Minnesota Chapter Report

NCD Rivers and Streams Technical Committee

Compiled by: Ann Kuitunen, MN NCD Rep. (ann.kuitunen@.state.mn.us)

Minnesota Department of Natural Resources, Division of Fish and Wildlife

Minnesota DNR Fisheries recently completed an update to the list of designated trout streams in the state. We added portions of 42 trout streams totaling 57.6 miles, and remove 31 streams from the designated list totaling 149.7 miles. Streams removed from the list were marginal streams where trout management was tried based on limited information, but where it became apparent that the streams were not in fact suitable for trout.

Minnesota DNR has been recommended to receive $1.8 million for future stream habitat projects. Funding will come from a constitutional amendment in Minnesota that dedicates a portion of sales tax revenue for fish and wildlife habitat.

Minnesota DNR Fisheries completed a project to convert a partial dam on the Minnesota River at Granite Falls into a riffle that will provide spawning habitat for numerous species.

Minnesota River

Staff continue to monitor Channel Catfish and Flathead Catfish population with annual hoop net assessments and continue to monitor fish community health through annual IBI electrofishing assessments.

An array of 9 acoustic receivers has been established and staff are monitoring movement of Paddlefish and Shovelnose Sturgeon within the Minnesota River along with many tagged fishes immigrating form the Mississippi River and St. Croix River.

During 2016, the Environment and Natural Resources Trust Fund provided funding for a three-year project to 1) collect water quality, phytoplankton, and zooplankton data; 2) survey backwater fish communities; 3) measure physical habitat characteristics; and 4) evaluate population dynamics and movement patterns of Shovelnose Sturgeon and Paddlefish. Sixty-six Paddlefish were caught from the Minnesota River during the last 2 years, which is 65 more than the DNR sampled during the previous 20 years, providing exciting evidence that a significant population inhabits the Minnesota River.

Lake City Office

Finished up publishing some old Large Brown Trout winter telemetry data collected right before 2000. Asked the question, do large brown trout use the same habitat features in streams with natural cover versus streams with artificially-placed cover (i.e., HI streams) during winter? The paper should be coming out in North American Journal of Fisheries Management sometime this year (2018).

Lessard – Sams Outdoor Heritage Commission funds (LSHOC)

Coordination with Trout Unlimited on several stream habitat projects in the southeast portion of Minnesota. Projects include habitat improvement, flood damage repair, riparian vegetation management, stream restoration, monitoring of completed projects.

South Branch of the Root River Project - Designs were finalized and construction started for installation of woody debris. Project is scheduled to be completed by June of 2018.

Coolridge Creek tributary project – scoping and design of culvert removal.

University of Minnesota – Mark Hove, malacologist

Tillery, J., A. Franzen, M. Davis, M. Hove, K. Johnson, S. Marconie, S. Marr, M. Pletta, A. Sampson, B. Sietman, C. Swanson, and T. Wagner. 2017. Ligumia subrostrata metamorphose on centarchids, esocids fundulids, and some cyprinids in the laboratory. Ellipsaria 19(2): 34-35.

Sietman, B., M. Davis, M. Hove, M. Pletta, T. Wagner, S. Marr, Z. Secrist, M. Freeburg, A. Scheunemann, K. Krupp, E. Hagemeyer, A. Franzen, C. Swanson, and A. Sampson. 2017. Cumberlandia monodonta - host enigma resolved. Ellipsaria 19(3): 18-20.

Hornbach, D., D. Allen, M. Hove, and K. MacGregor. 2018. Long-term decline of native freshwater mussel assemblages in a US Wild and Scenic River. Freshwater Biology 63(3): 243-263.

Sietman, B. E., M. C. Hove, and J. M. Davis. 2018. Host attraction, brooding phenology, and host specialization on freshwater drum by 4 freshwater mussel species. Freshwater Science 37(1) 96-107.

United States Geological Survey

Application of dimensionless sediment rating curves to predict suspended-sediment concentrations, bedload, and annual sediment loads for rivers in Minnesota. Scientific Investigations Report 2016-5146; Prepared in cooperation with the Minnesota Pollution Control Agency and the Minnesota Department of Natural Resources; By: Christopher A. Ellison, Joel T. Groten , David L. Lorenz, and Karl S. Koller

https://pubs.er.usgs.gov/publication/sir20165146

Minnesota Department of Natural Resources, Department of Ecological and Water Resources

Region 1 – northeast Minnesota

Several stream restoration projects have been completed by the Technical Service Area #3 (TSA3) for local SWCD's. They often work with the MNDNR on design. The largest planned for this year is Sargent Creek, in Duluth. This project will restore more than 4000 feet of trout stream, much of which is incised. A similar project is planned for Mission Creek next year, and Miller Creek the year following. The MNDNR is also working with MNDOT on the replacement of culverts with bridges on trout streams that are tributaries to Lake Superior. Objectives include restoring aquatic organism passage and creating as aesthetically natural of a channel as possible in each case.

Upper Mississippi Long Term Resource Monitoring (LTRM)

2018 routine Long term Resource Monitoring fish sampling was completed on Pool 4. A total of 33,609 fish were captured. See below.

Other LTRM fish information is located on their Graphical browser.

https://www.umesc.usgs.gov/ltrmp.html

https://www.umesc.usgs.gov/data_library/fisheries/fish_page.html

Species	Day Electrofishing	Fyke Netting	Large Hoop Netting	Small Hoop Netting	Mini Fyke Netting	Total
Emerald shiner	1512	0	0	0	10623	12135
Gizzard shad	4768	9	0	0	5776	10553
Bluegill	866	453	17	12	2198	3546
Weed shiner	335	0	0	0	2491	2826
Largemouth bass	539	8	0	2	245	794
Yellow perch	546	119	1	4	25	695
Black crappie	72	113	9	2	128	324
Mimic shiner	183	0	0	0	94	277
Freshwater drum	80	52	92	15	9	248
Smallmouth bass	204	0	1	1	7	213
Rock bass	158	10	0	10	21	199
Logperch	107	0	0	0	50	157
Spotfin shiner	121	0	0	0	25	146
Bullhead minnow	80	0	0	0	27	107

Johnny darter	34	0	0	0	69	103
Pugnose minnow	8	0	0	0	95	103
Shorthead redhorse	85	3	7	2	0	97
Brook silverside	53	0	0	0	38	91
White bass	56	2	2	1	25	86
Northern pike	61	11	5	1	3	81
Silver redhorse	62	11	1	0	3	77
Bowfin	28	41	0	1	5	75
Common carp	59	14	0	0	2	75
Channel catfish	5	2	27	33	1	68
Spotted sucker	57	4	0	0	0	61
Golden shiner	34	0	0	0	25	59
Golden redhorse	49	3	0	1	2	55
Spottail shiner	29	0	0	0	17	46
Pumpkinseed	8	14	0	0	15	37
River redhorse	36	0	0	0	0	36
Flathead catfish	3	0	18	5	0	26
Longnose gar	12	0	3	0	8	23
Sauger	22	0	0	0	0	22
Yellow bullhead	5	12	0	1	4	22
Green sunfish	3	0	0	0	16	19
Smallmouth buffalo	3	0	16	0	0	19
Walleye	15	3	0	0	1	19
Quillback	13	0	0	0	0	13
White crappie	5	3	0	0	4	12
River carpsucker	10	0	1	0	0	11
Tadpole madtom	0	0	0	1	10	11
River darter	0	0	0	0	5	5

Shortnose gar	0	1	0	0	4	5
Silver chub	1	0	0	4	0	5
Mud darter	0	0	0	0	4	4
Pirate perch	1	0	0	0	3	4
White sucker	4	0	0	0	0	4
Silver lamprey	1	1	0	0	1	3
Blue sucker	2	0	0	0	0	2
Central mudminnow	1	0	0	0	1	2
American brook lamprey	1	0	0	0	0	1
Bigmouth buffalo	1	0	0	0	0	1
Bluntnose minnow	0	0	0	0	1	1
Fathead minnow	0	0	0	0	1	1
Mooneye	0	0	1	0	0	1
River shiner	1	0	0	0	0	1
Speckled chub	0	0	0	0	1	1
Trout perch	1	0	0	0	0	1
						33609

MN DNR EWR & Fisheries

In coordination with the Minnesota Biological survey rare species work was completed in Southeast MN. Species of Greatest Conservation Need (SGCN) were surveyed in the Upper Mississippi River and Lower St Croix, including the Mississippi River Pools 3-8. Work was completed by Doug Dieterman (Fisheries Research), Steve DeLain (LTRM), Andrew Herberg (MBS) and Chris Dawald (LTRM). Funding was from the State Wildlife Action Grant. Targeted species were three big-river fishes Crystal Darter, Bluntnose Darter, and Warmouth and one small stream fish, Redside Dace. We captured several Redside Dace in different southeast Minnesota watersheds and even did a population estimate for the Cannon River watershed. State agency report is done and we are submitting a manuscript to a regional journal for the Redside Dace work.

Major Findings:

- Absence of Crystal Darters in 2016/2017 collections indicates that this species is extremely rare and supports listing as State Endangered.

- Non-detection of Bluntnose Darter and rarity in historical collections (fewer than 12 ever collected in Minnesota) merits this species as a candidate for State Endangered status.

- Western Sand Darter and Pirate Perch may be more common than previously thought and our catch rate data and sampling strategy should be repeated to better assess temporal trends in their status.

- Warmouth continue to persist in low abundance in Pool 8 and perhaps in slightly higher abundance in Pool 6. However, these populations may be isolated and warrant future research on degree of isolation, home range and mobility, and identification of potential barriers.

Training Opportunities

Registration is open for: The Fundamentals of River Science: Applied Geomorphology & Ecology June 11 - 15, Marshall MN

https://files.dnr.state.mn.us/eco/streamhab/workshop-flyer.pdf

Save the date for:

River Restoration 2018
PROTECTING & RESTORING RIVERS IN THE FACE OF UNCERTAINTY
OCTOBER 28-30 • TWO HARBORS, MINNESOTA

Keynote speakers are Dave Rosgen, Philip Roni, Bob Barr and Janine Castro. Registration opens in July.

https://www.riverrestoration2018.com/

MN DNR EWR RIVER ECOLOGY UNIT (REU)

March 2017 changed our name from the Stream Habitat Program to the River Ecology Unit. The REU staff are as follows: St. Paul office: Ian Chisholm, supervisor; Lecia Babeu, Mark Ellefson, Ben Gosack, Kitty Hurley, Ann Kuitunen, Dan O'Shea, and Kevin Zytkovicz; Fergus Falls office: Luther Aadland, Amy Childers, Neil Haugerud and Amanda Hillman; Lake City office: Beth Knudsen; Lake City Center for Mussel Propagation: Mike Davis, Madeline Pletta, Zeb Secrist, Bernard Sietman and Tricia Wagner. See the attached newsletters for projects that the REU are working on.

SHP Currents

Winter 2016
Issue #4

Stream Restoration Projects - completed or started in 2016

Stream restoration projects constructed or started in 2016:

- **Buffalo River in Hawley, Phase 2** = meanders were added to a straightened, unstable reach through the Hawley golf course. *SHP: funding, conceptual design, oversight of construction, monitoring – Luther, Neil, Amanda, Ann & crew. Others: Buffalo Red River WD, Houston Engineering.*

- **Lake Shady Dam, Zumbro River in Oronoco** = the dam that failed in Sept. 2010 will be removed and replaced with a rock-arch-rapids. A meandering channel will be constructed through the reservoir sediments. *SHP: funding, conceptual design, oversight of construction, monitoring – Luther, Neil, Kevin, Mark, Amanda, Ann & crew. Others: Kevin Stauffer -MN DNR FAW; Olmsted County.*
- **Brown's Creek in Norris Camp** = completed in May of 2016. A levee was breached in 3 places with riffles which allowed flow from an upstream wetland complex through a wet prairie and eventually back to the original Browns Creek channel. The ditch that carried the flow previously was left in place, but will now only carry flood flows. *SHP: conceptual design, oversight of construction– Neil. Others: USFWS; Gretchen Mehmel & Charlie Tucker -MNDNR FAW.*
- **Grand Marais Creek** - restoration of "e" channel where channelized. *SHP: conceptual design - Luther, Neil. Others: Dave Friedl, Tom Groshens MNDNR EWR; Houston Engineering.*
- **Solid Bottom Creek=** channel was realigned to reduce sediment input into the trout stream and provide habitat through riffle and toe-wood construction. *SHP: conceptual design and oversight of construction - Luther. Others: Dave Friedl -MNDNR EWR; Jeff Tillma, Nathan Olson, Mandy Erickson -MNDNR FAW; Fisheries Construction crew.*
- **Adrian Dam, Kanaranzi Creek** = the dam was replaced with a series of riffles. *SHP: advice and conceptual design were provided – Luther. Others: USFWS; Region 4 CWL staff, Brian Nyborg -MNDNR EWR.*
- **Middle Fork of the Whitewater River, in Whitewater State Park** = a terrace along the river was previously re-enforced two times using geotextile and riprap; the most recent failure of this approach occurred in 2010. Together with a long term sediment assessment and prioritization study, this reach was completely redesigned applying Natural Channel Design methodology. The first phase was completed Fall 2016 with a completion of the project expected by Fall 2017. *SHP: funding, conceptual design, oversight of construction, monitoring – Ian, Luther, Neil, Kevin, Dan, Mark, Amanda, Ann, James, Harmony. Others: Chris, Steve (Management Resources) and Jan, Shawn, Brent & Colon (Parks).*
- **Sandhill River near Fertile** = This fall 18 riffles were constructed for grade control through this channelized reach. This winter four check dams were/will be partially removed (abutments cut to grade) with rock-arch-rapids. This project will allow for fish passage between quality upstream and downstream habitat. *SHP: funding, conceptual design, oversight of construction, monitoring – Luther, Neil, Amanda, Ann and crew. Others: Jamison Wendel -MNDNR FAW; Stephanie Klamm, Tom Groshens, Jason Vinje, Lori Clark -MNDNR EWR; ACOE; Houston Engineering (riffles); Sand Hill WD.*

