

Red Clover and Last Chance Creeks Stream Flow Monitoring Report



Red Clover Creek, May 2012

**Feather River Coordinated Resource Management
Plumas Corporation
May 2012**

This report displays stream flow data collected by the Feather River Coordinated Resource Management group (FRCRM) on Red Clover and Last Chance creeks. This report attempts to display all stream flow data collected on Red Clover and Last Chance creeks to date. There are no conclusions drawn from the data in this report. Further analysis and discussion of the Red Clover data is available in the Red Clover McReynolds Monitoring Reports from 2007-2010. These reports are available on the FRCRM website under the Red Clover McReynolds project tab.

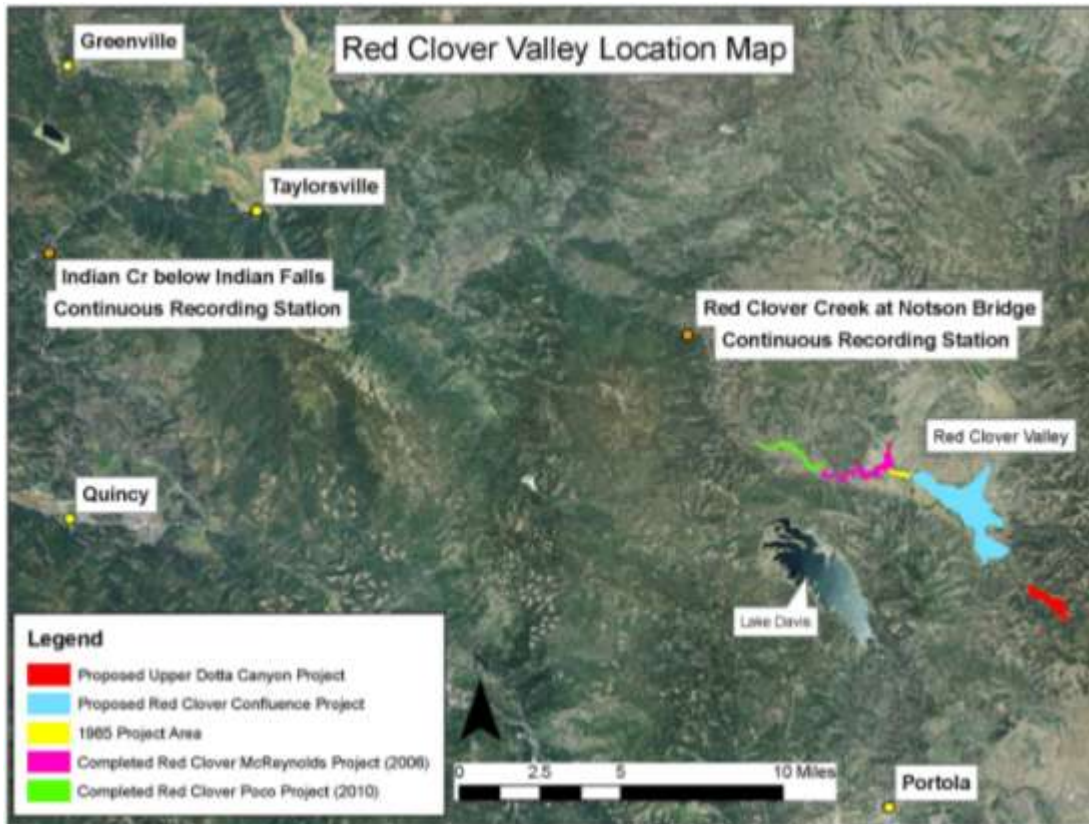
Included in the tables with the FRCRM stream flow data are data from the California Department of Water Resources (DWR) stream flow monitoring station on Indian Creek below Indian Falls (ICR). These data are provided to show the relationship between the Red Clover and Last Chance creeks stream flows and the stream flow coming out of Indian Valley. ICR is a continuous recording station. Data included in the tables from ICR is from 12:00 pm. Available stream flow data from ICR starts in 2007. All stream flow data are displayed with a map of locations where the data were collected as well a monthly summary of precipitation totals from that year. The purpose of the precipitation summary chart is to show the magnitude and distribution of precipitation throughout the water year. Precipitation data are taken from nearby DWR weather stations in Thompson Valley and Doyle Crossing. The Thompson Valley station, the closest station to Red Clover Valley, started collecting data in mid-December 2006. Precipitation totals previous to December 2006 are from the Doyle Crossing weather station. See Table 1 for yearly precipitation totals from both stations for comparison between the two, as well as percent historic average annual precipitation for the Feather River Basin.

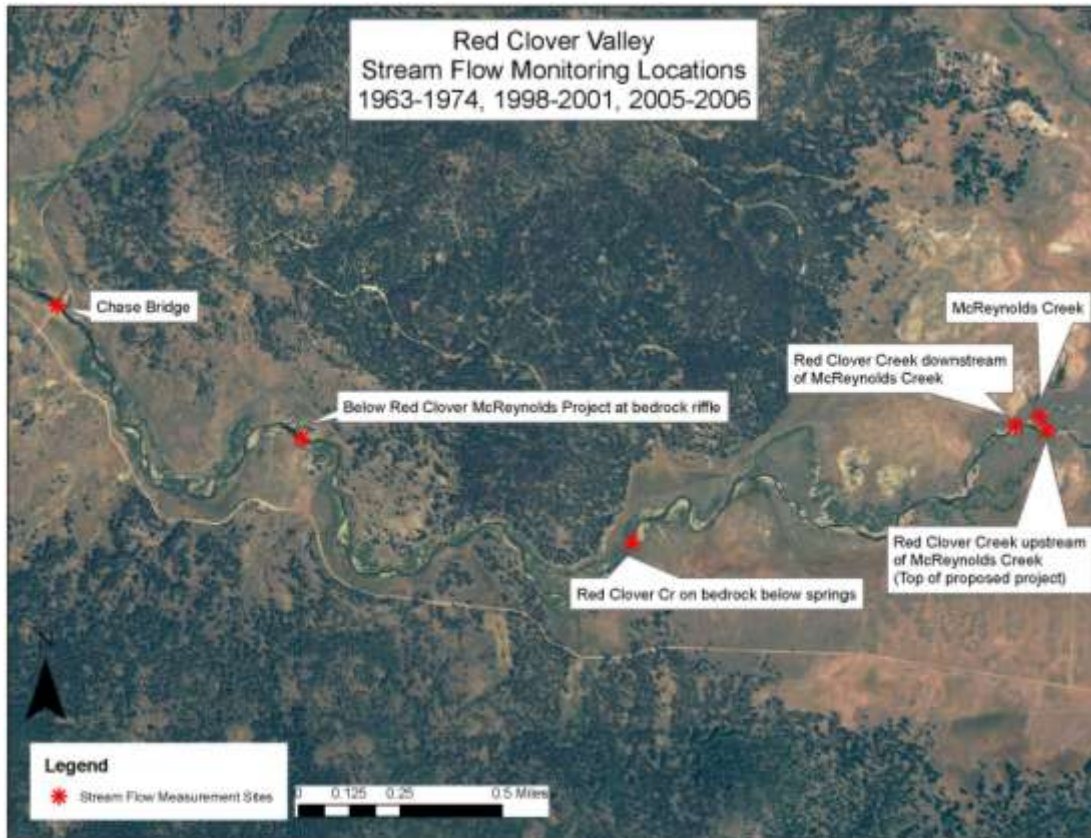
	% Avg Precip	Doyle Crossing (in)	Thompson Valley (in)
2011	142%	22.41	33.59
2010	101%	14.55	28.6
2009	84%	17.11	21.8
2008	68%	11.49	Not totaled due to missing data
2007	60%	9.02	Not totaled due to missing data
2006	154%	35.07	Not in operation
2005	109%	14.56	Not in operation

**Stream flow data is discussed in calendar year (January 1- December 31). Precipitation is displayed in water year (October 1- September 30). All stream flow data is displayed in cubic feet per second (cfs).

