PERAZZO MEADOWS RESTORATION HYDROLOGIC MONITORING DATA REPORT, UPPER AND MIDDLE PERAZZO MEADOWS, SIERRA COUNTY, CALIFORNIA

WATER YEAR 2012

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Truckee River Watershed Council

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January 2016

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Perazzo Meadows Restoration Hydrologic Monitoring Data Report, Upper and Middle Perazzo Meadows, Sierra County, California, Water Year 2012

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January 15, 2016

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1. PROJECT PURPOSE AND INTRODUCTION

The Truckee River Watershed Council (TRWC) requested that Balance Hydrologics, Inc. (Balance) monitor streamflow and groundwater conditions at multiple locations in at Perazzo Meadows, Sierra County, California. The purpose of the monitoring program is to evaluate pre- and post-restoration hydrologic conditions in the Upper Little Truckee River watershed as part of the Perazzo Meadows Restoration project. Monitoring streamflow, groundwater levels, and their interactions are important for the following reasons:

- Streamflow is the principal attribute affecting aquatic habitat and fish populations;
- Little is known about shallow groundwater fluctuation and the amount that can be retained in restored meadows;
- Limited documentation is available regarding the effect of meadow restoration on downstream peak flows and mid- to late-summer baseflow;
- Observed conditions and restoration performance criteria need to be placed in context of long-term variability in order to make reliable comparisons to other systems and other years, (e.g. are initial post-project conditions representative of extreme drought or above-average precipitation); and
- A continuous record of streamflow and groundwater levels allows for an evaluation of the restoration program in terms of geomorphic and vegetation changes that accompany trends in streamflow and groundwater levels for which the project was designed.

This report summarizes groundwater conditions in Upper and Middle Perazzo Meadows and streamflow at six different locations upstream and downstream of Upper, Middle, and Lower Perazzo Meadows for water year 2012 (WY2012)[1], the third year of a multi-year hydrology monitoring program. This data report includes:

- A brief description of what measurements were made, and where;
- A summary of the measurements;

[1] Most hydrologic and geomorphic monitoring occurs for a period defined as a water year, which begins on October 1 and ends on September 30 of the named year. For example, water year 2012 (WY2012) began on October 1, 2011 and concluded on September 30, 2012.

- Daily, monthly, and annual streamflow values for the six gaging stations during WY2012;
- Daily groundwater levels at 20 wells for select areas of the meadows;
- A comparison of annual peaks, daily mean, and base streamflow at measured inflows to and outflows from Perazzo Meadows; and
- A comparison of groundwater level fluctuations in a restored meadow to groundwater levels prior to restoration.

Gage maintenance and data collection is continuing during WY2013.

1.1 Acknowledgments

Funding for this project is from the U.S. Forest Service-Tahoe National Forest (from the American Reinvestment and Recovery Act), awarded to the TRWC. Work was carried out in coordination with the TRWC, the U.S. Forest Service (USFS), and the University of California at Merced (UC Merced) and individuals from those organizations were instrumental in helping to develop the monitoring program. Beth Christman of the TRWC, Randy Westmoreland and Michael Pickard (formerly of the US Forest Service, currently with UC Merced) conducted field monitoring and data collection activities as part of this program.

2. SITE DESCRIPTION

2.1 Perazzo Meadows

Perazzo Meadows is located in the Little Truckee Watershed, part of the Truckee River Watershed, about 15 miles northwest of the Town of Truckee in Sierra County, California. The Meadows are accessed from Jackson Meadows Road to the north and from Henness Pass Road to the south (**Figure 1**). Its watershed comprises three named tributaries: the Little Truckee River (termed Lacey Creek upstream of Webber Lake), Perazzo Creek, and Cold Stream. The series of meadows is divided into an Upper, Middle, and Lower Meadow (see **Figure 1**), separated by small canyons and volcanic bedrock outcrop.

These sub-alpine meadows are situated in a glacially-formed basin, now filled with glacial outwash and alluvial silt, sand, and gravel. The watershed reflects many of the geologic events that have shaped the Central Sierra: the hillsides north and south of the meadows consist of andesitic breccia, mudflow deposits, and welded tuff, while the headwaters of Perazzo Creek drain meta-sedimentary rocks. A veneer of glacial till and moraines are also present throughout the margins of the valley. A number of glacial outwash terraces are present within the alluvium of the valley floor; most notably on the south side of the Middle Meadow at an elevation approximately 30-feet above the Middle Meadow. Remnant outwash terraces are also present on the northeast side of the Upper Meadow, approximately 2- to 3-feet higher than the meadow surface. The banks of Perazzo Creek and the Little Truckee River are typically composed of sand and silty sand overlying gravel and cobble, with occasional exposures of silty clay underlying the alluvial sediments.

Hydrology in the watershed is influenced by California's Mediterranean climate and the sub-alpine elevation. The watershed ranges from 6,459 feet above mean sea level (msl, NGVD29) at the Lower Meadow to 9,148 feet msl at Mount Lola. Most of the annual precipitation falls as snow, with occasional summer thunderstorms and early fall rainstorms. Annual peak flows tend to occur during spring snowmelt, but periodic rain-on-snow events account for the highest flows. Perennial streams and associated wet

meadows are supported by springs emanating from the adjacent hillsides, especially on the south side of the valley, creating discharge slope wetlands.[2]

2.2 Restoration Activities

Prior to restoration, portions of the meadows had been converted from riparian low and middle gradient meadows to dry meadows (Swanson, 2008). The channel followed a meandering course through the meadow, and flow was largely contained in one single-thread channel in most locations with limited floodplain connectivity. During the summers of 2009 and 2010, the USFS employed a 'plug and pond' restoration approach to block the channel with the aim of spreading water across the valley floor or floodplain to reoccupy multiple relic channels that have been abandoned in an effort to restore wetter conditions to the meadow.

2.3 Groundwater Monitoring

Balance and the TRWC established a groundwater monitoring program beginning in summer 2009, just prior to implementation of restoration activities in the Upper Watershed. A network of eleven shallow monitoring wells ('piezometers') was installed in the Upper and Middle Meadows, supplementing four monitoring wells that had been previously installed by the USFS. Wells were installed in the Upper Meadow on August 21, 2009, and the Middle Meadow on August 27, 2009. On September 23, 2009, several piezometers were instrumented with water-level recorders, programmed to measure and record water levels every 15 minutes. In order to relate changes in groundwater level to water surface elevations in the channel, several staff plates were installed in the main stream channel to monitor stream stage. Groundwater and stream stage monitoring station locations are shown in **Figures 2 and 3**.

Piezometers were designed with the aim of measuring seasonal water-table fluctuations, and range in depth from 4.1 to 8.0 feet below the meadow surface. Piezometer locations were chosen to represent a range of geomorphic and hydrologic conditions, including spring-fed areas with perennial saturation (e.g. Piezometers 09-02, 09-06), upland surfaces (e.g. 09-05, FS-14, 09-11), and areas adjacent to the main channel (e.g. 09-03, 09-09), as shown in **Figures 2 and 3**.

[2] Meadow and wetland terminology used herein is based on Weixelman and others' (2011) hydrogeomorphic classification system for the Sierra Nevada and Southern Cascade Ranges in California.

Campbell well points were used to construct the screened interval of each piezometer, with a nominal diameter of 1¼-inches, and connected via galvanized steel couplers to 1¼-inch galvanized steel pipe. The well points were driven by hand with a fencepost pounder until refusal, presumably in gravels or perhaps clayey silt at depth. In order to evaluate potential vertical hydraulic gradients, a reflection of the upward or downward movement of shallow groundwater, the piezometers were selected with screens only in the bottom 24 inches. When present, vertical hydraulic gradients provide an indication of the shallow groundwater flow direction, either downward from the surface into the ground, or upward from the ground to the surface.

During the summer of 2011, UC Merced researchers installed a number of wells in Lower Perazzo Meadow, where restoration had not yet taken place, and assisted with field measurements of groundwater levels in the Middle Meadow and streamflow at the Lower Perazzo Meadow outlet, as part of a Sierra-wide study of restoration effects on meadow hydrology. Data from the UC Merced study are not included in our analysis at this time.

Piezometers were monitored by TRWC and Balance staff beginning in September 2009. Monitoring consists of measuring the depth to water with an electronic water-level sounder and measuring the specific conductance and temperature of the groundwater at each piezometer. Specific conductance measures the ability of water to conduct electricity, and is a field surrogate for the concentration of total dissolved salts in the water. Snow and rain have a very low specific conductance, (approaching zero) and groundwater is considerably higher; as water passes over and through the ground, salts are dissolved and the specific conductance increased. Higher specific conductance, therefore, indicates longer residence times in the ground, or transmittal through salt-bearing geologic formations, and can be used to distinguish groundwater sources.

The piezometers were occasionally bailed after water-level readings were taken in order to 'flush' the piezometer and allow the water level to equilibrate with the surrounding soil. The specific conductance and temperature measured in bailed piezometers were thus assumed to have remained representative of groundwater conditions. TRWC or Balance staff performed these activities approximately monthly during the dry season and periodically during months of snowpack as access permitted.

2.4 Streamflow Monitoring

The TRWC authorized Balance to establish and maintain a streamflow monitoring program beginning in summer 2009, just prior to implementation of restoration activities in the Upper Watershed. Beginning October 1, 2009, one continuous-recording streamflow gaging station was established on the Little Truckee River at the downstream end of the Middle Meadow (Station ID LTPM). Early in WY2011, Balance received additional authorization to establish five additional streamflow gaging stations to help evaluate inflows to the meadow, flows through the meadows and downstream of the meadows. Four gages were installed and instrumented in November 2010, while two additional gages were installed and instrumented in August 2011. All six gages were instrumented with water level and temperature recorders, programmed to measure and record readings every 15 minutes. For the purposes of this report, our results are presented as daily mean streamflow values. Locations of all six streamflow gaging stations are illustrated in **Figure 4** and summarized in **Table 1**. WY2012 is the first year we are reporting a full annual record for all six stream gages.

Balance stream-gaging practices follow procedures used by the USGS, as outlined by Carter and Davidian (1968). Balance hydrologists, forest service staff, and UC Merced staff measured flow over a range of different water depths at all six stations. Based on our periodic site visits, staff plate readings, and streamflow measurements, we created an empirical stage-to-discharge relationship for each station, also referred to as a stage-discharge "rating curve." We then used this rating curve at each station to convert the continuous-logging record of stage to flow. As is typically done, we applied multiple stage shifts to account for local scour and fill during the monitoring period, and the effects of leaf and debris dams during low flows. As with all open-channel gaging of natural streams, a higher degree of uncertainty remains at high flows and during periods of ice formation, despite efforts to be as precise as possible, as discussed in more detail by Rantz (1982).

2.4.1 Description of the Streamflow Gaging Stations

2.4.1.1 Perazzo Creek above Perazzo Meadows (PCAP)

The stream gage is located on the west bank of Perazzo Creek, along a bedrock channel approximately 0.5 miles upstream from the Upper Perazzo Meadow and approximately 1.4 miles upstream from the confluence with the Little Truckee River. The gaging site was selected to evaluate inflows to the Upper Meadow from Perazzo Creek. The gaging station was installed on November 17, 2010 and designated as 'PCAP'

(Perazzo Creek above Perazzo) according to Balance Hydrologics' gaging station naming conventions. The watershed area above PCAP is approximately 6.1 square miles and receives an average of 63.5 inches of precipitation (USGS, 2011). This gage can be affected by ice during winter and spring months.

2.4.1.2 Little Truckee River above Perazzo Meadows (LTAP)

The stream gage is located on the south bank of the Little Truckee River, just downstream of a bedrock channel and boulder riffle, approximately 0.25 miles upstream from the Upper Perazzo Meadow, at the USFS road #7-030 Bridge. The gaging site was selected to evaluate inflows to the Upper Meadow from the Little Truckee River. The gaging station was installed on November 18, 2010 and designated as 'LTAP' (Little Truckee River above Perazzo) according to Balance gaging station naming conventions. The watershed area above CSAP is approximately 15.8 square miles and receives an average of 58.6 inches of precipitation (USGS, 2011). This gage can be affected by ice during winter and spring months.

2.4.1.3 Little Truckee River, Upper Perazzo Meadow (LTUM)

The stream gage is located on the east bank of the Little Truckee River, along a boulder and cobble channel approximately 0.9 miles downstream from the confluence with Perazzo Creek, downstream of Upper Perazzo Meadow, at the Henness Pass Road Bridge. The gaging site was selected to evaluate outflows from the Upper Meadow, which originate from the Little Truckee River and Perazzo Creek, as well as a portion of inflows to the Middle Meadow. The gaging station was installed on November 19, 2010 and designated as 'LTUM' (Little Truckee below Upper Perazzo Meadow) according to Balance gaging station naming conventions. The watershed area above LTUM is approximately 25.5 square miles and includes the subwatersheds gaged by LTAP and PCAP and additional intervening areas of 3.6 square miles. Mean annual precipitation in the contributing watershed area is approximately 58.5 inches (USGS, 2011). This gage can be affected by ice during winter and spring months.

2.4.1.4 Cold Stream above Perazzo Meadows (CSAP)

The stream gage is located on the right (east) bank of Cold Stream, a perennial tributary to the Little Truckee River, along a step-pool reach with abundant wood, approximately 1.57 miles upstream from the confluence. The gaging site was chosen to be well above the meadow to avoid the dynamic channel changes in the lower alluvial fan reach, and very steep and dynamic reaches above the alluvial fan. The

gaging station was installed on August 18, 2011. The gaging site has been designated as 'CSAP' (Cold Stream above Perazzo Meadows) according to Balance gaging station naming conventions. The watershed area above CSAP is approximately 3.1 square miles and receives an average of 54.2 inches of precipitation (USGS, 2011). Due to access restrictions and very dynamic channel conditions, this gage is operated as a baseflow gage, with measurements occurring during the summer and fall months only.

2.4.1.5 Little Truckee River at Middle Perazzo Meadow (LTPM)

The stream gage is located on the north bank of the Little Truckee River at the outlet of the Middle Meadow. The gaging site was selected to evaluate outflows from the Middle Meadow, as well as inflows to the Lower Meadow. The gaging station was installed on September 25, 2009 and designated as 'LTPM' (Little Truckee at Middle Perazzo Meadow). The watershed area above LTPM is approximately 32.8 square miles and includes the subwatersheds gaged by the four upstream gages (LTAP, PCAP, CSAP, and LTUM) and additional intervening areas totaling 4.2 square miles. The contributing watershed receives an average of 56.3 inches of precipitation (USGS, 2011). This gage can be affected by ice during winter and spring months.

2.4.1.6 Little Truckee River at Lower Perazzo Meadow (LTLM)

The stream gage is located on the north bank of the Little Truckee River at the outlet of the Lower Meadow. The gaging site was selected to evaluate flows at the outlet of the Lower Meadow, an unrestored meadow, downstream of the Upper and Middle Meadows. The gaging station was installed on August 18, 2011 and designated as 'LTLM' (Little Truckee at Lower Meadow), according to Balance gaging station naming conventions. The watershed area above LTLM is approximately 34.2 square miles and includes the subwatersheds gaged by the five upstream gages (LTAP, PCAP, CSAP, LTUM and LTPM) and additional intervening areas totaling 1.4 square miles. The watershed receives an average of 56.3 inches of precipitation. This gage can be affected by ice during winter and spring months.

2.5 Historical Streamflow Gaging

The United States Geological Survey (USGS) operated a stream gage from June 26, 1993 to September 30, 1998 (partial WY1993 – WY1998) on the Little Truckee River downstream from Perazzo Meadows (USGS 10341950). Historical streamflow at this station was affected by the Sierra Valley diversion ditch immediately upstream. Mean annual flows for the period of record at the USGS gage ranged between 23.5 cfs to 183

cfs. Peak annual flows ranged between 300 cfs to 3,980 cfs. Peak flows are generally less affected by diversions and can be used for context when interpreting peak flows reported for Perazzo Meadows. **Table 2** summarizes the USGS gage station information and data for the period of record. This station was reoccupied on November 11, 2012 for gaging flows during WY2013.

We understand that streamflow data has been collected on the Sierra Valley Diversion Ditch, but have not evaluated that data set as part of this monitoring program. During Fall 2012, the USGS re-established this gage, maintaining real-time data access through the USGS National water data web interface.

2.6 Comparisons to Other Watersheds

The streamflow records for Perazzo Meadows are compared to at least one of two other nearby gaging records to provide a basic check on flow magnitudes and timing of streamflow variations. These gages include: 1) Sagehen Creek, near Truckee, California (USGS 10343500), about 7 miles to the southeast, and; 2) Cold Creek, near Truckee, California (Hastings and others, 2012), approximately 13.5 miles to the southeast.

The Sagehen Creek station (USGS 10343500) measures streamflow from a 10.5 square-mile watershed with a mean annual precipitation of 38 inches. Sagehen Creek watershed is more distant from the Sierra Nevada crest with less precipitation than many of the Perazzo Meadow contributing watersheds. However, this gaging station has a long, 65-year, continuous period of record with no upstream storage or diversions; therefore, is referenced or used in this report for comparison with general trends in hydrology.

Cold Creek is a tributary to Donner Creek, a tributary to the Truckee River, and has a watershed size of 12.6 square miles, which originates at the eastern crest of the Sierra Nevada. This location provides a comparable watershed relative to mean annual precipitation (approximately 49 inches) (USGS, 2011) but a slightly lower elevation (5,920 feet) than and more distant from Perazzo Meadows (6,459 feet to 7,221 feet). Balance installed this gaging station on October 5, 2010 and operates this gage year-round for the Truckee River Watershed Council (TRWC). This station is rarely affected by ice and its hydrology is more influenced by higher elevations along the Sierra Crest than the Sagehen Creek gage, and therefore provides a reasonable record for correlation and estimation of daily flows during ice-affected periods at Perazzo Meadows.

3. WY2012 HYDROLOGIC SUMMARY AND DISCUSSION

This section summarizes the WY2012 annual precipitation, streamflow conditions at each gaging station, and groundwater trends, concluding with a comparison of streamflow stations and discussion of groundwater conditions during the first full year after the completion of restoration in the Middle Perazzo Meadows.

3.1 Annual Precipitation

Annual precipitation for Perazzo Meadows is evaluated from daily data collected at Independence Creek (California Data Exchange Center, 2011) located at similar elevation (6,500 feet) and approximately 3.5 miles southeast of Perazzo Meadows. Annual and long-term average snow-water equivalent is reported from Central Sierra Snow Lab, located near Donner Pass at 6,950 feet elevation and about 11 miles south-southwest. The Snow Lab has over 100-years of record and serves as a good reference for comparison to WY2012 observed conditions at Perazzo Meadows.

Cumulative-annual precipitation during WY2012 is illustrated in **Figure 5** with the daily mean and minimum air temperatures. WY2012 was a year with below-average precipitation (22.5 inches, as measured at Independence Creek) and exhibited a low annual snowpack. For instance, on May 1, when the maximum long-term annual snowpack (snow-water equivalent) is typically observed, WY2012 was only 66 percent of average (NRCS, 2012). Snow-water equivalent during WY2012 is illustrated in **Figure 6**, relative to long-term averages.

WY2012 began with a moderate (2 inches) precipitation event in the first week (October 4-5, 2011), followed by a dry period that persisted until November when an additional 1.9 inches was received in smaller snowfall events during that month. Dry and cold conditions dominated late November and lasted through mid-January of 2013. Warmer weather and measurable rain (4.9 inches) fell on a thin snow pack between January 20 and 21, 2013, and was enough to trigger mid-winter peak flows. February was noted for additional, but limited, snowfall, while another event with mixed precipitation was recorded on March 15-17, 2013 (approximately 5 inches). Annual snowpack reached its maximum in April at 66 percent of the long-term average snowpack for the time of year. The spring arrived early with warmer weather and rain in late April, which triggered peak snowmelt conditions. Summer remained dry with the exception of frequent afternoon thunderstorms in July and August. Continued warm temperatures and absence of measurable rainfall through the end of the water year

contributed to baseflow in local streams to fall below long-term averages, and to the lowest levels observed since monitoring began in WY2010.

3.2 Streamflow

In the following subsections, we describe streamflow during water year 2012 at each gaging station from upstream to downstream. We first summarize inflows to Upper Perazzo Meadow from Perazzo Creek and the Little Truckee River (stations PCAP and LTAP). We then describe flows on the Little Truckee River below the Upper Meadow and above the Middle Meadow (LTUM). Together with Cold Stream (CSAP), these stations account for the bulk of inflows to the Middle Meadow. Middle Meadow outflow (LTPM) is described in relationship to the inflows. Finally, we describe conditions at the outflow from the Lower Meadow (LTLM), which has not yet been restored. Streamflow is reported as daily mean values, unless otherwise specified. We note that there are additional intermittent tributaries, springs, and other areas between gages, which were not gaged (see **Figure 4**); estimates of contributing flow from these intervening tributary areas based on those data collected at the existing six gaging stations.

3.2.1 Perazzo Creek above Upper Perazzo Meadow (PCAP)

Table 3 provides information and observations from site visits and manual measurements of flow at Station PCAP. An annual streamflow summary, including peak flows, monthly, and annual statistics is provided in **Form 1**. Daily mean stage and flow are graphically illustrated in **Figures 7 and 8**, respectively.

The water year began with flows below 1 cfs but increasing in response to fall rainstorms. Ice-affected streamflows began in late November and persisted until mid-January when a rain-on-snow event (January 20-21, 2012) generated a winter peak flow of 86.7 cfs. Periods of ice-affected flow were estimated using a correlation to Cold Creek in Truckee, California. Streamflow quickly receded following another extended dry, cold period that lasted through about mid-March. Annual peak streamflow of 248 cfs occurred on April 26, 2012 and was associated with peak snowmelt runoff during warm weather and a rain-on-snow event. Peak snowmelt was followed by dry and warm conditions, resulting in quickly receding streamflow punctuated by ephemeral increases associated with summer thunderstorms. Sustained by springs, groundwater discharge to the channel and remaining snowmelt, baseflow of about 0.25 cfs persisted into the next water year (WY2013), significantly less than the approximately 1 cfs

baseflow at the beginning of WY2012. In total, Perazzo Creek contributed approximately 10,148 acre-feet of surface water to the Upper Meadow during WY2012.

3.2.2 Little Truckee River above Upper Perazzo Meadow (LTAP)

Table 4 provides information and observations from site visits and manual measurements of flow. An annual streamflow summary, including peak flows, monthly, and annual statistics is provided in **Form 2**. Daily mean stage and flow are graphically illustrated in **Figures 9 and 10**, respectively.

The water year began with flows of about 1 cfs, then increasing in response to fall rainstorms. Ice-affected streamflows were identified early in the water year and persisted through mid-January when a rain-on-snow event (January 21, 2012) generated a winter peak flow. Streamflow quickly receded during another extended dry, cold period with ice-affected flows through late-February. Periods of ice-affected flow were estimated using a correlation to Cold Creek in Truckee, California. Annual peak streamflow of 694 cfs, coincident with peak snowmelt, occurring on April 26, 2012 and associated with warm weather and a rain-on-snow event. Streamflow quickly receded following rapidly warming and dry weather. During this year of below average precipitation and unseasonably warm temperatures, flow ceased at the gaging station between August 20th and 25th. In total, the Little Truckee River contributed approximately 19,589 acre-feet of surface water to the Upper Meadow in WY2012.

3.2.3 Little Truckee River below Upper Perazzo Meadow (LTUM)

Table 5 provides information and observations from site visits and manual measurements of flow. An annual streamflow summary, including peak flows, monthly, and annual statistics is provided in **Form 3**. Daily mean stage and flow are graphically illustrated in **Figures 11 and 12**. A comparison of Upper Perazzo Meadow streamflow inputs and outputs is provided in **Figure 13**.

Mean daily flow at the beginning of the water year was approximately 3 cfs. Similar to upstream gages, streamflow responded to fall rainstorms, but was affected by ice as winter began and persisted through mid-January when a rain-on-snow event (January 20-21, 2012) generated a winter peak flow (202 cfs). Streamflow quickly receded during another extended dry, cold period with ice-affected flows through late-February. Periods of ice-affected flow were estimated using a correlation to Cold Creek in Truckee, California. Peak snowmelt runoff of 752 cfs occurred on April 26, 2012 and was

associated with warm weather and a rain-on-snow event. Streamflow then quickly receded during an early dry and hot summer with small responses to a few summer thunderstorms. Flow continued to recede through the summer to an end of the water year baseflow below 0.2 cfs, significantly below baseflows recorded in the beginning of the water year. In the absence of snowmelt, baseflow was likely sustained by groundwater discharge to the channel that originates from Perazzo Creek. In total, the Little Truckee River at the outlet of Upper Perazzo Meadows discharged approximately 32,729 acre-feet of water during WY2012. This is 3,280 acre-feet more than the sum of the two contributing tributaries (PCAP + LTAP = 29,449). While the accuracy of the gaging can exceed 10 percent, it is reasonable that some portion of this volume originated from the 3.6 square mile intervening areas (totaling 14 percent of the total watershed).

3.2.4 Cold Stream above Middle Perazzo Meadow (CSAP)

Table 6 provides information and observations from site visits and manual measurements of flow at Station CSAP. Daily streamflow for the partial water year is provided in **Form 4**. Daily mean stage and flow are graphically illustrated in **Figures 14 and 15**.

The water year began with approximately 2 cfs of streamflow and responded to fall rainstorms. The gage was affected by ice intermittently until mid-January when a rain-on-snow event (January 20-21, 2012) generated a winter peak flow (40 cfs), then at times through the remainder of the winter. This station is located at a higher elevation relative to the other stations and can be subjected to longer and more frequent periods of ice. Periods of ice-affected flow were estimated using a correlation to Cold Creek in Truckee, California. Streamflow quickly receded during another extended dry, cold period until mid-March. The peak streamflow for the year was 58.4 cfs on May 16, 2012, a couple weeks after the annual peak flow recorded at other gaging stations. The delay at this station is likely attributed to the fact that this station is located at higher elevation relative to the other stations, allowing for more snowpack storage, delayed warming, and a longer melt duration. Streamflow receded quickly during an early and dry summer, punctuated by ephemeral increases in flow associated with summer thunderstorms. Perennial flow in Cold Stream is supported by springs in the upper watershed which sustained a baseflow of about 0.75 cfs into the next water year (WY2013), significantly less than the approximately 2 cfs at the beginning of WY2012 but significantly more than the Little Truckee River where it enters the Middle Meadow (at station LTUM). In total, Cold Stream contributed approximately 3,923 acre-feet of

surface water to the Middle Meadow in WY2012; though only 12 percent of the annual runoff at LTUM, Cold Stream supplies the majority of the baseflow downstream of it confluence with Little Truckee River.

3.2.5 Little Truckee River below Middle Perazzo Meadow (LTPM)

Table 7 provides information and observations from site visits and manual measurements of flow. An annual streamflow summary, including peak flows, monthly and annual statistics is provided in **Form 5**. Daily mean stage and flow for Station LTPM are graphically illustrated in **Figures 16 and 17**. A comparison of Middle Perazzo Meadow streamflow inputs and outputs is provided in **Figure 18**.

At the beginning of the water year streamflow exceeded 5 cfs. Similar to upstream gages, streamflow responded to autumn rainstorms, but was affected by ice as winter began and persisted until a rain-on-snow event (January 20-21, 2012) generated an estimated winter peak flow of 150 cfs. Periods of ice-affected flow were estimated using a correlation to Cold Creek in Truckee, California. Streamflow quickly receded during another extended dry, cold period. The annual peak streamflow of 896 cfs occurred on April 26, 2012, coincident with peak snowmelt runoff during warm weather and a rain-on-snow event. Streamflow then receded quickly during an early and dry summer with a few summer thunderstorms and small responses in streamflow. Baseflow receded to below 1 cfs towards the end of the water year, significantly less than at the beginning of WY2012. In total, the Little Truckee River, at the outlet of Middle Perazzo Meadow discharged approximately 40,987 acre-feet of water during WY2012.

Total runoff inflows to the Middle Meadow during WY2012 were 32,729 acre-feet from the Little Truckee River (at station LTUM) and 3,923 acre-feet from Cold Stream (station CSAP). The total outflow volume (at station LTPM) was 40,987 acre-feet, a difference of 4,335 acre-feet. While the accuracy of the gaging can exceed 10 percent, it is reasonable that some portion of this volume originated from the 4.2 square mile intervening areas (see **Figure 4**).

3.2.6 Little Truckee River below Lower Perazzo Meadow (LTLM)

Lower Perazzo Meadow, downstream from LTPM, has not yet been restored. Beginning in August 2011, Balance began coordinating with UC Merced researchers to develop a continuous record of flow at the Lower Meadow outlet (LTLM) to characterize baseline conditions in preparation for future restoration activities. This gage is the downstream-most gaging station in Perazzo Meadows, located approximately 0.85 river miles

upstream of the Sierra Valley Diversion Ditch. Ongoing collection of baseline data prior to restoration of the meadow will provide a valuable data set against which to compare post-restoration conditions. Finally, a complete year of data at this station can be used to evaluate differences in meadow storage between a restored meadow (Middle or Upper Meadow) and an unrestored meadow (Lower Meadow).

Table 8 provides information and observations from site visits and manual measurements of flow at Station LTLM. Daily streamflow for the partial water year is provided in **Form 6**. Daily mean stage and flow are graphically illustrated in **Figures 19 and 20**. A comparison of inputs and outputs to the Lower Perazzo Meadow is shown in **Figure 21**.

Streamflow at the beginning of the water year exceeded 6 cfs. Similar to upstream gages, flow responded to fall rainstorms. The gage was affected by ice intermittently through most of the winter, and the periods of ice-affected flow were estimated using a correlation to Cold Creek in Truckee, California. A rain-on-snow event on January 20-21 generated an estimated winter peak flow of 327 cfs. Subsequently, additional snowmelt and rain-on-snow events generated ephemeral peaks in flow into the spring months. The annual peak streamflow was 1,337 cfs on April 26, 2012 and was associated with warm weather and a rain-on-snow event. Streamflows quickly receded with the onset of a warm, dry summer. A few summer thunderstorms resulted in small responses in streamflow through the remainder of the water year. Baseflow receded to near 1 cfs into the next water year (WY2013), significantly less than approximately 6 cfs at the beginning of WY2012. In total, the Little Truckee River, at the outlet of Lower Perazzo Meadow discharged approximately 44,594 acre-feet of water in WY2012.

Total runoff input volume to the Lower Meadow is computed to be 40,987 ac-ft. (Station LTPM), compared to total runoff output volume (Station LTLM) of 44,594 acre-feet, a difference of 3,607 acre-feet. A portion of this additional runoff volume reasonably originates from the intervening areas (1.4 square miles) between the two gages (see **Figure 4**). The accuracy of stream gaging can also exceed 10 percent.

3.2.7 Comparison of Streamflow and Annual Runoff during WY2012

WY2012 streamflow hydrographs from all six stations are illustrated in **Figure 22** runoff volumes for all six stations (including estimates for ungaged areas) are reported in **Table 9**. Snowmelt recession runoff is reported for all six stations on a monthly basis (May-

September) in **Table 10**, while monthly mean streamflow and unit-streamflow is tabulated in **Figure 23**.

Based on a comparison of streamflow at all six stations, we draw the following conclusions:

- Through comparison to streamflow on Cold Creek in Truckee, we conclude that the flow records are consistent with regional hydrology trends;
- Based on the frequency, methods used, and accuracy of our streamflow measurements, the flow records are reasonably accurate and consistent with USGS standards;
- All six stations exhibited similar timing for peak flows with the exception of Cold Stream (CSAP). The runoff peaks at CSAP show a delay relative to the other five stations and is attributed to the higher elevation of the station (see **Figure 22**);
- Baseflows at the beginning of WY2012 ranged between 0.75 cfs to 12 cfs, increasing from upstream to downstream, and were greatly reduced by the end of the water year when they ranged between 0 cfs to 2.2 cfs. Reduced baseflows were associated with the below average precipitation and an early snowmelt period (see **Figure 22**);
- Annual runoff volumes were greatly reduced relative to the previous water year, which is consistent with records of below average precipitation during WY2012 and above average precipitation during WY2011. For instance, runoff to the Upper Meadow from the Little Truckee River and Perazzo Creek totaled 79,235 acre-feet in WY2011 as compared to only 29,263 acre-feet in WY2012 (see **Table 9**);
- Monthly runoff during the snowmelt period May through September decreased between one and two orders of magnitude (**Table 10**). Perennial flow through the meadow is likely attributable to perennial flows from groundwater-supported tributaries (i.e., Perazzo Creek and Cold Stream) and slow release of groundwater from the restored meadows; and
- Relative to WY2011, mean monthly streamflow at all stations showed a significant recession between May and September after the occurrence of the annual peak flow in April 2012. For instance, mean monthly inflows to Perazzo Meadows (LTAP + PCAP) exceeded 200 cfs in May and were reduced to less than 0.2 cfs by

September. Similarly, mean monthly outflows from Perazzo Meadows (LTLM) were approximately 300 cfs in May and were reduced to 2.2 cfs by September (see **Figure 23**).

3.3 Groundwater

Groundwater levels were monitored in piezometers, beginning in July 2009 and continued through WY2012. The piezometers were located (shown in **Figures 2 and 3**) to characterize groundwater response to the plug and pond restoration efforts. Field observations during water year 2012 are presented in **Table 11**, including depth to groundwater, specific conductance, water clarity and odor, and qualitative observations. Specific conductance in groundwater over the course of the monitoring period is illustrated in **Figure 24**. **Figure 25** shows depth to groundwater during the monitoring period.

Restoration activities were carried out during Summer 2009 in the Upper Meadow and Summer 2010 in the Middle Meadow. Limited information is available regarding pre-project groundwater levels in the Upper Meadow because most of the piezometers were installed only days before restoration activities began. In the Middle Meadow, however, a full year of groundwater monitoring was completed prior to restoration, allowing for comparison of groundwater levels before and after the restoration period. As outlined in the first annual monitoring report for this study, groundwater response to restoration ranged from 0 to 6 feet in the Upper Meadow, and 0.5 to 2 feet in the Middle Meadow, depending on location (Shaw, 2010).

3.3.1 Groundwater Conditions in the Upper Meadow

Groundwater in the Upper Meadow illustrated a range of levels in response to below average precipitation and runoff measured during WY2012, relative to above normal conditions during WY2011, normal conditions during WY2010, and below normal conditions during WY2009 (**Figure 25**). Although not strictly true at all wells, groundwater levels by the end of WY2012 by-in-large returned to levels observed at the end of WY2009 (when the Upper Meadow was restored), after slightly higher levels at the end of water years 2010 and 2011. Flood levels (above ground surface levels) were also considerably higher and sustained during WY2011, although infrequent overbank flows in the meadow elevated groundwater levels during WY2012 near those achieved in a WY2011. In nearly all piezometers, elevated groundwater levels carried over into WY2012, with the exception of piezometer 09-05, located on the 2-3 foot terrace at distance from Perazzo Creek and shows seasonal fluctuation each year. Piezometers

showing declining groundwater levels following WY2010 snowmelt also exhibited similar conditions during WY2012, though to a slightly deeper level and concurring with the extended streamflow recession recorded during WY2012. Piezometers FS-12 and FS-13, located near former channels near the river, showed groundwater levels holding fairly steady through the end of WY2012.

Figure 26 compares streamflow during WY2012 in Perazzo Creek (PCAP) and Little Truckee River (LTAP) with groundwater levels in the portions of the Upper Meadow that exhibited prominent seasonal fluctuation. In line with below normal precipitation and snowpack conditions, streamflow and groundwater levels receded to lower levels by the end of WY2012. Unlike water years 2011, the Little Truckee River ceased flowing in late August and water levels in piezometer 09-03 (located in a wetland near the Little Truckee River) lowered below ground surface, which may be typical in dry years. Some potential drought management concepts to explore for sustaining downstream wet meadows include (a) preserving or protecting springs and baseflow in the Perazzo Creek sub-watershed and (b) management of streamflow at Webber Lake Dam.

