Minnesota Department of Natural Resources
Division of Fish and Wildlife
Section of Fisheries

Stream Survey Report

Three Mile Creek
2011

By

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SUMMARY

Three Mile Creek is a designated trout stream with its headwater located approximately 2.5 miles northwest of the city of Fairhaven in southeastern Stearns County, Minnesota. It flows 8.7 miles into Otter Lake and eventually into the Clearwater River and then the Mississippi River. The stream has an agricultural watershed of 9,673 acres. An initial survey was conducted in 1977 and this was the first survey since 1999.

Rosgen stream classification in 2011 classified the upper reach as a C5 channel, which is very susceptible to shifts in both lateral and vertical stability caused by direct channel disturbance and changes in the flow and sediment regimes of the contributing watershed. The lower reach was classified as an E4 channel, which is stable unless the stream banks are disturbed, and significant changes in sediment supply and/or streamflow occur.

Stream temperatures sampled in 2010 were favorable for trout survival in the upper reach, with less than 1% of the readings above 68°F. However, the lower reach was less favorable for brook trout survival, with 9% of the readings above 68°F and 34% above 64°F. The relatively high percentage of readings above 68°F combined with the extreme temperature changes indicates that conditions are unstable and not favorable for brook trout survival throughout the lower reach of the stream.

Sixteen fish species were captured in 2011 via backpack electrofishing, dominated in number by brassy minnow (30%), fathead minnow (17.5%), central mudminnow (9.4%) and Johnny darter (9%). Northern pike (27%) dominated the sample by weight, followed by creek chub (23.2%), brassy minnow (15.4%), central mudminnow (7.2%) and white sucker (6.4%).

STUDY AREA

Three Mile Creek is a designated trout stream with its headwater located approximately 2.5 miles northwest of the city of Fairhaven in southeastern Stearns County. The stream flows 8.7 miles and empties into Otter Lake (Figure 1). Three Mile Creek has a gradient of 14.7 ft/mi and a sinuosity of 2.12. The stream has a watershed of 9,673 acres with estimated land uses of 62.1% agriculture (crops/pasture), 23.2% forest, 5.4% wetland, 4.6% shrub grassland, 3.1% developed, and 1.6% open water (Table 1; Figure 2).

Three Mile Creek was designated as a trout stream in 1951 and was stocked annually with 150 – 300 yearling brook trout from 1951 – 1979. No stocking has occurred since 1979 primarily due to the lack of angler easements and access. An initial survey was conducted in 1977 with subsequent fish surveys conducted in 1983, 1984 and 1999. Temperature profiles were conducted in 1980, 1999, 2001, and 2010. Through all of these surveys only one brook trout has ever been sampled in Three Mile Creek.

METHODS

Analysis of land use and map production was performed using ArcMap 10 and the 2001 international land use/land cover data. Rosgen stream classification (Rosgen 1996) was performed at two sites within the stream (Figure 3). Stream classification measurements included the calculation of slope, sinuosity, entrenchment ratio (flood prone width relative to stream channel width), and pebble count. Elevations were recorded using a Trimble Spectra Precision Laser (model LL200-4) level. RiverMorph© 4.3 software was used to analyze the data and calculate stream classifications (Stream Restoration Software (2001-2011). Water temperatures were measured using a Hobo Pendant® temperature data logger model UA-001-08 at two sites within the stream (Figure 3). The data loggers were set to collect temperatures hourly. Data was used to evaluate minimum, maximum and daily fluctuation in temperature between May 1, 2011 and September 30, 2011.

Fish were sampled using both Halltech HT 2000 and Smith Root BP-15D backpack electrofishing units, using pulsed direct current, at three sampling stations established during the 1999 survey (Figure 3). All fish were enumerated, identified and bulk-weighed by species.

