "It was natural.")
Some aquaculture opportunities on some areas has limited potential. Harvested lots of commercial fish in early parts of the century, Upper or Lower Smith, near Meredosia. In last several years has been some commercial interest in recent years.

Marsh habitat is missing in the Illinois River, by maintaining the levees, turning the pumps off, can subsurface water infiltrating into the areas behind the levee. Natural seed base exists and these plants will return. Hennepin Drainage District, Spunky Bottoms are examples of where this has occurred.

Specific Locations within the Alton Pool

River mile 5 – 10 , Swan Lake, want backwater depth, need to monitor, constructed and operational now. Lower pool for fish, middle pool fish and migratory birds, upper portion migratory birds.

Discussion is that most of what has been identified as objectives is within the levees, and there is not a lot of additional information the group can provide to the database. Expanding the database with habitat depth, secchi disk targets, etc is beyond knowledge of this group. Region 4 Illinois DNR folks would be some of the best contacts to add this knowledge. Landowner participation is necessary as well.

Nutwood and Harwell Drainage Districts – Setback levee or put holes through levee to get fish habitat restored in older channels, lateral connectivity. Also have opportunities to establish marsh habitat through keeping levees in place, turning off pumps, allowing aquatic vegetation to reestablish. Opportunities to restore bottomland hardwood habitat as well in floodplain, and wet prairie also.

Eldred Drainage District – Similar potential to Nutwood and Hartwell

Keach, South Quincy Drainage District (on the Mississippi, not the Illinois, but it's a good example) – Nearly all of these are soybeans and corn now. Nearly all are pumped now to provide drainage so that they can be farmed. Some, like the Quincy district have enough water that the DNR now puts fish in some waters. In the 1950's about 13 drainage districts were selected on the Illinois River, about 50,000 acres identified that had high potential to restore back to wetland habitat. Thompson Lake was included. Jenkins and Walraven were the engineers that put that report together. All of these sites should be included in the environmental sustainability habitat objectives.

Could use a waterfowl feeding/resting area/shorebird habitat halfway between Meredosia and Swan Lake. Group had some difficulty targeting the best drainage districts that had the greatest potential. Nutwood and Hartwell Drainage District probably have the best potential.

Add an "other icon" at each delta to either set back the flank levee so that the tributary delta becomes more natural, allowing meanders, islands, etc. Alternatively, could leave the levees in place, and dredge to expand islands, and fish connectivity to tributaries. Other districts which have potential are: Mile 30 - Eldred and Spanky, Hillview- Mile 49, Big Swan – 50-56, Scott County Drainage District around mile 60

Group wanted to make sure that some river habitat, deepwater habitat and island habitat improvements are done to insure that sufficient habitat is available to maintain areas for population dispersal, overwintering, and movement of individuals and species is preserved. A listing of spots to concentrate efforts or at least to look at are:
Upper end of swan Lake – river mile 13, Twelve mile island – deepen side channel – deep water habitat needed, River mile 19 – Morton Island – deepwater habitat
River mile – 39 – Fisher Island – erosion of island , McKeevers island – erosion – Mile 49, Blue island, backwater habitat,

The above listing and the listing on the environmental objective map were essentially copied from a previous report entitled " Draft Fact Sheet – Lower Illinois River – Alton Pool, Illinois River Ecosystem Restoration, August 2001" done by Mike Cochran and T. Miller.

GROUP 2

Participants --- David Ahrens, Wayne Herndon, John Marlin, Matt O'Hara, Mike Schwar, Michelle Simone, Randy Timmons, Mike Wefer, Mike Zerbonia, (w/Ross Adams)

??? Historical land covers as targets for restoration

Starting Point – RM 119, Icon 52, Havana

Pool-wide objectives:

- Restore additional 10% of Upper La Grange floodplain (bluff to bluff) to floodplain, terrestrial habitats – with a goal of significant contiguous areas (min. 10 ac for wetlands, 100 ac forests, etc.)

- Maintain depths of existing backwaters and increase area available for overwintering fish (3m+) in backwaters by 5% by 2020 and 10% 2-3m, 25% 1-2 m, 60% less than 1m
- Maintain 50% of existing backwaters for exclusion of exotic species and reconnect 25% of currently isolated backwater areas and historical backwater lakes (Fish areas every 10 miles)

- Maintain habitat-protecting levees (e.g. Emiquon) until river conditions adequate to allow reconnection

- Reduce incidence of summer water level "bumps" to less than 1 year in 3
- Reduce sedimentation throughout pool
- Avoid conflicts between habitat enhancements and potential or existing fleeting areas

- As much as possible, use environmental dredge material to provide area for mast tree plantings (appropriate elevations and soil composition)

- Promote marsh and moist soil habitat development in backwater areas
- Manage fisheries to reduce populations of exotic (destructive) fish species
- Increase mussel diversity
- Protect and enhance habitat for threatened and endangered species

Site-Specific Objectives:

52 – Spoon River – potential meander restoration upstream of mouth (reconnection)

51 – Thompson Lake - ???

50 – Quiver Lake – restore depth, aquatic vegetation

Restore side channel behind Quiver Island, RM 121-122

Restore depth at Liverpool Lake, Liverpool side channel, riprap Meyers Ditch

Restore backwater habitat and maintain levees at Thompson Lake, Flag Lake – RM 128.5-132

Controlled disconnection of Clear Lake for moist soil or keep connected RM 130-133?

Windbreaks in Clear and Chautauqua Lake?

RM 132-137 – Rice Lake – reopen Senate Island side channel (1-2 m) (RM 135) – multiple habitat enhancements throughout lake complex – expand EMP project – dredge lakes to various depths, place material onto Duck Island, pile up to create mast tree planting areas, control structure for moist soil unit
RM 136.5 – Copperas Creek lock structure – OK as is

RM 134-148 Spring Lake Bottoms – restore as per Hennepin/Hopper – very valuable large contiguous area

RM 141 - 143 Coon Hollow Island, Banner Marsh etc. – restore channel depths behind islands

Enhancements to Banner Marsh? RM 138-144 – levee maintenance most critical – habitat improvement as appropriate

RM 148 – restore Turkey Island side channel depth

Pekin Lake – typical backwater requirements

38 – Isolated backwaters ?

Peoria Pool

Pool-wide objectives:

- Restore additional 20% of Peoria Pool floodplain (bluff to bluff) to floodplain, terrestrial habitats – with a goal of significant contiguous areas (min. 10 ac for wetlands, 100 ac forests, etc.)
- Maintain depths of existing backwaters and increase area available for overwintering fish (3m+) in backwaters by 5% by 2020 and 10% 2-3m, 25% 1-2 m, 60% less than 1m
- Maintain 50% of existing backwaters for exclusion of exotic species (e.g. Hennepin/Hopper) and reconnect 25% of currently isolated backwater areas and historical backwater lakes (Fish areas every 10 miles)
- Maintain habitat-protecting levees (i.e. Hennepin/Hopper) until river conditions adequate to allow reconnection

- Create islands, windbreaks and wavebreaks to enhance habitat in lake and backwaters
- Reduce incidence of summer water level “bumps” to less than 1 year in 3
- Reduce sedimentation throughout pool
- Avoid conflicts between habitat enhancements and potential or existing fleeting areas
- As much as possible, use environmental dredge material to provide area for mast tree plantings (appropriate elevations and soil composition)
- Promote moist soil and marsh plant development in backwater areas
- Manage fisheries to reduce populations of exotic (destructive) fish species
- Increase mussel diversity
- Protect and enhance habitat for threatened and endangered species

How to keep Peoria Pool from sedimenting in?

