

Feather River Coordinated Resource Management Watershed Monitoring Program

2010 Report



High flow measurements with bridge crane at Taylorsville, April 2010.

Prepared by Plumas Corporation
Quincy, CA
Spring 2011

Introduction to FR-CRM Monitoring Program

2010 Monitoring Report Summary

This report tiers to Feather River Coordinated Resource Management (FRCRM) group monitoring reports from 1999 through 2009. The 2010 Water Year (October 1, 2009- September 30, 2010) was a normal water year with 101% of normal historic precipitation. Last Chance Creek and Lights Creek continue to be the most temperature impaired streams measured in the upper Feather River Watershed. Throughout the following report keep in mind the similarity between the 2000 and 2010 water years. Both water years had 101% of normal precipitation and average summer air temperatures of 61.4°F.

This year both the Spanish Creek and Indian Creek at Flounoy Bridge Continuous Recording Stations failed. The Spanish Creek station was not replaced by the FRCRM, since the United States Geological Survey (USGS) installed a real time continuous recording station on Spanish Creek downstream of the Highway 70 Bridge near the Quincy Community Services District. This station can be found on the USGS website under the name Spanish Creek at Quincy, CA (station #11401920). The Indian Creek at Flounoy Bridge station will be replaced in spring 2011.

Most important findings in this monitoring report:

- Increased groundwater appears to be influencing late season water temperature and stream flow on Last Chance Creek at Doyle Crossing.
- Increased groundwater appears to be influencing late season water temperature on Red Clover Creek at Notson Bridge.
- An increase in base flow volume by 41.2 acre feet at Doyle Crossing for Aug 1 through Sept 30 in 2010 compared to 2000.

Data Issues

- Flounoy Bridge transducer failed July 30, 2010. The sensor will be replaced in Spring 2011.
- Indian Creek at Taylorsville is not represented in most of the graphs, because the sensor was out of the water, only collecting high flow data. Funding has been provided by the USFS RAC, Title II funds, to install a low flow sensor in 2011.
- Spanish Creek pressure transducer failed December 20, 2009. The water temperature sensor continued to operate through the end of the water year. The station was removed in October and not replaced. A new station operated by USGS will take the place of this station in future reports. The new USGS station is about 0.75 miles downstream of the discontinued FRCRM station.
- Battery failure during the end of the flow season on Indian Creek at Taylorsville. The battery failed on June 10, 2010. When the battery was replaced on June 18 the water was already below the sensor level.

About the Feather River CRM

The FRCRM, a proactive consortium of 24 public agencies, private sector groups, and local landowners, was established in 1985 in response to widespread erosion and channel degradation in the Feather River watershed. One hundred and forty years of intensive resource use, including mining, historic grazing, timber harvesting, and railroad and road construction, have all contributed to a watershed-wide stream channel entrenchment process. FRCRM was able to initiate systematized monitoring in the Feather River watershed in 1999 to establish baseline data for assessing long-term trends in watershed condition, and the potentially significant effects of restoration projects on watershed function. Most of the monitoring effort is concentrated in the Indian Creek subwatershed because of its highly degraded upper watershed condition, and high potential for benefit from

restoration with many linear miles of alluvial channels. Monitoring site locations follow a nested approach. Please see the diagram at the end of the report that shows monitoring station locations with project locations.

Watershed Monitoring Program Background

Background information such as an overview of the watershed, monitoring program objectives, more detailed earlier data, and protocols can be found in the FRCRM watershed monitoring reports from 2001, 2004, and 2005. Reports (2005-09) can be found on the monitoring page of the FRCRM website at www.feather-river-crm.org. The monitoring network was installed in 1999 and data have been collected from 2000-2010.

Initial funding for FRCRM's monitoring program was provided by a Clean Water Act 319(h) grant (Aug 1998 to Dec 2000). Subsequent funding sources were: the California Surface Water Ambient Monitoring Program (SWAMP) from Oct 2000 to Dec 2003 and the Plumas Watershed Forum (2004 to 2006). Physical and biological surveys of FRCRM's 20 monitoring reaches have not been conducted since 2003. Funding has been provided by the USFS RAC, Title II funds, to operate and maintain the continuous recording stations as well as complete surveys on the monitoring reaches in 2011.

Monitoring Program Description

This report documents on-going monitoring data from the 2010 Water Year (WY) (October 1, 2009-September 30, 2010).

Three main subwatersheds of the Feather River are covered under this monitoring program:

- Indian Creek
 - Spanish Creek
 - Middle Fork Feather River
 - North Fork Feather River
- } **East Branch North Fork Feather**

Data Collected at the Continuous Recording Stations (CRS):

- **Stage** (calibrated to flow)
- **Water Temperature**
- **Air Temperature** (except at Wolf Creek and DWR Weir)
- **Turbidity** (NTU's) - currently only at Indian Creek at Taylorsville

Much of the FRCRM restoration efforts are concentrated on restoring meadow hydrologic function. This includes restoring floodplain function and groundwater recharge. Two metrics that indicate restored hydrologic function are increased summer baseflow levels and decreased summer water temperatures.

Stream flow stage, air and water temperature are recorded every 15 minutes by Campbell CR10X data loggers at the following FR-CRM monitoring stations: Red Clover Creek at Notson Bridge; Last Chance Creek at Doyle Crossing and at Million Dollar Bridge; Cottonwood Creek above and below Big Flat (not on map); Indian Creek at the Calif. Department of Water Resources (DWR) weir (above the confluence of Red Clover Creek), at the Flournoy Bridge (below the confluence of Red Clover

Creek), and at the Taylorsville Bridge; Lights Creek at Deadfall Lane Br.; Wolf Creek at the Ball Field Bridge in Greenville; and Spanish Creek at Dyrr Bank near Gansner Park in Quincy.

The stage, air and water temperature readings are stored as hourly averages and then summarized into daily files at the end of each water year. To continuously record turbidity, an Analite 195 laser sensor (a nephelometric probe) was installed on Indian Creek at Taylorsville Bridge in 2001 and on Spanish Creek (2001-06). The data loggers are capable of storing up to six months of data. FRCRM staff and contract technicians download data monthly to ensure reliable station operation. Because of periodic channel shifts at most of the stations, monthly calibration measurements are required. FRCRM staff is also responsible for capturing discharge measurements over the range of flows at each station in order to maintain/update the rating tables. Rating tables are reviewed and/or updated annually by Sagraves Environmental Services.

Table 1. Watershed Area above Continuous Recording Stations

Watershed Area above Continuous Recording Stations (for station location see Figure 1)	
Station	Area (acres)
Last Chance at Doyle Crossing	61,746
Red Clover at Notson Bridge	69,121
Indian Creek at DWR Weir	72,619
Indian Creek at Flournoy Bridge	281,132
Indian Creek at Taylorsville	343,193
Lights Creek at Deadfall Bridge	67,722
Wolf Creek at Ball Field Bridge	31,945

DWR Flow & Weather Stations

The California Department of Water Resources (DWR) maintains four weather stations and two continuous recording flow stations in the Feather River watershed to assist in managing the water resources. The two DWR flow stations are on Indian Creek below Indian Falls (ICR) and on the Middle Fork Feather River near Portola (MFP). Four weather stations installed by DWR in the Indian Creek watershed include Doyle Crossing (DOY) in 2000, Jordan Peak (JDP) in 2005, Thompson Valley (TVL) in 2006 and Taylorsville (TAY) in 2007. All of the DWR weather and flow stations are accessible on the DWR California Data Exchange Center (CDEC) website at cdec.water.ca.gov. Stream discharge and stage height are recorded at the DWR flow stations, while the DWR weather stations record precipitation, temperature, relative humidity, wind speed, wind direction, solar radiation and atmospheric pressure.

**Please note the 2010 precipitation data from the DWR weather station at Taylorsville contains errors and should be disregarded.

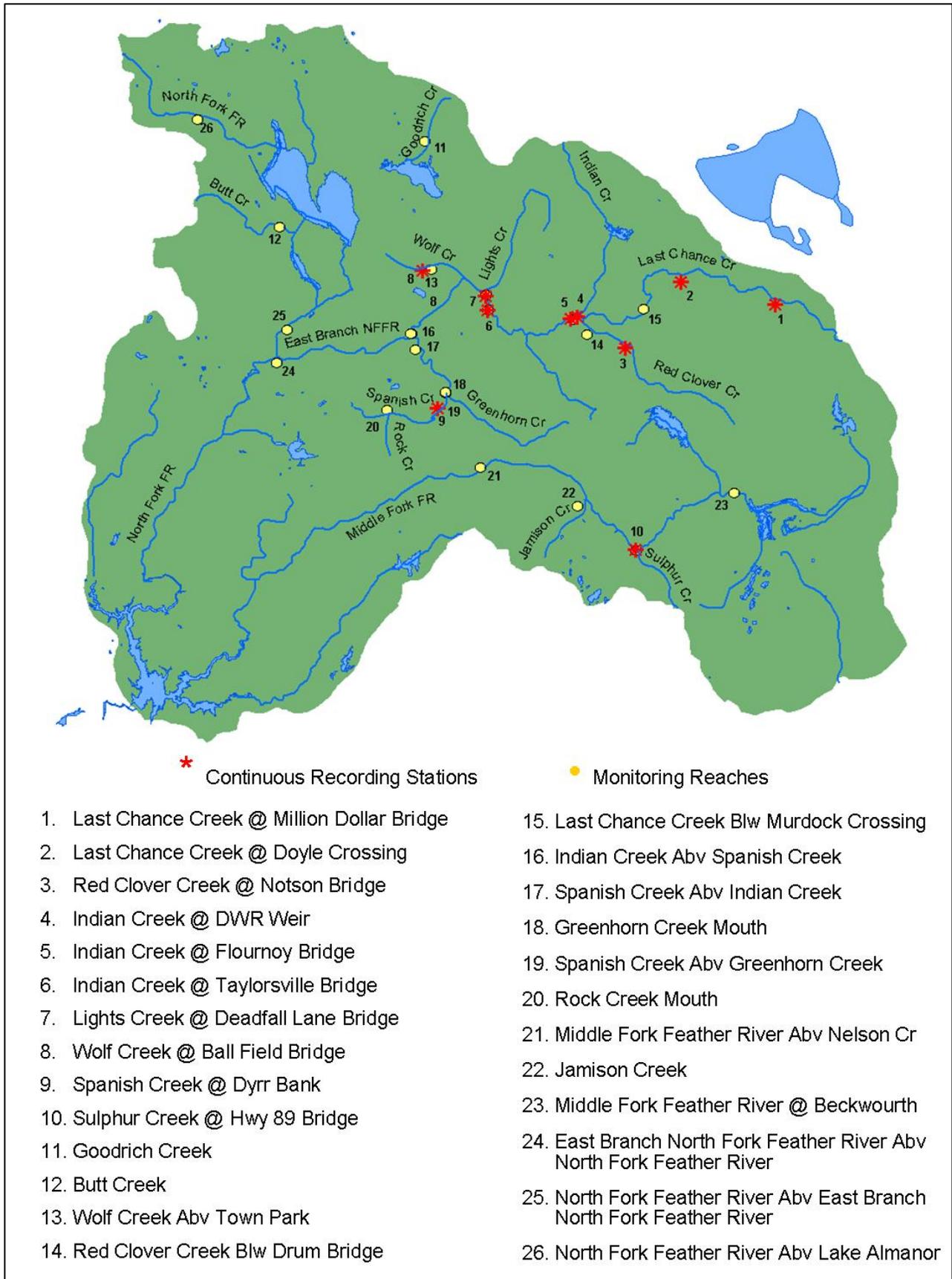


Figure 1. Feather River CRM Continuous Recording & Monitoring Reach Locations

Table 2. Upper Feather River Watershed Monitoring Sites and Parameters Recorded

Map #	Monitoring Site by Subwatershed	Monitoring Type
	North Fork Feather River (NFFR) watershed	
26	NFFR @ Domingo Springs (abv Lake Almanor)	MR [∞]
	NFFR@ Seneca (blw Lake Almanor)	MR
25	NFFR @ above confluence with (acw) East Branch NFFR	MR
12	Butt Cr (abv 307 Br)	MR
11	Goodrich Cr	MR
24	East Branch mouth (acw NFFR)	MR
17	Spanish mouth (acw Indian)	MR
	Spanish Creek @ Keddie abv Blackhawk Cr.	CRS (USGS)
	Spanish Creek @ Quincy	CRS (USGS)
19	Spanish Cr acw Greenhorn	MR
18	Greenhorn Cr mouth	MR
9	Spanish @ Gansner Park (Hwy 70)	CRS [†]
20	Rock Cr mouth	MR
16	Indian Cr blw Indian Falls (acw Spanish Cr)	MR & CRS (DWR)
13	Wolf Cr @ Town Park	MR
8	Wolf Cr @ Main St Bridge moved to Ball Field Br.	CRS
7	Lights Cr @ Deadfall Lane Br	MR & CRS
6	Indian Cr @ Taylorsville (TAY)	MR & CRS & Weather Station (DWR)
5	Indian Cr @ Flournoy (below confluence with [bcw] Red Clover)	MR & CRS
4	Indian Cr @ DWR weir (acw Red Clover)	CRS
	Red Clover Cr @ Chase Bridge	MR
	Thompson Valley (TVL)	Weather Station (DWR)
14	Red Clover Cr @ Drum Bridge	MR
3	Red Clover @ Notson Bridge	CRS
15	Last Chance (LC) Cr @ Murdock	MR
2	Last Chance (LC) Cr @ Doyle Crossing (DOY)	CRS & Weather Station (DWR)
	McClellan Cr	MR (DWR)
	Cottonwood Cr @ Big Flat	CRS abv & blw Big Flat
	Little Stoney Cr	MR (DWR)
	Willow Cr	MR (DWR)
	LC @ Alkali Flat low water crossing	MR (DWR)
	Ferris Cr	MR (DWR)
1	LC @ Million Dollar Bridge	CRS
	LC @ Bird-Jordan	MR (DWR)
	Jordan Peak (JDP)	Weather Station (DWR)
	Middle Fork Feather River (MFFR) watershed	
21	MFFR abv Nelson Cr	MR
	MFFR @ Sloat	staff gage
22	Jamison Cr @ 23N37 Br	MR
10	Sulphur Cr @ Hwy 89 (Clio)	MR
	Boulder Cr	staff gage
	Barry Cr	staff gage
	Sulphur @ Lower Loop Bridge	staff gage
	Sulphur @ Upper Loop Bridge	staff gage
23	MFFR blw A23 Br (Beckwourth)	MR
	MFFR near Portola (MFP)	CRS (DWR)

[∞] Monitoring Reaches (MR) refers to those surveyed by FR-CRM unless otherwise noted in parentheses. Long term monitoring of these sites is expected to give watershed managers a better understanding of processes and long term trends in these subwatersheds. Data collected at Monitoring Reach sites can be found in the SWAMP final report, with details on protocols in Appendix A.

