



Report No. WI-2013-05
10 October 2013

The Watershed Institute

Science and Environmental Policy
California State University
Monterey Bay
www.watershed.csUMB.edu

100 Campus Center, Seaside, CA,
93955-8001
831 582 4694 / 4431.

*Central
Coast
Watershed
Studies*

CCoWS

2013 Annual Report: Hydrologic Conditions in Baseflow Reaches Pursuant to Conditions 14 and 15, Santa Lucia Preserve, Monterey County, California

Sheldon Leiker
Aimee Teaby
Chelsea Neill
Douglas Smith (Ph.D.)

Lead author contact details:
sleiker@csUMB.edu
ateaby@csUMB.edu
cneill@csUMB.edu
dosmith@csUMB.edu

Preface

This report presents the results of the 2013 baseflow condition surveys of the four major streams flowing through Santa Lucia Preserve– Lower Las Garzas, Potrero, 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 Wildlife, 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 Christina Fischer of the Santa Lucia Conservancy and Scott Brown of Balance Hydrologics for providing logistic support and reference information. We thank Nicholas Sadrpour and August Delforge for field assistance and support. Thomas Christensen provided precipitation data for San Clemente Dam.

Table of Contents

Preface.....	1
Acknowledgments.....	1
List of Figures	3
1 Introduction.....	4
2 Methods	5
2.1 Baseflow Conditions Mapping	5
2.2 Specific Conductance Profiles	6
3 Results	6
3.1 Lower Las Garzas Creek.....	7
3.2 Portrero Creek	7
3.3 San Jose Creek.....	8
3.4 San Clemente Creek	8
4 Discussion	8
5 Conclusion.....	9
6 References	10
7 Figures	11

List of Figures

- Figure 1. Annual rainfall at San Clemente Dam, water years 1922 – 2013
- Figure 2. Map showing Lower Las Garzas Ck. generalized flow conditions on 9/20/13
- Figure 3. Map showing Lower Las Garzas Ck. generalized flow conditions on 10/30/90
- Figure 4. Specific conductance plot for Lower Las Garzas Ck. for 1990 and 2013
- Figure 5. Map showing Potrero Creek generalized flow conditions on 9/13/13
- Figure 6. Map showing Potrero Creek generalized flow conditions on 10/06/90
- Figure 7. Specific conductance plot for Potrero Creek for 1990, 1991, and 13
- Figure 8. Map showing San Jose Creek generalized flow conditions on 9/27/13
- Figure 9. Map showing San Jose Creek generalized flow conditions for September 1990
- Figure 10. Specific conductance plot for San Jose Creek for 1990, 1991, and 2013
- Figure 11. Map showing San Clemente Creek generalized flow conditions on 9/21/13
- Figure 12. Map showing San Clemente Creek generalized flow conditions on 9/28/90
- Figure 13. Specific conductance plot for San Clemente Creek for 1990, 1991, and 2013

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 September 13, 2013 through September 27, 2013 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 2013 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 as much as possible 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 channel¹,” 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 Potrero 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 isolated 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 conductance², 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 2013 baseflow survey are briefly summarized and compared with 1990 reference baseflow conditions. Two of the four streams (Las Garzas and San Clemente) were approximately equivalent to the 1990 reference baseflow conditions while San Jose Creek had locally “wetter” conditions, and Potrero Creek had locally drier conditions. There was less precipitation in water year 2013, 14.47 inches, than the average year, 21.31 inches (Figure 1). This water year followed a below average rainfall year in 2012. Water year 2013 is considered a drought year because it is the second consecutive dry or critically dry water year. The below average rainfall, which was only slightly higher than 1990 (13.1 inches) and drought conditions have led to below average stream flow throughout Monterey County.

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 20, 2013 (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 2013, Garzas had conditions that were similar to, or slightly "wetter," conditions as compared to the conditions in October of 1990 (Figure 3). In 2013, Pinyon Peak Reach and the upper reaches had a dry channel and intermittent surface flow with occasional isolated pools. The Terraced Alluvial Reach consisted of isolated pools, dry channel, and limited surface flows. The upstream portion of the Alluvial Fan Reach had surface flow and the downstream portion was dry. This portion of the creek was slightly wetter than 1990, given the flow in the Alluvial Fan Reach and Lower SLP where there was none in 1990. In 1990, the majority of the "Protected Baseflow Reach" was dry or predominately, and, similarly, 2013 the "Protected Baseflow Reach" was dry with intermittent flow and occasional isolated pools.

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 2013 is less variable, but it follows the same general trend as 1990 (Figure 4). The specific conductance values are lower than the values from 1990 upstream, and similar to the 1990 values downstream.

3.2 Potrero Creek

The Potrero Creek baseflow survey was conducted on September 13, 2013. The survey extended from the SLP gatehouse to Potrero Trail Bridge crossing (Figure 5). There was continuous surface flow throughout the mid to lower portion of the "Protected Baseflow Reach" while the upper portion was dry. Downstream of the "Protected Baseflow Reach" the channel was dry. The upper reach was mainly dry with intermittent surface flow. Wolshner et al. (2004) describes the "Protected Baseflow Reach" section as surveyed in 1990 as having locally discontinuous flow (Figure 6). In 2013, Potrero Creek was similar to 1990 conditions, but locally drier.

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 2013 were generally lower than 1991 measurements (Figure 7). In 2013, 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 September 27, 2013. The survey began at the SLP property line and extended upstream to Stickleback Pond (Figure 8). There was continuous surface flow in the “Protected Baseflow Reach” and dry conditions for the remainder of the surveyed reach within intermittent surface flow. The 1990 survey was discontinued above Van Winkley’s Canyon and found predominantly dry conditions for the majority of the survey (Figure 9). In 2013, San Jose Creek was “wetter” than 1990 conditions.

Specific conductance measurements from San Jose Creek were generally equivalent or lower in 2013 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 21, 2013 (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,” while the upstream reach was predominately dry channel with intermittent wet 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.

Only two specific conductance measurements were taken during the 1990 survey and two measurements from the 1991 survey. Specific conductance data from 2013 are lower than the data from 1990 and 1991 (Figure 13). Compared with the little reference data that exists for 1990 conditions and the continuous surface flow in the “Protected Baseflow Reach”, San Clemente Creek is equivalent to 1990 conditions.

4 Discussion

The 2013 water year rainfall (14.47 inches) was very similar to 1990 rainfall (13.1 inches) and lower than the average rainfall (21.31 inches). The reference condition in 1990 was after four years of drought. In 2013, after one year of below average rainfall following two years of above average rain, we would expect the baseflow to be similar or slightly higher than 1990. We would also expect the specific conductance profiles to be similar or slightly lower than the 1990

reference measurements because 1990 was preceded by four drought years rather than one drought year. Baseflow expectations were met overall, given that San Clemente and Lower Las Garzas were equivalent to 1990 conditions, San Jose Creek was locally wetter, and Potrero Creek was locally drier than 1990 conditions. Specific conductance expectations were met.

5 Conclusion

Baseflow conditions were surveyed on the four major streams that 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. All of the surveyed Creeks are clearly equivalent to, or wetter than, the 1990 reference year except for Potrero Creek, which appears to be locally drier. The original 1990 study did not describe the resolution of observation (minimum stream length that could be mapped as a separate dryness condition). Thus, a very great difference in dryness would have to prevail before we would definitively state that a stream was, in fact, dryer than reference conditions. Given this level of uncertainty in the reference study, and the general similarity in conditions, we cannot conclude that the creeks are drier in 2013. Thus, results from baseflow mapping and specific conductance plots suggest that 2013 conditions are generally equivalent to those of 1990.

