Plum Creek Watershed

Comprehensive Surface Water Resource Report

Pierce and Pepin Counties, Wisconsin

Prepared by:

Martin P. Engel and Scott W. Peavey

Wisconsin Department of Natural Resources

West Central Region

Lower Chippewa River Basin

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Lower Chippewa Basin Team

Marty Engel – Senior Fisheries Biologist
Scott Peavy – FisheriesTechnician (LTE)
Sara Peot – Fisheries Technician (LTE)
Heather Mcleod – Fisheries Technician (LTE)
Ken Schreiber – Water Quality Specialist
Brian Spangler - Fisheries Technician
Patty Asher – Fisheries Technician (LTE)
Derek Pierce – Laborer Helper (LTE)

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Introduction

As part of the Lower Chippewa Basin Comprehensive Surface Water Resources Monitoring Program, the Plum Creek Watershed was sampled during the 1999 field season. The Plum Creek watershed comprehensive stream survey was conducted to gather baseline data on fish habitat, sport and nongame fish communities, temperature regimes, and macroinvertebrate communities. The purpose of this report is to summarize the condition of surface water resources in the Plum Creek Watershed, document impairments, and recommend management goals and objectives aimed at protecting or improving it. This information will provide a foundation on which to base future management decisions. The data can be used to address both local management and division issues such as; monitoring, fish stocking, trout stream classifications, fishing regulations, watershed projects, water regulation and zoning permits, biodiversity, outstanding and exceptional waters classification, fish habitat restoration, and acquisition goals and boundaries.

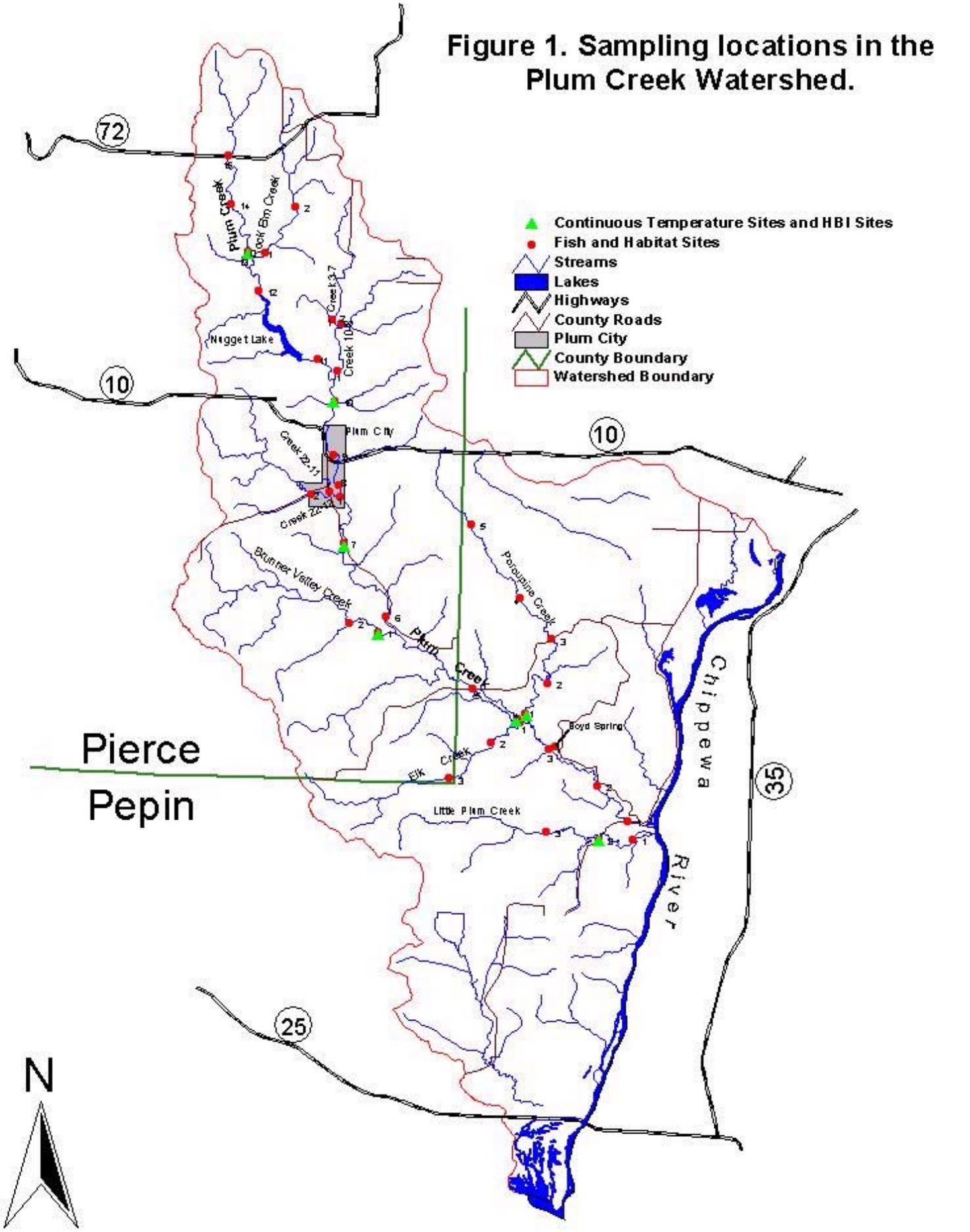
Summary of Water Resource Conditions

Watershed Description

The Plum Creek watershed is 88 square miles with approximately 49 square miles (55.6%) in Pierce County, and 39 square miles (44.4%) in Pepin County **(Figure 1)**. Plum Creek is the primary waterway with a base flow of approximately 55 cubic feet per second near its mouth. The watershed drains rolling agricultural and wooded areas with many of the tributaries originating in steep coulees. The watershed also drains one small urban area, the village of Plum City. Plum Creek has three named tributaries; Elk, Porcupine and Rock Elm Creeks and a number of small-unnamed tributaries.

Plum Creek originates in southeastern Pierce county and flows southeasterly about 27 miles where it enters the Chippewa River in south central Pepin County. Nugget Lake is located on the main stem of Plum Creek. Nugget Lake is formed by a base flow bottom draw, earthen dam used for flood control. The flowage encompasses 116-acres, is 1.8 miles long and has a maximum depth of 50 feet. The lake supports a warmwater sport fishery.

Figure 1. Sampling locations in the Plum Creek Watershed.



Prior to this survey, the watershed included two Class II trout streams or stream reaches, for a total of 5.5 miles of classified trout water (WDNR, 1980). The majority of streams in the watershed, prior to this investigation were considered warmwater forage streams. Fish surveys conducted at 37 sites in the summer of 1999 found predominately coldwater streams. Three trout species, (brook, brown, and rainbow trout), 12 warmwater game/panfish species and 28 additional non-game fish species were found. Currently, brook trout dominate the coldwater fishery in this watershed. White sucker, brook stickleback, blacknose dace, creek chub and johnny darters were the most common forage species.

Watershed Problems

Water resource problems most common in the watershed include flashy stream flows and flooding, over pasturing and stream bank erosion, extensive sand bed loads, and degraded thermal regimes. Other problems in the watershed include cropland and gully erosion, barnyards and organic loading. Over the past 150 years major changes in land use occurred from unsettled forest and prairie to extensive logging of the heavily forested watershed, to intensive agriculture. These activities have resulted in increased flood frequency, reduced surface water infiltration and loss of groundwater recharge rates.

The primary causes of streambank erosion and bedload problems appear to be a combination of cattle grazing and frequent flooding. Repeated flooding, streambank grazing and upland erosion contribute to loss of fish cover through widening and stagnation of stream channels, sedimentation of pools and riffles and elimination of bank cover. Wide sluggish stream channels, loss of bank cover and low groundwater recharge rates are primary factors contributing to elevated stream temperatures during summer months and freezing temperatures during winter months. Spawning habitat is lost through sedimentation (filling-in) of spawning substrate. This filling-in of spawning substrate in riffle areas impairs reproductive success of trout by reducing inter-gravel flow which is necessary to maintain suitable temperature and oxygen conditions for eggs and larval fish. Sedimentation of riffles also eliminates habitat for food organisms such as macroinvertebrates.

Many of the streams including the main stem of Plum Creek, have summer water temperatures that are above optimal for some coldwater aquatic species, especially trout. Elevated water temperatures may be caused by a number of factors including lack of stream shading, reduced infiltration and groundwater recharge, and a relatively shallow, wide stream morphometry. The elimination of streambank vegetation

in the Plum Creek watershed reduces shading and increases solar radiation, which increases stream temperatures. Streambank erosion and resulting sedimentation of the bottom results in wider, shallower stream reaches which allows increased solar radiation and contributes to elevated water temperatures.

Several recent observations of partially treated wastewater entering the stream from the sewage treatment plant in Plum City are a concern. Department records do not show Plum City to be exceeding wastewater permit limits. Further investigation of wastewater discharge and monitoring techniques are needed to determine what corrective action is necessary to minimize stress and toxic effects to fish and other aquatic life downstream of the facility.

Current land use problems within the watershed result in loss of habitat, sedimentation, and degraded thermal regimes. The cumulative effect of these impacts has decreased the suitability of many portions of the Plum Creek watershed to support healthy, native coldwater aquatic communities.

Historic Watershed Conditions

Historically, Plum Creek and its tributaries had undergone a dramatic transformation from pristine, forested coldwater trout streams to degraded marginal trout streams often requiring trout stocking to provide recreational fisheries. Prior to the 1850s, the Plum Creek watershed was nearly 100% virgin deciduous forest with a mix of oak openings and prairie. The highly protected watershed supported numerous spring fed coldwater streams and healthy native brook trout populations. However, during the late 1800s through the early 1900s, the stream was severely degraded by deforestation, agricultural activities, wastewater effluent, and construction of milling dams. Conservation practices beginning around the 1930s including soil erosion control programs, reforestation and wastewater treatment has allowed numerous streams to improve to the point where stocking is no longer needed. More recently, flood control programs have had primarily positive results. These activities have reduced flooding and improved infiltration of surface runoff while only causing minor thermal impacts on permanent flowing waters. Currently, many streams in the watershed have recovered to the point of supporting a variety of native Class I and II brook trout water.

Threats to the Watershed

Current threats to the watershed include flooding, bank and cropland erosion and destabilization of the thermal regimes in tributary streams. Excessive overgrazing and bank erosion contribute large amounts of sediment to Plum Creek. Such practices degrade fish and aquatic life habitat and warm surface waters. Prolonged droughts can weaken spring flow and threaten the fragile coldwater temperature regime that currently supports a recovering native brook trout fishery.