Moist soil unit at Woodford State Wildlife Unit

Peoria Lake to Henry – backwaters, islands, moist soil as appropriate

REFERENCE – Mid-Peoria Pool 2020 Plan for project IDs (M. Cochran, J. Mick)

GROUP 3

Participants --- Ken Barr, Dan Sallee, Mark Beorkrem, Bill Graham, Charlene Carmack, Julianna Cruz, Jim Slowikowski, Todd Bitner.

Entire River:

**Revisit natural resources inventory (note to Ken Barr) ** The original Natural Resources Inventory was incorporated into the new one.

endangered and threatened species and natural areas protection, management and enhancement

Forester should examine entire IL River reach for mast tree needs and floodplain forest needs from diversity and depth of forest and habitat needs for migratory songbirds, need for increasing acreage, utilize CREP/IL 2020

Regulate and develop environmentally friendly fleeting operations

Control or elimination of exotic and invasive species

Manage fisheries to reduce populations of exotic/invasive species

Maintain 50% of currently isolated backwaters for exclusion of exotics and protection of high quality habitat, increase connectivity of 25% of currently isolated backwaters

Lockport Pool:

Lockport Pool has virtually no natural channel, all canal

Goal – Establish Aquatic barriers for exotic species

25 % reduction in nutrient loading

Water Clarity affected by resuspension of sediments by barges through navigation season

Elimination of secondary use standards for this reach

Improve Secchi Level (water clarity)

Tom Butts State Water Survey (Dana Shackleford 2nd author) Water Quality work done in 1990-1991 should be referenced

MWRD data base should be referenced

Water levels affected substantially by MWRD actions up to 10 feet per incidence.

Systematic removal of contaminated sediments

Removal of sunken and abandoned barges (if not serving habitat purpose) and related materials

Brandon Pool:

25 % reduction in nutrient loading

Elimination of secondary use standards for this reach

No Net Loss of wetlands at mouth of Des Plaines River

Maintain existing aquatic and terrestrial areas in reach miles 290-291

Fish screen for water intakes (power plant) and fleeting operations

Removal of abandoned barges and cables

Dresden Pool:

#1 Maintain and protect Treats Island side channel

#1 removal of contaminated sediments from Treats island side channel

Elimination of secondary use standards for reach above mile 278

Removal of abandoned barges and cabling, particularly at Mile 281

3 two islands (Moose and 1 unnamed) River Mile 276 restore backwater depth and flow

Maintain/protect existing aquatic plant bed acreage pool-wide

Fish Passage through Dam

Marseilles Pool:

Maintain/restore side channel depths at Big and Little Dresden Island mile 271
Note: Mussel bed present here not previously documented

#3 protect and maintain Aux Sable Creek Delta area mile 268

#4 protect and maintain Sugar Island side channel mile 262

#4 update GIS data on Material Services gravel pit which extends much further than shown, miles 262.5 – 258 investigate obtaining Material Services property for recreational area

#5 (Moody) or McNeels Bayou, reconnect to river mile 257 ~

#6 contaminated sediments, improve water depth

#6 Johnson Island protect and maintain mile 249.6

10% increase in bottomland hardwood forest acreage, improve diversity

Ballards Island- dredge for overwintering habitat mile 247.5+ , and restore brown bullhead habitat, 25% over 6 foot depth

Water level fluctuations need to be controlled

#7 protect and maintain, restore if necessary depth Marseilles Canal

fish passage at tailrace of mile 246-7 utilize old power house/paper plant

Starved Rock Pool:

fish passage at tailrace of mile 246-7 utilize old power house/paper plant

Rapids and Tailwater Endangered Species fishery (redhorse) mile 244.2

#8 Bulls Island Bend restore overwintering habitat in side channel,

Mayo Islands & Hitt islands Mile 237-239 increase backwater channel depth

Contaminated sediments remove from river mile 232-235

Restore wetlands north bank, above Buffalo Rock along rr tracks and Dee Bennett Rd, river miles lock and marina river mile 231-235

Remove exotic species at lock land (Corps land) river mile 231 -235

#12 Investigate islands above dam for stability and restore water depth,

Increased bank erosion in sensitive resource areas due to dam operations, rare plant communities (terrestrial) south shore mile 231-233, sandstone erosion

Control recreational boat access in miles south side 231-233 due to impact on sensitive area

Fish passage

Peoria Pool:

Abandoned barge removal at Plum Island

#13 improve water depth throughout behind Plum Island

Leopold Island mile 230.7 armor erosion, prevent erosion, important fish habitat, maintain trees for eagle roosting and fishing

Pool wide, protect and enhance Bald Eagle roosting habitat

Pool wide, red-shouldered hawk, brown creeper protect and enhance

Pool Wide boltonia decurrens protect and manage habitat

Huse Slough(upper end) mile 224 quality wetland habitat backwater lake protect and enhance, needs contaminate cleanup, owned by City of LaSalle

Vermillion River & Little Vermillion protect and enhance delta areas for fishery and terrestrial habitat

Lake DePue contaminated sediment removal

Remove contaminated sediment at mile 218.5-219 north bank

Appendix F. Management Actions

Purpose:
To review and identify management actions that are most likely to contribute towards achieving the established goals and objectives.

Background:
For the purposes of these workshops, Management Actions are: regulatory, operational or structural tools or activities that can be implemented to positively address environmental objectives (e.g. hydraulically dredge a backwater area). Participants reviewed a list of management actions that had been compiled from previous planning to assess their ability to meet the objectives that were discussed the previous day Time was given to ensure all the groups were able to review all of the actions. The reports from each group were presented in a plenary session to provide other participants the opportunity to ask for and receive clarification.

Results:
What follows is the management information gathered and reviewed at the Peoria Workshop. It is organized into three sections: management action tables, plenary report, and working group reports.

Each working group prepared a master worksheet to record the group's changes, additions, and deletions to the list of management actions. The changes from all the groups were compiled in the following worksheets (Table B1). There were 41 management actions added, 8 actions were modified, and 23 additional comments were added. These results will be merged with those from other workshops, and the entire management actions database published in the UMR-IWW System Navigation Feasibility Study Interim Report will be updated.

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management. The entire plenary report can be found in Appendix E.

