

Belle River Watershed
St. Clair, Macomb, and Lapeer counties
2008

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Environment

The Belle River watershed is located in the northern part of the Lake Erie basin and its 230 square miles of drainage area includes portions of Lapeer, St. Clair, and Macomb counties (Figure 1). The Belle River rises in the morainal hills south of Dryden and flows in a generally southeasterly direction to the St. Clair River. The basin is long and narrow, being about 40 miles in length and generally less than 10 miles in width (Knutilla 1969). In much of its lower reaches its width is less than 5 miles (Figure 2). Being a narrow basin, tributary streams are small and many have intermittent flow. The Belle River basin has relatively flat topography with the principal relief features of morainal hills in the headwaters area and along portions of its boundaries (Figure 3). The geology of the area limits groundwater contributions to the river. Most of the western third of the basin comprises morainal deposits dumped from glaciers and contain fine to coarse materials. They are generally poorly sorted and are therefore relatively impermeable and are not a source of large ground-water supplies. The remainder of the basin comprises lake bed deposits. These deposits are primarily clay and fine sand and are also impermeable (Knutilla 1969).

The Belle River is 73.5 miles in length and has another 76.5 miles of tributary rivers, streams, and drains. Most stream gradients are small, generally averaging falls of less than 10 feet per mile. A few tributary streams and most headwater streams in the western part of the basin have higher gradient, but seldom exceed falls of more than 20 feet per mile (Figure 4). Elevation in the basin ranges from 1,100 to 576 feet above sea level (Knutilla 1969).

The Belle River watershed is primarily rural with some urban areas within downtown clusters including Marine City, East China, China Township, Imlay City, Almont, and Richmond. Although the percentage of agriculture use has fluctuated over the years, it still remains the dominant land use at 54% based on 2009 aerial imagery (St. Clair County Health Department 2015). In addition, 25% is forested, 8% residential, 8% wetlands, and 5% other. Many of the tributaries to the Belle River flow through agricultural land and have historically been straightened and dredged.

History

In 1973, walleye fry were planted in the Belle River to develop a spawning population in the river (Table 1). It is unclear what evaluation took place, but a note in the file indicates the plant failed and the stocking program did not continue. There was also discussion of developing a coho and Chinook salmon program in the Belle in the early 1970s. This management direction did not have local support and was not pursued further. Steelhead were planted in 1973, but reports indicate this initial plant failed (Table 1). Steelhead were stocked again in 1981 and have since been stocked annually. Stocking numbers have ranged from 7,000 to 20,000 yearling steelhead annually, but the current management plan recommends stocking 7,000 annually.

A fish survey was conducted on the Belle River in 1974 at nine sites along the river (MDNR, Fish Division files). A total of 53 species were caught, with rock bass, common shiners, northern hog suckers, and eastern sand darters being the most abundant and most common species among sites. The eastern sand darter is classified as State Threatened and was found at the five most upstream locations.

The Michigan Department of Environmental Quality, Water Resources Division conducted macroinvertebrate surveys in 1992, 1997, 2002, 2007, and 2012. During some years, additional surveys including fish community, habitat, and water chemistry were also conducted. Portions of the North Branch and the upper Belle River generally had poor to fair ratings, whereas the middle sections had good to excellent ratings.

Current Status

Fish surveys were conducted at various sites throughout the watershed in August 2008. Sampling was done at the sites previously sampled in 1974 to allow direct comparison between time periods (Figure 2, sites 2-10). In addition, surveys were done at one additional site on the Belle River further upstream (Figure 2, site 1), as well as on three tributaries to the Belle River (Figure 2, sites 11-13). The width of the stream determined which electrofishing equipment was used. Three tributaries and most upstream sites on the mainstem were narrow and wadable and were sampled with a backpack electrofishing unit. The two most downstream sites were wide and deep and were sampled using a boat electrofishing unit. The remaining sites were sampled using a stream electrofishing unit.

A qualitative biological protocol for wadable streams was developed by the Great Lakes and Environmental Assessment Section (GLEAS) of the Michigan Department of Environmental Quality (MDEQ), called Procedure 51 (MDEQ 2002), and was used to evaluate the fish collection data. The protocol evaluates 10 measures of the fish community to evaluate its overall health. Each metric was scored as +1, 0, or -1 and the ten categories were summed for a total score. Total scores of +5 or higher are classified as excellent, scores of -5 or lower are classified as poor and acceptable sites are those that scored +4 to -4. Better stream quality is normally indicated by greater cool water fish diversity and abundance, as well as more even distribution of individuals among taxa at one station compared to another. Conversely, poorer stream quality is indicated by lower diversity and abundance at one station compared to another (MDEQ 2002).

North Branch Belle River @ Summers Road

The North Branch of the Belle River is a small tributary at the upper end of the watershed, which flows into the Belle River south of Imlay City (Figure 2, site 11). The fish community was sampled using a backpack electrofishing unit. The site began about 30 feet upstream of the culvert and continued upstream a distance of 175 feet. The stream averaged 18 feet wide and the water depth ranged from 8 to 18 inches; averaging about a foot. The substrate was silt and we sank down about 2 feet. The habitat was classified as 100% run; no riffle or pool habitat was present. The riparian area was wooded and there were many logs in the river and overhanging brush on the banks.

A total of 45 fish were caught, represented by 12 species (Table 2). Creek chubs, mottled sculpin, and johnny darters were the most abundant. Most categories in the GLEAS assessment scored a 0 and the overall GLEAS score for this site was -1 (acceptable) (Table 3). The number of darter species was good and most are indicators of good water quality. Conversely, 5 of the 12 species were classified as "tolerant" (common in highly degraded streams) and accounted for almost 60% of the total catch.

Weston Drain @ Summers Road

Weston Drain is a tributary to the Belle River located in the upper part of the watershed (Figure 2, site 12). The fish community was sampled using a backpack electrofishing unit. The site began 200 feet downstream of the culvert and went 150 feet upstream. The stream averaged 12.5 feet wide and water depth ranged from 6 to 18 inches; averaging 8 inches. The substrate was primarily gravel, with rocks, cobble, and some sand pockets. The habitat was mostly run (85%), with some riffles (15%) but no pools. The riparian area was wooded and the banks were vegetated and stable.

A total of 236 fish were caught, made up of 11 species (Table 2). Mottled sculpins, rainbow darters, and creek chubs were the most common species caught. The overall GLEAS score was +1, getting an "acceptable" rating (Table 3).

