River Restoration: Practices and Concepts

A hands-on workshop on the latest techniques for dam removal

April 18, 2002

Purdue Unversity Calumet

Hammond, IN

Sea Grant
ILLINOIS - INDIANA

PURDUE UNIVERSITY · PC · CALUMET

CHICAGO WILDERNESS™
A Regional Nature Reserve

River Restoration: Practices and Concepts

A hands-on workshop on the latest techniques for
Dam Modification and Removal

April 18, 2002
Purdue University Calumet
Hammond, IN

Proceedings Editors

Leslie Dorworth
Illinois-Indiana Sea Grant College Program
Purdue University Calumet
Hammond, IN 46323-2094

Diane Trgovcich-Zacok
Chicago Wilderness
Purdue University Calumet
Hammond, IN 46323-2094

Produced by the Illinois-Indiana Sea Grant College Program, Phillip E. Pope, Director. Illinois-Indiana Sea Grant College Program is a joint federal and state program of Purdue University, West Lafayette, Indiana, and the University of Illinois at Urbana-Champaign. Funding is provided by the National Sea Grant College Program, National Oceanic and Atmospheric Administration, and the U.S. Department of Commerce. The U.S. Government is authorized to reproduce and distribute Reprints for governmental purposes notwithstanding any copyright that may appear issued in furtherance of the Cooperative Extension Service of both Purdue University and the University of Illinois at Urbana-Champaign. Purdue University and the University of Illinois offer equal opportunities in programs and employment.

For additional copies, contact Illinois-Indiana Sea Grant Communications 217-333-8055

IISG-02-03

River Restoration: Dam Modification and Removal Agenda

Time	Topics	Speaker	Organization
8:00	Registration and Coffee		
8:30	Welcome	Terrence Dougherty	Purdue Calumet University
8:35	Past, Present, and Future of Dams	Steve Pescitelli Neil Ledet	Illinois Department of Natural Resources Indiana Department of Natural Resources
9:05	Dam Removal: A Water Quality Perspective	Bruce Yurdin	Illinois Environmental Protection Agency
9:35	Effects of Dams on Fish, Macroinvertebrates, Habitat, and Water Quality in the Fox River, IL	Vic Santucci	Max McGraw Wildlife Foundation
10:35	Break		
10:50	Socioeconomics of the Removal Process	Jody Rendziak	NRCS
11:25	Sediment Transport After Dam Removal	Martin Rye	Inter-Fluve
12:00	Lunch		
1:00	To Remove or Not to Remove: Alternatives to Dam Removal	Rob Linke	Watershed Resources Consultants, Inc.
1:30	A Rural Perspective: Dam Removal on the Prairie River. WI	Robert Martini	Wisconsin Department of Natural Resources
2:15	Life in the Fast Lane: An Urban Perspective on Dam Removal	John Nelson	Wisconsin Department of Natural Resources
3:00	Break		
3:15	Empowering the Local Community in the Dam Removal Decision-making Processes	Helen Sarakinos	River Alliance of Wisconsin
4:15	Wrap Up of Workshop	Dennis Dreher	Northeastern Illinois Planning Commission

River Restoration: Practices and Concepts

Dam Modification and Removal, April 18, 2002 Purdue University Calumet

Workshop Evaluation

How did you hear about the Workshop?	❑ Brochure mailing ❑ Newsletter ❑ Internet	❑ Word of mouth ❑ Other: ____________	
What type of organization are you affiliated with?	❑ Natural Resource Manager ❑ Consultant ❑ Park Department	❑ City Planner ❑ Public Works ❑ Engineer	❑ Landscape Architect ❑ Academia/Student ❑ Other: ____________

		(Please circle one)			
Please rate the conference on the following items:	Overall quality of presentations:	*excellent*	*good*	*adequate*	*poor*
	Workshop notes and handouts:	*excellent*	*good*	*adequate*	*poor*
	Audio-visual logistics:	*excellent*	*good*	*adequate*	*poor*
	Lunches and breaks:	*excellent*	*good*	*adequate*	*poor*
	Conference location & facilities:	*excellent*	*good*	*adequate*	*poor*
	Hotel accommodations:	*excellent*	*good*	*adequate*	*poor*
	Overall conference:	*excellent*	*good*	*adequate*	*poor*

Which presentations did you find most useful and why?	
What two areas would you most like to attend in a half or full day futureworkshops?	Topic 1: Topic 2:
Additional comments?	

Please complete this survey and return it to the registration desk before you leave. If you are unable to turn in the survey the day of the conference, please send it to Susan Delatorre, IL-IN Sea Grant Program, Biological Sciences, Purdue University Calumet, Hammond, IN 46322-2094, fax 219-989-2130.

Thank you for taking a few moments to fill out this survey to better serve you at future workshops.

Thank you to all of the Steering Committee Members that worked to organize this workshop:

Leslie Dorworth, Illinois-Indiana Sea Grant College Program
Dennis Dreher, Northeastern Illinois Planning Commission
Neil Ledet, Indiana Department of Natural Resources
Rob Linke, Watershed Resource Consultant, Inc.
Jeff Mengler, US Fish and Wildlife Service
Steve Pescitelli, Illinois Department of Natural Resources
Jean Sellar, US Army Corps of Engineers
Kent Taylor, Openlands Project
Scott Tomkins, Illinois Environmental Protection Agency
Diane Trgovcich-Zacok, Chicago Wilderness
Nancy Williamson, Illinois Department of Natural Resources

I would like to extend my greetings to all the attendees of the Conference on Dam Modification and Removal at Purdue University Calumet. Unfortunately I am in Sanibel Harbor, Florida, at the 2002 Engineering Deans Institute and cannot be with you as I had hoped to be. We at Purdue Calumet are happy to be able to provide a setting for conferences such as this where important issues are being discussed to help solve problems of the Calumet Region.

One of topics of the conference I am attending has been the beneficial collaboration in technology that is achieved when engineers work with their colleagues in different disciplines, including business and the sciences. As an environmental microbiologist, I know that this multi-disciplinary collaboration must extend to areas beyond "high tech", and especially to the fields of environmental science. It is only through the interplay of ideas and expertise from many fields that we can evaluate the many different alternatives to find solutions that remedy problems in creative ways.

Dam Modification and Removal is a topic of interest to many of us with academic interest in environmental fields. I know that you will have many beneficial conversations during this Conference. I look forward to perhaps interacting with you all in future similar conferences.

Michael Gealt, Dean
School of Engineering, Mathematics and Science
Purdue University Calumet

River Restoration: Practices and Concepts
Dam Modification and Removal Conference

held at:

Purdue University Calumet
Hammond, IN

April 18, 2002

John Aavang
Restorationist
McHenry County Conservation District
6720 Keystone Road
Richmond, IL 60071
Ph: 815-653-2297

William Bean
Region 2 – Wildlife Supervisor
IDNR – DFW
1124 N. Mexico Road
Peru, IN 46970
Ph: 765-473-9324
E-Mail: bbean@dnr.state.in.us

Peter Berrini
Senior Geologist
Cochran & Wilken, Inc.
5201 S. Sixth Street Road
Springfield, IL 62703
Ph: 217-585-8300
E-Mail: pberrini@cochran-wilken.com

Ken Bosar
115 W. Washington – Suite 13685
Indianapolis, IN 46204
Ph: 317-266-8000

Edward R. Braun
Fisheries Biologist
IN Dept. of Natural Resources
5570 N. Fish Hatchery Road
Columbia City, IN 46725
Ph: 260-691-3181
E-Mail: ebraun@dnr.state.in.us

David F. Bucaro
Hydraulic Engineer
US Army Corps of Engineers
111 N. Canal Street – Suite 600
Chicago, IL 60606
Ph: 312-353-6400 x3041
E-Mail: david.f.bucaro@usace.army.mil

Craig A. Bruska
Superintendent
Lake County, IL Forest Preserve
24237 W. Ivanhoe
Wauconda, IL 60084
Ph: 847-968-3407
E-Mail: cbruska@co.lake.il.us

Steven Byers
IL Nature Preserves Commission
914 S. River Road
McHenry, IL 60050
Ph: 815-385-9014
E-Mail: sbyers@dnrmail.state.il.us

Dave Chadwick
Student
University of Michigan
523 N. Main Street – Apt. #3
Ann Arbor, MI 48104
E-Mail: wick@umich.edu

Rick Conrad
Aquatic Biologist
Bureau of Water Quality
5150 W. Kilgore Ave.
Muncie, IN 47304-4797
Ph: 765-747-4896
E-Mail: rick100@hotmail.com

Leslie Dorworth
Illinois-Indiana Sea Grant College Program
Purdue University Calumet
2200 169th Street
Hammond, IN 46323
Ph: 219-989-2726
E-Mail: dorworth@calumet.purdue.edu

Terence Dougherty
Dept. of Biology
Purdue University Calumet
2200 169th Street
Hammond, IN 46323
Ph: 219-989-2404

Dennis Dreher
Northeastern Illinois Planning Commission
222 South Riverside Plaza – Suite 1800
Chicago, IL 60606
Ph: 312-454-0400
E-Mail: dreher@nipc.org

Dan Feltman
Staff Engineer
Robert H. Anderson
220 W. River Drive
St. Charles, IL 60174
Ph: 630-584-3530
E-Mail: dfeltman@rhaengr.com

Shelly Fuller
208 S. Lasalle – Suite 1235
Chicago, IL 60604
Ph: 312-208-0650

Bruce Halverson
Senior Hydraulic Engineer
Baird and Associates
2981 Yarmouth Greenway
Madison, WI 53711
Ph: 608-273-0592
E-Mail: bhalverson@baird.com

Jeff Hampshire
Property Manager/Biologist
IDNR – Pigeon River FWA
P.O. Box 71
8310 E. 300 North
Mongo, IN 46771
Ph: 260-367-2164
E-Mail: jhampshire@dnr.state.in.us

Megan Hearne
Student
University of Michigan
1608 White Street – Apt. 1
Ann Arbor, MI 48104
E-Mail: mhearne@umich.edu

Jill Hoffmann
Aquatic Biologist
IN Dept. of Natural Resources
402 W. Washington Street – Room W265
Indianapolis, IN 46229
Ph: 317-233-5468
E-Mail: jhoffmann@dnr.state.in.us

Marvin Hubbell
Manager
Dept. of Natural Resources
Division of Ecosystems and C2000 Program
524 S. 2nd Street
Springfield, IL 62701
Ph: 312-782-7940
E-Mail: mhubbell@dnrmail.state.il.us

Karen C. Kabbes
President
Kabbes Engineering, Inc.
1250 S. Grove Ave. – Suite 105
Barrington, IL 60010
Ph: 847-842-9663
E-Mail: kckabbes@kabbesengineering.com

Karen Koskey
Watershed Engineer
Kane County Environment Management
719 Batavia Avenue
Geneva, IL 60134
Ph: 630-208-8665
E-Mail: koskykaren@co.kane.il.us

Robert Lamb
Board Member
LaPorte County Park Board
809 State Street – Suite 306A
LaPorte, IN 46350
Ph: 219-326-6808 x223
E-Mail: lcpoffice@csinet.net

Kerry Leigh
Christopher B. Burke Engineering
9575 W. Higgins Road – Suite 600
Des Plaines, IL 60018
Ph: 847-823-0500
E-Mail: kleigh@cbbel.com

Mitch Marcus
Assistant Property Manager
IDNR – Pigeon River FWA
P.O. Box 71

8310 E. 300 North
Mongo, IN 46771
Ph: 260-367-2164
E-Mail: mmarcus@dnr.state.in.us

Nicole Mays
Northeast – Midwest Institute
218 D Street SE
Washington, DC 20003
Ph: 202-464-4010
Ph: nmays@nemw.org

Rick McAndless
Resource Conservationist
North Cook County SWCD
P.O. Box 407
Streamwood, IL 60107
Ph: 847-468-0071
E-Mail: Rick.Mcandless@il.usda.gov

Sky K. Medors, P.E.
Civil Engineer
Lawson-Fisher Associates P.C.
525 W. Washington Avenue
South Bend, IN 46601
Ph: 574-234-3167
E-Mail: smedors@lawson-fisher.com

Marc Miller
Watershed Organizer
Prairie River Network
809 s. 5th Street
Champaign, IL 61820
Ph: 217-344-2371
E-Mail: mmiller@prairierivers.org

Tracy Norfleet
Policy Analyst
Northeast-Midway Institute
218 D. Street SE
Washington, DC 20003
Ph: 202-464-3540
E-Mail: tnorfleet@nemw.org

John Peters
Restorationist
McHenry County Conservation District
18410 Highway 14
Woodstock, IL 60098
Ph: 815-653-2297 x15
E-Mail: jpeters@mccdistrict.org

Thomas Polzin
Vice President, Civil Engineering
Hey and Associates, Inc.
28045 N. Ashley Circle – Ste 101
Libertyville, IL 60048
Ph: 847-356-6859
E-Mail: tpolzin@heyassoc.com

William Poole
Senior Environmental Scientist
Natural Resources Consulting, Inc.
P.O. Box 128
Cottage Grove, WI 53527
Ph: 608-839-1998
E-Mail: nrcinc@chorus.net

John Quail
Project Coordinator
Friends of the Chicago River
407 S. Dearborn – Suite 1580
Chicago, IL 60605
Ph: 312-939-0490 x20
E-Mail: jquail@chicagoriver.org

Perry Rech
Friends of the Chicago River
407 S. Dearborn – Suite 1580
Chicago, IL 60605
312-939-0490

John Richardson
Senior Project Manager
J.F. New and Associates
708 Roosevelt Road
Walkerton, IN 46574
Ph: 574-586-3400
E-Mail: jrichardson@jfnew.com

Bob Robertson
Kankakee FWA
P.O. Box 77
North Judson, IN 46366
Ph: 219-896-3673

Thomas P. Ryterske
District Conservationist
USDA NRCS
545 Randall Road
St. Charles, IL 60174-1592
Ph: 630-584-8240 x3
E-Mail: Thomas.ryterske@il.usda.gov

Ilhad Safa
5077 Maple
Dearborn, MI 48126
Ph: 313-226-6783

Dan Saffen
Chief Landscape Architect
IN Dept. of Natural Resources – Engineering

402 W. Washington Street – Room W299
Indianapolis, IN 46204
Ph: 317-232-4157
E-Mail: dsaffen@dnr.state.in.us

James Schardp
EPA GLNPO
77 West Jackson
Chicago, IL 60685
Ph: 312-353-5085
E-Mail: schardp.james@epa.gov

Stuart Shipman
Biologist
Dept. of Natural Resources
5570 N. Hatcherry Road
Columbia City, IN 46725
Ph: 260-691-3181
E-Mail: sshipman@dnr.state.in.us

Joe Short
Student
University of Michigan
P.O. Box 4193
Ann Arbor, MI 48106
E-Mail: shortj@umich.edu

Robert Sliwinski
ASLA
Christopher B. Burke Engineering
9575 W. Higgins Road – Suite 600
Des Plaines, IL 60018
Ph: 847-823-0500
E-Mail: jurban@cbbel.com

Tim Straub
Civil Engineer
USGS – WRD
221 N. Broadway Ave.
Urbana, IL 61801
Ph: 217-344-0037 x3024
E-Mail: tdstraub@usgs.gov

Anne Sylvan
4424 N. Manor
Chicago, IL 60625
Ph: 773-588-7976

Kent Taylor
Openlands Project
25 E. Washington Street – Ste 1650
Chicago, IL 60602-1708
Ph: 312-427-4256 x 242
E-Mail: ktaylors@openlands.org

Diane Trgovcich-Zacok
Science and Land Management Team Coordinator
Chicago Wilderness Program
Purdue University Calumet
2200 169th Street
Hammond, IN 46323
Ph: 219-989-2015
E-Mail: zacok@calumet.purdue.edu

Larry Wayland
Chief Civil Engineer
IDNR Engineering Division
402 W. Washington – Room W299
Indianapolis, IN 46204
Ph: 317-232-4150
E-Mail: lwayland@dnr.state.in.us

Bill White
Manager
Science and Planning Section
IL Dept. of Natural Resources
524 S. 2nd Street
Springfield, IL 62701
Ph: 217-782-7940
E-Mail: bwhite@dnrmail.state.il.us

John J. Wills
President
Christopher B. Burke Engineering West
116 W. Main Street – Suite 201
St. Charles, IL 60174
Ph: 630-443-7755
E-Mail: kthelen@cbbel.com

Peter Weiss
Valparaiso University
Civil Engineering
Valparaiso, IN 46383
Ph: 219-464-5123

Dan L. Zay
Project Manager
DLZ Michigan, Inc.
1425 Keystone Ave.
Lansing, MI 48911
Ph: 517-393-6800
E-Mail: dzay@dlz.com

Dennis A. Zebell, P.E.
Senior Civil Engineer
Lawson-Fisher Associates P.C.
525 W. Washington Avenue
South Bend, IN 46601
Ph: 574-234-3167
E-Mail: dzebell@lawson-fisher.com

SPEAKERS

Neil Ledet
Fawn River State Fish Hatchery
6889 North SR 327
Orland, IN 46776
Ph: 260-829-6241
E-Mail: nledet@dnr.state.in.us

Robert Linke, P.E.
Watershed Resource Consultants, Inc.
6N568 Juniper Court
St. Charles, IL 60175
Ph: 630-377-1796
E-Mail: rnjlinke@accesschicago.net

Robert Martini
WI Dept. of Natural Resources
107 Sutcliff Ave.
Rhinelander, WI 54501
Ph: 715-365-8969
E-Mail: martire@state.wi.us

Jeffrey Mengler
Botanist/Wetland Ecologist
Chicago Illinois Field Office
U.S. Fish and Wildlife Service
1250 South Grove – Suite 103
Barrington, IL 60010
Ph: 847-381-2253
E-Mail: Jeffrey-mengler@fws.gov

Brian Miller
Assistant Director & Program Leader
Illinois-Indiana Sea Grant College Program
Purdue University
1200 Forest Products Building
West Lafayette, IN 47907-1200
Ph: 765-494-3573
E-Mail: bmiller@fnr.purdue.edu

John Nelson
Dept. of Natural Resources
Service Center
W5750 Woodchuck Lane
Box 408
Plymouth, WI 53073
Ph: 920-892-8756
E-Mail: nelsoj@dnr.state.wi.us

Steve Pescitelli
Dept. of Natural Resources
Silver Springs State Park
Yorkville, IL 60560
Ph: 630-553-0164
E-Mail: spescitelli@dnrmail.state.il.us

Jody Rendziak
North Cook Soil and Water Conservation District
899 Jay Street
Elgin, IL 60120
Ph: 847-608-8165 x2
E-Mail: jody.rendziak@il.usda.gov

Martin E. Rye, P.E.
Inter-Fluve, Inc.
735 W. Wisconsin Avenue – Suite 600
Milwaukee, WI 53233
Ph: 414-289-7743
E-Mail: mrye@interfluve.com

Vic Santucci
Max McGraw Wildlife Foundation
P.O. Box 9
Dundee, IL 60118
Ph: 847-695-4610
E-Mail: vsantuc@ix.netcom.com

Helen Sarakinos
Small Dams Program Manager
River Alliance of Wisconsin
306 E. Wilson – Suite 2W
Madison, WI 53703
Ph: 608-257-2424
E-Mail: hsarakinos@wisconsinrivers.org

Bruce Yurdin
IL Environmental Protection Agency
Dept. of Watershed Management
1021 N. Grand Avenue E
Springfield, IL 62702
Ph: 217-782-3362
E-Mail: EPA1177@epa.state.il.us

Neil Ledet

Fisheries Biologist
Indiana Department of Natural Resources

Neil graduated from Humboldt State University in 1975 with a BS degree in Fish Management. After working a couple of temporary resource positions, Neil was hired in 1976 as the IDNR Assistant Manager at Bass Lake State Fish Hatchery. In 1977 he was promoted to Indiana's Anadromous Biologist position working on Lake Michigan. Since 1982, Neil has been the District 2 Fisheries Biologist in northeast Indiana. In addition to district responsibilities, Neil manages the St. Joseph River Trout and Salmon Program jointly with the Michigan DNR and is the Fisheries Section FERC licensing contact for northern Indiana.

Rob Linke, P.E.
Consulting Engineer
Watershed Resource Consultants, Inc.

Mr. Linke is a professional engineering consultant with expertise in the fields of stormwater and floodplain management, environmental permitting and river & stream restoration. He is graduate of Valparaiso University with a degree in Civil Engineering and is a Registered Professional Engineer. Mr. Linke has held the positions of Project Manager and Project Engineer for a wide variety of civil engineering projects, including stormwater management planning, floodplain analyses, stream bank stabilization projects, lake management studies, and dam removal projects. Rob is an active member of the Fox River Ecosystem Partnership, and his passions for fishing and paddling encourage his interests in dam removal as means of improving the qualities of these local experiences.

Presentation Abstract

Dams have a profound effect on the physical and biological functions of our rivers. Most of the dams in the Midwest are very old and in poor condition. In many cases, they have exceeded their intended life span and no longer serve the functions for which they were originally constructed. In the last decade, growing environmental awareness and changing social values have fueled a growing movement to have these derelict dams removed in an effort to restore our rivers to their free-flowing condition. Dam removal is only one alternative for managing our aging dams, but it is usually the most cost effective river restoration tool and therefore has drawn much attention from resource conservation groups and natural resource agencies. Identifying and coping with the social, technical, economic and legal issues associated with a dam removal are essential to completing a successful dam removal project to restore a river.