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

Table F1. Management Actions

Element/ Parameter	Extent	ID	Management Action	Comments
Water Quality				
Water Clarity	Main Channel	1	Apply watershed BMPs (best management practices)	
		2	Stabilize river banks	
		3	Pool scale drawdown to consolidate soft sediments	
		4	Minimize dredge disturbance/frequency	
		5	Minimize dredge slurry return water	
		6	Minimize bankside dredged material placement	
		7	Stabilize dredged material	
		8	Tributary reservoirs	
		9	Speed and wake restrictions - ~~rec. boats~~ (all watercraft)	
Comments/ Additions:			Evaluate and modify mechanisms to deal with watershed influences to eliminate spiking hydrographic cycle (system wide)	
		52	Restore natural tributary areas through delta areas	
			Minimize open water dredged material placement	
			Sediment traps	
			Increase depth in main channel (reduce resuspension)	Highly controversial
			Require upper waterway to meet EPA general use standards	Pollution control needs to be better designed
				Entire system should meet general use standards
				Include more/all WQ parameters, see USACE guidance 110-2-8154

Table F1. Management Actions (cont.)

Element/ Parameter	Extent	ID	Management Action	Comments
Water Quality cont.				
	Backwaters	10	Pool scale drawdown to consolidate soft sediments	
		11	Drawdown management units	
		12	Drawdown isolated backwaters	
		13	Isolate and drawdown contiguous backwaters	No net loss of cont. backwater
		14	Temporarily isolate and drawdown contiguous backwaters	Concern they would become permanent by default; some want to delete
		15	Construct wind breaks	
		16	Construct Wave breaks	
		17	~~Remove bottom feeding fishes (carp)~~	Replace with Control exotic species
		18	Increase plant density	
		19	Increase plant distribution and diversity of native species	
		20	~~Reduce algae production~~	
Comments/ Additions:			Increase depth of backwaters	
			No net loss of backwaters	
			Speed, wake, and motor restrictions	
				Pollution control needs to be better designed
				Entire system should meet general use standards
				Include more/all WQ parameters, see USACE guidance 110-2-8154
			Pollution control of all phases (i.e., solids, liquids, gases	

Table F1. Management Actions (cont.)

Element/ Parameter	Area	ID	Management Action	Comments
Geomorphology				
Backwater Depth	Backwater Areas	21	Hydraulic dredging	
		22	Mechanical dredging	
		23	~~Consolidate sediment~~ Drawdowns to consolidate sediment	goal or result of action
		24	~~Divert~~ Improve flow to increase backwater scour	
Comments/ Additions:			Increase meander scour through placement of hard structures - for low flow depth diversity (modify geometry)	
Water Level	Main Channel	25	Pool scale drawdown	
Comments/ Additions:			Hydrographic smoothing (system wide) by dam operation	
	Backwater Areas	26	Pool scale drawdown	
		27	Drawdown management units	
		28	Drawdown isolated backwaters	
		29	Isolate and drawdown contiguous backwaters	
		30	Temporarily isolate and drawdown contiguous backwaters	Disagreement about what is temporary and what is permanent
Comments/ Additions:			Smooth hydrograph by regulatory	
Connectivity	Floodplain	31	Acquire real estate rights, restore water to leveed floodplain areas via surface and subsurface connectivity	
		32	Reconfigure, restore flow to secondary channels	

Table F1. Management Actions (cont.)

Element/ Parameter	Area	ID	Management Action	Comments
Geomorphology (cont)				
Connectivity (cont.)		33	Restore flow to isolated backwater areas	Needs site specific targets; connection may be more appropriate term
		34	Create habitat corridors for floodplain terrestrial wildlife	
		35	Restore natural tributary channels through delta areas	
		36	Notch levees or maintain levees	
		37	Set back levees	
		38	Increase water levels	Help with hydrograph?
		39	Increase terrestrial area	
Comments/ Additions:				
Island protection	Main Channel		Protect Islands, especially in main channel	
Geomorphology (cont)	Secondary Channels	40	Notch closures	
Connectivity (cont)		41	Divert or improve flow	
		42	Increase ~~water levels~~ depth	Help with hydrograph?
		43	Dredge secondary channels	
		44	Modify, maintain, or remove levees	
Comments/ Additions:			Maintain current and historic backwater mouths	
	Longitudinal	45	Build fishways	Only downstream of Kankakee at this time
		46	Modify gate operations	
		47	Modify lock operations	Cycle locks for fish
		48	Remove tributary dams	

Table F1. Management Actions (cont.)

Element/ Parameter	Area	ID	Management Action	Comments
Pattern of Habitats				
Aquatic areas		49	Introduce flow to isolated backwater areas (dissolved oxygen, temperature)	Connect (?)
		50	Restore flow to secondary channels	
		51	Restore surface and subsurface flow to floodplain areas isolated by levees	
		52	Restore natural tributary channels through delta areas	Add to water quality too
		53	Divert more tributary delta flow into open impounded areas	
		54	Create rock and gravel substrate areas	
		55	Create shallow rock and gravel riffle areas	
		56	Incorporate woody debris into bank protection	Water clarity also
		57	Incorporate woody debris into 2° and small channels	
		58	Restore flow and geometry of secondary channels (dissolved oxygen, temperature)	
		59	Modify flow distribution from dam gates - tailwater habitat	
		60	Grading, vegetation planting	
		61	Rock groins, hard points	
		62	Anchored woody debris	
		63	Off-shore rock revetments	
		64	Submerged rock vanes	
		65	Notch wing dams to create hydraulic, depth diversity	
		66	Notch closing dams to increase side channel flow (dissolved oxygen, temperature)	
		67	Construct temporary structures to divert flow (dissolved oxygen, temperature)	
		68	Use larger rock, make bank revetments irregular	
		69	Incorporate woody debris into channel structures	
		70	Construct hard points, groins for shoreline stabilization	
		71	Construct off-shore revetments	

Table F1. Management Actions (cont.)

Element/ Parameter	Area	ID	Management Action	Comments
Pattern of Habitats				
Aquatic areas cont.		72	Construct seed islands	
		73	Construct bendway weirs	
		74	Construct chevrons	
		75	Modify flow splits between main and off-channel areas	
		76	Dredge backwater areas, increase depth	
		77	Dredging to restore and create secondary channels	
		78	Shore pipe, boosters to reach target sites	
		79	Use small dredges to expand placement options	
		80	Bend width reductions where possible	
Comments/ Additions:			Upland dredged material placement for beneficial use	
			Behind levee dredged material placement	
			Maintain selected agricultural levees for wetland management	
			Protect and restore, mussel beds and increase diversity	
			Restore native submersed and emergent communities	
Terrestrial		81	Place dredged material to create wetland areas	
		82	Placement on existing, construct new beaches for shore and wading birds	
		83	Semi-confined channel placement (chevrons)	
		84	Unconfined placement in floodplain (for mast trees)	
		85	Unconfined placement in floodplain	
		86	Maintain beaches	
		87	Island construction	
		88	On floodplain to raise areas for mast-producing trees	
		89	Confined placement in floodplain	

Table F1. Management Actions (cont.)