6 References

- Croyle, Z, Smith, D.P.. 2007. 2007 Annual report: hydrologic conditions in baseflow reaches pursuant to conditions 14 and 15, Santa Lucia Preserve, Monterey County, California. Prepared for The Santa Lucia Conservancy. The Watershed Institute, California State University Monterey Bay, Publication No. WI-2007-3, 28pp.
- Napolitano M, Hecht B. 1992. Baseline hydrologic assessment of streams and springs at Rancho San Carlos, Monterey County, California, 1990 - 1991. Consulting report prepared by Balance Hydrologics on behalf of The Habitat Restoration Group. 85 pp.
- Paddock, E. and Smith, D. 2009. 2009 Annual Report: Hydrologic Conditions in Baseflow Reaches Pursuant to Conditions 14 and 15, Santa Lucia Preserve, Monterey County, California. Prepared for The Santa Lucia Conservancy. The Watershed Institute, California State University Monterey Bay, Publication No. WI-2009-3, 28pp.
- Woyshner M, Brown S, Hecht B. 2003. Dry season hydrologic and geomorphic conditions on lower Las Garzas Creek, Monterey County, California, 2002. Consulting report prepared by Balance Hydrologics for the Santa Lucia Conservancy. 123 pp.
- Woyshner M, Brown S, Hecht B. 2004. 2004 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.
- 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

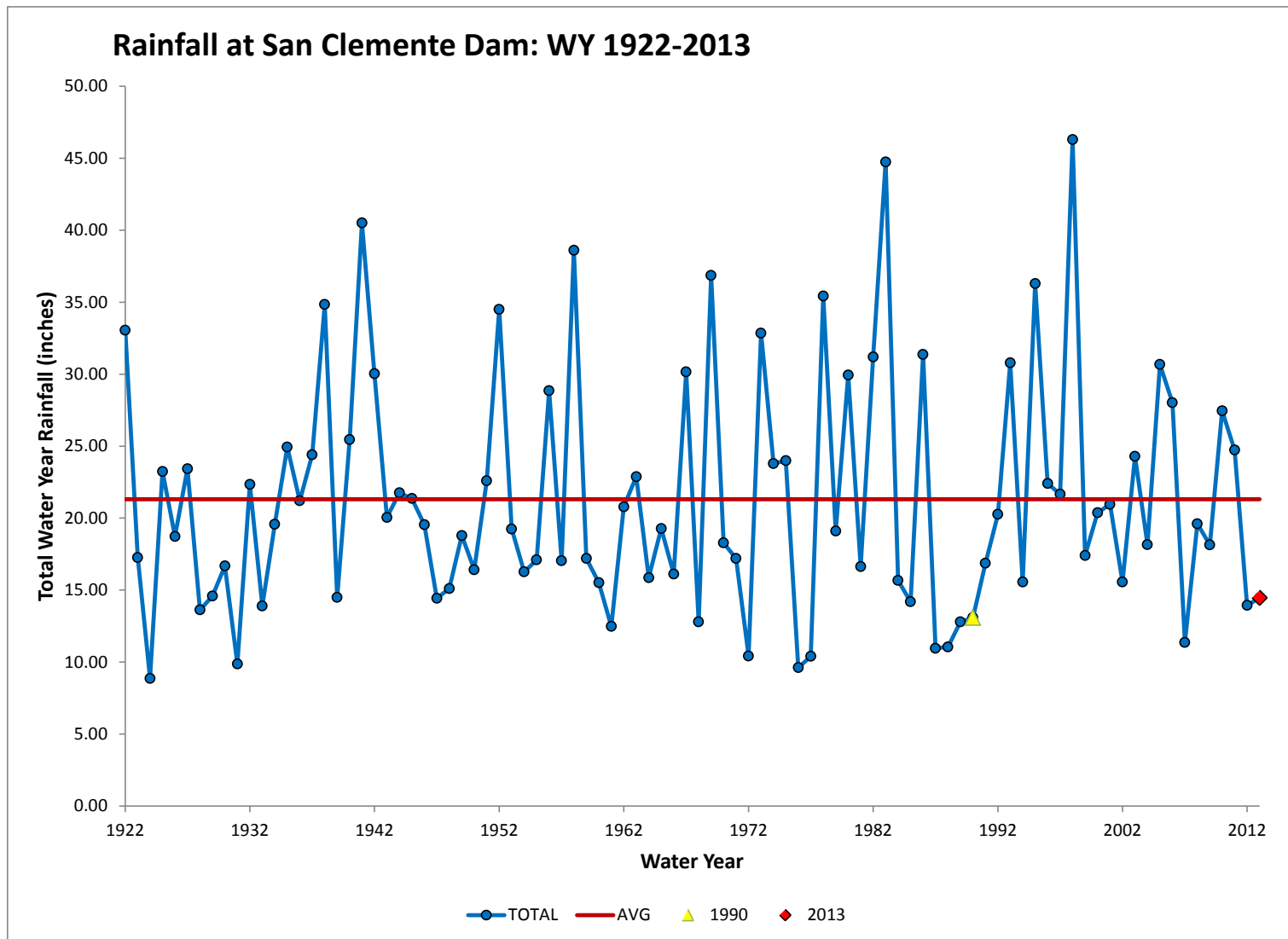


Figure 1. Total rainfall at San Clemente Dam for water years 1922-2013 resulted in an average rainfall of 21.31 inches. Water year 2013 received nearly equivalent rainfall to 1990. The 14.47 inches of precipitation in 2013 was only slightly higher than the 13.1 inches of rainfall in 1990. The year prior to 2013 also received less than average rainfall which explains why baseflow conditions in 2013 were usually equivalent to 1990 which had similar conditions.

