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2016 Water Quality

Santa Lucia Preserve,
Monterey County, California

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Preface

This report has been prepared for the Santa Lucia Conservancy and presents the results of biannual water quality monitoring from 2009–2016 for Lower Las Garzas, Potrero, San Jose, and San Clemente Creeks. The data collected will serve an integral part establishing a long term dataset necessary for future analyses.

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1 Introduction

The Santa Lucia Preserve (SLP) is a 20,000 acre low density development in Monterey County, California. The Santa Lucia Conservancy (SLC) is a non-profit organization established to manage 18,000 undeveloped acres of the SLP. Four streams within the SLP are monitored by the SLC: Las Garzas Creek, San Jose Creek, Potrero Creek and San Clemente Creek (Figure 1). Since the formation of the SLC in 1995 water quality data have been collected intermittently by various organizations.

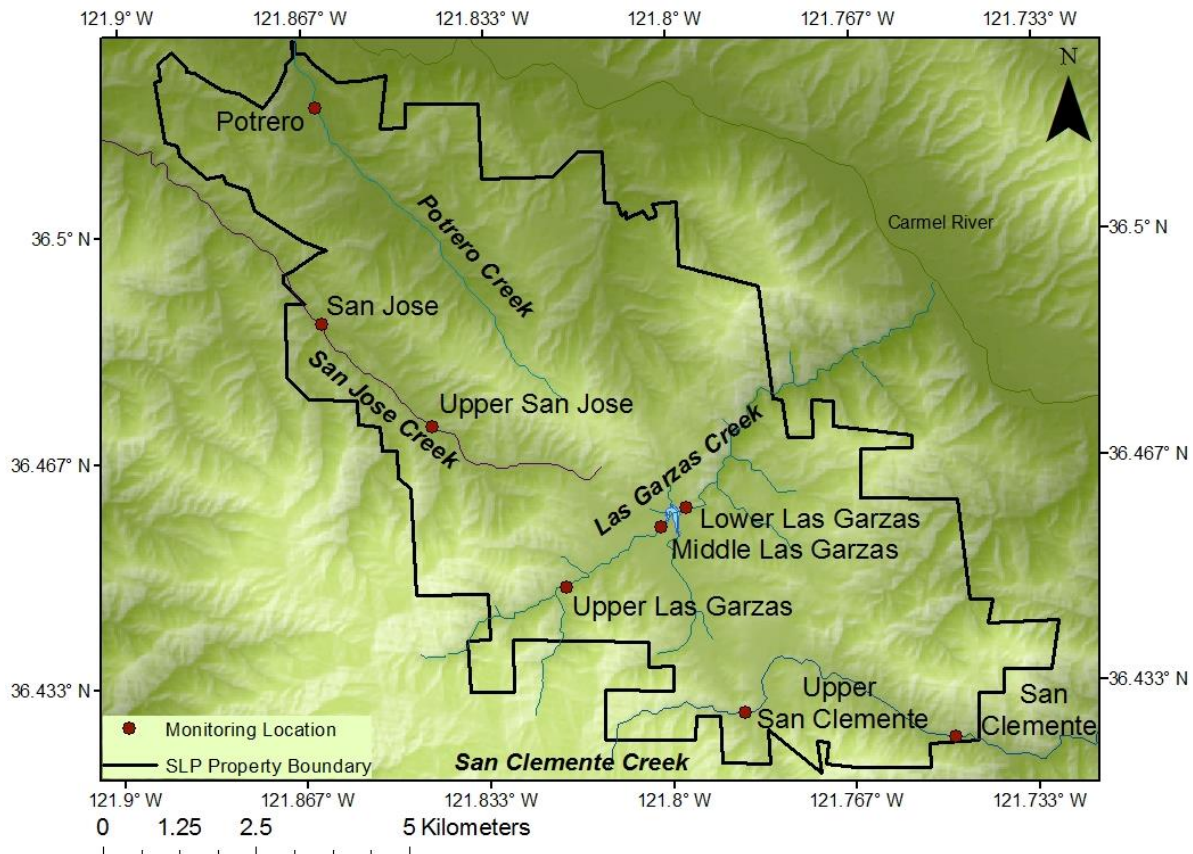


Figure 1: Map of Santa Lucia Preserve showing eight monitoring sites on four streams within the property boundary.

