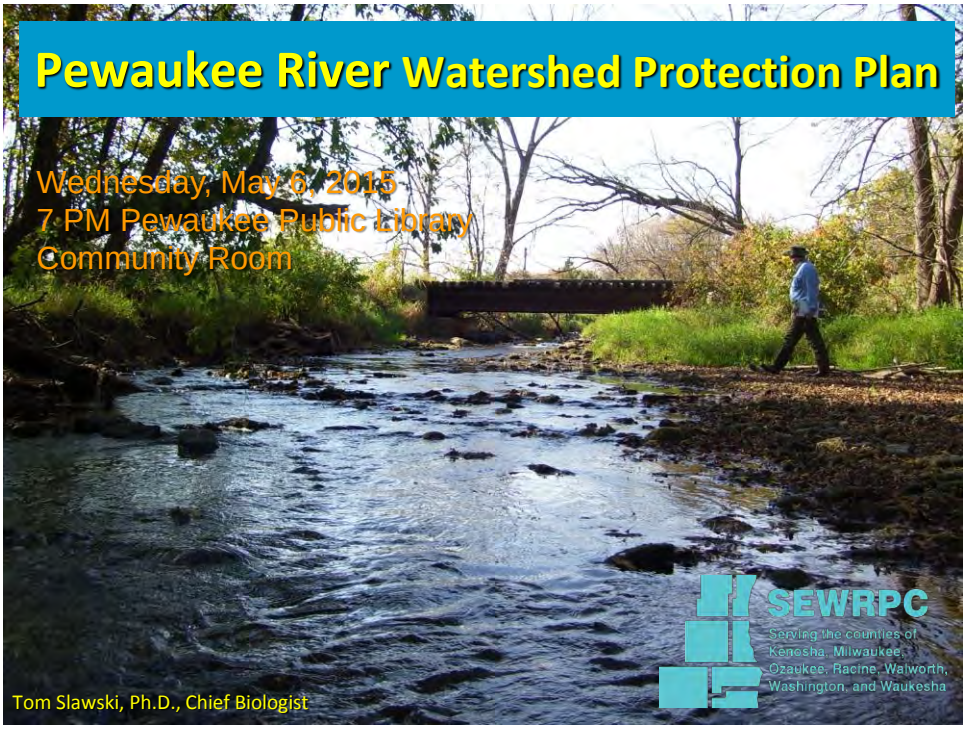
300-1000
ITEM 4

Pewaukee River Watershed Protection Plan

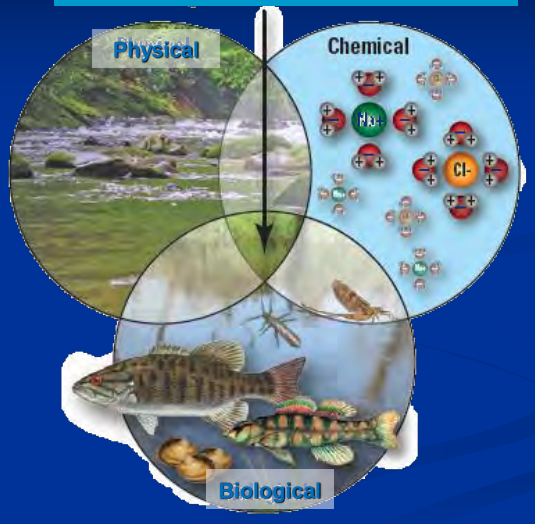


Wednesday, May 6, 2015
7 PM Pewaukee Public Library
Community Room

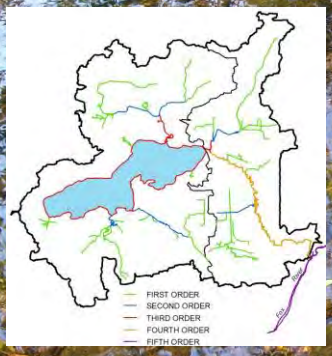
SEWRPC
Serving the counties of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha

Tom Slawski, Ph.D., Chief Biologist

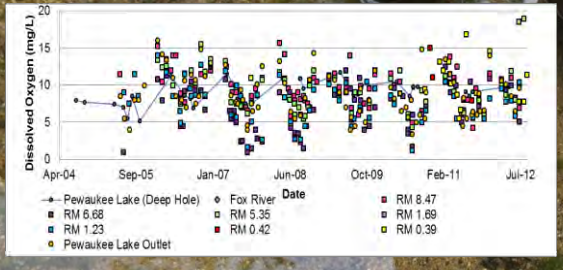
Ecological "Stream Health"

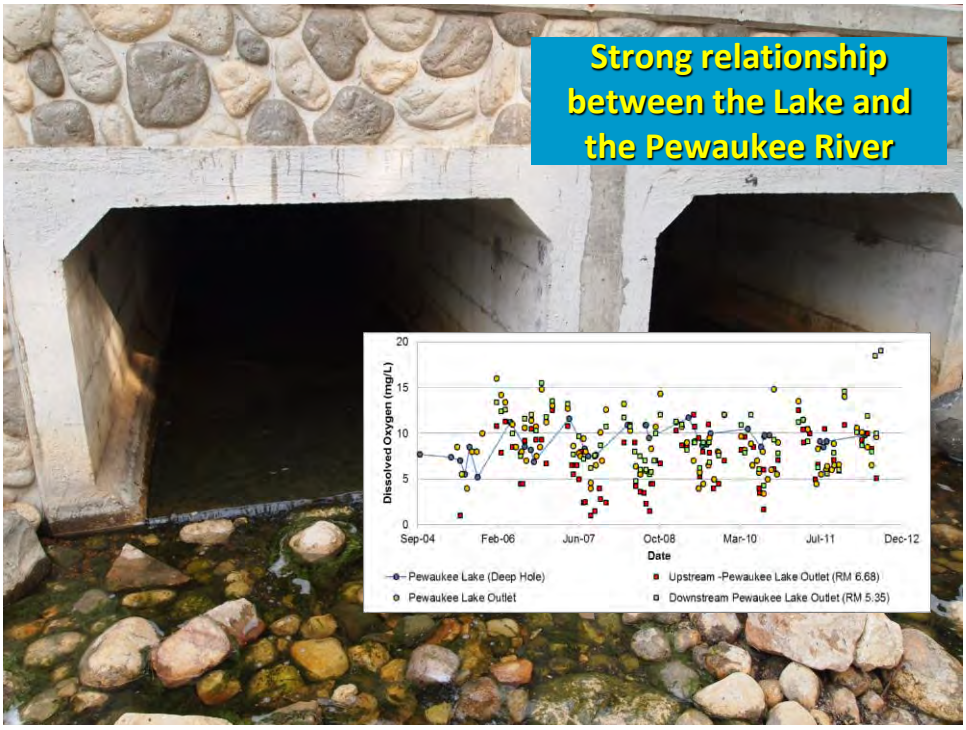


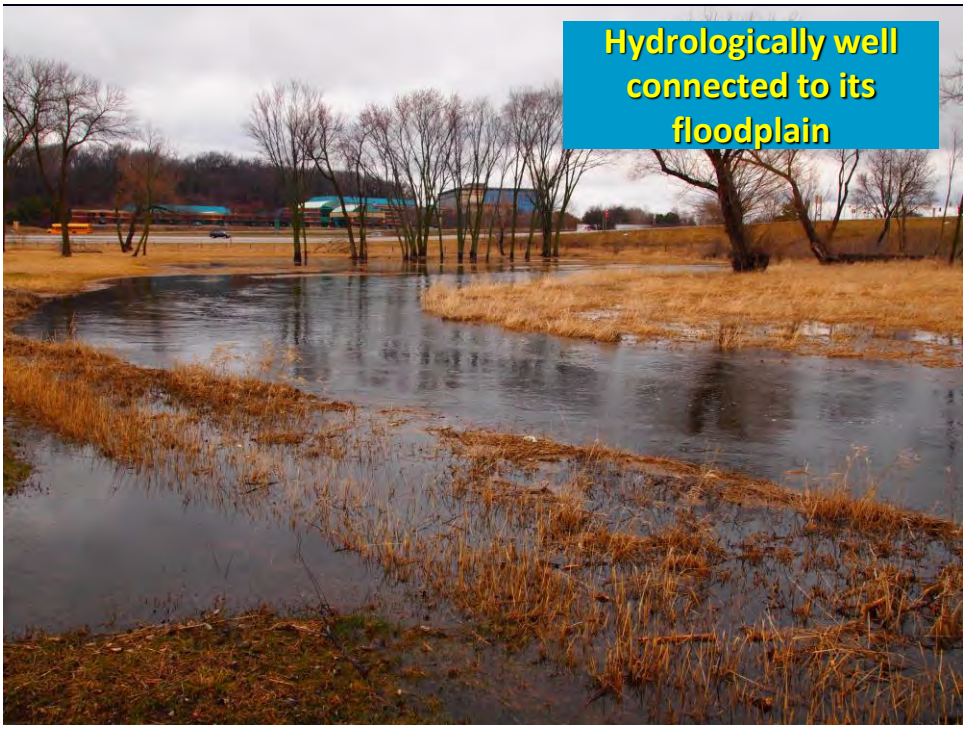
Ecological
"Sream Health" is a reflection of its watershed



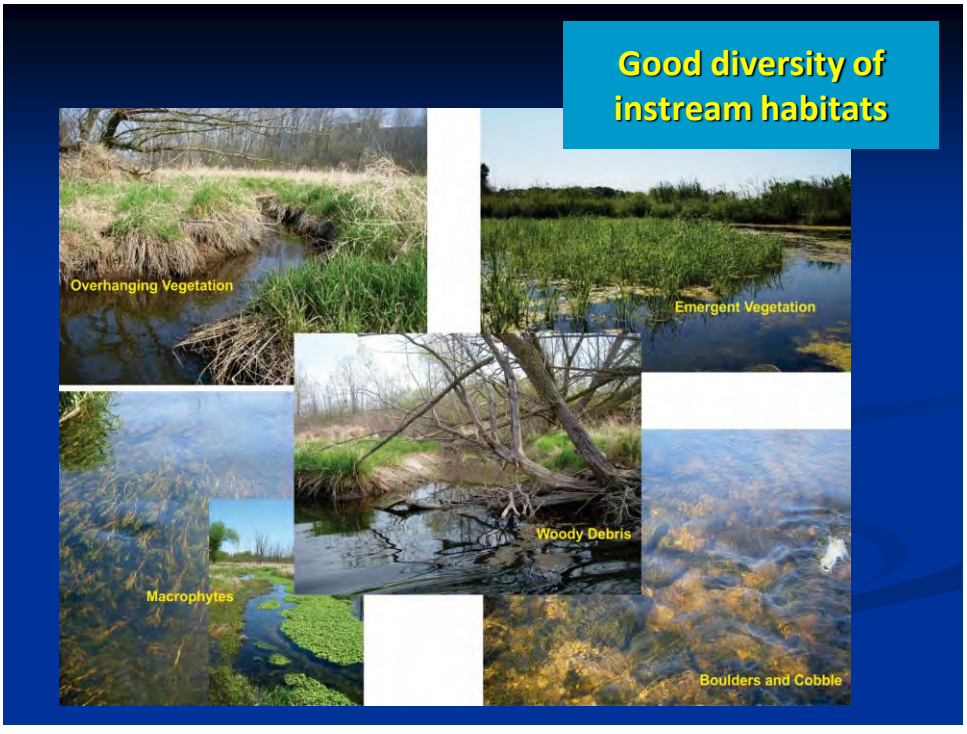
Good water quality within the Pewaukee River




Strong relationship between the Lake and the Pewaukee River
Dissolved Oxygen (mg/L)
20
15
10
5
0
Sep-04
Feb-06
Jun-07
Oct-08
Mar-10
Jul-11
Dec-12
Date
Pewaukee Lake (Deep Hole)
Upstream -Pewaukee Lake Outlet (RM 6.68)
Pewaukee Lake Outlet
Downstream Pewaukee Lake Outlet (RM 5.35)


Hydrologically well connected to its floodplain


Good diversity of instream habitats


Good diversity of instream habitats
Overhanging Vegetation
Emergent Vegetation
Woody Debris
Macrophytes
Boulders and Cobble


Rainbow darter
Rock bass
Smallmouth bass
Johnny darter
Spottail shiner


Johnny Darters, guarding male
Brian J. Torreano, newsletter@bjdarters.com

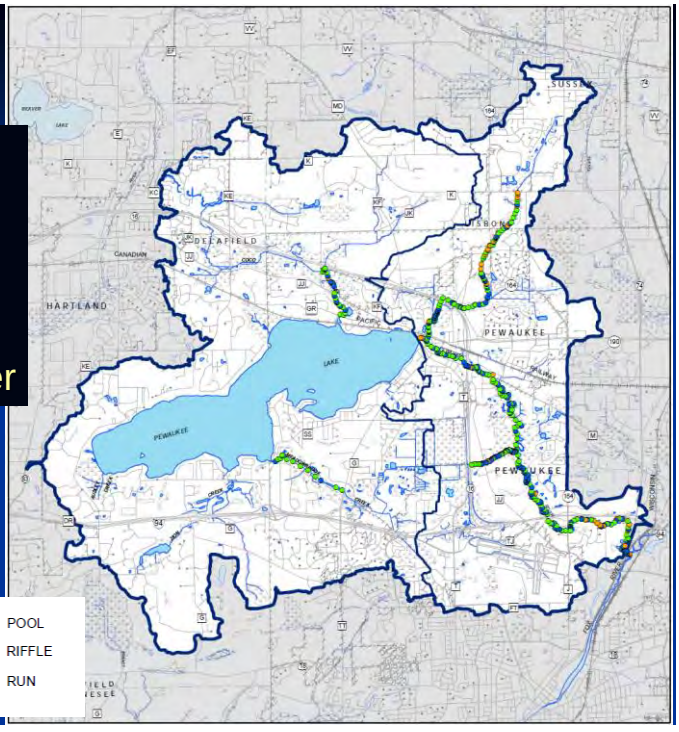
Johnny Darters, mating pair

Brian J. Torreano, newsletter@btdarters.com

Johnny Darters, Fry

Brian J. Torreano, newsletter@btdarters.com

Challenge: Aquatic habitats are not evenly distributed within the river



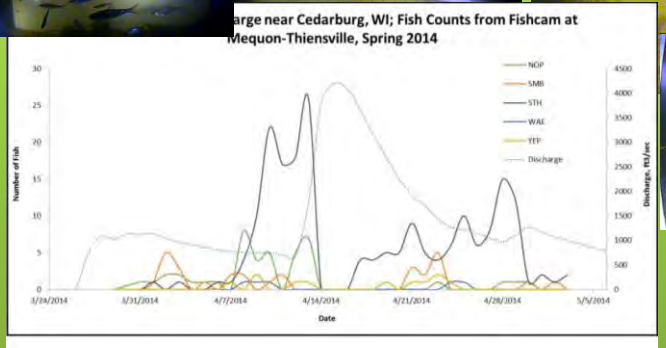
River Continuum concept:

