Upper Mississippi River Restoration:

Managing a Dual Purpose River for Fish and Wildlife Habitat


Mud Lake HREP, Lower Pool 10

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Mississippi River Habitat Specialist

Upper Mississippi River Restoration
Leading·Innovating·Partnering

<u>Outline:</u>

General overview:
- Human alterations to the River ecosystem
- Events that set groundwork for authorization of UMRR

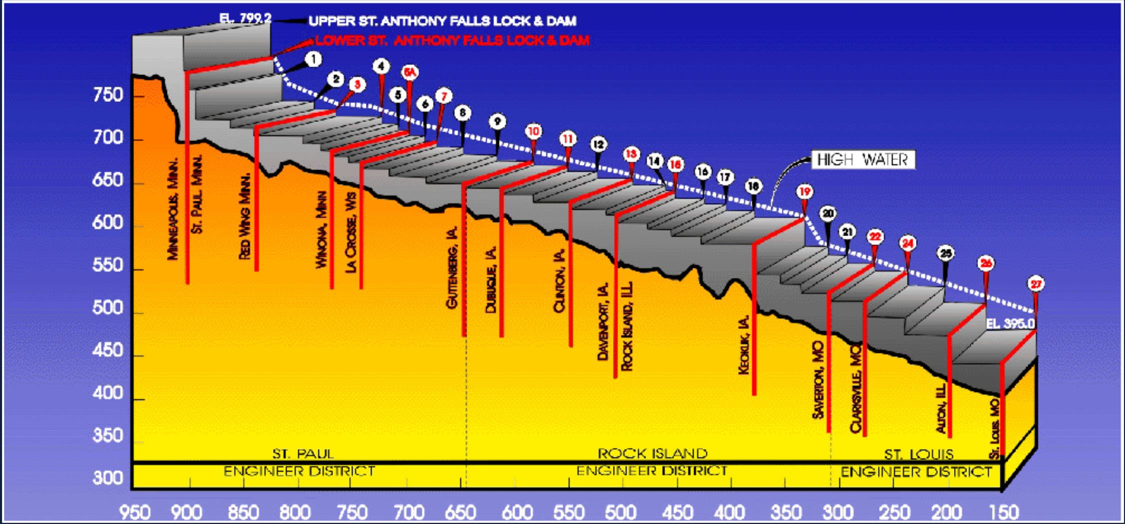
Examples of HREP Design and Features:
- Island Restoration
- Dredging
  - Mechanical
  - Hydraulic

Planning and Design "Lessons Learned"

Mud Lake HREP, Lower Pool 10

Locks And Dams on the Upper Mississippi River System

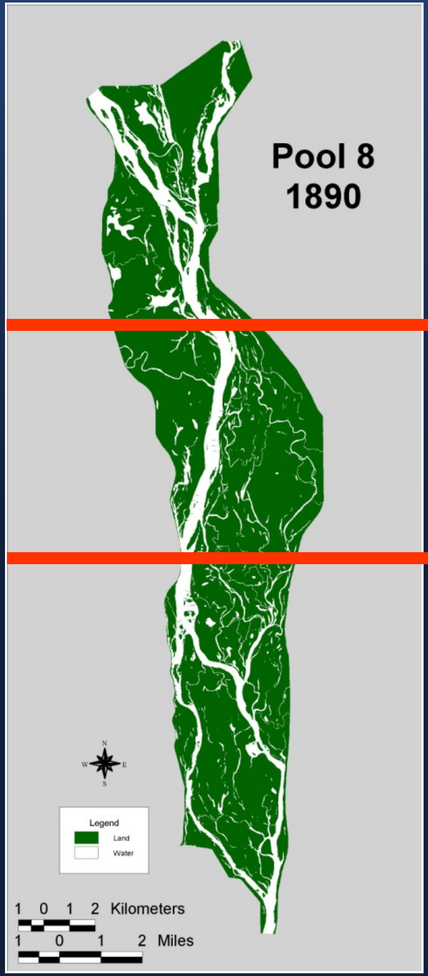
1934-1940

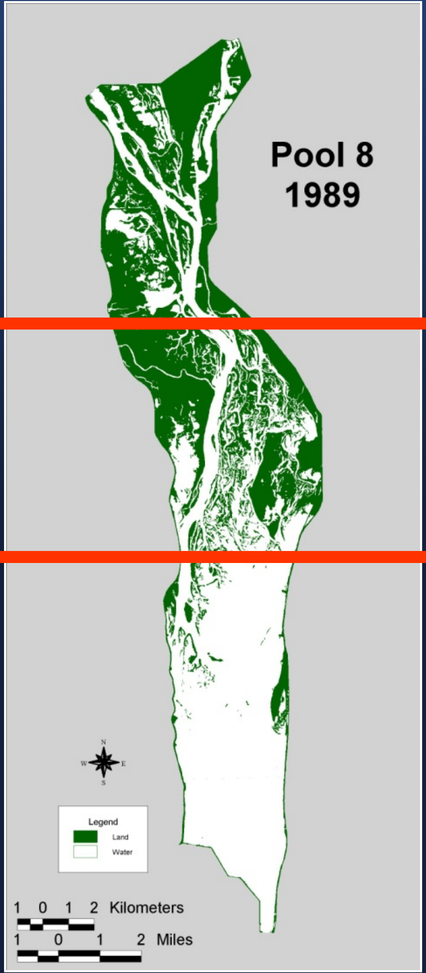


"Stairsteps" of Water


1890


2000

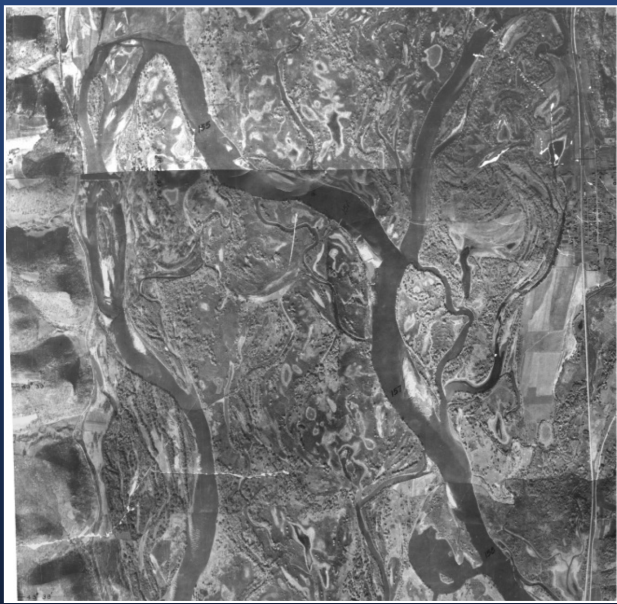

Pool 8
1890
N
W
E
S
Legend
Land
Water
1 0 1 2 Kilometers
1 0 1 2 Miles


Pool 8
1989
N
W
E
S
Legend
Land
Water
1 0 1 2 Kilometers
1 0 1 2 Miles

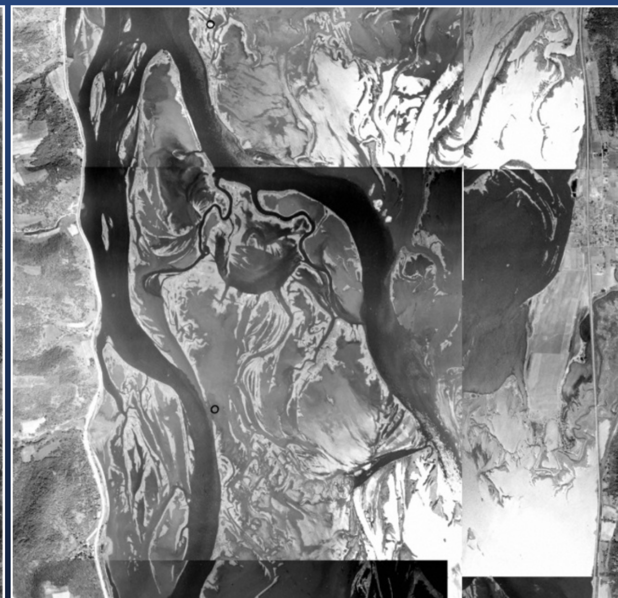

Minnesota
Wisconsin
Iowa
Illinois
Missouri

Habitat Loss in Lower Pool 8

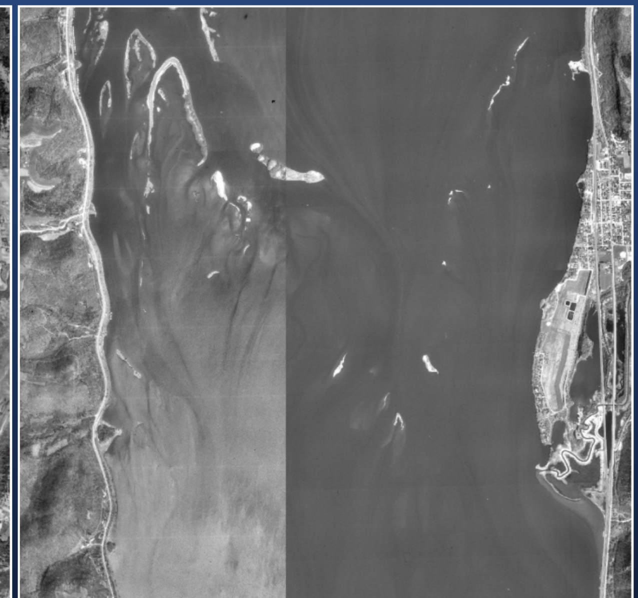
1930



1938



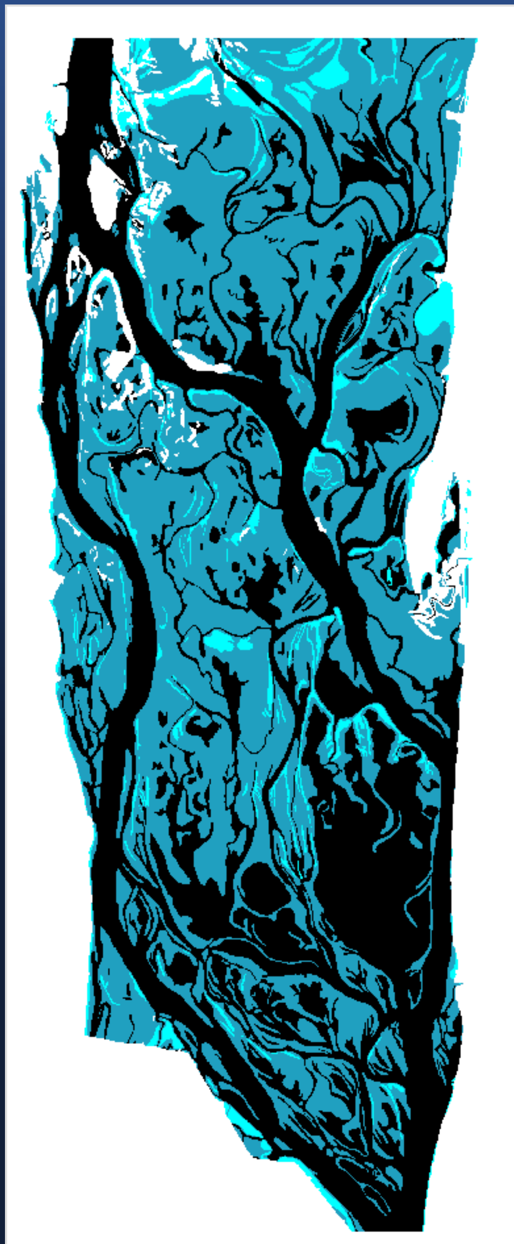
1990



- Permanently Elevated Water Levels
- Island Loss and Erosion
- Increased Connectivity
- Sedimentation

