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2017 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 2009–2017 for 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.

Acknowledgments

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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 (Fig. 1). Since the formation of the SLC in 1995 water quality data have been collected intermittently by various organizations.

This report presents water quality data from eight monitoring sites (Fig. 1). 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.

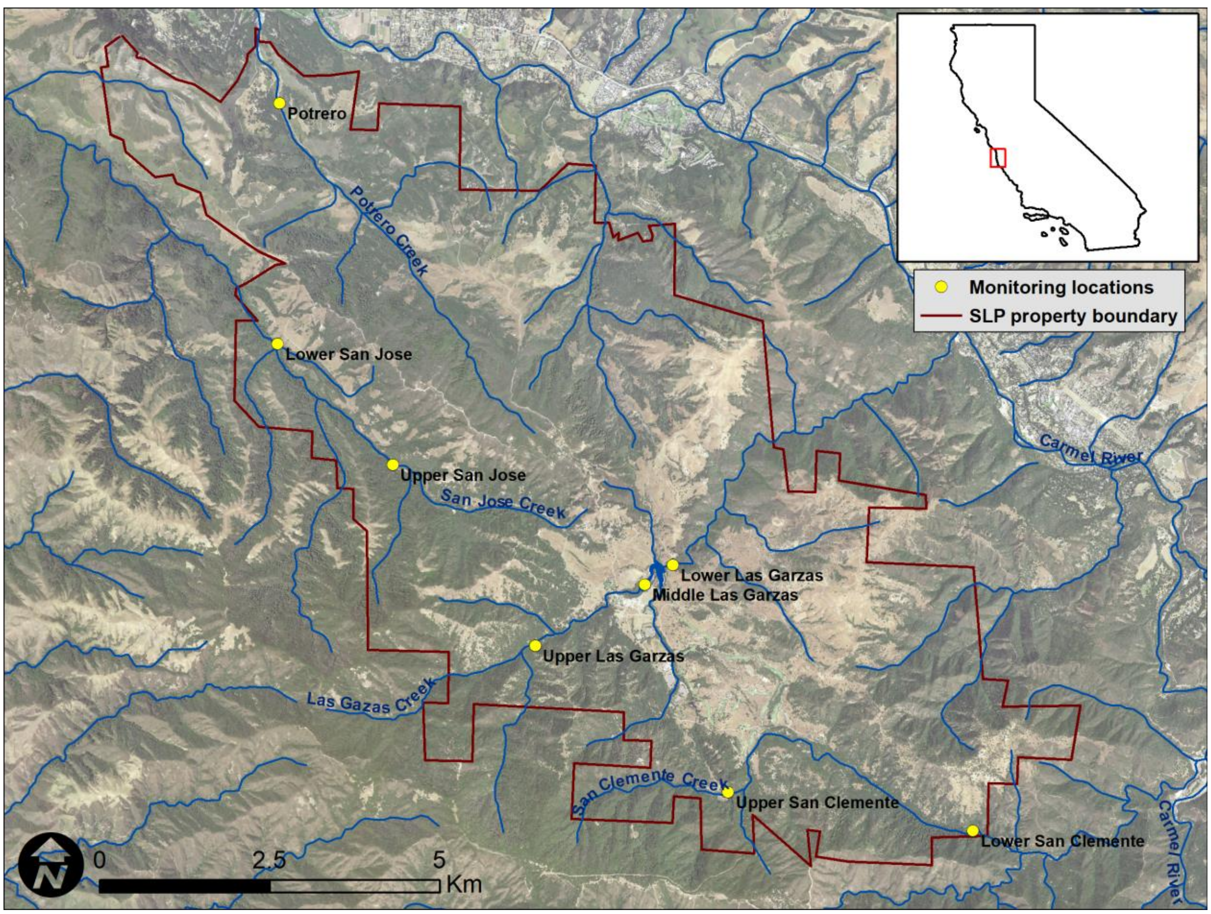


Figure 1: Map of Santa Lucia Preserve showing eight monitoring sites on four streams within the property boundary.

1.1 Suspended Sediment and Stream Nutrients

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 500 mg/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 suspended sediment concentrations above 1650 mg/L causes loss of habitat from increased sediment deposition (Coats et al. 1985).