Robert Martini

Project Manager for the Wisconsin River Project
Wisconsin Department of Natural Resources

Robert Martini is the project manager for the Wisconsin River Project for the Wisconsin Department of Natural Resources. He is responsible for reviewing all FERC relicensing issues for the 47 dams on the Wisconsin River system. He previously worked on acid rain research, groundwater contamination issues and the Wisconsin River cleanup program.

John E. Nelson
Senior Fisheries Biologist
Wisconsin Department of Natural Resources

John Nelson is a Senior Fisheries Biologist with the Wisconsin Department of Natural Resources in Plymouth, Wisconsin. He is a 20 year veteran of the Department and has worked most of that time at Plymouth with a focus on river and small lake management. He has a B.S. degree in Fisheries from the University of Wisconsin at Stevens Point and a M.S. degree in Biology from Tennessee Technological University. His interest in impounded rivers and dam removal comes from his masters work on Cordell Hull Reservoir on the Cumberland River in Tennessee and his direct involvement with several dam removals in Wisconsin.

Stephen M. Pescitelli

Stream Ecologist
Illinois Department of Natural Resources

Steve Pescitelli is a Stream Ecologist with the Illinois Department of Natural Resources. He obtained both his B.S. and M.S. degrees from the University of Illinois at Urbana Champaign. He has been responsible for the following watersheds in northeastern Illinois since July 1994: Fox, Des Plaines, DuPage, and Kankakee. Job responsibilities include monitoring fish communities, management of sport fisheries, permit review, watershed planning, habitat and stream restoration, and outreach and education. Steve has many professional interests including the various factors affecting fish community structure, fragmentation in aquatic systems and dam modification and removal.

Jody A Rendziak
Community Planner
USDA-Natural Resources Conservation Service

Jody Rendziak is a specialist with the NRCS State Planning Team. She received her Masters degree in Urban and Regional Planning from the University of Illinois at Urbana-Champaign. Jody's role with NRCS is to help county offices and partners enhance their effectiveness in working with people to address natural resource issues. Much of her work involves helping citizens throughout Illinois develop watershed management plans. She conducts training about the watershed planning process, facilitates meetings to help communities reach consensus about problems, objectives and solutions, provide technical assistance in community planning and sociology, develop guidance material, and write planning documents.

Marty E. Rye, P.E.
Civil Engineer
Inter-Fluve, Inc.

Marty has over thirteen years of professional experience in the areas of river engineering, natural resource and watershed management, and related civil works projects as a hydrologist, design engineer, and project manager. He has a BS in Agricultural Engineering and a BS in Civil Engineering from the University of Minnesota. He worked for the Minnesota Department of Natural Resources and a regional consulting engineering firm prior to joining Inter-Fluve as the Manager of the Milwaukee Office.

He is proficient in channel designs, hydrology, design of hydraulic structures, and related computer software applications. Marty's project experience includes dam removals, hydraulic and hydrologic studies, design of hydraulic structures, flood routing, floodplain analysis, and storm water quality analysis. He is also skilled in community planning and project design, management, and implementation. Marty's broad experience has given him a unique perspective into issues that municipalities face which have a direct impact on water resources management.

Selected Publications

Dam Removals – A Discussion of issues and impacts, ASCE / EWRI 2000 Joint Conference on Water Resources Management and Water Resources Planning and Management, Minneapolis, MN.

Additional Education

USCOE Training Workshops including HEC-1, Advanced HEC-1, Advanced HEC-2

National Symposium on Assessing the Cumulative Impacts of Watershed Development on Aquatic Ecosystem and Water Quality

North American Lake Management Society, Short Course Phosphorus Inactivation and Interception

Wildland Hydrology, Fluvial Geomorphology for Engineers

Inter-Fluve, Process-Based Channel Design

Sediment Transport Aspects of River Restoration Planning and Design Short Course.
2000 ASCE / EWRI Joint Conference on Water Resources Management
And Water Resources Planning and Management

Hydraulic Design of Stable Channels Using the SAM Hydraulic Design Package, 2000.
Ron Copeland, Milwaukee, WI.

Evaluating Streambank Stability and the Effectiveness of Environmentally-Sensitive Bank-Stabilization Measures. 2001. ASCE Reno, NV.

1998 and 1999 Annual Conferences of the State Dame Safety Officials

Served seven years on the Arden Hills Minnesota Planning Commission

Vic Santucci

Fisheries Research Biologist
Max McGraw Wildlife Foundation

Vic received both bachelors and masters degrees in Zoology from Southern Illinois University at Carbondale and is certified as a Fisheries Scientist by the American Fisheries Society. He has been working in fisheries research since 1985 and has been employed as a Fisheries Research Biologist with the Max McGraw Wildlife Foundation for the past 11 years.

Helen Sarakinos

Small Dam Program Manager
River Alliance of Wisconsin

Helen Sarakinos is a native in Canada and completed a Master's of Science degree in aquatic ecology at McGill University. Over the years, she has worked on numerous river-related issues as a scientific researcher including the effects of point-source discharges and sedimentation on river ecosystems, and, recently, a scientific assessment of the state of water quality and aquatic ecosystems in the San Joaquin Valley, California. In July 2001, Helen switched tracks and joined the River Alliance of Wisconsin, a statewide river advocacy group, as the Small Dams Program Manager. The goal of the Small Dams Program is to help improve the dam repair or removal decision-making process in communities by providing information that enables selective dam removal to be considered on its merits. The job description includes pursuing opportunities to restore rivers in Wisconsin using selective dam removal, developing positive relationships with government agency personnel, dam owners, local citizens and officials, conservation groups and others in determining prospective dam removal projects, identifying research needs and initiating projects to address them, and educating the public and the media about the benefits of selective small dam removal as a river restoration tool.

Bruce J. Yurdin
Illinois Environmental Protection Agency
Bureau of Water

Mr. Yurdin is the Manager of the Watershed Management Section in the Illinois EPA's Bureau of Water. This Section is responsible for a wide variety of planning and regulatory activities. Some of those activities include:

- The oversight and funding of nonpoint source pollution control projects under Section 319 of the Clean Water Act (2002 budget of approximately $9.5 million),
- The review of permit applications for agrichemical facilities, livestock operations and stream and wetland conversion projects, and
- The development of Total Maximum Daily Loads (TMDLs) for impaired waters in Illinois.

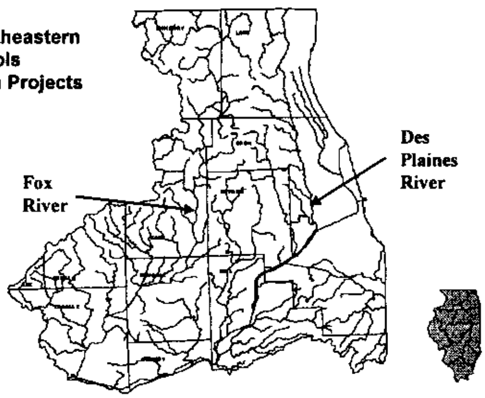
Mr. Yurdin has been with the Illinois EPA since 1979. Mr. Yurdin is a graduate of the University of Southern California, with a B.S. in Biology, and has a M.S. in Civil Engineering from Southern Illinois University.

Revised 3/02

Northeastern Illinois Dams:
Past, Present and Future

Stephen M. Pescitelli
Illinois Department of Natural Resources

Northeastern Illinois Dam Projects



Effect of dams on stream ecosystems

- **Water Quality**
- **Habitat**
- **Flow**
- **Food Source**
- **Connectivity**

EFFECTS OF DAMS ON BSC STREAM RATINGS

Dam	DS-2	DS-1	US-1	US-2	US-3
Waubonsee	-	B	D	D	D
Brewster	-	B	D	D	D
Yorkville	A	B	D	C	B
Hofmann	-	C	D	E	C

Dam Reasons Northeastern ILLINOIS

PAST	PRESENT
POWER + + + + +	POWER +
RECREATION + + +	WATER SUPPLY +
WATER SUPPLY + +	FLOOD CONTROL +
	RECREATION + + +
	??? + + + + +

The past
Dam Important Dates

- Indian Creek Massacre 1860
- Fish Passage Law 1880
- Stoppage of Boulder Hill Dam - End of Fox River Stratton Plan 1977
- Hofmann Dam Project – Corps removing dams
- C2000 Ecosystem Program – Partnership involvement

The present

Current Illinois Dam Projects

Removed	**1**
Design phase for removal	**6**
Feasibility Completed	**2**
Fish passage	**3**
Feasibility planned	**3**

The present

Design for Removal

Basin	Dam	Height	Length	Start?
Des Plaines	Hofmann	8	258	Fall 2002
	Fairbanks	2	158	Fall 2002
	Armitage	5	110	Fall 2002
Fox	Brewster	10	50	2002*
	S. Batavia	6	250	2002
	N. Batavia	12	180	2003

The present

Project	Dam	Height	Length
Feasibility Complete	North Avenue	3	365
	Blackberry Ck.	10	40
Fish Passage	McHenry/Algon	5	110
Fish/Boat Passage	Yorkville*	7	530
Feasibility Planned	Dam No. 1C	1	108
	Dam No. 1B	1	121
	Ryerson Dam	3	100
	Dam No. 1A	1.5	140

The present

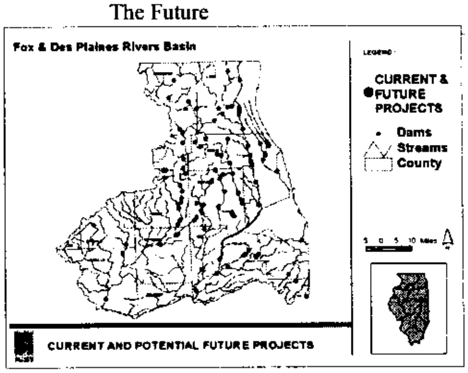
Other Dam Activities

- Fox River Dam Study
- DuPage River Study
- Dayton Hydro Re-licensing
- Statewide Dam Task Force
  - Policy review
  - Internal coordination
  - Education program

ILLINOIS ISSUES

- Public Acceptance – they do give a dam
- Regulatory – new issue
- Cost of Projects – $\$10^6$ vs. $\$10^3$
- Non-native Species

The Future



Dam Workshop

April 18, 2002

Good Morning. I would also like to welcome you to the workshop. It's great to see that many of you were able to travel out of your home state.

First off. I'm not an expert on dams. I'm a fisheries biologist who believes that removing or modifying obsolete dams is a valid option which has the potential for significant river restoration benefits. Like many of you, I am here to gain a better understanding of the issues surrounding dams. I would like to thank Illinois-Indiana Sea Grant, Purdue University Calumet and Chicago Wilderness for sponsoring this workshop. The sponsors and steering committee have put together a diverse agenda to provide us with a look at some of the main issues surrounding dams.

To help kick off this workshop, I have borrowed some background information from the publication, Dam Removal Success Stories. This 1999 publication was prepared by Friends of the Earth, American Rivers and Trout Unlimited, and reflects why most of us are here today.

Over the past 100 years, the United States has led the world in dam building, blocking and harnessing rivers for hydro power, irrigations, flood control and water storage. The US Army Corps of Engineers has cataloged approximately 75,000 dams greater than six feet tall along with tens of thousands of smaller dams. The National Research Council estimates that the number of US dams is over 2.5 million. A 1998 quote from then US Secretary of the Interior, Bruce Babbitt, helps put this in perspective. "That means we have been building, on average, one large dam a day, every single day, since the Declaration of Independence."

Few human actions have more significant impacts on a river system than the presence of a dam. As a result, dams occupy a central role in the debate about protecting and restoring our rivers. A less know page in the history of rivers is dam removal. For decades dam removal has been an accepted approach for dam owners to deal with unsafe, unwanted or obsolete dams. Just as for any building or other human construction, dams have finite lifetimes and are often removed when they become obsolete or dangerous.

Although dams can provide important benefits, dams also cause negative impacts to rivers, wildlife and sometimes local communities. Some dams no longer provide any benefits while continuing to harm the river. Others have significant negative impacts that outweigh the dam's benefits. Still others simply are so old and/or unsafe that they cost too much money to maintain. In these situations, dam removal has been demonstrated to be a reasonable option to eliminate negative impacts and safety concerns.

Like many Midwestern states, Indiana has our share of dams. Approximately 1,200 dams fall under the jurisdiction of the Indiana Department of Natural Resources (IDNR) Division of Water. These include watershed dams built to create lakes in water poor areas of the state, containment dams to control waste on mine lands and dams built on high gradients rivers to mill grain and generate power. Of the 1,200 dams, 70 are owned by the IDNR of which 32 have been identified as having safety issues. Recent legislative action has provided $10 million mainly for engineering studies to bring the IDNR owned dams up to safety standards. Additional appropriations will likely be required to repair or remove these. The Division of Water estimates that up to 1,000 more dams not regulated by the IDNR are present in the state. Many of these are privately owned and do not present a high downstream hazard. However, they do impact the stream's ecology.

To help promote river restoration through dam removal, the IDNR Fisheries Section has committed some time and effort through our planning process for each of our district fisheries biologists to identify and prioritize dams in their regions where removal would enhance degraded stream habitats.

Secondly, the Indiana Chapter of the American Fisheries Society developed a Resolution on the Role of Dams and Benefits of Dam Removal to the River Systems and Citizens of Indiana. This resolution acknowledges that some Indiana dams were, and still are, an important feature and focal point for many Indiana communities. However, the resolution points out that some of these structures are unsafe, uneconomical to maintain, no longer serve the intended purpose, restrict the movement of the aquatic community and negatively impact water quality. The resolution goes on to point out that selective dam removal has proven to be an effective means of restoring river ecosystems, but continues to be overlooked as a significant restoration tool in Indiana. This resolution was passed by the membership in March 2001 and was later adopted by the Indiana Wildlife Society.

Before this resolution was even adopted, we began to see the benefits. To develop the resolution, IAFS resolution committee members needed to research the issues. This involved a considerable amount of correspondence with our Division of Water. We found that we had more common ground then we anticipated and our line of communication has greatly improved.

As our Department began to coordinate the feasibility studies, several divisions were invited to the table. Fisheries biologists were also asked for input regarding the pros and cons of removal. Of the 28 dams involved in this round of studies, removal was an option for seven.

I am going to take just a few minutes to talk about one of the dams where removal is being considered. This is the Nasby Dam. It is one of three state owned dams located on the Pigeon River Fish and Wildlife Area. It is an earthen dam, 15 feet high that was constructed in 1911. It was originally used to divert water through a cannel to operate a grist mill then later converted to generate electricity. Generation was eventually discontinued and the property was transferred to the state in 1956. This was one of the first land acquisitions which makes up this 12,000 acre property. The dam also has a V shaped concrete weir and a stop log structure which allows some manipulation of the impoundment elevation. The dam forms a 35 acre impoundment and has flooded 1 mile of river channel. Since 1995, three drownings have occurred immediately below this dam and two others occurred prior to that. Nasby Dam can be dangerous during high water events, especially when people use poor judgement.

One of the interesting issues associated with the removal of this structure is the possible impact to a 45-acre high quality fen which boarders the north side of the impoundment. One could argue that if it is a true fen, the water elevation in the impoundment would have minimal impact. On the other hand, what exotic plant species will encroach into the fen once the water elevation is lowered? Our Department is reluctant to remove this dam to restore this section of river if it results in the loss of one of the few quality fens we have. The jury is still out on this one but no options have been ruled out.

Progress is measured in many different ways. While I can't tell you that our Department has implemented a dam removal program or that Nasby Dam will come down, I can say that dam removal in Indiana is an option that is a lot less radical than it was just a couple of years ago.

Dam Removal—A Water Quality Perspective

Bruce J. Yurdin

Manager, Watershed Management Section, Bureau of Water

Illinois Environmental Protection Agency

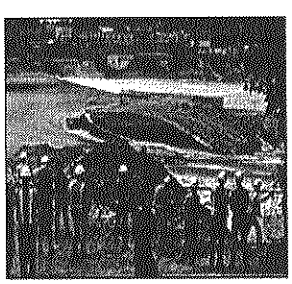
Why Dam Removal Now?

- Safety and Age (from 2001 ASCE report)
  - 2100 dams reported as "Unsafe"
  - 61 dams "Failed" in 1999-2000
- FERC Relicensing
  - 1993—160 renewal (on 260 dams)
  - 1996—550 renewals
  - 1999 and 2000—450 renewals
- Biological impacts
  - Anadromous fish
  - 297 U.S. native mussel spp.-- >70% T &E
  - ESA

2

Edwards Dam During Removal

- Built in 1837
- 24 feet high, for barges/sawmills
- Barges gone by 1850s
- Power <0.1 of 1% in Maine
- Removal opened 17 miles to fisheries



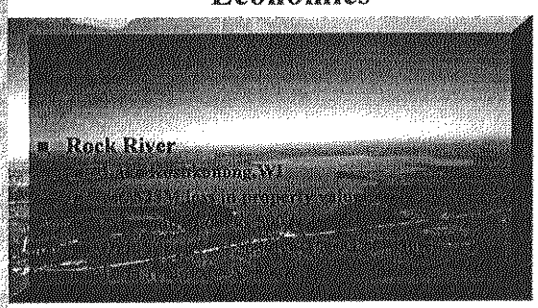
3

Dam Removal in the U.S.

- 75,000 dams (>2m) in U.S.
  - = one built/day since July 4, 1776
- 465 dams removed, as of 1999
- 2 x 10^6 dams in U.S.
  - <1% considered for removal (according to American Rivers and other environmental groups)

4

Problems with Dam Removal: Economics



5

Problems, continued: Economics, Fish and Sediment

- Elwha and Glines Canyon Dams (WA)
  - Increase of 390,000 salmon and steelhead, not 12-20,000 from hatchery
  - 18 Million cy sediment
- Kalamazoo River (MI)
  - 18 dams, impedes fish mvmt to Great Lakes
  - PCB contamination along 65 miles
- Milltown Dam (MT)
  - 6.6 Million cy
  - PWS threatened—mine tailings
    - 2100 tons As
    - 13,100 tons Cu
    - 19,000 tons Zn

6

Problems with Sediment

- Corps study of 4 dams on the lower Snake River
  - Salmon restoration on 140 miles
  - 5% of power from Bonneville Power Admin.
  - Irrigation, navigation
- Findings:
  - 100----150M cy impounded----50% would be released after dam removal (5-10yrs)
  - DDT, dioxin and Mn

Dams considered for removal

7

Snake River: Pollutants, Predictability, and Politics

- 26 populations of Pacific salmon on ESA
- Corps: "We have no exact way to predict what will happen."
- July 2000, Clinton Administration opts not to remove dams

8

Is sediment a problem?

- IL WQ Stds prohibit unnatural turbidity and deposits
- Consider contaminants?
- Is there a predictive path from sediment to the water column?
- Will it move?

9

Sediment Quality Assessment Procedures

- Equilibrium Partitioning
- Tissue Residues
- Interstitial Water Toxicity
- Benthic Community Structure
- Whole Sediment Toxicity and Sediment Spiking
- Sediment Quality Triad
- Sediment Quality Guidelines

10

Two Types of Aquatic Life Effects Approaches to Sediment Toxicity

- Equilibrium Partitioning
  - Predicts fate of nonionic compounds and divalent metals
  - Based on interaction in pore water with C, particle size and AVS
- Biological Effects Correlation
  - Compares field and lab data
  - Can demonstrate level of adverse affect

11

Equilibrium Partitioning

$$C_s = C_d \, f_{oc} \, K_{oc}$$

where:

- C_d is dissolved concentration
- f_{oc} is the organic carbon content of the sediment
- K_{oc} is the organic carbon partitioning coefficient, which can be empirically related to the octanol/water partitioning coefficient.
- Need to account for SEM/AVS ratio

12

Biological Effects Correlation Approach to Sediment Toxicity

ER-L: Sediment screening values based on a biological effects correlation approach, represents chemical concentration ranges that are rarely associated with toxicity(Long et al., 1995; USEPA, 1997).

- ER-M: Sediment screening values based on a biological effects correlation approach, represents chemical concentration ranges that are usually associated with toxicity(Long et al., 1995; USEPA, 1997).
- TEL: the concentration of a specific contaminant in sediment below which biological effects are not expected(USEPA, 1997).
- PEL: the range of concentrations of a specific contaminant in sediment within which biological effects are usually or always observed (USEPA, 1997).

13

Chemical	NOAA and USEPA ER-L	NOAA and USEPA ER-M	CCME ISQGs	USEPA $SQAL_{OC}$	USEPA TEL PEL
Arsenic	8.2	70	5.9	NA	7.24 41.6
Lead	46.7	218	35.0	NA	30.2 112
Zinc	150	410	123	NA	124 271
Acenaph -thene	0.016	0.500	0.0067	0.130	0.00671 0.0889
benzo(a)pyrene	0.430	1.600	0.0319	NA	0.0748 0.693
Total PCBs	0.0227	0.180	0.0341	NA	0.0216 0.189*

14

Application of Bio Effects Criteria

- Milltown Dam (MT)
  - As 0—1590
  - Cu 39—10,800
- Savage Rapids Dam (WA)
  - As 2.09—2.61
  - Cu 36—106

All units in mg/kg

- USEPA bio effects criteria
  - As 8.2 ER-L
  - As 70 ER-M
  - Cu 34 ER-L
  - Cu 270 ER-M
- USACE criteria
  - As 57
  - Cu 390

15

Sediment Movement

- Can sediment movement predictive models assist in the understanding of chronic/acute effects?
  - 1-D Models: STARS, HEC-6, Elwha Reservoir model
  - 2-D Models: GSTARS, NETSTARS
- What is the appropriate time frame—are they case-specific?