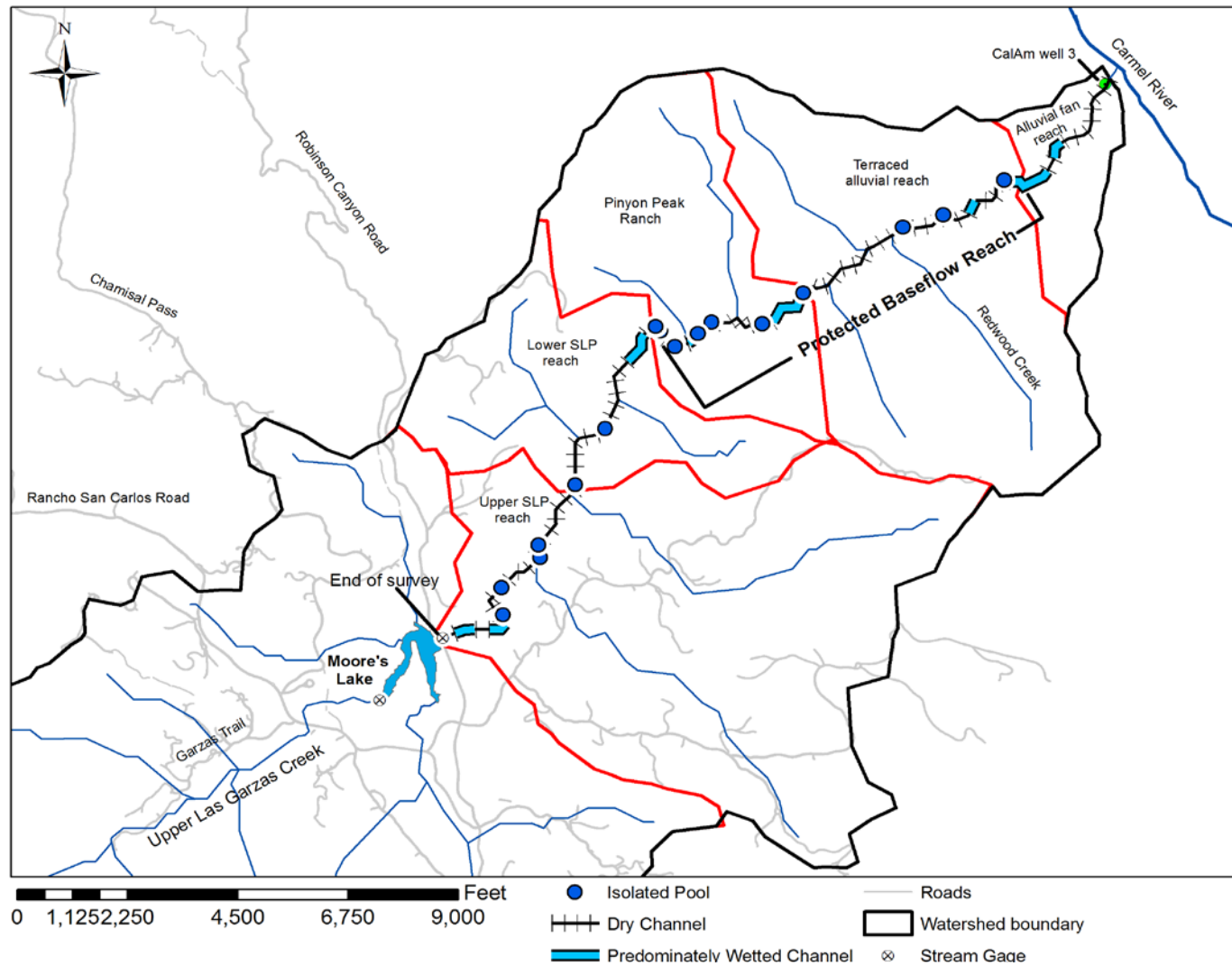
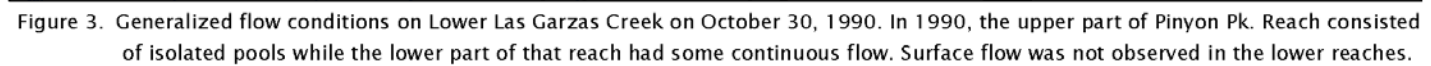


Figure 2. Map of generalized flow conditions for lower Las Garzas Creek on September 20, 2013. In 2013, Pinyon Peak Reach and the upper reaches had a dry channel and intermittent surface flow with occasional isolated pools. The Terraced Alluvial Reach consisted of isolated pools, dry channel and brief surface flows. The upstream portion of the Alluvial Fan Reach had surface flow and the downstream portion was dry.



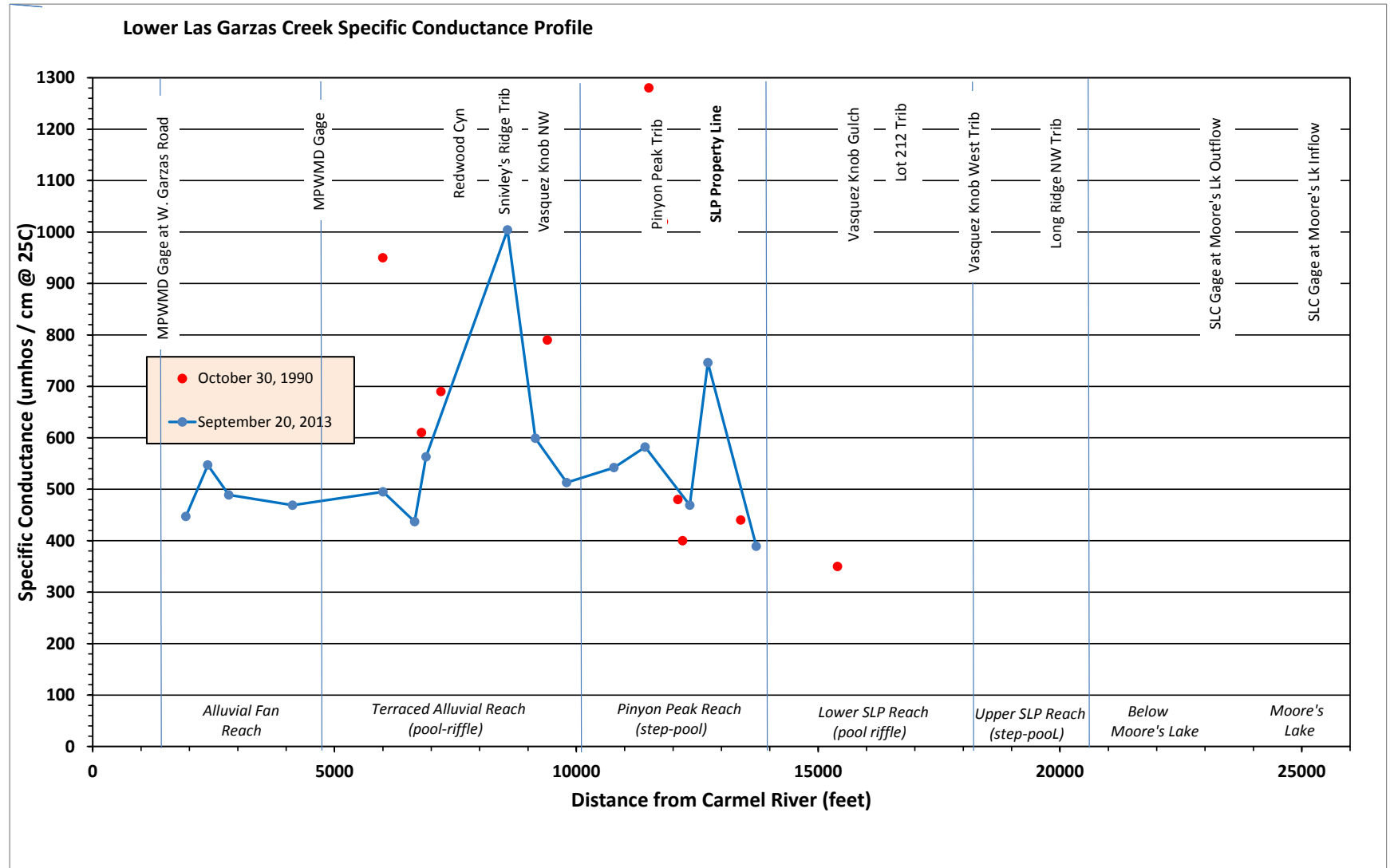


Figure 4. The comparison of Lower Las Garzas Creek specific conductance measurements from October 30, 1990 and September 20, 2013 illustrated the 2013 specific conductivity was generally lower than 1990 conditions downstream and similar to 1990 conditions upstream. The specific conductivity data for 1990 was extremely variable, so it is very difficult to "characterize" the data for 1990 with a meaningful average. Some of the highest values recorded in 2013 were taken in isolated pools.