[†] Continuous Recording Stations (CRS) are maintained and operated by FR-CRM unless otherwise noted in parentheses.

2010 Monitoring Program Findings

FRCRM is continuously collecting data throughout the Upper Feather River Watershed. The 2010 Water Year experienced normal annual precipitation with 101% of historic average annual precipitation for the Feather River Basin. Summer average air temperature in the following charts is an average of DWR weather stations at Antelope Lake, Doyle Crossing, Quincy, and Grizzly Ridge from June 1 through September 30. The average summer air temperature for 2010 was 61.4°F.

Table 3. Precipitation and Summer Air Temperature Averages

Water Year (10/1-9/30)	Percent of Historic Average annual precip for the entire Feather River Basin from CDEC*	Total annual precip (inches) at Indian Cr in Genesee (Wilcox data)**	Summer Average Air Temperature ⁺
1996		59.25	
1997		61.6	
1998	144%	60.9	
1999	99%	47.2	
2000	101%	43.3	61.4
2001	56%	21.2	63.0
2002	77%	33.3	62.3
2003	111%	50.7	63.2
2004	83%	41.15	61.7
2005	109%	45.5	60.5
2006	154%	66.25	62.3
2007	60%	31.05	61.5
2008	68%	25.4	62.9
2009	84%	38.05	62.6
2010	101%	33.85	61.4
		43.9 = Avg	

* Averages derived by DWR from all reporting stations in the watershed. The ten stations in the Feather River Watershed are Sierraville, Vinton, Portola, Chester, Strawberry Valley, Brush Creek, Greenville, Quincy, DeSabra, and Nicolaus. In 2010 2/10 stations were reporting averages (Vinton and Chester).

** The values in the Indian Creek in Genesee Precip column are unrelated to the Percent of Historic Average Annual Precip values. The Percent Historic Average is an average of weather stations throughout the watershed, which is calculated by DWR.

⁺ Average derived from DWR weather stations at Antelope Lake, Doyle Crossing, Grizzly Ridge, and Quincy. Data is missing from Doyle Crossing in 2000, Grizzly Ridge in 2001, and Antelope Lake in 2007.

Water Temperature

Introduction

The Central Valley Regional Water Quality Control Board has identified water temperature as a water quality concern in the Feather River Watershed. A variety of parameters, such as air temperature, duration of exposure to air temperature, volume of water, and surface exposure to insolation, were used to compare water temperature between sites and between years. Figures 2, 4, 6, 8, and 10 analyze water temperatures from seven continuous recording stations with usable low flow data (six in Indian Creek subwatershed, and one in Spanish Creek) for the 2010WY. Figures 3, 5, 7, 9, and 11 display water temperatures from 2000-2010 for stations affecting Genesee Valley. These are the stations expected to show the most response from Pond and Plug projects (Last Chance Creek @ Doyle Crossing, Red Clover Creek at Notson Bridge, and Indian Creek below Red Clover- Flournoy Bridge). Indian Creek above Red Clover- DWR weir is included to show water temperatures on Indian Creek above the confluence of Last Chance and Red Clover creeks.

Maximum daily water temperature

Figures 2 and 3 graph the highest one hour-long temperature that was recorded during the annual sampling period. The DWR weir, above the confluence of Red Clover Creek, had the lowest recorded maximum daily temperature in 2010 and throughout the 2000-2010 period in the Indian Creek subwatershed. This is most likely due to Indian Creek above this location being primarily fed by cold water from the bottom of Antelope Lake. Figure 2 also shows Red Clover Creek may have a warming influence on Indian Creek below the confluence (at Flournoy Br.), yet this warming influence is not seen in Figure 4. Further monitoring may be needed to discern the influence of Red Clover Creek on Indian Creek water temperature. Last Chance Creek at Doyle Crossing and Lights Creek have the warmest maximum daily water temperatures in 2010, but Last Chance at Doyle Crossing shows a decrease in maximum daily water temperatures since 2003 (Fig 3). Maximum daily water temperatures have also decreased slightly at Notson Bridge since 2006. Figure 3 does not show much correlation between water temperature and summer average air temperature at Last Chance at Doyle Crossing and Red Clover at Notson Bridge. The relationship between water and air temperature is more apparent at Indian Creek at Flournoy Bridge.

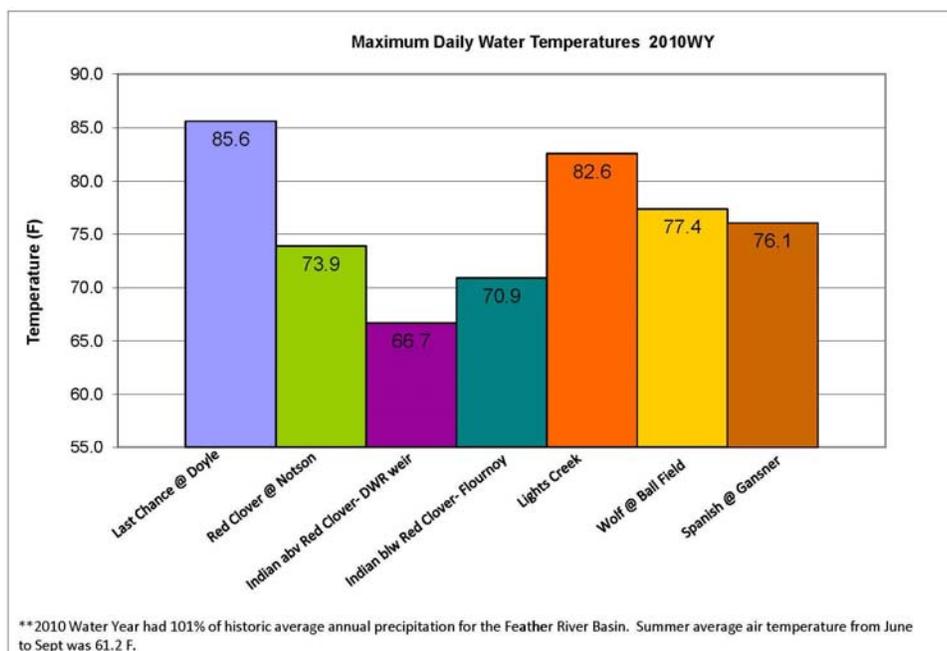


Figure 2. 2010 Maximum Daily Water Temperatures at all stations

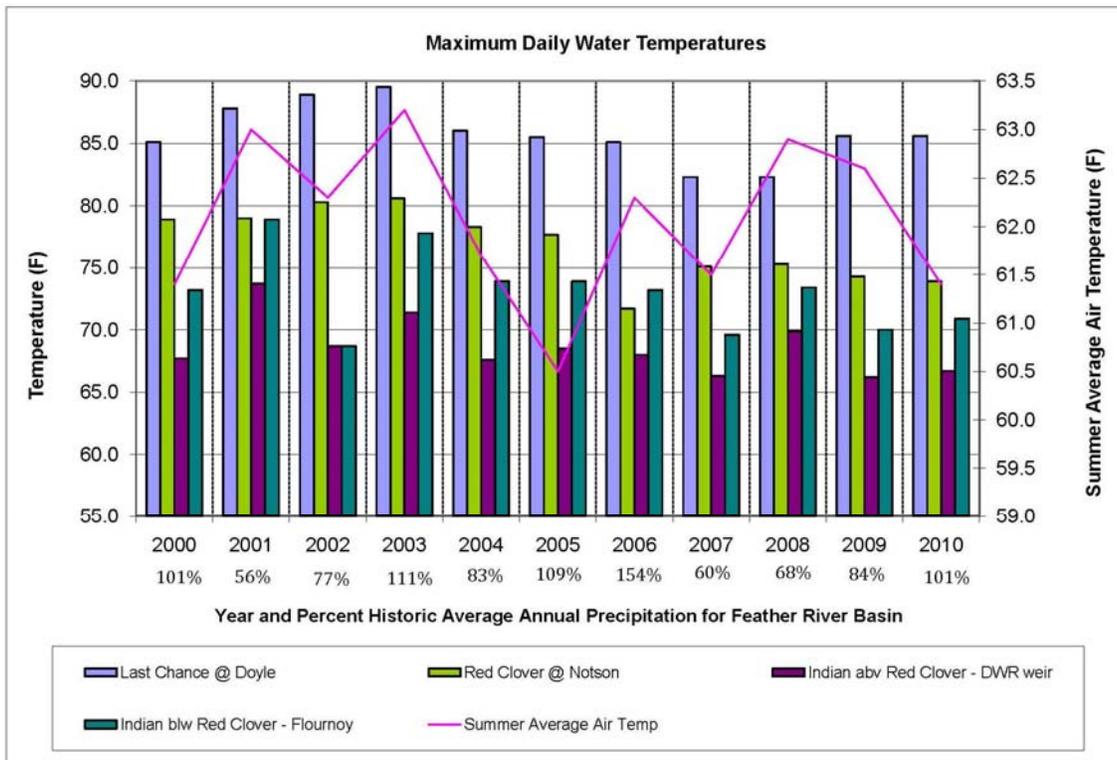


Figure 3. Maximum Daily Water Temperatures recorded in 2000- 2010 for stations affecting Genesee Valley

Maximum weekly average water temperature

Figures 4 and 5 show maximum weekly average water temperature, which is calculated by taking a running seven day average of mean daily water temperature for the entire water year. Then, the maximum value of the averages is taken. Figure 4 shows that Lights and Last Chance creeks are the two warmest channels in 2010. The warming effect Red Clover Creek has on Indian Creek is not seen in 2009 or 2010 (Fig 4 and 5). Figure 5 also does not show much correlation between water temperature and summer average air temperature at Last Chance and Red Clover creeks. The relationship between water and air temperature is more apparent at Indian Creek at Flournoy Bridge.