Stream Restoration Projects - on deck

Project ready to break ground

- **Marsh Lake Dam** = the **Pomme de Terre River** will be rerouted into its historic channel joining the **Minnesota River** downstream of the dam and the dam will be modified into a rock-arch-rapids. *SHP: conceptual design, future oversight of construction– Luther. SHP will be involved in mussel relocation prior to construction. Others: ACOE.*

Projects that have been funded

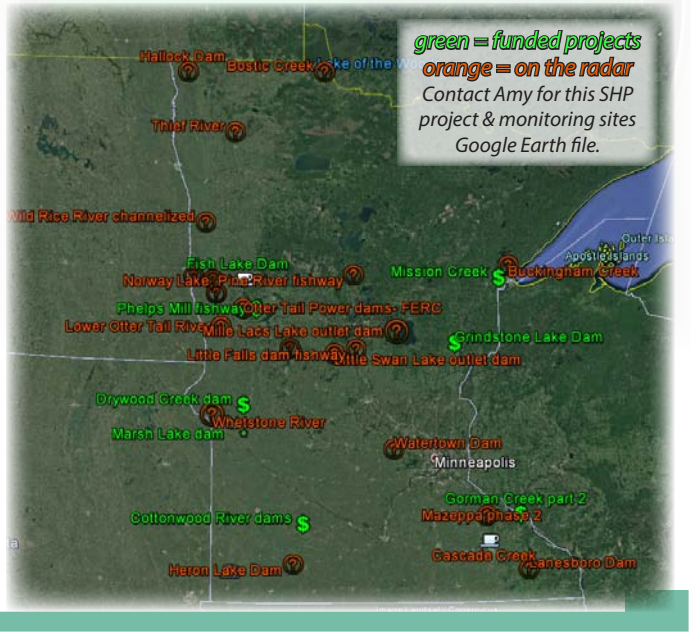
- **Gorman Creek, part 2** - river restoration *SHP: conceptual design, project coordination - Kevin, Mark, Amanda. Others: Melissa Konsti, Kevin Stauffer - MNDNR FAW.*
- **Drywood Creek** - failed carp dam slated for dam removal and channel restoration *SHP: conceptual design - Neil. Others: Ryan Bjerke, -MNDNR EWR; Pomme de Terre River Association.*
- **Cottonwood River Dams** - removal of 3 dams *SHP: project development - Amanda. Others: Lucas Youngsma – MNDNR EWR.*
- **Phelps Mill, Otter Tail River** - dam modification *SHP: funding, project coordination, conceptual design- Luther, Amanda. Others: Howard Fullhart MNDNR FAW, Houston Engineering, USFWS, Otter Tail County.*

Projects in design phase

- **Mound Creek in Blue Mounds State Park** = the dam failed in spring 2014. Fall 2016 the MNDNR decided that it would be removed and a channel restoration would be constructed through the accumulated reservoir sediment. This river is inhabited by federally threatened Topeka shiner. *SHP: conceptual design– Luther. Others: Region 4 CWL staff -MNDNR EWR; MNDNR PAT; MNDNR Engineering.*
- **Mission Creek near Duluth** = an unstable reach will be stabilized with meanders and toe-wood sod mats. *SHP: funding, project coordination, conceptual design– Luther, Amanda. Others: Keith Anderson - SCWD; Karl Koller -MNDNR EWR; Ann Thompson – South St. Louis Watershed Conservation District.*
- **Grindstone Lake Dam, Grindstone River** - removal -- currently working on getting a requisition for technical services. *SHP: project coordination, surveying, design ideas – Kevin, Mark, Amy, Luther, Neil, Amanda. Others: Leslie George -MNDNR FAW; Jon Hendrickson – MNDNR Engineering.*
- **Fish Lake Dam, Pelican River** = dam modification with rock-arch-rapids, dam also controls Pelican Lake. *SHP: conceptual design – Luther. Others: Julie Aadland – MNDNR EWR; Pelican Lake Association, Houston Engineering, USFWS.*

Projects on the radar

- **Mille Lacs Lake, Rum River:** rock-arch-rapids to replace outlet dam
- **Whetstone River/Minnesota River:** river restoration that will bypass the dam
- **Buckingham Creek:** restoration of a dammed & degraded trout stream
- **Thief River:** remeander to avoid meander cutoff
- **Cascade Creek:** channel restoration
- **Lower Otter Tail River:** restoration of channelized reach - collecting data and developing a master plan. *SHP, Buffalo Red River WD, Houston Engineering*
- **South Branch Buffalo River:** restoration of ditch - collecting data and developing a master plan. *SHP, Buffalo Red River WD, Houston Engineering*
- **Fergus Falls Dams, Otter Tail River:** 5 hydropower dams on the river owned by Otter Tail Power are up for FERC relicensing
- **Pelican Rapids Dam, Pelican River:** dam removal/ modification on the Pelican River.
- **Wolverton Creek:** restoration of a ditched channel
- **Whiskey Creek:** restoration of a ditched channel
- **Hallock Dam, Two Rivers:** evaluating options
- **Watertown Dam, S. F. Crow River:** evaluating options
- **Austin (Ramsey Mill Pond) Dam, Cedar River:** evaluating options
- **Lanesboro Dam, S. B. Root River:** evaluating options
- **Norway Lake Dam, Pine River:** evaluating options
- **Little Swan Lake Dam:** evaluating options
- **Mazeppa, N.F. Zumbro River:** repair of flood damage to original project
- **Swessinger WMA, near Worthington:** restoration of a ditched channel
- **Wild Rice River:** ACOE project to address a channelized reach
- **Lake Carlos Dam, Long Prairie River:** evaluating options
- **Bostic Creek:** restoration of a ditched channel
- **Fisheries projects:**
  - Fish Creek - dam removal, channel restoration and culvert replacement
  - Crane Lake - culvert modification
  - Red Sand Lake - dam modification



Knutson Dam Modification

Ribbon cutting ceremony

Knutson Dam on Cass Lake was removed and replaced with a rock-arch-rapids design. It is the first dam modification on the Mississippi River. The project was constructed in fall 2015 with a few modifications that followed in spring 2016.

In the news The project was covered multiple times throughout the process by the local news - Lakeland Public Television. Latest story was Dam to provide safety, better habitat on Mississippi River

Documentary A documentary of the whole project was created by David Quam and is available on YouTube: Knutson Dam Story .

USDA
United States Department of Agriculture

Knutson Dam Improvement Project

CHIPPEWA NATIONAL FOREST

August 2016

TOPIC: In 2015, the Forest Service successfully implemented the Knutson Dam Improvement Project. The project removed the failing Knutson Dam and reconnected the Mississippi River at the outlet of Cass Lake through construction of an innovative rock arch rapids. The project restored spawning habitat for a variety of warm water species such as walleye and white sucker. It enhanced aquatic organism passage to over 30 miles of river and more than 72,000 acres of lakes such as Cass Lake and Lake Winnibigoshish, which are world-class walleye fisheries.

The project also improved recreational fishing access through the addition of a modern fishing pier, reduced the potential for lakeshore erosion on Cass Lake, and reduced the safety hazard of the former logging dam. The final cost of the project will be slightly over $1.1 million.

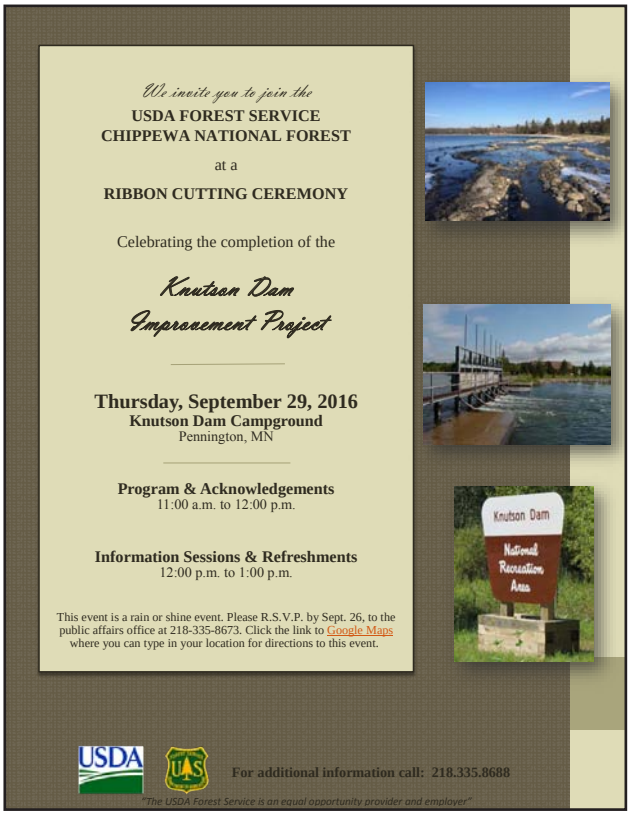
BACKGROUND: Knutson Dam, on Cass Lake, was originally built in the early 1900's as a logging dam by the J. Neils Logging Company. In 1926, the Forest Service purchased the dam under Public Law 270. The dam was rebuilt in 1928 and reconstructed in 1964. It was the second in a series of eight dams on the Mississippi Headwaters lakes. Ottertail Power Company owns the dam upstream that controls the water level of Lake Bemidji. Six dams downstream are operated by the U.S. Army Corps of Engineers.

PARTNERSHIPS: The project could not have been accomplished without the support of our partners who recognized the significant economic, social and natural resource value of the project. The partners include: Leech Lake Band of Ojibwe, Minnesota Department of Natural Resources, U.S. Fish and Wildlife Service, Lessard-Sams Outdoor Heritage Council, Midwest Glacial Lakes Partnership, and Ottertail Power Company.

PROJECT RECOGNITION: The U.S. Forest Service's Chippewa National Forest recently received the prestigious national "Rise to the Future" award for the Knutson Dam Replacement Project on the Mississippi River. The award is the highest national recognition of aquatic accomplishment that the U.S. Forest Service bestows. This award emphasizes collaborative and integrated efforts with partners in aquatic resource management that result in meaningful changes to U.S. Forest Service aquatic resource conditions.

The project was also selected for the Lake and River Stewardship Award that is part of the Lake Friendly Awards given annually for watershed improvement projects. The Nature Conservancy nominated the project for this award and was presented to the Chippewa NF in June.

Forest Service



Luther program consultant , river scientist

Luther is busy consulting, working on several project designs, and writing.

Luther has worked on the design for a variety of projects including:

- Lake Shady on Zumbro River
- Grindstone Dam on Grindstone River
- Sandhill River
- Whetstone River/Upper Minnesota River
- Marsh Lake on Upper Minnesota River
- Blue Mounds State Park, Mound Creek
- Mille Lacs Lake outlet dam on Rum River
- Phelps Mill dam on Otter Tail River

As far as writing, this winter he will be working on:

- publishing the barrier data from the report ***Barrier Effects on Native Fishes of Minnesota*** in the Transactions of the American Fisheries Society journal,
- finalizing edits to the ***Ecological Implications and Strategies for Invasive Carp in MN*** report,
- Luther and Neil are working on the final edits on their book chapter "Restoring Stream Ecosystems in the Midwest" in the book Ecological Restoration in the Midwest: Building a Legacy, which is a collaborative effort with University of MN,
- writing a chapter on stream restoration for the Red River Valley and Aspen Parklands book,
- final edits to an article "River Revival" that will be in the April/May edition of the Conservation Volunteer.

Workshops

2016 This summer we taught the ***Fundamentals of Stream Restoration: Applied Geomorphology and Ecology*** workshop in July, with the help of Karl Koller and Jon Lore. Thirty-six people attended the course including summer interns for Amanda, Ann, and Kevin.

2017 We will announce workshop dates and locations in January. We are now be offering the first three workshops in the Stream Restoration Series every summer for the next several years. They will be required to be taken in order.

Students surveyed and classified upper Lawndale Creek and the Pelican River just north of Fergus Falls.

SHP Workshop website

Mussel Program Activities

Mike, Bernard, Zeb, Shelby, Tricia, Madeline

We welcomed Madeline (Maddie) Pletta to the mussel program in May 2016 as our propagation biologist. She earned a M.S. from Missouri State University and spent almost two years propagating Atlantic Slope mussels at Virginia Fisheries and Aquatic Wildlife Center at Harrison Lake National Fish Hatchery in Charles City, VA.