Jerome Creek @ Hessen Road

Jerome Creek is a small tributary to the Belle River, entering the lower portion of the river just west of I-94 (Figure 2, site 13). A backpack electrofishing unit was used beginning 135 feet downstream of the culvert and covering a total distance of 375 feet. The stream averaged 12 feet wide and water depth ranged from 3 to 30 inches; averaging 8 inches. The substrate was a combination of clay (55%), silt (30%), and gravel (15%). The stream habitat was primarily run (75%), with similar amounts of pool (15%) and riffle (10%). The riparian area was wooded and there were some logs in the creek.

A total of 281 fish were caught, represented by 15 species (Table 2). Creek chubs and bluntnose minnows were the most abundant, accounting for 65% of the total catch. Similar numbers of blackside darters, green sunfish, white sucker, johnny darters, and pumpkinseeds accounted for an additional 29% of the catch. Nine of the 15 species were classified as "tolerant" and they contributed 86% of the total catch. The GLEAS score was -2 giving this site an "acceptable" rating (Table 3).

Belle River @ Bishop Road

A backpack electrofishing unit was used to sample the fish beginning just upstream of the Bishop Road culvert and proceeding 205 feet upstream (Figure 2, site 1). This was the most upstream site sampled on the Belle River. The stream averaged 11 feet wide and water depth ranged from 6 to 24 inches; averaging 18 inches. The substrate consisted of silt on top of gravel and clay. The stream habitat was 100% run; no riffles or pools. The riparian area was wooded and there was a good amount of woody material in the river. The banks appeared stable and contained overhanging brush.

A total of 166 fish were caught, represented by only 6 species (Table 2). Creek chubs and johnny darters were the most abundant species, making up 87% of the total catch. Because of the low number of species caught and 95% of the catch being made up of "tolerant" species, this site had the lowest GLEAS score (-4) relative to other sites in the survey (Table 3). Of note, this was the only site in the survey where a grass pickerel was caught.

Belle River @ Schultz Road

A stream electrofishing unit was used to sample the fish community in a 500 foot station at Schultz Road (Figure 2, site 2). The river at this site averaged 40 feet wide and water depth ranged from 0 to 3.5 feet; averaging 3 feet. The trapezoidal channel shape, lack of sinuosity, and presence of spoils along the banks are indications this section had been previously dredged. The substrate was 100% silt

and it was difficult to walk in because you would sink in at least a foot with every step. The stream habitat was 100% run; no riffles or pools. The riparian area included a narrow margin of vegetation along the stream, with agricultural fields on either side.

A total of 87 fish were caught, represented by 16 species. The number of species caught increased substantially from the previous site upstream where only 6 species caught. It is typical to see the number of species increase as sampling proceeds downstream due to the increased stream width; the stream averaged 11 feet wide at Bishop Road compared to 40 feet at this site. Although the number of species increased, this site had the lowest catch-per-effort (CPE) of any of the sites that were stream shocked or backpack shocked (Table 2). The GLEAS score improved to a +2 (Table 3).

Belle River @ Riley Center

A stream electrofishing unit was used to sample fish at Riley Center (Figure 2, site 3). The river averaged 35 feet wide and water depth ranged from one-half to 2 feet deep; averaging a foot. Although the substrate was still dominated by silt (80%), the site included sand (15%) and cobble (5%). Similar to the previous two sites on the Belle River, the habitat at this site was rather uniform, consisting of 100% run.

The catch increased substantially from the previous upstream site to 295 fish, represented by 16 species (Table 2). Mottled sculpins made up 10% of the catch and are indicators of cold water. Darters were also abundant, contributing 58% of the total catch. There was a significant improvement in the GLEAS score at this location, earning an excellent score of +7 (Table 3).

Belle River @ Memphis

A stream electrofishing unit was used to sample 500 feet in Memphis (Figure 2, site 4). The stream averaged 40 feet wide and water depth ranged from 1 inch to 3.5 feet; averaging a foot. There was a dramatic improvement in the substrate, with 100% cobble. There was also a change in habitat type, with 40% run, 30% pool, and 30% riffle.

The improvements in habitat clearly translated into better fish catches. The number of fish caught (731) more than doubled relative to the previous site upstream. The species diversity also increased with 19 species present. Darters were again abundant, with rainbow darters accounting for over a quarter of the total catch. Rainbow darters are considered an indicator species of a healthy stream. This is also the first site that stonecats were caught, which is another indicator species of good water quality. Two other species that were caught on the mainstem for the first time in this survey were central stonerollers and river chubs; both of these species prefer swift moving water. Overall, this site had one of the highest catches of "intolerant" species (7) and only 2% of the catch was made up of "tolerant" species. The site had a GLEAS score of +7, similar to the previous site (Table 3).

Belle River @ Kroner Road

A stream electrofishing unit was used to sample a 500 foot station at Kroner Road (Figure 2, site 5). The stream increased in size (averaged 49 feet wide) and depth (ranged from 3 inches to 3.5 feet; averaging 1.5 feet) relative to the upstream sites. The substrate was varied, including sand (73%) and cobble (25%), with some boulders (1%) and clay (1%). The habitat was classified as 10% run, 65% pool, and 25% riffle.

This site had the highest catch (1,008 fish), greatest CPE (202 fish/100 feet), and a large increase in the diversity of the catch (27 species) (Table 2). Most of the increase in species was attributed to the addition of various shiners, minnows, and chubs. Minnows accounted for 51% of the catch, followed by darters (19%), and suckers (15%). This site also had a high catch of "intolerant" species and conversely, only 5% of the catch was made up of "tolerant" species. The GLEAS score improved to +8 (Table 3).

Belle River @ Gratiot

A stream electrofishing unit was used to sample 500 feet at Gratiot (Figure 2, site 6). The stream decreased in width to 36 feet and the water depth ranged from 6 inches to 2.5 feet; averaging 1.5 feet. The substrate was 80% cobble, 15% sand, and 5% boulders. There was a shift in habitat type to predominantly run (60%), and less pool (30%), and riffle (10%).

A total of 511 fish were caught, represented by 26 species (Table 2). The species composition of the catch was very similar to that found at the previous site upstream but fish abundance was lower. A catch of note was a single rainbow trout and this was the only site where a trout was caught. This fish was likely a stocked steelhead that failed to migrate. But the catch is significant because it shows that a cold-water species can survive the warmest part of summer. The GLEAS score for this site was +8 (Table 3).