16

Hofmann Dam-Des Plaines River (IL)

- One of a trio on lower Des Plaines River
  - Hofmann Dam (state owned)
  - Armitage Avenue Dam (Cook County owned)
  - Fairbanks Road (Cook County owned)
- ~ 10-14 feet, Mod. Ogee crest, low hazard
- 1998 IDNR fish collection, downstream spp. only include
  - Northern pike
  - Smallmouth bass
  - Muskellunge

17

Hofmann Dam

- Hofmann Dam impounds approx. 21,000 cy sediment
  - Armitage and Fairbanks <<< less
- Approximate Costs (x $1000)

	Partial Removal	Full Removal	%
Access	40	40	1.5
Dam removal	400	550	17
Sediment	**1,700**	**1,700**	**67**
Restoration	400	400	15
Total	2,500	2,600	

18

Hofmann Dam
Sediment Concentrations (mg/kg)

Constituent	Range	USEPA TEL/PEL
Benzo(a)pyrene	2.2—3.2	0.0748/0.693
As	7.2—10.0	7.24/41.6

19

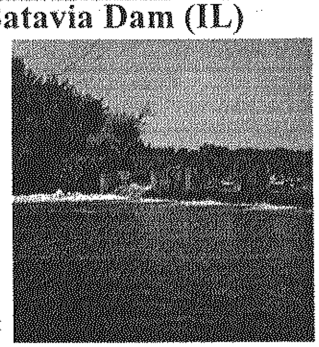
Hofmann Dam
Sediment Movement

- HEC-RAS
- No field data available
- Model input required estimates for void ratio, specific composition
- Assumed near-bank material is stable and would not move with "normal" flows
- 3000 cy would "move" (15% of 21,000cy)
  - Equal to 1—2 days load @ flood flow

20

South Batavia Dam (IL)

- Fox River, one of over a dozen (in IL)
- Sloping face structure—in 2 sections, poor condition
- Abandoned
- Length—686 feet
- Approx. 20,000 cy fine grained sediment



21

South Batavia Dam
Sediment Concentrations (mg/kg)

Constituent	Conc.	Back-ground	USEPA TEL/PEL
Benzo(a)pyrene	1.07	NA	0.0748/0.693
Zn	1260	0-798	7.24/41.6

Other SEMs within normal range

23

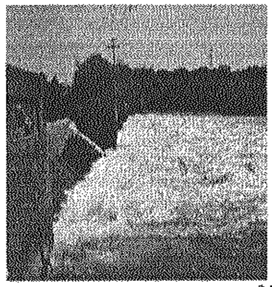
South Batavia Dam
Sediment—Acute Affects

	Supernatant Analysis (mg/L)			
Constituent	4Hr	12Hr	24Hr	WQ Std
Zn	0.54	0.34	0.18	0.1

24

Dam Recommendations

- Sediment will move—how much, during what flows?
  - Transport model
- Contaminants—what concentrations, what depths?
  - Depth integrated sampling
  - Historic data
  - Acute—chronic
  - Sediment affects standards/criteria



25

Fox River
Fish Passage Feasibility Study

Overview and Preliminary Data Summary

DRAFT

Conducted by

Max McGraw Wildlife Foundation and U.S. Environmental Protection Agency

Funded by

Illinois Department of Natural Resources Conservation 2000 Ecosystem Program
U.S. Environmental Protection Agency
Max McGraw Wildlife Foundation

Sponsored by

Fox River Ecosystem Partnership
Illinois Department of Natural Resources
Division of Fisheries and Office of Water Resources

Prepared by

Victor J. Santucci, Jr. and Stephen R. Gephard
Max McGraw Wildlife Foundation
P.O. Box 9
Dundee, Illinois 60118
847-695-4610

February 4, 2002

Fox River Fish Passage Feasibility Study

Project Overview

Many dams on the Fox River were originally built in the 1800's to provide mechanical power for grist and saw mills. Although extremely important in their time, most dams today serve no functional purpose except to maintain the flat-water pool or impoundment that is created upstream of the dam. This study will describe fish and macroinvertebrate populations, aquatic habitat, water quality, and dams in the Fox River between the Chain of Lakes and Dayton, Illinois (~100 river miles). We will identify species targeted for fish passage in each river segment between dams and summarize pertinent life history and biological information for priority species. We will discuss effects of dams on fish and macroinvertebrate populations, aquatic habitat, water quality, and recreational opportunities in the river and the potential outcomes of five action scenarios: a) maintaining dams with no modifications, b) removing dams completely, c) lowering dams and ramping the remaining structure, c) constructing fishways (e.g., pool-and-weir fishways and Denil fishways), and d) constructing fishway/canoe chute bypass channels. Fish passage options will be proposed for each of 15 Fox River mainstem dams. Options include conceptual designs, preliminary cost estimates, and summaries of biological and recreational benefits.

Objectives

The overall objectives of the project are:

1) Determine the effects of dams on fish and macroinvertebrate populations, physical habitat, and water quality in the Fox River between Chain of Lakes and Dayton, Illinois.

2) Determine opportunities for dam removal or modification to enhance fisheries and improve river-based recreational activities, and outline options for such actions.

Abstract of Preliminary Results

We examined the effects of dams on fish communities, macroinvertebrates, aquatic habitat, and water quality in a 100-mile reach of the Fox River, Illinois. The reach contained 15 low-head dams that fragmented the river into a series of free-flowing and impounded segments. We sampled 40 sites located in free-flowing river directly below dams, impounded river directly above dams, and free-flowing or impounded mid-segment areas between dams. Index of Biotic Integrity values for fish were higher at below dam and mid segment free-flowing sites (mean for both = 46; a highly valued "B" stream) than above dam and mid segment impounded sites (29 and 30; a limited value "D" stream). Biological Condition Scores for macroinvertebrates were higher at below dam and mid segment free-flowing sites (mean = 418 and 474) than above dam and mid segment impounded sites (206 and 203). Invertebrate samples from offshore-

impounded areas behind dams consisted almost entirely of tolerant oligocheats (aquatic worms) and chironomids (midge larvae). Quality Habitat Evaluation Index scores indicated good habitat quality at below dam and mid segment free-flowing sites (mean = 72 and 76) and severely degraded habitat at above dam and mid segment impounded sites (36 and 43). Dissolved oxygen levels fluctuated widely in impounded river reaches (<3 to >20 mg/l) due to slowed current velocity and high planktonic algae abundance. Dams were found to impound 55% of the river and restrict distributions for 30 fish species. Our data suggest that dams may adversely affect warmwater stream fish and macroinvertebrate communities by degrading habitat and water quality and acting as barriers to fish movement. Removing dams would improve the ecological health of the Fox River by eliminating barriers to fish migration, restoring high quality river habitat, and eliminating lake-like conditions that support high algal biomass and substandard dissolved oxygen levels. Fishways that allow fish to navigate over or around dams should be considered only when dam removal is not an option.

Specific Tasks and Methods

Task 1. Fish community assessment.

- Fish were sampled during July-September 2000 at 40 stations between the Chain of Lakes and Dayton, Illinois. Stations were located directly above and below each of the 15 Fox River channel dams. Ten additional sites (mid segment stations) were located in impounded and free-flowing areas between dams.

- We collected fish by boat electrofishing, backpack shocking, and seining following protocols used by the IDNR.

- Fish community and population statistics used for data analysis included species richness, index of biotic integrity (IBI), and relative abundance of harvestable-size sport fish.

- Statistics were compared among below dam free-flowing, mid segment free-flowing, mid segment impounded, and above dam impounded stations.

Task 2. Macroinvertebrate community assessment.

- Macroinvertebrates (aquatic insects, crustaceans, snails, and worms) were sampled during summer 2000 at the same 40 stations sampled for fish.

- We collected invertebrates with kick-netting and hand-picking techniques following protocols used by the IEPA. Accumulated fine sediments from deeper-water, impounded stations also were sampled with a ponar grab.

- A multi-metric biological condition index was developed for the Fox River following USEPA Rapid Bioassessment protocols. Metrics used in the index include: taxa richness, number of EPT taxa (mayflies, stoneflies, caddis flies), percentage of EPT individuals, percentage of chironimid individuals (midge larvae), number of tolerant taxa, Macroinvertebrate Biotic Index scores, and percentage of clinger insects.

- Biological condition scores were compared between sampling locations in a manner similar to fish community index scores.

Task 3. Aquatic habitat quality assessment.

- Aquatic habitat (substrate, fish cover availability, stream morphology, riparian area, pool/riffle quality, and gradient) was evaluated during summer 2000 at the same 40 stations sampled for fish and macroinvertebrates.

- We used the Ohio EPA's Quality Habitat Evaluation Index (QHEI) and IEPA's Stream Habitat Assessment Procedure (SHAP) to assess habitat at each station.

- QHEI and SHAP scores were compared between sampling locations in a manner similar to fish population analyses.

Task 4. Aquatic habitat quantity assessment.

- During fall 2000, we canoed and boated the entire length of river between the Chain of Lakes and Dayton, Illinois and recorded macrohabitat features (impounded reaches, free-flowing reaches, natural pools, riffles, runs, glides, aquatic vegetation, and streamside wetlands) on 1999 color aerial photographs of the river (scale = 1:400).

- Habitat features were converted to Arcview shape files using geo-referenced aerial photos as the base layer and gross estimates of the amount of each habitat feature were made for each between-dam river segment in order to determine the large-scale impact of Fox River dams on riverine habitat.

Task 5. Accumulated sediment assessment.

- During summer 2000, USEPA Region 5 sampled to determine the quantity, quality (particle size), and toxic chemical characteristics of bulk sediments accumulated behind each dam.

Task 6. Water quality assessment.

- Water quality sampling took place at 11 free-flowing and 11 impounded stations between McHenry and Dayton, Illinois during August 2001.

- Each station was monitored continuously for 40 hours with Hydrolab datasondes that recorded temperature, dissolved oxygen, conductivity, and pH every 15 min. Datasondes were set 1-2 ft. off bottom in the middle of the river channel.

- Spot sampling with an additional datasonde measured each of the four water quality parameters at each station during early morning (6:00-9:00 a.m.) and early evening (6:00-9:00 p.m.) hours. Surface, mid-depth, and near-bottom spot samples were taken at left-of-center, mid-channel, and right-of-center locations to examine vertical and horizontal variation in water quality. Additional 1-ft. depth and sonde depth spot samples were taken at mid-channel locations only.

- Water grab samples were collected at each mid-channel location (1-ft. depth) during morning and evening spot sampling (*N* = 44 samples total). USEPA or Illinois EPA laboratories analyzed each sample for turbidity, total suspended solids, total organic carbon, chlorophyll a, total phosphorus, total dissolved phosphorus, total kjeldahl nitrogen, ammonia nitrogen, and nitrite/nitrate nitrogen. Unionized ammonia concentrations were determined from total ammonia, temperature, and pH data. Estimates of total nitrogen were obtained by summing total kjeldahl nitrogen and nitrate/nitrite nitrogen values.

- Dissolved oxygen and oxygen-influencing water chemistry parameters (listed above) were compared among free-flowing and impounded river reaches to determine the effects of dams on water quality in the river.

- To better understand within-segment effects of dams on dissolved oxygen concentrations, we used continuous recording datasondes and spot sampling to monitor dissolved oxygen at 8-11 transects in each of four between-dam river segments. Each segment was sampled for 24 hours during September 2001. Two datasondes were set mid channel at upper and lower locations of free-flowing river reaches and upper and lower locations of impounded river reaches. Spot sampling occurred at 6-9 transects located in the impounded river and two transects in the free-flowing river.

Task 7. Dam removal or modification options.

- During summer 2000, we visited each of the Fox River dams to gather site information (dam height, area available for fishway construction, and unique features that might pose problems or opportunities for dam removal or modification). This information was used in determining possible options for dam removal or modification (lowering and ramping, fishway construction, and canoe/fish bypass construction) at each dam.

Task 8. Final report and education outreach seminars.

- A final report is being prepared with the expected completion date of April 30, 2002. Evening public outreach seminars were held to inform FREP partners, government agencies, local municipalities, and interested citizens of the effects that dams are having on Fox River fish invertebrates, habitat, and water quality and potential dam removal or modification options to improve conditions in the river.

Results to Date

Task 1. Fish community assessment.

- Approximately 20% of the river mainstem was sampled (linear distance).

- Fox River dams are having a negative effect on the fish community. IBI values were higher at below dam and mid segment free-flowing stations than above dam and mid segment impounded stations. Based on the Illinois Biological Stream Characterization (BSC), impounded reaches of the river averaged a "D" rating, or Limited Aquatic Resource (mean IBI = 30), whereas free-flowing reaches averaged a "B" rating, or Highly Valued Aquatic Resource (mean IBI = 46).

- More fish species were found at below dam and mid segment free-flowing stations (mean = 29 and 25 species, respectively) than above dam and mid segment impounded stations (16 and 18 species, respectively).

- Relative abundance of individuals was higher below dams and at mid segment free-flowing stations (mean = 822 and 756 fish/h, respectively) than above dam and mid segment impounded stations (137 and 201 fish/h, respectively).

- The state threatened river redhorse was collected at four stations, all of which were located in free-flowing reaches of the river.

- Relative abundance of harvestable-sized sport fish was substantially higher at free-flowing reaches (74-87 fish/h) compared to impounded reaches (33-39 fish/h).

- Relative abundance of channel catfish and smallmouth bass, principal game species in the river, also was substantially higher at free-flowing stations than impounded stations.

- By acting as barriers, dams appear to be limiting movement and affecting fish distributions throughout the river. Thirty species of fish were found to have either truncated (only found in the lower river) or discontinuous (absent from middle river) distributions. Sauger, American eel, skipjack herring, mooneye, speckled chub, longnose gar, shortnose gar, and three species of buffalo were collected only below the lowest dam (Dayton), which is located 5.6 miles above the Illinois River confluence.

Task 2. Macroinvertebrate community assessment.

- Dams alter and degrade Fox River macroinvertebrate communities. Biological Condition Scores were substantially higher at below dam and mid segment free-flowing stations (mean = 418 and 474) than above dam and mid segment impounded stations (206 and 203).

- Stations within free flowing reaches of the river had an abundance of mayflies and caddis flies whereas impounded stations had high proportions (>95%) of tolerant midge larvae (chironomids) and benthic worms (oligocheates).

- Freshwater mussels are imperiled within the state and nationally. Mussel diversity and abundance currently is low in the Fox River compared to historical samples. Mussels use fish as a means of expanding their distributions because mussel larvae attach to fish for a period of time in their development. Dams may be affecting the recolonization of mussels to sections of the river with improved water conditions because they block fish migrations.

Task 3. Aquatic habitat quality assessment.

- The quality of habitat in impounded waters above Fox River dams is severely degraded compared to free-flowing reaches of the river. Dams appear to degrade Fox River habitat by slowing flow, accumulating fine sediments, reducing habitat variability, and generally creating lake-like conditions in the impounded areas above dams.

- On average, QHEI values were low for above dam and mid segment impounded reaches (mean = 36 and 43, respectively) and high for below dam and mid segment free-flowing reaches (72 and 76, respectively). Based on these scores, habitat in the impounded portions of the river is considered severely degraded whereas habitat in the free-flowing portions is of good quality.

- Similar results were found for the SHAP analysis, although these data did not correlate as well with IBI scores ($r = 0.69, P = 0.001$) as QHEI scores ($r = 0.89, P = 0.001$). SHAP scores indicated good habitat at free-flowing stations, fair habitat at the mid segment impounded stations, and poor conditions above dams.

- The strong relationship between habitat index values and fish community index values suggests that habitat quality may be an important factor influencing fish community quality in the river.

Task 4. Aquatic habitat quantity assessment.

- The 15 Fox River dams are impounding 47% of river miles and 55% of surface area in the nearly 100 miles of river between Chain of Lakes and Dayton, Illinois. The overall negative effect of dams on the health of the river is substantial given the high percentage of river that is impounded by dams and the poor conditions found in these impoundments during summer.

Task 5. Accumulated sediment assessment.

- The volume of fine grain sediments that have accumulated in the areas approximately 1,000 ft. above each Fox River dam ranges between 10,500 (Montgomery Dam) and 292,000 (Elgin Dam) cubic yards.

- Sediments behind dams are primarily fine sands and silt. A preliminary examination of sediment contamination data indicated that Fox River sediments are generally "clean."

Task 6. Water quality assessment.

- Nutrient concentrations (total phosphorus and nitrogen) during the summer low flow period were moderate in the river near McHenry (0.1 mg/l-Ph, 1.7 mg/l-N), increased to high levels at Elgin (0.5 mg/l-PH, 3.5 mg/l-N), and remained high at all stations through Dayton (>0.4 mg/l-PH, >2.5 mg/l-N).

- Algal biomass was high throughout the Fox River from McHenry to Dayton.

- Dissolved oxygen concentrations fluctuated widely at impounded stations (2.5 - >20 mg/l), but not at free-flowing stations (5-8 mg/l). Dissolved oxygen fluctuations appear to be driven by daytime photosynthesis (oxygen is produced) and nighttime respiration (oxygen is consumed) of planktonic algae. The decomposition of organic material in the water column and fine sediments that accumulate in the impoundments above dams also may be acting to remove oxygen from the water.

- Minimum dissolved oxygen levels fell below the IEPA recognized standard of 5 mg/l at 9 of 11 impounded reaches of the river from McHenry to Dayton. We also found that: 1) substandard dissolved oxygen levels occurred throughout impounded reaches, not just immediately above the dams, 2) substandard oxygen sags lasted from 1.5 to 16 hours in a 24-hour period, and 3) substandard dissolved oxygen conditions occurred during periods of low flow and high water temperature, or from July through September in 2001.

- Ph values exceeded the IEPA recognized standard of 9 units during early evening at 8 of 11 impounded stations and 1 of 11 free-flowing stations (Dayton).

- Water flowing over dams lost oxygen to the atmosphere during the day and added oxygen to the water at night. In general, a far greater amount of oxygen was lost during the day than was added at night.

- Dams did not directly cause organic enrichment or fluctuating and substandard dissolved oxygen levels. However, the impoundments that form behind dams provided a lake-like environment that supported the production of high algal biomass, which in turn, influenced dissolved oxygen concentrations in the river.

- Dissolved oxygen was not sufficiently low to kill fish directly, but it may have reached a level that limited the use of impoundments by all but the more tolerant species of fish and invertebrates. In addition, extended periods of low oxygen and highly fluctuating oxygen conditions may act to stress aquatic organisms without causing mortality. Degraded oxygen conditions occurred at a time of year when other stressors, such as high turbidity, low flow conditions, and high water temperatures also may be influencing fish and invertebrates in the river.

Task 7. Dam removal or modification options.

- We recommend that fish passage be considered at all Fox River dams. Fish passage is needed to 1) allow fish to access important spawning and nursery habitats in tributaries and stream-side wetlands, 2) allow fish to repopulate areas where they no longer exist, 3) allow freshwater mussels to repopulate areas where they no longer exist, 4) provide for genetic mixing in fish and mussel populations that are isolated by dams, 5) provide access to the Fox River by important Illinois River game and non-game fishes (the Fox is the third largest tributary to the Illinois River), and 6) improve recreational fishing opportunities in the Fox River by providing for seasonal migrational runs of sport fishes, such as walleye, sauger, white bass, skipjack herring, and large sucker species.

- Priority species targeted for fish passage include channel catfish, flathead catfish, muskellunge, northern pike, white bass, smallmouth bass, sauger, walleye, goldeye, mooneye, skipjack herring, redhorse suckers (golden, silver, shorthead, and the Illinois threatened river redhorse), buffalos (smallmouth, bigmouth, and black), carpsuckers (highfin and river), and northern hog sucker.

- Fish passage options include a) removing dams completely, c) lowering dams and ramping the remaining structure, c) constructing fishways (e.g., pool-and-weir fishways and Denil fishways), and d) constructing fish/canoe bypass channels. In many cases, we present more than one option for individual dams.

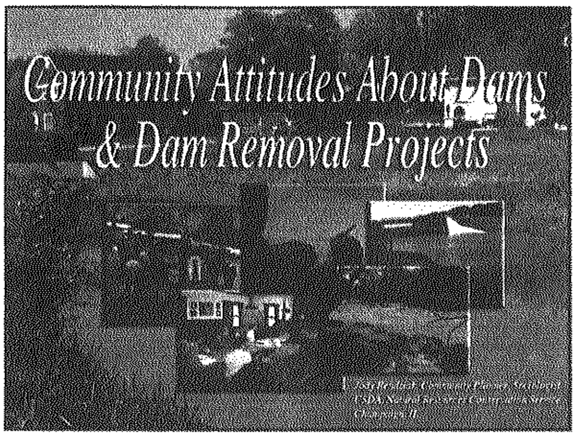
- Dam removal is the best option for all Fox River dams when the ecological health of the river is of prime consideration. Removing dams will eliminate barriers to migration for all types and sizes of fish, restore high quality river habitat, and eliminate lake-like conditions that support high algal biomass and substandard dissolved oxygen levels. Dam removal is relatively inexpensive (compared to other options presented), eliminates safety risk to the public (people drown at dams), and requires no maintenance because the structure is removed.

- Lowering and ramping dams provides for reconnection of the river by allowing most fishes to pass over dams, but it does little to improve degraded water quality and habitat conditions. This option probably is not feasible at most dams on the Fox River because they are long (>250 ft.) and the amount of fill (small and large boulders) needed to build a ramp at the proper slope may be cost prohibitive. Ramping may be a suitable option for small tributary dams that cannot be removed for whatever reason.

- Fishways and bypass channels will allow many (not all) fish to navigate over or around dams, but will do nothing to improve habitat and water quality conditions in the river. Fishways have associated operational and maintenance costs and are relatively expensive to build (~$1,600 linear ft. for Denil fishways). Fishways and bypass channels should be considered only when dam removal is completely ruled out as a fish passage option.