This report presents water quality data from eight monitoring sites (Figure 1). We discontinued photomonitoring in 2015 following several years of unchanging conditions. The goal of this report is to continue a baseline data set for suspended sediment concentrations and water nutrient levels. Biannual water quality data collected since August 2009 are presented and compared.

1.1 Suspended Sediment and Stream Nutrients

The sediment load in streams is influenced by average and peak precipitation, discharge, geology, anthropogenic impacts, and the size of the drainage basin (Milliman and Syvitski 1992, Walling and Fang 2003). Increased sediment loads might have negative effects on stream habitat for macroinvertebrates, fish spawning and rearing, and other aquatic organisms (EPA 2003, Jha 2003, Smith et al. 2005). Specific levels of suspended sediment concentrations of 500mg/l or higher have shown sublethal stress as well as blood cell count and chemistry changes in Steelhead (Redding and Schreck 1982), and long term concentrations above 1650 mg/L suspended sediment will cause loss of habitat from increased sediment deposition (Coats et al. 1985).

Stream nutrient levels in surface water are naturally influenced by geology, vegetation and climate (Beaulac and Reckhow 1982, Hynes 1983, Clark et al. 2000). Dissolved nitrate plus nitrite as nitrogen (nitrate), dissolved ammonia plus ammonium as nitrogen (ammonia) and dissolved orthophosphate as phosphorus (orthophosphate) are three stream nutrients that are monitored for water quality. Nutrients may be released and levels may increase as a result of development (soil movement) or agriculture (fertilizer application/manure) or from atmospheric deposition (Beaulac and Reckhow 1982, Smith et al. 1999). Forested, undeveloped watersheds mostly have a low and homeostatic nutrient load (Beaulac and Reckhow 1982). In undeveloped watersheds across the United States, Clark et al. (2000) found that the median flow-weighted concentrations were 0.020 mg/L for ammonia as N, 0.26 mg/L for total nitrogen and 0.010 mg/L for orthophosphate as P. The California EPA is in the scoping process to propose nutrient water quality objectives. Nutrients alone do not affect Beneficial Uses protected by the California EPA because various levels of nutrients will cause eutrophication depending on the stream itself ([SWRCB] 2011). Monitoring for nutrient levels and eutrophication in streams will help establish a baseline for the stream in question.

A snapshot of stream suspended sediment load and stream nutrients over an extended period of time provides a long term measure of watershed conditions for the four streams sampled on the SLP. Precipitation conditions during sampling will affect the magnitude of the resulting sediment and nutrient loads. Biannual sampling in August and March provides one sample during the dry season with low stream discharges and one sample during the wet season with higher stream discharges. Long term monitoring will enable the SLC to detect any negative changes in suspended sediment load or stream nutrients in the future.

1.2 Monitoring Locations

This report presents water quality data collected from eight monitoring sites (Appendix A, Figure 1). There are two monitoring sites on San Clemente Creek. The site named “San Clemente” is 30 meters upstream from the gage, a half mile upstream from the property line. The site named “Upper San Clemente” is 50 meters downstream from the intersection of Robinson Canyon Road and San Clemente Creek, 5 meters upstream of the footbridge.

There are two monitoring sites on San Jose Creek. The site named “San Jose” is the downstream site located upstream of a cement weir. The site named “Upper San Jose” is located near Lot 46, near Rancho San Carlos Road.

There are three monitoring sites on Las Garzas Creek. The site named “Lower Garzas” is 50 meters downstream from Moore’s Lake. The site named “Middle Garzas” is upstream of Moore’s Lake, upstream of the culvert. The site named “Upper Garzas” is 50 meters upstream of the intersection of Las Garzas Trail Road and Las Garzas Creek.

There is one monitoring site on Potrero Creek. The site is located in the lower reach of the creek, 50 meters downstream of the gage.