Belle River @ Westrick Road

A 675 foot station was sampled using a stream electrofishing unit (Figure 2, site 7). The stream width increased slightly to 42 feet and the site was deeper, ranging from 6 inches to 4 feet; averaging 2 feet. There was also a shift in substrate from one dominated by cobble at the previous site, to one dominated by silt (90%), with some sand (10%). There was also a shift in habitat to predominantly run (90%), with 10% pool and no riffles. These changes in habitat are due to a reduction in stream gradient.

The catch dropped dramatically to only 140 fish (Table 2). This produced a CPE that was the second lowest for wadable sections and was an 80% reduction from the previous site upstream. Although the number of fish caught was reduced, the number of species caught was tied for the greatest at 28 species. Suckers were common at this site with five species accounting for a third of the total catch by number. An eastern sand darter was caught at this site, which is significant because the eastern sand darter is a State Threatened species. Its distribution in Michigan is restricted to the southeast part of the state, which is the northern extent of its geographic range. This site had the highest GLEAS score of +9 (Table 3).

Belle River @ Indian Trail

A 465 foot station was sampled using a stream electrofishing unit (Figure 2, site 8). The stream averaged 40 feet wide and water depth ranged from 4 inches to 4 feet; averaging about 1.5 feet. The substrate was diverse including silt (39%), sand (35%), and clay (25%), with a small amount of gravel (1%). The site contained 100% run habitat, with no pools or riffles present. There was a fair amount of attached filamentous algae at this site, as well as some aquatic vegetation near the banks.

Both the catch (432 fish) and catch rate (92.9 fish/100 feet) improved from the previous site. The number of species caught remained high (28 species), tying the previous site with having the most

species present. The catch also included the State Threatened eastern sand darter. This site had a GLEAS score of +8 (Table 3).

Belle River @ King Road

As we progressed downstream, the river became deeper and was not suitable for wading. At King Road, a 1,300 foot station was sampled using a boat electrofishing unit (Figure 2, site 9). The stream averaged 50 feet wide and water depth ranged from 1 to 5 feet; averaging 2.5 feet. The substrate was predominantly silt over sand and the habitat was 100% run. There were good amounts of aquatic vegetation along the banks, made up of several native species.

A total of 124 fish were caught, represented by 17 species (Table 2). The overall catch rate was much lower relative to the other sites (9.5 fish/100 feet). However, this site was sampled using a boat electrofishing unit and CPEs are not comparable to the other sites sampled with either a backpack or stream electrofishing unit. For example, species oriented to the bottom are less well represented in boat electrofishing. Although round gobies, which are bottom oriented, were found upstream of this location, they were not collected at this site. This is likely due to being less susceptible to capture with a boat electrofishing unit compared to a stream electrofishing unit.

New species were caught at this site, primarily due to the proximity to the St. Clair River. This is the first site where emerald shiners and brook silversides were caught. These two species are more commonly associated with the St. Clair River than an inland river. Striped shiners and golden redhorse were the most common species, each accounting for 20% of the total catch. A GLEAS score was not calculated because the GLEAS methodology was developed for only wadable streams.

Belle River @ Meisner Road

A 1,300 foot station was sampled using a boat electrofishing unit at Meisner Road (Figure 2, site 10). The site averaged 50 feet wide and water depth ranged from 1 to 7 feet; averaging 3 feet. The substrate was silt covered sand, with some gravel and the habitat was 100% run. Aquatic vegetation was found throughout the site.

A total of 39 fish were caught, represented by only 9 species (Table 2). Similar to the previous site, the presence of species like emerald shiners reflect species more commonly found in the St. Clair River.

Water Temperature Monitoring

Water temperature monitoring (Onset Hobo Water Temperature Pro v2 Data Loggers) was conducted at a sub-set of the fish sampling sites (Figure 2). The temperature loggers were deployed in early summer 2010 and retrieved in the fall and were programmed to record temperature hourly.

Weston Drain, a tributary in the upper Belle River watershed had the coolest water temperature, but the average temperature exceeded 70 oF during both July and August (Table 4). The water temperature on the Belle River increased from Schulz Rd downstream and was the highest at Kroner Rd, before decreasing slightly at the Gratiot and Indian Trail sites. Although there were minor differences in absolute temperature, the pattern was consistent among sites (Figure 5).

Analysis and Discussion

Ten sites were surveyed on the Belle River in 2008 and the most common and abundant species included suckers (white sucker, golden redhorse, and northern hog sucker), common shiner, rock bass, and johnny darter (Table 1). Other species that were common among sites but were less abundant included northern pike, green sunfish, blackside darter, smallmouth bass, and creek chub.

There was a noticeable shift in the fish community from the upstream sites progressing downstream. Although the catch rate was good at the most upstream site at Bishop Road (81 fish/100 feet), 95% of the catch comprised species that are tolerant of a wide range of environmental conditions, indicating a degraded environment. It is not surprising that this site had the lowest GLEAS score of -4. Although the catch rate was reduced at the next site downstream at Schultz Road (17.4 fish/100 feet), the fish community had a lower percentage of "tolerant" species in the catch and there was an increase in the number of "intolerant" species. These changes are reflected in the improved GLEAS score of +2 for this site. In general, there was an improvement in catch rates and GLEAS scores as we progressed downstream from Riley Center to Indian Trail.

The improved catches and fish community in the middle sites reflects improvements in stream habitat. Beginning at Riley Center, the substrate transitions to a combination of sand and cobble compared to the upstream sites that were all silt. The sites from Memphis to Westrick Road also contain varied habitat including pools, riffles, and runs. These sites with diverse habitat and substrate support a more diverse and balanced fish community. There has been extensive dredging and modifications to the Belle River upstream of Riley Center and these changes have contributed to the degradation of the fish community.

The two most downstream sites at King Road and Meisner Road had reduced catch rates and species diversity. A part of these results are due to differences in sampling gear. These sites were wide and deep so sampling was done with a boat electrofishing unit compared to the other sites which were sampled while wading. The GLEAS Procedure 51 was designed for wadable streams so GLEAS scores were not calculated for these last two sites. Several new species were caught at the more downstream locations, including emerald shiner, brook silverside, gizzard shad, and round goby. These species are more commonly found in the connecting St. Clair River and provide evidence of movement of fish between these two systems.

Eastern sand darters were found at two sites. This species is on the State Threatened list, with southeast Michigan being the northern edge of its range (Scott and Crossman 1973). The eastern sand darter is found in streams and rivers with sandy substrates and lakes with sandy shoals. They are often found in slow moving waters where fine sand is deposited, often immediately downstream of a bend (Daniels 1993). Siltation is a major factor in the decline of this species. The eastern sand darter is reliant on unstable, shifting sand bar habitats which can dramatically change in location, quantity, and quality from year to year dependent upon river flows. Because this habitat is so variable and reliant upon natural sediment transfers within systems, modifications to riparian areas, channel or flow alterations, nutrient enrichment, or other habitat modifications (Simon 1993) can completely change the amount, quality, and locations of these shifting sand bars to the detriment of the eastern sand darter.