RESULTS

Temperature monitors were deployed to collect hourly readings from May 1 through September 30, 2011. Unfortunately, problems occurred and no data was collected in 2011. The upper temperature logger had a fatal error and did not record any temperature data and the lower monitor was never found. High water during the spring and early summer likely washed the lower logger downstream. It was not recovered. Due to the lack of 2011 data, this report summarizes the temperature data collected during the 2010 season for these same two sites. At the upper site, a total of 3,672 readings were taken between May 1 and September 30, 2010 with 4.3% and 0.1% of the readings above 64°F and 68°F, respectively (Figure 4). Hourly temperatures in the upper site ranged from 41.8°F to 68.1°F with an average temperature of 56.1°F (Table 2). At the lower site, 3,612 readings were taken between May 1 and September 30, 2010 with 34% and 9% of the readings above 64°F and 68°F, respectively (Figure 4). Hourly temperatures in the lower site ranged from 41.1°F to 75.0°F with an average temperature of 60.4°F (Table 2). There were also extreme temperature changes (10 – 15°F daily) that took place during a typical summer day in this reach.

Rosgen stream classification was performed at two stations along the length of the stream (Figure 3). The upper station was located upstream of the County Road 7 road crossing, approximately 1.5 miles downstream of the headwaters. This station was slightly entrenched (2.3), had a high width/depth ratio (15.6) and high sinuosity (2.12). The substrate within this cross section had a D_{50} particle size classified as fine sand (0.25 mm). Fines (sands or silts) made up 86.2% of the cross sectional pebble count. The station was classified as a C5 stream type (Table 3). This stream type is very susceptible to shifts in both lateral and vertical

stability caused by direct channel disturbance and changes in the flow and sediment regimes of the contributing watershed (Rosgen 1996).

The lower station was located upstream of the CR 45 road crossing (Figure 3), approximately three miles downstream of the headwaters. This station was slightly entrenched (6.6), had a very low width/depth ratio (8.2), and had very high sinuosity (2.12). The substrate within this cross section had a D_{50} particle size classified as medium gravel (8.5 mm). Fines made up 15.7% of the cross sectional pebble count. The station was classified as an E4 stream type (Table 3). This stream type is a hydraulically efficient channel form and maintains a high sediment transport capability. E4 channels are very stable unless the stream banks are disturbed and significant changes in sediment supply and/or streamflow occur (Rosgen 1996).

Fish sampling using backpack electrofishing collected sixteen species in 1.23 hours of electrofishing. Less than 5% of the total length of the stream was electrofished (Table 4). Numbers were dominated by brassy minnow (30%), fathead minnow (17.5%), central mudminnow (9.4%), and Johnny darter (9%; Table 5). Total weight was dominated by northern pike (27%), creek chub (23.2%), brassy minnow (15.4%), central mudminnow (7.2%) and white sucker (6.4%; Table 5). Intolerant species only made up 11% of the sample while tolerant species made up 37% of the sample (Table 5). Other species sampled included: blacknose shiner, brook stickleback, green sunfish, Iowa darter, largemouth bass, northern redbelly dace, pumpkinseed, sand shiner, and yellow perch.

DISCUSSION

Land use practices within the Three Mile Creek watershed have remained largely agricultural from 1977 to 2011. Previous surveys (MNDNR 1977, 1984) indicated that agriculture (row crops and pasture) was the dominant land use and that held true in 2011.

Temperature data at the upper site indicate that favorable conditions exist for brook trout in this upper reach. Favorable conditions for brook trout include a stable temperature profile

with areas that allow refuge from temperatures above 68°F (Scott and Crossman 1979). Relatively few readings above 68°F indicate that favorable conditions exist for brook trout in this upper reach. Less than 1% of the readings in this area were above 68°F and less than 5% of the readings were above 64°F. However, this covers less than one fifth of the entire stream length. Water temperatures at the lower site indicate that water temperatures routinely exceed 68°F during the summer. This area also experiences extreme daily temperature fluctuations. These conditions indicate that water temperatures are too unstable for brook trout survival in this area and throughout most of the remaining stream.