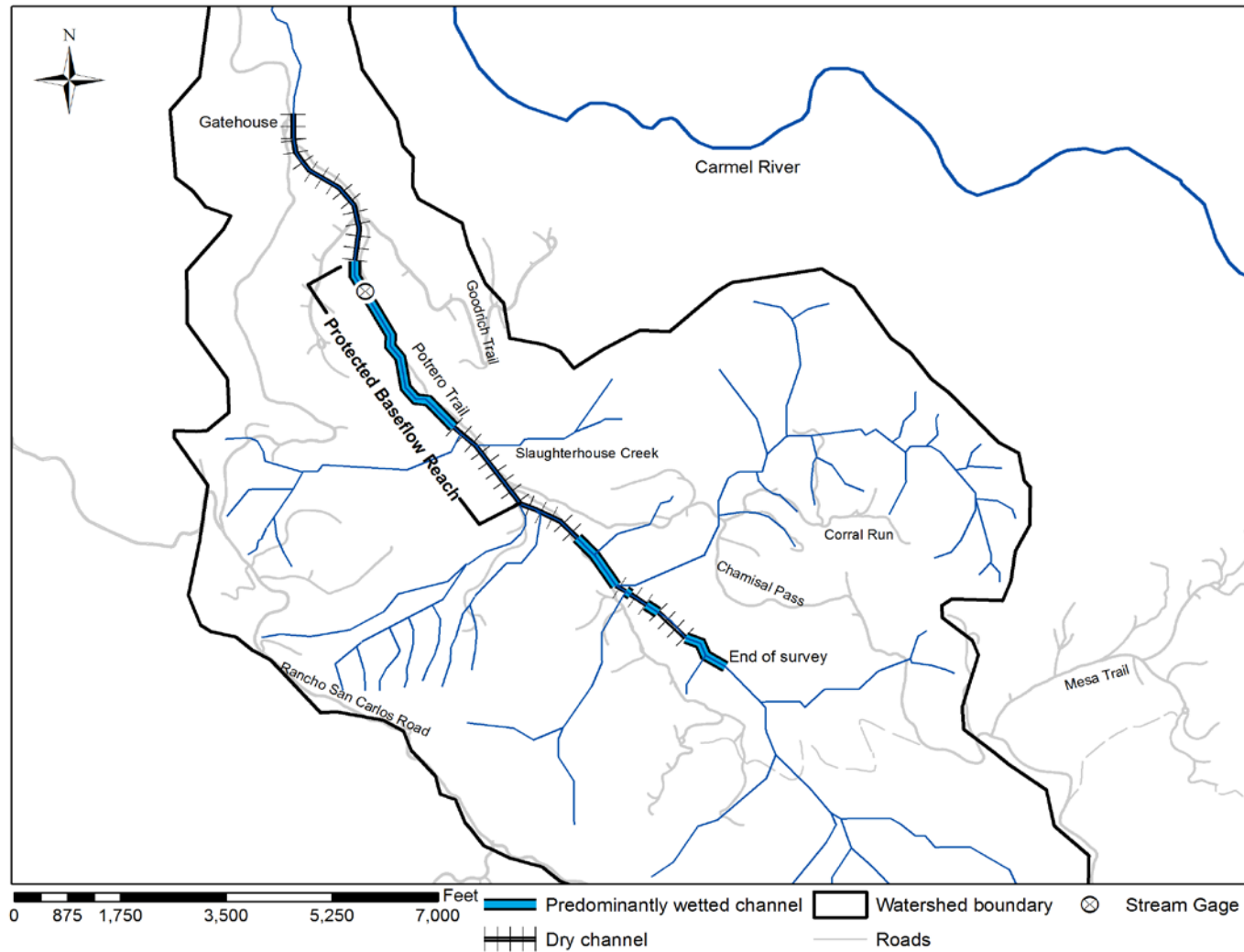


Figure 5. Map of generalized flow conditions on Potrero Creek on September 13, 2013. There was continuous surface flow throughout the mid to lower portion of the "Protected Baseflow Reach." Downstream of the "Protected Baseflow Reach" the channel was dry. The upper reach was mainly dry with intermittent surface flow.

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

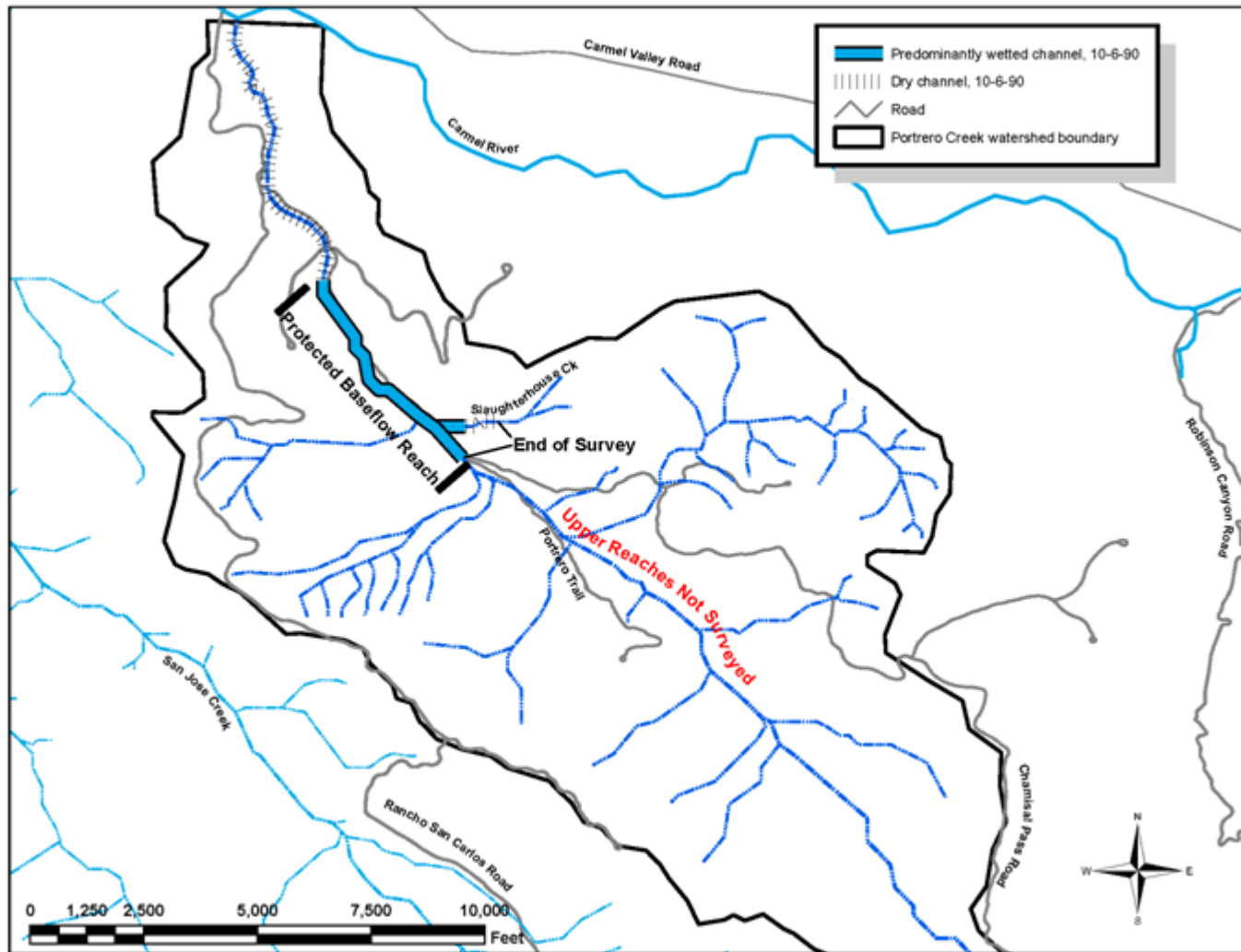


Figure 6. Generalized flow conditions on Potrero Creek on October 6, 1990.