Task 8. Final report and education outreach seminars.

- The final report will be available in May 2002. Public outreach seminars hosted by Friends of the Fox River were presented on January 29, 2002 at Aurora University (attendance = ~ 100) and January 31, 2002 at Dundee Public Library (attendance = 42). An additional seminar, hosted by the St. Charles Park District was presented on January 24, 2002 at Pottawatamie Community Center in St. Charles (attendance = 30).



Overview

- Why is understanding community attitudes important?
- What do communities care about?
- How can we learn about community attitudes?

Project Purpose

- Develop a tool for assessing community attitudes about dams and rivers.
- Investigate the attitudes of local people about dams and rivers.
  - Is the dam important to the community?
  - In what ways is it important?
  - What is their understanding of the impact of dams on rivers and the impact of removal?

Why Assess Community Attitudes?

- Devise an appropriate planning process.
- Develop effective educational initiatives.
- Reduce potential for misunderstanding, conflict and controversy.
- Maximize potential for implementing management strategies that are in our best ecological, economic, and social interests.

Understanding Community Attitudes Is NOT

- Assessing functional, economic, environmental or other criteria.
- Fact finding about the merits of dam removal or its impact for the community.
- Educating communities about the merits of dam removal or its impact.

Challenges

- Beliefs are not always understood by asking questions.
- Sometimes we do not know what we value until it is threatened.
- Attitudes can be affected by planning and management activity.
- Timing.

Why Do Communities Care?

Citizens' perspectives are influenced by the values they attribute to the dam.

- Functional, safety, economic, and environmental.
- Dams may also represent certain values that may be described as "cultural": concerning people and their shared experiences, norms, and beliefs.

Attitudes About Landscape Features

- Place attachment
  - Emotional connection to a physical site because of personal interactions.
  - The more meaningful the interactions, the more meaningful the place becomes.
- Spatial Component of Experience
  - Spatial component is inherent to personal experience.
  - Physical sites have the capacity to organize individual experiences and transmit aspects of shared experiences.

Attitudes About Landscape Features

- Environmental cognition
  - Certain aspects of a community's environment may be exaggerated or minimized in importance, other features left out entirely or incorrectly perceived.
- Spatial Manifestation of Values
  - Physical places and objects can manifest cultural values.
- Means of Experience
  - Certain landscape features enhance people's ability to experience other features.

Why Do Communities Care?

Batavia, Illinois Example

- Emphasized importance of the Fox River to the identity, social fabric, and economy of the community.
- View protection of the aesthetic and recreational values of the river as integral to maintaining the character and quality of life in the community in the face of tremendous growth and change.
- Threats to the aesthetic and recreational features of the river are considered threats to community character and quality of life.

Methodology for Assessing Community Attitudes

- Observation
- Review of written records
- Interviews and/or focus groups
- Visual Preference Surveys

Observation

- Public interactions
- Recreational and civic features
- Visibility
- Aesthetics
- Riparian land use
- Commemoration of history

Review of Written Records

- What is important to this community?
- What are the major trends and issues in this community?
- Recent activity concerning dam and related issues.
- Have citizens expressed strong opinions about the dam or related issues?

What Records?
- Town logos, official stationary, welcome signs, banners
- Local and metro newspapers
- Meeting minutes
- Newsletters of civic groups

Interview/Focus Group Topics

- About the community
  - What is important to this community?
  - What are the major issues and trends, and how is the community responding?
  - What is the community's identity and values?
  - How does the river and its related features (i.e., the dam) fit in?
- Interactions with the dam
- Awareness of the dam
- Aesthetic & recreational preferences regarding dam and river

Interview Focus Group Topics

- Perceptions about impact of dams on rivers and of dam removal
  - Water quality and quantity
  - Recreation
  - Fisheries
  - Property values
  - Aesthetics
  - Community
    - Identity
    - Local economy
    - Community conflict & cohesion
    - Quality of life

Visual Preference Surveys

- Citizens give a "score" to different landscape images.
- Aggregate responses to characterize landscape preferences of community.
- Can be done by mail or in a group setting.

Conclusion

Planners can better understand community attitudes about dams and dam removal projects by:

- Considering basic concepts of how people relate to their environment.
- Investigating the larger community context.
- Using social science tools to determine how important the dam is to the community and why it might be important.

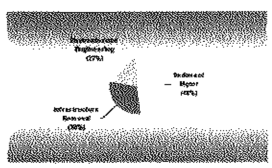
Sediment Management for Dam Removals

Marty E. Rye, P.E.

inter-fluve, inc.

Why Do We Care?

- Project Cost
- Permitting
- Environmental Concerns
- Liability
- Project Performance
  - Aesthetics
  - Recreational Use
  - Economic



Relative Magnitude of Costs for Dam Removal Elwha River, WA (Morris & Fan, 1997)

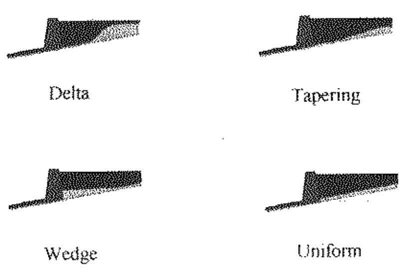
Purpose Of Presentation

- *Briefly* Describe Physical Process of Sedimentation
- *Briefly* Describe Options for Sediment Management for Dam Removal
- Some Data on Short-Term Impacts of Dam Removal on Downstream TSS
- Summary of Tools Needed to Ensure Responsible Dam Removal Sediment Management

Sedimentation Patterns Related to Several Conditions

- *Hydrologic Conditions*
- *Stream Inlet Locations*
- *Sediment Characteristics*
- *Reservoir Geometry*
- *Outlet Design*
- *Operating Rule*

Longitudinal Deposit Geometry



Morris & Fan, 1997

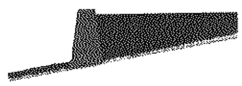
Physical Process of Sedimentation

Pre-Dam Conditions

Sediment Transport
Continuity

Physical Process of Sedimentation

New-Reservoir Conditions



Interruption of Sediment Transport

Physical Process of Sedimentation

Young Reservoir Conditions

Coarser Sediment Drops Out at Upstream Limits

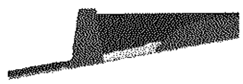
Physical Process of Sedimentation

As the Reservoir Ages

- Sediment Delta Progresses Downstream
- Finer Sediment Deposited Near the Dam Face

Physical Process of Sedimentation

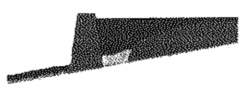
As the Reservoir Ages



- Sediment Delta Progresses Downstream
- Finer Sediment Deposited Near the Dam Face

Physical Process of Sedimentation

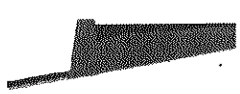
As the Reservoir Ages



- Sediment Delta Progresses Downstream
- Finer Sediment Deposited Near the Dam Face

Physical Process of Sedimentation

Aged Reservoir



- Equilibrium is Reached
- Sediment Layers
  - *Finer Material Covered by Coarser Material*
  - *Consolidation of Material*

Impacts of Sediment Release

- Fisheries
- Benthic Organisms
- Municipal Water Supply
- Industrial / Agricultural Uses
- Water Treatment
- Morphology
- Conveyance Capacity

Deterministic Tools Are Limited

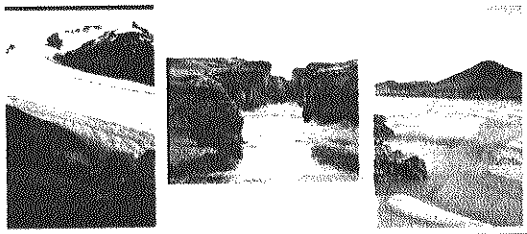
- Stochastic Phenomenon
- Dam Removal Similar to Flushing Operations Used for Reservoir Sediment Management
  - *Widely Used in France for Inspection*
  - *Used in China as Part of Rule of Operation*
  - *Published Data is Limited and Project Specific*

Sediment Management Approaches for Dam Removal

- Minimal Management
- In-Place Stabilization
- Time Stepped Approach
- Excavation and Stabilization of Reservoir Sediments

Two Extremes in Timescale Yield Two Extremes in Sediment Management

Geologic Time Scale

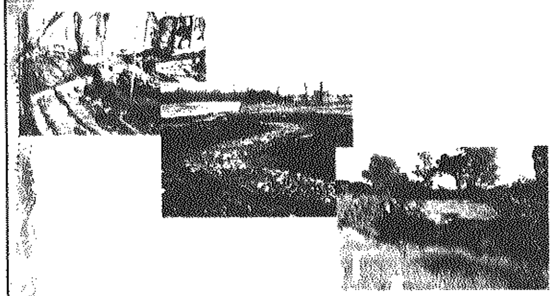


This Leads to the "Rip 'n Run"

Minimal Management

Advantages	Concerns
Cheaper than Active Management of Sediment	Degraded Stream Reach
Easier to Design	Downstream Impacts
No Long-Term Construction and Monitoring	Aesthetics
Allows More Dams to be Removed	Social Impacts

Engineering Time Scale
Leads to a "Full-Restoration"



Full Restoration

Advantages	Concerns
Restores Ecological Function Quickly	Resource Competition Delays Other Dam Removals
Aesthetic	$$'s
Social Benefits	
Restores Capability of Stream to Adapt	
Engineering Objectives Can Be Met	

Choices within the Extremes

In-Place Stabilization by Constructing an Over-Steepened Transition Channel or a Series of Transitions

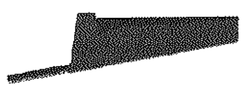
Ramp – Steep Channel

Step-Pool Series of Drops

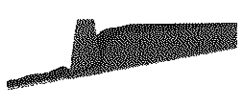
Partial Restoration

Advantages	Concerns
Initially Cheaper than 'Full-Restoration'	Is this River Restoration? Responsiveness
Provides Some Short-Term Function	Design Components / Design Standards
Aesthetic Benefits	Life-Cycle Costs / Maintenance
Minimizes Floodplain Sediment Migration *(Contaminated Sediment)*	

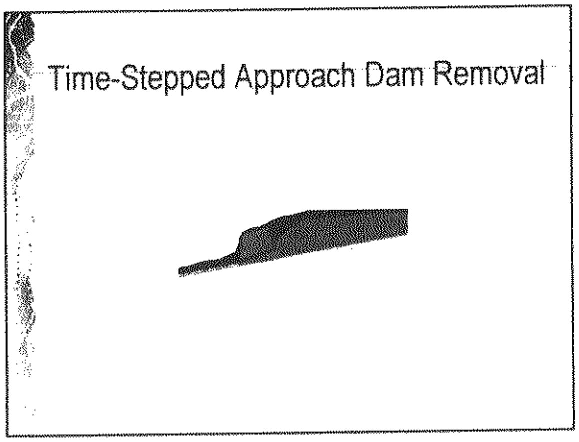
Time-Stepped Approach Dam Removal

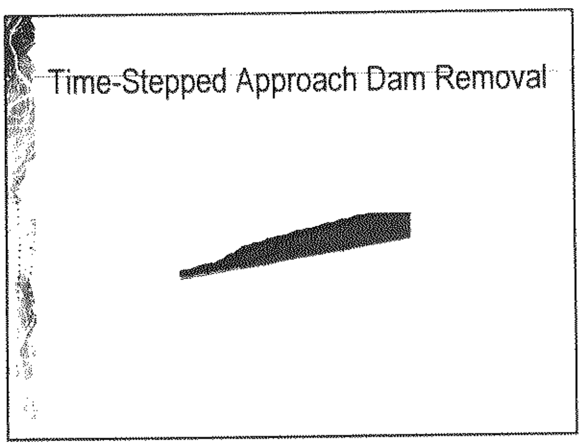


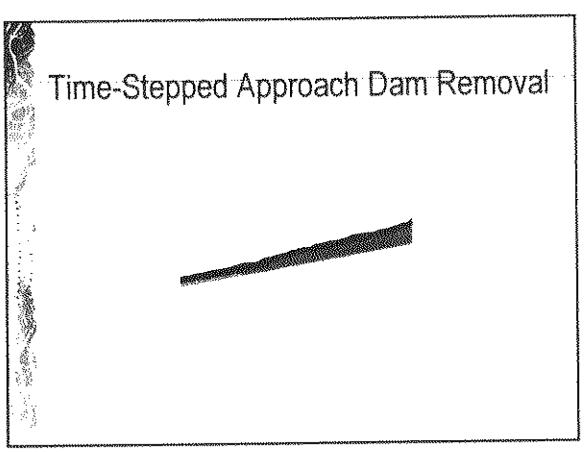
Time-Stepped Approach Dam Removal



Open Lower Gate


Time-Stepped Approach Dam Removal


Time-Stepped Approach Dam Removal

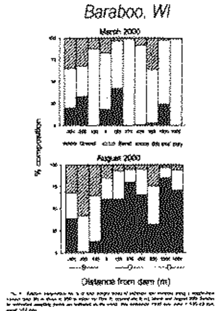

Time-Stepped Approach Dam Removal

Time-Stepped Removal

Advantages	Concerns
Spreads the Impact Over Time – Allows Downstream Natural Communities to Adapt	Does Not Explicitly Address Floodplain Sediment Removal
Allows Floodplain Sediments to Dewater, Aerate, Consolidate, Vegetate	Still Have An Incised System – Can Get Stabilized by Vegetation Establishment Delaying Eventual "Natural Rehabilitation"
Can Monitor Downstream Impacts During Process	

Impact of Storm Event on Channel Substrate Following Dam Removal

Baraboo, WI



(Stanley, Luebke, Doyle, Marshall, 2002)

Short-Term Impacts of Dam Removal on TSS

Two Case Studies

- Mill Pond Dam on the Pomme de Terre River
- Frazee Dam on the Otter Tail River

Appleton Mill Pond
Dam Removal Case History

Pomme de Terre River in Western Minnesota

Provided Power for Local Mill Site

Concrete Rubble Dam

Dam Ht = 17 ft

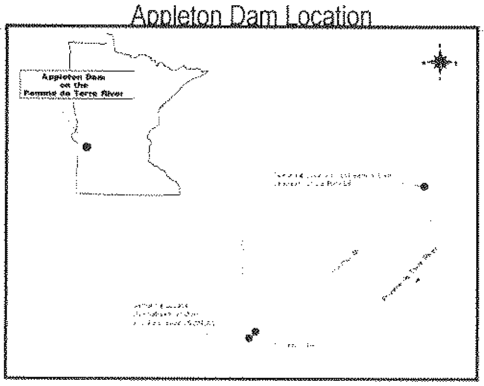
Dam Length = 157 ft

Size of Reservoir = 57 ac

D.A. = 907 sq. miles

Removed in Winter 1998

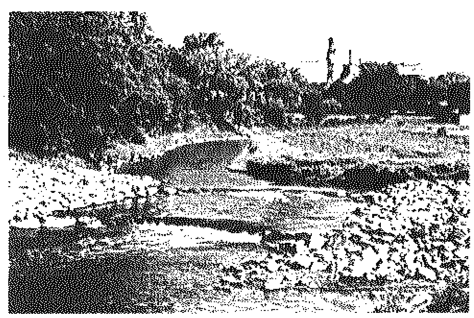
Appleton Dam Location



Appleton Dam Before Removal

Aerial Photo of Appleton Dam's Pool

Appleton Dam After Removal



Frazee Dam Removal Case History

Otter Tail River in Northwest Minnesota

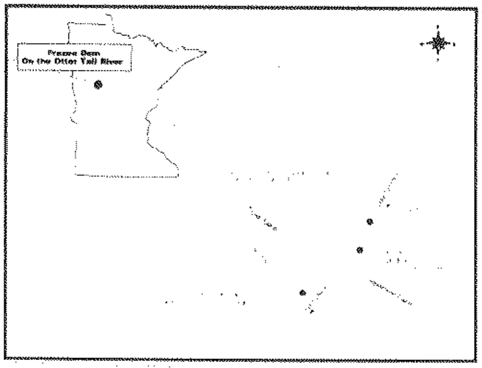
Dam Ht = 19 ft

Dam Length = 60 ft

D.A. = 237.7 sq. miles

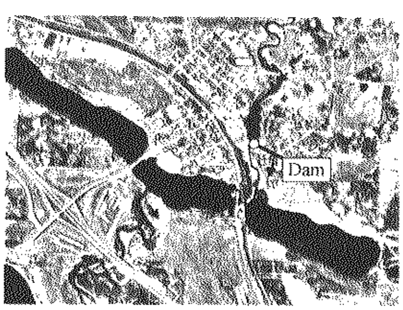
Removed in Winter 1998

Frazee Dam Location

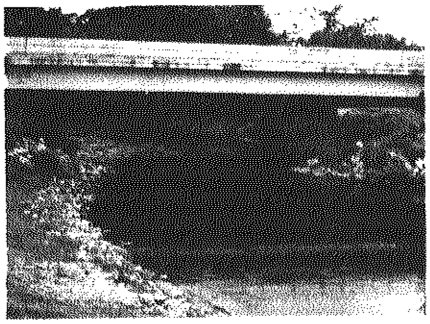


Frazee Dam Before Removal

Aerial Photo of Frazee Dam Pool Before Removal



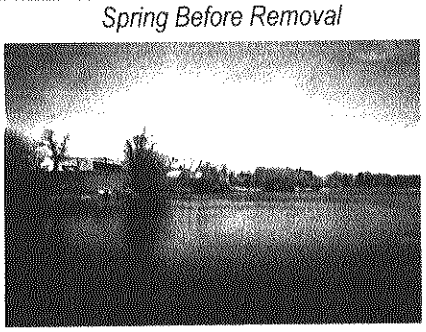
Frazee Dam Site After Removal



T.H. 87 Crossing Upstream of Dam Site

Progression of Frazee Pool

Spring Before Removal

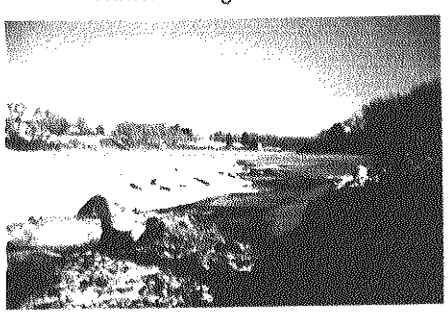


Progression of Frazee Pool

Fall Before Removal

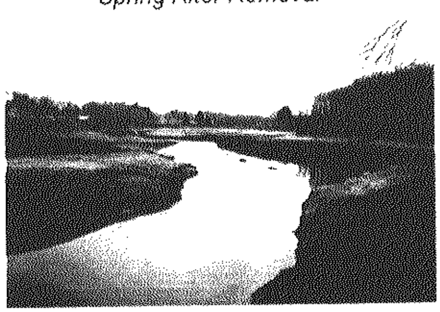
Progression of Frazee Pool

Winter During Removal



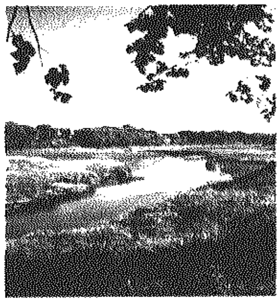
Progression of Frazee Pool

Spring After Removal



Progression of Frazee Pool

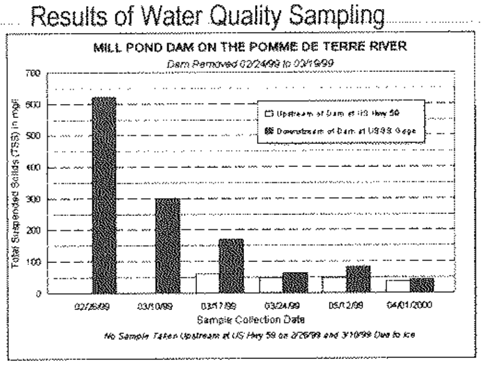
Summer After Removal



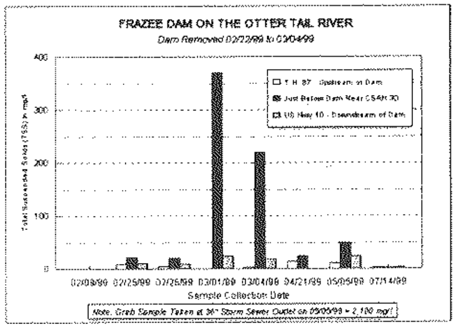
Impact of Dam Removal on Water Quality Was Measured

Total Suspended Solids (TSS) Concentrations were Measured Using a Depth Integrated Sampler

Results of Water Quality Sampling



Results of Water Quality Sampling

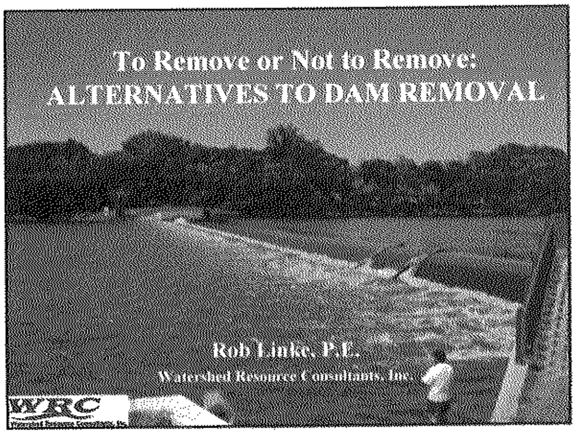


Comparison of Measured TSS Values

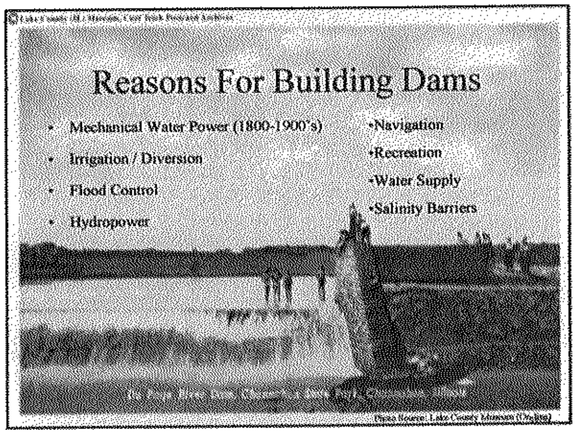
A Grab Sample Taken At Frazee (2,100 mg/l)