Nine of the ten sites surveyed on the Belle River in 2008 were also evaluated in 1974, allowing for comparisons between time periods (Table 5). However, caution must be used when making comparisons due to differences in sampling gear. For example, contemporary electrofishing gear is

much more efficient than that used in previous surveys. Therefore, although direct comparisons of numbers may not be appropriate, differences in species composition and relative abundance of species is still useful. Similar to the results from 2008, suckers, common shiners, rock bass, and johnny darters were among the most common and abundant. Also, consistent with 2008, the sites from Riley Center to Gratiot had the highest catches.

One difference between the two time periods is that eastern sand darters were more common among sites and more abundant in the 1974 survey. They were found at 5 sites and made up 8% of the catch in 1974 versus just 2 sites making up 1% of the catch in 2008.

The Belle River can be characterized as a warm water stream. The water temperature at two sites was over 70oF for most of late May through August (Figure 5). The graph shows the daily variation in temperature, reaching a maximum in the afternoon and a low overnight. There are extended periods from mid-June to mid- August where the maximum daily temperature exceeds 80 oF. The warm water temperatures are not surprising because of the local climate and the relatively impermeable nature of the surface geology does not promote groundwater input which would reduce the stream temperatures. Most of the flow in the Belle River is derived from surface water runoff.

Management Direction

The steelhead stocking program has created a seasonal fishery for this cold-water species in the Belle River. Yearling steelhead are stocked in early spring and are only in the stream a short time before they migrate to the St. Clair River. It is unclear whether those fish go upstream in the St. Clair River to Lake Huron or downstream to Lake Erie. Either way, the steelhead return to the Belle River to spawn, typically beginning a year or two later. The steelhead begin returning as early as November, with the number of returning fish increasing in March and April when spawning occurs. This creates a seasonal fishery from November to mid-May. After hatching, juvenile steelhead spend their first year or two in a stream before migrating to the Great Lakes. Because the Belle River is a warm-water stream, reaching temperatures of 80o F in the summer, juvenile steelhead cannot survive here. Thus, the steelhead fishery would not be possible without annual stocking.

Recently, a Belle River Watershed Management Plan was completed in 2015 by the Belle River Watershed Advisory Group. The Watershed Management Plan outlines the actions necessary to improve water quality and to protect, enhance, and restore the Belle River, its tributaries, and its headwaters. Fisheries Division staff should continue work with partners on implementation of the plan.

References

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Table 1.-Fish stocking summary for the Belle River.

Species	Year	Number	Average Length (in)
Walleye	1973	265,000	Fry
Steelhead	1973	124,650	Fry
	1981	20,000	3.7
	1982	20,000	3.7
	1983	20,000	6.0
	1984	15,000	6.3
	1985	10,000	6.2
	1986	15,000	6.9
	1987	15,010	7.1
	1988	12,400	7.3
	1989	10,170	7.9
	1990	9,760	6.7
	1991	9,700	7.1
	1992	10,000	7.9
	1993	11,600	7.5
	1994	13,400	7.2
	1995	11,600	7.8
	1996	11,627	7.4
	1997	12,333	7.8
	1998	12,071	8.1
	1999	12,172	7.4
	2000	12,001	7.7
	2001	12,000	7.7
	2002	12,600	7.8
	2003	13,001	7.9
	2004	12,400	7.6
	2005	8,500	7.4
	2006	6,900	7.5
	2007	7,100	8.0
	2008	7,501	7.2

Table 2.-Catch summary from 2008 fish survey on Belle River watershed.

	N. Br.	Weston	Jerome	Belle River										Freq
	Belle R.	Drain	Creek	Bishop	Schultz	Riley	Memphis	Kroner	Gratiot	Westrick	Indian	King	Meisner	
	Summer	Summers	Hessen	Rd	Rd	Center		Rd			Tr	Rd	Rd	
Gizzard shad											1	21	17	3
Longnose gar														0
Central stoneroller	1	3	2				145	99	21					6
Goldfish										1				1
Common carp			1		1					2			3	4
Striped shiner								66	14		108	24		4
Spotfin shiner						3		5	3	5	3			5
Common shiner		17	1			6	15	155	30	6	1			8
Redfin shiner								4						1
Horneyhead chub								2	13			1		3
River chub							55	92	29	4	63	3		6
Golden shiner			1		3									2
Emerald shiner												5	2	2
Rosyface shiner					1	1	4	72	25	1	15			7
Sand shiner											9			1
Mimic shiner								6	10		11			3
Bluntnose minnow			62		3	7		4	14	3	15	8		8
Fathead minnow			5					2						2
Creek chub	13	55	120	65				2	12	27	1	1		9
Blacknose dace		7						2						2
White sucker	1	1	18	10	5	4	4	19	12	3	7			11
Northern hog sucker		2								4	4			7
Spotted sucker					9					5	2	12	1	5
Silver redhorse												4		1
Golden redhorse					1	7	6	48	8	33	36	24	8	9
Shorthead redhorse										1	15			2
Redhorse sp.														0
Black bullhead	2													1
Brown bullhead					1			1	1					3
Channel catfish											3	2		2
Stonecat							2	12	4	3	2			5
Tadpole madtom	1													1
Brindled madtom											2			1
Madtom sp.														0
Grass pickerel				1										1
Northern pike					5	5	3	3	3	3		3	1	8
Central mudminnow	1		1											1
Rainbow trout									1					1
Brook silverside												2		1

