

# 2010 EAGLE CREEK TEMPERATURE STUDY

## ANNUAL REPORT



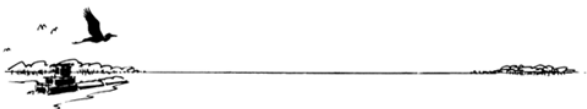
Prepared for:

**Lower Minnesota River Watershed District**

By: Scott Soil and Water Conservation District

February 2012

*Lower Minnesota River Watershed District*



**Background:** This study was initiated by the Lower Minnesota River Watershed District (LMRWD) to evaluate the impact storm water runoff from Highway 101 has on temperatures of Eagle Creek, a DNR designated trout stream. Temperature loggers were placed upstream and downstream of Highway 101 by Bonestroo in June of 2006 (see Figure 1), and have been recording stream temperature since that time. Scott Soil and Water Conservation District (SWCD) contracts with the LMRWD to collect and report the temperature data. The loggers record temperature in 15-minute intervals. Since trout are sensitive to temperature, it is a critical variable to monitor. The optimal temperature range for adult brown trout is approximately 12.4 – 17.6° Celsius (Bell, 2006). March through October, rainfall was recorded at the Watershed Outlet Monitoring Program (WOMP) Station (see Figure 1) and was used for this study. Precipitation was not recorded during January, February, or December.



**Figure 1.** Location of temperature loggers and WOMP station

**Results:** Under most conditions, temperature results track atmospheric temperatures. During winter months, the downstream water is cooler because it is exposed to cold air longer than upstream. During summer months, the downstream water is warmer because it is exposed to warm air longer.

During warm summer days, water temperatures occasionally exceed the optimal range for brown trout. This is likely due to hot air temperatures. However, more noticeable warming of water temperatures downstream of highway 101 also occur following some rain events, while the upstream logger does not respond as drastically (see Figure 2). This trend may in part be attributed to runoff caused by rain heating up after landing on and flowing across the hot pavement of Highway 101.

A second possible variable to consider is overflow from the pond located between Highway 101 and the railroad tracks, which discharges into Eagle Creek from the west (see Figure 3). The downstream temperature logger is located approximately 30 feet downstream of this input. This pond holds water which is likely warmed by a combination of solar energy and storm water inflow from the area south of Hwy 101. Large amounts of warm water may be released during rain events as the pond fills and overflows. An investigation conducted on August 19, 2009, during a 2-inch rain event (see Figure 3) shows numerous temperature monitoring locations on Eagle Creek upstream and downstream of the pond tributary, including the tributary itself. The temperature of Eagle Creek rises almost 2°C directly after the tributary discharges into Eagle Creek. The tributary water is almost 5°C higher than Eagle Creek. Temperature spikes appear to

be due less from direct Highway 101 runoff, but rather more significantly, a combination of the warm ponded water, runoff from Highway 101, and an increase of water volume leaving the pond. The temperature of the pond may not actually increase during storm events, but rather the volume of water discharging into Eagle Creek is perhaps the stronger influence on temperature rise. This greatly exceeds the small increase in temperature that typically occurs during dry periods that could be attributed to atmospheric warming of the stream. Even though the temperature exceeds the optimal range for brown trout by only a few degrees and for only a short period, these rapid temperature increases could be stressful to the brown trout population.

Water temperature is an important factor influencing the health of trout streams. Overall, water quality of Eagle Creek appears good. Brown trout are making a comeback (Peterson, 2008), water temperatures rarely exceed optimal brown trout range, and most of the riparian area is in a natural state. However, the state water quality standard for Class 2A waters maintain there shall be “no material increase” in temperature. Future monitoring will help track whether the planned road construction will reduce the temperature spikes in Eagle Creek following rain events.

**Notes for 2010:** 2010 was a year of record rainfall and floods. For instance, in the latter half of March and end of September, the MN River backed up into Eagle Creek (Figures 6-8). During the backwater conditions, the downstream temperatures became very erratic while upstream temperatures were quite muted (see figure 4). It is unclear why the downstream logger provided the erratic values, but both loggers reflected the temperature impacts of the MN River backwater.

Figure 9 shows mean daily temperatures. Monthly graphs displaying the raw 15-minute temperature values are provided following figure 9.

**Recommendations:** Since the loggers are nearing the end of their lifespan, new loggers could be installed in the same locations, plus one upstream of the pond tributary and possibly one in the tributary or pond. The upstream logger should be placed in a location less likely to get buried in sediment.

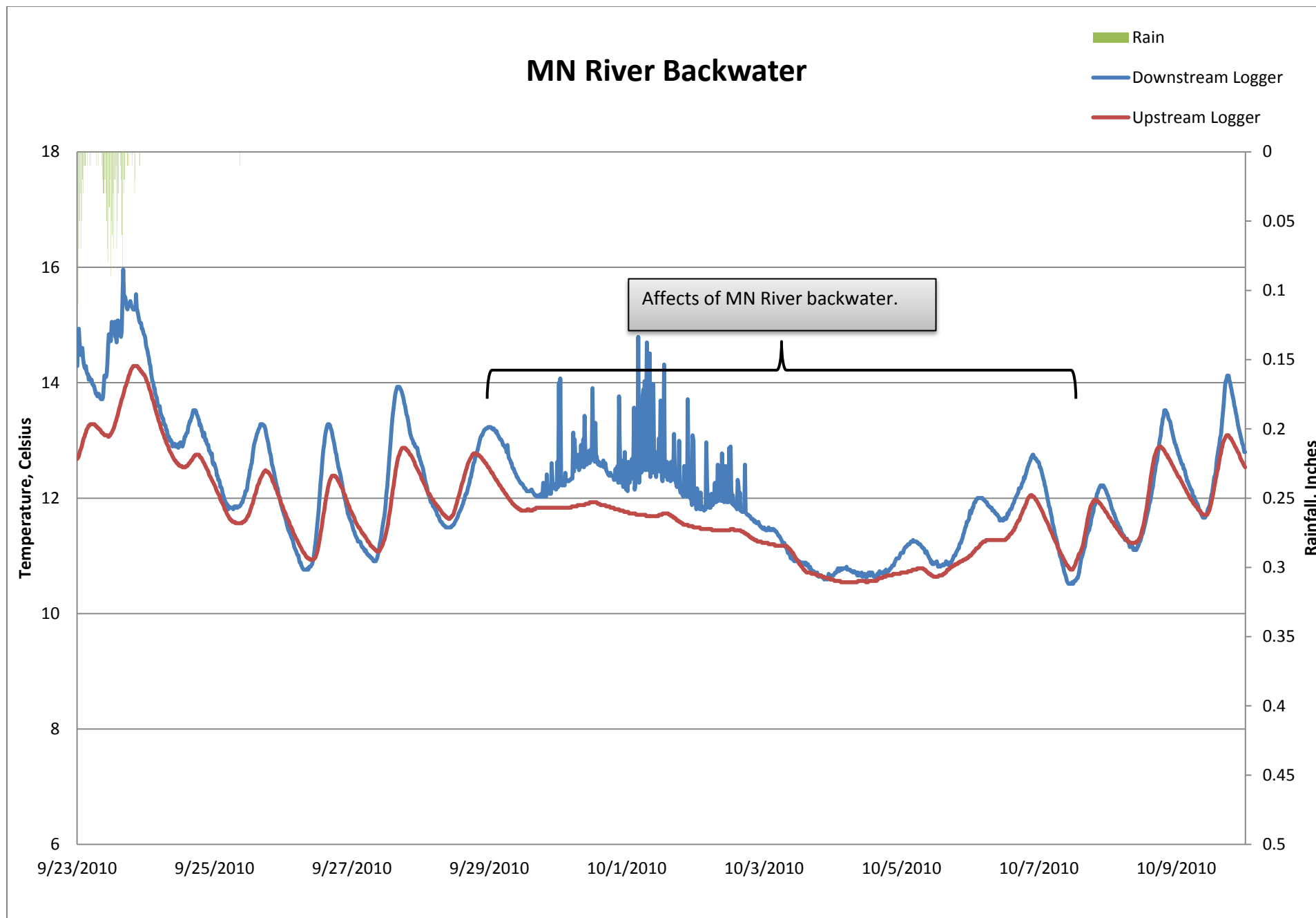
Road construction will be taking place on Highway 101 during 2011 and 2012, including the stretch of road that crosses Eagle Creek. Some runoff will be reduced to Eagle Creek and diverted to a storm water holding pond. By continuing monitoring efforts, the opportunity exists to determine how much influence the roadway has on stream temperature before, during, and after construction is complete.







