Conservation Resource Alliance

Little South Branch Pere Marquette River Habitat Enhancement Project

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Agenda

1. Introduction……..Scott Courts
2. Historical Review and 2025 Construction Overview..... Nate Winkler
3. Budget……..……Nate Winkler
4. Current and Planned Next Steps…….Nate Winkler
5. Community Contributions…….Tom Johnson
6. Question and Answers……..Nate Winkler
7. Closing…….……Scott Courts

TROUT STREAM IMPROVEMENT IN MICHIGAN

CLARENCE M. TARZWELL

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Maintaining trout fishing at its former standard of excellence is proving to be a serious problem. Fish hatchery methods and fish culture are only two of the necessary steps leading to more and better trout fishing in our streams. Some thought must be given to the welfare of the fish after planting, and attention to improving the habitat. We can no longer depend merely on stocking because if conditions in the stream itself are not favorable, we cannot hope to be successful in producing large numbers of fish of suitable size. Conditions in the waters themselves must be bettered if the fish are to have adequate cover and food. It is possible to improve a stream considerably in counteracting the natural deficiencies by artificially improving upon what has been naturally provided or by restoring what man has destroyed.

Deforestation and lumbering practices have nearly ruined many of our streams, the former has removed shade and cover and has caused quick run-offs which are carrying immense quantities of ruinous sand into the streams every year, covering up the spawning beds and food producing areas. One of the methods of lumbering was directly in opposition to the production of trout. Dams flooded the spawning beds, and log drives scoured them out. Flooding for the drives widened the streams and washed into them non-productive sand which covered up the gravel. The rivers were cleared of all jams and cover before the drives and they were swept clear of any vestige of cover by the rush of logs. All these things—the destroying of spawning beds, the covering of great areas with sand, the excessive widening of the stream, and the removal of all cover, are now making themselves harmfully apparent. Perhaps the best way to regulate conditions already disturbed is to restore as nearly as possible original and normal conditions.

This problem is being attempted by the introduction of various types of barriers, hides, and covers. These devices are modeled after those made naturally. It is thought that they will accomplish several things toward restoring the streams to their former condition such as: digging pools, furnishing shade and cover, aiding in the production of more fish, stimulating food conditions, and improving fishing conditions as a sport.

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(Tarzwell, 1931
Transactions of the American Fisheries Society)

Referenced List of the Benefits of Woody Debris in Streams, and a List of the Negative Impacts of Indiscriminate Debris Removal

Below is a review of the documented benefits of having large woody debris in streams (and a few other miscellaneous facts), taken from the papers in my files. The best overview papers of the different roles woody debris plays in streams – pro and con – are probably Gregory and Davis, 1992 (especially Figure 1, p. 127), Gurnell et al., 1995, and Piégay and Gurnell, 1997.

Stream Channel Formation and Erosion

- **Stable woody debris increases the stability of a stream channel by absorbing the energy of flood flows, reducing water velocity at low and moderate flows, and reducing erosion of the stream bank and stream bed at both local and regional scales**
  - Abbe and Montgomery, 1996; Ehrman and Lamberti, 1992; Gurnell et al., 1995; Hygelund and Manga, 2003; Keller et al., 1995; Keller and Macdonald, 1995; Manga and Kirchner, 2000; Marston, 1982; Piégay and Gurnell, 1997; Smith et al., 1993a; Wallace et al., 1995
- **Stable woody debris affects channel form by slowing and directing flood flows and temporarily storing sediment**
  - Bilby, 1984; Diez et al., 2000; Gurnell et al., 1995; Keller and Swanson, 1979; Marston, 1982; Mutz, 2000; Piégay and Gurnell, 1997; Smith et al., 1993a; Thompson, 1995
- **Embedded woody debris (stumps rooted into the stream bank, logs stuck into the stream bed) reduce local bank erosion**
  - Keller and Swanson, 1979
- **Removing woody debris decreases critical shear stress and increases channel bed erosion (to maintain channel slope)**
  - Assani and Petit, 1995; Heede, 1985; Smith et al., 1993b
- **In larger natural streams, woody debris is usually oriented to the flow such that it does not reduce flow conveyance or increase flooding frequency.**
  - Gippel et al., 1996a
- **Water flow blockages may be reduced by rotating woody debris, rather than removing it (laboratory flume study)**
  - Young, 1991
- **Woody debris occupying less than about 10% of the stream channel width does not reduce flow conveyance (field study)**
  - Gippel et al., 1996b
- **Stream blockages as high as 50% cause only a 1% rise in base flow stage levels (laboratory flume study)**
  - Young, 1991
- **Stream blockages as high as 80% are required to significantly increase flood levels (laboratory flume study)**
  - Young, 1991