Table 2.-Continued

	N. Br. Belle R.	Weston Drain	Jerome Creek	Belle River										Freq
	Summer Rd	Summers Rd	Hessen Rd	Bishop Rd	Schultz Rd	Riley Center	Memphis	Kroner Rd	Gratiot	Westrick	Indian Tr	King Rd	Meisner Rd	
Mottled sculpin	11	78		8		31	161	26	21					7
Rock bass	1				25	46	18	2	85	14	28	5	1	10
Green sunfish	3		18	3	2	2	4		3	9	2	1		11
Pumpkinseed			12		2					1				3
Bluegill			4		12					4				3
Longear sunfish														0
Hybrid sunfish					3							4		2
Smallmouth bass						1	1	17	10		1	2	1	7
Largemouth bass			3							1				2
Black crappie					5					1				2
Eastern sand darter										1	6			2
Greenside darter		3				85	80	58	70	4	29			7
Rainbow darter	2	56				9	195	118	34					6
Barred fantail darter		1												1
Johnny darter	8	13	17	79	8	56	3	9	9	3	15	1		12
Yellow perch										4	3	2	5	4
Logperch							1	3	9	1	11			5
Blackside darter	1		16			20		2	8	13	9			7
Iowa darter														0
Round goby										9	30			2
Total catch	45	236	281	166	87	295	731	1008	511	140	432	124	39	
No. of species	12	11	15	6	16	16	19	27	26	28	28	17	9	
Weight (pounds)	2.3	1.3	6.1	8.6	20.0	18.6	20.1	104.0	36.7	19.8	39.9	19.6	33.2	
Station length	175	150	375	205	500	455	500	500	500	675	465	1300	1300	
Avg width	18	12.5	12	11	40	35	40	49	36	42	40	50	50	
CPE (#/100 ft)	25.7	157.3	74.9	81.0	17.4	64.8	146.2	201.6	102.2	20.7	92.9	9.5	3.0	
Riffle/Pool/Run	0/0/100	15/0/85	10/15/75	0/0/100	0/0/100	0/0/100	30/30/40	25/65/10	10/30/60	0/10/90	0/0/100	0/0/100	0/0/100	
Silt	100	0	0	100	100	80	0	0	0	90	39	100	100	
Sand	0	15	100	0	0	15	0	74	15	10	35	0	0	
gravel	0	80	0	0	0	0	0	0	0	0	1	0	0	
Cobble	0	5	0	0	0	5	100	26	85	0	0	0	0	

Table 3.-Procedure 51 scores for wadable stream sites for the 2008 fish survey of Belle River watershed sites.

	Belle River																					
	N Br Belle Summers Rd		Weston Drain Summers Rd		Jerome Creek Hessen Rd		Bishop Rd		Schultz Rd		Riley Center		Memphis		Kroner Rd		Gratiot		Westrick Rd		Indian Tr	
	#	Score	#	Score	#	Score	#	Score	#	Score	#	Score	#	Score	#	Score	#	Score	#	Score	#	Score
Total Taxa	12	0	11	0	15	1	6	-1	16	1	16	1	19	1	27	1	26	1	28	1	28	1
Darter Taxa	5	1	5	1	2	0	2	0	1	-1	5	1	5	1	6	1	6	1	6	1	7	1
Sunfish Taxa	2	0	0	-1	3	1	1	0	5	1	2	0	2	0	2	0	2	0	5	1	2	0
Sucker Taxa	1	-1	2	1	1	0	1	0	3	1	3	1	3	1	3	1	3	1	5	1	5	1
Intolerant Taxa	3	0	2	0	0	-1	1	-1	3	0	6	1	7	1	7	1	8	1	7	1	8	1
% Tolerant	58	-1	29	0	86	-1	95	-1	26	0	23	0	2	1	5	1	13	1	16	1	9	1
% Omnivore	38	0	24	0	74	-1	45	0	16	0	4	1	1	1	4	1	11	1	7	1	5	1
% Insectivore	58	0	75	1	23	-1	54	0	26	-1	79	1	76	1	76	1	66	1	76	1	86	1
% Piscivore	2	0	0	-1	1	0	0.6	-1	34	1	18	1	3	0	10	0	19	1	13	0	7	0
% Simple LS	9	0	35	0	12	0	6	0	18	0	19	0	35	0	57	1	37	0	48	1	48	1
Overall Score		-1		1		-2		-4		2		7		7		8		8		9		8

Table 4. Monthly water temperature summaries from the Belle River watershed, 2010.

Month	Weston Drain			North Branch			Schultz Road			Riley Center		
	Avg	Min	Max									
June	68.9	59.2	77.4	72.0	61.8	80.0	70.3	61.2	77.1	70.6	62.8	77.8
July	73.0	60.6	83.9	76.5	65.1	85.8	75.1	64.1	83.6	75.4	64.3	84.0
August	70.8	58.6	80.5	73.4	66.1	79.7	72.4	63.8	78.5	73.0	64.1	79.6
September	61.4	52.6	78.0	63.4	53.9	77.9	62.2	54.4	76.3	62.9	55.1	78.0
October	52.1	43.1	60.9	53.1	45.0	61.2	52.7	43.8	60.3	53.2	46.1	60.1

Month	Memphis			Kroner Road			Gratiot			Indian Trail		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
June	71.2	61.7	80.7	71.8	61.4	82.2	71.5	61.7	79.3	71.0	63.3	77.8
July	75.9	63.6	86.3	76.8	63.7	87.9	76.3	64.6	86.1	75.5	65.1	83.7
August	73.6	62.7	82.6	74.6	63.6	83.2	74.0	63.9	81.2	73.3	64.0	80.1
September	63.3	54.6	79.7	64.1	55.3	80.9	63.8	55.3	79.6	63.4	56.0	78.3
October	53.3	45.3	61.4	53.4	44.7	62.1	53.3	45.1	61.6	53.4	45.9	60.1

Table 5.-Continued.

0

	Belle River									Freq
	Schultz Rd	Riley Center	Memphis	Kroner Rd	Gratiot	Westrick	Indian Tr	King Rd	Meisner Rd	
Brook silverside										0
Mottled sculpin										0
Rock bass		33	18	75	65			4		5
Green sunfish										0
Pumpkinseed	4								2	2
Bluegill	2		1					1		3
Longear sunfish					5					1
Hybrid sunfish										0
Smallmouth bass				1	7		1			3
Largemouth bass										0
Black crappie	1		3		1					3
Eastern sand darter	1	2	9	10	6					5
Greenside darter										0
Rainbow darter			7	1						2
Barred fantail darter										0
Johnny darter		1			1		1			3
Yellow perch										0
Logperch										0
Blackside darter		2			3					2
Iowa darter										0
Round goby										0
Total catch	18	49	90	104	109	8	32	10	23	
No. of species	8	9	11	10	14	6	9	5	5	
Station length	1,200	1,000	500	500	500	400	1,200	1,000	1,500	
CPE (#/100 ft)	0.02	0.05	0.18	0.21	0.22	0.02	0.03	0.01	0.02	