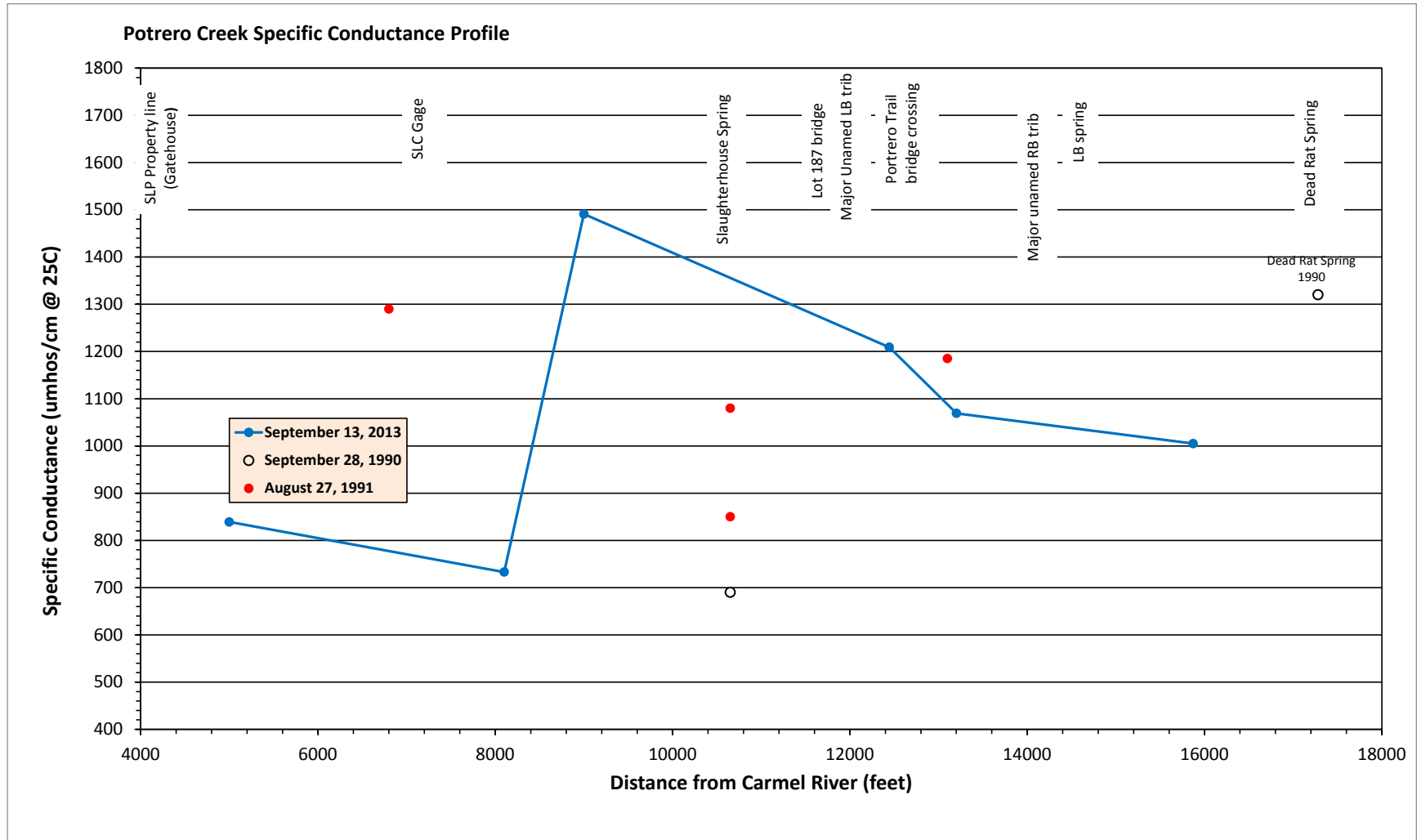


Figure 7. The comparison of Potrero Creek specific conductance measurements from September 1990, August 1991 and September 2013 illustrated the 2013 specific conductivity was generally lower than 1990 and 1991 conditions with the exception of one reading . There was not enough flow for a measurement of the Slaughterhouse Spring in 2013.

