Namekagon River Cold-Water Zone

Fish Habitat History Report

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Introduction

The Namekagon River, located in northwest Wisconsin, is part of the St. Croix National Scenic Riverway (riverway). The riverway was established by Congress in 1968 under the Wild and Scenic Rivers Act (WSRA) to protect and enhance its outstanding natural, scenic, and recreational values.[1] Although the scenic Namekagon River appears undisturbed from human impacts, major logging in the late 1800's and early 1900's changed the land-use and riparian habitat along the river from an old-growth forested landscape to a landscape of early-succession forest and agriculture.[2] Populations of native, cold-water fishes declined as a result of habitat changes. The cold-water zone extended approximately 30 miles from the tailwater of the Namekagon Lake Dam to the headwater of Hayward Flowage (Figure 1).[3]

The riverway is administered by the National Park Service (NPS). The WSRA and NPS recognize the states' jurisdiction over fish and wildlife management. The Chippewa Tribes manage their treaty-reserved fish and wildlife resources within the ceded territory, which includes the Namekagon River. The Great Lakes Indian Fish and Wildlife Commission (GLIFWC) assists its member Tribes in affirming and implementing ceded territory rights. Representatives from the NPS, Wisconsin Department of Natural Resources, Minnesota Department of Natural Resources, and GLIFWC developed a Fisheries Management Plan to provide a unified approach to managing the riverway fishery. Prior to the plan being developed, a unified approach to fish management was lacking due to different regulations, management philosophies, and missions among these entities. The goals of the Fisheries Management Plan for the St. Croix National Scenic Riverway are to:

- maintain, or, where necessary, restore the integrity of near-natural riverine plant, fish, and wildlife communities;
- maintain, restore, and evaluate habitat to provide sustainable fisheries;
- manage the river corridor to restore or maintain a climax riparian vegetative cover;
- recognize treaty-reserved rights and resources within the riverway;
- develop a fisheries management strategy that places primary emphasis on habitat protection over promotion and development of recreational uses; and
- focus fisheries habitat restoration activities on correcting detrimental, human induced, habitat alterations.

As stated in the Fisheries Management Plan, fish habitat restoration activities will 1) mimic or use natural processes and features; and 2) be applied to accelerate well-studied recovery needs.

The agencies described the following desired future conditions and alternatives in the Fisheries Management Plan for the Namekagon and St. Croix Rivers:

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[1] Wild and Scenic Rivers Act. 16 U.S.C. 1271-1287.

[2] Osh (Barbara) Andersen et al. "Transformation of a landscape in the upper mid-west, USA: The history of the lower St. Croix River valley, 1830 to present," *Landscape and Urban Planning* 35: 247-267 (1996).

[3] National Park Service, Wisconsin Department of Natural Resources, Minnesota Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission. Fisheries Management Plan for the Namekagon and St. Croix Rivers. 103 pages. Unpublished (2004).

> "The ultimate long-term goal for the coldwater zone" of the Namekagon River is "restoration of stream and watershed habitat to a condition that will support a coldwater community dominated by native brook trout as the top predator species. This may require a very long-term (100-200 year) time frame. It is a goal that may or may not be attainable, since it will require about a 10 degree Fahrenheit cooling of the average summer stream temperature.
>
> Factors that are expected to work in favor of the goal include: 1) gradual demise of the dams and flowages which will eliminate a significant warming influence; 2) gradual vegetative succession to a climax type in the riparian zone which will increase shading and provide a source of big woody cover in-stream; 3) continued presence of a seed stock of wild brook trout in the tributaries; and 4) a heavily restricted sports angling fishery.
>
> Factors which will tend to counter the goal are: 1) stream channel morphology (wide and shallow) which cannot be restored to pre-logging conditions without resorting to habitat enhancement techniques which are restricted under the present Wild and Scenic Rivers Act; 2) tributary brook trout populations under increasing threat from extensive beaver colonization; 3) uncertain genetic attributes of the residual brook trout populations; 4) presence of a well-established brown trout population; 5) groundwater extraction (pumping) from increasing development and urbanization in the peripheral watershed; and 6) global warming."[4]

Wuebbles and Hayhoe examined four scenarios under each of two general circulation models to predict that the annual average daily maximum temperature in the Midwest is very likely to increase between 4 and 16 F by the year 2095 – the magnitude of change influenced by climate sensitivity and human emissions.[5] By 2095, summer temperatures in northwestern Wisconsin could be very similar to those of present-day eastern Kansas. Because even conservative climate change models predict warming to an extent that could extirpate brook trout, Wisconsin fishery managers may need to adjust long-term expectations for brook trout and other cold-water species.

To address the factor of a well-established brown trout population mentioned above, the Fisheries Management Plan describes the introduced brown trout as "an ecological surrogate for brook trout" and that "brown trout are now a keystone species, maintaining the basic biological integrity of this fish community." The Fisheries Management Plan states that "the negative connotation associated with the term 'exotic' is not merited and is counter to rational ecological management" since "brown trout have been well integrated into the existing fish community for nearly a century." The management position

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[4] National Park Service, Wisconsin Department of Natural Resources, Minnesota Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission. Fisheries Management Plan for the Namekagon and St. Croix Rivers. 103 pages. Unpublished (2004).

[5] D.J. Wuebbles and K. Hayhoe. "Climate change projections for the United States Midwest," *Mitigation and Adaptation Strategies for Global Change* 9 (2004): 335.

stated in the Fisheries Management Plan is that "the term exotic is primarily a descriptive historical biogeographic term."[6]

The agencies came to agreement that:

> "Over the short term (at least), a more realistic future condition would be to sustain a coldwater fish community characterized by optimal populations of wild brown trout while continuing thermal habitat restoration efforts. As long as thermal habitat keeps brook trout from reemerging as the top predator in the coldwater zone, brown trout should fulfill that role. This species demonstrated positive role in the coldwater ecosystem merits its protection and continued management emphasis."

The agencies determined that several factors favor a brown trout fishery:

> "1) gradual demise of the dams and flowages; 2) succession to climax vegetation in the riparian zone; 3) a highly restricted sports angling fishery; 4) genetic adaptation and the ability to exploit big river habitats in marginal thermal conditions; 5) fisheries research and development in the culture of wild (non-domestic) genetic stocks; 6) popularity and growing public appreciation for the unique aspects offered by this fishery; and 7) ability to spawn successfully in mainstream habitats."

Factors that counter the goal of managing for brown trout are:

> "1) highly variable reproductive success; 2) sub-optimal in-stream habitat, especially big woody cover; 3) beaver activity on coldwater tributaries; 4) global warming; 5) bias associated with exotic status; and 6) logistic problems, uncertainty and lack of support for efforts to culture wild genetic stocks."

The agencies agreed that "relying purely on passive natural processes" to increase big woody cover "might take several centuries." Also, "the in-stream habitat restoration phase could be accomplished with active habitat manipulation by deliberately adding big woody cover to the stream channel to mimic pre-logging conditions. Big wood cover will have limited influence, though, on the river's thermal budget."

Our expectation is that this report will be used by the NPS, WDNR, and GLIFWC to identify a historical baseline condition to guide the design and implementation of future restoration projects, specifically the addition of big woody cover to the Namekagon River.[7]

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[6] National Park Service, Wisconsin Department of Natural Resources, Minnesota Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission. Fisheries Management Plan for the Namekagon and St. Croix Rivers. 103 pages. Unpublished (2004).

[7] National Park Service, Wisconsin Department of Natural Resources, Minnesota Department of Natural Resources and the Great Lakes Indian Fish and Wildlife Commission. Fisheries Management Plan for the Namekagon and St. Croix Rivers. 103 pages. Unpublished (2004).

Problem statement

According to NPS policy, natural resources will be managed to preserve fundamental physical and biological processes. The NPS endeavors to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems. Management policies allow for intervention to restore natural ecosystem functioning that has been disrupted by past or ongoing human activities. The NPS also recognizes that active management may be necessary to restore ecosystems to a natural condition or to maintain the closest approximation of natural conditions when a truly natural system is no longer attainable.[8]

Restoration of the historical fish habitat to an ecosystem resembling historical conditions almost certainly will be necessary to perpetuate brook trout and other biota that depend upon cold water and are important to the riverway as natural and recreational resources. Unfortunately, comprehensive historical documentation on Namekagon River habitat conditions that existed prior to the present day is lacking. The Fish Habitat History Report is needed to ensure that any habitat manipulations constitute habitat restoration consistent with NPS policy.

In addition to the importance of the trout fishery, the NPS is mandated to protect the Namekagon River's free-flowing character and other natural, scenic, and recreational values. Canoeing and kayaking are popular recreational activities in the cold water zone of the Namekagon. Any habitat restoration activities will need to be carefully designed to balance fish habitat restoration needs with the protection of other recreational values and the free-flowing character of the river.

In this report, we examine the following hypotheses:

1. The river is wider and shallower now than it was prior to European settlement.
2. The river has less big woody cover on the banks and in the stream channel than it did historically, due primarily to riparian timber harvest and log driving activities more than a century ago.
3. Brook trout were more abundant in the Namekagon River before the logging era.

To the degree possible, this report describes the habitat and fish community conditions of the riverway through several eras; from the first European-American exploration, through settlement and logging, to the present day.

Methods

Historians evaluate the accuracy and relevance of information by applying four criteria: 1) first- or second-hand observation; 2) purpose or possible bias of the statement; 3) author's knowledge of the subject; 4) context of the statement. We examined printed materials including books, magazines,

[8] National Park Service, *Management Policies* (2006).

newspaper accounts, archeological records, agency reports, museum records, land surveys, fishing records, diaries, and photographs. We obtained historical documents and photographs from museums, historical societies, and libraries primarily in Wisconsin. In addition to traditional sources for historical materials, we also searched websites including genealogy exchange sites for Sawyer and Bayfield Counties, historical federal and state archives, and commercial sites for historical images and documents (http://ebay.com, http://amazon.com, http://delcampe.net/, and http://www.playle.com/).