Overall Outlook

Overall, the outlook for stream quality in the Plum Creek watershed is good. Many tributaries have experienced major improvements in native brook reproduction. A large portion of the Plum Creek downstream from Nugget Lake now supports sufficient numbers of wild adult brook and brown trout to provide an outstanding sport fishery. Continued soil and water conservation practices along with the installation of innovative Best Management Practices (BMPs) would have a number of positive effects on the water resources of the Plum Creek Watershed. In addition, reduction of sediment loads and nutrients to the Nugget Lake Reservoir and other waterbodies would improve water quality and prolong reservoir life. With time, we could reasonably anticipate major improvements in water quality, temperature regimes and habitat. In response, trout reproduction, size structure and adult densities could continue to improve dramatically throughout much of the watershed. As these degraded coldwater streams improve, their non-game fish communities will decline and shift toward more intolerant coldwater species.

Methods

Monitoring activities for this comprehensive watershed survey were initiated in June 1999 and completed September 1999. The following is a summary of the methods used to collect information for this survey.

Fish Surveys

Electrofishing surveys were conducted during the summer of 1999 at 37 sites on 11 streams in the watershed **(Figure 1)**. Surveys were conducted at approximately one site per mile of permanent stream.

Each site was 35 times the mean stream width (MSW) in length. Single-run electrofishing surveys were conducted at each site to inventory the sport and nongame fish communities. This inventory was also used to calculate trout Catch per Unit Effort (CPUE), a measure of density or fish abundance. Trout collected were marked and released. If more than 20 trout per 100 meters (4 inches and greater, of any species) were captured, a second electrofishing run was made. Based on the information from these two runs, a population estimate was calculated (Bailey's modification of the Peterson Estimate, Ricker,1975). Within each survey station, all fish species were identified and counted to determine the fish assemblage. A coldwater Index of Biotic Integrity (IBI) (Lyons, et al, 1996) was then used to calculate the quality and health of the fish community. The IBI rating ranges from 0 (very poor) to 100 (excellent).

On small streams, fish were collected using either one or two AbP-3 pulse DC backpack shockers. On larger streams, fish were collected using either one or two 235 Volt, 5 Amp DC generator-type stream shockers with 2 to 3 electrodes per shocker. All fish collected were identified to species and counted, and all game and panfish were measured to the nearest 0.1-inch.

Habitat Assessment

Habitat assessments were conducted at each fish survey site **(Figure 1)** following procedures outlined in Simonson et al. (1994). The habitat segment of each station was 35 times the (MSW) in length. The assessments included measurement of stream flow, width, depth, substrate composition, and streambank characteristics. Stream flow was measured with a Swoffer 2100 flow meter. Fish habitat ratings were determined for each site according to Simonson et al. (1994) using the appropriate score sheet for the stream's width (> 10 or < 10 meters).

Physical Characteristics

Stream gradient and drainage areas were obtained for each survey station. Stream gradient was calculated using the Terrain Navigator CD-ROM topographic map. Basin or drainage area was derived from Henrich and Daniel (1983). In addition, lengths were needed for some streams or stream segments. Stream lengths again were obtained from Koperski etal, 1996; Gebkin et al, 1972; Klick and Gebkin, 1971or the Terrain Navigator CD-ROM topographic map. If published lengths were inconsistent with survey findings the newly measured lengths were reported.

Macroinvertebrates

Aquatic macroinvertebrates were collected at seven sites in the watershed, during April and October 1998 **(Figure 1)**. Sites were located on the main stem of Plum Creek and on the larger tributaries. Samples were collected with a D-frame net using methods outlined in Hilsenhoff (1982). The samples were preserved in 70% ethanol and sent to UW-Stevens Point for sorting and identification. Results were reported using the Hilsenhoff Biotic Index (HBI) which provides a relative measure of organic loading to a stream. The HBI rating system ranges from 0 (excellent) to 10 (very poor).

Temperature

Instantaneous water and air temperatures were taken during each fish survey. To get a better picture of temperature extremes during summer conditions, maximum/minimum thermometers were placed in streams at most fish survey sites. The thermometers were deployed for five to six day periods at most sites during the fish surveys. In addition, HOBO (Onset Computer Corp.) recording thermometers were placed in streams at seven sites in the watershed **(Figure 1)**. The recording thermometers measured and recorded stream temperatures on a 60-minute interval between June 25th and September 31st, 1999.

Results and Discussion

Results and discussion are divided into two sections, the "Overall Watershed Conditions and Recommendations" and "Subwatershed Descriptions". The overall watershed section will try to present a picture of the condition of the entire watershed and the main stem as a whole. The subwatershed section will discuss in more detail the portion of main stem, tributaries and individual streams within that area. The raw data and summaries for all sites are located in **Table 1** and **Appendices A-C**.

Overall Watershed Condition and Recommendations

Index of Biotic Integrity

The Index of Biotic Integrity (IBI) provides a relative measure of the health or quality of the fish community. IBI scores for streams in the watershed are shown in **Figure 2**. **Tables 2 and 3** are

guidelines

for interpreting IBI scores. The entire Plum Creek watershed was scored as coldwater streams. IBI scores varied tremendously throughout the watershed with most streams being "Fair"(33%) to "Good"(31%). The remaining sites ranked "Excellent" (11%), "Poor" (14%) and "Very Poor" (11%). Headwater streams upstream from Nugget Lake and some downstream tributaries had "Poor" IBI values. These areas generally are farmed more intensively. Even though there has been tremendous negative impacts to Plum Creek watershed over the past 150 years the watershed condition is now improving. Several small streams have retained remnant coldwater fish communities and have replenished Plum Creek and other tributaries. Many of these remnant communities are found in small tributaries located in protected and forested coulee watersheds. Sites on many of these streams received "Good" or "Excellent" ratings.

Hilsenhoff Biotic Index

HBI provides a relative measure of organic loading to a stream. HBI scores for the watershed are shown in **Figure 3** and **Table 4. Table 5** is a guideline for interpreting HBI scores. Plum Creek upstream from Nugget Lake (station 13) showed fairly significant organic pollution. This may also be true for Rock Elm Creek, both of which drain intensive agricultural regions. Little Plum Creek showed some organic pollution and this may be the case in some other tributaries, however for the majority of sites monitored organic pollution was slight or not apparent.

Trout Catch per unit Effort

Trout abundance values are a qualitative measure of trout CPUE or density. Trout abundance values for the watershed are shown in **Figure 4**. **Table 6** is a guideline for interpreting trout abundance levels

Table 1. Station Summary for the Plum Creek Watershed in Pierce and Pepin Counties, Wisconsin
June, July, August & September, 1999.

Waterbody	Station	Habitat	Habitat Rating		Coldwater	HBI	Coldwater		Trout CPUE (no./mi.)		P. E. >= 4" (no./mi.)		Trout	Water Temp.	Summer Water Temp.			Opening Day
		Score	(<10 meters)		IBI Rating	Score	HBI Rating	Brook	Brown	Rainbow	Brook	Brown	Stocked	Max./Min. (F.)	Max. (F.)	Min. (F.)	Mean (F.)	Vehicle Count
Plum Creek	1	28	Fair*	40	Fair			30.8	23.1					65 / 55				1
Plum Creek	2	16	Poor*	40	Fair			128.0	48.6					65 / 55				2
Plum Creek	3	24	Fair*	40	Fair			455.0	85.3	4.7				65 / 54				1
Plum Creek	4	40	Fair	60	Good	2.50	Excellent	486.0	6.1					63 / 54	73.15	48.96	56.6	2
Plum Creek	5	25	Fair	50	Fair			896.0	4.9		1053.6			63 / 53				3
Plum Creek	6	20	Poor	70	Good			1609.0	111.7		1296.6			63 / 55				3
Plum Creek	7	50	Good	70	Good	3.94	Very Good	1922.0	924.0		811.7	1710	BRN (F)	62 / 53	73.83	50.28	60.57	3
Plum Creek	8	50	Good	60	Good			6088.0	1271.0		3911.4	2299.6	BRN (F)	65 / 55				6
Plum Creek	9	57	Good	60	Good			2900.0	3333.0		1603.2	3856.6	BRN (F)	65 / 55				6
Plum Creek	10	52	Good	70	Good	3.21	Excellent	6233.0	1143.0		1818.5	1216.3	BRN (F)	62 / 55	73.83	50.84	60.06	3
Plum Creek	11	67	Good	40	Fair			526.6	0.0				BRN (F)	65 / 57				3
Plum Creek	12	42	Fair	20	Poor			0.0	0.0					72 / 60				0
Plum Creek	13	43	Fair		-	5.87	Fair	-	-					72 / 63	84.29	60.64	70.34	0
Plum Creek	14	45	Fair	10	Poor			0.0	0.0					70 / 60				0
Plum Creek	15	57	Good	10	Poor			0.0	0.0					73 / 58				0
																		0
Boyd Spring	1	20	Poor	80	Good**			18.8	0.0					51 / 47				0
Porcupine	1	35	Fair	40	Fair	2.26	Excellent	26.3	0.0					66 / 56	74.53	51.79	61.32	0
Porcupine	2	55	Good	0	Very Poor			0.0	0.0					66 / 54				0
Porcupine	3	35	Fair	0	Very Poor			0.0	0.0					64 / 52				0
Porcupine	4	40	Fair	0	Very Poor**			0.0	0.0					64 / 54				0
Porcupine	5	25	Fair	40	Fair**			0.0	0.0					62 / 48				0
Elk Creek	1	30	Fair	40	Fair**			16.1	0.0					64 / 54				0
Elk Creek	2	61	Good	20	Very Poor			0.0	0.0					65 / 53				0
Elk Creek	3	40	Good	40	Fair			0.0	0.0					66 / 54				0
2-15	1	40	Fair	90	Excellent	2.97	Excellent	751.5	0.0					56 / 47	59.79	46.65	51.3	1
2-15	2	43	Fair	70	Good			116.8	0.0					57 / 47				0
Creek 22-12	1	35	Fair	90	Excellent			386.4	0.0					65 / 52				0
Creek 22-12	2	55	Fair	70	Good			32.2	0.0					62 / 56				0
Creek 22-11	1	30	Fair	90	Excellent			418.6	0.0					56 / 48				0
Creek 10-8	1	53	Good	40	Fair			477.9	0.0					63 / 55				0
Creek 10-8	2	62	Good	90	Excellent			1272.0	0.0					60 / 51				0
Creek 3-7	1	82	Excellent	60	Good			966.0	0.0					61 / 56				0
Rock Elm	1	63	Good	10	Poor			0.0	0.0					72 / 61				0
Rock Elm	2	63	Good	10	Poor			0.0	0.0					68 / 59				0

Table 1. Station Summary for the Plum Creek Watershed in Pierce and Pepin Counties, Wisconsin
June, July, August & September, 1999.