- **Woody debris higher in the water column causes less flow blockage than logs positioned along the bottom (laboratory flume study)**
  - Young, 1991
- **Stable woody debris can reduce erosion of exposed stream banks and channel bars by protecting developing thickets of riparian vegetation, for decades or even centuries**
  - Abbe and Montgomery, 1996; U.S. Forest Service, 1988

Fish

- **A greater variety of fish occur in streams with woody debris**
  - Montgomery and Piégay, 2003; Piégay and Gurnell, 1997; U.S. Forest Service, 1988; WAWRC, 2000
- **Woody debris causes the formation of good fish habitat such as pools, backwaters and fast-flowing chutes, in small to mid-size streams**
  - Andrus et al., 1988; Baillie and Davies, 2002; Beechie and Sibley, 1997; Bilby and Bisson, 1998; Bilby and Ward, 1991; Carlson et al., 1990; Collins and Montgomery, 2002; Gurnell et al., 1995; Hilderbrand et al., 1997; Hunt, 1993; Keller et al., 1995; Keller and Macdonald, 1995; Ralph et al., 1994; Richmond and Fausch, 1995; Tasmanian Inland Fisheries Service; U.S. Forest Service, 1988, 1989.
- **Woody debris provides fish "refuges" during floods**
  - Gurnell et al., 1995; McMahon and Hartman, 1989; U.S. Forest Service, 1988
- **Woody debris provides nursery habitat for juvenile fish**
  - U.S. Forest Service, 1984; U.S. Forest Service, 1988
- **Woody debris jams temporarily store sediment, reducing siltation of fish habitat like riffles and pools, and increasing the variety of stream habitats**
  - Bilby and Bisson, 1998; Keller et al., 1995; Keller and Macdonald, 1995; Keller and Swanson, 1979; U.S. Forest Service, 1988
- **Debris jams help streams retain organic materials (leaves, small sticks), which is food for macroinvertebrates and fish**
  - Bilby and Likens, 1980; Ehrman and Lamberti, 1992; Piégay and Gurnell, 1997
- **Large woody debris increases the diversity of habitat types in streams of all sizes**
  - Gurnell et al., 1995
- **Large pools containing pieces of woody debris contain more fish than pools without woody debris**
  - Flebbe, 1999.

Macroinvertebrates

- **Woody debris increases macroinvertebrate production and diversity**
  - O'Connor, 1991; Piégay and Gurnell, 1997; Smock et al., 1985; Smock et al., 1989; Smock et al., 1992

- **Woody debris provides shelter and food to macroinvertebrates, which in turn are important food for fish.**
  - Benke and Wallace, 1990; Bilby and Bisson, 1998; Gurnell et al., 1995; Hilderbrand et al., 1997; Piégay and Gurnell, 1997; Tasmanian Inland Fisheries Service Fact Sheet; U.S. Forest Service, 1984; Wallace and Benke, 1984; WAWRC, 2000
- **Decaying woody debris releases nutrients and organic materials into the stream that benefit macroinvertebrates**
  - Piégay and Gurnell, 1997; Smock et al., 1989; U.S. Forest Service, 1984; U.S. Forest Service, 1988

Negative Impacts of Indiscriminant Woody Debris Removal
(according to Gregory and Davis, 1992 [mostly], and others)

