River Temperature Changes in a Northern Michigan Watershed

By: James Gerberding, and Lucas Frazier (Lake Superior State University)
Tim Cwalinski (Michigan Department of Natural Resources)

River temperatures are a key component in Michigan streams that dictate fish species distribution, abundance, and growth. This is particularly true for trout. For brook trout, summer water temperatures above 72° Fahrenheit for extended periods of time are linked to declines in abundance. This article describes trends in temperature data of sections of the mainstream and East Branch Black River, which are in the northern Lower Peninsula of Michigan (Figure 1). It also provides baseline temperature analysis that can be compared to future data. The months of focus for this data are June, July, and August since water temperatures for the Black River watershed rarely reach 72°F outside of this timeframe. The Upper Black River Council and Michigan Department of Natural Resources have cooperated at collecting hourly summer temperature data at many sites in the Black River watershed for the last 10-15 years. For this study, we will focus on seven of these sites (Figure 2).

Brook trout are a freshwater fish that can be found in the primary branches of the Black River watershed, which include the mainstream, the East Branch Black, and Canada Creek. Extended water temperatures from 68-71°F are stressing on brook trout, while extended temperatures above 72°F can lead to extreme stress and force this species to seek thermal refugia (groundwater seeps) either locally, or to migrate to colder sections of the river. Sometimes this migration is not possible due to physical barriers. For the reaches of stream analyzed in this document, summer upstream brook trout migration is likely for trout in the downstream reaches of the mainstream Black River.

Figures 3 and 4 demonstrate the number of summer days by year when sites reached the 72°F mark at least one time during a given day. These seven river sections are all in good shape and two of the sites (Clark Bridge and Crockett Rapids) are naturally warmer in the summer since they are the furthest downstream.

Figures 5 and 6 specifically show Clark Bridge and Crockett Rapids sections in the mainstream Black River. There is obvious temperature variability from year to year, which is a result of a number of factors including winter and summer ambient temperatures, and warm summer precipitation. Some suggest climate change will impact

our Michigan trout streams over a period of decades and centuries. These are graphs that can be updated as time progresses to see if these periods of warm temperatures have a significant impact on stream temperatures.

Figures 7 and 8 demonstrate the average amount of hours in a day that temperatures reached above 72°F at the two downstream sites on the mainstream Black River. Even with the colder temperatures in 2014, the average time temperatures persisted above 72°F was relatively the same among years. At Crockett Rapids Bridge (Figure 8), 72°F is typically attained for 8-10 hours in the day at the hottest periods in the summer. This is a considerable amount of time in the day when temperatures are at a stress level for brook trout. It also explains why brook trout densities are higher in this reach in the spring and fall, and much lower in the warmer summer months.

This data was examined as a student research project for LSSU, with data provided by MDNR. It can be used as a baseline for maximum temperature thresholds when considering suggested future climate changes. Analyzing these changes in river temperatures could help show effects of climate changes on them and give reasoning on to why this climate change could alter sensitive ecosystems.

REFERENCES

"Brook Trout." National Parks Service. U.S. Department of the Interior, n.d. Web. 24 Mar. 2017.

River Temperature Data for the Black River watershed, northern Michigan 2005-2016. Michigan DNR.

Figure 1. Approximate location of the upper Black River watershed in the northern Lower Peninsula depicted by denoted box.