Tricia Wagner, will become a Natural Resource Technician, as she will remain on part time through the winter and into next field season.

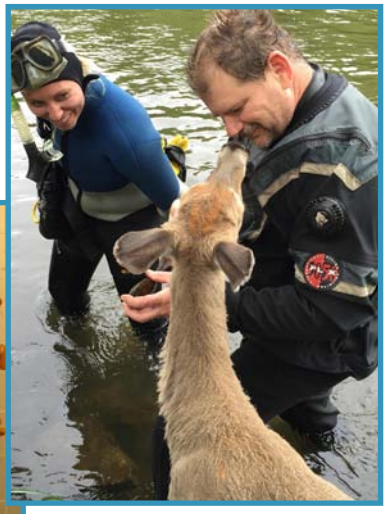
The mussel lab has expanded with the addition of two pulse flow feeding systems and sediment culture for juvenile mussels.

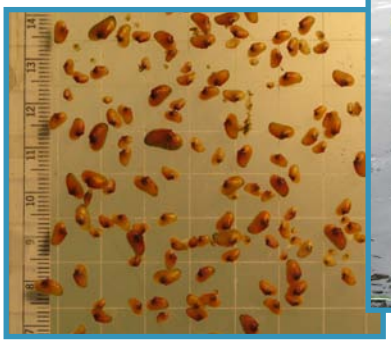
In 2016, we produced 205,042 juvenile mussels of eight species from five separate rivers using more than 1,600 host fish. Juvenile mussels were raised in the laboratory and in propagation cages with the expectation of release into reintroduction sites beginning in fall 2017.

Other field activities include:

- Higgins eye pearly mussel Essential Habitat Area surveys and monitoring on the Mississippi River at Prairie Du Chien and Harpers Slough, and on the Wisconsin River at Orion and Prairie Du Sac for the U.S. Army Corps of Engineers.
- We completed eleven bridge surveys and conducted one mussel relocation for MNDOT.
- We surveyed mussels in the Rock, Crow Wing, and Sand Hill watersheds.
- Host fishes for the Pondmussel, Spectaclecase, and Mucket were examined as part of the State Wildlife Grant.
- We continued a long-term tagging study with USGS to examine mussel vital rates in the Mississippi River at West Newton.

right: Maddie hiking on the island of Dominica





Ligumia recta (Black sandshell)

Mussels in the News 2015

- Post Bulletin: Meet the DNR's mussel man
- Works Progress video: I live here! And other mussel musings
- WIRED: "Absurd creature of the week: This mussel does an incredible impression of a fish"
- Advocate Tribune: CURE outing uncovers jewels of the Minnesota River
- Your Classical: Mississippi mussels making a comeback
- U.S. Fish & Wildlife Service - Field notes: Monitoring for the Endangered Winged Mapleleaf Mussel
- Twin Cities Pioneer Press: St. Paul Mississippi River/Mussels get a helping hand
- Twin Cities Pioneer Press: Native mussels in Mississippi River signal cleaner waters

Mussels in the News 2016

- Minnesota Zoo: Restoring freshwater mussels
- WI DNR: Fish ferry serves endangered mussels well on the Wisconsin River
- Eyewitness 5 News: Freshwater mussels help detect water contaminates in Minneapolis
- MN Lottery: Lottery dollars help improve Minnesota's water quality *Very cool video! Zeb has the MOV file if anyone would like it.*

Mussels of Minnesota website

Ann & crew fish & river ecologist

Fish sampling - Summer 2016

Fish sampling for 2016 was challenged by water flows. There was a lot of high water, so most of our sampling sites were chosen based on where we could access the water. While most of the state had high water, 3 sites on the Redwood River were challenging due to low flows.

We were able to get **pre- data** for two dam removal projects:

- Grindstone River – 3 sites
- Sandhill River – 3 sites

Long-term monitoring – Yellow Medicine River that now has 27 years of data.

Post-project data was collected from:

- 2 sites on Lawndale Creek.
- 2 sites on the Knife River in Lake County, one site was in the restoration reach and the other was upstream of there.

New sampling sites:

- 1 on the Pomme de Terre
- 5 on the Redwood River

Returned to a site on the Cedar River main stem and one of its tributaries, Otter Creek.

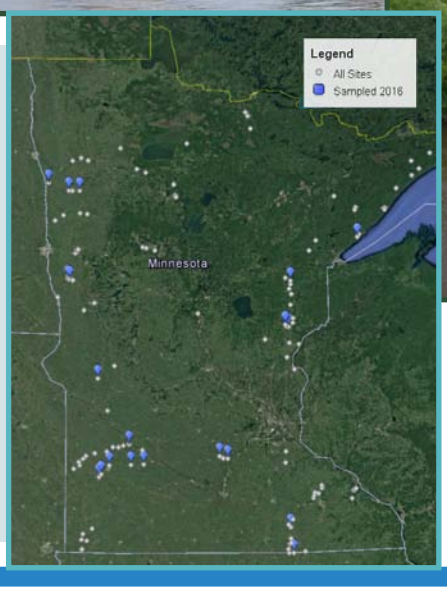
Ann's interns - summer 2016

- Olin Halsten *- currently a junior at Northland College – majoring in Fisheries & Wildlife Ecology with a Fisheries emphasis*
- Xe Khang *- a junior at the U of M: Twin Cities – majoring in Fisheries & Wildlife*
- Ellen Anderson*- a junior attending Valley City State University – majoring in Fisheries & Wildlife*
- Kayla Hansch*- graduated from Gustavus Adolphus College with a B.A. in Biology*

Fish sampling sites summer of 2016

- Grindstone River – 3 sites
- Lawndale Creek – 2 sites
- Sandhill River – 3 sites
- Pomme de Terre River: 1 site
- Redwood River: 5 sites
- Knife River: 2 sites
- Otter Creek: 1 site
- Cedar River: 1 site
- Yellow Medicine River = long term site

Over 8,000 fish and 64 species sampled in a total of 392 cells.



Amanda restoration coordinator

LSOHC Projects Completed:
Phase II of the Buffalo River in the Hawley Golf Course

Projects in Construction:
Lake Shady on Zumbro River
Sand Hill River
Whitewater River

Tidbits:

- Stream crossing inventories have been completed in the following watersheds: Buffalo River, Cottonwood River, St. Croix River, Kettle River and the Root River. The Otter Tail and Snake Rivers are partially completed.
- Amanda presented the recently finished "Stream Crossings Inventory and Barrier Ranking Guidelines" at the 2016 Stream Practitioners Workshop.
- Amanda has attended a number of project develop meetings for possible future projects including: Bostic Creek, Long Prairie River dam, Austin dam, and Watertown dam.
- Amanda now represents the SHP as a member of the International Red River Board (IRRB) Aquatic Ecosystems Committee. Last fall she presented at the IRRB Board meeting held in Devil's Lake, ND.
- Buffalo River has finally had a bankfull event since 2 projects have been completed. We are monitoring the sites during recovery.

- Amanda and Luther teamed up with a couple of people in Parks and Trails to user test our rock-arch-rapids. PHOTOS

Group News –

- As a significant project partner, the DNR was recognized for their work on the Knutson Dam project during a ceremony held by the USFS in September. The project was nationally recognized by the USFS with a "Rise to the Future" award. This award is the highest form of recognition that the USFS can bestow on the National Forests and their partners. A documentary of the project has been made by David Quam and can be viewed on YouTube. See page 3.
- Luther, Neil, Amy and Amanda participated in a facilities tour with Otter Tail Power to discuss what to expect during their 2020 re-licensure.
- BWSR Academy – Amy, Neil and Amanda presented on stream health and stability, project examples, and funding opportunities.

Amanda's summer 2016 interns

- Aaron Green - *a senior at NDSU and will be graduating in Dec. with a degree in Natural Resource Management. He has been offered a graduate position at NDSU.*
- Rosalyn Nelson – *will be graduating in Dec. from Bemidji State with a degree Geohydrology. Rosalyn is currently working as an intern with hopes to work on groundwater in the future.*

Kevin hydrographer

A new methodology to improve road/river crossings

Beginning in 2013, Kevin has been working with the DNR's Flood Mapping Program on a cooperative effort to improve the design of road/river intersections. Through research, site assessment, and modeling the cooperative effort has had a few successes, such as:

- 17 crossings have been assessed and modeled
- 5 crossings have been constructed or are in progress

Through quantified results and modeling of the 17 assessed crossings, the following improvements were made to proposed design configurations:

Average improvements of:

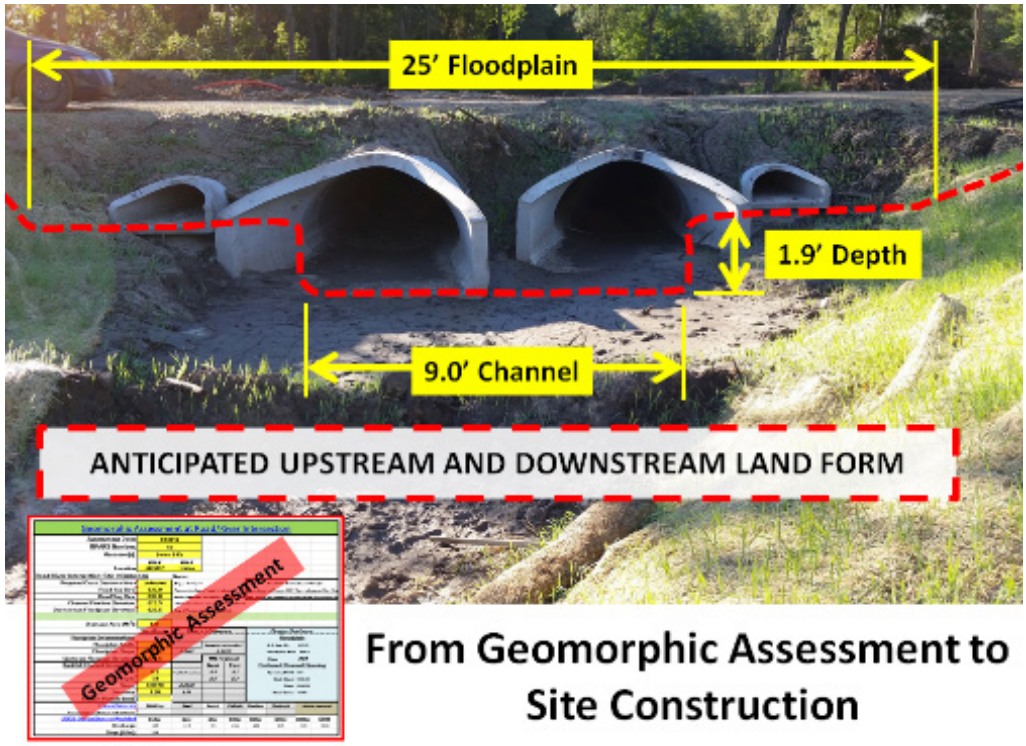
- 32% channel velocity
- 49% shear stress on channel (bed and banks)

Achievements to date of this cooperative effort:

- An initial study has been completed.
- A design process and procedures manual has been drafted.
- Tentative inclusion into the MPARS process is being discussed.
- Tentative FEMA fee wavier on mandated flood zone requirements is being considiered.

Although there is much work still needed to achieve validation of the applied principles, the initial results look promising.

SHP is seeking volunteer road designers that are willing to provide feedback on our initial release of materials on 'how to' apply geomorphology into road design. For more information please contact Kevin.



From Geomorphic Assessment to Site Construction

Kevin's summer 2016 interns

- James Pydynkowski *- St. Cloud University*
- Harmony Schaupp *– St. Cloud University*

They worked on geomorphology and discharge measurements.

A newly constructed road/river crossing with proper channel and floodplain dimensions and capacity.

Whitewater State Park – 2016 Middle Fork of the Whitewater channel restoration project

Last October SHP staff, along with Parks and Management Resources completed the first phase of a channel restoration through the Whitewater State Park. Construction posed a few challenges to overcome and Phase 2 is expected to proceed by summer2017. This project is anticipated to be complete by the fall of 2017.

The completed channel realignment with sloped & seeded banks.

Mark channel survey specialist

The Whitewater WARSSS report has been completed. Mark and Kevin are currently working on completing the Master Restoration Plan.

A few highlights from the WARSSS study:

- 70% of the estimated sediment yield of the streams is from bank erosion.
- Much of the bank erosion issues are due to legacy effects of poor soil conservation practices from settlement through the 1930s, as well as channel straightening/ ditching, and culvert impacts present today.
- Simply put ... most of the streams are incised - which leads to increased erosion rates.
- Reference sites encompassing combinations of 3 stream types and 7 valley types were identified (some represent multiple valley types). Nineteen representative sites were identified that represent combinations of stream types, valley types, and Pfankuch stability ratings. These reference and representative sites are used to stratify both the impacts/ impairments and restoration recommendations in the rest of the watershed.