Waterbody	Station	Habitat	Habitat Rating		Coldwater	HBI	Coldwater		Trout CPUE (no./mi.)		P. E. >= 4" (no./mi.)		Trout	Water Temp.	Summer Water Temp.			Opening Day
		Score	(<10 meters)		IBI Rating	Score	HBI Rating	Brook	Brown	Rainbow	Brook	Brown	Stocked	Max./Min. (F.)	Max. (F.)	Min. (F.)	Mean (F.)	Vehicle Count
Little Plum	1	20	Poor	60	Good			209.3	0.0					66 / 54				0
Little Plum	2	35	Fair	40	Fair	3.26	Good	64.4	0.0					64 / 52	73.22	49.44	59.53	0
Little Plum	3	45	Fair	40	Fair			0.0	0.0					64 / 52				0

* Fish Habitat Rating Score (>10 meters).

Abbreviations:

** Rating may not be representative when the total number of individuals caught is less than 25 for coldwater or less than 50 for warmwater. A rating of very poor may apply.

*** Max./Min. water temperatures for all stations were taken during five to six day periods between August 19th and August 26, 1999.

(S)-Spring Stocked Fingerlings

****Max./Min. air temperatures were taken at a selected station within most subwatersheds at the same time as the water temperatures for that station.

*****Angler counts were conducted May 6, 2000, between the hours of 7:00 and 11:00 AM.

(- - indicates site was not visited)

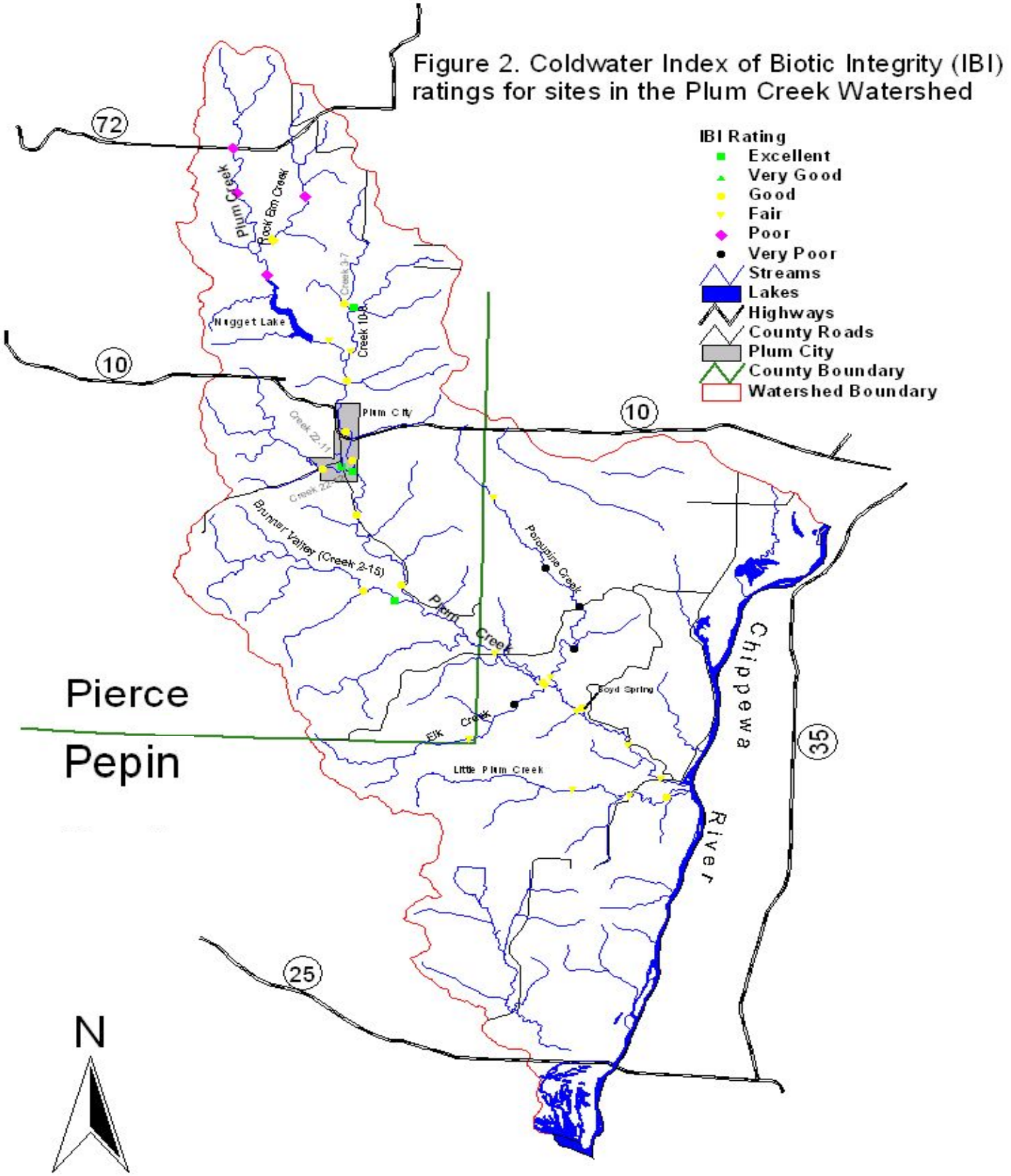


Figure 2. Coldwater Index of Biotic Integrity (IBI) ratings for sites in the Plum Creek Watershed
IBI Rating
Excellent
Very Good
Good
Fair
Poor
Very Poor
Streams
Lakes
Highways
County Roads
Plum City
County Boundary
Watershed Boundary
72
10
10
35
25
Plum Creek
Rock Elm Creek
Creek 3-7
Creek 10-8
Nugget Lake
Plum City
Creek 22-11
Creek 22-
Brunner Valley (Creek 2-15)
Porcupine Creek
Plum Creek
Boyd Spring
Elk Creek
Little Plum Creek
Chippewa River
Pierce
Pepin
N

Table 2. Guidelines for interpreting coldwater Index of Biotic Integrity (IBI) scores (from Lyons et al, 1996).

Overall IBI Score	Biotic integrity score	Interpretation and Fish community attributes
100 – 90	Excellent	Comparable to the best situations with the least human disturbance: mottled or slimy sculpins are usually common; intolerant, native stenothermal coolwater species such as lampreys or redside dace may also be present; brook trout are the primary top carnivores and are present in good numbers; exotic salmonids are absent or uncommon; tolerant species may be present in low to moderate numbers.
80 – 60	Good	Evidence for some environmental degradation and reduction in biotic integrity; either brook trout or sculpins may be uncommon or absent; exotic salmonids often dominate, keeping the abundance of top carnivores high; tolerant species may be common but do not dominate.
50 – 30	Fair	The stream reach has experienced moderate environmental degradation, and biotic integrity has been significantly reduced; total species richness is often relatively high, but intolerant and native stenothermal coldwater species are uncommon or absent; native stenothermal coolwater species and exotic salmonids may be moderately common, but tolerant eurythermal species or warmwater species or both are usually more abundant
20 – 10	Poor	Major environmental degradation has occurred, and biotic integrity has been severely reduced; total species richness may be relatively high, but intolerant species, top carnivores, and salmonids are absent; a few native stenothermal coolwater species such as brassy minnows or brook sticklebacks may persist in low numbers; tolerant eurythermal species or warmwater species or both dominate.
0 or no score	Very Poor	Human disturbances and environmental degradation have decimated the natural coldwater fish assemblage of the reach; either only warmwater and tolerant species remain, or fish abundance is so low (<25 individuals captured) that the IBI cannot be calculated.

Table 3. Guidelines for interpreting overall warmwater Index of Biotic Integrity (IBI) scores (from Lyons, 1992).

Overall IBI Score	Biotic integrity score	Fish community attributes
100 – 65	Excellent	Comparable to the best situations with minimal human disturbance; all regionally expected species for habitat and stream size, including the most intolerant forms, are present with a full array of age and size classes; balanced trophic structure.
64 - 50	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species, especially top carnivores, are present with less than optimal abundances or size/age distributions; trophic structure shows some signs of imbalance.
49 - 30	Fair	Signs of additional deterioration include decreased species richness, loss of intolerant forms, reduction in simple lithophils, increased abundance of tolerant species, and/ or highly skewed trophic structure (e.g., increasing frequency of omnivores and decreased frequency of more specialized feeders); older age classes of top carnivores rare or absent.
29 - 20	Poor	Relatively few species; dominated by omnivores, tolerant forms, and habitat generalists; few or no top carnivores or simple lithophilous spawners; growth rates and condition factors sometimes depressed; hybrids sometimes common.
19 - 0	Very Poor	Very few species present, mostly exotics or tolerant forms or hybrid; few large or old fish; DELT fish (fish with deformities, eroded fins, lesions, or tumors) sometimes common.
No score	Very Poor	Thorough sampling finds few or no fish; impossible to calculate IBI.

