

# Hay Creek Assessment

WBIC # 2131900

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Hay Creek is a seven mile cool-warm headwater stream that flows north and empties into Bridge Creek (Figure 1). The stream is classified as a Class I trout stream and is identified as an exceptional resource water. The watershed is approximately 5,000 acres. The land use of Hay Creek is mostly patchy wooded areas and wetland (56%) with nearly the rest (39%) in agricultural pasture and row crops (Figure 2). Portions of the stream have wooded and wetland buffer areas, however other reaches are impacted by cattle pasturing in the stream and eroding banks that are degrading habitat. Stream substrate is almost entirely sand and silts, with little cover for fish. Cover that is available is primarily from aquatic macrophytes.

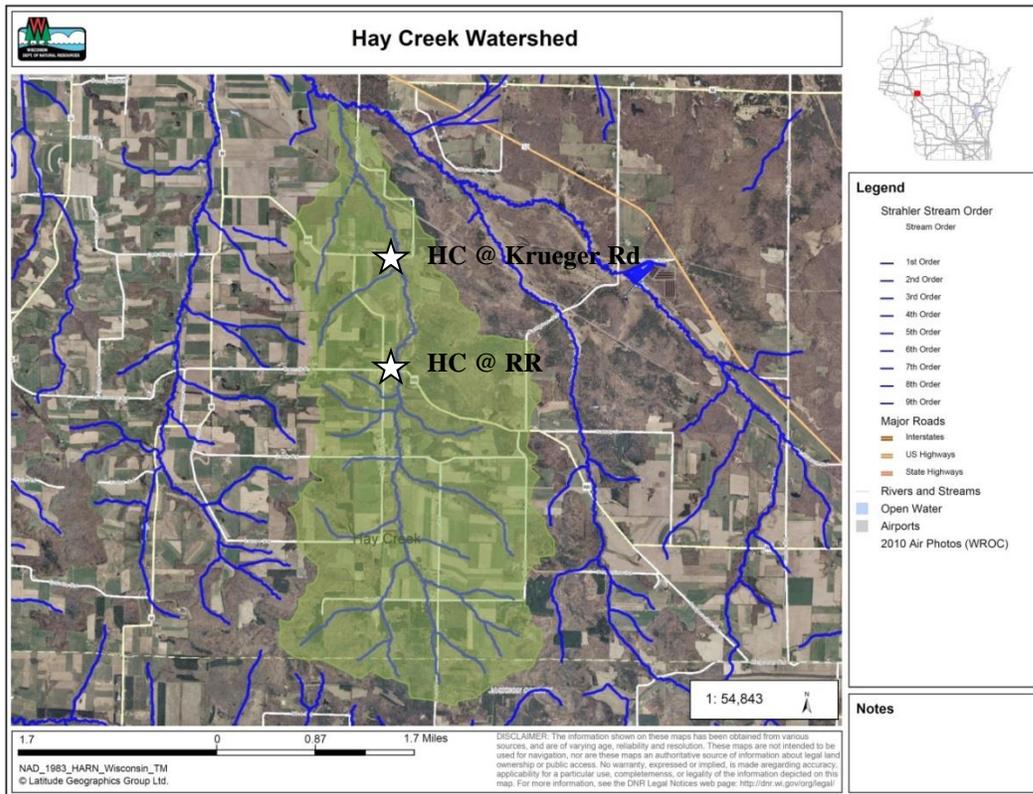


Figure 1. Hay Creek (HC) watershed and monitoring site locations at Krueger Road and CTH RR.

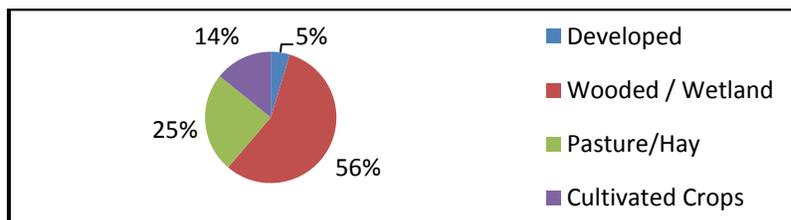


Figure 2. Land use in Hay Creek watershed.

Stocking records for Hay Creek extend back to 1938. Fingerling Rainbow and Brook trout were stocked from 1938 to 1952 when yearling and eventually legal sized trout were stocked in 1960. Early reports suggested that the stream was suitable for a put-and-take fishery only. However, a 1976 survey revealed naturally reproducing brook trout in the stream and the biologist suggested that the classification should be increased from a Class IIa to a Class Ia for the entire length of the stream. Recent data however, have only caught one trout in nine surveys, and there was no evidence of natural reproduction.