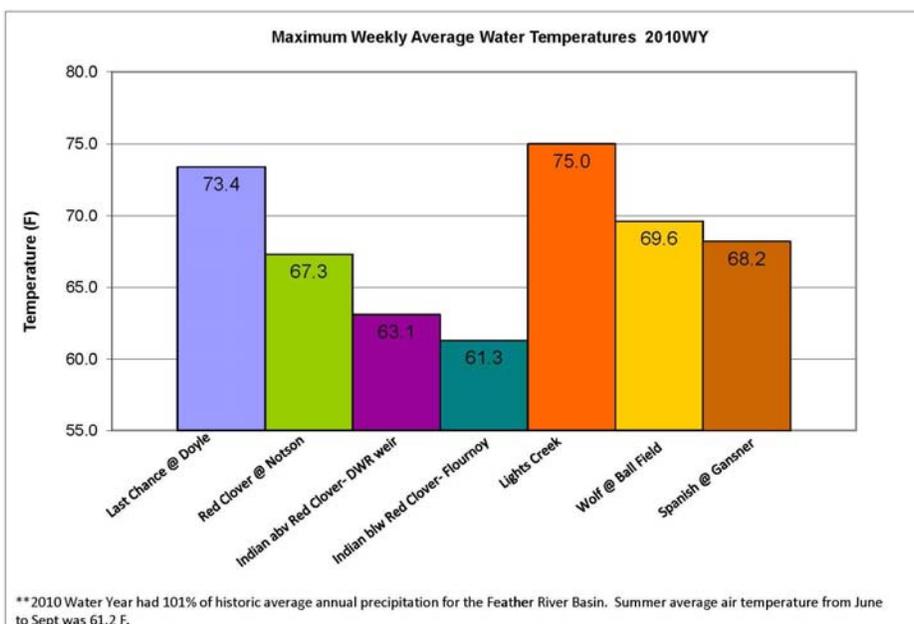


Figure 4. 2010 Maximum Weekly Average Water Temperatures at all stations

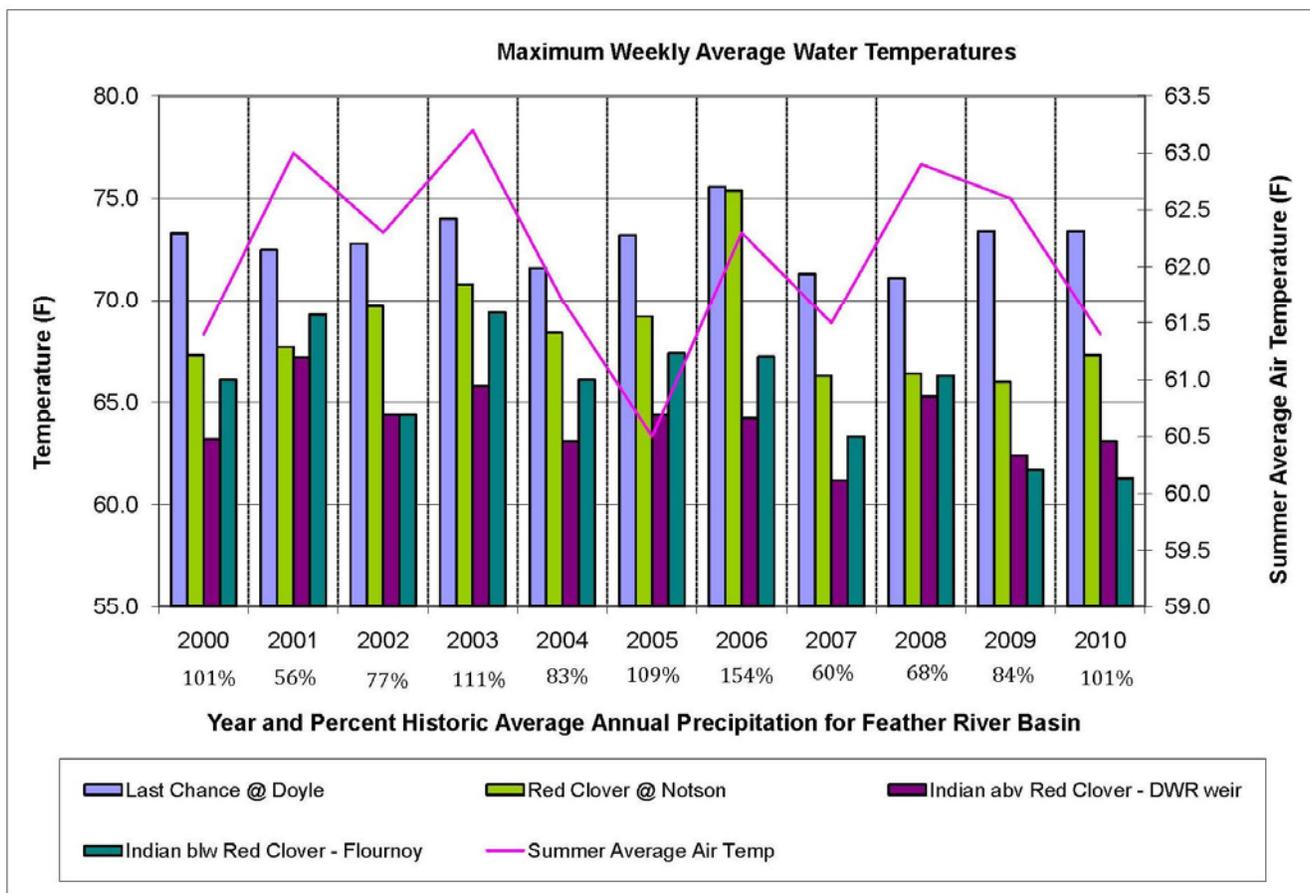


Figure 5. Maximum Weekly Average Water Temperatures recorded in 2000- 2010 for stations affecting Genesee Valley

Daily Maximum Water Temperature >75°F

Figures 6 and 7 display the number of days that had an absolute one-hour long temperature greater than 75°F among the seven continuous recording stations with usable low flow data from 2010 (Fig 6) and 2000-2010 (Fig 7). A reading greater than 75°F can be lethal to coldwater fish species, even if it is just a short-term maximum temperature reading. Last Chance and Lights creeks are the most impaired creeks monitored in the Indian Creek watershed during 2010. A downward trend in days above 75°F has been seen at Notson Bridge after 2006 (when Red Clover McReynolds project was constructed) and at Doyle Crossing after 2004 (when Last Chance Phase I was completed).

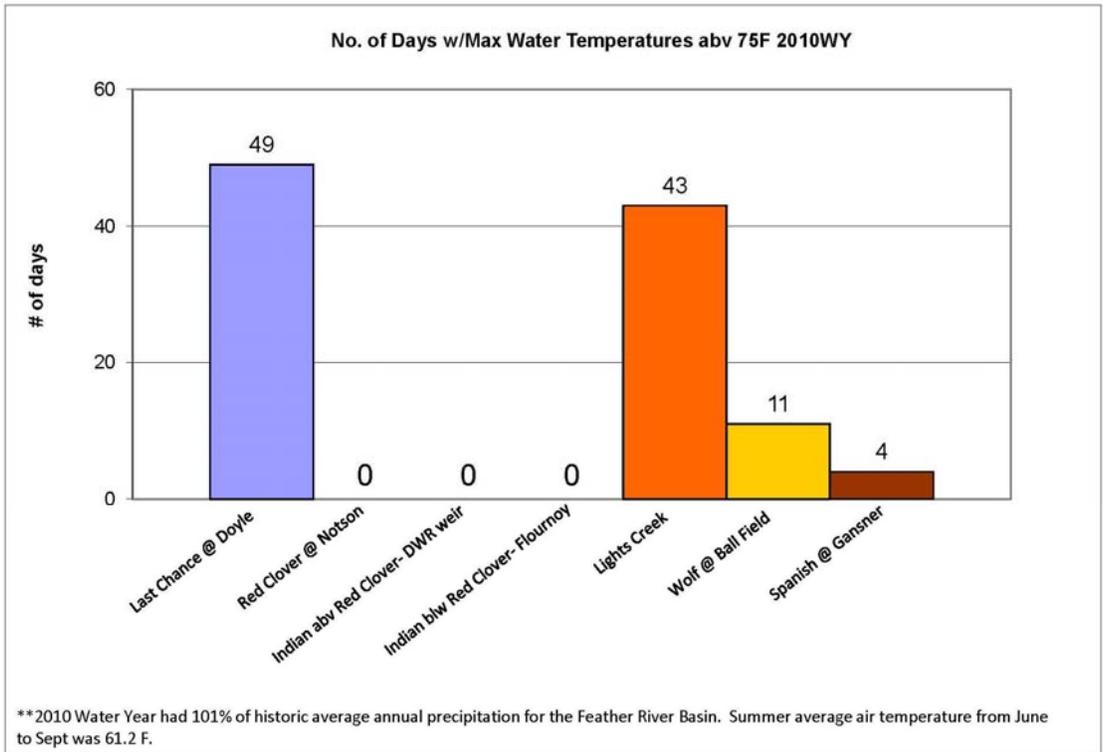


Figure 6. Number of days with maximum water temperature above 75F recorded in 2010

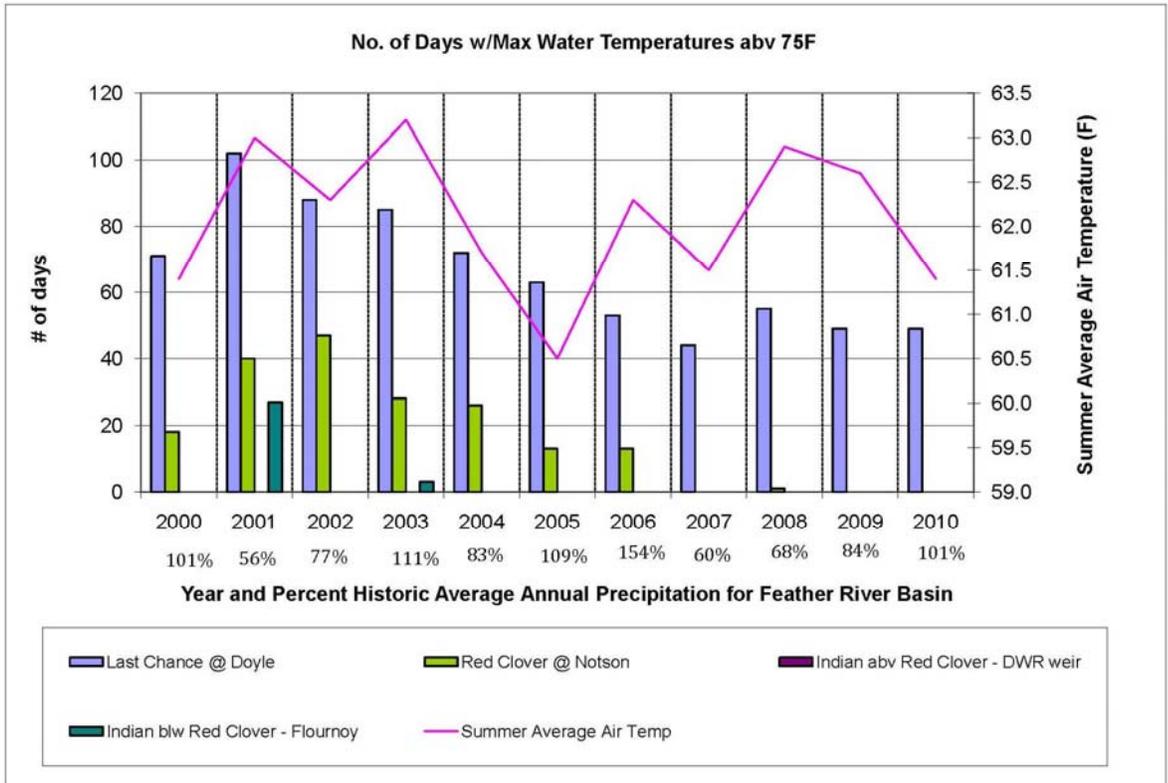


Figure 7. Number of days with maximum water temperature above 75F recorded in 2000-2010 for stations affecting Genesee Valley

Maximum summer diurnal water temperature fluctuation

Figures 8-11 display the maximum and average diurnal water temperature fluctuation. This is calculated by finding the difference between the maximum and the minimum water temperature in a 24-hour period (diurnal fluctuation). Then, a running seven day average of the diurnal fluctuation is calculated for June 1- Sept 30. Afterward the maximum value (Figures 8 and 9) and average value (Figures 10 and 11) of the averages is taken. This parameter is heavily dependent on air temperatures and insolation. For both Figures 9 and 11, 2010 show some of the smallest diurnal fluctuation in the entire 2000-2010 period. Last Chance Creek and Red Clover Creek seem to have been experiencing smaller diurnal fluctuations since 2005 and 2006, respectively. Stations missing in Figures 8-11 are due to significant gaps in the June 1- Sept 30 data.