		90	Construct hard point in floodplain for ephemeral pools	Propose elimination?
Element/ Parameter	**Area**	**ID**	**Management Action**	**Comments**
Pattern of Habitats		91	Construct islands in impounded areas and backwaters	
Terrestrial cont.		92	Seed islands	
		93	Chevron islands	
		94	Rock islands	
		95	Islands with varied top elevation, fine material	
		96	Low islands - ~~mud flats~~ and sand bars	
Comments/ Additions:			Behind levee dredged material placement for crop fields	
			Behind levee dredged material placement for beneficial use	
			Stabilize eroding ravines	
			UMR-wide BMP practices that apply	
			Control selected native and exotic species	
			Promote diverse moist soil vegetation	
Land Cover/Use		97	Modify and manage habitats on refuges (see habitat below)	
		98	Manage vegetation cover	
		99	Manage water levels	
		100	Modify habitat structure in floodplain and backwaters	
		101	Plant vegetation on dredged material deposits	
		102	Plant floodplain trees (mast trees)	
		103	Harvest floodplain trees	TSI/TSM
		104	Plant floodplain prairie	
		105	Burn floodplain prairie	
		106	Control invasive exotic species	
		107	~~Place dredged material to~~ create wetland areas	
		108	~~Unconfined dredged material placement in~~ Raise floodplain elevation (for mast trees)	

Table F1. Management Actions (cont.)

		109	Growing season drawdowns	
Element/ Parameter	**Area**	**ID**	**Management Action**	**Comments**
Plants and Animals				
Fish		110	Adjust angling, commercial fishing regulations as needed	
		111	Modify angler attitudes about exploitation	
		112	Enforce fishing regulations	
		113	Stock fish	
Comments/ Additions:			Conduct biomanipulation of fish and wildlife community (various actions)	
			Reintroduce/maintain native fish species stocks	
			Modify dredging activities for invertebrate habitat	
			Reconnect fish species to habitat to restore life cycles	
			Control exotic species	
			Promote commercial utilization of appropriate species	
Wildlife		114	Conduct biomanipulation of fish and wildlife community (various actions)	
		115	Adjust hunting and trapping regulations as needed	
		116	Modify hunter attitudes about exploitation	
		117	Enforce hunting regulations	
		118	Reintroduce native species	
Comments/ Additions:			Promote habitat for water bird species and other wetland wildlife	

Table F1. Management Actions (cont.)

Element/ Parameter	Area	ID	Management Action	Comments
Plants and Animals				
Exotics		119	Formulate control of invasive exotic species	
		120	Construct, operate, maintain barrier on Illinois River	
		121	Require antibiotic treatment of Great Lakes freighter ballast water	
		122	Regulate use of exotic species for fishing bait	
		123	Regulate biota transfer by fishing boats	
		124	Apply species-specific toxicants and biological controls	
		125	Kill zebra mussels on vessels in lock chambers	Is this realistic?
		126	Restrict and enforce use of exotic species in aquaculture	
Comments/ Additions:			Barge cleaning stations (hulls for zebra mussels)	
			Public awareness for catch and DO NOT release program	
Plants and Animals		127	Protect, increase populations of threatened, endangered species	
T&E			Increase, restore, and maintain suitable habitat for T&E species	
Comments/ Additions:			Reintroductions based on historic records	

Table F1. Management Actions (cont.)

Element/ Parameter	Area	ID	Management Action	Comments
Best Management Practices				
All			Modify habitat (see below)	
		128	BMPs	
		129	Conservation tillage	
		130	Contour farming, terraces	
		131	Grassed waterways	
		132	Establish perennial cover, crops	
		133	~~Stabilize eroding ravines~~	
		134	Conservation Reserve Program land set-aside	
		135	Erosion control structures along intermittent streams	
		136	Construct, maintain small impoundments	
		137	Restore drained lakes, wetland areas	
		138	Riparian buffer strips	
		139	Restore stream channels, floodplain areas	
		140	Urban stormwater management practices	
		141	Construction site erosion prevention practices	
		142	Increase pervious surface in developed areas	
Comments/ Additions:			Employ USDA and IDA set-aside programs such as CREP, WRP, etc	
			Land acquisitions or easements	
			Watershed groups	
			Livestock management	
			Promote more diverse crop rotations	

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management. The entire plenary report can be found in Appendix E.

Water Quality MC
Management action in addressing water quality regulations (3)

Water Quality BW
#13 needs to be cleared up. How much isolation? This is something that needs a Target range. (each group spent about 30 min on this). Group 2 – No net loss of existing contiguous backwater. For #20, needs a target range or remove.

There is a concern that temporary isolation would lead to permanent isolation. Duck hunters would prefer to keep the low-level "temporary" levees in place like they are now. Also there's concern that current temporary may NOT lead to permanent LOW LEVEL isolation.

Geomorphology BWD, BWA
Slight discussion of consolidated sediments. Consolidation is the result. Management Action is a draw down. Need to qualify "for consolidation of sediments"

Geomorph, Connect, Floodplain
Want clarification of #38, #42. Almost have to raise pool to raise floodplains. Then you might raise ground water levels. Maybe increase depth. Really more of an objective than an action.

Patterns of Habitats Landcover/use
#107, #108 Use material (e.g. Dredged material). This way you aren't limiting to only dredged material.

Working Group Reports

The Working Group reports below were prepared by the recorder in each group as a record of the discussion. Working group reports are not inclusive of all of the work. Much of the groups' data generation was done on master worksheets and maps and compiled for production in a formal report for the Upper Mississippi River – Illinois Waterway Navigation Feasibility Study.

GROUP 1

Participants --- Ross Adams, Steve Havera, Michael Cochran, Rob Davinroy, Eric Laux, Mike Cox , Bob Clevenstine, Stan Ebersohl, Tim Kelley, Jon Kauffeld – Recorder

Bottom end of Illinois River, Alton Pool – Pool 26

Pool Wide objective on lower river to target agricultural levees to improve floodplain surface and subsurface connectivity to river. In nearly all of the drainage district areas that we would recommend restoration, there are potentials to setback levees, remove levees to allow floodplain and channel connectivity, and to keep portions of levees in place to maintain high quality wetland habitat. Nearly all of these restorations will be governed by existing land topography and floodplain elevation in relation to river elevation and 10 year flood elevations. We would recommend 1 foot or less contours be mapped for each restoration project and analyzed before detailed restoration plans are designed.

The dramatic fluctuations of river flows on the Illinois River (spikes in the hydrograph) is a unique problem to this river. Most of this problem is probably attributable to the City of Chicago and the addition of 40% of river flows coming from Lake Michigan. Special and unique management actions need to be taken to address this issue. Possible solutions are off-stream regulation reservoirs, greater dam control, or other regulatory controls on the City of Chicago Metropolitan Water Reclamation District.