In the absence of pre-restoration data in the Upper Meadow, we can roughly quantify the potential effects of plug-and-pond restoration by evaluating changes in groundwater volume in areas of the Upper Meadow that are assumed to have become desiccated and targeted for rewatering through restoration practices. For instance, remnant channels and terraces west of the active channel are thought to have typically been dry before restoration and in most years as the result of an active incised channel, which contained most annual flows. During these years, we assume groundwater storage was minimal or obsolete in the terraces. Post-restoration groundwater conditions along these terraces and remnant channel are captured by piezometers 09-04 (lower terrace and remnant channel) and 09-05 (upper terrace) (see **Figure 2** for locations). In WY2012, a dry year, we observed groundwater in these piezometers to be near or just below the ground surface in June (June 15th), followed by a 3- to 5-foot decline in groundwater levels through the end of the water year. If we assume meadow soils and alluvium have a typical 30-percent porosity, the estimated change in groundwater storage across this area is calculated to be to be almost 85 acre-feet over this time period. In the absence of local evapotranspiration (ET) data, we make an assumption based on regional norms (Snider, 1999) that roughly 20 percent of this volume is lost to ET, leaving remaining storage of roughly 68 acre-feet. Runoff volumes measured at the outlet of the Upper Meadow (LTUM) approached 1,240 acre-feet over the same time period (June 15-September 30, 2012). Based on this

water balance, the contribution of groundwater storage to streamflow is approximately 5 percent of total flow (neglecting groundwater outflows).

3.3.2 Groundwater Conditions in the Middle Meadow Before and After Restoration

Figures 24 shows groundwater specific conductance in piezometers groundwater in the Middle Meadow prior to (WY2010) and following restoration activities (WY2011 and WY2012), and illustrate a range in response to restoration activities across the Middle Meadow. In general, we observe similar or slightly wider range of specific conductance across the Middle Meadow after restoration with the wider range suggesting possible mixing of waters, old (i.e., groundwater) and new (surface waters) as the result of restoration.

Figure 25 shows depth to groundwater in piezometers located at across the Middle Meadow prior to and after restoration. Groundwater levels vary depending upon location in the meadow, so specific areas are highlighted in **Figures 27 and 28**, comparing pre- and post-restoration groundwater conditions. Prior to restoration (during WY2010), groundwater levels in former floodplain areas (Piezometer 09-09, **Figure 27**) were consistently below the meadow surface, even during spring peak flows with a 5- to 10-year recurrence interval. Following restoration activities, water levels were consistently above the ground surface, with ponded water up to 1-foot deep throughout the winter and spring of WY2011 and for shorter periods of time in WY2012. Near the seasonal springs at the northeast portion of the meadow, the groundwater levels and fluctuations as represented by Piezometer 09-11 (**Figure 28**) appear to be somewhat unique when compared to data from other areas. Groundwater levels fluctuate seasonally regardless of changes associated with the restoration project. This is consistent with earlier interpretations suggesting the area is supplied by a deeper source of groundwater that supports a local hydraulic floor, distinct from shallow groundwater and surface water moving down valley.

In areas closer to the channel, as represented by Piezometers 09-06, 09-09, and 09-10, groundwater levels remained consistently high through the summer months and into the drier months of the end of the water year, with specific conductance values slightly elevated in response to the drier conditions and slower groundwater movement.

3.4 Channel – Floodplain Interactions

Through plug-and-pond restoration, meadow areas have become more hydrologically connected to conditions in the channel. This is particularly noticeable in portions of the

Middle Meadow (see **Figure 27**) where a restoration has facilitated higher groundwater levels regardless of water year type (WY2011 was wet while WY2012 was dry). We attribute these changes to more overbank flooding and resultant storage produced by plug-and-pond method.

Evaluation of restoration success also requires monitoring over a range of year types (i.e., wet, average, and dry) to understand changes in surface water and groundwater interactions. WY2012 was a particularly dry year and we observed some of the lowest streamflows on the Little Truckee River and regionally in many years. Despite these conditions, we observed a resiliency in streamflow at the outlets of the restored meadows. We attribute this resiliency in streamflow to releases of stored groundwater within the restored meadow, but also augmented by spring-fed tributaries (i.e., Cold Stream, Perazzo Creek). **Figure 29** shows stabilized groundwater levels in the restored meadow likely contributed from reduced evapotranspiration and, in some cases (piezo 09-06), groundwater rebounds with additional storage from channel-floodplain interactions.

4. SUMMARY AND CONCLUSIONS

Three years after plug and pond restoration activities in the Upper Meadow and two years after the Middle Meadow restoration, we observed groundwater levels at Upper and Middle Perazzo Meadows to vary spatially and temporally, and in some locations, from the year type (i.e., wet, average or dry year). Precipitation and snowpack conditions during WY2012 were below normal. Ongoing stream gaging at inflows and outflows from the three (Upper, Middle, and Lower) Perazzo Meadows indicated significantly less runoff volumes during WY2012 relative to the previous water year (a wet year). Under these conditions, groundwater levels in the Middle Meadow were generally elevated relative to pre-restoration conditions. Although we observed 5-foot declines in groundwater levels in some areas, these levels were still higher than pre-restoration conditions.

In dry years, such as WY2012, we identified the importance of spring-fed tributaries for sustaining instream flow and near-channel saturation. While the Little Truckee River above Perazzo Meadow ceased to flow in August, hydrologic support came from Perazzo Creek and Cold Stream—two spring-fed tributaries. Secondary hydrologic support for late season instream flows appears to also have originated from meadow drainage in the absence of precipitation.

Evaluation of streamflow and groundwater data suggests that meadow restoration activities have resulted in a more connected channel-floodplain system with benefits of groundwater storage and late season release. We conclude that in some cases, groundwater storage promoted by plug-and-pond restoration may meter groundwater to the channel over the driest months of the year and provide as much as 5 percent of baseflow in the channel.

Balance is continuing stream and groundwater monitoring activities during WY2013, a second consecutive drought year, which will assist with expanding the preliminary interpretations of gaging and groundwater monitoring at Perazzo Meadows and further evaluate the effects of water storage and release in the restored meadows. Additional data collected will help develop a better understanding of how individual storms and episodic events affect (and are affected by) the reconfigured meadow systems, and help infer how meadow function may differ in years with different climate and precipitation patterns.

5. LIMITATIONS

This report was prepared in general accordance with the accepted standard of practice existing in Northern California at the time the investigation was performed. No other warranties, expressed or implied, are made. It should be recognized that interpretation and evaluation of streamflow records and of subsurface conditions is a difficult and inexact art. Judgment leading to conclusions and recommendations presented above were based on existing information and personnel communications, which in total represent an incomplete picture of the site. More extensive studies, including those recommended above, can reduce some of the uncertainties associated with this study.

Balance Hydrologics has prepared this report for the Truckee River Watershed Council's exclusive use on this particular groundwater and surface water monitoring study. Analyses and information included in this report are intended for use at the watershed scale. Analyses of channels and other water bodies, rocks, earth properties, topography and/or environmental processes are generalized to be useful at the scale of a watershed, both spatially and temporally. Information and interpretations presented in this report should not be applied to specific projects or sites without the expressed written permission of the authors, nor should they be used beyond the particular area to which we have applied them.

This study was conducted to monitor work done by others. Our conclusions and any implied or inferred recommendations are based on a limited range of surface water and groundwater data in a region of relatively complex geology. They are limited to restoration evaluation purposes and should not be used for design or site-specific work. If readers are aware of additional data, observations, conditions, or forthcoming changes to the bases of our decisions, please contact us or the Truckee River Watershed Council at the first opportunity, such that this report may be promptly revised.

6. REFERENCES

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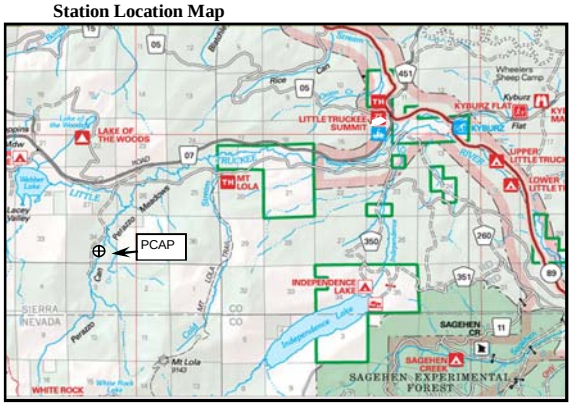
FORMS

Water Year:	**2012**
Stream:	Perazzo Creek
Station:	Above Perazzo Meadows (PCAP)
County:	Sierra County, California

Form 1. Annual Hydrologic Record, WY2012

Station Location Map



Station Location / Watershed Descriptors

N 39° 27' 53", W 120° 23' 16" near Truckee, California. Gage is located on west bank.
Along USFS Road 07-030 bridge
Land use includes timber harvesting, recreation, and open space
Flows are unregulated
Drainage area is 6.1 square miles.

Annual Mean Flows

Annual mean flow for WY2012 is 14.0 cfs; WY2011 is 37.4 cfs.

Peak Flows (WY2012)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
1/20/2012	23:00	5.42	87	5/9/12	21:00	5.06	100
1/25/2012	1:45	5.37	78	5/14/12	20:45	5.24	125
3/16/12	6:15	5.18	55	5/15/12	19:45	5.26	128
4/26/12	**6:45**	**5.88**	**248**				
04/30/12	20:15	5.31	135				

Extreme for period of record (WY2012) is 248 cfs on April 26, 2012.

Period of Record

Staff plate and water level recorder were installed on November 17, 2010.
Gaging is sponsored by the Truckee River Watershed Council and USFS

WY 2012 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	**0.8**	**2.3**	*1.9*	**1.7**	**3.6**	**2.8**	**19.4**	**108.8**	**52.9**	**5.3**	**0.3**	**0.2**
2	**0.8**	**1.9**	*2.0*	**1.6**	**3.3**	**2.5**	**11.5**	**82.9**	**53.6**	**4.9**	**0.3**	**0.2**
3	**0.9**	**2.3**	*1.6*	**1.7**	**3.6**	**2.3**	**11.8**	**62.6**	**48.2**	**4.6**	**0.3**	**0.2**
4	**1.4**	**2.9**	*1.7*	**1.8**	**3.4**	**2.4**	**14.2**	**54.1**	**50.2**	**4.2**	**0.3**	**0.2**
5	**3.3**	**3.7**	*1.8*	***2.2***	**3.3**	**2.3**	**13.3**	**52.5**	**37.7**	**3.9**	**0.3**	**0.2**
6	**2.6**	**3.4**	*1.6*	***2.0***	**3.2**	**2.4**	**18.3**	**56.2**	**29.1**	**3.4**	**0.2**	**0.3**
7	**2.4**	**3.2**	*1.7*	***2.4***	**3.0**	**2.3**	**12.4**	**62.7**	**28.1**	**3.0**	**0.2**	**0.2**
8	**2.9**	**4.4**	*1.7*	***2.6***	**3.0**	**2.2**	**13.1**	**71.4**	**29.2**	**2.7**	**0.2**	**0.2**
9	**3.0**	**3.5**	*1.2*	***2.5***	**3.0**	**2.4**	**15.3**	**88.2**	**25.3**	**2.4**	**0.2**	**0.2**
10	**6.5**	**3.0**	*1.3*	***2.7***	**3.2**	**2.8**	**16.5**	**92.9**	**21.0**	**2.2**	**0.2**	**0.2**
11	**10.0**	**2.9**	*1.3*	***2.6***	**3.9**	**3.1**	**17.6**	**86.6**	**21.1**	**2.0**	**0.2**	**0.2**
12	**4.2**	**3.6**	*1.2*	***2.8***	**3.4**	**2.8**	**18.0**	**86.1**	**22.0**	**1.9**	**0.2**	**0.3**
13	**4.0**	**3.4**	*1.5*	***2.7***	**2.8**	**3.1**	**27.5**	**86.7**	**22.6**	**1.5**	**0.2**	**0.3**
14	**3.8**	**3.3**	*1.4*	***2.6***	**2.5**	**3.6**	**14.9**	**95.1**	**23.0**	**1.2**	**0.2**	**0.2**
15	**3.3**	**3.1**	*1.5*	***2.2***	**2.7**	**19.4**	**15.2**	**91.5**	**21.9**	**1.1**	**0.2**	**0.3**
16	**2.9**	**3.2**	*1.4*	***2.0***	**2.3**	**41.5**	**17.8**	**96.2**	**19.5**	**1.0**	**0.2**	**0.3**
17	**2.5**	**3.0**	*1.2*	***2.1***	**2.2**	**28.6**	**20.1**	**79.3**	**19.0**	**0.9**	**0.2**	**0.3**
18	**2.1**	**3.5**	*1.1*	**2.9**	**2.1**	**14.0**	**23.1**	**71.1**	**16.4**	**0.9**	**0.2**	**0.3**
19	**1.7**	**3.3**	*1.2*	**6.0**	**2.2**	**9.9**	**27.1**	**67.0**	**14.7**	**0.8**	**0.2**	**0.3**
20	**1.7**	**3.2**	*1.0*	**18.9**	**2.2**	**8.4**	**41.5**	**70.4**	**12.8**	**0.8**	**0.2**	**0.3**
21	**1.6**	**3.2**	*1.0*	**32.8**	**2.2**	**10.7**	**64.4**	**75.8**	**11.0**	**0.7**	**0.2**	**0.3**
22	**1.5**	**2.7**	*0.7*	**36.2**	**2.1**	**11.8**	**85.1**	**66.7**	**9.8**	**0.6**	**0.2**	**0.3**
23	**1.5**	**2.5**	*0.8*	**27.9**	**2.4**	**11.7**	**102**	**58.3**	**11.0**	**2.4**	**0.2**	**0.3**
24	**1.4**	**2.8**	*0.7*	**57.8**	**2.4**	**9.5**	**102**	**48.6**	**8.8**	**1.4**	**0.2**	**0.3**
25	**1.7**	**2.9**	*0.7*	**65.9**	**2.6**	**9.2**	**93.7**	**40.5**	**8.0**	**0.8**	**0.2**	**0.3**
26	**1.5**	**3.0**	*0.6*	**48.6**	**2.2**	**8.9**	**184**	**33.4**	**7.2**	**0.6**	**0.2**	**0.3**
27	**1.9**	**2.7**	*0.6*	**35.1**	**2.3**	**7.9**	**82.6**	**27.6**	**6.7**	**0.5**	**0.2**	**0.3**
28	**2.3**	**2.7**	**0.9**	**34.4**	**2.4**	**9.0**	**66.3**	**32.0**	**6.2**	**0.5**	**0.2**	**0.3**
29	**2.3**	**2.7**	**1.5**	**20.6**	**2.3**	**8.5**	**70.5**	**38.9**	**5.9**	**0.4**	**0.2**	**0.3**
30	**2.3**	**2.5**	**1.9**	**11.6**		**11.3**	**91.9**	**41.3**	**5.5**	**0.4**	**0.2**	**0.3**
31	**2.3**		**1.7**	**5.3**		**20.8**		**46.5**		**0.4**	**0.2**	
MEAN	2.6	3.0	1.3	14.3	2.8	9.0	43.7	66.8	21.6	1.8	0.2	0.3
MAX. DAY	10.0	4.4	2.0	65.9	3.9	41.5	184.3	108.8	53.6	5.3	0.3	0.3
MIN. DAY	0.8	1.9	0.6	1.6	2.1	2.2	11.5	27.6	5.5	0.4	0.2	0.2
cfs days	81	91	40	442	80	278	1311	2072	649	57	7	8
ac-ft	161	180	80	877	158	552	2600	4110	1287	114	14	16

Monitor's Comments

1. Daily mean values are based on 15-minute automated measurements of stage; stage shifts have been applied to account for changes in sedimentation of the gage over the course of the monitoring program.
2. Stage and flow are commonly affected by ice in the winter months; these periods have been adjusted to correct for daily mean flow
3. Peak flows associated with snow-melt hydrographs commonly occur between April and June; multiple peaks are also common
4. Data are subject to revision, should additional measurement or observer account warrant adjustment of the new rating curve.
5. Italicized font indicates an estimated flow (when affected by ice) and are based on correlation to nearby stream gages

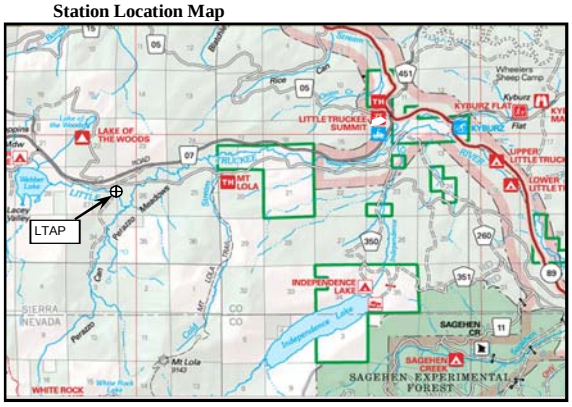
Water Year 2012 Totals:		
Mean flow	**14.0**	(cfs)
Max. daily flow	**184**	(cfs)
Min. daily flow	**0.21**	(cfs)
Annual total	**5,116**	(cfs-days)
Annual total	**10,148**	(ac-ft)

Balance Hydrologics, Inc. PO Box 1077, Truckee, CA 96161 phone: (530) 550-9776, Berkeley (Main Office) (510) 704-1000
www.balancehydro.com

Water Year:	**2012**
Stream:	Little Truckee River
Station:	Above Perazzo Meadows (LTAP)
County:	Sierra County, California

Form 2. Annual Hydrologic Record, WY2012

Station Location Map



Station Location / Watershed Descriptors

N 39° 28' 59", W 120° 22' 57" near Truckee, California. Gage is located on south bank approximately 130 feet upstream of USFS Road 07-030 bridge.
Land use includes timber harvesting, recreation, open space, and rural residential.
Streamflow may be affected by Webber Lake (reservoir)
Drainage area is 15.8 square miles.

Annual Mean Flows

Annual mean flow for WY2012 is 27 cfs, WY2011 (partial) is 88.5 cfs.

Peak Flows (WY2012)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
1/21/12	9:00	2.06	82	5/14/12	7:15	2.87	262
3/16/12	16:30	2.12	93	5/17/12	7:15	2.92	280
4/26/12	**13:15**	**3.71**	**694**	5/22/12	10:00	2.78	230
05/01/12	19:15	3.13	385	6/5/12	9:15	3.01	343

Extreme for period of record (WY2011-2012) is 694 cfs on April 26, 2012.

Period of Record

Staff plate and water level recorder were installed on November 18, 2010.
Gaging is sponsored by the Truckee River Watershed Council and USFS

WY2012 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	**0.9**	*0.5*	*0.9*	*0.9*	*3.8*	**32.1**	**21.4**	**332**	**39.7**	**5.9**	**1.6**	**0.0**
2	**1.5**	*0.5*	*0.9*	*0.9*	*3.6*	**12.5**	**26.4**	**280**	**50.4**	**5.7**	**1.5**	**0.0**
3	**1.4**	*0.4*	*0.7*	*1.0*	*3.4*	**8.5**	**28.0**	**212**	**34.9**	**6.7**	**1.4**	**0.0**
4	**4.0**	*0.5*	*0.8*	*1.0*	*3.5*	**8.6**	**32.2**	**174**	**28.9**	**7.9**	**1.3**	**0.0**
5	**0.6**	*0.4*	*0.8*	*1.0*	*3.3*	**11.2**	**23.3**	**160**	**157**	**6.6**	**1.1**	**0.0**
6	**0.2**	*0.4*	*0.7*	*0.9*	*3.1*	**3.9**	**31.0**	**151**	**107**	**5.7**	**1.0**	**0.0**
7	**1.2**	*0.5*	*0.8*	*1.1*	*3.0*	**3.0**	**24.9**	**153**	**56.1**	**5.2**	**0.9**	**0.0**
8	**1.6**	*0.5*	*0.8*	*1.2*	*3.0*	**5.2**	**25.0**	**160**	**40.3**	**5.1**	**0.8**	**0.0**
9	**1.9**	*0.5*	*0.5*	*1.1*	*2.9*	**9.2**	**27.9**	**154**	**35.5**	**4.8**	**0.8**	**0.0**
10	**8.6**	*0.5*	*0.6*	*1.2*	*2.9*	**8.5**	**31.1**	**189**	**31.8**	**4.3**	**0.7**	**0.0**
11	**15.7**	*0.5*	*0.6*	*1.2*	*3.1*	**6.8**	**28.8**	**173**	**27.5**	**4.0**	**0.7**	**0.0**
12	**4.6**	*0.6*	*0.5*	*1.2*	*3.1*	**9.3**	**50.7**	**177**	**21.6**	**3.6**	**0.6**	**0.0**
13	**2.9**	*0.6*	*0.7*	*1.2*	*3.1*	**8.6**	**36.5**	**162**	**20.3**	**3.4**	**0.5**	**0.0**
14	**2.5**	*0.7*	*0.6*	*1.2*	*3.0*	**14.1**	**17.2**	**190**	**36.0**	**3.3**	**0.5**	**0.0**
15	**2.1**	*0.7*	*0.7*	*1.0*	*3.0*	**22.9**	**23.1**	**195**	**29.8**	**3.0**	**0.4**	**0.0**
16	**1.7**	*0.7*	*0.6*	*0.9*	*3.0*	**52.6**	**24.7**	**165**	**24.6**	**2.7**	**0.2**	**0.0**
17	**1.5**	*0.7*	*0.6*	*1.0*	*2.9*	**38.1**	**29.7**	**167**	**21.5**	**2.3**	**0.1**	**0.0**
18	**1.3**	*0.8*	*0.5*	*0.9*	*2.8*	**14.4**	**32.5**	**176**	**18.3**	**2.2**	**0.1**	**0.0**
19	**1.1**	*0.8*	*0.5*	*0.7*	*2.7*	**11.9**	**49.2**	**136**	**14.0**	**2.2**	**0.1**	**0.0**
20	**1.0**	*0.8*	*0.5*	**16.9**	*2.6*	**13.7**	**92.9**	**108**	**11.6**	**2.3**	**0.0**	**0.0**
21	**0.9**	*0.8*	*0.4*	**39.8**	*2.6*	**22.5**	**140**	**88**	**10.9**	**2.2**	**0.0**	**0.0**
22	**0.9**	*0.8*	*0.3*	**37.9**	*2.7*	**25.7**	**218**	**133**	**9.6**	**2.2**	**0.0**	**0.0**
23	**0.8**	*0.8*	*0.4*	**13.9**	*2.7*	**30.6**	**276**	**110**	**9.4**	**3.1**	**0.0**	**0.0**
24	**0.7**	*0.8*	*0.3*	**10.4**	*2.9*	**34.2**	**303**	**77.7**	**8.6**	**2.9**	**0.0**	**0.0**
25	**0.7**	*0.8*	*0.3*	**12.1**	*3.1*	**27.1**	**293**	**62.5**	**8.2**	**2.5**	**0.0**	**0.0**
26	**0.7**	*0.8*	*0.3*	**9.0**	*2.9*	**26.0**	**531**	**63.0**	**6.5**	**2.1**	**0.0**	**0.0**
27	**0.6**	*0.8*	*0.3*	*8.8*	*2.9*	**26.9**	**350**	**57.3**	**6.0**	**2.1**	**0.0**	**0.0**
28	**0.6**	*0.8*	*0.4*	*6.2*	*2.8*	**24.8**	**236**	**46.3**	**6.3**	**2.0**	**0.0**	**0.0**
29	**0.5**	*0.8*	*0.4*	*5.1*	*1.9*	**22.4**	**231**	**57.6**	**6.1**	**1.9**	**0.0**	**0.0**
30	**0.5**	*0.8*	*0.5*	*4.5*		**30.9**	**260**	**49.0**	**5.9**	**1.8**	**0.0**	**0.0**
31	**0.5**		*0.7*	*4.0*		**26.0**		**44.0**		**1.7**	**0.0**	
MEAN	2.1	0.6	0.6	6.1	3.0	19.1	116	142	29.5	3.6	0.5	0.0
MAX. DAY	15.7	0.8	0.9	39.8	3.8	52.6	531	332	157	7.9	1.6	0.0
MIN. DAY	0.2	0.4	0.3	0.7	1.9	3.0	17.2	44.0	5.9	1.7	0.0	0.0
cfs days	63.6	19.3	17.5	188	86.2	592	3495	4403	885	111	14.2	0.0
ac-ft	126.2	38.2	34.7	373	171	1175	6932	8734	1755	221	28.1	0.1

Monitor's Comments

1. Daily mean values are based on 15-minute automated measurements of stage; stage shifts have been applied to account for changes in sedimentation of the gage over the course of the monitoring program.
2. Stage and flow are commonly affected by ice in the winter months; these periods have been adjusted to correct daily mean flows
3. Italicized font indicates an estimated flow (when affected by ice) and are based on correlation to Cold Creek in Truckee, CA
4. Peak flows associated with snow-melt hydrographs commonly occur between April and June; multiple peaks are also common
5. Daily mean flows may be affected by operations at Webber Lake (Reservoir)
6. Data are subject to revision, should additional measurement or observer account warrant adjustment of the new rating curve.

Water Year 2012 Totals:		
Mean flow	**27.0**	(cfs)
Max. daily flow	**531**	(cfs)
Min. daily flow	**0.00**	(cfs)
Annual total	**9,876**	(cfs-days)
Annual total	**19,589**	(ac-ft)

Balance Hydrologics, Inc. PO Box 1077, Truckee, CA 96161 phone: (530) 550-9776, Berkeley (Main Office) (510) 704-1000
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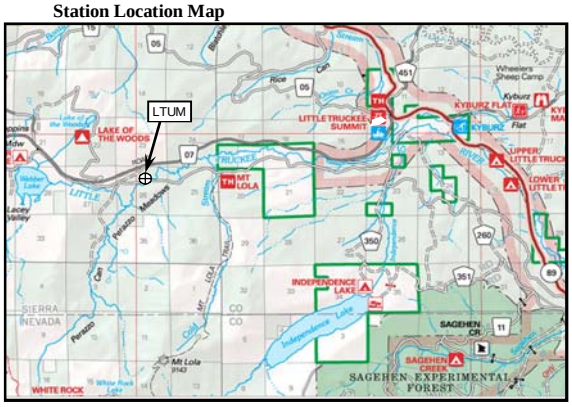
Form 3. Annual Hydrologic Record, WY2012

Water Year:	**2012**
Stream:	Little Truckee River
Station:	Upper Perazzo Meadows (LTUM)
County:	Sierra County, California

Station Location Map



Station Location / Watershed Descriptors

N 39° 29' 10", W 120° 22' 13" near Truckee, California.
Located on east bank, approx. 40 feet downstream from Henness Pass Rd bridge. Subject to ice.
Land use includes timber harvesting, recreation, open space, and rural residential
Streamflow may be affected by Webber Lake (reservoir)
Drainage area is 25.5 square miles.

Annual Mean Flow

Annual mean flow for WY2012 is 45 cfs, WY2011 (partial) is 141 cfs.

Peak Flows (WY2012)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
1/20/12	23:45	6.46	202	5/15/12	21:00	7.13	374
4/26/12	**10:00**	**8.89**	**752**	5/22/12	11:30	6.93	323
4/30/12	21:45	7.64	503	6/2/12	12:15	6.35	186
5/10/12	19:45	7.06	357	6/5/12	11:00	7.02	351

Extreme for period of record (WY2011) is 801 cfs on June 29, 2011.

Period of Record

Staff plate and water level recorder were installed on November 19, 2010.
Gaging is sponsored by the Truckee River Watershed Council and USFS

WY2012 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	**2.8**	**4.5**	**4.2**	*4.1*	*7.8*	**52.1**	**47.2**	**452**	**93**	**11.0**	**1.6**	**0.3**
2	**2.8**	**3.7**	**3.8**	*4.1*	*7.6*	**39.3**	**37.3**	**387**	**135**	**10.5**	**1.5**	**0.3**
3	**2.8**	**3.9**	**3.9**	*4.3*	*7.3*	**17.0**	**34.5**	**313**	**114**	**10.4**	**1.3**	**0.3**
4	**3.2**	**5.2**	**3.7**	*4.3*	*7.4*	**10.9**	**42.8**	**263**	**115**	**11.3**	**1.2**	**0.3**
5	**12.8**	**4.8**	**3.9**	*4.3*	*7.2*	**9.0**	**42.4**	**246**	**211**	**9.8**	**1.4**	**0.3**
6	**7.7**	**5.3**	**3.7**	*4.2*	*7.0*	**9.5**	**43.7**	**237**	**156**	**9.5**	**1.0**	**0.4**
7	**7.0**	**5.2**	**3.9**	*4.4*	*6.9*	**10.6**	**36.4**	**242**	**97**	**7.5**	**1.0**	**0.4**
8	**9.2**	**4.9**	**4.0**	*4.5*	*6.9*	**8.7**	**34.3**	**254**	**80.2**	**6.7**	**1.0**	**0.4**
9	**8.8**	**4.9**	**3.9**	*4.5*	*6.8*	**8.7**	**34.8**	**269**	**72.3**	**6.4**	**0.9**	**0.3**
10	**11.9**	**4.8**	**3.7**	*4.6*	*6.7*	**9.2**	**40.7**	**305**	**61.6**	**5.9**	**0.8**	**0.3**
11	**22.4**	**4.9**	**3.7**	*4.6*	*7.0*	**8.9**	**47.0**	**291**	**56.2**	**5.4**	**0.8**	**0.4**
12	**13.7**	**6.2**	*4.0*	*4.6*	*7.0*	**8.9**	**49.0**	**297**	**50.3**	**4.9**	**0.7**	**0.4**
13	**9.7**	**5.9**	*4.0*	*4.6*	*7.0*	**10.5**	**50.7**	**297**	**49.9**	**5.2**	**0.7**	**0.3**
14	**9.8**	**5.7**	*3.6*	*4.5*	*6.8*	**23.1**	**38.9**	**329**	**63.4**	**4.0**	**0.8**	**0.3**
15	**8.5**	**5.3**	*3.6*	*4.2*	*6.9*	**17.8**	**36.3**	**330**	**57.8**	**3.5**	**0.7**	**0.2**
16	**7.7**	**5.1**	*3.7*	*4.1*	*6.9*	**50.8**	**39.5**	**319**	**49.8**	**3.1**	**0.5**	**0.2**
17	**6.8**	**5.6**	*3.7*	*4.2*	*6.8*	**51.0**	**47.4**	**305**	**44.9**	**3.1**	**0.6**	**0.2**
18	**6.1**	**4.8**	*4.2*	*4.2*	*6.6*	**33.8**	**64.4**	**298**	**40.4**	**3.0**	**0.6**	**0.2**
19	**5.8**	**5.4**	*3.7*	**3.8**	*6.5*	**30.9**	**92.4**	**252**	**33.8**	**3.1**	**0.5**	**0.2**
20	**5.4**	**5.5**	*3.4*	**30.7**	*6.4*	**23.0**	**152**	**226**	**27.9**	**3.4**	**0.6**	**0.2**
21	**5.2**	**5.3**	*3.4*	**92.0**	*6.4*	**28.4**	**240**	**212**	**24.8**	**3.0**	**0.6**	**0.2**
22	**4.7**	**4.9**	*3.1*	**41.3**	*6.6*	**40.4**	**336**	**248**	**22.0**	**2.7**	**0.6**	**0.2**
23	**4.4**	**4.5**	*3.2*	**27.7**	*6.6*	**44.6**	**414**	**216**	**22.5**	**4.9**	**0.4**	**0.2**
24	**4.4**	**5.5**	*3.1*	**17.2**	*6.8*	**38.4**	**446**	**161**	**20.5**	**5.7**	**0.5**	**0.2**
25	**4.3**	**5.8**	*3.1*	**13.0**	*7.1*	**37.8**	**435**	**133**	**17.9**	**4.0**	**0.5**	**0.2**
26	**4.1**	**5.3**	*3.1*	**14.3**	*6.8*	**35.6**	**664**	**123**	**15.8**	**3.1**	**0.5**	**0.2**
27	**4.0**	**5.2**	*3.0*	*12.4*	*6.8*	**30.8**	**453**	**110**	**14.1**	**2.6**	**0.4**	**0.2**
28	**4.3**	**5.3**	*3.2*	*10.1*	*6.7*	**35.7**	**350**	**99**	**13.0**	**2.4**	**0.3**	**0.2**
29	**4.4**	**5.1**	*3.3*	*9.1*	*19.6*	**27.9**	**343**	**117**	**12.3**	**2.2**	**0.3**	**0.2**
30	**4.3**	**4.9**	*3.5*	*8.5*		**33.0**	**385**	**115**	**11.4**	**2.1**	**0.2**	**0.2**
31	**4.3**		*3.9*	*8.0*		**44.0**		**113**		**1.6**	**0.3**	
MEAN	6.9	5.1	3.6	11.8	7.3	26.8	169.2	243.9	59.4	5.2	0.7	0.3
MAX. DAY	22.4	6.2	4.2	92.0	19.6	52.1	663.8	451.7	211.1	11.3	1.6	0.4
MIN. DAY	2.8	3.7	3.0	3.8	6.4	8.7	34.3	98.6	11.4	1.6	0.2	0.2
cfs days	213.5	153.3	112.0	366.5	212.8	830.7	5076.5	7559.8	1782.8	162.1	22.6	7.9
ac-ft	423.5	304.1	222.2	727.0	422.0	1647.7	10069.3	14994.8	3536.1	321.6	44.8	15.7

Monitor's Comments

1. Daily mean values are based on 15-minute automatd measurements of stage; stage shifts have been applied to account for changes in sedimentation of the gage over the course of the monitoring program.
2. Daily mean stage and flow are commonly affected by ice in the winter months; these periods have been adjusted to correct daily mean flow
3. Peak flows associated with snow-melt hydrographs commonly occur between April and June; multiple peaks are also common
4. Daily mean flows may be affected by operations at Webber Lake (Reservoir)
5. Italicized font indicates an estimated flow (when affected by ice) and are based on correlation to nearby stream gages

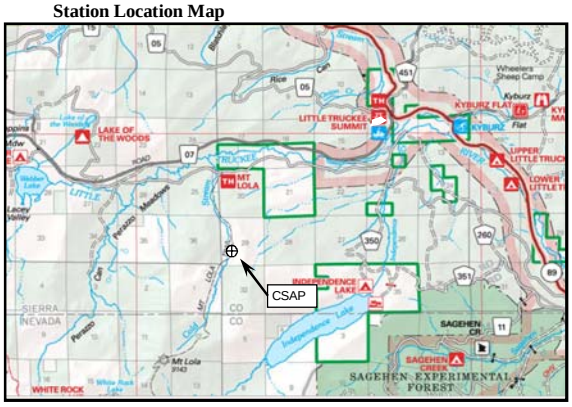
Water Year 2012 Totals:		
Mean flow	**45**	(cfs)
Max. daily flow	**664**	(cfs)
Min. daily flow	**0.16**	(cfs)
Annual total	**16,501**	(cfs-days)
Annual total	**32,729**	(ac-ft)

Balance Hydrologics, Inc. PO Box 1077, Truckee, CA 96161 phone: (530) 550-9776, Berkeley (Main Office) (510) 704-1000
www.balancehydro.com

Form 4. Annual Hydrologic Record, WY2012

Water Year:	**2012**
Stream:	Cold Stream
Station:	Above Perazzo Meadows (CSAP)
County:	Sierra County, California

Station Location Map



Station Location / Watershed Descriptors

N 39° 28' 23", W 120° 20' 30" near Independence Lake, California. Gage is located on east bank
Gage accessed from Cold Stream Meadow Road, approx. 1,000 ft d/s of Lola Trail footbridge
Land use includes timber harvesting, recreation, and open space
No known regulation or diversions affect flow
Drainage area is 3.1 square miles.

Annual Mean Flow

Mean daily flow for WY2012 is 5.4 cfs, WY2011 (n/a).