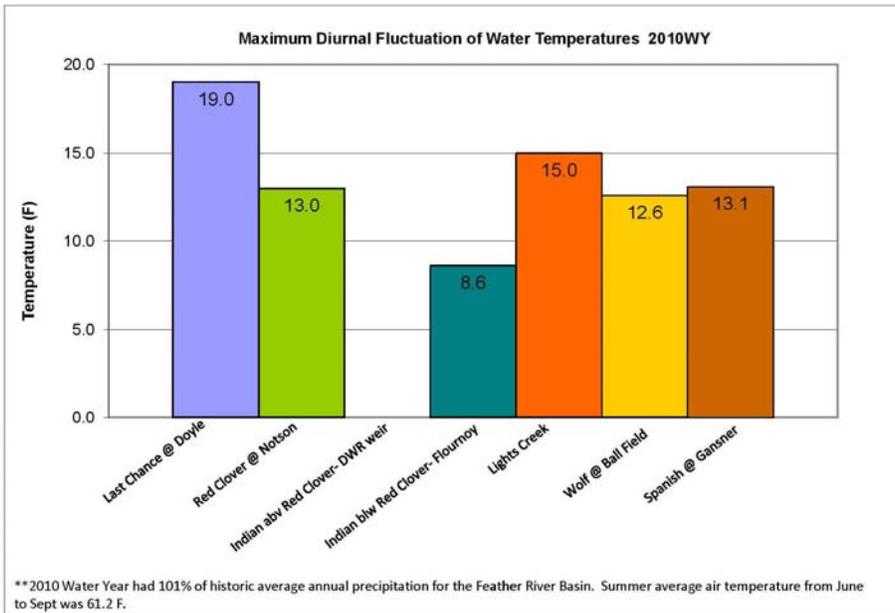


Figure 8. Maximum diurnal fluctuation of water temperature 2010

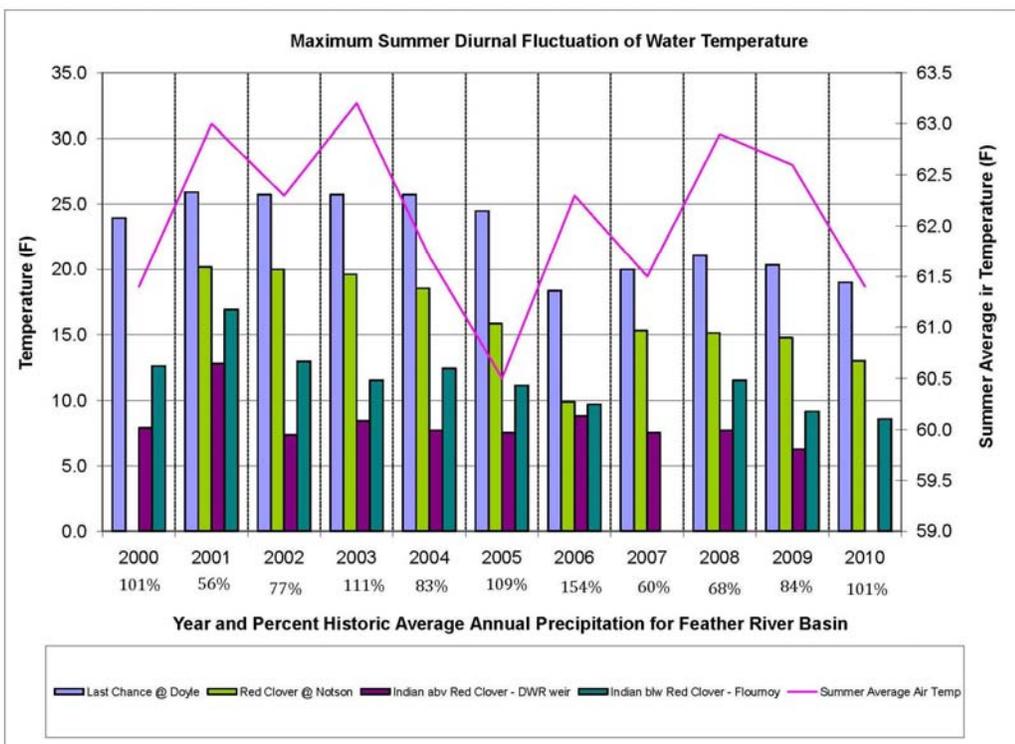


Figure 9. Maximum Diurnal Fluctuation of water temperature recorded in 2000-2010 for stations affecting Genesee Valley

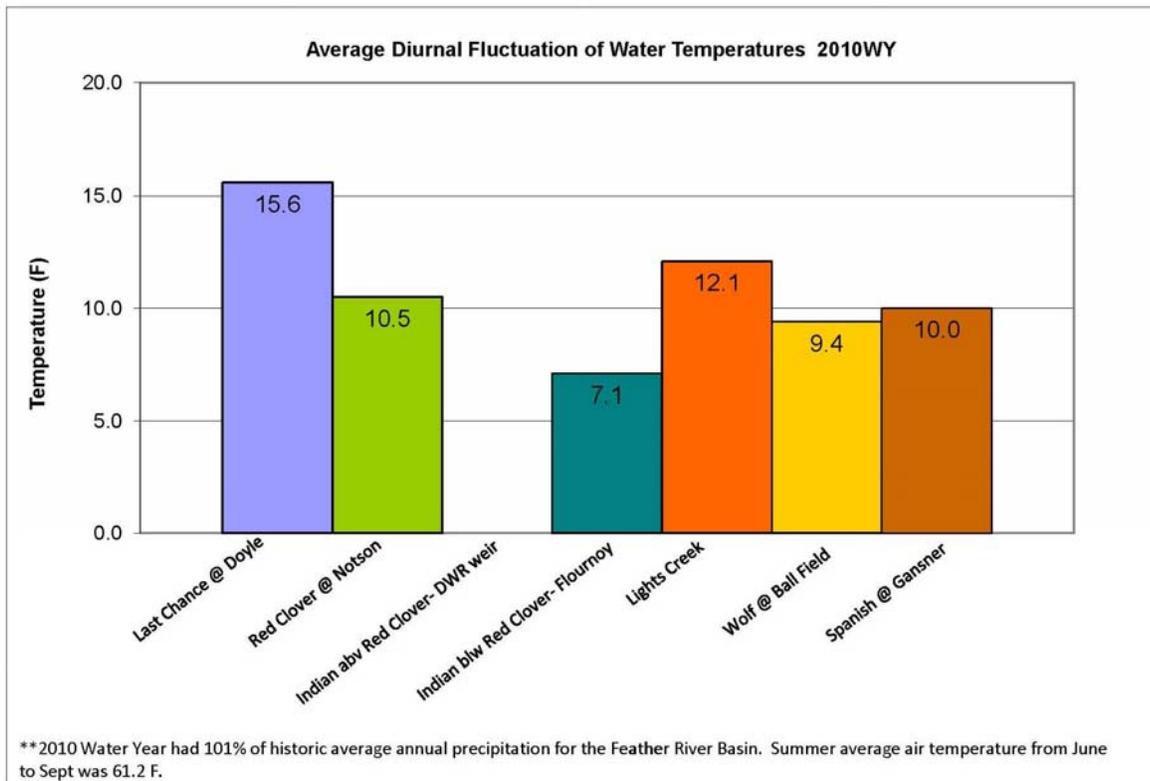


Figure 10. Average diurnal fluctuation of water temperature 2010

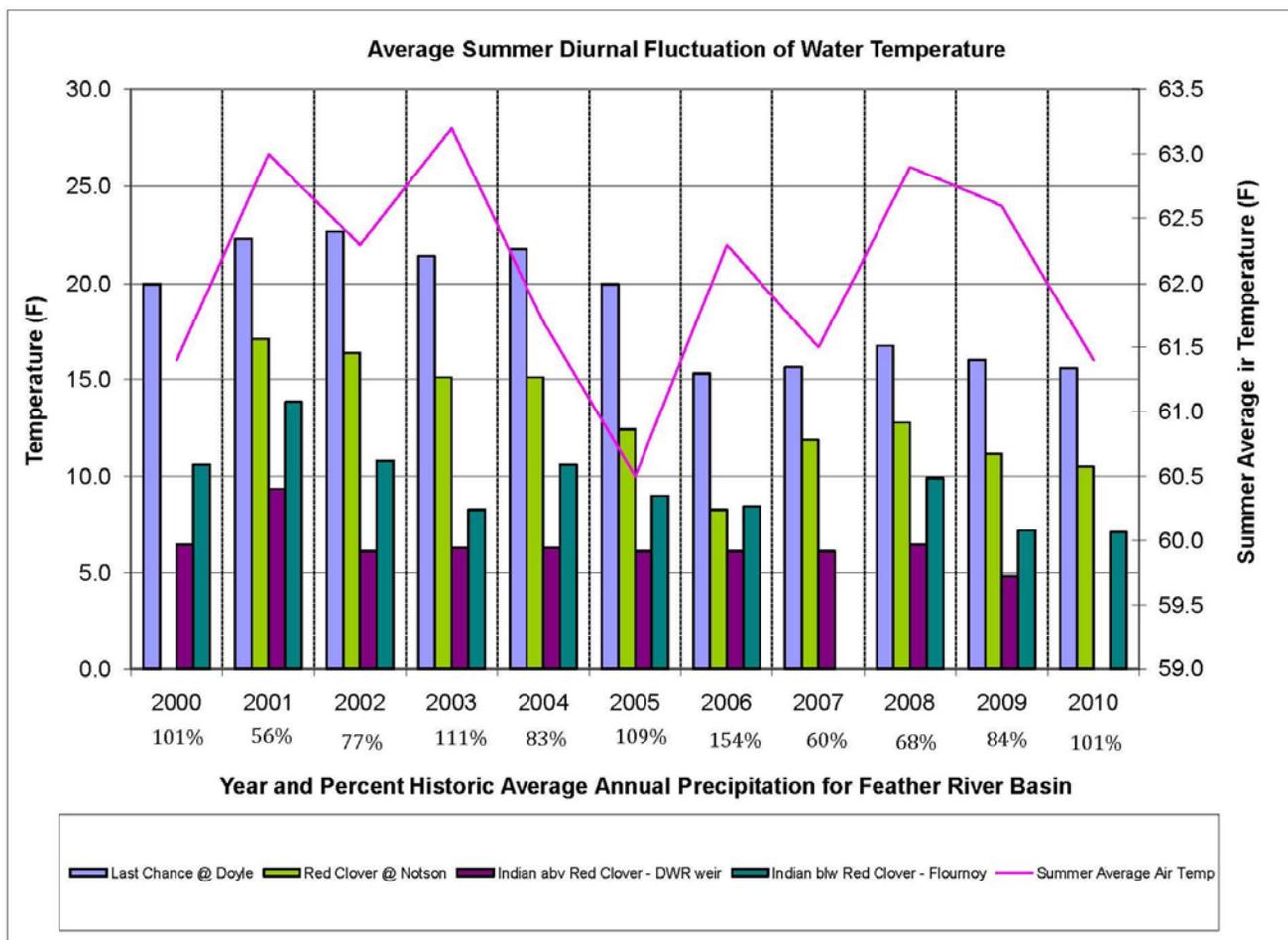


Figure 11. Average Diurnal Fluctuation of water temperature recorded in 2000-2010 for stations affecting Genesee Valley

Project Specific Water Temperature Data

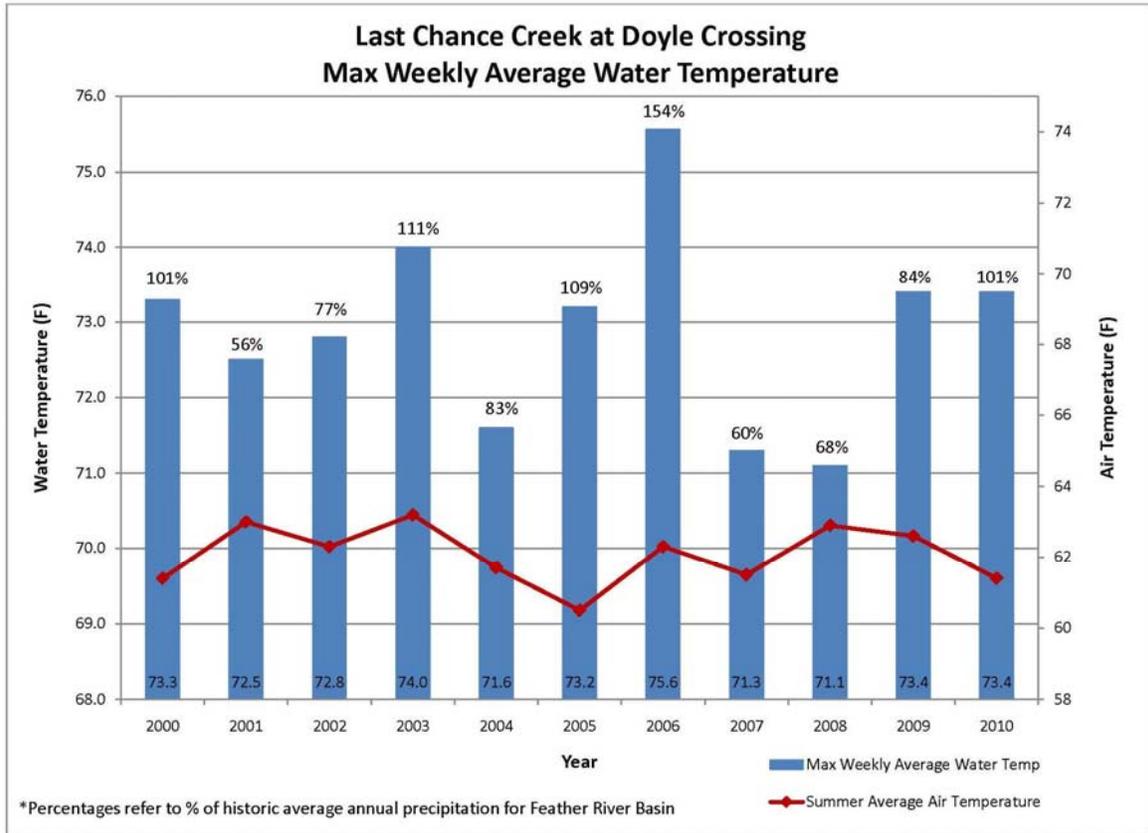


Figure 12: Maximum Weekly Average Water Temperature at Doyle Crossing for years 2000-2010

