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2010 Annual Report:
Hydrologic Conditions in Baseflow Reaches Pursuant to Conditions 14 and 15, Santa Lucia Preserve, Monterey County, California

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Preface

This report presents the results of the 2010 baseflow condition surveys of the four major streams flowing through Santa Lucia Preserve– Lower Las Garzas, Portrero, San Jose, and San Clemente Creeks. This report has been prepared for the Santa Lucia Conservancy and is primarily intended for the staff of Monterey County and California Department of Fish and Game, in accordance with the baseflow monitoring and reporting requirements outlined in County Conditions 14 and 15. The scope of this report is limited to the presentation and evaluation of existing baseflow conditions as required by Conditions 14 and 15, and is not intended as a comprehensive analysis. However, data collected will serve an integral part establishing a long term dataset necessary for future analyses.

Acknowledgments

We would like to acknowledge Chris Hauser and Jim Sulentich of the Santa Lucia Conservancy and Scott Brown of Balance Hydrologics for providing logistic support and reference information. We thank Stefanie Kortman, Casey Lanier and Colin Nicol for field assistance and support. Greg James provided precipitation data for San Clemente Dam.

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1 Introduction

The Santa Lucia Preserve (SLP) is a residential community established in 1994 on the 20,000 acre Rancho San Carlos property in Carmel Valley, California. The Santa Lucia Conservancy manages 18,000 acres of open space while the remaining 2,000 is occupied by the community. Before approving the final Environmental Impact Report for development, The Monterey County Planning and Building Inspection Department, the lead CEQA agency, imposed stipulations for the SLP to protect streams flowing through the property. Conditions 14 and 15 require annual baseflow monitoring on four major streams flowing through the property.

- *Condition 14*

  "Measured daily base flows in Potrero Canyon, San Clemente and Las Garzas Creeks shall be recorded at approved locations near the boundaries of Rancho San Carlos. An annual survey of pools and base flow conditions in the gaged creeks and in San Jose Creek shall be conducted in September of each year. At least every year, a base flow monitoring report for evaluating base flow conditions shall be prepared and filed with Environmental Health, Water Resource Agency, the Department of Fish and Game, and the Monterey County Planning and Building Inspection Department."

- *Condition 15*

  "If the Base Flow Monitoring Report demonstrates that the base flow in any of the four creeks has dropped below the October 1990 level as a direct result of the project, flow shall be augmented by discharging water into the creek near the upstream end of the affected Base Flow Reach. The rate of augmentation shall be of an amount sufficient to sustain pools and base flow approximately equal to conditions in October 1990; the maximum required combined augmentation for all four creeks is 30 gpm at the points where the augmented water reaches the protected base flow reaches. The proposed augmentation methods, the actual rate(s) of augmentation and the location(s) of augmentation shall be reviewed with the Water Resources Agency prior to implementation of this condition."

Baseflow conditions were surveyed from August 23, 2010 through September 30, 2010 and compared to October 1990 conditions pursuant to the requirements of Conditions 14 and 15. This report is a compilation of the findings of the 2010 baseflow conditions mapping and specific conductance profiles of the four creeks flowing through the Santa Lucia Preserve.

Although the scope of this report is limited to the requirements of Conditions 14 and 15, the data collected will serve an integral part establishing a long term dataset necessary for future analyses.

2 Methods

The baseline comparison for baseflow conditions is an October 1990 study as indicated in Condition 15. The purpose of the study was to develop a "baseline characterization of the physical influences of stream aquatic and associated riparian habitat conditions at Rancho San Carlos" (Napolitano and Hecht 1992). Balance Hydrologics conducted the annual baseflow survey prior to 2007. From 2007 to the present, the study was conducted by graduate students of CSUMB. Methods used in previous surveys have continued to be used to maintain continuity (Woyshner et al. 2004;2005, Croyle and Smith 2007). Beginning in the 2009 report, an additional descriptor, "isolated pool", was added to provide more detail about drying channel reaches (Paddock and Smith 2009).

2.1 Baseflow Conditions Mapping

Surveys of the four major creeks in the Santa Lucia Preserve were conducted by walking the length of the creek and recording qualitative observations. Baseflow conditions were described in detail and the locations of changing conditions were recorded with a GPS unit. The results were mapped in GIS. The 1990 surveys predate the use of GPS and therefore exact locations of changing stream conditions are not known. For comparison purposes, definitions from previous surveys which describe stream conditions have been retained. Furthermore, the maps presented in this report have been formatted similar to previous surveys to maintain consistency within the dataset. The following definitions are used to describe sub-reach channel conditions (Woyshner et al. 2004;2005, Croyle 2007).

- *"Predominantly wetted channel:* Flowing segments and/or strings of isolated pools, without reference to exact location of segments. Most pools contain at least some water, however riffles may be dry. In the 1990 and 1991 memos and field notes, these segments were referred to as "continuously wetted channel[1]," but we have changed the phrase to avoid confusion with "continuously flowing" and to provide a more general definition that can be applied to all creeks. Some short sections of dry channel may be included, but the reach/sub-reach was defined as having predominantly wetted conditions."

[1] "'Wetted channel,' as used in the 1990 and 1991 reconnaissance reports, described channels with sufficient moisture to sustain riparian vegetation reliably during droughts. Generally, these were channels in which mature riparian vegetation could expect to obtain water from pools, underflow, or springs. In some cases, most notably Portrero creek, a 'wetted' channel had no expression of surface water, but we had reason to believe (often supported by digging in pools) that moist or saturated sands were within a few feet of the bed (Woyshner et al. 2005)."

- *"Predominantly dry channel:* Stream reaches or sub-reaches with isolated pools and completely dry channel (short, predominantly-wetted channel segments separated by long dry channel segments). Some very short sections with flowing water may be included, but reach-wide conditions are predominantly dry or contain only low-volume pools. Many to most pools in these reaches are dry. The current mapping of the 1990/1991 accounts and field notes is based on reach descriptions without reference to exact locations of surface water and dry segments."
- *"Isolated Pool:* Stream reaches or sub-reaches that are intermediate in character between Predominantly Dry and Dry. There are single pools isolate by very long reaches of dry channel."
- *"Dry:* Stream reaches or sub-reaches having no surface water"

2.2 Specific Conductance Profiles

In addition to qualitative descriptions and mapping of baseflow conditions, specific conductance[2], dissolved oxygen, temperature, and pH were measured at select pools during each survey. Specific conductance is used as a proxy for "dryness" in the watershed. As the watershed begins to dry, groundwater with increasing amounts of dissolved solids feeds stream baseflow. This results in higher specific conductance. As streams begin to dry, specific conductance generally increases as demonstrated on Lower Garzas Creek by Wolshner (2003). Specific conductance is used additionally as a quantitative indicator when evaluating stream "dryness" due to changes in baseflow conditions between years.

3 Results

Results for the 2010 baseflow survey are briefly summarized and compared with 1990 reference baseflow conditions. All four streams were "wetter" than the 1990 reference baseflow conditions. There was more precipitation in water year 2010, 27.46 inches, than the average year, 21.43 inches (Figure 1). This water year is the first year of above average rainfall after three years of below average rainfall.

[2] Specific conductance measures the ability of water to conduct electrical current and is a relative measure of the amount of dissolved solids in water.

3.1 Lower Las Garzas Creek

A baseflow survey of Lower Las Garzas Creek was conducted on September 17, 2010 (Figure 2). The survey began at the confluence of the Las Garzas Creek and Carmel River and extended upstream to Moore's Lake at Robinson Canyon Road. In September 2010, Garzas showed wetter conditions than the conditions in October of 1990 (Figure 3). In 2010, Pinyon Peak Reach and the upper reaches had continuous surface flow. The upstream portion of the Terraced Alluvial Reach consisted of isolated pools while the rest of the reach consisted of continuous surface flow and some intermittent dry areas. The upstream portion of the Alluvial Fan Reach had surface flow and the downstream portion was dry.

The specific conductivity data for 1990 is extremely variable, so it is difficult to "characterize" the data for 1990 with a meaningful average. The specific conductance from September 2010 is less variable, but it follows the same general trend as 1990 (Figure 4). The underlying trend is from higher values to lower values with distance upstream. The specific conductance values are lower than the values from 1990.