Background by Era

Native American cultures (Pre-1831)

Native American tribes may have influenced habitat and fish abundance by evidence of riverside settlements and fishing. In the Ojibwe language, Namekagon means "place of the sturgeon." Near the mouth of the Namekagon River, the Ojibwe used an ancient fish dam built on the St. Croix River by people that predated the Ojibwe culture. The Ojibwe tribes returned to the fish dam every May to capture sturgeon swimming upstream. The fish dam was built as a V-shape with large boulders blocking sturgeon passage so that they would swim into the center where fishermen speared the fish as they swam into large baskets. The existence of the fish dam is confirmed in the journals of Joseph Nicollet. Log drives destroyed the remnants of the fish dam in the mid 1800's, but descriptions of the annual tribal migration to the sturgeon fishing grounds survived.[9]

In addition to fishing and hunting, the Ojibwe used the river as a primary transportation route. European explorers and fur traders noted that there were several heavily-used portage trails between water bodies in northern Wisconsin. A portage trail connected the Lac Courte Oreilles lakes with the Namekagon River at Hayward. At the northern end of the Namekagon route, a portage trail connected the Namekagon River to Lake Owen near where the river turns south at Cable. Pictographs drawn on trees along the river provided travelers with information on species in the area; Henry Schoolcraft described these billboards for waterway travel.[10]

We know that large wood and debris inhibited regular travel along the nearby Brule River into Lake Superior.[11] In fact, in 1680 Daniel Greysolon, Sieur de Du Lhut described canoeing the Brule River to its source, cutting trees and breaking about 100 beaver dams along the way (approximately 3 per mile or 1.9 per kilometer). The Namekagon may have been similar to the Brule. In 1692, LeSueur was sent by the King Louis XIV of France to establish a post at Chequamegon. LeSueur's orders were to "endeavor to maintain the peace recently concluded with the Sioux and the Sauteurs" (Chippewas), so that the profitable fur trade could continue uninterrupted. "The French wanted the fur trade of the Sioux, and ... a trail or highway had to be kept up from Chequamegon, straight down the Namakagon to the St. Croix."[12] Because of the importance of these rivers to the fur trade, it is possible that travelers along

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[9] Lafayette Connor, *Cecilia: The Trials of an Amazing Ojibwe Woman 1834-1892* (Danbury: Burnett County Historical Society, 2006).

[10] Henry Schoolcraft, "We frequently passed the figure of a man, drawn on a blazed pine, with horns, giving the idea of an evil spirit. The occiput of the bear, and head bones of other animals killed in the chase, are hung upon poles at the water's side, with some ideographic signs. The antlers of the deer are conspicuous. Other marks of success in hunting are left on trees, so that those Indians who pass and are acquainted with the signs, obtain a species of information. The want of letters is thus, in a manner, supplied by signs and pictographic symbols."

[11] Lafayette Connor, *Cecilia: The Trials of an Amazing Ojibwe Woman 1834-1892* (Danbury: Burnett County Historical Society, 2006), 5. "When ascending this stream, the small canoe was the answer to many of their problems. There were many trees, logs, limbs and overhanging rocks and in some places, the trees grew so close together that it was almost impossible to squeeze through even while carrying a small canoe. Large trees and debris that had collected during the high waters, presented the same problem as the rocky rapids."

[12] G.M. Burnham, *The Lake Superior Country in History and in Story,* (Ashland: Paradigm Press, 1996), 464p.

these routes could manipulate and remove woody debris within the river to ease the passage of birch-bark canoes.

On the upper Namekagon River, early explorers noted an Ojibwe village on Lake Pacwawong, a wide stretch of the river where wild rice provided a reliable annual crop. In addition to the wild rice, the villagers also subsisted on crops of corn, potatoes, pumpkins, beans, as well as abundant wild blueberries along the banks of the river.[13] The village likely had an impact on local water quality, evidenced by the eight large, permanent lodges and cultivation.

European-American settlement (1831-1860)

During two different expeditions in 1831 and 1834, Henry Schoolcraft, an explorer who lived among Native American tribes, described the Namekagon River, the surrounding vegetation, and animal species present.[14] Upon reaching the Namekagon from the northern portage near the present town of Cable, Schoolcraft described the river at the portage as being about seventy-five feet wide, with the deepest parts not exceeding eighteen inches. He described the banks of the river as being covered with large pines, hardwood, and spruce. His men had to get out and lift their canoes at rapids above Pacwawong, float kegs of food downstream, and carry bags from the canoes over the worst shallows. Schoolcraft also tells us that the banks of the Namekagon were covered with blueberries, cicuta plant, and fox grape. During the July, 1831 expedition, Schoolcraft noted the abundance of brook trout in the Namekagon River caught and eaten by the explorers upstream of Pacwawong, near Cable. This critical observation informs that brook trout inhabited the main channel during the hottest month of the year. Long-term temperature records from Fort Snelling, MN confirm that 1831 was a normal year for temperature.[15]

In addition to Schoolcraft's description, Joseph Nicollet described the Namekagon River in August of 1837 as being navigable throughout its entire course and favored course of travel for the local people.[16] At this time, both the Namekagon and St. Croix Rivers had boulder obstacles and rapids that required wading to push the canoe or portage. When Nicollet noted the Namekagon was navigable throughout

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[13] Henry Schoolcraft, "PUCKWAEWA VILLAGE. At four o'clock we had got everything down the shallows, mended our canoe, and reached the _Pukwaewa_--a noted Indian village, where we encamped. The distance is about nine miles from the western terminus of the portage, course W.S.W. We found it completely deserted, according to the custom of the Indians, who after planting their gardens, leave them to go on their summer hunts, eating berries, &c. We found eight large permanent bark lodges, with fields of corn, potatoes, pumpkins, and beans, in fine condition. The lodges were carefully closed, and the grounds and paths around cleanly swept, giving the premises a neat air. The corn fields were partially or lightly fenced. The corn was in tassel. The pumpkins partly grown, the beans fit for boiling. The whole appearance of thrift and industry was pleasing."

[14] Henry R. Schoolcraft, *Personal Memoirs of a Residence of Thirty Years with the Indian Tribes of the American Frontiers: with Brief Notices of Passing Events, Facts, and Opinions, A.D. 1812 to A.D. 1842* (Philadelphia: Lippincott, Grambo and Co., 1851). Henry R. Schoolcraft, *Narrative of an Expedition through the Upper Mississippi to Itasca Lake, the Actual Source of this River; Embracing an Exploratory Trip through the St. Croix and Burntwood (or Broule) Rivers; in 1832* (New York: Harper and Brothers, 1834).

[15] Donald G. Baker, Bruce F. Watson, and Richard H. Skaggs, "The Minnesota long-term temperature record," *Climate Change* 7 (1985):225-236.

[16] Joseph N. Nicollet, trans. by Andre Fertey, ed. by Martha Coleman Bray, *Journals of Joseph N. Nicollet*. (St. Paul: Minnesota Historical Society Press, 2004), 145-146.

its entire course, he was likely referring to the availability of enough water to float a canoe and not the ease or difficulty of navigating.

A few years after the Schoolcraft and Nicollet expeditions, the United States government sent geologic surveyors to assess water resources for navigation purposes. In 1852, David Dale Owen, a geologist working for the U.S. government, described the Namekagon River as having thin, sandy, and gravelly banks with streambed consisting of rocks from the size of small pebbles to boulders the size of a half bushel.[17] Owen noted that above Pacwawong, numerous boulders of half-bushel size inhibited navigation on the river. In 1880, the Report of the Secretary of War described the Upper Namekagon as generally narrow with frequent stretches of rapids over native trap rock with several falls from 2 to 4 feet.[18] The report described the banks of the river as being high with pine, hemlock and birch.

Descriptive reports provide a sketch of what the Namekagon River may have looked like before logging occurred, but most of this evidence is anecdotal and cannot be confirmed without trusting the source, finding multiple sources, or measuring past habitat conditions. Our most reliable historical information for describing past habitat conditions is from the public land surveys conducted by the United States General Land Office in Wisconsin from 1832 to 1866. Surveyors employed by the General Land Office conducted township surveys on the upper Namekagon River between 1855 and 1858. These surveys include important notes for describing a pre-logging landscape along the Namekagon River, including descriptions of tree species (Figure 2), cedar swamps, soil quality, location of lakes, and river widths and depths. Tree species noted in these surveys include birch, pine, white pine, yellow pine, black pine, aspen, oak, balsam, spruce, and tamarack. As evidenced on the Public Land Survey maps, many cedar and tamarack swamps were present on the tributaries and mainstem of the Namekagon River.

Logging (1861-1901)

Prior to the arrival of a state road in 1877 and railroad in 1881 (Figure 3), the primary means of transportation to the cold-water zone of the Namekagon River was by river or trail. Early logging on the Namekagon was accomplished by selecting trees close enough to the river that they could be floated to sawmills downstream. Accounts of the earliest logging were summarized by Eldon Marple, an expert on Sawyer County history.[19] The best timber along river banks was illegally harvested from federally owned

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[17] David Dale Owen, Report of a Geological Survey of Wisconsin, Iowa, and Minnesota; and incidentally a portion of Nebraska Territory (Philadelphia: Lippincott, Grambo and Co., 1852), 158-160.

[18] United States, Report of the Secretary of War: Volume II (Washington, 1880), 1618. "The source of the Namakagon is Lake Namakagon, situated in the southeast corner of Bayfield County, and near the divide in the watersheds of the Chippewa River and Lake Superior. They consist of numerous lakes, and extensive cedar and tamarac marshes. From Namakagon Lake to Veazie's the river is generally narrow and rapid, stretches of rapids over native trap-rock being frequent. There are also several vertical falls of from 2 to 4 feet. The banks are high on either side, stretching away into high broken ridges and sand barrens, covered with the various kinds of pine; hemlock and birch being found on the upper portions of the river. From Veazie's to the mouth the river is from 100 to 200 feet wide, and in some cases attaining a greater width in passing over gravel bars. There are several sharp pitches and rapid, principal of which are "Little" and "Big Bull" Rapids, and "Dupee Flats." The river is navigable for small boats, such as bateaux and canoes, at a stage of 1 foot above low-water. The slope of the river is about 5 feet per mile."