Red Clover Creek

Stream flow monitoring on Red Clover Creek in Red Clover Valley was initiated by the US Forest Service in 1963-1974 at Chase Bridge. The Forest Service recommenced stream flow monitoring at Chase Bridge from 1998-2001. The Feather River Coordinated Resource Management group (FRCRM) initiated stream flow monitoring in Red Clover Valley associated with meadow restoration projects in 2005. The results from these monitoring efforts are displayed in tables below. Stream flow monitoring maps may show more than one year's monitoring stations.





1963-1974 & 1998-2001

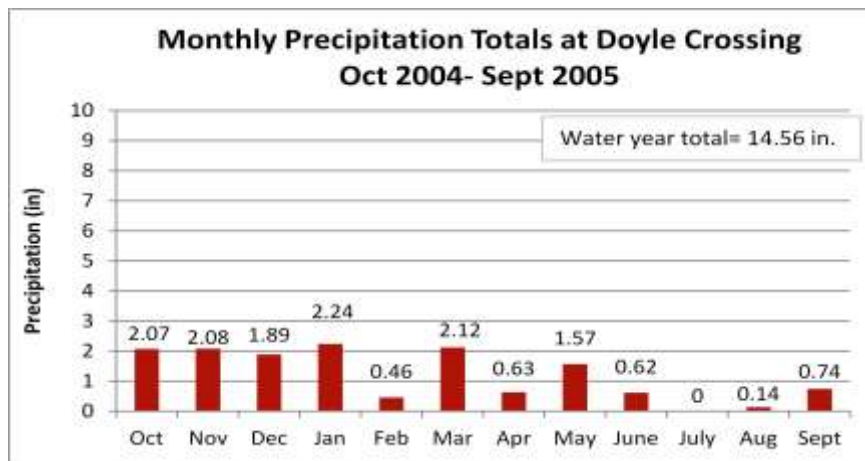
The stream flow monitoring initiated by the US Forest Service is summarized in the Red Clover Creek Watershed Assessment. “The average minimum flow from mid-June to mid-September at Chase Bridge was 2.2 cubic feet per second (cfs) for the ten-year period with daily values ranging from <0.1 to 81 cfs. The lowest flows generally occur from August to mid-September. From mid-June to mid-September at Chase Bridge, stream flow is below 1 cfs 20 percent of the time. The seven-day minimum summer flow at Chase Bridge ranged from <0.1 to 2.1 cfs from 1964-1974 with an average of 1.2 cfs. Low flow measurements below Chase Bridge were initiated in 1998. The lowest flows measured in 1998, 1999, 2000, and 2001 were 3.1, 2.6, 0.4, and 0.3 cfs respectively.” (Red Clover Creek Watershed Assessment, 2006)

2005

In 2005 stream flow measurement sites were established above, within, and below the Red Clover McReynolds Meadow Restoration Project area. Stream flows were measured at these sites once a month prior to construction in 2006. No continuous stream flow data is available in Red Clover Valley. The closest continuous recording station to Red Clover Valley is on Red Clover Creek at Notson Bridge, approximately 10 miles downstream from the top of the Red Clover McReynolds Project area. Table 2 displays pre-project stream flow data collected in 2005.

Table 2: Red Clover McReynolds Project Stream Flows (cfs)- 2005

Date	Upstream of confluence with McReynolds Creek (top of project)	McReynolds Creek	Downstream of confluence with McReynolds Creek	Red Clover Cr on bedrock below springs	Red Clover Cr upstream of bedrock riffle (bottom of project)	Notson Bridge
6/3/2005	15.3	0.08	15.12	15.81	17.77	44.4
7/20/2005	1.39				1.03	5.0
8/10/05 am	0.79		1.15	1.24	1.54	5.9
8/10/05 pm	1.41				1.14	3.4
9/14/2005	1.85				1.61	5.6

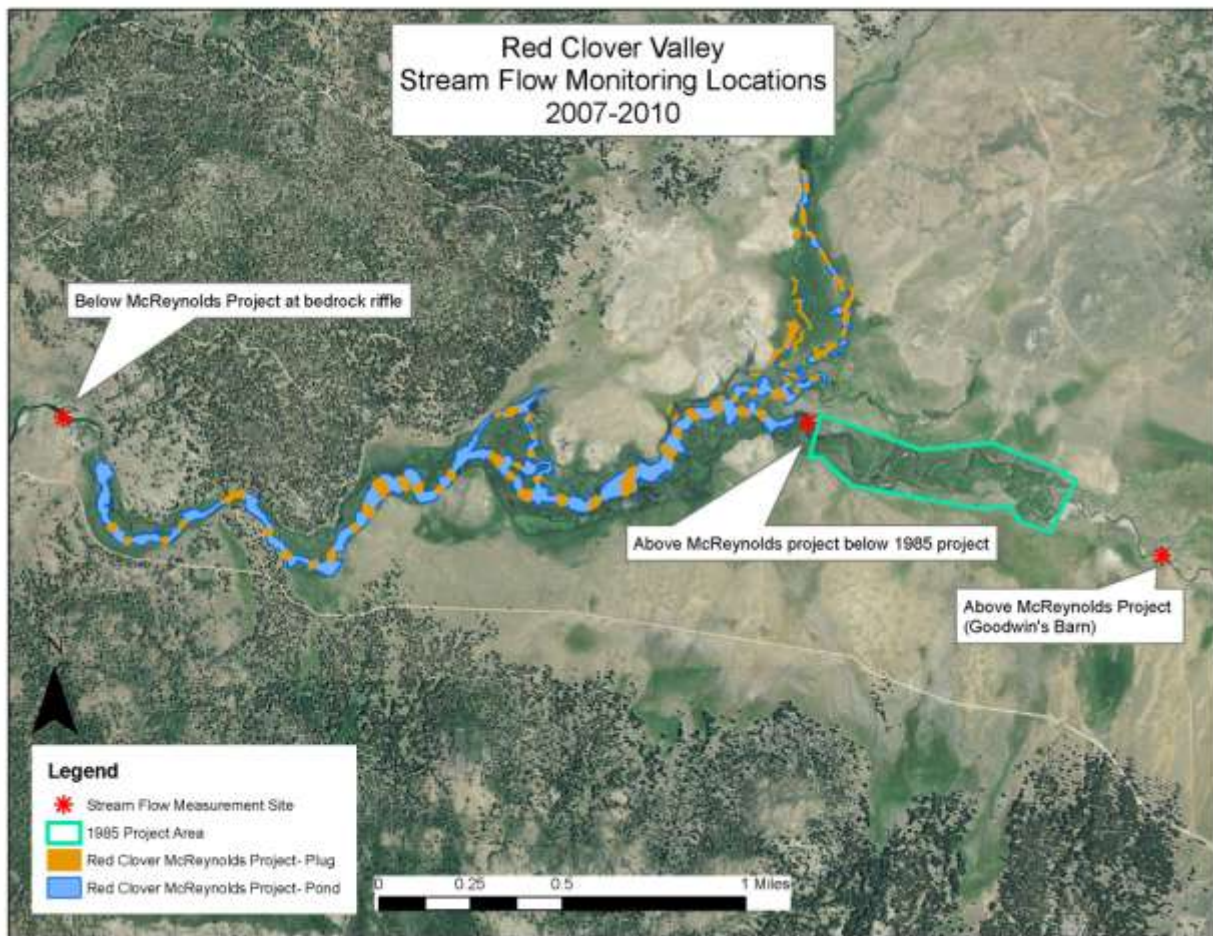
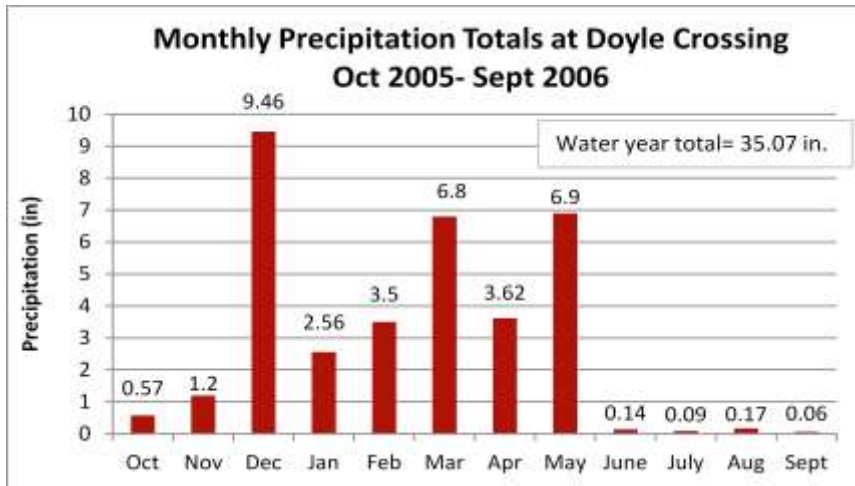