Some discussion on temporary and or/permanent isolation and drawdown of contiguous backwaters. Concern from fishery habitat people that this management action potentially reduces fish habitat availability. Perhaps some cumulative analysis of all these actions occurring in the system should be made so that from a system wide perspective significant fish migration, spawning, or population productivity is not impacted. Some target range of the % of the system, or some minimum level of connectivity on the system that is not compromised would be worth developing.

Fish passage, only below Kankakee confluence to not compromise exotic species management objectives.

Reintroduce and maintain native fish

Assist commercial fishery by helping to establish/develop market uses or markets for big head, silver, Asian carp that currently do not exist or need help jump starting.

Consider other mussels, invertebrates, amphibians, reptiles and war-blooded vertebrates dependent on floodplain and wetland habitats. in system wide habitat management.

Trash removal is a management action that can be added

Fish species to target management for:

Sturgeon
Smallmouth bass
Carps

Important Ecological Concepts – Many of the fish species on the Mississippi and Illinois Rivers have a survival strategy of being able to harvest increased energy levels as a result of flooding. This increase of energy and area is turned into increased productivity in terms of greater production, greater growth. The use of this increase results in a long term population survival strategy. We have disrupted this by leveeing off the floodplain. The Illinois River is a major migration corridor for may waterbird and neotropical migrants in both spring and fall. Quality wetland habitats for feeding, resting and mesting are necessary throughout the floodplain to satisfy their life cycle requirements.

Perhaps transects which would measure shallow backwater habitats, river channel acreage, deep backwater habitats, emergents, grassland, forests, etc in the floodplain along with a sampling of relative abundance of fish, amphibian species, avifauna and other wil is the best that can be measured on a system wide basis.

GROUP 2

Participants --- David Ahrens, Wayne Herndon, John Marlin, Matt O'Hara, Mike Schwar, Randy Timmons, Mike Zerbonia, (w/Ross Adams), Byron Paulsen, Dan Sallee

Some patterns of habitat (backwater scour, seed islands, chevrons, rock islands) more applicable to Mississippi than Illinois

Sediment traps from tributary areas important WQ need

Increase channel depth to reduce resuspension – esp important during low water – debate priority

Reduce resuspended sediment in barge fleeting areas, speed and wake restrictions for all watercraft?

Do we want to isolate any more contiguous IL River backwater areas, even for habitat improvements? – some may see it as an effective way to restore habitat but others feel that more than enough of the floodplain has already been isolated (no net loss of contiguous backwaters)– dredging may be preferred to isolation

Question whether temporary isolation would really be temporary – maintaining connectivity important in all seasons.

Debate relative benefits of isolation vs. maintaining connectivities

Increasing depth often more effective for WQ than drawdown (drawdowns - unsuccessful drawdowns, nutrient release, water heated, DO?)

Reducing algal production not a major issue in IL River backwaters

Limited management alternatives for water level except drawdown

Include maintenance of selected agricultural levees for habitat purposes

Mussel beds likely to be affected by many of these management actions

Do not want to focus on dredge placement as only means to manage these areas – other ways to raise ground level, create wetlands

Where does easement acquisition etc. fit in?

GROUP 3

Participants --- Mark Beorkrem, Julianna Cruz, JimSlowikiwski, Bill Graham, Charlene Carmack, Todd Bitner, Brad Thompson

Water Quality: (Main Ch.)

Require entire river (IL and other reaches) to meet general use WQ standards

Add water quality as a separate parameter, not just water clarity

Define all parameters of WQ standards (ER 1110-2-8154)

Speed and wake restrictions on all tow boats

Pollution control of all phases (e.g. solids, liquids and gases)

(Backwaters)

Add water quality as a separate parameter, not just water clarity

Define all parameters of WQ standards (ER 1110-2-8154)

Pollution control of all phases (e.g. solids, liquids and gases)

#13: Some feel this should be removed and some do not

#20: Eliminate this action (not known to be a problem on Il reach)

Geomorphology: Backwater Depth (Backwaters)

#23: Unclear whether this is a goal or outcome rather than an action

#24: Change “divert” to “improve”

Add action: Island Protection – Protect islands, especially in main channel

Water Level: (Backwaters)

#29: There is disagreement amongst the group of what constitutes temporary vs. permanent.

Connectivity: (Floodplain)

(Secondary Channel)

#41: Reword to “Divert and/or Improve Flows”

(Longitudinal)

#47: Reword to “Cycle lock operations for fish passage”.

Pattern of Habitats: (Terrestrial)

#86: Change to “Maintain beaches”.

#96: Reword to “Low islands and sand bars”

(Land Cover/Use)

#103: Change to “Timber stand management”.

Plants and Animals (Fish)

#111: Sp. “Exploitation”

(Exotics)

#119: Reword to “Formulate controls of invasive exotic species”.

#125: Comment – is this really practical without any other adverse impacts to the ecosystem

Add action: Public awareness for a ‘catch and do not release’ program for invasive exotics

(TE)

Add action: Increase habitat specific for TE species

#128: Reword to "BMPs- Control livestock access to waterways"

Appendix G. Species and Population Parameters

Purpose:
To identify plant and animal species and appropriate units of measure that should be considered for future environmental objectives planning efforts.

Background:
Recent environmental planning efforts for the Environmental Management Program and other Upper Mississippi River System restoration and maintenance programs have focused on habitats and the impacts of Corps activities on habitats. It has been recognized that planning needs to be expanded to include additional functional and structural ecosystem elements.

During the planning stages of this workshop, organizers were considering objectives for plant and animal species and quickly encountered difficulty in selecting guilds, species, or units of measure for plants and animals. Emergent and submersed aquatic plants, diving ducks, and dabbling ducks were eventually selected based on the perception that knowledgeable resource managers could interpret the units of measure selected. It was determined that stem density was a relatively standard unit of measure for aquatic plants and that use-days during migration periods were relatively standard measures of waterfowl abundance.

Specific objectives for fish were desired, but the selection of guilds, or species, or units of measure quickly complicated the issue. It was decided therefore to back-off on the specifics for fish objectives and only indicate that there is an objective for several general categories of fish determined during earlier phases of the Navigation Study: protected, sport, commercial, forage, and exotic fishes in channel and backwater habitats. The unit of measure became particularly complicated because of our desire to establish quantitative objectives, but our general inability, or lack of commitment, to conduct fish community stock assessments. Discussion of the unit of measure is particularly important because of our need for measurable objectives and our selection of evaluation tools.

These issues were discussed during a plenary session at the workshop, with the results to be forwarded to an expert panel. A focus group of workshop participants will continue work with the expert panel to refine fisheries objectives. The larger list of species such as reptiles, amphibians, other birds, and mammals will be considered during future phases of the adaptive management and assessment process recommended in the Navigation Study Interim Report.