3.2 Potrero Creek

The Potrero Creek baseflow survey was conducted on September 29, 2010 and extended from the SLP gatehouse to Potrero Trail Bridge crossing (Figure 5). There was continuous surface flow in the "Protected Baseflow Reach". The lower reach was dry with isolated pools. The upper reach had continuous surface flow until going dry approximately 1,000 feet before the end of survey point. Wolshner et al. (2004) describes the "Protected Baseflow Reach" section as surveyed in 1990 as having locally discontinuous flow (Figure 6). In 2010, Potrero Creek was "wetter" than 1990 conditions.

Only two specific conductance measurements were taken during the 1990 survey and four measurements from the 1991 survey. Conditions in 1991 were wetter than 1990, but still well below average. Potrero Creek specific conductance measurements taken in 2010 were lower than 1991 measurements (Figure 7). In 2010, there was not sufficient water for a specific conductivity measurement in Slaughterhouse Creek. Potrero Creek conductivity measurements have consistently been relatively high compared to other creeks on the Santa Lucia Preserve.

3.3 San Jose Creek

The San Jose Creek baseflow survey was conducted on August 23 and 25, 2010. The survey began at the SLP property line and extended upstream to Stickleback Pond (Figure 8). There was continuous surface flow through the "Protected Baseflow Reach" and for the majority of the surveyed creek. San Jose Creek became dry approximately 4,000 feet downstream of stickle back pond. The 1990 survey was discontinued above Van Winkley's Canyon and found predominantly dry conditions for the majority of the survey (Figure 9). In 2010, San Jose Creek was "wetter" than 1990 conditions.

Specific conductance measurements from San Jose Creek and contributing springs and tributaries were lower in 2010 than measurements from 1990 (Figure 10). On the San Jose Creek, the trend for specific conductivities is from lower values to higher values with distance upstream.

3.4 San Clemente Creek

The baseflow survey for San Clemente Creek was conducted on September 30, 2010 (Figure 11). The survey began at the SLP property line (Dormody Road) and continued upstream to Robinson Canyon Road. There was continuous surface flow in the "Protected Baseflow Reach". The upstream portion of the stream had mostly continuous flow with some dry reaches and isolated pools. During the 1990 survey, San Clemente Creek was surveyed from the San Clemente Trail Bridge to Robinson Canyon Road (Figure 12). No 1990 reference data for the conditions through the "Protected Baseflow Reach" exist. Only one short section was described as predominantly wetted, while the remainder of the creek was described as predominantly dry. Discharge at the gage site was estimated to be approximately 0.03 ft^3/s on September 20, 2010 while August 23 and November 5, 1991 estimates are 0.04 ft^3/s.

Only two specific conductance measurements were taken during the 1990 survey and two measurements from the 1991 survey. Specific conductance data from 2010 are lower than the data from 1990 and 1991 (Figure 13). Although little reference data exists for 1990 conditions, judging by conductance values and the continuous surface flow in the "Protected Baseflow Reach", San Clemente Creek is "wetter" than 1990 conditions.

4 Discussion

The 2010 water year rainfall (27.46 inches) was significantly higher than 1990 rainfall (13.1 inches) and higher than the average rainfall (21.43 inches). The reference condition in 1990 was after four years of drought. In 2010, after a year of above average rainfall following three years of below average rainfall, we would still expect the baseflow to be "wetter" than 1990. We would also expect the specific conductance profiles to be lower than the 1990 reference measurements. Both baseflow and specific conductance expectations were met.

5 Conclusion

Given the differences in water years 1990 and 2010 and the antecedent water years leading 1990 and 2010, we would anticipate wetter baseflow conditions in 2010 than were present in 1990. Baseflow conditions were surveyed on the four major streams which flow through the Santa Lucia Preserve – Lower Las Garzas, Potrero, San Clemente, and San Jose. The baseflow characteristics of these streams were collected and compared with the 1990 reference conditions as stipulated in County Condition 14. Results from baseflow mapping and specific conductance plots suggest 2010 conditions are "wetter" than those of 1990 for Lower Las Garzas, Potrero, San Clemente and San Jose Creeks.

6 References

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Woyshner M, Brown S, Hecht B. 2005. 2005 Annual report: hydrologic conditions in baseflow reaches pursuant to conditions 14 and 15, Santa Lucia Preserve, Monterey County, California. Consulting report prepared by Balance Hydrologics for the Santa Lucia Conservancy. 29 pp.

7 Figures

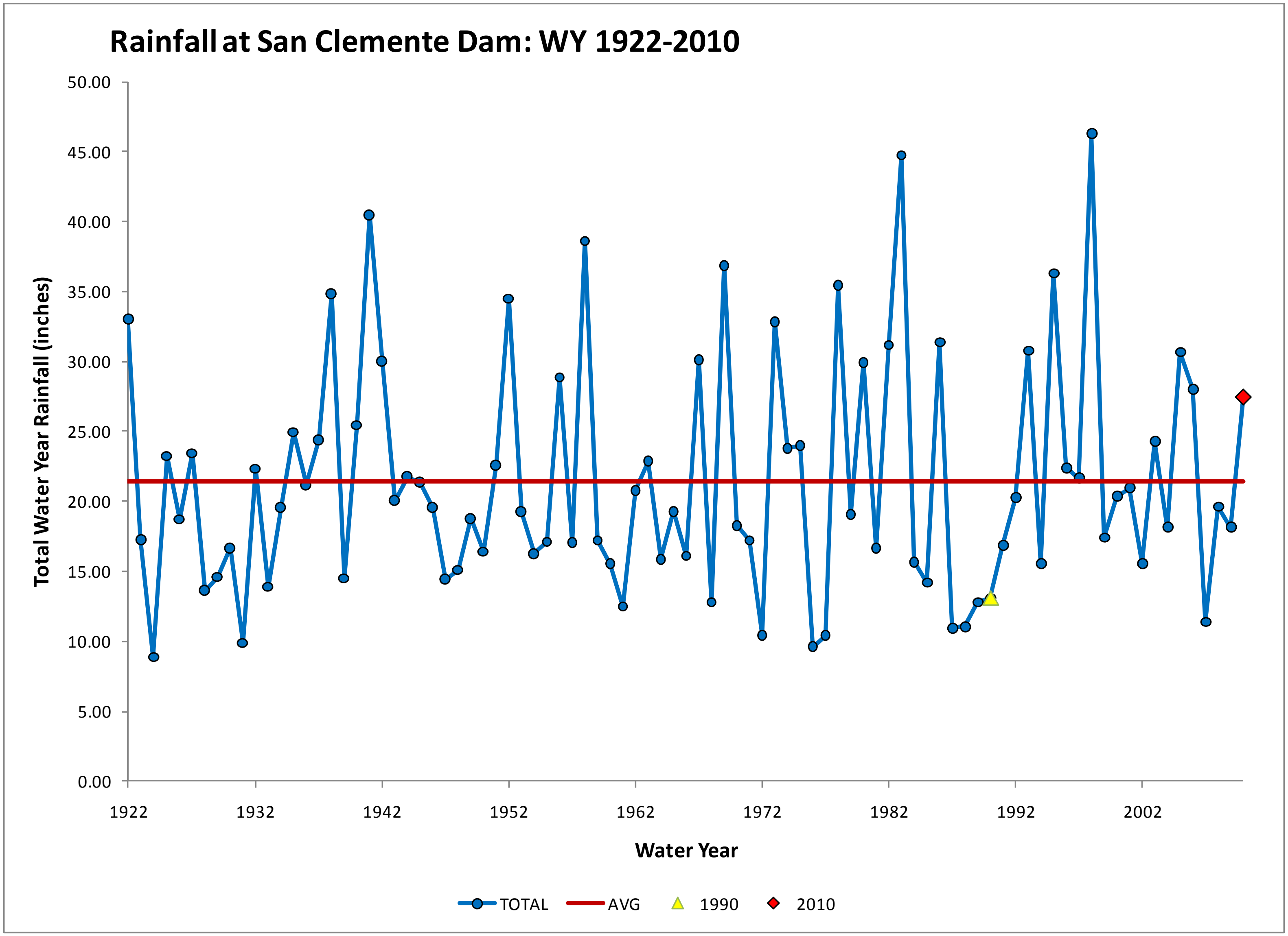

Figure 1. Total rainfall at San Clemente Dam for water years 1922-2010 resulted in an average rainfall of 21.43 inches. Water year 2010 received more rainfall than 1990 and the years preceding 1990. The 27.46 inches of precipitation in 2010 partially explained why baseflow conditions in 2010 were "wetter" than 1990.