Conclusions – Tools Needed

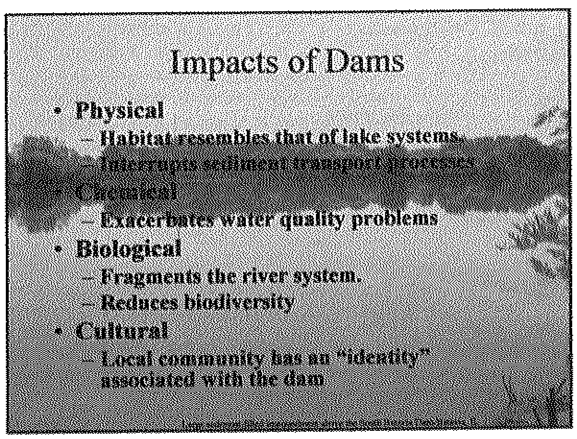
- Ensure Sufficient **Flexibility in Permitting Rules** to Treat Dam Removal as *a Component* of River Restoration /Management
  - Risk-Based
  - Site / Project Specific with an Understanding of Overall Goals
- Ensure **Flexibility in Funding** Allows Different Approaches
- Ensure Dam Removal **Design Incorporates a Specific Strategy** to Meet Specific Project Goals
- **Include a Monitoring Component of Dam Removal** - Collect and Publish More Data Regarding Dam Removal (Morphology, Short/Long Term Sediment Concentration, Fisheries, Macroinvertebrate, Water Quality, etc)



To Remove or Not to Remove:
ALTERNATIVES TO DAM REMOVAL
Rob Linke, P.E.
Watershed Resource Consultants, Inc.
WRC



Reasons For Building Dams
• Mechanical Water Power (1800-1900's)
• Irrigation / Diversion
• Flood Control
• Hydropower
•Navigation
•Recreation
•Water Supply
•Salinity Barriers



Impacts of Dams
• Physical
– Habitat resembles that of lake systems.
– Interrupts sediment transport processes
• Chemical
– Exacerbates water quality problems
• Biological
– Fragments the river system.
– Reduces biodiversity
• Cultural
– Local community has an "identity" associated with the dam

Reasons To Remove a Dam

- Improve public safety
- Restore fish passage
- Allow canoe / boat passage
- Mitigate water quality problems associated with the dam impoundment
- Dam owner unwilling / unable to pay cost of maintaining dam

Reasons To Consider Alternatives Other Than Total Dam Removal

- Limited funding
- Need to maintain current impoundment level (navigation, irrigation, recreational boating, etc.)
- Sediment contamination (potential negative impacts to downstream ecosystem)
- Opposition by local community (usually they are the stakeholder with the most "weight")

ALTERNATIVES

FISH LADDERS

ROCK RAMPS

BYPASS CHANNELS

A GENERAL COMPARISON OF ALTERNATIVES

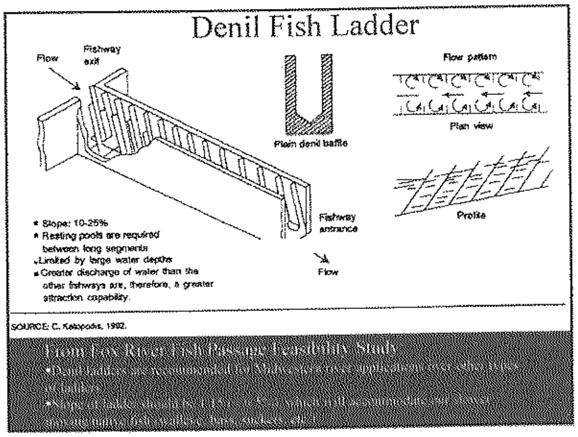
FISH LADDERS

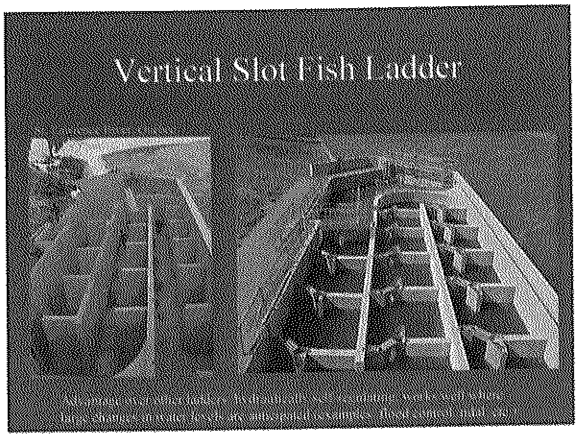
- Pool and Weir
- Denil
- Vertical Slot
- Alaskan Steeppass

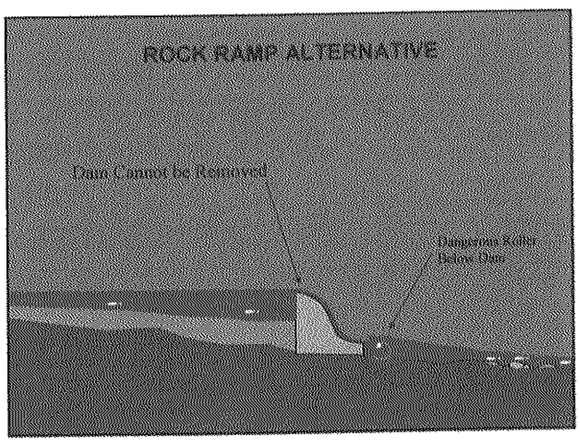
Ganaraska Fish Ladder

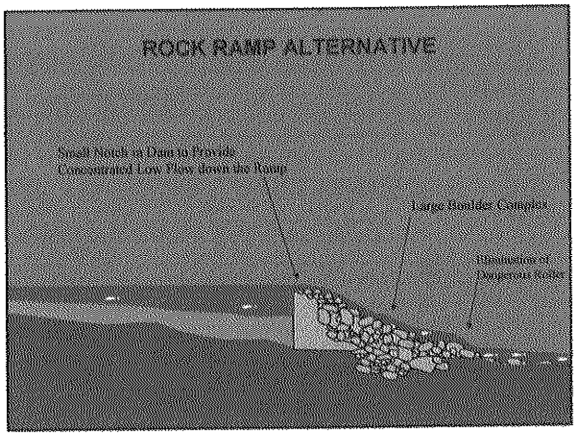
POOL AND WEIR
STYLE LADDER

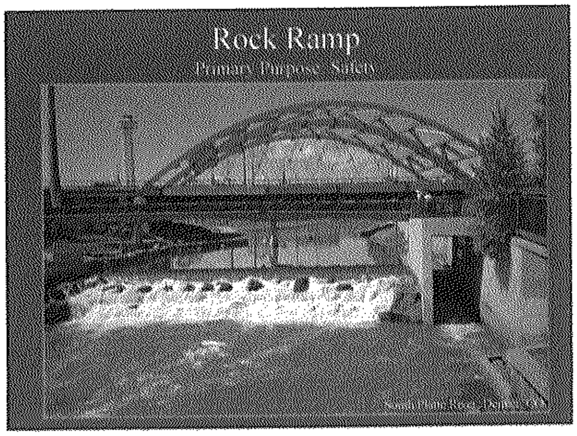
Source: Ganaraska Fishway Webpage

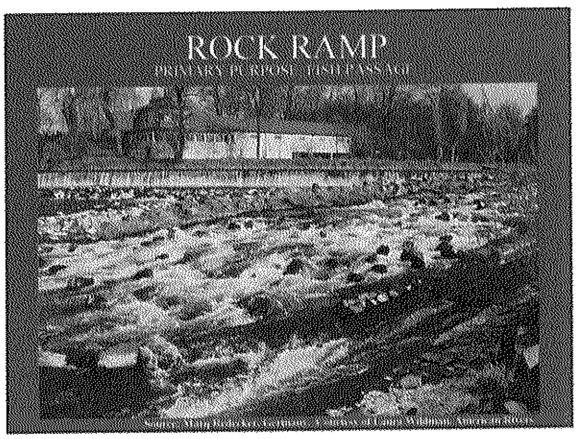

Denil Fish Ladder
Flow
Fishway exit
Plain denil baffle
Flow pattern
Plan view
Profile
Fishway entrance
Flow
• Slope: 10-25%
• Resting pools are required between long segments
• Limited by large water depths
• Greater discharge of water than the other fishways are, therefore, a greater attraction capability.
SOURCE: C. Katopodis, 1992.
From Fox River Fish Passage Feasibility Study

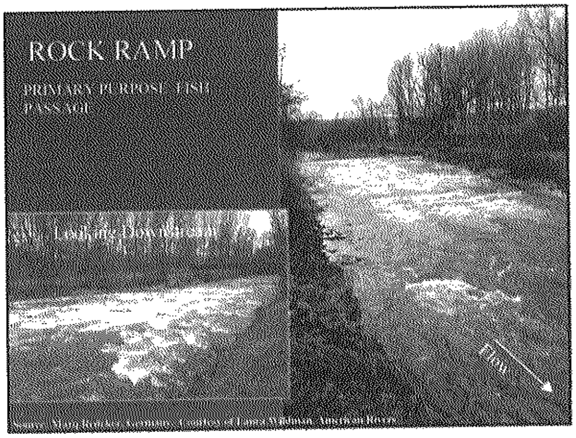

Vertical Slot Fish Ladder

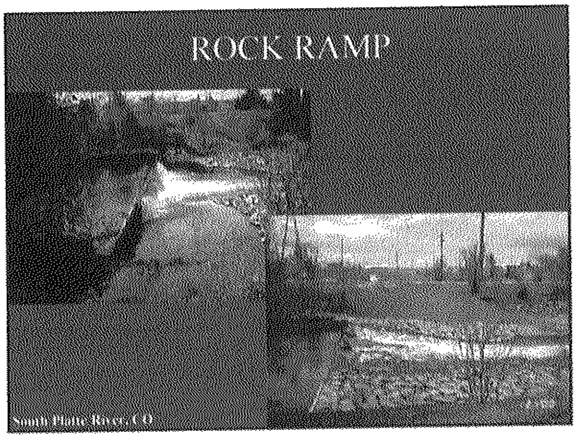

ROCK RAMP ALTERNATIVE
Dam Cannot be Removed
Dangerous Roller Below Dam

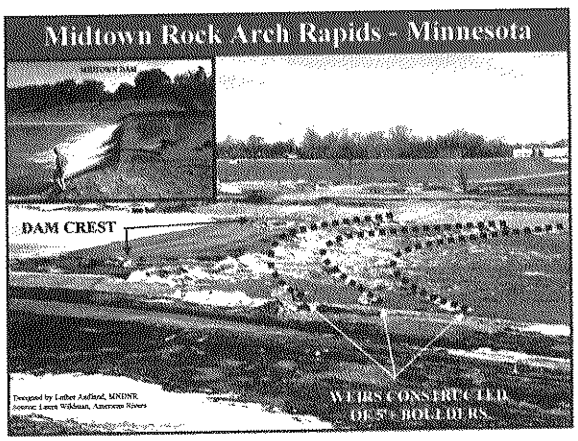

ROCK RAMP ALTERNATIVE
Small Notch in Dam to Provide
Concentrated Low Flow down the Ramp
Large Boulder Complex
Illustration of
Dangerous Roller

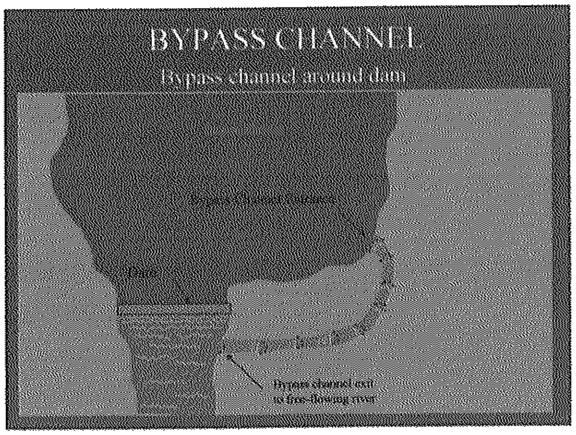

Rock Ramp
Primary Purpose: Safety

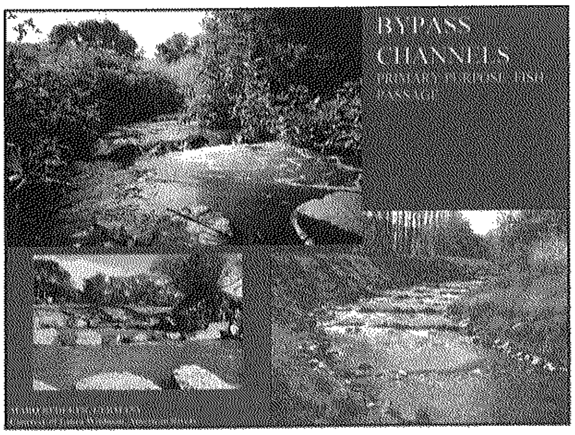

ROCK RAMP
PRIMARY PURPOSE: FISH PASSAGE

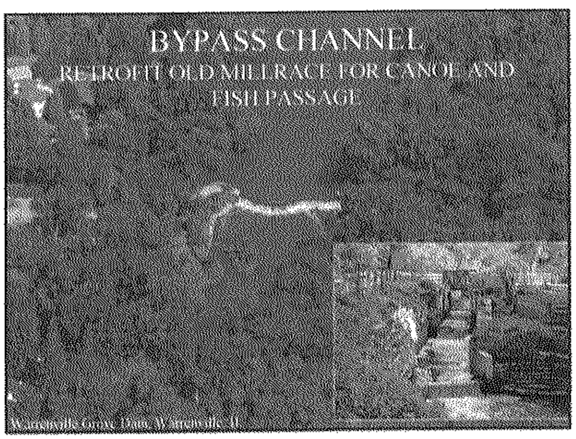

ROCK RAMP
PRIMARY PURPOSE: FISH PASSAGE
Looking Downstream
Flow

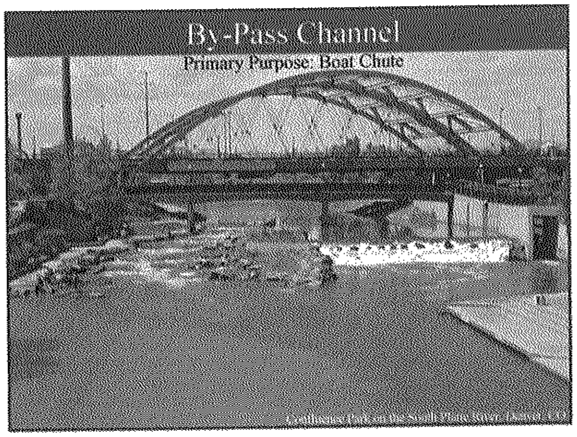

ROCK RAMP
South Platte River, CO

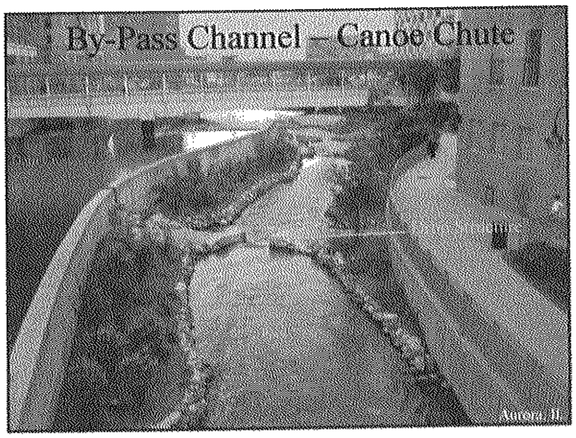

Midtown Rock Arch Rapids - Minnesota
MIDTOWN DAM
DAM CREST
WEIRS CONSTRUCTED OF 5'+ BOULDERS
Designed by Luther Aadland, MNDNR
Source: Laura Wildman, American Rivers

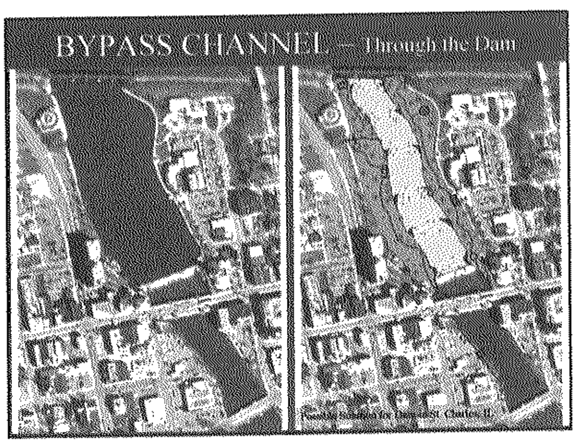

BYPASS CHANNEL
Bypass channel around dam
Dam
Bypass channel exit
to free-flowing river


BYPASS
CHANNELS
PRIMARY PURPOSE: FISH
PASSAGE


BYPASS CHANNEL
RETROFIT OLD MILLRACE FOR CANOE AND
FISH PASSAGE
Warrenville Grove Dam, Warrenville, IL


By-Pass Channel
Primary Purpose: Boat Chute


By-Pass Channel – Canoe Chute
Aurora, IL


BYPASS CHANNEL – Through the Dam

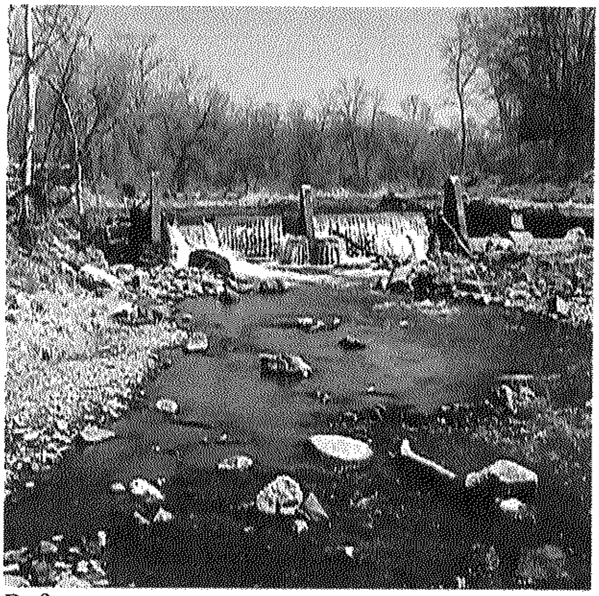
CONCLUSIONS

- There are alternatives to complete dam removal, however the costs to build them increase dramatically when the alternative is required to serve multiple functions (safety, fish passage, boat passage, etc.)
- Alternatives, unlike total dam removal, will require constant maintenance and manipulation to insure they function as intended
- Complete dam removal is usually the most cost effective alternative (lowest cost to meet the most number of objectives)
- Dam removal is a more "forgiving" option. Other alternatives can become major failures if errors are made during design or construction. Dam removal increases chances of a successfully achieving project goals

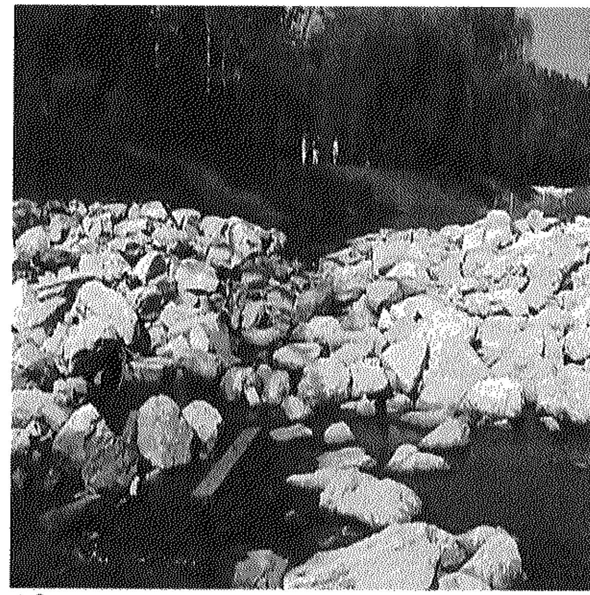
QUESTIONS

CURRENT DAM REMOVAL / RIVER RESTORATION PROJECTS IN ILLINOIS

Stone Gate Dam on Waubonsie Creek, Removed 1999

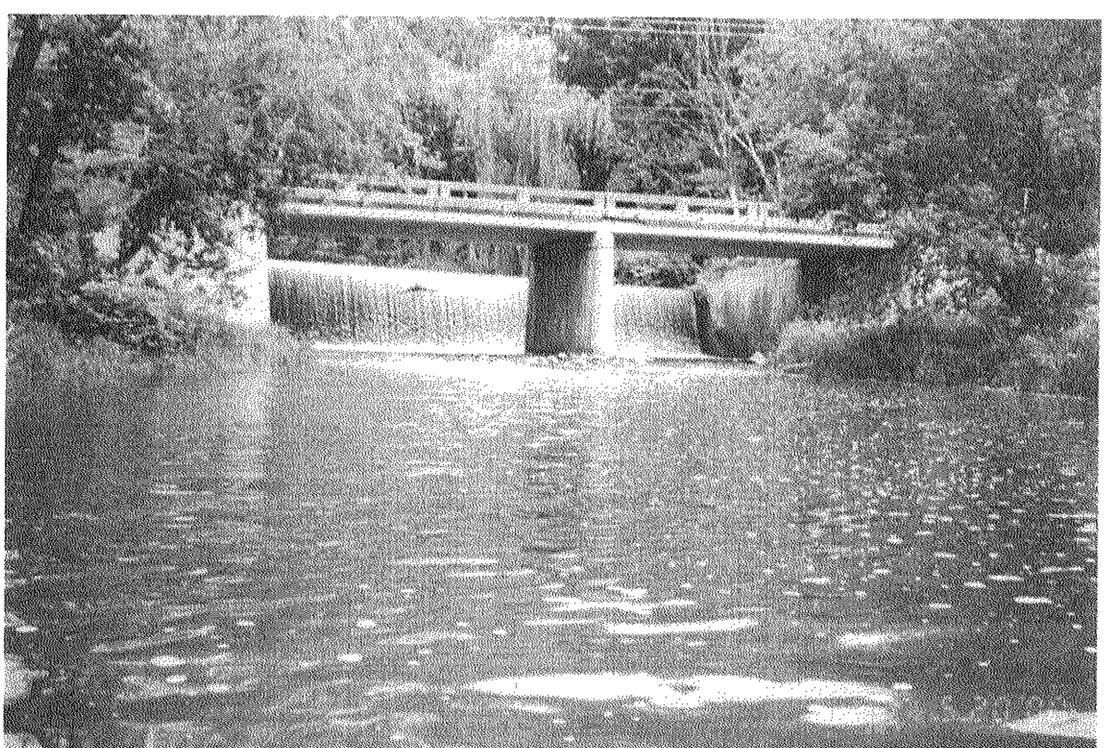


Before



After

Status: Initial removal & restoration was not entirely successful. The constructed riffle (above right) was modified in 2001 to allow for better fish passage.