Results:
A participant from the Illinois DNR responded to the question of whether it was necessary to estimate the total abundance of fish in the Illinois River. The simple answer was no, but it was explained in more detail several reasons why such efforts are not practical. First, total population abundance estimates require a very considerable amount of sampling effort and, for some rare species, total population size may be impossible to

estimate. Even when population estimates are made the margin of error may be so wide that the estimate is nearly meaningless.

A better method to measure population response to environmental change is to sample specific habitats with the same proportional effort year after year (i.e., trend sampling) to detect population change in response to environmental change. The Long Term Electrofishing Surveys on the Illinois River have demonstrated the effectiveness of this approach to detect change. Another indicator of ecological improvements is the vigor of the fishing tournaments. Fishing tournaments did not occur during the period that the Illinois River fishery was degraded, but they have become much more popular recently since the fishery has improved. Bassmasters tournaments have been held in Peoria and Alton pools and local tournaments are becoming more common nearly everywhere. The catch of walleye and sauger exceeds that of Lake Erie which is widely renowned as one of the best fisheries.

Another problem encountered in estimating river fish populations is their mobility among habitats. Fish may concentrate in certain places during different parts of the day or year. During daytime, fish may be sheltered in structure along channel borders. During nighttime, however, the same fish may move out into open water areas. Sampling one habitat during one part of the day only will miss some fish. Sampling both habitats during different times of day may double count the fish. These factors are other reasons total population estimates are difficult to make with confidence.

Another IL DNR employee suggested that fish condition is another characteristic that might be measured. He explained how the fitness of fish has changed in response to environmental conditions. The combination of fitness and year class size together could provide another view of the condition of the river fishery.

Another participant suggested that local population estimates over many river reaches could serve as surrogates for river-wide estimates. Results from specific channel reaches, backwaters, or project areas could be extrapolated.

A US Army Corps of Engineers (USACE) participant asked why we need precise population estimates. Theiling responded that USACE Division and Headquarters reviewers are looking for quantitative estimates of the benefits of restoration projects. Various habitat evaluation methodologies that estimate habitat units have traditionally been used. The thought is that firm quantitative estimates of population changes may provide stronger justification for restoration measures. Another participant suggested the annual discreet measurements of relative abundance may be suitable. Theiling suggested that quantitative measures of abundance may provide a better demonstration and valuation of restoration project responses. A second person from USACE indicated that the operations branch of the Corps is looking for justification to spend more money on large rock preferred as fish habitat by biologists. It was thought that an increased number of fish using large rock crevices would provide that justification.

A participant suggested that creel surveys may be a valuable tool because they would evaluate the users response to restoration. While recognized as a viable tool, creel surveys are very expensive and would likely miss many of the nighttime fishers, which may in fact be a large portion of the recreational fishers.

Someone from the US Fish and Wildlife Service was asked his opinion as a wildlife biologist, he thought bird use of specific areas may be used to estimate forage fish resources.

Plenary Report

The plenary comments are taken directly from the plenary report and only include discussion specifically related to management. The entire plenary report can be found in Appendix E.

Species Plenary Session (2:00 –2:45)

Look at survival strategy. If you tie this back to an ecologically sustainable system it is important to look at survival strategies of animals. Species of Fish on large river system – part of their strategy when it floods is to migrate out into the temporary expansion of habitat. Fish exploit expansion of habitat and turn that into a peak of production. For species that can do this they have a significant increase in biomass the next year. By levying off the floodplain we have limited that process. Another example with mammal (swamp rabbit) – Historically flood plain animal. They are gone now because when it floods the little bit of habitat they have gets flood because inward side of levee is bare and because of agriculture and they have no escape habitat so they have been eliminated. We need to consider allowing animals to move in and out of floodplain. None of these measurements really allow us to address this.

Theiling – I appreciate these comments, but how do we measure this?

You cannot sample large river systems with the precision necessary to answer the questions you are asking. You need to sample habitat types in a pool with the same proportional effort as you have habitat types. Get a relative change from year to year. This is still subjective due to staff and equipment. You can get stuff on a relative basis, but not any precision. "The river is continually improving". Fishing tournaments on the Illinois are becoming world class. The only reason they are here is because the fish are here. (who studied)Spring Valley to Starved Rock Lock and Dam estimated 1mill fish. Confidence limits were really high.

Theiling -If money and equipment weren't an issue would a full survey of the populations be worth doing?

No

Saugers Example – Originally stocked fish were 75%-85% of tournament young of the year. Now they are 1% of tournament.

Theiling – Stoddard Bay – Jeff Janvrin – Catch per unit effort of Blue gill was phenomenal. Is it important to differentiate between river wide vs. habitat restoration?

Depends on where – Backwater area – hard to quantify success. It is hard to determine cause and effect. However, go to hunting area (where ingress and egress are limited) and data from .5 ft – 6ft. may be valuable. So where there is no or limited connectivity this type of data may be valuable.

Theiling –So, in an open system – it doesn't matter how you sample because results are foggy and in a closed system doesn't matter how as long as it is sampled some before and after. In an open system you can get general trends.

Lots have to do with general conditions in any year, time, and place.

Diversity – Not applicable to the large river system.

LTRM can give some year class strength. This might be another indices.

You need to look carefully at species you select. Consider well-being (proportion of length vs. weight) of the fish, year class strength. OR Get good trend information by looking at YCS (year class strength) by looking at well being (mass/length) by YC and by species. Give good idea of health of population over river.

Theiling – Is there any usefulness in having different measurements for different guilds?

Right now we use only one set because there isn't anything else.

Is it possible, instead of trying to come up with pool/reach number, to make targets for specific projects? Can you use local indices of improvement to evaluate management actions rather than extrapolation to the whole river?

Why do we need precise numbers?

For benefit/cost analysis.

We can't do this

Theiling – Washington has asked us to do that. How many bass will be grown in Swan lake, how many will be caught and how does that relate to the number of minnows and licenses bought for fishing.

Discreet measurements of habitat that are updated yearly. Combine with relative abundance survey to get long-term trends. Take series of transects to measure habitat values that could go back to year after year to see how management affects habitat, abundance, diversity, biomass.

Theiling – The problems is response times. What Mike talked about with Suagers came at the costs of Billions of dollars in waste treatment facilities. You have to “take it on faith”. The cost of measuring a decrease in sediment load will be very high yet the changes will be very slow. Need to wait to see benefits.

Do you want to spend lots of money to document this or just take it on faith?

When we create a borrow hole can you make estimates of how many fish use it? If create a habitat asset can you give an estimate of how many fish it can support? EG – How many more fish could over winter in the reconnected backwater?

Yes

Creel Surveys- Daytime is very difficult. Night fisherman is hard.

Ask people, do survey of fishermen. If we do this, ask where will you be staying, and how long. In this way you could get a very intensive Creel survey.

A very intensive Creel survey was done on ILWW.

The units need to be run past a biologist and an ecologist. They have different views to look at things.

For forage fish, maybe use birds as an index.