[19] Eldon Marple, "The Rivers… Highways of Yesteryear," *The Visitor*, May 28, 1983.

forested land because logs could be floated downstream to the sawmill without the need for proving origin; this illegal harvest was termed "bank chances". The earliest accounts of bank chance harvest along the Namekagon River were from 1861. The early loggers that explored the cold-water zone for bank chances described the floodplain as lacking large white pine timber. Based on personal recollections of early loggers, Marple explained that the sandy soils of the Namekagon River flats between the river and the surrounding hills supported groves of red pine and jack pine, which were less profitable timber species that the white pine in the nearby hills. This statement is not inconsistent with the vegetation data from Public Land Office surveys because the surveyors only noted trees along transects and some trees along transects near the river are simply referred to as pine, while other trees are described as white pine. To facilitate bank chance harvesting, a dam was built at Phipps as early as 1868 to hold back water levels prior to log drives.[20]

The arrival of the Chicago, St. Paul, Minneapolis, and Omaha Railway (The Northwestern Line) in 1881 brought passenger and freight transportation to the upper Namekagon River, allowing lumber companies to export their products to larger markets (Figure 5). Large-scale logging also began in 1881 on the upper Namekagon River. By this time, most of the timber stands of the lower Namekagon River and St. Croix River were already exploited.[21]

In 1885, the Wisconsin Legislature authorized Anthony J. Hayward "to build, maintain and operate dams and other improvements across the Namakagon River and its tributaries, above… Hayward."[22] The law required dams to be constructed and maintained so that logs could pass through sluice gates.[23] The dams could only be operated up to twelve hours per day so that natural flow of the river would not be diminished in order to guarantee water to the flowage dams downstream of Hayward.[24] Log drives changed many river systems in the Mississippi River Basin and Great Lakes tributaries.

As the logging era came to a close when the once vast stands of white pine dwindled, The Northwestern Line promoted tourism in northern Wisconsin.[25] Although the rail lines were primarily used for freight, passenger service connected tourist destinations to larger cities including Chicago, Louisville, Milwaukee, St. Louis, and St. Paul. Pamphlets published by The Northwestern Line as early as 1885 touted fishing and hunting opportunities in towns along the railroad.[26] By 1901, the era of floating logs

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[20] The dam at Phipps, known as "Handscomb's Dam," was attributed to Henry H. Hanscomb, operator of a lumber camp in the 1860's.

[21] Osh (Barbara) Anderson, Thomas R. Crow, Sue M. Lietz, Forest Stearns, "Transformation of a landscape in the upper mid-west, USA: The history of the lower St. Croix River valley, 1830 to present," Landscape and Urban Planning 35 (1996): 247-267.

[22] State of Wisconsin, Laws of Wisconsin, Chapter 43, (1885).

[23] State of Wisconsin, Laws of Wisconsin, Chapter 43, Section 2, (1885).

[24] State of Wisconsin, Laws of Wisconsin, Chapter 43, Section 3, (1885).

[25] William Bruce Leffingwell, Chicago and North Western Railway Company, *Hunting and fishing along the North-Western Line: a book descriptive of the best resorts in America for deer, bear, goose, duck, and snipe shooting* (Chicago: Rand, McNally & Co., 1895). Chicago, St. Paul, Minneapolis & Omaha Railroad, *Camping fishing and hunting in northern Wisconsin* (Chicago: The Northwestern Line, 1904).

[26] Chicago, St. Paul, Minneapolis & Omaha Railroad, *Health and Pleasure Midst the Pines: an Invitation to a Beautiful and Bountiful Wilderness* (Chicago: Chicago and Northwestern Railway, 1885). Chicago, St. Paul,

on the Namekagon River came to a close as logging railroads delivered remaining timber to the sawmills. The landscape changes caused by logging probably resulted in a river warmed by logging dams and sunlight previously shaded by bank vegetation.

"All trout streams in the state must yield the banner to the noble and lordly Namakagon."[27]

The booming tourism industry brought demand for fishing opportunities. The Namekagon River was already well-known for its abundant brook trout, but published descriptions made it famous. In 1883, George O. Shields published a fly-fisherman's description of the Namekagon River near Cable, noting that in one day's fishing, seven in the party strung 160 trout weighing from a quarter of a pound to a pound with the aggregate weight being over fifty pounds.[28] The author also mentions that a heavy rain overnight raised the stream nearly a foot and the fishing was less successful on their second day, although they caught 93 brook trout.[29] In an 1885 railroad tourism publication, The Northwestern Line advertised that the Namekagon River "with its innumerable tributaries, is celebrated among sportsmen throughout the country for the quality of its brook trout, and it is a common occurrence for one fisherman to secure from the clear, deep, cool and swift waters thirty or forty pounds of the delicious fish in the sporting hours of a single day."[30] We can speculate that brook trout were still very abundant as late as 1893, just before stocking of Pacific rainbow trout in the river; an article in *The Hayward Journal* stated that it was very common "for two fishermen to bag 100 to 150 fine trout in one day's

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Minneapolis & Omaha Railroad, *Camping fishing and hunting in northern Wisconsin* (Chicago: The Northwestern Line, 1904).

[27] *Washburn News and Itemizer*, April 12, 1907, "Cable, Wisconsin." Description of the Namekagon River: "This stream is distinctly a Cable stream since it favors this village almost exclusively with its presence in the region of its best trout fishing. Its source is at the beautiful Lake Namakagon 9 miles from the village. From thence it flows southwesterly and passes within a half mile of the village. The best of wagon road leads to the stream in all directions and there is no particular choice of fishing grounds. The average width of the stream is about 4 rods and it flows along over a stony bed making many curves, and bends plunging over the rocks and diving down inclines making the riffles, slow current, deep holes and all of the other kinds of places that delights the heart of the fisherman in a trout stream. The banks are comparatively low and the stream is very easy to get at all along its course. There is no brush to bother the angler, tangle his line and breed profanity. Any part of the stream can be fished with the use of hip boots and many of the very best holes can be reached from the bank. The stream is bordered almost throughout with heavy timber that makes the welcome shade in which the "big fellows" delight to stay. There can be question in the mind of the true lover of the sport that Namakagon River was created solely as a trout stream and there are many in Cable who are ready to fight if any intimation is made of a desire to divert the stream for degrading commercial purposes. Bait fishing is excellent the very first day of the open season and fly fishing begins as early as the latter part of May, when the big ones take the flies greedily. Speckled beauties abound and here and there a rainbow trout is hooked. Trout weighing two pounds are not at all uncommon and the prize fish during the year 1906 weighed 3 ¼ pounds. The big ones give the angler excitement to his heart's content for many of them put up fights of half an hour before going into the baskets. But strange to say none of the big ones in this stream ever get away. One can walk out from Cable in the morning and get an excellent catch and return in a few hours. The natives however do not deny that there is an occasional mosquito."

[28] George O. Shields, *Rustlings in the Rockies: Hunting and Fishing by Mountain and Stream* (Chicago: Belford, Clark and Co., 1883), 265.

[29] George O. Shields, *Rustlings in the Rockies: Hunting and Fishing by Mountain and Stream* (Chicago: Belford, Clark and Co., 1883), 261-266.

[30] Chicago, St. Paul, Minneapolis & Omaha Railroad, *Health and Pleasure Midst the Pines: an Invitation to a Beautiful and Bountiful Wilderness* (Chicago: Chicago and Northwestern Railway, 1885).

fishing in this stream, and many times have such a party taken twice that number of speckled beauties."[31] As late as 1899, publications reported brook trout angling in the Namekagon River.[32]

Post-logging (1902-1961)

From the fisherman's perspective in 1883, the easiest way to fish the Namekagon River was to wade out until clear of all brush and cast the fly to deep holes below large rocks in the middle of the channel or to driftwood along a bank.[33] We know from this description that the banks of the river were covered with brush and wood while the middle of the channel had less wood. The author described the river in May as being thirty to fifty yards wide and from one to three feet with many deep holes and rapids. Just 20 years later, a tourism pamphlet published by The Northwestern Line in 1904 mentions that the Namekagon River was free from brush and easily waded, contrary to the 1883 description. The lack of wood on the riverbank is confirmed in a 1907 newspaper article stating that the banks of the river were comparatively low, the river was easy to access, there was no brush to bother the angler, and the best holes could be fished from the bank.[34]

The subtle distinction of brush being gone from the river in 1904 and 1907 while brush was present in 1883 is important for understanding the habitat change and its contribution to the decline of cold-water fish populations that occurred from logging. The Northwestern Line, the same railroad that in 1885 touted that a day's fishing effort could secure 30 to 40 pounds of trout, published a pamphlet in 1904 acknowledging "a number of years ago the fishing in the stream was injured by logging operations, but is rapidly regaining its old-time renown."[35] These early descriptions before and after logging inform that logging effectively removed brush, stream bank vegetation, and large pieces of wood from the river, which is consistent with the understanding of logging impacts on other rivers.[36]

The Namekagon River's renown as a world-class brook trout stream was short-lived as brook trout populations were threatened by a river altered by logging. However, other relevant historical changes in the Namekagon River are important for understanding the changes to the fish assemblage, including accounts of recreational fishing pressure in the Cable area and stocking of non-native trout. In the early 1890's the Wisconsin Fisheries Commission started stocking European brown trout and Pacific rainbow trout throughout Wisconsin; rainbow trout were stocked in the Namekagon River as early as 1893.[37]

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[31] *Hayward Journal-News*, June 9, 1893. "1893 Fishing Report: Fishing is Very Good," Reprinted in *The Hayward Journal Sawyer County Historical Review*, September, 1953.
[32] William C. Harris, editor, *The American Angler* (New York: Outing Publishing Co., August 1999)
[33] George O. Shields, *Rustlings in the Rockies: Hunting and Fishing by Mountain and Stream* (Chicago: Belford, Clark and Co., 1883), 261-266.
[34] *Washburn News and Itemizer*, April 12, 1907, "Cable, Wisconsin."
[35] Chicago, St. Paul, Minneapolis & Omaha Railroad, *Camping fishing and hunting in northern Wisconsin* (Chicago: The Northwestern Line, 1904), 19-21.
[36] William Gerald Rector, *Log Transportation in the Lake State Lumber Industry: 1840-1918*, (Glendale: Arthur H. Clark Co., 1953); Christer Nilsson, et al., Forecasting environmental responses to restoration of river used as log floataways: an interdisciplinary challenge, Ecosystems 8(2005): 779-800.
[37] State of Wisconsin, Public Documents of the State of Wisconsin: Being the Biennial Reports of the Various State Officers, Departments, and Institutions for the Fiscal Term Ending September 30, 1894. Volume II (Madison: Democrat Printing Company, State Printer, 1895), 45.

Unfortunately, few stocking records were kept until 1933; most of the early stocking records were published in Wisconsin Senate Reports. Non-native brown trout fared better than the native brook trout in a river warmed and altered by dams and from the logging of pine, hemlock, cedar, and hardwood trees that once shaded the river (Figure 8). Tourism pamphlets touted that brown and rainbow trout up to four pounds could be hooked on a fly rod. Newspaper advertisements in the large industrial cities offered land for sale while promoting the abundant and large trout.[38] Wisconsin Senate reports show that brook trout were also being stocked in Namekagon tributaries by 1894,[39] which could indicate that wild populations declined due to habitat loss or overfishing. We can infer that stocked brown trout and rainbow trout quickly replaced brook trout in the Namekagon River.