Figure 3. Hilsenhoff Biotic Index (HBI) ratings for sites in the Plum Creek Watershed

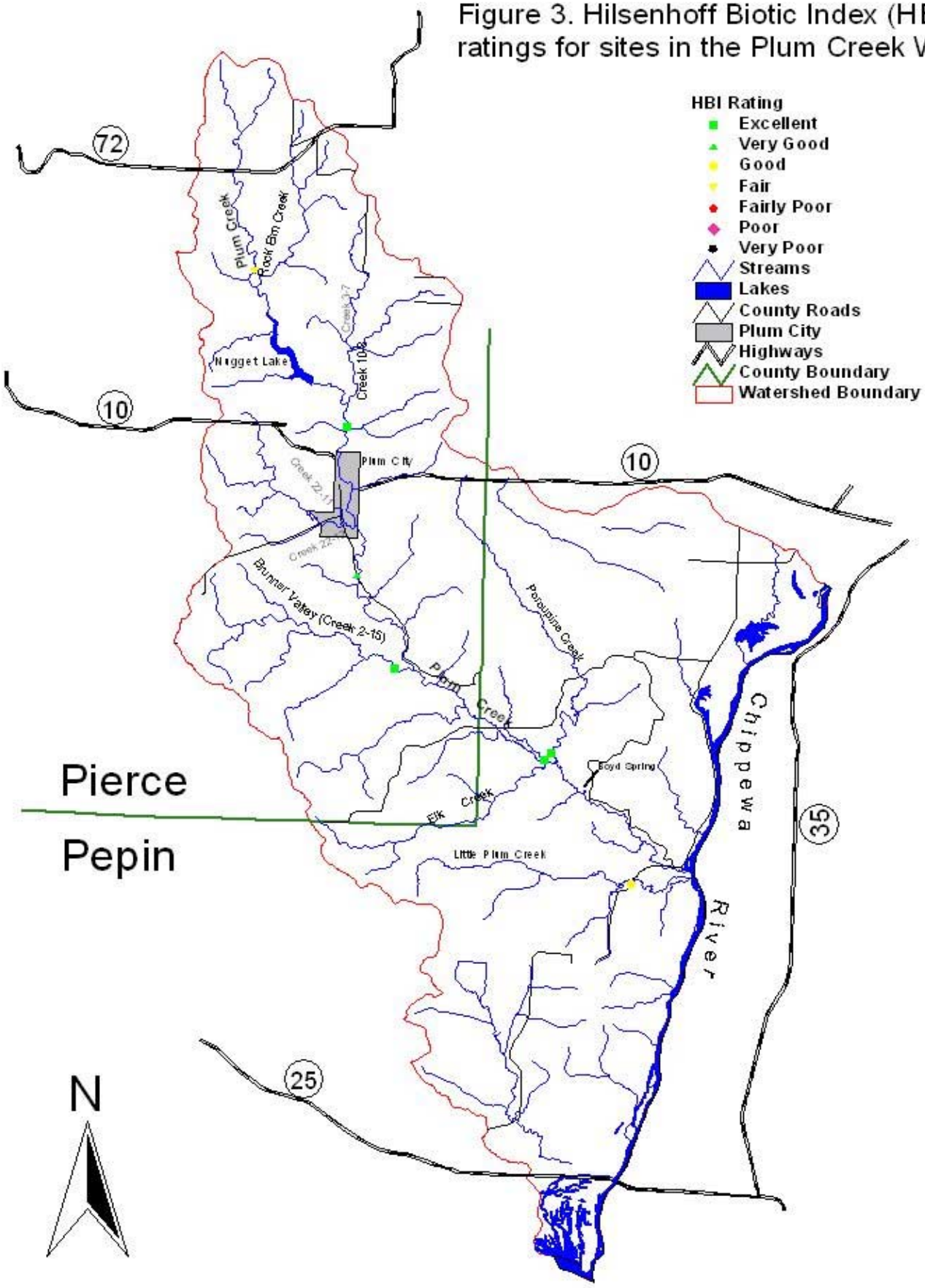


Table 4. Summary of Hilsenhoff Biotic Index (HBI) scores at sites in the Plum +Creek Watershed and Tributaries from April and October 1999.

River or Stream	Location	Closest Station(s)	HBI Score	HBI Rating
Plum Creek	CTH U*	7	3.935	Very Good
Plum Creek	CTH HH	13	5.868	Fair
Plum Creek	Elk Creek Rd.*	4	2.500	Excellent
Plum Creek	330th. Ave.	10	3.212	Excellent
Porcupine Creek	Beaverslide Rd.	1	2.263	Excellent
Little Plum Creek	Byington Rd.	2	3.263	Good
Brunner Valley	CTH U	1	2.966	Excellent

* Represents 1998 Data

Table 5. Guidelines for interpreting Hilsenhoff Biotic Index (HBI) values (Hilsenhoff, 1987).

Biotic Index score	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 (putrid!)

Figure 4. Trout densities for sites in the Plum Creek Watershed

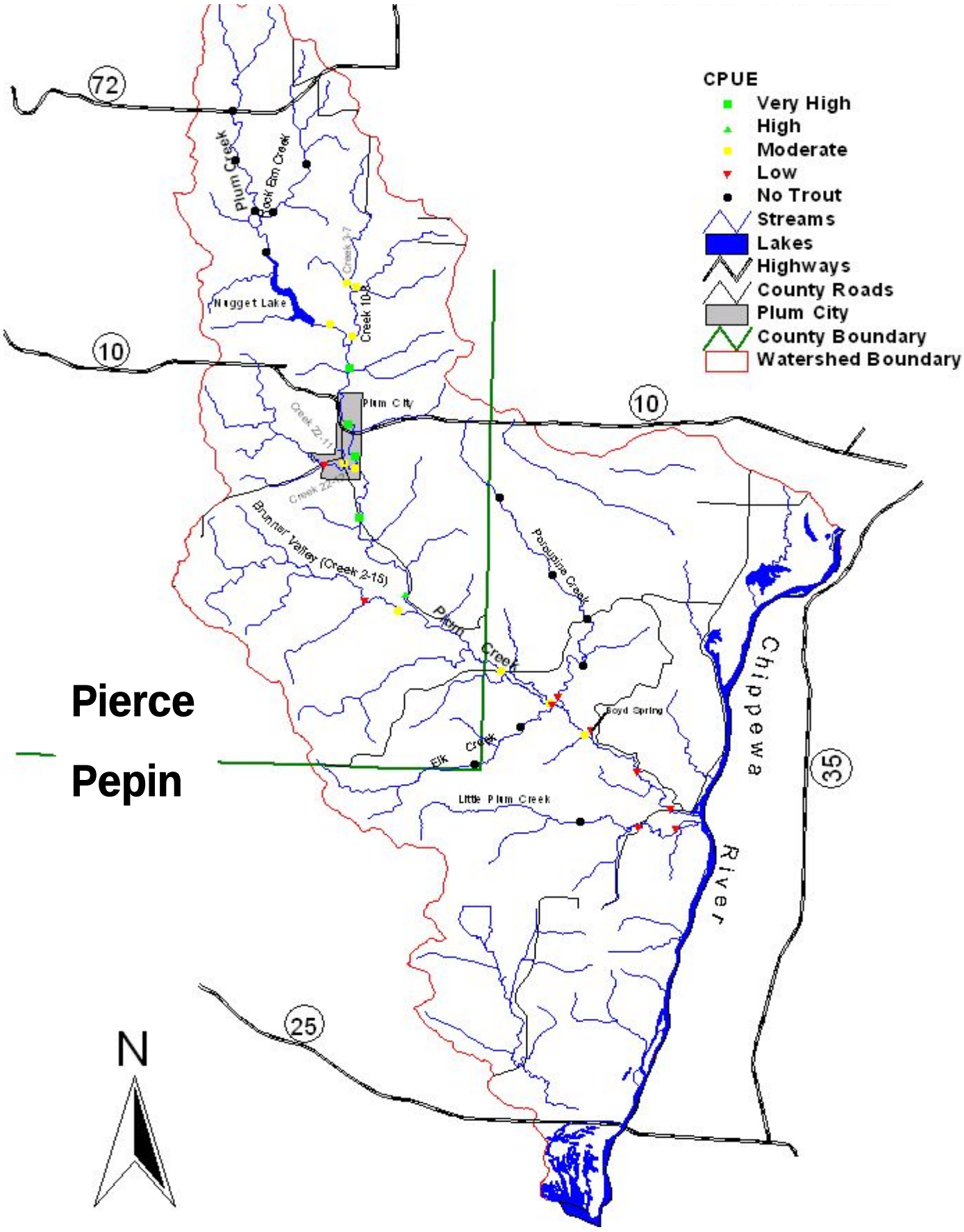


Table 6. General guidelines for interpreting trout abundance values during July and August in Dunn, St. Croix, Pierce and Pepin County streams, Wisconsin.

Abundance Level	C.P.U.E* No. / Mile (all sizes)	Pop. Est.** No. / Mile (>= 4.0 in.)	Pounds** Per Acre (>=4.0 in.)
Low	< 250	< 500	< 35
Moderate	250-1000	500 – 1500	40 – 90
High	> 1500	1500 – 3500	100 – 175
Very High	> 2500	> 3500	> 175

*C. P.U.E. – Catch per Unit Effort includes all trout captured including young of the year with one pass made with standard electrofishing gear.

**Population estimates and pounds per acre obtained form the estimate include age 1 trout or trout approximately 4 inches and larger.

from this region of the state. The vast majority of streams in the watershed have trout abundance levels in the low (33%) to moderate (28%) range. Five sites (14%) had trout densities in the high to very high range. Approximately 33% of the 36 sites sampled had no trout present. Poor thermal regimes and only "Fair" habitat are the primary reasons this watershed is not producing as many trout as it could. Good habitat and ideal water temperatures for approximately 12 miles downstream from Nugget Lake support excellent populations of native brook and naturalized brown trout. In addition, several small tributaries originating in protected coulees support native brook trout populations.

Habitat Ratings

Habitat ratings provide a measure of habitat quality and/or quantity available for fish to utilize within that segment of stream. The habitat ratings for the watershed are shown in **Figure 5**. **Tables 7 and 8** are guidelines for interpreting habitat ratings. The watershed is dominated by "Fair"(51%) to "Poor"(11%) habitat ratings, suggesting that habitat quality and/or quantity are a limiting factor. In the watershed, habitat is most generally effected by poor substrate, poor bank stabilization, non-diverse stream morphology, and lack of cover. On the other hand 35% of the habitat rated "Good" and 3%, Excellent". This good habitat is reflected in the sport fishery.