Old stone dam on Blackberry Creek (Fox River Tributary) *Status:* Study Phase Completed. Full removal anticipated.

Sources: Steve Pescitelli, IDNR, and Natural Areas Ecosystem Management

CURRENT DAM REMOVAL / RIVER RESTORATION PROJECTS IN ILLINOIS

The following are pictures of dams that are in the planning stages of removal/modification. In some cases, the dams may not be totally removed, but instead will be modified to allow for fish and canoe passage.

Des Plaines River Dam Removal Feasibility Study for Three Dams

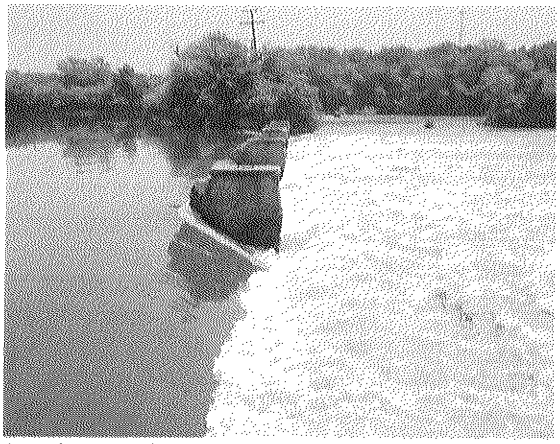
Hoffman Dam

Armitage Avenue Dam

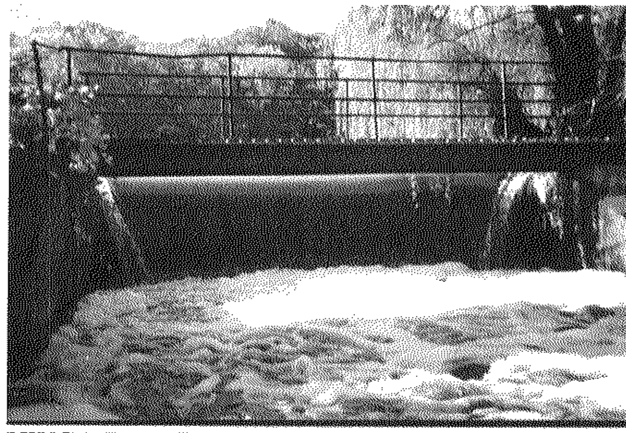
Fairbanks Road Dam

Sources: www.chicagopaddling.org & Steve Pescitelli, IDNR

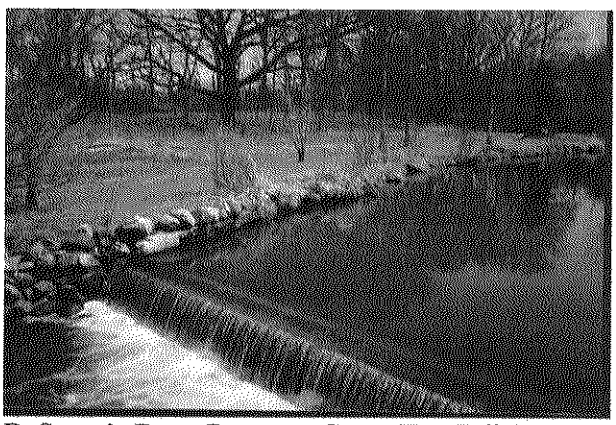
CURRENT DAM REMOVAL / RIVER RESTORATION PROJECTS IN ILLINOIS



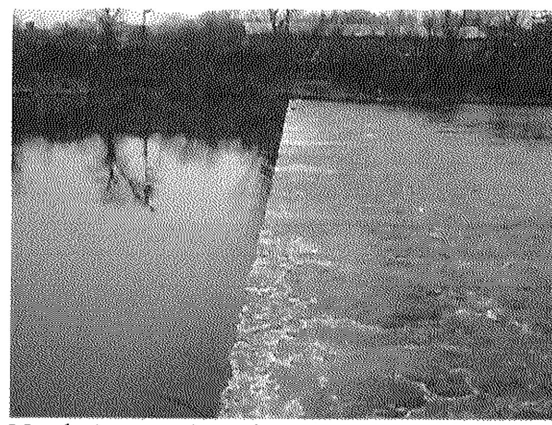
South Batavia Dam, Fox River
Status: Study Complete Removal in 2002?



YWCA Dam, Brewster Creek (Fox Trib.)
Status: Preliminary Engineering Phase



DeSanto's Dam, Brewster Creet (Fox Trib.)
Status: Removal Option Selected. Preliminary Engineering Phase



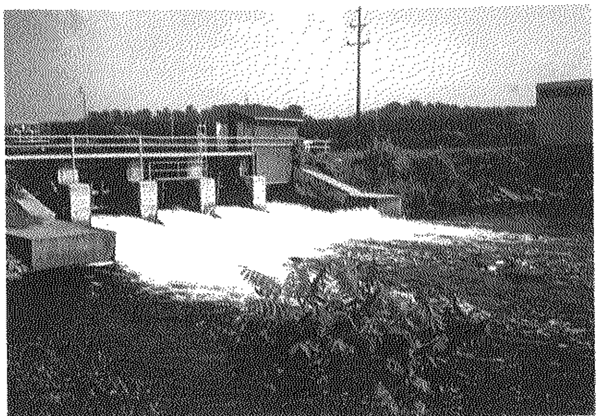
North Avenue Dam in Aurora, Fox River
Status: Removal Option Selected, awaiting funding and Final Engineering Plans

Yorkville Dam, Fox River **Status:** Study of the removal and rebuild options completed. City requesting modification option be considered.

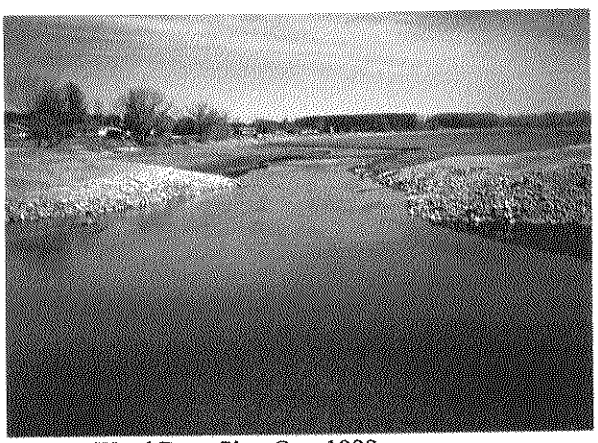
Upper Batavia Dam, Fox River.
Status: Removal Option selected. DNR to complete demolition & restoration plan

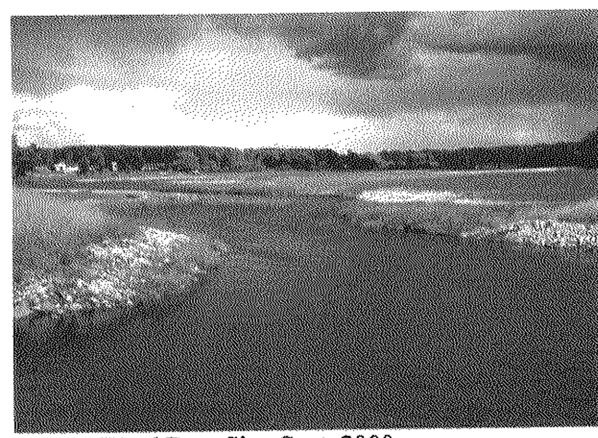
SUCCESSFUL DAM REMOVAL PROJECTS

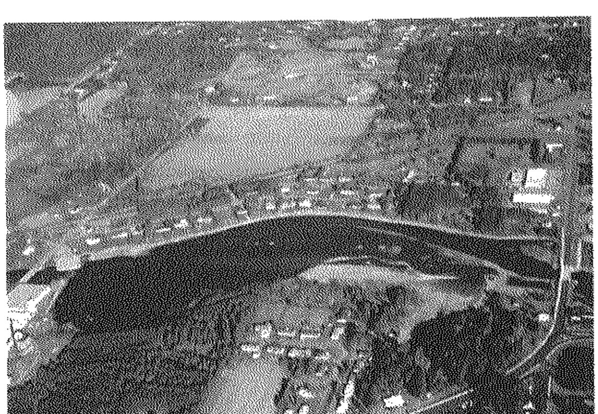
Ward Dam on the Prairie River, Wisconsin

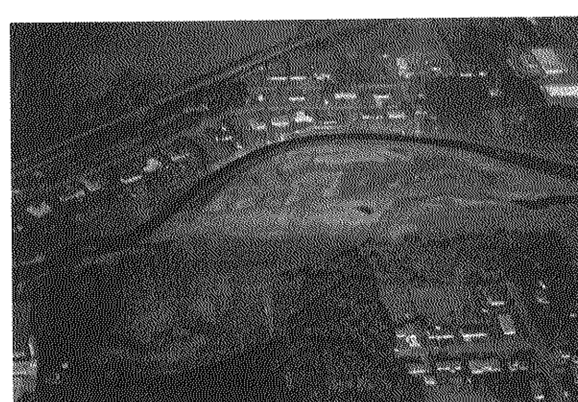

Ward Dam, just before removal, Sept. 1999


Ward Dam after initial breach, Oct. 1999


Former Ward Dam Site, Oct. 1999


Former Ward Dam Site, Sept. 2000

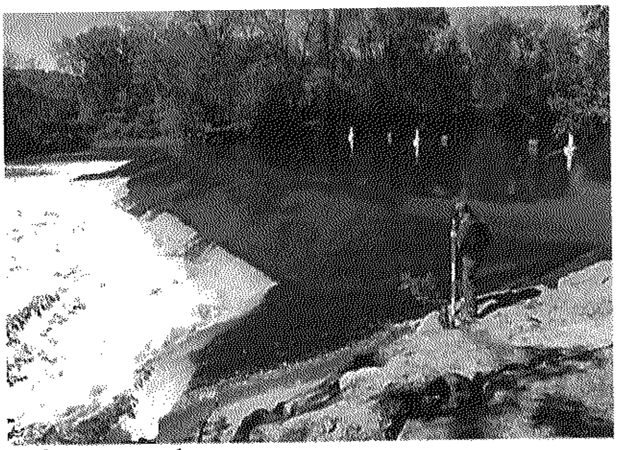

Aerial Photo of Ward Dam Impoundment immediately After drawdown, Oct. 1999

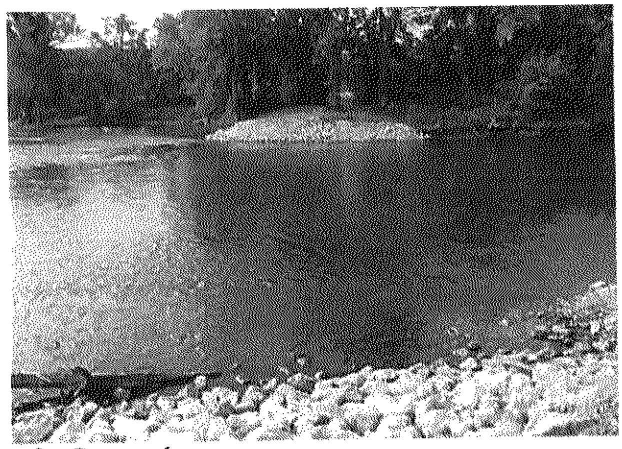

Aerial Photo of Ward Dam Impoundment, 1 year later in Nov. 2000

Source: Bob Martini, Wisconsin Department of Natural Resources

SUCCESSFUL DAM REMOVAL PROJECTS

Welch Dam on the Cannon River, Minnesota


Before Removal

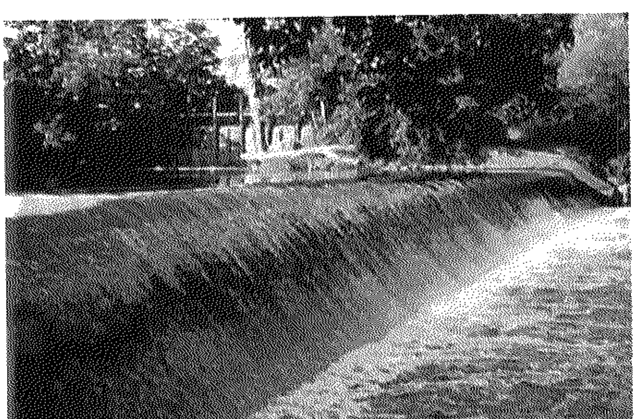

After Removal

Rock Hill Dam on the Conestoga River, Pennsylvania


During Removal


After Removal (Looking upstream into the former impoundment area)

Waterworks Dam on the Baraboo River, Wisconsin

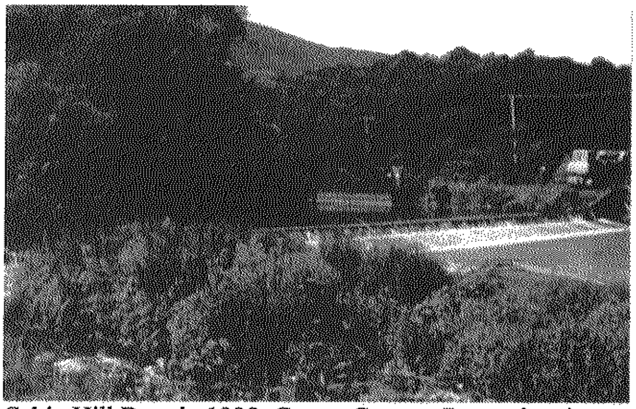

Before Removal


After Removal (Looking downstream; dam was located about mid-picture)

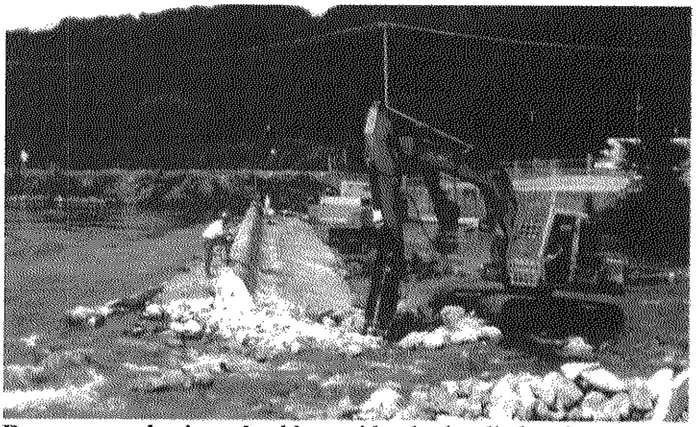
Source: Wisconsin River Alliance & American Rivers

SUCCESSFUL DAM REMOVL PROJECTS

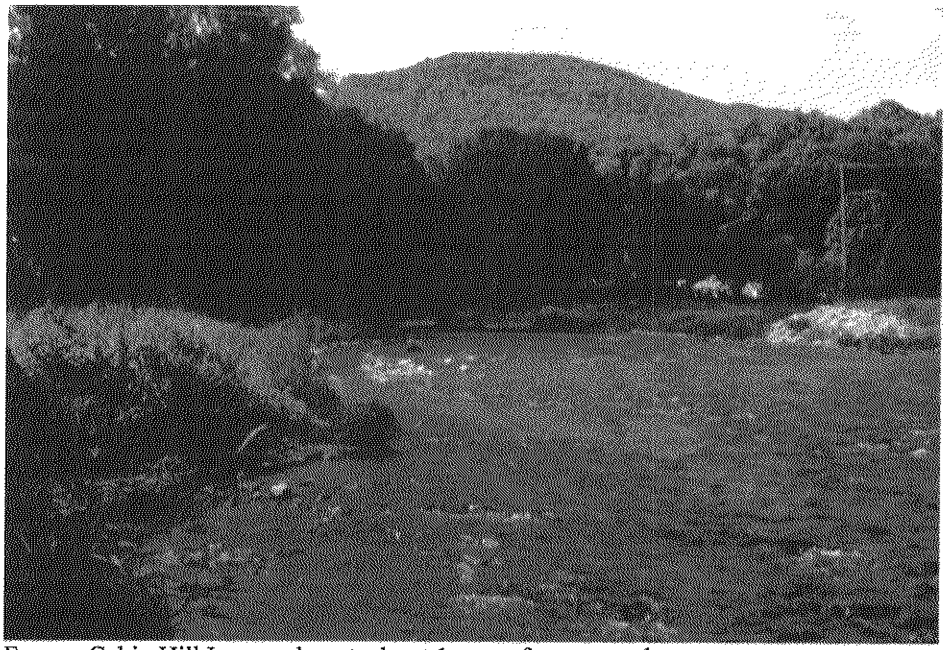
Cabin Hill Dam on Spring Creek, Pennsylvania
Removed 1998



Cabin Hill Dam in 1998; Centre County, Pennsylvania



Dam removed using a backhoe with a hydraulic breaker



Former Cabin Hill Impoundment, about 1 year after removal

Source: Scott Carney, Pennsylvania Fish & Boat Commission

Prairie River Watershed Restoration
By Bob Martini – DNR Rhinelander
March, 2001

Introduction – For almost 120 years the Prairie River has had up to four dams in its watershed. Over the past decade all dams have been removed. This report describes the removal process and lays the groundwork for documentation of the river's recover.

Description of the Watershed – The Prairie River Watershed contains approximately 223 stream miles of the Prairie River and its tributaries in north central Wisconsin. The watershed covers 234 square miles and drains to the upper Wisconsin River entering at Merrill. The water quality of the system is good with all but 11.0 miles of stream fully supporting its potential use classification. Over 94% of the classified stream miles are listed as cold water fisheries. About 75% of the watershed is wooded or wild with the rest in low density residential and agriculture. The mainstream of the Prairie River is 30.9 miles in length with medium hard, slightly acid clear water. Fish species present include brook, brown and rainbow trout, smallmouth bass, largemouth bass, northern pike, walleye, white sucker, redhorse, panfish and forage fish. The state record brook trout (9 lbs 15 ox.) was caught in the Prairie River in 1944. The Prairie River is one of Wisconsin's best trout streams known for its high quality angling experience. Mean annual flow at the Hwy. C bridge is about 180 cfs. The flood of record (1941) was about 5800 cfs.

Watershed History – Early European exploration of the area was related to the fur trade. Later, logging was the dominate activity in the watershed (1880-1900), followed by lumbering in later years. Both the Prairie River and Wisconsin River were used to transport logs and lumber to markets downstream. Several sawmills were built in the Merrill area, including one on the former Ward Mill Pond. Four dams were authorized by the Wisconsin Legislature in the 1880's for the purpose of driving logs on the prairie River. Two former logging dams (Ward and Prairie Dells) were also rebuilt for the generation of electricity around 1905.

The Ward Dam was built on the site of an earlier logging dam in 1905. The dam was authorized by Chapter 226, Laws of 1893 to John Conner for 21'head dam used to supply process water and generate electricity for a papermill on site. Its generation capacity was approximately 186 KW from 13 feet of head when the generators were abandoned in 1991. The dam was a 21-foot high earth and concrete structure approximately 675 feet long with five wooden tainter gates. The concrete structure was also a railroad bridge providing rail access to the paper mill.

The pond was approximately 118 acres, about 13 feet maximum-depth with 770 acre feet of storage capacity. In 1988 the owner of the Ward Dam attempted to secure a FERC (Federal Energy Regulatory Commission) license for the project. After consulting with WDNR and the USFWS, they abandoned their license application and FERC declared the project "non-jurisdictional" since the Prairie River was not a navigable stream. WDNR challenged this determination and proved the stream was navigable which resulted in a reversal of the FERC jurisdiction decision in 1994.