September 17, 2010: Las Garzas Creek Generalized Wetted and Dry Conditions

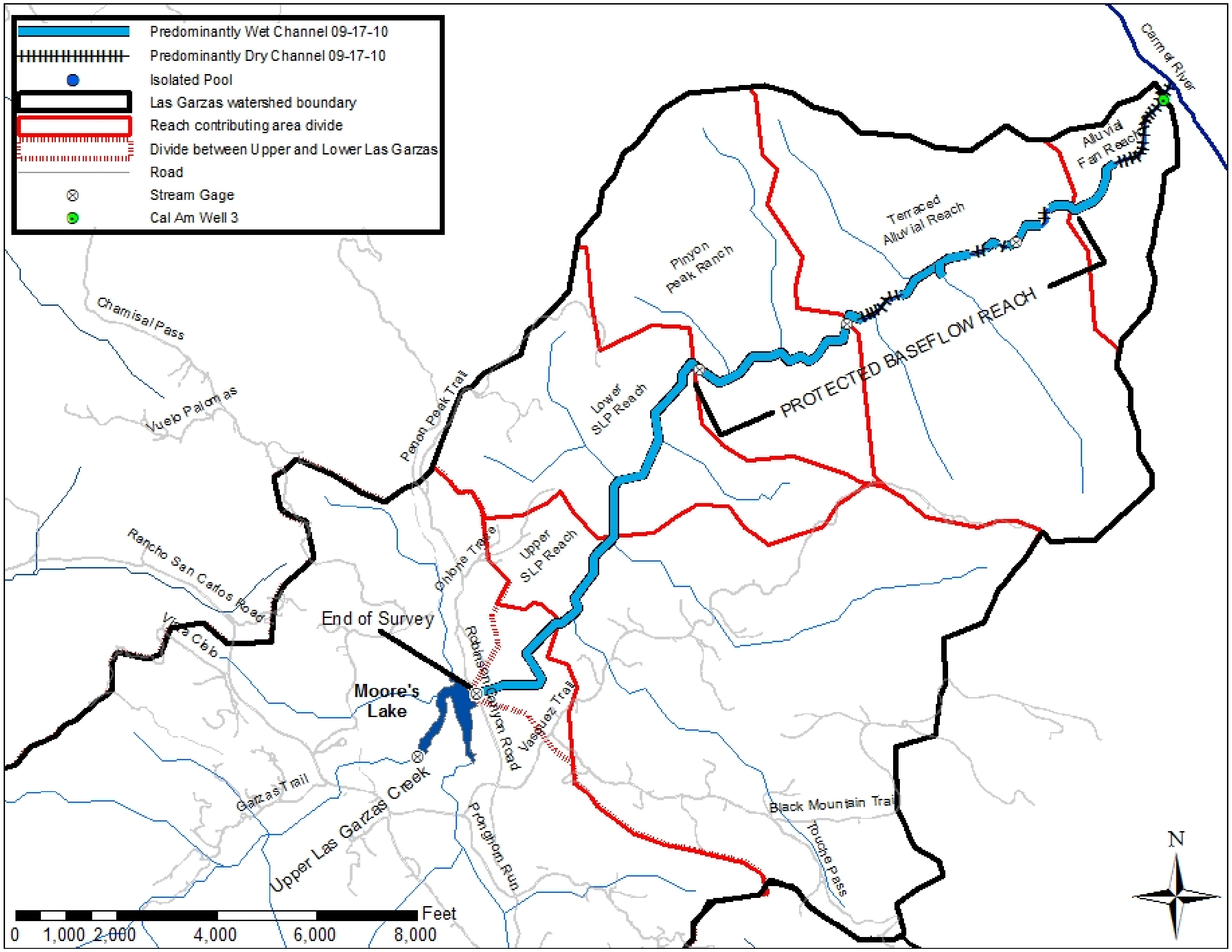

Figure 2. Map of generalized flow conditions for lower Las Garzas Creek on September 17, 2010. In 2010, Pinyon Peak Reach and the upper reaches had continuous surface flow. The upstream portion of the Terraced Alluvial Reach consisted of isolated pools while the rest of the reach consisted of surface flow and some intermittent dry areas. The upstream portion of the Alluvial Fan Reach had surface flow and the downstream portion was dry.

October 30, 1990: Lower Las Garzas Creek Generalized Wetted and Dry Conditions

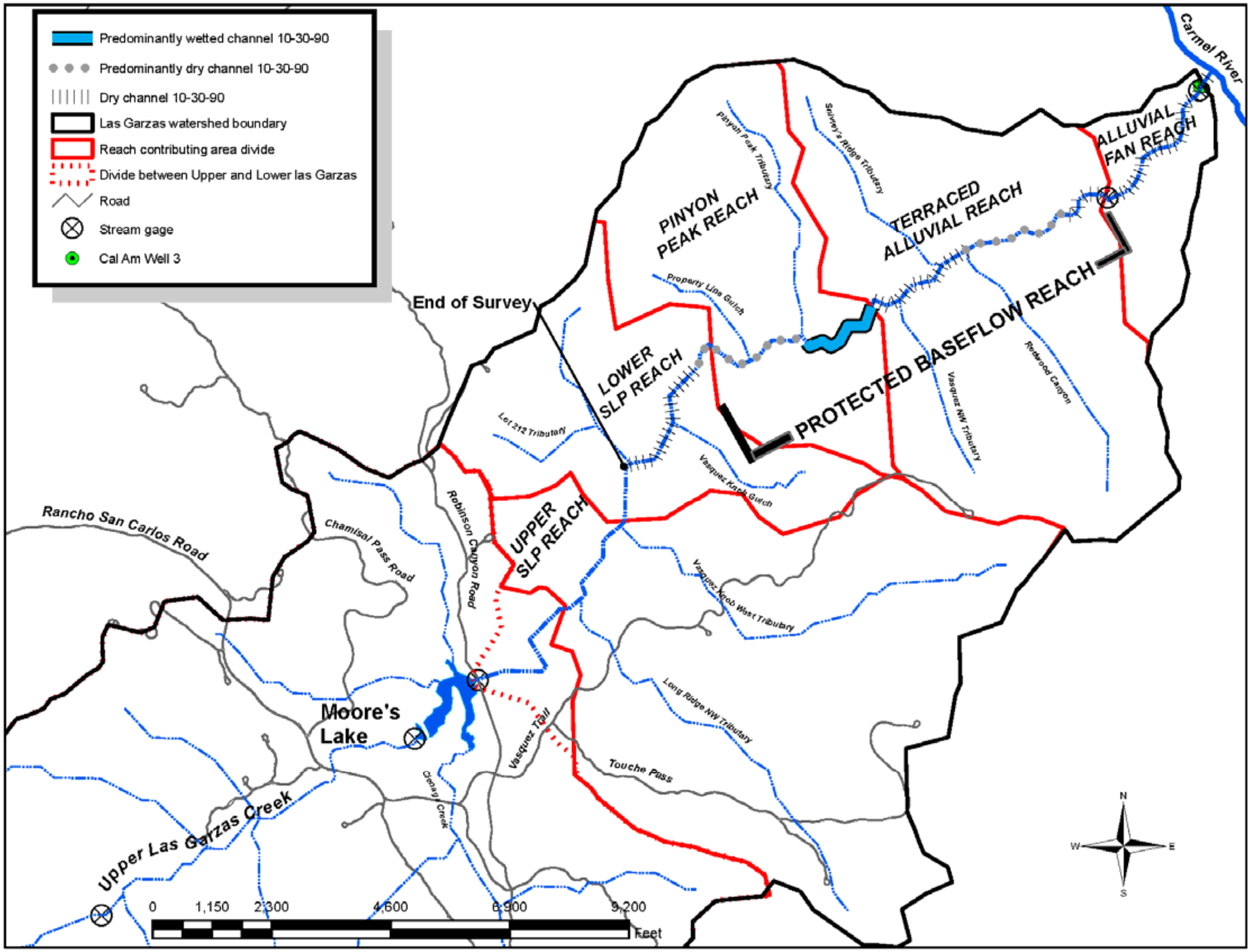

Figure 3. Generalized flow conditions on Lower Las Garzas Creek on October 30, 1990. In 1990, the upper part of Pinyon Pk. Reach consisted of isolated pools while the lower part of that reach had some continuous flow. Surface flow was not observed in the lower reaches.