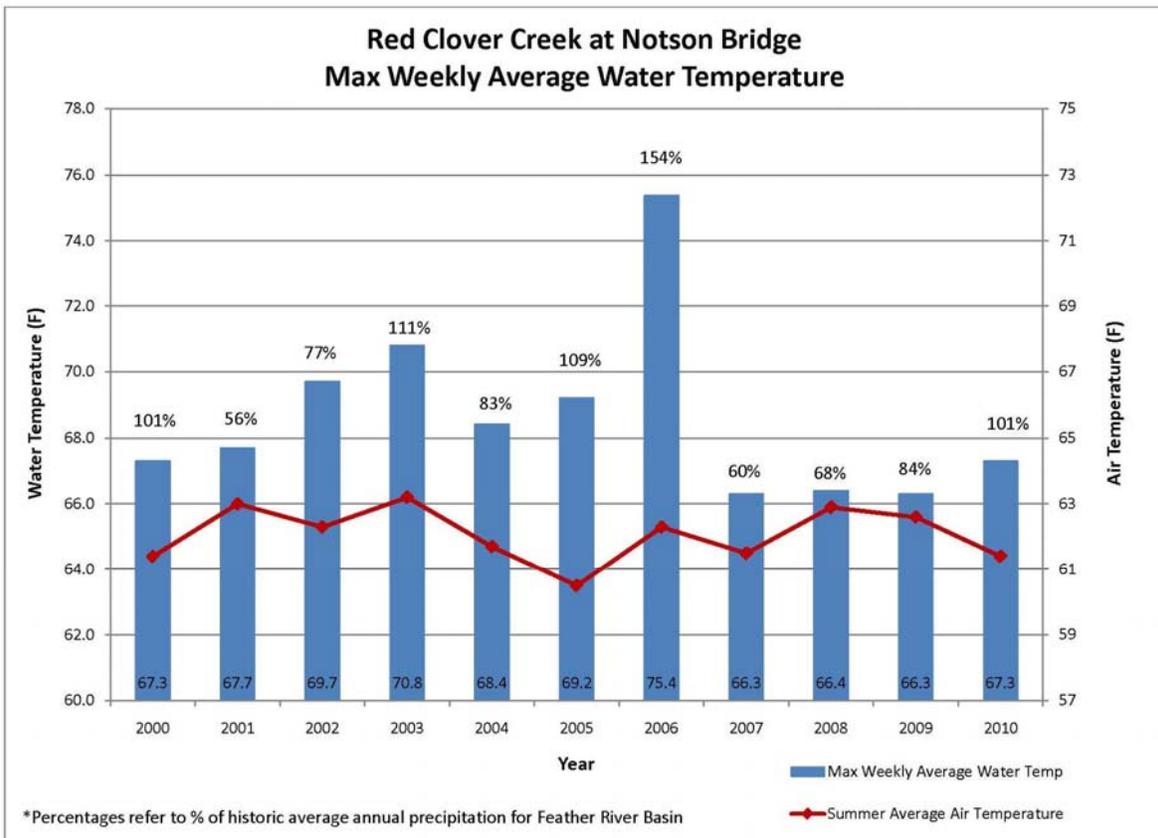


Figure 13: Maximum Weekly Average Water Temperature at Notson Bridge for years 2000-2010

Discussion

Last Chance Creek at Doyle Crossing and Lights Creek are consistently the most temperature impaired channels, followed by Wolf Creek and Spanish Creek. This temperature impairment of Last Chance, Wolf, Lights, and Spanish creeks may be from the diminishment of groundwater recharge and release function of the watershed above these stations. The locally high temperature readings at Doyle Crossing on Last Chance Creek possibly can be attributed to enhanced solar radiation from water sheeting over bedrock and a 400-foot long unshaded pool above the recording station. During May-October 2010 a HOBO temperature logger was placed upstream of this pool to record water temperature previous to flowing through the unshaded section of Last Chance Creek. The temperature logger was lost, probably taken by beaver, before it was collected in October. A temperature logger will be placed here again in 2011.

Figure 12 displays maximum weekly average water temperature on Last Chance Creek at Doyle Crossing. The warmer water temperatures in the high precipitation year of 2006 may be due to high stream flows scouring out shade plants on the banks within the gullied channel and resulting in a high width to depth ratio, more insolation, and more surface water influence in the water temperatures. The warmer water temperatures in 2006 could also be due to meadows still filling after restoration. In 2007 and 2008 there is a significant decrease in water temperatures, despite about a 50% decrease in precipitation. In 2009 and 2010 water temperature warm despite cooler air temperatures. It appears there is little correlation between maximum weekly average water temperature and summer average air temperature. It could be suggested that this decline in water temperature may be attributed to more groundwater influence than air temperature.

The same reasoning could pertain to Figure 13, which displays maximum weekly average water temperature on Red Clover Creek at Notson Bridge. The water temperatures in 2010 at both Doyle Crossing and Notson Bridge are almost identical to the water temperatures in 2000, with similar percent historic precipitation and summer average air temperatures.

Stream Flows

Many of the FRCRM projects entail restoring the meadow/floodplain features in the watershed. This results in increasing the residence time of groundwater in the landscape. This increased time results in increased opportunity for infiltration into shallow and deep aquifers. Groundwater pathways are complex and not readily understood. A portion of the groundwater potentially infiltrates into dispersed deep bedrock fractures, along the boundary zone between the meadow alluvium and bedrock. This groundwater may flow in a down-valley direction along this boundary zone to emerge as channel surface water well downstream of a project area. A primary purpose of the FRCRM's nested network of streamflow stations is to detect hydrologic change at increasing watershed scales. We have been collecting data at these stations since 2000. Stations are located from ten to thirty miles downstream of the CRM's on-going project focus areas. The expectation is that surface and sub-surface base flow changes resulting from restoration can be detected down-watershed.

Figure 14 displays the weekly minimum average flows on Last Chance, Red Clover, and Indian creeks. This is calculated by taking a running seven day average of the average daily water flow for the entire water year. Then, the minimum value of the averages is taken. Figure 14 shows what may be early evidence of a measurable down-valley increase in flows from restoration project work. Figure 1 shows the location of the four stations. The Flournoy station (blue) is on Indian Creek, and is downstream of the confluence of Indian Creek, Last Chance Creek and Red Clover Creek. The 378-acre Red Clover McReynolds project was completed in December 2006. The Red Clover Poco Project, constructed in 2010, restored 160 acres of meadow. Over 1,800 acres of meadow restoration has occurred in the Last Chance Creek watershed between 2001-07. The Notson station (green) is on Red Clover Creek, about

six miles upstream of Flournoy station. The Doyle Crossing station (red) is on Last Chance Creek about ten miles upstream of Flournoy station. The DWR weir (purple) is on Indian above the confluence with Red Clover, and about ¼ mile upstream of the Flournoy station.

In Figure 14, precipitation in 2000 (pre-project) is comparable to 2010 (post-project). However, flows at Flournoy are dramatically higher in 2007-2010, and are also greater than the sum of the flows at the other three stations. Figure 15 displays 2010WY weekly average minimum flows for all continuous recording stations.

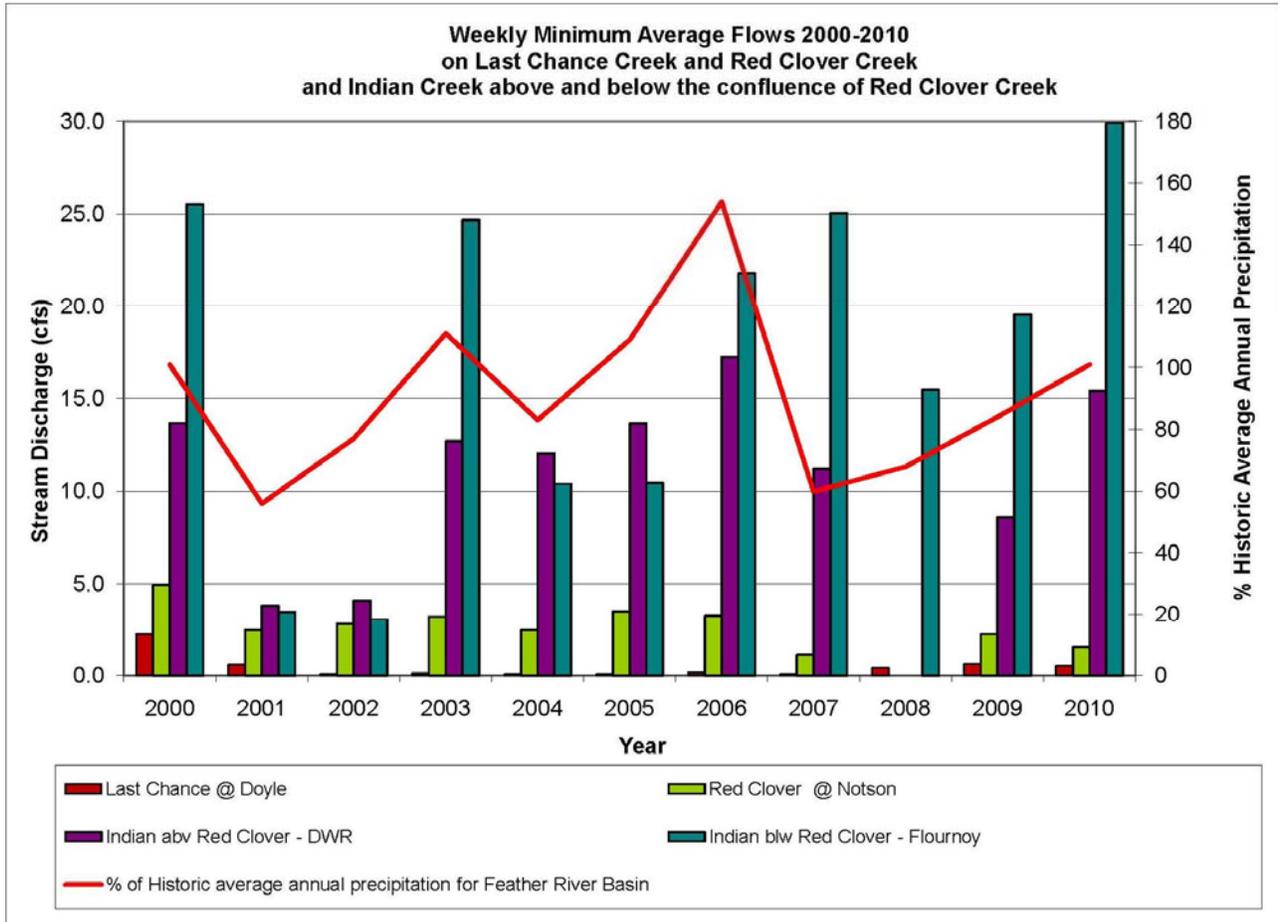


Figure 14. Weekly Minimum Average Flow from 2000-2010 on Last Chance Creek and Red Clover Creek and Indian Creek above and below the confluence of Red Clover Creek

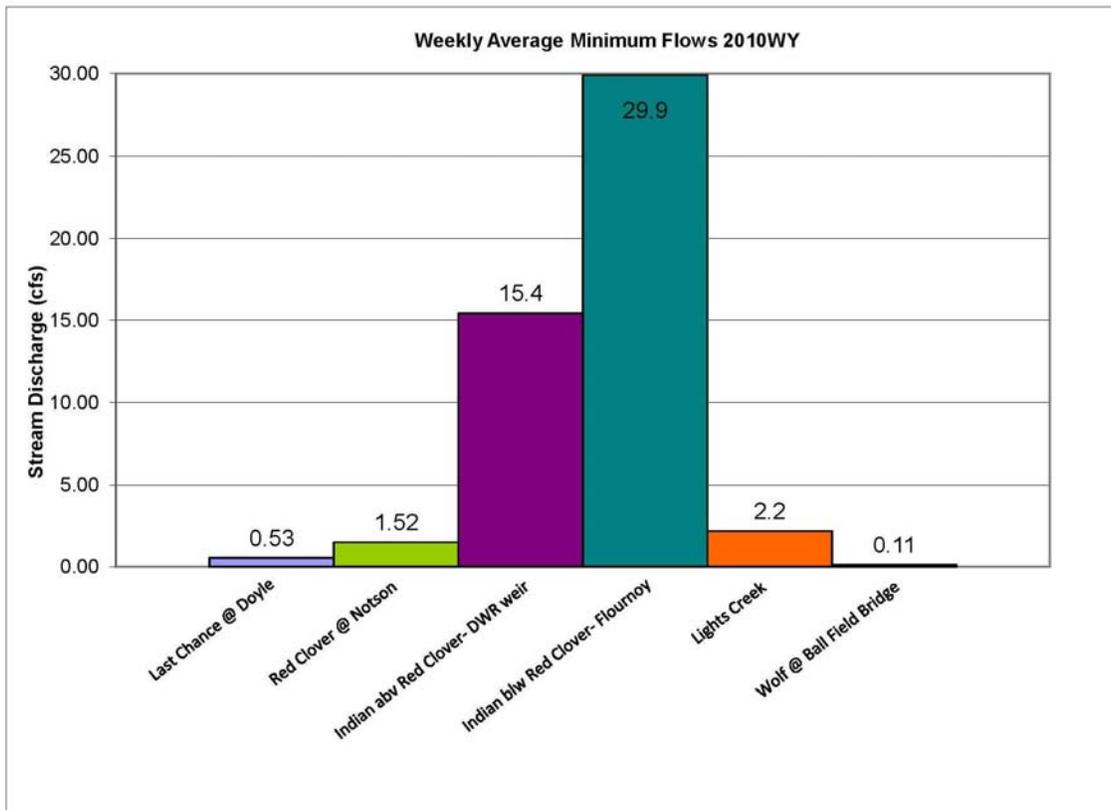


Figure 15. Weekly Average Minimum Flow 2010WY

Project Specific Flow Data

Figures 16 and 17 display the spring hydrographs of Red Clover Creek at Notson Bridge and Last Chance Creek at Doyle Crossing, respectively, from May 1 through September for 2000WY and 2010WY. 2000WY is compared to 2010WY, since both years had 101% of normal historic average annual precipitation for the Feather River Basin.