- From headwaters to mouth, streams change in a predictable fashion:
  - Size
  - Temperature
  - Habitats
  - Food Sources
- **Each section is dependant upon up and down-stream reaches to function properly**

Engineered fishway at Milwaukee River Thiensville Dam at river mile 19

http://www.co.ozaukee.wi.us/PlanningParks/fishwaycamera.html

Engineered fishway at Milwaukee River Thiensville Dam at river mile 19



Fish Counts and Abbreviation Key

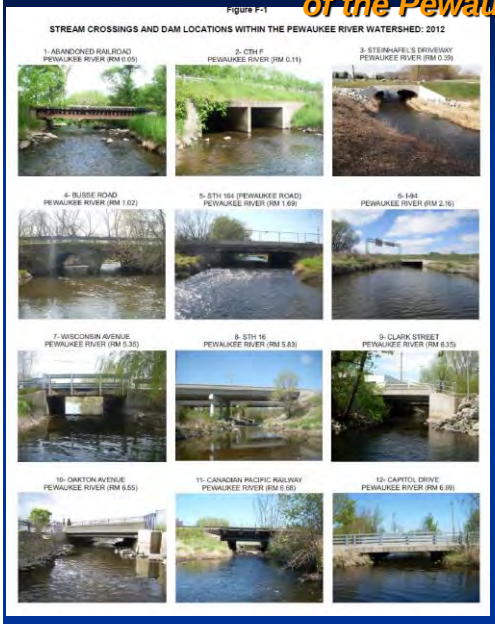
Northern Pike (NOP): 42 fish
Walleye (WAE): 5 fish
Smallmouth Bass (SMB): 29 fish
Yellow Perch (YEP): 11 fish
Steelhead (STH): 200 fish

USGS discharge data for the Milwaukee River is unavailable prior to 3/27/14 due to ice on the river.

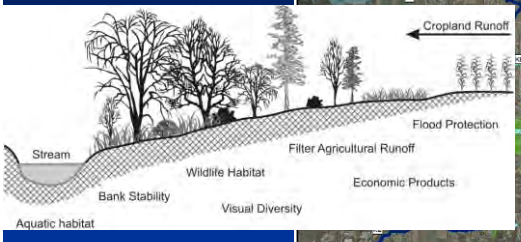
Fish counts start 3/29/14 when video begins.

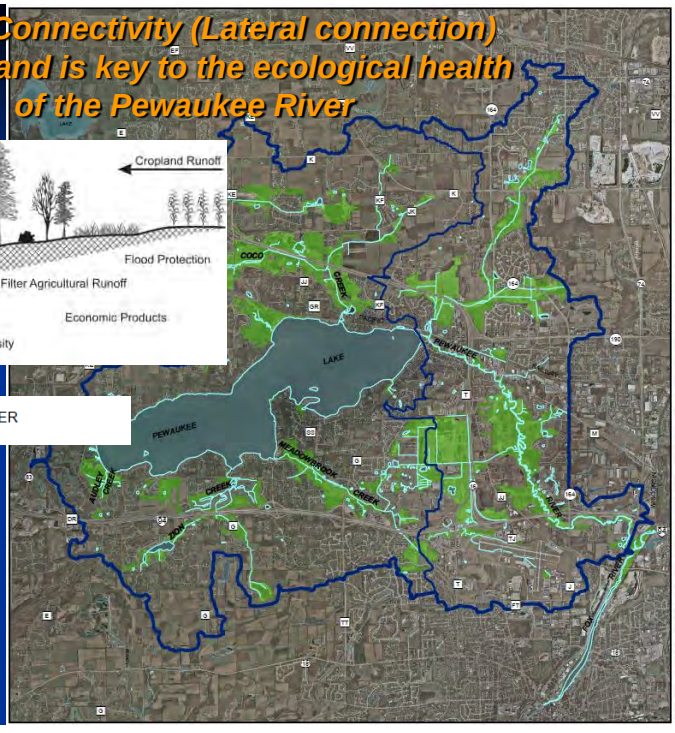
Main migratory species and species of interest are shown. Stream resident and lesser migratory species are not shown in graph for ease of reading.

Stream Connectivity (Longitudinal connection) with the land is key to the ecological health of the Pewaukee River

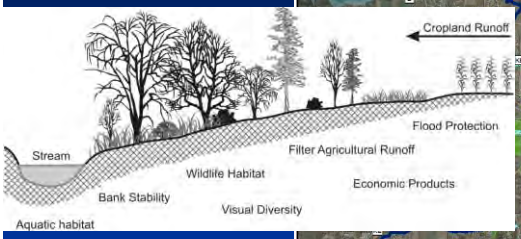


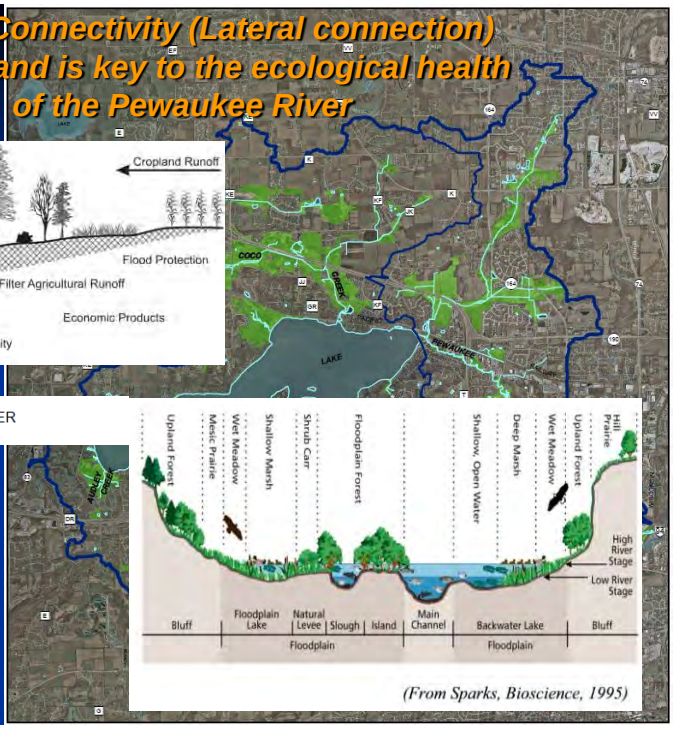
Stream Connectivity (Lateral connection) with the land is key to the ecological health of the Pewaukee River



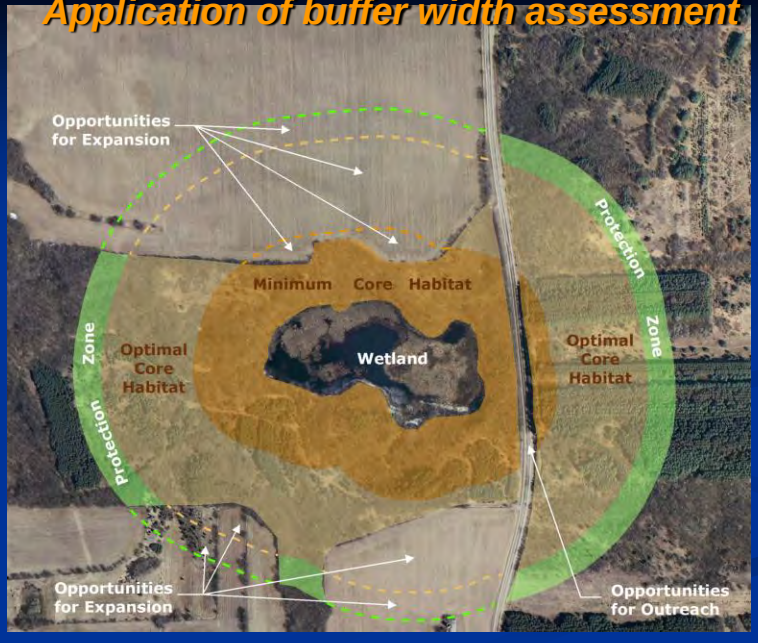


Stream Connectivity (Lateral connection) with the land is key to the ecological health of the Pewaukee River





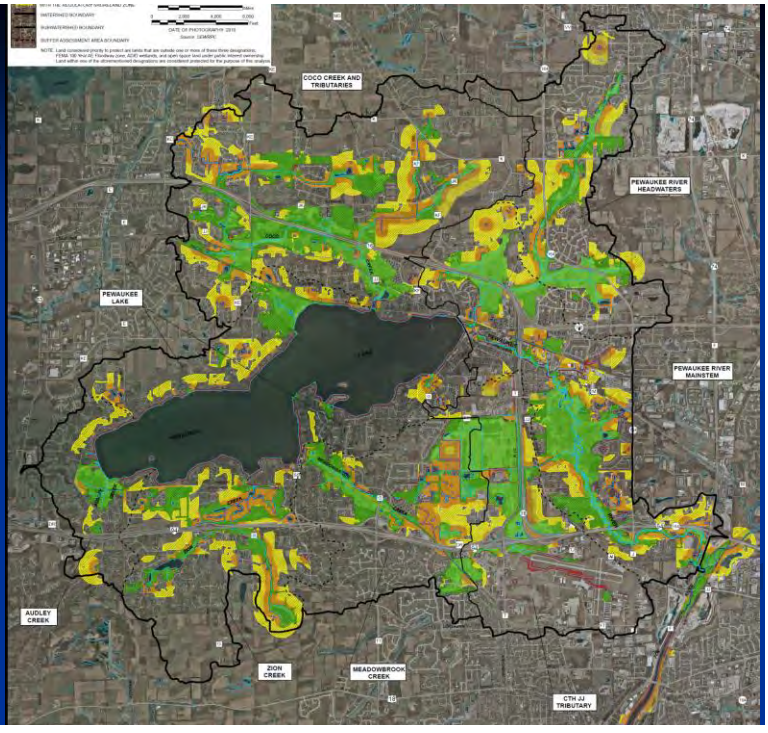
Application of buffer width assessment



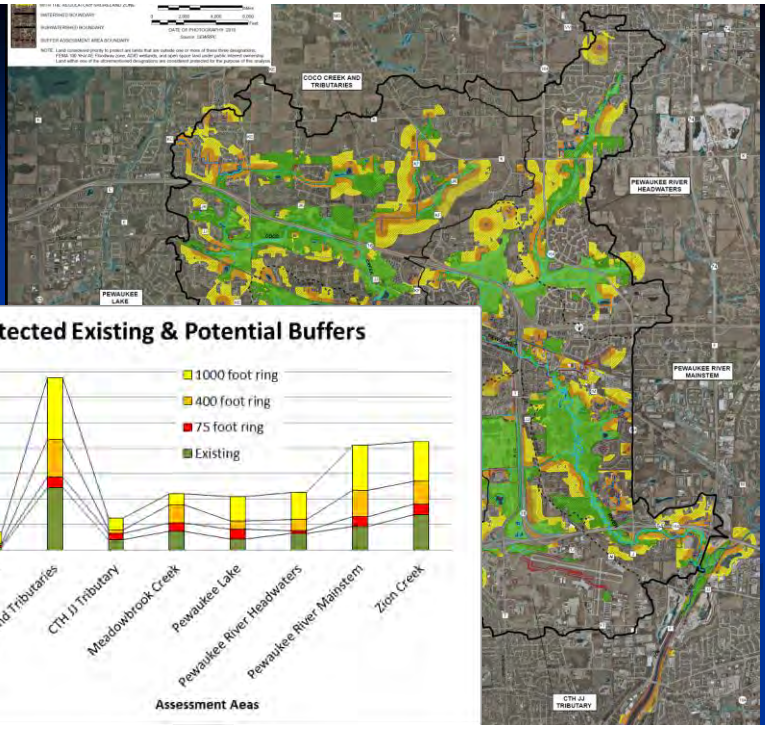
See http://www.sewrpc.org/SEWRPC/Environment.htm

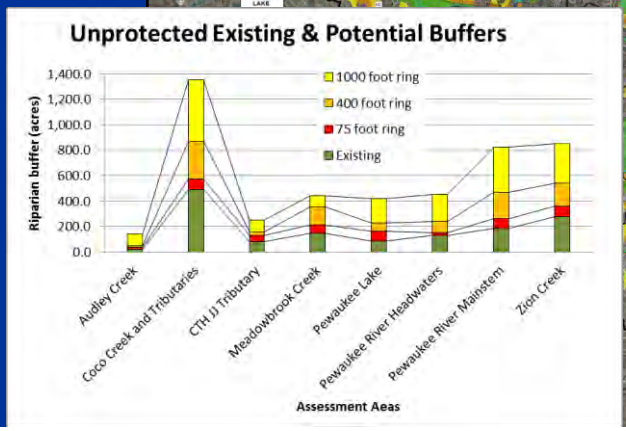
Prioritization Scheme-Protect & expand the integrity of the existing landscape, where possible