A great flood in 1941 wiped out reproducing populations of rainbow trout in the Namekagon River upstream of Hayward and destroyed historical features like the narrow gauge railroad bridge at the confluence with Big Brook. Below Hayward, a limited self-sustaining rainbow trout fishery persisted in Rainbow Creek. In the upper Namekagon, rainbow trout were sustained through annual stocking and were confined to the river, while brown trout became self-sustaining in the river and some tributaries, particularly Big Brook and Mosquito Brook. Although brook trout were abundant in the river mainstem prior to logging, they were found only in the cold-water tributaries post-logging until naturally reproducing populations were rediscovered in the river in the 1970's. After 1933, stocking of brook trout in the Namekagon River ceased until the 1970's.

The Wisconsin Conservation Department decreased stocking of fingerling brown trout in the 1940's and increased stocking of yearling brown trout because of fishing pressure and the increased populations of northern pike and bass throughout the length of the river, especially near the Pacwawong and Phipps Flowages.[40]

Reforestation and Restoration (1961 – Present)

After years of stocking more trout to mitigate for habitat loss, the Wisconsin Conservation Department proposed experimental trout habitat improvement of a section of the Namekagon River for trout populations. In 1961, the agency coordinated the project, hiring a contractor to perform the work using a dragline. The locations of the projects were in Sawyer County, Section 20, T42N, R8W and Bayfield County, Sections 20 & 21, T43N, R7W. The Sawyer County project is described in a 1961 intra-department memorandum:

> "The stream in the experimental area flows almost straight. At the upper end of the section a single wing deflector was installed. This wing extends across almost three-fourths of the width of the river, leaving a channel 35 feet wide. It is constructed by scooping up the bottom

[38] *Milwaukee Leader*, 1 May 1928, "The Nemakagon Valley around Northwoods Beach is a Mecca for Trout Fishermen."

[39] State of Wisconsin, Public Documents of the State of Wisconsin: Being the Biennial Reports of the Various State Officers, Departments, and Institutions for the Fiscal Term Ending September 30, 1894. Volume II (Madison: Democrat Printing Company, State Printer, 1895), 48.

[40] Wisconsin Conservation Department, intra-office memorandum from Clarence A. Wistrom to Edw. Schneberger. December 29, 1950. Wisconsin Department of Natural Resources Namekagon River File.

materials and depositing them for the wing. The wing is eight feet wide at the top and is 18 inches above water level. The channel at the end of the wing is now three feet deep, with a water velocity of about 1.7 feet per second. It flows parallel to the other bank and provides good cover. Immediately below this single wing an island was created in the middle of the stream. The island is approximately 30 feet in diameter. It was shored up with cedar poles on the upstream side to prevent erosion. This splits the current, with a good flow and a deep channel on either side. Below the island a second single wing was created. This reduces the channel to one-half the original width. This again creates a two and one-half to three foot depth channel. Finally, below the second wing, a third single wing was installed. This wing again reduces the channel to half the original width. In addition, a pile of partly submerged boulders were placed off the end of the wing to create cover and break up the uniform bottom."[41]

These structures, built almost 50 years ago, continue to provide habitat for many aquatic species.[42]

The Wild and Scenic Rivers Act (1968)

By the 1960's there was rising concern over the loss of our country's free-flowing rivers. In his 1965 State of the Union address, President Lyndon Johnson stated that "the time has also come to identify and preserve free-flowing stretches of our great rivers before growth and development have made the beauty of the unspoiled waterway a memory." On October 2, 1968, the President signed the Wild and Scenic Rivers Act into law. The WSRA evolved from a series of bills sponsored by Senator Gaylord Nelson from Wisconsin, Senator Walter Mondale from Minnesota, Senator Henry Jackson from Washington, and Senator Frank Church from Idaho. The WSRA was a result of a long process in which legislators, the public, corporate interests, and environmentalists put their mark on the bill.

Gaylord Nelson's beloved Namekagon River was among the first eight rivers to be designated under the WSRA. Congress designated the Namekagon River to preserve it in a natural condition as a free-flowing river, as defined under the WSRA; protect and enhance its exceptional natural, scenic, and cultural resources for current and future generations; and provide high-quality recreational opportunities that do not detract from its exceptional natural, scenic, cultural, and aesthetic resources and values.[43]

The WSRA protects rivers in several ways. To preserve free-flowing character, it prohibits new dams, channelization, and other harmful water resources projects. It identifies a management agency responsible for assuring the river's protection; in the case of the Namekagon River, the NPS. It requires establishment of riverway boundaries and authorizes land acquisition and other land protection measures to protect the river corridor. Perhaps most uniquely, the WSRA protects rivers by encouraging cooperation between the management agency and other governmental units, landowners, and private organizations. Since designation in 1968, management of the Namekagon River has included acquisition of land along the corridor in fee title and easement; management planning; research projects, including

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[41] Howard Fallis, *Experimental development, Namekagon River*, Wisconsin Conservation Department, intra-office memorandum. July 11, 1961. Wisconsin Department of Natural Resources Namekagon River File.
[42] Frank B. Pratt, Jr., Hayward Office, WDNR, personal communication.
[43] National Park Service. General Management Plan, Upper St. Croix and Namekagon Rivers. Saint Croix National Scenic Riverway. 69 pages (1998).

one on the ecological effects of the Pacwawong and Phipps Flowages; establishment of visitor facilities including a visitor center, landings and primitive campsites; an additional law enforcement presence; and education and interpretation of river resources. However, the WSRA does not provide guidelines for restoration or timeframes for dam removal.

Remnants of Logging: Pacwawong and Phipps Flowages

There are several obstructions to the free-flow of the Namekagon River that have been in place since before designation in 1968 (Figure 12). In the cold-water zone, these include the Pacwawong and Phipps dams. Pacwawong was originally a natural lake on the river as shown by survey maps from 1858, but Pacwawong increased in surface area when a dam was built on the downstream end of Pacwawong to pond water in 1883 with a head of 10 feet. The Phipps Dam was in place by 1868. Both dams were built by the logging industry. Water would be released from behind the dams when needed to drive logs downstream. Over time, these logging dams fell into a state of disrepair. In 1989, the NPS acquired the Phipps Dam from private entities. A 1988 inspection of the Phipps Dam by the State of Wisconsin had found that the dam was extremely hazardous. Over 100 large spikes protruded into the flow and the timber crib had deteriorated. Much of the rock fill had washed away leaving three foot holes between the timbers; space that could easily entrap a person. The State's inspection stated that the spikes needed to be cut off or removed and that the cribs needed to be either filled with rock or the top layer of timbers removed.

As the new owner of the Phipps Dam and manager of the Riverway, the NPS was responsible for its safety. After some discussion, NPS management decided that removal of the hazardous portion would be the best way to meet the State requirements. Removal would eliminate the safety hazard and help restore the free-flowing character of the river. In 1989, the NPS removed the spikes and most of the dam material that was above the water line. In summer 1990, the remainder of the logs and planks associated with former dam were removed, eliminating the safety hazard. The rock used to fill the rock cribs was left on stream bed. After this reduction, the dam still raises the level of river behind it by about 4 feet.

The NPS also acquired the land surrounding Pacwawong Dam and claimed responsibility for the dam. The WDNR shares in the responsibility since the Wisconsin Legislature transferred water regulation authority to them from the Public Service Commission of Wisconsin in 1969. In 1982, the dam was inspected by a NPS engineer. The inspection recommended removing the timbers with protruding metal drift pins. Since the exposed pins were potentially very dangerous to canoeists, the NPS removed this material in 1990 making the dam less hazardous.

Both the Pacwawong and Phipps Dams have a measurable effect on the ecology of the Namekagon River by increasing water temperatures within and downstream of the flowages. The shallow water depths, dark organic substrate, and low water velocities result in elevated temperatures.[44] The fish history of

[44] Terence P. Boyle & David R. Beeson, *The effects of Pacwawong & Phipps Flowages on ecological aspects of the Namekagon River*, National Park Service, Water Resources Division (1987).

these flowages shows that they support a warm-water fish population including northern pike and bass that prey on small trout. These flowages serve as nursery areas for these warm-water species.

Cap Creek Restoration Project

In 1988 the NPS acquired a private trout hatchery adjacent to the Namekagon River on Cap Creek. The hatchery was created in the early 1950's by diverting Cap Creek out of the area and through a ditched channel. This allowed for the excavation of several trout ponds. In addition to the excavated trout ponds, the hatchery consisted of service buildings and a residence. In 1989, the NPS removed the hatchery buildings and residence, but the shallow, spring fed ponds remained.

A project to restore Cap Creek to its original channel was undertaken by WDNR and the NPS in 2004. Cap Creek was re-connected to the Namekagon River and to the large spring seep known as Schultz Springs. One former pond was filled, and others were retained as semi-isolated, adjacent wetlands. Fish can now move freely between the Namekagon River and the restored channel of Cap Creek (Figure 10). Brook trout have responded positively. In December, adult brook trout spawn in the Namekagon River immediately downstream of the mouth of Cap Creek (at photo point in Figure 10). Young-of-year brook trout can be observed in the Schultz Springs seeps throughout the year. And literally hundreds of adult brook trout congregate in the Namekagon River at the mouth of Cap Creek all winter (Figure 11) due to the stabilizing thermal influence of groundwater from Cap Creek and Schultz Springs.[45]

Analysis

Hypothesis 1: The river is wider and shallower now than it was prior to European settlement.

We compared river measurements from public land surveys to measurements taken from recent aerial photographs of the Namekagon River in 2005 (Table 1). The United States General Land Office conducted public land surveys of Wisconsin from 1832 to 1866. Township surveys on the Cold-water Zone of the Namekagon River took place between 1855 and 1858. These surveys include important notes for describing a pre-logging landscape along the Namekagon River, including tree species, cedar swamps, soil quality, and river widths and depths. Surveyor's notes on river width generally were recorded to the nearest 20 links in a chain. Experienced surveyors likely visually estimated perpendicular river widths in most locations, rather than actually measuring them. A link of a chain is 7.92 inches long; so a plus-or-minus 10-link recording represents an estimate that is plus-or-minus 6.5 feet. If river width did not change appreciably because of logging, any change between then and now may be difficult to detect due to lack of measurement accuracy, since surveyors essentially rounded to the nearest 13th foot.