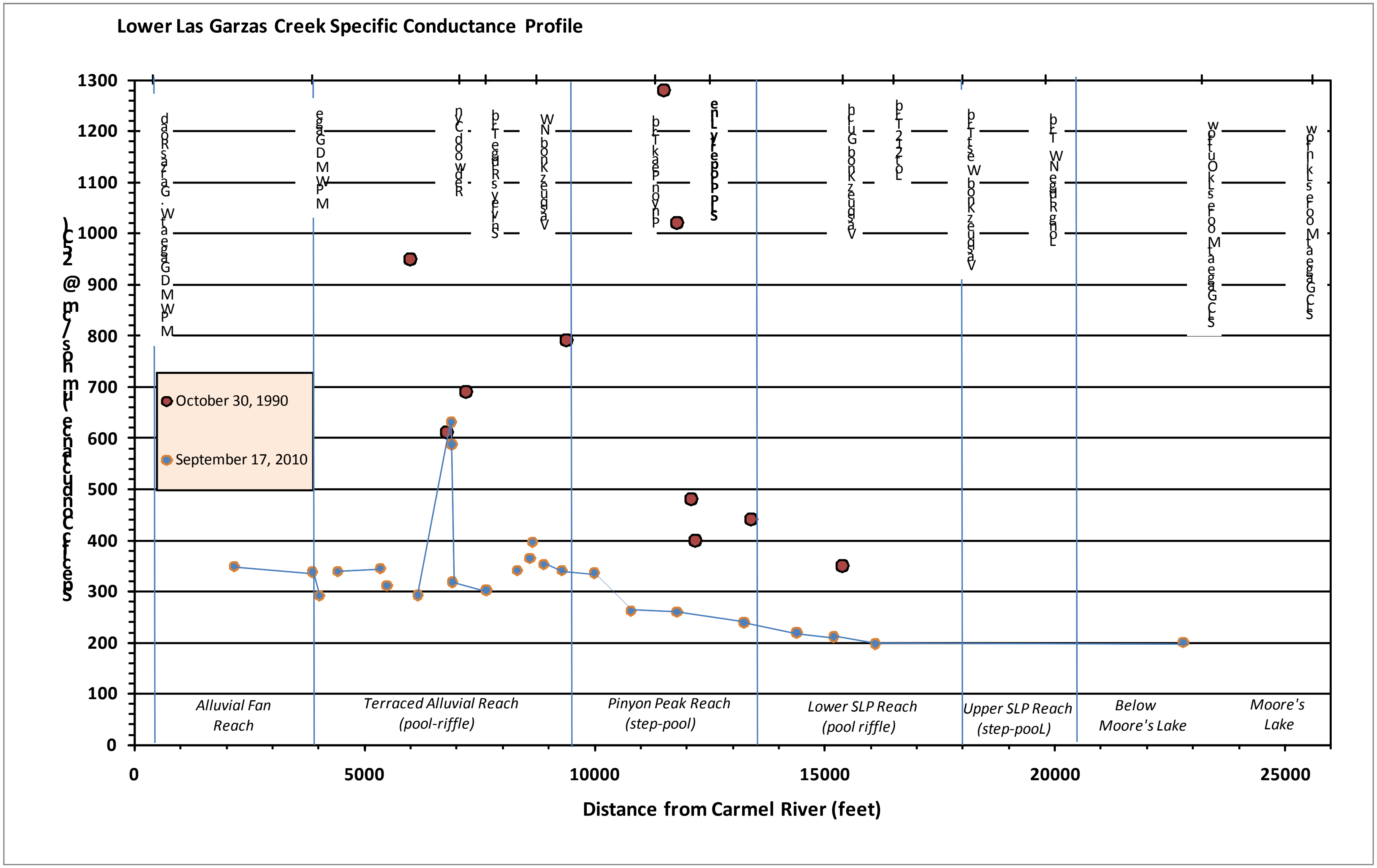

Figure 4. The comparison of Lower Las Garzas Creek specific conductance measurements from October 30, 1990 and September 17, 2010 illustrated the 2010 specific conductivity was generally lower than 1990 conditions. The specific conductivity data for 1990 was extremely variable, so it is very difficult to "characterize" the data for 1990 with a meaningful average. The specific conductance on September 2010 was less variable, but follows the same general trend as 1990. The underlying trend was from higher values downstream to lower values upstream. For 2010 data, line breaks indicate discontinuous flow.

September 29, 2010: Potrero Creek Generalized Wetted and Dry Conditions

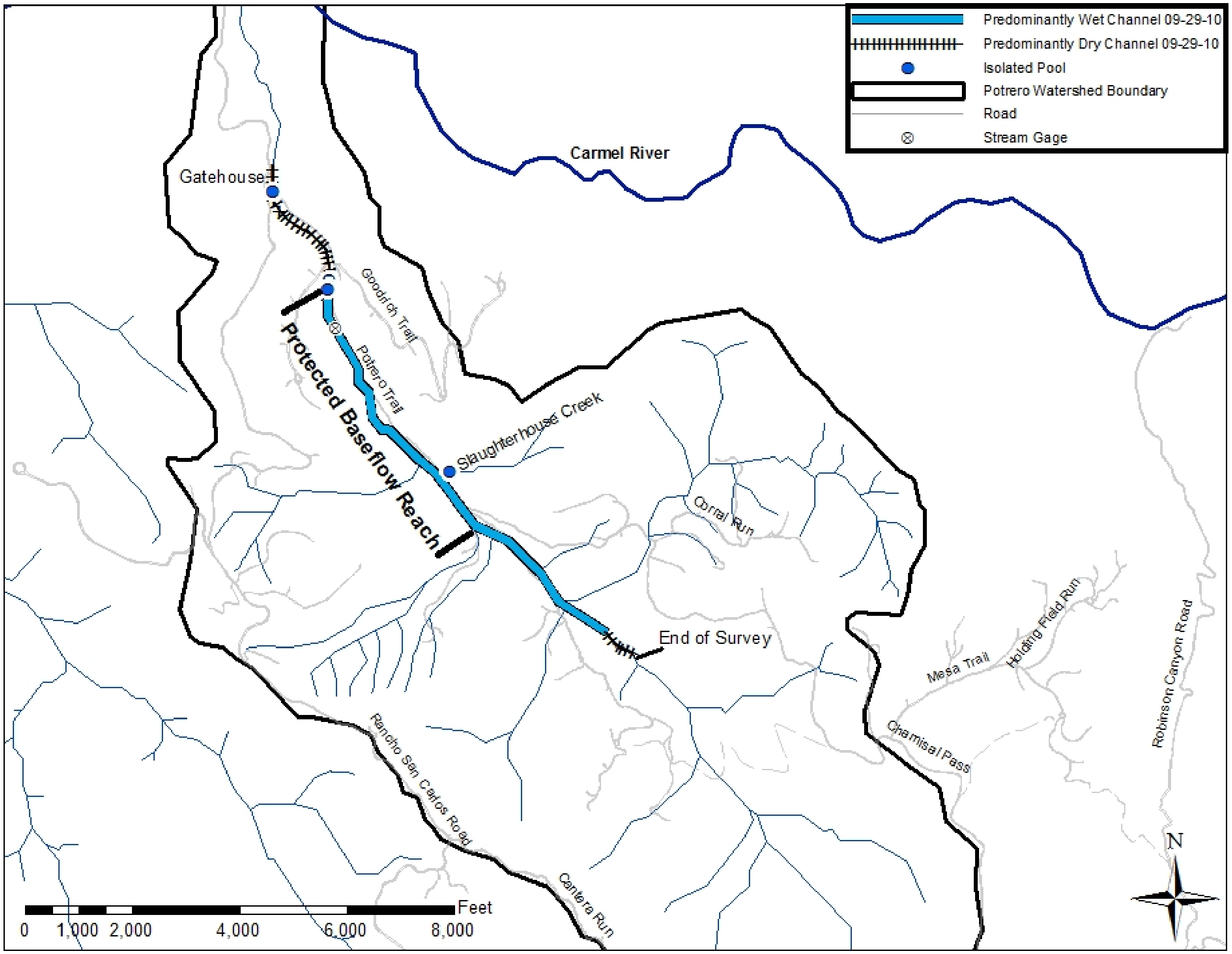

Figure 5. Map of generalized flow conditions on Potrero Creek on September 29, 2010. There was continuous surface flow in the "Protected Baseflow Reach". The lower reach was dry with isolated pools. The upper reach had continuous surface flow until going dry approximately 1,000 feet before the end of survey point.