- Decreased stream channel stability
  - Increased downcutting
  - Increased scouring
  - Channel widening
  - Local bank erosion
- Decreased volume, depth and number of pools
- Increased stream velocity and shear stress
- Reduced capacity to retain and process organic matter (food for bugs and fish)
- Release of sediment from behind debris jams
- Reduced macroinvertebrate and fish production
- Reduced quality of fish habitat
  - Loss of winter cover
  - Loss of flood refuges
  - Loss of food organisms
  - Loss of juvenile fish rearing areas

References Cited:

Abbe, T., and D. Montgomery. 1996. Large woody debris jams, channel hydraulics and habitat formation in large rivers. *Regulated Rivers: Research and Management* 12:201-221.

Andrus, C., B. Long, and H. Froehlich. 1988. Woody debris and its contribution to pool formation in a coastal stream 50 years after logging. *Can. J. Fish. Aquatic Sci.* 45:2080-2086.

Assani, A., and F. Petit. 1995. Log-jam effects on bed-load mobility from experiments conducted in a small gravel-bed forest ditch. *Catena* 25:117-126.

Baillie, B., and T. Davies. 2002. Influence of large woody debris on channel morphology in native forest and pine plantation streams in the Nelson Region, New Zealand. *New Zealand J. Marine and Freshwater Res*. 36:763-774.

Beechie, T., and T. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in Northwestern Washington Streams. *Trans. American Fisheries Soc*. 126:217-229.

Benke, A., and J. Wallace. 1990. Wood dynamics in coastal plain blackwater streams. *Can. J. Fish. Aquatic Sci*. 47:92-99.

Bilby, R. 1984. Removal of woody debris may affect stream channel stability. *J. Forestry* 82:609-613.

Bilby, R., and P. Bisson. 1998. Function and distribution of large woody debris. Chapter 13 (p. 324-346) in *River Ecology and Management – Lessons from the Pacific Coastal Region*. S. Kantor, ed. Springer, New York, NY. 705 pp.

Bilby, R., and G. Likens. 1980. Importance of organic debris jams in the structure and function of stream ecosystems. *Ecology* 61:1107-1113.

Bilby, R., and J. Ward. 1991. Characteristics and function of large woody debris in streams draining old-growth, clear-cut, and second-growth forests in southwestern Washington. *Can. J. Fish. Aquatic Sci*. 48:2499-2508.

Carlson, J., C. Andrus, and H. Froelich. 1990. Woody debris, channel features, and macroinvertebrates of streams with logged and undisturbed riparian timber in northeastern Oregon, U.S.A. *Can. J. Fish. Aquatic Sci*. 47:1103-1111.

Collins, B., and D. Montgomery. 2002. Forest development, wood jams, and restoration of floodplain rivers in the Puget Lowland, Washington. *Restoration Ecol*. 10:237-247.

Diez, J., S. Larranaga, A. Elosegi, and J. Pozo. 2000. Effect of removal of woody debris on streambed stability and retention of organic matter. *J. N. American Benthological Soc*. 19:621-632.

Ehrman, T., and G. Lamberti. 1992. Hydraulic and particulate matter retention in a 3rd-order Indiana stream. *J. N. American Benthological Soc*. 11:341-349.

Flebbe, P. 1999. Trout use of woody debris and habitat in Wine Spring Creek, North Carolina. *Forest Ecology and Management* 114:367-376.

Gippel, C., B. Finlayson, and I. O'Neill. 1996a. Distribution and hydraulic significance of large woody debris in a lowland Australian river. *Hydrobiologia* 318:179-194.

Gippel, C., I. O'Neill, B. Finlayson, and I. Schnatz. 1996b. Hydraulic guidelines for the re-introduction and management of large woody debris in lowland rivers. *Regulated Rivers: Research and Management* 12:223-236.

Gregory, K., and R. Davis. 1992. Coarse woody debris in stream channels in relation to river channel management in woodland areas. *Regulated Rivers: Research and Management* 7:117-136.