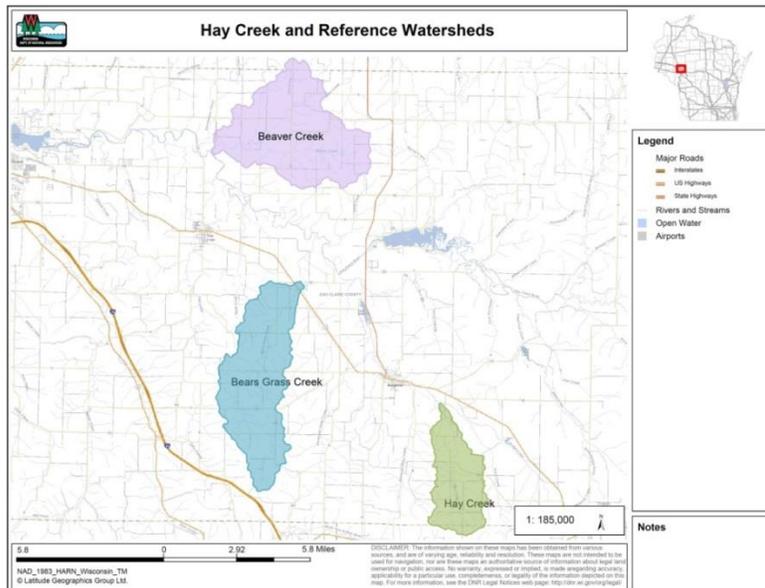
Fish and water resources staff collected fishery, continuous temp, water chemistry, habitat, and macroinvertebrate data from Hay Creek at two sites, Krueger Road and CTH RR. Fish surveys were completed following Guidelines for Assessing Fish Communities of Wadable Streams in Wisconsin (WDNR, 2001). Station lengths were generally determined by multiplying 35 times the mean stream width (MSW) with a minimum station length of 100m and maximum of 400 meters or at the end of the nearest habitat feature (Lyons, 2006). Habitat evaluations were completed following protocol for wadable streams (Simonson et al., 1994). Aquatic macro-invertebrates were collected using a D-frame net following methods outlined in Hilsenhoff (1987). The samples were preserved with denatured alcohol and sent to UW-Stevens Point for sorting and identification.

Macroinvertebrate samples were evaluated using the Hilsenhoff Biotic Index (HBI) which provides a relative measure of organic loading to a stream. The HBI index uses a 0 to 10 scale where water quality improves as the value decreases. The macroinvertebrate Index of Biotic Integrity (IBI) was also used to evaluate the biotic integrity of each stream site. The macroinvertebrate IBI was developed for streams within specific eco-regions of Wisconsin. The IBI includes metrics related to assemblage composition, structure and function and assesses a wide range of environmental conditions including land use, habitat and water quality (Weigel, 2003). The index uses a scale of 0 to 10 where overall quality and biotic integrity improves as the score increases

Grab total phosphorus samples were collected monthly from May through October at the Krueger Road site. Samples were collected and analyzed following criteria outlined in the Wisconsin 2014 Consolidated Assessment and Listing Methodology Document (WisCALM) (DNR, 2013). The total phosphorus water quality criterion for wadeable streams is 75 ug/L and can be found in [NR 102.06](#) of Wis. Admin. Code. Continuous temperature monitoring was completed using Hobo pendant loggers. Readings were recorded at one hour intervals.

Sites on Beaver and Bears Grass Creeks were used as local references to assess the biological, physical and thermal potential of Hay Creek. Beaver Creek represents a least impacted site and generally has protected watershed land use compared to other area streams. The site on Bears Grass Creek has benefited from the installation of best management practices including cattle removal and establishment of protected riparian buffers and some in-stream habitat restoration work. These practices were installed as a result of the Priority Watershed Project in the Lower Eau Claire Watershed.

Fish surveys were completed from 2010-2014 to assess the entire fish community for calculating Indexes of Biotic Integrity (IBI). Hay Creek scores at CTH RR ranged from 70-100, equating to “good”-“excellent.” Scores at Krueger Rd also ranged from “good”-“excellent” with values of 80-100. IBI scores from Hay Creek were similar to or better than scores calculated for the reference sites Beaver (60-80, “good”) and Bears Grass Creeks (70-100, “good”-“excellent”).