The means of river width were 117.3 feet in 1858 ($SD = 39.8$, $n = 38$) and 101.7 feet in 2005 ($SD = 51.5$, $n = 38$). Results suggest that the river is not significantly different in width than it was prior to logging ($t = 1.99$, $p = 0.14$). In fact, a deeper, narrower channel is often typical of streams and rivers impacted by

[45] Dave Neuswanger, Hayward Office, WDNR, unpublished data.

logging drives.[46] We cannot definitively state that the river width and depth has appreciably changed due to logging.

Hypothesis 2: The river has less big woody cover on the banks and in the stream channel than it did historically, due primarily to riparian timber harvest and log driving activities more than a century ago.

Post-logging photographs show very little woody cover in the Namekagon River, consistent with historical accounts of other rivers used for log transportation in the Mississippi River and Great Lakes basins. Current levels of wood in the Namekagon River have been measured as approximately 10 pieces per 100 linear meters with a mean diameter of approximately 0.2 meters.[47] Recently measured wood levels in headwater streams and rivers within the Ottawa National Forest, Michigan are approximately 10 pieces per 100 square meters and 33 pieces per 100 linear meters in streams ranging from 2-12 m bankfull width in watersheds logged at least once since 1804.[48] Streams that flow through unlogged, old-growth forests have more abundant and larger pieces of large wood than streams flowing through logged, second growth forests. Namekagon River wood levels are considerably lower than wood levels in rivers flowing through old-growth forests.[49] Model calculations for a river of the Namekagon's size using Streamwood, a freely-available model developed by Oregon State University for Pacific Northwest Rivers, predict that old-growth levels of woody cover may have been as much as 50 pieces per 100 linear meters, more than 5 times current levels. Wood abundance at old-growth levels will take centuries to achieve without active management toward restoration. Parameters within this model can be altered to match characteristics of the upper Namekagon River. No comparable model has been developed for mid-western river systems.

We can conclude that current levels of wood in the Namekagon River and its tributaries are likely 3 to 5 times lower than historical levels based on literature review and models of wood input to river systems.

Hypothesis 3: Brook trout were more abundant in the Namekagon River before the logging era.

Logging degraded trout streams throughout the state of Wisconsin and decreased the abundance of brook trout. The Wisconsin Conservation Commission report in 1916 recommended a thorough survey of trout streams in the state because the waters that at one time were excellent trout streams no longer had the proper natural conditions for the development and growth of trout. "The timber and brush have been cut from the banks, and the stream now meanders through farm and pasture lands, where,

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[46] William Gerald Rector, *Log Transportation in the Lake State Lumber Industry: 1840-1918*, (Glendale: Arthur H. Clark Co., 1953).
[47] Frank B. Pratt, Jr., Hayward Office, WDNR, unpublished data.
[48] Jean M. Cordova, Emma J. Rosi-Marshall, Jennifer L. Tank, and Gary A. Lamberti, Coarse particulate organic matter transport in low-gradient streams of the Upper Peninsula of Michigan, Journal of the North American Benthological Society 27(2008): 760-771.
[49] Jean M. Cordova, Emma J. Rosi-Marshall, Asako M. Yamamuro, and Gary A. Lamberti, Quantity, controls and functions of large woody debris in Midwestern USA streams, River Research and Applications 23(2007): 21-33.

during the summer months, hogs and cattle wallow in the waters."[50] For many years after logging, the federal government and the Wisconsin Conservation Commission stocked streams and rivers once abundant with natural populations of brook trout, essentially addressing the symptom of reduced trout instead of the cause, namely degraded habitat caused by logging.

Based on historical descriptions of fishing in the Namekagon River, we know that brook trout were present in the river before and even during the logging era (Table 1). Three separate published accounts between 1883 and 1893 describe the abundance of brook trout in the Namekagon and its tributaries at numbers that seem impossible to imagine today. Presently, brook trout are rarely found in the mainstem of the Namkagon River, except near the outlets of the cold-water tributaries. Based on historic descriptions of brook trout abundance and the relatively small brook trout populations at present, we can infer that brook trout were abundant in the Namekagon River before the logging era and declined soon thereafter.

Summary

We have reviewed the historical habitat of the Namekagon River from pre-logging conditions through present-day. Results suggest that the Namekagon River is not significantly different in width compared to pre-logging. However, a deeper, narrower channel is often typical of rivers impacted by logging drives. Logging effectively reduced large woody debris, which provides habitat for fish. A primary focus for managing and restoring the river is recovery of native brook trout, an important sport fish in the cold-water zone. Although we have inferred that brook trout were abundant in the Namekagon River prior to logging, they have been limited to the cold-water tributaries post-logging. Our expectation is that the results will be used by the National Park Service and Wisconsin Department of Natural Resources as a baseline to guide future restoration projects.

[50] Biennial Report of the State Conservation Commission of Wisconsin for the Years 1915 and 1916. Wisconsin Conservation Commission. Cantwell Printing Co., State Printer. Madison, WI. The report also describes the problems associated with removal of bank vegetation. "Rains, owing to the timber and brush being cut, cause a heavy wash and flood. There is no question but that many thousands of trout from the state hatcheries are planted in streams in which the fish cannot exist. What may have been a good trout stream a decade ago is today nothing but a dirty roily creek."

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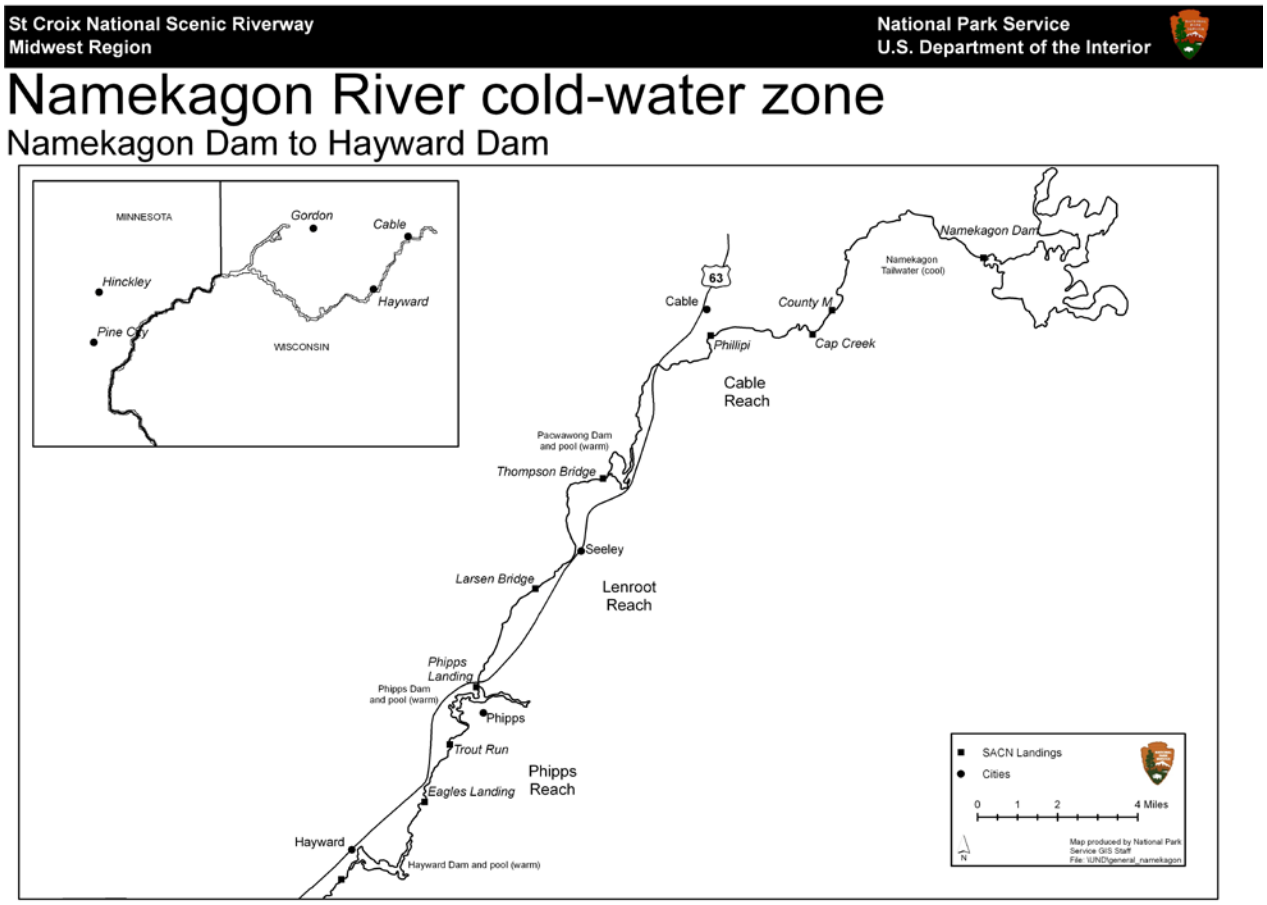

Figure 1. Map of the Namekagon River cold-water zone from Namekagon Lake to Hayward Dam. From 2001 Fisheries Management Plan for the St. Croix and Namekagon Rivers. Map created by Rebecca Haass.