Peak Flows (WY2012)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
1/20/12	22:30	4.30	40	5/19/12	15:00	4.28	38
4/26/12	5:00	4.31	41	6/2/12	17:45	4.29	39
4/30/12	21:45	4.16	27				
5/16/12	**16:30**	**4.44**	**58**				

Extreme for period of record, (partial WY2011-WY2012) is 58.4 cfs on May 16, 2012

Period of Record

Staff plate and water level recorder were installed August 18, 2011.
Gaging is sponsored by the Truckee River Watershed Council and USFS

WY2012 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	**2.1**	**1.8**	**5.1**	**1.6**	**1.6**	**1.4**	**1.7**	**22.2**	**26.7**	**5**	**1.6**	**0.9**
2	**2.2**	**1.6**	**5.2**	*1.4*	**1.5**	**1.3**	**1.6**	**19.1**	**30.0**	**5**	**1.6**	**0.9**
3	**2.3**	**2.7**	**22.4**	*1.4*	**1.5**	**1.3**	**1.7**	**15.5**	**29.2**	**5**	**1.7**	**0.9**
4	**2.7**	**9.7**	**2.9**	**1.5**	**1.6**	**1.4**	**1.6**	**13.4**	**28.2**	**5**	**1.7**	**0.9**
5	**9.9**	**14.8**	**1.8**	**1.4**	**1.5**	**1**	**1.6**	**12.7**	**21**	**5**	**1.6**	**0.9**
6	**2.8**	**2.8**	**1.9**	**1.5**	**1.6**	**1**	**1.5**	**13.4**	**18**	**4**	**1.5**	**1.0**
7	**2.9**	**2.9**	**1.9**	**1.3**	**1.5**	**1**	**1.6**	**14.4**	**16**	**4**	**1.5**	**0.9**
8	**3.2**	**16.4**	**1.9**	**2.6**	**1.5**	**1.2**	**1.7**	**16.2**	**15**	**4**	**1.4**	**0.9**
9	**3.2**	**9.1**	**1.8**	**1.5**	**1.5**	**1.3**	**1.8**	**19.3**	**13**	**4**	**1.3**	**0.9**
10	**6.1**	**2.2**	**1.8**	**1.3**	**1.3**	**1.3**	**1.9**	**20.9**	**12**	**4**	**1.2**	**0.8**
11	**7.7**	**2.2**	**1.8**	**3.0**	**1.4**	**1.2**	**2.0**	**20.9**	**12**	**4**	**1.3**	**0.8**
12	**5.1**	**2.4**	**1.9**	**6.3**	**1.4**	**1.1**	**1.8**	**21.9**	**12**	**3**	**1.3**	**0.8**
13	**4.8**	**2.4**	**1.8**	**3.8**	**1.4**	**1.3**	**1.8**	**25.8**	**13**	**3**	**1.4**	**0.8**
14	**4.4**	**2.3**	**1.7**	*1.1*	**1.3**	**1.3**	**2.0**	**30.9**	**14**	**3**	**1.4**	**0.8**
15	**3.9**	**2.3**	**1.6**	*8.8*	**1.4**	**1.6**	**1.9**	**34.2**	**13**	**3**	**1.3**	**0.8**
16	**3.4**	**2.3**	**1.5**	*1.0*	**1.3**	**1.7**	**2.1**	**39.5**	**12**	**3**	**1.2**	**0.8**
17	**3.1**	**2.1**	*1.6*	*0.9*	**1.4**	**1.7**	**2.4**	**35.4**	**13**	**2**	**1.2**	**0.8**
18	**2.9**	**2.0**	*1.8*	0.9	**1.3**	**1.6**	**2.8**	**30.7**	**12**	**2**	**1.2**	**0.8**
19	**2.9**	**7.5**	*1.6*	0.9	**1.3**	**1.5**	**3.9**	**28.4**	**10**	**2**	**1.1**	**0.8**
20	**2.7**	**12.8**	*1.6*	**7.1**	**1.3**	**1.7**	**5.9**	**31.1**	**10**	**2**	**1.0**	**0.8**
21	**2.5**	**2.4**	*1.6*	**16.7**	*1.4*	**1.7**	**9.1**	**32.3**	**9**	**2**	**1.0**	**0.8**
22	**2.4**	**2.1**	*1.4*	**19.1**	**1.3**	**1.7**	**12.3**	**29.7**	**8**	**2**	**1.0**	**0.8**
23	**2.3**	**2.1**	*1.5*	**13.6**	**1.3**	**1.6**	**16.5**	**28.0**	**8**	**3**	**1.0**	**0.8**
24	**2.1**	**2.4**	**1.6**	**5.0**	*1.3*	**1.5**	**18.7**	**25.0**	**7**	**3**	**1.0**	**0.7**
25	**2.3**	**2.4**	**1.6**	**2.1**	*1.3*	**1.5**	**17.5**	**21.2**	**6**	**2**	**1.0**	**0.8**
26	**2.0**	**2.4**	**1.5**	**2.1**	*1.2*	**1.4**	**27.6**	**17.4**	**6**	**2**	**1.0**	**0.8**
27	**1.9**	**2.3**	**1.5**	**1.9**	**1.3**	**1.3**	**15.2**	**15.4**	**6**	**2**	**0.9**	**0.8**
28	**2.2**	**2.2**	**1.5**	**1.9**	*1.2*	**1.4**	**13.7**	**14.8**	**5**	**2**	**0.9**	**0.8**
29	**2.1**	**2.4**	**1.6**	**1.8**	**1.5**	**1.3**	**14.9**	**15.3**	**6**	**2**	**0.9**	**0.7**
30	**2.1**	**2.0**	**1.6**	**1.7**		**1.6**	**18.0**	**17.6**	**5**	**2**	**1.0**	**0.8**
31	**2.1**		**1.6**	**1.7**		**1.9**		**21.2**		**2**	**0.9**	
MEAN	3.3	4.2	2.6	3.8	1.4	1.4	6.9	22.7	13.2	3.2	1.2	0.8
MAX. DAY	9.9	16.4	22.4	19.1	1.6	1.9	27.6	39.5	30.0	5.4	1.7	1.0
MIN. DAY	1.9	1.6	1.4	0.9	1.2	1.1	1.5	12.7	5.3	1.7	0.9	0.7
cfs days	102.3	125.3	80.4	117.1	40.4	44.9	206.6	703.8	396.4	98.4	38.1	24.3
ac-ft	202.9	248.5	159.5	232.3	80.1	89.0	409.9	1396.0	786.2	195.2	75.6	48.3

Monitor's Comments

1. Daily mean values are based on 15-minute automated measurements of stage; stage shifts have been applied to account for changes in sediment scour or fill at the gage over the course of the monitoring program
2. Stage and flow are commonly affected by ice in the winter months; these periods have been adjusted to correct for the daily mean flow
3. Italicized font indicates an estimated flow (when affected by ice) and are based on correlation to Cold Creek near Truckee, CA
4. Data are subject to revision, should additional measurement or observer account warrant adjustment of the rating curve.

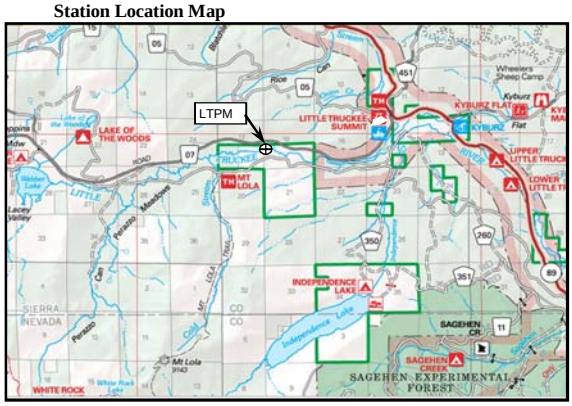
Water Year 2012 Totals:		
Mean flow	**5.4**	(cfs)
Max. daily flow	**39**	(cfs)
Min. daily flow	**0.74**	(cfs)
Annual total	**1,978**	(cfs-days)
Annual total	**3,923**	(ac-ft)

Balance Hydrologics, Inc. PO Box 1077, Truckee, CA 96161 phone: (530) 550-9776, Berkeley (Main Office) (510) 704-1000
www.balancehydro.com

Form 5. Annual Hydrologic Record, WY2012

Water Year:	**2012**
Stream:	Little Truckee River
Station:	Middle Perazzo Meadow Outlet (LTPM)
County:	Sierra County, California

Station Location Map



Station Location / Watershed Descriptors

N 39° 29' 42", W 120° 20' 7" near Truckee, California. Gage is located on north bank in downstream-most pond, part of the USFS plug and pond restoration project.
Land use includes timber harvesting, recreation, open space, and rural residential
Flows may be affected by Webber Lake (reservoir)
Drainage area is 32.8 square miles.

Annual Mean Flows

Annual mean flow for WY2012 is 56.5 cfs, WY2011 is 161.6 cfs.

Peak Flows (WY2012)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
1/21/12	0:15	--	150	5/10/12	22:15	2.56	410
4/23/12	21:45	3.01	641	5/15/12	22:15	2.62	431
4/26/12	**11:00**	**3.84**	**896**	5/22/12	14:45	2.41	351
5/1/12	1:45	2.94	564	6/5/12	14:30	2.44	361

Extreme for period of record (WY2010-WY2011) is 1,052 cfs on June 7, 2010

Period of Record

Staff plate #1 installed Sep 23, 2010. Datalogger installed on Oct 1, 2009.
Staff plate #2 installed Sep 28, 2010.
Staff plate #3 installed Jun 8, 2011.
Gaging is sponsored by the Truckee River Watershed Council and USFS

WY2012 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	**5.6**	**6.9**	**7.2**	*8.8*	**14.0**	**12.9**	**68.6**	**522**	**156**	**17.9**	**2.6**	**0.8**
2	**5.4**	**5.5**	**6.7**	*9.0*	**12.6**	**25.5**	**49.5**	**455**	**171**	**17.2**	**2.6**	**1.0**
3	**5.3**	**5.7**	**6.7**	*9.8*	**11.6**	**18.5**	**46.3**	**369**	**156**	**16.5**	**2.5**	**1.0**
4	**5.8**	**8.6**	**6.1**	*9.9*	**10.9**	**15.0**	**53.8**	**305**	**160**	**17.3**	**2.5**	**0.9**
5	**22.4**	**7.7**	**6.4**	*9.6*	**9.5**	**14.0**	**48.0**	**284**	**224**	**16.3**	**2.4**	**1.0**
6	**13.0**	**8.6**	**5.7**	*9.1*	**8.9**	**14.3**	**45.5**	**271**	**195**	**14.3**	**2.4**	**1.8**
7	**10.3**	**8.6**	**5.8**	*10.3*	**8.5**	**14.5**	**42.4**	**275**	**126**	**13.3**	**2.1**	**1.7**
8	**10.8**	**8.0**	**6.2**	*10.8*	**8.1**	**12.3**	**42.5**	**286**	**101**	**11.3**	**2.1**	**1.7**
9	**11.0**	**7.9**	**5.6**	*10.6*	**7.7**	**12.7**	**47.1**	**309**	**96.0**	**10.5**	**2.2**	**1.3**
10	**14.2**	**7.8**	**4.8**	*11.2*	**8.1**	**13.1**	**55.6**	**349**	**79.4**	**9.8**	**2.2**	**1.1**
11	**27.9**	**8.0**	**4.9**	*11.0*	**9.3**	**13.7**	**65.7**	**341**	**72.1**	**9.1**	**2.0**	**1.1**
12	**20.4**	**10.4**	**5.5**	*11.4*	**9.0**	**13.6**	**58.0**	**336**	**64.1**	**8.2**	**2.0**	**1.2**
13	**13.9**	**9.9**	*7.5*	*11.3*	**9.5**	**11.8**	**62.3**	**340**	**65.3**	**7.7**	**2.1**	**1.0**
14	**13.2**	**9.5**	*7.5*	*10.7*	**8.8**	**24.4**	**49.5**	**379**	**77.2**	**8.4**	**2.5**	**1.0**
15	**11.7**	**8.8**	*7.7*	*9.4*	**11.3**	**52.9**	**45.7**	**380**	**77.7**	**6.6**	**2.6**	**1.0**
16	**11.0**	**8.6**	*7.4*	*8.9*	**10.9**	**66.2**	**53.5**	**377**	**65.1**	**6.1**	**2.2**	**0.9**
17	**9.9**	**8.5**	*7.0*	*9.4*	**9.3**	**77.5**	**67.5**	**360**	**56.8**	**5.1**	**2.2**	**0.9**
18	**8.7**	**10.3**	*6.7*	*9.1*	**8.2**	**55.1**	**91.8**	**346**	**51.3**	**4.9**	**2.1**	**0.9**
19	**8.3**	**9.2**	*6.9*	*7.8*	**8.5**	**44.9**	**129**	**301**	**45.7**	**5.0**	**2.1**	**0.9**
20	**7.4**	**10.6**	*6.5*	*150*	**8.2**	**37.6**	**186**	**272**	**38.8**	**5.1**	**1.7**	**0.9**
21	**7.5**	**10.0**	*6.5*	*150*	**8.1**	**43.0**	**277**	**262**	**33.9**	**4.7**	**1.5**	**0.9**
22	**6.9**	**9.2**	*5.8*	**70.0**	**7.7**	**58.8**	**392**	**288**	**31.3**	**4.1**	**1.4**	**0.8**
23	**6.4**	**8.3**	*6.1*	**38.0**	**8.5**	**61.0**	**493**	**268**	**32.8**	**10.5**	**1.5**	**0.8**
24	**6.3**	**9.9**	*5.9*	**26.0**	**9.1**	**48.8**	**570**	**212**	**30.9**	**10.3**	**1.4**	**0.8**
25	**6.5**	**10.8**	*5.8*	**26.0**	**10.5**	**47.8**	**510**	**183**	**26.9**	**7.1**	**1.3**	**0.9**
26	**6.1**	**9.7**	*5.7*	**25.0**	**8.8**	**46.4**	**787**	**166**	**24.3**	**5.4**	**1.2**	**0.9**
27	**6.0**	**9.3**	*5.6*	**24.0**	**9.0**	**40.5**	**547**	**148**	**21.5**	**4.6**	**1.0**	**0.9**
28	**6.1**	**9.3**	*6.1*	**15.0**	**10.7**	**45.2**	**404**	**130**	**19.6**	**4.0**	**1.0**	**0.9**
29	**6.5**	**9.1**	*6.3*	**17.1**	**9.0**	**37.7**	**394**	**145**	**19.0**	**3.6**	**0.9**	**0.8**
30	**6.4**	**8.8**	*6.9*	**16.3**		**51.5**	**433**	**149**	**18.0**	**3.3**	**0.9**	**0.8**
31	**6.3**		*8.0*	**15.1**		**63.4**		**144**		**3.1**	**0.8**	
MEAN	9.9	8.8	6.4	24.5	9.5	35.3	203.9	288.8	77.9	8.8	1.9	1.0
MAX. DAY	27.9	10.8	8.0	150.0	14.0	77.5	787.2	521.7	224.2	17.9	2.6	1.8
MIN. DAY	5.3	5.5	4.8	7.8	7.7	11.8	42.4	129.8	18.0	3.1	0.8	0.8
cfs days	307.2	263.5	197.4	760.6	274.6	1094.8	6117.0	8951.6	2336.9	271.6	58.1	30.7
ac-ft	609.4	522.6	391.5	1508.6	544.7	2171.5	12133.1	17755.5	4635.3	538.7	115.3	60.9

Monitor's Comments

1. Daily mean values are based on 15-minute automated measurements of stage; stage shifts have been applied to account for changes in bed conditions or ice build-up at the gage over the course of the monitoring program.
2. Stage and flow are commonly affected by ice in the winter months; these periods have been estimated through correlation to Cold Creek.
3. Peak flows associated with snow-melt hydrographs commonly occur between April and June; multiple peaks are also common
4. Daily mean flows may be affected by operations at Webber Lake (Reservoir)
5. Data are subject to revision, should additional measurement or observer account warrant adjustment of the new rating curve.
6. Italicized font indicates an estimated flow (when affected by ice) and are based on correlation to Cold Creek in Truckee, CA

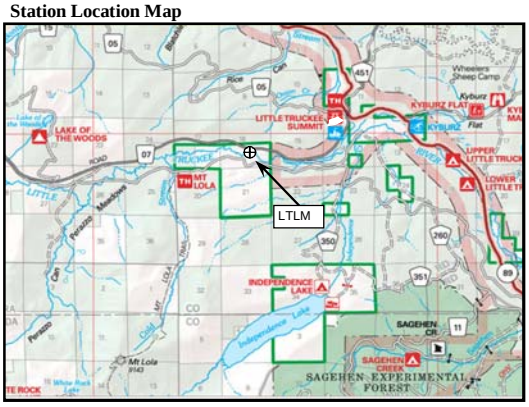
Water Year 2012 Totals:		
Mean flow	**56.5**	(cfs)
Max. daily flow	**787**	(cfs)
Min. daily flow	**0.8**	(cfs)
Annual total	**20,664**	(cfs-days)
Annual total	**40,987**	(ac-ft)

Balance Hydrologics, Inc. PO Box 1077, Truckee, CA 96161 phone: (530) 550-9776, Berkeley (Main Office) (510) 704-1000
www.balancehydro.com

Water Year:	**2012**
Stream:	Little Truckee River
Station:	Lower Perazzo Meadow outlet (LTLM)
County:	Sierra County, California

Form 6. Annual Hydrologic Record, WY2012

Station Location Map



Station Location / Watershed Descriptors

N 39° 29' 39", W 120° 19' 07" near Independence Lake, California. Gage is located on north bank
Gage is accessed from USFS Road 07 (Henness Pass Road)
Land use includes timber harvesting, recreation, rural residential, and open space
Flow may be affected by Webber Lake (reservoir)
Drainage area is 34.2 square miles.

Annual Mean Flows

Annual mean flow for WY2012 is 61.4 cfs; WY2011 (n/a)

Peak Flows (WY2012)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
1/20/12	23:30	6.49	327	5/10/12	23:45	6.74	449
3/17/12	10:00	7.15	198	5/15/12	23:30	6.81	483
4/26/12	**12:45**	**8.67**	**1337**	5/22/12	15:45	6.50	352
5/1/12	2:45	7.32	733	6/5/12	14:45	6.57	380

Extreme for period of record (WY2012) is 1,337 cfs on April 26, 2012

Period of Record

Staff plate and water level recorder were installed August 18, 2011.
Gaging is sponsored by the Truckee River Watershed Council

WY2012 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	**6.6**	**8.6**	*9.1*	*9.5*	**19**	**17**	**78**	**648**	**147**	**18**	**4.8**	**1.7**
2	**6.8**	**6.9**	**8.8**	**8.8**	*19*	**34**	**61**	**535**	**158**	**17**	**4.7**	**1.9**
3	**6.6**	**6.9**	*8.8*	**7.8**	*18*	**24**	**54**	**389**	**146**	**16**	**4.6**	**2.0**
4	**7.6**	**9.2**	**8.1**	*8.5*	*17*	**20**	**65**	**300**	**154**	**17**	**4.2**	**1.9**
5	**24**	**8.7**	**8.5**	*8.4*	*16*	*20*	**58**	**277**	**222**	**16**	**4.1**	**2.1**
6	**17**	**9.4**	*8.5*	*8.3*	*15*	**19**	**53**	**261**	**190**	**14**	**4.2**	**3.1**
7	**14**	**9.2**	**7.1**	*8.2*	**13**	*19*	**47**	**267**	**125**	**13**	**3.7**	**2.9**
8	**14**	**8.6**	**7.7**	*8.1*	*13*	*19*	**48**	**279**	**105**	**11**	**3.5**	**2.8**
9	**14**	**8.7**	*7.7*	*8.5*	*13*	*19*	**53**	**309**	**99**	**11**	**3.5**	**2.3**
10	**17**	**8.5**	*7.7*	*8.4*	*13*	*19*	**63**	**359**	**88**	**10**	**3.2**	**2.1**
11	**27**	**8.5**	**7.9**	*8.3*	**15**	**18**	**77**	**350**	**80**	**9.1**	**3.0**	**2.2**
12	**21**	**11**	**7.5**	*8.2*	*15*	**19**	**71**	**339**	**73**	**8.3**	**2.9**	**2.3**
13	**15**	**10**	*7.5*	*7.5*	**15**	**17**	**75**	**349**	**74**	**8.0**	**3.0**	**2.1**
14	**14**	**9.5**	*7.5*	*7.1*	**14**	**29**	**60**	**405**	**83**	**8.6**	**3.6**	**2.1**
15	**13**	**9.0**	**6.8**	**6.6**	*20*	**65**	**53**	**401**	**83**	**7.3**	**3.6**	**2.1**
16	**12**	**8.8**	**7.1**	*6.6*	*18*	**84**	**63**	**401**	**72**	**7.0**	**3.1**	**2.1**
17	**11**	**8.4**	**7.5**	*6.6*	*16*	**118**	**78**	**379**	**65**	**5.8**	**3.3**	**2.0**
18	**10**	**9.7**	*7.5*	**5.3**	**13**	**64**	**98**	**353**	**57**	**6.1**	**3.1**	**2.0**
19	**9.8**	**9.3**	*7.1*	**5.1**	*13*	**57**	**126**	**294**	**50**	**6.2**	**3.0**	**2.0**
20	**9.0**	**11**	*7.1*	**42**	**13**	**44**	**175**	**259**	**41**	**6.7**	**2.6**	**2.0**
21	**9.0**	**10**	*7.1*	**151**	*13*	**54**	**269**	**249**	**36**	**6.0**	**2.4**	**2.0**
22	**8.6**	**9.0**	*7.1*	**81**	**13**	**73**	**420**	**279**	**33**	**5.3**	**2.2**	**2.0**
23	**8.0**	**7.4**	*7.1*	**41**	*13*	**74**	**559**	**258**	**34**	**12**	**2.2**	**2.0**
24	**8.0**	**9.4**	*7.1*	**41**	**14**	**58**	**633**	**201**	**31**	**14**	**2.2**	**1.9**
25	**8.3**	**10**	**7.2**	**28**	**15**	**57**	**623**	**170**	**27**	**10**	**2.1**	**2.3**
26	**7.9**	**9.5**	**6.7**	**27**	*15*	**54**	**1128**	**153**	**25**	**8.3**	**2.1**	**2.3**
27	**7.6**	**9.2**	**6.6**	***30***	**13**	**47**	**697**	**139**	**22**	**7.2**	**1.8**	**2.2**
28	**7.9**	**9.0**	**7.1**	***28***	*13*	**55**	**447**	**124**	**20**	**6.5**	**1.8**	**2.2**
29	**8.2**	**9.2**	**9.1**	**26**	**12**	**45**	**426**	**131**	**20**	**6.1**	**1.8**	**2.1**
30	**8.2**	**9.1**	**9.5**	**20**		**60**	**489**	**137**	**19**	**5.6**	**1.8**	**2.2**
31	**8.1**		*9.5*	*20*		**78**		**135**		**5.3**	**1.6**	
MEAN	11.6	9.0	7.7	21.9	14.9	44.6	238.2	294.5	79.3	9.8	3.0	2.2
MAX. DAY	27.4	10.6	9.5	150.7	20.0	118.2	1128.1	648.1	222.2	18.0	4.8	3.1
MIN. DAY	6.6	6.9	6.6	5.1	12.0	16.9	47.1	123.9	18.7	5.3	1.6	1.7
cfs days	359.1	271.2	239.3	679.8	432.4	1381.5	7146.8	9130.9	2379.5	302.8	94.0	65.1
ac-ft	712.3	537.8	474.7	1348.3	857.6	2740.3	14175.6	18111.2	4719.7	600.5	186.4	129.2

Monitor's Comments

1. Daily mean values are based on 15-minute automated measurements of stage; stage shifts have been applied to accoutn for changes in sediment scour or fill at the gage over the course of the monitoring program
2. Stage and flow are commonly affected by ice in the winter months; these periods have been adjusted to correct daily mean flow
3. Italicized font indicates an estimated flow (when affected by ice) and are based on correlation to Cold Creek near Truckee, CA
4. Data are subject to revision, should additional measurement or observer account warrant adjustment of the rating curve.

Water Year 2012 Totals:		
Mean flow	**61.4**	(cfs)
Max. daily flow	**1128**	(cfs)
Min. daily flow	**1.65**	(cfs)
Annual total	**22,482**	(cfs-days)
Annual total	**44,594**	(ac-ft)

Balance Hydrologics, Inc. PO Box 1077, Truckee, CA 96161 phone: (530) 550-9776, Berkeley (Main Office) (510) 704-1000
www.balancehydro.com

TABLES

Table 1. Streamflow gaging station summary, Perazzo Meadows, Little Truckee River Watershed, Sierra County, California

Gage	Gage Code	Location	Elevation	Drainage Area	Instrumentation	Period of Record	Extremes for Period of Record	Peak Discharge for Current Water Year	Remarks
		NAD27	*ft above MSL*	*(mi^2)*				*(cfs)*	
Perrazo Creek above Perazzo Meadow	PCAP	N39° 27' 53", W120° 23' 16"	6,627	6.1	Type C staff plate + Continuous water-level recorder	November 17, 2010 to current water year	248 cfs, April 26, 2012	248	Located in bedrock reach with numerous seeps entering channel at baseflow.
Little Truckee above Perazzo Meadow	LTAP	N39° 28' 59", W120° 22' 57"	6,583	15.8	Type C staff plate + Continuous water-level recorder	November 18, 2010 to current water year	694 cfs, April 26, 2012	694	Located on south bank, approximately 130 feet upstream from USFS road 7-030 bridge; subject to ice
Little Truckee at Upper Perazzo Meadow outlet	LTUM	N39° 29' 10", W120° 22' 13"	6,534	25.5	Type C staff plate + Continuous water-level recorder	November 19, 2010 to current water year	801 cfs, June 29, 2011	752	Located on east bank, approx. 40 feet downstream from Henness Pass Rd bridge; subject to ice
Cold Stream above Perazzo Meadow	CSAP	N39° 28' 23", W120° 20' 30"	7,221	3.1	Type C staff plate + Continuous water-level recorder	August 18, 2011 to current water year	58.4 cfs, May 16, 2012	58.4	Highest elevation station, subject to longer periods of ice and snow; delayed annual peak flow
Little Truckee at Middle Perazzo Meadow outlet	LTPM	N39° 29' 42", W120° 20' 7"	6,463	32.8	Type C staff plate + Continuous water-level recorder	October 2009 to current water year	1,052 cfs, June 6, 2010,	896	Gage relocated on September 28, 2010 and June 8, 2011. Current location is at last pond in Middle Meadow Plug and Pond project.
Little Truckee at Lower Perazzo Meadow outlet	LTLM	N39° 29' 39", W120° 19' 07"	6,459	34.2	Type C staff plate + Continuous water-level recorder	August 18, 2011 to current water year	1,337 cfs, April 26, 2012	1,337	Located below Lower Meadow, north bank

Notes:

1. Webber Lake Reservoir is located on the Little Truckee River above Perazzo Meadows. The Webber Lake outlet includes a rectangular weir with fish screens. Periodic cleaning, installation, and removal of fish screens may affect flows at downstream locations

Table 2. Historical gaging summary, Little Truckee River below Diversion Dam, near Sierraville, California
USGS station #10341950, Water Years 1993-1998

Water Year	Annual Mean Flow	Maximum Daily Flow	Minimum Daily Flow	Peak Flow	Peak Stage	Date
	(cfs)	*(cfs)*	*(cfs)*	*(cfs)*	*(ft)*	
1993 (partial)	--	--	--	350	5.86	6/26/1993
1994	23.5	227	1.5	300	5.86	4/19/1994
1995	183.2	1,290	2.2	1,630	8.14	6/27/1995
1996	113.4	1,700	2.3	1,880	9.78	5/16/1996
1997	122.1	2,400	2.1	3,980	12.50	1/2/1997
1998	106.4	602	1.8	697	6.02	6/16/1998

Notes:

1. Gaging station was located N 39 29' 29", W120 19' 39", approximately 1.3 miles downstream of Balance gaging station LTLM at 6,380 feet elevation with a drainage area of 36.1 square miles.
2. Little Truckee Diversion Dam is an active diversion, operated by the Sierra Valley Water Company; most flows are affected by diversion.
3. WY1993 partial: June 17 -September 30, 1993
4. This station was re-established by the USGS in the Fall of 2012.

Table 3. Field Observer Log
Perazzo Creek above Upper Perazzo Meadow (PCAP), WY2012

Site Conditions				*Streamflow*			*Water Quality Observations*			*High-Water Marks*		*Remarks*
Date/Time (observer time) (mm/dd/yr)	Observer	Stage (feet)	Hydrograph (R/F/S/B)	Measured Discharge (cfs)	Instrument Used (AA/PY)	Estimated Accuracy (e/g/f/p)	Water Temperature (deg C)	Field Specific Conductance (µmhos/cm)	Adjusted Specific Conductance (at 25 deg C)	Estimated stage at staff plate (feet)	Inferred dates? (mm/dd/yr)	
9/29/2011 8:45	mp	4.05	B	0.94	FM	g	--	--	--	--	--	Sunny, warm, velocity readings taken with flow mate. GH @ 8:22 = 4.043, GH @ 8:55 = 4.048
10/7/2011 11:15	ds, cs	4.17	D	1.72	PY	g/f	4	36	61	--	--	Sunny, 4"" of snow on the ground, 35degrees. 11:15-11:25, debris dams removed d/s of gage at crest . Rain storm 10/5/11 (early am). Pool appears to have filled w/ sand and pea gravel since this time last year. Sculpin seen during Qmeas, 11:26 GH 4.17 ft, 11:46 GH 4.17 ft.
11/17/2011 12:15	cs, bkh	4.23	B	2.23	PY	g	2.6	48	84	5.15	--	Water clear, snow on banks, no ice in channel or around staff plate. Some leaf litter @ riffle crest removed at 12:55, and gage height changed -0.015, 12:11 GH 4.23, 12:35 GH 4.23, 12:58 GH 4.215, HWM at 5.15, perhaps last spring?
1/6/2012 11:45	cs	frozen	B	1.62	PY	f	0.4	48	90	--	--	Broke ice to measure flow, few small areas with no ice, water clear, 1-in. of old snow on ground, staff plate and PTs frozen in 12" of ice, ice onbanks is 0-12 in thick, see photos
3/9/2012 10:44	ds, rw	4.24	U	1.95	PY	e/g	--	--	--	--	--	Thick ice on channel margins, appears that water level was slightly higher when ice formed staff plate buried in snow, dug out during Q meas, but did not appear to affect the pool outlet geometry could no access datalogger, iced it 10:55 GH 4.24, 11:34 GH 4.23
5/11/2012 10:34	cs, bkh	5.13	U	68.7	AA	g	1.8	19	33	~5.7	4/26/2012	Water clear, some snow on the banks (patches. access road mostly free of snow, with a few drifts. north slopes of watershed contain lots of snow above 7500 ft. willows still dormant. 10:15 GH 5.12 +-0.02, 10:53 GH 5.13 +-0.02
6/7/2012 12:55	jo, bkh	4.77	F/U	23.9	AA	f	7.7	23	35	--	--	Water clear, no snow on the banks or near the channel, some snow remains at the higher elevations/north faces, velocity measured at surface at all verticals 12:49 GH 4.77, 13:20 GH 4.76
7/13/2012 11:30	cs, bkh	4.12	B	1.45	PY	f	15	50	63	4.43	--	Difficult x-section, low velocities, low flow; water clear; wildflowers blooming here but not in meadow. 11:10 GH 4.12, 11:40 GH 4.12.
8/8/2012 13:36	bkh	3.86	B	0.20	PY	f	17	85	102	--	--	Water clear and warm, low flow conditions, GH 13:25 3.86
9/7/2012 14:15	bkh	3.85	B	0.20	PY	g	15	85	108	~5.6	Spring	Rain 2 days ago, low flows - little truckee above perazzo is dry. Perazzo Creek and Cold Stream sustain flow in little truckee d/s of meadows. No flow line is about 3.6 feet on staff, GH at 15:05 3.84 feet
10/4/2012 13:20	bkh	3.88	B	0.23	PY	f	--	--	--	--	--	No leaf dams, but. Alders still grean but most willows have dropped leaves. leaf dams are likely over next 1-2 months. Qbf I at stage 5.4-5.6. No SCT taken. GH 13:15 3.875, GH 13:45 3.875

Observer Key: (ds) is David Shaw, (rw) is Randy Westmoreland, (mp) is Michael Pickard, (bkh) is Brian Hastings, (jo) is Jonathan Owens, (cs) is Collin Strasenbu
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B
Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter, (FM) Flow-Mate. If estimated, from rating curve (R) or visual
Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) = > 10%
High-water mark (HWM): Measured or estimated at location of the staff plate
Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductar

Table 4. Field Observer Log
Little Truckee River above Upper Perazzo Meadows (LTAP), WY2012

Site Conditions				*Streamflow*			*Water Quality Observations*			*High-Water Marks*		*Remarks*
Date/Time (observer time) (mm/dd/yr)	Observer	Stage (feet)	Hydrograph (R/F/S/B)	Measured Discharge (cfs)	Instrument Used (AA/PY)	Estimated Accuracy (e/g/f/p)	Water Temperature (deg C)	Field Specific Conductance (µmhos/cm)	Adjusted Specific Conductance (at 25 deg C)	Estimated stage at staff plate (feet)	Inferred dates? (mm/dd/yr)	
9/29/2011 10:15	mp	0.86	B	1.73	other	g	--	--	--	--	--	Sunny, warm, velocity measured with Marsh-McBurney + FlowMate, GH @ 9:48 = 0.86, GH @ 10:45 = 0.86
10/7/11 13:00	ds	0.80	B	0.52	PY	e	7.1	23	36	--	--	~0.5" rain, 6" snow in previous 48 hours; hard freeze during nights, warming during the day to 55 deg F, snowmelt, flow measured in bedrock reach with left bank boulders.
11/17/11 11:15	bkh, cs	0.805	B	0.27	PY	f	2.3	22	39	--	--	Partly sunny, 40 deg F, Pool at gaging station is frozen, likely since early November ; broke ice to read staff plate, estimated additional flow from seeps between measurement location and gage (10 gpm); water clear, snow on banks,
1/6/2012 13:00	cs	--	B	1.37	PY	g	0.7	19	36	--	--	O\vercast, 40 deg F, ice approx. 12" thick at gage, PTs frozen, ice reading 1.22 at staff plate; water clear, measurement location unaffected by ice or snow
3/9/2012 14:00	ds, rw	1.11	B	3.37	PY	g	--	--	--	--	--	Sunny, warm, 55 deg; weather to turn colder with precipitation for next couple weeks; perched ice at water surface suggests diurnal fluctuation; ~0.1 at Qmeasure station; snow on north bank; gage pool is ice covered.
5/11/2012 12:00	bkh, cs	2.53	F	158	AA	g	7.8	23	34	3.0	4/26/2012	Sunny, warm 65 degrees, peak snowmelt occurred late April, flows are still high with snow remaining on the north slopes. Identified error on staff plates (missing 0.3 ft of staff plate above 3.0 ft); Water is clear and temperature seems to be warm for this part of year (Webber Lake releases?) downloaded levelloggers.
6/7/2011 14:15	bkh, jo	1.77	F	46.7	AA	f	13.0	27	36	--	--	Sunny, warm, flows are still relatively high; x-section measured in bedrock narrows; angular rocks on bed--surface velocity measured
7/13/2012 12:00	bkh, cs	0.99	B	3.14	PY	f	18.5	35.4	41	--	--	Sunny, warm 75 degrees, difficult measurement; algae on bed; baseflow is early this year
8/8/2012 14:30	bkh	0.73	B	0.81	PY	f/p	--	--	--	--	--	Sunny, warm; difficult flow measurement; logging active in area; water truck pulling water from just downstream of bridge
9/7/2012 15:30	bkh	-0.33	--	NO FLOW	--	e	12.6	45.0	60	--	--	No flow below gaging station; some flow entering gaging pool. Possible dewatering from recent water withdrawals(?) Weather has also been warmer than average. Flow/no flow likely at 0.15' on staff plate
10/4/2012 15:00	bkh	dry	--	NO FLOW	--	e	--	--	--	--	--	Pool at gage reduced to 200 sq. feet; abundant fish, PTs are dry