2006

In 2006 the Red Clover McReynolds Meadow Restoration Project was constructed. In 2006 stream flow was only measured once just before project construction commenced.

Table 3: Red Clover McReynolds Project Stream Flows (cfs)- 2006

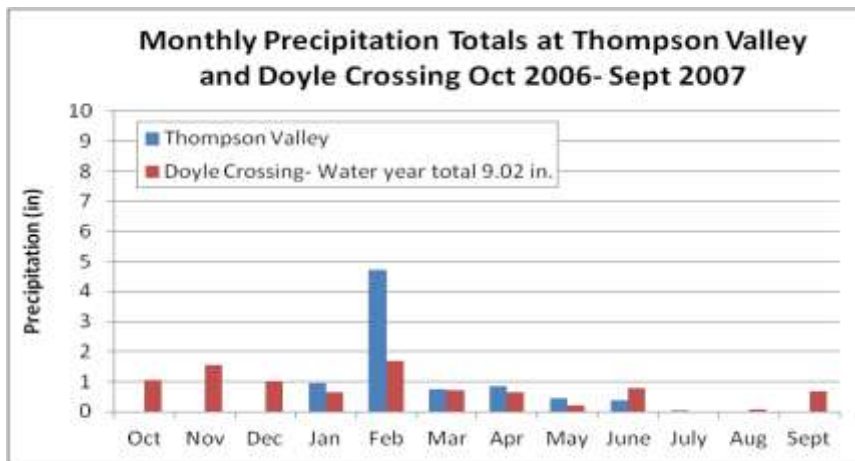
Date	Above confluence with McReynolds Creek (top of project)	Notson Bridge
8/8/2006	1.08	3.7



2007

2007 was the first year of post-project stream flow monitoring for the Red Clover McReynolds project. The station above the McReynolds project was moved upstream $\frac{1}{4}$ mile in 2007. The station below the Red Clover McReynolds project was the same as in 2005.

Date	Upstream of McReynolds project and below 1985 project	Red Clover Cr upstream of bedrock riffle (bottom of project)	Notson Bridge	ICR
6/5/2007	3.81	2.64	2.9	60
6/21/2007		0.58	2.5	37
6/28/2007	1.39	0.34	2.0	29
7/12/2007	1.18	0.08	1.5	26
8/10/2007	0.03	0	2.3	20
9/27/2007	0.02	0.01	5.4	27

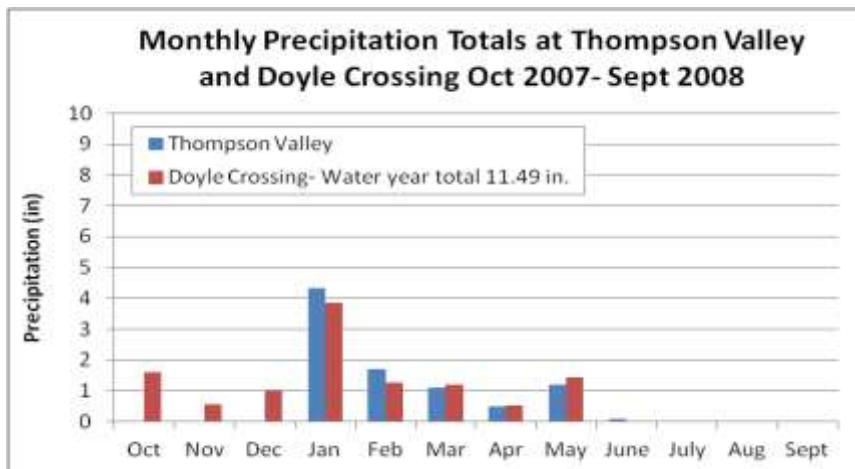


2008

In 2008 the stream flow measurement above the Red Clover McReynolds Project was moved further upstream to above the 1985 check dam project at the Goodwin Ranch barn and corrals. The monitoring station was moved due to beaver interfering with the measurement site. The measurement site below the project was not moved. Stream flow was measured weekly from June through September 2008 compared to monthly in previous years. Notson Bridge continuous recording station had a computer failure in 2008. Stream flow data is only available at Notson Bridge from monthly stream flow measurements rather than continuously.

Table 5: Red Clover McReynolds Project Stream Flows (cfs)- 2008

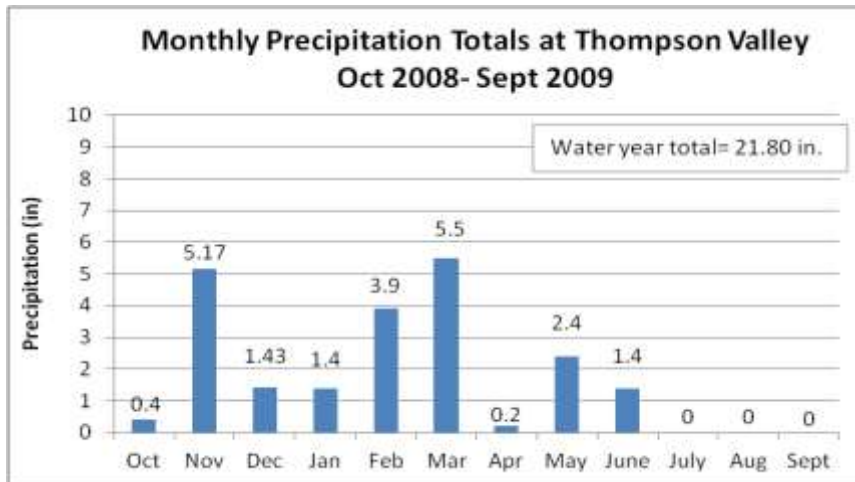
Date	Upstream of McReynolds and 1985 projects (Goodwin's Barn)	Red Clover Cr upstream of bedrock riffle (bottom of McReynolds project)	Notson Bridge	ICR
5/22/2008	8.08	11.43		189
6/5/2008	3.81	2.64		104
6/10/2008	6.84	5.3	10.6	79
6/24/2008	2.36	1.64		44
7/3/2008	2.28	1.34		25
7/7/2008	2.68	0.43	2.77	19
7/14/2008	2.07	0.17		17
7/22/2008	1.65	0.03		15
8/5/2008	1.17	0.01		12
8/13/2008	1.44	0	2.33	11
8/21/2008	1.49	0		8.8
8/25/2008	1.39	0		3.7
9/2/2008	1.39	0		4.8
9/10/2008	1.46	0	1.97	9.1
9/18/2008	1.51	0		6.8
9/25/2008	1.56	0		12
9/29/2008	1.63	0		11
10/13/2008	1.87	0.69	2.66	31
11/11/2008	1.98	1.7	7.22	87
12/12/2008	2.05	1.37	4.48	72



