

DATE: November 26, 2002

FILE REF: 3200

TO: Bob Masnado - WT/2
Water Quality Standards & Policy Section Chief

FROM: Rob McLennan - Oshkosh *R. McL*
Upper Fox River Basin Team Leader

DEC - 3 2002

SUBJECT: Stream Classification for Westfield Creek

This memo is to formally request revisions to Chapters NR 102 and/or 104, Wisconsin Administrative Code, relative to the classification of Westfield Creek, to which the Village of Westfield Wastewater Treatment Facility discharges in Marquette County. Specifically, it is requested that the current Warmwater Sport Fishery designated use be changed to a Coldwater Sport Fishery use on a seasonal basis from September 15 through May 15.

Attached is a memo from Scott Provost, Water Resource Specialist, dated November 20, 2002, describing a study undertaken to determine the appropriate stream classification. This study, conducted in conjunction with a baseline monitoring project, concludes that a seasonal Coldwater Sport Fishery designation represents the potential use of this reach of Westfield Creek.

Recognizing the current effort to update Chapter NR 104, this change should be included in the Phase 2 revisions, because it may necessitate more stringent effluent limitations for the Westfield WWTF. We recognize that the WPDES No. WI-0022250 cannot impose more stringent limitations associated with the revised classification, until code revisions become effective.

If you have any questions, please contact Scott Provost or Jeff Haack.

Prepared by: Jeffrey J. Haack, Water Resources Engineer *JH*

Noted:

Charlie Verhoven Date: *11/27/02*
Charlie Verhoven - Green Bay - NER Water Leader

- cc: Scott Provost - NER/Wautoma (w/o attachment)
- Jeff Haack - NR/Green Bay (w/o attachment)
- Charlie Verhoven (Attn.: Linda Vogen) - NER/Green Bay (w/o attachment)
- Rob McLennan (Attn: Mark Stanek) - NER Oshkosh (w/attachment)
- Laura Bub - WT/2 (w/attachment)

w/o

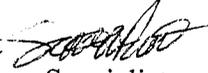
w/o } Attachment available electronically *JH*



DATE: November 20, 2002

FILE REF: Westfield Creek

TO: Jeffery Haack, NER
Water Resources Engineer

FROM: Scott Provost 
Water Resource Specialist

SUBJECT: Stream Classification for Westfield Creek, Marquette County, Wisconsin.

Stream Classification for Westfield Creek, Marquette County

Introduction

The Village of Westfield wastewater treatment facility (WWTF) discharges to Westfield Creek (WIBIC #166000) in the Village of Westfield (SE1/ NW1/4 Sec. 12, T.16N. R8E.) via outfall 001. The WWTF is an oxidation ditch type utilizing two secondary clarifiers.

Westfield Creek officially begins below the dam of Lawrence Lake in Marquette County, however it is hydraulically connected to Lawrence Creek separated only by the impoundment, Lawrence Lake. From the official start of Westfield Creek, the stream has an average gradient of .0023 and is currently classified as warmwater sport fishery (WWSF) for the entire reach of 11.0 miles. In the Village of Westfield, a hydro-electric dam creates an impoundment, Westfield Millpond, and separates the stream into two distinct reaches. These reaches have different attributes that create conditions requiring a change in classification below the Westfield Millpond. This ultimately changes the stream classification for the Village of Westfield WWTF.

The purpose of this study was to determine the appropriate stream classification for Westfield Creek at the WWTF. The determination was made from data generated for the Westfield Creek Wadable Baseline Monitoring Project, continuous temperature monitoring probes and electro-fishing. This report summarizes physical, chemical and biological data collected from August 2001 through October 2002 and recommends that the appropriate stream classification below the Westfield Millpond Impoundment be revised to Cold Water Community (COLD) from 15 September to 15 May of every year. The balance of the year, 16 May to 14 September the WWSF classification would apply.

Methods

The Westfield Creek Wadable Baseline Monitoring Project was slated to run over a two-year period to evaluate streams in the Montello River Watershed (UF-13). Fish communities, habitat and macroinvertebrates were evaluated as described in the Baseline Monitoring protocols (WDNR, 2000).

Fish Community Assessment: Fish surveys were completed as described in *Guidelines for Assessing Fish Communities of Wadable Streams In Wisconsin* (WDNR, 2000). Fish surveys were conducted by using a stream shocker, Fishery Biologist - Dave Bartz; Technician - Dave Paynter; Wastewater Specialist - Michael Reif, assisted with the stream shocking. Shocking was also conducted in April to determine if migration of salmonids into Westfield Creek was occurring from tributaries to Westfield Creek (Caves and Tagatz creeks), during periods of the year where temperatures in Westfield Creek were suitable for salmonids.