Protected vs Vulnerable

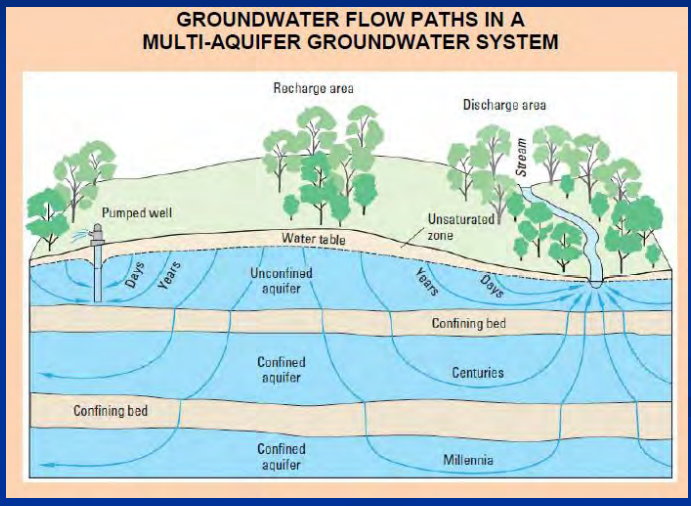


Protected vs Vulnerable

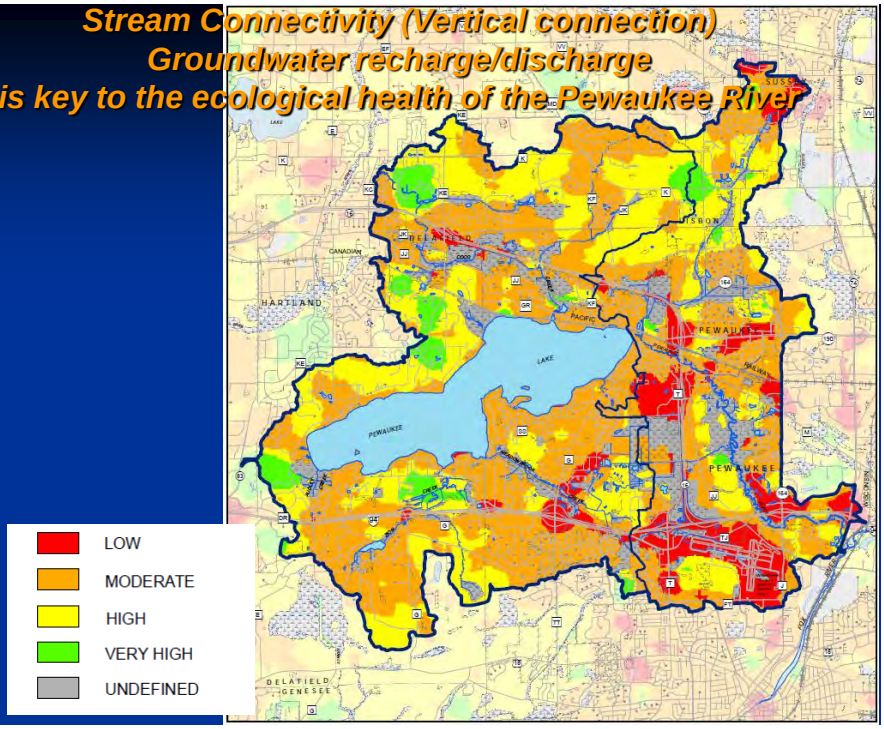




Stream Connectivity (Vertical connection)
Groundwater recharge/discharge
is key to the ecological health of the Pewaukee River



Stream Connectivity (Vertical connection)
Groundwater recharge/discharge
is key to the ecological health of the Pewaukee River



Problem: Aquatic communities respond to many environmental variables…

- Streamflow, stream size, position

- Basin characteristics

- Habitat

- Land cover, water quality, connectivity

USGS, MA-RI Water Science Center

Problem: …aquatic communities also respond to many human alterations.

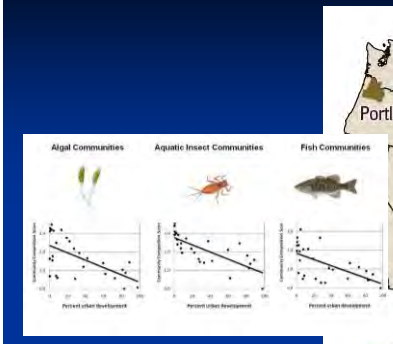
- Water-use (withdrawals, returns)

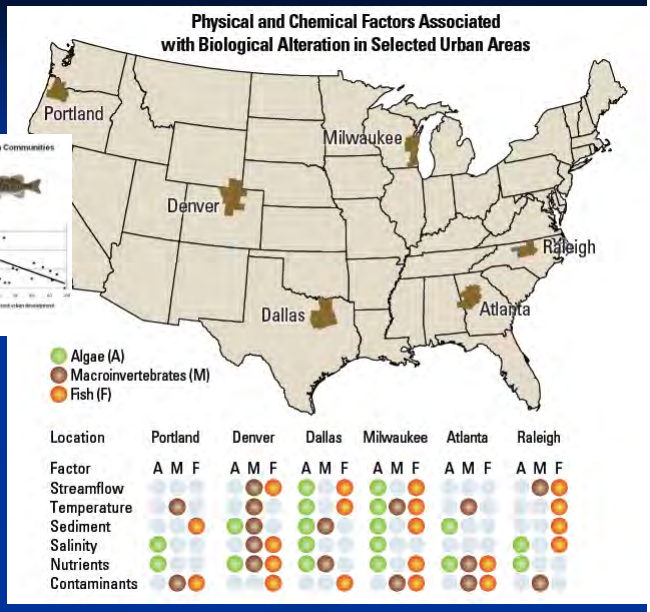
- Land cover/land-use/imperviousness

- Water quality, habitat loss, flow fluctuations

- Connectivity, impoundment, channelization

USGS, MA-RI Water Science Center



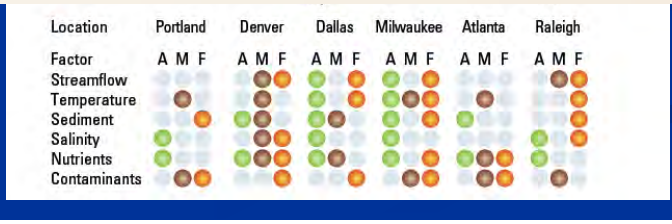


(USGS, Ecological Health in the Nation's Streams, 1993–2005)

Prioritization Scheme (USGS, Ecological Health in the Nation's Streams, 1993–2005)

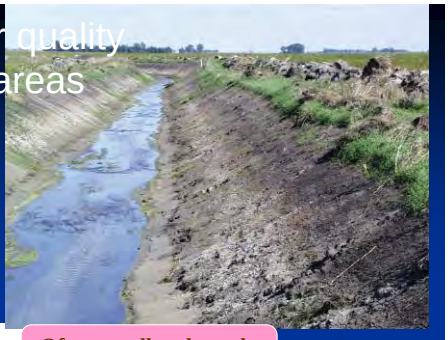
Highlights of Major Findings and Implications

- The presence of healthy streams in watersheds with substantial human influence indicates that it is possible to maintain and restore healthy stream ecosystems. Such streams can also offer insights into how stream health can be maintained amid anticipated changes in land use or restored when stream health has deteriorated as a result of human actions.

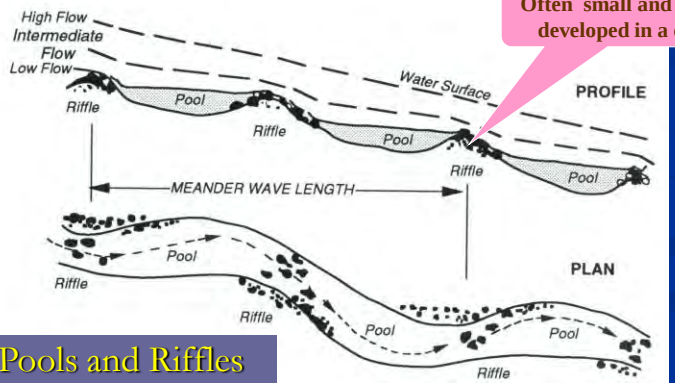


Opportunities to improve water quality and fisheries in urban areas

Opportunities to improve water quality and fisheries in agricultural areas



Agricultural Ditch Characteristics



Often small and poorly developed in a ditch

Pools and Riffles


Need to continue to be vigilant, communicate, and ready to take advantage of opportunities to improve water quality and wildlife on the Pewaukee River

Menomonee River (Phase 1) Fish Passage Restoration Project:

April 30, 2015
11th Annual Clean Rivers Clean Lake Conference

SEWRPC
Thomas M. Slawski, Chief Biologist
Southeastern Wisconsin Regional Planning Commission

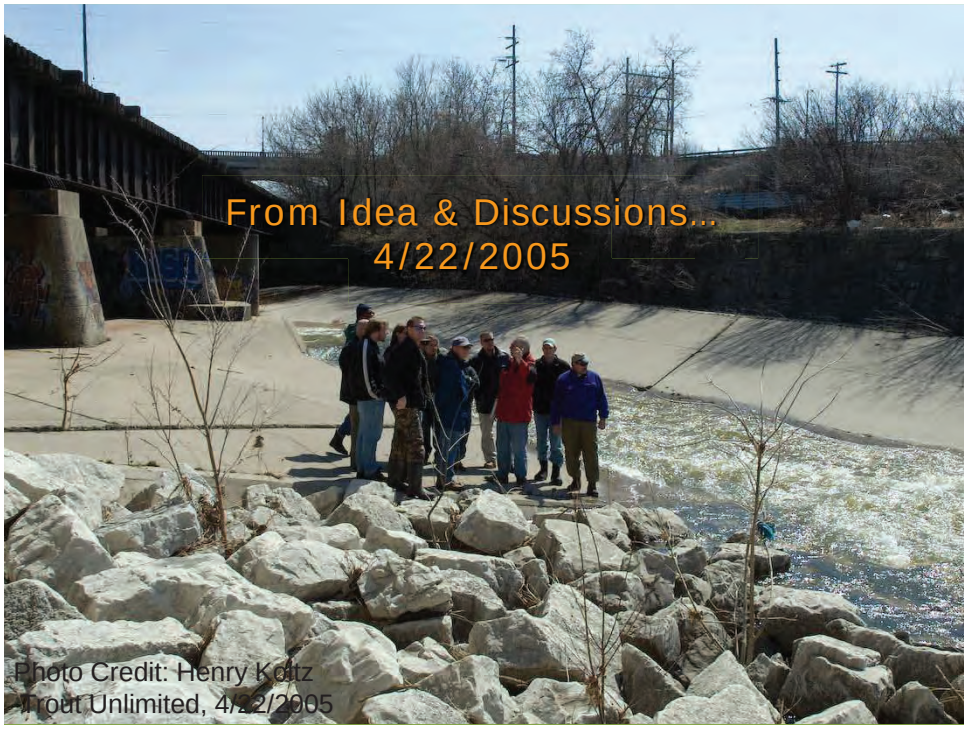
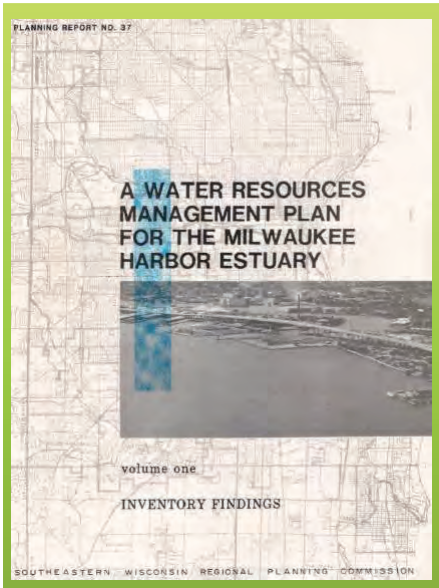


Photo Credit: Henry Koltz
Trout Unlimited, 4/22/2005

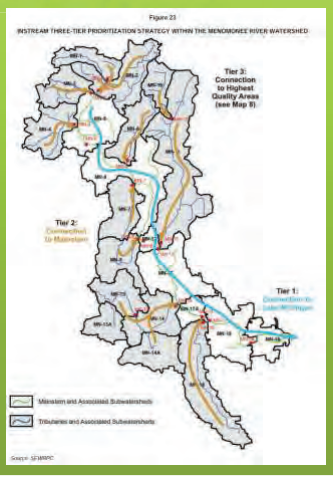
Over $1.3 million in grants and in-kind contributions by the project partners:

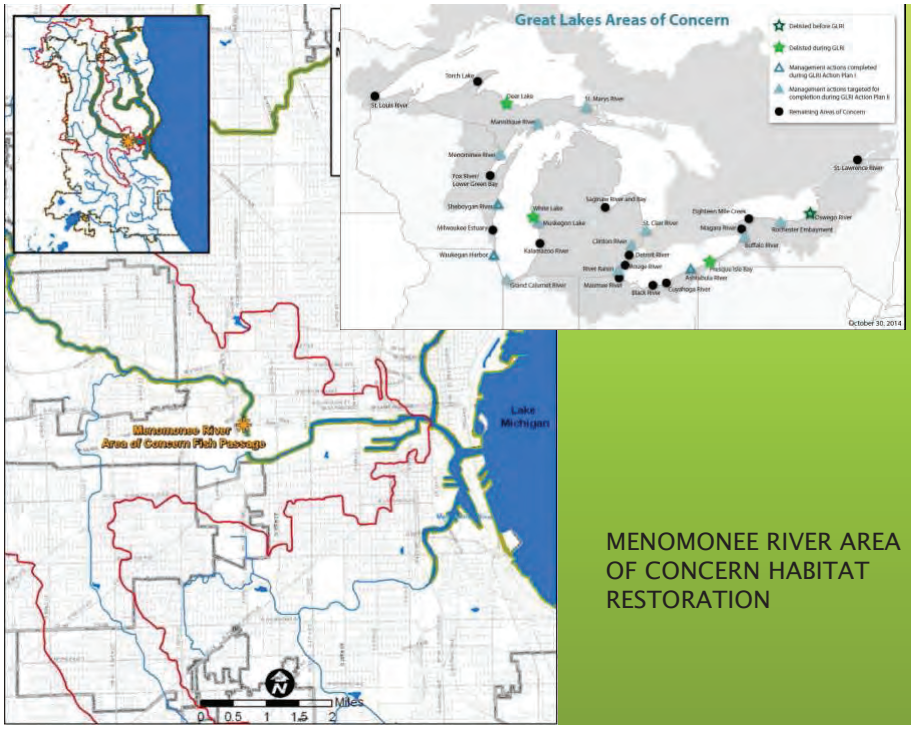
US EPA ($1,103,000 GLRI grant)
National Fish and Wildlife Foundation ($200,000 grant),
Trout Unlimited, Southeastern Wisconsin Chapter
Milwaukee Riverkeeper
WDNR
SEWRPC



Why are we doing this?