RESOURCE PROBLEMS

1940



Loss of Depth Diversity

(Lower Pool 8)

- < 0.3 m
- 0.3 to 1.8 m
- > 1.8 m

Used with permission from:
Jim Rogala, USGS UMESC

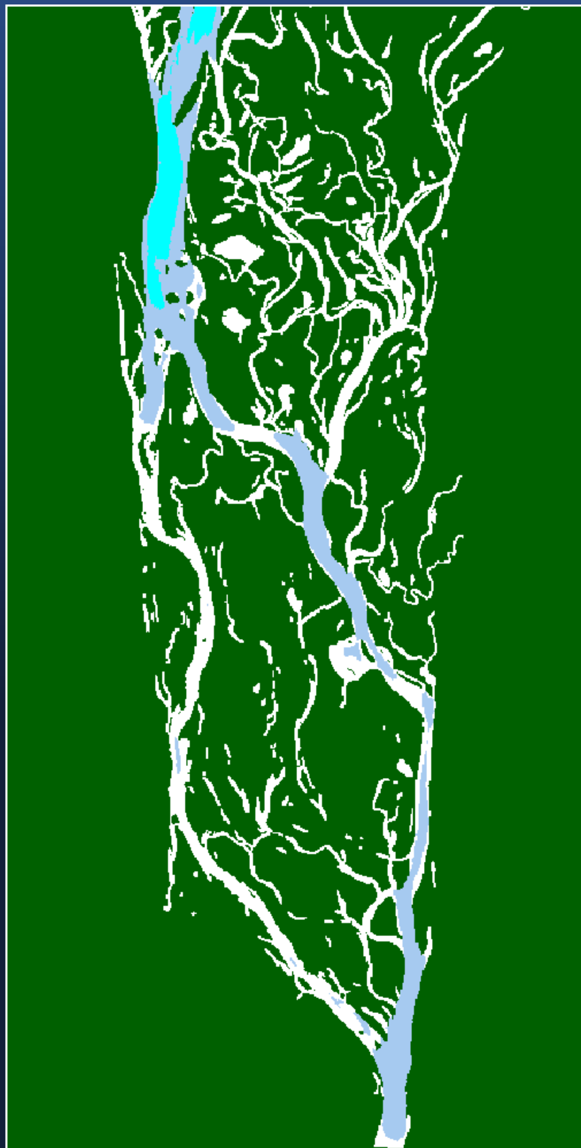
1990

RESOURCE PROBLEMS

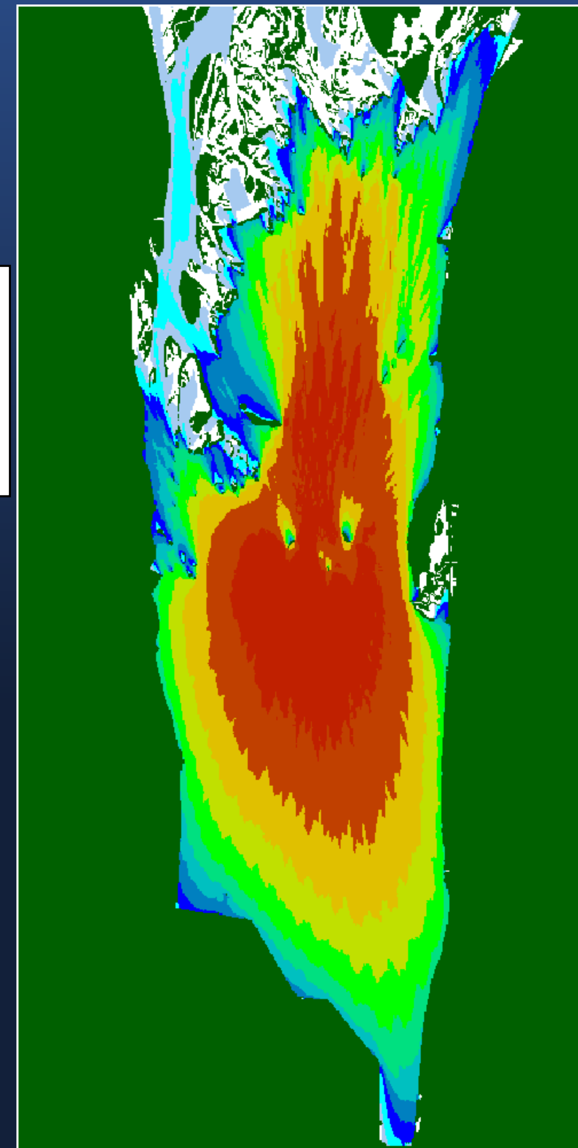
WIND FETCH

Lower Pool 8

Pre Lock and Dam 1937

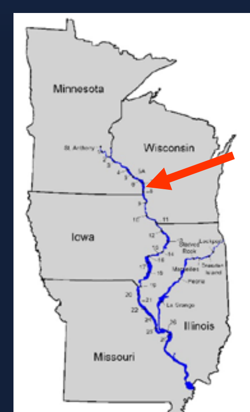


1989



Lowest fetch

Highest fetch



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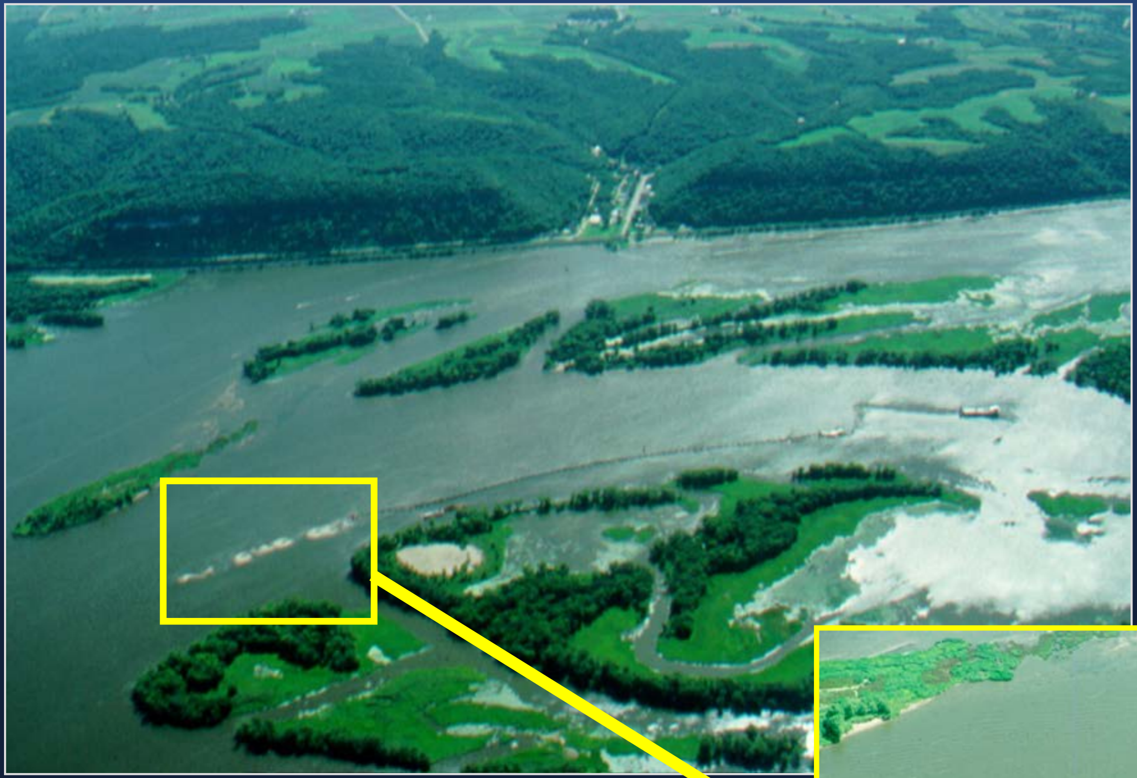
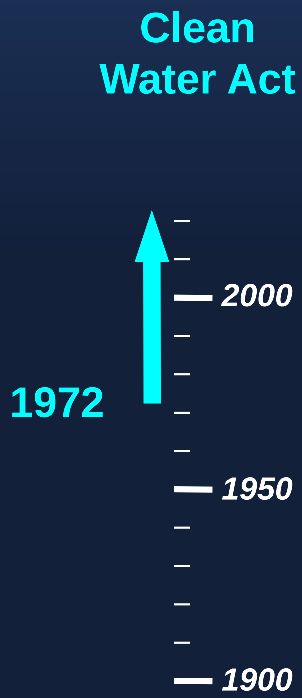
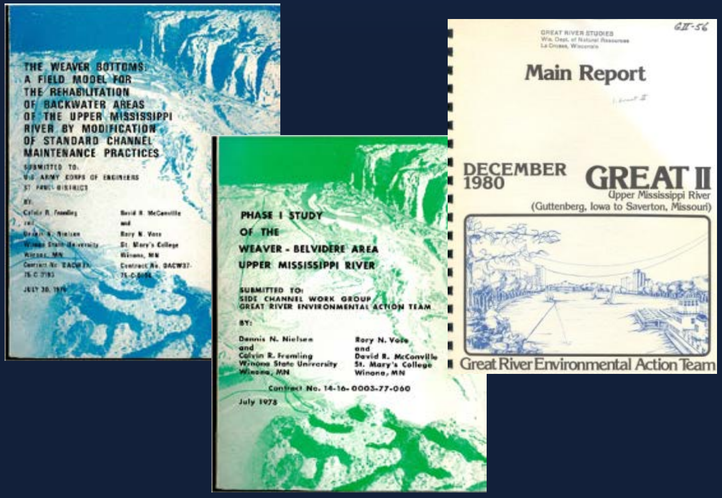
Clean Water Act