Rock Island District used larger rocks this year at an additional $4/ton. Now we are requiring a fishery biologist to say how many more fish are in the larger crevices and will it be cost effective. Concrete cost/benefit. We have to remember to focus on trend analysis and not get caught up on statistical sampling. Agree to make a whole bunch of assumptions, put a $ on it and move on.

That is what we are continuously doing on EMP. Most recently Habitat Units (HU) (relationship between quality and quantity).

Diesel engine example. New engine was being created when there was a low demand for it. But then once it was created the demand was there. OR Bean counters want to see you go through some process to arrive at your numbers. In a few years the assumptions will change. You’ve got to figure out a way that is reasonable and logical. You may not use it, but when conditions are right you may use it.

As long as you have the narrative, even if it isn’t statistically sound.

Just go through the process.

Theiling – People are looking for the navigation study to break new ground to put dollars on this.

You can have your numbers but they will have to be based on subjective data. Otherwise you will study yourself to death.

Appendix H. Conceptual Model Presentation

The overall purpose of a conceptual model developed for the UMR-IWW Navigation Study is to identify the linkages and sequencing of identified objectives and associated management actions and facilitate a comprehensive assessment of the potential risks and impacts posed by improvements to the navigation infrastructure. The conceptual model can contribute to the overall purpose through the following:

- Visually characterize a complex system to better understand and manage it
- Identify the major drivers, stressors, and endpoints of the system
- Define the functional relationships (i.e., linkages) between stressors and endpoints
- Assist in decisions on impact assessment, restoration and management actions, and evaluation tools
- Provide a framework for implementing adaptive management and restoration
- Develop a structure for additional input from stakeholders

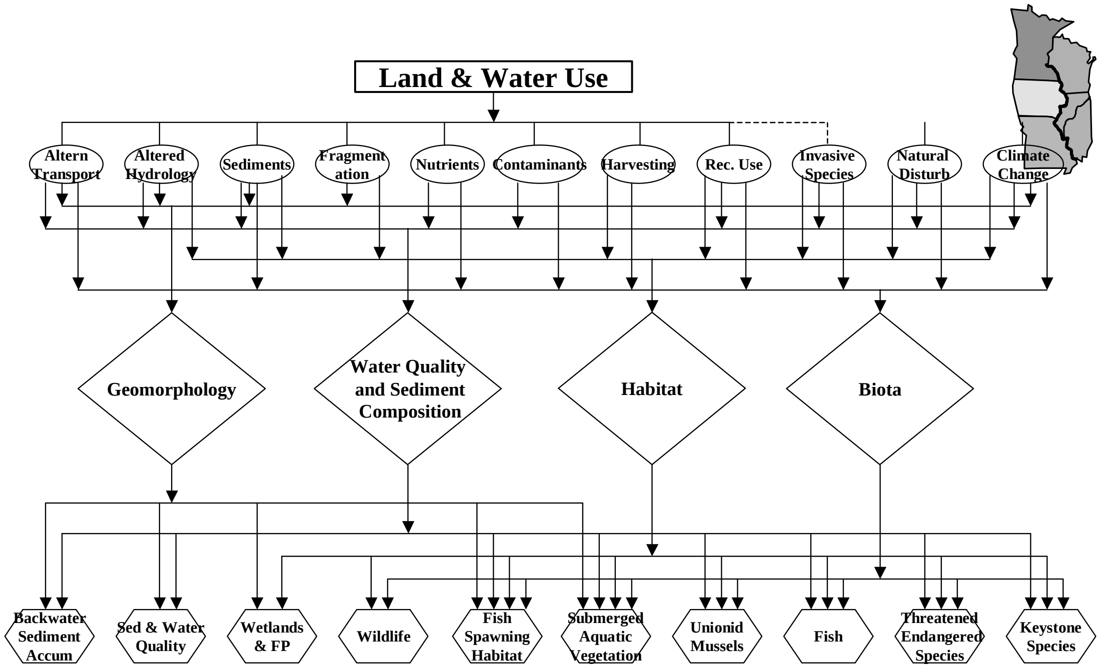
The following slides were used at each of the workshops to present information on the current draft conceptual model.