Stream classification in 2011 indicated that the upper station (C5 stream type) is very susceptible to shifts in both lateral and vertical stability caused by direct channel disturbance and changes in the flow and sediment regimes of the contributing watershed (Rosgen 1996). The lower station (E4 stream type) indicates that this area is relatively stable; however, this area is just upstream of a large cow pasture which has disturbed much of the stream bank and has created some braided channels just downstream of the site. Rosgen (1996) indicated that this channel type is very stable unless the stream banks are disturbed, and significant changes in sediment supply and/or streamflow occur. This area will likely become more unstable over time with continued cattle grazing.

Since the initial survey in 1977, 22 different fish species have been documented within Three Mile Creek. Electrofishing in 2011 sampled 16 species, of which six were classified as tolerant and two as intolerant. All species sampled in 2011 were also sampled in 1984. Brook trout were annually stocked from 1951 – 1979; however, only one brook trout has ever been sampled in Three Mile Creek and that was collected in 1983.

Management Implications

The 1977 survey recommended that trout stocking be discontinued due to lack of habitat as well as lack of angler easements and access. In 1984, a casual inquiry was made of riparian land owners to purchase angler easements and met with little interest. Based on water temperature data, the only area suitable for brook trout survival exists in the upper two miles of Three Mile Creek. Limiting factors for the stream continue to be channelization, marginal water temperatures throughout most of its length, and seasonal populations of other piscivores, especially in the lower part of the stream. Based on temperature data and the lack of interest by landowners to sell angler easements, it is still recommended that neither brook trout nor brown trout be stocked into Three Mile Creek.

REFERENCES

RiverMorph, LLC. (2011) RiverMorph (stream restoration software – professional edition), version 4.1.1 www.rivermorph.com. Copyright © 2001 – 20111 RiverMorph LLC, Louisville, KY.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Scott, W. B. and E. J. Crossman. 1979. Freshwater Fishes of Canada. Department of Fisheries and Oceans, Scientific Information and Publications Branch. Ottowa, Canada.

Three Mile Creek Survey. 1977, 1983, 1984, 1999. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Fisheries, St. Paul.

Table 1. Three Mile Creek (M-71-2) watershed estimated land use.

Land Use	Percent*
Cultivated Crops	50.7
Pasture	11.4
Forest	23.2
Developed	3.1
Grassland Shrub	4.6
Wetland	5.4
Open Water	1.6

* Based on 2001 National Land Cover Data

Table 2. Summary of Three Mile Creek (M-71-2) temperature data (recorded hourly) from two locations between May 1 and September 30, 2010.

Station	Min	Avg	Max	Readings	N[1] > 64°F	N[1] > 68°F
Upper	41.8	56.1	68.1	3,672	157	3
Lower	41.1	60.4	75.0	3,612	1,212	315

[1] Number of hourly observations recorded above 64°F and 68°F, respectively.

Table 3. Results of Rosgen classification sites for Three Mile Creek (M-71-2) sampled during Fall 2011.

Parameter	Upper station	Lower Station
Bankfull width (ft)	16.89	12.01
Mean depth@ bankfull (ft)	1.08	1.46
Cross sectional area (ft^2)	18.22	17.53
Max depth @ bankfull (ft)	1.61	2.57
Flood prone width (ft)	38.79	78.82
Width/depth ratio	15.64	8.23
Entrenchment ratio	2.3	6.6
Water surface slope (ft/ft)	0.003	0.002
Sinuosity	2.12	2.12
Pebble count D_{50} (mm)	0.25	8.47
% fines	86.2	15.7
Stream type	**C5**	**E4**

Table 4. Electrofishing station information and physical data sampled from Three Mile Creek (M-71-2) on September 16 – 19, 2011.

Station	Length (m)	Length (ft)	Effort (sec)	Water Temp (°F)	Dissolved Oxygen	Conductivity
EF 1	185	608	1,324	51.0	9.45	631
EF 2	171	562	1,934			
EF 3	161	527	1,177	54.2	8.66	602
Total	517	1,697	4,435			

Table 5. Species sampled by backpack electrofishing from Three Mile Creek (M-71-2) on September 16 – 19, 2011.