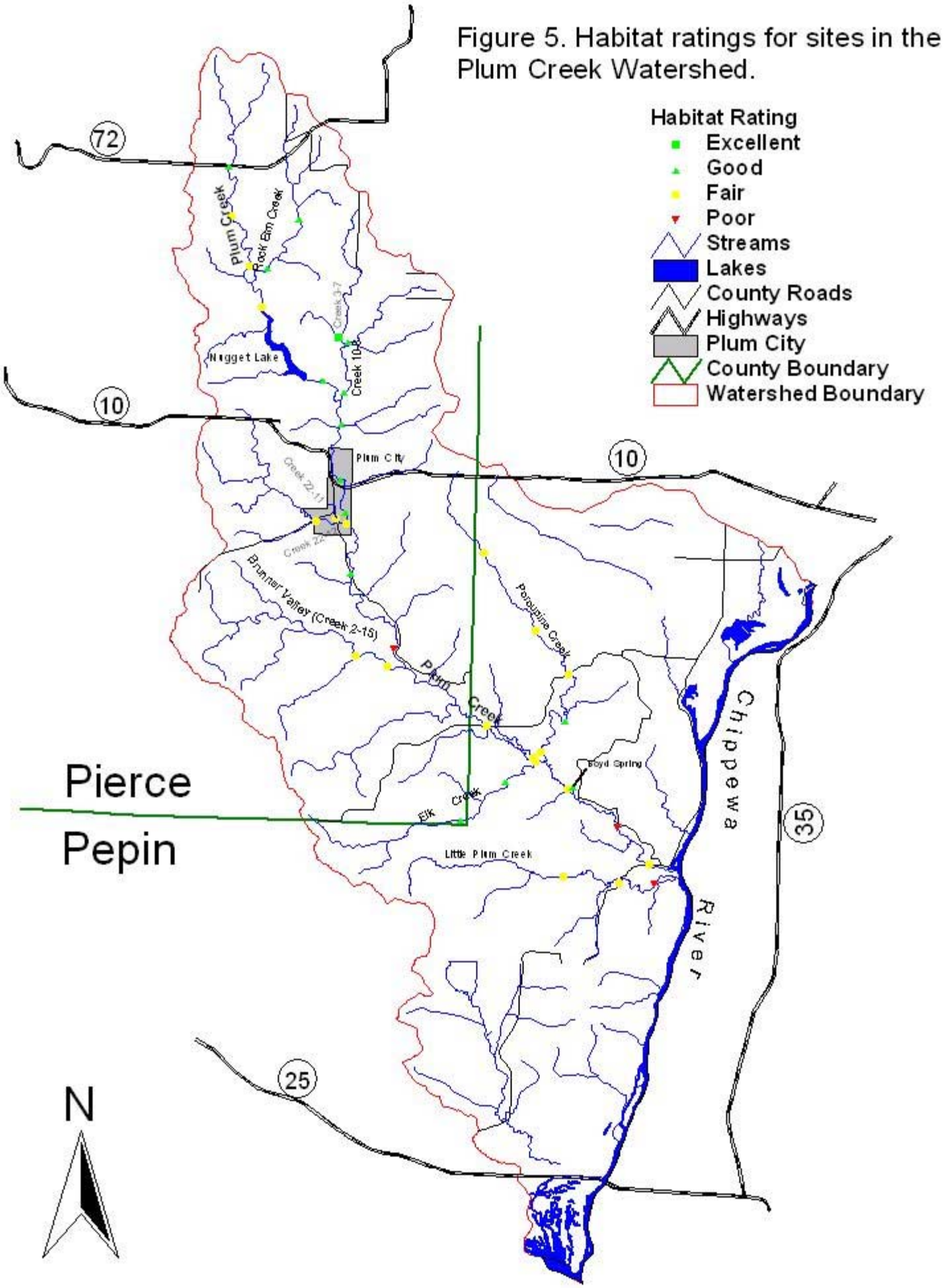


Figure 5. Habitat ratings for sites in the Plum Creek Watershed.
Habitat Rating
Excellent
Good
Fair
Poor
Streams
Lakes
County Roads
Highways
Plum City
County Boundary
Watershed Boundary
72
10
10
35
25
Plum Creek
Rock Elm Creek
Creek 3-7
Creek 10-8
Nugget Lake
Plum City
Creek 22-17
Creek 22-15
Brunner Valley (Creek 2-15)
Porcupine Creek
Plum Creek
Boyd Spring
Elk Creek
Little Plum Creek
Chippewa River
Pierce
Pepin
N

Table 7. Guidelines for interpreting fish habitat ratings for small streams < 10 m wide (compiled from Simonson, Lyons, and Kanehl, 1994).

Habitat score	Qualitative Rating	Dominant characteristics of physical habitat for each scoring category.
>= 75	Excellent	Riparian zone well protected; no significant bank erosion; pools common, wide, deep, slow velocity habitat, balanced by other habitats; stream very deep and narrow; diverse habitats, meandering stream with deep bends and riffles common; fine sediments are rare or absent; cover/shelter for fish abundant.
50 - 74	Good	Riparian zone protected, but buffer width moderate; limited bank erosion; pools present, not frequent or overabundant; stream relatively deep and narrow; diverse habitats, bends and riffles present, but not abundant; fines present but limited, generally in stream margins or pools; cover common, but not extensive
25 - 49	Fair	Riparian zone moderately disturbed, buffer narrow; moderate bank erosion; pools present, but either rare or overly dominant, few other habitats present; stream moderately deep and narrow; habitat diversity low, occasional riffles or bends; fines common in mid-channel areas, present in riffles and extensive in pools; occasional cover, limited to one or two areas.
< 25	Poor	Most of the riparian zone disturbed, buffer very narrow or absent; Extensive bank erosion; pools either absent or dominant, not balanced by other habitats; stream relatively wide and shallow; habitat monotonous, riffles or bends rare, generally continuous run habitat; fines extensive in all habitats; cover rare or absent.

Table 8. Guidelines for interpreting fish habitat ratings for large streams > 10 m wide (compiled from Simonson, Lyons, and Kanehl, 1994).

Habitat score	Qualitative Rating	Dominant characteristics of physical habitat for each scoring category.
> 80	Excellent	No significant bank erosion; stream very deep; diverse habitats, meandering stream with deep bends and riffles common; extensive rocky substrate; cover/shelter for fish abundant.
60 - 80	Good	Limited bank erosion; stream relatively deep; diverse habitats, bends and riffles present, but not abundant; moderate rocky substrate; cover common, but not extensive.
20 - 60	Fair	Moderate bank erosion; stream moderately deep; habitat diversity low, occasional riffles or bends; limited rocky substrate; occasional cover, limited to one or two areas.
< 20	Poor	Extensive bank erosion; stream relatively shallow; habitat monotonous, riffles or bends rare, generally continuous run habitat; rocky substrate uncommon; cover rare or absent.

Stream Temperatures

Temperature was examined a couple of different ways during this survey. Results of continuous temperature monitoring throughout the summer at seven sites are presented in **Table 1**. Maximum/minimum temperatures taken at the time of the each stream's fish survey are presented in **Appendix A**. **Table 9** shows what the limiting and optimal temperatures are for brook and brown trout. Examining the data will show that many of the streams in the watershed have temperatures above or barely optimal for brook trout growth and survival. Many of these streams maximum temperatures approach lethal limits for brook trout. Plum Creek upstream from Nugget Lake has temperatures that exceed lethal limits for both brook and brown trout. Porcupine Creek also exceeds lethal limits for brook trout. Several small tributaries have temperatures suitable for brook trout reproduction. Both brook and brown trout natural reproduction occurs in the main stem of Plum Creek from the confluence of Creek 10-8 downstream to Brunner Valley.

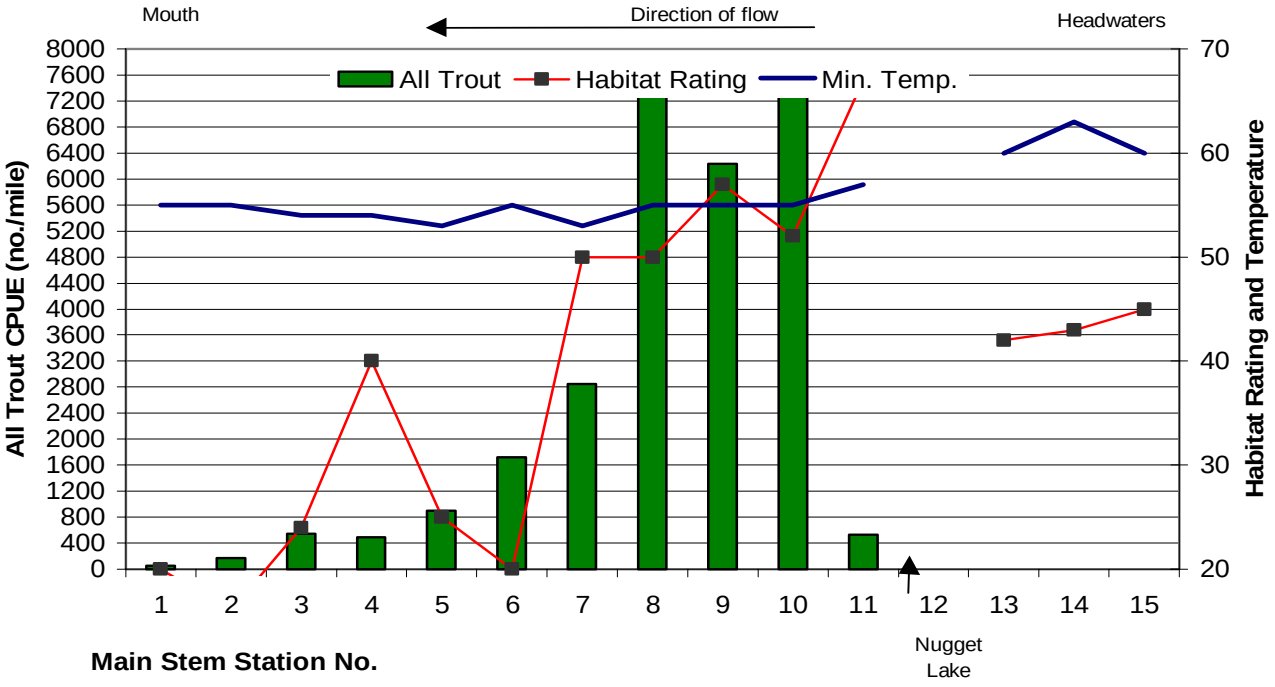
Table 9. Upper limiting (near lethal) and optimal temperatures for adult brook and brown trout (Raleigh 1982, 1986).

Brown Trout	**Temperature Range**
Upper limiting (near lethal) temperature	81 degrees F. (27.2 C.)
Optimal for growth and survival	53.6 - 66.2 degrees F. (12-19 C.)
Brook Trout	
Upper limiting (near lethal) temperature	74.8 degrees F. (23.8 C.)
Optimal for growth and survival	51.8 - 60.8 degrees F. (11 - 16 C.)