2 Methods

2.1 Suspended Sediment, Stream Discharge and Instantaneous Load Data

A water sample for sediment analysis was taken biannually at each location from March 2009 to August 2016. The suspended sediment concentration (mg/L) was sampled by evenly dividing the stream width into a minimum of three intervals and collecting water with a DH-48 depth integrated sediment sampler. The suspended sediment concentration was found by filtering the sample and finding the mass of sediment per liter of water. Stream discharge measurements were conducted using standard hydrologic practices such as a SonTek Flow Tracker velocity meter or three inch Parshall Flume. Instantaneous load concentration (mg/s) was calculated as the product of the stream discharge and suspended sediment concentration.

2.2 Stream Nutrients

Water samples were collected biannually from each site from March 2009 to August 2016. Beginning in April 2015, the samples were sent to Monterey Bay Analytic Services (MBAS) to analyze nutrients with a Lachat QuickChem flow-injection analyzer. The nutrients analyzed were ammonium, nitrate+nitrite and soluble reactive phosphate (SRP) (orthophosphate). This report provides a snapshot of stream nutrient concentrations (ppm) for future comparison and monitoring.

3 Results

3.1 Suspended Sediment, Stream Discharge and Instantaneous Load

Upper San Clemente had the highest concentration of suspended sediment and instantaneous load concentration in March 2016. Upper Garzas had the lowest suspended sediment concentration at 0.112 mg/L. Middle Garzas had the highest suspended sediment concentration at 224.910 mg/L while San Clemente and Potrero had the least at below detectable limits in August 2016 (Table 1.1 & 1.2). Middle Garzas had the highest flow in March 2016 while San Jose had the highest flow in August 2016.

Fifteen samples over seven years have indicated that suspended sediment may be recently increasing. Despite a possible increase in suspended sediment load this year, streams on the SLP carry very little suspended sediment, indicating good aquatic habitat for steelhead, macroinvertebrates, and other aquatic organisms.

3.2 Stream Nutrient Data

The streams at the SLP have historically had a low concentration of ammonium, SRP and nitrate + nitrite (Table 2.1 & 2.2). Stream nutrient concentrations were low, if not below minimum detectable limit, in both March and August 2016. In March 2016 all sampled streams had slightly higher nitrate+nitrite concentrations, but low levels of ammonium and SRP. In August 2016 nitrate + nitrite concentrations dropped and the only sampling location with a detectable nutrient was Middle Garzas, which was a standing pool of water.

4 Discussion

The 2016 water year brought more precipitation (22.25 inches) than the past four years, possibly causing more runoff and suspended sediment. This year was also the first year since 2011 where the “dry” sampling month had no dry channels. The increase in water could have diluted the nutrient concentrations in the streams causing most of the streams to have concentrations below detectable limits in the dry months.

Water quality monitoring parameters indicate that there are no impacts at this time, in keeping with previous monitoring results.

5 Water Quality Data Tables

Table 1: Suspended sediment concentration (mg/l), water discharge (l/s) and instantaneous load concentration (mg/s) from 8 monitoring sites on 4 creeks of the SLP. Table continues on page 11.