Figure 16 shows base flows recorded on Red Clover Creek at Notson Bridge for 2000 and 2010. Data are missing from July 5 to Aug 10, 2000. This chart shows very similar base flows in 2000 and 2010.

Figure 17 shows the base flows recorded on Last Chance Creek at Doyle Crossing in 2010 are slightly greater than that of 2000 from July through September. Precipitation events in August and September are similar in 2000 (0.37 in) and 2010 (0.32 in). The slightly augmented base flow in 2010 could be due to the restoration of ten miles of stream channel on Last Chance Creek upstream of Doyle Crossing, as well as the timing and intensity of precipitation. A sum of the stream flows in August and September at Doyle Crossing were taken for 2000 and 2010. In August 1 through September 30, 2000 there was 89.4 acre-feet of water. The same dates in 2010 show 130.6 acre-feet of water. The base flow augmentation in August and September 2010 was 41.2 acre-feet more than in 2000, an average of 0.68 acre-feet per day (0.34 cubic feet per second per day).

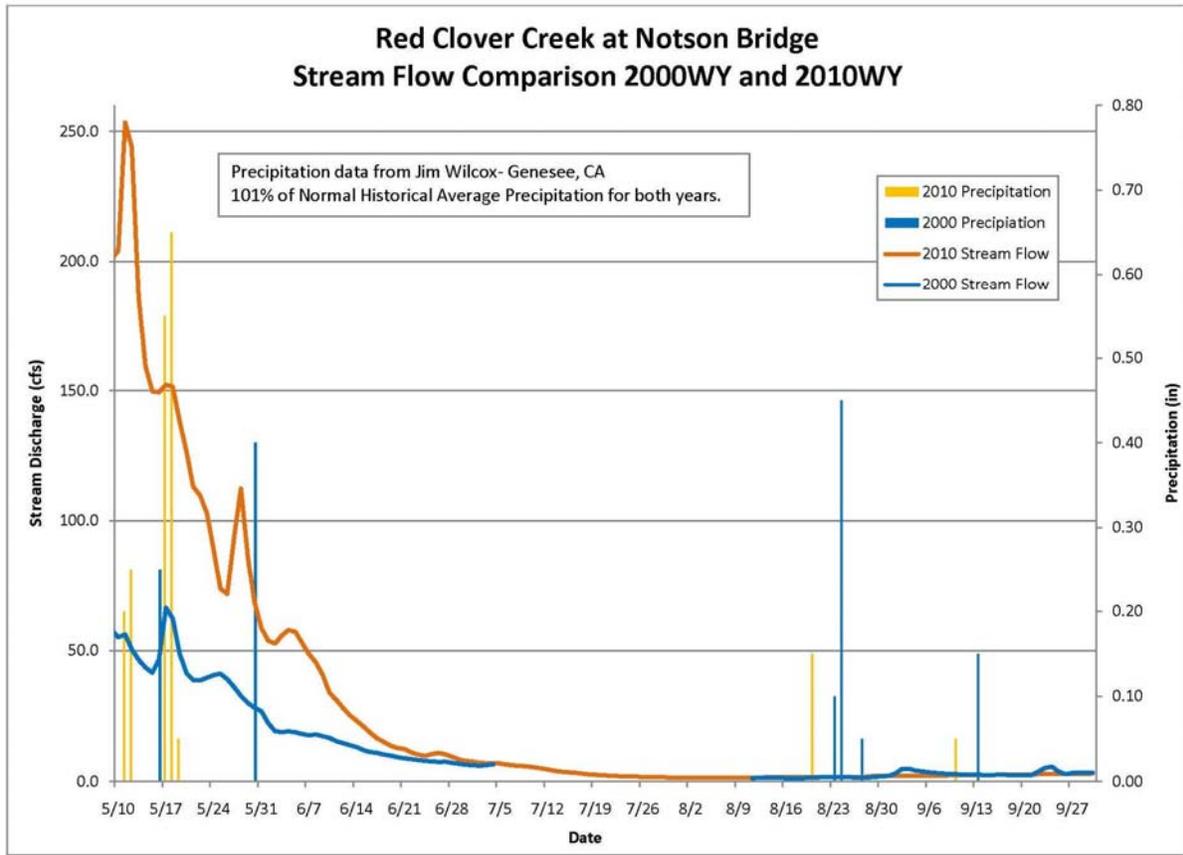


Figure 16: Spring recession and summer stream flows in 2000WY and 2010WY at Notson Bridge

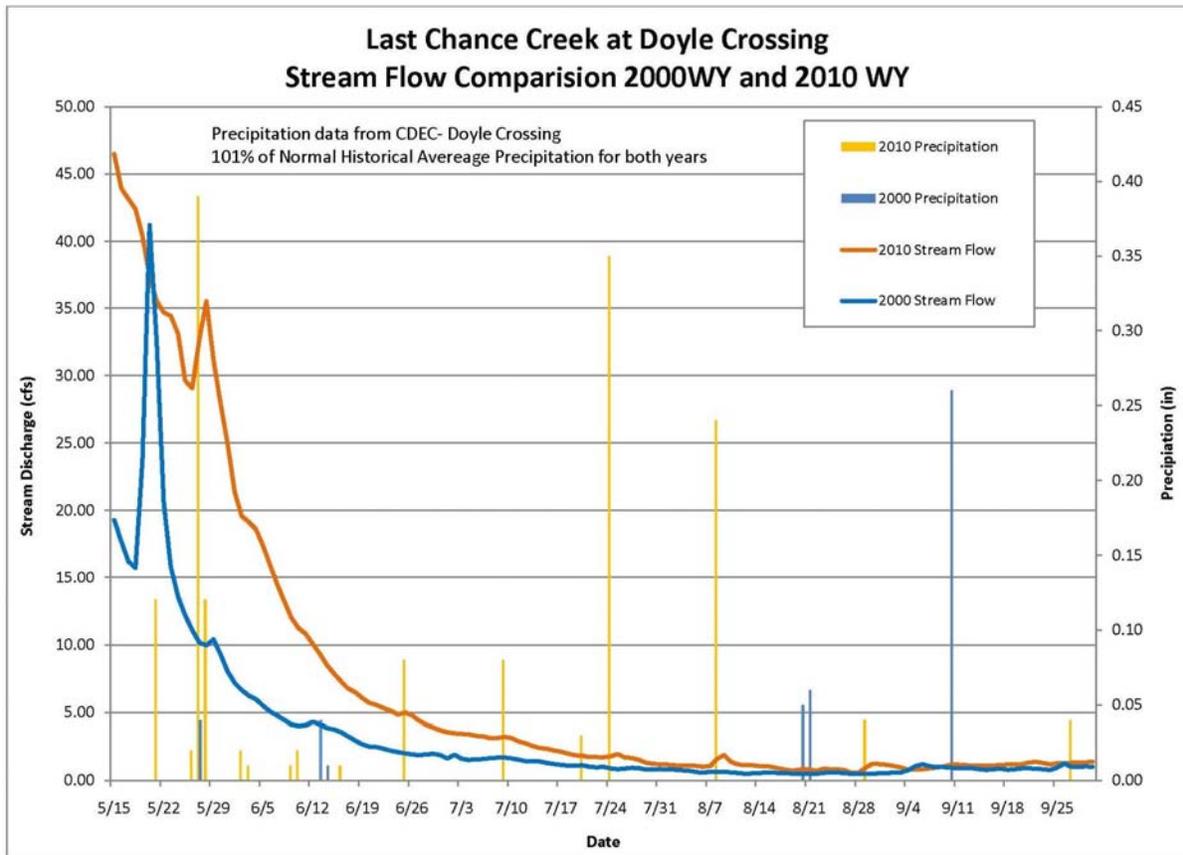
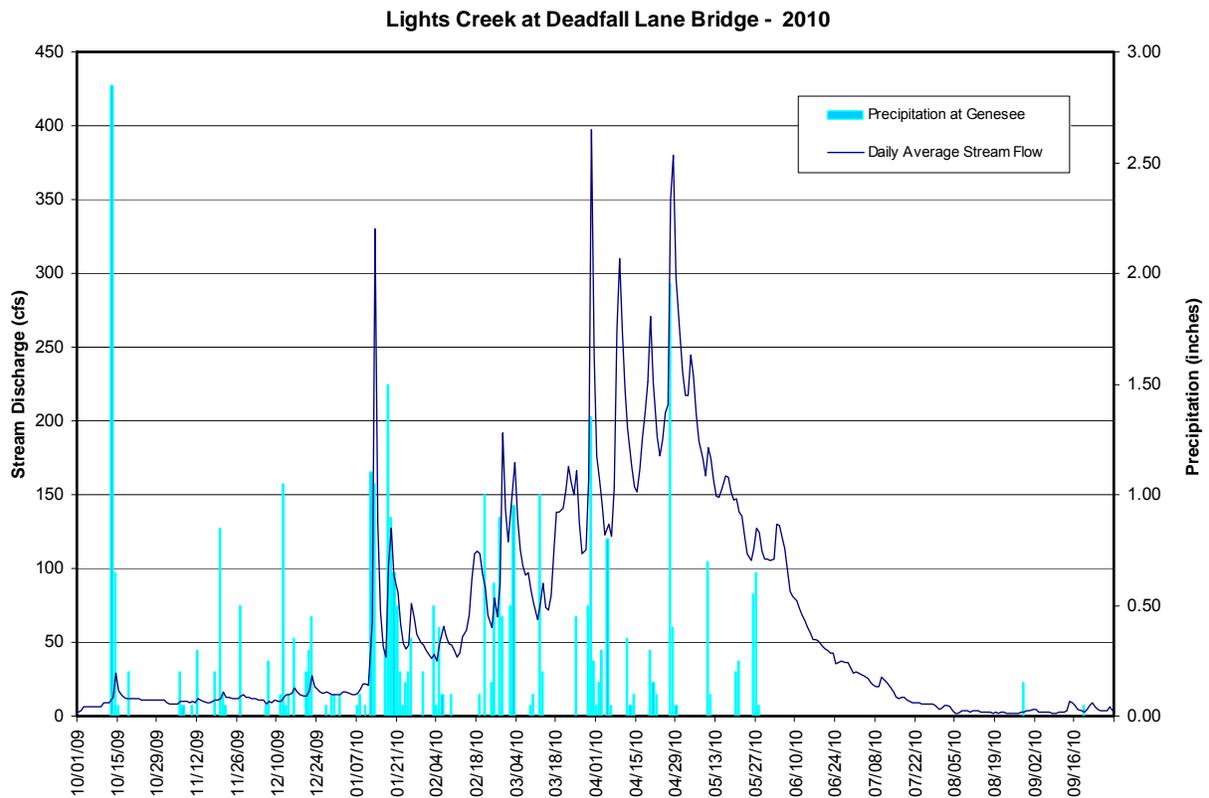
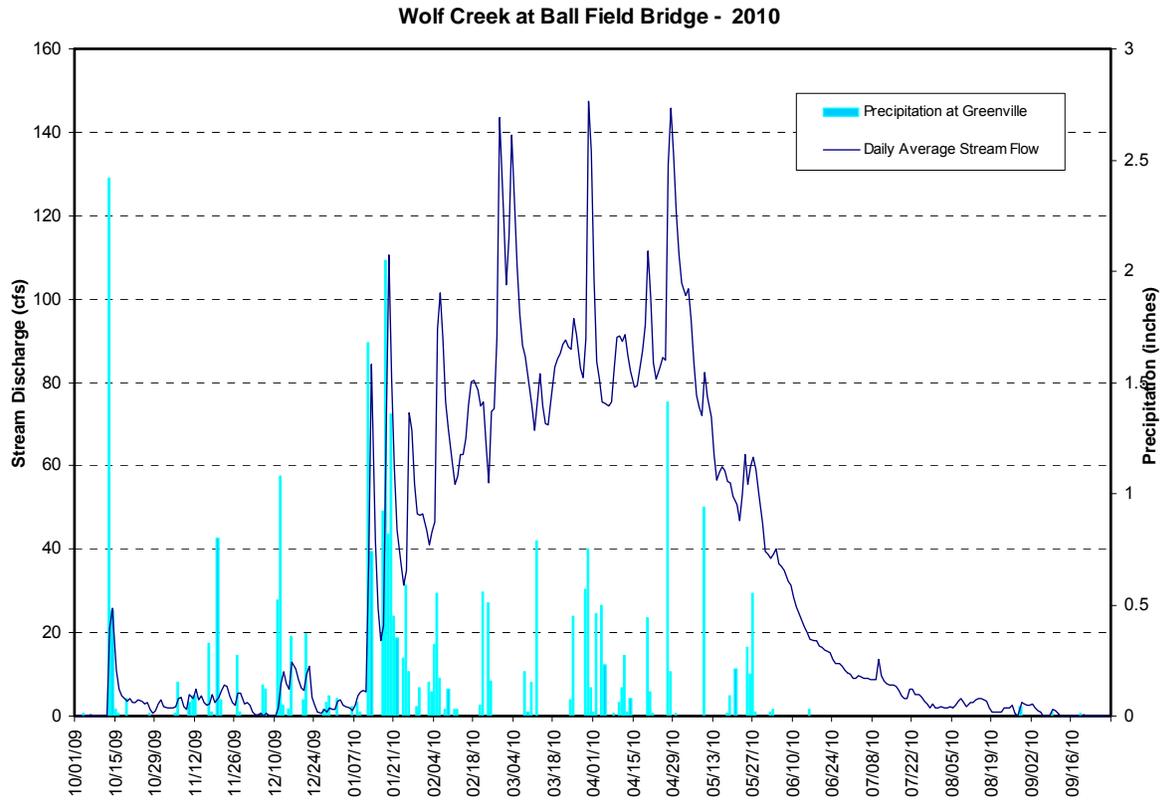
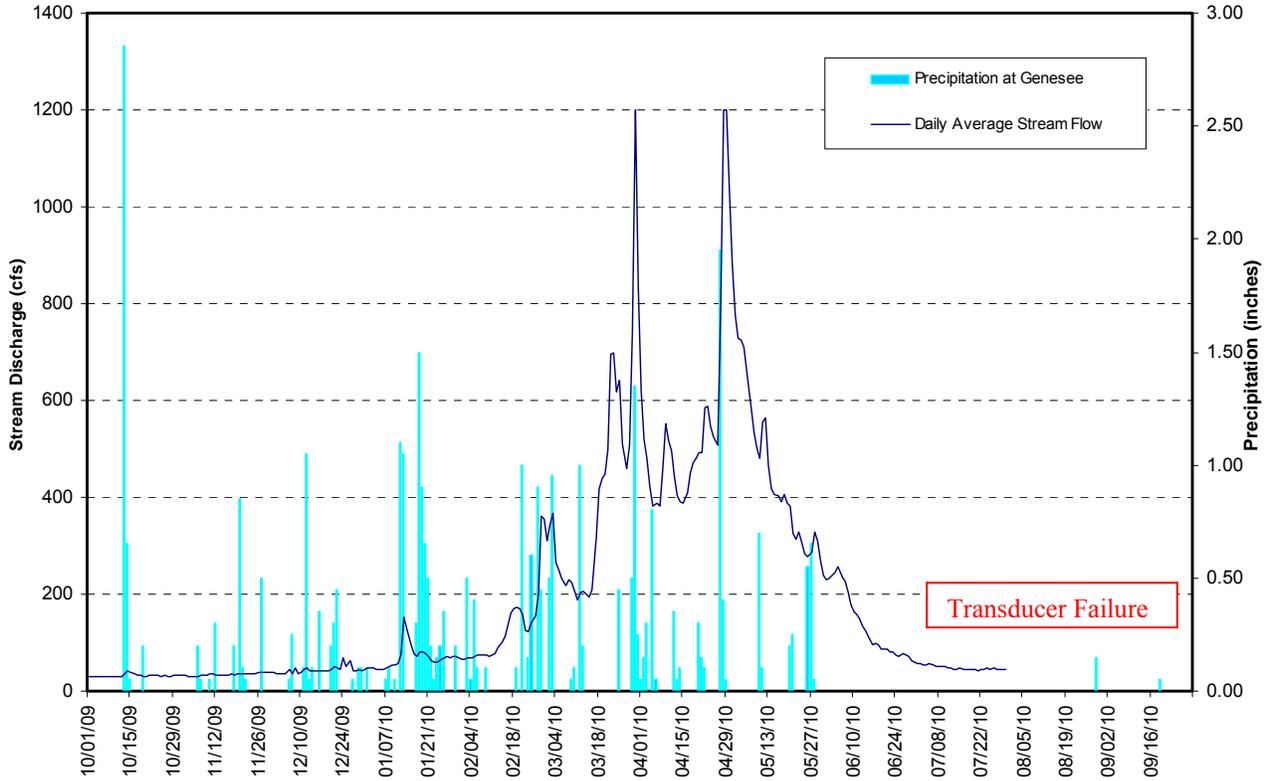