**Figure 3. Investigative Temperature Monitoring During Rain Event.** White arrows indicate flow direction. Callouts indicate temperature values taken at approximately 4:00pm on August 19, 2009 during a 2" rain event. Notice temperature increase between (B) and (C). Tributary (E), which comes from the pond, is contributing warmer water than the direct contribution from Highway 101 (estimated that 5–10 cfs water coming from tributary during time of measurement).



**Figure 4 MN River backwater affects loggers.** During times of MN River backwater, the downstream logger was very erratic and the upstream temperatures muted.





**Figure 5** Normal conditions at downstream logger (logger under RR bridge)



**Figure 7** Upstream logger location during March 2010 flood



**Figure 6** March 2010 MN River Backwater at downstream logger



**Figure 8** Flooding near upstream logger during March 2010

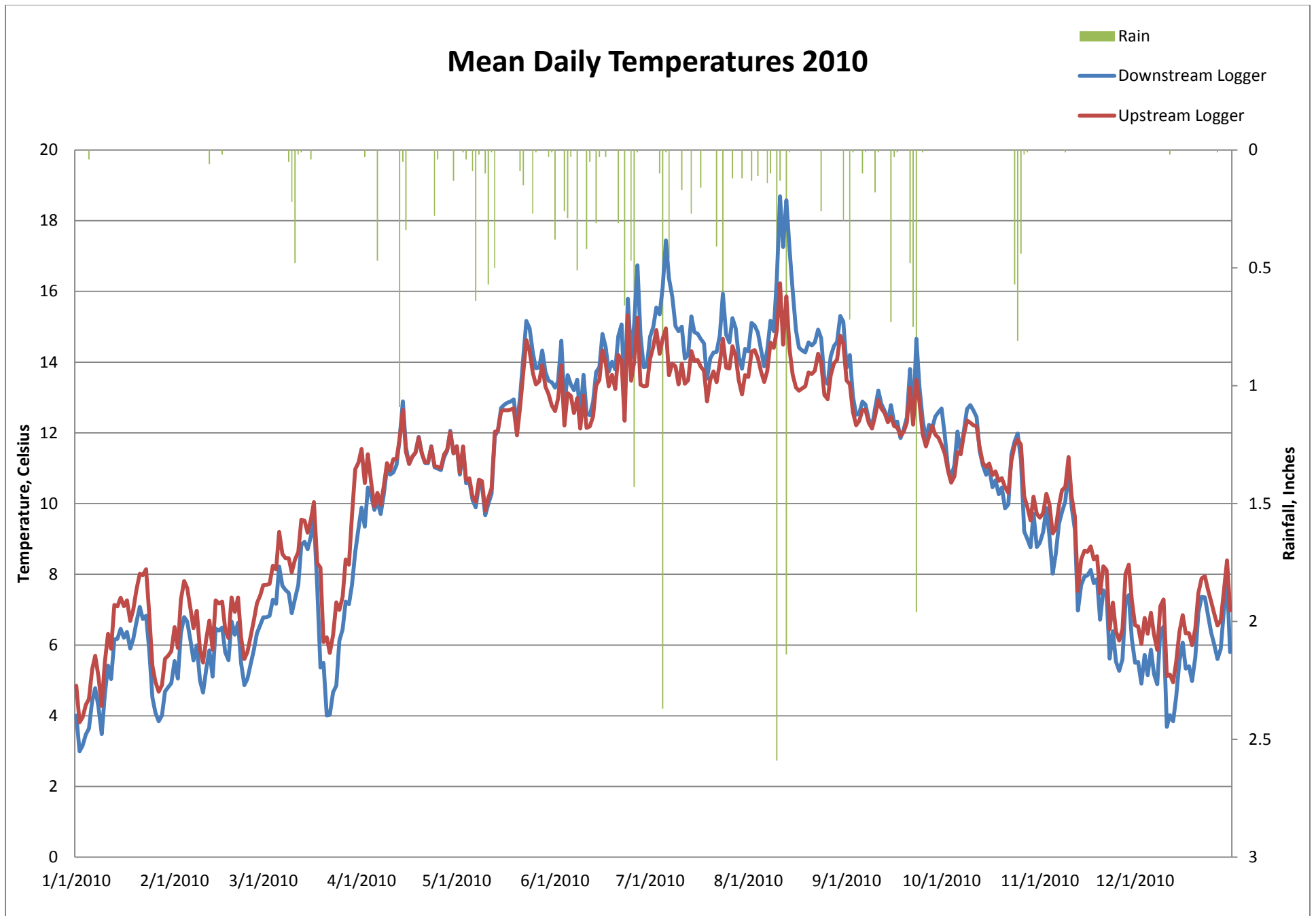
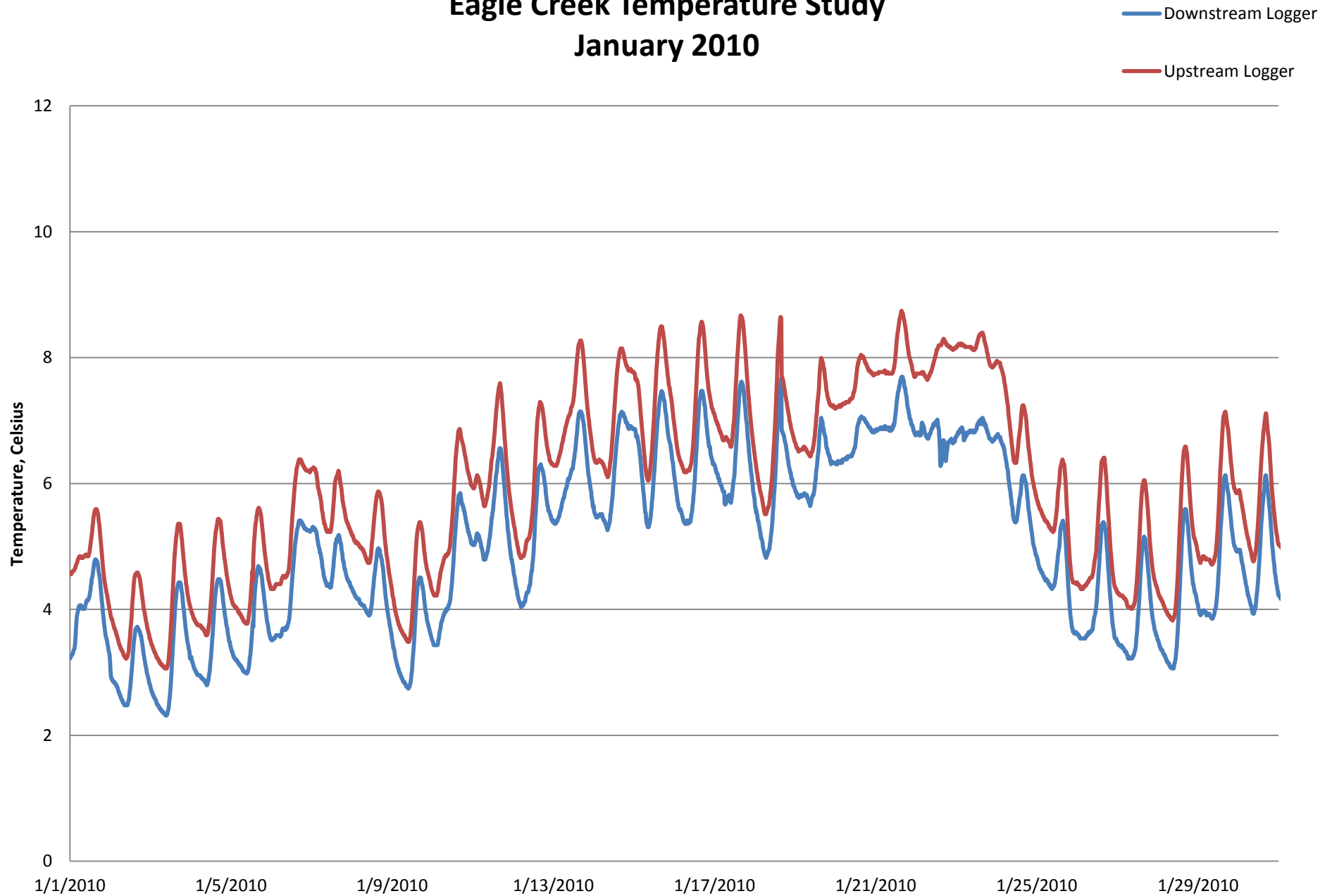