**Figure 3. Location of Hay Creek within Eau Claire County and proximity to reference streams Beaver and Bears Grass Creeks.**

The Natural Community model predicted Hay Creek as a cool-warm headwater and the current fish community verifies this prediction as correct. The most common species observed in Hay creek are: creek chub, johnny darter, central mudminnow, brook stickleback, western blacknose dace and white sucker. Other species seen include: fathead minnow, fantail darter, northern redbelly dace, brassy minnow, pearl dace, longnose dace, and American brook lamprey. Nearly 75% of the fish found in the stream are tolerant species. Intolerant species found in surveys include lamprey and a few brook trout, however the presence of trout was a result of stocking therefore were excluded from analysis (Figure 4). In comparison, BGC and Beaver Creek have nearly 75% of their make-up composed of intolerant species.

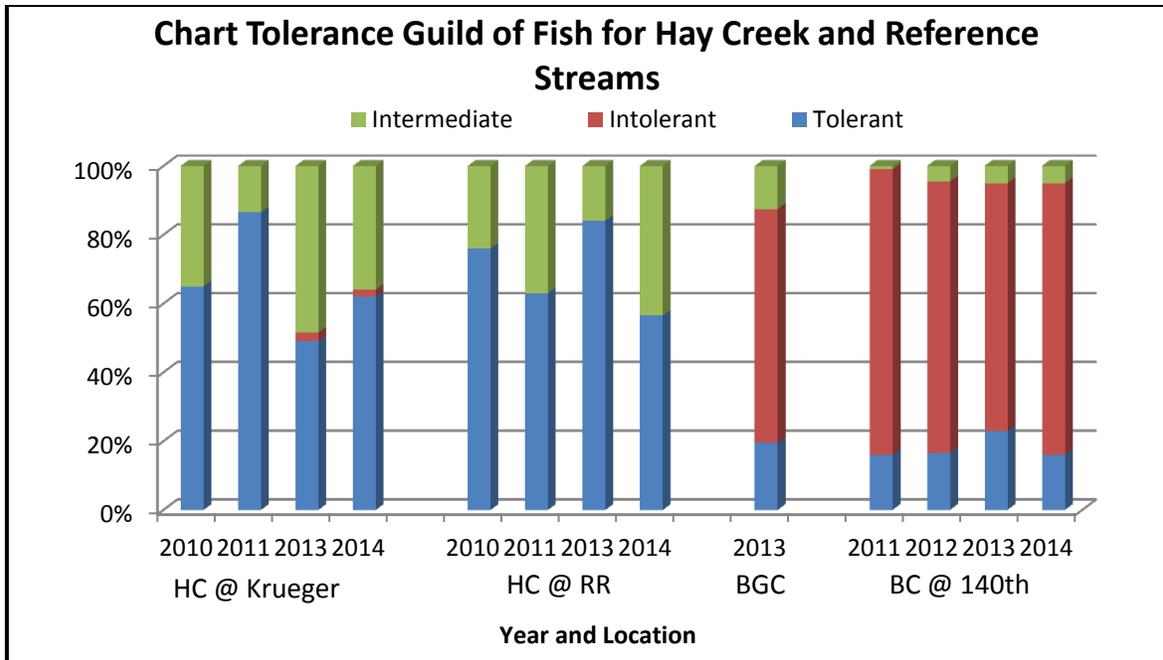


Figure 4. Percentage of tolerant, intermediate and intolerant fish species in Thompson Valley Creek (TVC) and two reference streams, Beaver Creek (BC, least impacted reference site) and Bears Grass Creek (BGC, moderately impacted reference site).

Habitat surveys were conducted at both Krueger Road and CTH RR. Scores ranged from “fair” to “excellent”. Krueger Rd has better scores due to less erosion, better buffering, more riffles and pool area. Both sites had high percentages of fine sediment and had moderate fish cover. CTH RR had no buffer present and moderately high bank erosion. Bank erosion is caused by heavy pasturing right up to the stream.

Continuous temperature monitoring indicates Hay Creek water temperatures range from cold to cool-warm, depending upon the year. The average temperature at CTH RR should be adequate for brook trout growth and reproduction (Table 1 and Figure 5.) while Krueger Road may be marginally too warm. There was nearly 4-5°F difference in maximum daily mean temperatures from 2010-2014 at both sites on Hay Creek. The summers of 2010 and 2011 were warm and wet compared to the long term average, while 2012 was hot and dry (Table 2.). The summer of 2013 was dry, but the average air temperature was normal and 2014 was average. Hay Creek is consistently higher in temperature than Beaver Creek.