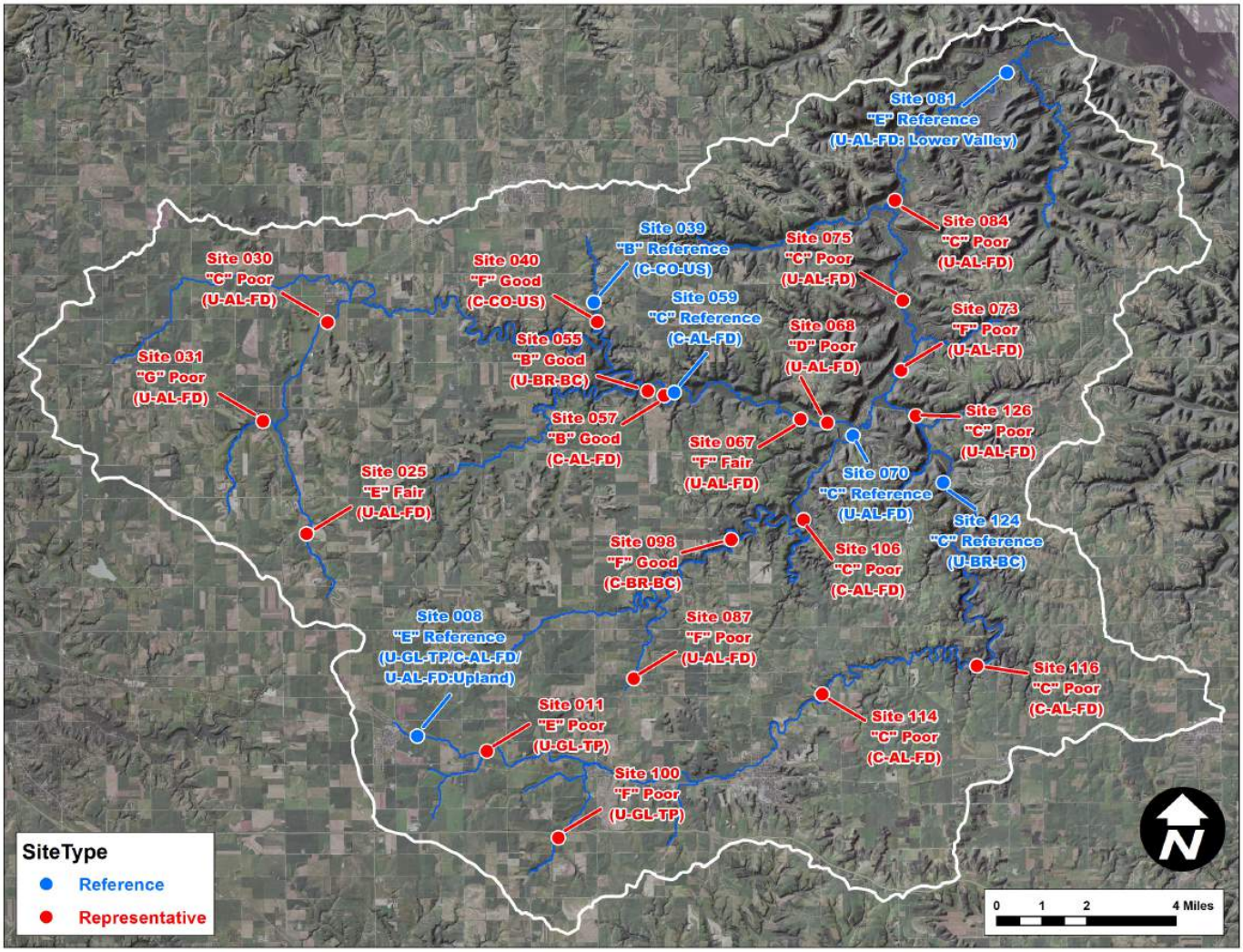


Figure 125. *Reference and representative site locations.*

Neil restoration & monitoring

Neil consults on various restoration projects and provides reference reach data as needed.

This year he has been involved in various restoration projects including Buffalo River, Browns Creek in Norris Camp, and Sandhill River.

He continues to collect data and monitor the Lawndale Creek channel restoration.

Neil continues to be involved in reviewing and providing expertise about fish passage on the Fargo-Moorhead Diversion project.

above: Neil taking discharge measurements on the Pelican River during the workshop. left: a completed riffle/ford on Browns Creek.

Amy outreach specialist

Amy has been involved in editing the ***Ecological Implications and Strategies for Invasive Carp in MN*** report. The authors- Luther, Ian, and Amy -received numerous comments from Fisheries and the Shallow Lakes Program that were reviewed, addressed, and incorporated into a revised draft.

Amy handles workshop requests, inquiries, and the planning, logistics, and preparation for offered workshops.

This past year she developed outreach materials for projects including the Lower Otter Tail restoration project and Blue Mounds State Park dam failure. She will be involved in the public outreach component of the relicensing of 5 hydroelectric dams in Fergus Falls.

Amy is part of the whitepaper team from the Stream Practitioners' Group. The group wrote a whitepaper in response to Minnesota Statutes 2016, Section 103G.245 Subd. 2 that creates an exception to the need for a DNR permit for culvert restoration and replacement when replaced with a culvert of the same size and elevation. This paper is being shared with management and legislators with hopes that the statute will be overturned.

A tour of the 5 Otter Tail Power hydroelectric dams with OTP, FERC, and DNR. This is Pisgah Dam.

Lecia river ecologist

Stream Type/Valley Type Project

Summary of final output goal:

- Two primary custom Python scripts and ArcGIS tools that will be part of a single custom Toolbox that can be added to users' Arc Toolbox collection.
- Output of those tools -> creation of two separate GIS layers indicating Stream and Valley Types in the stream reach.
- An additional script will also be part of the custom Toolbox to help users standardize and simplify the process for data preparation necessary to run the custom built tools, including simple hydrological correction of DEMs.
- Beginnings of a Stream Type and Valley Type statewide GIS layer that will be added to/edited as new stream reaches are analyzed.

Steps currently in progress:

- Improving user experience and documentation for Stream Typing Tool.
- Valley Typing Tool
  - » Improve processing speeds, create ArcGIS tool interface for script, document steps to create "Users Guide," tweak final layer symbology and attribute table components of Valley Type layer product.
  - » Finalize recommended procedure for detailed Valley Type classification using geology layers.
- Complete statistical analysis comparison between GIS derived classification and field surveyed classification results.

Watershed Health Assessment Framework Beth, Ben, Kitty, Ian, Dan

The **Watershed Health Assessment Framework** project has continued to grow during 2016. Our analysis products, online mapping tools and scope of agency partners and project demands continue to expand.

The WHAF project now has 3 dedicated staff:
Beth Knudsen – Project Coordinator
Ben Gosack - GIS Specialist and Data Analyst
Kitty Hurley – Map Application Developer (MNIT)

So while we continue to grow, we have maintained the same core focus. Borrowing from Simon Sinek's "start with why" approach to project management, we begin with "why" – the project purpose:

Why? Manage for healthy, resilient ecological systems and human communities.

How? By delivering difficult concepts like complexity, scale and ecological health in a way that makes them accessible to everyone; so we can work together to tackle our most complex and difficult problems; to be a learning organization and engender creative solutions.

What? A watershed health assessment framework synthesizes data into health scores to show patterns across scales; it embeds a consistent process for investigating and evaluating health to build a shared ecological understanding. It is a platform for collaboration, for sharing of new data and for integrating other model results into a system view.

The WHAF map application has many new features for saving, sharing and collaborating. We have also added a series of important ecological and health context reports for all of Minnesota's major watersheds:

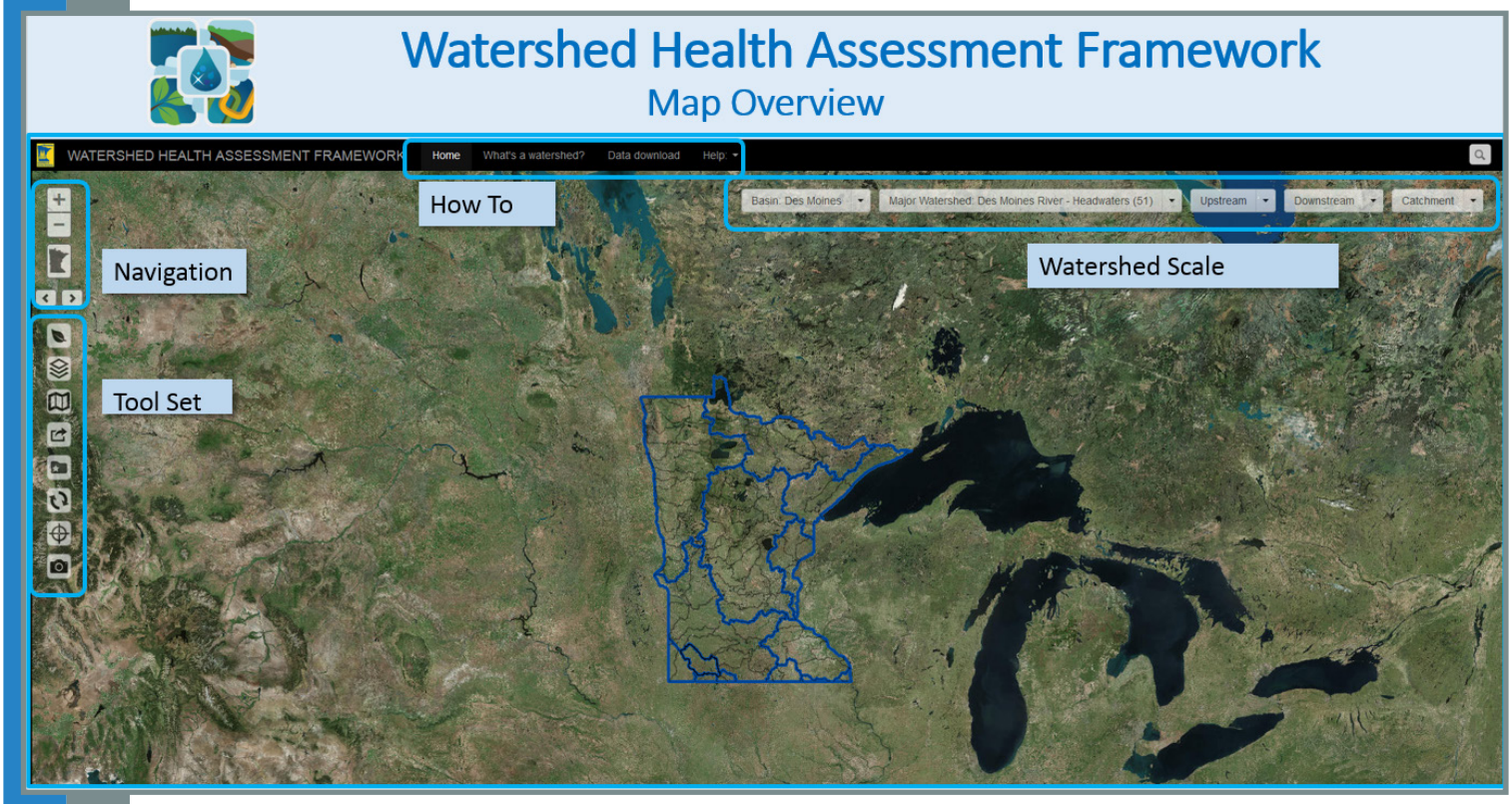
Watershed Context Reports

Watershed Health Report Cards

The other major project work effort is occurring behind the scenes. Our core team is developing a **Decision Support System** that streamlines the exploration of watershed health, compares health across scales for a user selected location, and lets the user build and share a report of their findings. Evaluating and comparing the expected ecological system impacts for different natural resource management actions is the next step already in our cross-hairs. More on that in 2017!

This report to the legislature on the DNR's Clean Water funded work includes (pg 17-21) a nice snapshot of the changes and updates available in the WHAF.

Subscribe to our quarterly newsletter to get the latest news on WHAF advancements and learn ways to apply the WHAF to your resource management challenge.

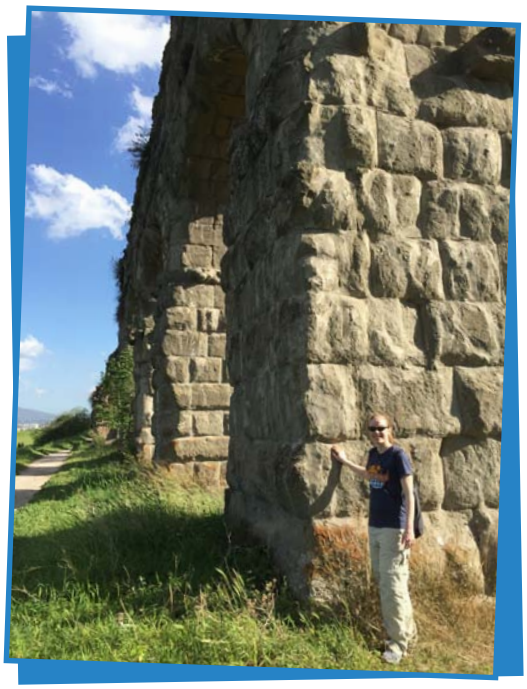


WHAF - Kitty GIS Developer

WHAF's new GIS Developer

Kitty Hurley is a GIS Developer working on the WHAF's interactive map application. She is housed within MNIT and her office is located in the Central Office.