Habitat Assessment: Habitat was evaluated as described in *Guidelines for Evaluating Habitat of Wadable Streams* (WDNR, 2000). LTE staff assisted with the procedures. Instantaneous flows were measured with a Swiffer Instruments, Inc. Model 2100 Series Current Velocity Meter. Data was evaluated and scored according to the Fish Habitat Rating – Rivers (FHR-Rivers) as described in *Guidelines For Evaluating Fish Habitat in Wisconsin Streams* (Simonson, Lyons, Kanehl, 1994).

Macroinvertebrates Community Assessment: Macroinvertebrates were collected in the fall of 2001 by using methods described in *Guidelines for Collecting Macroinvertebrates Samples for Wadable Streams* (WDNR, 2000). Samples were delivered to the University of Wisconsin – Stevens Point, Aquatic Entomology Lab for identification. After identification was completed, a Hilsenhoff Biotic Index (HBI) was calculated and a rating assigned. It is important to note the HBI was designed for riffle areas. All stations with the exception of WC-3 were void of riffle areas. The HBI may have generated scores that would show a more poor rating than actual.

Water Quality Assessment: Instantaneous dissolved oxygen concentrations and temperatures were evaluated during the habitat evaluations, which were completed in August 2001, using *YSI 55 Dissolved Oxygen Meter*. Dissolved oxygen (DO) and temperature were also monitored from 8 August 2001 to 10 August 2001 to evaluate any significant changes in diurnal fluctuations. In addition to dissolved oxygen monitoring, long-term daily temperatures were monitored using *Onset* temperature loggers. These were programmed to record stream temperatures on an hourly basis from 9 August 2001 to 21 October 2002.

Three sites were monitored on the Westfield Creek. Station number WC-1 was several miles downstream below the confluence of Caves Creek. Station number WC-2 was above and below outfall 001 from the Village of Westfield WWTF. Station number WC-3 was below the Lawrence Lake Dam. As a control, station number LC-1 was located on Lawrence Creek upstream of anthropogenic influences (See Figure 1 for location of sites and outfall).

Results

Each station that was monitored is described below. All stations had fish, habitat and macroinvertebrates assessed with the exception of WC-1. Due to depth and volume of water, attempts to electro-fish this station were unsuccessful.

Westfield Creek Station #1 (WC-1):

Figure 2.
Upstream
view of
beginning
of station.



The stream travels through largely wooded and marsh habitat (see figure 2.). A number of tributaries join the creek (see Figure 1.). Caves Creek is a cold water trout stream and joins Westfield Creek upstream of this station. Riparian buffers are present along the banks. A large amount of woody debris was found in the stream, which provide habitat for aquatic organisms.

Habitat Assessment:

Westfield Creek scored in the fair range (53) for habitat according to the FHR-Rivers method. The WC-1 station scored the highest than other stations on Westfield Creek. The streambed is mostly composed of fine sand and silt with little rocky substrate, with some stream banks exposed and subject to erosion. The lack of rocky substrate had the largest impact on the score. The conditions of the streambed are a function of the geology of the area, therefore silty sediments and lack of rocky substrate are to be expected.

The cover for fish rating scored in the excellent range (see table 1 for results of the habitat rating). This station is similar to the others in respect to fish cover. Woody debris provides excellent habitat for fish and other organisms, which was an important factor in the habitat rating for Westfield Creek.

Table 1. Score summary for habitat rating.

Habitat Item	Calculated Value	Score	Rating
Bank Stability	< 18.5% bare soil	8	Good
Max. Thalweg Depth	< 1.04 m	16	Good
Bend:Bend	15.7	4	Fair
Rocky Substrate	0 %	0	Poor
Cover for Fish	13.6 %	25	Excellent
	Total	53	Fair

Macroinvertebrate Assessment:

The macroinvertebrate assessment yielded a HBI score of 5.69, which rates as fair. The assessment showed six orders and 15 families, and 90.6% of the invertebrates had HBI

tolerances of 6 or less. The absence of riffle area may skew the HBI resulting a rating more poor than actual stream conditions.

Water Quality and Characteristics:

Habitat and water quality evaluation was conducted on 14 August 2001. Water stage height appeared to be below normal by 0.1m (~ 4 in.). Stream flow was at 1.52 m³/s (53.6 cfs). The average depth at the flow cross section was 0.60 m (1.96 feet) and average velocity was at .25 m/s (0.81 ft/s). Water temperature was 18.6°C (65.5° F) and air temperature was 23.9°C (75.0 ° F). The concentration of DO was 7.73 mg/l, (82.8% saturation). Primary production of DO is probably low due to the lack of submerged macrophytes. Submerged macrophytes comprise 2.9% of the total fish cover measured in the stream, which is less than all other stations upstream. The remainder of the fish cover was primarily woody debris. Groundwater, stream tributaries, and natural mixing are the primary sources of DO at this station.