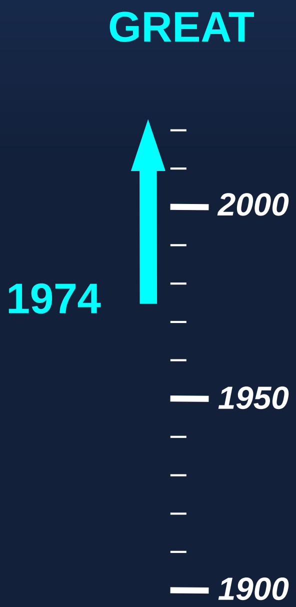


State of Wisconsin Sued Corps for Indiscriminate Placement of Dredged Material



Great River Environmental Action Team (GREAT)





Lock and Dam 26

LD 26
Lawsuit

1970's

2000
1950
1900

Upper Mississippi River System Environmental Management Program

(Upper Mississippi River Restoration)

"To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system." ***-- Section 1103, WRDA 1986***

EMP

1999

1986

2000

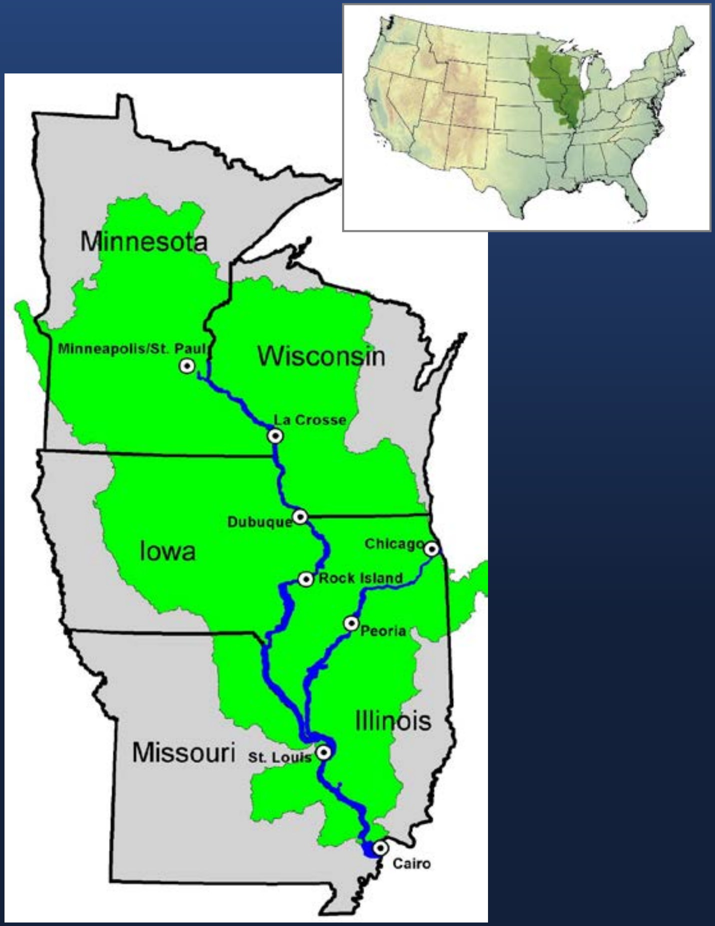
1950

1900

Upper Mississippi River Restoration

Geographical Extent and Program Partners

Upper Mississippi River Restoration
Leading·Innovating·Partnering



- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- States of:
  - Minnesota
  - Wisconsin
  - Iowa
  - Illinois
  - Missouri
- Public
- U.S. Geological Survey

US Army Corps of Engineers
Illinois Department of Natural Resources
Illinois Natural History Survey
Minnesota Department of Natural Resources
USGS science for a changing world
DNR
Wisconsin Dept. of Natural Resources
U.S. Fish & Wildlife Service

Upper Mississippi River Restoration

Program Elements

Upper Mississippi River Restoration
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Long Term Resource Monitoring

Habitat Rehabilitation and Enhancement Projects

Pool 8 Islands, Phase I

US Army Corps of Engineers

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

ILLINOIS NATURAL HISTORY SURVEY

Minnesota DEPARTMENT OF NATURAL RESOURCES

USGS science for a changing world

DNR

WISCONSIN DEPT. OF NATURAL RESOURCES

U.S. FISH & WILDLIFE SERVICE

Upper Mississippi River Restoration

HREP Accomplishments Since 1986

- **38 projects in planning**
- **57 projects completed**
- **>100,000 acres of habitat restored**
- **In 5 different states**
- **On > 1,200 miles of the Mississippi and Illinois Rivers**

Upper Mississippi River Restoration
Habitat Rehabilitation and Enhancement Projects

Dredging and disposal for HREPs is permitted through an MOU between the State of Wisconsin and Corps of Engineers. State statutes regarding MOU were passed following GREAT (early 1980's).

All Projects Must Meet the Following:

- 50 year project life
- Minimize operation and maintenance
- No recreation benefits can be used to justify projects
- Almost all water based construction and support

A Combination of Tools and Approaches

Backwater Dredging

Island Construction

Bank Stabilization

Culverts to Oxygenate Backwaters

Seed Islands

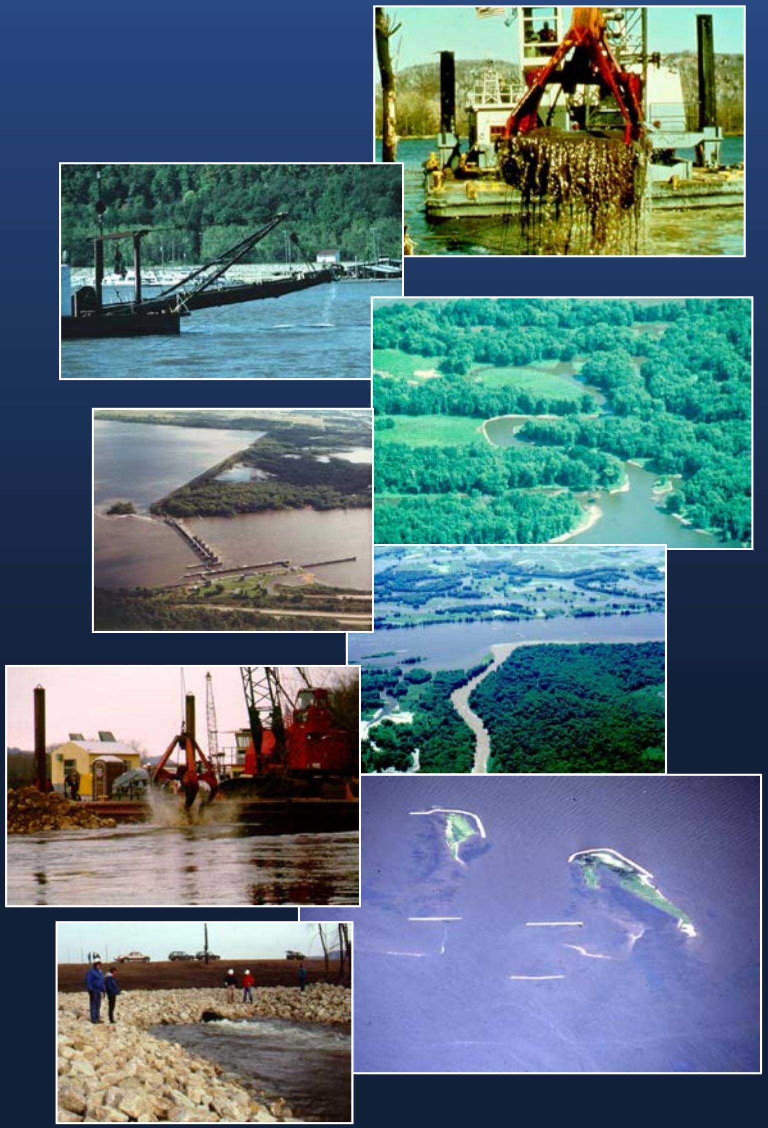
Moist Soil Units

Modifications of Wing Dams and Closing Dams

Partial Closing Dams

Revegetation of Disposal Sites

Habitat Channels



Common HREP Goals/Objectives

- Increase emergent, submersed and floating leaved aquatic vegetation
- Create backwater fish overwintering habitat
- Enhance backwater fish spawning and summer habitat
- Enhance channel habitat for riverine fish and mussels
- Increase and maintain quality dabbling duck habitat
- Increase and maintain quality diving duck habitat
- Create habitat for neotropical migrants and shorebirds
- Create turtle nesting habitat

Harpers Slough HREP, Lower Pool 9

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In the Beginning…

Lake Onalaska Islands and Dredge Cuts, Pool 7

Shadow zone of islands

Aquatic vegetation in shadow zone of islands

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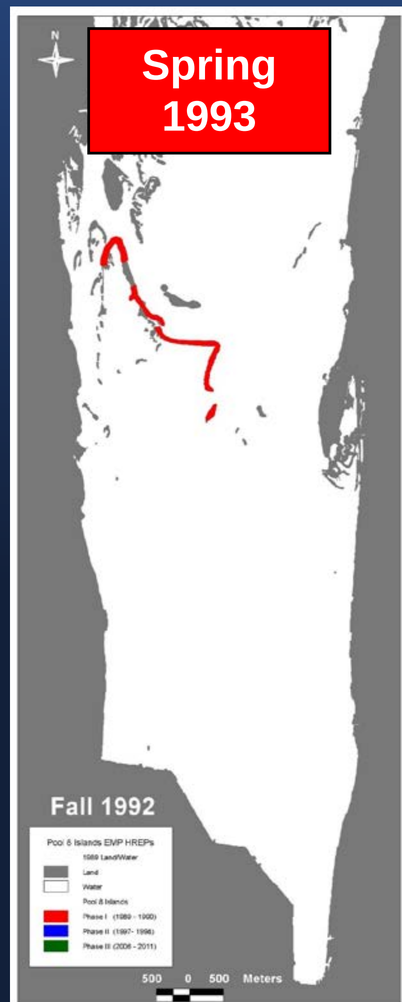
Constructed 1988 - 1990

Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project

Phase I



Pool 8 Islands, Phase I (1992-1993)

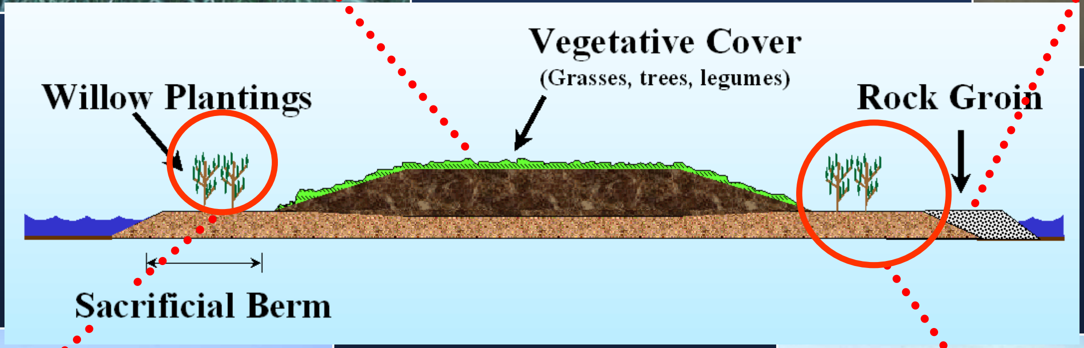
BUILDING AN ISLAND

Constructing sand base with dredged material

Shaping fine material (topsoil)

Sand base and work limit stake

Design features to stabilize constructed islands.



Subtle changes in island elevation to make islands stable during floods.

During flood of 1993

After flood of 1993

Lessons Learned!

Focus on wind direction during growing season!

Pool 8 Islands, Phase I (1992-1993)

Pool 9 Islands (1995)

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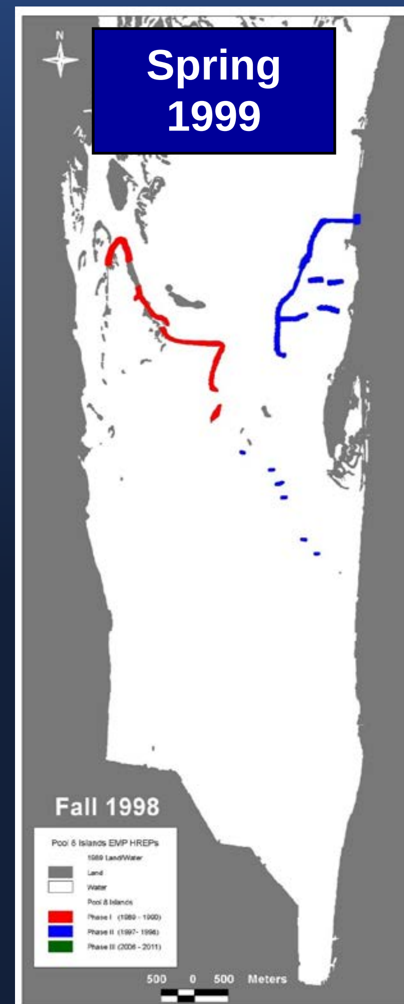
Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project

Phase I

Phase II



POOL 8 ISLANDS PHASE II, POOL 8 (Stoddard Bay)

Constructed between Oct. 1997 and Summer 1999

October 1961

August 1994

August 2000

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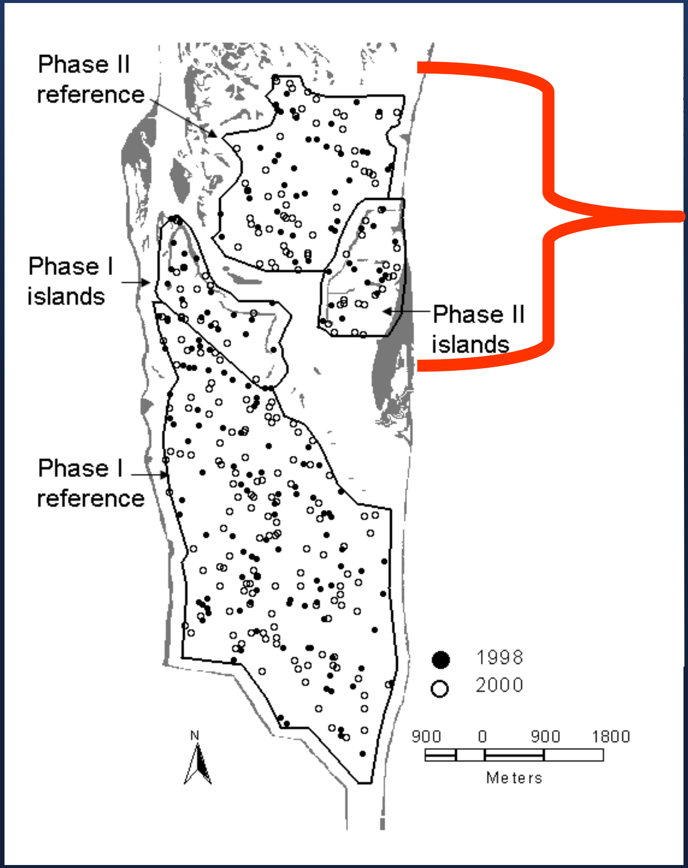
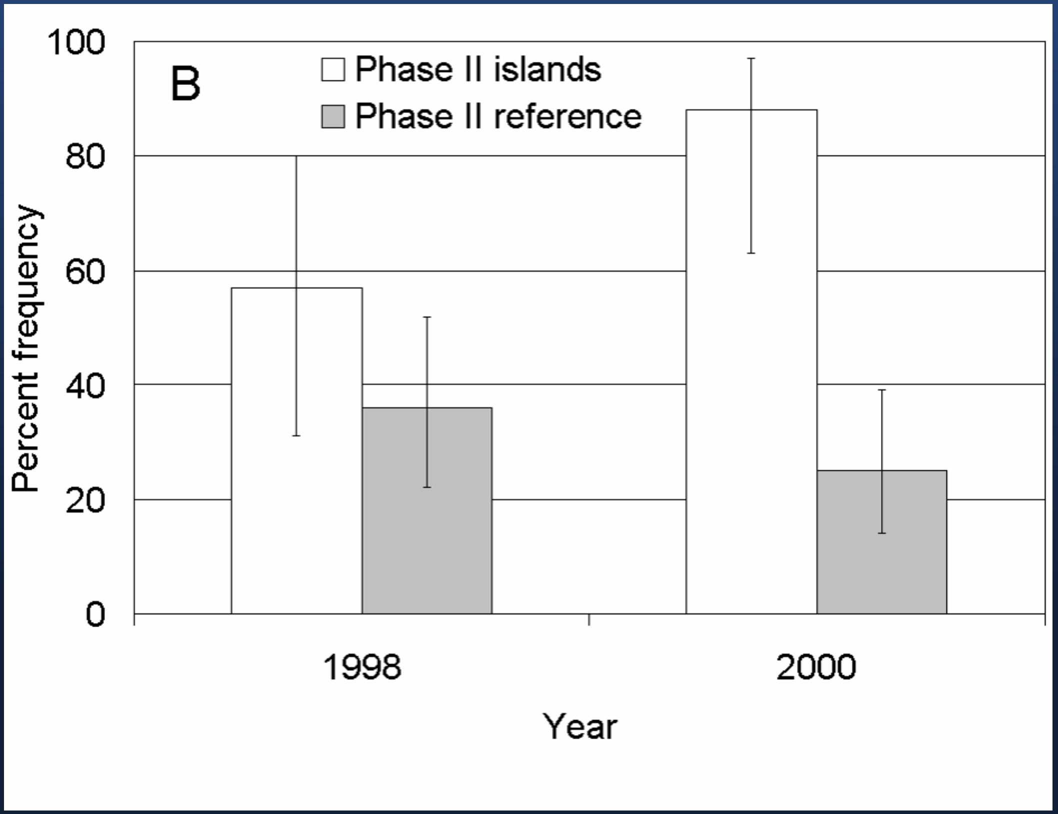
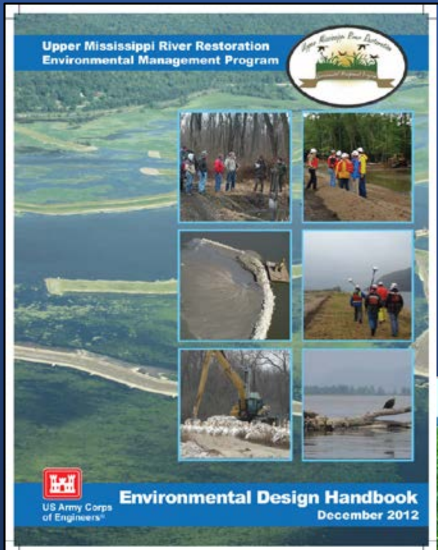
Observed Increase in Aquatic Vegetation was Significant



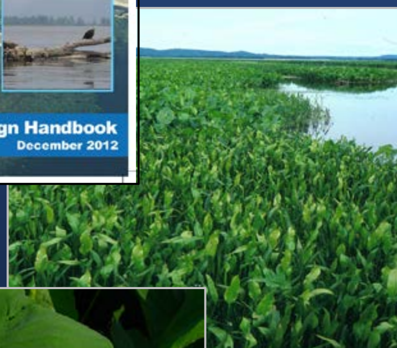


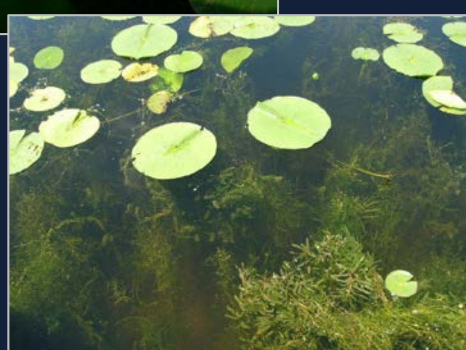
Graph and Figure from: Langrehr, Gray and Janvrin. Evaluation of Aquatic Macrophyte Community Response to Island Construction in the Upper Mississippi River, 2007



Criteria to Achieve Aquatic Vegetation Objectives

General criteria were initially developed by resource managers. These criteria have been confirmed and refined over time based on project monitoring and LTRMP data.