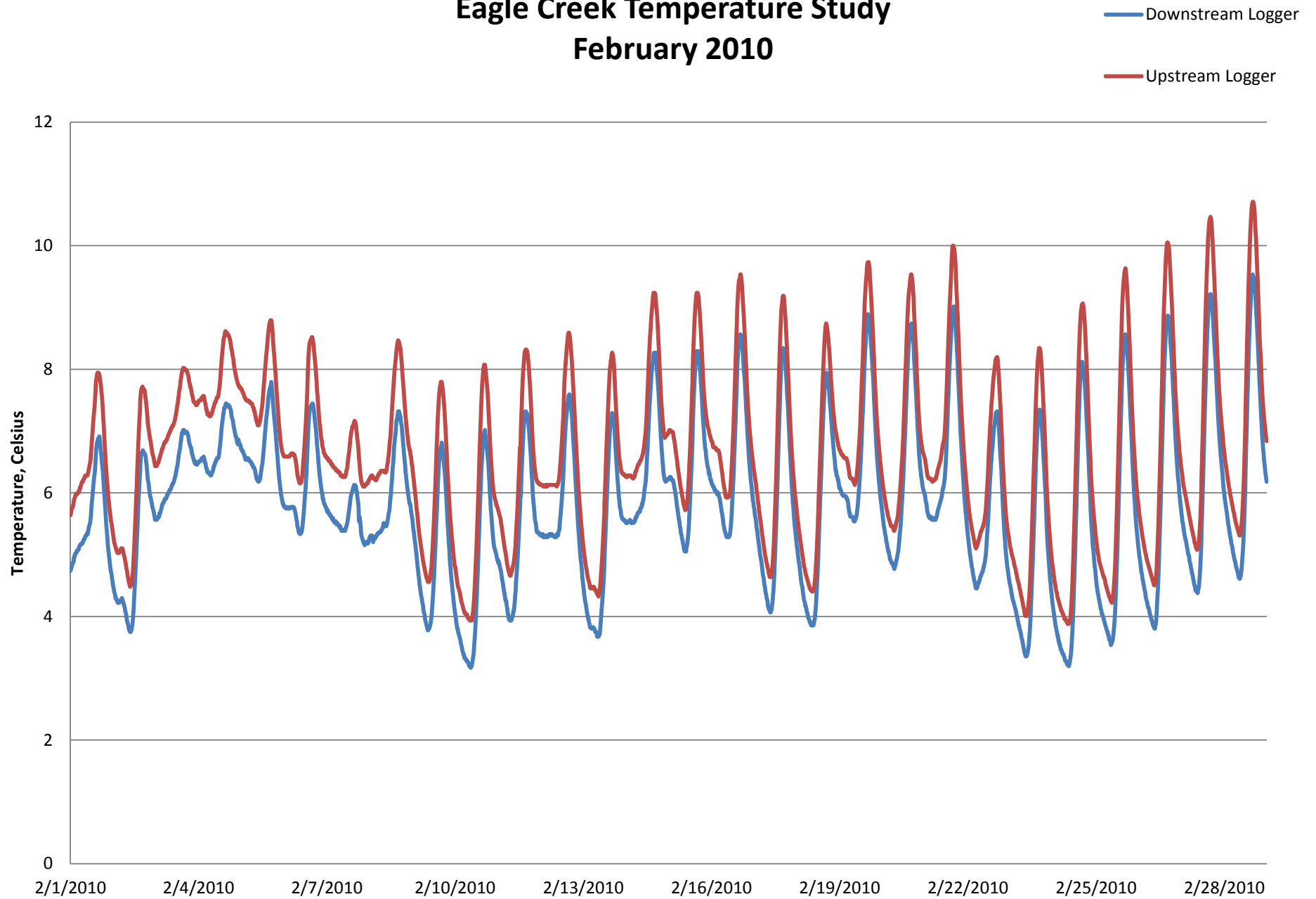
Figure 9. Mean Daily Temperature Values



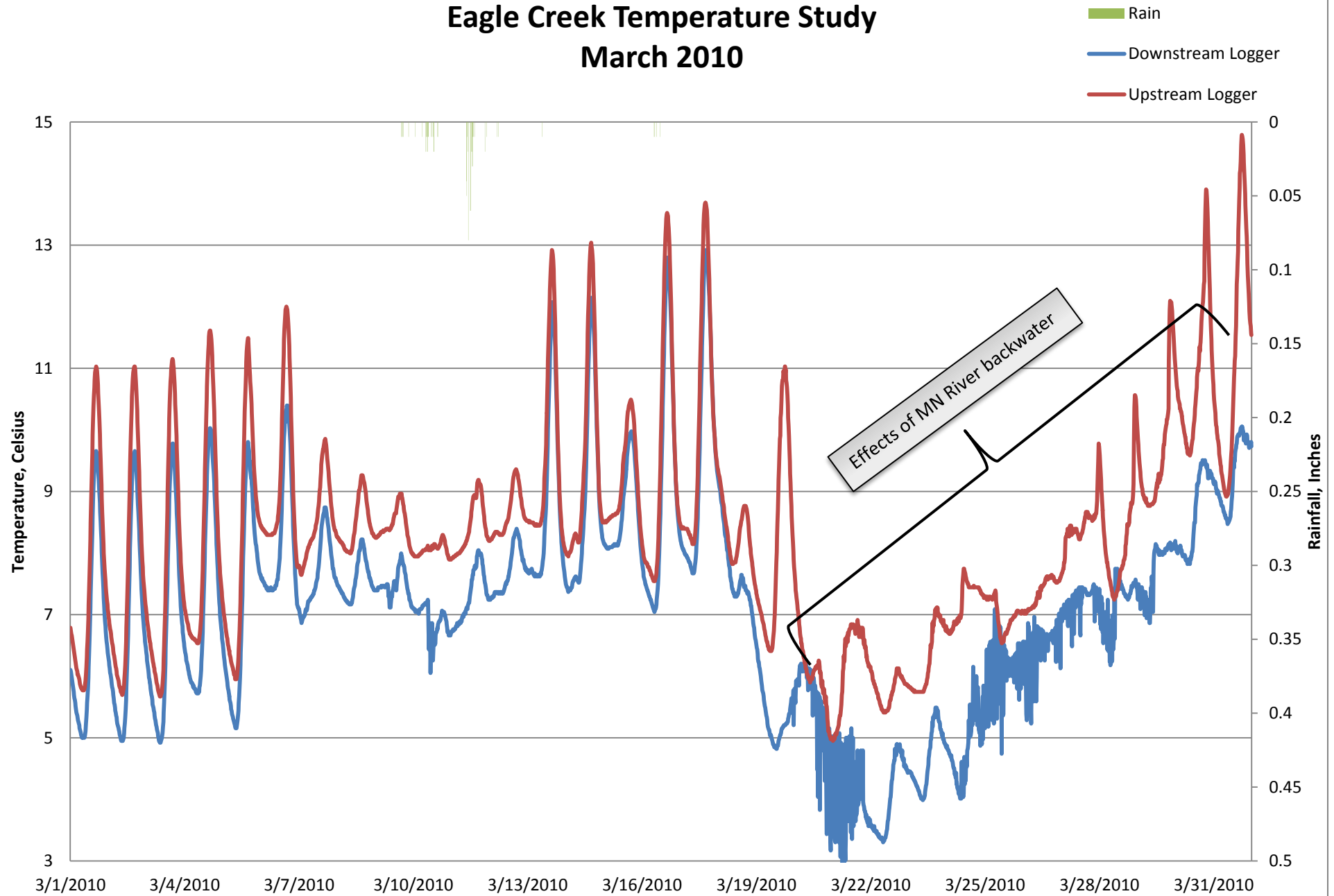