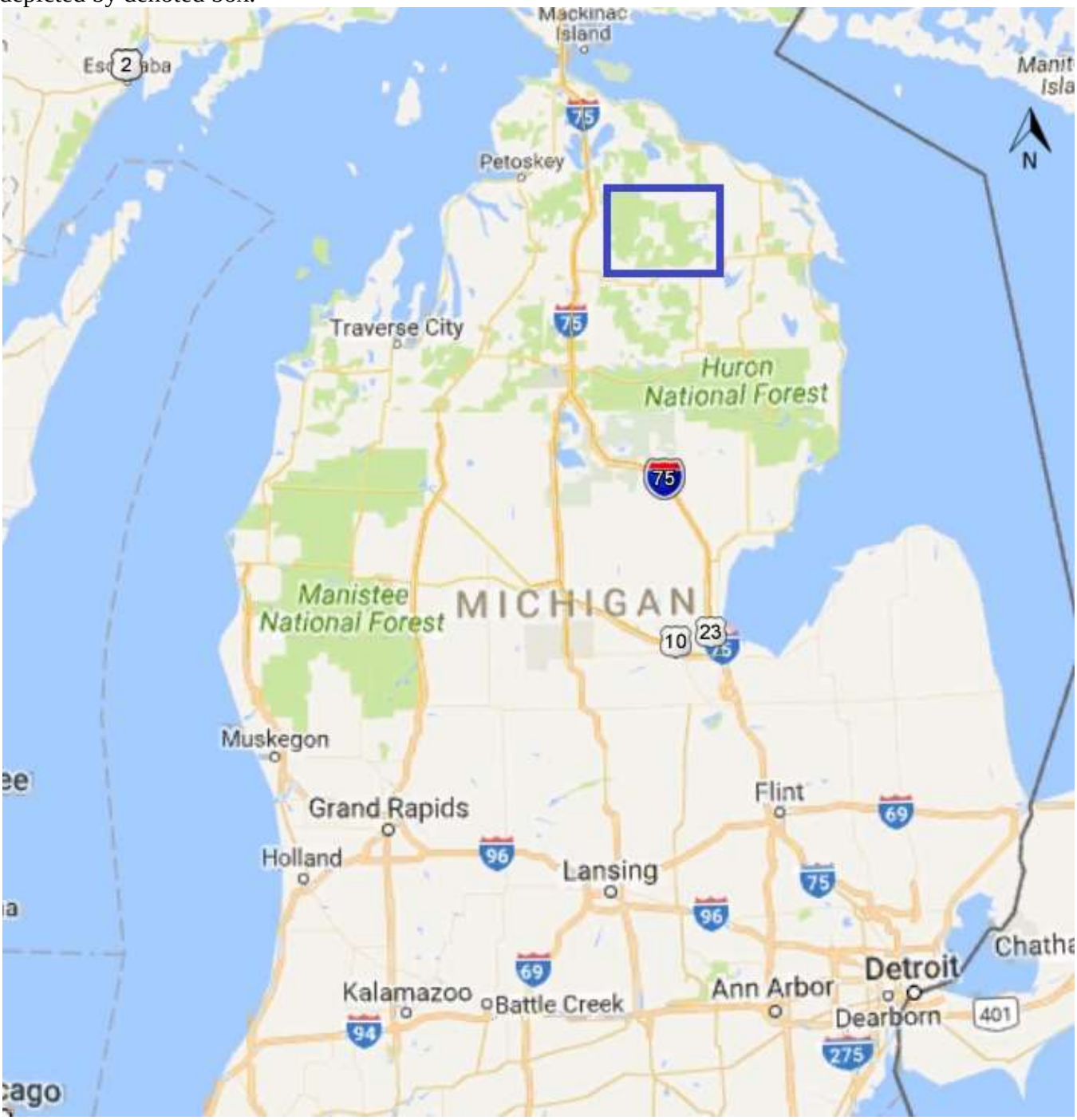


Figure 2. Approximate locations of the temperature sampling sites.