2009

The flow measurement sites stayed the same in 2009 as in 2008. Flow measurements were collected weekly in July through September. The flow measurements at the bottom of the McReynolds project also serve as the inflow and pre-project data for the Red Clover Poco Project constructed in 2010.

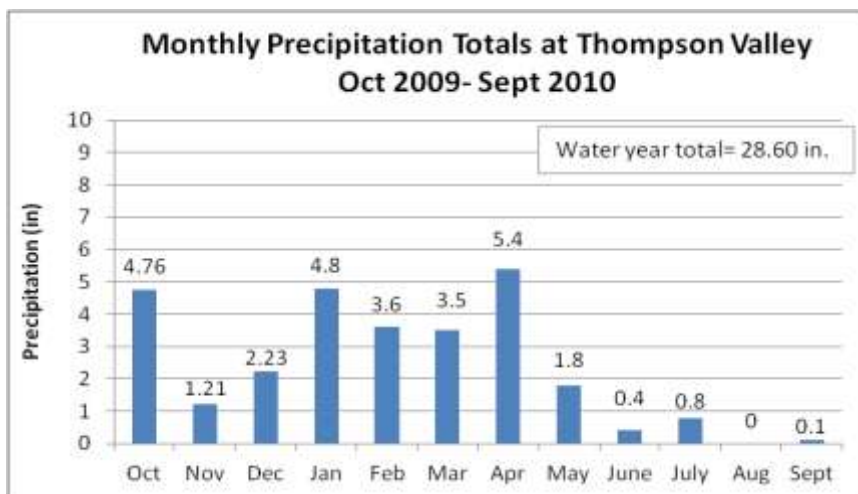
Date	Upstream of McReynolds and 1985 projects (Goodwin's Barn)	Red Clover Cr upstream of bedrock riffle (bottom of McReynolds project)	Notson Bridge	ICR
5/12/2009	13.68	14.11	39.8	675
6/10/2009	6.88	6	11.6	198
7/8/2009	1.62	0.61	3.0	38
7/15/2009	2.1	0.46	2.78	32
7/23/2009	1.83	0.05	2.5	23
7/29/2009	1.61	0.01	2.3	21
8/4/2009	1.55	0.01	2.3	19
8/11/2009	1.49	0.01	2.1	20
8/18/2009	1.46	0.001	2.4	20
8/26/2009	1.33	0	2.6	18
9/2/2009	1.56	0	2.8	17
9/10/2009	1.39	0	3.1	17
9/15/2009	1.33	0	2.15	22
9/21/2009	1.38	0	3.3	27
9/28/2009	1.35	0	3.6	23
10/8/2009	1.43	0	Dead battery	38
10/13/2009	Not measured	0.83	3.0	65
11/13/2009	1.66	2.01	5.16	83

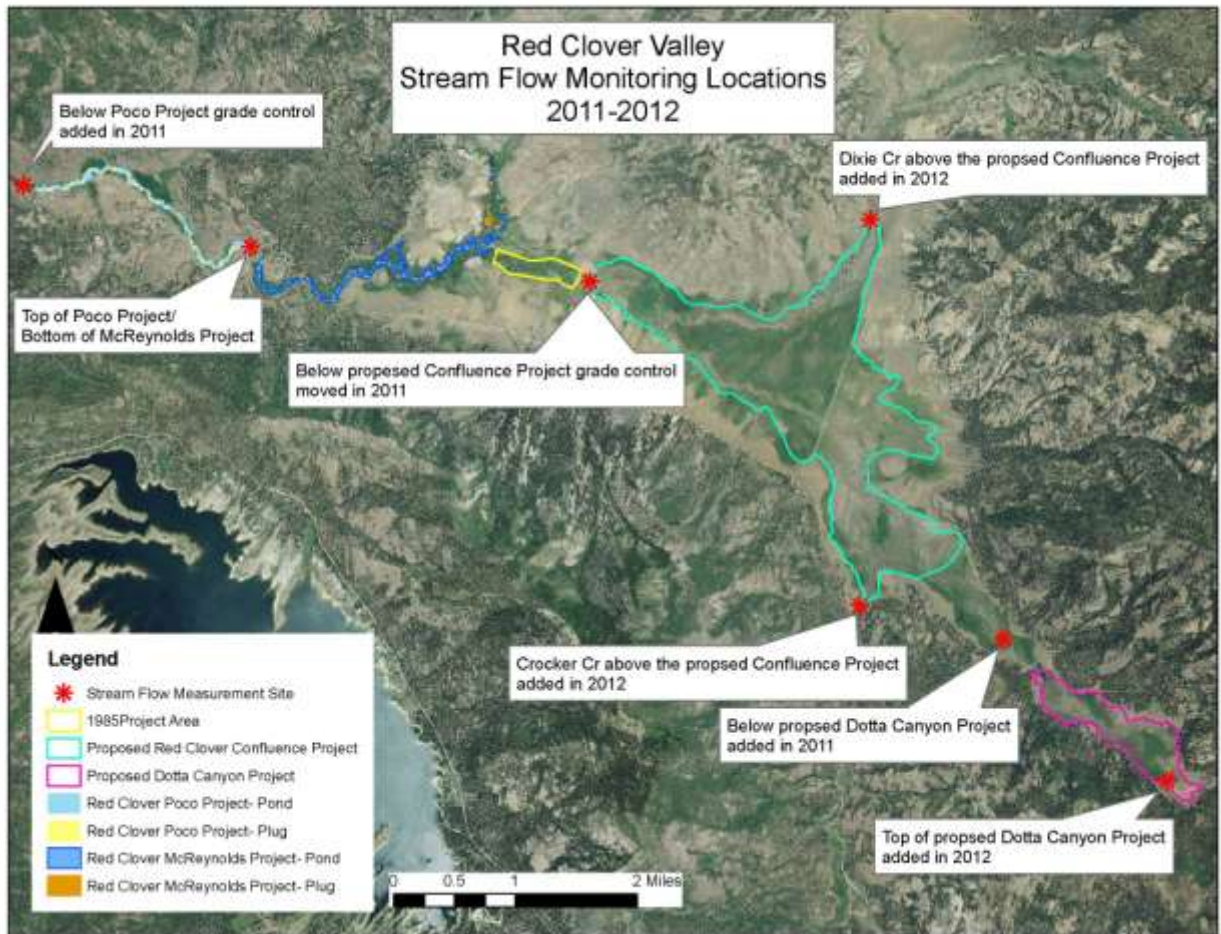


2010

The flow measurement sites remained the same in 2010 as in 2008 and 2009. Flow measurements were collected every other week in August and September. Stream flow coming out of the Red Clover McReynolds project did not reach zero in 2010 as it did in 2007-2009. The flow measurements at the bottom of the McReynolds project also serve as the inflow and pre-project data for the Red Clover Poco Project. Red Clover Poco Project construction began in August 2010. Water started to inundate the bottom flow measurement site, from project construction, in October 2010.