Nutrient levels in surface waters are naturally influenced by geology, vegetation and climate (Beaulac and Reckhow 1982, Hynes 1983, Clark et al. 2000). Dissolved nitrate/nitrite as nitrogen (nitrate), dissolved ammonia/ammonium as nitrogen (ammonia as N) and dissolved orthophosphate as phosphorus (orthophosphate) are three stream nutrients that are monitored for water quality. Nutrient levels may increase because of development (soil movement), agriculture (fertilizer application/manure) or 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). Nutrients alone do not affect Beneficial Uses protected by the California EPA because effects of nutrients are highly variable and site specific (SWRCB 2011). Monitoring nutrient levels and eutrophication in streams will help establish a baseline for the streams in question.

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 Department of Public Health and U.S. Environmental Protection Agency (EPA) established the drinking water standard of nitrate and nitrite as 10 mg/L (CCRWQCB 2013; EPA 1980). Though no drinking water standards exist for phosphorus, the EPA recommends phosphorus not exceed a concentration above 0.1 mg/L in streams (Mueller et al. 1995). The EPA has also established criteria for maximum ammonia concentrations, though effects of ammonia are location specific. Ammonia concentrations above 2 mg/L exceed the continual exposure criteria for fish (Mueller et al. 1995).

Biannual suspended sediment and nutrient load measurements provide a long term measure of watershed conditions and establishes a baseline dataset to compare observed changes to. Precipitation during sampling affects the magnitude of sediment and nutrient loads. Twice-yearly sampling in March and September provides one sample during the wet season with higher stream discharges and one sample during the dry season with lower stream discharges. Long term monitoring enables the SLC to detect changes in suspended sediment or stream nutrient loads and alter management techniques as needed.

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 “Lower 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 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 September 2017. 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 acoustic doppler velocimeter 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 September 2017. From March 2009 to August 2014, water samples were analyzed in the CSU Monterey Bay (CSUMB) water quality lab using a colormetric detection method and Lachat flow-injection analyzer. The lab at CSUMB tested samples for ammonium as N (mg/L), nitrate+nitrite as N (mg/L) and phosphate as P (mg/L). Beginning in April 2015, samples were sent to Monterey Bay Analytic Services (MBAS) to analyze dissolved nutrients with a Lachat QuickChem flow-injection analyzer. The MBAS laboratory tested samples for ammonia as N (mg/L), nitrate as N (mg/L), nitrite as N (mg/L) and orthophosphate as P (mg/L). The MBAS lab uses method EPA 300.0 (ion chromatography) for orthophosphate, nitrate and nitrite analysis and method EPA 350.1(semi-automated colorimetry) for ammonia (Pfaff JD 1993; O'Dell JW 1993). These differences in analytes, as well as reporting limits and detection limits between the two labs creates a disruption in data analysis (Table 1). This report provides a snapshot of stream nutrient concentrations (ppm) for future comparison and monitoring.

Table 1. Analyte reporting limits and detection limits of the water quality lab at CSU Monterey Bay (CSUMB) and the Monterey Bay Analytical Services lab (MBAS). Nutrients not analyzed for this report by each lab is noted with an 'x'.

	CSUMB		MBAS	
Analyte	**Reporting Limit (mg/L)**	**Detection Limit (mg/L)**	**Reporting Limit (mg/L)**	**Detection Limit (mg/L)**
Ammonia-N	x	x	0.1	0.04
Ammonium-N	0.025	0.01	x	x
Nitrate-N	x	x	0.1	0.01
Nitrite-N	x	x	0.1	0.01
Nitrate+nitrite-N	0.25	0.05	x	x
Othophosphate-P	0.025	0.01	0.1	0.02