Table 1. Stream thermal class breakdowns by Maximum Daily Mean (F) values.

Temperature Class	Max Daily Mean (F)
Cold Water	<69.3
Cool-Cold	69.3-72.5
Cool-Warm	72.5-76.28
Warm	76.28

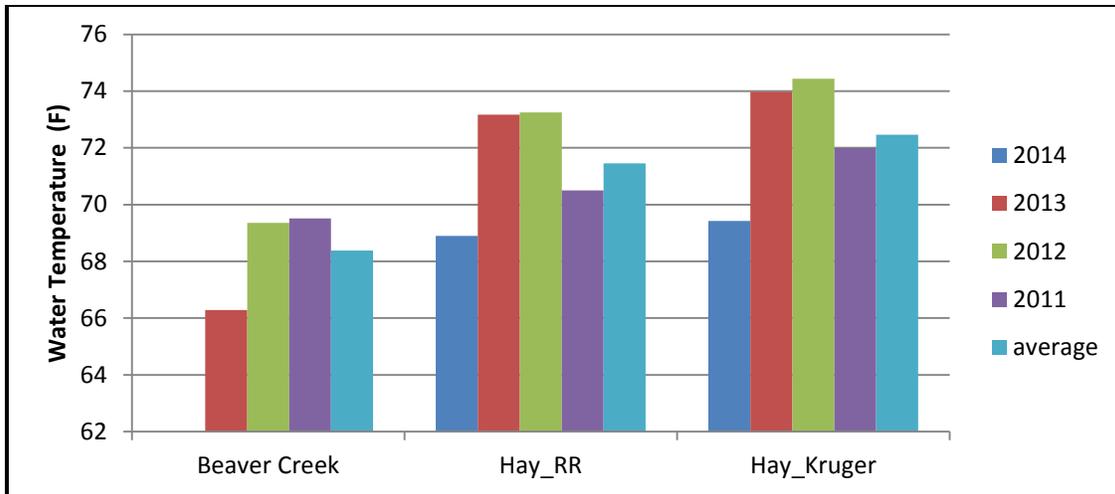


Figure 5. Maximum daily mean water temperatures (F) of Thompson Valley Creek at multiple locations and reference stream Beaver Creek from 2010-2014.

Table 2. Weather summary (2010-2014) from the closest weather station to Hay Creek watershed.

Year	2014	2013	2012	2011	2010	Long Term Average
Summer Average Air Temp (F)	69.2	69.4	71.8	70.1	70.8	69.3
Summer Average Precip (Inches)	4.16	2.53	2.46	5.7	6.03	4.3
Year Characterization	Normal	Normal and Dry	Hot and dry	Warm and Wet	Warm and Wet	

\*Air Temperature and Precipitation data report for Eau Claire

\*Summer is defined as June, July and August

Hilsenhoff Biotic Index (HBI) scores were similar between the two sites and ranged from 5.847 to 6.43 indicating fairly significant organic loading to the streams.

Macroinvertebrate Index of Biotic Integrity (mIBI) scores ranged from 4.65-7.3 (“fair to good” ratings) at Krueger Road and -0.80 to .13 at CTH RR (“poor”) The very low mIBI scores at CTH RR indicate a degraded invertebrate community. Land use at CTH RR and upstream is dominated by crop fields and cattle pasturing throughout the stream corridor. Table 3 and 4). Macroinvertebrate data from Beaver Creek shows HBI values ranging from 1.8-3.1 and mIBI values from 6.2-8.2. These values show that overall; Beaver Creek has a much healthier macroinvertebrate community and significantly less organic pollution.

Table 3. Hilsenhoff Biotic Index (HBI) rating system (1987) used to indicate water quality and pollution issues.

Hilsenhoff Biotic Index (HBI) rating system		
Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	No apparent organic pollution
3.51-4.50	Very Good	Possible slight organic pollution
4.51-5.50	Good	Some organic pollution

5.51-6.50	Fair	Fairly significant organic pollution
6.51-7.50	Fairly Poor	Significant organic pollution
7.51-8.50	Poor	Very significant organic pollution
8.51-10.00	Very Poor	Severe organic pollution

**Table 4. Macroinvertebrate Index of Biotic Integrity (mIBI) rating the quality of the macroinvertebrate community.**

<b>Macroinvertebrate Index of Biotic Integrity (mIBI)</b>	
<b>IBI Score</b>	<b>IBI Rating</b>
< 2.5	Poor
2.5 – 4.9	Fair
5.0 – 7.4	Good
>7.5	Excellent