Emergent Vegetation

Water Depth: <0.6 meters

Water Velocities: 0.0 m/sec preferred, <0.1 m/sec acceptable over portions of the area

Substrate: Wide range, but not highly organic/flocculent or pure sand

Wind Fetch/Island Placement: Determine based on equation provided under Engineering Consideration 4: Wind-driven Wave Action for the water depth <2 feet that makes up the majority of area in shadow zone of island (for example, if 75%, of the water depth in the shadow zone of the island is 1 foot, then spacing should be based on minimizing sediment resuspension in 1 foot of water).

Rooted Floating Leaf Vegetation

Water Depth: <0.8 meters

Water Velocities: 0.0 m/sec preferred, <0.1 m/sec acceptable over portions of the area

Substrate: Wide range, but not highly organic/flocculent or pure sand

Wind Fetch/Island Placement: Determine based on equation provided under Engineering Consideration 4: Wind-driven Wave Action for the water depth 3 feet that makes up the majority of area in shadow zone of island (for example, if the majority (i.e. 75%) of the water depth in the shadow zone of the island is 1.5 foot, then spacing should be based on minimizing sediment resuspension in 1.5 foot of water).

Submersed Vegetation

Water Depth: June-September water depth 1-4 feet range, best around 2-3 feet

Water Velocities: June-September velocity 10 cm/s or less (higher upper limit is suggested to give Vallisneria an edge to compete with coontail and elodea).

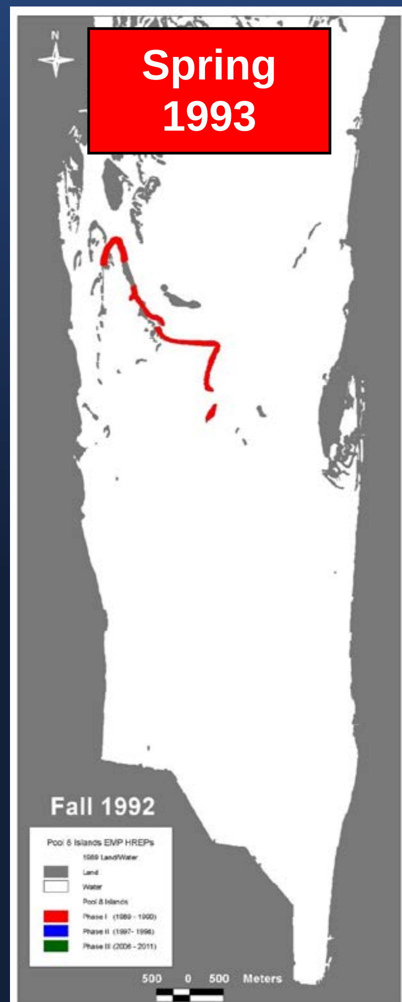
Substrate: Silt/clay is the best substrate for most species except Vallisneria americana and Heteranthera dubia which prosper on 'sand with silt' substrate best.

Wind Fetch/Island Placement: Wind fetch 1,000 m or less

Island Restoration
Upper Mississippi River - Lower Pool 8

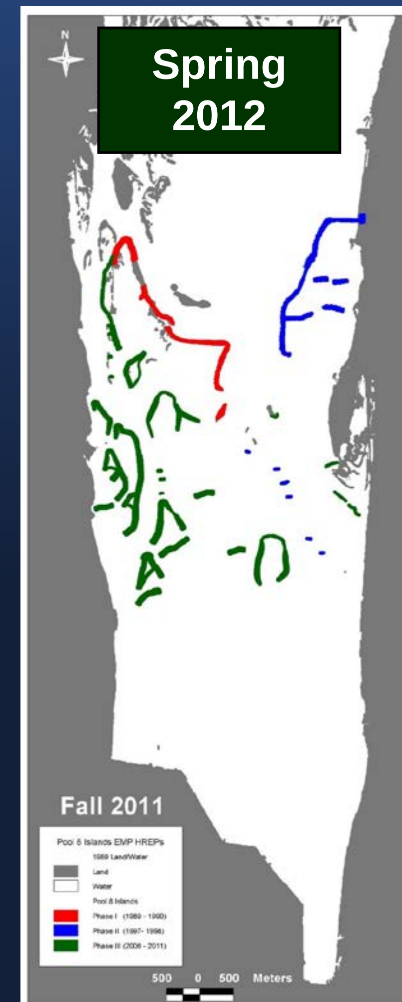
Pre Project

Phase I



Phase II

Phase III



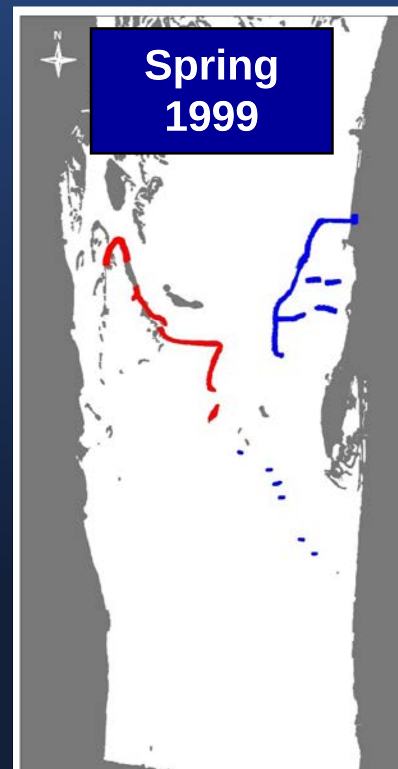
Island Restoration
Upper Mississippi River - Lower Pool 8

Pre Project

Phase I

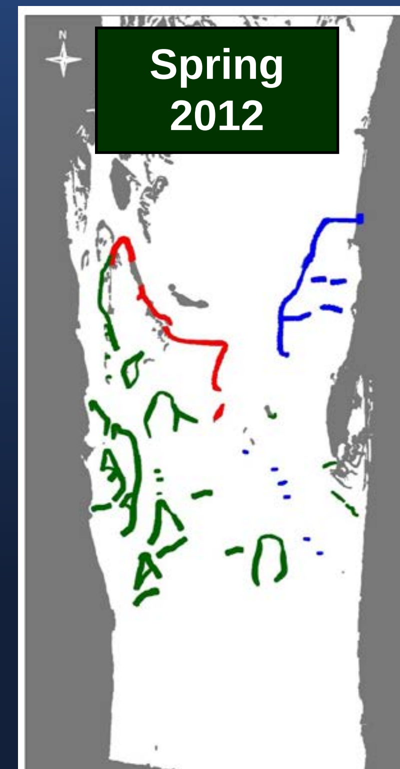
- 26 Acres of Isl.
- 1,000 Acres impacted
- 200,000 yd³ sand
- 75,000 yd³ fines
- 8,000 yd³ rock
- $1.64 million

Phase II



- 26 Acres of Isl.
- 600 Acres impacted
- 211,600 yd³ sand
- 66,235 yd³ fines
- 38,623 yd³ rock
- $2.65 million

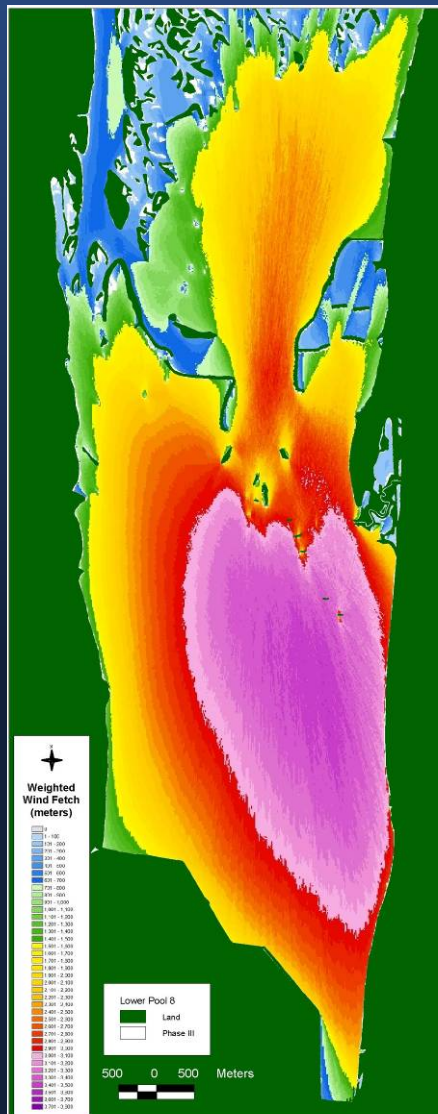
Phase III



- 150 Acres of Isl.
- 3,000 Acres Impacted
- 800,000 yd³ sand
- 200,000 yd³ fines
- 100,000 yd³ rock
- $18.00 million