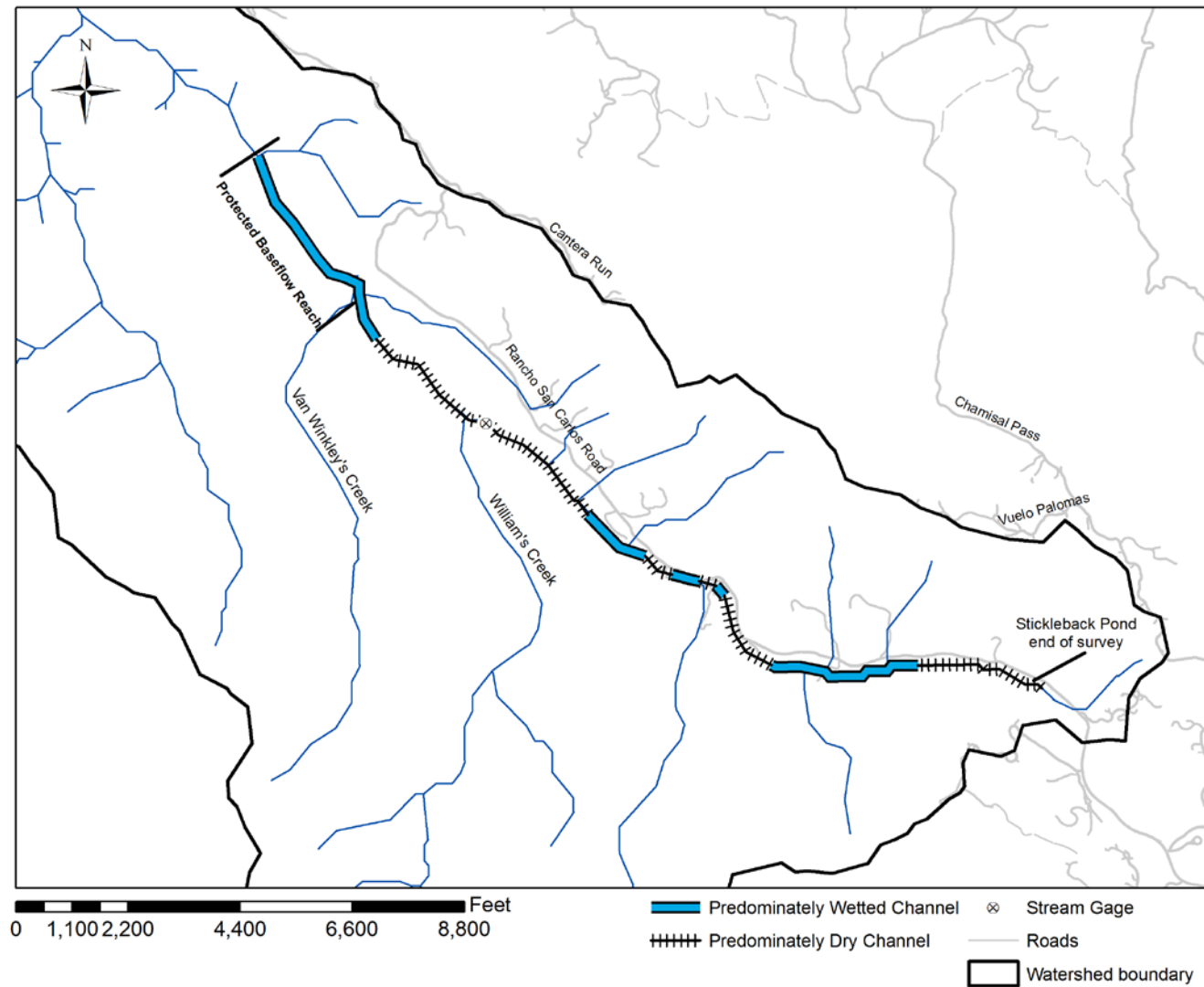


Figure 8. Map of generalized conditions on San Jose Creek on September 27, 2013. There was continuous surface flow in the “Protected Baseflow Reach” and dry conditions for the remainder of the surveyed reach within intermittent surface flow.

September 1990: San Jose Creek Generalized Wetted and Dry Conditions

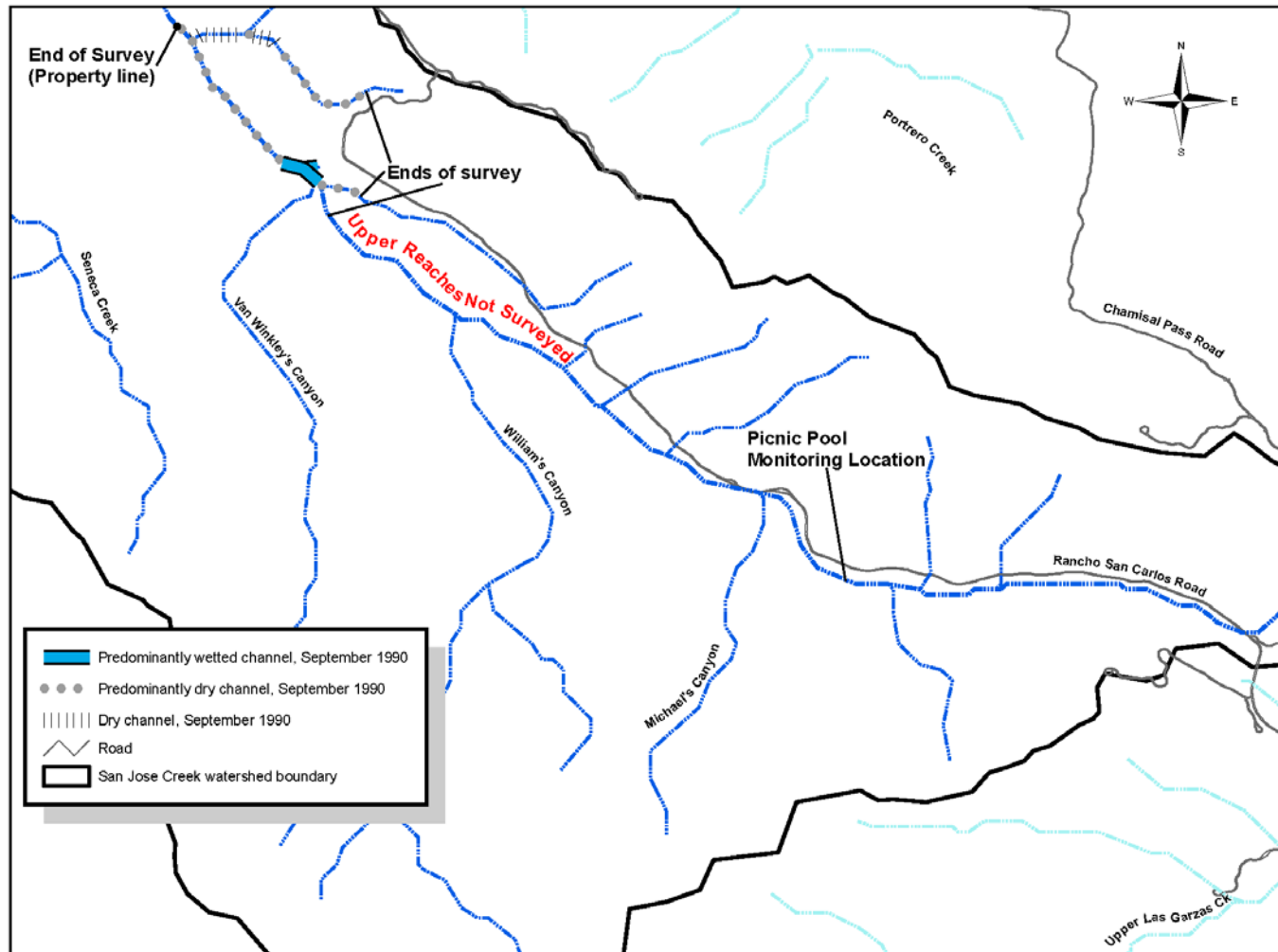


Figure 9. Generalized flow conditions on San Jose Creek in September 1990.