| Location | Suspended Sediment Concentration (mg/l) | Q (l/s) | Instantaneous Load Concentration (mg/s) | Location | Suspended Sediment Concentration (mg/l) | Q (l/s) | Instantaneous Load Concentration (mg/s) |
|--------------------|---|---------|---|--------------------|---|---------|---|
| | | | | August 2009 | | | |
| | | | | Upper Garzas | NA | dry | NA |
| | | | | Mid Garzas | NA | dry | NA |
| | | | | Lower Garzas | 0.023 | pool | NA |
| | | | | Potrero | 0.208 | 0.8 | 0.16 |
| | | | | Upper San Clemente | 0 | 0.1 | 0 |
| | | | | San Clemente | 0.027 | 0.7 | 0.018 |
| | | | | Upper San Jose | 0 | trace | 0 |
| | | | | San Jose | 0 | 3.1 | 0 |
| March 2010 | | | | August 2010 | | | |
| Upper Garzas | 0 | 132.8 | 0 | Upper Garzas | 0 | 10.4 | 0 |
| Mid Garzas | 0 | 239.6 | 0 | Mid Garzas | 0 | 8.4 | 0 |
| Lower Garzas | 0 | 333.4 | 0 | Lower Garzas | 0 | 8.0 | 0 |
| Potrero | 0.008 | 43.5 | 0.36 | Potrero | 0.016 | 2.2 | 0.034 |
| Upper San Clemente | 0 | 75.9 | 0 | Upper San Clemente | 0 | 4.3 | 0 |
| San Clemente | 0 | 196.2 | 0 | San Clemente | 0 | 10.8 | 0 |
| Upper San Jose | 0.007 | 60.8 | 0.41 | Upper San Jose | 0 | 7.7 | 0 |
| San Jose | 0 | 169.2 | 0 | San Jose | 0 | 23.7 | 0 |
| March 2011 | | | | August 2011 | | | |
| Upper Garzas | 0.023 | 639.9 | 14.785 | Upper Garzas | 0 | 14.5 | 0 |
| Mid Garzas | 0 | 185.5 | 0 | Mid Garzas | 0 | 11.3 | 0 |
| Lower Garzas | 0 | 197.7 | 0 | Lower Garzas | 0.008 | 29.0 | 0.232 |
| Potrero | 0.083 | 352.8 | 29.351 | Potrero | 0.119 | 3.3 | 0.391 |
| Upper San Clemente | 0.007 | 31.4 | 0.208 | Upper San Clemente | 0 | 7.7 | 0 |
| San Clemente | 0 | 102.8 | 0 | San Clemente | 0 | 10.5 | 0 |
| Upper San Jose | 0.041 | 274.3 | 11.249 | Upper San Jose | 0 | 3.7 | 0 |
| San Jose | 0.045 | 828.4 | 37.071 | San Jose | 0.008 | 19.0 | 0.143 |
| March 2012 | | | | August 2012 | | | |
| Upper Garzas | 0 | 80.9 | 0.202 | Upper Garzas | dry | dry | NA |
| Mid Garzas | 0.008 | 108.2 | 0.850 | Mid Garzas | dry | dry | NA |
| Lower Garzas | 0.011 | 139.9 | 1.534 | Lower Garzas | 0.016 | pool | NA |
| Potrero | 0.010 | 9.9 | 0.103 | Potrero | 0.064 | 1.2 | 0.078 |
| Upper San Clemente | 0.001 | 11.6 | 0.007 | Upper San Clemente | 0.017 | 1.2 | 0.021 |
| San Clemente | 0 | 57.0 | 0 | San Clemente | 0.040 | 1.1 | 0.044 |
| Upper San Jose | 0 | 29.7 | 0.1489 | Upper San Jose | 0.096 | 0.4 | 0.038 |
| San Jose | 0.010 | 104.1 | 1.0540 | San Jose | 0.012 | 7.0 | 0.081 |
| March 2013 | | | | August 2013 | | | |
| Upper Garzas | 0 | 8.4 | 0 | Upper Garzas | dry | dry | NA |
| Mid Garzas | 0 | 45.6 | 0 | Mid Garzas | dry | dry | NA |
| Lower Garzas | 0 | 25.8 | 0 | Lower Garzas | dry | dry | NA |
| Potrero | 0.028 | 3.8 | 0.105 | Potrero | 0.001 | 0.8 | 0.0005 |
| Upper San Clemente | 0.014 | 9.3 | 0.131 | Upper San Clemente | 0.003 | pool | NA |
| San Clemente | 0.004 | 17.1 | 0.069 | San Clemente | 0 | 1.0 | 0 |
| Upper San Jose | 0 | 8.4 | 0 | Upper San Jose | dry | dry | NA |
| San Jose | 0.001 | 26.2 | 0.025 | San Jose | 0.005 | 2.0 | 0.010 |
| April 2014 | | | | August 2014 | | | |
| Upper Garzas | 0 | 24.0 | 0 | Upper Garzas | dry | dry | dry |
| Mid Garzas | 0.011 | 22.0 | 0.231 | Mid Garzas | dry | dry | dry |
| Lower Garzas | dry | dry | dry | Lower Garzas | dry | dry | dry |
| Potrero | 0.056 | 2.7 | 0.151 | Potrero | dry | dry | dry |
| Upper San Clemente | 0 | 2.5 | 0 | Upper San Clemente | dry | dry | dry |
| San Clemente | 0 | 5.3 | 0 | San Clemente | 0.001 | 0.4 | 0.000 |
| Upper San Jose | 0.001 | 0.0 | 0 | Upper San Jose | dry | dry | dry |
| San Jose | 0.010 | 20.3 | 0.198 | San Jose | 0.002 | 0.5 | 0.001 |