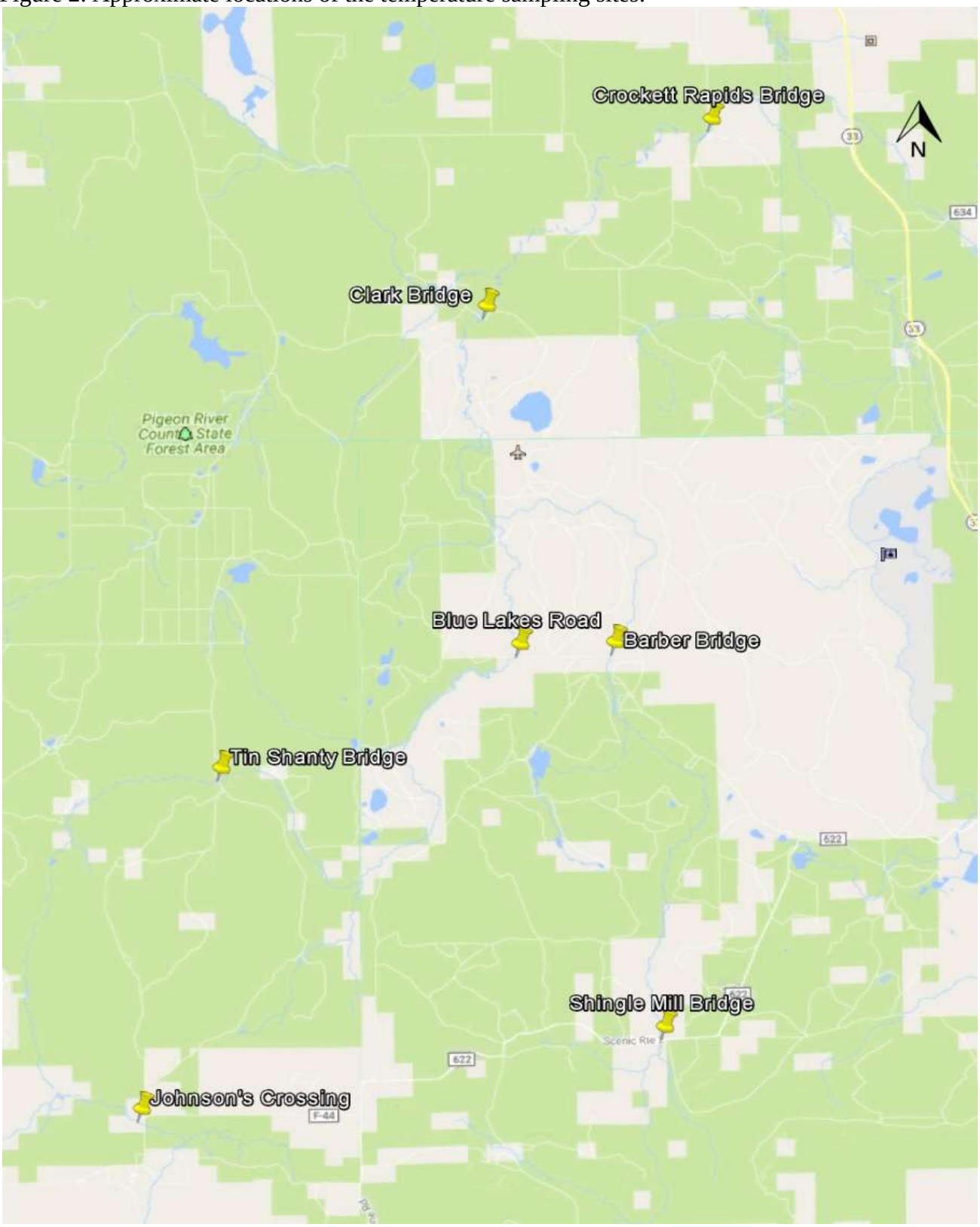


Figure 3. The number of days during the summer months of the year when the water temperature rose above 72°F in the Mainstream Black River.