Figure 17: Spring recession and summer stream flows in 2000WY and 2010WY at Doyle Crossing

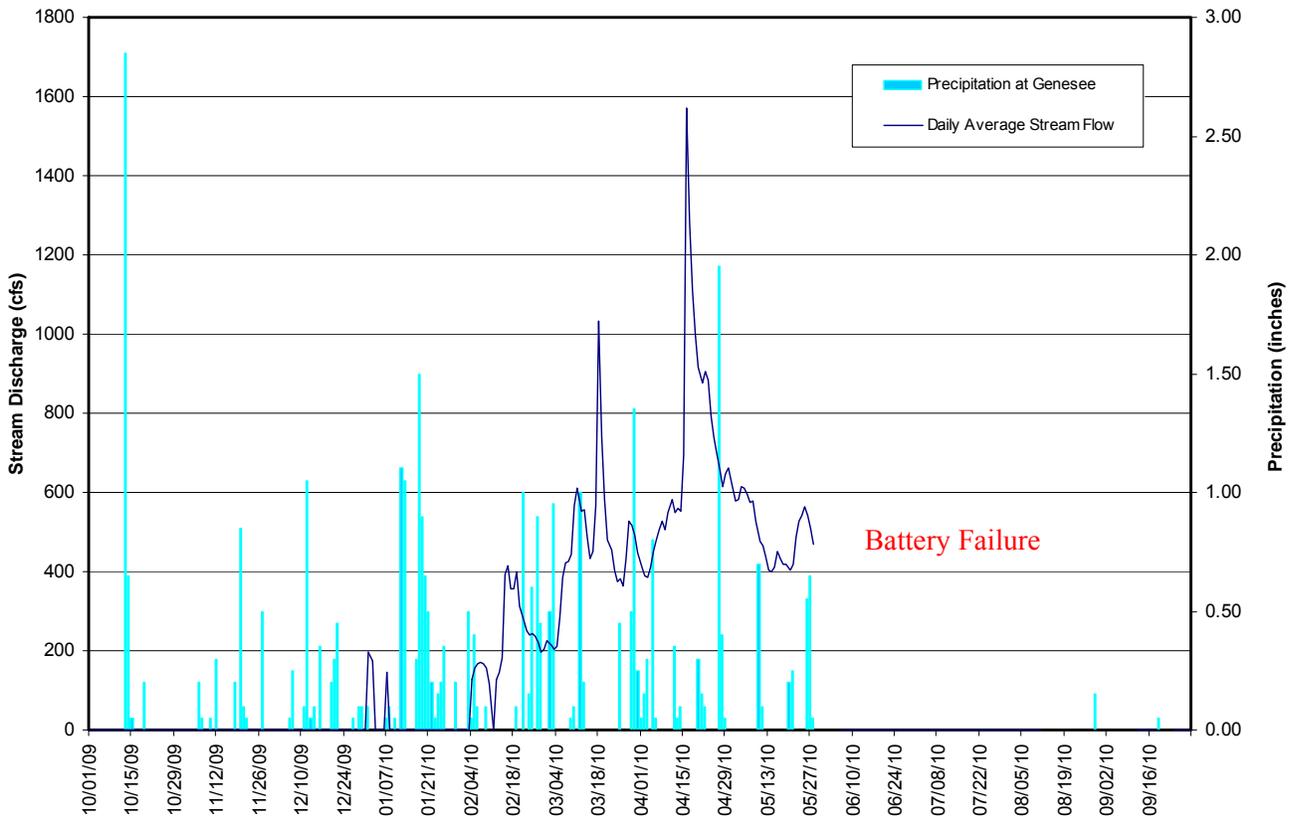
Watershed Hydrographs for continuous recording stations WY2010 (precipitation data taken at nearby weather stations)



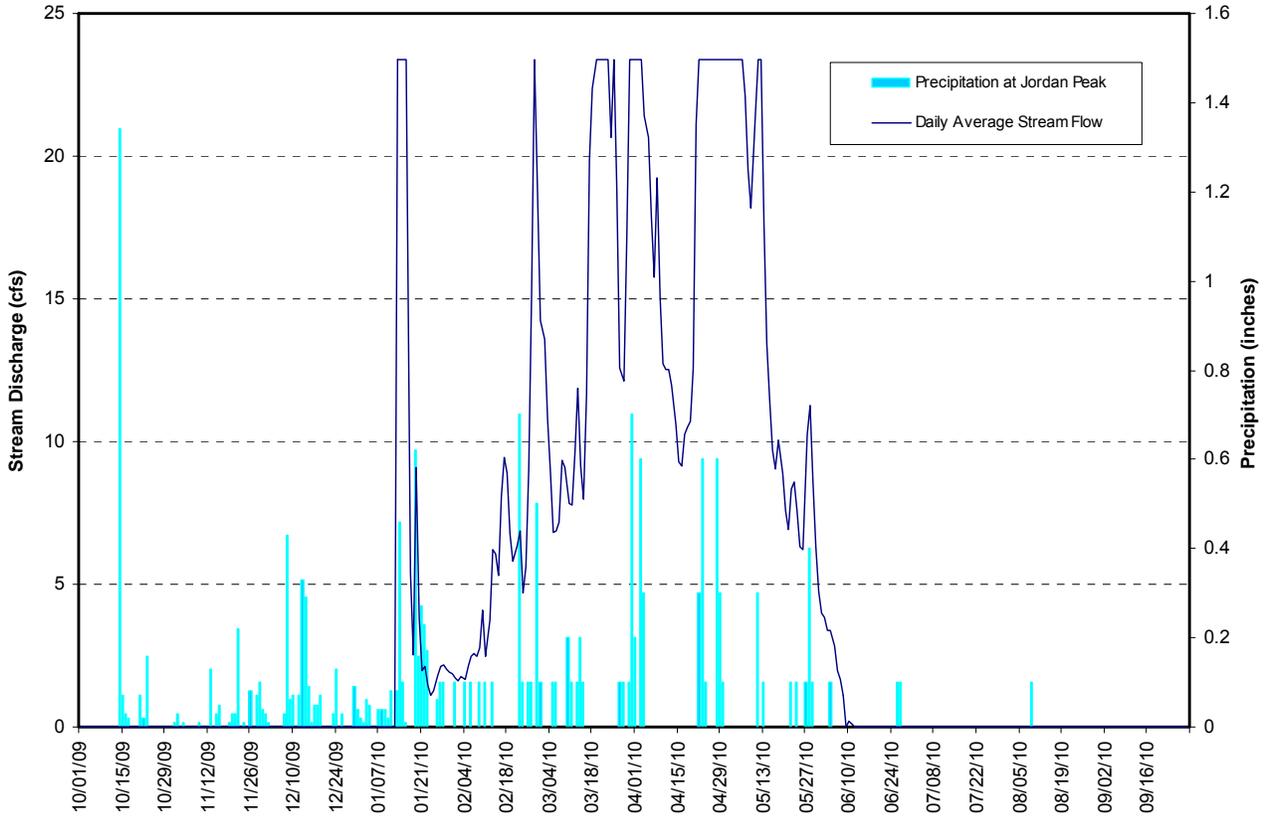
Indian Creek at Flournoy below Red Clover - 2010