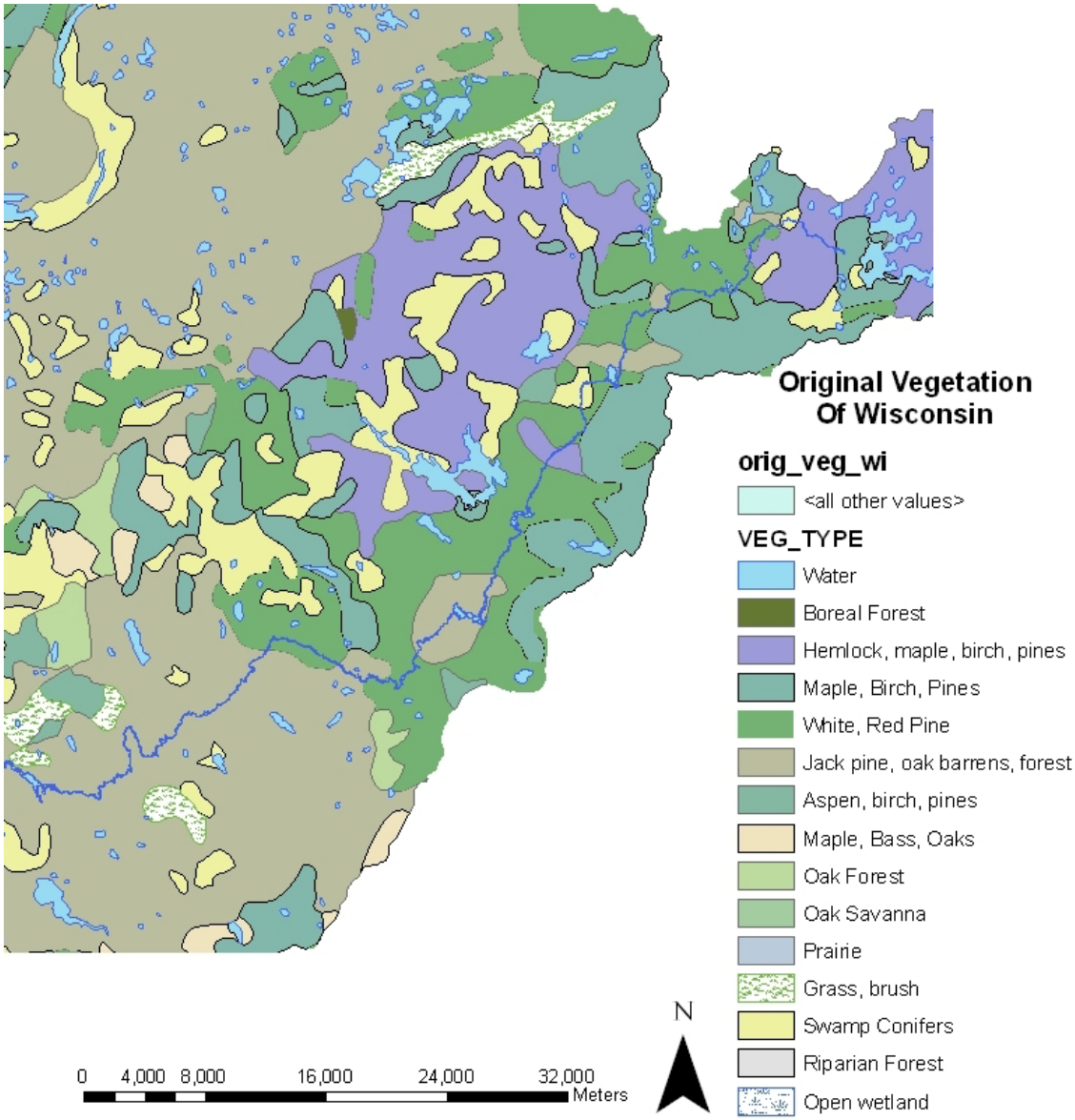

Figure 2. Original vegetation in the Namekagon River basin determined from land surveys conducted by the U.S. Public Land Office from 1855 to 1858.

Figure 3. Picture of Chicago, St. Paul, Minneapolis, and Omaha (The Northwestern Line) passenger train at Cable in the late 1800's. Photo courtesy of Cable/Namakagon Area Historical Museum, Cable, WI.

Figure 4. The earliest known published photograph of the upper Namekagon River near Cable, WI (Turner, 1889). This photograph was likely taken after completion of the railroad to Ashland in 1883 and before publication in 1889. The probable location for this photograph is near the Cable railroad bridge looking upstream. The photograph shows strong evidence of recent disruption and instability in the high, exposed, eroded banks found nowhere on the upper Namekagon River at present. The outflow of Lake Namekagon was controlled by 1883 for the purposes of gaining enough water to float logs to the Hayward mill.

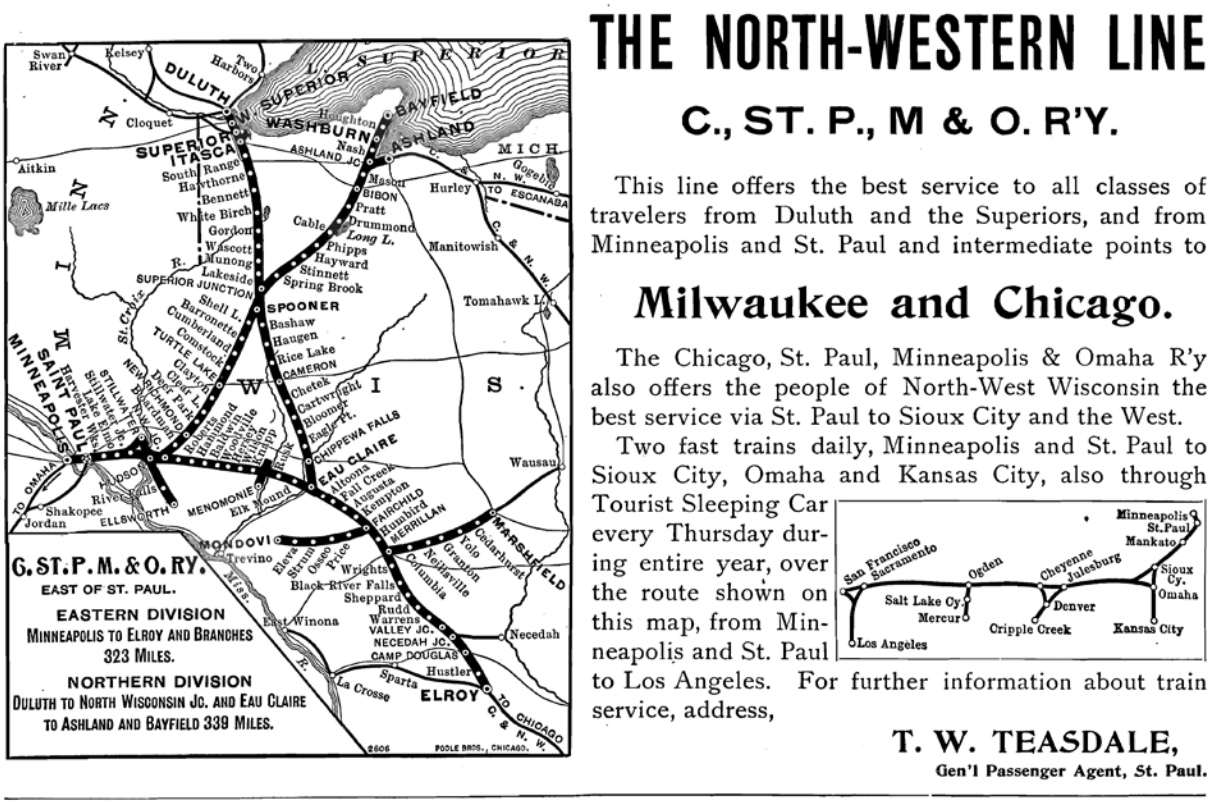

Figure 5. Map of the "Omaha X" of the Chicago, St. Paul, Minneapolis & Omaha Railway in Wisconsin. The station at Spooner served as a junction for the railway (Turner, 1898).

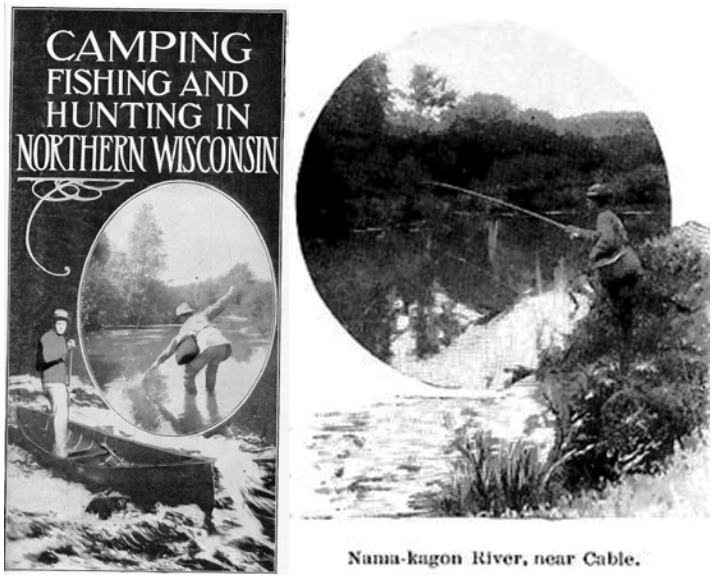

Figure 6. Publication of the Chicago and Northwestern Railway from 1904 advertising fishing and hunting opportunities along lines owned by the railway.

Figure 7. Snags enhance habitat of a side channel of the Namekagon River between Pacwawong Dam and Phipps Flowage. Photograph taken July, 2008.

Figure 8. Pre-1928 photograph of Namekagon River at Leonard School Road Bridge near Seeley, WI showing bare foothills in the background, a lack of wood in the river, and reduced shade from logging. Photo courtesy of NPS, River Rats collection.

Figure 9. The result of the Cap Creek restoration project is shown in the photograph taken at the mouth of Cap Creek on July 31, 2008.

Figure 10. Cap Creek outflow has become a major spawning area for brook trout in the main channel of the Namekagon River along the reach shown in this photograph. July 31, 2008.

Figure 11. Brook trout in Namekagon River near mouth of Cap Creek. Photograph taken on 7/31/2008.