Date	Upstream of McReynolds and 1985 projects (Goodwin's Barn)	Red Clover Cr upstream of bedrock riffle (bottom of McReynolds project)	Notson Bridge	ICR
6/12/2010	16.46	16.14	24.2	422
7/15/2010	3.2	1.36	2.92	51
8/2/2010	1.88	0.09	1.6	31
8/26/2010	1.08	0.04	1.9	20
9/16/2010	2.81	0.01	2.6	29
9/30/2010	1.6	0.6	2.67	30
10/27/2010	2.6	Could not measure due to back water from Red Clover Poco Project construction	5.88	138



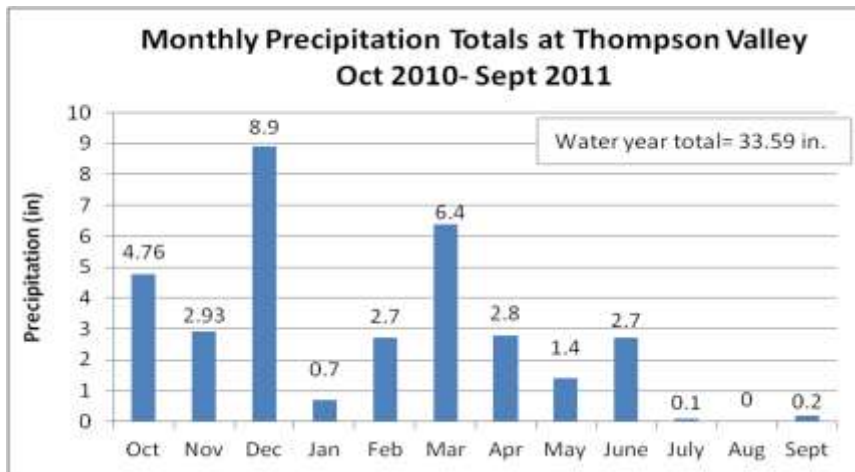


2011

In 2011 two more monitoring sites were added to the existing two sites. A measurement site was added downstream of the proposed Dotta Canyon Project. The monitoring site at the Goodwin Ranch barn and corrals was moved downstream about ¼ mile. This site was moved due to the proposed Red Clover Confluence Project, so was moved to below where the proposed grade control structure would be placed. The measurement site at the top of the Red Clover Poco Project was across the remnant channel at the first plug. This is essentially the same measurement site as below the Red Clover McReynolds Project above at the bedrock riffle. This site was measured until beaver moved into the project area and flooded the measurement site in August 2011. In August the top of the Red Clover Poco measurement was moved downstream to the upper US Forest Service Seepage Run stream flow measurement site. This was the closest location to the top of the project that was not being affected by beaver. The second measurement site was added downstream of the Red Clover Poco Project below the grade control structure.

Table 8: Red Clover Valley Stream Flows (cfs)- 2011

Date	Below proposed Dotta Canyon Project	Below proposed Confluence Project just downstream from previous Goodwin's Barn measurement site	Top of POCO Project	Below POCO Project grade control	Notson Bridge	ICR
5/6/2011	28.94	Not wadeable	Not wadeable	Not wadeable	411.2	2170
5/20/2011	11.53	71.78	82.1	89.42	123.7	1060
6/22/2011	2.89	27.94	23.95	27.81	61.2	905
7/15/2011	1.66	6.23	6.18	9.55	12.4	215
8/18/2011	0.18	2.53	1.08	2.23	4.5	70
9/19/2011	0.07	2.33	0.66	0.11	3.0	49
10/25/2011	0.71	2.81	0.92	0.96	Data not available until Nov 2012	91

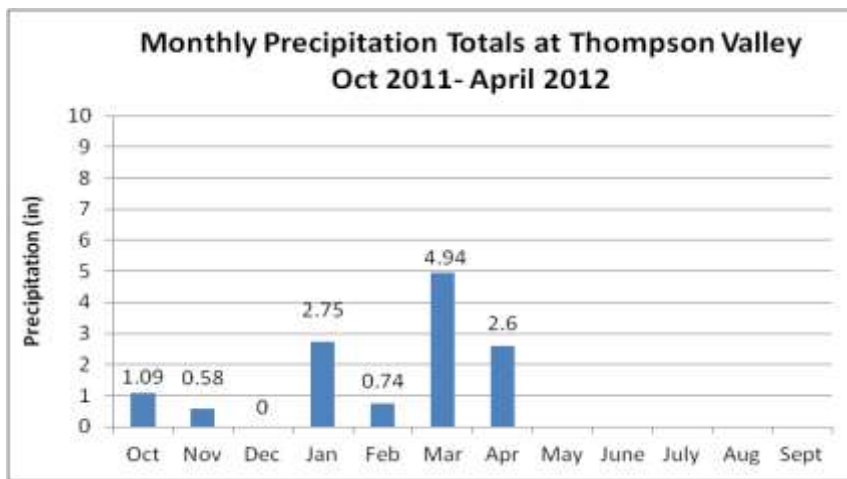


2012

In 2012 three new stream flow measurement sites were added in Red Clover Valley. A site was added above the proposed Dotta Canyon Project. Two new sites were added to measure tributary stream flow within the proposed Red Clover Confluence Project area. The measurement sites below the Dotta Canyon Project, below the proposed Red Clover Confluence grade control structure, and below the Red Clover POCO grade control structure remain in the same locations. The flow monitoring site at the top of the Red Clover POCO Project/below the Red Clover McReynolds Project was removed due to issues with beaver.

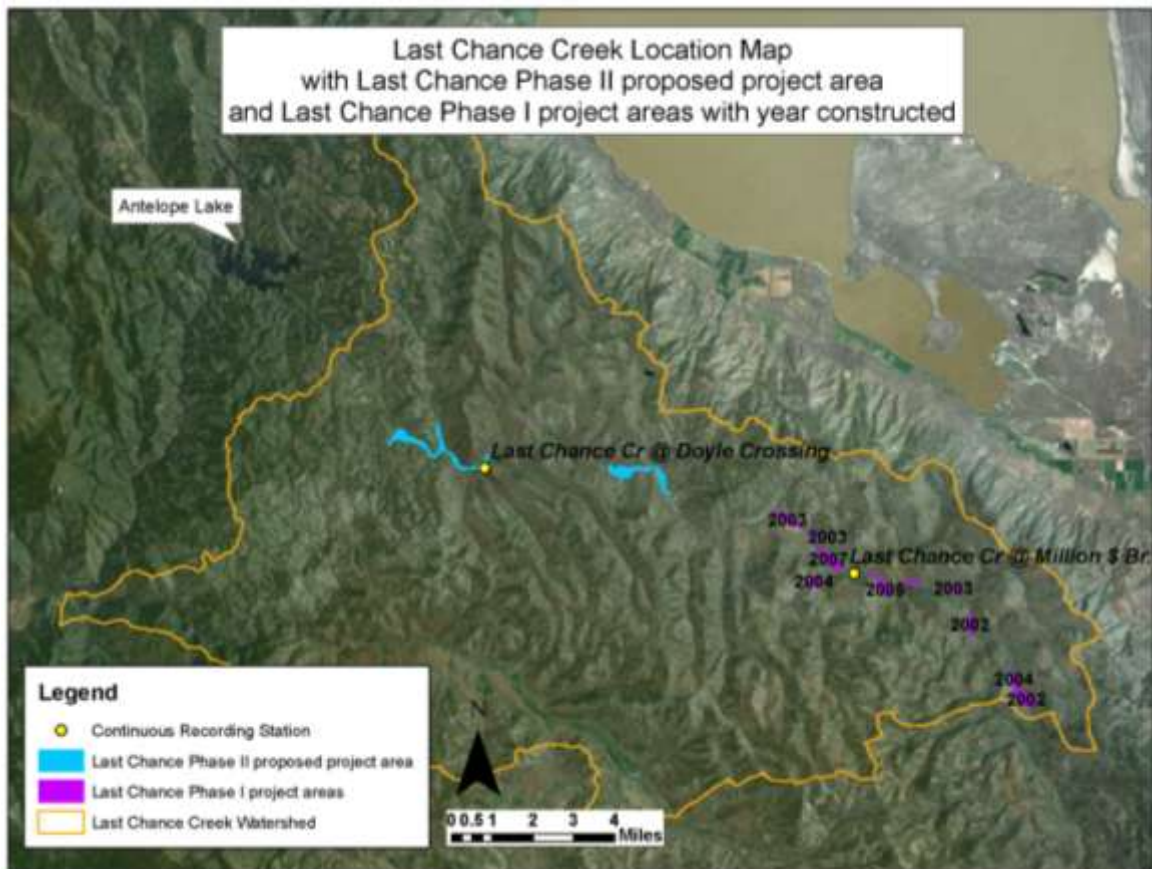
Stream flow measurements to date are included in Table 9. Notson Bridge data from 2012 Water Year (10/1/11-9/30/12) will not be available until November 2012.