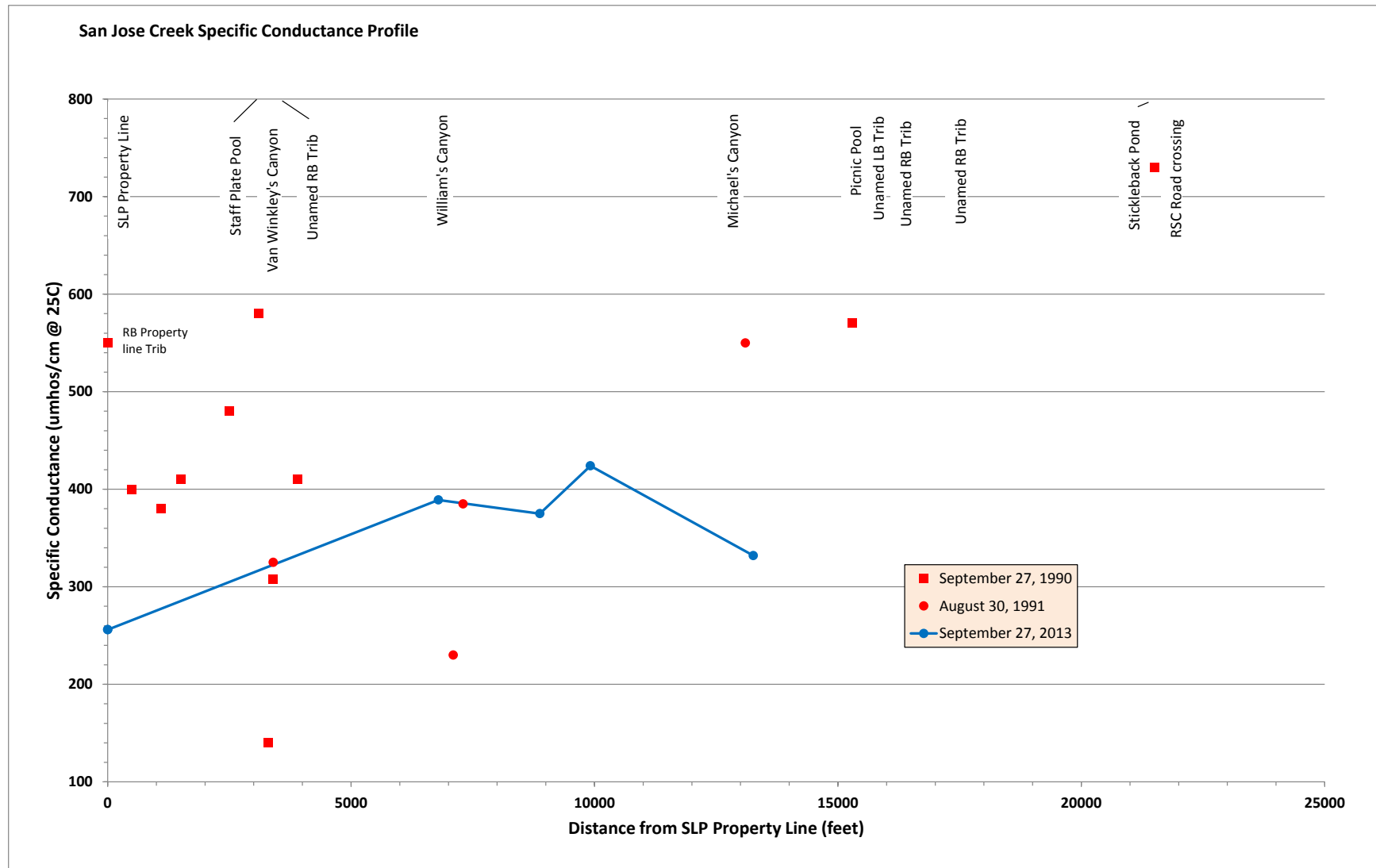


Figure 10. The comparison of San Jose Creek specific conductance measurements from September 1990, August 1991 and September 2013 illustrated the 2013 specific conductivity was generally equivalent or lower than 1990 and 1991 conditions.

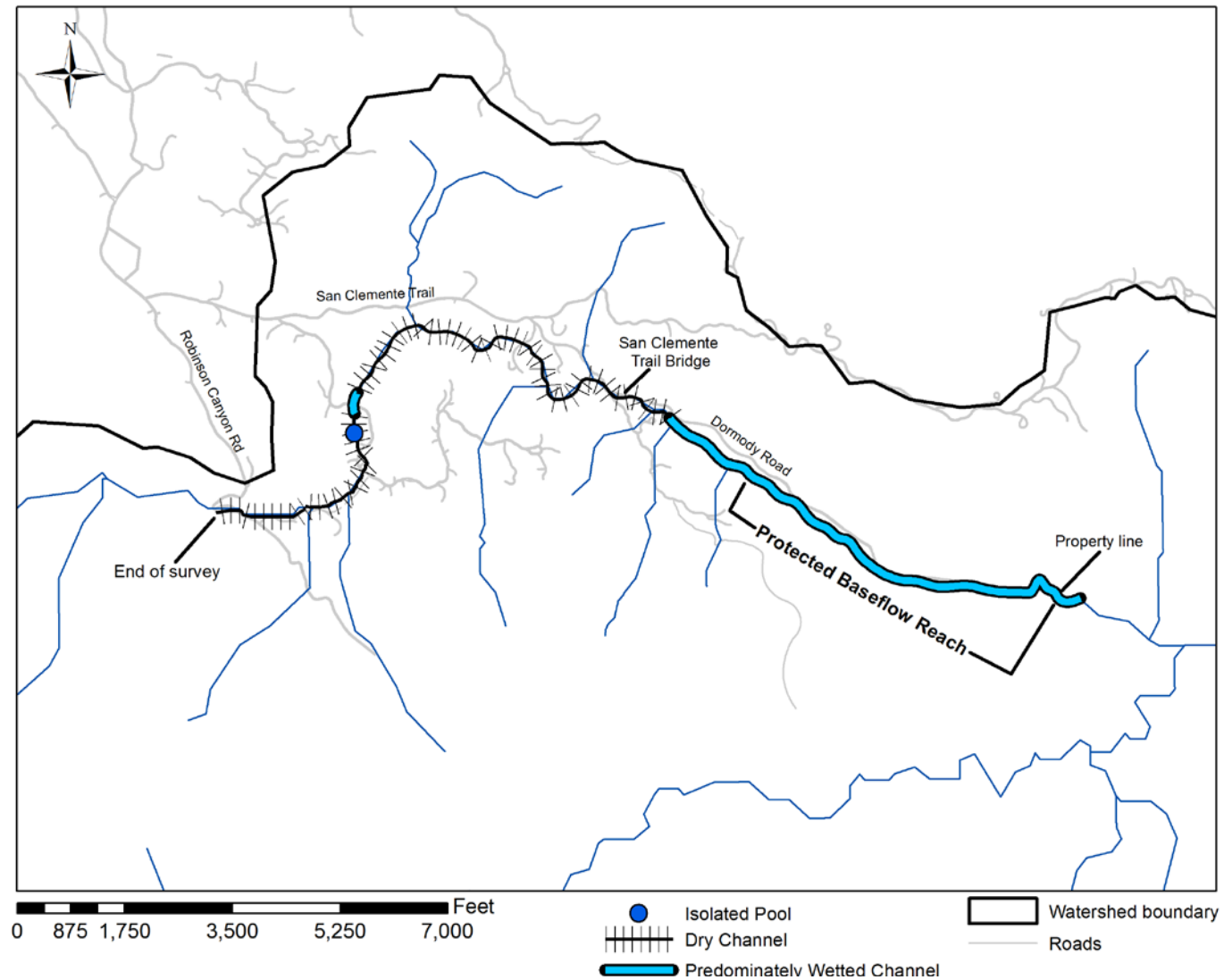


Figure 11. Map of generalized flow conditions on San Clemente Creek on September 21, 2013. There was continuous surface flow in the “Protected Baseflow Reach,” while the upstream reach was predominately dry channel with intermittent wet reaches and isolated pools.