Westfield Creek Station #2 (WC-2):

Figure 3. Downstream view of WC-2.



WC-2 was located downstream of the Westfield Millpond and the Village of Westfield WWTF, approximately 150 feet upstream of the Pioneer Park Bridge (see figure 3.)

The stream travels through the northern edge of the Village of Westfield. The northern side of the stream is primarily a wooded area. The outfall for the WWTF is located approximately midway through the station on the north side. The south side of the stream is mainly residential and commercial development, however riparian buffers are present.

Fish Assessment:

Fish assessment was conducted on 10 September 2001. Total number of fish captured in the station was 195 over a station length of 402.5m (1320.5 ft.). The dominant sport fish species in the station were Smallmouth Bass (n=9) and Largemouth Bass (n=9). The majority of fish captured were forage species. Common Shiner (n=90), Horny Head Chub (n=29) and White Sucker (n=31) were the dominant forage species. One intolerant species of fish was found - smallmouth bass. The warmwater IBI calculated a score of 45, which rates as fair.

On 29 April 2002, we electro-fished a reach approximately ½ mile downstream of the WWTF outfall to determine if salmonid species were present during seasons with cooler

water temperatures. We found nine salmonid species (8 brook, 1 rainbow trout). Water temperature was 8.3°C (47°F) and average daily water temperature was 9.4°C (48.9°F).

Habitat Assessment:

Westfield Creek scored in the fair range for habitat. Westfield Creek streambed is mostly composed of fine sand and silt with little rocky substrate, with some stream banks exposed and subject to erosion.

All other parameters in the habitat rating scored in the excellent range (see table 2 for results of the habitat rating). A very large bend near the WWTF outfall and smaller meanders present provided a good bend:bend ratio.

Table 2. Score summary for habitat rating.

Habitat Item	Calculated Value	Score	Rating
Bank Stability	< 32.5% bare soil	4	Fair
Max. Thalweg Depth	< .84 m	4	Fair
Bend:Bend	8.8	12	Excellent
Rocky Substrate	1.3 %	0	Poor
Cover for Fish	12.4 %	25	Excellent
	Total	49	Fair

Macroinvertebrate Assessment:

The macroinvertebrate assessment yielded a HBI score of 5.62, which rates as fair. The assessment showed nine orders and 15 families, and 86.8% of the invertebrates had HBI tolerances of 6 or less. The absence of riffle area is similar to WC-1 and may have skewed the HBI rating.

Water Quality and Characteristics:

Habitat and water quality evaluation was conducted on 16 August 2001. Weather conditions were similar to the previous evaluations. Stream flow appeared to be below normal about 0.1m (~ 4 in.). Stream flow was at 1.48 m³/s (52.3 cfs). The average depth at the flow cross section was 0.28 m (0.93 feet) and average velocity was at 0.49 m/s (1.6ft/s). Water temperature was 19.0 °C (66.2 °F) and air temperature was 19.1°C (66.4 °F). The concentration of DO was 8.2 mg/l, which is slightly below saturation. Primary production from groundwater and the upstream impoundment may be maintaining DO concentrations. Submerged macrophytes comprise 11.7% of the total fish cover measured in the stream. The remainder of the fish cover was primarily woody debris and some boulders.

Westfield Creek Station #3 (WC-3):

The station was located downstream of the 4th Avenue Bridge and approximately 1000 feet downstream of the Lawrence Lake dam. The stream flows through a wooded area with remnants of agricultural land uses, mainly pasture (see figure 4). Meanders are not commonly found, which has ultimately reduced the habitat rating. Riparian buffers are

Figure 4.
View
downstream
of station
WC-3.



present along the banks. Many coldwater springs are present; however, the fish species indicate a WWSF. An appreciable number of fallen logs are found in the stream, which provide habitat for aquatic organisms. Midway through the station a ripple composed of boulders is found, which adds value to the habitat.

Fish Assessment:

Fish assessment was conducted on 5 September 2001. The total number of fish captured in a 381.5m (1,252 ft.) station length was 1,408. The dominant sport fish species in the station were Bluegill (n=67) and Largemouth Bass (n=10). Two Brown trout were also captured. The overwhelming majority of fish captured were forage species. Common Shiner (n=602), Horny Head Chub (n=285) and White Sucker (n=186) were the dominant forage species. Three intolerant species were found, American eel, Fantail Darter, and Mottled Sculpin. The Warmwater IBI calculated a score of 30, which rates as fair.

Habitat Assessment:

Westfield Creek scored in the fair range for habitat. The stream has few bends, which resulted in a lower score for the bend to bend ratio. Westfield Creek streambed is mostly composed of fine sand and silt with little rocky substrate, except one riffle area found in the station. Bank stability and cover for fish parameters scored in the excellent range (see table 3 for results of the habitat rating).

Table 3. Score summary for habitat rating.