In May of 1998, the owner of the Ward Dam (International Papers, Inc.) applied to the Department for a permit to abandon and remove the dam. Their economic analysis showed that the cost of rebuilding, operating and maintaining the structure substantially exceeded the generation potential of the turbines. Factors in this decision included:

1. Cost of reconstruction was estimated at $1.5 to $2.0 million.
2. Reconstruction was necessary because of inadequate spillway capacity, severely deteriorated concrete, and decaying wooden tainter gates.
3. Cost of operation was about $50,000/year.
4. Value of electricity generation was about $34,000/year.
5. International Papers (IP) had closed the paper mill several years earlier and was interested in selling the entire property as soon as possible.

6. Presence of the dam was inhibiting the sale of the mill buildings which were adjacent to and part of the structure. As a high hazard dam, the dam break analysis showed part of the mill building downstream of the dam was below the flood shadow elevation and, therefore, could not be occupied without flood proofing.
7. In April, 1996 approximately $100,000 in damages caused by improper gate operation was paid to riparian homeowners by I.P. Removal of the dam solved several problems at once.

Between May, 1998 and the beginning of the drawdown on Labor Day weekend, 1999, there were nine legal challenges mounted by local residents to prevent the dam from being removed. During this time press coverage (radio, TV, newspaper) was extensive (weekly) and several hundred "save the dam" signs appeared throughout Lincoln County. Bomb threats were registered with the owner and people working on dam removal were threatened.

The actual drawdown began at midnight August 30, 1999, and proceeded at the rate of 1" per hour. During the first day, the rate was increased to approximately 6" per hour when it was observed that sediment was not being resuspended at excessive rates. The entire shoreline was inspected by DNR staff at least twice during the drawdown and approximately 200-500 mostly young-of-the-year fish were observed stranded in the shallows. Most of the fish were bullheads, bluegills and small panfish with a few small largemouth bass. The next day another series of legal challenges occurred which temporarily stopped the drawdown at about 6' below full elevation.

During September the exposed mudflats were seeded near the bridge and dam site. By October 1, over 100 seedlings/square meter were visible in the unseeded organic soil zone, and thousands of seedlings/square meter in the hydroseeded/mulched area. On October 1 one of the five gates and the adjacent apron was removed and by October 28 the coffer dam was removed allowing the Prairie River to run free for the first time in approximately 110 years.

By mid-November the entire structure had been removed and approximately 2400 lbs of perennial rye had been spread on about 60 acres of the 120-acre former flowage. The seeded are germinated and was visible as a light green growth by the first snow on November 19, 1999. By May, 2000 the entire former flowage was green with natural or seeded plants and by August the vegetation was so thick it was waist high and difficult to walk through in places. The most common wild pioneering plant species were smartweed, wild cucumber, grasses and sedges.

An urban stormwater management system was designed and built to convey stormwater from the old outfall to the new channel of the Prairie River. This system utilizes three permanent shallow wildlife ponds to settle sediment and absorb energy and approximately 3000 feet of vegetated waterways that filter the stromwater before it enters the Prairie River.

In February, 2001 local units of government (City of Merrill, Town of Merrill and Lincoln County), DNR and a long list of partners began planning habitat restoration and recreation facilities for the dewatered former 120-acre pond. Most of the land formerly inundated by the Ward Dam was donated by International Papers to the City of Merrill for public recreation and habitat enhancement.

The estimated cost of removal and seeding was approximately $250,000 but that figure included the cost of an attempt to save the railroad bridge that was built into the dam structure. By the time it was determined that the bridge was not salvageable, significant costs had been incurred. The original removal estimate (without bridge salvage) was about $95,000.

Most of the organic sediment remained in place after the drawdown. Only the fine material from the submerged river channel moved downstream. No complaints were received about sediment accumulation in the downstream parks and no problems with sediment accumulation were observed by DNR staff.

Fish habitat enhancement for warmwater, coolwater and cold water fish communities is planned for a four-year period beginning in 2001.

Prairie Dells Dam – The next dam upstream from Ward was the Prairie Dells Dam. Mr. T.B. Scott was authorized by Chapter 151 Laws of 1880 to build a dam of 72' head in Section 13, Township 32N, Range 7E, for the purpose of driving logs downstream to the Wisconsin River. In 1904-05 the dam was rebuilt as a hydroelectric dam with a head of about 65 feet. The engineer for the project made a decimal error in the calculation of flow, storage, and hydroelectric generation potential which was not discovered until the structure was completed and the turbines were built. The turbines were moved to another dam on the Wisconsin River but the Prairie Dells Dam was allowed to stand without serving its intended purpose or generating power for almost 90 years.

In 1980, dam safety engineers determined the structure was unsafe. The owner (Lincoln County) spent almost $500,000 trying to repair, redesign and reconstruct the dam before deciding that the cost was too high. The dam was breeched to relieve water pressure and reduce the hazard in 1983. In August, 1991 the dam was removed by blasting and backhoe.

The estimated sediment accumulated in the channel above the dam was approximately 20,000 cubic yards in the 2.6-mile long pond (122 acres). A sediment trap was installed downstream of the dam to prevent sedimentation of downstream habitat. Approximately 20,000 cubic yards of sediment were removed over a three-year period. Considerably more sediment moved downstream and filled an area of Ward Pond which held 5-6 feet of water in 1972, but only had 2-3 inches of water by 1999 when the Ward Dam was removed. By 1995, the boulder area downstream of Prairie Dells Dam which had been covered by 2'-3' of sand from dam removal was again free of sediment.

Key elements of the project included:

1. No vegetation management was undertaken other than to scatter some rye grass seed after removal near the dam. The entire pond area was quickly revegetated by natural plant colonization.
2. Water temperatures were cooler in summer and warmer in winter after dam removal.
3. Fisheries surveys conducted in 1999 after all dam removal scars had healed found a thirty-fold increase in young-of-the-year brook trout below the former dam site.
4. A destination-type canoe and kayak whitewater area 2.5 miles long was restored by dam removal.
5. Plans for hiking trails and other recreation facilities are completed for the publicity-owned surrounding watershed.
6. Mayflies, stoneflies, caddisflies, and kayakers recolonized the high gradient (75' of drop over 2.5 miles) restored river the summer after the dam was removed.
7. Estimated cost of reconstruction was over $1 million and the cost of removal was approximately $200,000.
8. Regionally significant vistas at the Dells were restored.

Remnant Logging Dam – After the Prairie Dells Dam was removed, the remains of an old logging dam upstream reappeared. The dam was authorized by Chapter 55, Laws of 1901 to Mr. Emil Thomas in Section 12, Township 32N, Range 7E, of Lincoln County for the purpose of driving logs and manipulating water flows for log drives.

The sill of the remnant dam impounded about three feet of head but was so deteriorated that gaps and holes in the structure creating a hazard that could act as strainers to trap boaters or waders in the area. The impoundment warmed the water in summer and the structure was a barrier to fish passage. The sill logs were removed by DNR fish crews in October, 2000 to eliminate the impounded area, remove safety hazards and restore unimpeded fish movement. The rest of the structure (abutments, apron supports, etc.) remains in place.

Logging Dam – The fourth and final dam on the Prairie River was authorized by Chapter 255, Laws of 1880 to Mr. Able Neff in Section 14, Township 33N, Range 8E, for log driving. Although this dam was to have a head of up to 20 feet, it either was never built or evidence of the structure was washed away after abandonment. No sign of the dam remains today.

What did we learn from the Prairie River Restoration Process? – Over the past 20 years, three dam removal projects on the Prairie River have improved habitat, allowed free passage of fish and mussels to over 225 miles of the Prairie River and its tributaries, increased brook trout reproduction thirty-fold, restored important aesthetic and whitewater boating resources, and saved the taxpayers millions of dollars in dam repair, reconstruction, and operating costs. This river is a microcosm of dam issues statewide.

State law requires a dam safety inspection at least once every 10 years for all large dams. Because of a shortage of dam safety engineers, this frequency has slipped to about once every 17 years in reality.

In contrast, FERC licensed dams are required to be inspected annually with a more thorough engineering analysis paid for by the dam owner every 5 years. Due to infrequent inspections, a dam's natural enemies (water, ice, gravity and economics) often cause damage that goes unreported and unaddressed for over a decade. When a Department dam safety engineer finally visits, there are often multiple deficiencies to correct. Common problems include downstream floodplain riparian development, inadequate spillway capacity for flood protection levels required in state statutes, steel and concrete damage, inoperable gates, erosion, woody vegetation on dikes, seepage, excessive settling and operation problems. Dam owners often neglect routine maintenance and fail to recognize that dams have a limited design life.

Many dam inspection reports list a dozen or more deficiencies which the owner is often ordered to correct. Compliance schedules as long as 10 years may be granted but essential repairs may be required immediately for major safety concerns. Since most dams under state authority do not produce hydropower (and consequently, do not create a revenue stream) the owner is faced with a "remove or repair" conundrum. Since repairs often involve major reconstruction of the structure, the owner can easily face unanticipated costs ranging from hundreds of thousands to millions of dollars. When the owner concludes the cost is unjustifiable or unobtainable, the problem often becomes a major community issue.

Communities often have difficulty dealing with dam "repair or remove" decisions for several of the following reasons:

1. Many people have fond and direct memories associated with the impoundment formed by the dam. In most cases, no one in the community remembers the pre-dam condition of the river and they have difficulty accepting that a healthy riverine ecosystem could be re-established. Wisconsin has been a national leader in its attempts to build public support for the value of lakes and then need to preserve shorelines. This successful program coupled with the ancient human affinity for water views and benefits, creates a strong emotional bond between people and their local waterbody. When a dam is proposed for removal, the local citizens individually and collectively pass through the classic stages of grief make it difficult to communicate the complex engineering, dam safety, environmental and economic issues necessary to resolve the "repair or remove" question. Some people never get past the early stages of grief.

2. Most people are unfamiliar with basic engineering concepts, probability (e.g. regional flood forecasting), economic principles, and environmental analysis techniques which can inhibit rational communication and collective decision making. Several "myths" of dam removal invariably surface:

- The idea that the dam will no longer provide flood control, in spite of the fact the structure never had any flood control capacity to begin with (the dam may actually make major floods worse due to the limited spillway capacity and the potential for dam failure;
- The mistaken belief that the river will dry up if the dam is removed because "the river's water comes from the pond" formed by the dam;
- The misconception that dam removal will create unvegetated mud flats that will remain unsightly for years.

3. Many people do not understand or accept the need for basic dam safety features required by law e.g., spillway capacity needed to withstand a regional flood, structural monitoring, concrete repair and maintenance. When faced with an unsafe dam they often cannot believe how expensive dam

repairs can become. They occasionally accuse the Department of inflating repair costs estimates to favor dam removal. In most cases, high cost repairs are not offset by revenue; therefore, repair funds are sought from various units of government. A recent University of Wisconsin study found that in Wisconsin cases over the last 20 years, the dam repair option was often four to five times as expensive as the dam removal option.

4. Interests with riparian ownership or potential to profit from the existence of a lake may exaggerate perceived problems associated with dam removal to create opposition to the dam removal option. The following issues are examples of misconceptions or problems recently used to argue against dam removals in Wisconsin.

    - Stormwater management from city streets will be difficult and expensive.
    - Undesirable vegetation will take over the dewatered bed.
    - Blastomycosis (a fungal lung disease) cases will increase in the area.
    - The cost of removal in higher than the repair cost.
    - Fish will die.
    - Flooding will increase.
    - The river will dry up.
    - Social problems (beer parties, crime, litter, etc.) will occur on the dewatered bed.
    - The area will be "unsightly" for years.
    - Wells will dry up.
    - Downsteam parks will be flooded and covered with sediment if the dam is removed.
    - Eagles will relocate, beavers will dam the river, migrating birds will not have a place to rest.
    - Property values will decline; tax base for schools, etc. will erode.
    - Endangered species and other wildlife will be adversely affected.

For each issue listed above, an environmental analysis conducted by the Department showed that the perceived problems in the Prairie River watershed would not occur or could be mitigated if proper management practices were included in the dam removal plan.

On the other hand, several dam removal environmental analyses conducted recently by the Department in the Prairie River Watershed and at locations all over Wisconsin have identified the following advantages for the selective removal of unsafe dams:

- Cost to taxpayers is lower than reconstruction and long-term care.
- "Dam break" flood hazards are eliminated thus reducing flood insurance costs and damage potential.
- Fish movement is allowed for the first time in many decades (in most cases).
- "Overlap fisheries" are developed; coldwater, coolwater, and warm water fish communities occur at different times in the same river reach.
- Aquatic biodiversity increases above and below the dam.
- Water quality improves (temperatures are lower, dissolved oxygen is higher).
- In some cases, formerly riparian property values can increase depending on the type of recovery plan developed for the land created by draining the pond.
- Public access and recreational uses increase if the exposed lakebed is developed into a park or is donated to local units of government.
- The "river continuum concept" is restored allowing the river to perform its normal functions including sediment movement, fish migration, carbon movement, habitat maintenance, wetland enhancement, and flood attenuation.
- Fish and other aquatic species are able to move to seek their various seasonal, daily or life stage habitat needs. Fish communities are more stable as a result of habitat accessibility.

In spite of the above advantages of dam removal, there are cases where removal is not the preferred option. If anyone comes forward with the financial, engineering and long-term ownership capabilities required for dam ownership, under Wisconsin law that person is entitled to apply for a permit to own and maintain the dam. In some cases, dam removal will alter the hydraulic properties of a river enough to cut new channels which could resuspend entombed toxic materials in currently vegetated alluvial sediments. Some public safety, water quality or wildlife habitat situations might favor dam repair if funds are available to upgrade the structure. If the value of the pond created by the dam is truly as high as dam removal opponents claim, then it follows that the political process will authorize the necessary public repair funds which were not available from private sources, including the owner.

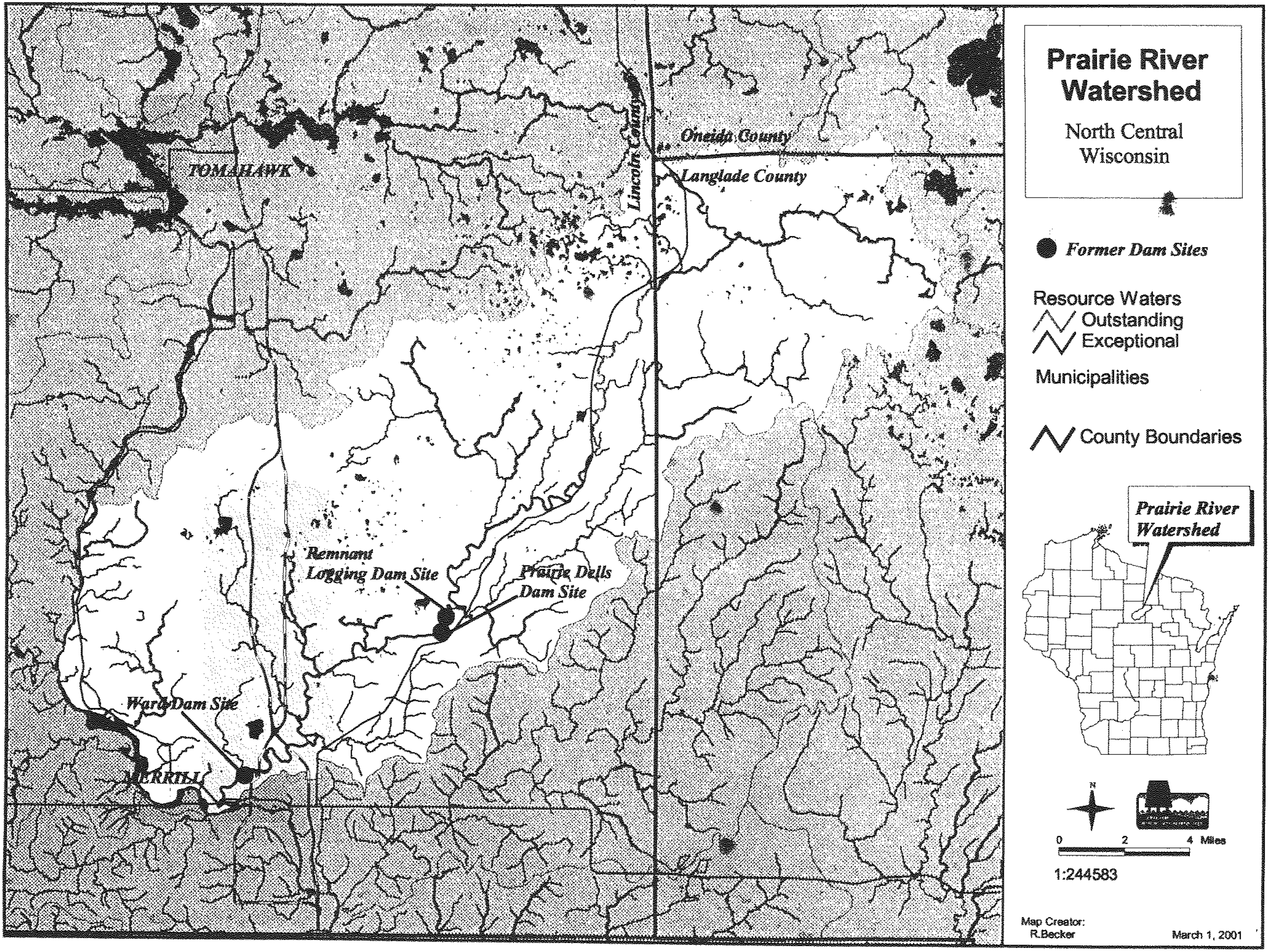
The mechanism for addressing these difficult issues is the public involvement process. Most dam "repair or remove" questions are not resolved until several public meetings, hearings and information sessions are held. Press coverage is usually extensive. Involvement of local and state elected officials is a feature of virtually every case. Multiple state and local agencies are involved. Up to a dozen legal challenges per dam removal have occurred. Organizations such as the River Alliance of Wisconsin and Trout Unlimited are involved in most cases to provide information and a statewide perspective which can often be lost in the heat of a local battle.

Wisconsin has been involved in many dam removal decisions over the past few decades. Some of the following lessons we have learned from the Wisconsin dam decommissioning experience may also be applicable to other areas:

1. Don't underestimate the depth of feeling people have about their local waterbody. Extensive public involvement is essential to the local decision making process, but even the best public involvement may not overcome all participants' anger, frustration and resentment over dam removal. (Threats and personal intimidation have occurred in some cases.)
2. Each case has site-specific issues, problems and characteristics. Dam removal policies need to be flexible, data driven and selective, not general in scope.
3. Most dam removal cases will consume all the staff time available and tasks will still go undone. The actual removal process requires on-site, daily oversight by engineering and biological professionals to address unforeseen problems.
4. An adequate dam safety inspection and data management system is essential to choose those sites with high habitat benefit potential from among the numerous dams that don't meet safety standards.
5. An interdisciplinary basinwide approach is necessary to choose and plan dam removal candidates which are unsafe, unlikely to be rebuilt, and will result in the most Public Trust benefits.
6. Now that gross water pollution problems have largely been addressed in Wisconsin (over 90% of point sources meet or exceed Clean Water Act standards), many aquatic biologists believe there is nothing river managers can do to improve aquatic habitat more effectively than selective removal of unsafe dams.

Acknowledgements: Over the past 10 years, people from more than a dozen DNR programs have participated in the Prairie River Restoration Project. During the Ward and Prairie Dells dam removals, DNR staff were on site at least 35 consecutive days. The following people played a major role: Dan Peerenboom, Gary Bartz, Bob Martini, Mitch Zmuda, Dale Lang, Al Hauber, Max Johnson, Pete Segerson, Dave Seibel, Mike Cain, Meg Galloway, Rich Wissink, Chuck Fitzgerald, Ron Becker, Dave Heath, Scott Watson, and staff from the Merrill and Antigo offices.

The River Alliance of Wisconsin and Trout Unlimited both testified at the Ward Dam Hearing and have pledged assistance to the restoration efforts at Ward and Prairie Dells.