She holds a B.A. in Geography and Water Resources from Gustavus Adolphus College and a M.S. in Geographic Information Science from Saint Mary's University of Minnesota. Prior to her new role, Kitty spent three years as a GIS Developer at the Minnesota Department of Health, and has previously worked at Hennepin County, and the city of Brooklyn Park. In her free time Kitty likes to hike, snowshoe, ice skate, rollerblade, and travel with her husband, Eric around the globe. This past April they traveled to Italy, and were able to walk alongside, and even touch ancient Rome's aqueducts, located a few miles outside the center of the present day city (photo).



DEPARTMENT OF NATURAL RESOURCES

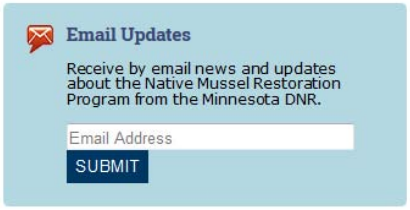
REU Currents

Winter 2017/2018
Issue #5

Center for Aquatic Mollusk Programs (CAMP) Mike, Bernard, Zeb, Maddie, Tricia

CAMP Newsletter

Starting summer 2017, Zeb and the CAMP team began writing a quarterly newsletter available via MMB's Govdelivery program. So far two issues have been distributed with the next one to be sent late January. You can join the other 880+ people signed up to receive this newsletter on the Mussels of Minnesota web page.



Mike receives awards

Mike Davis received the Conservation Award, the UMRCC's (Upper Mississippi River Conservation Committee) highest honor, at this year's event. The recipients of this award are recognized for their years of service on the Mississippi River. Mike has dedicated his 31 years at the DNR to improving the health of the Mississippi River ecology. Through his extensive study of mussels, he has elevated the mussel program to national prominence.

Mike also received the Corp of Engineers Public Service award in recognition of his commitment to ecosystem restoration through the propagation of mussels. As an employee of the state of Minnesota, for 30 years he has provided immeasurable expertise and skill preventing the extinction of native mussels and preventing the spread of invasive species.

He has shown great leadership on the Mussel Coordination Team and in field research. His untiring efforts and contribution reflect great credit upon himself, the state of Minnesota, and the nation.

Mussels of Minnesota website

Holy Grail of Hosts

CAMP biologists recently uncovered a mystery that has stumped malacologists (mussel biologists) across the country for decades; finding the host fish for the Federally Endangered Spectaclecase mussel (Cumberlandia monodonta). After years of trial and error, along with some detective work, our staff determined that Mooneye (Hiodon tergisus) and Goldeye (Hiodon alosoides) are suitable laboratory hosts. As further host defining evidence, we recovered juvenile Spectaclecase from Mooneye captured near Spectaclecase colonies in the St. Croix River. Thus, confirming that Mooneye is a host in nature. Many tens of thousands of juvenile Spectaclecase were recovered and placed into culture chambers for growth. Several methods are being tested for optimal growth and survival. The research was done in collaboration with Mark Hove and staff at the University of Minnesota.

Revival of the Cedar River Watershed

The mussel program recently received a Cooperative State Wildlife Grant in conjunction with the Iowa DNR. The objectives are to study Species in Greatest Conservation Need (SGCN) found in the Cedar River watershed of MN and Iowa. Seven species of native mussels will be reared in the laboratory and released into reintroduction sites along the Cedar River. Additionally, we will study host requirements for the larval stage of three mussels: the threehorn wartyback *(Obliquaria reflexa)*, threeridge (*Amblema plicata*), and wabash pigtoe (*Fusconaia flava*).

National Geographic goes to CAMP

Our mussel lab drew the attention of Joel Sartore, a photographer for National Geographic. Joel specializes in documenting endangered species and landscapes around the world. He is the founder of the Photo Ark, a 25-year documentary project to save species and habitat. He was delighted to photograph a variety of mussel and fish species to add to his Photo Ark Collection.

CAMP new publication

Sietman B.E., M.C. Hove, and J.M. Davis. 2018. Host attraction, brooding phenology, and host specialization on freshwater drum by 4 freshwater mussel species. Freshwater Science. https://doi.org/10.1086/696382

Abstract: Freshwater mussels are a diverse group of bivalves with equally diverse life-history traits. We examined host-attracting behaviors, larval-brooding phenology, and larva–host relationships for E*llipsaria lineolata, Leptodea fragilis, Potamilus alatus*, and *Truncilla truncata* through extensive field and laboratory studies. Our data from laboratory trials and recovery and identification of juvenile mussels from naturally infected fish support the long-held assumption that freshwater drum (*Aplodinotus grunniens*) probably is the exclusive host for these species and is a suitable host for *Potamilus ohiensis* and T*runcilla donaciformis*. These species have subtle but distinctive host-attracting behaviors involving use of a mantle lure to facilitate larval transfer to the host. General lure morphology and movement behavior were similar between *E. lineolata* and *T. truncata* and between *L. fragilis* and *P. alatus*, species pairs that are closely related, whereas displaying orientation was variable among species. *Ellipsaria lineolata, L. fragilis*, and *P. alatus* were long-term larval brooders, but duration and correspondence with displaying activity were dissimilar. *Truncilla truncata* was a short-term larval brooder in the St. Croix River and is among the few documented examples of short-term brooding in the Tribe *Lampsilini*. The range of morphological and behavioral characters in these mussels coupled with the relatively uncommon character of specializing on a single host species make this group a model for evolutionary, phylogenetic, and ecological studies.

Host attraction, brooding phenology, and host specialization on freshwater drum by 4 freshwater mussel species

Bernard E. Sietman,[1,3] Mark C. Hove,[2,4] and J. Mike Davis[1,5]

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[4]mark_hove@umn.edu

[5]mike.davis@state.mn.us

ONLINE: Jan 08, 2018 RECEIVED: Mar 16, 2017 ACCEPTED: Sept 14, 2017

Mussels in the News

- Works progress video "I live here and other mussel musings" (video)
- Minnesota Lottery Proceeds Help Improve Minnesota's Water Quality (video)
- Restoring Freshwater Mussels: Minnesota Zoo
- Fish ferry serves endangered mussels well on the Wisconsin River: WI DNR
- Mississippi mussels making a comeback: MPR News
- Freshwater Mussels Help Detect Water Contaminates in Minneapolis: 5 Eyewitness News
- Coral of the River : Winona Post
- Discovery May Help Save Species: Winona Post
- Spectaclecase Success: MN DNR Facebook
- MN Zoo Conservation Cabin: MN Zoo Facebook
- Pomme De Terre Mussel Relocation: MN DNR Facebook
- Mitochondrial transcription in freshwater mussels with DUI; Bretton, S. et al. 2017

Mussel relocation all hands on deck

In August several REU staff, and others, collected and relocated 4,062 mussels (13 species, 1 SGCN) from the footprint of structures being constructed this winter. Summer 2018 there will be a much larger collaborative effort to collect and relocate thousands of mussels from the reach to be abandoned. The new channel connecting the Pomme de Terre River directly to the Minnesota River is currently being excavated and will be reconnected this summer.

Minnesota Department of Natural Resources
August 30, 2017 ·

The DNR teamed up with the US Army Corps of Engineers recently to rescue native mussels. Workers crawled through the Pomme de Terre River in Swift County to rescue the mussels before water is diverted to the Pomme de Terre's historic channel next year.

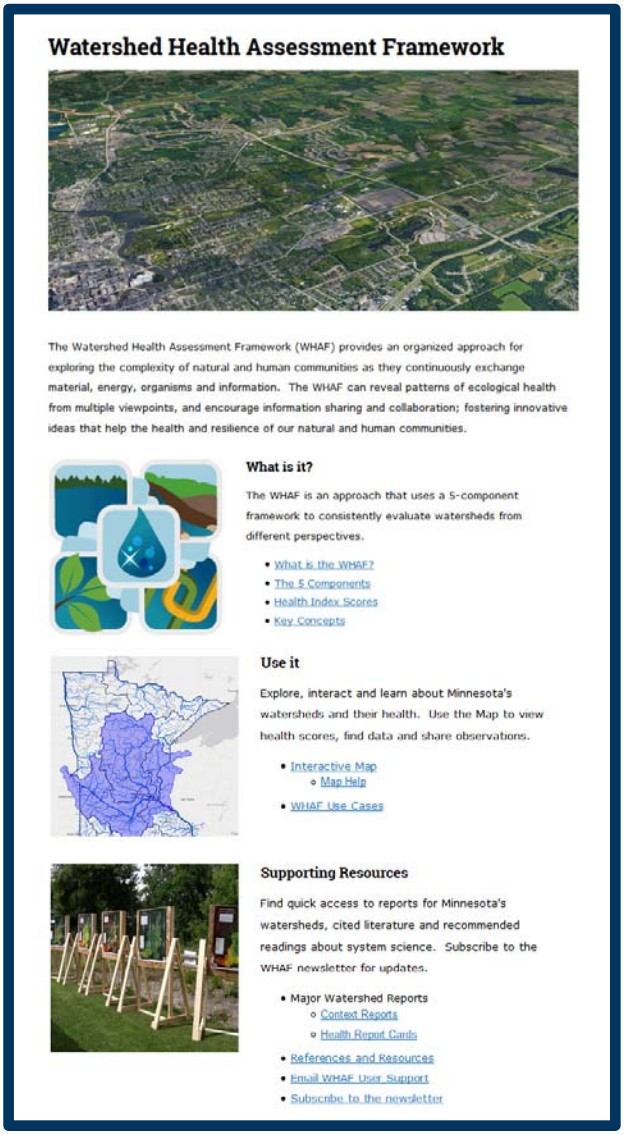
After documenting the number of species in the Pomme de Terre, DNR fisheries workers moved the mussels to the Minnesota River. The $9.4 million Marsh Lake project will restore wetlands and improve water quality along the Minnesota River. The project includes rerouting the Pomme de Terre River downstream of the Marsh Lake dam to its historic channel. #conservation

Like Comment

Watershed Health Assessment Framework Beth, Ben, Kitty, Dan

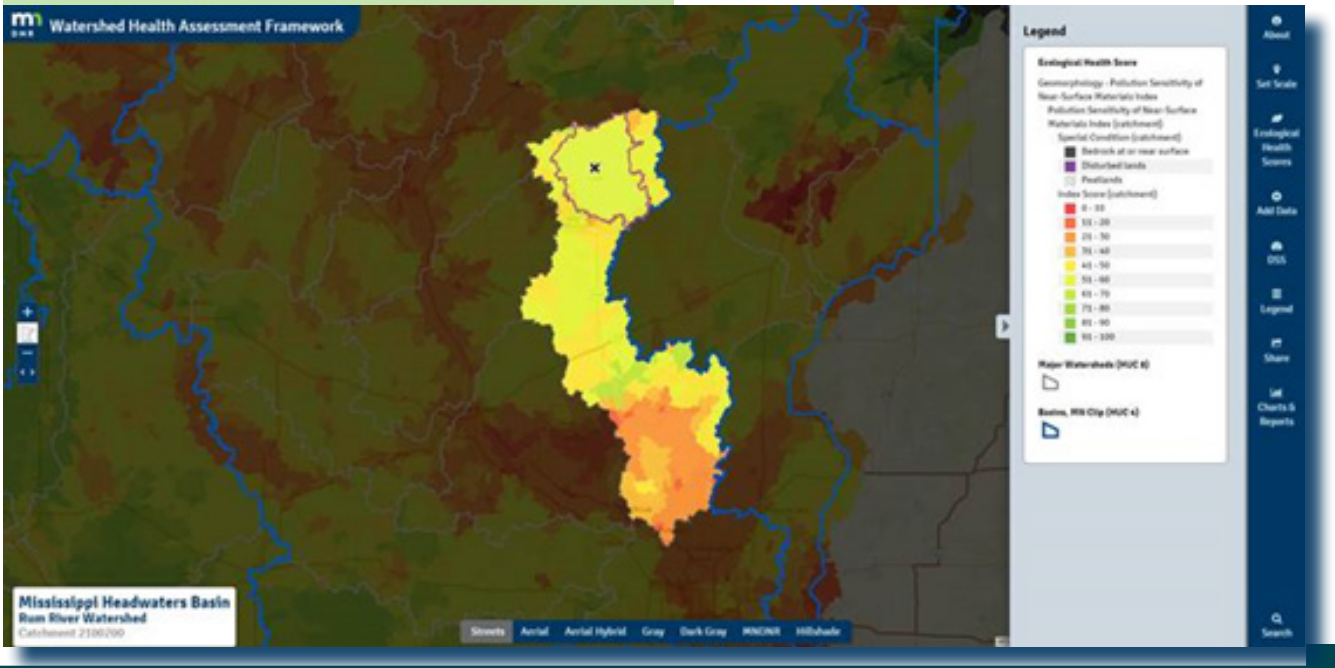
WHAF Web Redesign

The WHAF Team ended 2017 on a high note, deploying a re-design of the WHAF web pages. The new approach more deliberately connects the dots between the 5-component framework, system management concepts, health scores and the WHAF Map experience. Please take a look and send us feedback on our new design.