Habitat Item	Calculated Value	Score	Rating
Bank Stability	< 6.7% bare soil	12	Excellent
Max. Thalweg Depth	< .44 m	0	Poor
Bend:Bend	52.1 %	0	Poor
Rocky Substrate	18.9 %	8	Fair
Cover for Fish	18.3 %	25	Excellent
	Total	45	Fair

Macroinvertebrate Assessment:

The macroinvertebrate assessment yielded a HBI score of 4.65, which rates as good. The assessment showed 11 orders and 26 families, and 92.0% of the invertebrates had HBI

tolerances of 6 or less. The presence of the riffle area may have shown a more accurate HBI value.

Water Quality and Characteristics:

On 9 August 2001, stream flow was at 1.06 m³/s (37.5 cfs). The average depth at the flow cross section was 0.38 m (1.26 feet) and average velocity was 24 m/s (.78ft/s). Water temperature was 28.2°C (82.7° F) and air temperature was 28.8°C (83.8° F). The concentration of dissolved oxygen was 7.11 mg/l slightly below saturation. Primary production from the stream and Lawrence Lake may be maintaining DO concentrations. Submerged macrophytes compose 33.4% of the total fish cover measured in the stream. The remainder of the fish cover was primarily woody debris and boulders associated with the riffles area.

Figure5. Downstream view of Lawrence Creek at the end of station LC-1.

Lawrence Creek Station #1 (LC-1):

LC-1 was conducted to evaluate the change in habitat, macroinvertebrates and fish communities of the headwaters of Westfield Creek before anthropogenic influences.

This Outstanding Resource Water (ORW) stream meanders through a wet meadow surrounded by forest. Habitat improvement has been conducted on the stream by the WDNR over the past several decades. Brush bundles and undercut banks are present. Figure 5 is a photograph of the stream at the end of the station.



Fish Assessment:

The Index of Biological Integrity (IBI) for cold water streams was used to calculate a rating for fish. Total number of fish captured was 322. The dominant fish species in the station were Brook Trout (n=233) and Mottled Sculpin (n=57). Both of the species are indicative of coldwater streams and are considered an intolerant species. Lawrence Creek would have scored higher, however some tolerant species were found. Largemouth Bass (n=2), Northern Pike (n=2), Central Mudminnow (n=3) and White Sucker (n=23). Some of these species are probably the result of fish migration upstream from Lawrence Lake and may not have been present in a totally natural setting. Fish were free from deformities, eroded fins or scales, lesions and tumors (DELT). A wide range of length was witnessed in Brook Trout, up to 254 mm (10 in.) suggesting good age structure to that point. Harvesting may be having an impact on older trout, as the largest

trout capture was 269 mm (10.6 in.). It should be noted the station is easily accessible for anglers from a walking path.

Habitat Assessment:

Lawrence Creek scored in the excellent range for habitat. The stream habitat could be improved by decreasing the width to depth ratio in certain areas. Some techniques used to prevent widening of the stream are having a positive effect. Where brush bundles were installed and working properly, the stream responded well. However, where brush bundles have become eroded the stream has started to widen. This is relatively minor and can be remedied quickly in the future. 46.3% of the fish cover was macrophytes.

The streambed is composed mainly of sand to fine sand with some pockets of silt usually located in pools and/or on the shallow side of a bend. The level of fines encountered is inherent to the aquifer material and soils associated with the area, therefore it is not likely to be a controllable factor for improvement. Land use upstream is almost entirely in a natural state (wooded or wet meadow); thus, this parameter is unlikely to change. All other parameters in the habitat rating scored in the excellent range (see table 4 for results of the habitat rating).

Table 4. Score summary for habitat

Habitat Item	Calculated Value	Score	Rating
Riparian Buffer	> 10m	15	Excellent
Bank Erosion	< .20m	15	Excellent
Pool Area	44.2 %	10	Excellent
Width:Depth Ratio	13.7	10	Good
Riffle:Riffle Ratio	4.5	15	Excellent
Fine Sediments	26 %	5	Fair
Cover for Fish	15.5 %	15	Excellent
	Total	85	Excellent

Macroinvertebrate Assessment:

The macroinvertebrate assessment yielded a HBI score of 4.86, which rates as good. The assessment showed 10 orders and 23 families, and 95.7% of the invertebrates had HBI tolerances of 6 or less. The absence of a riffle area may have skewed the HBI value.

Water Quality and Characteristics:

Despite low rainfall and warm conditions for July and August, stream flow appeared to be normal. The rich groundwater discharge maintained cool water via baseflow. On 9 August 2001, stream flow was measured at 0.523 m³/s (18.5 cfs). The average depth at the cross section flow was 0.43 m (1.42 feet) and average velocity was at .27 m/s (.9 ft/s). Water temperature was 16.6°C (61.9° F) and air temperature was 26.8°C (80.2° F). Dissolved oxygen was at 10.32 mg/l. Dissolved oxygen levels at this temperature are above saturation, which is probably a response to primary production in the stream. Groundwater and stream water mixing with the atmosphere is the other sources of DO.