Observer Key: (cs) is Collin Strasenburgh; (bkh) is Brian Hastings; (ds) is David Shaw, (jo) is Jonathan Owens, (rw) is Randy Westmoreland-USFS, (mp) is Michael Pickard-USFS
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter; can be accompanied with (BB) Bridge-Board at high flows. If estimated, from rating curve (R) or visual (V)
Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) = > 10%
High-water mark (HWM): Measured or estimated at location of the staff plate
Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductanc
Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Table 5. Field Observer Log
Little Truckee River below Upper Perazzo Meadow (LTUM), WY2012

Site Conditions				*Streamflow*			*Water Quality Observations*			*High-Water Marks*		*Remarks*
Date/Time (observer time) (mm/dd/yr)	Observer	Stage (feet)	Hydrograph (R/F/S/B)	Measured Discharge (cfs)	Instrument Used (AA/PY)	Estimated Accuracy (e/g/f/p)	Water Temperature (deg C)	Field Specific Conductance (µmhos/cm)	Adjusted Specific Conductance (at 25 deg C)	Estimated stage at staff plate (feet)	Inferred dates? (mm/dd/yr)	
9/29/11 11:30	mp	4.75	B	2.91	other	e	--	--	--	--	--	sunny, warm, velocity readings taken with flow mate. GH @ 1057 = 4.749, GH @ 1201 = 4.745
10/7/11 14:15	ds	4.88	B	4.84	PY	e	9.7	48	70	--	--	sunny, warming, 0.5" rain and 3" snow previous 48 hrs, water has slight rust color, snowmelt increasing through day
11/17/11 13:45	bkh, cs	4.87	B	4.15	PY	g	6	46	74	--	--	Partly cloudy, windy, 45 deg F, storm predicted for tomorrow; water clear, NO ice or snow at gage
1/6/12 14:00	cs	4.82	B	3.60	PY	g	2	41	73	--	--	Overcast, 40 deg F, ice at staff plate, stage is approximate; NO ice affecting flow measurement, water clear
5/11/12 13:30	bkh, cs	6.76	S	273	AA	g	9.1	25	37	7.6	4/26/2012	sunny, 60 degrees, water clear, banks clear of snow, willows beginning to bud; difficult wading conditions
6/7/11 12:15	bkh, jo	5.87	F	95.1	AA	g	10.9	28	39	--	--	sunny, water clear, algae beginning to grow in bed; all willows are leafed out; boulders are slippery with algae
7/13/12 13:15	bkh, cs	4.82	B	4.45	PY	f	20.1	57	63	--	--	water turbid (murky brown), rocks have algae
9/7/12 13:00	bkh	4.465	B	0.27	PY	f	17.5	75	88	--	--	Mostly sunny, warm, very low flow; measured flow 500-ft downstream of gaging station; willow still green; water has green hue, abundant algae
10/4/12 12:15	bkh	4.405	B	0.14	PY	f-p	11.8	66	90	--	--	Very low flow; "zero-flow" is likely at 4.25 on staff plate; abundant algae in pools; willows are changing color and dropping leaves

Observer Key: (cs) is Collin Strasenburgh; (ds) is David Shaw; (bkh) is Brian Hastings; (jo) is Jonathan Owens; (mp) is Michael Pickard-USFS
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter. ("Other") includes Marsh-McBurney or Flo-Mate meters; If estimated, from rating curve (R) or visual (V).
Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given
High-water mark (HWM): Measured or estimated at location of the staff plate
Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance
Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Table 6. Field Observer Log:
Cold Stream above Middle Perazzo Meadows (CSAP), WY2012

Site Conditions				*Streamflow*			*Water Quality Observations*			*High-Water Marks*		*Remarks*
Date/Time (observer time)	Observer	Stage	Hydrograph	Measured Discharge	Instrument Used	Estimated Accuracy	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Estimated stage at staff plate	Inferred dates?	
(mm/dd/yr)		*(feet)*	*(R/F/S/B)*	*(cfs)*	*(AA/PY)*	*(e/g/f/p)*	*(deg C)*	*(µmhos/cm)*	*(at 25 deg C)*	*(feet)*	*(mm/dd/yr)*	
9/29/2011 13:15	mp	3.52	B	2.01	FM	g	--	--	--	--	--	Sunny, warm, velocity readings taken using flow mate. GH @ 13:04 = 3.52, GH @ 13:26 = 3.52
10/17/2011 17:00	ds, jo	3.605	B	2.71	PY	f	8.2	36	52	3.8	early Oct.	Pine needles washed up at pool outlet; some riparian vegetation flattened from snow
6/7/2012 10:55	bkh, jo	3.99	B-F	15.2	AA	f	5.4	27	44	4.5	April	Water clear; downstream control looks similar to last fall; small rain and snow Monday
7/13/2012 14:15	bkh, cs	3.59	B	2.99	PY	g	15.0	44	54	4.13		Water clear; flowers in full bloom
8/8/2012 11:08	bkh, ds	3.46	B	1.29	PY	f	--	--	--	5.3	1/20/2012	Warm day; 2 flow measurements performed; pool overflow is towards left edge
8/8/2012 11:30	bkh, ds	3.45	B	1.25	PY	g	--	--	--	--	--	2nd flow measurement
9/7/2012 11:25	bkh	3.38	B	0.92	PY	g	7.7	47	70	--	--	Some rain 2 days ago; willows still green
10/4/2012 10:55	bkh	3.295	B	0.71	PY	g	4.5	42	69	--	--	Water clear; pool controllooks normal; water level isbelow staff plate; zero flow would correspond to stage ~ 3.0 feet

Observer Key: (ds) is David Shaw, (jo) is Jonathan Owens, (mp) is Michael Pickard, (bkh) is Brian Hastings
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter, (FM) Flow Mate. If estimated, from rating curve (R) or visual (V).
Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) = > 10%
High-water mark (HWM): Measured or estimated at location of the staff plate
Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Table 7. Field Observer Log:
Little Truckee River below Middle Perazzo Meadow (LTPM), WY2012

Site Conditions				Streamflow				Water Quality Observations			Remarks
Date/Time (observer time) (mm/dd/yr)	Observer	Stage3 (feet)	Hydrograph (R/F/S/B)	Discharge (cfs)	Instrument Used (AA/PY)	Estimated Discharge (cfs)	Estimated Accuracy (e/g/f/p)	Water Temperature (oC)	Field Specific Conductance (µmhos/cm)	Adjusted Specific Conductance (at 25 oC)	
10/7/2011 10:15	ds, cs	0.96	b	10.4	PY	--	g	4.2	48	80	Sunny, cool, 4" new snow on ground, about .75" rain fell on 10/5. water is slightly cloudy. Stage seems to be about .2' above algae growth line. GH @ 935 = .96. Lower GH @ 930 = 5.48. Lower GH @ 1028 = 5.47
11/17/2011 9:42	cs, bkh	0.90	b	8.07	PY	--	g	3.1	51	88	Snow expected tonight and tomorrow; water clear, snow on N-facing slopes; beaver dam ~100' u/s gage
1/6/2012 9:52	cs	--	b	6.42	PY	--	g	0.6	45		Ice in pool; frozen at staff plate (stage 3 is top of ice); no ice in riffles or obstructing flow; no precip for past 6 weeks; water clear, no snow on ground
4/24/2012 14:37	bkh, ds	2.69	r	520	AA	--	g	7.2	24	37	Thunderstorms yesterday, meadows are flooded, nearing peak snowmelt, multiple channels over riffle, right bank tree fell during measurement; upper gages still inaccessible due to patchy snow cover.
6/7/2012 15:32	bkh, jo	1.70	f/u	115	AA	--	g	14.2	35	44	Streamflow still relatively high, algae on boulders and cobbles
7/13/2012 9:58	cs, bkh	0.81	b	8.71	PY	--	f	16.1	69	83	Water slightly turbid (murky brown), bed surface covered in short brown algae
8/8/2012 15:00	bkh	0.46	b	1.83	PY	--	g				Algae on cobbles, water is murky/turbid; SCT meter not working
8/10/2012 12:15	bkh	0.47	b	1.57	PY	--	f	18.6	100	110	Measurement taken on plug upstream of gage; Some flow is likely subsurface through cobbles and gravels in plug.
8/10/2012 11:21	bkh	0.47	b	2.16	PY	--	g-f				Water is murky, algae covering rocks; cleared section of small cobbles
9/7/2012 17:05	bkh	0.46	b	1.38	PY	--	f-p	17.3	106	125	Beaver built dam upstream; water cloudy
10/4/2012 16:15	bkh	0.44	b	0.76	PY	--	g	13.2	100	129	Beaver dam now ~2.5' high, ~150' upstream of gage; water in pond is turbid

Observer Key: (mw) is Mark Woyshner; (ds) is David Shaw; (rw) is Randy Westmoreland (USFS); (mp) is Michael Pickard (USFS), (cs) is Collin Strassenburgh, (bkh) is Brian Hastings, (jo) is Jonathan Owens
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter. If estimated, from rating curve (R) or visual (V).
Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given
High-water mark (HWM): Measured or estimated at location of the staff plate
Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Table 8. Field Observer Log
Little Truckee River below Lower Perazzo Meadow (LTLM), WY2012

Site Conditions				*Streamflow*			*Water Quality Observations*			*High-Water Marks*		*Remarks*
Date/Time (observer time) (mm/dd/yr)	Observer	Stage (feet)	Hydrograph (R/F/S/B)	Measured Discharge (cfs)	Instrument Used (AA/PY)	Estimated Accuracy (e/g/f/p)	Water Temperature (oC)	Field Specific Conductance (µmhos/cm)	Adjusted Specific Conductance (at 25 oC)	Estimated stage at staff plate (feet)	Inferred dates? (mm/dd/yr)	
9/28/2011 14:15	mp	4.38	B	8.40	Other	g	--	--	--	--	--	Sunny, warm, velocity readings taken with flow mate. GH @ 1330 = 4.385. GH @ 1512 = 4.38
10/7/2011 16:30	ds, cs	4.52	B	13.7	PY	e	9	48	70	--	--	~1 inch of snow on ground and melting; water slightly above algae line on rocks
10/19/2011 10:00	UCM	4.43	B	10.1	Other	--	--	--	--	--	--	
1/6/2012 15:40	cs	4.38	B	6.93	PY	g	1.2	42		--	--	Water clear, green filamentous algae on rocks; no ice obstructions despite thin ice along banks
3/9/2012 15:25	ds, rw	4.61	B, R	17.5	PY	e	--	--	--	--	--	Probable diurnal flow increase during measurement; snow on some banks, but minimal snow in channel
4/24/2012 16:00	bkh, ds	7.00	R		float	p	--	--	--	--	--	Flow is too deep and fast to wade safely; bed is mobile
5/11/2012 15:15	bkh, cs	6.34	F	268	AA	g	11.3	24	31	6.7	4/26/2012	Water clear; flow is wadeable; willows budding; sand hill crane in Middle Meadow
5/31/2012 16:57	UCM			119	Other	--	--	--	--	--	--	No comments available
6/7/2012 16:30	jo, bkh	5.53	F, B	115	AA	g	14.6	35	44	6.6 to 7.0	4/26/2012	Some left bank erosion d/s of staff; willows fully leafed, grass on banks; fallen tree downstream still in place but not trapping much other wood
6/21/2012 10:52	UCM	4.90	--	35.9	Other	--	--	--	--	--	--	No comments available
6/21/2012 14:49	UCM	4.89	--	33.5	Other	--	--	--	--	--	--	No comments available
7/4/2012 16:15	UCM	4.40	--	14.5	Other	--	--	--	--	--	--	No comments available
7/13/2012 9:12	cs, bkh	4.39	B	8.36	PY	g	15.2	69	85	4.8	June	Water slightly cloudy; foam bubbles on surface; low flow -- baseflow; its been hot last 2 weeks in the 80s; minimal snow remaining in high country; gravel bars exposed; significantly less flow since last visit.
7/17/2012 14:33	UCM	4.31	--	5.33	Other	--	--	--	--	--	--	No comments available
8/8/2012 16:00	bkh	4.12	B	3.03	PY	g,f	--	--	--	8.5-8.7	spring melt	HWM confirmed, therefore flows may have reached fallen tree d/s; consider possible backwater
8/10/2012 13:30	bkh	4.12	B	2.31	PY	f, p	--	--	--	--	--	Low flow limits cross sections to measure flow; this location is deep and slow
8/10/2012 14:10	bkh	4.12	B	2.48	PY	g, f	22.3	114	119	--	--	Sunny and hot; flow vectors influenced by cobbles
9/7/2012 18:05	bkh	4.10	B	2.05	PY	f	16.9	105	125	--	--	Cattle grazing in meadow; water mostly clear

Observer Key: (UCM) is University of California, Merced); (mp) is Michael Pickard; ds = Dave Shaw; cs = Collin Strasenburger; bkh = Brian Hastings, rw = randy westmoreland (USFS)

Stage: Water level observed at outside staff plate

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)

Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter, ("Other") refers to a Marsh-McBurney or Flo-mate; If estimated, from rating curve (R) or visual (V).

Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given

High-water mark (HWM): Measured or estimated at location of the staff plate

Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Table 9. Annual Runoff, Perazzo Meadows, Little Truckee River Watershed, Sierra County, California, water year 2012

Gaging Station	Gage ID	Drainage Area	Measured Runoff	*Estimated Runoff*	Unit Runoff	Unit Runoff	Remarks
		(mi^2)	*(acre-feet)*	*(acre-feet)*	*(acre-feet/square mile)*	*(cfs/square mile)*	
Perrazo Creek above Upper Perazzo Meadow	PCAP	6.1	10,148	--	1,664	2.3	Unregulated perennial tributary to the Upper Perazzo Meadow
Little Truckee above Upper Perazzo Meadow	LTAP	15.8	19,589	--	1,240	1.7	Streamflow is regulated by Webber Lake (reservoir); tributary to the Upper Perazzo Meadow
Remaining ungaged contributing area above LTUM	--	3.6	--	*2,992*	*831*	--	This area includes lower Perazzo Creek canyon (~70%) and portions of the Upper Perazzo Meadow (~30%); lower estimated unit-runoff may be associated with storage in the meadow
Little Truckee, below Upper Perazzo Meadow	**LTUM**	**25.5**	**32,729**		**1,283**	**1.8**	**Outlet to the Upper Perazzo Meadow; this gage is the sum of the above two gaging stations and the ungaged contributing area**
Cold Stream, above Middle Perazzo Meadows	CSAP	3.1	3,923	--	1,265	1.8	Unregulated perennial tributary to the Middle Perazzo Meadow
Remaining ungaged contributing area above LTPM	--	4.2	--	*4,335*	*1,032*	--	Lower Cold Stream canyon and two unnamed perennial tributaries
Little Truckee, below Middle Perazzo Meadow	**LTPM**	**32.8**	**40,987**	**--**	**1,250**	**1.7**	**Outlet to the Middle Perazzo Meadow**
Remaining ungaged contributing area	--	1.4	--	*3,607*	*2,576*	--	Area includes an intermittent tributary, higher estimated unit-runoff may be associated with absence of storage in the un-restored lower meadow.
Little Truckee, below Lower Perazzo Meadow	**LTLM**	**34.2**	**44,594**	**--**	**1,304**	**1.8**	**Outlet to the Lower Perazzo Meadow (unrestored as of 2012)**

Notes:

1. Webber Lake Reservoir is located on the Little Truckee River above LTAP gaging station;
2. Values in *italics* indicate estimated values computed from other data
3. Unit runoff is expressed as cfs/square mile for the annual mean flow

Table 10. Snowmelt recession runoff, Perazzo Meadows, Little Truckee River Watershed, Sierra County, California
May through September, 2012

Gaging Station	Gage ID	Drainage Area	Monthly Runoff					Remarks
			May	June	July	August	September	
		(mi^2)	(acre-feet)	(acre-feet)	(acre-feet)	(acre-feet)	(acre-feet)	
Perrazo Creek above Upper Perazzo Meadow	PCAP	6.1	4,110	1,287	114	14	16	
Little Truckee above Upper Perazzo Meadow	LTAP	15.8	8,734	1,755	221	28	0	Streamflow ceased between August 20-23, 2012
Little Truckee, below Upper Perazzo Meadow	**LTUM**	**25.5**	**14,995**	**3,536**	**322**	**45**	**16**	Includes an ungaged area of 3.6 square miles
Cold Stream, above Middle Perazzo Meadows	CSAP	3.1	103	1,094	1242	332	106	
Little Truckee, below Middle Perazzo Meadow	**LTPM**	**32.8**	**17,756**	**4,635**	**539**	**115**	**61**	Includes an ungaged area of 4.2 square miles
Little Truckee, below Lower Perazzo Meadow	**LTLM**	**34.2**	**18,111**	**4,720**	**601**	**186**	**129**	Includes an ungaged area of 1.4 square miles

Notes:

1. Webber Lake Reservoir is located on the Little Truckee River above LTAP gaging station; outlet includes a rectangular weir;.

Table 11. Field Observer Log: Shallow groundwater, Perazzo Meadows, Sierra County, California
Water years 2010, 2011, and 2012

Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer 09-1 - Head of Upper Meadow									
Total Depth	5.34 *ft bgs*								
Depth to bottom =	8.30 *ft btoc*								
Total Stickup =	2.96 *ft above gs*								
Elevation =	6567.5 *ft*								
8/21/09 0:00	ds,bc	6.75	3.79	6563.7					piezometer installed; DTW does not necessarily reflect static water level
9/23/2009 17:16	ds	7.1	4.14	6563.3	8.8	66	97		stratified: SC/T: 122 uS (@ 25 deg C) at top (82 uS @ 9.4 deg C)
10/23/2009 9:43	bc	4.64	1.68	6565.8	7.9	73	108	n	labelled top of casing
12/4/2009 12:39	bc	4.60	1.64	6565.8	4.3	62	102	n	water clear, no odor
5/21/2010 16:00	ds,rw	3.04	0.08	6567.4	2.8	31	55		DTSW=2.83 (several inches deep and flowing), SCTsw=20@2.9C, 35@25
7/19/2010 13:45	bc	3.64	0.68	6566.8	11.0	47	65	n	ground is wet
8/23/2010 16:40	bc	4.78	1.82	6565.7	12.5	68	90	y	water clear
9/28/2010 15:40	bc	4.98	2.02	6565.5	11.0	90	124	n	water clear, no odor
11/2/2010 9:50	ds	3.89	0.93	6566.6	6.1	75	116	n	not stratified; flowing water in depression NW of piezo; main channel now SE of piezo, ponds and plugs in original channel; SC/T = 50 uS @ 25 deg C; downloaded
7/8/2011 7:41	ds, bc	2.71	-0.25	6567.7	3.2	16	27	n	top section of pipe buried and unable to recover LL. Filled with s and g, 1" of water on surface
8/11/2011 10:40	bc	--	--	--	--	--		--	silted in, no standing water, ground dry
9/12/2011 11:25	bc	--	--	--	--	--		--	silted in
10/9/2011 0:00	bc	--	--	--	--	--		--	silted in
11/3/2011 0:00	ds	--	--	--	--	--		--	unable to locate
12/5/2011 0:00	bc	--	--	--	--	--		--	silted in
5/18/2012 0:00	bc, ds	--	--	--	--	--		--	silted in
6/15/2012 0:00	bc	--	--	--	--	--		--	silted in
7/17/2012 0:00	bc	--	--	--	--	--		--	silted in
8/14/2012 0:00	bc	--	--	--	--	--		--	silted in
Piezometer 09-2 - East side of Upper Meadow									
Total Depth	4.24 *ft bgs*								
Depth to bottom =	6.00 *ft btoc*								
Total Stickup =	1.76 *ft above gs*								
Elevation =	6556.8 *ft*								
8/21/09 0:00	ds, bc	4.34	2.58	6554.3	--	--	--	--	piezometer installed; DTW does necessarily reflect static water level
9/23/2009 15:51	ds	4.02	2.26	6554.6	8.0	105	157		wp230
10/23/2009 10:03	bc	2.43	0.67	6556.2	5.8	107	168	n	
12/4/2009 11:45	bc	2.26	0.50	6556.3	2.8	112	194	n	water clear, no odor
5/21/2010 13:30	ds, rw	2.06	0.30	6556.5	4.4	24	40		
6/12/2010 14:10	bc	2.26	0.50	6556.3	6.9	33	50		
7/19/2010 12:15	bc	2.72	0.96	6555.9	8.3	53	74	n	
8/23/2010 15:00	bc	2.97	1.21	6555.6	6.6	98	150	y	water clear, no odor
9/28/2010 16:05	bc	2.68	0.92	6555.9	6.3	114	176	n	water clear, no odor
11/2/2010 10:20	ds	2.31	0.55	6556.3	3.9	110	184	n	gradual increase in SC with depth, SC/T: 225 uS (at 25 deg C) at bottom of piezo
7/8/2011 10:06	ds, bc	2.22	0.46	6556.4	7.1	118	177	y	water clear, turbid at bottom, no odor, SC/T (top) = 44.1 uS @ 10.2 deg C, 62.3 uS @ 25 deg C
8/11/2011 10:50	bc	2.48	0.72	6556.1	8.3	154	227	no	no stratification, water clear
9/12/2011 11:30	bc	2.36	0.60	6556.2	8.0	137	203	yes	no stratification
10/9/2011 11:35	bc	2.13	0.37	6556.5	6.6	133	206	yes	water clear
11/3/2011 11:00	ds	2.29	0.53	6556.3	4.0	142	237	yes	dry at surface
12/5/2011 11:20	bc	2.04	0.28	6556.6	1.7	154		no	
5/18/2012 10:25	ds, bc	2.13	0.37	6556.5	5.1	92	148	no	no stratificaiton
6/15/2012 11:00	bc	2.41	0.65	6556.2	4.7	133	217	yes	water clear. SC/T (depth) 174.6 uS @ 3.2 deg C, 301.2 uS @ 25 deg C
7/17/2012 0:00	bc								Unable to remove cap
8/14/2012 0:00	bc								Unable to remove cap
9/17/2012 12:30	bc	3.43	1.67	6555.2	7.3	124	188	yes	slightly muddy
10/18/2012 0:00	ds	2.67	0.91	6555.9	5.0	121	196		ground is dry, slight strat. SC/T @ 25 deg C = 210 uS at depth

Table 11. Field Observer Log: Shallow groundwater, Perazzo Meadows, Sierra County, California
Water years 2010, 2011, and 2012

Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer 09-3 - Lower Upper Meadow, near confluence Upper Truckee / Perazzo Cr									
Total Depth	8.00 *ft bgs*								
Depth to bottom =	10.10 *ft btoc*								
Total Stickup =	2.10 *ft above gs*								
Ground Elevation =	6544.2 *ft*								
8/21/09 0:00	ds,bc	8.33	6.23	6538.0					piezometer installed; DTW does necessarily reflect static water level
9/23/2009 12:50									piezo is filled with sediment to depth 3.52 below toc; adjacent to constr. Access road
10/23/2009 11:25	bc	1.7	-0.40	6544.6	7.5	77	117	n	water ponded on ground surface
12/4/2009 11:04	bc								water ponded on surface and frozen solid
5/21/2010 14:30	ds, rw	0.93	-1.17	6545.4	2.1	83	142	n	water flowing at sfc, SC/T(sw) = 18 uS @ 3 deg C, 31 uS @ 25 deg C; depth to SW = 1.16 ft
6/12/2010 15:30	bc								unable to access due to high water
7/19/2010 10:40	bc	1.15	-0.95	6545.2	12.7	101	132	n	water ponded at sfc
8/23/2010 14:00	bc	1.49	-0.61	6544.8	12.2	102	136	y	water ponded at sfc; water clear, no odor
9/28/2010 15:00	bc	1.89	-0.21	6544.4	10.3	122	170	n	water ponded at sfc; water clear, no odor
11/2/2010 12:48	ds	1.59	-0.51	6544.7	40.7	114	182	n	waetr ponded at sfc, slightly lower elevation (by 0.10') than groundwater impling downward hydraulic gradient; sfc water SC=64@25
7/8/2011 13:13	ds, bc	0.38	-1.73	6545.9	4.5	74	122		depth to SW = 0.53', SC/T (top) = 58.5 uS @ 11 deg C, 80.1 uS @ 25 C
8/11/2011 10:15	bc	1.57	-0.53	6544.7	9.2	169	243	no	depth to SW = 1.5', water clear, SC/T (top) = 107.4 uS @ 10.7 deg C, 144.7 uS @ 25 deg C.
9/12/2011 0:00	bc	--	--	--	--	--		--	couldn't find, water on surface 1-4" deep, grasses really tall
10/9/2011 13:00	bc	1.31	-0.79	6545.0	8.00	99.50	146	yes	water clear, depth to SW = 1.31
11/3/2011 13:30	ds	1.63	-0.47	6544.7	5.00	133.00	212		SC/T: (sfc) 73 uS @ 25 deg C, 42 uS @ 3.1 deg C.
12/5/2011 12:46	bc	1.30	-0.80	6545.0	0.8	120		no	
5/18/2012 12:25	ds, bc	0.37	-1.74	6545.9	10.4	59	82		no stratification, SC/T: (sfc) 23 uS @ 10.5 deg C, 32.9 uS @ 25 deg C. Depth to surface 6.75", water higher in well than in streams water surface. No cap
6/15/2012 10:10	bc	0.91	-1.19	6545.4	10.1	63	88	yes	in standing water, water clear.
7/17/2012 0:00	bc								couldn't locate, carex waist high, water ponded on surface
8/14/2012 12:00	bc	1.74	-0.36	6544.6	10.3	94	131	yes	muddy, no strat
9/17/2012 11:45	bc	2.69	0.59	6543.6	7.9	112	166	yes	muddy, well almost dry
10/18/2012 0:00	ds	2.96	0.86	6543.3	6.7	108	168		meadow is driest I have seen since initial visit, pre-restoration. Water ponded in ponds. Little truckee Q = 0
Piezometer 09-4 - North Side lower upper meadow, adjacent to volcanic bedrock outcrop									
Total Depth	7.34 *ft bgs*								
Depth to bottom =	10.10 *ft btoc*								
Total Stickup =	2.76 *ft above gs*								
Elevation =	6546.2 *ft*								
8/21/09 0:00	ds,bc	6.92	4.16	6542.0	--	--	--	--	piezometer installed; DTW does necessarily reflect static water level
9/23/2009 14:59	ds	7.43	4.67	6541.5	8.7	69	101		wp228; installed levelogger
10/23/2009 12:02	bc	3.18	0.42	6545.7	7.1	99	150		
12/4/2009 10:32	bc	3.18	0.42	6545.7	1.7	68	122		
5/21/2010 17:25	ds, rw	2.23	-0.53	6546.7	3.7	56	95		SC/T sfc= 23 uS @ 4.9 deg C, 38 uS @ 25 deg C.
6/12/2010 16:00	bc								unable to access due to deep water and channels at well
7/19/2010 13:15	bc	2.85	0.09	6546.1	11.6	67	90	n	ground saturated but no standing water
8/23/2010 17:15	bc				12.0	65	87	y	water clear, no odor
9/28/2010 16:50	bc	3.26	0.50	6545.7	9.4	79	113	n	water clear, no odor
11/2/2010 12:10	ds	2.65	-0.11	6546.3	6.8	64	99	n	not stratified; surface water is 76 uS @ 25 deg C
7/8/2011 12:05	ds, bc	1.79	-0.97	6547.1	4.2	58	96	yes	water clear, depth to SW = 1.78. SC/T (top) = 54 uS @ 7.4 deg C, 81.1 uS @ 25 deg C
8/11/2011 12:20	bc	2.90	0.14	6546.0	9.0	121	175	no	ground wet, but no standing water, SC/T: (top) 99.9 uS @ 12.7 deg C, 130.3 uS @ 25 deg C.
9/12/2011 12:50	bc	3.03	0.27	6545.9	10.3	85	119	yes	no stratification
10/9/2011 12:20	bc	2.87	0.11	6546.1	8.0	98	146	yes	water clear, no strat
11/3/2011 12:50	ds	3.05	0.29	6545.9	6.7	107	165		saturated just below SFC, LL time 12:50 PC time 12:47
12/5/2011 12:00	bc	3.09	0.33	6545.8	2.1	111	196	no	
5/18/2012 11:00	ds, bc	1.98	-0.78	6546.9	6.2	55	85	no	DTS 1.98'. SC/T (depth) 140 uS @ 1.3 deg C., SC/T (sfc) 21.6 uS @ 5.8 deg C.
6/15/2012 11:40	bc	2.62	-0.14	6546.3	8.5	68	100	yes	no stratification, water clear, surfrace water at ground level
7/17/2012 12:40	bc	3.38	0.62	6545.5	11.9	122	163	yes	water slightly muddy. SC/T (depth) 142.2 uS @ 8.7 deg C., 200.4 uS @ 25 deg C
8/14/2012 13:15	bc	3.98	1.22	6544.9	10.7	180	251	yes	SC/T (depth) 173.6 uS @ 7.7 deg C, 258.3 uS @ 25 deg C.
9/17/2012 13:05	bc	5.44	2.68	6543.5	8.4	125	183	yes	slightly muddy. Stream dry, island pools.
10/18/2012 16:15	ds	5.57	2.81	6543.4	5.8	152	238	no	LL time = 1632, PC time = 16:31. data downloaded.

Table 11. Field Observer Log: Shallow groundwater, Perazzo Meadows, Sierra County, California
Water years 2010, 2011, and 2012

Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer 09-5 - North side, lower upper meadow, upland terrace									
Total Depth	5.26 *ft bgs*								
Depth to bottom =	10.01 *ft btoc*								
Total Stickup =	4.75 *ft above gs*								
Elevation =	6553.8 *ft*								
8/21/09 0:00	ds,bc	dry	--	--	--	--	--	--	piezometer installed
9/23/2009 14:46	ds	9.78	5.03	6548.8	11.2	145	197	y	wp227; very little water in bottom of well.
10/23/2009 12:12	bc	9.65	4.90	6548.9	9.3	362	517	n	murky brown color, water level near bottom of well
12/4/2009 10:18	bc	8.91	4.16	6549.6	6.8	298	459	n	water clear, no odor; capped
6/12/2010 15:45	bc	4.77	0.02	6553.8	9.2	174	250	n	
7/19/2010 13:05	bc	5.80	1.05	6552.7	10.6	171	237	n	
8/23/2010 17:00	bc	7.87	3.12	6550.7	10.1	194	270	y	water clear, no odor
9/28/2010 16:40	bc	8.62	3.87	6549.9	9.9	280	393	n	water clear, no odor
11/2/2010 11:58	ds	6.18	1.43	6552.4	7.3	96	145		stratified: 374@25 at depth
7/8/2011 11:48	ds, bc	4.85	0.10	6553.7	7.1	154	233	yes	water clear, SCT (top) = 127.1@15.4, 155.7@25
8/11/2011 12:05	bc	5.71	0.96	6552.8	8.6	112	163	no	SCT (top) = 128.3@12.3, 169@25
9/12/2011 12:40	bc	7.31	2.56	6551.2	10.1	112	158	yes	water clear, no stratification
10/9/2011 12:10	bc	8.23	3.48	6550.3	9.0	756	1080	yes	water clear, no stratification
11/3/2011 12:20	ds	8.33	3.58	6550.2	7.9	1092	1620		ground is dry, stratified, SCT (top) 250@25
12/5/2011 11:50	bc	7.98	3.23	6550.6	5.6	124	197	no	
5/18/2012 11:35	ds, bc	4.91	0.16	6553.6	8.2	105	154	no	
6/15/2012 11:50	bc	5.41	0.66	6553.1	8.4	105	152	yes	water clear, no stratificaiton
7/17/2012 13:00	bc	7.50	2.75	6551.0	7.7	98	147	yes	a little clear, no strat
8/14/2012 13:25	bc	8.71	3.96	6549.8	7.5	101	152	yes	water muddy, no strat
9/17/2012 13:15	bc	9.47	4.72	6549.1	7.5	127	187	yes	muddy
10/18/2012 0:00	ds	9.75	5.00	6548.8	6.7	107	165		
Piezometer 09-6 - S Side Middle Meadow, just east of willow line of Cold Creek									
Total Depth	5.35 *ft bgs*								
Depth to bottom =	8.60 *ft btoc*								
Total Stickup =	3.25 *ft above gs*								
Elevation =	6492.6 *ft*								
8/27/09 0:00	ds, tb	4.23	0.98	6491.7					piezometer installed; water level not static, but fairly stable
9/23/2009 10:35	ds	4.01	0.76	6553.0	9.3	95	137	y	replaced SCT meter battery just prior to measurement; installed levelloger after bailing well
10/1/2009 9:30	ds,bc	4.00	0.75	6553.0	7.3	82	124	n	downloaded levelogger
10/23/2009 12:58	bc	3.69	0.44	6553.3	6.4	82	127	n	water clear, no odor
12/4/2009 13:56	bc	3.83	0.58	6553.2	2.8	79	137	n	water clear, no odor
6/11/2010 15:00	ds	3.28	0.03	6553.8	4.6	98	160	n	stratified; SCT at water table = 94.4@9.3degC, 135@25; downloaded DL; saturated at sfc
7/19/2010 9:24	bc	3.47	0.22	6553.6	10.4	116	161	n	
8/23/2010 12:35	bc	4.21	0.96	6552.8	8.3	100	148	y	water clear, no odor; cap replaced with loose oversized cap
9/28/2010 13:45	bc	3.71	0.46	6553.3	6.4	86	133	n	water clear, no odor
11/2/2010 13:43	ds	3.41	0.16	6553.6	5.2	83	131	n	stratified: 88@25 in upper portion of well; water ponded in nearby depressions, evidence of surface flow in willows; downloaded datalogger
7/8/2011 13:50	ds, bc	2.72	-0.53	6554.3	4.8	93	150	yes	depth to sw=2.72, SCT (top) = 90.4@12.5, 118@25
8/11/2011 9:02	bc	3.25	0.00	6553.8	9.6	83	117	no	no stratification, water clear
9/12/2011 9:30	bc	3.61	0.36	6553.4	8.6	112	163	yes	water clear, SCT (top) = 95.4@8.6, 126.5@25
10/9/2011 13:40	bc	3.32	0.07	6553.7	7.0	108	165	yes	no stratification
11/3/2011 14:00	ds	3.44	0.19	6553.6	6.3	103	160		minimal stratification
12/5/2011 13:35	bc	3.45	0.20	6553.6	2.8	89	154	no	
5/18/2012 12:55	ds, bc	2.82	-0.43	6554.2	9.5	117	165	no	in standing water. SCT (depth) 120@1.6
6/6/2012 11:28	merced	3.02	-0.23	6554.01					
6/15/2012 9:00	bc	3.20	-0.05	6553.8	6.2	103	161	yes	water slightly muddy. SCT (depth) 139.4@4.7, 226.9@25
7/17/2012 10:30	bc	3.63	0.38	6553.4	7.5	128	193	yes	no strat
8/14/2012 13:50	bc	3.60	0.35	6553.4	7.5	138	211	yes	no strat, water clear
9/17/2012 10:55	bc	3.29	0.04	6553.7	6.9	101	155	yes	no strat, water slightly muddy
10/18/2012 12:58	ds	3.24	-0.01	6553.8	6.9	113	177		downloaded

Table 11. Field Observer Log: Shallow groundwater, Perazzo Meadows, Sierra County, California
Water years 2010, 2011, and 2012

Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer 09-7 - S Side lower middle meadow									
Total Depth	6.26 *ft bgs*								
Depth to bottom =	10.00 *ft btoc*								
Total Stickup =	3.74 *ft above gs*								
Elevation =	6472.7 *ft*								
8/27/09 0:00	ds, tb	7.19	3.45	6469.3	11.2	101	139		coupler driven onto pipe, could not remove, no cap installed
9/23/2009 11:16	ds	7.01	3.27	6469.5	9.7	102	72	y	SC rises slightly after purcging, ~10uS; water slightly turbid after bailing
10/1/2009 11:55	ds,bc	6.97	3.23	6469.5	9.5	81	115		downloaded levellogger; measurement from top of inside casing, not coupling
10/23/2009 14:30	bc	6.50	2.76	6470.0	8.1	73	107		water clear in color, no odor
12/5/2009 10:44	bc	6.38	2.64	6470.1	4.5	68	113	n	water clear, no odor; no cap installed; bird droppings
6/11/2010 16:00	ds	4.23	0.49	6472.3	8.5	95	142	n	temperature stratified, 4.1degC at bottom of well; downloaded DL
7/19/2010 8:13	bc	5.96	2.22	6470.5	8.3	96	142	n	no cap
8/23/2010 11:20	bc	6.59	2.85	6469.9	8.9	92	133	y	water clear, no odor, replaced cap
9/28/2010 0:00									unable to located piezo
11/3/2010 16:23	ds		-3.74	6476.5	6.6	119	183		well stickup is broken off, replaced; downloaded and removed datalogger to avoid damage.
7/8/2011 16:47	ds, bc				7.2	453	691		SCT (top) 66.5@25
8/11/2011 7:55	bc	4.26	0.52	6472.2	10.9	359	489	no	water clear, SCT (top) = 263.7@12.1, 328.5@25
9/12/2011 8:45	bc	4.05	0.31	6472.4	11.6	110	148	yes	no stratification, slightly muddy water
10/9/2011 15:30	bc	3.74	0.00	6472.7	9.2	100	143	yes	water clear
11/3/2011 16:00	ds	3.98	0.24	6472.5	5.4	93	149		did now download UC Merced LL, Stickup = 3.5'
12/5/2011 10:00	bc	3.99	0.25	6472.5	2.7	94	163	no	
5/18/2012 15:15	ds, bc				7.9	126	187	no	levelogger embedded in mud. Removed but is now resting on top of mud.
6/6/2012 12:22	merced	3.48							
6/15/2012 8:10	bc	3.78	0.04	6472.7	8.0	135	200	yes	water muddy, no stratification
7/17/2012 9:45	bc	4.66	0.92	6471.8	7.2	106	161	yes	muddy, no strat
8/14/2012 15:40	bc	4.57	0.83	6471.9	8.2	111	164	yes	very muddy
9/17/2012 10:15	bc	4.22	0.48	6472.3	7.9	102	154	yes	water clear, no strat
10/18/2012 14:06	ds	4.08	0.34	6472.4	5.6	89	140		downloaded
Piezometer 09-8 - Upper end middle meadow, north side									
Total Depth	4.80 *ft bgs*								
Depth to bottom =	9.75 *ft btoc*								
Total Stickup =	4.95 *ft above gs*								
Elevation =	6497.4 *ft*								
8/27/09 0:00	ds,tb	8.53	3.58	6493.8					piezometer installed; not static, fairly steady
9/23/2009 16:05	ds	8.42	3.47	6493.9	10.6	115	160	y	wp238; no stratification
10/1/2009 9:01	ds,bc	8.41	3.46	6493.9	10.4	97	135	n	
10/23/2009 13:20	bc	7.96	3.01	6494.4	9.4	104	149	n	water clear; no odor
12/4/2009 13:29	bc	7.82	2.87	6494.5	6.6	93	144	n	water clear no odor; capped
6/12/2010 16:30	bc	5.14	0.19	6497.2	9.7	149	209	n	
7/19/2010 9:45	bc	7.52	2.57	6494.8	9.4	117	167	n	
8/23/2010 13:00	bc	7.03	2.08	6495.3	10.7	101	140	y	water muddy at bottom, next to active construction
9/28/2010 14:15	bc	5.50	0.55	6496.8	10.2	98	134	n	water clear, no odor
11/2/2010 14:54	ds	4.97	0.02	6497.4	8.6	140	206		not stratified; no evidence of overland flow at this location
7/8/2011 14:30	ds, bc	4.69	-0.26	6497.6	6.0	104	163	yes	SCT (top) = 62.4@12.6, 80.6@25
8/11/2011 9:20	bc	5.46	0.51	6496.9	9.6	136	192	no	SCT (top) = 64.1@10.8, 84.8@25
9/12/2011 10:10	bc	5.81	0.86	6496.5	11.0	155	211	yes	water clear, no stratification
10/9/2011 14:05	bc	5.41	0.46	6496.9	9.1	161	232	no	couldn't get bailer in deep enough to bail.
11/3/2011 14:28	ds	5.95	1.00	6496.4	7.0	127	193		meadow dry, UC Merced levelogger pulled and replaced but not downloaded
12/5/2011 13:45	bc	5.95	1.00	6496.4	3.8	137	231	no	
4/24/2012 0:00	ds	4.54	-0.41	6497.8	10.8	158	210		SCT (depth) 113@1.6. SCT (sfc) 53.4@ 15.9, 64.7@25, new cap installed with levelogger
4/24/2012 0:00	ds	4.50	-0.45	6497.8					
5/18/2012 13:30	ds, bc	4.71	-0.24	6497.6	6.2	124	194		no stratification
6/6/2012 13:27	merced	4.89	-0.06	6497.43					
6/15/2012 9:25	bc	5.23	0.28	6497.1	7.2	136	205	yes	slightly muddy, SCT (depth) 127.8@4.9, 208.6
7/17/2012 10:55	bc	6.47	1.52	6495.9	7.3	133	200	yes	water clear, no strat
8/14/2012 14:10	bc	6.80	1.85	6495.5	8.8	127	182	yes	no stratification
9/17/2012 11:15	bc	6.62	1.67	6495.7	8.5	135	196	yes	water clear, no strat
10/18/2012 12:20	ds	6.64	1.69	6495.7	7.1	135	206		downloaded

Table 11. Field Observer Log: Shallow groundwater, Perazzo Meadows, Sierra County, California
Water years 2010, 2011, and 2012

Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer 09-9 - Upper end middle meadow, north side near lone double pine in meadow									
Total Depth	4.34 *ft bgs*								
Depth to bottom =	5.97 *ft btoc*								
Total Stickup =	1.63 *ft above gs*								
Elevation =	6493.2 *ft*								
8/29/09 0:00	ds,tb	4.04	2.42	6490.8	13.6	90	116	n	piezometer installed; water level not static
9/23/2009 18:00	ds				11.7	162	216		stratified: 147uS at top (111@12.3); installed levellogger
10/1/2009 8:48	ds,bc	3.87	2.25	6491.0	11.1	88	123	n	changed levellogger id to "09-9"; downloaded data
10/23/2009 13:12	bc	3.36	1.74	6491.5	9.4	102	145	n	water clear, no odor
12/4/2009 13:22	bc	3.20	1.58	6491.7	4.7	88	143	n	water clear, no odor
6/11/2010 14:07	ds				9.4	76	108	n	
7/19/2010 9:40	bc	3.50	1.88	6491.4	11.8	121	162	n	
8/23/2010 13:15	bc	4.47	1.16	6492.1	12.4	94	124	y	water clear, no odor
9/27/2010 11:00	ds	2.29	-1.02	6494.3	10.7	103	142	n	downloaded levellogger
9/28/2010 14:10	bc	2.38	-0.93	6494.2	11.2	101	137	n	water clear, no odor
11/2/2010 14:27	ds	1.92	-1.39	6494.6	7.1	100	150	n	not stratified, downloaded datalogger, HWM is 0.55' above ground surface
7/8/2011 14:14	ds, bc	1.07	-2.24	6495.5	7.8	76	113		depth to SW same as in well. SCT (top) = 69@10.5, 95.1@25
8/11/2011 9:15	bc	1.86	-1.45	6494.7	12.1	126	167	no	water clear, SCT (top) 144.4@12.7, 185.6@25
9/12/2011 9:50	bc	2.11	-1.20	6494.4	12.6	182	238	yes	no stratification
10/9/2011 13:55	bc	2.08	-1.23	6494.5	9.3	190	270	yes	water clear
11/3/2011 14:20	ds	2.19	-1.12	6494.4	7.1	173	262		no stratification, meadow surface dry
12/5/2011 13:15	bc	2.12	-1.19	6494.4	2.7	144	250	no	
4/24/2012 12:57	ds	0.94	-2.37	6495.6	3.4	112	192	no	SCT (depth) 102@.6, SCT (sfc water) 21.4@4.3, 35@25, downloaded levelogger. Depth to surface water 11.25"
5/18/2012 13:20	ds, bc	1.04	-2.27	6495.5	7.7	131	195	no	SCT (sfc) 27@11.3, 36@25. in flowing water, no stratification, datalogger downloaded
6/6/2012 13:22	merced	1.38	-1.9325	6495.17					
6/15/2012 9:15	bc	1.81	-1.50	6494.7	10.5	147	203	yes	no stratification
7/17/2012 10:40	bc	2.48	-0.83	6494.1	11.8	206	276	yes	water clear, SCT(depth) 204.9@10.1, 285.4@25
8/14/2012 14:05	bc	2.58	-0.73	6494.0	12.1	214	283	yes	water clear
9/17/2012 11:05	bc	2.45	-0.86	6494.1	10.2	192	267	yes	no strat, water slightly muddy
10/18/2012 11:50	ds	2.32	-0.99	6494.2	7.3	161	242		cap is off and missing, SCT at 25 = 234 at bottom, downloaded
Piezometer 09-10 - Lower Middle Meadow, S side, opposite and corral									
Total Depth	6.70 *ft bgs*								
Depth to bottom =	10.01 *ft btoc*								
Total Stickup =	3.31 *ft above gs*								
Elevation =	6477.1 *ft*								
8/29/09 0:00	ds,tb	5.76	2.45	6474.7	13.2	127	165	n	piezometer installed; water level not static
9/23/2009 12:35	ds	5.21	1.90	6475.2	9.0	120	174	y	
10/1/2009 11:04	ds,bc	5.11	1.80	6475.3	9.2	103	148	y	
10/23/2009 14:47	bc	4.38	1.07	6476.1	7.4	102	154	n	water clear, no odor
12/5/2009 10:13	bc	4.40	1.09	6476.1	2.6	91	158	n	water clear, no odor
6/11/2010 13:35	ds	3.85	0.54	6476.6	9.5	102	144	n	temp stratified; 5.3 degC at depth
7/19/2010 8:30	bc	5.00	1.69	6475.5	11.4	101	136	n	
8/23/2010 10:55	bc	5.80	2.49	6474.7	10.4	91	126	y	water clear, no odor
9/28/2010 12:00	bc	--		--	--	--		--	destroyed by cows
11/3/2010 16:00	ds	--	0.55	6476.6	7.9	75	111	n	well is destroyed, DTW reading is in remnant hole, was able to replace stickup, but well is filled with gravel; need to replace.
7/8/2011 16:20	ds, bc	--		--	15.6	25	30	n	knocked over by cows, water .75' deep at well, SCT is of SW
8/11/2011 8:30	bc	--		--	--	--		no	ground damp, no standing water
9/12/2011 8:20	bc	2.88	-0.43	6477.6	10.7	83	114	yes	water clear, brown at bottom, no stratification
10/9/2011 15:10	bc	2.88	-0.43	6477.6	7.9	87	129	yes	water clear
11/3/2011 15:00	ds	2.93	-0.38	6477.5	6.2	77	120		SCT (sfc) 160@25, UC Merced LL pulled but not downloaded, could not get LL back to bottom due to silt/mud
12/5/2011 10:17	bc	2.78	-0.53	6477.7	2.0	90	160	no	
5/18/2012 14:55	ds, bc	2.03	-1.28	6478.4	8.7	105	154		SCT (depth) 97.8@6.5, 151.6@25
6/6/2012 14:05	merced	2.66	-0.6525	6477.79					
6/15/2012 7:50	bc	2.82	-0.49	6477.6	10.4	146	203	yes	a little muddy, no odor, no strat
7/17/2012 9:25	bc	2.99	-0.32	6477.5	9.7	133	188	yes	water clear, no strat
8/14/2012 15:20	bc	2.55	-0.76	6477.9	9.6	150	212	yes	slightly muddy, no strat
9/17/2012 9:55	bc	2.86	-0.45	6477.6	7.6	122	182	yes	water clear. SCT at depth = 115.9@7C, 177@25C
10/18/2012 11:13	ds	2.95	-0.36	6477.5	4.8	126	207		SCT at bottom = 172@25C. Downloaded

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Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer 09-11 - N Side lower middle meadow, just N USFS boundary									
Total Depth	7.17 *ft bgs*								
Depth to bottom =	10.00 *ft btoc*								
Total Stickup =	2.83 *ft above gs*								
Elevation =	6474.7 *ft*								
8/29/09 0:00	ds,tb	9.88	7.05	6467.7	11.9	199	267		piezometer installed, water level not static, still rising
9/23/2009 12:00	ds	5.16	2.33	6472.4	10.8	111	151	y	
10/1/2009 11:26	ds,bc	5.01	2.18	6472.5	10.5	116	160		no stratification
10/23/2009 15:03	bc	3.98	1.15	6473.6	8.7	103	150	n	water clear, no odor
12/5/2009 10:28	bc	3.23	0.40	6474.3	2.6	81	141	n	
6/11/2010 12:52	ds	2.38	-0.45	6475.2	19.5	140	157	n	water ponded in depressions; downloaded DL; red-tail hawk; stratified: 131@4.9; 211@25 at depth; depth to SW from TOC = 2.65, suggests upward vertical hydraulic gradient
7/19/2010 7:50	bc	3.92	1.09	6473.6	12.8	178	137	n	
8/23/2010 10:35	bc	5.15	2.32	6472.4	11.6	148	198	y	water clear, 'oily' odor
9/28/2010 12:10	bc	4.85	2.02	6472.7	9.6	157	223	n	water clear, no odor
11/3/2010 15:15	ds	2.92	0.09	6474.6	9.1	154	223	n	ground is moist; no evidence of overland flow; water is flowing swale ~400' N of piezo, SC=164@25, appears to be spring fed from base of N hillside alluvial fan
7/8/2011 15:51	ds, bc	2.30	-0.53	6475.2	20.3	185	203	yes	depth to SW = 2.62. No stratification
8/11/2011 7:30	bc	3.59	0.76	6474.0	12.4	135	180	no	no stratfication
9/12/2011 8:00	bc	4.38	1.55	6473.2	11.9	118	157	yes	water clear, no stratification
10/9/2011 14:50	bc	3.23	0.40	6474.3	10.3	113	157	yes	
11/3/2011 15:30	ds	3.14	0.31	6474.4	6.7	99	151		no stratification
12/5/2011 10:30	bc	2.99	0.16	6474.6	3.2	80	136	no	
5/18/2012 14:40	ds, bc	2.40	-0.43	6475.1	8.4	83	121	no	no stratification, datalogger downloaded
6/6/2012 13:56	merced	2.49	-0.3433	6475.05					
6/15/2012 7:35	bc	2.98	0.15	6474.6	7.6	90	134	yes	water clear, no odor, no strat
7/17/2012 9:10	bc	4.46	1.63	6473.1	8.6	100	146	yes	water clear, no strat
8/14/2012 15:05	bc	4.97	2.14	6472.6	8.7	109	159	yes	water clear, no strat
9/17/2012 9:40	bc	4.75	1.92	6472.8	8.6	122	176	yes	water clear, no strat
10/18/2012 10:50	ds	4.25	1.42	6473.3	7.1	128	196		downloaded
Piezometer FS-12 - West (left) side Upper Meadow									
Total Depth	4.43 *ft bgs*								
Depth to bottom =	8.10 *ft btoc*								
Total Stickup1 =	3.67 *ft above gs*								
Total Stickup2 =	3.58 *ft above gs*								
Elevation =	6553.8 *ft*								
7/19/09 0:00	ds	7.14	3.47	6550.3	9.5	102	145	n	
9/23/2009 16:19	ds	5.3	1.63	6552.1	9.9	90	122	n	stratified: 49 uS/cm at top (37@10.8)
10/23/2009 10:22	bc	6.98			7..6	85	127	n	stinky; well seems disturbed and data point is an outlier, omitted from the record
12/4/2009 12:18	bc	5.60	1.93	6551.8	4.7	36	59	n	water clear, no odor
5/21/2010 15:30	ds, rw	7.77	4.10	6549.7					SCT reading Lerr
6/12/2010 0:00	bc								unable to remove cap
7/19/2010 11:55	bc								unable to remove cap
8/23/2010 15:35	bc	4.54	0.96	6552.8	12.2	59	78	y	water light brown; cut cap off well, new stickup = 43" (see 'Total Stickup2)
9/28/2010 15:50	bc	4.32	0.74	6553.0	9.7	64	90	n	water clear, no odor
11/2/2010 11:17	ds	3.96	0.38	6553.4	6.5	62	40		stratified: 112@25 in bottom 1-2" of well; 78@25 in adjacent pond
7/8/2011 11:10	ds, bc	6.18	2.60	6551.2	3.6	47	79	yes	water slightly turbid. Depth to SW = 41". SCT (top) = 19.1@3.8, 31.9@25
8/11/2011 11:20	bc	3.65	0.07	6553.7	10.4	35	47	no	ground wet, but no standing water, no stratification
9/12/2011 12:20	bc	4.06	0.48	6553.3	10.5	41	57	yes	no stratification
10/9/2011 11:15	bc	3.97	0.39	6553.4	8.0	42	63	yes	water clear, no strat
11/3/2011 11:20	ds	4.01	0.43	6553.3	5.2	41	66		
12/5/2011 11:05	bc	4.30	0.72	6553.1	3.3	37	64	no	
5/18/2012 10:05	ds, bc	7.87	--	--	4.3	22	36	no	no stratification, water ponded in depression at sfc
6/15/2012 10:40	bc	4.25	0.67	6553.1	10.8	45	61	yes	water clear, no strat
7/17/2012 11:50	bc	4.59	1.01	6552.8	12.2	48	64	yes	water clear, no strat
8/14/2012 12:25	bc	4.60	1.02	6552.8	13.8	75	95	yes	slightly muddy, SCT (depth) 65.4@11, 89.8@25
9/17/2012 12:10	bc	4.63	1.05	6552.7	11.0	69	95	yes	water clear
10/18/2012 0:00	ds	4.57	0.99	6552.8	8.0	71	105		not stratified

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Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD)	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer FS-13 - East (right) side Upper Meadow									
Total Depth	4.10 *ft bgs*								
Depth to bottom =	7.35 *ft btoc*								
Total Stickup =	3.25 *ft above gs*								
Elevation =	6555.2 *ft*								
7/19/09 0:00	ds	5.69	2.44	6552.8	8.4	102	145	n	stratified: 75 uS/cm at top of water table
9/23/2009 16:04	ds	4.88	1.63	6553.6	8.2	104	152	y	stratified: 62 uS/cm at top of water table; installed levellogger programmed for 09-03
10/23/2009 10:14	bc	3.09	-0.16	6555.4	6.5	41	63	n	labeled well; standing water at base of well
12/4/2009 12:09	bc								frozen
5/21/2010 14:20	ds, rw	7.49	4.24	6551.0	4.4	24	39		1" water on sfc, SCTsfc same as piezo; checked meas several times.
6/12/2010 14:40	bc	3.59	0.34	6554.9	7.0	26	38	n	water ponded on sfc
6/16/2010 12:30	ds	2.53	-0.72	6556.0				n	water flowing at sfc; downloaded LL
7/19/2010 11:55	bc	2.66	-0.59	6555.8	11.7	30	46	n	water ponded on sfc
8/23/2010 15:45	bc	3.54	0.29	6555.0	15.4	177	216	y	ground wet, no standing water; water brown, no odor
9/28/2010 15:55	bc	3.48	0.23	6555.0	10.8	151	207	n	water clear, no odor
11/2/2010 11:00	ds	3.00	-0.25	6555.5	4.1	40	67	y	conductance same as sfc water ponded at base of well 0-3" deep; downloaded datalogger
7/8/2011 10:45	ds, bc	6.86	3.61	6551.6	4.2	17	28	yes	water clear, turbid at bottom, cut off stuck cap, in 3-4" standing water and needs cap. SCT (top) = 18.1@4.9, 29.3@25
8/11/2011 11:30	bc	2.65	-0.60	6555.8	11.3	27	37	no	depth to SW = 2.65', no stratification
9/12/2011 12:15	bc	2.85	-0.40	6555.6	14.7	50	63		ground wet, no stratification
10/9/2011 11:25	bc	2.75	-0.50	6555.7	8.6	44	63	yes	water slightly muddy, depth to SW = 2.75'
11/3/2011 11:10	ds	2.78	-0.47	6555.7	2.4	38	67	yes	file downloaded, cap missing
12/5/2011 11:15	bc	2.64	-0.61	6555.9					frozen depth to ice
5/18/2012 10:10	ds, bc	2.45	-0.80	6556.0	3.8	21	36	no	depth to surface 29.375", water flowing on surface, datalogger downloaded
6/15/2012 10:45	bc	2.61	-0.64	6555.9	9.6	30	43	yes	in standing water. 2.48' to surface water
7/17/2012 11:55	bc	3.34	0.09	6555.2	12.5	137	180	yes	water clear, no strat
8/14/2012 12:35	bc	3.41	0.16	6555.1	12.5	143	189	yes	light brown, no strat
9/17/2012 12:20	bc	3.54	0.29	6555.0	10.4	152	208	yes	slightly muddy
10/18/2012 0:00	ds	3.39	0.14	6555.1	7.8	141	208		not stratified, downloaded
Piezometer FS-14 - West (left) side Upper Meadow, upstream bedrock reach, on upland terrace									
Total Depth	5.28 *ft bgs*								
Depth to bottom =	8.08 *ft btoc*								
Total Stickup =	2.80 *ft above gs*								
Elevation =	6553.8 *ft*								
7/19/09 0:00	ds	7.64	4.84	6549.0	9.5	471	671	n	
9/23/2009 16:33	ds	7.05	4.25	6549.6	9.6	413	580	y	stratified: 412 uS at bottom (413@9.6); smells bad, like feces or rotting flesh; no levelogger installed
10/23/2009 10:37	bc	4.50			8.3	41	60	n	water clear, no odor; data point is an outlier, omitted from the record
12/4/2009 11:21	bc	7.93	5.13	6548.7	4.5	63	104	n	water clear, no odor, no cap
6/12/2010 15:00	bc	7.02	4.22	6549.6	6.5	23	36		no cap
7/19/2010 11:40	bc	4.33	1.53	6552.3	10.7	36	50	n	no cap
8/23/2010 15:15	bc	4.7	1.90	6551.9	11.8	59	79	y	water clear, no odor, replaced cap
9/28/2010 16:25	bc	4.68	1.88	6552.0	10.8	72	99	no	water clear, no odor
11/2/2010 10:45	ds	4.31	1.51	6552.3	7.6	68	102		terrace is now surrounded by remnant channels with flowing sw; terrace sfc appears to be 2-4' higher than meadow/floodplain; this piezo probably better reflects changes from surface flow and restoration activities than other gw-influenced areas.
7/8/2011 10:25	ds, bc	3.89	1.09	6552.7	6.2	113	177	yes	water clear, needs pvc cap. SCT (top) = 54@10.2, 75@25
8/11/2011 11:05	bc	4.17	1.37	6552.5	8.1	50	73	no	SCT (top)= 52.3@9.2, 74.8@25
9/12/2011 11:45	bc	4.38	1.58	6552.3	9.3	70	100	yes	a little sediment in water (light tan), no stratification
10/9/2011 11:50	bc	4.25	1.45	6552.4	8.7	81	118	yes	water clear
11/3/2011 11:35	ds	4.38	1.58	6552.3	6.1	40	62	yes	beaver dam u/s, stratified 8" below sfc, SCT (depth) 86.6@6.9, 132@25
12/5/2011 11:30	bc	4.42	1.62	6552.2	4.0	75	125	no	
5/18/2012 10:40	ds, bc	4.02	1.22	6552.6	2.4	73	128	no	dry ground, missing cap
6/15/2012 11:15	bc	4.32	1.52	6552.3	5.6	71	114	yes	no strat, water clear/slightly muddy
7/17/2012 12:20	bc	4.89	2.09	6551.7	6.2	65	102	yes	water clear, no strat
8/14/2012 12:55	bc	5.09	2.29	6551.5	7.5	80	122	yes	water clear, no strat
9/17/2012 12:45	bc	5.32	2.52	6551.3	7.7	65	97	yes	water clear
10/18/2012 0:00	ds	5.05	2.25	6551.6	6.4	65	100		minimal strat, SCT at bottom = 110@25C

Table 11. Field Observer Log: Shallow groundwater, Perazzo Meadows, Sierra County, California
Water years 2010, 2011, and 2012

Site Conditions					Water Quality Observations				Remarks
Date/Time	Observer	Top-of-casing to water (ft)	Depth to water (ft, bgs)	Water Surface Elevation NGVD/NAVD	Temperature (°C)	Specific Conductance (at field temp.) (µS/cm)	Specific Conductance (at 25 °C) (at 25 °C)	Bailed?	
Piezometer FS-15 - Upper Meadow, Immediately downstream of bedrock reach									
Total Depth	5.52 *ft bgs*								
Depth to bottom =	7.72 *ft btoc*								
Total Stickup =	2.20 *ft above gs*								
Elevation =	6548.3 *ft*								
7/19/09 0:00	ds								not measured (locking cap)
9/23/2009 15:20	ds	7.58	5.38	6542.9					wp229 unable to get SC reading due to mud at bottom; equipped with FS water level recorder
10/23/2009 11:04	bc	4.04	1.84	6546.5	9.6	54	79		water clear, no odor; added label
12/4/2009 10:47	bc	3.88	1.68	6546.6	6.7	53	83	n	water clear, no odor;
6/12/2010 15:15	bc	3.74	1.54	6546.8	4.7	43	70	n	
7/19/2010 11:07	bc	3.93	1.73	6546.6	9.9	53	74	n	
8/23/2010 14:30	bc	4.13	1.33	6547.0	14.6	59	73	y	clear on top, brown on bottom, no odor
9/28/2010 15:10	bc	4.05	1.25	6547.0	12.7	63	83	n	water clear, no odor
7/8/2011 12:35	ds, bc	3.46	0.66	6547.6	5.8	44	70	yes	very turbid water with no odor. Cap stuck so cut off top, took off 1.875". SCT (top) = 44.8@7.2, 67.2@25
8/11/2011 12:45	bc	3.58	0.78	6547.5	9.2	57	82	no	SCT (top) = 57.1@11.7, 76.8@25
9/12/2011 13:00	bc	4.08	1.28	6547.0	11.4	62	84	yes	water brown, no stratification
10/9/2011 12:30	bc	3.39	0.59	6547.7	11.7	50	67	yes	water clear
11/3/2011 13:00	ds	3.9	1.10	6547.2	9.1	50	71	no	ground dry, not stratified
12/5/2011 12:10	bc	3.92	1.12	6547.18	6.1	44	69	no	
5/18/2012 10:50	ds, bc	3.4	0.60	6547.70	3.0	58	101	no	missing cap, SCT (depth) 430@2.2, 750@25.
6/15/2012 11:30	bc	3.74	0.94	6547.36	5.5	69	110	yes	medium muddy. SCT (depth) 98.1@4.9, 159.8@25
7/17/2012 12:30	bc	4.56	1.76	6546.54	9.5	92	130	yes	water muddy, no strat
8/14/2012 13:05	bc	5.02	2.22	6546.08	10.8	105	146	yes	very muddy, no strat
9/17/2012 13:00	bc	5.61	2.81	6545.49	11.3	92	125	yes	muddy, well just about dry
10/18/2012 0:00	ds	5.03	2.23	6546.07	10.6	84	115		not stratified, PVC broken, stickup = 24.5" on N side.

Notes:
1) ds is David Shaw (Balance); bc is Beth Christman (Truckee River Watershed Council); rw is Randy Westmoreland (USFS); tb is Travis Bagget (Balance)
2) NR is not recorded, -- is not applicable
3) Water surface elevationsare based on ground surface elevations indicated on high-resolution digital elevation models (DEM) provided by the USFS.
4) btoc=below top of casing; bgs=below ground surface

Specific conductance: Measured in micromhos/cm in field using a YSI30 hand-held meter; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

FIGURES

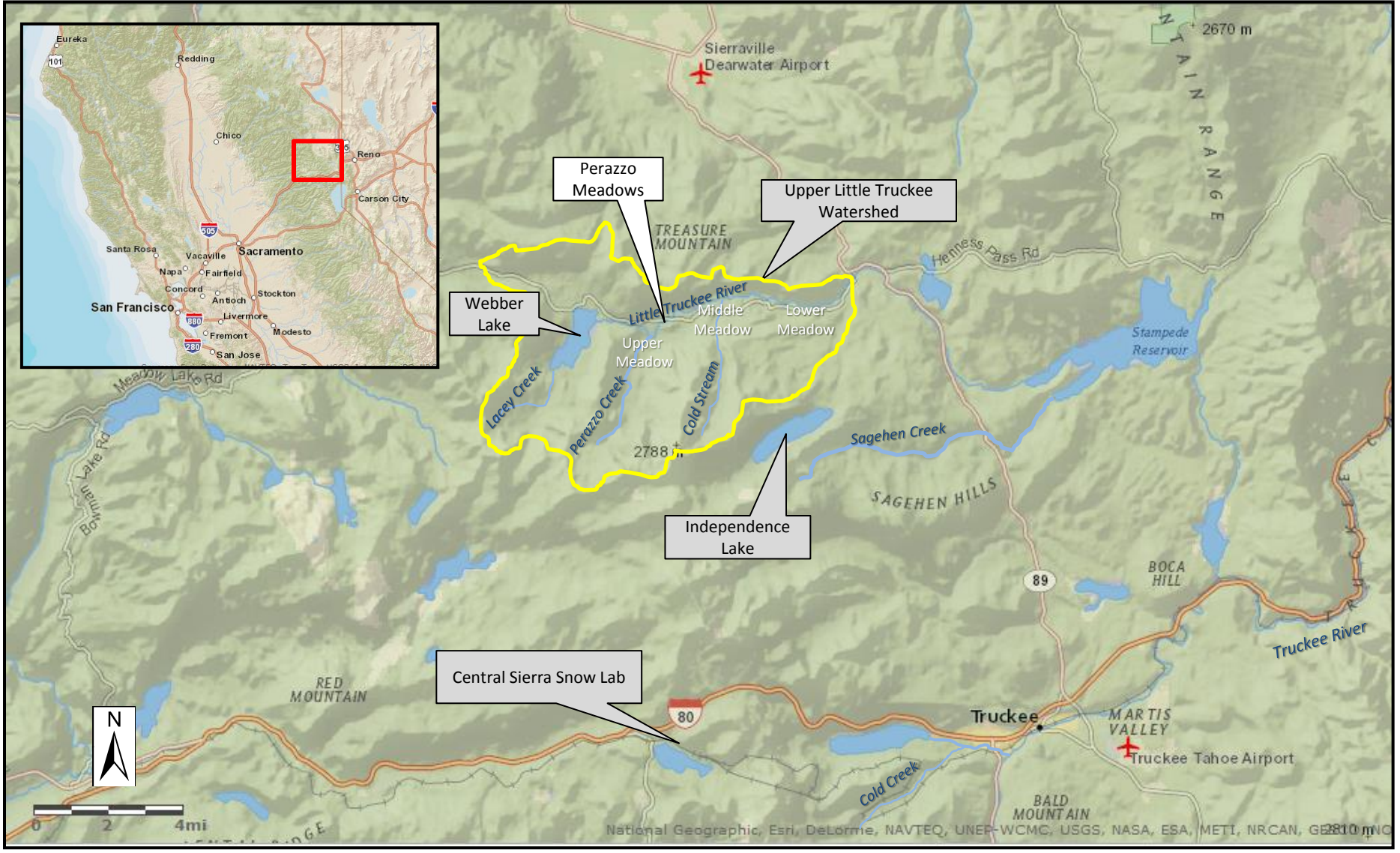

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Figure 1. **Perazzo Meadows, Sierra County, California**
Perazzo Meadows is part of the Upper Little Truckee watershed, in the headwaters of the Truckee River. Other locations discussed in this report are identified on this map.