Habitat and temperature are both limiting factors of trout abundance . When examining the main stem of Plum Creek it should be noted that there are three distinct sections; the upper, middle and lower sections. **Figure 6** is a plot of CPUE, habitat rating, and minimum water temperature at each station on the main stem. The upper reaches above Nugget Lake (stations 12-15) generally have "Fair" habitat ratings and "Poor" coldwater IBI scores. Summer mean water temperatures are approaching what is considered a coolwater system (22-24^0 C or 70 75^0 F), (Lyons et al, 1996). The middle reaches (stations

5-11) generally

Figure 6. Trout Catch per Unit Effort (no./mile), fish habitat ratings and minimum water temperatures for the main stem of Plum Creek during the summer of 1999 Station locations are identified in Figure 2.



have "Good" habitat scores and lower mean summer water temperatures due to the influx of coldwater springs and tributaries. This results in strong natural trout reproduction and higher adult populations. Summer water temperatures in the lower reaches of Plum Creek (stations 1-4) change little when compared to the middle reaches, however habitat scores decline to"Fair". Heavy sand bedloads fill pools and cover spawning substrate limiting reproduction and adult populations.

Trout Stocking

Table 10 summarizes recent trout stocking efforts within the watershed. Plum Creek watershed has improved to the point where trout stocking is no longer needed to support fishable populations throughout most of the stream. Supplemental stocking of brook trout fingerlings will be initiated on a trial basis in Pepin County waters. Additional trout stocking may be necessary if drought conditions negatively impact water temperature and base flow.

Table 10. Summary of trout stocking in the Plum Creek watershed

Stream or River	Approximate Location	Miles Stocked	Historic Numbers	Historic ~ Years	Current	Future
Plum Creek	Middle reaches					
	CTH U to Nugget Lake	5.2	1,500 (F) Browns	99	1,500 (F) Browns	Discontinue Stocking
		5.2	1,200 (F) Browns	94-98		
		5.2	1000 (F) Browns	93		
		5.2	500 (F) Brown	91		
		5.2	2,200 (F) Brown	90		
		5.2	1,200 (F) Browns	86-89		
		5.2	1,200 (F) Browns	84		
		5.2	3,200 (F) Brown	83		
		5.2	1,200 (F) Browns	77-82		
		5.2	1,200 (F) Browns	75		

F – Fall fingerlings

Angler Use

The results from an angler-use survey are summarized in **Table 1**. The Plum Creek Watershed as a whole receives moderate pressure from anglers. In general, angler accessibility within the watershed is not an issue at this time. However, increased angler interest in this recovering coldwater resource in combination with its potential to provide quality-fishing opportunities, warrant a Department acquisition and instream habitat improvement program.

Trout Stream Classifications

Based on updated information gathered on fish communities, habitat, and temperatures, stream classifications were re-evaluated. **Table 11 and 12** summarize current and proposed stream classifications for the entire watershed. **Figures 7 and 8** are maps of current and proposed stream classifications. Currently, most streams in the watershed are listed as unknown or warmwater forage streams (Koperski et.al, 1996). However, based on new information from this survey, it is recommended that 23.4 miles be upgraded to classified trout water. Several streams including Plum Creek above Nugget Lake, Rock Elm, Porcupine and Elk Creek subwatersheds are recommended to remain classified as warmwater forage fish streams. It should also be noted that many streams in the watershed have the potential to be upgraded in classification. Given the proposed classification changes, the Plum Creek

watershed will increase from 5.5

Table 11. Detailed explanation of current stream classifications for the Plum Creek watershed.

STREAM NAME	PORTION TROUT WATERS	BROOK	BROWN	RAINBOW	CLASS I PORTION	MI	CLASS II PORTION	MI	CLASS III PORTION	MI	Public Lands
Pierce County											
Creek 34-3	All	n						0.3			
Plum Creek	CTH U to Nugget Lake	n	x				CTH U in S34, T25N, R15W upstream to Nugget Lake	5.2			
Totals (5.5)					Class I	0.0	Class II	5.5	Class III	0.0	

n - natural

s – stocked

Table 12. Detailed explanation of proposed stream classifications for the Plum Creek watershed, 1999.

STREAM NAME	PORTION TROUT WATERS	BROOK	BROWN	RAINBOW	CLASS I PORTION	MI	CLASS II a PORTION	MI	CLASS II b PORTION	MI	CLASS III PORTION	MI	Public Lands
PEPIN COUNTY													
Boyd Spring	All	n								0.1			
Little Plum	Upstream to CTH N	n								4.6			
Plum Creek	Upstream to Pierce Cty Line	n	n		CTH SS Upstream to Pierce Cty Line	0.4				8.0			
Totals (13.1)						**0.4**				**12.7**			
Pierce County													
Plum Creek	Pepin County Line Upstream to Nugget Lake	n	n			11.7							
Creek 2-15 (Brunner Valley)	All	n						2.0					
Creek 10-8	All	n								2.0			
Creek 3-7	All	n								0.1			
Creek 34-3	All	n								0.3			
Totals (16.1)					**Class I**	**11.7**	**Class II a**	**2.0**	**Class II b**	**2.4**	**Class III**	**0.0**	

n - natural

s – stocked

Figure 7

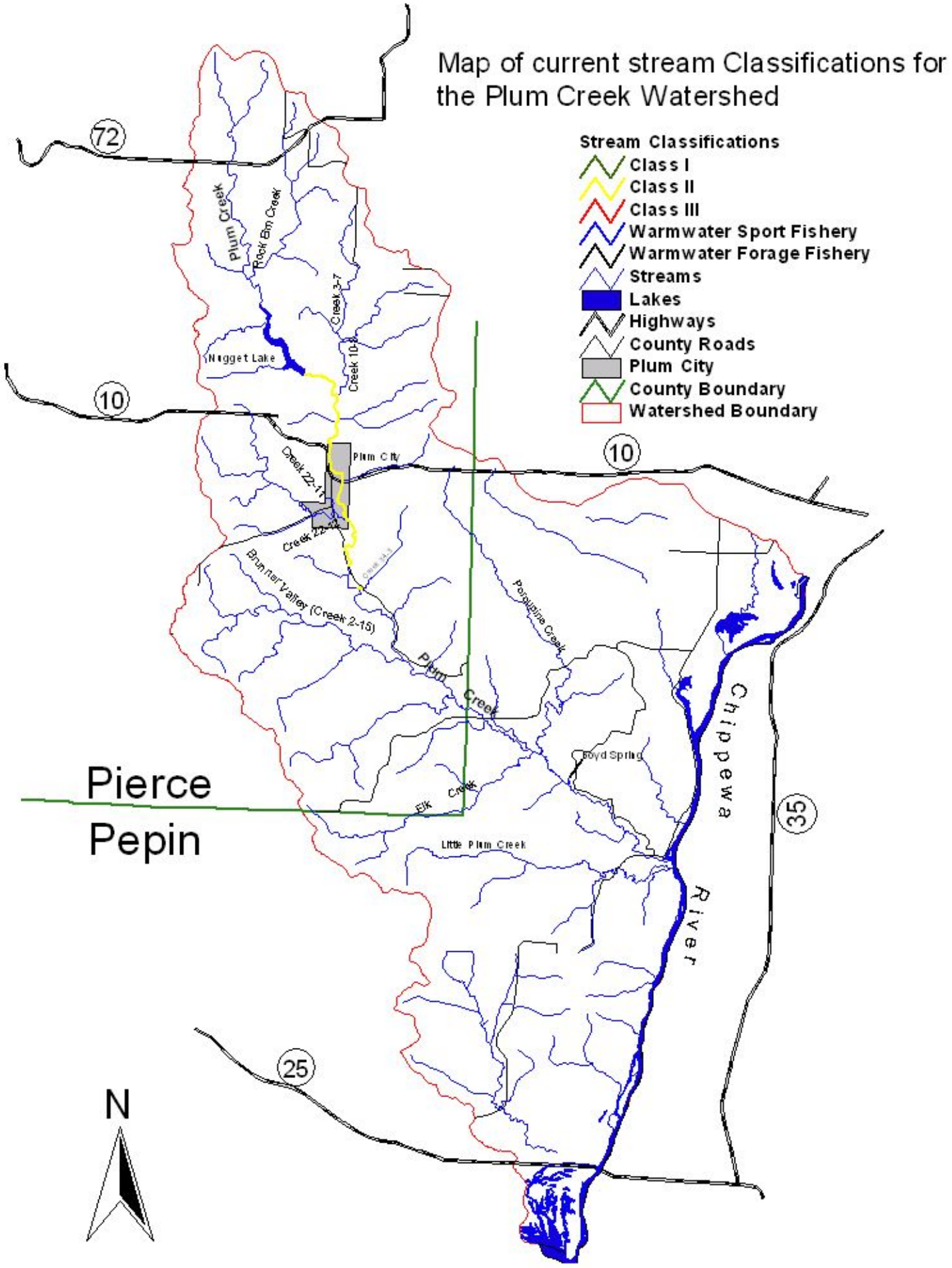
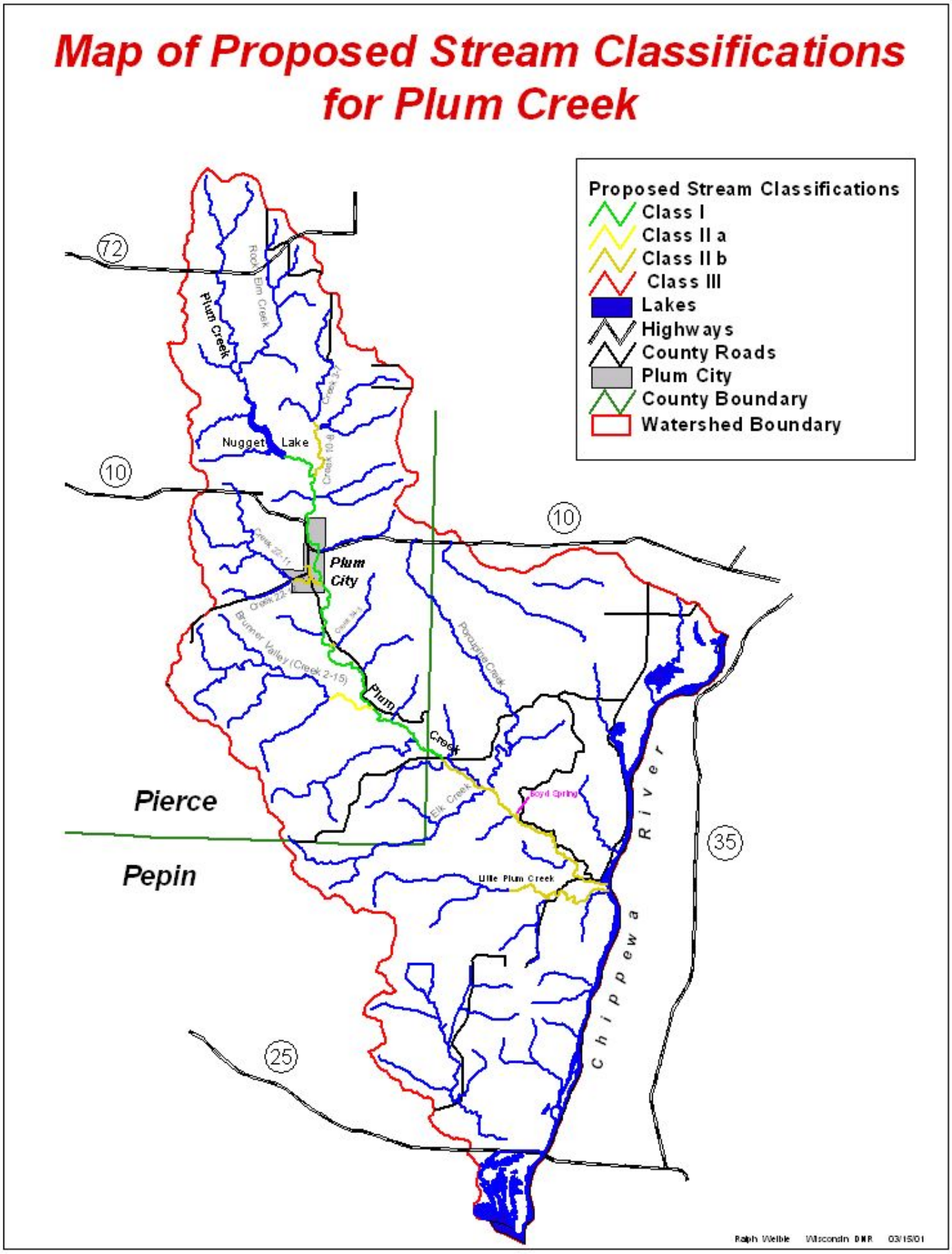