Interactive map update

In addition to the web pages, the WHAF interactive map is also undergoing a facelift from the ground-up to create a more accessible and usable web mapping application. The update aims to make the map more usable for all audiences, and easier to maintain in the future. *Below is a screenshot of the application in-action.*



Watershed Health Assessment Framework cont'd

Decision Support

The WHAF team is designing a way for users to analyze how different management actions will impact watershed health. To do so, the team developed a series of relationships that connect management actions with system mechanisms and ecosystem responses.

To date, the team has developed connections between 80 Management Actions, 45 Mechanisms and 44 System responses resulting in a database with more than 1500 relationships. To maintain the data relationships, a Python micro-framework called Flask will be leveraged to link the database to our mapping application. Expect to hear more about the WHAF DSS is 2018.

Analysis Updates

In 2017, several health index scores were updated including new data for our Groundwater Susceptibility index. We coordinated with MPCA to provide GIS analysis of watershed characteristics for a nutrient study and the prioritization of streams for the WRAPS process. A GIS Toolbox for custom land cover charts was developed and distributed to DNR staff.

A web platform was created for advanced users to view the statistical relationship between WHAF health scores and the quality of aquatic communities in Minnesota streams.

Clean Water Staff Support

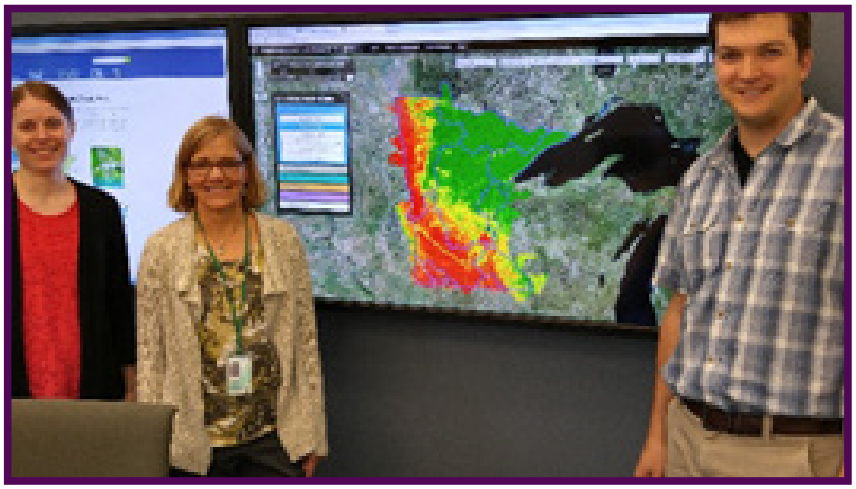
Our work continues to support the work of DNR and PCA Clean Water funded staff. From technical reports to public presentations, the WHAF is showing up in many settings across Minnesota. More direct support includes partnering with PCA to write the WRAPS Stream Protection Prioritization and creating a Land Use toolbox to create custom land use charts in ArcMap.

Education and Outreach

To support our growing user base, we gave a WHAF training at the DNR Computer Training Center. Attended by fifteen Clean Water funded staff from multiple state agencies, attendees continue to engage as our 'WHAF Cohort', helping to guide WHAF development.

The WHAF has also been getting used by educators for outreach, classroom experiences and field days. From a Water Quality Course at the University of MN to middle schoolers at Whitewater State Park, it has been a year of building opportunities for outreach and education.

Want to know more? Subscribe to our newsletter for periodic updates.



Email Updates

Receive by email news and updates on the Watershed Health Assessment Framework from the DNR.

Email Address

SUBMIT

Stream Restoration Projects completed or started in 2017

Stream restoration projects completed in 2017:

- **Lake Shady Dam, Zumbro River in Oronoco** = the dam that failed in Sept. 2010 was removed and replaced with a rock-arch-rapids. A meandering channel with riffles was constructed through the reservoir sediments. *REU: funding, conceptual design, oversight of construction, monitoring – Luther, Neil, Kevin, Mark, Amanda, Ann & crew. Others: Kevin Stauffer (Fisheries); Olmsted County.*
- **Sandhill River near Fertile** = within a long channelized reach, 18 riffles were constructed for grade control and four check dams were partially removed (abutments cut to grade) and modified with rock-arch-rapids. These were the only barriers on this river, so fish passage has now been restored connecting quality upstream and downstream habitat. The project was finished well under budget so options are being examined for additional habitat projects in the areas including the removal of Sand Hill Lake outlet dam and resetting a problematic culvert on Kittleson Creek. *REU: funding, conceptual design, oversight of construction, monitoring – Luther, Neil, Amanda, Ann and crew. Others: Jamison Wendel (Fisheries); Stephanie Klamm, Tom Groshens, Jason Vinje, Lori Clark (EWR); ACOE; Houston Engineering (riffles); Sand Hill WD.*
- **Mille Lacs Lake Dam, Rum River** = outlet structure (fish barrier) was modified with a rock-arch-rapids for fish passage. The dam downstream on Ogechie Lake was removed for wild rice production. *REU: conceptual design – Luther. Others: Houston Engineering, Fisheries & Parks staff, Mille Lacs Band of Ojibwe.*
- **Dam remnants on Minnesota River in Granite Falls** = remnants of a power dam were removed or rebuilt into a rapids under and just downstream of Hwy 212 bridge. *REU: conceptual design - Luther; construction oversight - Luther, Neil. Others: Chris Domeier (Fisheries), Lucas Youngsma (EWR), Shane Rustin (Engineering).*
- **Gorman Creek dam near Kellogg** = dam under a bridge was removed and replaced with a rock-arch-rapids. *REU: conceptual design & designing for the site - Luther. Others: DOT engineers (replacing dams under bridges with rapids is being used more widely by DOT).*

Stream restoration projects started in 2017:

- **Drywood Creek near Fairfield** = A channel has been cut in, the floodplain has been shaped and the dam (carp dam that failed) was removed. Next spring 2 riffles and all toe-wood structures will be installed and final plantings completed. *REU: conceptual design - Neil. Others: Brady Swanson, Jon Lore, Brooke Hacker, Ryan Bjerke (EWR); Chris Domeier (Fisheries); Ross Reiffenberger -TSA Engineer, Pomme de Terre River Association.*
- **Marsh Lake Dam, Pomme de Terre River confluence with Minnesota River** = Modification of the outlet structure is ongoing. Channel excavation will begin spring 2018 to reconnect the Pomme de Terre River via its historic channel to the Minnesota River. Mussels in the footprint of channel structures were relocated this summer. A larger rescue effort will take place this summer to rescue mussels from the abandoned channel. *REU: conceptual design, future oversight of construction – Luther. Others: Chris Domeier (Fisheries); ACOE.*
- **Middle Fork of the Whitewater River, in Whitewater State Park** = restoration work continues. *REU: funding, conceptual design, oversight of construction, monitoring – Kevin, Ian, Luther, Neil, Dan, Mark, Amanda, & Ann. Others: Chris, Steve (Engineering) and Jan, Shawn, Brent & Colon (Parks).*

(bottom) Lake Shady - North Branch of Zumbro River river restoration where a channel was excavated through the deposited reservoir sediment. (top) Looking downstream at the newly constructed rock arch rapids.

Stream Restoration Projects on deck

Projects ready to break ground

- **Mound Creek in Blue Mounds State Park = dam failed in spring 2014. The project engineer has been hired and dam removal designs have begun. It is expected to break ground next spring. This river is inhabited by federally threatened Topeka shiner.** *REU: funding, conceptual design– Luther. Others: Region 4 CWL staff (EWR); Parks; Engineering.*
- **Mission Creek near Duluth – an unstable reach will be stabilized with meanders and toe-wood sod mats. This project in undergoing cultural/archaeological review due to the Native American burial ground in the near downstream area.** *REU: funding, project coordination, conceptual design– Luther, Amanda. Others: Keith Anderson - SCWD; Karl Koller (EWR); Ann Thompson – South St. Louis Watershed Conservation District.*
- **Fish Lake Dam, Pelican River = outlet dam modification with rock-arch-rapids.** *REU: conceptual design – Luther. Others: Julie Aadland (EWR); Pelican Lake Association, Houston Engineering, USFWS.*

Projects that have been funded

- **Gorman Creek, part 2 - river restoration.** *REU: conceptual design, project coordination - Kevin, Mark, Amanda. Others: Melissa Konsti, Kevin Stauffer (Fisheries).*

Projects in design phase

- **Grindstone Lake Dam, Grindstone River = removal or modification options are being considered for this Fisheries owned dam. A public meeting was held fall 2017. Additional funds were received by Dam Safety.** *REU: project coordination, surveying, design ideas – Kevin, Mark, Amy, Luther, Neil, Amanda. Others: Leslie George (Fisheries); Jon Hendrickson (Engineering), Dam Safety.*
- **Cottonwood River Dams - removal/modification of 3 dams. Currently reviewing RFQs from consultants.** *REU: project coordination - Amanda, design – Luther. Others: Lucas Youngsma (EWR).*
- **Phelps Mill, Otter Tail River = dam modification. Two public meetings have been held. Waiting for Otter Tail County to decide between a fishway or full modification.** *REU: funding, project coordination, conceptual design- Luther, Amanda. Others: Howard Fullhart (Fisheries), Houston Engineering, USFWS, Otter Tail County.*
- **Lower Otter Tail River =restoration of channelized reach. Field surveys completed. Prioritizing restoration segments.** *REU: assisting in design – Luther, Neil, Amanda, Amy. Others: Buffalo Red River WD, Houston Engineering.*
- **Willow River Dam = the DNR owned dam failed in 2016 flood. Replacement/removal/modification options are being considered. A public input meeting was held fall 2017.** *REU: design ideas - Luther, public outreach - Amanda, Amy. Others: R2 EWR staff, Fisheries, and Dam Safety.*

Projects on the radar (alphabetical)

- **Austin (Ramsey Mill Pond) Dam, Cedar River:** evaluating options
- **Bostic Creek:** ditched channel around bog. Funding received for grade stabilization in the ditch. Groundwater flow monitoring of bog to begin.
- **Buckingham Creek:** dammed & degraded trout stream
- **Cascade Creek, Rochester:** ditched channel
- **Crane Lake:** culvert modification *(Fisheries)*
- **Fergus Falls Dams, Otter Tail River**: 5 hydropower dams owned by Otter Tail Power are going through the FERC relicensing process
- **Fish Creek**: dam removal, channel restoration and culvert replacement *(Fisheries)*
- **Hallock Dam, Two Rivers**: evaluating options
- **Lake Carlos Dam, Long Prairie River**: evaluating options
- **Lanesboro Dam, S. B. Root River:** evaluating options
- **Little Swan Lake Dam:** evaluating options
- **Miller Creek, Duluth**: channel restoration behind Kohls. Recommended LSOHC funding for ML2018.
- **Mud Creek**: collaboration with TNC possibly taking a watershed approach to prairie and stream restoration.
- **N.F. Zumbro River, Mazeppa:** repair of flood damage to original project
- **Norway Lake Dam, Pine River:** evaluating options
- **Pelican Rapids Dam, Pelican River:** dam removal/ modification, city is evaluating options
- **Red Sand Lake** - dam modification *(Fisheries)*
- **Shell River culverts**: 3 culvert replacements in the Otter Tail watersheds. Recommended LSOHC funding for ML2018.
- **South Branch Buffalo River:** ditched channel. Collecting data and developing a master plan.
- **Thief River:** remeander to avoid meander cutoff
- **Watertown Dam, S. F. Crow River:** evaluating options
- **Whetstone River/Minnesota River:** river restoration that will bypass the dam
- **Whiskey Creek:** ditched channel
- **Wild Rice River:** ACOE project to address a channelized reach
- **Wolverton Creek:** ditched channel

We have a Google Earth file of completed restoration projects, funded projects, fish & mussel monitoring sites, and projects on the radar. If you have sites to add or want the most current version, contact Amy.

Ian — Unit Supervisor, river scientist

Amy started this newsletter roughly three years ago in Fall of 2014, and this edition encapsulates our work in 2017. As we have grown to 18 full time permanent staff, including myself, and Kitty (who is technically MNIT staff that works on the WHAF project), the newsletter is intended primarily to keep each other informed as to what, exactly, we are all doing. It should also be informative for those interested in a more intimate and un-contextualized view of our annual work. We are a diverse group, working on a host of important pieces of natural systems. I say natural systems here, rather than just 'rivers', because the valley rules the stream, and to work on one is to inherently be working on the other, at some level. What is apparent to me, when I look at the breadth of our work, is the consistency in the level of dedication and commitment from work area in rivers to another. Consistency shows too, when I consider how rich the knowledge is in each facet of our work. We are truly delving into unique areas of knowledge, at levels that are surprising. But our strength and what makes us even better than the outstanding work we do individually, is in the collective acumen of our Unit. We have not explored this fully yet, the idea of turning to each other to merge our expertise, say WHAF selection and prescriptions for a suitable catchment for stream reach restoration, with restoration of a mussel bed, with re-design of downstream problem road intersections, with subsequent monitoring and analysis of fish densities and habitat use, and artful telling of the story that enfolds – but we are getting there. At least, I hope so . . .