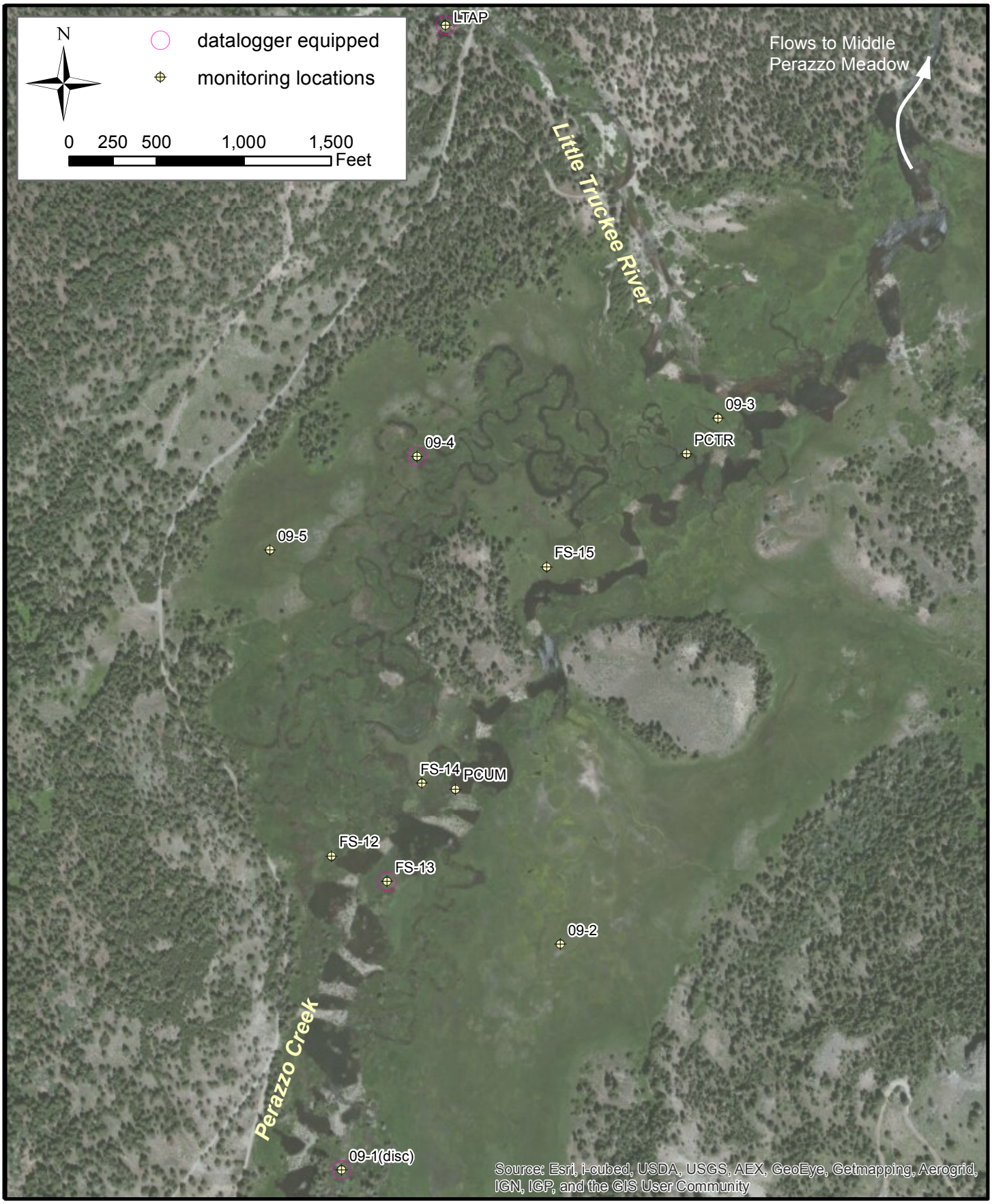

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Figure 2. Location of groundwater and surface water monitoring stations Upper Perazzo Meadow, Sierra County, California

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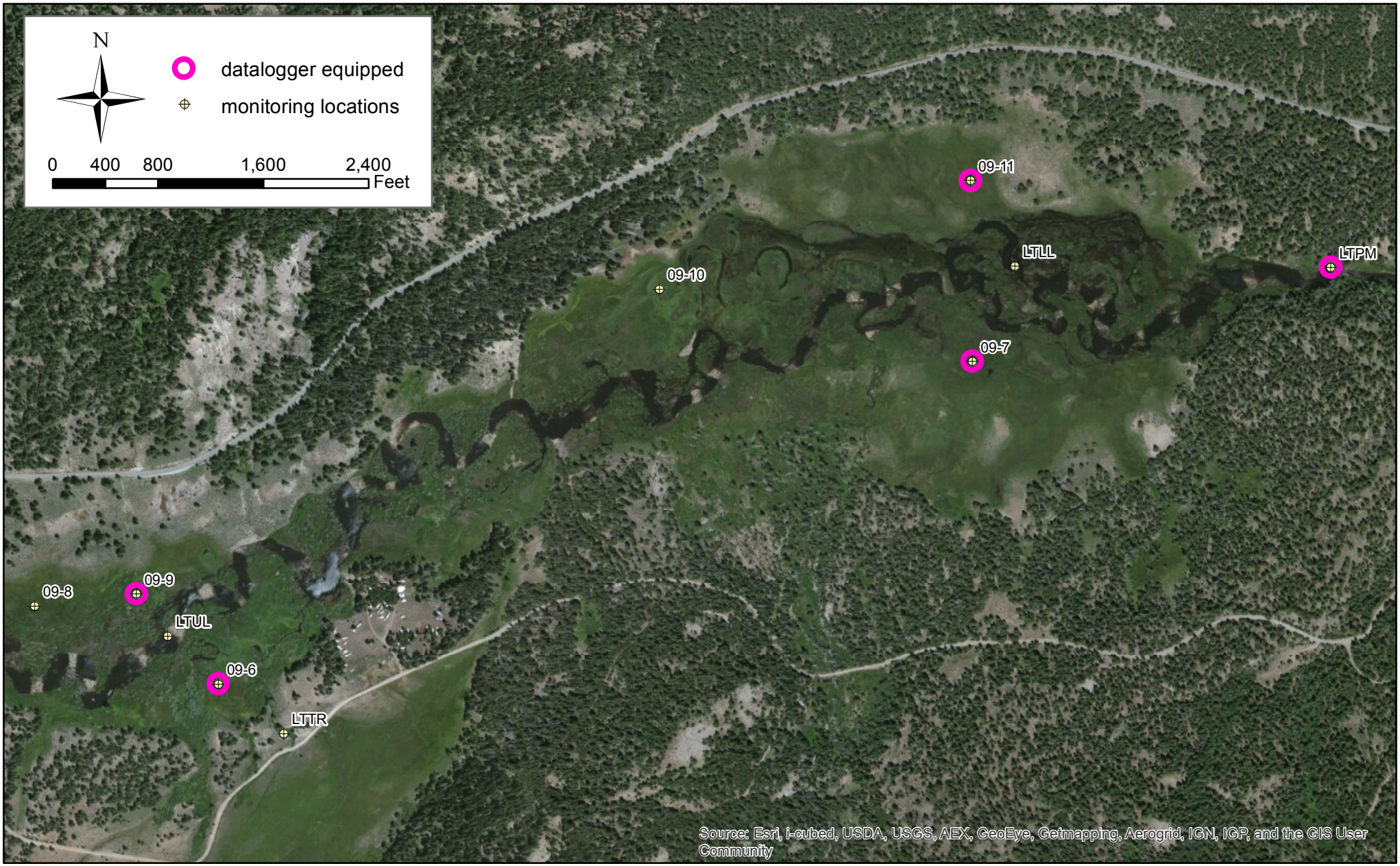

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Figure 3. Groundwater and surface water monitoring stations Middle Perazzo Meadow, Sierra County, California

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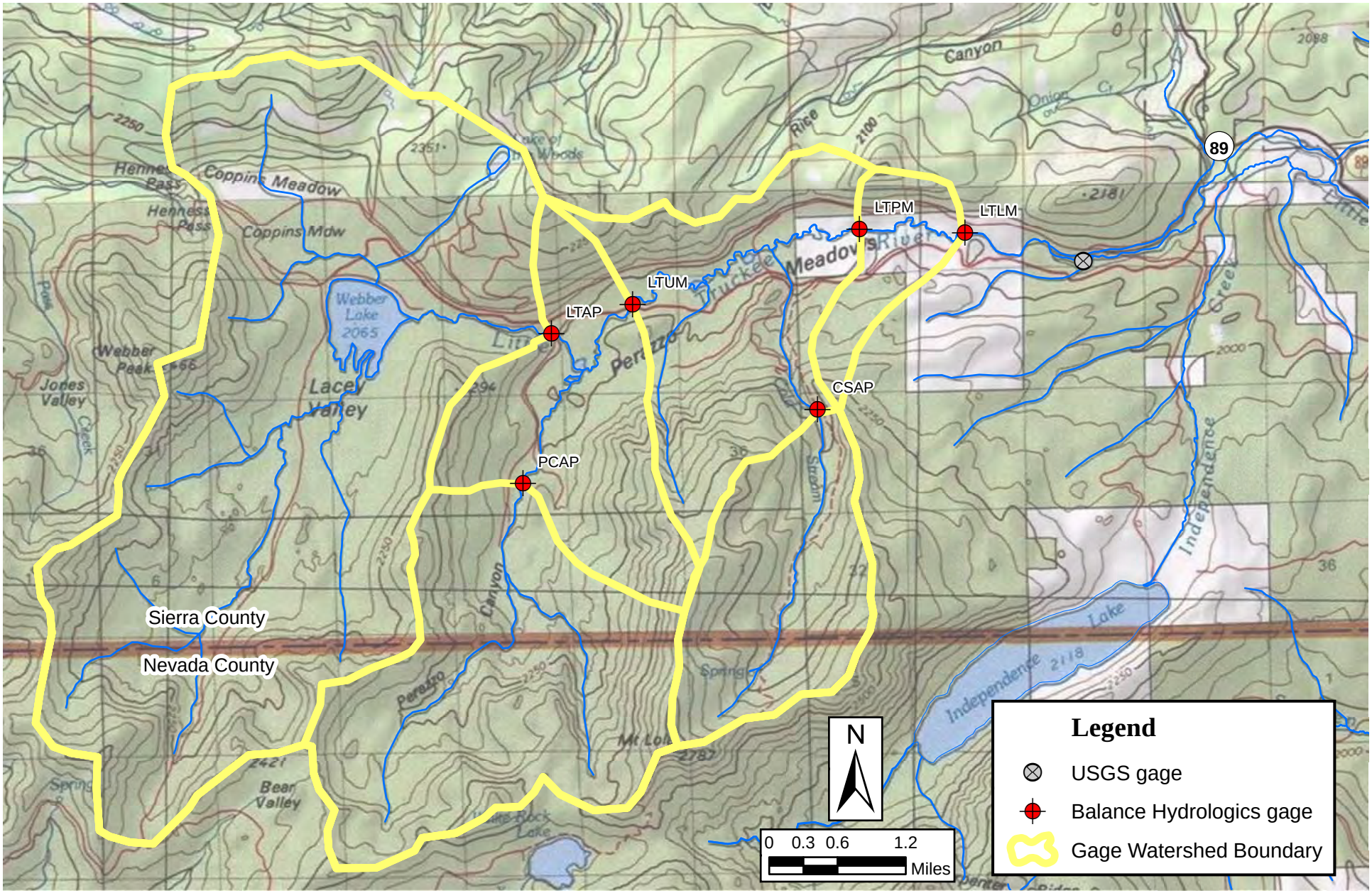

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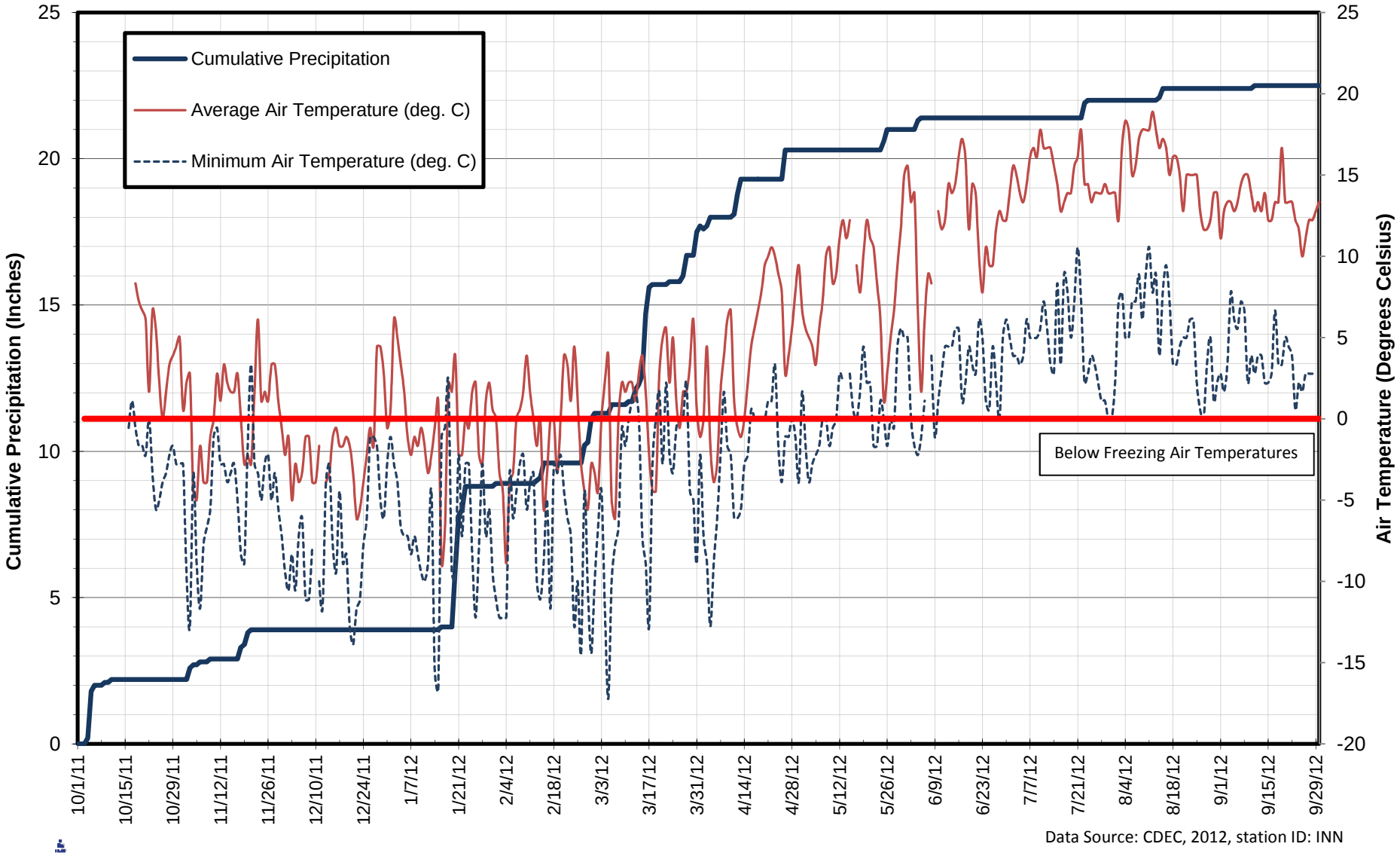
Figure 4. **Stream gaging locations and contributing watersheds, Perazzo Meadows, Sierra and Nevada Counties, California**

209116 streamgage locations.mxd



Data Source: CDEC, 2012, station ID: INN

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Figure 5. **Cumulative precipitation and daily minimum and mean temperatures, Independence Creek, Sierra County, California, Water Year 2012.** Weather station located approximately 3.5 miles southeast of Perazzo Meadows at 6,500 feet elevation.

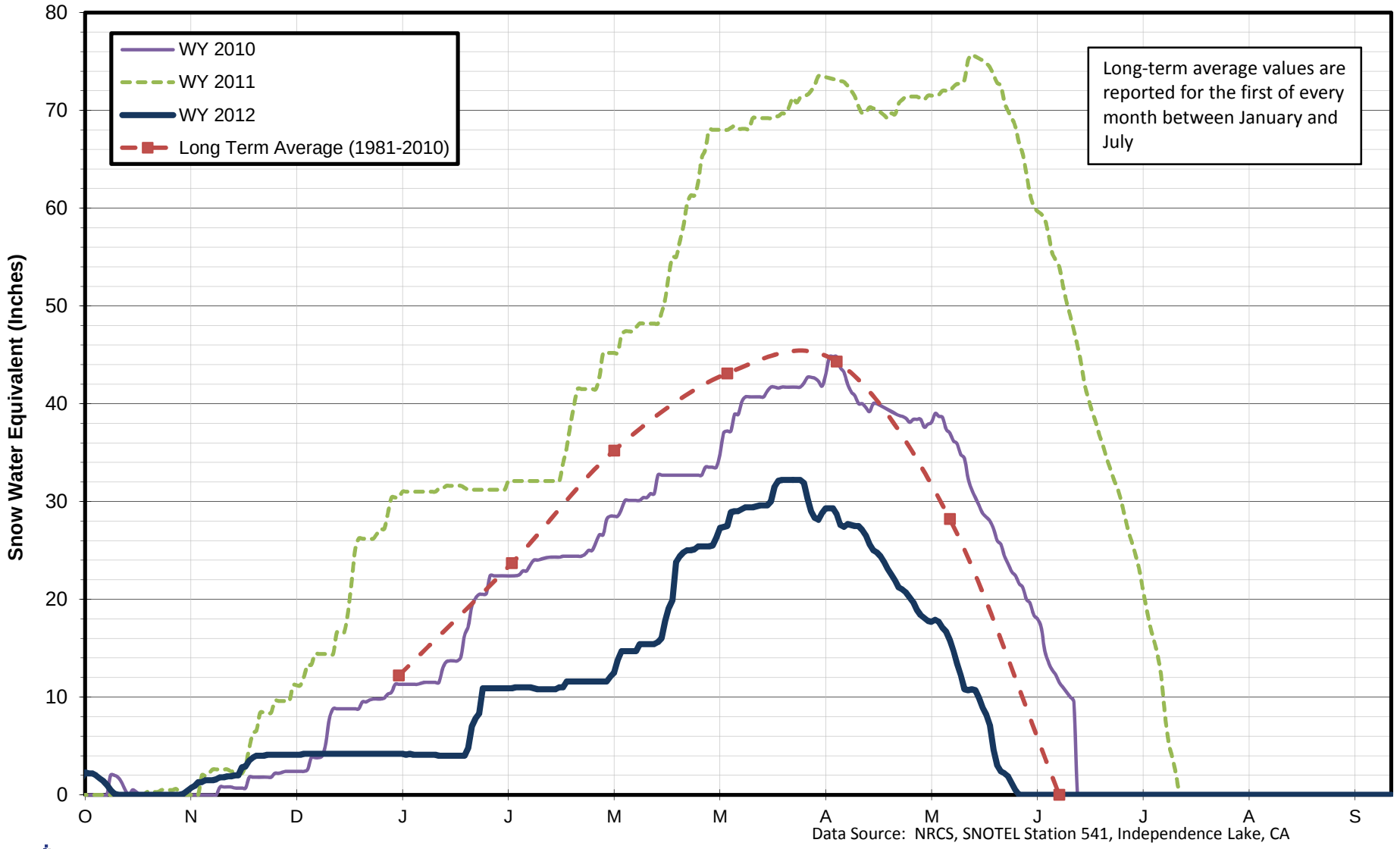

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Figure 6. Snow water equivalent, Independence Lake, Nevada County, California, water years 2010, 2011 and 2012 as compared to long-term average. SNOTEL station is located approximately 3.5 miles south-southwest of Perazzo Meadows at 8,352 feet elevation. WY2010 was average, WY2011 was wet, while WY2012 was dry.

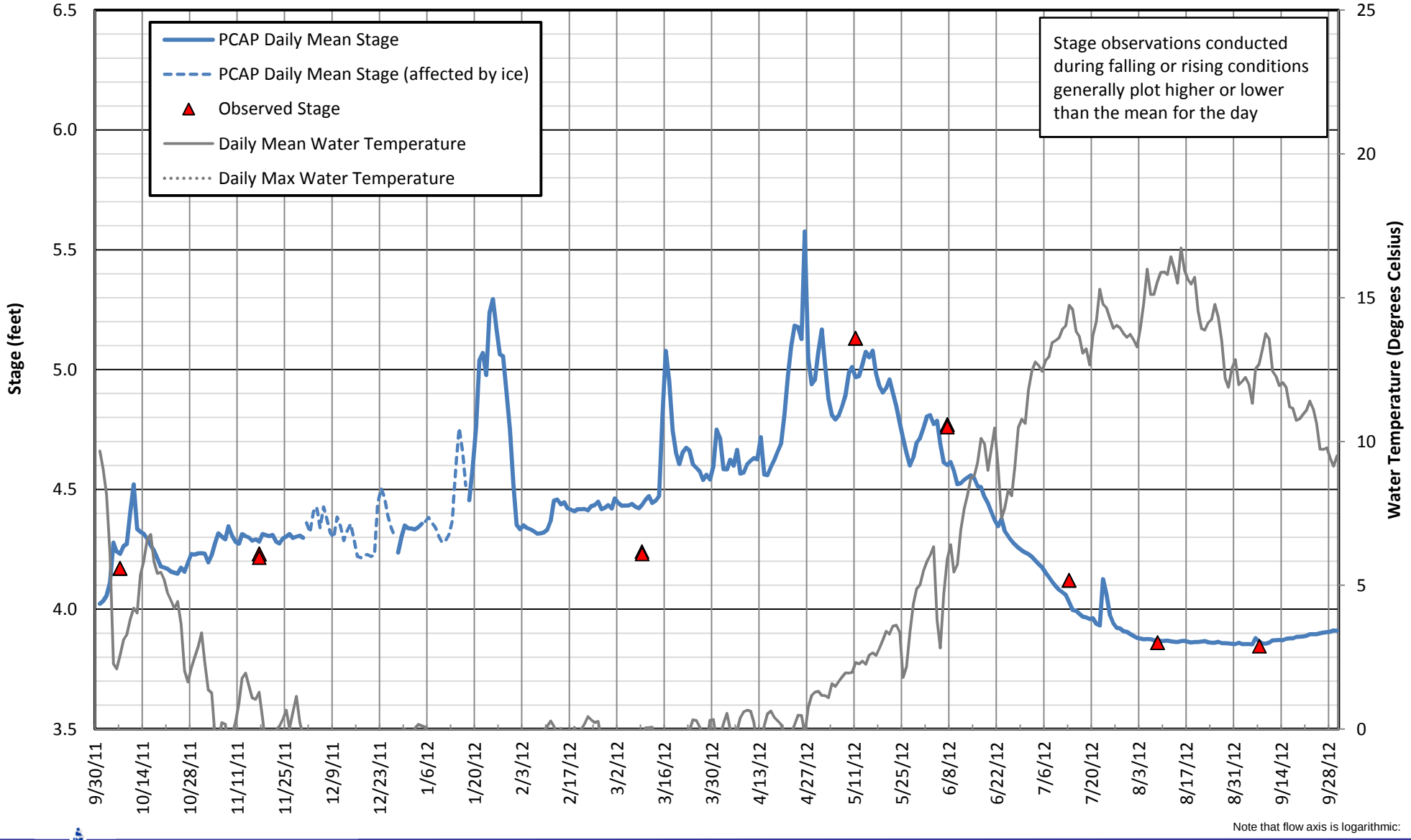

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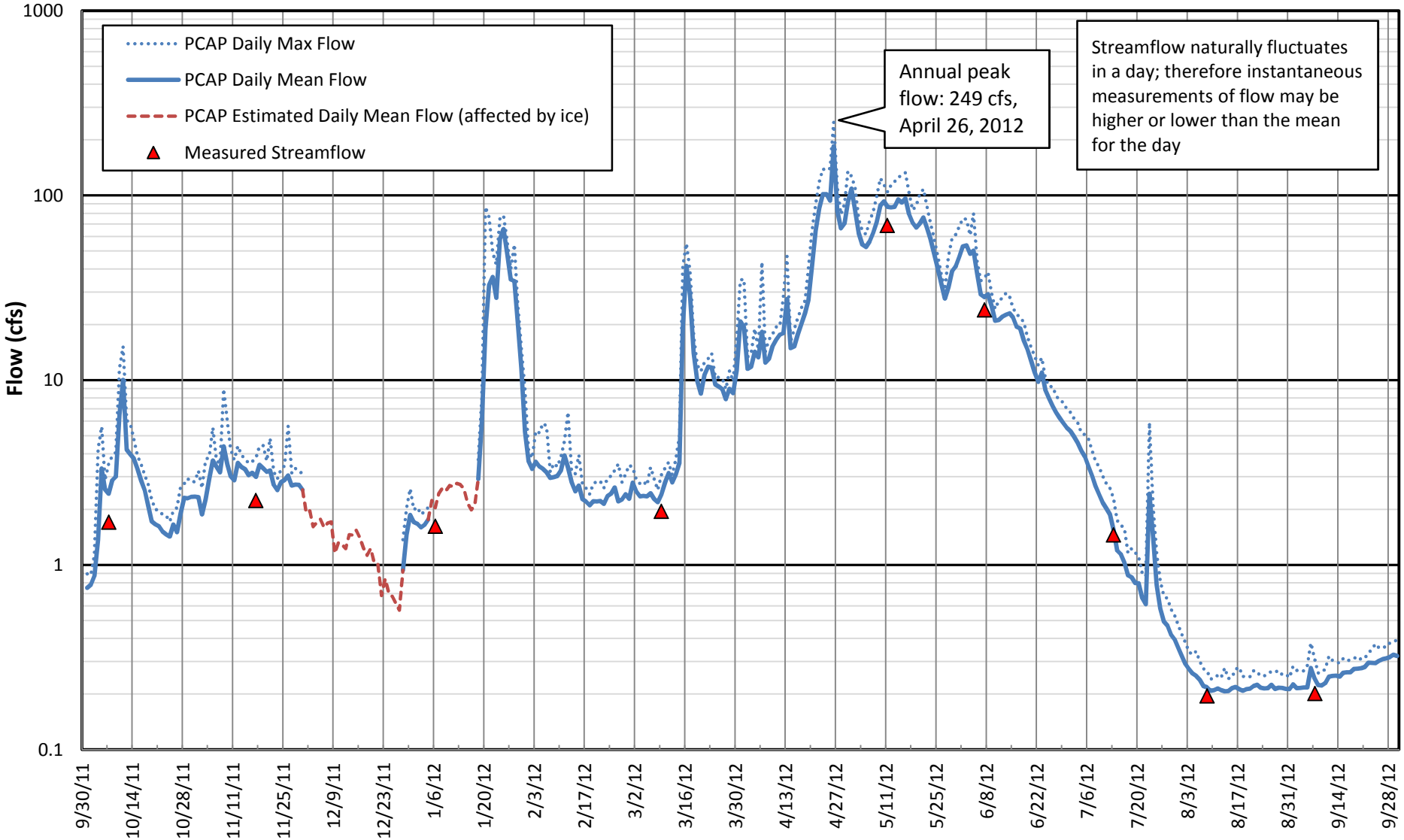
Figure 7. Daily stage and water temperature, Perazzo Creek above Perazzo Meadows (PCAP), Sierra County, California, water year 2012.

"Stage" is read on the staff plate at the gaging station and represents a relative water level in the creek, set to an arbitrary datum. It does not represent the depth of water from the creek bed.



Note that flow axis is logarithmic:

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Figure 8. Daily flow hydrograph, Perazzo Creek above Perazzo Meadows (PCAP), Sierra County, California, water year 2012.

Periods of streamflow affected by ice were estimated using correlation with Cold Creek near Truckee, California.

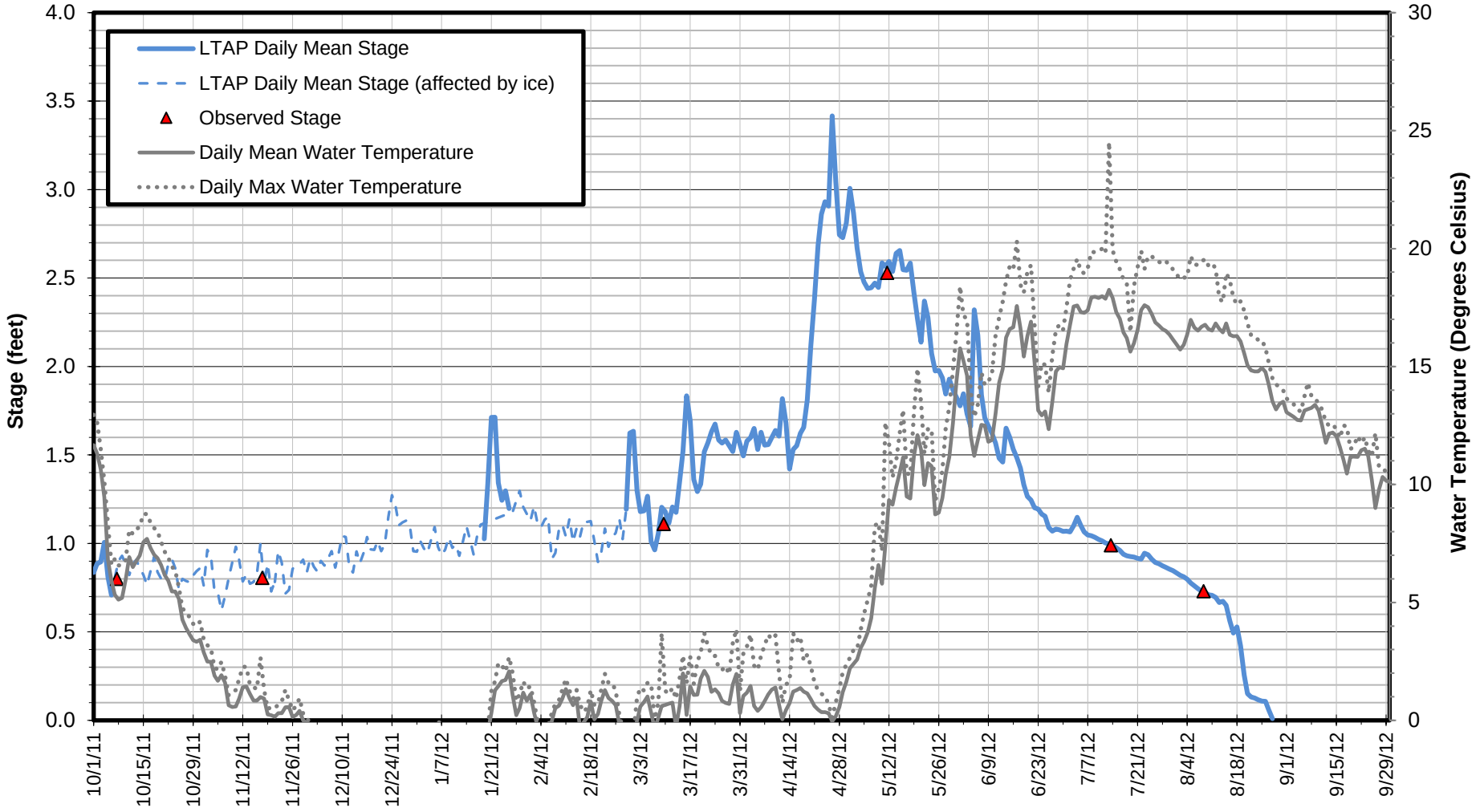

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Figure 9. **Daily stage and water temperature: Little Truckee River above Perazzo Meadows (LTAP), Sierra County, California, water year 2012.** Ice affected periods were apparent during the months of November through February.

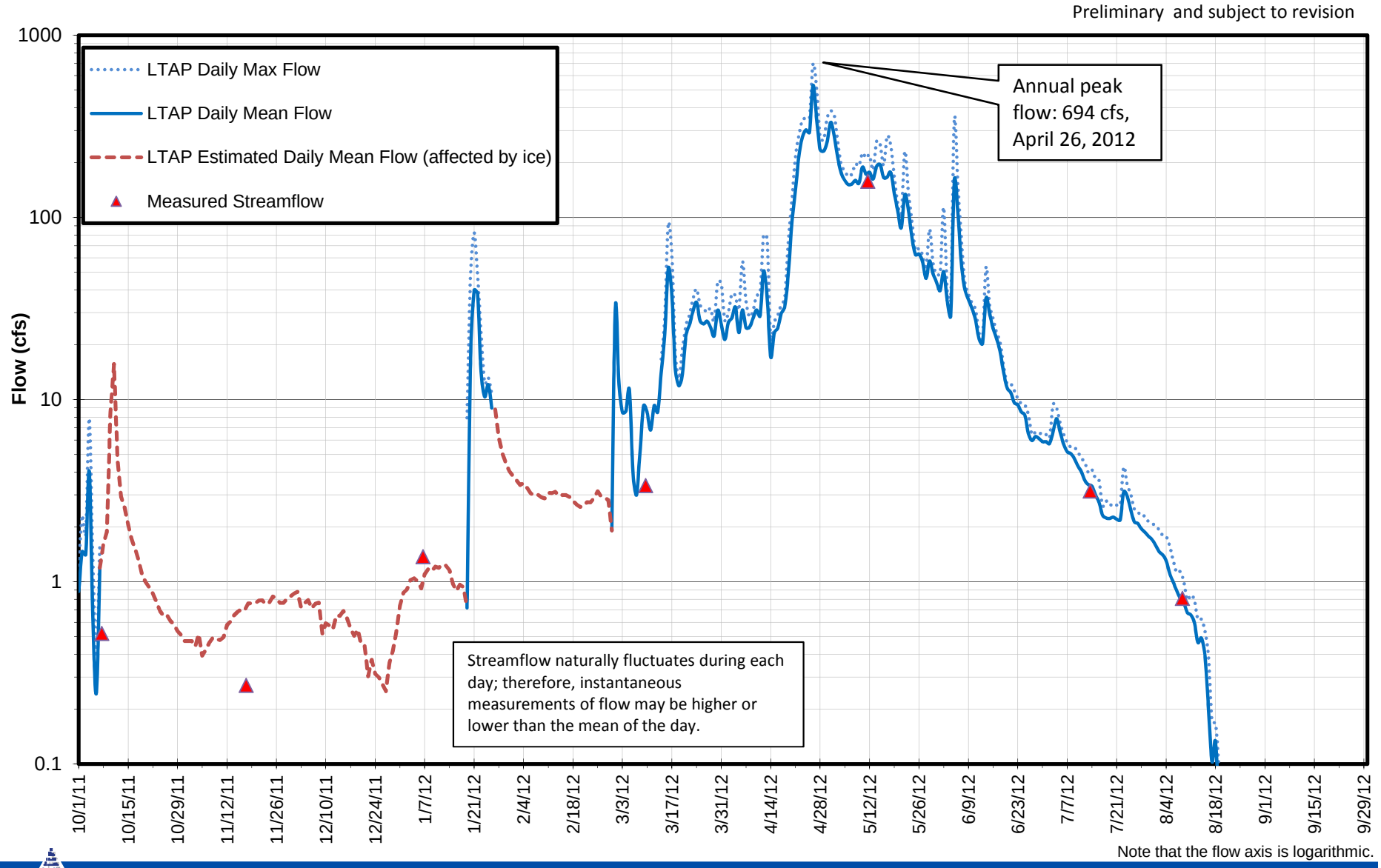

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Figure 10. Daily flow hydrograph, Little Truckee River above Perazzo Meadows (LTAP), Sierra County, California, water year 2012. Period of streamflow affected by ice were estimated using correlation with Cold Creek near Truckee, California. Data suggest that streamflow ceased between August 20-23. 2012.

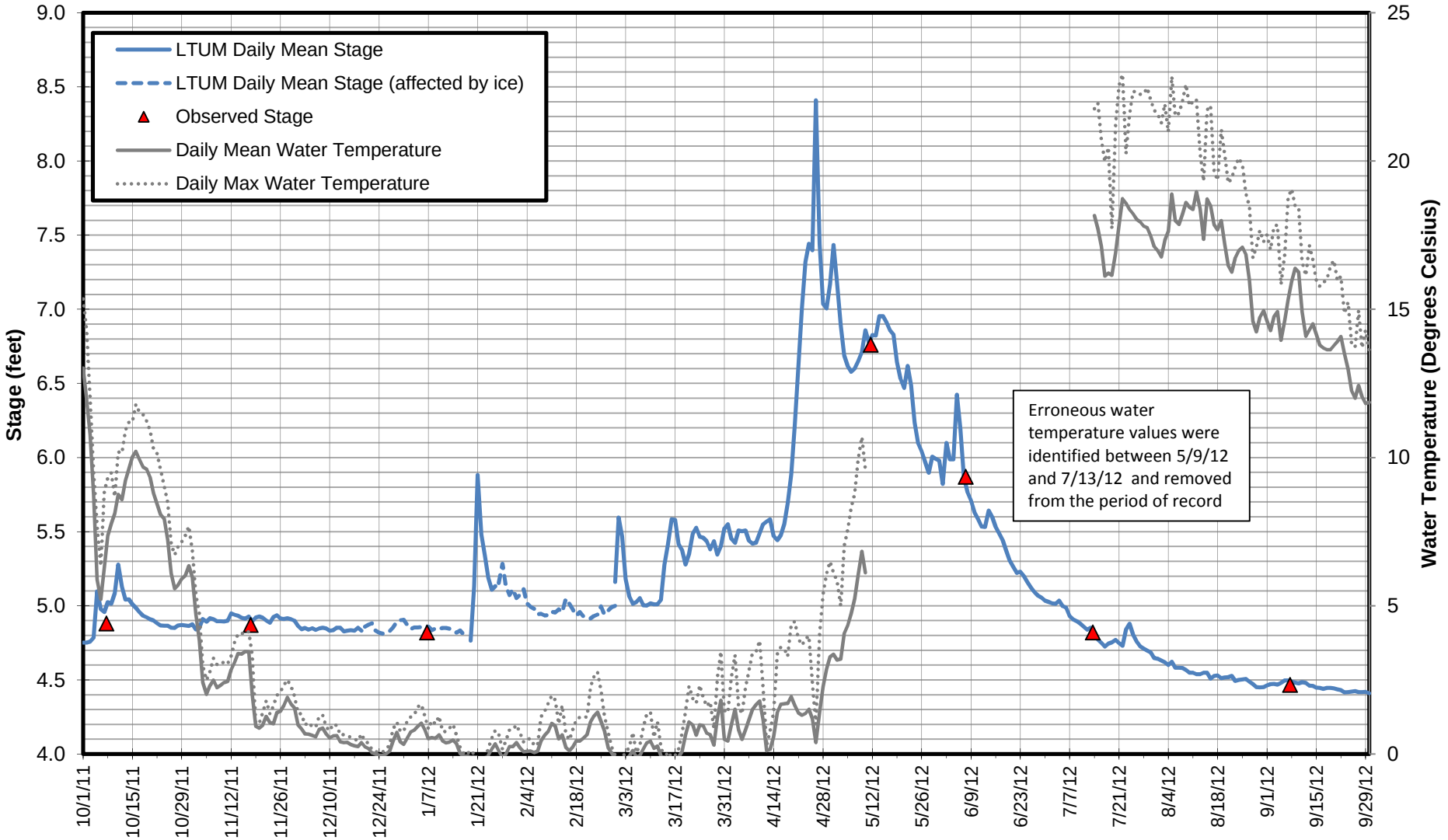

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Figure 11. Daily stage and water temperature, Little Truckee River, below Upper Perazzo Meadows (LTUM), Sierra County, California, water year 2012.