Species	Site 1	Site 2	Site 3	Total	CPUE (#/hr)	Bulk Weight (g)	Length Range (mm)
Blacknose shiner[1]	14		25	**39**	31.7	29	44 – 54
Brassy minnow			217	**217**	176.4	480	55 – 70
Brook stickleback[2]	6		9	**15**	12.2	15	35 – 58
Central mudminnow[2]	12	23	33	**68**	55.3	225	34 – 107
Creek chub[2]	3	9	5	**17**	13.8	724	64 – 200
Fathead minnow[2]	31		96	**127**	103.3	123	46 – 72
Green sunfish[2]		1		**1**	0.8	11	82
Iowa darter[1]		14	26	**40**	32.5	52	35 – 56
Johnny darter	27	38		**65**	52.8	146	52 – 75
Largemouth bass	12	11	5	**28**	22.8	116	54 – 88
Northern pike		17		**17**	13.8	840	169 – 248
Northern redbelly dace	8	1	21	**30**	24.4	51	41 – 62
Pumpkinseed		5		**5**	4.1	64	79 – 95
Sand shiner	1			**1**	0.8	1	64
White sucker[2]	1	2	37	**40**	32.5	199	64 – 149
Yellow perch		12	2	**14**	11.4	38	54 – 102
Total	**115**	**133**	**476**	**724**	**588.6**	**3,114**	

[1] Intolerant species
[2] Tolerant species

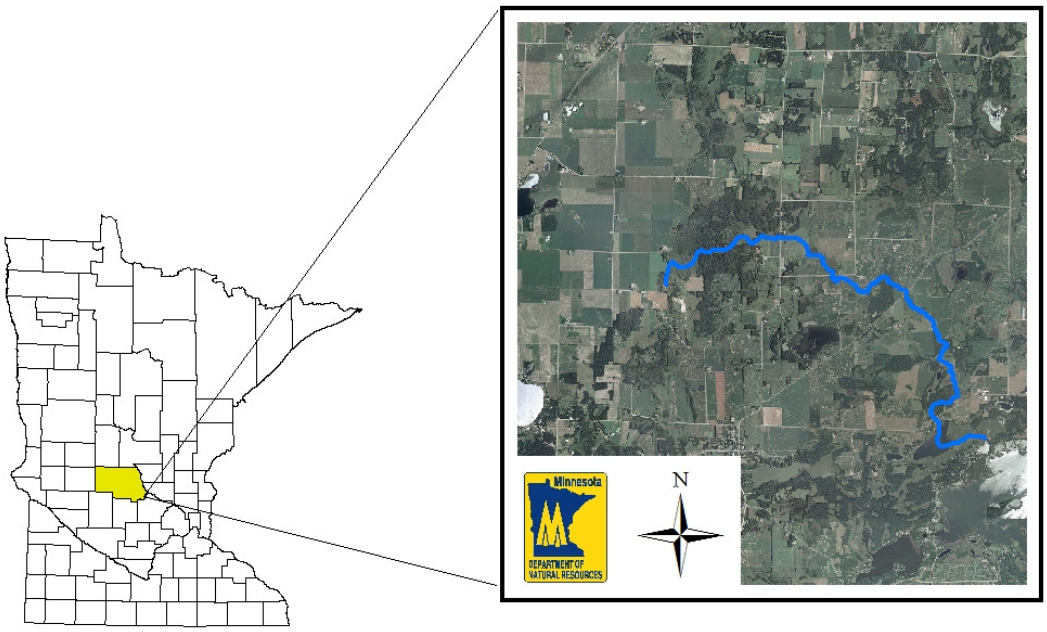


Figure 1. Location of Three Mile Creek (M-71-2), Stearns County, Minnesota.