October 06, 1990: Portrero Creek Generalized Wetted and Dry Conditions

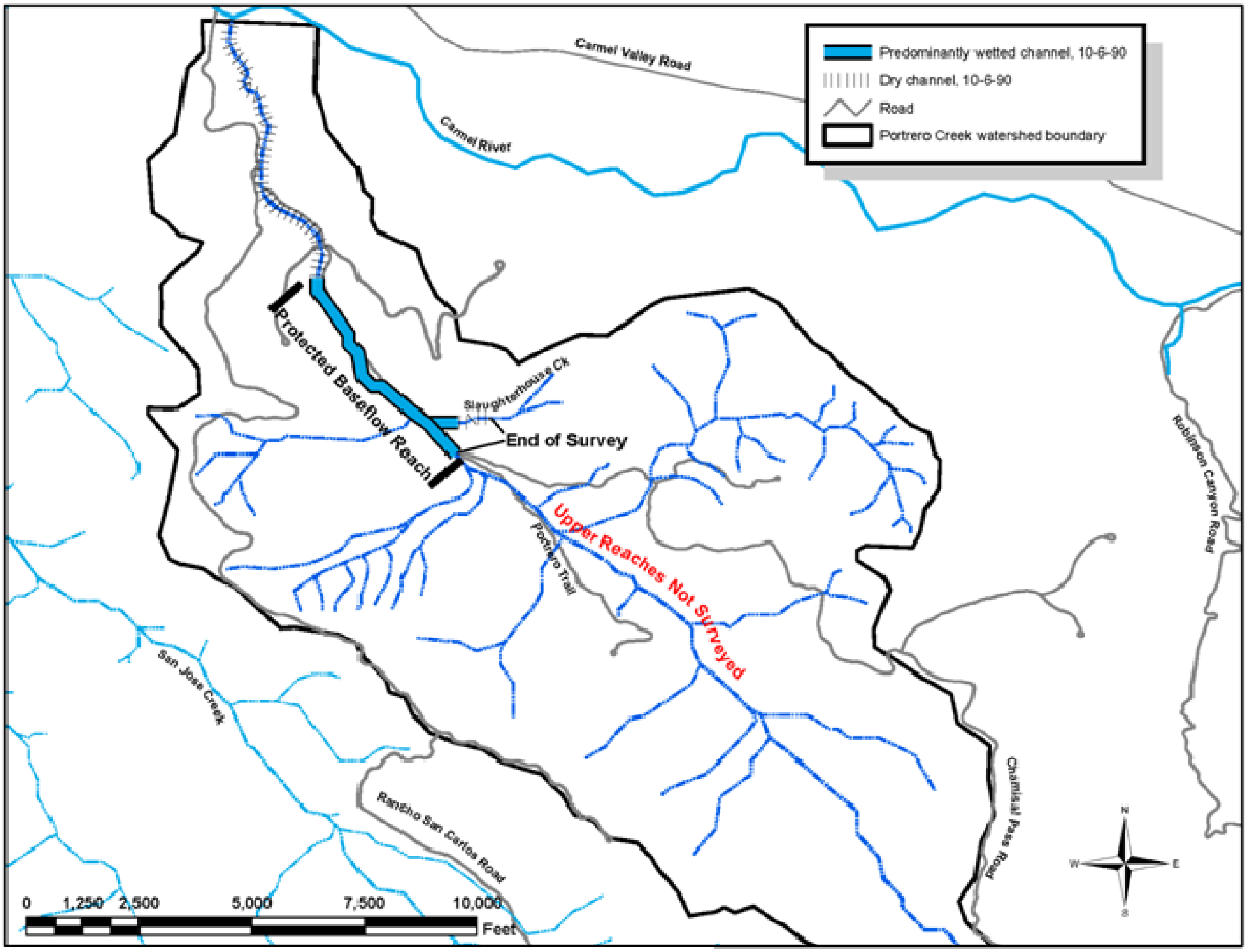

Figure 6. Generalized flow conditions on Potrero Creek on October 6, 1990.

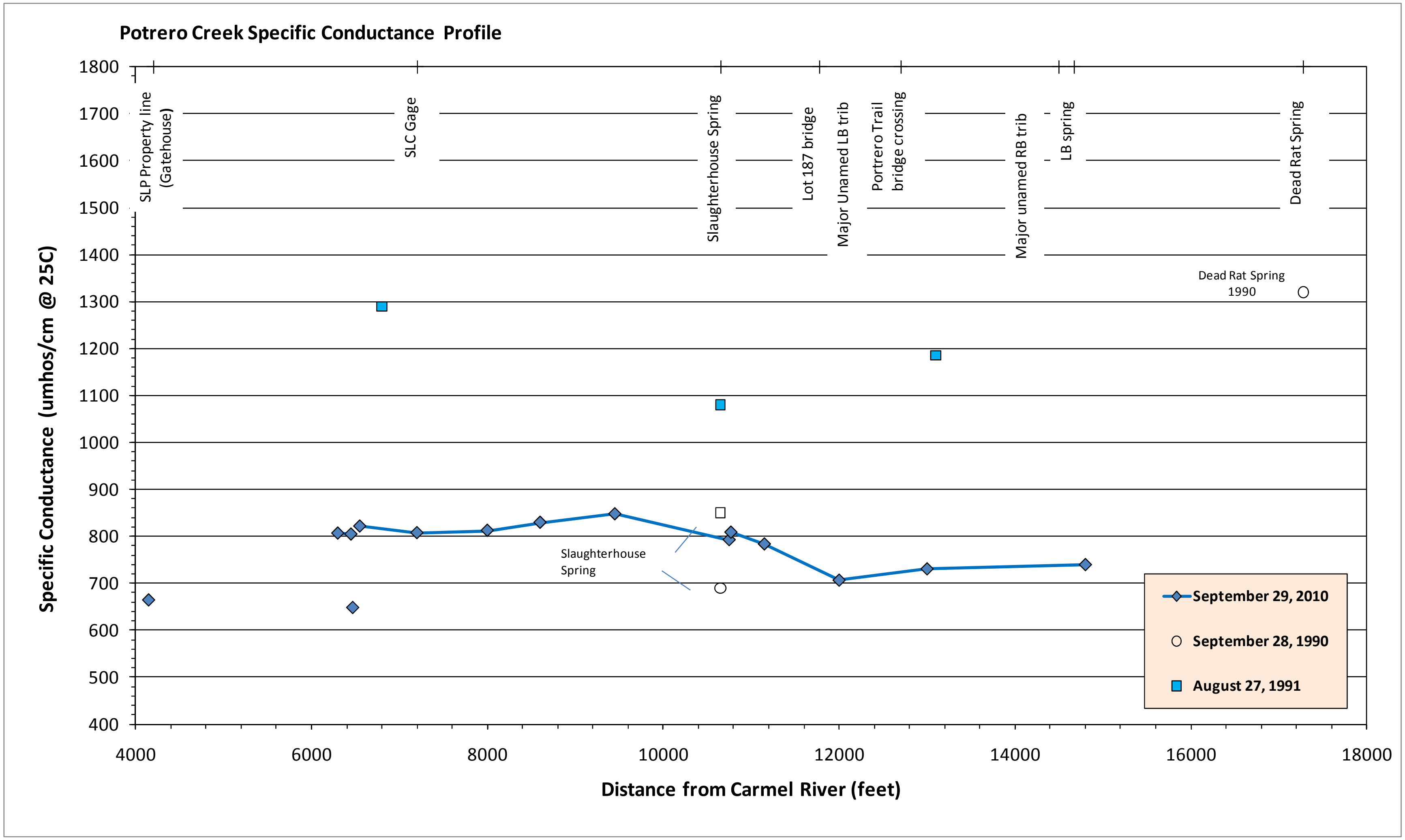

Figure 7. The comparison of Potrero Creek specific conductance measurements from September 1990, August 1991 and September 2010 illustrated the 2010 specific conductivity was generally lower than 1990, 1991 conditions. There was not enough flow for a measurement of the Slaughterhouse Spring in 2010. For 2010 data, line breaks indicate discontinuous flow.