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

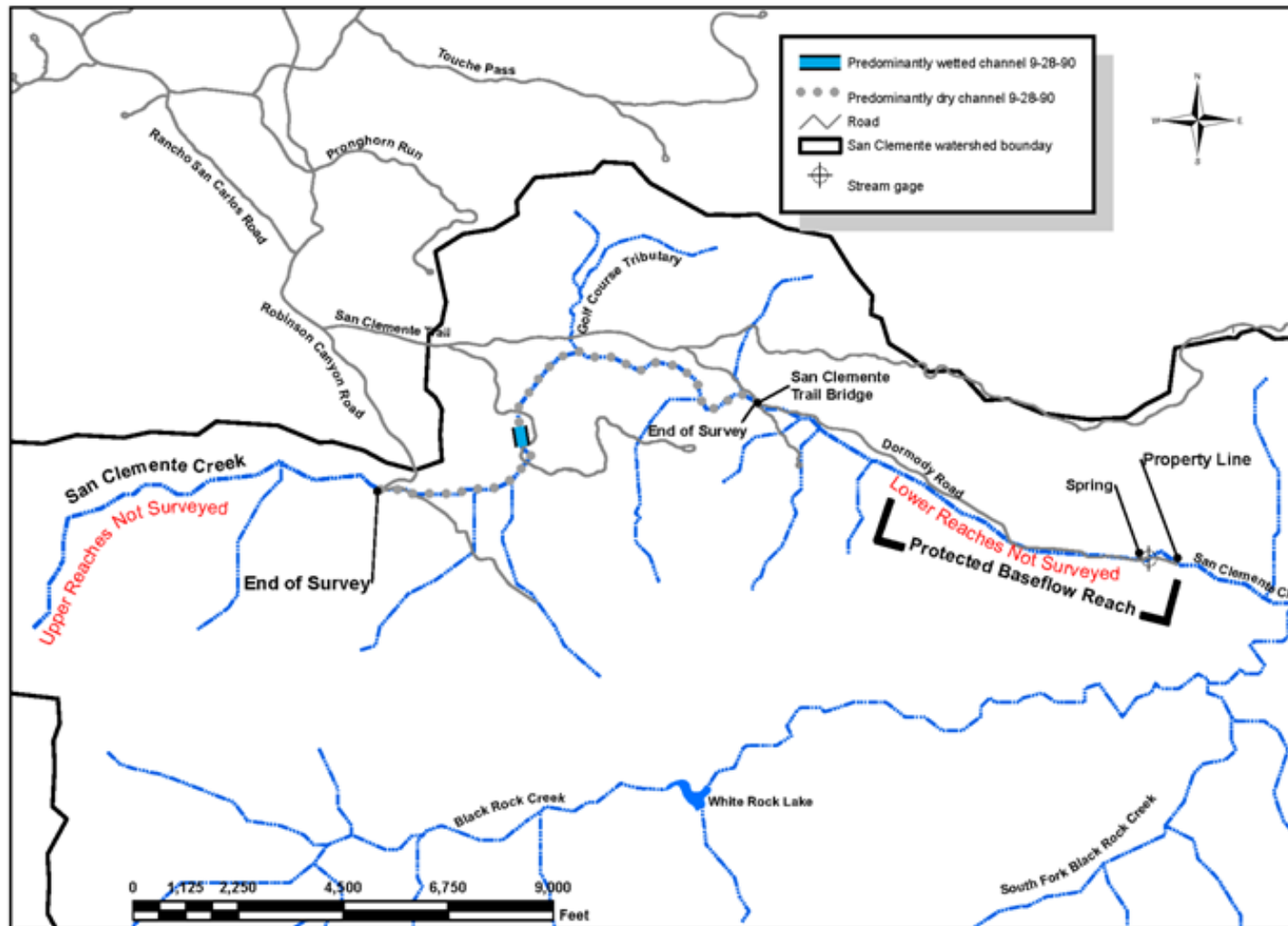


Figure 12. Generalized flow conditions on San Clemente Creek on September 28, 1990.

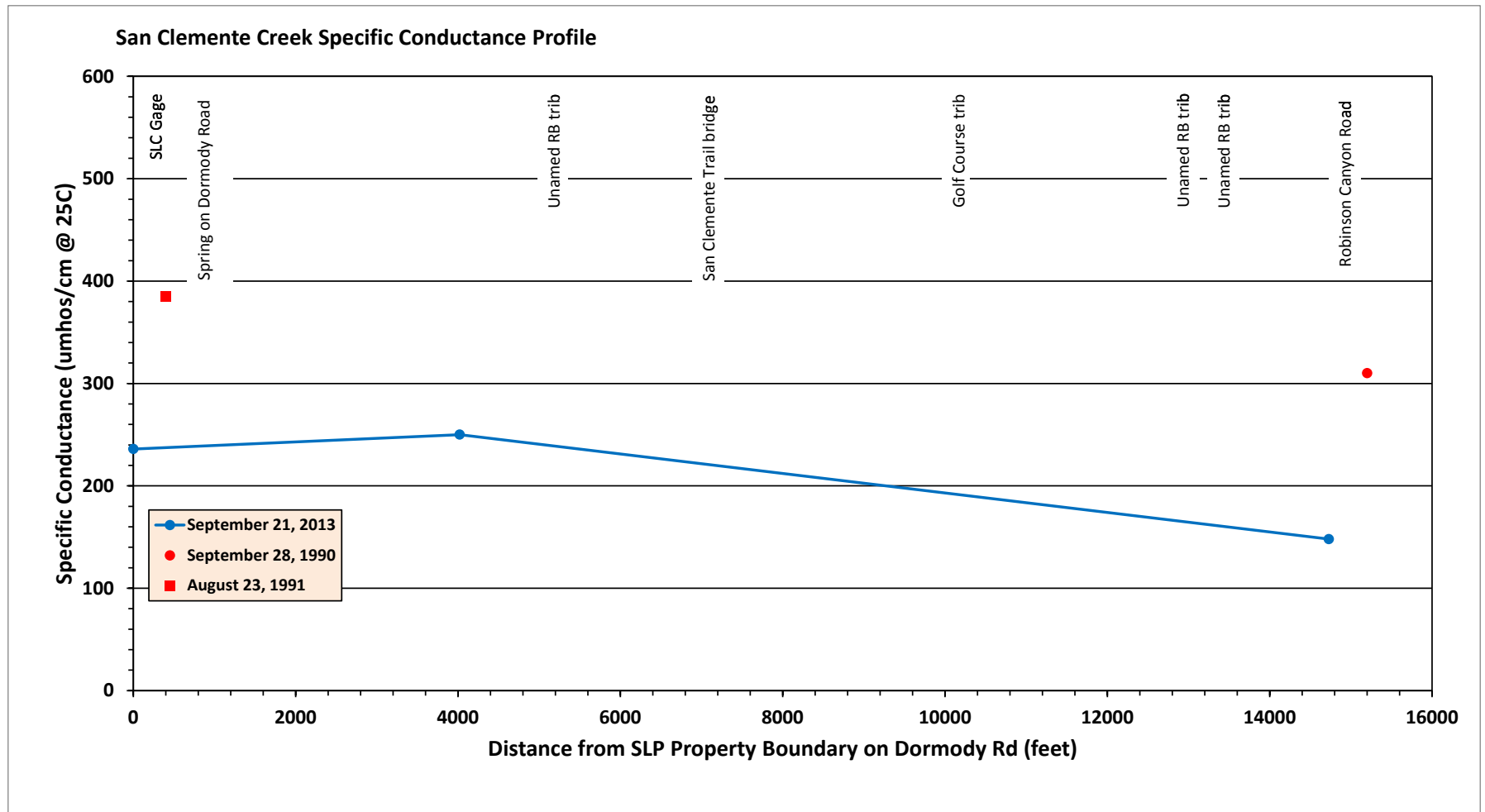


Figure 13. The comparison of San Clemente Creek specific conductance measurements from September 1990, August 1991 and September 2013 illustrated the 2013 specific conductivity was generally lower than 1990 and 1991 conditions.