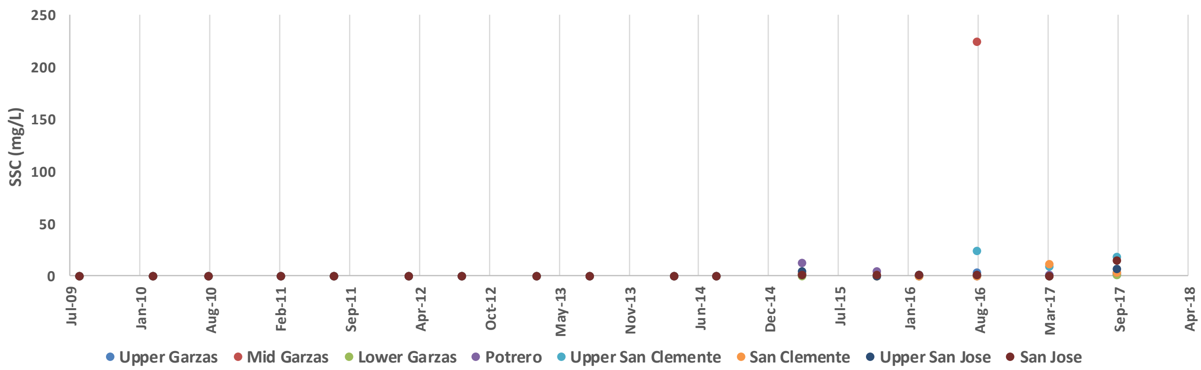
3 Results

3.1 Suspended Sediment, Stream Discharge and Instantaneous Load

Lower San Clemente had the highest concentration of suspended sediment and instantaneous load concentration in March 2017 at 11.078 mg/L and 6012.08 mg/s, respectively (Table 1.1 & 1.2). Lower and Middle Garzas had the lowest suspended sediment concentration at 0.065 mg/L. San Jose had the lowest instantaneous load concentration at 42.355 mg/s. In September 2017, Upper San Clemente had the highest suspended sediment concentration at 18.028 mg/L while Lower Garzas had the least at 0.337 mg/L. San Jose had the highest instantaneous load concentration at 617.790 mg/s. Lower Garzas had the highest flow in March 2017 while San Jose had the highest flow in September 2017.

Eight years of biannual sampling indicates that suspended sediment may be recently increasing (Fig. 2). Suspended sediment values range from near 0 to 24 mg/L, with a substantially greater concentration (224.910 mg/L) occurring at Middle Garzas in August 2016. Suspended sediment concentrations increased at each sampling site beginning in 2016. Despite a possible increase in suspended sediment load over the past two years, streams on the SLP carry very little suspended sediment, indicating good aquatic habitat for steelhead, macroinvertebrates, and other aquatic organisms.

Figure 2. Suspended sediment concentrations from 8 monitoring sites on 4 creeks in the SLP from 2009-2017.