"To continue to identify problems and practical, cost-effective water resources management actions to achieve the agreed upon fishable and swimmable water use objectives & water quality standards"



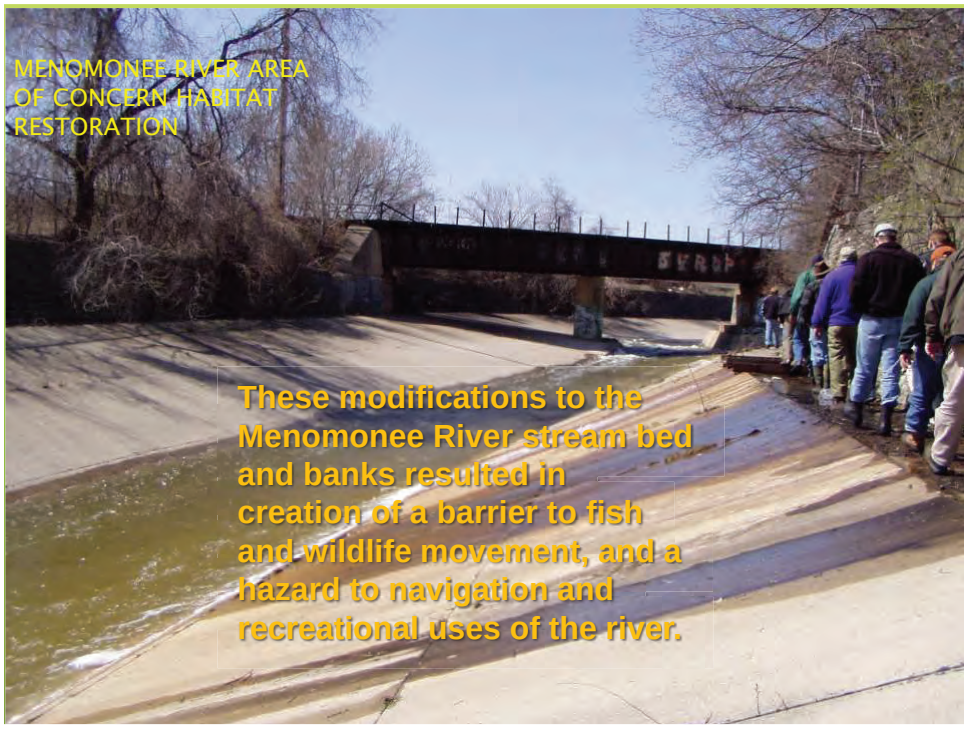


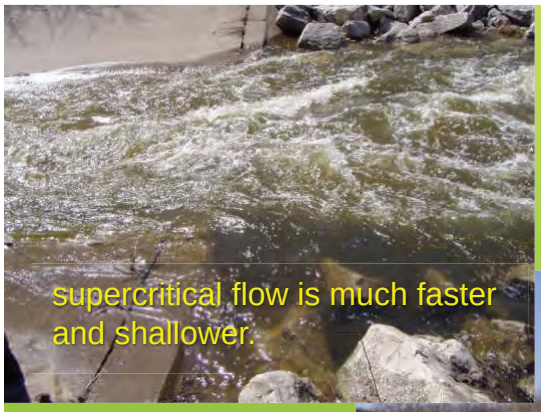
MENOMONEE RIVER AREA OF CONCERN HABITAT RESTORATION

MENOMONEE RIVER AREA OF CONCERN HABITAT RESTORATION

MENOMONEE RIVER AREA
OF CONCERN HABITAT
RESTORATION

Menomonee R Falk Dam
(abandoned 2003)





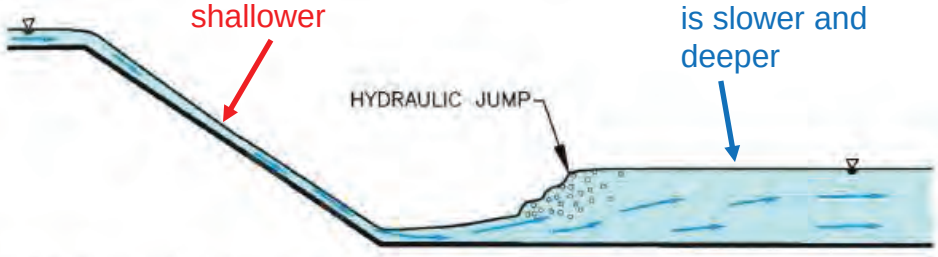
supercritical flow is much faster and shallower.

This concrete lining created extremely high water velocity conditions

Supercritical versus Subcritical Flows

Supercritical flow is much faster and shallower

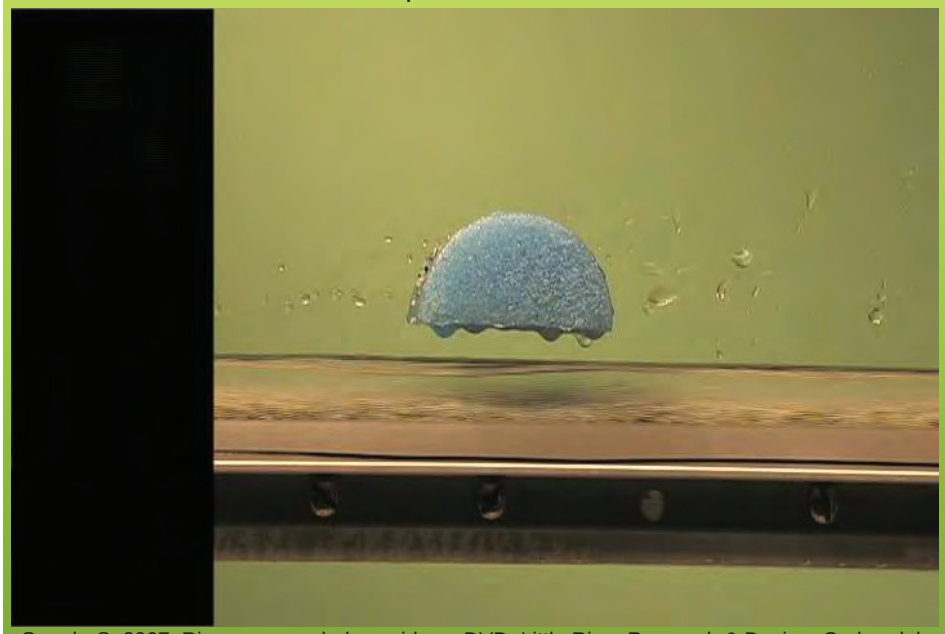
Subcritical flow is slower and deeper



Courtesy of Wright Water Engineers, Inc. and ASDSO.
Source: Wright, Kenneth R., Kelly, Jonathan M., Houghtalen, Robert J., & Bonner, Mark R. "Emergency Rescues at Low-Head Dams." Paper presented at Dam Safety 1995, the 12th annual conference of the Association of State Dam Safety Officials, Atlanta, GA, September 1995.

Gough, S. 2007. River geomorphology videos. DVD. Little River Research & Design, Carbondale, IL; www.emriver.com.

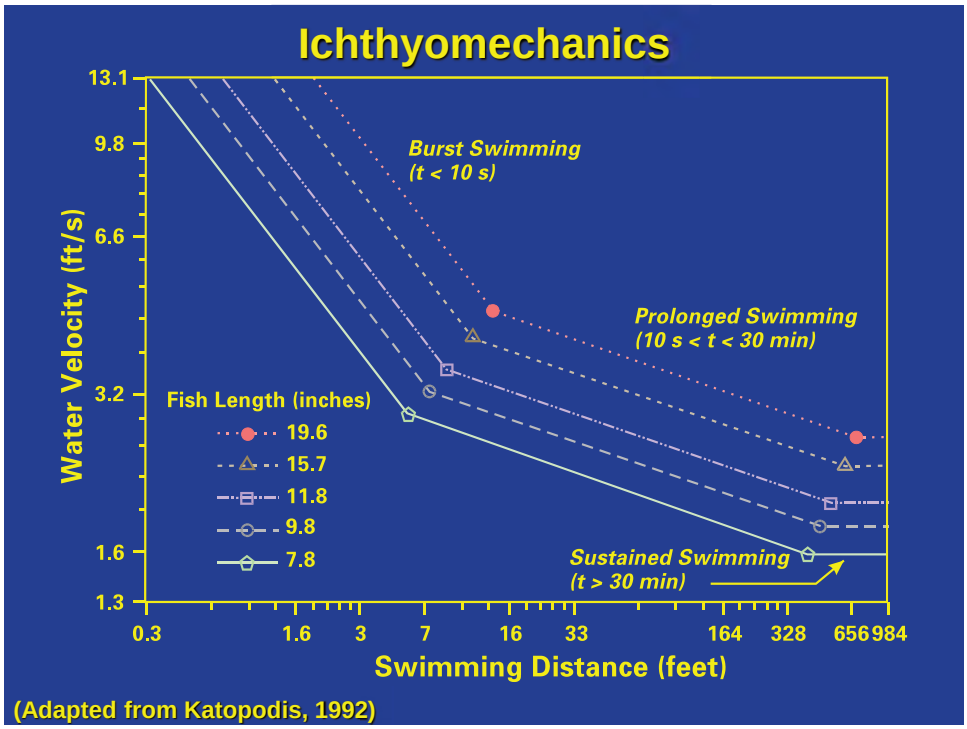
Subcritical vs Supercritical Flows

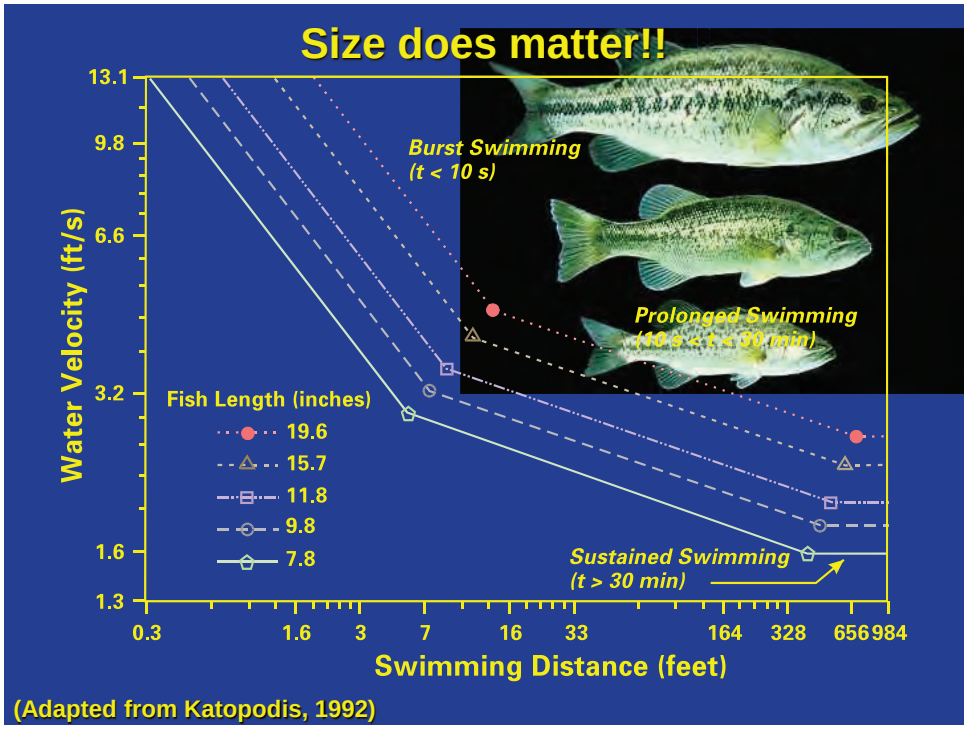


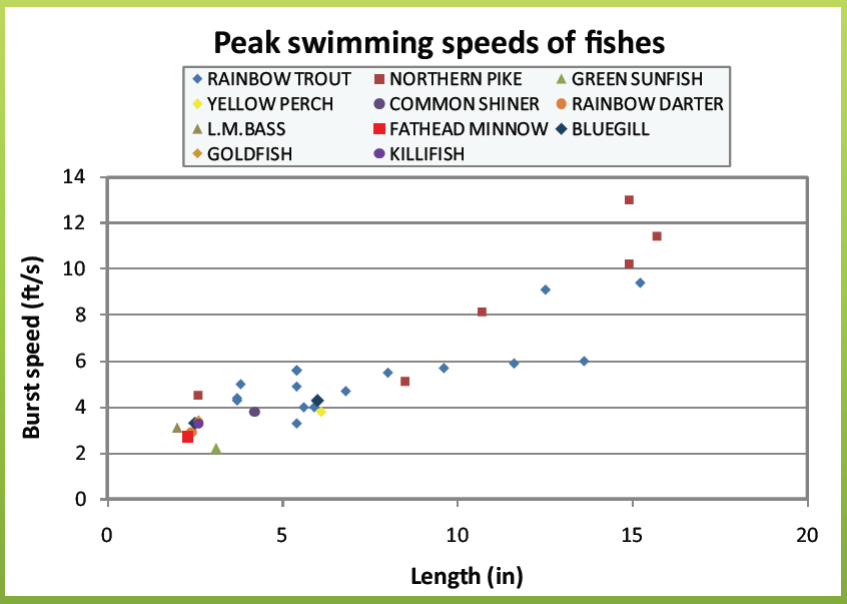
Gough, S. 2007. River geomorphology videos. DVD. Little River Research & Design, Carbondale, IL; www.emriver.com.

Smallmouth bass and dusky shiners in high velocity closeup

Gough, S. 2007. River geomorphology videos. DVD. Little River Research & Design, Carbondale, IL; www.emriver.com.