Note: "0" indicates measurement below minimum detection limit.

Table 1 (continued): Suspended sediment concentration (mg/l), water discharge (l/s) and instantaneous load concentration (mg/s) from 8 monitoring sites on 4 creeks of the SLP.

| Location | Suspended Sediment Concentration (mg/l) | Q (l/s) | Instantaneous Load Concentration (mg/s) | Location | Suspended Sediment Concentration (mg/l) | Q (l/s) | Instantaneous Load Concentration (mg/s) |
|--------------------|---|---------|---|----------------------|---|---------|---|
| April 2015 | | | | November 2015 | | | |
| Upper Garzas | 2.027 | 6.031 | 12.223 | Upper Garzas | dry | dry | dry |
| Mid Garzas | 1.263 | 20.800 | 26.269 | Mid Garzas | dry | dry | dry |
| Lower Garzas | dry | dry | dry | Lower Garzas | pool | pool | pool |
| Potrero | 11.987 | 1.976 | 23.394 | Potrero | 4.258 | NA | 0.000 |
| Upper San Clemente | 0.932 | 8.100 | 7.553 | Upper San Clemente | dry | dry | dry |
| San Clemente | 1.716 | 18.400 | 31.569 | San Clemente | 0.000 | 1.491 | 0.000 |
| Upper San Jose | 4.044 | 2.697 | 10.906 | Upper San Jose | dry | dry | dry |
| San Jose | 0.783 | 11.774 | 9.219 | San Jose | 0.399 | 1.194 | 0.477 |
| March 2016 | | | | August 2016 | | | |
| Upper Garzas | 0.112 | 344.198 | 38.526 | Upper Garzas | 2.603 | 2.370 | 6.168 |
| Mid Garzas | 0.217 | 370.997 | 80.629 | Mid Garzas | 224.910 | pool | pool |
| Lower Garzas | 0.153 | 459.117 | 0.153 | Lower Garzas | 0.108 | 2.800 | 0.302 |
| Potrero | 0.828 | 60.800 | 50.319 | Potrero | 0.000 | 0.030 | 0.000 |
| Upper San Clemente | 1.105 | 122.399 | 135.296 | Upper San Clemente | 23.755 | 1.100 | 26.130 |
| San Clemente | 0.242 | 222.298 | 29.663 | San Clemente | 0.000 | 1.400 | 0.000 |
| Upper San Jose | 0.434 | 119.199 | 51.733 | Upper San Jose | 1.280 | 9.000 | 11.522 |
| San Jose | 0.578 | 17.500 | 10.120 | San Jose | 0.667 | 10.900 | 7.268 |

Note: "0" indicates measurement below minimum detection limit.

Table 2: Water samples from the monitoring sites were tested for ammonium (ppm), soluble reactive phosphorus (SRP) (orthophosphate) (ppm), and nitrogen as nitrate and nitrite (ppm). As of 2015, nutrient samples were taken to Monterey Bay Analytic Services for testing. Table continues on page 12.