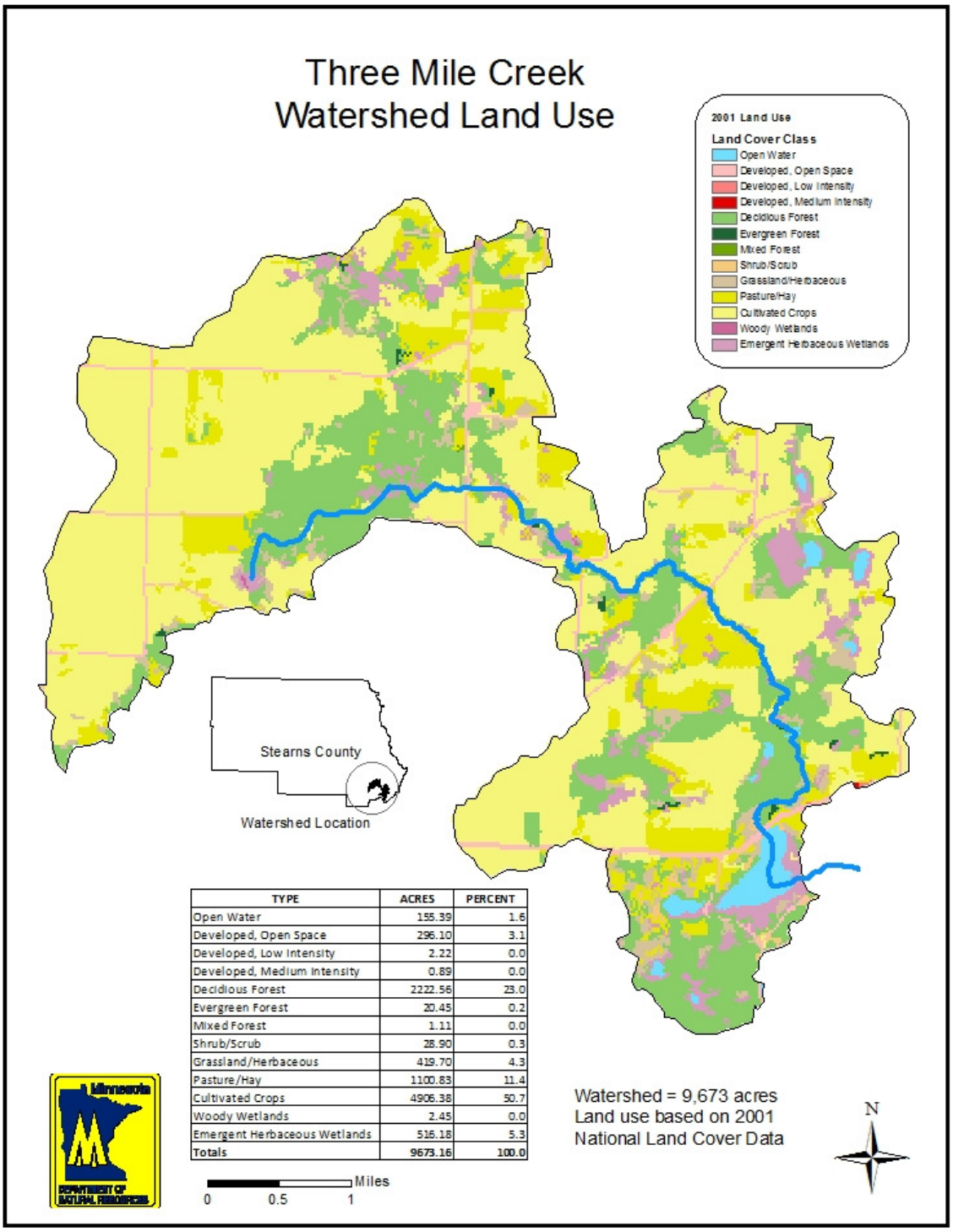


Figure 2. Three Mile Creek (M-71-2) watershed land use estimates based on 2001 National Land Cover Data.