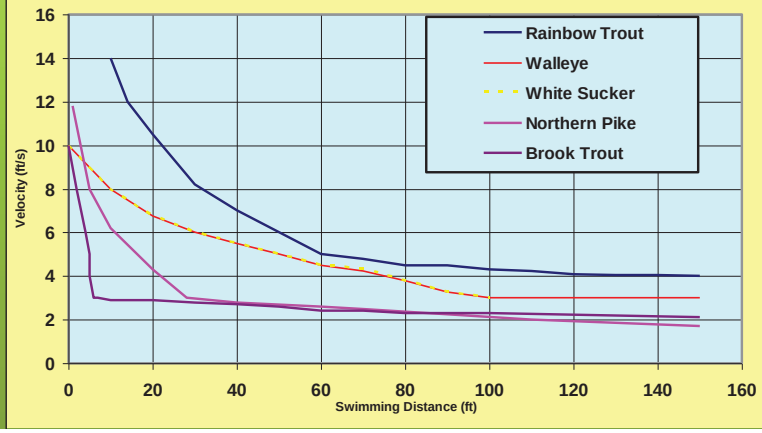

Ichthyomechanics
Water Velocity (ft/s)
13.1
9.8
6.6
3.2
1.6
1.3
Burst Swimming
(t < 10 s)
Prolonged Swimming
(10 s < t < 30 min)
Fish Length (inches)
19.6
15.7
11.8
9.8
7.8
Sustained Swimming
(t > 30 min)
0.3
1.6
3
7
16
33
164
328
656
984
Swimming Distance (feet)
(Adapted from Katopodis, 1992)


Size does matter!!
Water Velocity (ft/s)
13.1
9.8
6.6
3.2
1.6
1.3
Burst Swimming
(t < 10 s)
Prolonged Swimming
Fish Length (inches)
19.6
15.7
11.8
9.8
7.8
Sustained Swimming
(t > 30 min)
0.3
1.6
3
7
16
33
164
328
656
984
Swimming Distance (feet)
(Adapted from Katopodis, 1992)



data from Domenici and Blake 1997

Relationship Between Water Velocity and Fish Swimming Distance between Resting Areas
Adapted from Ontario Ministry of Natural Resources

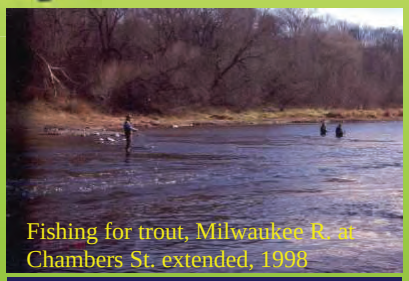


What do we know about barrier impacts to migration?

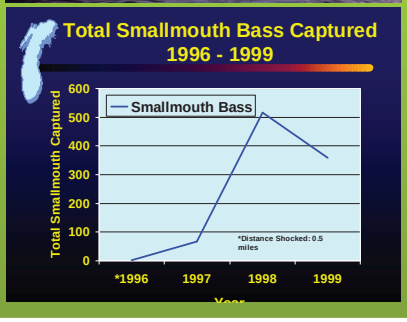
North Avenue Dam Fish Community

Post-Dam Abandonment

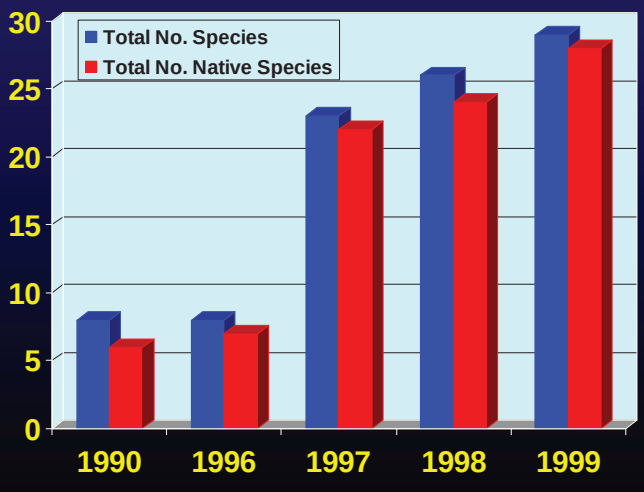
- 31-native species (as of 2007)
- Dominated by top predators smallmouth bass and walleye (stocked)
- Well-balanced community 5 sucker; 3 darter; 5 sunfish species
- Lake sturgeon and greater redhorse (threatened)
- Simple lithophilic spawners common
- Carp numbers greatly reduced along with other tolerant species green sunfish, white sucker, fathead minnow, black bullhead
- Rainbow trout, chinook salmon, coho salmon, *lake trout*
- Dissolved oxygen normal
- Fair to Good habitat

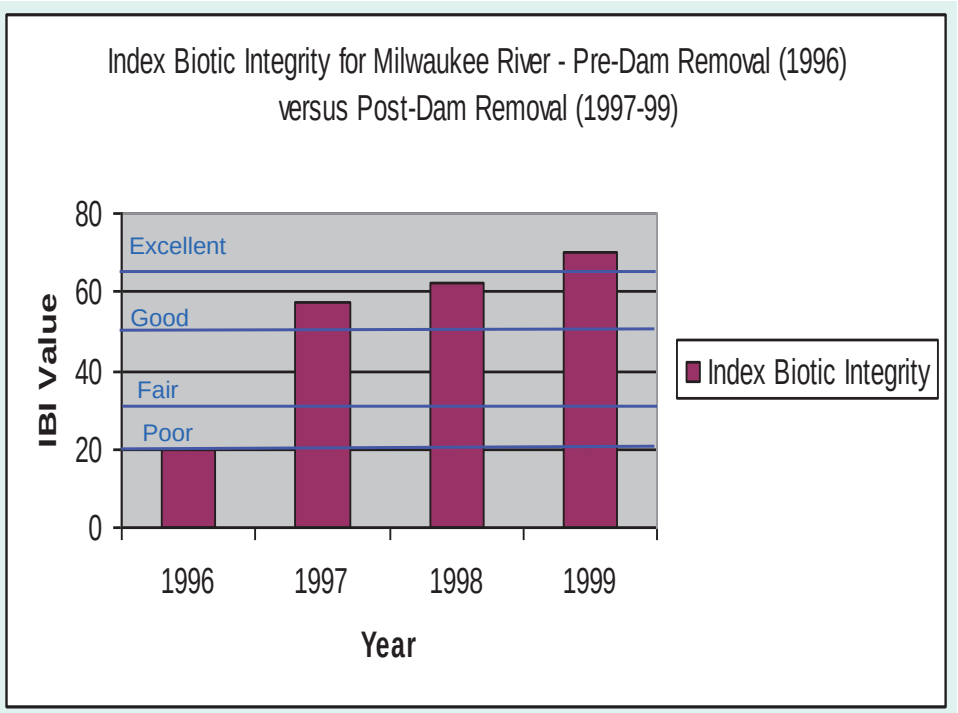


Fishing for trout, Milwaukee R. at Chambers St. extended, 1998



Number of Native Species Vs. Total Species Captured

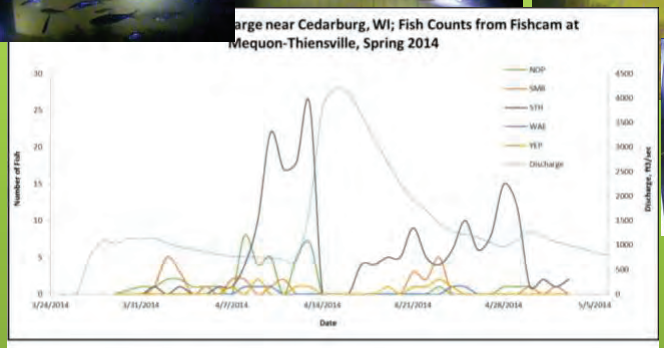




Engineered fishway at Milwaukee River Thiensville Dam at river mile 19

http://www.co.ozaukee.wi.us/PlanningParks/fishwaycamera.html

Engineered fishway at Milwaukee River Thiensville Dam at river mile 19



Fish Counts and Abbreviation Key

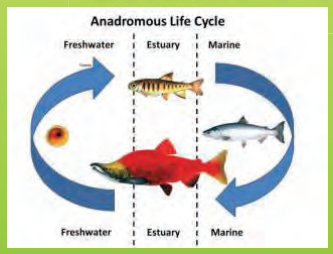
Northern Pike (NOP): 42 fish
Walleye (WAE): 5 fish
Smallmouth Bass (SMB): 29 fish
Yellow Perch (YEP): 11 fish
Steelhead (STH): 200 fish

USGS discharge data for the Milwaukee River is unavailable prior to 3/27/14 due to ice on the river.

Fish counts start 3/29/14 when video begins.

Main migratory species and species of interest are shown. Stream resident and lesser migratory species are not shown in graph for ease of reading.

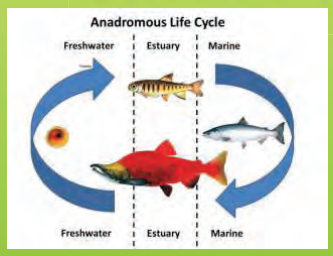
Fish Movement on Great Lake Tributaries

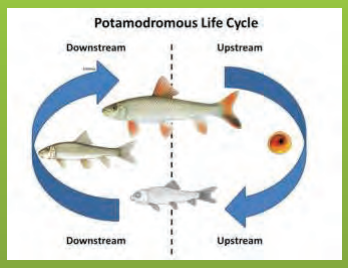


Milwaukee R. walleye below Thiensville Dam, Ozaukee Co. spring 2005

Source: http://thefisheriesblog.com

Fish Movement on Great Lake Tributaries



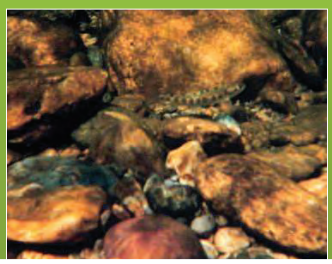


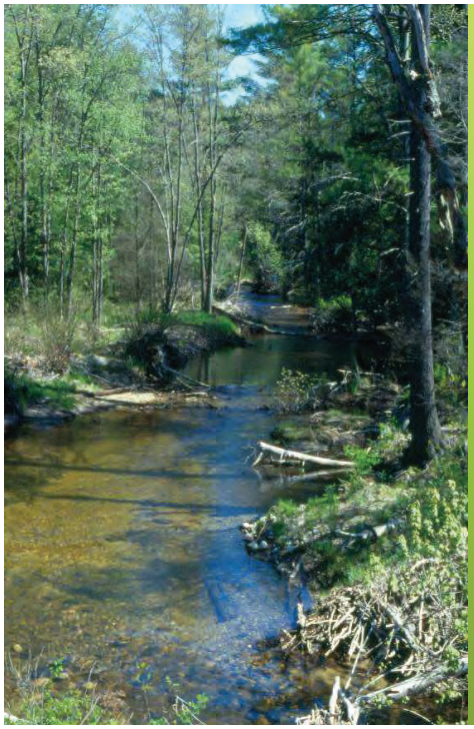
Milwaukee R. walleye below Thiensville Dam, Ozaukee Co. spring 2005

Source: http://thefisheriesblog.com

Nursery Habitat

- Clean, well oxygenated gravels
- Habitat with moderate – swift current
- Adequate interstitial spaces





River Continuum concept:

- From headwaters to mouth, streams change in a predictable fashion:
  - Size
  - Temperature
  - Habitats
  - Food Sources
- **Each section is dependant upon up and down-stream reaches to function properly**

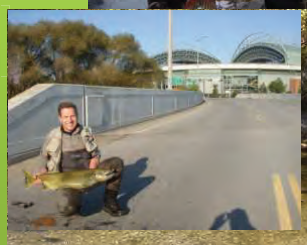
Design Objectives

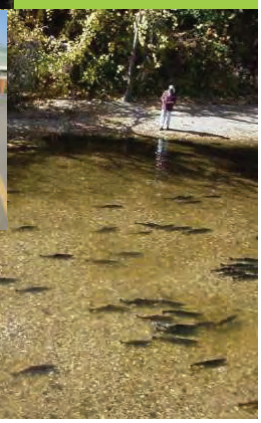
- Pass native potadromous spring migratory fishes.

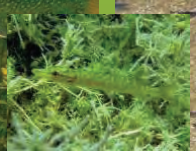
Surrogate: Northern pike

- "Cause No Harm"
- Navigation
- Aesthetic enhancements

Menomonee R. spring run pike and fall run salmon along Miller Stadium







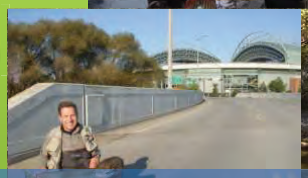
Design Objectives

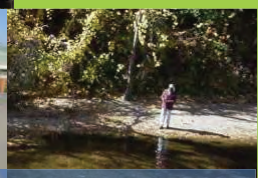
- Pass native potadromous spring migratory fishes.