Temperature

Comparison of the 14-month temperature monitoring project yielded data pertinent to a seasonal classification of Westfield Creek. Data from Lawrence Creek is used as a control to show the potential of the stream if impoundments were not present (see figure 6 for temperature graph). The first impoundment, Lawrence Lake, has a large impact to the temperature regime of Westfield Creek. The dramatic increase in temperature can be seen in figure 7 and when compared to figure 6.

Figure 6. shows stream temperatures August 2001 through October 2002, upstream of anthropogenic influences such as impoundments.

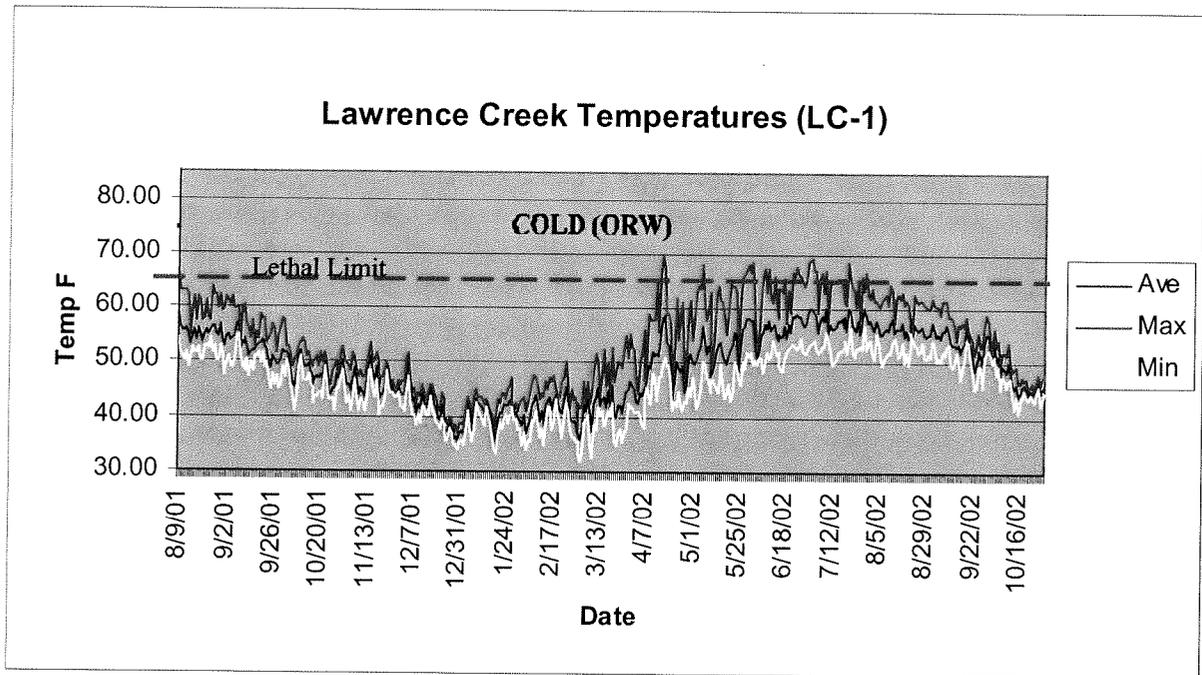
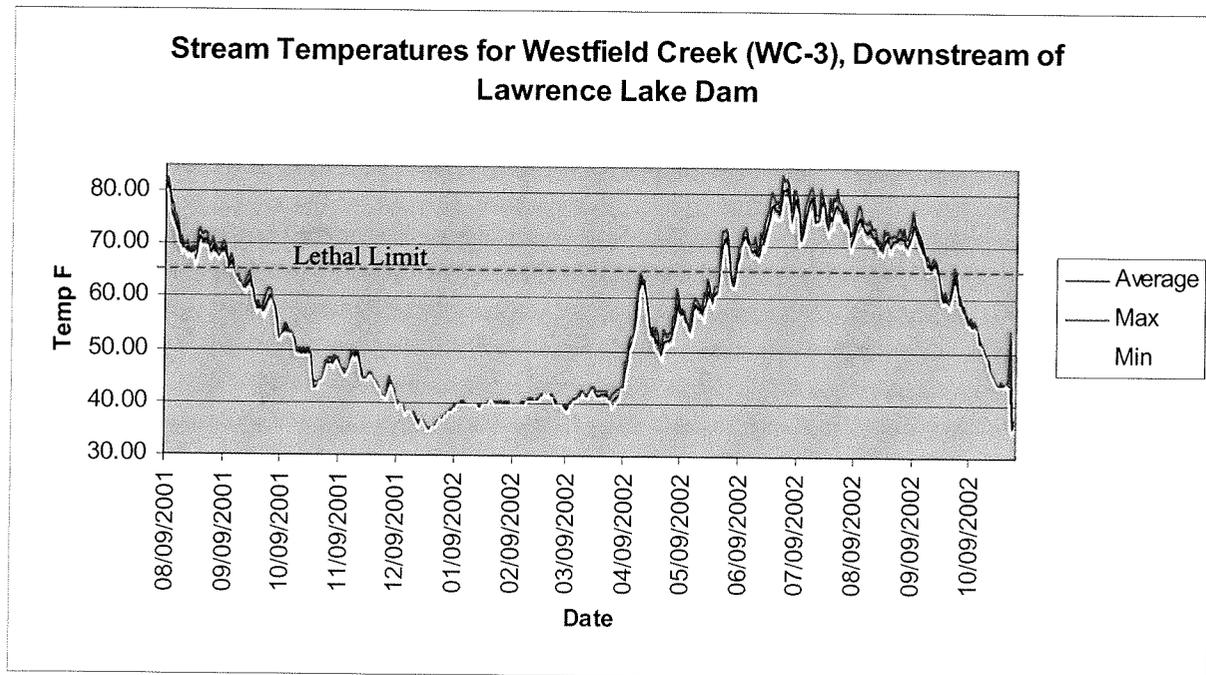