August 23 & 25, 2010: San Jose Creek Generalized Wetted and Dry Conditions

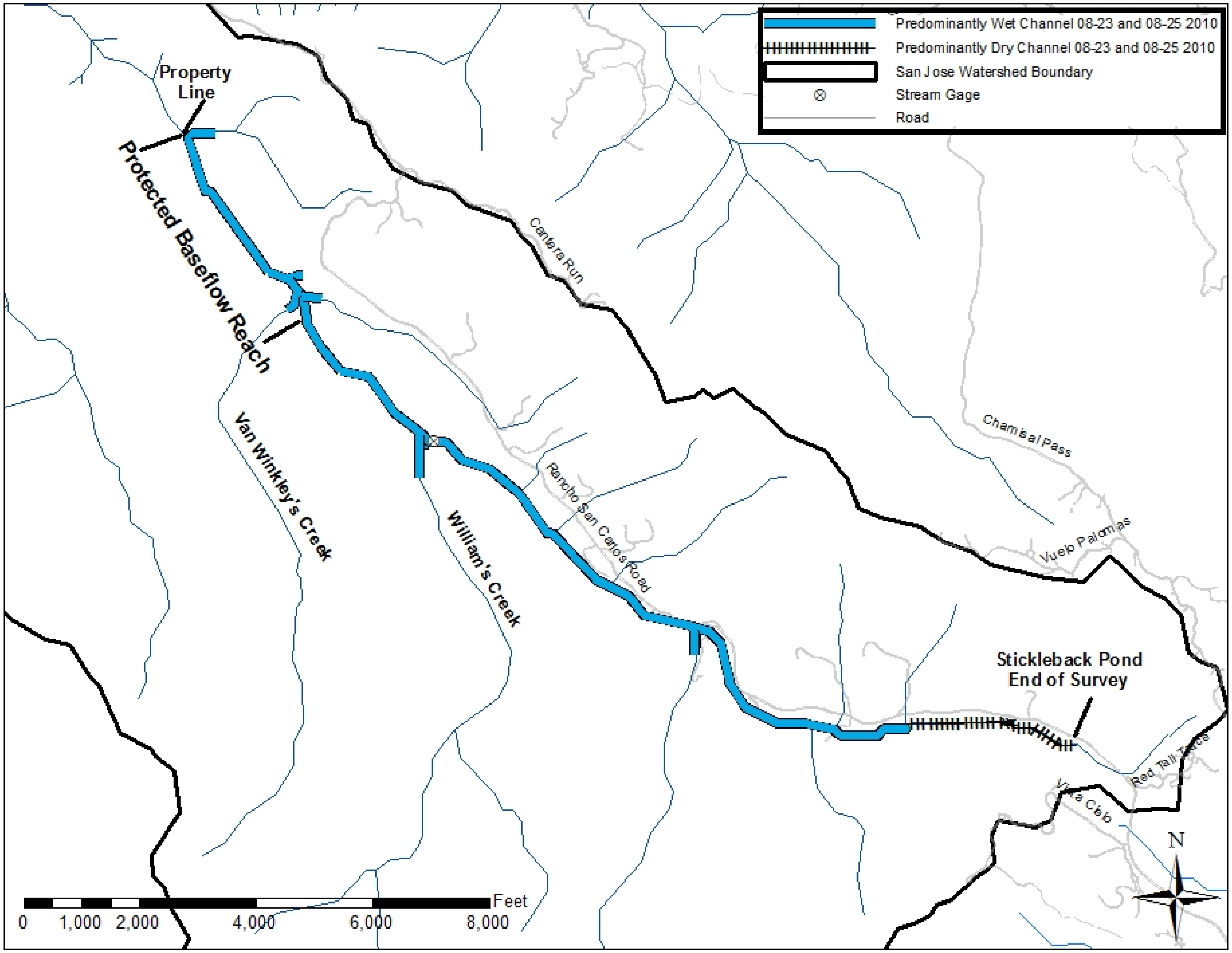

Figure 8. Map of generalized conditions on San Jose Creek on August 23 and 25, 2010. There was continuous surface flow in the "Protected Baseflow Reach" and for the majority of the surveyed creek. The creek became dry approximately 4,000 feet downstream of stickle back pond.

September 1990: San Jose Creek Generalized Wetted and Dry Conditions

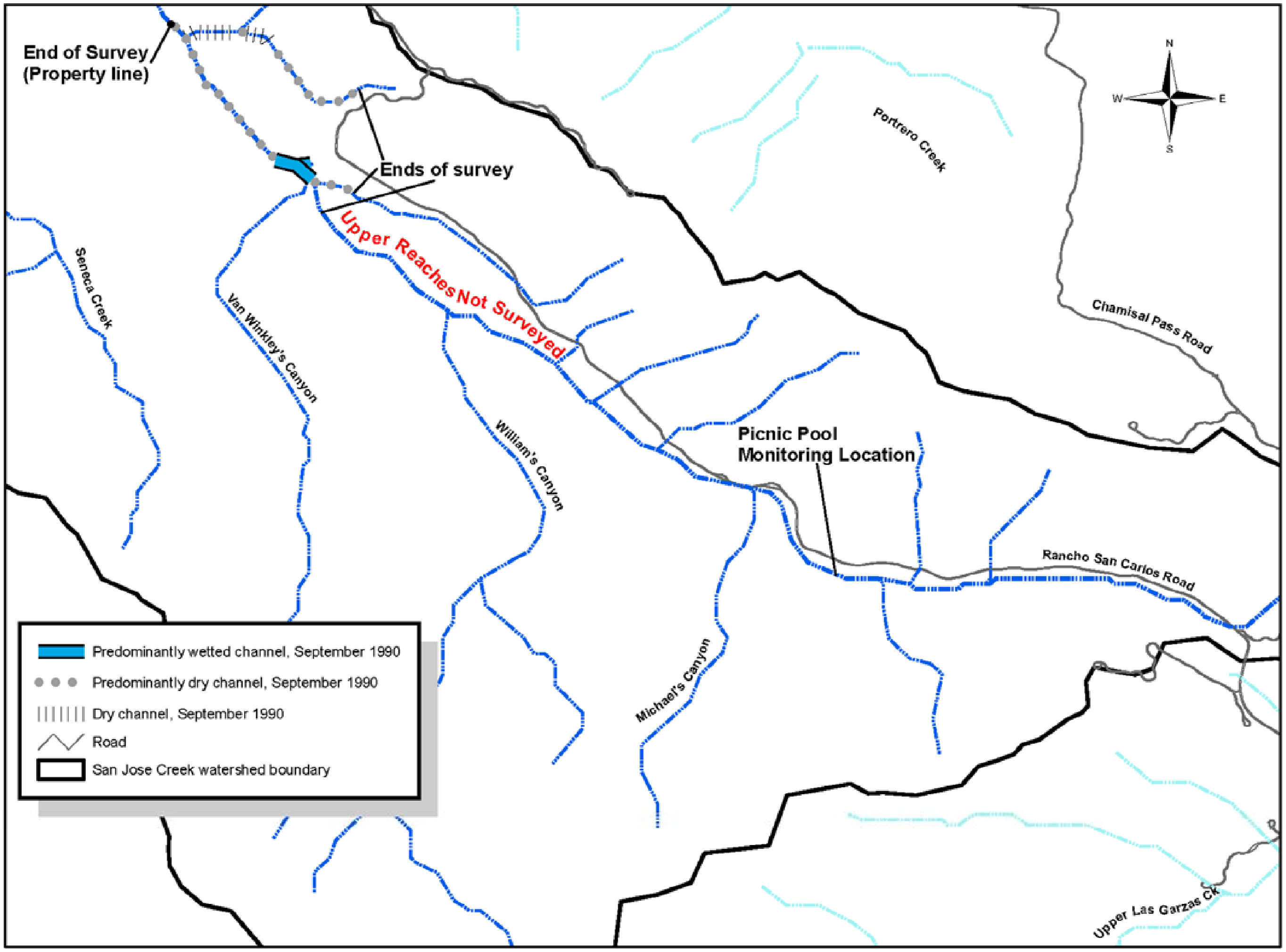

Figure 9. Generalized flow conditions on San Jose Creek in September1990.