Surrogate: Northern pike

- "Cause No Harm"
- Navigation
- Aesthetic enhancements

Menomonee R. spring run pike and fall run salmon along Miller Stadium

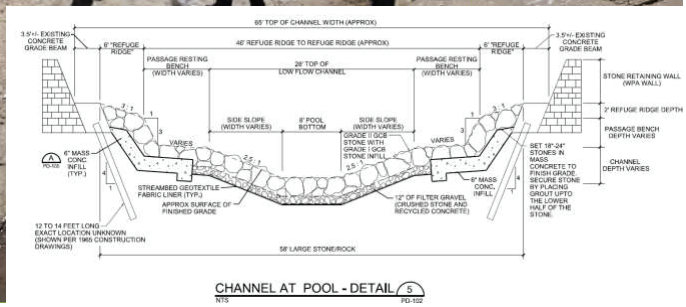




Milwaukee Estuary Area of Concern (AOC)
2 of 11 Biological Use Impairments (BUI) – Degraded Fish & Wildlife Populations and Loss of Habitat

Geomorphic Design Criteria

- Immoveable stream bed incised within 1% probability flood 13,500 cfs (FEMA FIS)
- Shear stress 19 lbs/ft^2 to 30 lbs/ft^2 (d_{50} 3 ft to 5 ft diameter, angular)
- Two-stage channel summer Q7,2 (16 cfs) & spring (300 cfs)
- Riffle Grade Control <0.8 ft ; mean velocity 2 ft/s Northern pike
- Base flow effective water depth pools/runs ≥3.5 ft

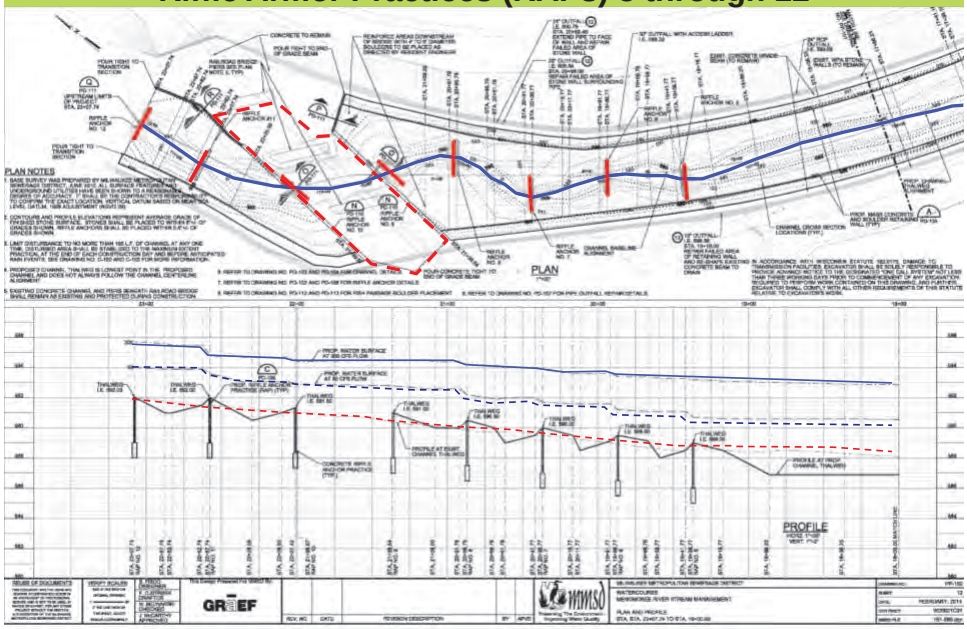


Protecting the integrity of the existing walls

Protecting the integrity of the existing walls & streambed

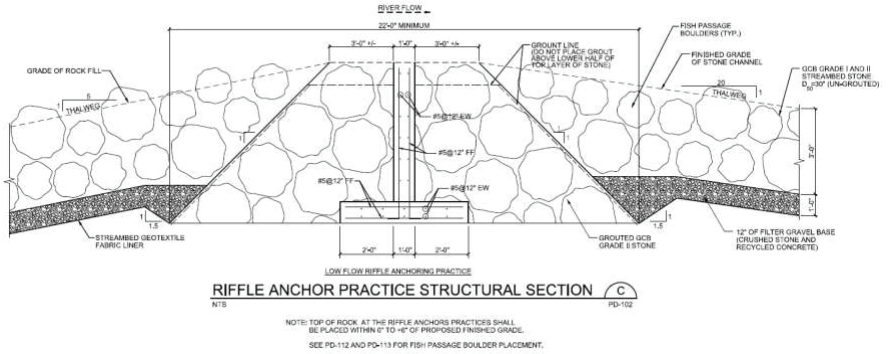
These are big boulders!

Menomonee R. Plan and Profile View
Riffle Armor Practices (RAPs) 5 through 12



Plan Detail of Rock Arch Riffles

Plan Detail of Riffle Anchor Practice



LOW FLOW RIFFLE ANCHORING PRACTICE

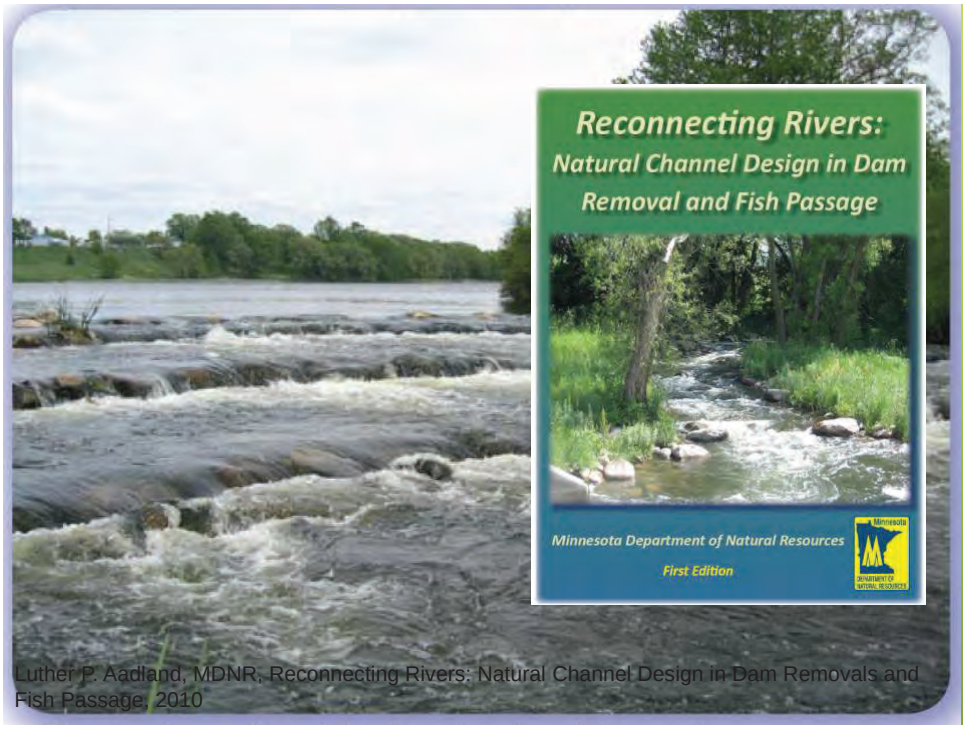
RIFFLE ANCHOR PRACTICE STRUCTURAL SECTION (C)

NTS PD-102

NOTE: TOP OF ROCK AT THE RIFFLE ANCHORS PRACTICES SHALL BE PLACED WITHIN 0" TO +6" OF PROPOSED FINISHED GRADE.

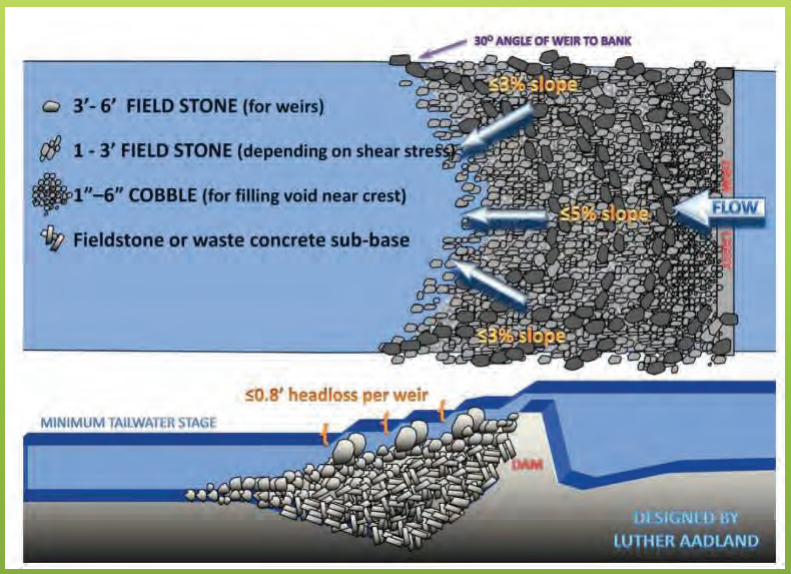
SEE PD-112 AND PD-113 FOR FISH PASSAGE BOULDER PLACEMENT.

Plan Detail of Rock Arch Riffles



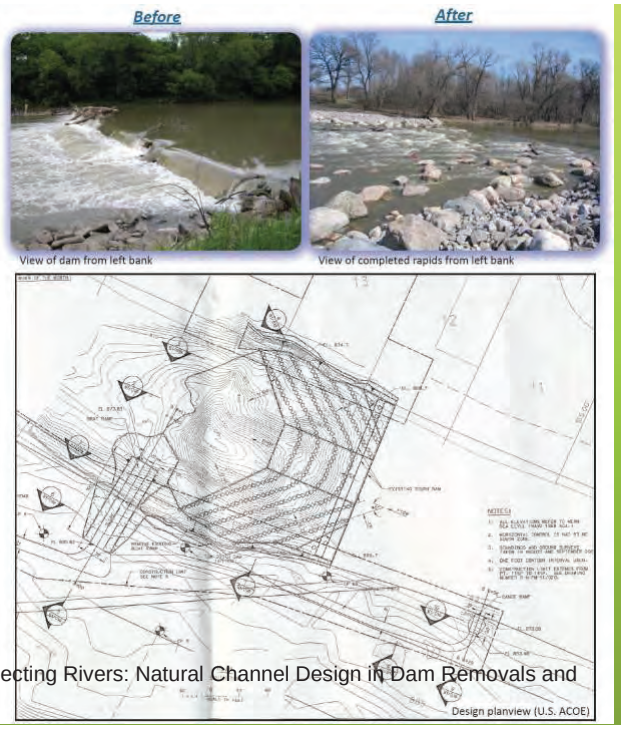
Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010

Generalized conceptual design of the Rock Arch Rapids



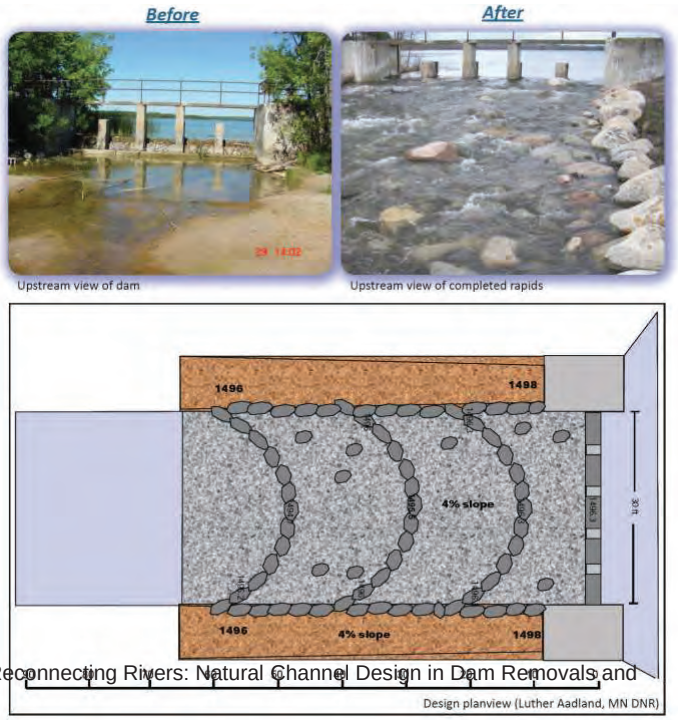
Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010

FARGO SOUTH DAM project example applying the Rock Arch Rapids Design



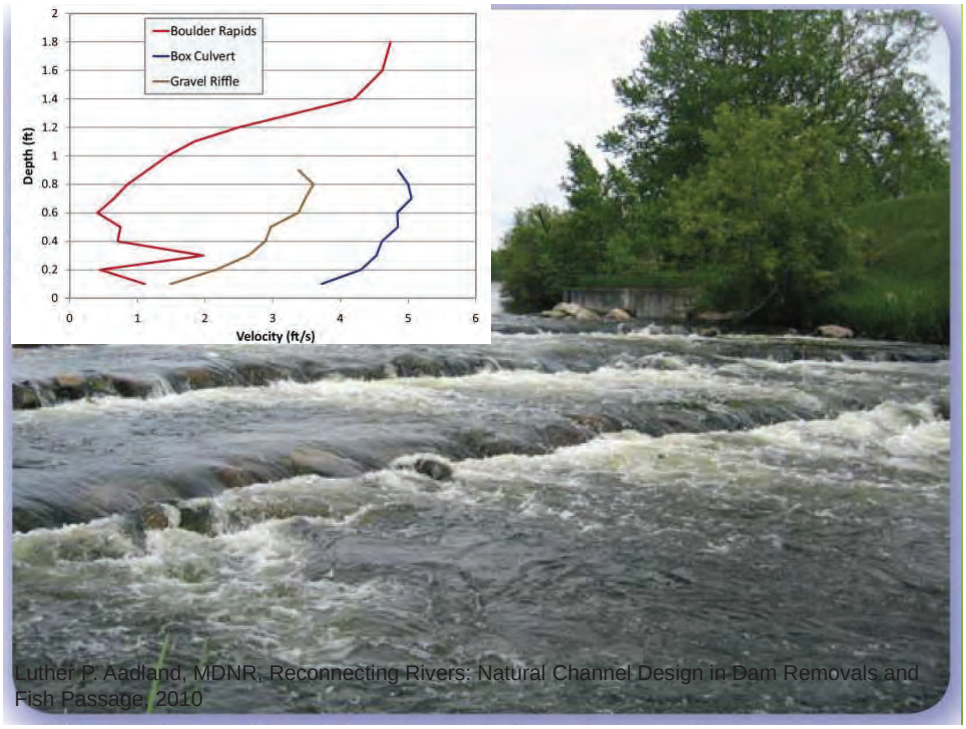
Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010

MANY POINT LAKE DAM, Otter Tail River, project example applying the Rock Arch Rapids Design