| Location | Ammonium (ppm) | SRP (ppm) | Nitrate + Nitrite (ppm) | Location | Ammonium (ppm) | SRP (ppm) | Nitrate + Nitrite (ppm) |
|--------------------|----------------|-----------|-------------------------|--------------------|----------------|-----------|-------------------------|
| | | | | August 2009 | | | |
| | | | | Upper Garzas | dry | dry | dry |
| | | | | Mid Garzas | dry | dry | dry |
| | | | | Lower Garzas | 0.452 | 0.020 | 0.020 |
| | | | | Potrero | 0.030 | 0.089 | 0.039 |
| | | | | Upper San Clemente | 0.022 | 0.032 | 0.035 |
| | | | | San Clemente | 0.032 | 0.027 | 0.076 |
| | | | | Upper San Jose | no data | no data | no data |
| | | | | San Jose | 0.022 | 0.045 | 0.020 |
| March 2010 | | | | August 2010 | | | |
| Upper Garzas | 0.014 | 0.018 | 0.013 | Upper Garzas | 0.012 | 0.028 | 0.014 |
| Mid Garzas | 0.016 | 0.021 | 0.154 | Mid Garzas | 0.012 | 0.035 | 0.014 |
| Lower Garzas | 0.025 | 0.016 | 0.015 | Lower Garzas | 0.041 | 0.046 | 0.024 |
| Potrero | 0.028 | 0.110 | 0.068 | Potrero | 0.021 | 0.180 | 0.046 |
| Upper San Clemente | 0.017 | 0.026 | 0.010 | Upper San Clemente | 0.018 | 0.052 | 0.007 |
| San Clemente | 0.016 | 0.028 | 0.017 | San Clemente | 0.010 | 0.054 | 0.032 |
| Upper San Jose | 0.021 | 0.078 | 0.018 | Upper San Jose | 0.041 | 0.120 | 0.071 |
| San Jose | 0.021 | 0.062 | 0.054 | San Jose | 0.037 | 0.093 | 0.060 |
| March 2011 | | | | August 2011 | | | |
| Upper Garzas | 0.016 | 0.000 | 0.052 | Upper Garzas | 0.019 | 0.012 | 0.009 |
| Mid Garzas | 0.020 | 0.000 | 0.096 | Mid Garzas | 0.025 | 0.048 | 0.103 |
| Lower Garzas | 0.021 | 0.000 | 0.035 | Lower Garzas | 0.030 | 0.037 | 0.025 |
| Potrero | lab error | lab error | 0.123 | Potrero | 0.017 | 0.129 | 0.022 |
| Upper San Clemente | 0.033 | 0.004 | 0.033 | Upper San Clemente | 0.016 | 0.027 | 0.012 |
| San Clemente | 0.034 | 0.007 | 0.041 | San Clemente | 0.014 | 0.030 | 0.067 |
| Upper San Jose | 0.031 | 0.043 | 0.074 | Upper San Jose | 0.011 | 0.100 | 0.009 |
| San Jose | 0.029 | 0.048 | 0.077 | San Jose | 0.014 | 0.092 | 0.011 |
| March 2012 | | | | August 2012 | | | |
| Upper Garzas | 0.016 | 0 | 0.096 | Upper Garzas | dry | dry | dry |
| Mid Garzas | 0.029 | 0 | 0.052 | Mid Garzas | dry | dry | dry |
| Lower Garzas | 0.021 | 0 | 0.035 | Lower Garzas | 0.031 | 0.023 | 0.050 |
| Potrero | lab error | lab error | 0.123 | Potrero | 0.022 | 0.215 | 0.054 |
| Upper San Clemente | 0.033 | 0.004 | 0.033 | Upper San Clemente | 0.029 | 0.030 | 0.047 |
| San Clemente | 0.034 | 0.007 | 0.041 | San Clemente | 0.020 | 0.023 | 0.121 |
| Upper San Jose | 0.031 | 0.043 | 0.074 | Upper San Jose | 0.016 | 0.071 | 0.028 |
| San Jose | 0.029 | 0.048 | 0.077 | San Jose | 0.014 | 0.057 | 0.033 |
| March 2013 | | | | August 2013 | | | |
| Upper Garzas | 0.016 | 0.017 | 0.028 | Upper Garzas | dry | dry | dry |
| Mid Garzas | 0.021 | 0.030 | 0.037 | Mid Garzas | dry | dry | dry |
| Lower Garzas | 0.021 | 0.023 | 0.021 | Lower Garzas | dry | dry | dry |
| Potrero | 0.061 | 0.128 | 0.106 | Potrero | 0.049 | 0.217 | 0.075 |
| Upper San Clemente | 0.024 | 0.035 | 0.034 | Upper San Clemente | 0.033 | 0.022 | 0.048 |
| San Clemente | 0.015 | 0.039 | 0.029 | San Clemente | 0.032 | 0.004 | 0.135 |
| Upper San Jose | 0.019 | 0.071 | 0.045 | Upper San Jose | dry | dry | dry |
| San Jose | 0.039 | 0.097 | 0.038 | San Jose | 0.036 | 0.023 | 0.085 |
| April 2014 | | | | August 2014 | | | |
| Upper Garzas | 0.018 | 0.015 | 0.024 | Upper Garzas | dry | dry | dry |
| Mid Garzas | 0.019 | 0.030 | 0.020 | Mid Garzas | dry | dry | dry |
| Lower Garzas | dry | dry | dry | Lower Garzas | dry | dry | dry |
| Potrero | 0.036 | 0.133 | 0.072 | Potrero | dry | dry | dry |
| Upper San Clemente | 0.022 | 0.031 | 0.020 | Upper San Clemente | 0.069 | 0.051 | 0.052 |
| San Clemente | 0.018 | 0.033 | 0.027 | San Clemente | 0.062 | 0.070 | 0.142 |
| Upper San Jose | 0.023 | 0.036 | 0.034 | Upper San Jose | dry | dry | dry |
| San Jose | 0.017 | 0.067 | 0.032 | San Jose | 0.064 | 0.076 | 0.073 |