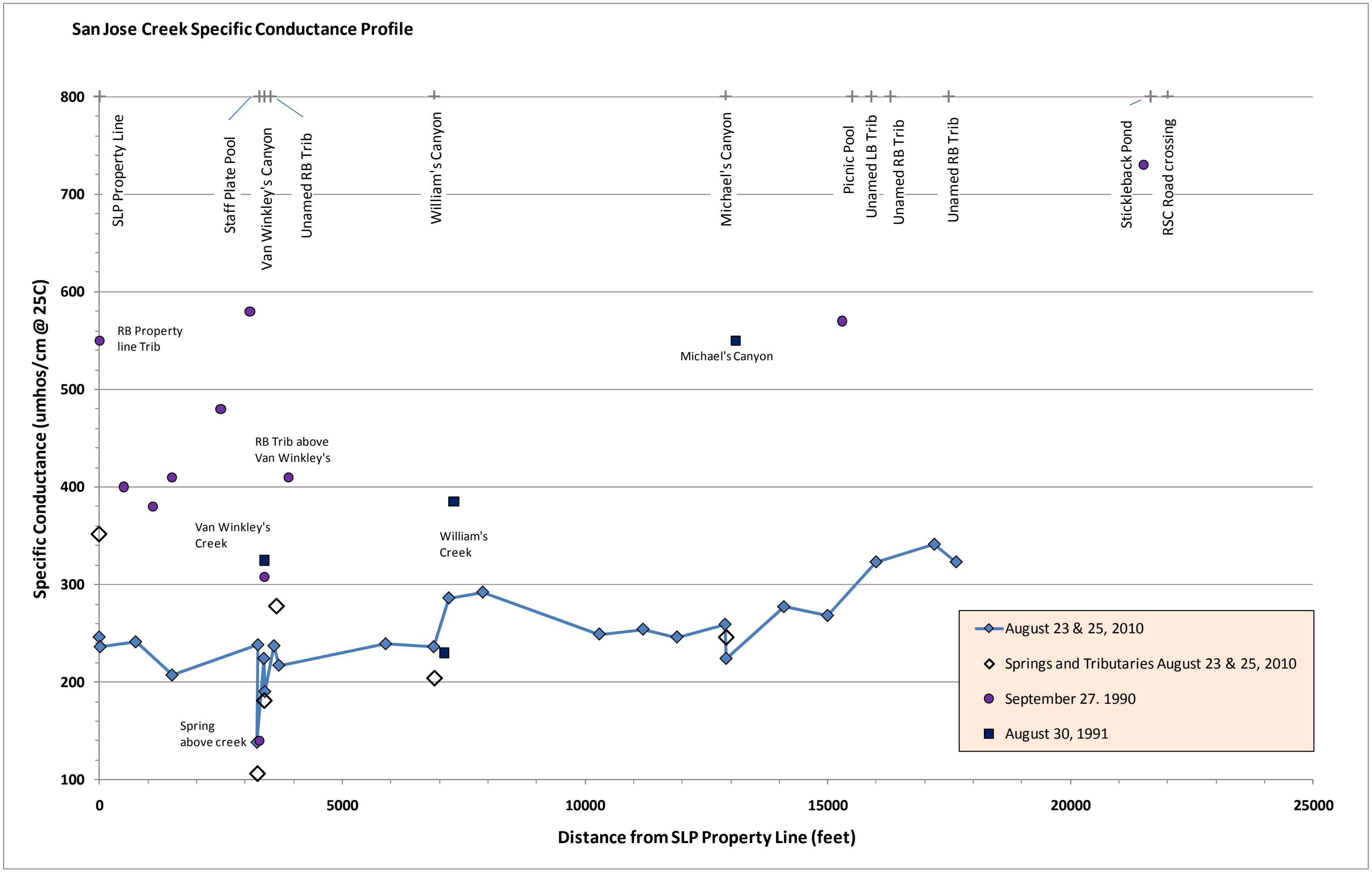

Figure 10. The comparison of San Jose Creek specific conductance measurements from September 1990, August 1991 and August 2010 illustrated the 2010 specific conductivity was generally lower than 1990, 1991 conditions. The underlying trend was from lower specific conductivity values downstream to higher values upstream. For 2010 data, spring and tributary measurements were indicated by a hollow marker.

September 30, 2010: San Clemente Creek Generalized Wetted and Dry Conditions

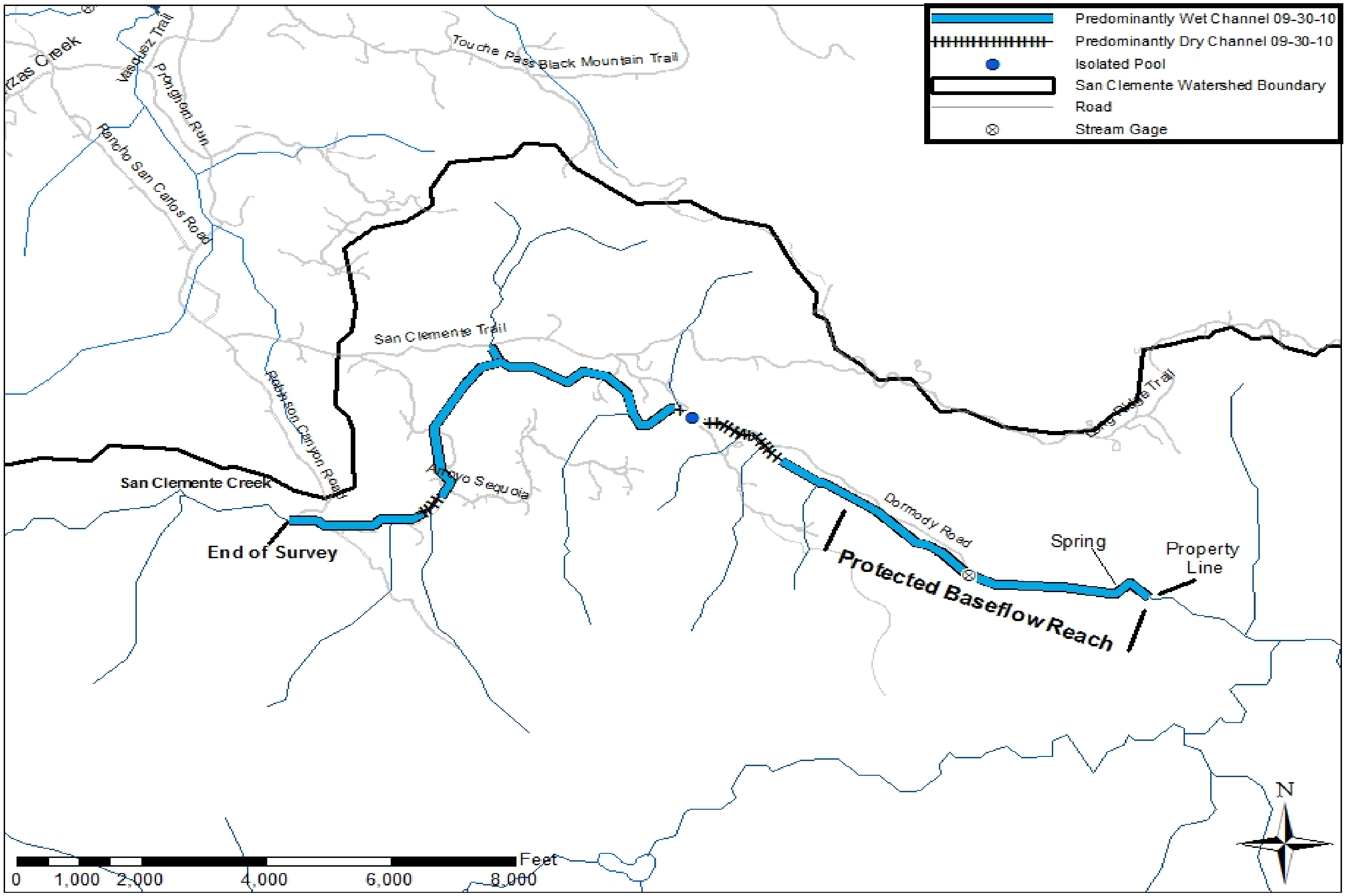

Figure 11. Map of generalized flow conditions on San Clemente Creek on September 30, 2010. There was continuous surface flow in the "Protected Baseflow Reach". The upstream portion of the stream had mostly continuous flow with some dry reaches and isolated pools.