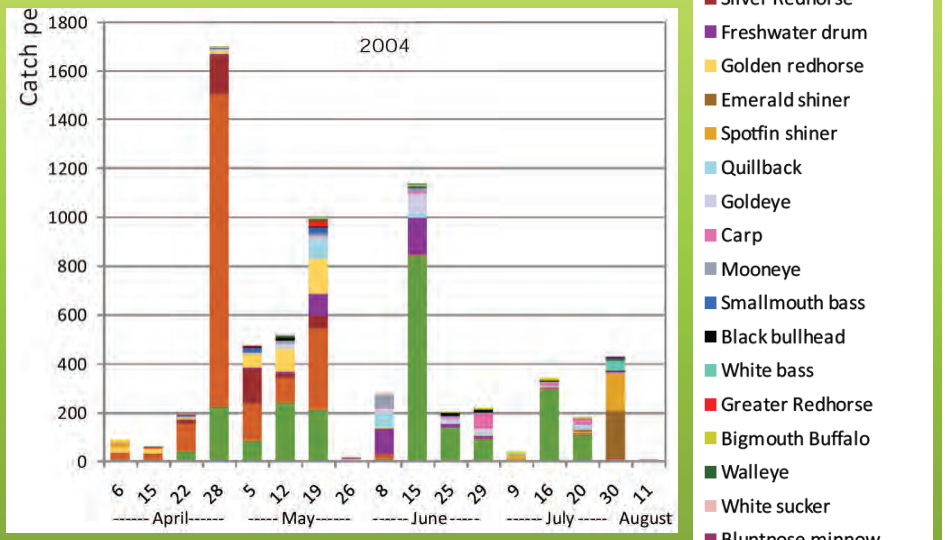
Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010

Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010



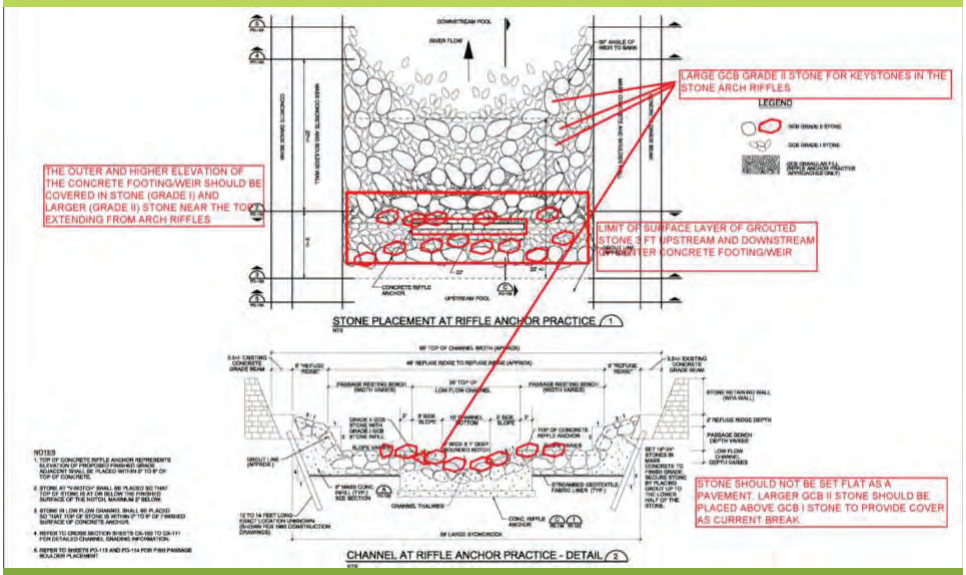
Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010

Catch in the Breckenridge fishway in 2004

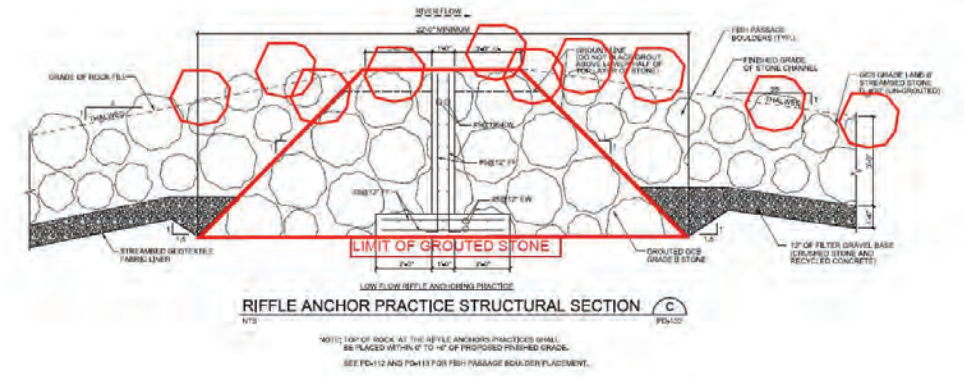


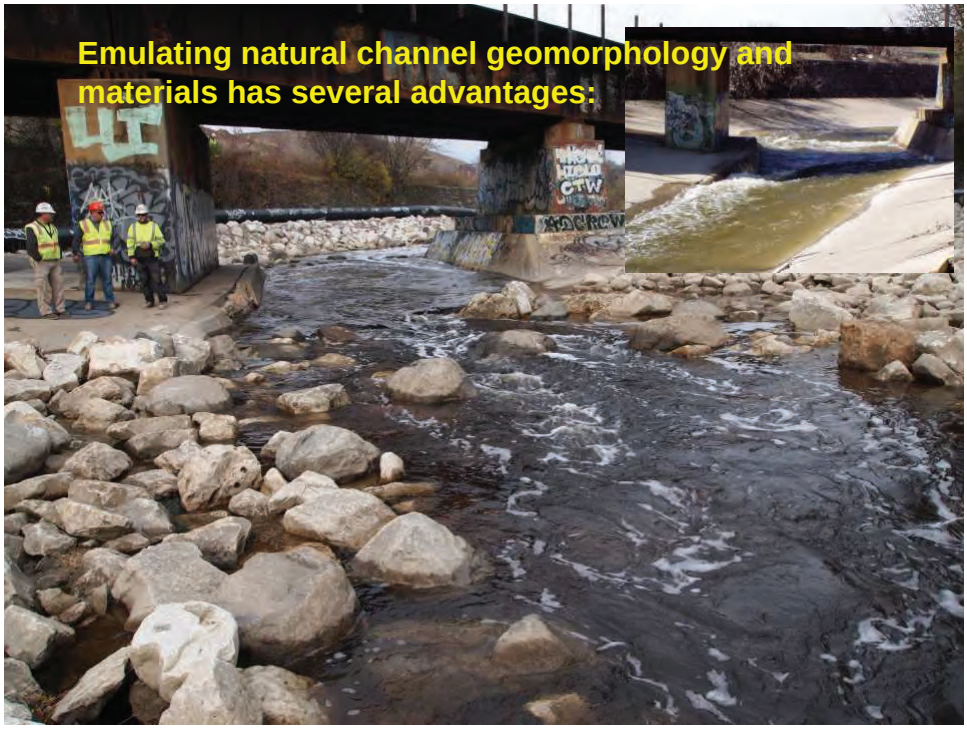
Luther P. Aadland, MDNR, Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, 2010

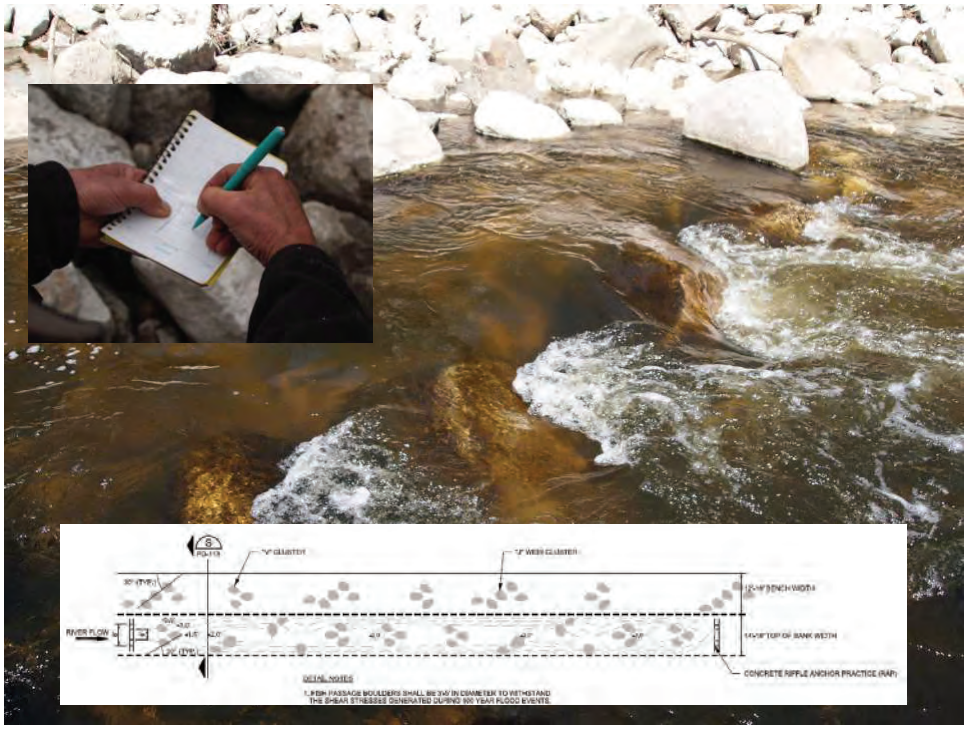
Plan Detail of Rock Arch Riffles



Plan Detail of Rock Arch Riffles







Large Boulder Function

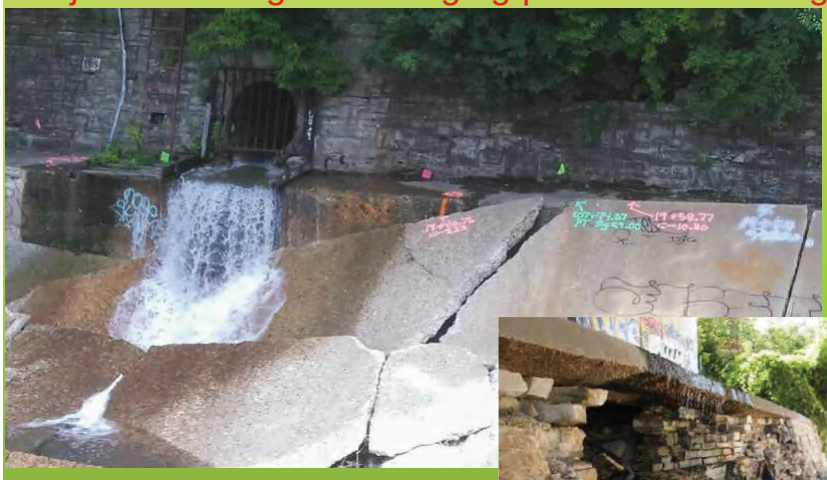
Project Challenges: Site Access, staging

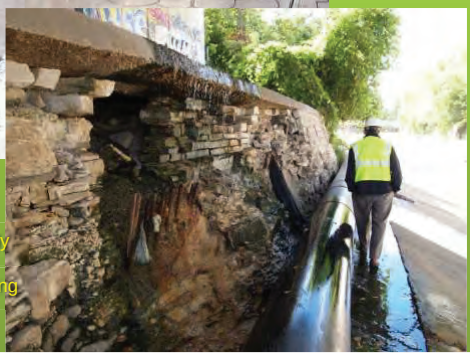
Photo Credit: Eddee Daniel
2013 Ludington Avenue
Waukesha, WI 53186
www.eddeed...

Project Challenges: Site Access, staging

Project Challenges: Managing permitted discharge flows

Project Challenges: Managing permitted discharge flows



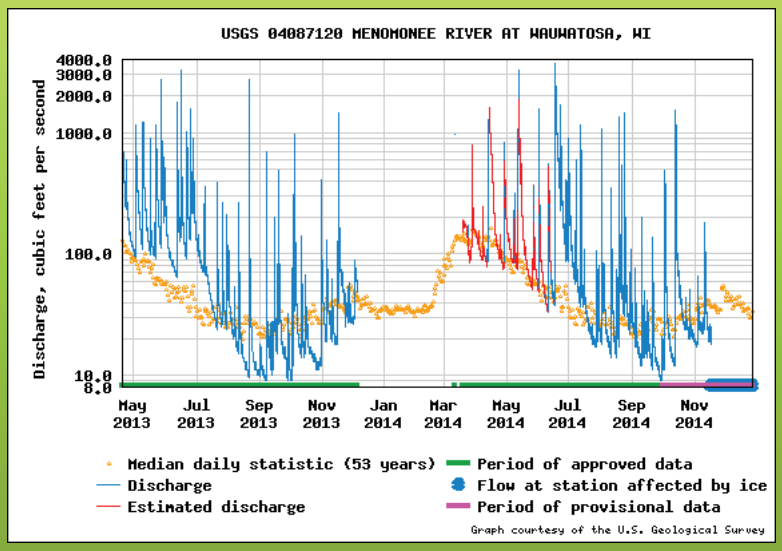


Millercoors 42-inch storm outfall discharged twice daily at up to approx. 1,500 GPM, in the middle of our project, which was a discharge of the backwash/filtering process