Date	Above the proposed Dotta Canyon Project	Below the proposed Dotta Canyon Project	Crocker Cr above the proposed Confluence Project	Dixie Cr above the proposed Confluence Project	Below proposed Confluence Project grade control	Below Poco Project grade control	ICR
5/2/2012	1.35	3.16	2.3	13.6	23.98	27.01	831



Last Chance Creek

Stream flow monitoring on Last Chance Creek was initiated by the California Department of Water Resources in 1966-1971 at the proposed Dixie Refuge Dam-site. In 1999 the FRCRM installed a continuous recording stream gage at Doyle Crossing. The continuous recording station collects stream stage and water temperature every 15 minutes and stores this data as hourly averages. Stream stage is calibrated to flow with monthly stream flow measurements. The FRCRM has maintained the continuous recording station at Doyle Crossing from 1999-present. In 2004 the FRCRM added an additional continuous recording station on Last Chance Creek at Million Dollar Bridge, as well as some additional stream flow monitoring sites. In 2008 and 2011-present the FRCRM added two new stream flow monitoring stations above and below the proposed Last Chance Phase II restoration project. The results from these monitoring efforts are displayed in tables below along with stream flow data from Indian Creek below Indian Falls (ICR). Stream flow monitoring maps may show more than one year's monitoring stations.



1966-1971

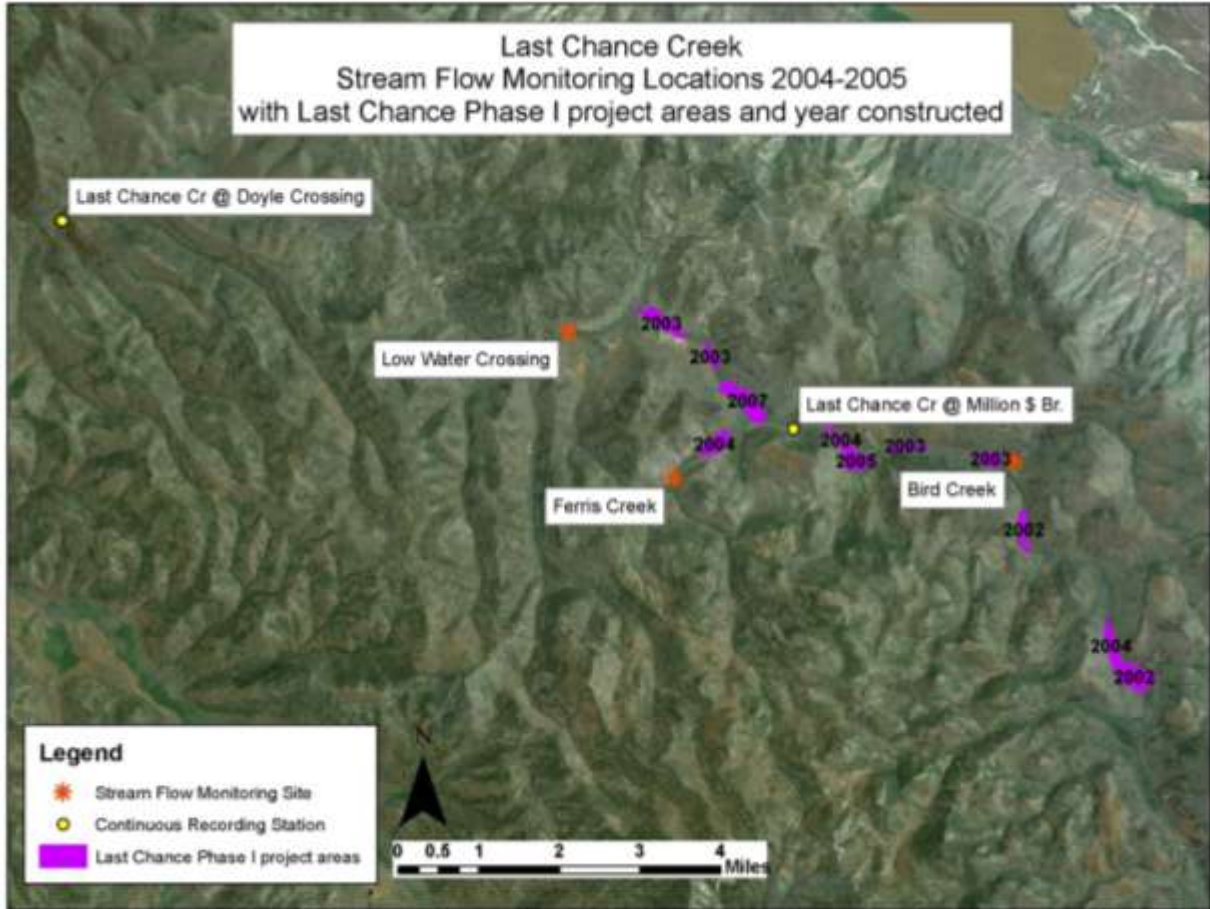
In 1966 the California Department of Water Resources (DWR) started monitoring stream flow on Last Chance Creek near the current low water crossing to determine the feasibility of a dam at this site. Table 10 below displays the results of the DWR monitoring effort.

Table 10: Last Chance Creek Stream Flows (cfs) at the proposed Dixie Refuge Dam-site near current low water crossing.												
	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
1966	1	3	2	3	2	38	17	4	<1	0	0	0
1969	<1	1	1	139	38	69	179	82	17	2	<1	<1
1970	<1	1	7	160	45	39	26	21	4	<1	0	<1
1971	<1	1	6	48	18	69	100	152	64	4	1	<1

Continuous Recording Station Data

The Doyle Crossing stream flow monitoring station has been the focus of FRCRM stream flow monitoring efforts on Last Chance Creek since 1999. Table 11 displays average monthly stream flow on Last Chance Creek at Doyle Crossing for the past thirteen water years. Blanks in the data table represent missing data due computer recording errors. In 2011 the continuous recording computer had a battery failure. More in depth continuous recording station data can be found on the FRCRM website (www.feather-river-crm.org) monitoring page.

