

Notson Bridge – Red Clover Creek

A continuous recording station (CRS) on Red Clover Creek at Notson Bridge was established in October 1999, and has been maintained continuously since installation. Red Clover Creek is tributary to Indian Creek, in the East Branch North Fork Feather River Watershed. Appendix F provides a map of restoration projects and gage location for the Red Clover Creek monitoring station.

The Red Clover Creek watershed has been the focus of meadow and channel restoration activities since 1985. Approximately three miles of channel were restored prior to 1996, with more intensive restoration activity occurring between 2005 and 2013 (see Figure 27 for representative pre- and post-restoration photos). The cumulative length of channel reconnected to the floodplain above the Notson Bridge station totals approximately 13 miles. Continuing the long-term data collection at this location is important for evaluating the cumulative impact of multiple meadow restoration projects across a variety of water year types, including severe multi-year droughts.

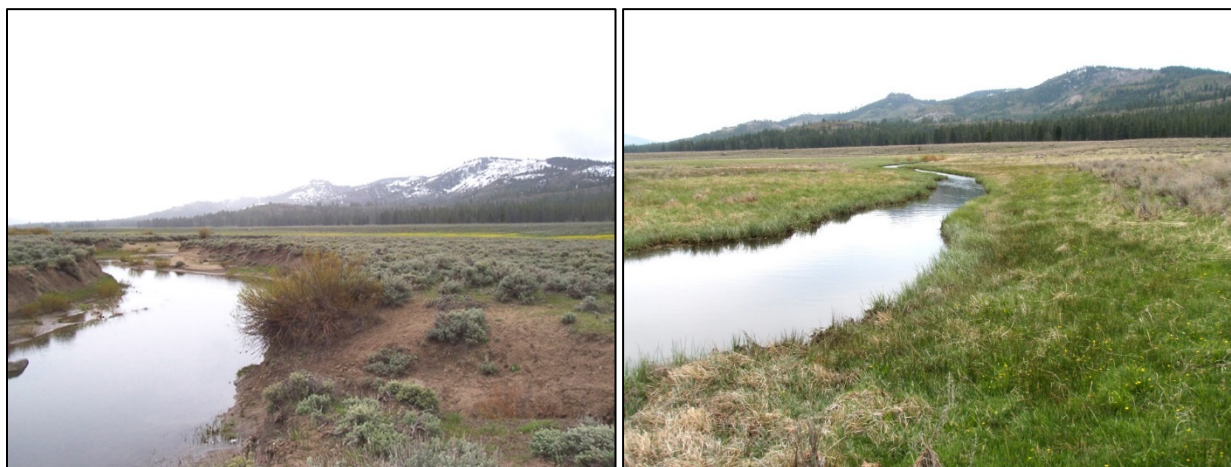


Figure 27. Red Clover Creek pre-restoration (left; 6/2006) and post restoration(right; 5/2012).

The drainage area above the Notson Bridge station is approximately 109 square miles, with an average annual precipitation of 32.6 inches (USGS StreamStats, 2018). Table 13 summarizes the data record for this gage (data gaps exist due to occasional equipment errors). Table 14 provides an overview of field data collected during the 2017 water year.

Geologic Characterization:

Red Clover Valley is a large meadow complex that has had some restoration work completed at the eastern and western ends resulting in several ponds and improved vegetation. This meadow is at an elevation of 5,400 ft and receives on average 25 inches of precipitation as a mix of rain and snow. The soils in this meadow are derived from the surrounding Neogene andesite and rhyolite deposits, as well as the Pliocene alluvial terrace that makes up the large center of the meadow. There are several N-W to S-E trending faults to the south and west of the meadow, and a fault that enters a portion of the meadow at the eastern end near the previous restoration sites.

Table 13. Data continuity for the Red Clover Creek/Notson Bridge Monitoring Station.

Water Year	Data Availability
2000	Start 10/23, DG: 7/5-8/10
2001	All
2002	DG: 11/27-5/1
2003	All
2004	All
2005	All
2006	DG: 10/8-11/18
2007	All
2008	error- calculated flow only
2009	Start 12/10
2010	Start 10/13
2011	All
2012	All
2013	10/1-3/14 only
2014	DG: 10/1-1/27
2015	All
2016	All
2017	6/19 from 1200-1300 hrs and 9/14 from 1200-1300 hrs (both due to battery replacement)
Water Year = 10/1 through 9/30 DG = Data Gap All = All year-round data	

Table 14. Summary of 2017 Water Year Data Collection at Red Clover Creek/Notson Bridge Station.