Map of current stream Classifications for the Plum Creek Watershed
Stream Classifications
Class I
Class II
Class III
Warmwater Sport Fishery
Warmwater Forage Fishery
Streams
Lakes
Highways
County Roads
Plum City
County Boundary
Watershed Boundary
72
10
10
35
25
Plum Creek
Rock Elm Creek
Creek 3-7
Creek 10-8
Nugget Lake
Plum City
Creek 22-17
Creek 22-18
Brunter Valley (Creek 2-15)
Porcupine Creek
Plum Creek
Boyd Spring
Elk Creek
Little Plum Creek
Chippewa River
Pierce
Pepin
N

Figure 8


Map of Proposed Stream Classifications for Plum Creek
Proposed Stream Classifications
Class I
Class II a
Class II b
Class III
Lakes
Highways
County Roads
Plum City
County Boundary
Watershed Boundary
72
10
10
25
35
Nugget Lake
Plum City
Plum Creek
Rock Elm Creek
Brunner Valley (Creek 2-15)
Porcupine Creek
Elk Creek
Boyd Spring
Little Plum Creek
Chippewa River
Pierce
Pepin
Ralph Wehle Wisconsin DNR 03/15/01

miles of classified trout water to 23.4 miles. "The State of the Lower Chippewa Basin" report (DNR, 2001) Plum Creek Watershed tables contain detailed explanations, including exact location proposed stream classifications.

Watershed Problems

Problems found associated with each stream that affects the potential for improved classification, are listed in "The State of the Lower Chippewa Basin, Plum Creek watershed tables. These tables also list the impacts that these problems have on each stream. As mentioned in the introduction, the most widespread problems in the watershed include cropland erosion, streambank pasturing, flooding, and streambank erosion. The impacts observed on almost every stream are loss or degradation of habitat, sedimentation, and elevated stream temperatures.

Proposed Monitoring and Watershed Improvement Practices

One important step in managing these problems is compiling historical information. Knowing if a stream has been improving or declining over the past twenty years can go a long way in showing how severely impacted the stream is and what kind of priority should be given to improving that stream. The most logical way of obtaining historical information in the future is through a long-term comprehensive monitoring program. We recommend that approximately 12 representative sites be selected throughout the watershed would to be sampled once every three to five years.

The State of the Lower Chippewa Basin, Plum Creek Watershed tables also list the suggested watershed improvements (Management Category), the need for those improvements and the priority or rank given to those improvements. In many cases, streams with a need for significant improvement may not have the highest priority. Those portions of stream that have the best potential to improve quickly were ranked highest.

Trout Fishing Regulations

The current trout regulation categories for streams in the watershed vary from Category 3 (9 " size limit, bag limit of 3) to Category 4 (size limit browns 12" & brooks 8", bag limit 3) and are not always easy for

fishermen to decipher. This is primarily because the watershed is located throughout two different counties and many streams are not shown in the Wisconsin Trout Fishing Regulations and Guide (WDNR, 1997). Category 4 regulations are being proposed for all streams within the watershed, except for the main stem of Plum Creek in Pepin County where special regulations (12" size limit, bag limit of 2) are recommended on a trial basis. These categories were selected to protect brook and brown trout fisheries from over harvest, to provide quality brook trout angling in Pepin County and to simplify regulations for fishermen.

Subwatershed Descriptions

The following is a discussion of comprehensive survey results for the Plum Creek Watershed. The descriptions are arranged into three subwatersheds (Upper, Middle and Lower) and provide a summary of each named, perennial waterbody including a discussion of water resource, conditions, problems affecting the resource and recommended management goals.

Upper Plum Creek Watershed

Upper Plum Creek watershed includes all surface waters that drain into Nugget Lake. The drainage includes approximately 7 miles of Plum Creek and 4 miles of Rock Elm Creek and their associated intermittent streams. The watershed in this location primarily consists of intermixed woodland and farms with heavy row cropping. The headwaters of Rock Elm Creek drain through the unincorporated village of Rock Elm.

This subwatershed is characterized as being flashy during runoff events and having a low base flow between events. Along with the entire Rock Elm subwatershed, upper Plum Creek is characterized as a cool or warmwater forage fish stream heavily impacted by an agricultural watershed. Fish habitat ratings were generally "Fair" in Plum Creek and "Good" Rock Elm. Coldwater IBI scores were "Poor" in both streams. These systems which are dominated by poor water quality had a "Fair" HBI rank which indicates there is "fairly significant organic pollution". Nugget Lake reservoir is impacted by excessive sediment and nutrient loading from upland and streambank erosion. Water quality, temperature and fish and aquatic life habitat would improve with dry run and gully flood control measures that increase infiltration rates. Agricultural BMPs such as bank stabilization, nutrient management and upland

sediment delivery reduction would improve habitat and water quality condition. The longevity of Nugget Lake would also benefit from

sediment reduction.

The water resource goal for Upper Plum Creek Watershed is to: 1) improve stream water quality and coolwater fish habitat by installing BMPs to reduce flooding, and stream sedimentation and 2) improve water quality and extend reservoir life by reducing sediment and nutrient delivery to Nugget Lake reservoir.

MiddlePlum Creek SubWatershed

Middle Plum Creek Watershed includes the main stem of Plum Creek and all its tributary streams from Nugget Lake dam downstream 12.1 miles to CTH SS in Pepin County. The drainage includes unnamed tributaries Cr. 10-8, Cr. 3-7,Cr. 22-12 (Rush Coulee),Cr. 22-11 and Cr. 2-15 (Brunner Valley),10-8 and 3-7.

Creeks 10-8 and 3-7 are small coulee tributaries that drain into Plum Creek approximately one mile downstream from Nugget Lake dam. These coldwater streams drain forested coulees and upland agricultural areas. Both streams contain "Moderate" densities of self sustaining brook trout, however adult fish habitat is lacking throughout the stream. Fish habitat scores were "Good" or better and coldwater IBI scores ranged from "Fair to "Excellent", with the "Fair" rank found at the most downstream site. No historic records are available for these streams, however current recommendations include listing these streams as Class II trout water. These streams do suffer from periodic flooding, bank erosion over grazing and barnyard impacts and would benefit from streambank and agricultural BMPs

The water resource goals for Creeks 10-8 and 3-7 subwatersheds is to improve and protect coldwater fish communities through flood control, reduction of sediment from grazing, bank and upland crop erosion and the installation of BMPs for barnyards.

The main stem of Plum Creek in the middle subwatershed passes through a relatively broad valley floor in a major coulee system. Land use in the valley floor consists of agricultural row cropping and grazing. The village of Plum City also occupies a portion of the valley floor and discharges its wastewater effluent

to the stream. The middle segment of Plum Creek begins at the outfall of Nugget Lake where water quality and water temperatures are not well suited for coldwater fish communities. However, bottom discharge

of the base flow from Nugget Lake dam begins the process of lowering summer water temperatures several degrees. Within one mile of the dam, the main stem of Plum Creek improves dramatically. Within this region groundwater input increases and a coldwater tributary (Creek 10-8) in conjunction with upstream flood control convert Plum Creek into a coldwater system. This coldwater status is preserved for approximately 12 miles by additional groundwater, spring and coldwater imputs around Plum City and Brunner Valley. The main stem of Plum Creek has "Good" habitat and coldwater IBI ratings throughout this section, except for station 11 below Nugget Lake dam where the IBI rating was "Fair". Organic pollution, measured by the HBI is slight to unapparent.

Water temperatures are suitable for both brook and brown trout reproduction and the stream currently has a self-sustaining trout population. Plum Creek approaches the upper limit of temperatures that are optimal for growth and survival of brook trout. However, this is probably overcome due to the streams steep gradients and groundwater interactions keeping the intra-gravel areas closer to the proper temperature for reproductive success.