Table 11: Average Monthly Stream Flow on Last Chance Creek at Doyle Crossing (cfs)													
Water Year	% Normal	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
2000	101	3.0	-	-	16.2	55.5	-	83.7	19.5	3.2	1.2	0.6	0.9
2001	56	1.0	1.2	2.8	4.6	2.2	16.7	4.3	1.4	0.8	0.6	0.6	0.7
2002	77	0.8	1.7	5.1	16.9	23.2	44.0	44.1	13.8	2.4	0.4	0.1	0.1
2003	111	0.5	1.6	7.3	39.8	25.8	47.7	65.2	47.0	4.9	0.9	0.5	0.4
2004	83	0.6	0.4	2.1	10.3	28.2	115.6	31.7	5.4	1.9	0.4	0.1	-
2005	109	0.8	0.9	3.3	-	19.3	87.0	81.0	37.3	6.2	0.9	0.1	0.4
2006	154	1.2	0.8	44.9	150.8	86.0	142.5	266.1	86.2	6.3	1.0	0.3	0.5
2007	60	0.9	0.8	0.7	1.4	6.6	28.9	12.0	3.7	1.3	0.1	0.1	0.3
2008	68	1.9	1.4	0.9	6.3	3.2	76.4	44.2	14.6	3.8	1.3	0.5	0.8
2009	84	2.4	2.5	3.3	3.1	12.2	55.2	25.9	8.4	3.7	1.3	0.9	0.9
2010	101	1.4	1.0	1.3	4.2	14.4	43.1	73.2	54.7	9.6	2.4	1.0	1.1
2011	142	1.3	Battery Error									1.2	0.7
Average		1.3	1.2	7.2	25.4	25.1	65.7	66.5	26.5	4.0	1.0	0.5	0.6



2004-2005

The FRCRM began constructing meadow restoration projects on the mainstem of Last Chance Creek in 2002. Eight reaches were constructed between 2002 and 2005. The FRCRM installed a second continuous recording station just downstream of these projects at Million Dollar Bridge in 2004. The Million Dollar Bridge recording station only collects stream flow data during the high flow and runoff seasons (winter into the early summer). In 2004 in addition to collecting stream flow data at Doyle Crossing and Million Dollar Bridge, the FRCRM monitored stream flow on Last Chance Creek at the low water crossing (near the 1966-1971 measurement site), on Ferris Creek, and on Bird Creek. The stream flow measurement on Ferris Creek was taken downstream of the project area, and the stream flow measurement on Bird Creek was taken on Bird Creek upstream of the project area and upstream of the confluence with Last Chance Creek.

Table 12: Last Chance Watershed Stream Flows (cfs)- 2004

	Bird Creek	Last Chance Creek at Million Dollar Br	Ferris Creek	Last Chance Creek at Low Water Crossing	Last Chance Creek at Doyle Crossing
8/3/2004	0.05				
8/24/2004			0.08		0.48
9/20/2004			0.24		0.70
10/11/2004			0.13		0.74
10/20/2004			0.32	0.12	2.26
11/11/2004			0.31	0.24	2.30
12/9/2004			0.81	8.02	3.71
12/15/2004		0.29	0.59	1.03	3.77

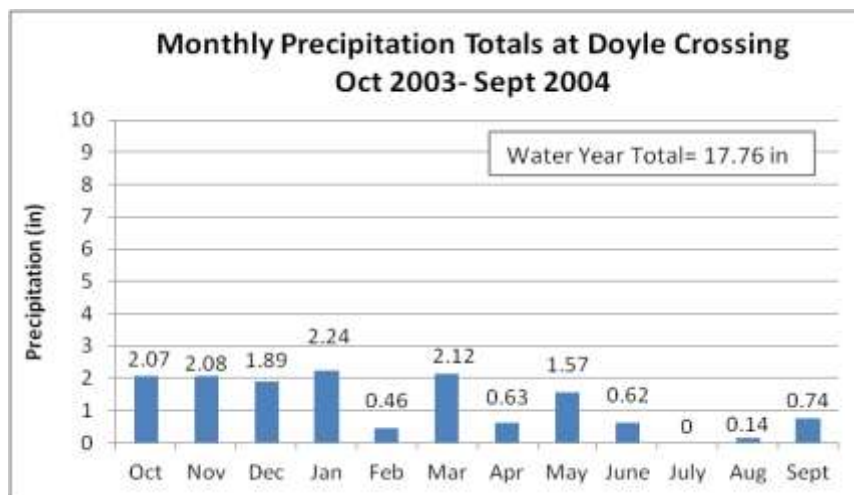
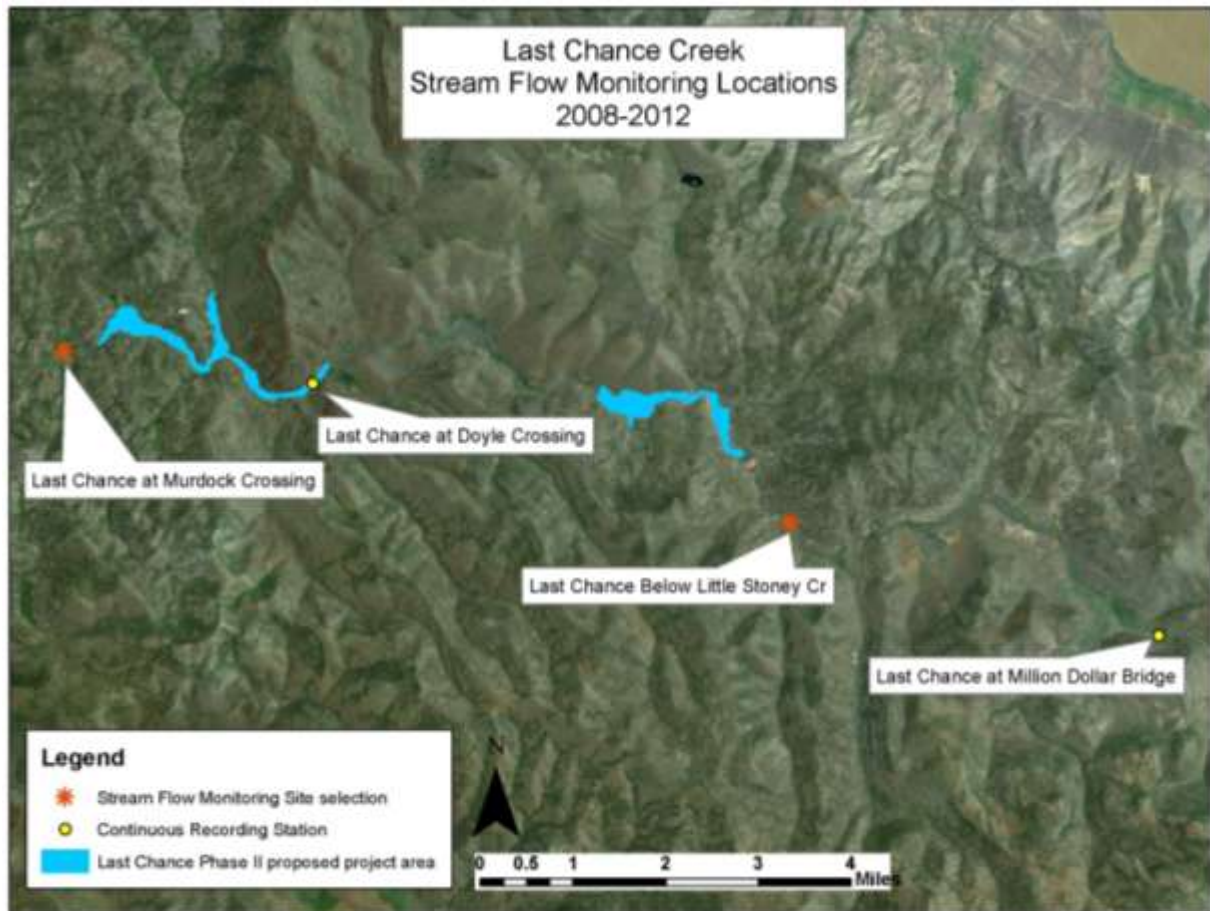
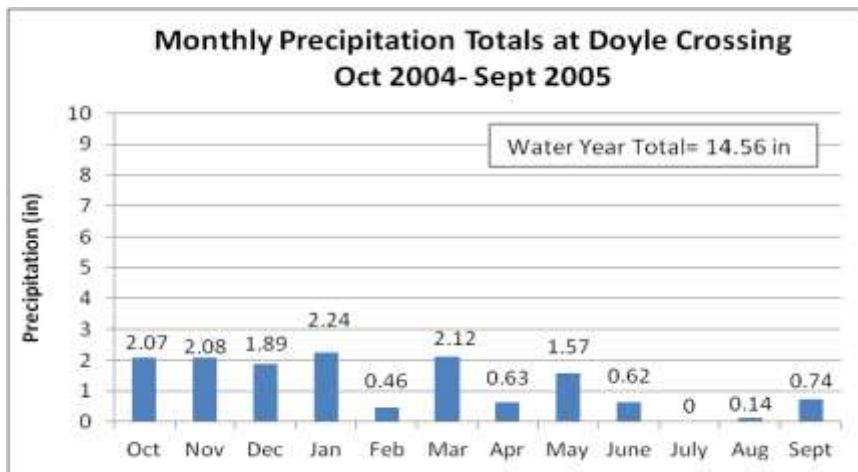