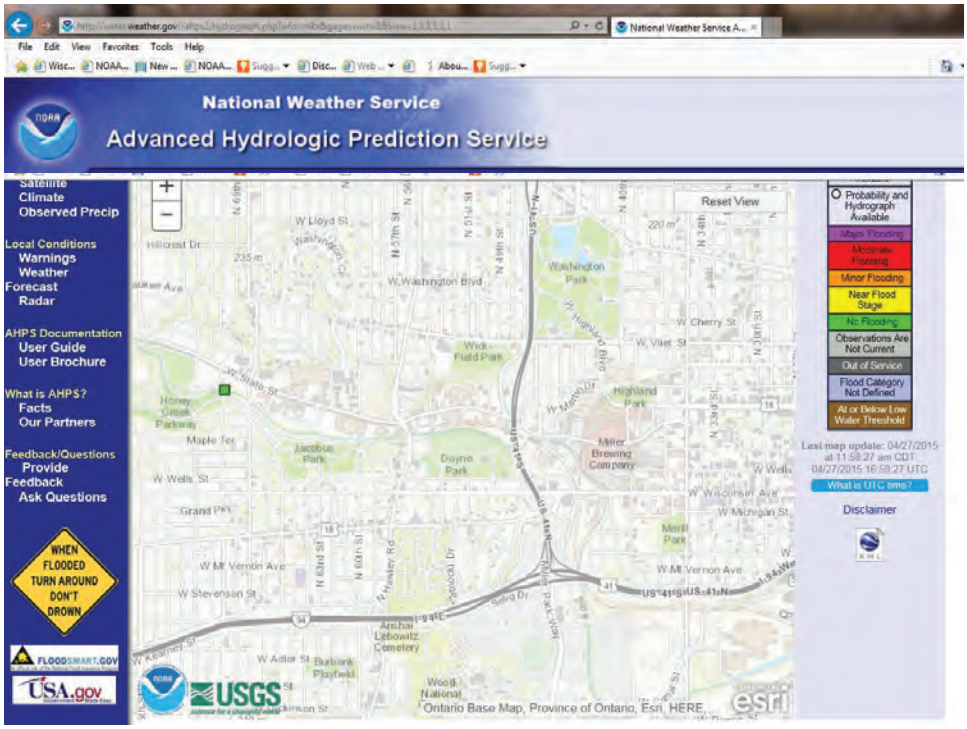
Project Challenges: Variable flows & predictions

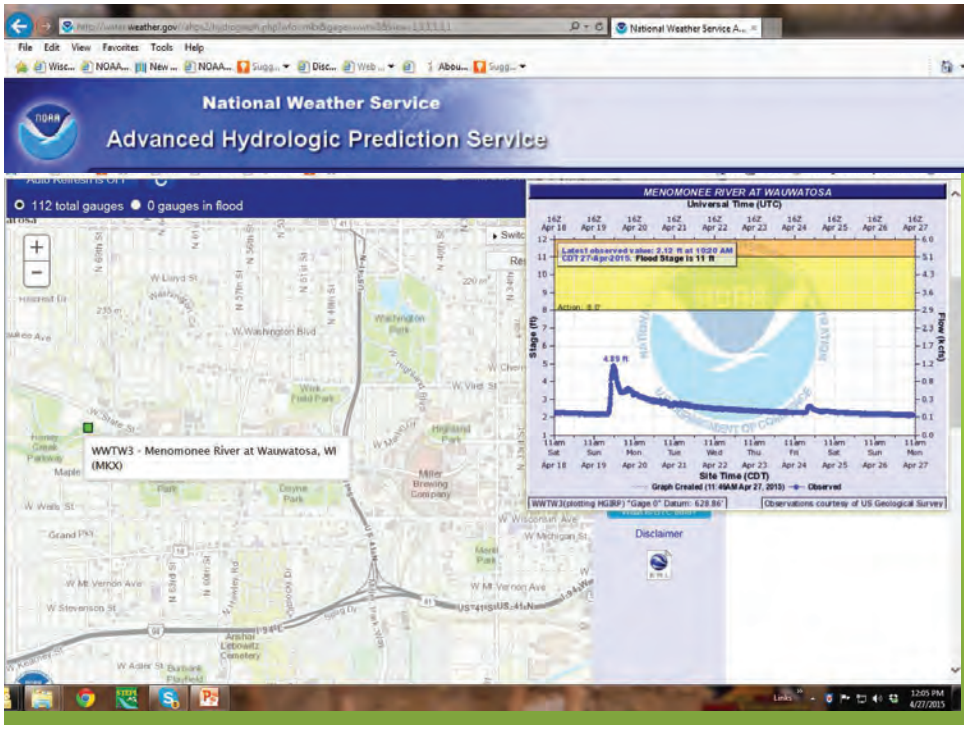
8/22/2013 (nearly 3,000 CFS)

Project Challenges: Variable flows & predictions



6/18/2014





Project Challenges: high flows, floating debris, trees

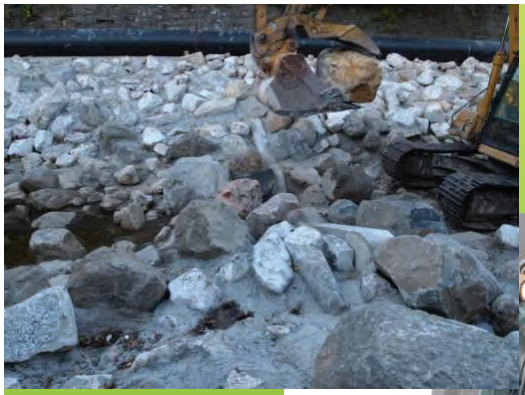
6/18/2014 (~2,000 CFS)

Project Challenges: high flows, floating debris, trees

6/18/2014 (~2,000 CFS)

Upstream RR Bridge

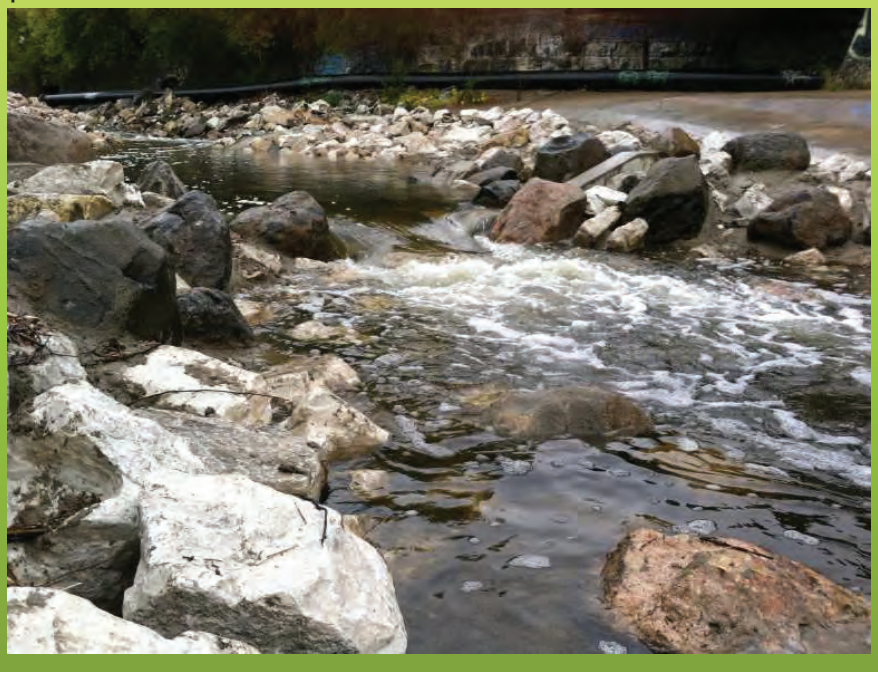
Upstream RR Bridge



Rap 11-10/25/13

Doug Hammes

Rap 11-10/17/13

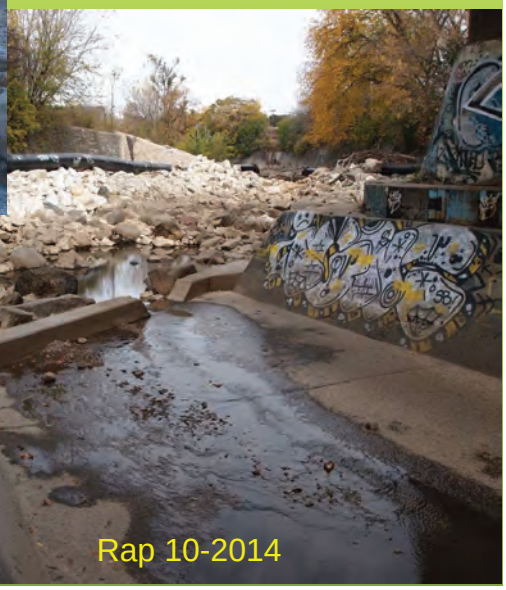


Rap 11-10/17/13

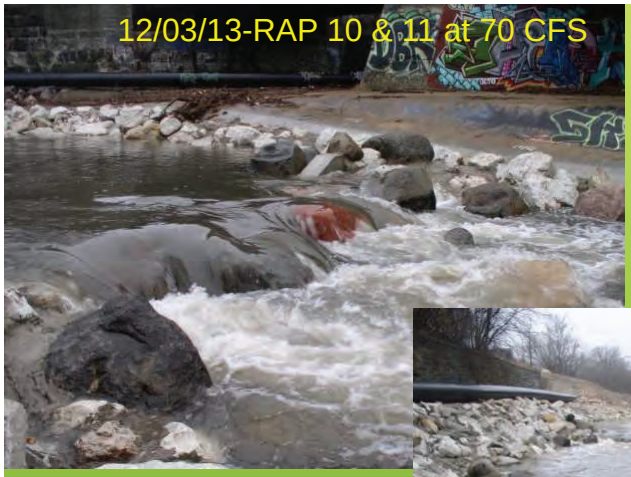
Rap 10-10/17/13

11/1/2013 ~100 CFS


Rap 10-10/25/13



Rap 10-2014


12/03/13-RAP 10 & 11 at 70 CFS

11/04/14

Reconstruction-1 of 4

Reconstruction- 2 of 4

Reconstruction- 3 of 4

Reconstruction- 4 of 4

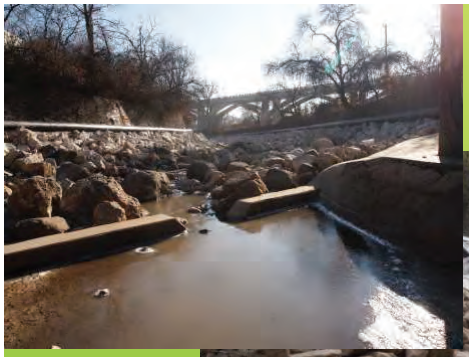
4/28/2015-RAP 10

4/28/2015-RAP 11

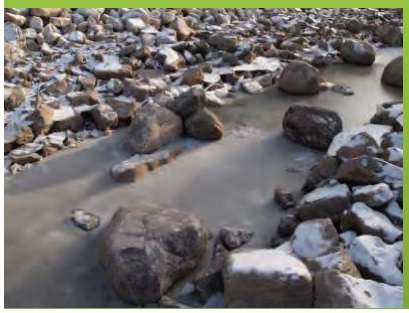
Downstream RR Bridge

Downstream RR Bridge

10/23/14-downstream bridge



11/04/14-downstream bridge



Results

4/28/2015

Results

04/28/2015- Upper Bar Formation

04/28/2015- Secondary Bench Flows

04/28/2015- Upper Bar Formation with split flow

04/28/2015- Lower Bar Formation with split flow


Continued sediment input & gradation


Was it a success?


Was it a success?
4/28/2015
4/22/2005

Good News Travels Fast!

October 20, 2014

"…I have been receiving reports from fellows I trust that both steelhead and salmon have been spotted all the way up in Meonomonee Falls, WI (including one this afternoon that triggered this e-mail)…."

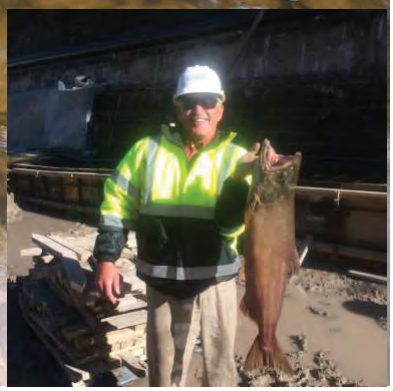
Henry Koltz, Trout Unlimited

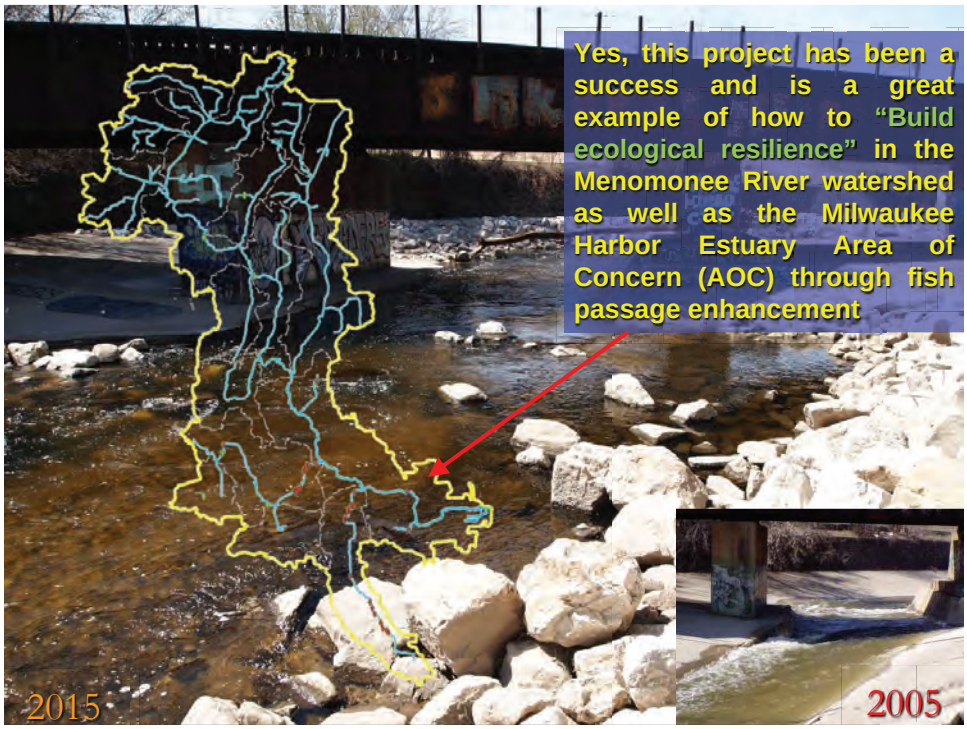
Henry and Friends--

"…saw salmon in Frontier Park in Butler as well as just downstream from Pilgrim Rd in the Falls. …Wardens have forwarded some along too. It's all cause for celebration no doubt!!

Cheryl Nenn
Riverkeeper

Species are finding their way into this reach.




Yes, this project has been a success and is a great example of how to "Build ecological resilience" in the Menomonee River watershed as well as the Milwaukee Harbor Estuary Area of Concern (AOC) through fish passage enhancement
2015
2005