Phase III Change to Weighted Wind Fetch

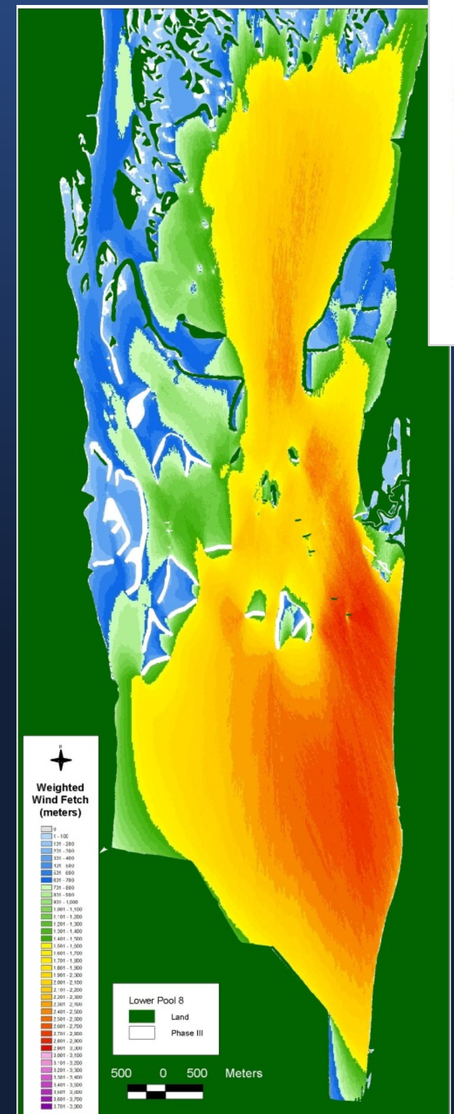
Pre Project

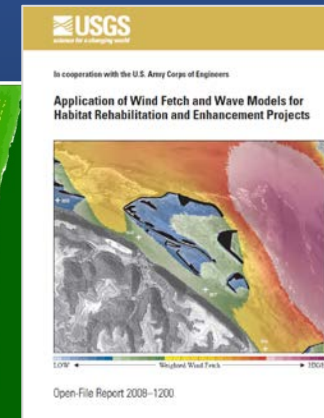


Weighted Wind Fetch (m)

Post Project

(2012)



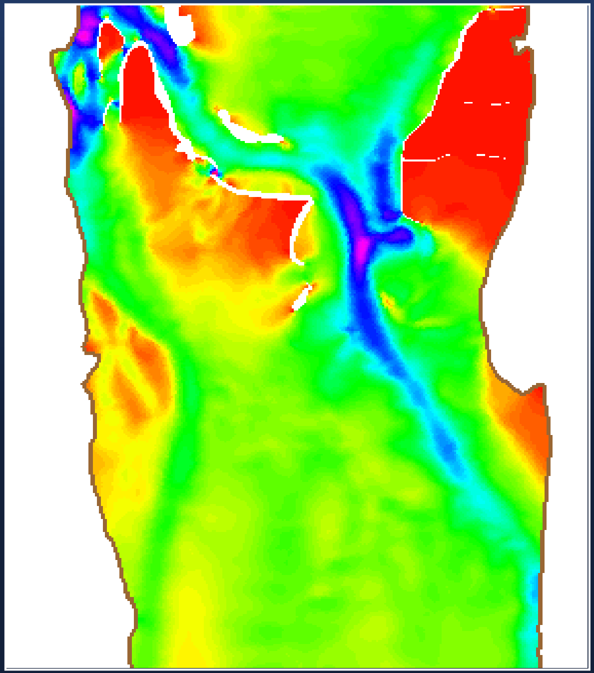


April – July, 1998 – 2007 climatological data, La Crosse, WI Municipal Airport. Model run provided by Jason Rohweder, USGS, UMESC

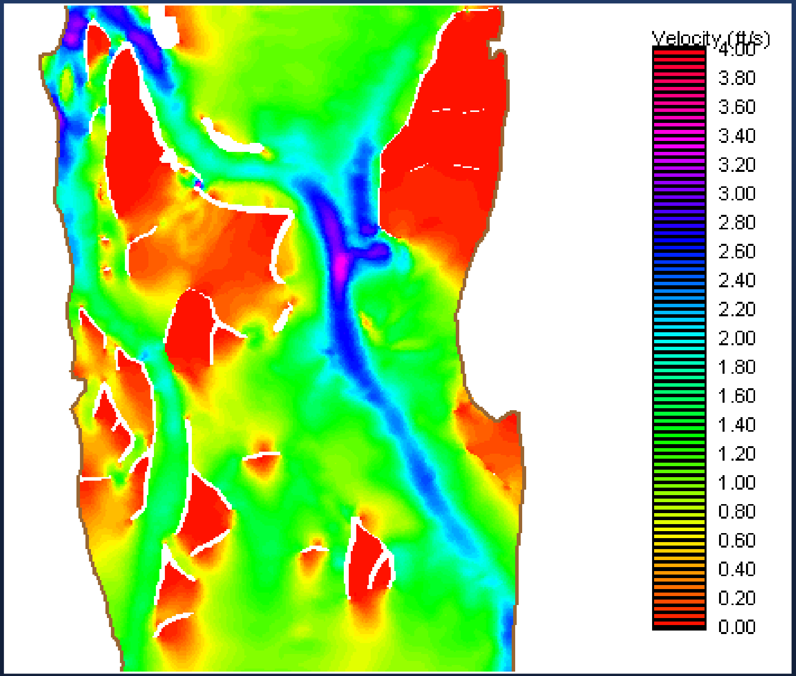
CUMULATIVE AFFECTS
Velocity Diversity And Sediment Transport

Hydraulic Model Results for 80,000 cfs
In the Pool 8 Islands Phase III Area

2001 Conditions



Predicted Change



Breakwaters

Rock Mound with Spawning Substrate

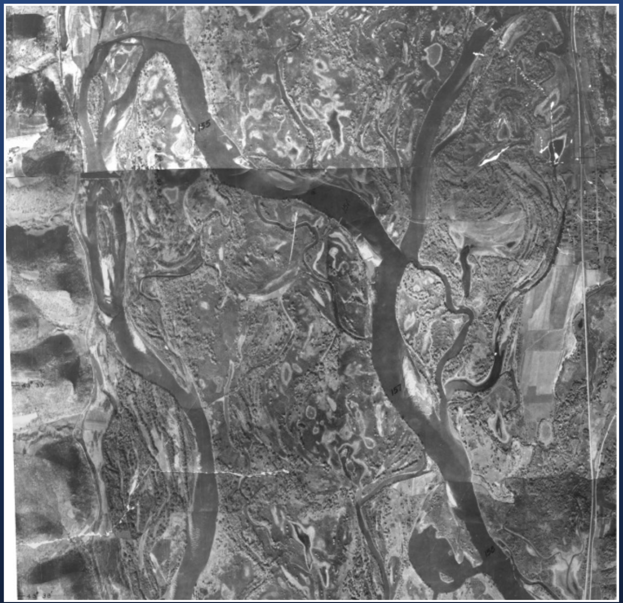
Rock Log

Rock Mound with Fines

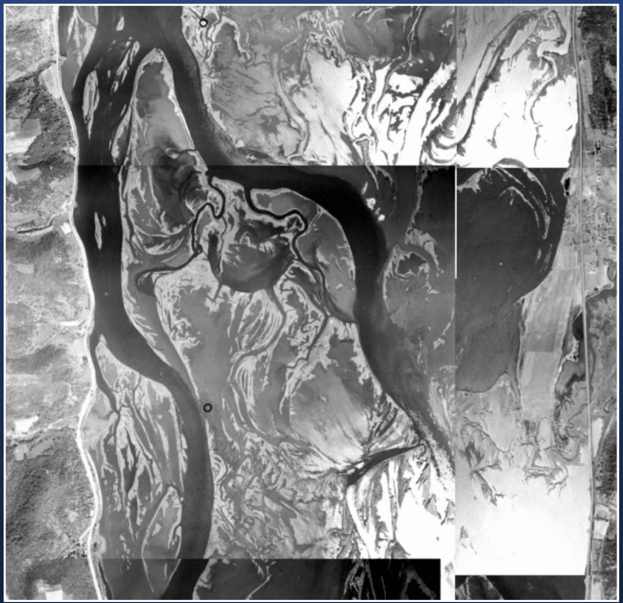
Pool 8 Islands, Phase III

Cumulative Benefits from HREPs in Lower Pool 8

1930



1938

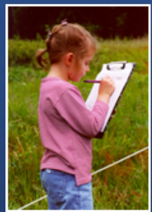


1997
2010

Bluegill Overwintering Habitat Criteria

- Water Depths > 4 Feet
- Water Velocities < 0.01 feet per second
- Warm water temperatures (> 32 degrees Fahrenheit)
- Dissolved Oxygen $\geq$ 5 ppm

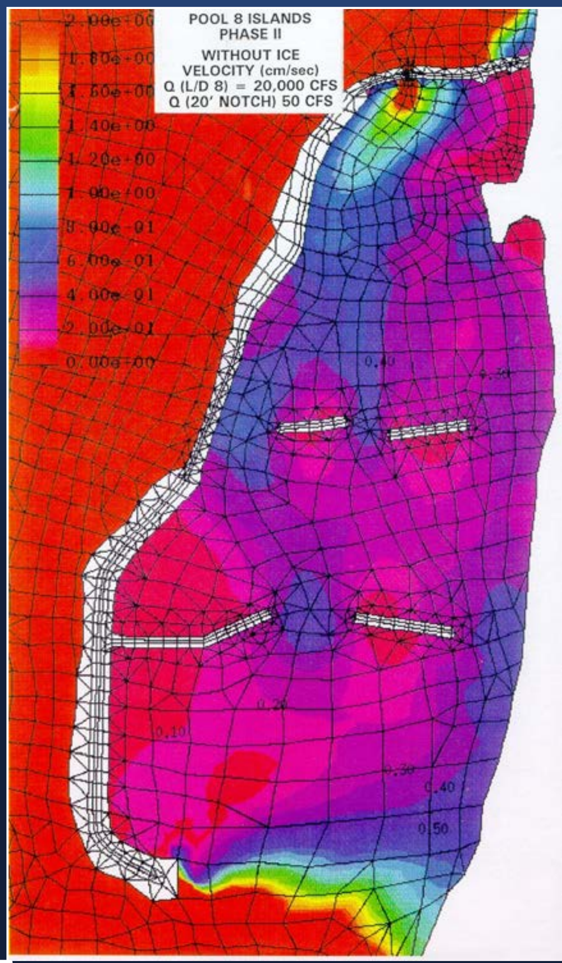
Hydraulic Modeling used to Predict Velocities



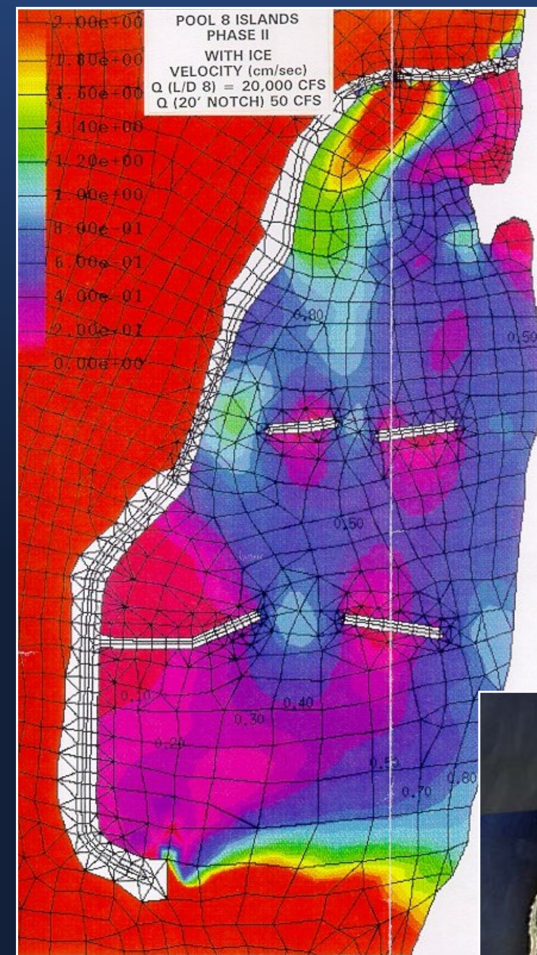
Lessons Learned!