Results of monitoring indicate the median total phosphorus concentration was 83 ug/L. The minimum and maximum concentrations were 46 ug/L and 537 ug/L, respectively. WisCALM describes the procedure to evaluate total phosphorus data by calculating a 90% upper (UCL) and lower confidence limit (LCL). If the LCL exceeds the criteria by two fold (150 ug/L for wadeable streams) an overwhelming exceedance of the criterion is found and the stream is placed on the impaired water list. The LCL for Hay Creek was 46.57 ug/L. Because the LCL is below the criterion and the median and UCL are above the criterion Hay Creek is classified in the “may exceed” category. Therefore the stream was not added to the 2014 303(d) impaired waters list due to phosphorus. Hay Creek was placed on the 2014 impaired waters list for degraded biological community.

## **Discussion**

Hay Creek is a cool-warm headwater stream that is classified as a Class I trout stream. Reproducing brook trout were found in the stream during the 1970s however recent surveys have not found reproducing trout in the stream. Hay Creek from Krueger Road downstream is well buffered, however upstream from Krueger Road is heavily pastured and land use is dominated by crop fields. As a result habitat conditions in mid and upper reaches are limited by sedimentation, shallow channel depth, bank erosion and lack of cover for fish.

Continuous temperature monitoring indicates Hay Creek water temperatures range from cold to cool-warm, depending upon the year. Cold water temperatures were found during the summer of 2014 which was a summer of average temperature and precipitation. The warmest water temperatures were found in 2012 and 2013 which were warmer and drier than the long term average. Hay Creek water temperatures were consistently higher than the reference site Beaver Creek. These warmer water temperatures may somewhat be a result of natural conditions (less stable groundwater inputs) however current land use practices are likely contributing to warmer stream temperatures. Extensive cattle pasturing throughout the stream corridor upstream Krueger Road has created a relatively

wide and shallow stream channel and open canopy. These conditions increase solar inputs that can increase water temperatures.

Macroinvertebrate indexes (HBI and mIBI) indicate the invertebrate community is degraded, especially in the middle and upper reaches. HBI results indicate there is a fair amount of organic loading to the stream.

Hay Creek was added to the 2014 303d impaired list for degraded biological conditions. The loss of reproducing brook trout and degraded invertebrate community indicate the stream is not meeting its biological potential. The degraded biological communities are a result of poor habitat and water quality conditions caused by extensive cattle pasturing and cropland runoff.

Total phosphorus concentrations range from very low to very high and median growing season concentrations are slightly above the State standard for wadable streams. A Soil and Water Assessment Tool (SWAT) model predicted TP yield from the HC watershed delivers 0.10-0.20 kg/ha/year (Adam, DNR), a relatively low value for the Lower Eau Claire River watershed. The median TP concentration from HC supports the model prediction of lower phosphorus yields.

## **Management**

Hay Creek was added to the 2014 list for a degraded biological community. MIBI results indicate the invertebrate community is degraded and HBI ratings suggest there is fairly significant organic loading to the stream. Historically (1970s), Hay Creek supported reproducing brook trout however only stocked trout have been recently found in the stream.

Restoration of vegetated buffer areas around the stream, full or partial exclusion of livestock, and in stream habitat restoration is needed to improve the quality of this stream. Stabilized stream banks and buffers would decrease the amount of sedimentation in the stream. Increased buffers and overhanging vegetation would stabilize streambanks and reduce the amount of solar inputs to the stream and decrease water temperatures. .

Even though Hay Creek was not added to the 2014 impaired waters list, the median TP concentration exceeded the standard. Sediment and nutrient loading from agricultural land use should be evaluated to determine reductions needed to reduce nutrient concentrations. Reductions in sediment from uplands should decrease sedimentation to Hay Creek and improve habitat conditions. Evaluations should also be conducted to determine sources of organic loading to the stream to improve conditions of the aquatic community.

Fisheries Management initiated a project in 2012 to stocked Hay Creek with feral brook trout fingerlings. The goal of this project is to determine if these trout carryover and start reproducing when they mature. The lack of carryover or reproduction would indicate the stream lacks suitable habitat for trout growth and reproduction. Limited carryover would

suggest trout can survive in Hay Creek but habitat conditions are not adequate to sustain the fishery. Surveys in 2015 are proposed to assess the overwintering and reproductive success of the feral brook trout that are being stocked in the stream.

## **References**

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