Parameter measured	Site visit dates	Data collected by	Comments
Stream Flow Measurement	5/8, 5/22, 6/19, 7/19, 8/1, 9/14	Plumas Corporation	
Temperature (Air, Water)	5/8, 5/22, 6/19, 7/19, 8/1, 9/14	Plumas Corporation	Continuous water temperature also available from gage site; air temperature from DWR Station at Thompson meadow (available via CDEC)
Electrical conductivity (Stream)	5/8, 5/22, 6/19, 7/19, 8/1, 9/14	Plumas Corporation	

Hydrology:

The data reported for Red-Clover Creek at Notson Bridge are for Water Year 2017 (October 1, 2016 – September 30, 2017).

Stream flow was manually measured monthly from May through September and the data used to calibrate the stream stage rating curve and verify the continuously recorded transducer data. Manually-measured stream flows ranged from 377 cfs (May) to 3.82 cfs (September). Daily average flows (Figure 28) from the CRS ranged from greater than the maximum rated flow of 831 cfs to 1.86 cfs (10/1/16). Because very few measurements were taken during the high flow period, there is uncertainty in the accuracy of rating curve for high flows. Therefore, reported discharge at higher flows, even at the existing rating, needs to be considered an estimate.

Several large storm events resulted in flows that exceeded the maximum rated gage height of 4.93 ft (831 cfs). In January, the Thompson Valley CDEC station recorded 5.9 inches of rain from 1/7/17 through 1/10/17. Hourly average flows in Red Clover Creek reached 606 cfs on 1/8/17 at 0900 hrs before exceeding the maximum rated stage for 49 hours. The maximum gage height reached 9.03 ft (4.1 ft above the maximum rated stage). A second storm event in February resulted in even greater sustained flows. Over the seven-day period from 2/4/17 through 2/10/17, the Thompson Valley CDEC station recorded 4.98 inches of rain. Hourly average flows reached 804 cfs on 2/6/17 at 2000 hrs before exceeding the maximum rated stage for 148 hours, reaching a peak gage height of 8.81 ft.