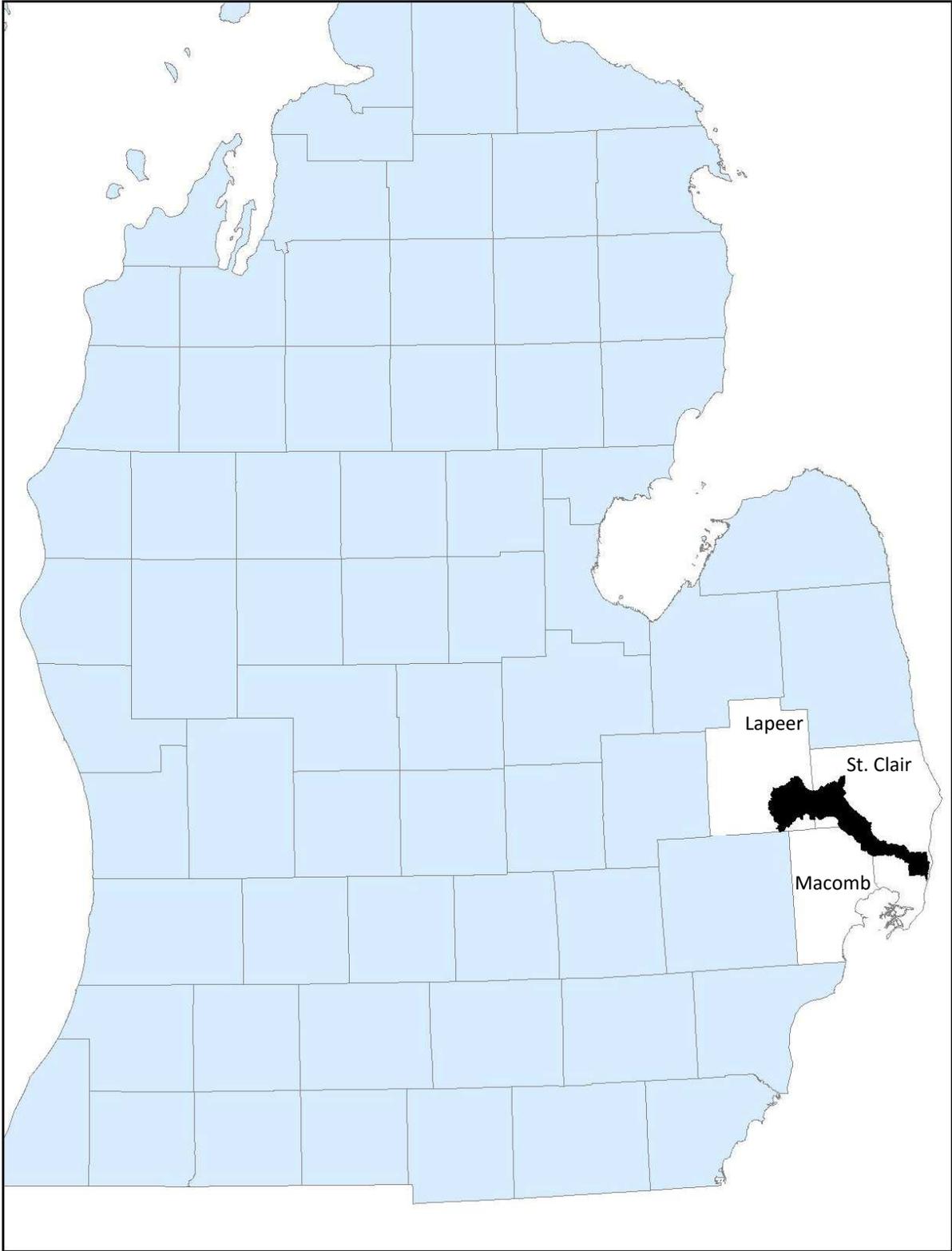


Figure 1.-Location map for the Belle River watershed.