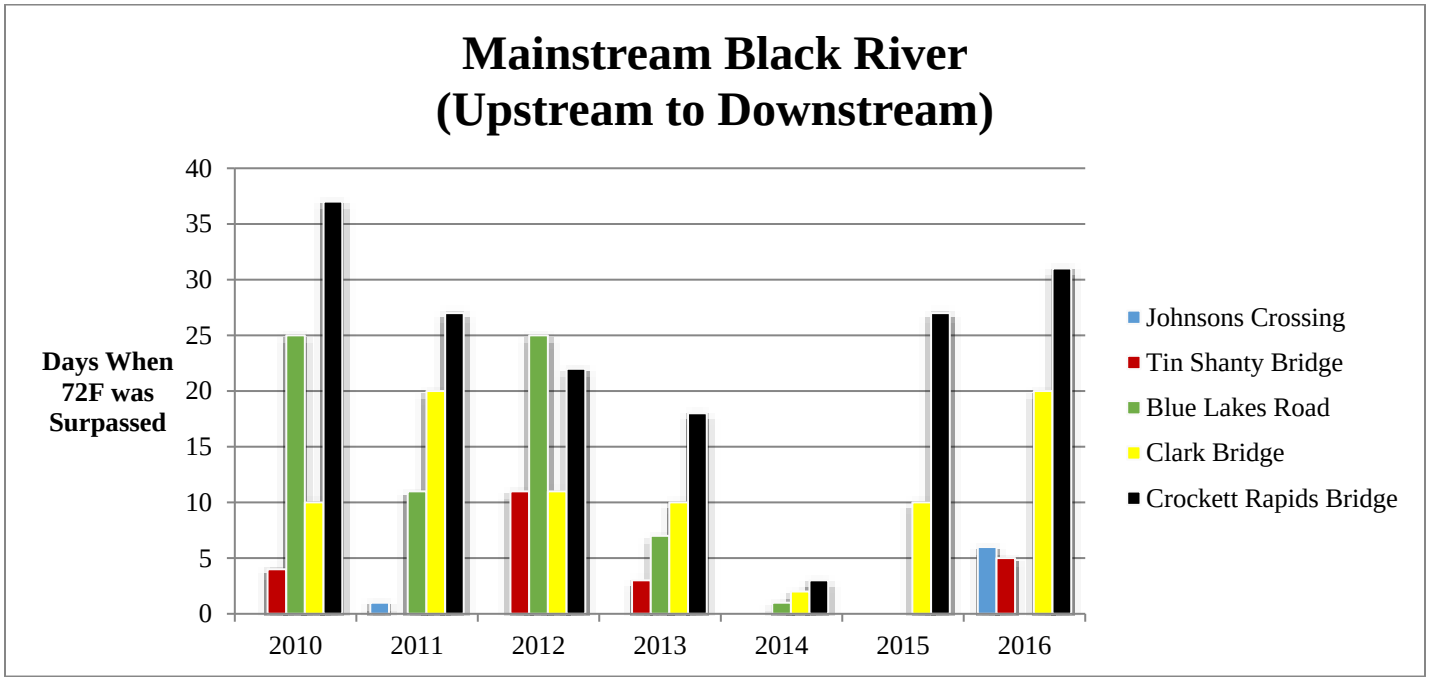


Figure 4. The number of days during the summer months of the year when the water temperature rose above 72°F for the East Branch Black River.