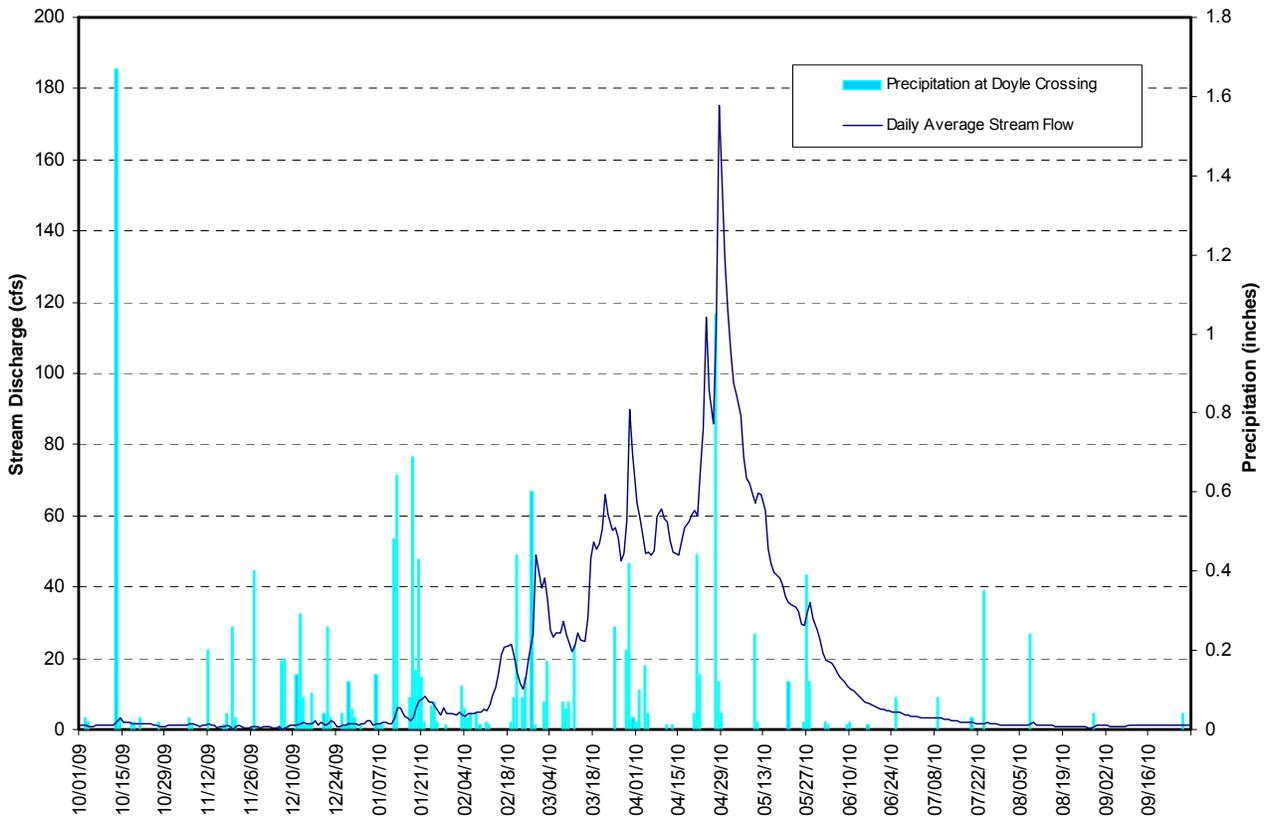
Indian Creek at Taylorsville Bridge - 2010



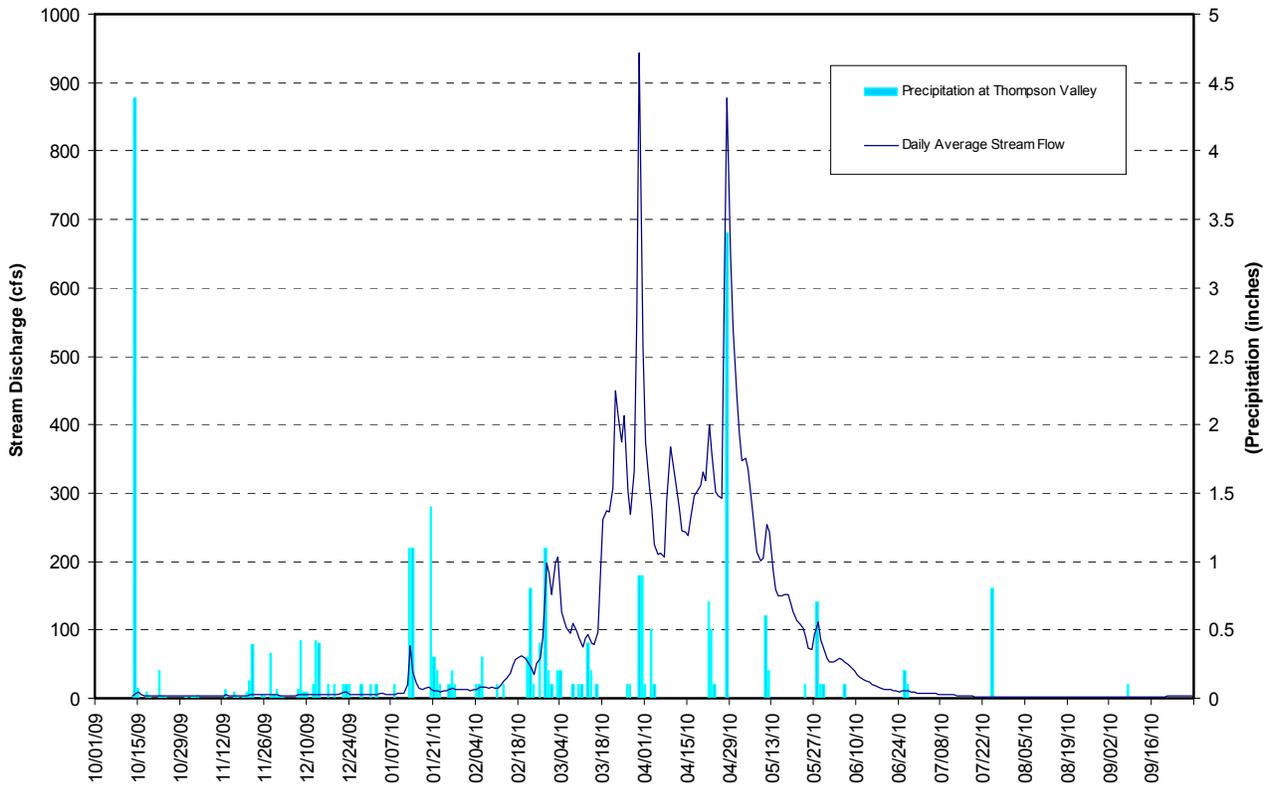
Last Chance Creek at Million Dollar Bridge - 2010



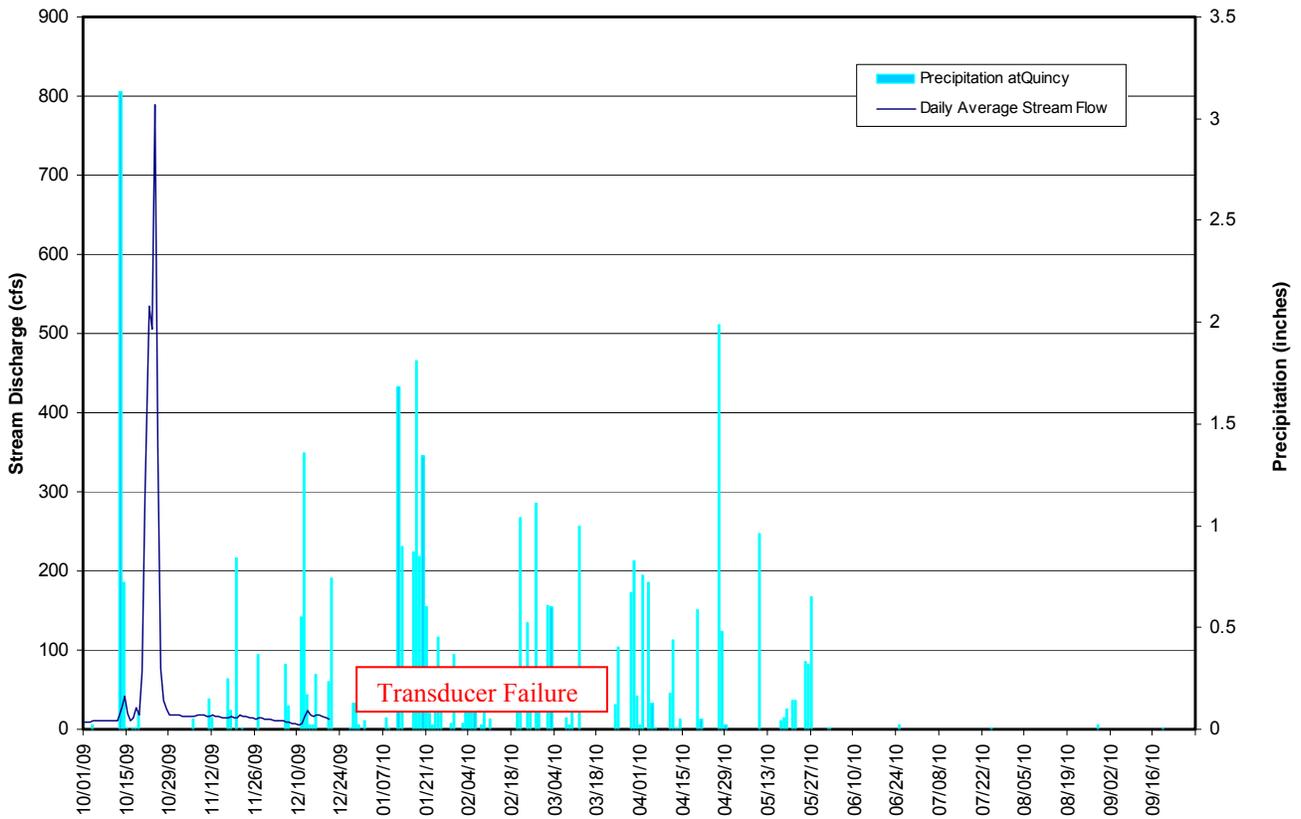
Last Chance Creek at Doyle Crossing - 2010



Red Clover Creek at Notson Bridge - 2010



Spanish Creek at Quincy Foot Bridge - 2010



Conclusion

The 2010 Water Year was a normal water year after three years of a drought. While Last Chance and Lights Creeks continued to be the most impaired streams for cold water fisheries that FR-CRM monitors, significant improvement in water temperatures were seen on Last Chance Creek at Doyle Crossing over the last four years of watershed monitoring data. Such water temperature improvements may be attributed to over 10 miles of channel and almost 1,500 acres of affected meadows that have been restored by FR-CRM on Last Chance Creek above Doyle Crossing. Eight more miles of restoration on Last Chance Creek above Doyle Crossing is planned for construction, and we hope to see more improvements in summer water temperatures and baseflow on Last Chance Creek at Doyle Crossing. There have also been improvements seen on Red Clover Creek at Notson Bridge in maximum weekly average water temperature. These improvements may be due to the effect of the Red Clover/McReynolds Creek Restoration Project, which restored three miles of channel nine miles upstream of Notson Bridge. An additional 2.5 miles was restored when the Red Clover POCO Project was constructed in 2010. Flows downstream of the project at Notson Bridge did not seem to be greatly affected by project construction.

Unlike the improvements on Last Chance Creek and Red Clover Creek, we foresee little improvement in summer water quality on Lights Creek, particularly with sediment contribution from fire and subsequent rehabilitation activities following the Moonlight fire in 2007. Wolf Creek water quality may improve with the channel restoration upstream of Main Street between Setzer Road Bridge and the Greenville Campground completed by the US Forest Service.

Feather River Watershed

North Fork Feather River

East Branch North Fork Feather River

Middle Fork Feather River

Indian Creek

Spanish Creek

Red Clover Creek

Last Chance Creek

@ Ball Field Bridge
 @ Deadfall Lane Br.
 Taylorsville Br.
 @ Flournoy Bridge
 @ DWR weir

Wolf Creek (1989 & 2002) 2.6 miles, 29 acres

Lights Creek (CRS)

Hossellus Creek (2002-2006) 1 mile, 60 acres

Ward Creek (1999) 1 mi./165 acres

@ Notson Bridge

Bagley (1996) .26 miles, 10 acres

Poco (1996) .23 miles, 20 acres

Red Clover Poco (2010) 2.5 miles, 160 acres

Red Clover McReynolds (2006) 4 miles, 350 acres

Red Clover Demonstration (1965) 1 mile, 70 acres

Noble (1990) .28 miles, 25 acres

Dale Creek (2007) .38 miles, 12 acres

Dotta Canyon (1998) .5 miles, 50 acres

Boulder Creek (1997) .75 miles, 20 acres

Willow Creek (1996) .25 miles, 11 acres

Greenhorn Creek (1991 & 2001) .75 miles, 18 acres

@ Dyrr Bank

Dyrr Bank (2006) .11 miles

Elizabethtown (2002 & 2003) .3 miles, 7 acres

Kellet Bank (2008) .5 miles

Silver Creek (2008) .4 miles

Doyle Crossing

Big Flat (1995 & 2004) 1 miles, 47 acres

Above & Below Big Flat

Stone Dalry (2001) .5 miles, 20 acres

Little Stony Creek (1996) .15 miles, 2 acres

PIIF (2003-07) 585 acres
 multiple project reaches include:
 Ferris Flat (2003)
 Ferris Creek (2003)
 Ferris Fields (2007)
 Alkali Flat (2002)

Million \$ Bridge

PIIF (2002-05) 350 acres
 multiple project reaches include:
 Jordan Flat + Supplemental (2002+05)
 Arday (2002)
 Bird-Jordan (2002)

Last Chance Charles-Matley (2004) .4 miles, 80 acres

Long Valley (2008) 2.1 mi/ 170 acres

Poplar Creek (1994 & 2003) .15 miles, 15 acres

Jamison Creek (1995 & 2005) .38 miles, 20 acres

Smith Creek (2007) .8 miles, 30 acres

Sulphur Creek (CRS)

Sulphur Bank Stabilization (2005) .1 miles

Rapp-Guldol (2007) .4 miles, 13 acres

Boulder Creek (2008) .6 miles, 17 acres

Humbug-Charles (2004) .5 miles, 60 acres

Carman (2001 & 2002) 2.5 miles, 245 acres

Little Last Chance (2007) 5 miles, 750 acres

Rowland (1997) 2 miles, 50 acres

Sulphur Cr.
 @ 89 Br.

● Continuous Recording Station (CRS)