Prairie River Watershed
North Central Wisconsin
Former Dam Sites
Resource Waters
Outstanding
Exceptional
Municipalities
County Boundaries
Prairie River Watershed
0 2 4 Miles
1:244583
Map Creator: R.Becker
March 1, 2001
Oneida County
Langlade County
Lincoln County
TOMAHAWK
MERRILL
Remnant Logging Dam Site
Prairie Dells Dam Site
Ward Dam Site

Life in the Fast Lane

An Urban Perspective on Dam Removal

John Nelson,

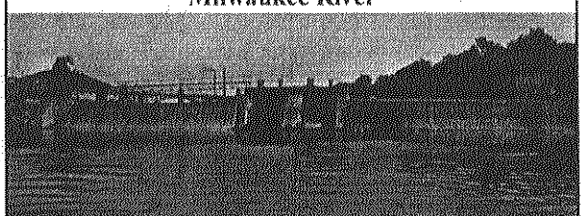
Senior Fisheries Biologist

Major Points

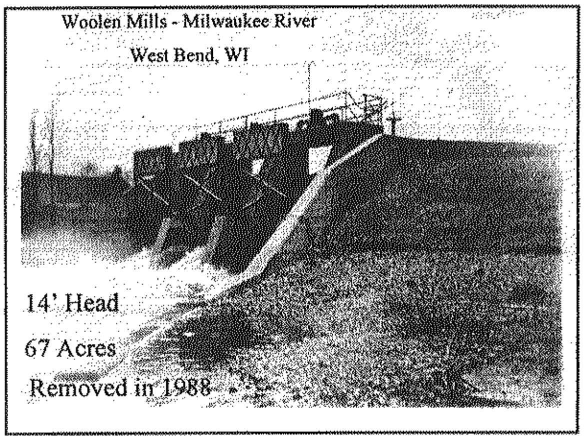
- Define Urban vs. Rural
- Urban Challenges and Opportunities
  - Communication
  - Politics
  - Urban Renewal
  - Recreation
  - Contaminants
  - Biology

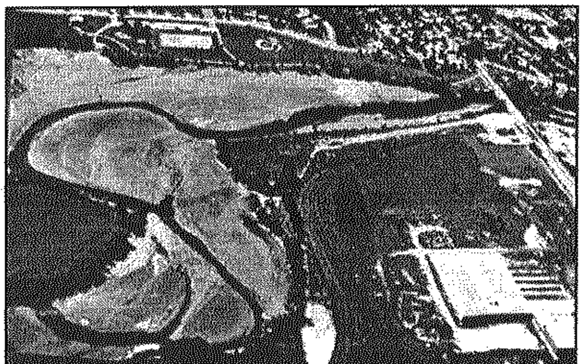
North Ave. Dam, Milwaukee

Milwaukee River



Breached in 1997





West Bend, WI Population = ~28,000

Milwaukee Metro Area Population = ~1 million

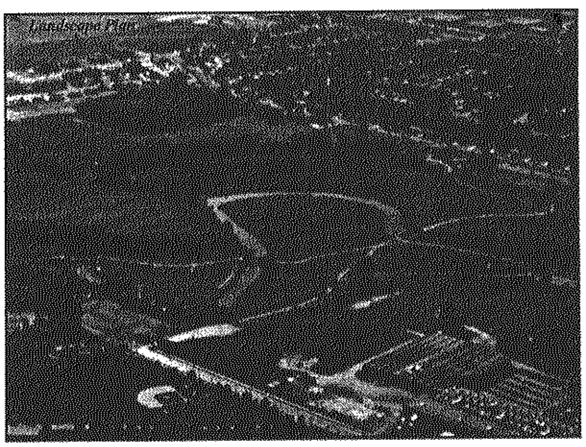
Communication with Media

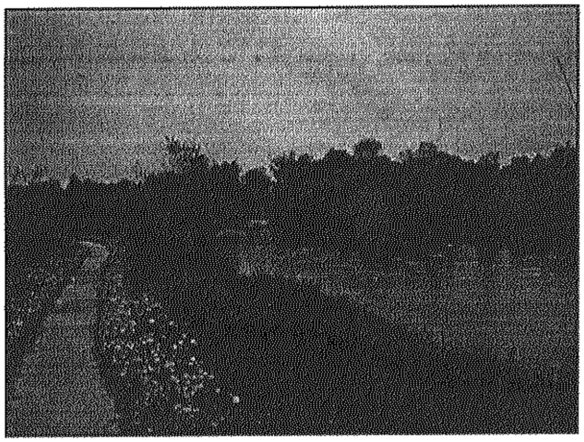
- Television
- Radio
- Print
- Designate a Media Contact !!!

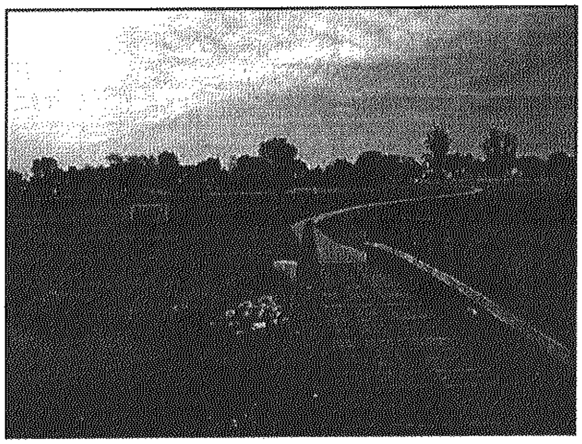
Political Involvement

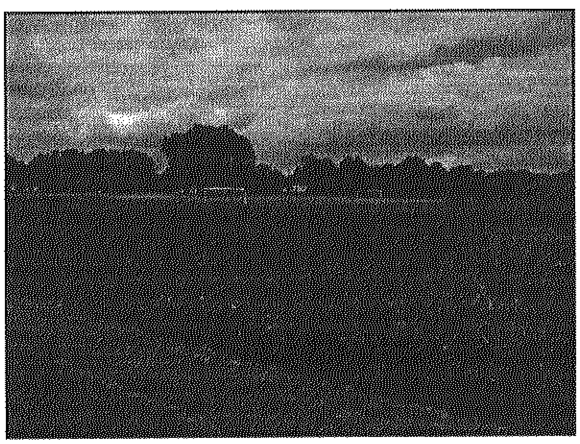
- Levels of Involvement
- Early Contacts
- Concise & Accurate Info
  - Who
  - What
  - Why
  - Economic Issues
  - Safety Issues

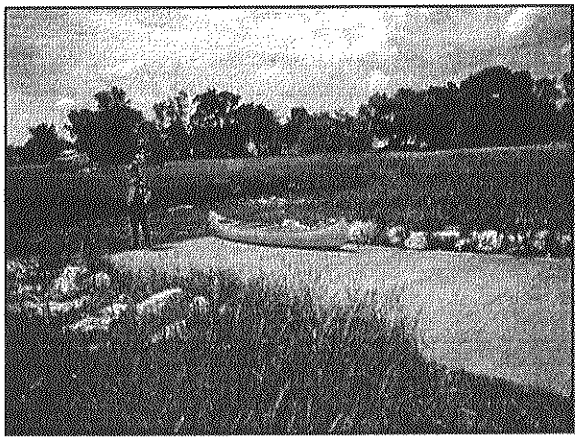
Milwaukee Journal/Sentinel Photo

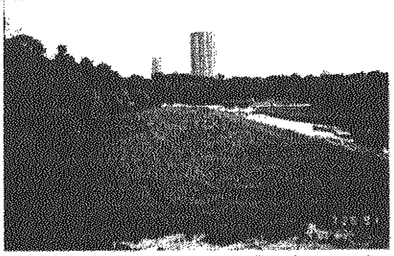








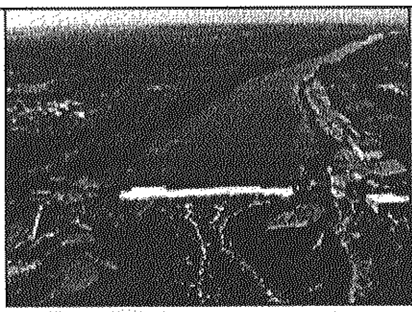




North Avenue Dam - Prospective Development Area

Feasibility Study Ideas:

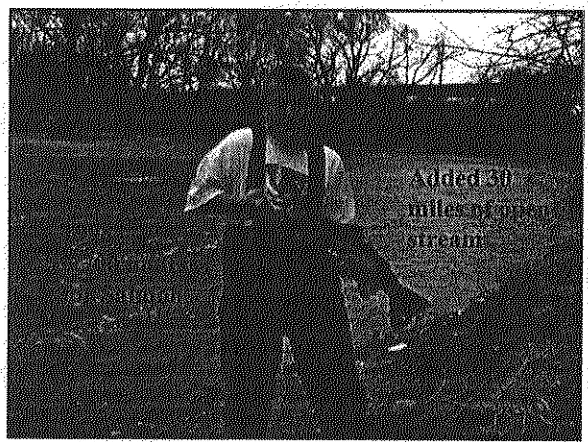
* *Trails*
* *Foot Bridges*
* *Overlooks*
* *Canoe Launch*

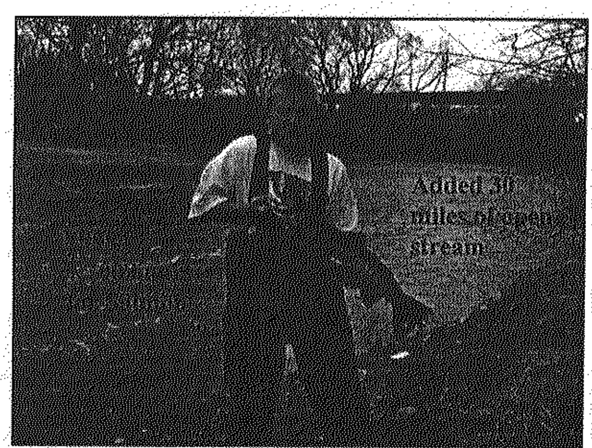


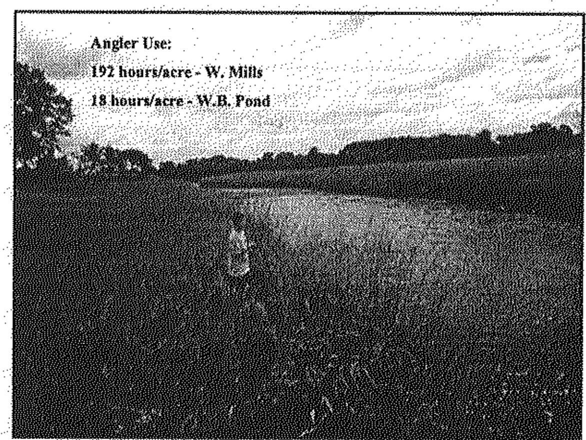
Edwards Dam in Augusta, Maine

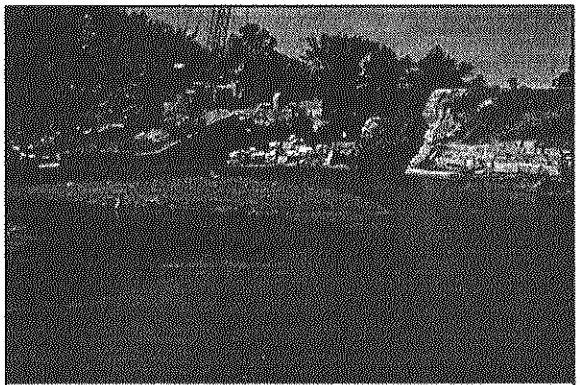
Tourism, Park Development, Riverfront Development, Recreational Facilities

AP Photo by Robert F. Bukaty

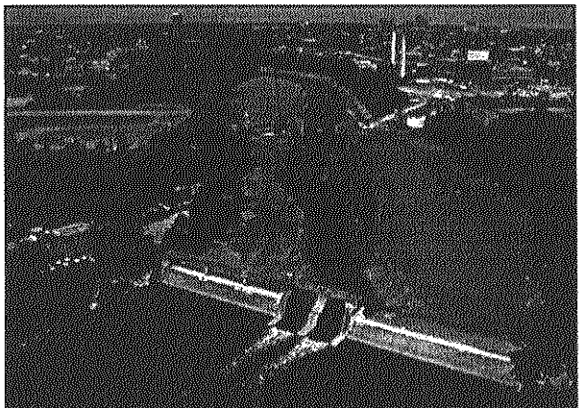

Added 30
miles of open
stream


Added 30
miles of open
stream


Angler Use:
192 hours/acre - W. Mills
18 hours/acre - W.B. Pond

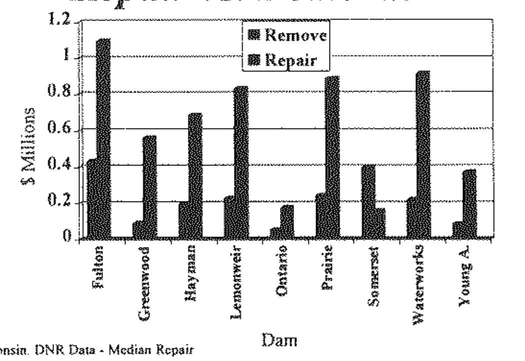


Woolen Mills - Rebuild = $3M - Remove = $87K plus development



North Avenue Removal Cost = $3M

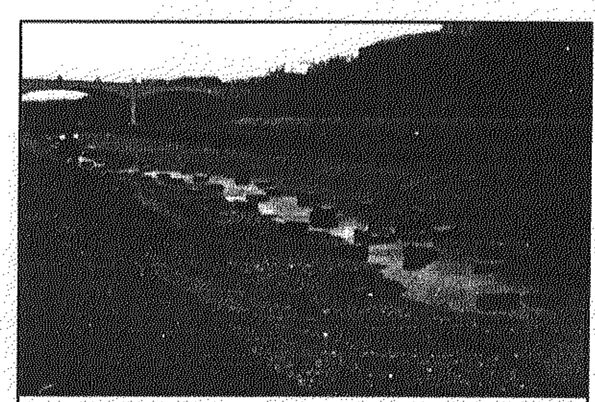
Repair vs. Removal



Wisconsin DNR Data - Median Repair Est. vs. Actual Removal Cost

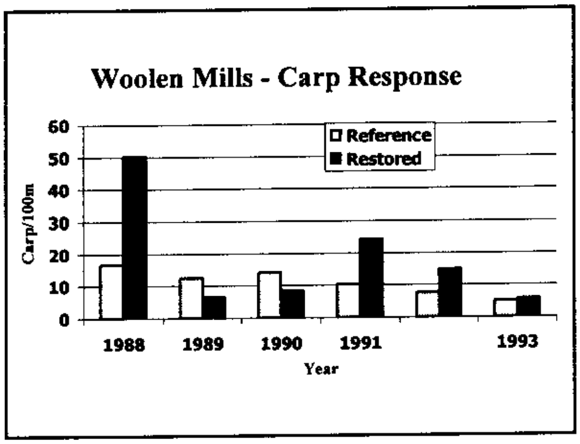
Woolen Mills Contamination

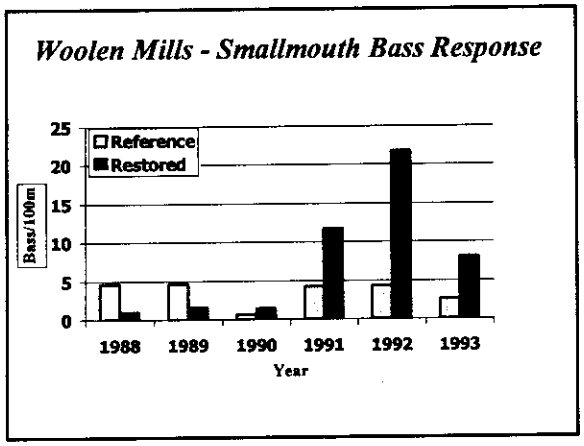
- Two former landfills on banks
- Leachate - Heavy Metals and Iron
- Capped
- Problem Solved



Baraboo River - Baraboo, WI

Coal Tar Contamination

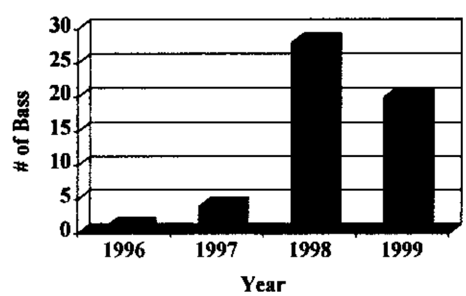




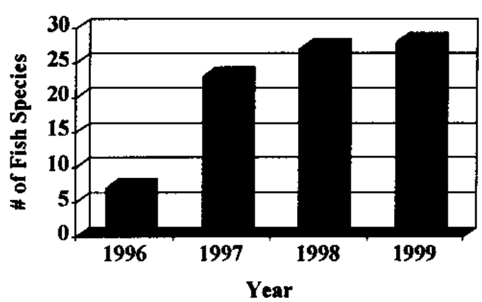
Woolen Mills IBI Scores

- Significant Increases in former impoundment between 1988 and 1993
- Little Change at Reference Sites
- Greater Diversity, fewer tolerant species, & more catostomids

North Ave. Smallmouth Bass



North Ave. Fish Species Count



Summary
Challenges & Opportunities

- Communication is Important and Intense
- Involves Politics
- Urban Renewal
- Recreation Increases
- Contaminants often an Issue
- Results in a Healthier Ecosystem

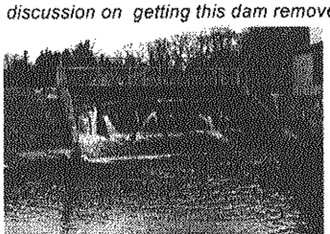
Empowering the Local Community in the Dam Decision-making Processes

River Alliance of Wisconsin

Helen Sarakinos
Small Dams Program Manager
River Alliance of Wisconsin

The Central Question

"There's a dam in my community that doesn't operate and is falling apart. How can I start a serious discussion on getting this dam removed?"



Amherst Dam, Waupaca River, WI

Overview

1. Why is Citizen Involvement in Dam Decision-making Needed?
2. Do Your Dam Homework
3. Issues to Consider
4. Tools to Use for Dam Removal
5. Develop a Strategy
6. After removal: It ain't over till the community sings…

Why is Local Involvement in Dam Decision-making Important?

- Community decisions to repair or remove a dam are often made with incomplete and inaccurate information;
- Knowledge = Power;
- Local voices reflect local views (more legitimate).

Do Your Dam Homework

- Observe and Record the Dam's Condition, Operation and Impact

Shopiere Dam, Turtle Creek, Wisconsin

...Homework, con't

- Get the Facts
  - regulatory jurisdiction (State or Federal)
  - ownership
  - inspection history
  - affected properties

Issues to Consider Regarding Dam Removal or Repair

- Environmental
- Economic
- Engineering
- Societal

Environmental Issues

- Are species of concern affected?
- What types/ how much habitat improvement or alteration will occur?
- Will removal promote undesirable species?

Economic Issues

- Economic benefits and costs of retaining vs. removing the dam and impoundment?
- Short- vs. long-term costs/benefits.
- How will property values be affected?
- Who will pay?

Engineering Issues

- What is the dam's physical condition?
- What is the size, type, age of dam?
- How much sediment is present?
- How accessible is the dam?
- Any creative and feasible alternatives?

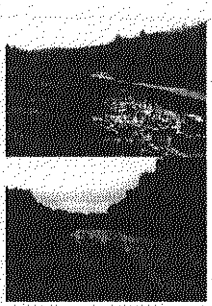
Societal Issues

- Are there historical factors involved?

Former Waterworks Dam impoundment, Baraboo River, Wis.

Societal Issues, con't

- What are the aesthetic concerns of the community?



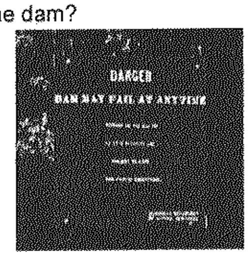
Former Willow Falls Dam, Willow River, WI
TOP: 1 month after removal
BOTTOM: 6 months after removal

Societal Issues, con't

- How many homes or businesses are on the impoundment?
- Who will own the exposed lands?

Societal Issues, con't

- What are the safety concerns of keeping or removing the dam?



Tools to Use In Pursuing a Dam Removal

- Economics
- Public Safety Laws
- Environmental Quality Issues
- Public Trust Doctrine

Economics as a Tool

Can use both economic "sticks" and "carrots"

Sticks = repair costs, maintenance and liability insurance

Carrots = market incentives: removal of a contingent liability, reclaimed waterfront land.

Think creatively!

Economics as a Tool

- Removal costs:
  - one-time cost
  - typically overestimated
- Market incentives:
  - removal of a contingent liability, reclaimed waterfront land, value of donated land.
- Tax incentives: non-waterfront assessments.

Economics as a Tool

- Repair Costs (all figures for Wisconsin)
  - Dam repairs cost on average 3 to 5 times more than removal costs; often underestimated
  - 300 - 400 dams face repair costs of $300,000 or more
  - In 1990s: 83 communities spent $22.4 M on dam repair (with WDNR grant $)

Economics as a Tool

- Operation and Maintenance Costs
  - Structural costs
  - Routine dredging costs
- Liability Costs
  - Large deductibles (often $1 million +)
  - Insurance $ directly related to dam's hazard ranking (high hazard dams can cost >$15K/yr)

Public Safety Laws as a Tool

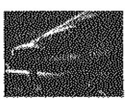
- State or Federal government inspects dams for safety to life or property.
- Many dams do not fall into the categories required for state inspection, which are commonly:
  - 25 feet or higher AND impounds 15+ acre feet

    OR
  - 6 feet or higher AND impounds 50+ acre feet

  ...but still potentially hazardous.

Environmental Quality Issues and Laws

- Fish passage and migration



- Species of concern / Endangered Species Act
- Water Quality / Clean Water Act
  - Impaired Waters, State 303(d) lists
  - Thermal Pollution
  - Sediment-related Issues

Public Trust Doctrine as a Tool

- Does the public's right to enjoy a free-flowing river and a healthy, fishable river ecosystem outweigh the benefits of a dam that needs repair?
- Has applied to building new dams but there is less precedent in applying to dam removal or repair decisions.

Developing a Strategy for Small Dam Removal

"OK, you've convinced me. Now go out and bring pressure on me!"

\- Franklin Delano Roosevelt

Developing a Strategy for Small Dam Removal

- Identify potential allies and opponents
- Know your facts.
- Educate, educate, educate!
- A picture is worth a thousand words.

Mounds Dam, Willow River, Wisconsin

Before

15 months after removal

Franklin Dam, Sheboygan River, Wis.

Before

After (simulation)

Franklin Dam, Sheboygan River, Wis.

Actual site after removal (12 mo.)

Developing a Strategy

Finally…

- Money talks.

Success! But it ain't over till the community sings…

- Clean ups following impoundment drawdown and dam removal.
- Actively pursue funding opportunities for restoration projects, park and trail development, interpretive signs or displays, etc.

After dam removal, con't

- Implement community visioning and planning processes for restoring the former impoundment
- Encourage continued monitoring and research on effects of dam removal.
- Publicize the success!

Conclusion

- Professionals need to provide as much information to communities as possible.
- Communities need to have a good grasp of the issues to make an informed decision about dam repair or removal.
- Societal issues are extremely important in dam removals and should be treated as such.

Notes