## Eagle Creek Temperature Study January 2010



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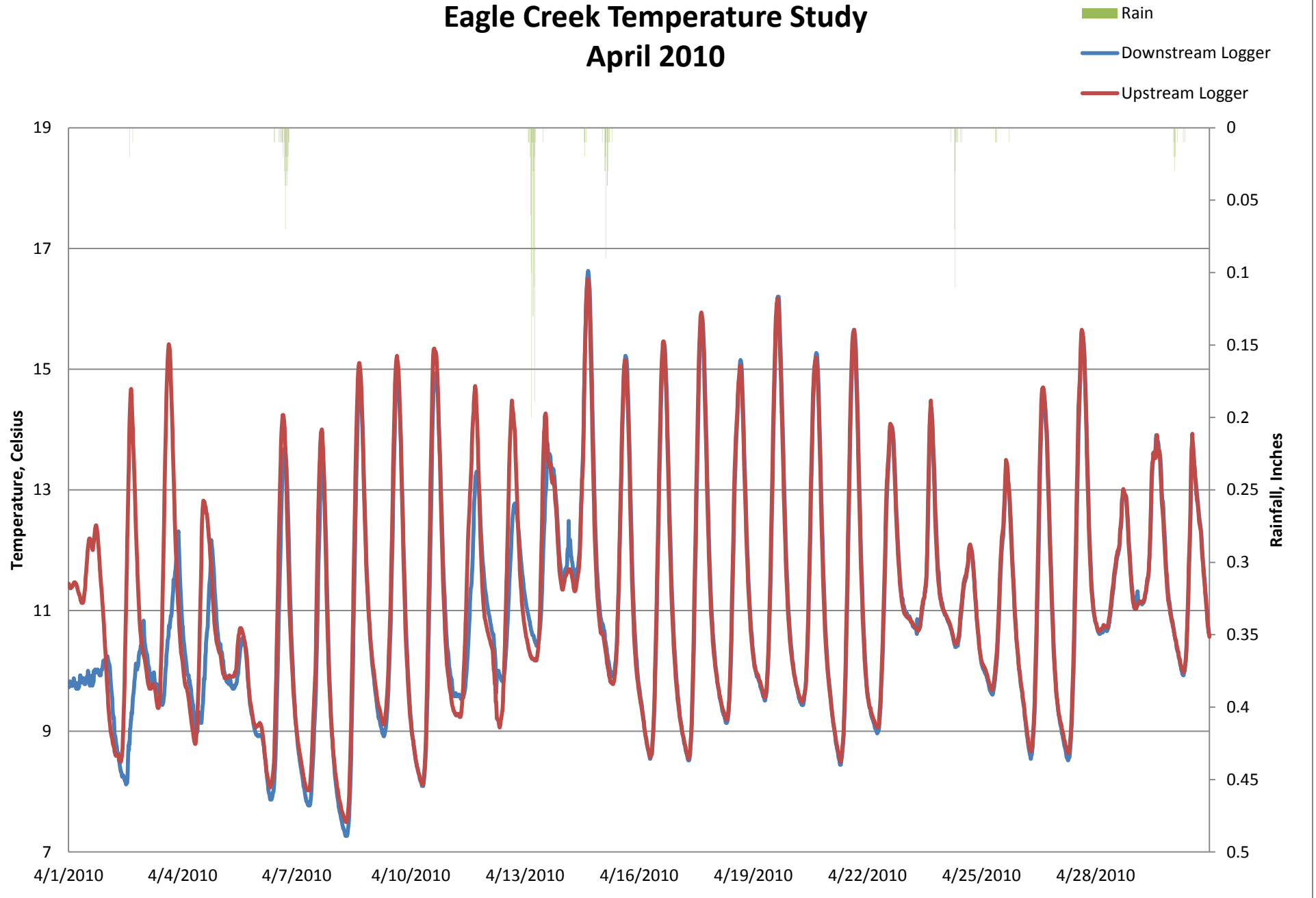