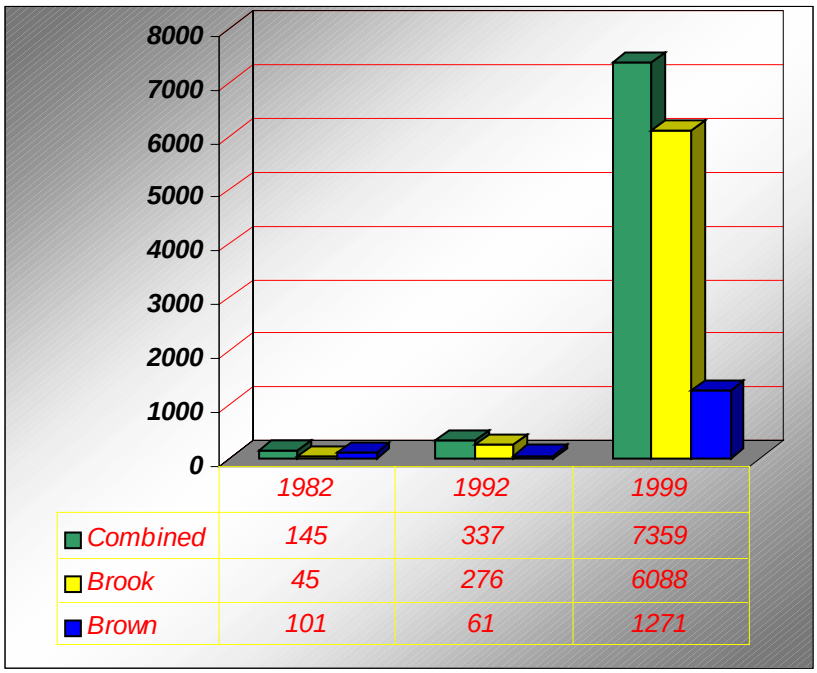
Currently, Plum Creek is listed as Class II trout water for 5.2 miles. Today, trout densities (CPUE) are "Moderate" just below Nugget Lake dam but quickly increase to "Very High" levels throughout this stretch **(Figure 6).** Adult population estimates and growth rates are excellent and with added instream habitat improvement this segment of stream can become premiere trout water. Such good trout populations have not always been the case. Within the past ten years there has been a major resurgence in brook and brown trout populations. **Figure 9** shows a 17-year trend in trout populations at station 8. This resurgence is typical throughout Plum Creek in this subwatershed area. Currently, Plum Creek is annually stocked in this area with approximately 1,200 fall fingerling brown trout. Such stocking is no longer needed at this time and has been discontinued.

Plum Creek is not protected nor devoid of problems, including; stream bank pasturing, bank erosion, barnyards, cropland erosion, flooding and urban impacts. The priority for addressing Plum Creek's problems should be very high. This segment of stream has tremendous resource potential as a coldwater sport fishery that should be enhanced and protected with the utmost level of urgency. Acquisition and

instream habitat improvement are highly recommended on Plum Creek from Nugget Lake County Park downstream to CTH SS. This section of Plum Creek should also be classified as Class I trout water.

Plum Creek would also benefit from stream bank stabilization, fencing, upland land use improvements, flood control, instream habitat improvements, and urban and agricultural Best Management Practices (BMP's). Water quality would improve and trout populations protected by improvements in operation of the Plum City wastewater processing plant. Bottom discharge of the steams base flow should continue.

Figure 9. Trends in trout abundance in Plum Creek (Station 8) over the past 17 years.
(Catch per Unit Effort – Trout No./Mile)



The water resource goal for the Middle Plum Creek main stem is to improve, protect and enhance the water quality, fish habitat, coldwater and sport fish communities and water temperature regime through acquisition and instream habitat improvement, sediment reduction from excessive grazing, bank and upland erosion, pollution reduction from the sewage treatment plant and the installation of BMPs for barnyards.

Creeks 22-12 (Rush Coulee) and 22-11 are small coulee tributaries that drain into Plum Creek in the Village of Plum City. Creek 22-12 drains urban residential areas, forested coulees and both floodplain and upland agricultural areas. Creek 22-11 originates in a spring pond in the village of Plum City and flows

a short distance through a residential area before entering Creek 22-12. Both streams contain "Moderate" densities of self sustaining brook trout, however adult fish habitat is lacking through the stream. Fish habitat scores were "Fair" and coldwater IBI scores ranged from "Good" to "Excellent". No historic records are available for these streams, however current recommendations include listing these streams as Class II trout water. Creek 22-12 does suffer from periodic flooding, isolated ditching, bank cropland erosion and would benefit from flood control, streambank and agricultural BMPs. Creek 22-11 is heavily impacted by barriers, channelization and urban impacts. The headwater spring pond is managed as a trout pond by the village. Habitat restoration and vegetative buffer strips along the stream channel would benefit wild trout resources, however such activities would be very difficult to implement in the confined urban setting. In addition, intermixing wild and domestic stocks are not recommended and therefore upstream and downstream barriers should remain in place.

The water resource goals for Creeks 22-12 and 22-11 subwatersheds is to improve and protect coldwater fish communities through flood control, reduction of sediment from grazing, bank and upland crop erosion and the infiltration of stormwater and reduction of residential mowing through the installation urban BMPs.

Creek 2-15 (Brunner Valley) is a small coulee stream that drains into Plum Creek approximately three miles southeast of Plum City. This coldwater stream drains forested coulees and upland agricultural areas. It contains "Moderate" densities of self sustaining brook trout, however adult fish habitat is lacking throughout the stream. Fish habitat scores were "Fair" and coldwater IBI scores ranged from "Good" to "Excellent". No historic records are available for this stream, however current recommendations include listing the stream as Class II trout water. This stream does suffer from periodic flooding, bank and cropland erosion, over grazing and barnyard impacts and would benefit from streambank and agricultural BMPs.

The water resource goals for Creek 2-15 subwatershed is to improve and protect coldwater fish communities through flood control, reduction of sediment from grazing, bank and upland crop erosion

and the installation of BMPs for barnyards.

Lower Plum Creek Subwatershed

Lower Plum Creek watershed includes the main stem of Plum Creek and all its tributary streams from CTHSS in Pepin County downstream to the Chippewa River. It includes four named tributaries, Elk, Porcupine and Little Plum creeks and Boyd Spring.

The main stem of Plum Creek in the lower subwatershed passes through a broad valley floor in a major coulee system. Land use in the valley floor consists of agricultural row cropping and light grazing. Woodlands are common along the stream and valley. The stream is characterized as a cold, relatively wide meandering stream that transports a heavy sand load and lacks pools and riffles.

The lower segment of Plum Creek covers an area from CTH SS to the Chippewa River. The main stem of Plum Creek generally has "Fair" habitat and coldwater IBI ratings throughout this section. A few warmwater gamefish and increasing numbers of warmwater minnows can be found toward the mouth. Organic pollution, measured by the HBI, was not apparent.

Water temperatures were coldest in the upstream end of this section, but warm slightly toward the mouth. Water temperatures appear suitable for both brook and brown trout reproduction, however trout densities are only "Moderate" to "Low". Plum Creek approaches the upper limit of water temperatures for optimal growth and survival of brook trout, but habitat appears to be a limiting factor for reproductive success and adult survival. Plum Creek in this subwatershed is plagued by fine sediment, mainly deep shifting sand which has filled pools and covered spawning substrate.

Currently, this segment of Plum Creek is not listed as trout water. Today, trout densities are high enough to warrant a Class II designation. The potential for improvement in this section of Plum Creek will remain limited by the sand bedload. As sediment contributions are reduced and the stream stabilizes trout densities will increase along with habitat gains. Acquisition and instream habitat improvement are recommended, however only after habitat improvement has been addressed in the middle Plum Creek

subwatershed. The lower Plum Creek subwatershed would also benefit from sediment reduction efforts throughout the middle and lower sections of the watershed. Furthermore the stream would benefit from stream bank stabilization, fencing, upland land use improvements and flood control.

The water resource goal for the Lower Plum Creek main stem is to improve, protect and enhance the water quality, fish habitat, coldwater fish communities and cold water temperature regime. This can be accomplished by, continued sediment reduction efforts throughout the watershed and from bank and upland erosion control and the installation of agricultural BMPs. As upstream conditions improve, acquisition and habitat improvement should be considered.

Elk Creek and Porcupine Creeks are small coulee tributary streams that drain into Plum Creek approximately 5.5 miles upstream from the mouth. Both coulees are partially forested with light agricultural activities on the valley floor and intensive agricultural uplands. Both streams contain few trout, all of which were found near their mouths. Fish habitat scores were generally "Good" in Elk Creek and "Fair" in Porcupine Creek. Coldwater IBI scores were generally "Very Poor" in Porcupine Creek and "Fair" at best in Elk Creek. Summer mean water temperatures show Porcupine Creek is currently a coolwater system (22-24^0 C or 70-75^0 F), (Lyons et al, 1996). Continuous temperature monitoring did not occur on Elk Creek, however maximum/minimum water temperatures for both streams were similar **(Table 1)**. No known historic records are available for these streams, however it is our professional opinion that prior to settlement these streams were coldwater systems and have the potential to be upgraded to classified trout water in the future. Current recommendations include retaining a warmwater forage fish designation, however additional thermal monitoring should occur to document any potential for coldwater recovery efforts. These streams do suffer from periodic flooding, over grazing, bank and cropland erosion and barnyard impacts. These streams would benefit from streambank and upland agricultural BMPs

The water resource goals for Elk and Porcupine Creek subwatersheds is to improve water quality, habitat and thermal regimes to the point where coldwater fish communities can be restored. This can be accomplished by improving infiltration of runoff water, flood control, reduction of sediment from grazing, bank and upland crop erosion and the installation of BMPs for barnyards.

Little Plum Creek is a small, high gradient coulee stream that drains directly into the Chippewa River just

downstream from the mouth of Plum Creek. This coldwater stream drains a small floodplain forest, an agricultural plain and many small wooded coulees. Little Plum Creek contains "Low" densities of self-sustaining brook trout within four miles of its mouth. Adult fish habitat is lacking throughout the stream. Fish habitat scores were "Fair" at best, however coldwater IBI scores ranged from "Good" near the mouth to "Fair" at the most upstream site. Mean summer maximum water temperatures exceed what is optimal

for brook trout growth and survival and approach what is considered lethal.

No historic records are available for this stream, however current recommendations include listing this stream as Class II trout water. Currently, Little Plum Creek suffers from periodic flooding, heavy sedimentation of the stream channel, severe bank erosion, over grazing cropland erosion and barnyard impacts. This stream would benefit from flood control, streambank and agricultural BMPs

The water resource goals for Little Plum Creek subwatershed is to improve and protect coldwater fish communities through flood control, reduction of sediment from grazing, bank and upland crop erosion and the installation of BMPs for barnyards.

Boyd Spring is a very small stream (0.1 miles) that flows from the base of a bluff. It drains into Plum Creek approximately four miles upstream from the mouth. This coldwater stream drains through a pastured valley floor, is very silty and contains an abundant bed of watercress. The brook trout population is very "Low" and both spawning habitat and adult fish habitat is lacking throughout the stream. Fish habitat scores were "Poor" and coldwater IBI scores were "Good". No historic records are available for this spring, however current recommendations include listing the spring as Class II trout water. This stream suffers from heavy siltation and over grazing and would benefit from fee title acquisition or streambank fencing.

The water resource goals for Boyd Spring are to improve and protect coldwater fish communities through acquisition and or stream bank fencing.

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Appendices not available in electronic form.