Figure 7. shows stream temperatures August 2001 through October 2002, downstream of anthropogenic influences such as impoundments. Salmonids here have little chance of escape to cooler tributaries.



Temperature probes downstream of the WWTF (Figure 8), and near CTH E bridge (Figure 9.) show similar periods when the temperature is suitable for coldwater species.

Figure 8. shows stream temperatures August 2001 through October 2002, downstream of anthropogenic influences such as impoundments. Salmonids here have opportunity to escape to cooler tributaries.

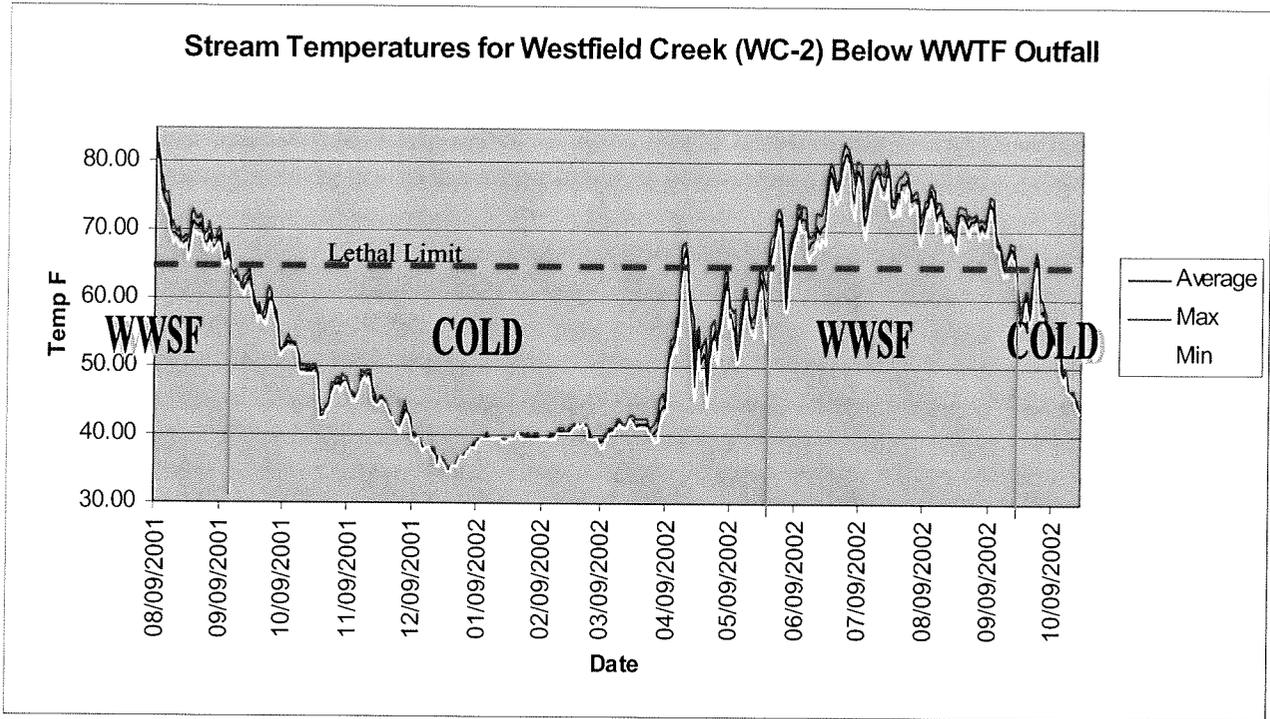
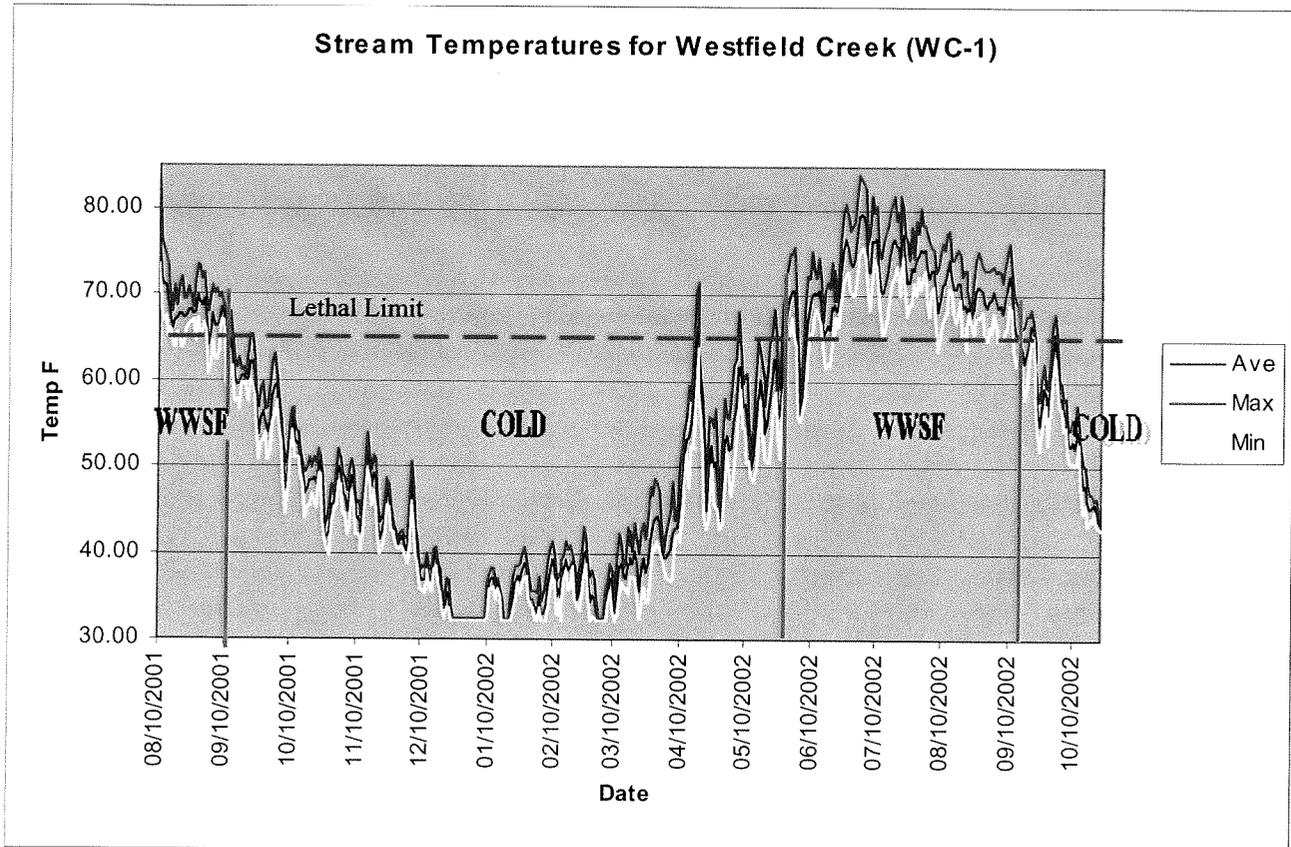


Figure 9. shows stream temperatures August 2001 through October 2002 for WC-1. This is similar to WC-2 however, more daily fluctuation is evident indicating some temperature recovery probably due to the input from Caves Creek.



Temperature probe placed at habitat station WC-1, is downstream of the Caves Creek which is currently rated as an Exceptional Resource Water (ERW). Caves Creek has habitat that is suitable for salmonids year-round and can be used as a retreat during periods of high temperature in Westfield Creek. Tagtaz Creek, an Outstanding Resource Water (ORW) is downstream of WC-1, which also can serve the same purpose for salmonids further downstream in Westfield Creek.

Dissolved Oxygen

Dissolved oxygen concentrations were often less than 100% saturated during peak photosynthetic periods. This could mean that DO concentrations could be dangerously low during peak respiration periods (pre-dawn), which may affect the fish community. During 3 days in August 2001, temperature and DO were monitored during peak photosynthetic and respiration periods to evaluate diurnal fluctuations of DO in Westfield Creek (See Table 5. for results).