When we do, we as a collective of outstanding resource professionals, will take a great leap forward – we will be putting things back together. And when we do, we deepen and grow even further, our work becoming still more relevant. So, here's to what we do – keep on reaching!

Luther — program consultant , river scientist

All in all Luther keeps busy consulting on projects, developing project designs, providing conceptual designs, presenting and providing expertise at public meetings, teaching workshops and writing.

This past year Luther worked on the conceptual and/or engineering design for a variety of projects including:

- ⇨ Lake Shady dam removal on Zumbro River
- ⇨ Grindstone Dam on Grindstone River
- ⇨ Sandhill River dam modifications
- ⇨ Whetstone River/Upper Minnesota River
- ⇨ Marsh Lake on Upper Minnesota River
- ⇨ Blue Mounds State Park, Mound Creek dam
- ⇨ Mille Lacs Lake outlet dam on Rum River
- ⇨ Phelps Mill dam on Otter Tail River
- ⇨ Fergus Falls dams on Otter Tail River
- ⇨ Fish Lake dam on Pelican River
- ⇨ Cottonwood River dams (3)
- ⇨ Willow River dam
- ⇨ Pelican Rapids dam on Pelican River
- ⇨ Mississippi Headwaters rapids in Itasca State Park

In the field Luther spent time overseeing the construction of:

- rapids and channel restoration in former Lake Shady on the Zumbro River,
- four rapids on the Sandhill River,
- Granite Falls rapids (removed dam remnants),
- rapids on Gorman Creek,
- improvements to Dunton Lock rapids on the Otter Tail River
- improvements to Heiberg rapids on Wild Rice River.

Out in front Luther gave several presentations including:

- a webinar to the Association of Dam Safety officials
- public information meeting for possible dam removal projects such as:
  - » Otter Tail Power dams, Fergus Falls
  - » Cottonwood River dams, Lamberton
  - » Phelp's Mill dam on Otter Tail River, Otter Tail County
  - » Grindstone dam on the Grindstone River, Hinckley

and was interviewed and filmed by:

- » Pioneer Public TV for a program on dam removal and fish passage (to air Spring 2018) and
- » Icon Films for a series on the state of large rivers of the world. Luther and Neil got to meet and fish with Jeremy Wade of River Monsters! This segment is set to air in April 2018.

As far as **writing**, Luther continues to work on:

- finalizing the edits to the *Ecological Implications and Science-based Strategies for Invasive Carp* in Minnesota report,
- publishing the barrier data from the report B*arrier Effects on Native Fishes of Minnesota* in the Transactions of the American Fisheries Society journal,

now that the following undertakings are completed:

- Minnesota Bigheaded Carps Risk Assessment, a report for the MN DNR by the University of Minnesota's MN Aquatic Invasive Species Research Center,
- "River Revivals" article was printed in the May/June edition of the Conservation Volunteer.

Amanda restoration coordinator

LSOHC Projects completed:
- Lake Shady on the Zumbro River
- Sand Hill River Dams

LSOHC Projects in construction:
- Drywood Creek
- Whitewater

Tidbits:
- Amanda continues to coordinate activities for LSOHC funded projects including: Lake Shady, Phelps Mill Dam, Grindstone Dam, Cottonwood River Dams, Mission Creek and Drywood Creek.
- Otter Tail and Snake River watersheds have complete culvert inventories.
- Amanda has worked to develop a 5 component prioritization framework for culvert replacement.
- Amanda and Amy are working with TNC to collaborate on stream restoration within the Prairie Corridor plan.
- Amanda and Neil participated in Aqua Chautauqua, a public education event in Fergus Falls.
- Amanda's summer 2017 interns were:
  - » Devon Libby who recently received his Master's degree in Geography at Mankato State University
  - » Claire Boudreaux who is working toward completion of a Bachelor's degree in Fisheries and Wildlife at Michigan State University.

Conferences and meetings attended in 2017
- Stream Practitioner Annual Meeting
- Mussel Coordination Team Meeting
- Legislative-Citizen Commission on Minnesota Resources (LCCMR)
- Upper Mississippi River Research Consortium
- Freshwater Mollusk Conservation Society Symposium
- MN American Fisheries Society Conference

Events

Aqua Chautauqua

This outreach event was held in Fergus Falls on August 12th. It was organized and hosted by University of MN Extension. Amanda and Neil tended an informational table and Otter Tail watershed posters created by Beth via the WHAF.

2018 Events
- Stream Practitioners Annual Meeting
  - » Jan. 17-18, 2018 in Duluth - Neil (chair) and Amy on the planning committee.
- River Restoration Conference
  - » Oct. 28-30, 2018 in Two Harbors
- Freshwater Mollusk Conservation Society Symposium
- Mussel Coordination Team Meeting
- Legislative-Citizen Commission on Minnesota Resources (LCCMR)
- FMCS Disease Workshop
- MN American Fisheries Society Conference
  - » Feb 6-8 in St. Cloud
- NCD Rivers & Streams Commitee meeting
  - » March 27-28 in Milan, IL

Fish sampling 2017 Ann, Lecia, & interns

Fish sampling - Summer 2017

Fish sampling for 2017 was challenged by water flows, either too high or too low. In the end, a total of 14 sites were sampled.

Pre-project data was collected from:

- Grindstone River (2 sites) - dam removal/modification

Post-project data was collected from:

- Sandhill River (3 sites) - dam modifications
- High Island Creek (2 sites) - dam removal

Long-term monitoring:

- Yellow Medicine River now has 28 years of data
- Otter Tail River now has 20 years of data. *Thank you to Sam Bump, Mark Ellefson, and Ben Gosack for subbing for interns.*

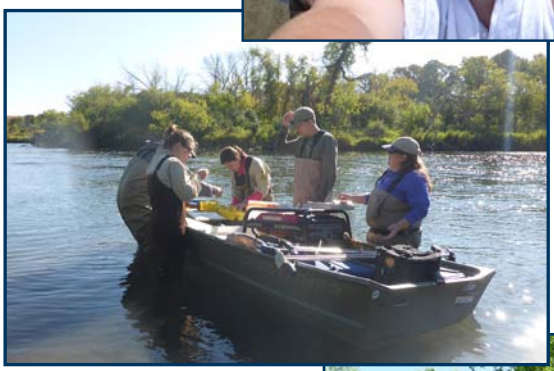
Note: Zebra mussels are having a major impact on the Otter Tail River. They are so prevalent, we considered them gravel for substrate quantification, often covering the entire surface of the cell being sampled. Water clarity was considerably higher than usual – past secchi disc and tube readings have ranged from 0.9 to 2.9 ft., averaging 2.1 ft. The secchi tube reading taken this year was > 3.9 ft. (maxing out the tube depth). Increased transparency has promoted the growth of submerged vegetation, which is now covering many of the rocks and bed surface.

River	# of sites	Site Status
Grindstone	2	existing
High Island Creek	2	existing
Sandhill	2	existing
Redwood	2	1 new, 1 existing
Little Fork	1	new
Ramsey Creek (Redwood tributary)	1	new
Yellow Medicine	1	long-term
Otter Tail	1	long-term

Ann's interns - summer 2017

- Andre Ferguson - *senior at Winona State University - Ecology major with a statistics minor*
- Jason Menk - *senior at the U of Minnesota – majoring in Fisheries, Wildlife & Conservation Biology*
- Brian Stockowitz - *senior at the U of Wisconsin, Stevens Point– majoring in Water Resources & Soil Science*
- Emma Lee - *senior at the U of Wisconsin, Platteville – double major in Animal Science and Biology*

Pictured below from left to right.



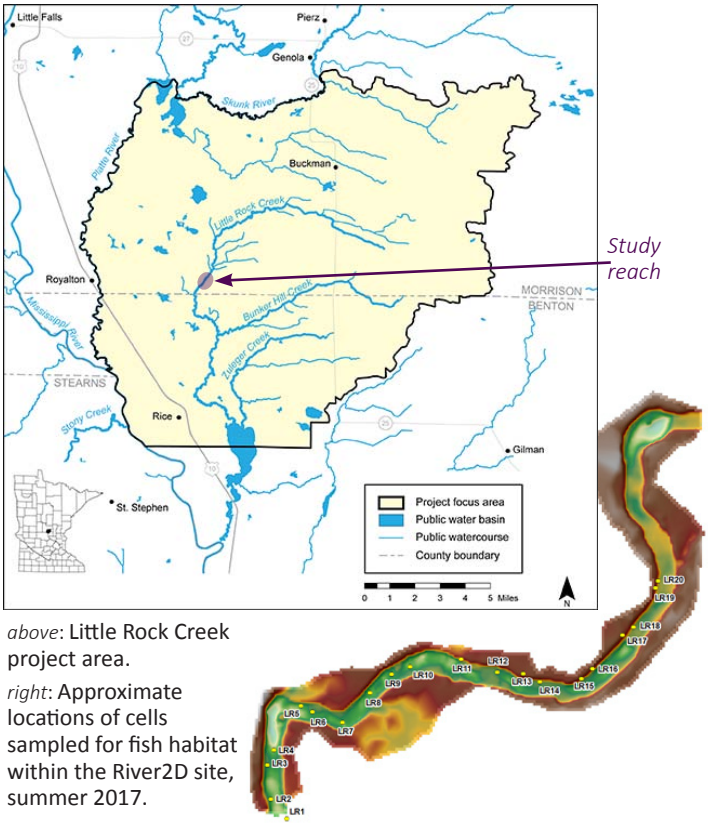
Little Rock Creek River2D IFIM Study

Dan, Ann, Mark, Lecia, & interns

Project purpose

Groundwater use has increased substantially in recent years in the Little Rock Creek Area, and the DNR just released a 5-year management plan outlining further study of the area with the goal of determining sustainable groundwater usage and limiting negative effects on the trout stream.

REU is collecting flow and site specific fish habitat use data to complete a River2D hydrodynamic model of a Little Rock Creek reach. This model, in combination with other DNR research, will be used to determine a sustainable diversion limit for cumulative groundwater use, and establish a protected flow in 2020.



above: Little Rock Creek project area.

right: Approximate locations of cells sampled for fish habitat within the River2D site, summer 2017.

Summary of fish data

- River2D site - downstream of Nature Rd/Cty 26.
  - » 20 cells sampled, 210 fish collected, 9 fish species found.
    - Species found were blacknose dace, brown trout, central mudminnow, creek chub, common shiner, fathead minnow, johnny darter, longnose dace, and white sucker.
- Downstream site -up from minimum maintenance Road
  - » 20 cells sampled, 84 fish collected, 8 fish species found.
    - Species found were blacknose dace, brown trout, brook stickleback, central mudminnow, creek chub, johnny darter, northern pike, and white sucker.

What was completed this summer

- Study site reconnaissance (East of Royalton, MN)
  - » Site chosen had good substrate and habitat type variety compared to other site options.
  - » Identified locations of survey stations.
  - » Installed rebar, nails and lath with intern assistance.
  - » Due to the dense summer vegetation, numerous turning points were needed to survey the entire reach, with good line of site to the stream channel.
- The stations and benchmarks along the reach were surveyed first, using both a Total Station and survey-grade GPS where good reception was available.
- An additional 4+ days were spent surveying channel features.
  - » Just under 1,000 feet of stream channel was surveyed in detail— identifying toe of bank, top of bank, bed topography, and more generalized floodplain topography. Substrate type was identified for all in-stream channel points collected, including at the toe of bank. Top of bank points were also taken at close intervals to delineate the top of bank along the reach well to improve the 2D hydro modeling accuracy. Floodplain ground shots were collected largely to see how well the surveyed elevations lined up with the LiDAR DEM.
- Discharge measurements were taken several times throughout the summer, at a wide range of flows – focusing on low flows. Point velocities will be used to calibrate the River2D model. Next spring, a HOBO data-logger will be installed to collect DO and temperature data at the site.
- Mark did much of the topographic survey planning, operated the Total Station, and processed the data – creating a bed topography TIN (terrain model)— formatting data for use in River2D modelling.
- Fish habitat sampling was completed on the ground surveyed stream reach, in addition to a second site further downstream.
  - » Fish habitat Model in River2D
    - Uses PHABSIM approach of Weighted Usable Area (WUA)
      - Composite suitability index, interpolated from fish preference curves (based on substrate, cover, depths & velocities preferences for fish species life stages) obtained from fish sampling data and hydrodynamic aspect of River2D model.