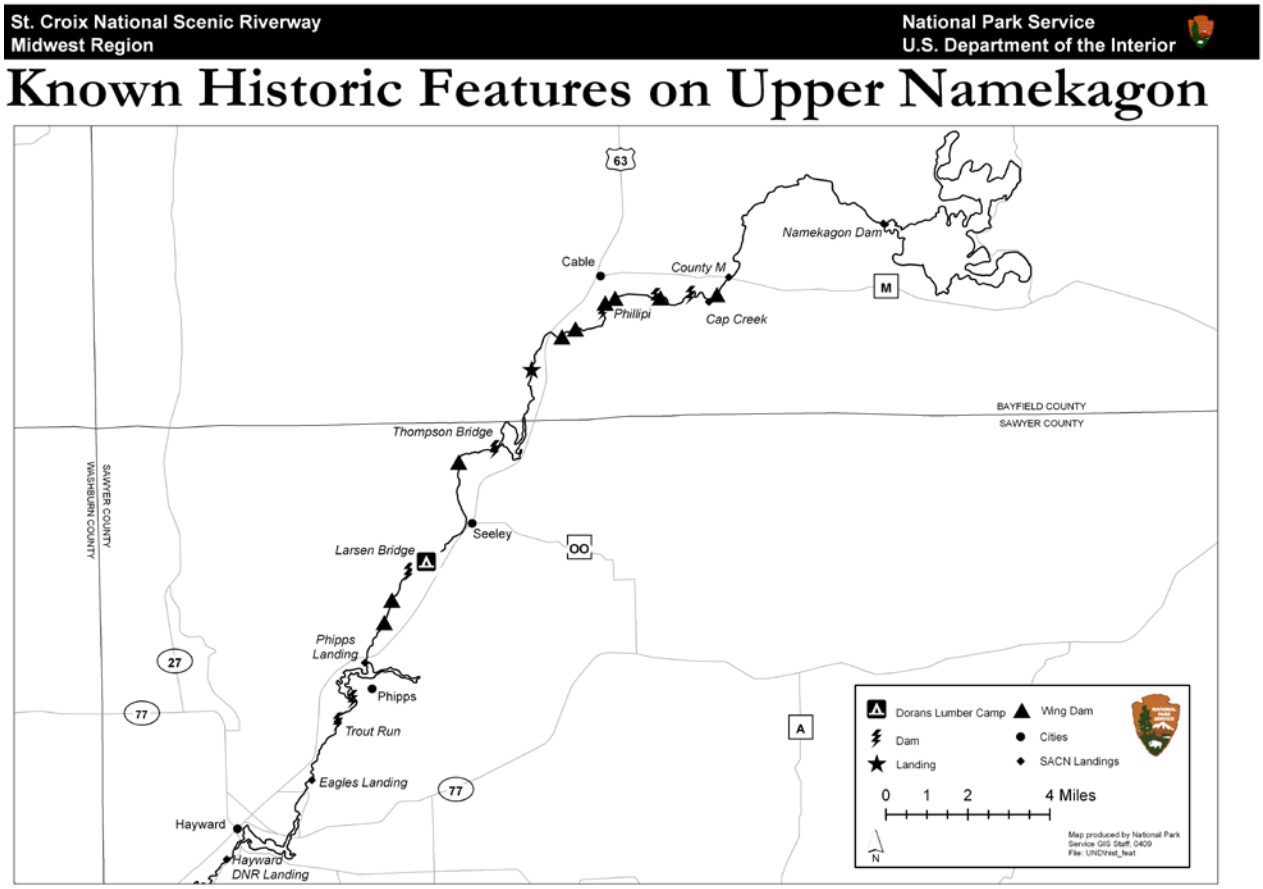

Figure 12. Map of Namekagon River historic features from Lake Namekagon to Hayward. Map created by Rebecca Haass.

Table 1. Width of Namekagon from U.S. General Land Office surveys circa 1858 versus 2005 WDNR Surface Water Webview, at section lines Bayfield and Sawyer County. NS = No significant change.

T-R-	Section	1858 survey	2005 WebView	Change/Comments
43-6W	8/9	66	243	Wider/ Lake Namekagon
	7/8	66	73	NS
	6/7	66	76	NS
43-7W	1	59	57	NS
	1/2	50	44	NS
	2/11	66	59	NS
	2/3	66	66	NS
	3/10	66	55	NS
	10/15	99	72	Slightly Narrower
	15/22	119	99	NS
	21/22	99	78	Slightly Narrower
	16/21(1)	79	68	NS
	16/21(2)	79	74	NS
	16/21(3)	79	86	NS
	20/21	83	77	NS
	19/20	132	125	NS
43-8W	24	132	147	NS
	23/24	132	117	NS
	23/26	132	102	Narrower
	26/35	132	33’	Much Narrower, but man-made (Squaw Bend Bridge)
	25	149	188	Wider
42-8W	3/4	264	328	Wider

	4/9	**132**	**90**	**Narrower**
	9/16	**165**	**174**	**Below Bridge-No Change (110' bridge)**
	15/16(1)	**132**	**139**	**NS**
	15/16(2)	**132**	**140**	**NS**
	16/21	**132**	**145**	**NS**
	20/21	**132**	**93**	**Narrower, Larsen Road Bridge**
	20/29	**132**	**113**	**NS, Tag Alder Bridge**
	29/30	**132**	**93**	**Narrower**
	30/31	**132**	**115**	**NS**
41-9W	**12/13**	**132**	**63**	**Narrower**
	13/14	**132**	**95**	**Narrower**
	14/23	**132**	**85**	**Narrower**
	23/26	**132**	**392**	**Wider- Lake Hayward**
	26/27	**132**	**1328**	**Much Wider-Lake Hayward**
	27/28	**132**	**97**	**Narrower**
	28/33	**132**	**108**	**NS**
	32/33(1)	**132**	**131**	**NS**
	32/33(2)	**132**	**106**	**Slightly Narrower**
	32/33(3)	**165**	**53**	**Much Narrower**

Table 2. Historical accounts of brook trout abundance in the Namekagon River prior to 1900.

Date	Author	Publication	Description
1831 (July)	Henry Schoolcraft		Abundant brook trout caught and eaten by explorers upstream of Pacwawong
1883 (May)	G. Shields	Rustlings in the Rockies	In one day's fishing, seven in the party strung one hundred and sixty trout weighing from a quarter of a pound to a pound
1885	The Northwestern Line	Health and Pleasure Midst the Pines	Common occurrence for one fisherman to secure from the clear, deep, cool and swift waters thirty or forty pounds of the delicious fish in the sporting hours of a single day
1893	Anonymous	The Hayward Journal	Very common "for two fishermen to bag 100 to 150 fine trout in one day's fishing in this stream, and many times have such a party taken twice that number of speckled beauties"

Appendix A. Tables with important dates for Namekagon River flowages and tributaries.

Table A1. Pacwawong Dam and Lake History

1831	Schoolcraft camped at Puckwaewa Village on the natural lake; noted eight large permanent bark lodges, fenced fields of corn, potatoes, pumpkins, and beans
1883	Dam built at downstream end of lake for ponding water and driving logs at lake's outlet by Al Blaisdell
1885	Chapter 43 authorized dam construction on the rivers
1887	Blaisdell Dam washed out; new stone-filled, timber crib dam was built at lake outlet by North Wisconsin Lumber Company; dam had 3 Tainter gates operable for a head of 10 feet
1911	Last log drive through the dam
1914	Inspection – logging dam with a 10 foot head
1922	PSC found dam washed out with obstruction remaining and holding back water
1933	Dam inspected by PSC – same condition as 1922
1934	PSC established a survey datum near the dam with water elevation at 100". Average control elevation of the rock and log obstruction at 98.47".
1941	Flood destroys wild rice
1945	Water level temporarily raised three feet; remaining wild rice disappeared
1952	WI highway commission complains that additional fill had been placed on dam and increased water level was endangering a state trunk highway.
1953	PSC inspects dam; water level is at 102.31". Review of flowage history determined that when the lake was partially drained that large springs fed the river at NW NW Section 2 and NE NE Section 3; Elodea, hornwort, musky weed, water lilies, and pondweeds present; sedges and cattails growing in southern end of flowage; warm-water fishery of northern pike and bluegills
1954	PSC issued orders that obstruction be maintained with width of 37 feet and crest no higher than 98.5 feet
1968	Namekagon river designated under the WSRA to preserve its free-flowing character and exceptional resources.
1969	Water regulation authority transferred from PSC to WDNR
1975	WDNR and NPS records indicate interest from Town of Lenroot to repair dam and raise lake level
1977	Survey of flowage (159.6 surface acres, maximum depth of 6 feet)
1981	Internal NPS memo listed dam as being of historical interest
1982	Stone-fill obstruction approximately 2 feet in height and 50 feet between banks
1986	Study by NPS on the effects of flowage on the ecology of Namekagon River
1990	NPS staff removed protruding spikes and timbers to make area less hazardous; after flowage levels dropped, someone built a rock wall across the river at the dam site raising the water level approximately 12", sharply dropping downstream water levels. The rock dam was removed by authorities

Table A2. Phipps Dam and Flowage History

1858	General Land Office surveys delineate Pacwawong Lake, a natural lake on the Namekagon River
1868	Records show dam present – built for Henry H. Hanscom logging operation
1870	Logging dam authorized in the laws of 1870
1897	Dam was used as a wagon bridge until 1938
1922	PSC found dam washed out with obstruction remaining and holding back water
1926	Obstruction raised 2 feet without authority; dam height approximately 13 feet
1950	Wisconsin Conservation Department memo mentions that flowages in Upper Namekagon River support warm-water fish populations such as northern pike and bass that prey on small trout
1954	PSC ordered obstruction to be maintained with a width of 65 feet and crest no higher than 96.5 feet
1968	Namekagon River designated under the WSRA to preserve its free-flowing character and exceptional resource values.
1977	Survey conducted on Phipps Flowage (142.6 surface acres, maximum depth of 13 feet)
1986	Study by NPS on the effects of flowage on the ecology of Namekagon River – flowage changed macroinvertebrate community composition
1988	Dam inspection by the State of Wisconsin finds Phipps Dam in extremely hazardous condition
1989	NPS aquires dam from private entity
1990	To remove a hazard to the public and comply with state regulations for dam safety, NPS staff removed logs and planks from the former dam; rock from cribs left in the stream; dam removal stopped short of full-scale restoration to prevent complete lowering of impoundment; *see photographs*
1991	Classified as a low hazard dam; dam height 4 feet, consisting of rocks remaining after 1990 removal of wooden structure; dam raises river approximately 4 feet behind it; crest length of dam about 150 feet
1992	Water level in flowage dropped approximately 2 feet; dam could be run in a canoe