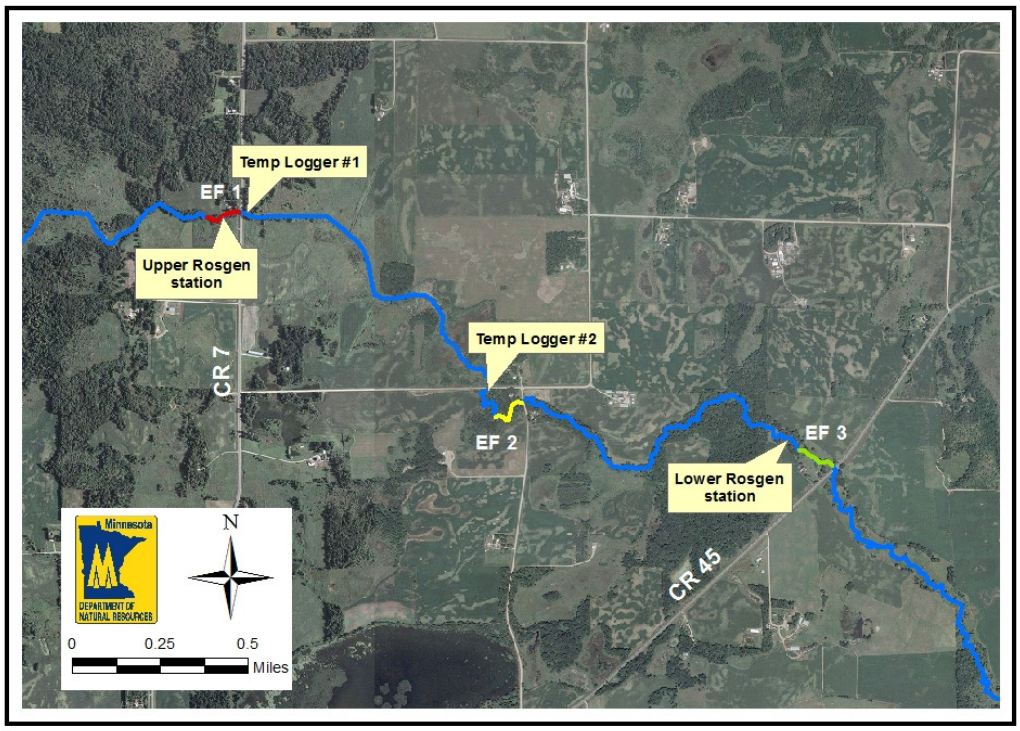
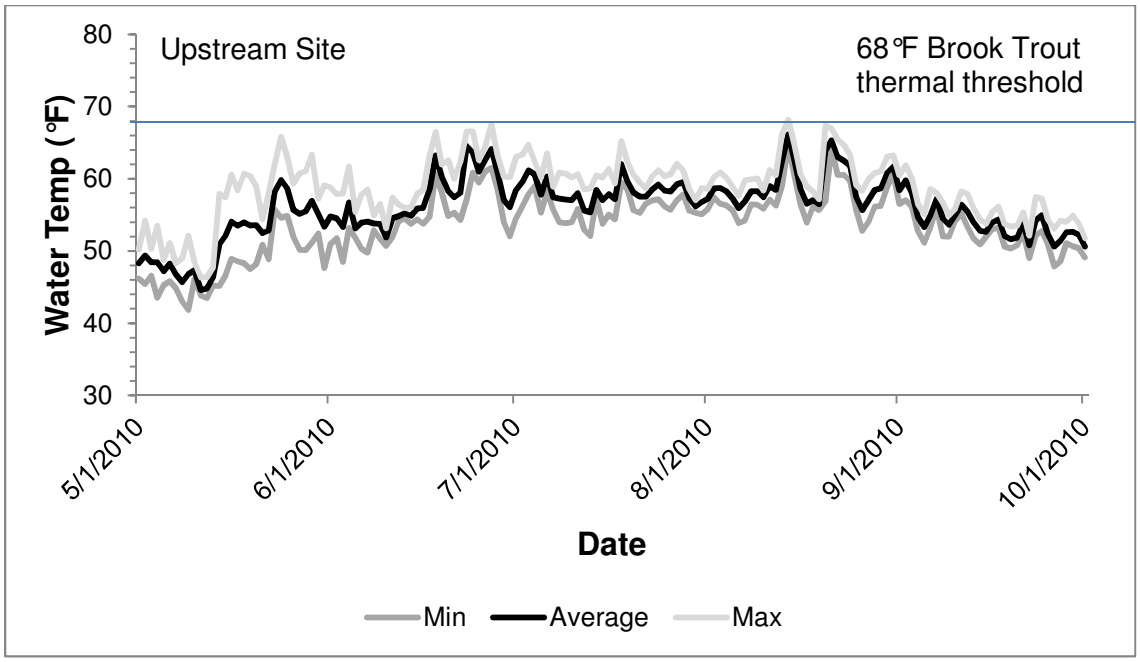