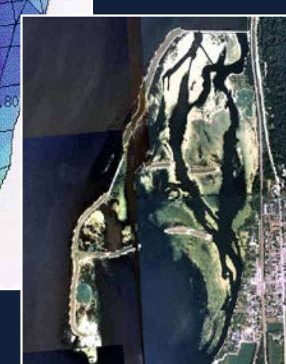
Factor in seasonal physical conditions that may affect velocity and discharge.

Without Ice



With Ice





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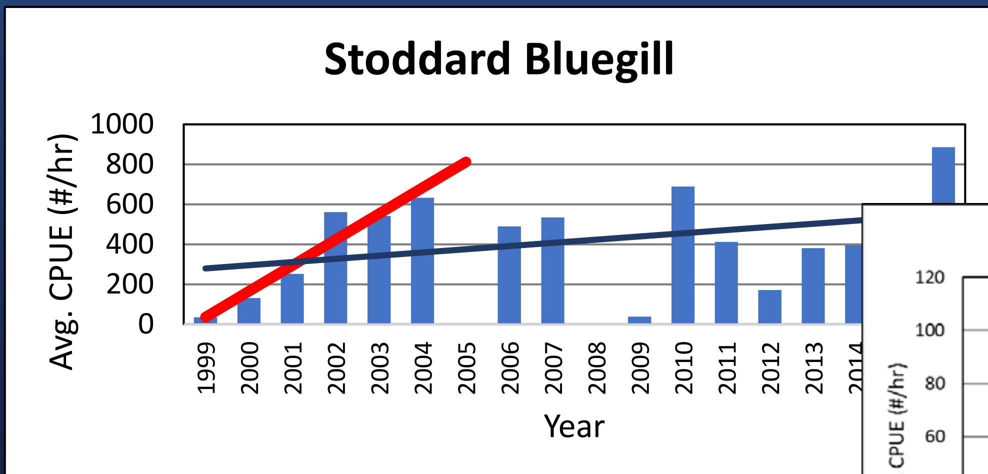
POOL 8 ISLANDS PHASE II, POOL 8 (Stoddard Bay)

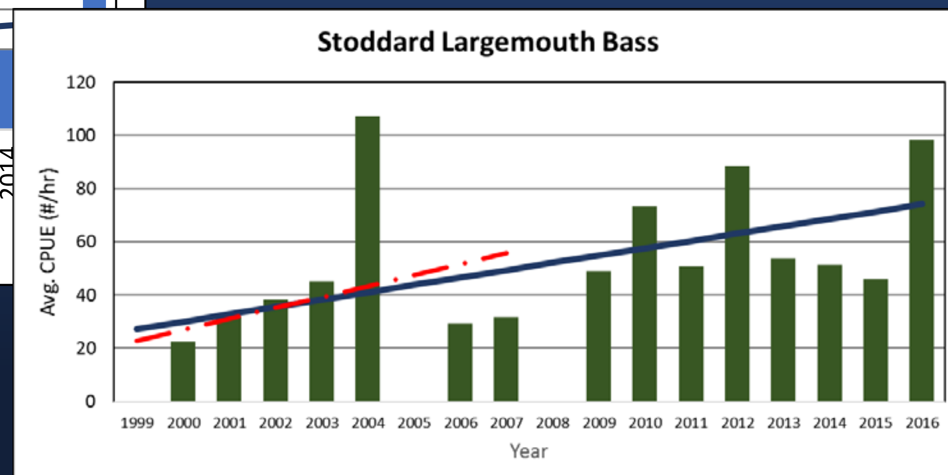
Fisheries Response Monitoring

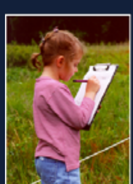
Functioning fall 1998, 640 acres

Average Pre-project Age 1+ CPUE = 0



Average Pre-project Age 1+ CPUE = 6





Lessons Learned!

Project performance monitoring has to take into consideration the life history of target biota.

Fall Fishing at Stoddard Bay

DREDGING

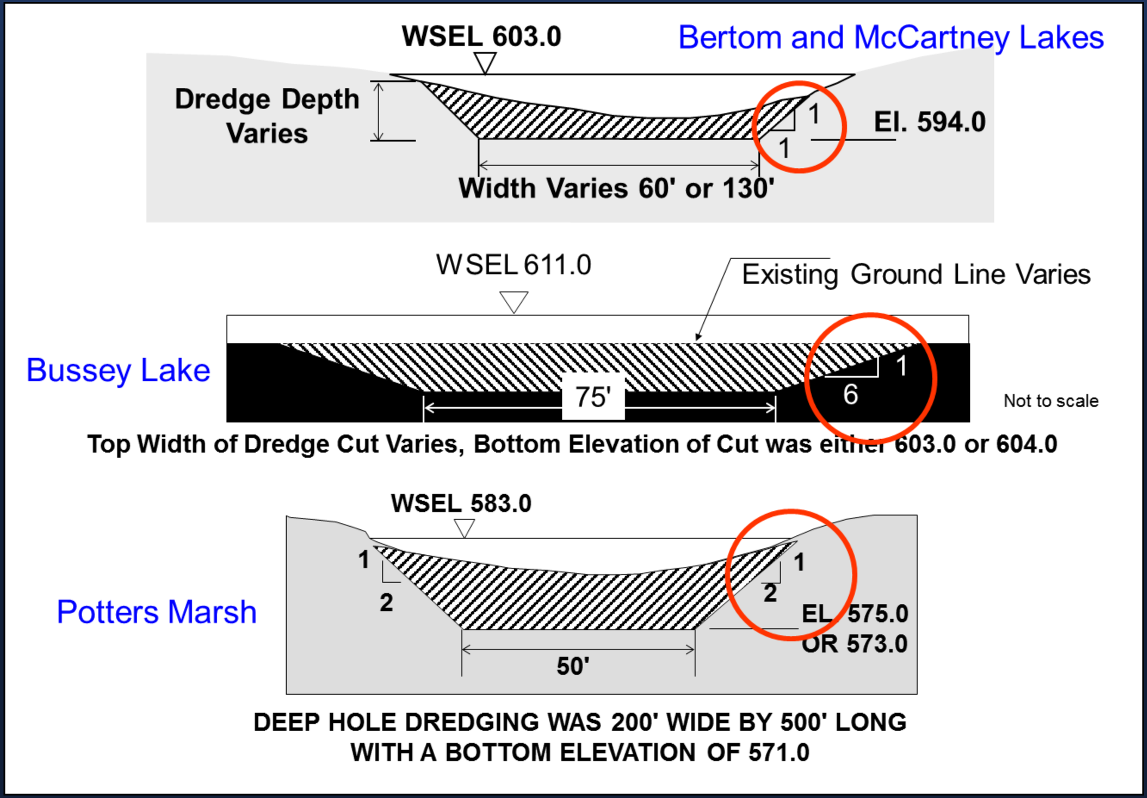
Hydraulic

Mechanical

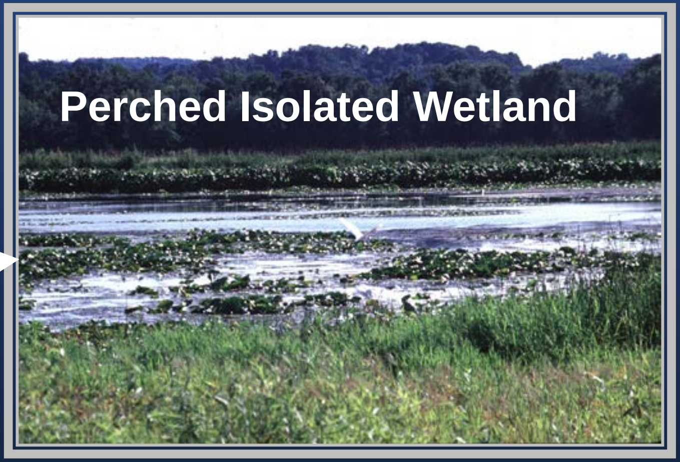
Lessons Learned!

DREDGE CUT DESIGN

Difference in sediment types require dredge cut designs to be based on local site conditions. The slope of the cut must include consideration of the geotechnical properties of the sediment.