Note: "0" indicates measurement below minimum detection limit.

Table 2.2: Water samples from the monitoring sites were tested for ammonium (ppm), soluble reactive phosphorus (SRP) (orthophosphate) (ppm), and nitrogen as nitrate and nitrite (ppm). *Denotes a change in analytic labs where the samples were sent.

| Location | Ammonium (ppm) | SRP (ppm) | Nitrate + Nitrite (ppm) | Location | Ammonium (ppm) | SRP (ppm) | Nitrate + Nitrite (ppm) |
|--------------------|----------------|-----------|-------------------------|----------------------|----------------|-----------|-------------------------|
| April 2015 | | | | November 2015 | | | |
| Upper Garzas | 0.000 | 0.000 | 0.100 | Upper Garzas | dry | dry | dry |
| Mid Garzas | 0.000 | 0.000 | 0.100 | Mid Garzas | dry | dry | dry |
| Lower Garzas | dry | dry | dry | Lower Garzas | pool | pool | pool |
| Potrero | 0.000 | 0.000 | 0.300 | Potrero | 0.000 | 0.000 | 0.400 |
| Upper San Clemente | 0.000 | 0.000 | 0.051 | Upper San Clemente | dry | dry | dry |
| San Clemente | 0.000 | 0.000 | 0.200 | San Clemente | 0.000 | 0.000 | 0.400 |
| Upper San Jose | 0.000 | 0.000 | 0.200 | Upper San Jose | dry | dry | dry |
| San Jose | 0.000 | 0.000 | 0.200 | San Jose | 0.000 | 0.000 | 0.300 |
| March 2016 | | | | August 2016 | | | |
| Upper Garzas | 0.000 | 0.000 | 0.300 | Upper Garzas | 0.000 | 0.000 | 0.000 |
| Mid Garzas | 0.000 | 0.000 | 0.400 | Mid Garzas | 0.220 | 0.000 | 0.000 |
| Lower Garzas | 0.000 | 0.000 | 0.400 | Lower Garzas | 0.000 | 0.000 | 0.000 |
| Potrero | 0.000 | 0.000 | 0.400 | Potrero | 0.000 | 0.000 | 0.000 |
| Upper San Clemente | 0.000 | 0.000 | 0.300 | Upper San Clemente | 0.000 | 0.000 | 0.000 |
| San Clemente | 0.000 | 0.000 | 0.400 | San Clemente | 0.000 | 0.000 | 0.000 |
| Upper San Jose | 0.000 | 0.000 | 0.400 | Upper San Jose | 0.000 | 0.000 | 0.000 |
| San Jose | 0.000 | 0.000 | 0.300 | San Jose | 0.000 | 0.000 | 0.000 |

Note: "0" indicates measurement below minimum detection limit.