Gurnell, A., K. Gregory, and G. Petts. 1994. The role of coarse woody debris in forest aquatic habitats: implications for management. *Aquat. Conservation: Marine and Freshwater Ecosystems* 5:143-166.

Heede, B. 1985. Channel adjustments to the removal of log steps: an experiment in a mountain stream. *Environ. Management* 9:427-432.

Hilderbrand, R., A. Lemly, C. Dolloff, and K. Harpster. 1997. Effects of large woody debris placement on stream channels and benthic macroinvertebrates. *Can. J. Fish. Aquatic Sci*. 54:931-939.

Hunt, R. 1993. *Trout stream therapy*. University of Wisconsin Press, Madison, WI. 74 pp.

Hygelund, B. and M. Manga. 2003. Field measurements of drag coefficients for model large woody debris. *Geomorphology* 51:175-185.

Keller, E., and A. Macdonald. 1995. River channel change: the role of large woody debris. Chapter 10 (p. 217-235) in *Changing River Channels*, edited by A. Gurnell and G. Petts. John Wiley & Sons, New York, NY. 442 pp.

Keller, E., A. Macdonald, T. Tally, and N. Merrit. 1995. *Effects of large organic debris on channel morphology and sediment storage in selected tributaries of Redwood Creek, Northwestern California*. U.S. Geological Survey Professional Paper 1454-P. 29 pp.

Keller, E., and F. Swanson. 1979. Effects of large organic material on channel form and fluvial processes. *Earth Surface Processes* 4:361-380.

Manga, M., and J. Kirchner. 2000. Stress partitioning in streams by large woody debris. *Water Resources Research* 36:2373-2379.

Marston, R. 1982. The geomorphic significance of log steps in forest streams. *Annals of the Assoc. of American Geographers* 72:99-108.

McMahon, T., and G. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon. *Can. J. Fisheries and Aquat. Sci*. 46:1551-1557.

Montgomery, D., and H. Piégay. 2003. Wood in rivers: interactions with channel morphology and processes. *Geomorphology* 51:1-5.

Mutz, M. 2000. Influences of woody debris on flow patterns and channel morphology in a low energy, sand-bed stream reach. *International Review of Hydrobiology* 85:107-121.

O'Connor, N.A. 1991. The effects of habitat complexity on the macroinvertebrates colonizing wood substrates in a lowland stream. *Oecologia* 85:504-512.

Piégay, H. and A. Gurnell. 1997. Large woody debris and river geomorphological pattern: examples from S.E. France and S. England. *Geomorphology* 19:99-116.

Ralph, S., G. Poole, L. Conquest, and R. Naiman. 1994. Stream channel morphology and woody debris in logged and unlogged basins of western Washington. *Can. J. Fish. Aquatic Sci*. 51:37-51.

Richmond, A., and K. Fausch. 1995. Characteristics and function of large woody debris in subalpine Rocky Mountain streams in northern Colorado. *Can. J. Fish. Aquatic Sci*. 52:1789-1802.

Smith, R., R. Sidle, P. Porter, and J. Noel. 1993a. Effects of experimental removal of woody debris on the channel morphology of a forest, gravel-bed stream. *J. Hydrology* 152:153-178.

Smith, R., R. Sidle, and P. Porter. 1993b. Effects on bedload transport of experimental removal of woody debris from a forest gravel-bed stream. *Earth Surface Processes and Landforms* 18:455-468.

Smock, L., E. Gilinsky, and D. Stoneburner. Macroinvertebrate production in a southeastern United States blackwater stream. *Ecology* 66:1491-1503.

Smock, L., G. Metzler, and J. Gladden. 1989. Role of debris jams in the structure and function of low-gradient headwater streams. *Ecology* 70:764-775.

Smock, L., J. Gladden, J. Riekenberg, L. Smith, and C. Black. 1992. Lotic macroinvertebrate production in three dimensions: channel surface, hyporheic, and floodplain environments. *Ecology* 73:876-886.