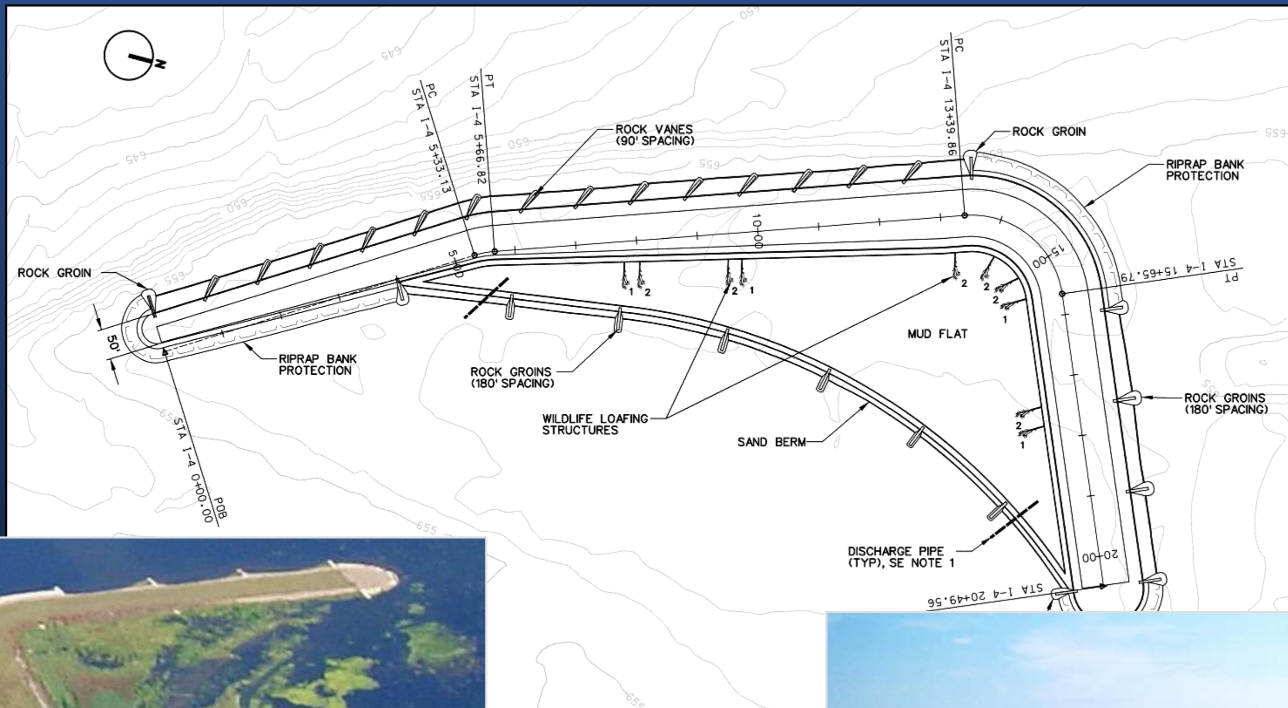


Incorporation of Isolated Wetlands into Island Design



Spring Lake Islands HREP, Pool 5

Mud Flats increase habitat diversity and increase capacity for fines



Lessons Learned!/Take Home Messages

Basic Elements to Planning Successful Projects

Pool 8 Islands, Phase I and III

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Lessons Learned!/Take Home Messages

Basic Elements to Planning Successful Projects

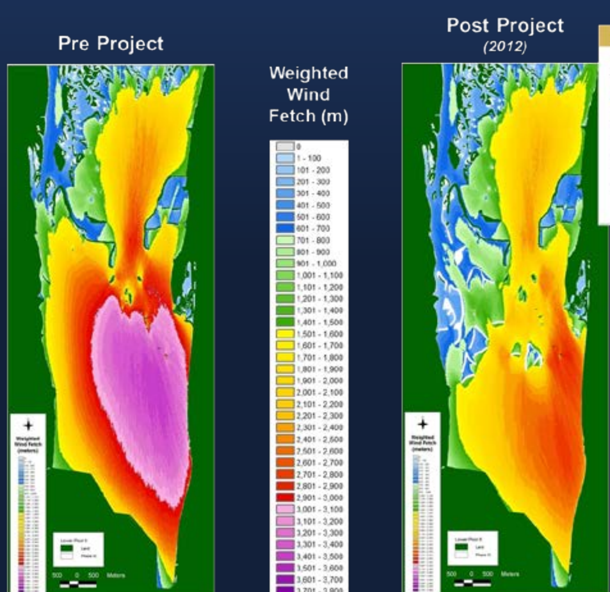
Goals describing the desired habitat and processes

Lessons Learned!/Take Home Messages

Basic Elements to Planning Successful Projects

Goals describing the desired habitat and processes

Measurable objectives that include physical and chemical parameters and consider life cycle of target species (CRITERIA)



April – July, 1998 – 2007 climatological data, La Crosse, WI Municipal Airport. Model run provided by Jason Rohweder, USGS, UMESC

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Lessons Learned!/Take Home Messages

Basic Elements to Planning Successful Projects

Goals describing the desired habitat and processes

Measurable objectives that include physical and chemical parameters and consider life cycle of target species (CRITERIA)

Include Design Considerations

For example: Use of rock should be minimized to allow for more aesthetic and natural looking conditions.

Minimize use of rock
Pool 8 Phase I, Boomerang Island

Spring Lake
Islands, Pool 5
Mud Flats

Incorporate existing
islands into design
Capoli Slough, Pool 9

Lessons Learned!/Take Home Messages

Basic Elements to Planning Successful Projects

Goals describing the desired habitat and processes

Measurable objectives that include physical and chemical parameters and consider life cycle of target species (CRITERIA)

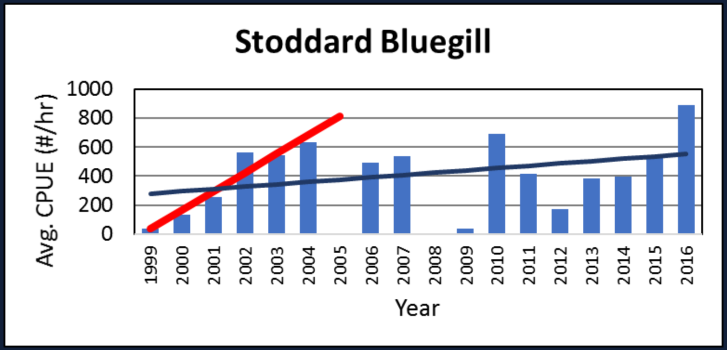
Include Design Considerations

> **For example: Use of rock should be minimized to allow for more aesthetic and natural looking conditions.**

Pre and post project monitoring should be practical:

- **Physical criteria (DO, Temp., Depth, etc.)**
- **Biotic should be long enough for populations to respond.**

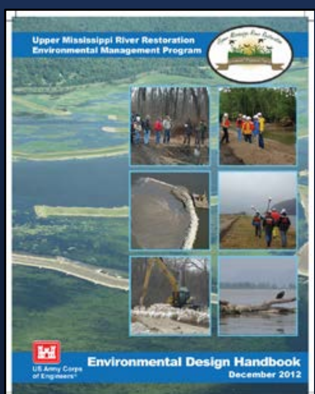
Average Pre-project Age 1+ CPUE = 0

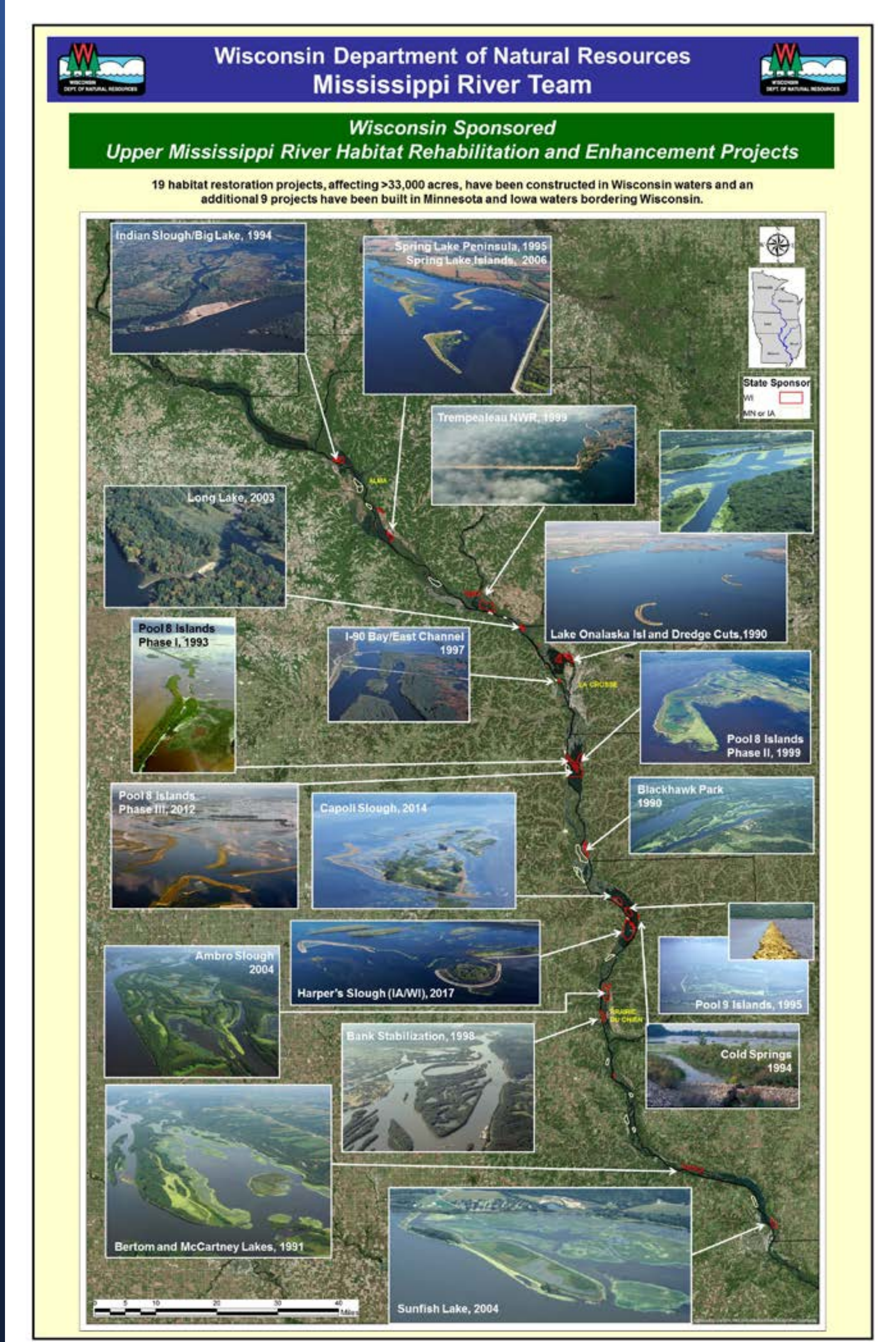


Upper Mississippi River Restoration

Leading · Innovating · Partnering

http://www.mvr.usace.army.mil/Missions/Environmental-Protection-and-Restoration/Upper-Mississippi-River-Restoration/





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