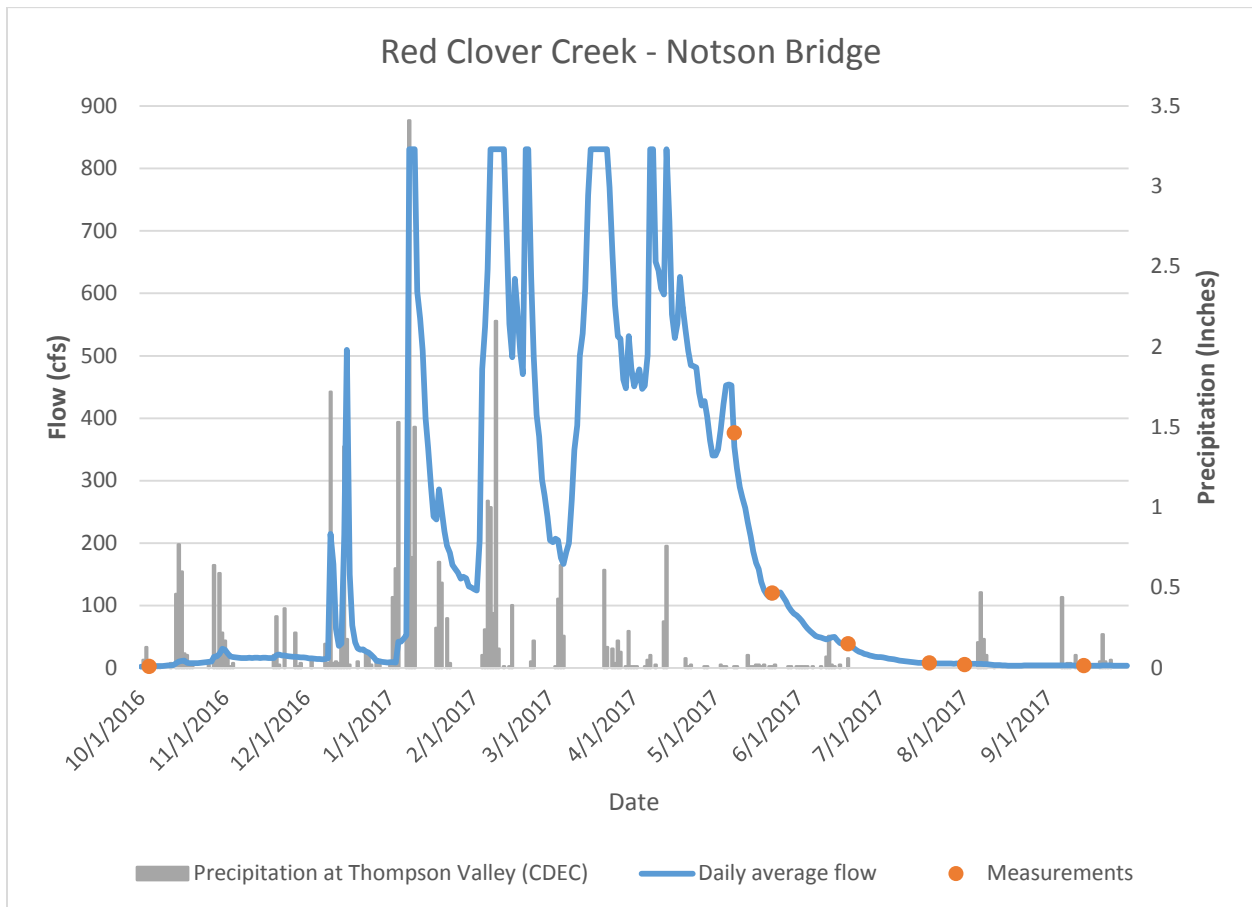


Figure 28. Daily average flow in Red Clover Creek at Notson Bridge (Source: CRS Campbell Scientific CS450 sensor) and precipitation (Source: Thompson Valley CDEC), water year 2017.

Hourly average water temperatures in Red Clover Creek were obtained from the continuous recording station at Notson Bridge. Daily average water and air temperature data are shown in Figure 29. Future analyses will include an evaluation of diurnal changes in water temperature.

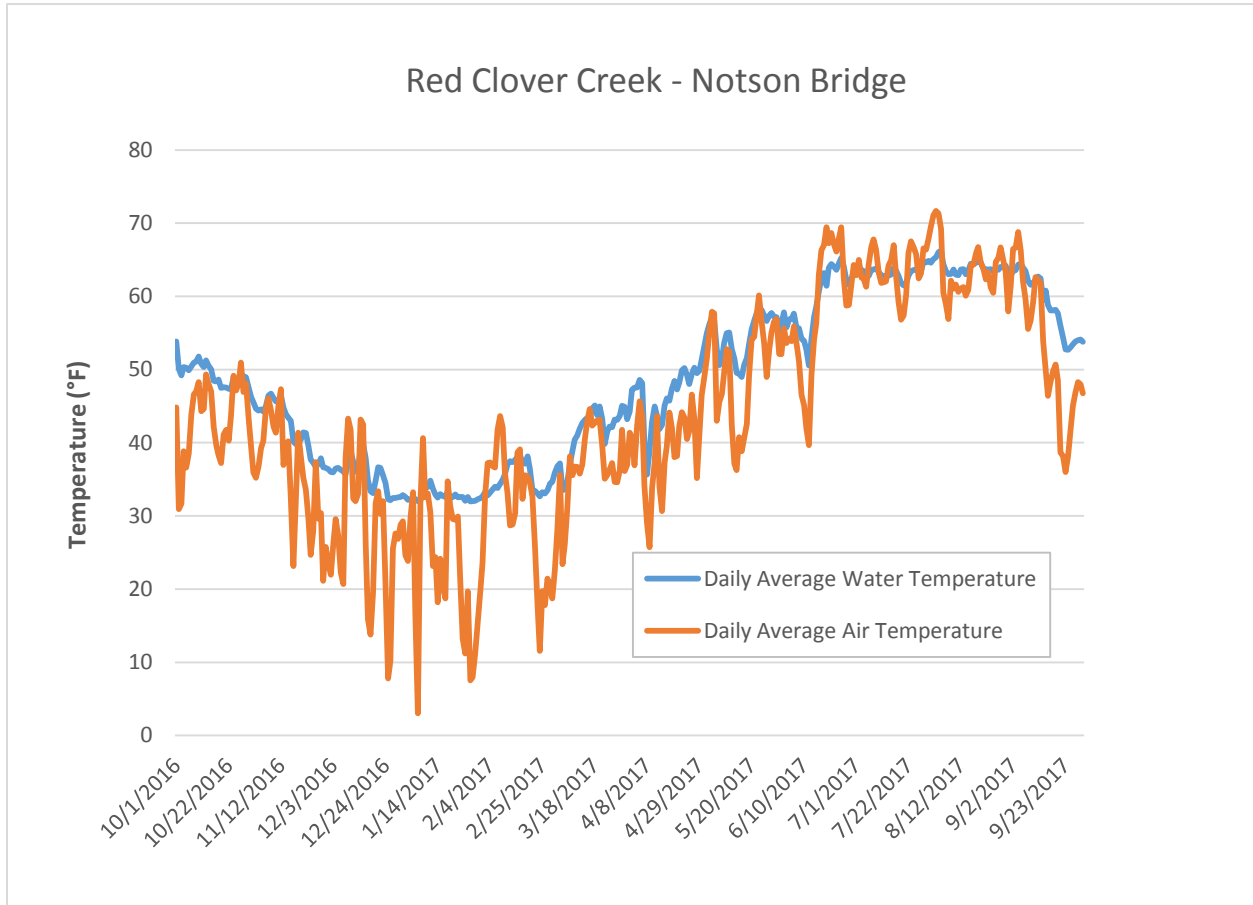


Figure 29. Daily average water temperature in Red Clover Creek (Source: CRS Campbell Scientific CS450 Sensor) and daily average air temperature (Source: Thompson Valley CDEC), water year 2017.