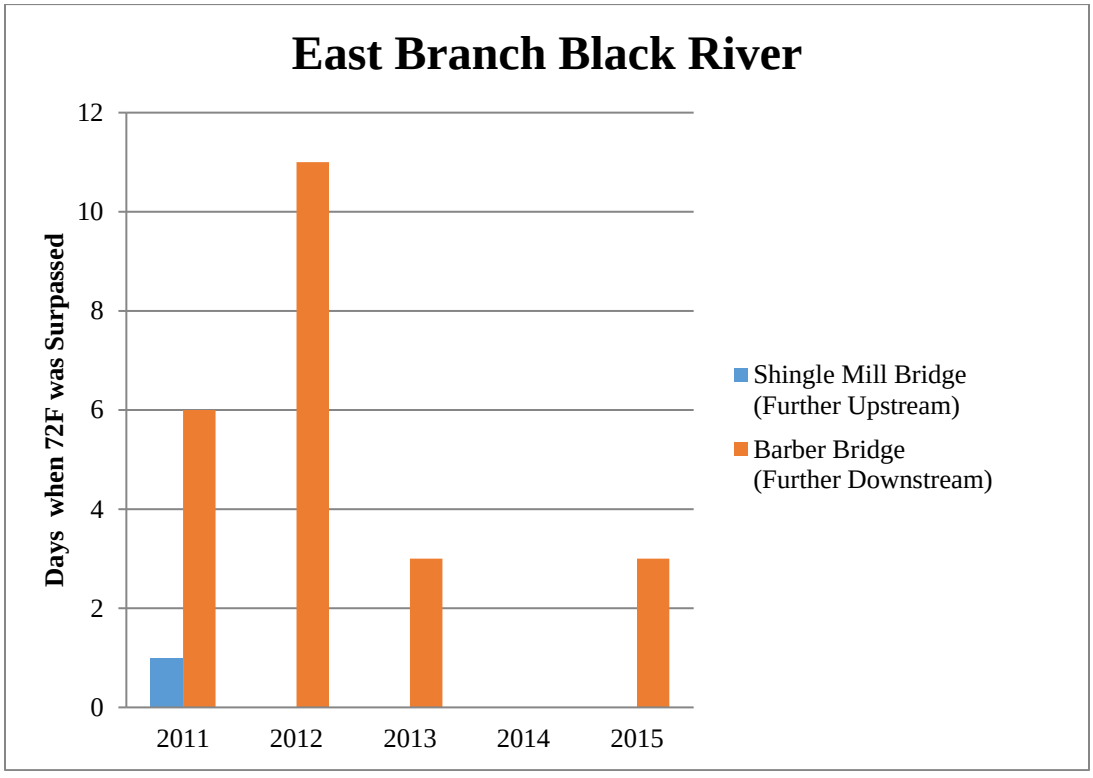
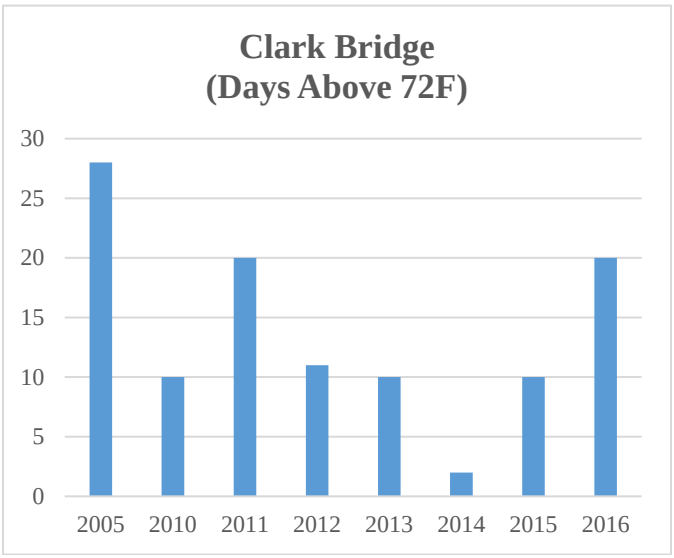


Figure 5 (left) and Figure 6 (right). These graphs show the number of days during the summer months of the year when the water temperature rose above 72°F for the Clark Bridge and Crockett Rapids sections of the mainstream.



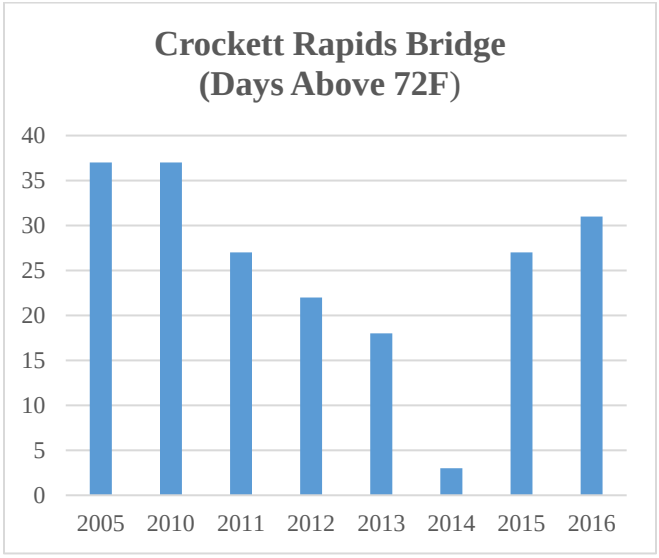


Figure 7 (left) and Figure 8 (right). Show the average time, in hours, the temperature persisted above 72° Ffor the Clark Bridge and Crockett Rapids sections of the mainstream.