Tasmanian Inland Fisheries Service. *Rivercare Management, Fish and Habitat Fact Sheet Number 5*.
http://www.ifc.tas.gov.au/Fact%20sheets%20for%20Rivercare/woody_debris.html

Thompson, D. The effects of large organic debris on sediment processes and stream morphology in Vermont. *Geomorphology* 11:235-244.

Effects of instream wood have been studied and the peer-reviewed scientific literature bears this out

"Many streams lack sufficient large organic material for biotic and abiotic functions (Beschta and Platts 1986).

The importance of large woody debris for salmonid habitat is well documented (Meehan 1991)."

U.S. Forest Service. 1984. *The seen and unseen world of the fallen tree*. General Technical Report PNW-164. 56 pp.

U.S. Forest Service. 1988. *From the forest to the sea: A story of fallen trees*. General Technical Report PNW-GTR-229. 153 pp.

U.S. Forest Service. 1989. *Coarse woody debris ecology in a second-growth* Sequoia sempervirens *forest stream*. General Technical Report PSW-GTR-110: 165-171.

Wallace, J., and A. Benke. 1984. Quantification of wood habitat in subtropical coastal plain streams. *Can. J. Fish. Aquatic Sci.* 41:1643-1652.

Wallace, J., J. Webster, and J. Meyer. 1995. Influence of log additions on physical and biotic characteristics of a mountain stream. *Can. J. Fish. Aquatic Sci.* 52:2120-2137.

WAWRC (Western Australia Water and Rivers Commission.) 2000. *Water Notes – the value of large woody debris (snags)*. 4 pp.

Young, W. 1991. Flume study of the hydraulic effects of large woody debris in lowland rivers. *Regulated Rivers: Research & Management* 6:203-211.

Also see the extensive annotated terrestrial and aquatic woody debris bibliography maintained by the U.C.-Berkeley Center for Forestry:
www.cnr.berkeley.edu/forestry/woodbiblio.html

Habitat Deficit Treatment Options

Erosion Control (also a habitat benefit)
Potentially larger scale, whole large oak and pine trees, some with rootwads attached placed as “ramps” down the bluff face, overlapping wood material at toe (highest cost, highest habitat benefit) using both equipment and hand labor

Habitat Improvement
Smaller to medium scale projects hand-installed, can be combined with equipment and hand-labor or just hand labor using smaller material

Habitat Improvement

Increased overhead cover, resting habit, and physical separation for varying age classes of wild salmonids as well as native, non-game fish species

Provides refuge particularly important for fish during drought and flood conditions

Stable surface for biofilm colonization and consumption by macroinvertebrates

Metered nutrient enrichment via decomposition of accumulated leaf packs

Reduced rate and volume of excess sedimentation

Increased spawning habitat through localized channel scour

Habitat Improvement

Improved over-winter fish habitat through pool formation and maintenance

Basking surfaces for reptiles (painted, wood, map, and snapping turtles, northern water snake)

Mitigates hydraulic energy during flood events

Perching habitat for kingfisher, great blue heron, and passerines

Furbearer feeding and loafing platforms

Project Scale, Scope, and Goals

Scale includes approximately 2 river miles upstream of Forman Road and from Merriville Road downstream to James Road (~5 miles total) with the ultimate goal of treating the entire length of the Little South Branch

Scope (aka Phase 1) includes 7 erosion sites and enhancement of fish habitat at approximately 50 sites

Goal is to raise private funds for CRA to permit, write grant proposals, and manage construction at these sites

CRA is a 501c3 agency (discuss tax deduction options with your tax expert)

Budget

LSBPM River Restoration (7 erosion and 50 fish habitat projects)
CRA cost estimate to permit, manage, and fundraise for project:

- $27,530/year for 3 years (total: $82,590), we are currently in year 2

Construction cost estimate:

- $256,000 total construction (for 3 year project/5 separate properties)
- $37,700 of $256,000 of year 1 construction budget spent to date
- Estimated 3 year total project cost: $338,590 (construction + project management)