September 28, 1990: San Clemente Creek Generalized Wetted and Dry Conditions

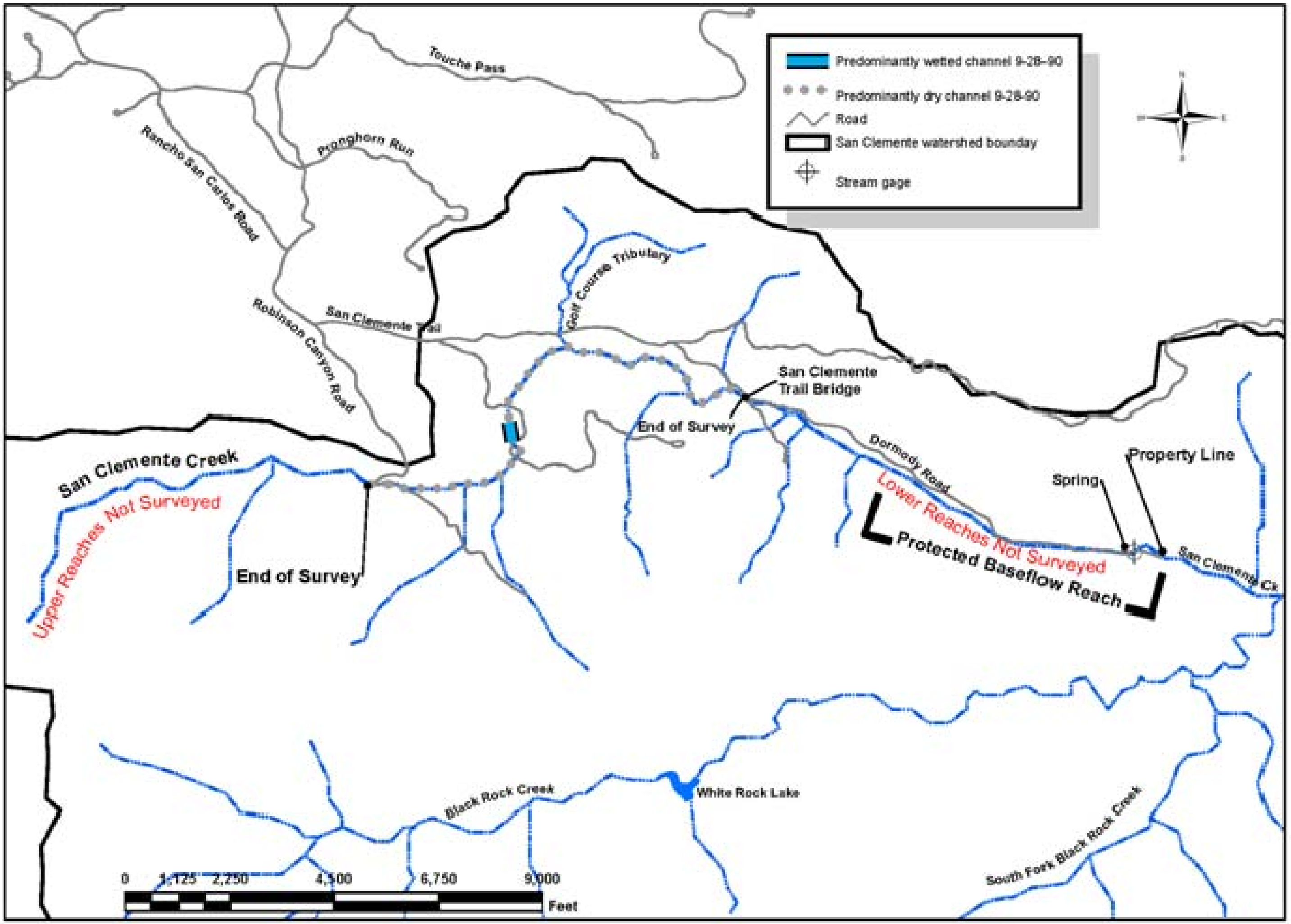

Figure 12. Generalized flow conditions on San Clemente Creek on September 28, 1990.

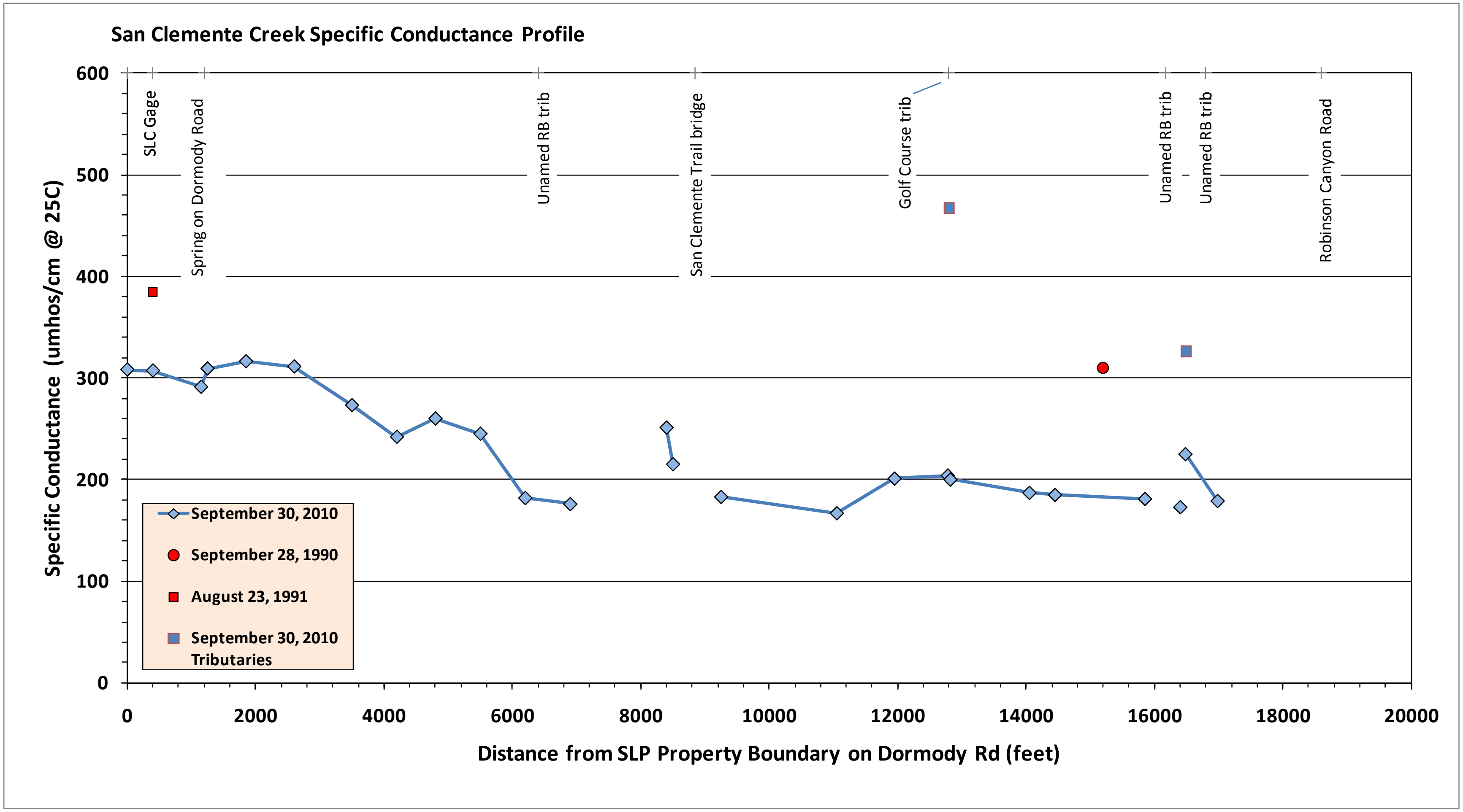

Figure 13. The comparison of San Clemente Creek specific conductance measurements from September 1990, August 1991 and September 2010 illustrated the 2010 specific conductivity was generally lower than 1990, 1991 conditions. For 2010 data, line breaks indicate discontinuous flow.