Appendix B. Photographs documenting Namekagon River area history

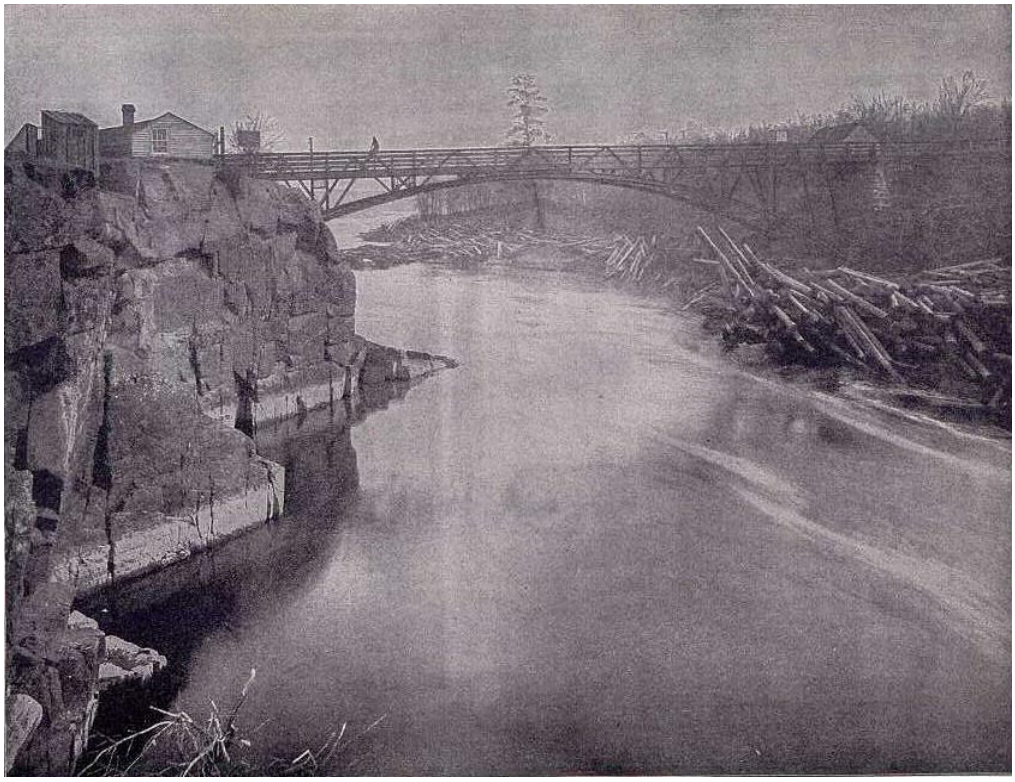

Figure B1. St. Croix River showing timber on riverbank after clearing of log jam - circa 1890.

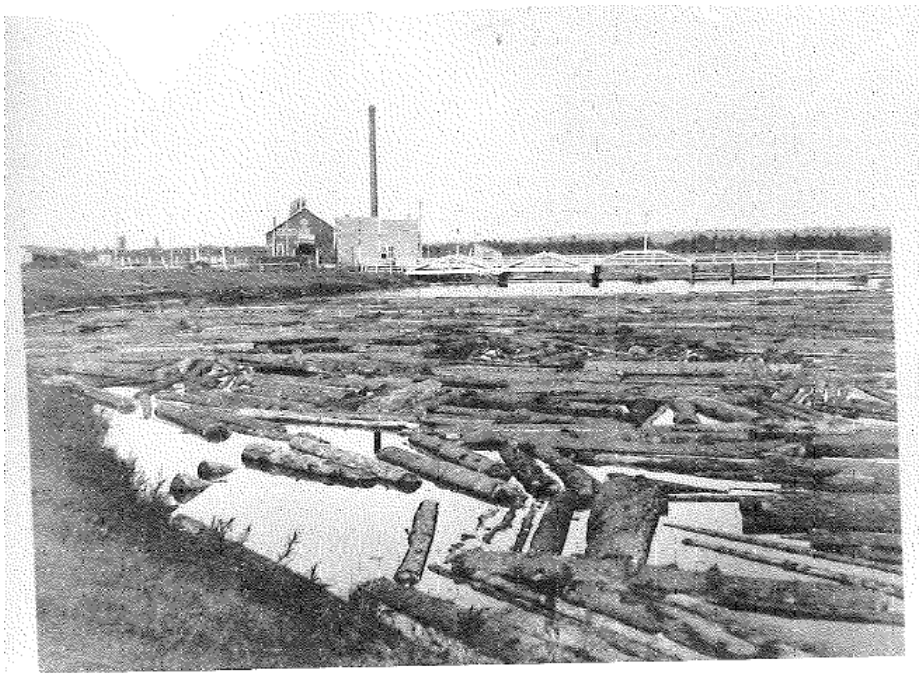

Figure B2. Log pond at Hayward Sawmill.

Figure B3. Radloff sawmill near Seeley on Namekagon River circa 1910. Photograph courtesy of Andrea Marple Wittwer.

Figure B4. 1913 Hayward Flowage.

Figure B5. Alley in Lumber Yard, North Wisconsin Lumber Company. Hayward, Wisconsin. Photograph courtesy of Sawyer County Historical Society.

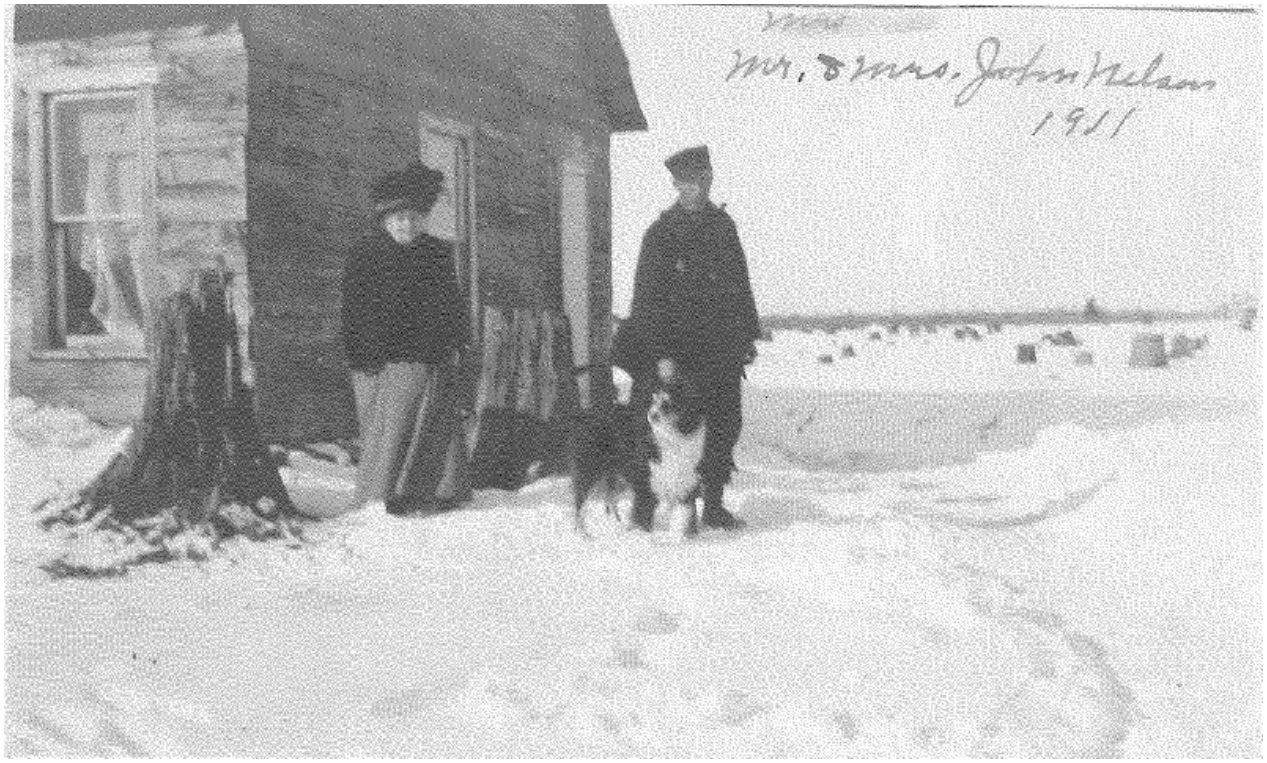

Figure B6. “Mr. & Mrs. John Nelson 1911”. Field showing stumps of trees in the Hayward area. Photograph courtesy of Andrea Marple Wittwer.

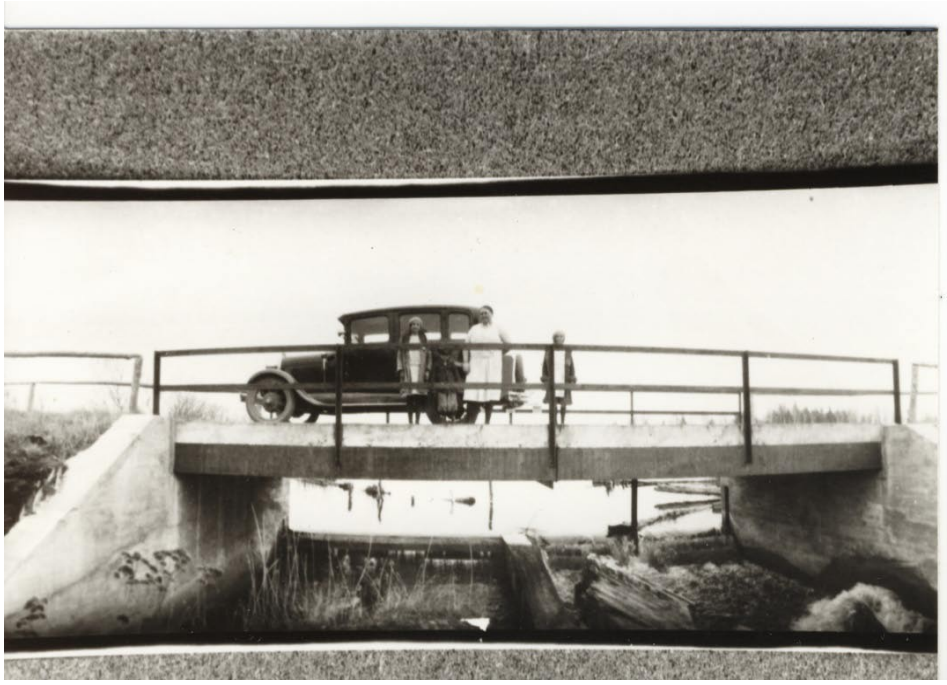

Figure B7. Dam at outflow of Lake Namekagon, rebuilt as a bridge after logging drives ended. Photograph courtesy of Cable/Namakagon Historical Society.

Figure B8. Rib Lake, Wisconsin postcard, postmarked 1909. Rib Lake was Wisconsin's last dedicated logging railroad. Logging railroads in northern Wisconsin removed timber after stands along rivers had been exploited.

Figure B9. Iron River area burn over, 1924. Photograph from U.S. Forest Service historical archives.

Figure B10. Campers at a Namekagon picnic ground in 1956. Campsites were full, so these campers used a Namekagon picnic ground in 1956. Photo courtesy of United States Forest Service federal archives.

Figure B11. Campers at a Namekagon picnic ground in 1956. Campsites were full, so these campers used a Namekagon picnic ground in 1956. Photo courtesy of United States Forest Service federal archives.