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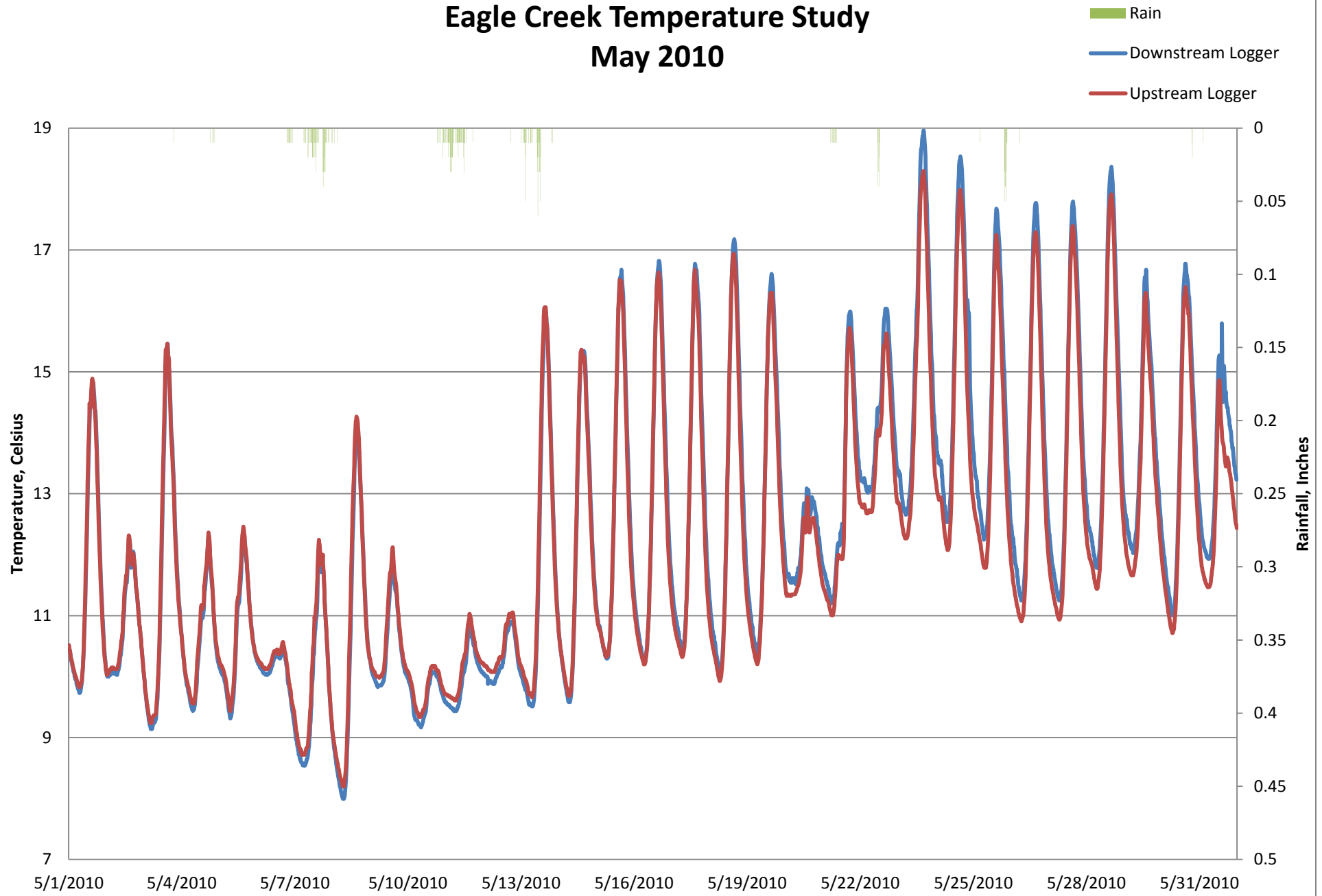




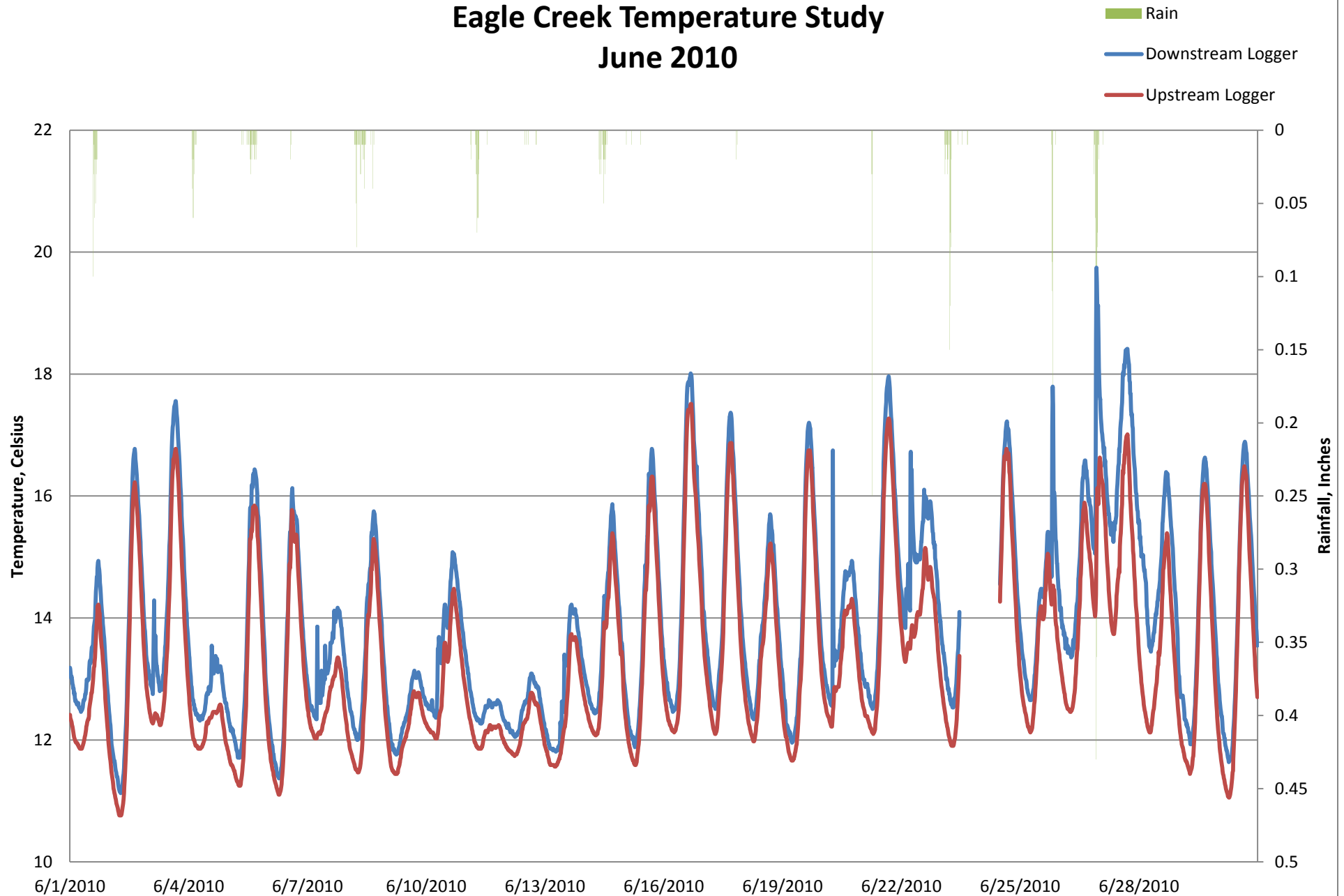
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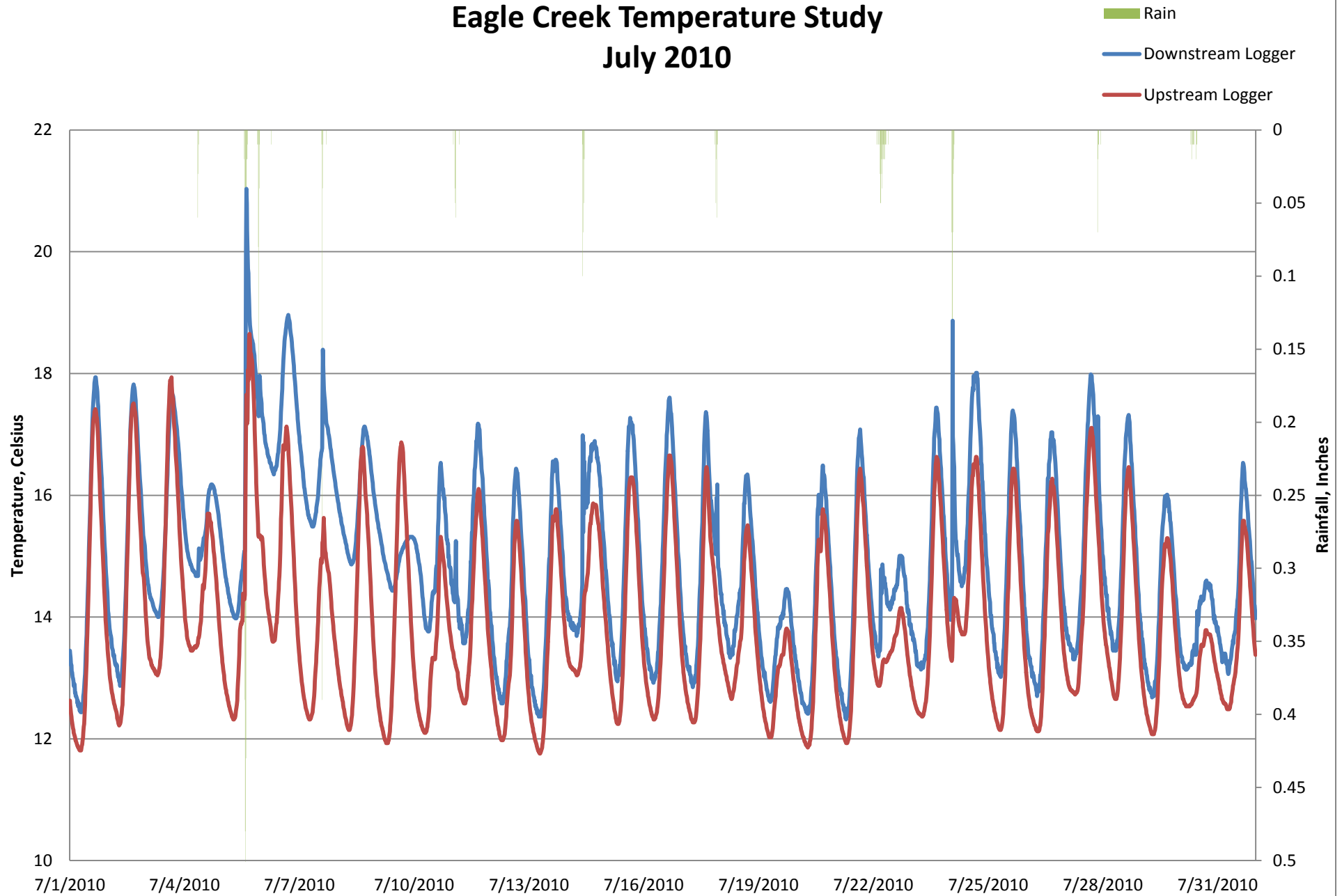