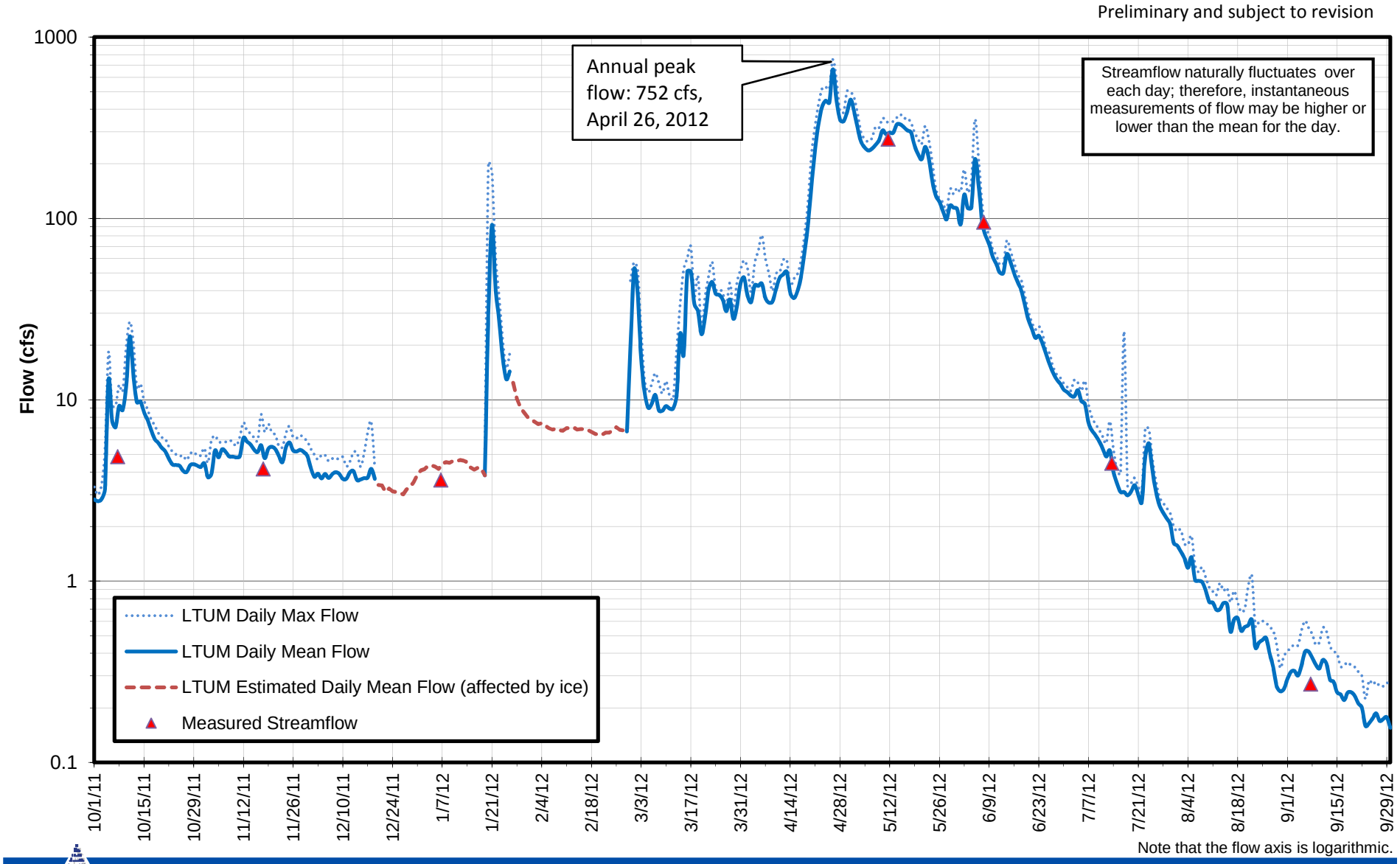

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Figure 12. **Daily flow hydrograph, Little Truckee River, below Upper Perazzo Meadow (LTUM), Sierra County, California, water year 2012.** Peak flow of 752 cfs occurred on April 26, 2012, concident with peak snowmelt. Periods of streamflow affected by ice were estimated using correlation with Cold Creek near Truckee, California.

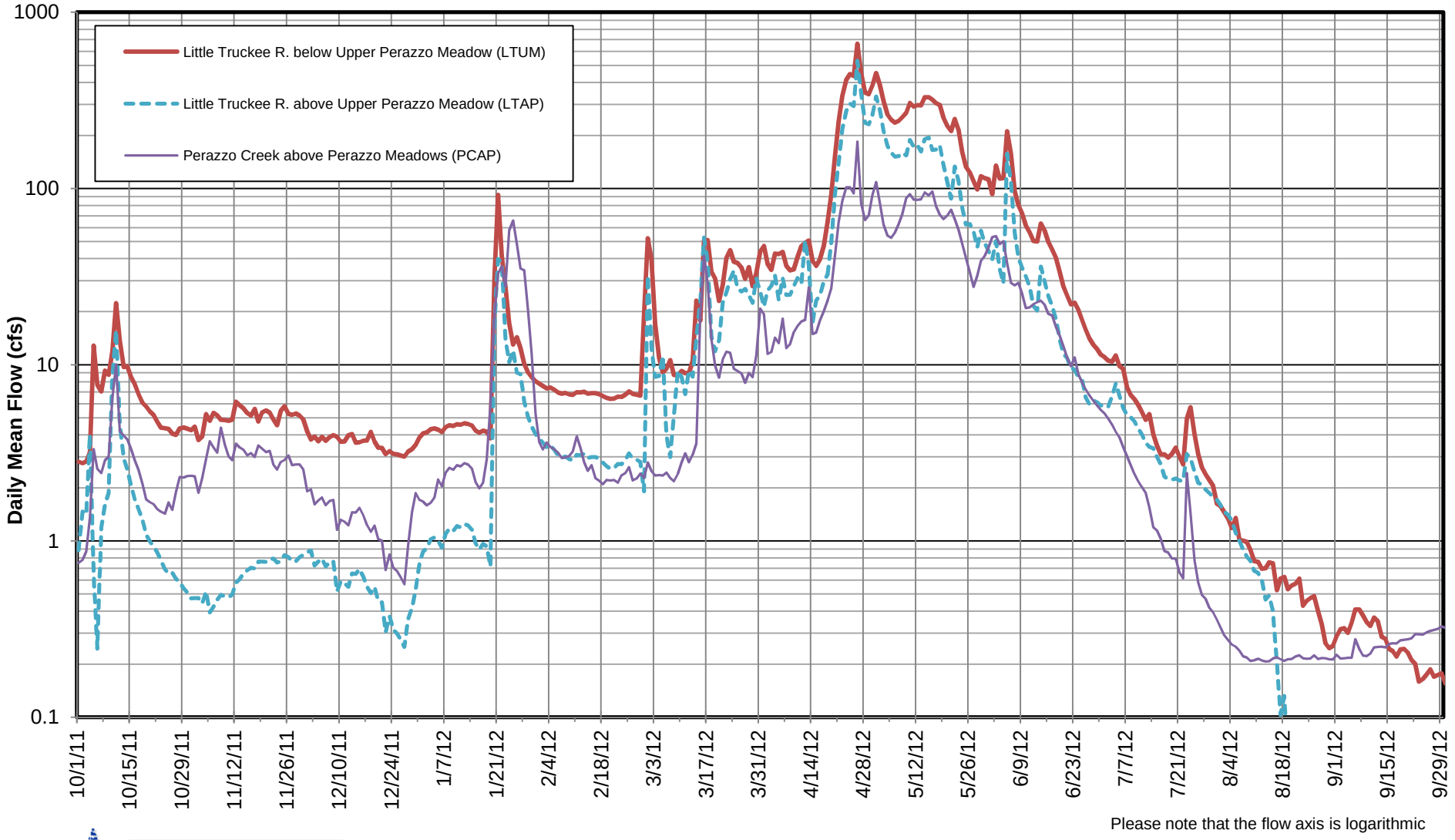

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Figure 13. **Daily flow hydrograph, Little Truckee River and Perazzo Creek, Upper Perazzo Meadow: Inflow and Outflow, Sierra County, California, water year 2012.** Perazzo Creek is a spring-fed tributary and provided perennial flow to the Upper Meadow in a dry year when the Little Truckee River ceased to flow by mid-late summer. The Little Truckee River, above Perazzo Creek, is also regulated.

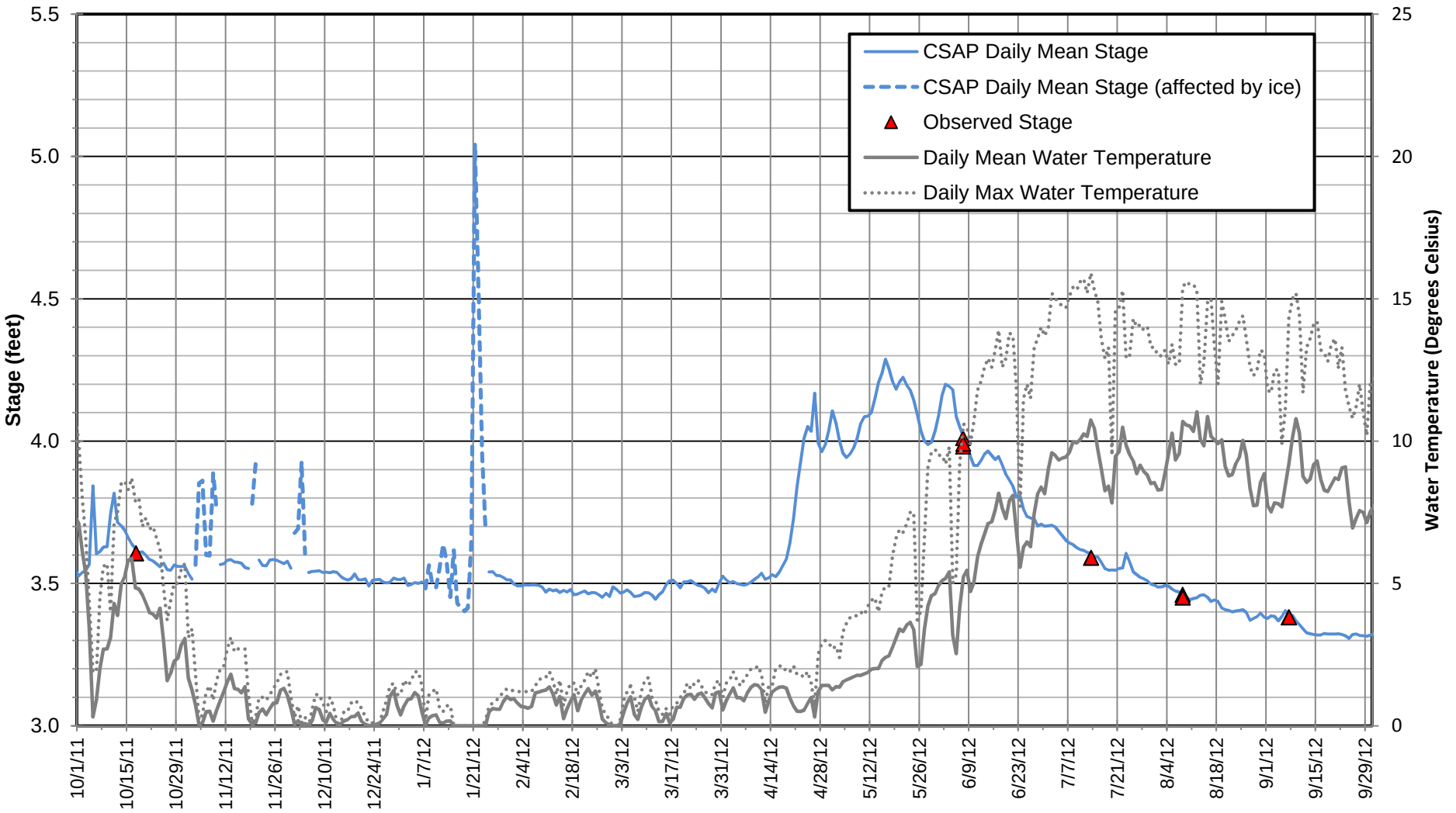

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Figure 14. Daily stage and water temperature, Cold Stream above Perazzo Meadows (CSAP), Sierra County, California, water year 2012

Ice jam during the January 20-21, 2012 rain-on-snow event likely attributed to a super-elevated stage reading.

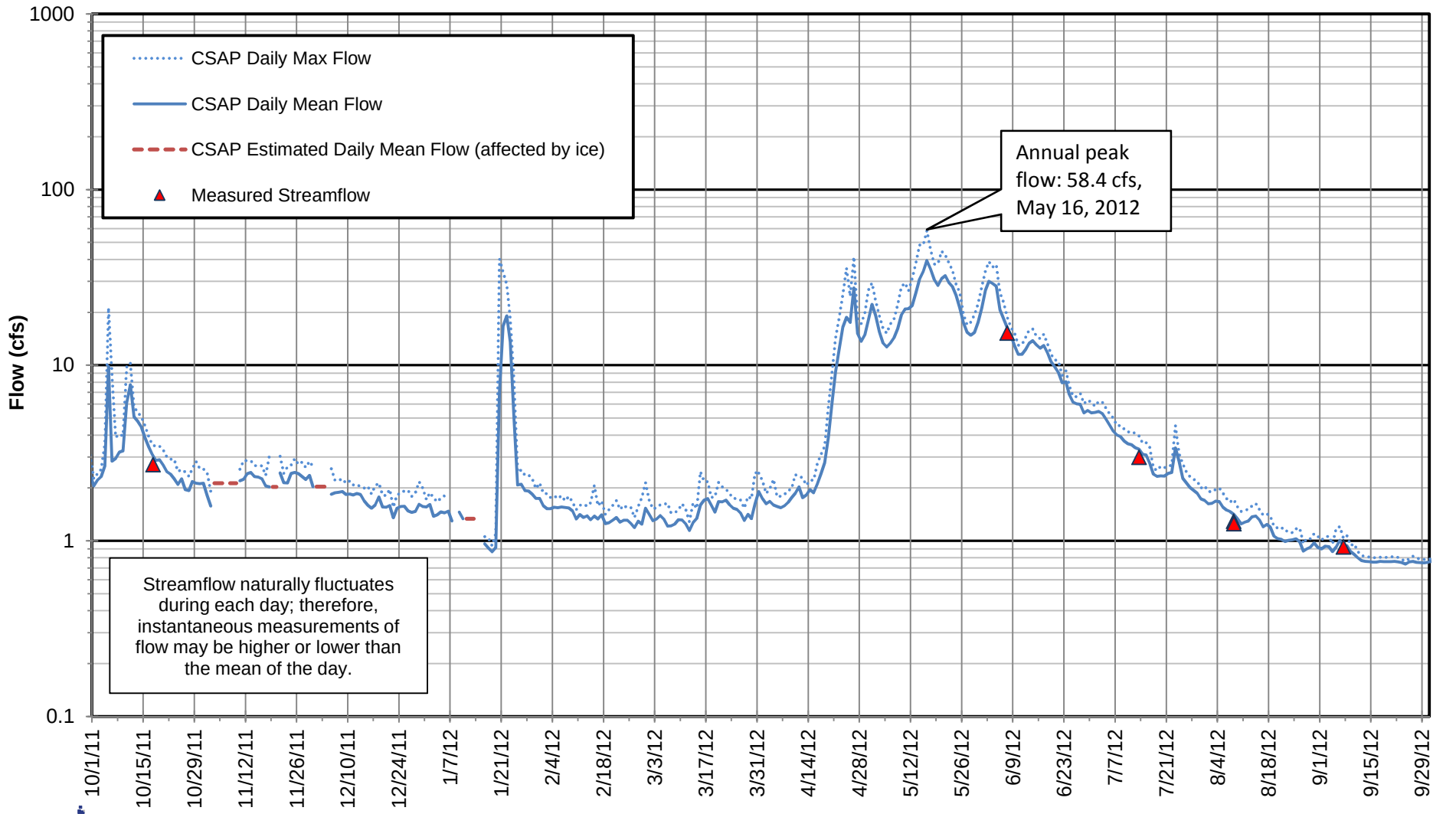

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Figure 15. Daily flow hydrograph, Cold Stream above Perazzo Meadows (CSAP) , Sierra County, California, water year 2012.

The annual peak flow of 58.4 cfs occurred on May 16, 2012 occurred more than two weeks after the annual peak flow was observed at other Perazzo Meadows stations, and is likley attributed to the station's higher elevation and greater snowpack.

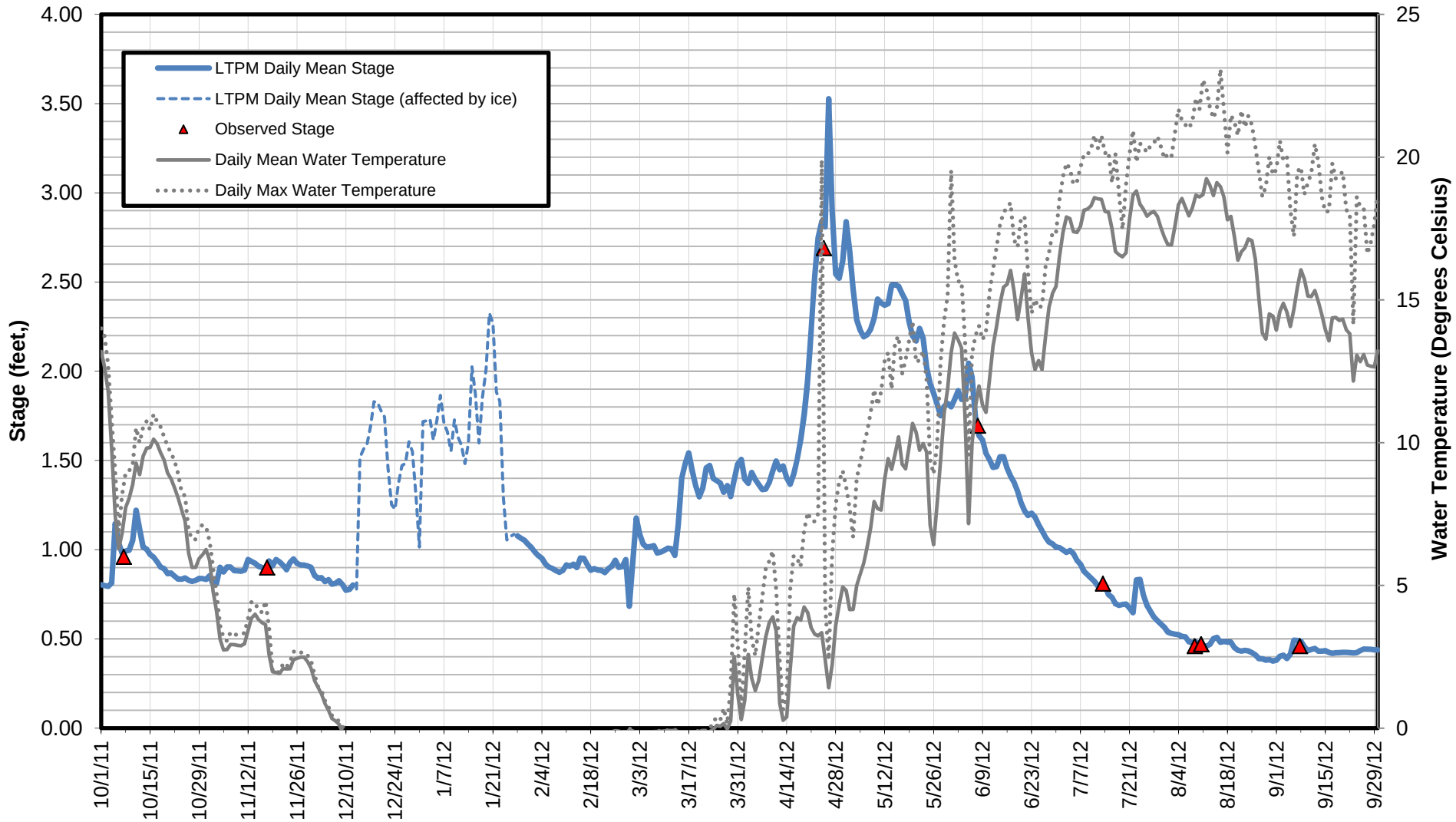

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Figure 16. **Daily stage and water temperature, Little Truckee River below Middle Perazzo Meadow (LTPM), Sierra County, California, water year 2012.**

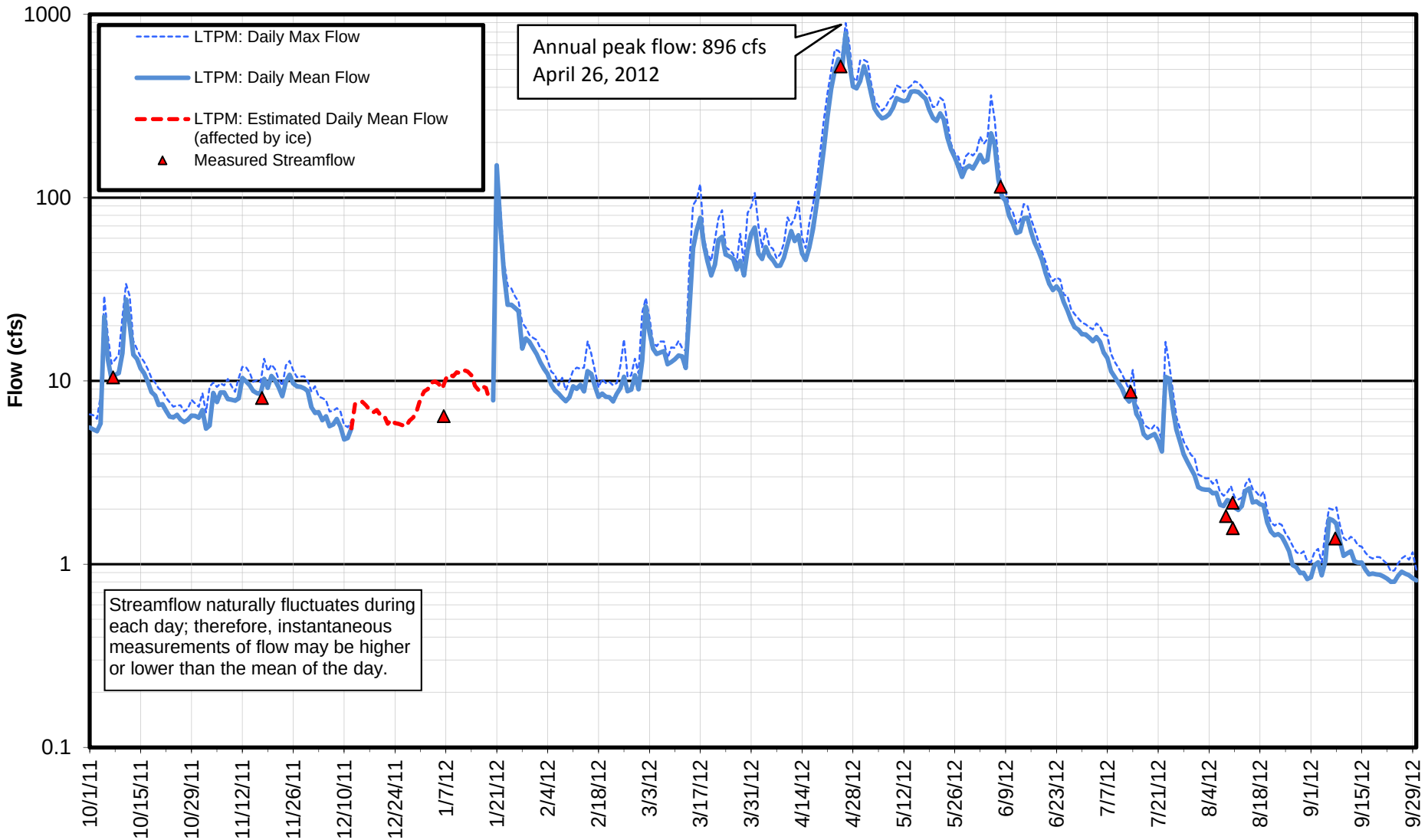

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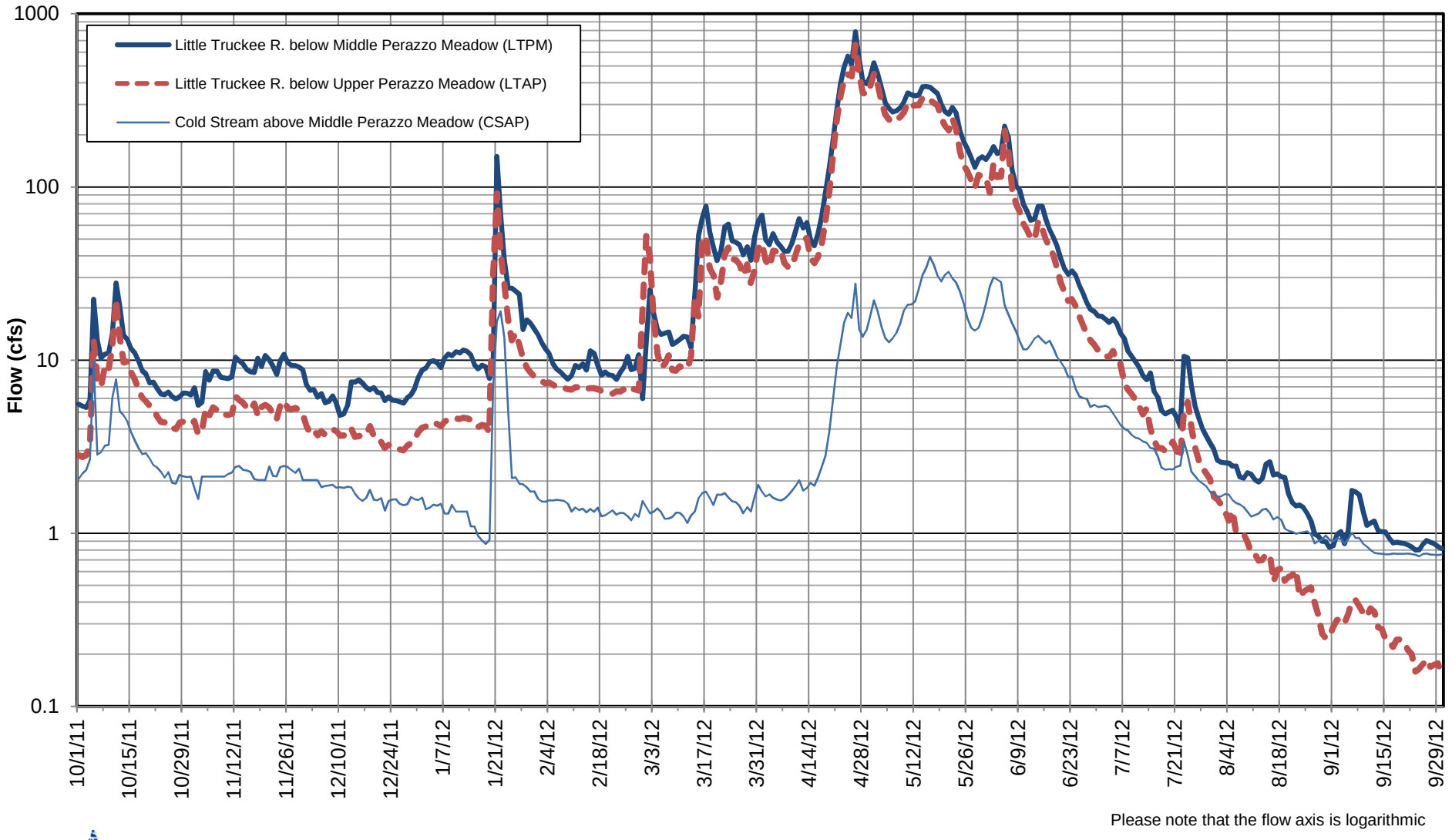
Figure 17. Daily flow hydrograph, Little Truckee River at Middle Perazzo Meadow outlet (LTPM), Sierra County, California, water year 2012. Annual peak flow of 896 cfs, coincident with peak snowmelt runoff, occurred on April 26, 2012.

209116 LTPM_DailyQ_WY12,Q_daily



Please note that the flow axis is logarithmic

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Figure 18. **Daily flow hydrographs, Little Truckee River, Middle Perazzo Meadow : Inflow and Outflow, Sierra County, California, water year 2012.** LTPM includes streamflows from LTUM and CSAP and an ungaged area of 4.2 square miles. Cold Stream provides a perennial source of hydrologic support to Middle and Lower Meadows

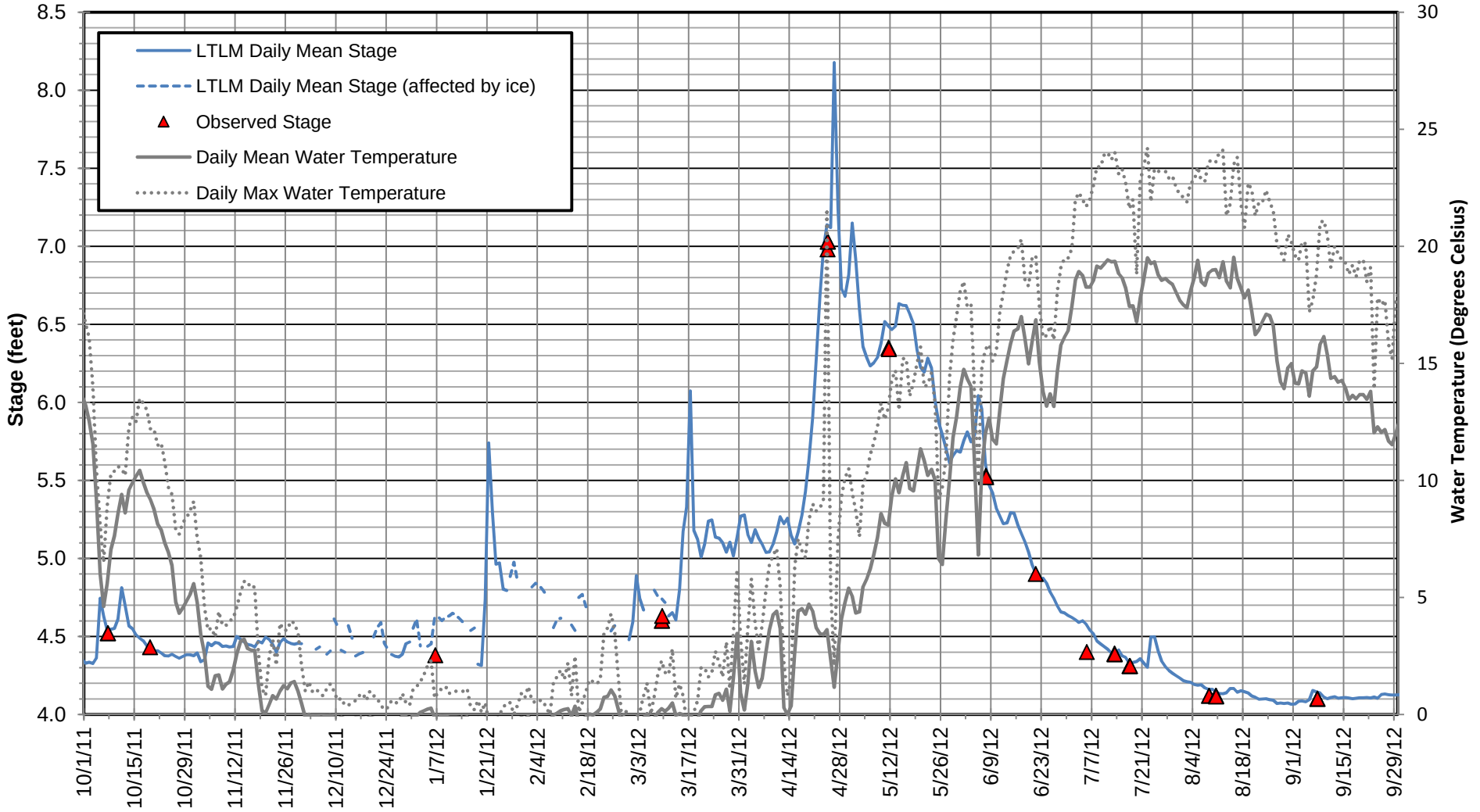

Figure 19. Daily stage and water temperature, Little Truckee River below Lower Perazzo Meadow , Sierra County, California, water year 2012

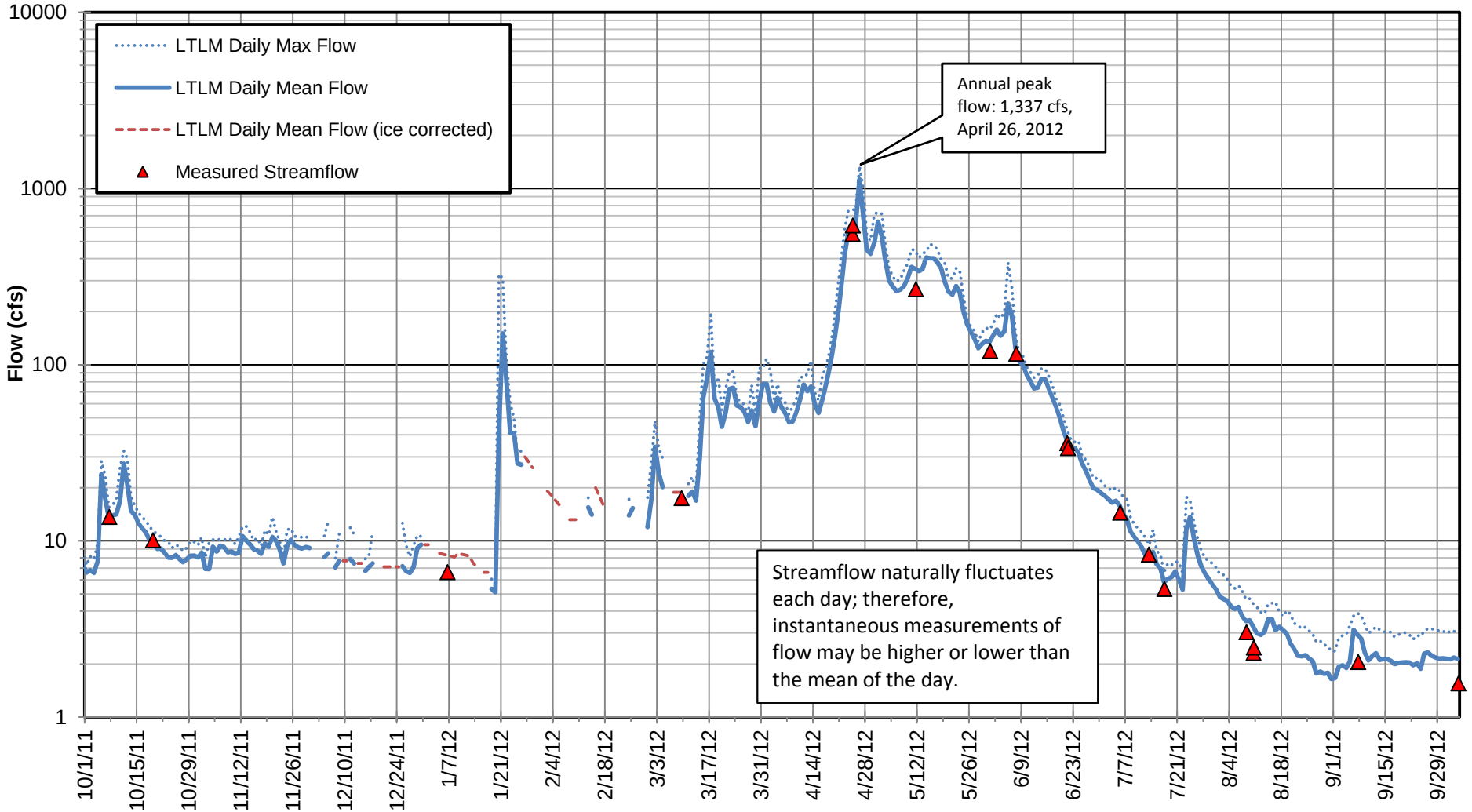

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Figure 20. Daily flow hydrograph, Little Truckee River below Lower Perazzo Meadow, Sierra County, California, water year 2012

Annual peak flow of 1,337 cfs occurred on April 26, 2012, coincident with peak snowmelt.