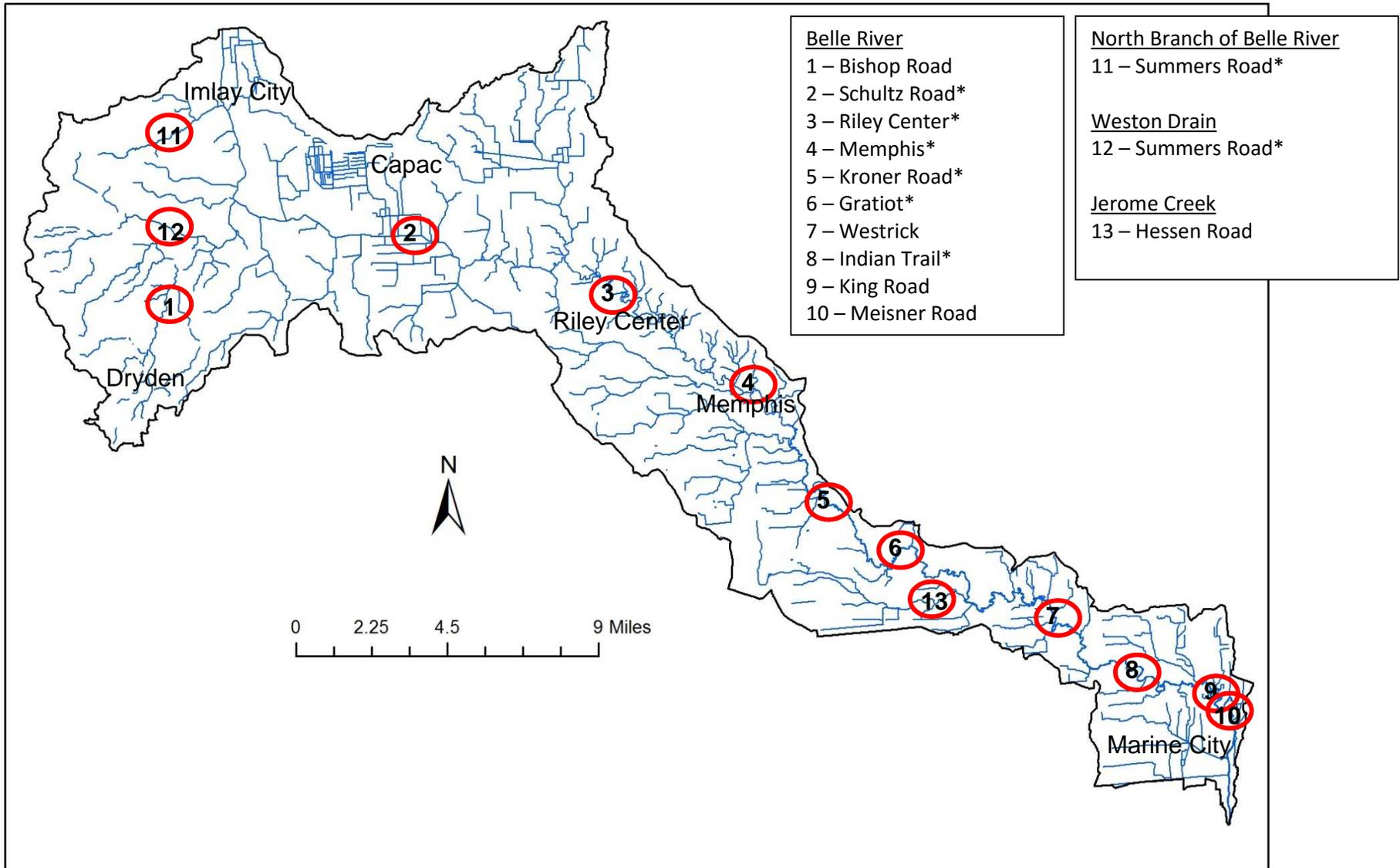


Figure 2.-Map of the Belle River watershed, with locations where fish surveys were conducted in 2008. Sites indicated with an asterisk also had temperature data collected in 2010.

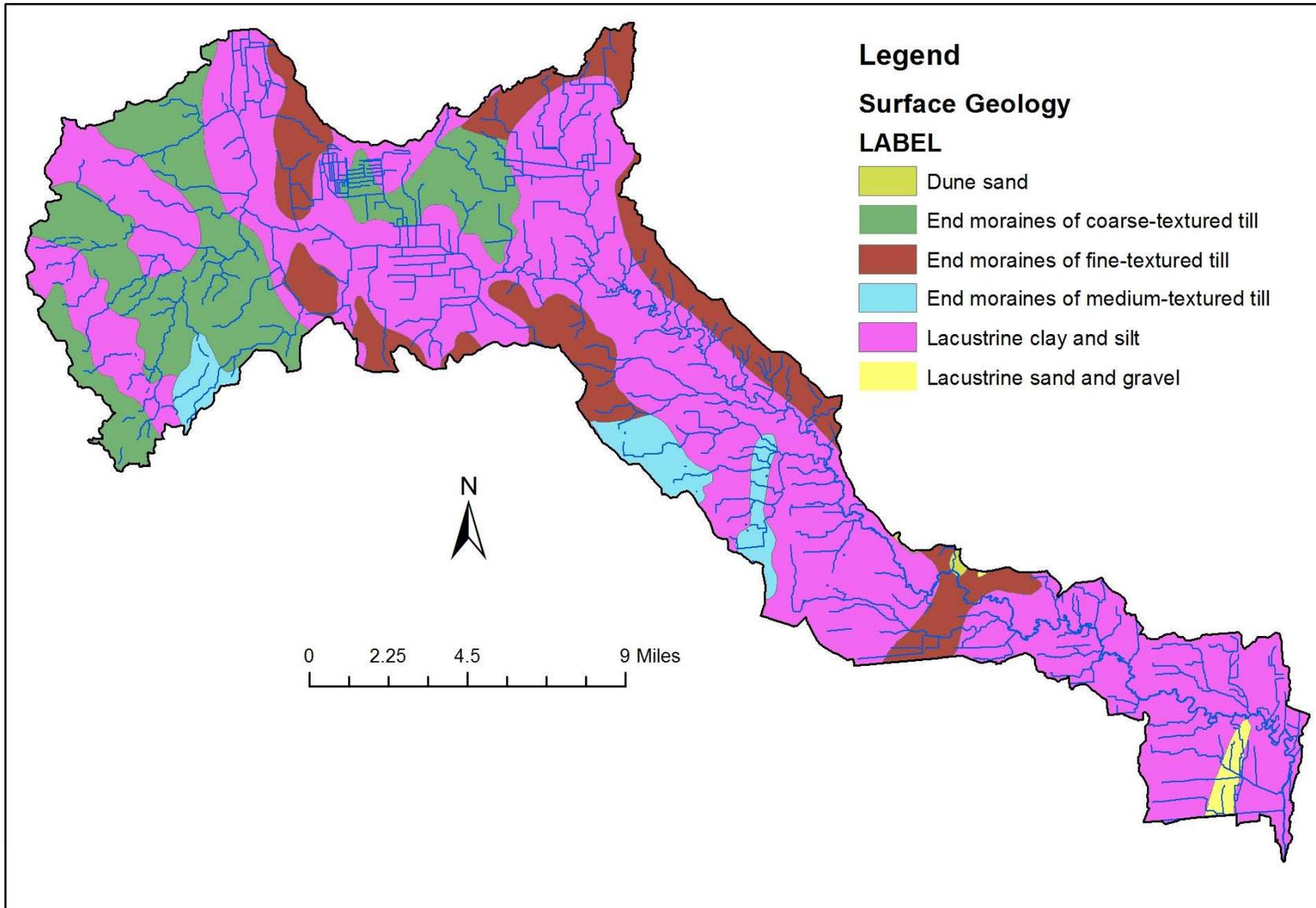


Figure 3-Surface geology map of the Belle River watershed.