Total raised to date: $231,235 (as of 1 Jan 2026)

- Private landowners
- Pere Marquette Watershed Council
- Charles A. Fellows Chapter of TU
- Pere Marquette Chapter of TU
- Lake County Riverside Property Owners Association
- Lake County Sheriff’s Department
- US Fish and Wildlife Service
- Great Lakes Energy

Current and Planned Tasks

1. Continue CRA & Project Steering Committee fundraising (private/federal/state)
2. Refine funding plan and strive to build and maintain $50,000 working capital
3. Conduct baseline fishery surveys (2026/2027)
4. Construction at 4 properties in 2026 (pending successful fundraising/grant outcomes)
5. Permit applications for 2027/2028 construction projects
6. Site visits with interested landowners

Community Funding

Community Support has resulted in a contribution of $186,235

Source of contributions:

1. Private landowners
2. Pere Marquette Watershed Council
3. Charles A. Fellows Chapter of TU
4. Pere Marquette Chapter of TU
5. Lake County Riverside Property Owners Association
6. Lake County Sheriff's Department
7. Great Lakes Energy
8. Restaurant 876 in Baldwin

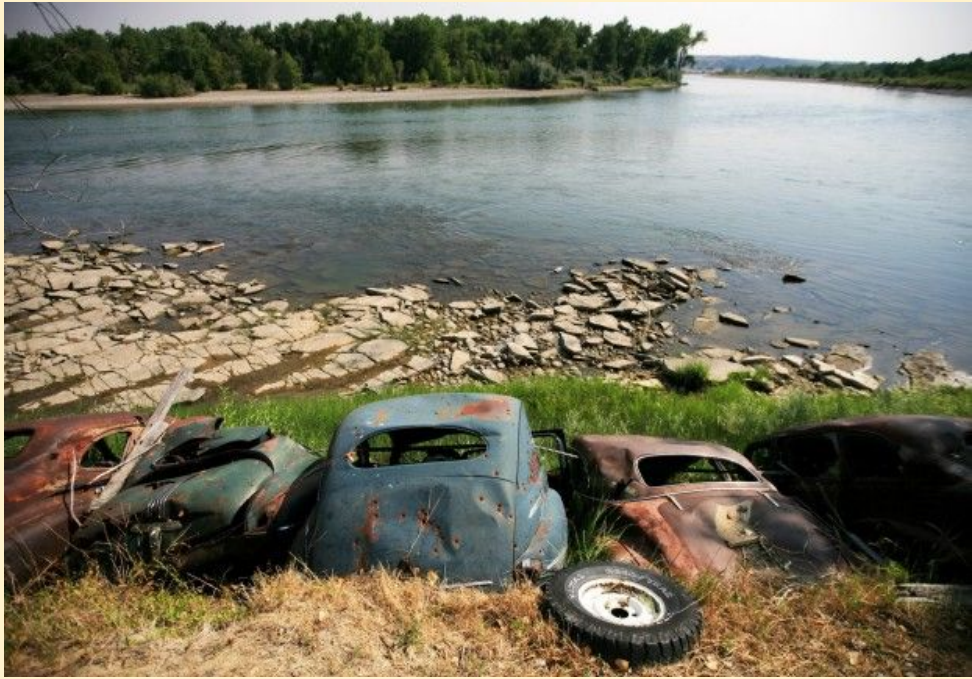
- Your ongoing support of the above organizations yields additional support of our river project

- Even a modest gift can add up to a significant contribution from funding sources due to grant match requirements