Table 13: Last Chance Watershed Stream Flows (cfs)- 2005

	Last Chance Creek at Million Dollar Br	Ferris Creek	Last Chance Creek at Low Water Crossing	Last Chance Creek at Doyle Crossing
2/16/2005	1.41	0.73	3.19	16.18
2/28/2005	3.96	0.86		42.19
3/23/2005		2.2		114.24
4/14/2005	4.5	5.04		70.82

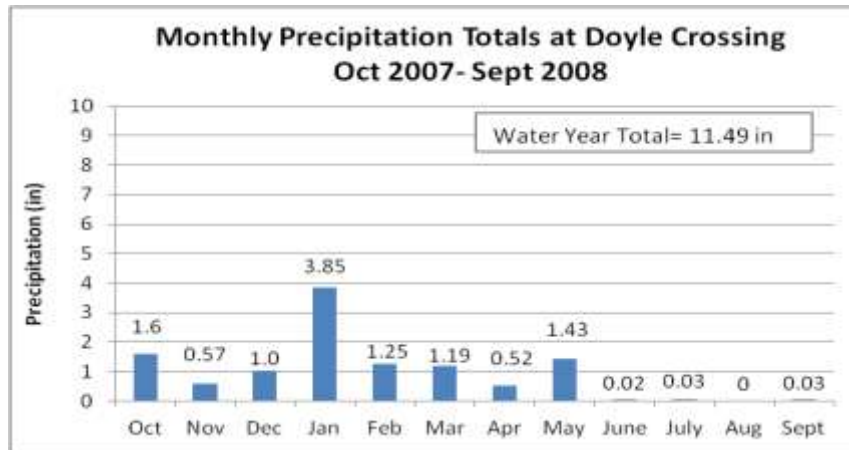


2008

In 2008 the FRCRM began collecting pre-project stream flow data at Murdock Crossing for the proposed Last Chance Phase II project. Murdock Crossing is downstream of the proposed Last Chance II project about ½ mile. Stream flow measurements continue to be collected at Doyle Crossing and Million Dollar Bridge.

Table 14: Last Chance Watershed Stream Flows (cfs)- 2008

	Last Chance Creek at Million Dollar Bridge	Last Chance Creek at Doyle Crossing	Last Chance Creek at Murdock Crossing	ICR
5/13/2008	0.34	12.79	13.83	250
7/29/2008	Not flowing	0.89	0.36	10

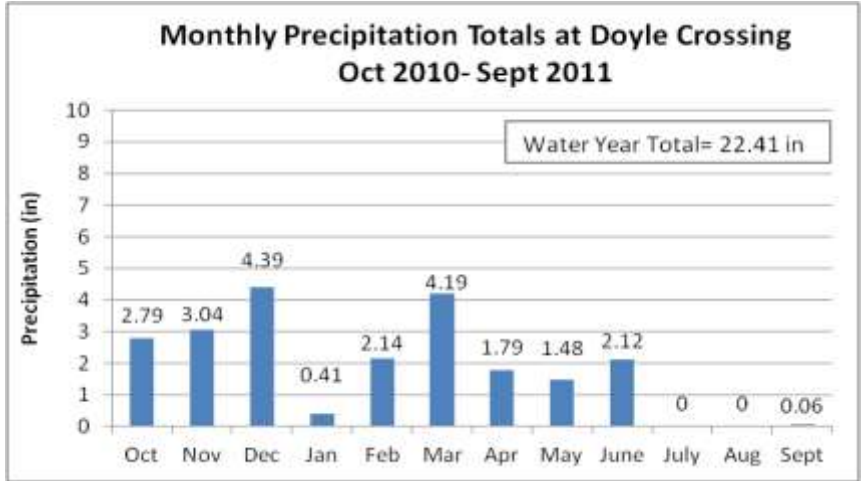


2011

In addition to the three existing stream flow measurement sites from 2008, Last Chance Creek below Little Stoney Creek was added in 2011. The Last Chance Creek below Little Stoney Creek measurement site is upstream of the proposed Last Chance Phase II Restoration Project. These sites were measured monthly. The Doyle Crossing continuous recording station had a battery failure in 2008. Stream flow data is only available from monthly stream flow measurements rather than continuously.

Table 15: Last Chance Watershed Stream Flows (cfs)- 2011

	Last Chance Creek at Million Dollar Bridge	Last Chance Creek Below Little Stoney Creek	Last Chance Creek at Doyle Crossing	Last Chance Creek at Murdock Crossing	ICR
5/19/2011	8.93	Not wadeable			1150
5/26/2011	9.83	40.77	56.61	93.76	1260
6/7/2011	36.2	Not wadeable			2970
6/21/2011	2.81	Not wadeable			900
7/7/2011	0.29	4.73	6.39	8.82	399
8/5/2011	Not flowing	1.15	0.33	1.46	90
9/9/2011	Not flowing	0.76	0.55	0.66	43
10/7/2011	Not flowing	1.59	1.01	2.36	118



2012

Table 15 displays the stream flow measurement data on Last Chance Creek to date in 2012. No additional sites were added in 2012.

Table 15: Last Chance Watershed Stream Flows (cfs) to date in 2012

	Last Chance Creek at Million Dollar Bridge	Last Chance Creek Below Little Stoney Creek	Last Chance Creek at Doyle Crossing	Last Chance Creek at Murdock Crossing	ICR
3/27/2012	2.08	Not wadeable	13.17	21.36	434
5/15/2012	0.21	3.47	4.13	5.53	342