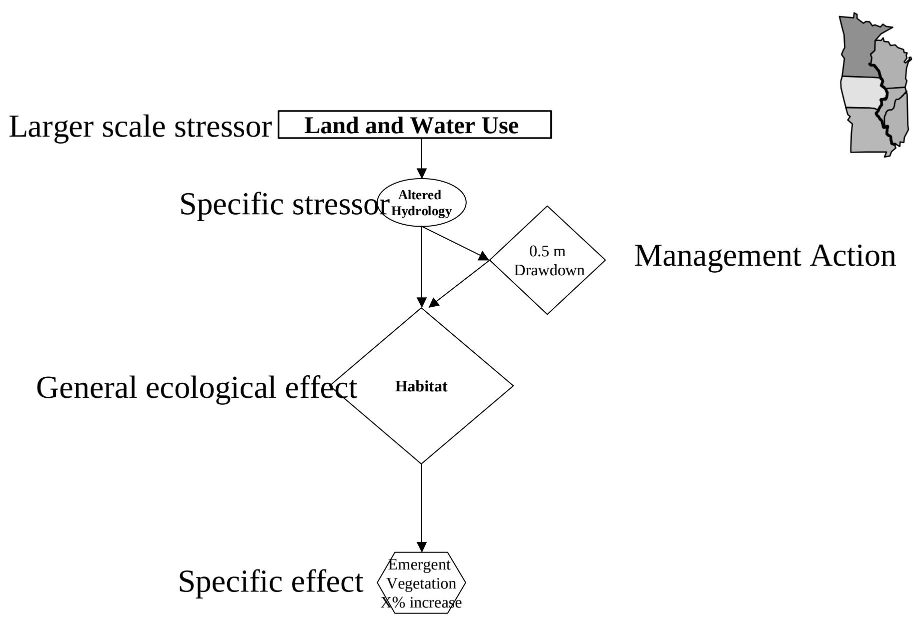
UMR-IWW Ecosystem Conceptual Models

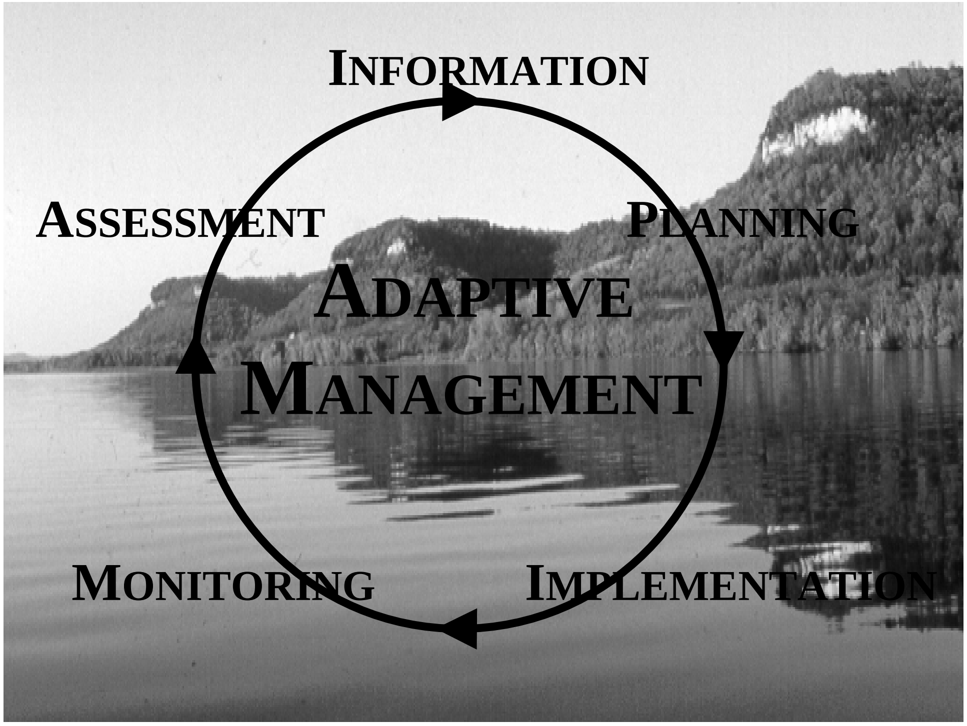
- **Background**
  - **Conceptual models help to gain a better understanding of the linkages between:**
    - **Environmental Objectives**
    - **Management Actions**
    - **State of the Ecosystem**
- **Task**
  - **Discuss the utility of developing a UMR-IWW ecosystem conceptual model**

Purposes of a Conceptual Model for the UMR-IWW

- **To visually present a complex system**
- **Creates a framework for additional input**
- **Provides a basis for decision making in relation to the achievement of objectives**
- **Develops a structure for implementing adaptive management and restoration**


Land & Water Use
Altern Transport
Altered Hydrology
Sediments
Fragment ation
Nutrients
Contaminants
Harvesting
Rec. Use
Invasive Species
Natural Disturb
Climate Change
Geomorphology
Water Quality and Sediment Composition
Habitat
Biota
Backwater Sediment Accum
Sed & Water Quality
Wetlands & FP
Wildlife
Fish Spawning Habitat
Submerged Aquatic Vegetation
Unionid Mussels
Fish
Threatened Endangered Species
Keystone Species


Larger scale stressor
Land and Water Use
Specific stressor
Altered Hydrology
0.5 m Drawdown
Management Action
General ecological effect
Habitat
Specific effect
Emergent Vegetation X% increase


INFORMATION
ASSESSMENT
PLANNING
ADAPTIVE
MANAGEMENT
MONITORING
IMPLEMENTATION

Appendix I. Power Point Presentations

This section contains the power point slides used to present background and introductory information throughout the workshops. They are given in the order they were presented on the agenda.

The Power Point Presentations will be included in the final version of the printed workshop reports. You can download them by going to the following FTP site

ftp://ftp.usace.army.mil/Incoming/MVR/NavStudy/**.**

Appendix J. Acronyms

AHAG	Aquatic Habitat Appraisal Guide
CAP	Continuing Authorities Programs
CBSG	Conservation Breeding Specialist Group
CCP	Comprehensive Conservation Plan
CERC	Columbia Environmental Research Center
CRP	Conservation Reserve Program
DNR	Department of Natural Resources
ECC	Economic Coordinating Committee
EMP	Environmental Management Program
ERDC	Engineer Research and Development Center
FWIC	Fish and Wildlife Interagency Committee
GIS	Geographic Information System
GLC	Governors' Liaison Committee
HEP	Habitat Evaluation Procedures
HNA	Habitat Needs Assessment
HREP	Habitat Rehabilitation and Enhancement Project
IADNR	Iowa Department of Natural Resources
IBI	Index of Biotic Integrity
IDWR	Illinois Department of Water Resources
ILDNR	Illinois Department of Natural Resources
INHS	Illinois Natural History Survey
ISWS	Illinois State Water Survey
IWL	Izzac Walton League
IWW	Illinois Waterway System
LTRMP	Long Term Resource Monitoring Program
MARC	Midwest Area Rivers Coalition
MNDNR	Minnesota Department of Natural Resources
MODNR	Missouri Department of Natural Resources
MODOC	Missouri Department of Conservation
MRBA	Mississippi River Basin Alliance
MVR	Rock Island District
NECC	Navigation Environmental Coordination Committee
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
SIU	Southern Illinois University
SMART	Specific, Measurable, Achievable, Results-oriented, and Time-specific
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UMESC	Upper Midwest Environmental Sciences Center
UMIMRA	Upper Mississippi, Illinois and Missouri Rivers Association
UMR	Upper Mississippi River
UMRCC	Upper Mississippi River Conservation Committee
UMR-IWW	Upper Mississippi River-Illinois Waterway System
UMRS	Upper Mississippi River System

USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WHAG	Wildlife Habitat Appraisal Guide
WIDNR	Wisconsin Department of Natural Resources
WRDA	Water Resources Development Act
WRP	Wetland Reserve Program

Appendix K. Workshop Glossary

Adaptive Management – A process that seeks to use management intervention and assessment as tools to strategically manipulate and understand the functioning of an ecosystem to better manage it.

Conceptual Model – Identifies components of interest in a complex system and defines functional interrelations among the components based on current knowledge and understanding of the system.

Ecosystem Attributes – The structural and functional elements of an ecosystem (e.g. plants, animals, soil, sediment, water quality, etc…).

Elements – Large-scale components of an ecosystem.

Endpoints – A measurable desired state or condition: the acceptable condition.

Environmental Objectives – Component specific, quantitative, local to regional scale (e.g. increase average depth of a backwater to 3 feet).

Evaluation Tools – Conceptual or predictive models or field methods used to evaluate how well management actions address environmental objectives.

Functional Ecosystem Elements – Physical and chemical processes that form the structural template or influence the occurrence or rate of biological functions.

Goals – A desired future state (broad/ non specific). A broad description of some desired future state or condition (e.g. naturalize hydrologic regime).

Management Actions – Regulatory, operational or structural tools or activities that can be implemented to positively address the environmental objectives (e.g. hydraulically dredged backwater area).

Objective Standardization – Collecting and organizing objectives in a uniform and hierarchically structured system-wide database.

Predictive model – Assembles existing data of a complex system and determines possible outputs based upon specific inputs and verified interrelations among the components.

Standardization – Collecting and organizing objectives into a uniform format by recognizing commonalities (e.g. text description, GIS database).

Structural Ecosystem Elements – Composition, distribution and relative abundance of habitat, plants and animals.

Sustainable Alternative Plans – Combinations of management measures or actions that balance economic, ecological, and social conditions so as to meet the current, projected, and future needs of the UMR-IWW without compromising the ability of future generations to meet their needs.

Vision – The statement: "To seek long-term sustainability of the economic uses and ecological integrity of the Upper Mississippi River System" was developed by members of the NECC and ECC.