Unpermitted log jam

Detroit Riprap

Bighorn River, MT

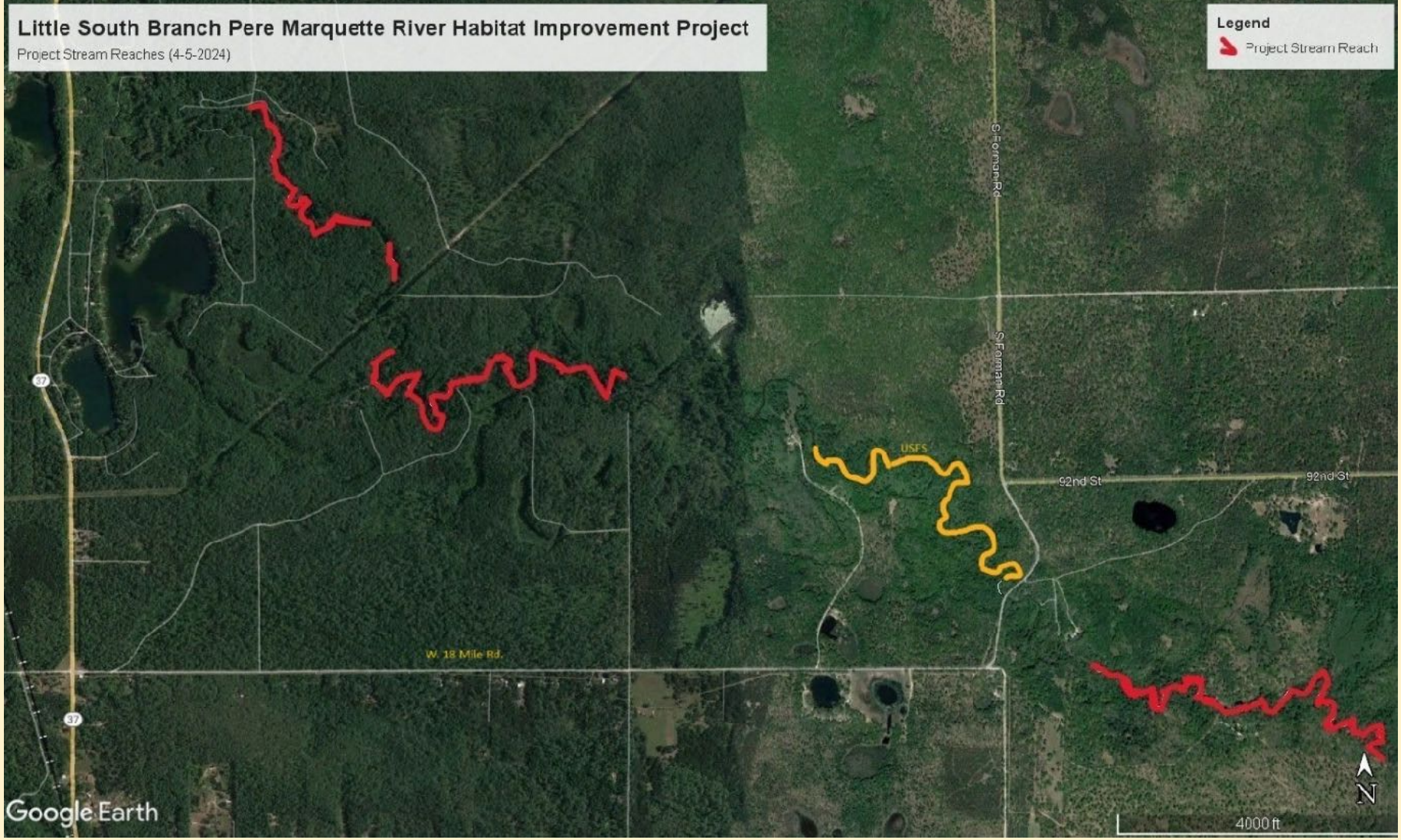


Yellowstone River, MT

Pine River log jam
(below Peterson Bridge)

Pine River log jam
(below Peterson Bridge)

Pine River log jam
(below Peterson Bridge)


Little South Branch Pere Marquette River Habitat Improvement Project
Project Stream Reaches (4-5-2024)
Legend
Project Stream Reach
S Forman Rd
S Forman Rd
USFS
92nd St
92nd St
W. 18 Mile Rd.
37
37
Google Earth
4000 ft
N


YANMAR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Question and Answer Period

Closing

Thank You!