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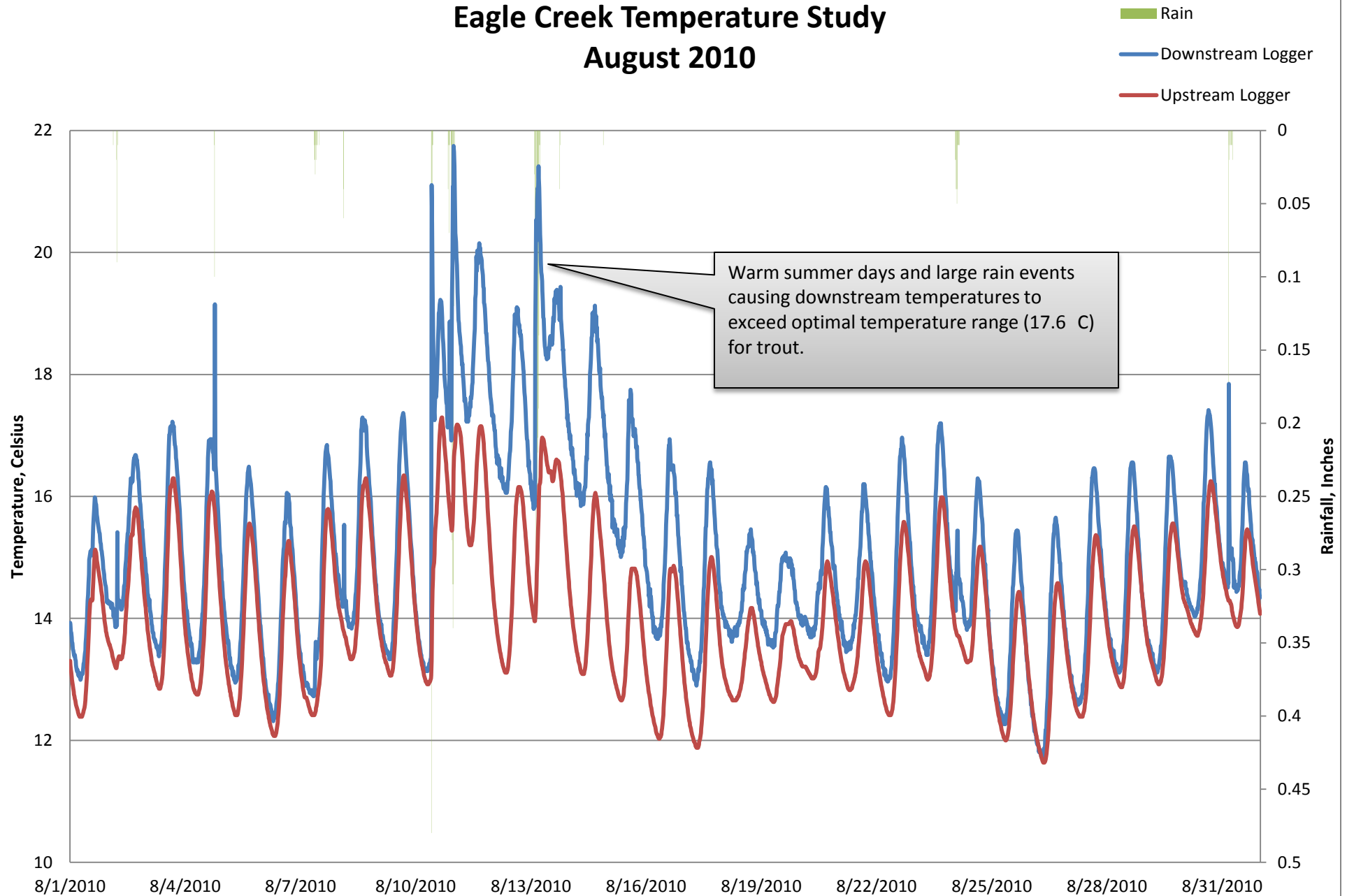