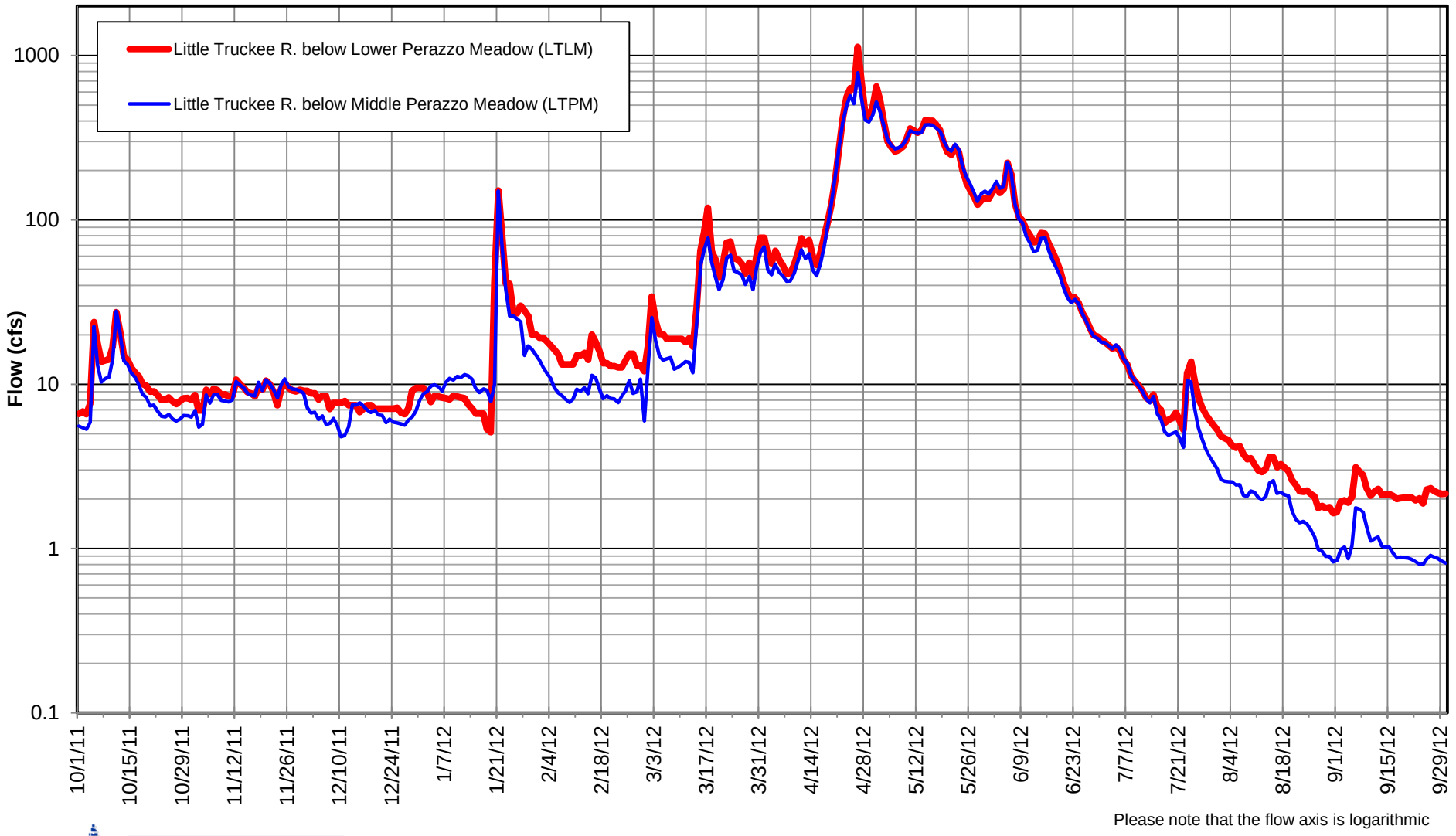

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Figure 21. **Daily flow hydrographs, Little Truckee River, Lower Perazzo Meadow : Inflow and Outflow, Sierra County, California, water year 2012.** Increases in flow below the Lower meadow can mostly be attributed to contributions from Cold Stream and an ungaged area of 1.4 square miles.

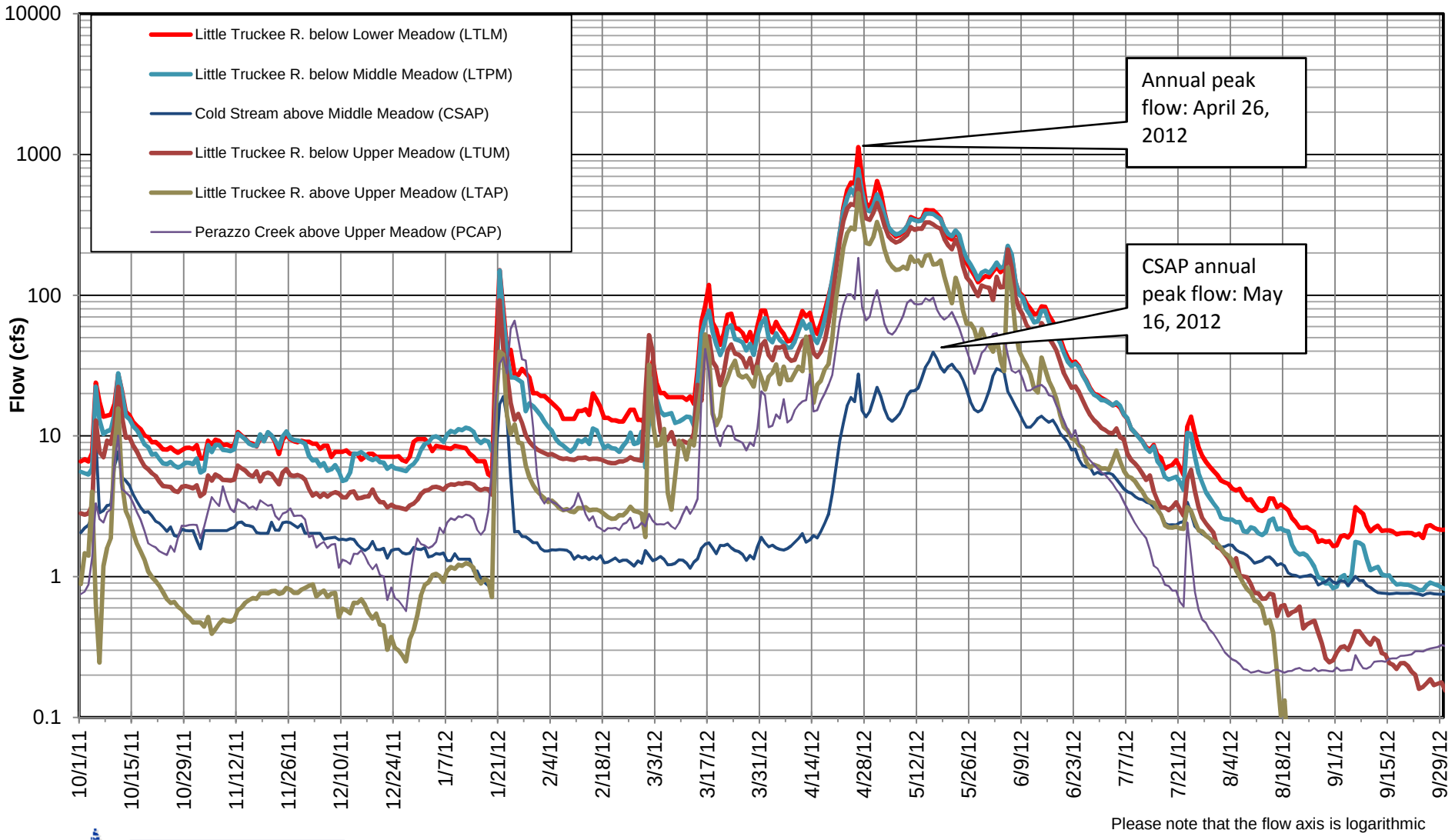

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Figure 22. **Flow hydrographs for all stations, Perazzo Meadows, Sierra County, California, water year 2012.** In general, all stations exhibited similar timing for peak flows. Daily streamflow was greatly reduced at the end of the water year when compared to the beginning of the water year for all stations.

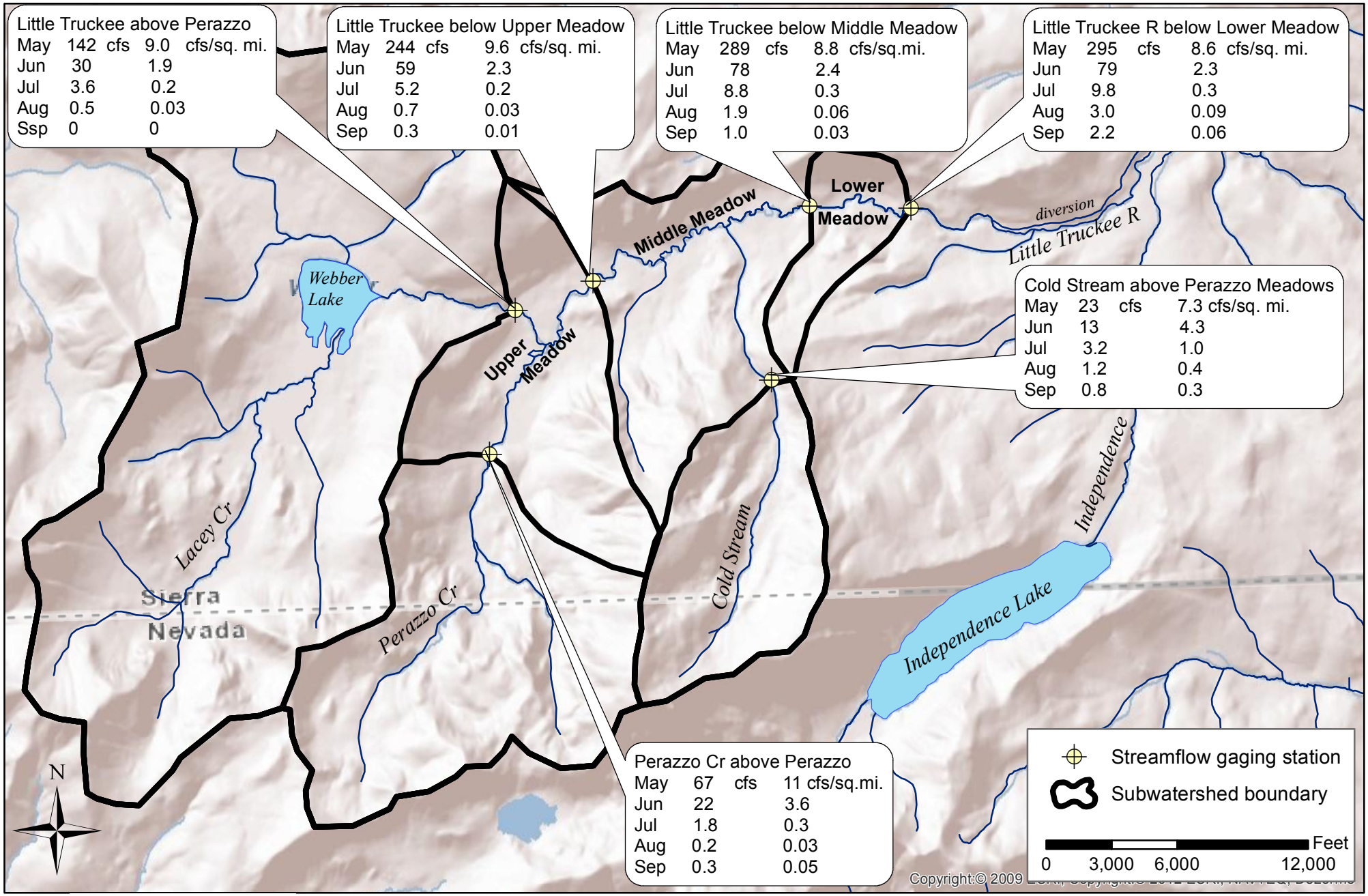

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Figure 23. Spring and Summer 2012 monthly streamflow Perazzo Meadows, Sierra County, California

W:\Projects\209116\209116 Gage Summary map.mxd

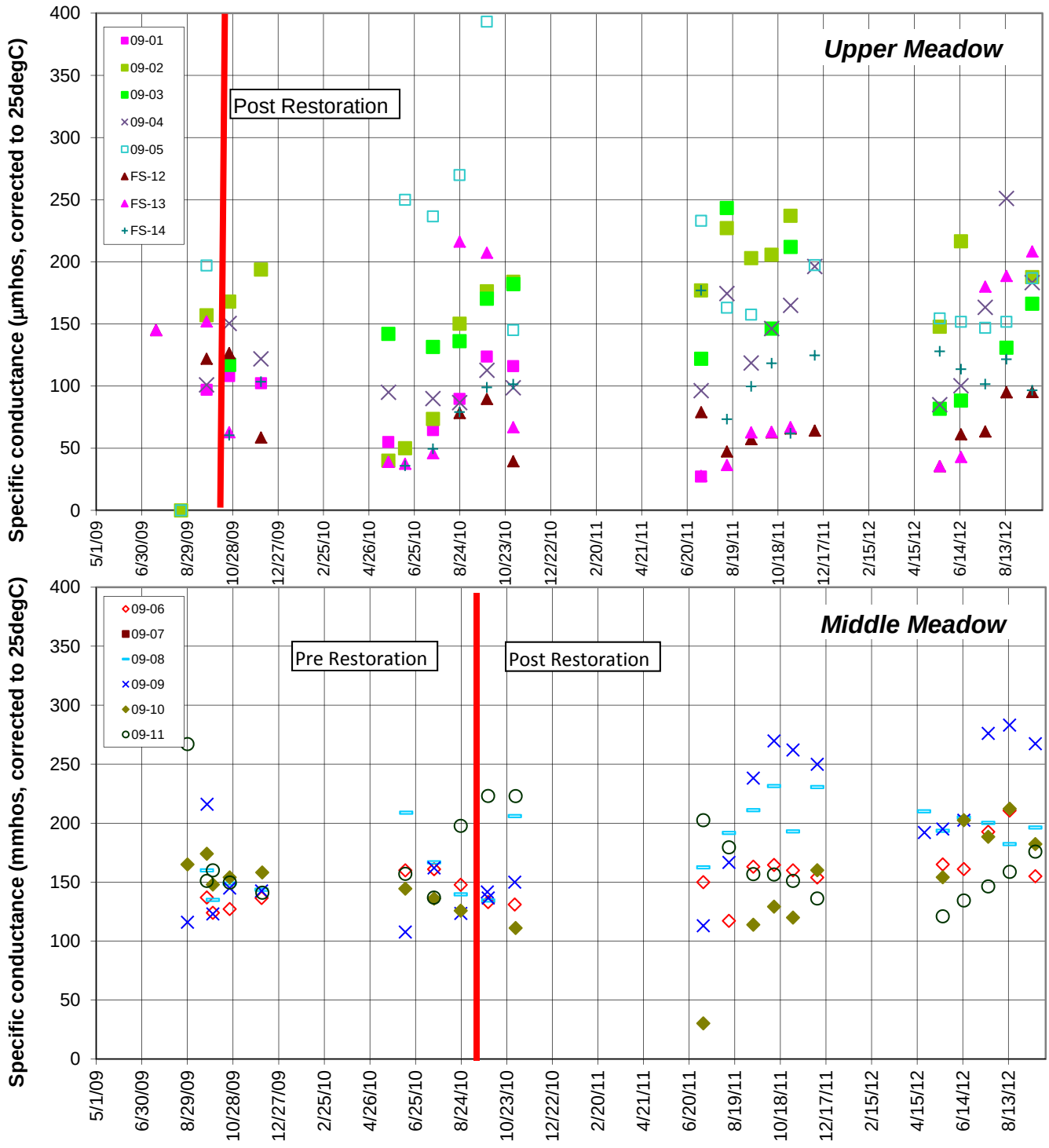

Figure 24. **Specific conductance of groundwater, Upper and Middle Perazzo Meadows, Sierra County, California, June 2009-September 2012**
In general, we observed similar or a wider range of SC values relative to previous years. See Figures 2 and 3 for piezometer locations.

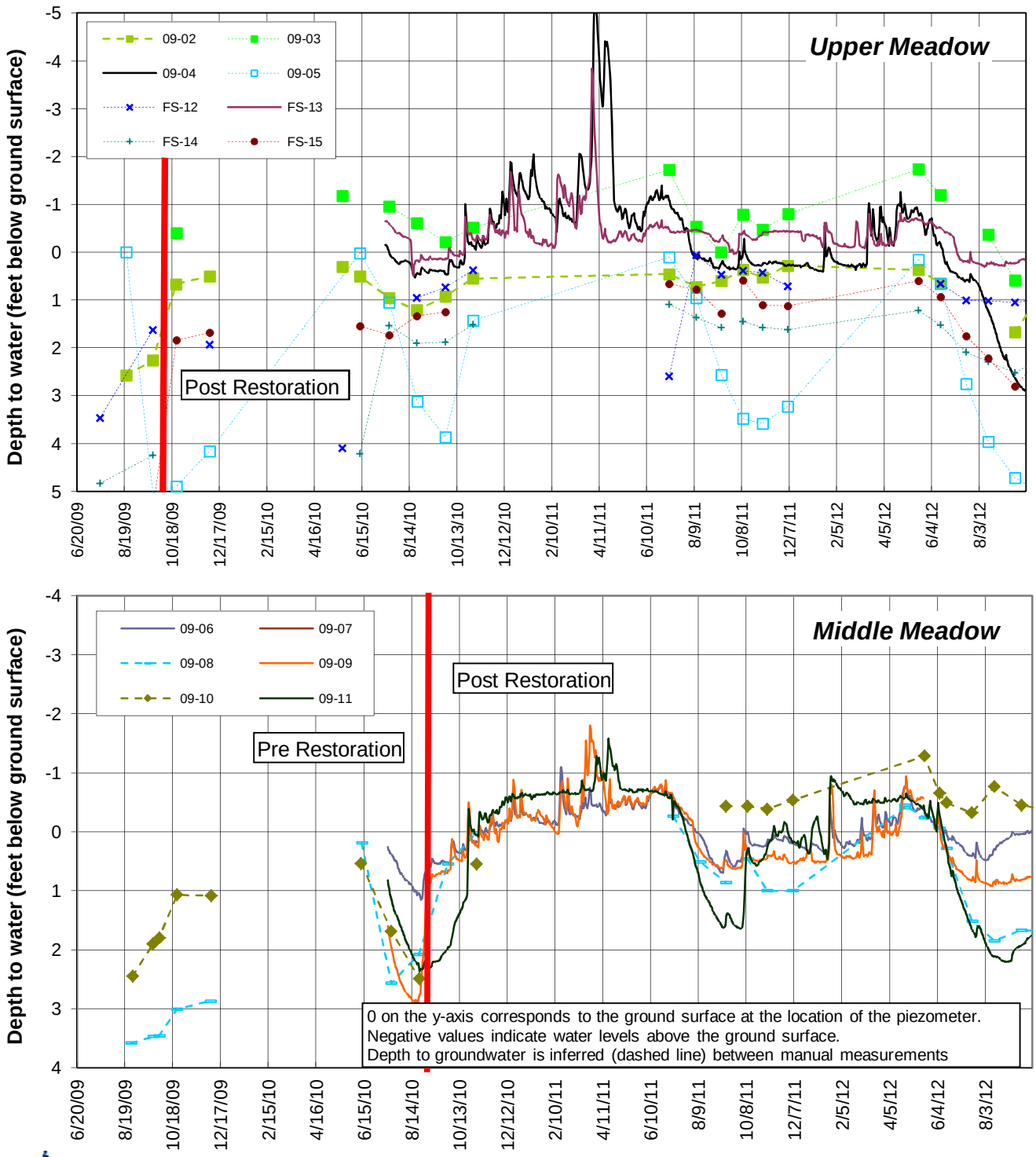

Figure 25. Depth to groundwater for the monitoring period, Upper and Middle Perazzo Meadows, Sierra County, California, June 2009 - September 2012. In a below average year (WY2012), we observed a range of groundwater levels in both the Upper and Middle restored meadows. Groundwater levels fluctuated between 1 and 5 feet post restoration; See Figures 2 and 3 for piezometer locations.

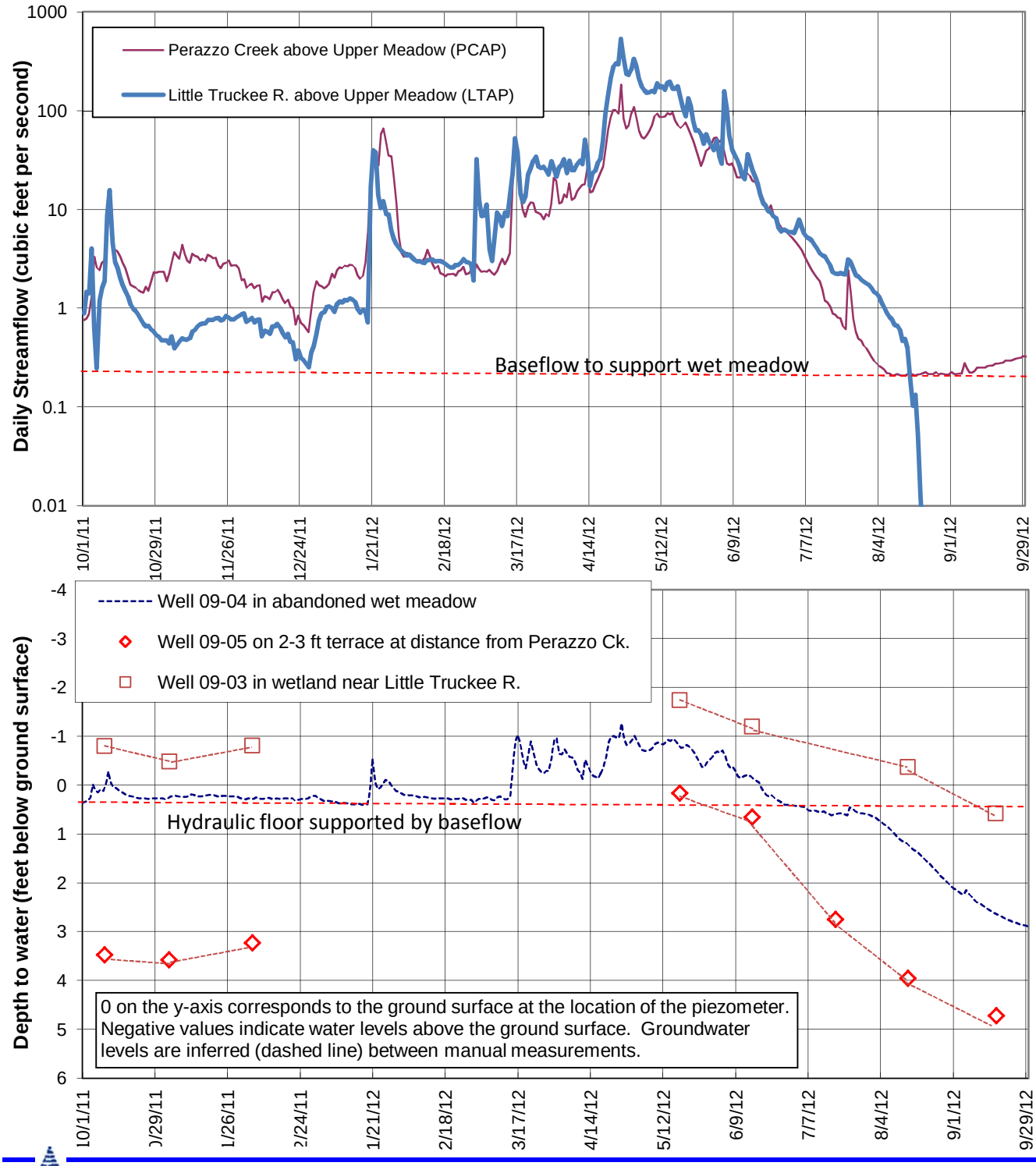

Figure 26. **Groundwater levels and adjacent streamflow recession, Upper Perazzo Meadow, Sierra County, California, water year 2012**

In line with below normal precipitation and snowpack conditions, streamflow and groundwater levels receded to lower levels by the end of WY2012. See Figure 2 for piezometer locations and Figure 4 for streamgage locations.

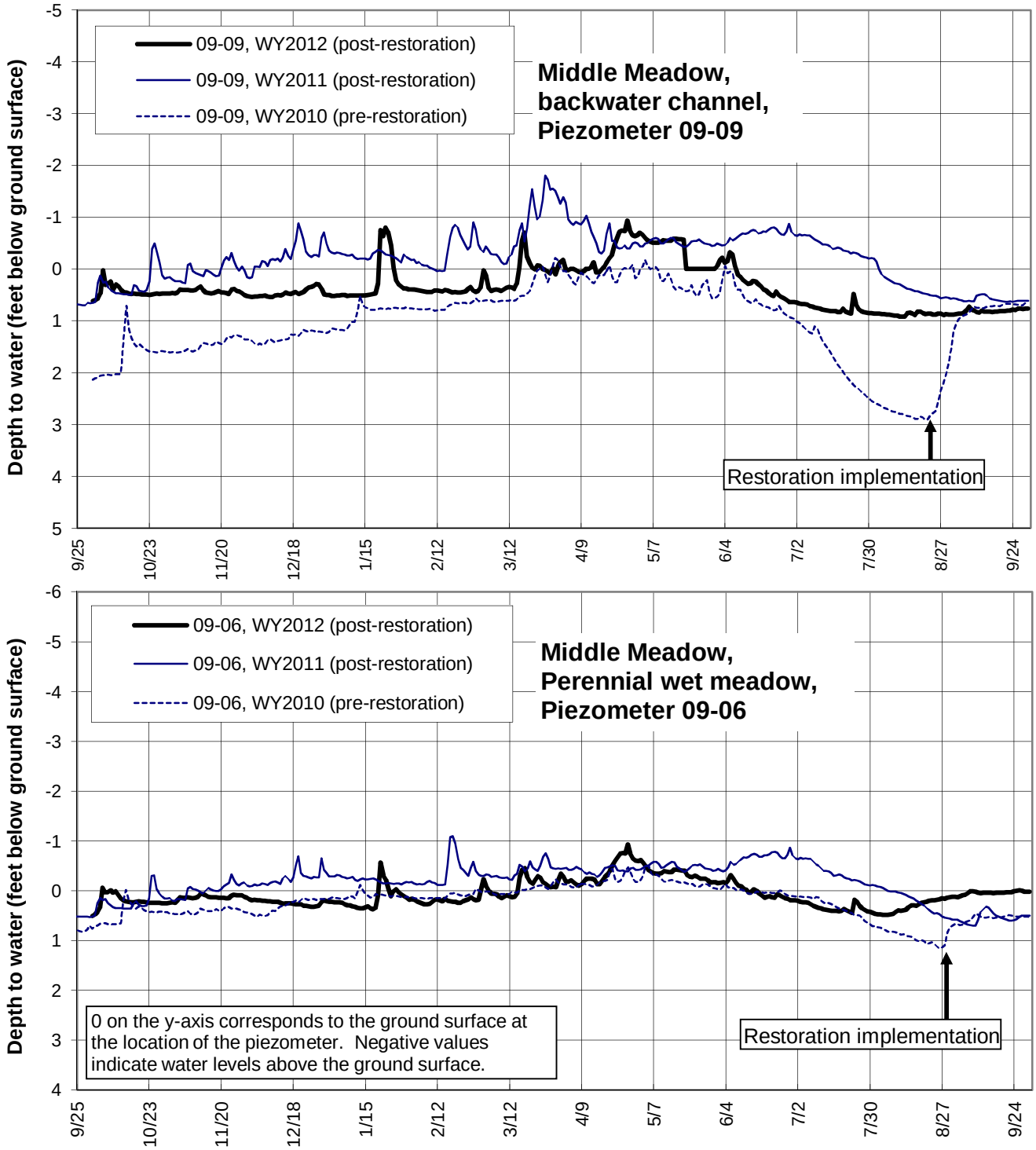

Figure 27. Depth to groundwater before and after restoration activities in Middle Perazzo Meadow, Sierra County, California

Restoration activities were carried out in late August 2010, Post-restoration groundwater levels are elevated and sustained in both WY2011 and WY2012. See Figure 3 for piezomter locations.

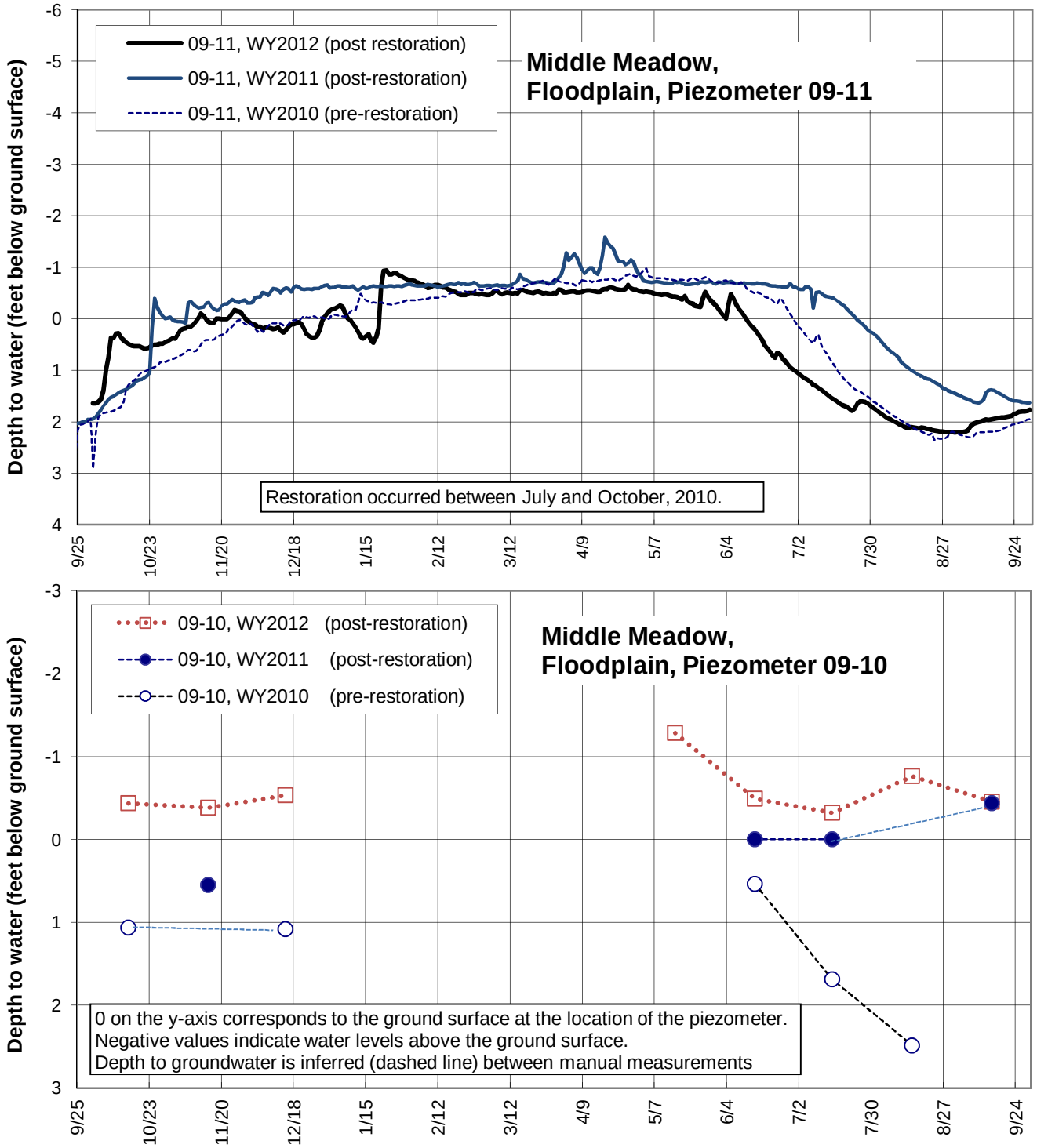

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Figure 28. **Depth to groundwater before and after restoration activities in Middle Perazzo Meadow, Sierra County, California**

Even in a below average year, the Middle Meadow continues to exhibit saturated or even ponded conditions along floodplain (09-11) when compared to pre-restoration conditions. Higher terrace locations (09-10) may still exhibit draining. See Figure 3 for piezometer locations.

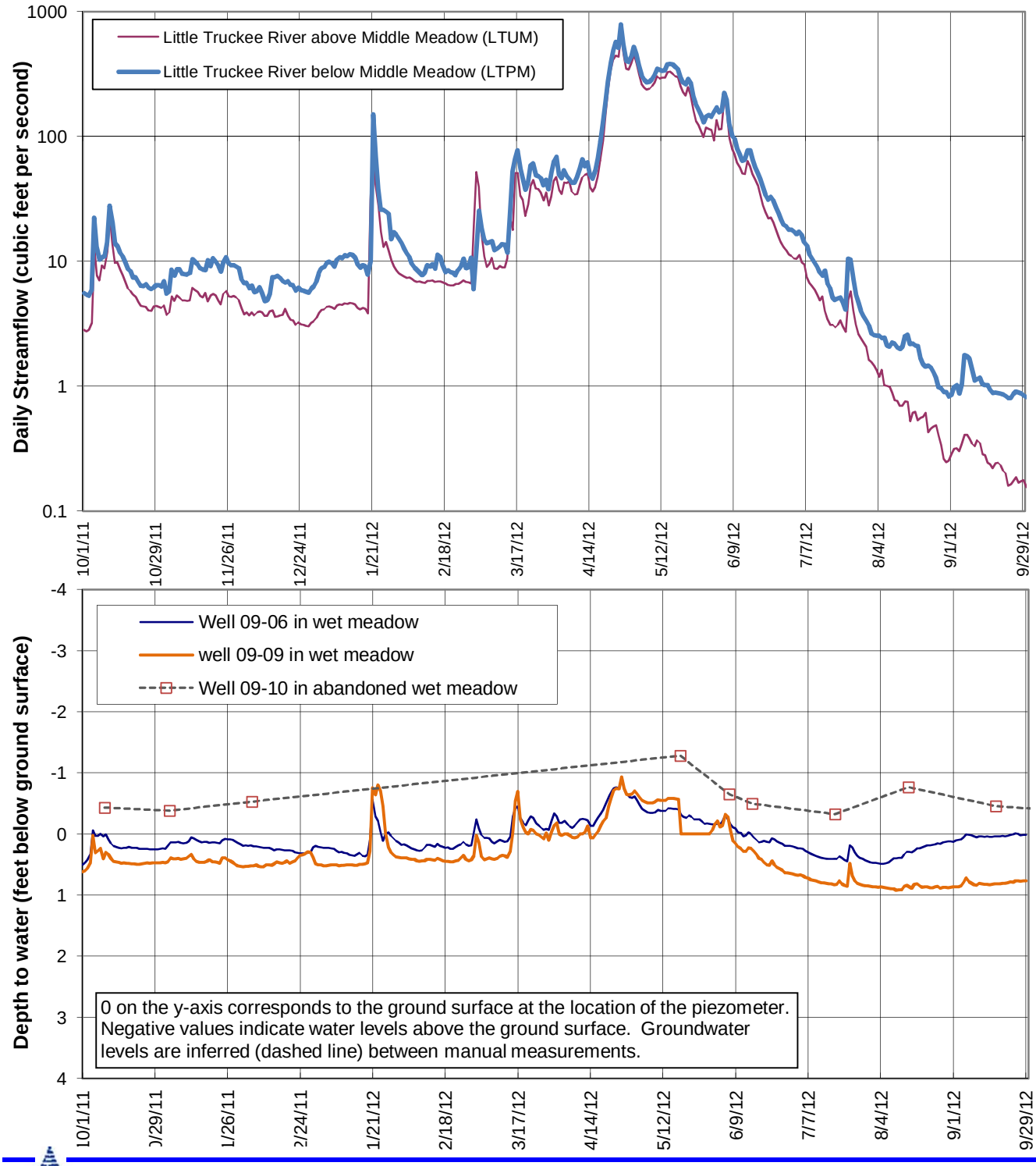

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Figure 29. **Groundwater levels and streamflow recession, Middle Perazzo Meadow, Sierra County, California, water year 2012**

In contrast to the Upper Meadow, groundwater levels in the Middle Meadow were sustained by baseflows in the Little Truckee River and supplemented by spring-supported flow . See Figure 3 for piezometer locations and Figure 4 for stream gage locations.