Figure 3. Location of electrofishing, temp logger, and Rosgen classification sites on Three Mile Creek (M-71-2), 2011.



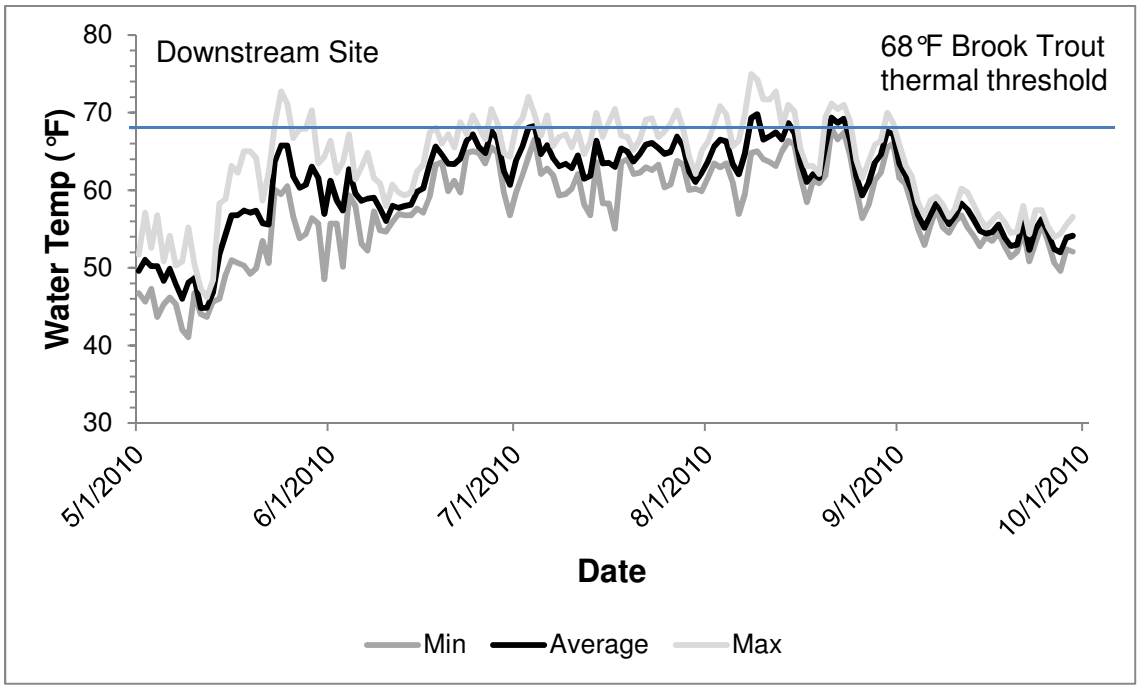


Figure 4. Mean daily temperatures (° F) recorded by a Hobo Pendant temperature monitor located at two sites in Three Mile Creek (M-71-2) from May 1 through September 30, 2010.

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