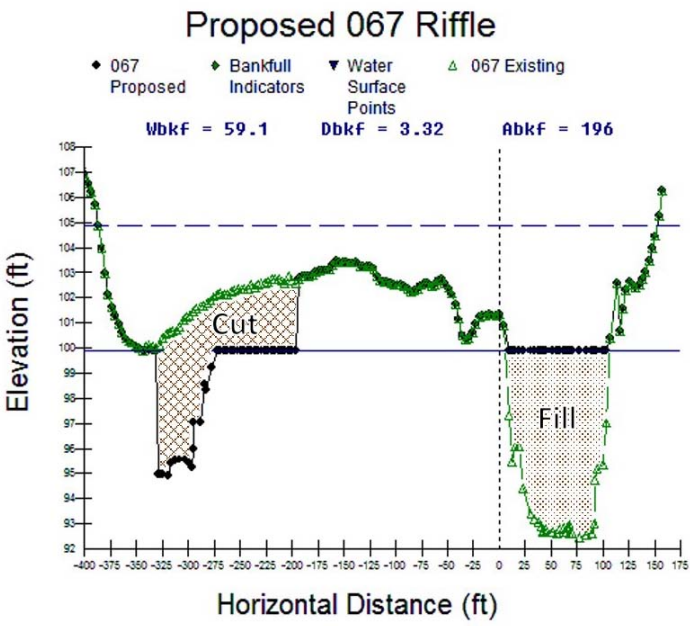
MN DNR website - Sustainable Use of Groundwater in the Little Rock Creek Area

Whitewater River Master Restoration Plan

Mark & Kevin

This document is meant to be paired with the Whitewater WARSSS study. The WARSSS study identifies the unstable river reaches in the watershed and quantifies the eroded sediment delivered to the river system. The Master Restoration Plan details the methods to reduce the in-channel erosion using channel restoration. It discusses the following:

1. Brief characterization of the watershed.
2. Brief summary of sediment sources detailed in WARSSS.
3. Brief discussion of factors related to sediment sources and their delivery.
4. Constraints to restoration (profile equilibrium, culverts, landowner participation)
5. Design approaches and concepts (for different valley type/stream type combinations and how recommended conversion scenarios are used to deal with erosional processes and constraints present).
6. Typical stream type conversion scenarios (typical cross-section and sediment reduction attained).
7. Breakdown of estimated restoration costs.
8. Prioritize areas for restoration.



above: Proposed conversion of a riffle from a F4 poor condition to a C4 good condition (Valley Type: U-AL-FD).

below: Normalized restoration costs by stream type conversion scenario. Converting "F" channels to "E" channels is one of the most expensive by foot but is most efficient at reducing bank erosion.

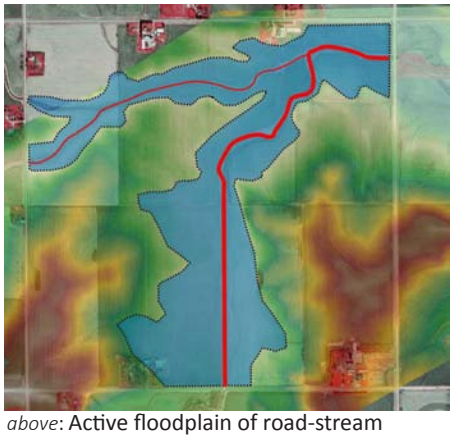
Scenario	No. of Reaches	MEAN $/foot	MEAN $/ton bank erosion
E (poor/fair) To E (good)	22	42	455
C To E	9	84	742
G To E	4	84	823
F To E	10	134	256
C (poor/fair) To C (good)	9	233	420
F To C	3	74	956
D To C	4	85	355

left: Estimates of restoration costs and dollars spent per ton of bank erosion prevented.

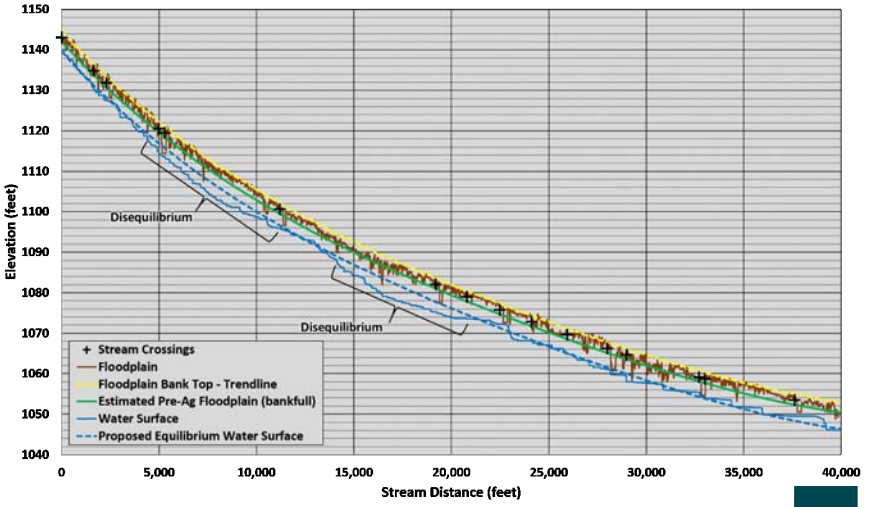
below: Portion of the profile from upper North Fork River. Proposed equilibrium water surface created by lowering floodplain trend line to match local base levels. Sections of water surface profile below equilibrium line highlight areas of channel bed to be raised.

Major	MinorS Sub-watershed	No. of Reaches	Restoration Cost	Stream Length (ft)	BANCS Predicted Erosion (tons)	$/Foot	$/ton Bank Erosion
Mainstem	40012	2	$3,711,703	39250	21607	$95	$172
	40015	4	$1,772,738	26133	2136	$68	$830
	40016	2	$8,621,982	18704	25061	$461	$344
	Sub Total	8	$14,106,423	84087	48804	$168	$289
Middle Fork	40018	2	$2,021,332	20852	3910	$97	$517
	40019	1	$360,430	3351	232	$108	$1,554
	40038	5	$1,791,137	24551	2685	$73	$667
	40040	6	$410,002	11868	547	$35	$750
	Sub Total	17	$5,476,788	71928	8156	$76	$672
North Fork	40017	5	$7,139,230	26826	5133	$266	$1,391
	40031	2	$822,838	14776	230	$56	$3,578
	40034	1	$1,244,612	13446	538	$93	$2,313
	40035	6	$4,473,210	58132	7588	$77	$590
	40037	3	$1,109,757	25469	1660	$44	$669
	Sub Total	17	$14,789,647	138649	15149	$107	$976
South Fork	40021	5	$4,853,788	71249	6877	$68	$706
	40023	1	$779,030	7734	487	$101	$1,600
	40024	4	$3,269,198	28160	20272	$116	$161
	40025	1	$219,135	5083	1033	$43	$212
	40039	7	$931,863	43132	5123	$22	$182
	40041	4	$898,403	28478	3379	$32	$266
	Sub Total	22	$10,951,418	183836	37171	$60	$295
Total		61	$44,430,388	467194	108498	$95	$410

*restoration cost estimated from excavation costs consisting of 30% of total
*excavation estimated at $7 per cubic yard



above: Active floodplain of road-stream intersection.



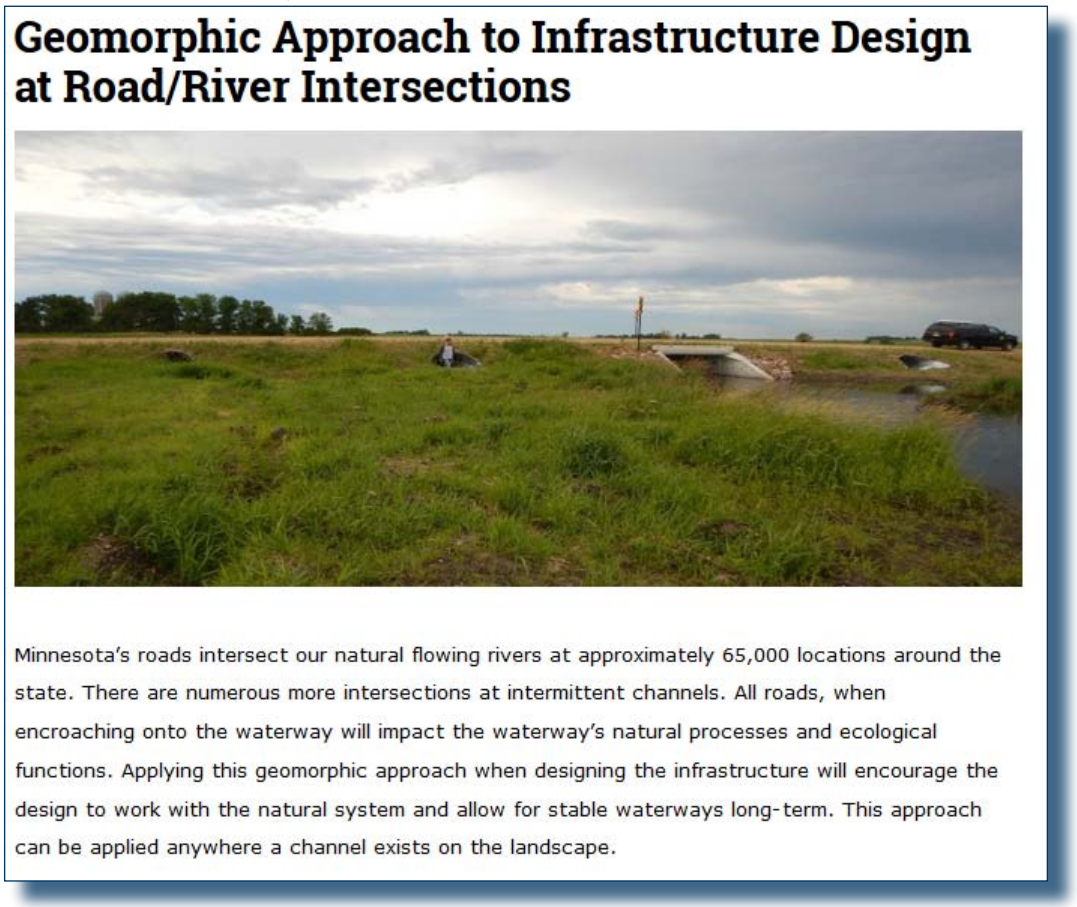
Kevin river scientist

Geomorphic Approach to Infrastructure Design

In close collaboration with our DNR's - Land Use Unit's – Flood Mapping Program, this approach to design provides designers of infrastructure a 'how to' manual with tools on establishing and applying critical landform metrics into design. Through application of these metrics into site design, the designers a can establish and quantify a 'least impactful' site design to the waterway.

Many milestones have been achieved in this effort with many to go. As our monitoring of implemented projects continues to grow, many improvements and tools will become available

Geomorphology Information website



Geomorphology Dataset

Coming soon:

Statewide Channel Morphology Dataset

Recently a statewide solicitation of channel morphology data was sent out by Kevin & Neil and they have begun to receive data. As the data is gathered and the database develops, a few standard products will become available for all to utilize.

A few critical uses of this dataset will be:

- Channel condition assessment
- Spatial assessment of channel conditions
- Improved hydrologic & hydraulic modeling through proper representation

All geomorphic data provided to this effort will be:

- part of this public information
- properly credited back to the provider and field collectors
- put in a central database under development

As this spatial database develops, the Geomorphology Program will seek feedback on improving products generated from this effort.

Workshops

2017 We offered the first three workshops in the River Science Series. **The Fundamentals of Stream Restoration: Applied Geomorphology and Ecology workshop** was completed in June. The instructors involved were Luther, Neil, Amanda, Amy, Mark, Jason Vinje, Karl Koller. Thirty-seven people attended the course including summer interns for Amanda and Ann. The two advanced courses were not completed due to low enrollment.

We also started offering **"Mentoring Opportunities"** via Project Review and On-site training. Those interested can sign up to a) have a project reviewed and/or b) to be notified of pending on-site training opportunities.

2018 We are offering:

- **The Ditching Dilemma workshop** March 19-21 in Blue Earth, MN.
- **The Fundamentals of Stream Restoration** June 11-15 in the Marshall area. We will announce the workshop details in February.

Students surveyed Long Branch Creek (above) and the Buffalo River just upstream of Hawley (bottom). Luther and Neil traveled between the four groups.

Neil restoration & monitoring

This year Neil has been busy:

- helping oversee construction of various projects including
  - » Pomme de Terre River/ Marsh Lake project
  - » Minnesota River at Granite Falls removal of dam remnant under Hwy 212
  - » Lake Shady rock arch rapids construction and channel excavation
  - » Sandhill dam modifications into rock arch rapids
  - » Drywood Creek channel and floodplain excavation.
- consulting on various restoration projects
- providing reference reach data as requested
- preparing for and teaching workshops
- preparing for and beginning the request for statewide geomorphic data from internal and external practitioners.
- helping develop Standard Deliverables for DNR watershed assessments
- planning the 2018 Stream Practitioner meeting (January 17-18 in Duluth) as the chair of the planning committee. He will be the chair again next year.

Amy outreach specialist

This year I have kept busy with:

- planning, advertising, and preparing for four offered workshops, of which one was held - *The Fundamentals or River Science* workshop in June in Fergus Falls.
- continued editing of the *Ecological Implications and Strategies for Invasive Carp in Minnesota* report. The document is being completely reformated for accessiblility. A revised draft is almost ready for a second round of peer review.
- writing my own and managing the submittal of articles for our weekly column "Natural Resource News" in the local paper - The Daily Journal.
- preparing for and attending public meetings on various dam projects.
- accessibility training and learning as new, and old, materials (presentations, flyers, papers, etc.) are being made accessible.
- planning for the first mussel relocation on the Pomme de Terre River with the second, a much larger, effort happening summer 2018.
- planning committe for Stream Pracitioner meeting in Jan. 2018.
- developing an Access database of stream restoration projects - with a ton of help from Zeb! Thanks Zeb!

SHP Workshop website