The large storms in January and February 2017 washed out the road accessing the Notson Bridge station, preventing early-season access at high flow levels. As a result, it was not possible to obtain calibration measurements that could be used to extend the rating curve. Later in the season, beaver activity approximately 500 ft downstream of the bridge raised the control, raising water levels in the gage pool and flow measurement cross-section. The calibration measurements taken throughout the summer and fall were used to develop shift corrections for the transducer data accordingly. Additionally, the air temperature sensor at the Notson Bridge station has been expired for a number of years; relevant air temperature data continued to be provided by the Thompson Meadow (TVL) CDEC station.

Surface water samples have been collected for $^{18}\text{O}/^{16}\text{O}$ isotopic analysis in the Red Clover Meadow complex by CSUS (as part of a separate project) since 2015-06-08. The project is student-run and the analysis of the samples is still in the queue for processing. Figure 30 (map of the Upper Feather River

Watershed) outlines the location of these surface water sampling points in the Red Clover complex as well as downstream from the meadow. Results from these analyses will be posted when the samples once they been analyzed.

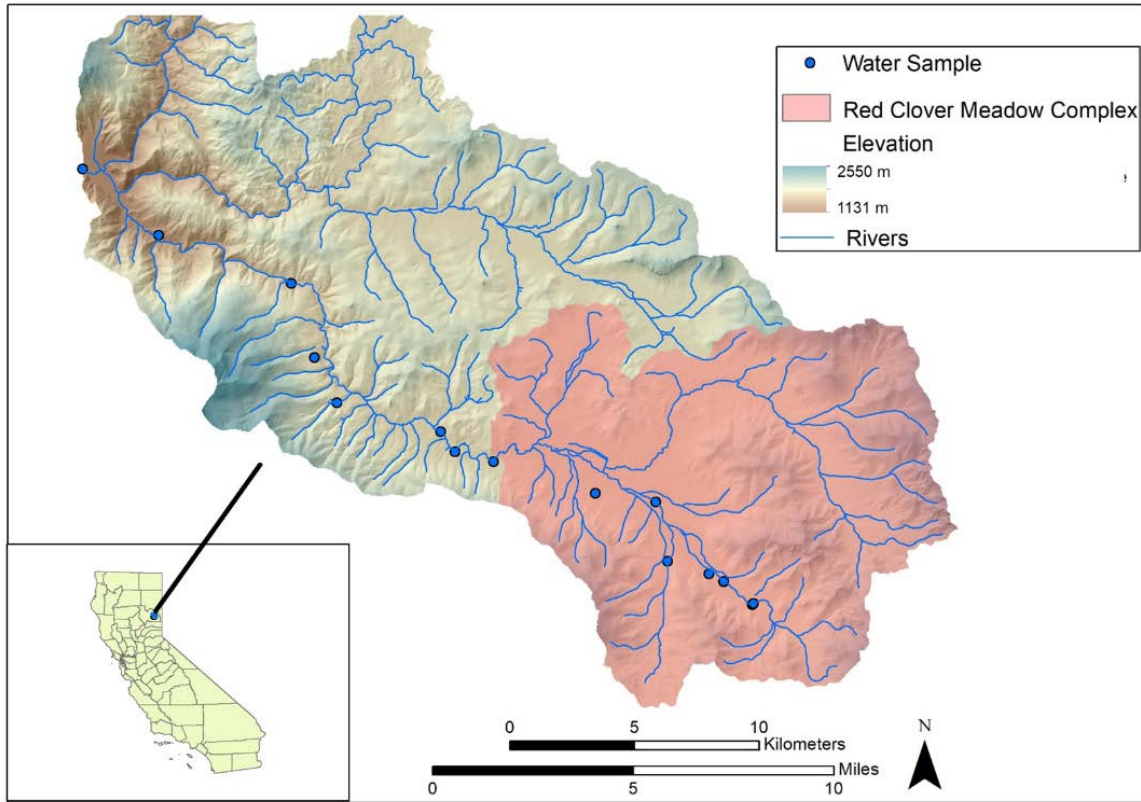


Figure 30. Red Clover Meadow complex $^{18}\text{O}/^{16}\text{O}$ surface water sample locations.