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7 Appendix A

Monitoring Site Locations

Note: Numbering system changed in August 2016 to reorder based on currently monitored sites, rather than historic sites.

Site #1: Potrero Creek

Location: 36.51898°N, -121.86406°W

Directions: This site is located 50 meters downstream of the Potrero streamflow datalogger, approximately a quarter mile upstream of the preserve main gate. Immediately following the main gate, turn left onto Potrero Canyon Road. There will be a small gravel parking pad on the right side. Park here and walk 100 meters south to the site.

Site #2: San Jose Creek

Location: 36.48709°N, -121.86329°W

Directions: From the main gate, follow Rancho San Carlos Road SE. Just past the Canterra Trail intersection, the road descends steeply into San Jose Creek Canyon. Near the bottom of the hill, there is a dirt road to the right. Park on the pavement at the beginning of the dirt road. Walk 300 meters down the road to the creek. The monitoring site is 50 meters downstream, just upstream of the cement weir.

Site#3: Upper San Jose Creek

Location: 36.47178°N, -121.84326°W

Directions: From site #2, continue heading southeast on Rancho San Carlos Road. The site is located about 2 miles up the canyon near Lot 46, just before the road splits around a group of trees. Park on the side of the road before the bridge of the Lot 46 driveway. Follow the hiking trail to the north side of the driveway, on the east side of the creek, for 50 m to the monitoring site.

Site #4: Lower Garzas Creek

Location: 36.45938°N, -121.79708°W, 100 m downstream from Moore's Lake Outflow datalogger.

Driving Directions: On Robinson Canyon Road, park alongside the road 50m south of the bridge where Moore's lake feeds into Garzas Creek. Climb over the fence and follow the abandoned gravel road to the left for about 150m to the site. (staff plate on tree upstream of crossing)

Site #5: Moore's Lake Inflow (Middle Garzas Creek)

Location: 36.45665°N, -121.80166°W

Driving Directions: From Rancho San Carlos Road heading SE, turn left onto Pronghorn Run at the equestrian center. Then turn left onto Lake Walk Trail. The stables will be on your left and

the corrals on your right. The trail curves left into a willow filled wetland where it crosses Garzas Creek. There is parking 25 meters past the culvert. (PVC marker)

Site #6: Upper Garzas Creek

Location: 36.44793°N, -121.81918°W

Driving Directions: Heading SE on Rancho San Carlos Road, turn right onto Garzas Trail just past Chamisal Pass Road. Drive up Garzas Trail to the cul-de-sac loop at the end of the road. Turn left onto a driveway that heads to 9 and 10 Las Garzas Trail immediately before the loop. In ¼ mile there is a bridge that crosses Garzas Creek. The site is about 50 m upstream from the bridge. (PVC marker)

Site #7: San Clemente

Location: 30 m upstream from the datalogger that is located at 36.42527°N,

121.74842°W
Driving Directions: From Robinson Canyon Road, drive east on San Clemente Road. At the Dormody Road intersection, take the left turn to continue heading down San Clemente Creek Canyon. The site is located a couple of miles down the road from the Dormody Road, and about a half a mile upstream from the San Clemente Ranch gate. Here you will find a small area off to the side of the road that is suitable for parking. (PVC marker)

Site #8: Upper San Clemente Creek, 36.428938°N, -121.788800°W

Directions: From the southern terminus of Rancho San Carlos Road, exit the gate and head south on Robinson Canyon Road. After about 1 mile, the road makes a sharp right, crosses a small intermittent creek and then heads back sharply to the left. After this zig zag in Robinson Canyon Road, there will be a gated driveway on the east side of the road to access lots 99 and 100. Park here, go through the gate, head down the driveway about 50 yards, then head to the left to the small stream. The sampling site is directly upstream from the footbridge. Gate combo is 9910.