Table 5. Diurnal fluctuation of DO in Westfield and Lawrence Creeks.

Date	Station	Nocturnal DO (mg/l)	Stream Temp (°C)	Diurnal DO (mg/l)	Stream Temp (°C)	Time
8/8/01	LC-1			10.04	13.6	08:46
	WC-3			7.06	27.7	09:12
	WC-2A			6.80	27.9	10:10
	WC-2B			6.59	27.6	10:28
8/9/01	LC-1	9.1	12.5	10.32	16.6	04:10/11:00
	WC-3	7.19	26.9	7.11	28.2	04:45/15:00
	WC-2A	6.44	27.9	7.06	27.6	04:58/15:20
	WC-2B	6.06	27.8	6.34	27.9	05:09/15:34
8/10/01	LC-1	9.28	11.4	11.3	16.2	05:09/13:40
	WC-3	6.7	25.5	7.33	25.5	05:24/13:58
	WC-2A	7.15	25.9	7.65	23.6	04:46/13:18
	WC-2B	6.38	25.9	7.42	24.0	04:36/13:09

Although DO levels were below saturation, they were still sufficient enough to support coldwater species if present. Significant decline in DO did not occur from diurnal to nocturnal periods.

Discussion

The completed habitat assessment indicates that Westfield Creek has sufficient cover and flow for salmonids and other cool water species. Macroinvertebrate assessment shows that there are signs of some organic pollution but the scores were relatively similar upstream and downstream of the WWTF outfall, which would indicate that effluent is not a significant impact to the macroinvertebrate community of Westfield Creek. Fish assessment showed a dramatic change in the fish community from salmonids to warmwater sportfish starting downstream of the Lawrence Lake Dam, yet habitat was suitable for salmonid species. Thus water temperature is preventing Westfield Creek from reaching its full potential.

High summer temperatures are first detected below the Lawrence Lake Dam, which increases stream temperature above the lethal limit for Brook Trout and other salmonid species. This reach of Westfield Creek downstream of the Lawrence Lake dam and upstream of the Westfield Millpond has no significant cool water tributaries for salmonid species to escape during periods of high temperatures, thus WWSF is an accurate classification for this reach. Westfield Creek below the Westfield Millpond has two major cool water tributaries that provide suitable habitat and cool water for salmonid species to migrate to during periods of high water temperatures. This allows cool water species to exist in the stream for approximately eight months of the year. As water temperatures rise due to upstream impoundments, fish can migrate to the Caves and Tagatz Creeks for suitable habitat and temperatures.

Temperature data shows that from 15 September to 15 May of a given year, Westfield Creek is suitable for salmonid species downstream of the Westfield Millpond. In addition to temperature data, shocking in April of 2002 showed salmonid species are present downstream of the WWTF outfall. Due to the seasonal temperature changes, suitable habitat and the presence of a wide array of macroinvertebrate species Westfield Creek supports trout during this time period and the correct classification of the stream should be COLD. As water temperatures increases from 16 May to 14 September, salmonids migrate to cooler tributaries leaving a warm water sport fishery and is recommended that Westfield Creek be classified as WWSF during these warm water months (see Table 6).

Table 6. Existing and recommended codified stream classifications for Westfield Creek.

Stream Reach	Existing Classification	Recommended Classification
Downstream of Lawrence Lake	WWSF	WWSF
Downstream of Westfield Millpond	WWSF	COLD ^a

COLD^a Seasonal COLD Classification 15 September through 15 May.

Imposing seasonal limits through seasonal classifications, will ensure adequate protection to the coldwater fishery. Westfield Creek may be improved in the future through some habitat modifications, but the primary limiting factor preventing Westfield Creek from reaching its full potential is stream temperature. Addressing temperature issues will do much to improve Westfield Creek.

References:

- Wisconsin Department of Natural Resources. 2000. **Guidelines for Assessing Fish Communities of Wadable Streams in Wisconsin.** Bureau of Fisheries Management, WDNR. Madison, Wisconsin. pp. 12.
- Wisconsin Department of Natural Resources. 2000. **Guidelines for Collecting Macroinvertebrate Samples from Wadable Streams.** Bureau of Fisheries Management, WDNR. Madison, Wisconsin. pp. 12.
- Wisconsin Department of Natural Resources. 2000. **Guidelines for Evaluating Habitat of Wadable Streams.** Bureau of Fisheries Management, WDNR. Madison, Wisconsin. pp. 23.
- Simonson, T.D.; Lyons, J.; Kanehl, P.D. 1994. **Guidelines for Evaluating Fish Habitat in Wisconsin Streams.** United States Department Agriculture. General Technical Report NC-164. St. Paul, Minnesota. pp. 36.

Figure 1. View of Montello River Watershed with pertinent locations

Montello River Watershed