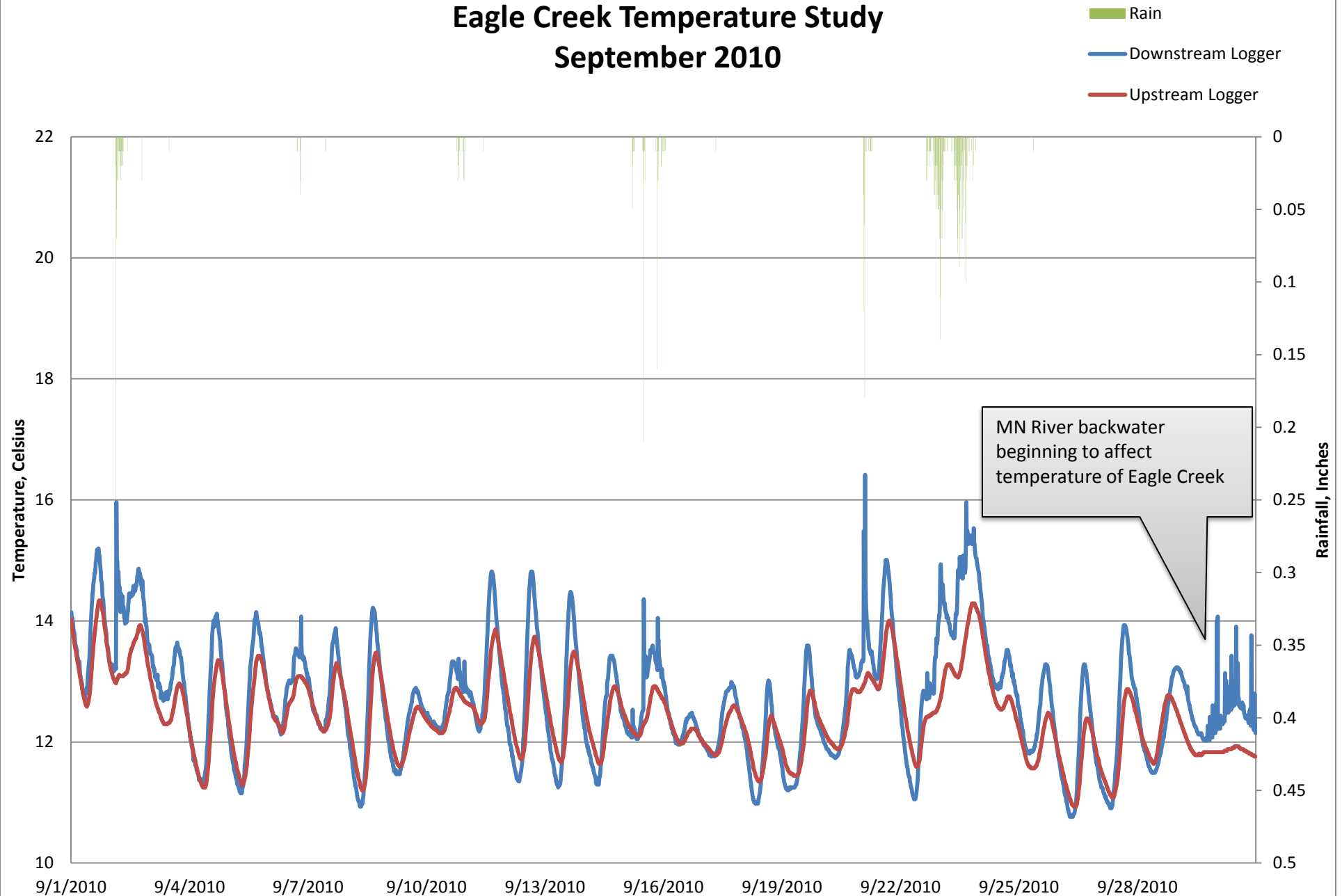
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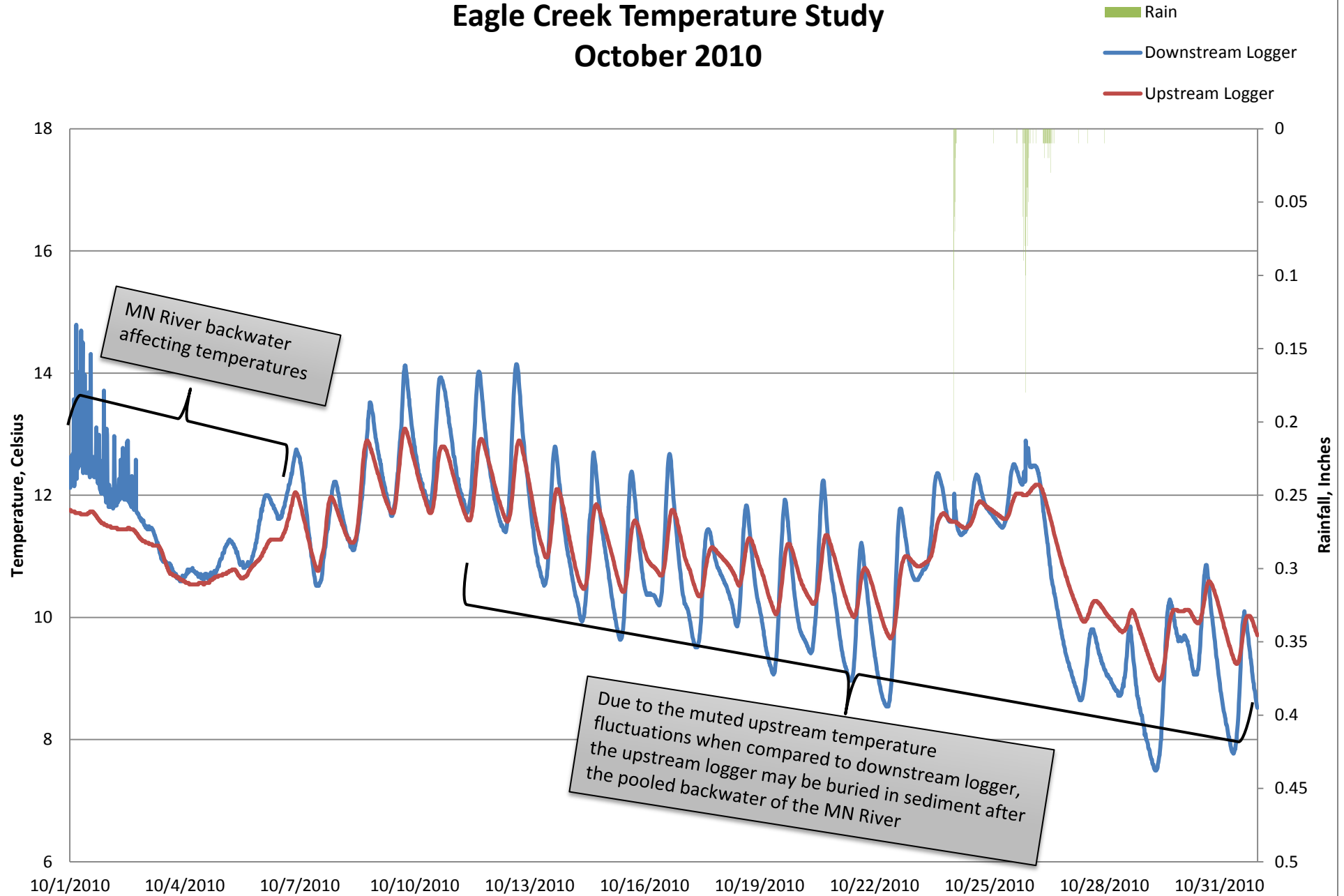