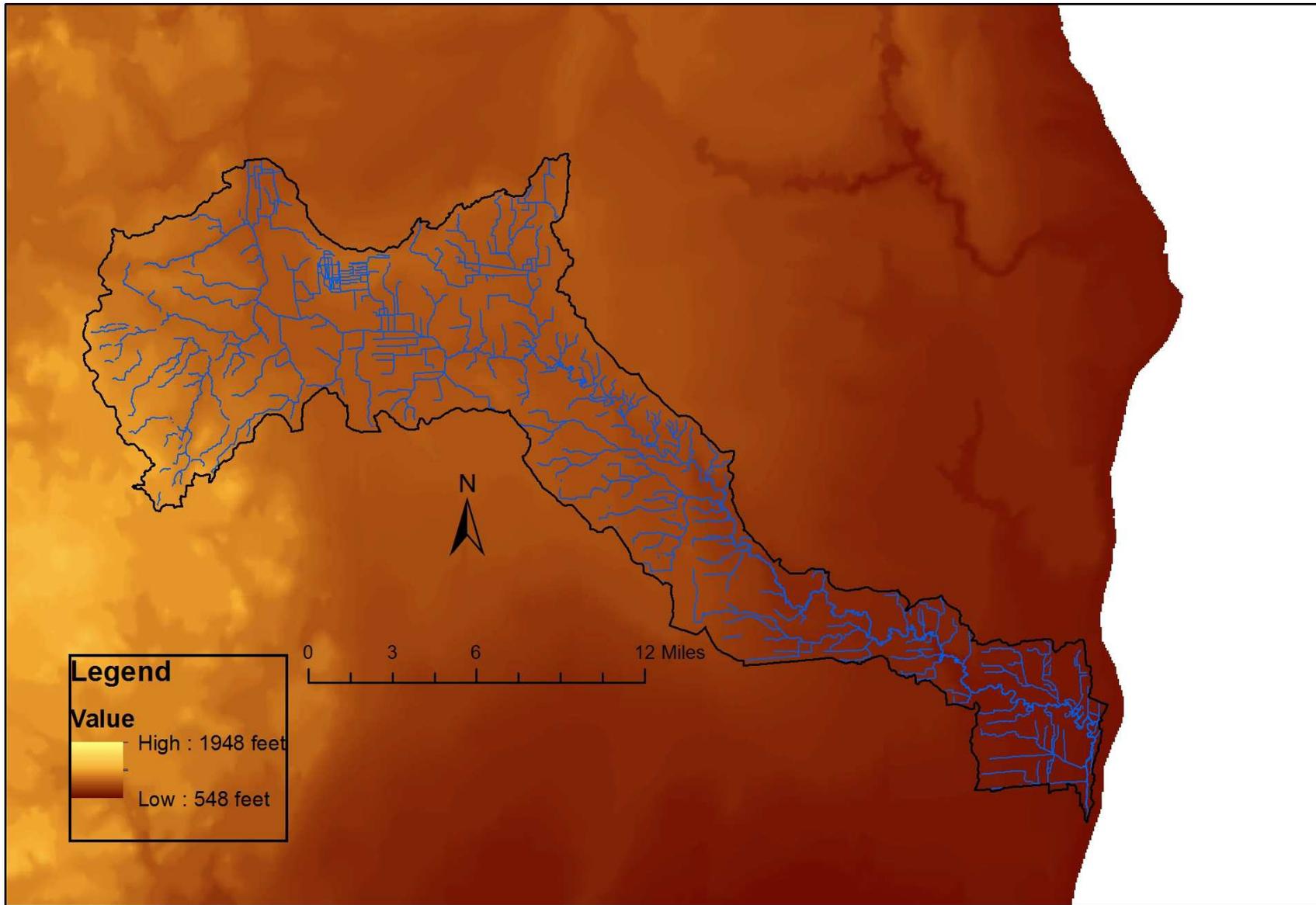


Figure 4.-Digital Elevation Model of the Belle River watershed.

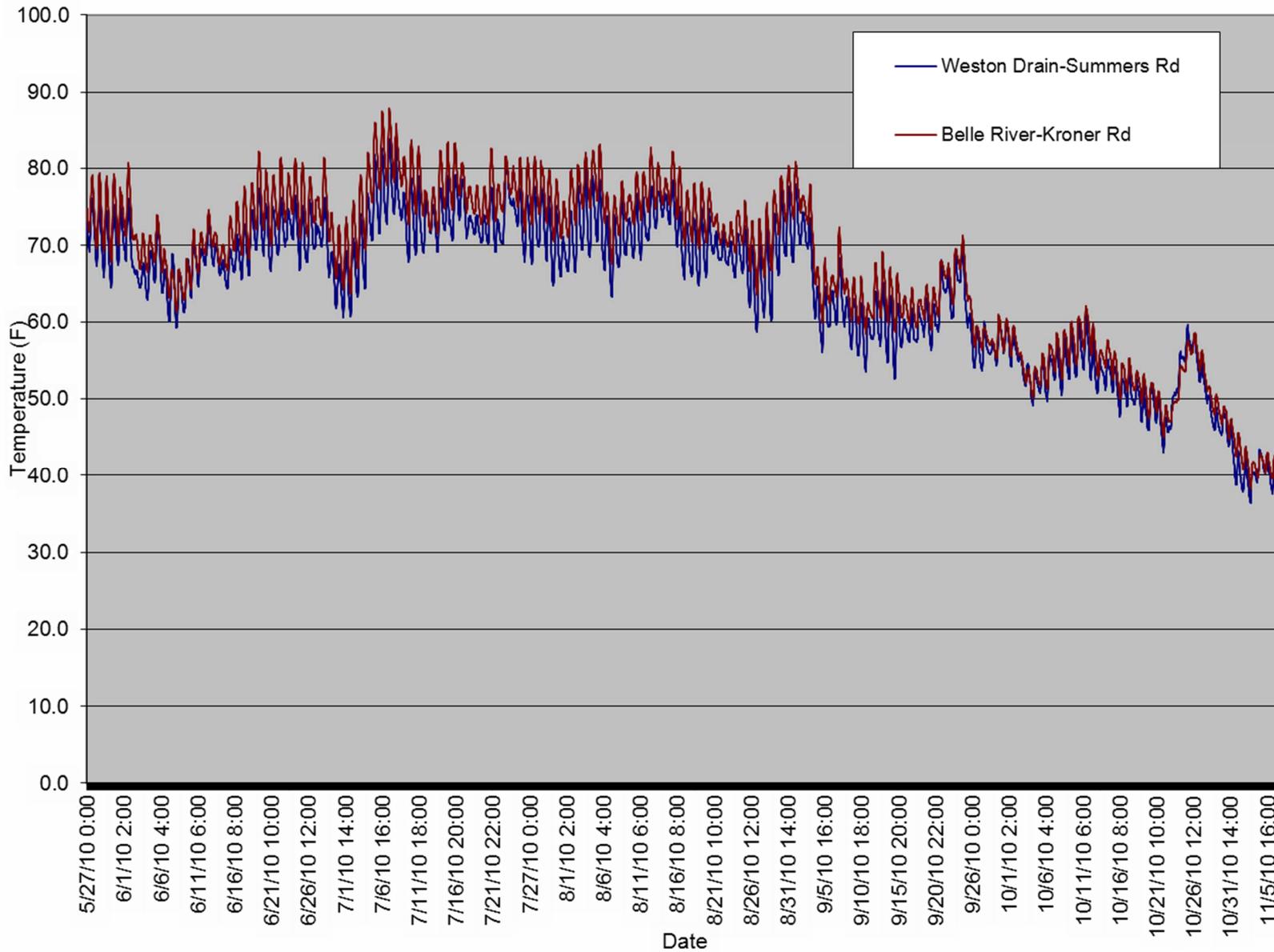


Figure 5. Water temperature from the Belle River.