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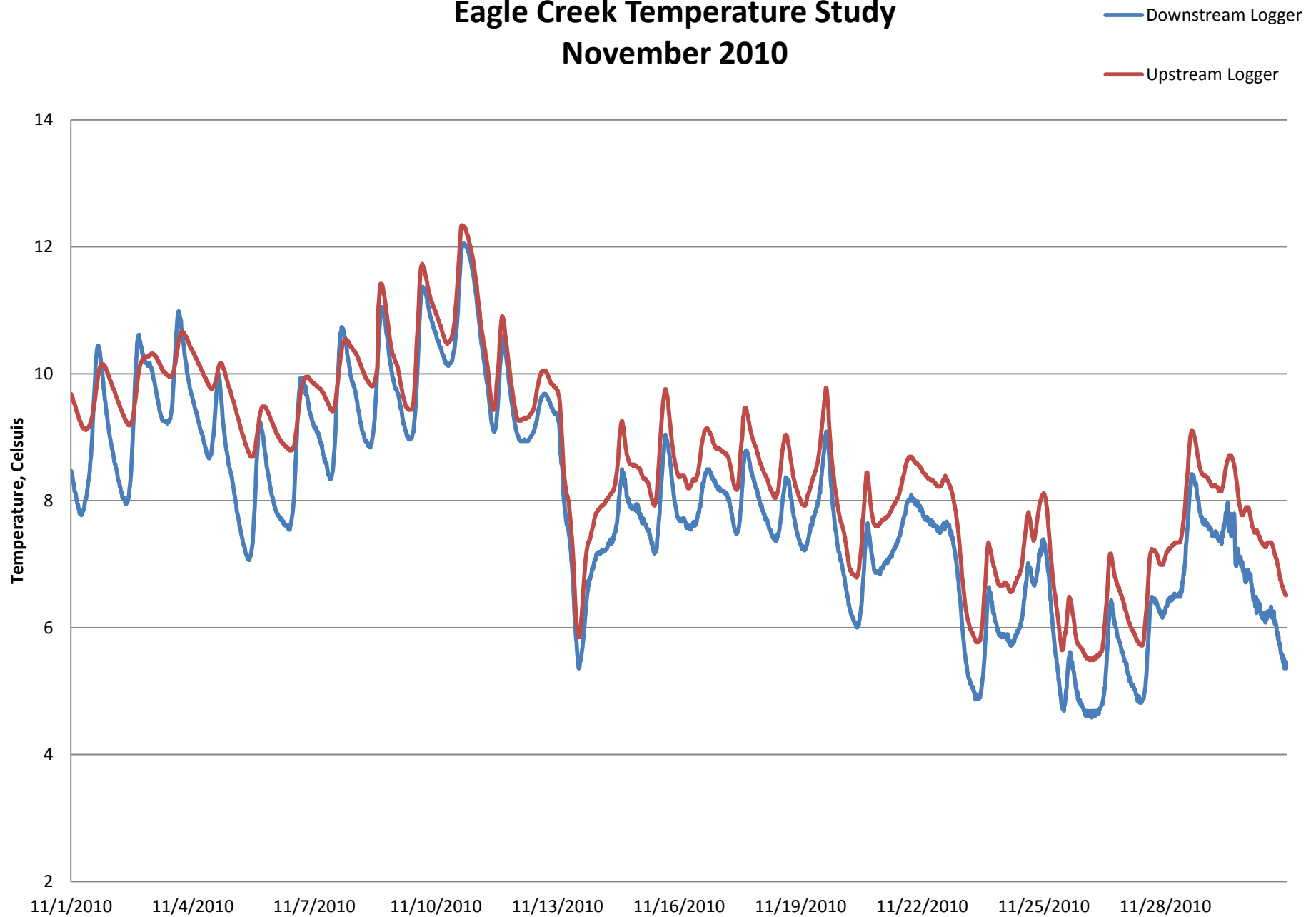




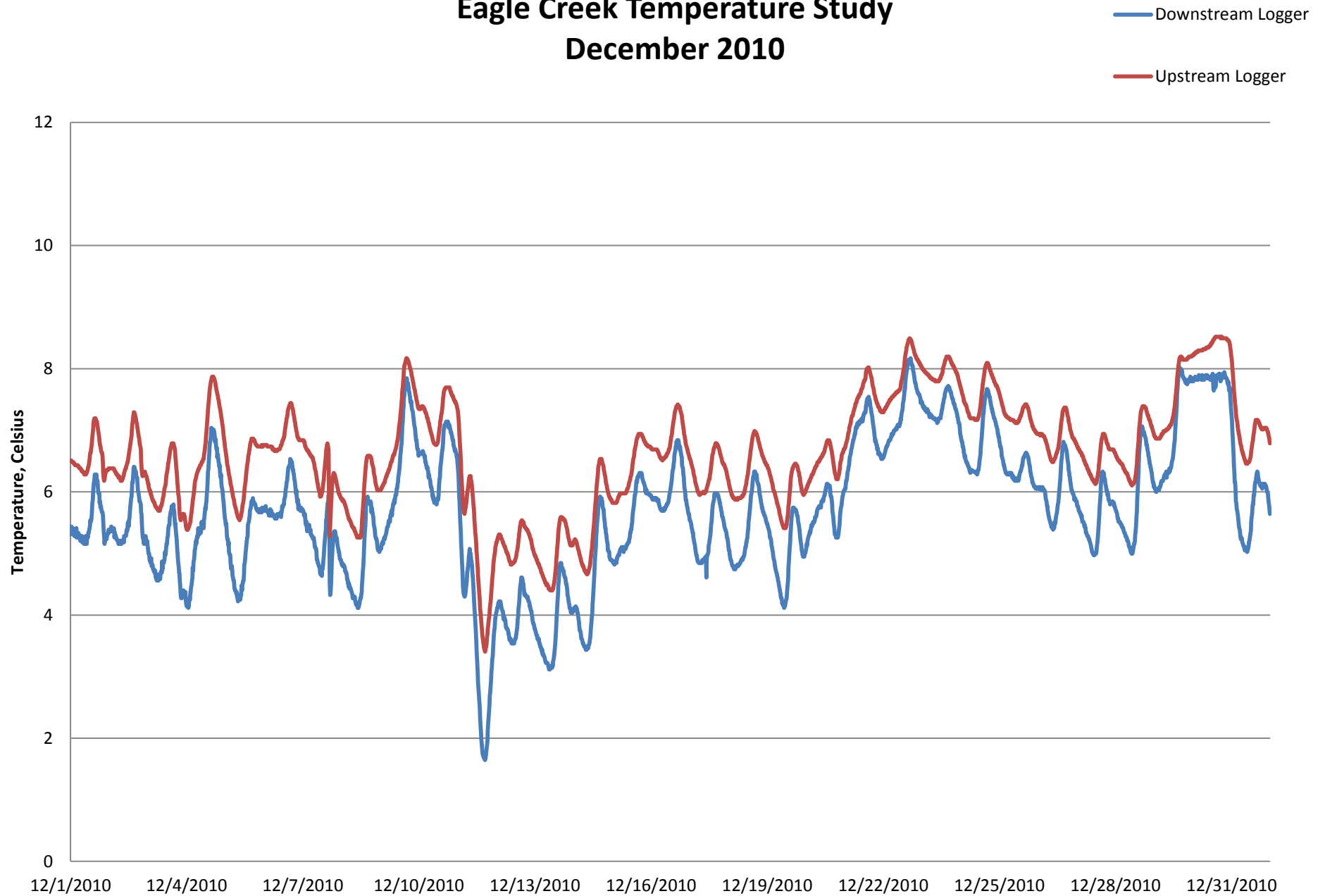
# Eagle Creek Temperature Study October 2010



## Eagle Creek Temperature Study November 2010



## Eagle Creek Temperature Study December 2010



**Works Cited:**

Bell J.M., 2006. The Assessment of Thermal Impacts on Habitat Selection, Growth, Reproduction, and Mortality in Brown Trout (*Salmo trutta* L): A Review of the Literature. Prepared for the Vermillion River EPA Grant #WS 97512701-0 and the Vermillion River Joint Powers Board. Applied Ecological Services, Inc.

Peterson, David. (2008, October 1). "Without a doubt: More trout in Eagle Creek." *Star Tribune*. 2008. Star Tribune. 21 May 2009 [[http://www.startribune.com/local/south/29842934.html?elr=KArksi8cyaiUo8cyaiUiD3aPc:\\_Yyc:aUU](http://www.startribune.com/local/south/29842934.html?elr=KArksi8cyaiUo8cyaiUiD3aPc:_Yyc:aUU)].