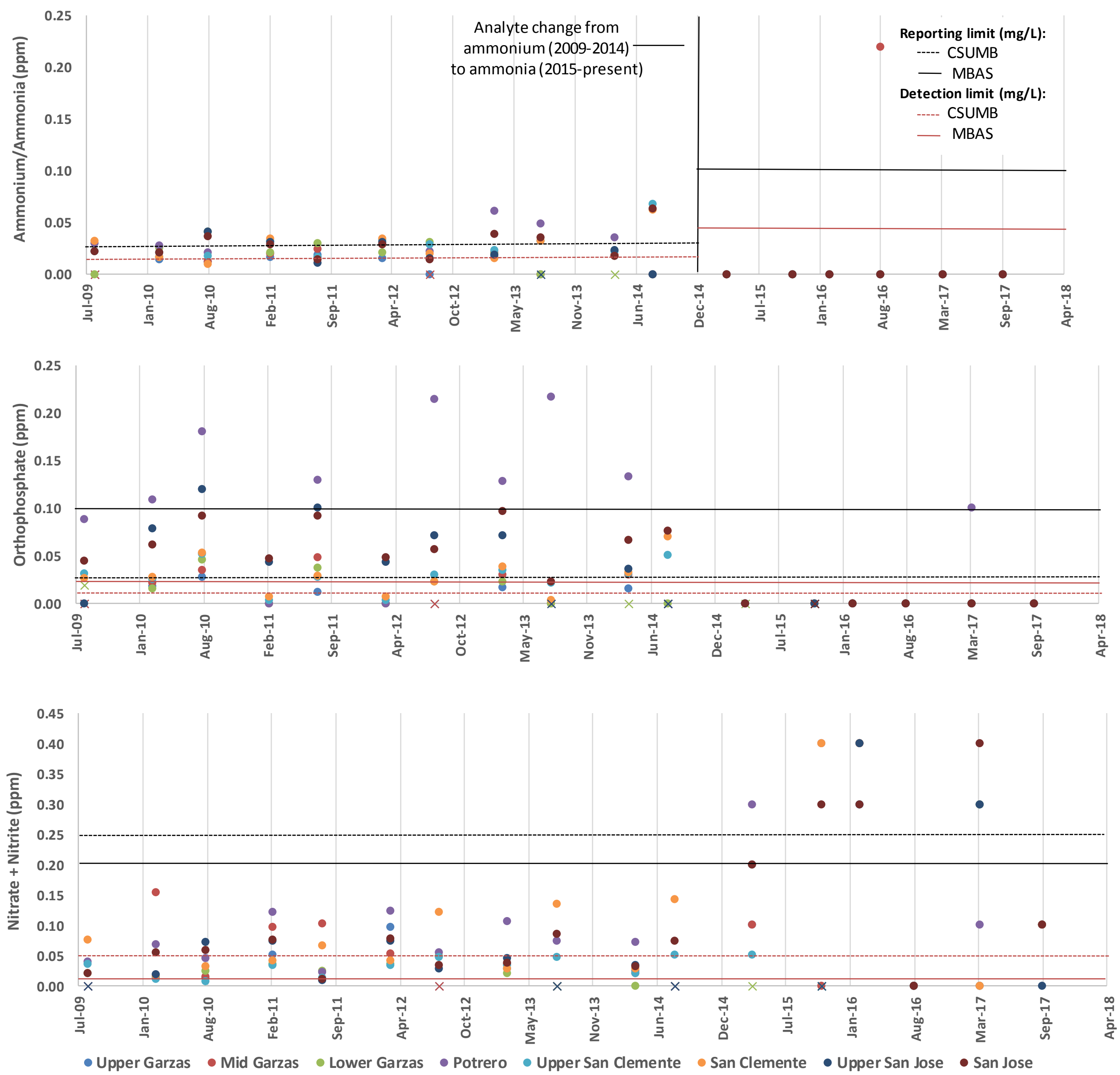


3.2 Stream Nutrient Data

Streams in the SLP have historically had low concentrations of ammonia, SRP and nitrate + nitrite (Table 2.1 & 2.2). In 2017, stream nutrient concentrations were low, if not below minimum detectable limit at each site. Ammonia and SRP concentrations at most sites were measured at 0 or below minimum detectable limits in both March and September. March samples had slightly higher nitrate+nitrite concentrations than September; in September, nitrate + nitrite concentrations dropped to 0.1 ppm in all streams except Upper San Jose.

Orthophosphate concentrations have reduced at most sites since sampling began in 2009, while nitrate + nitrite concentrations rose briefly between November 2015 and March 2017 in San Jose Creek (Fig. 3). When laboratories changed in 2015, evaluated analytes changed from ammonium (CSUMB) to ammonia (MBAS), prohibiting continuous comparison of concentration from 2009–2017. Since 2015, ammonia concentration at Middle Garzas in August 2016 was substantially higher than preceding or following years. This spike corresponded to a similar spike of SSC at the same site and date.

Figure 3. Ammonium/ammonia, orthophosphate and nitrate+nitrite concentrations at 8 monitoring sites in 4 creeks in the SLP from Aug 2009-Sep 2017. Sampling days where the monitoring site was dry is represented with an 'x'.



4 Discussion

Precipitation and fire events in the Carmel watershed over the past two years have possible implications to SLP water quality. The Soberanes Fire began in July 2016, eventually burning over 132,000 acres in Big Sur and Carmel. The SLP became a staging ground for fire suppression, resulting in 38 miles of installed fire lines and 1,700 acres of Preserve Wildlands burned (SLC

2017). The geomorphic changes caused by the fire and fire suppression techniques increased the likelihood of runoff and erosion. Winter rainfall following the Soberanes fire, water year 2017, had the highest precipitation (32.25 inches) since 1998, likely causing runoff and high concentrations of suspended sediment. Following this significant winter rainfall, all surveyed channels remained wetted during the 'dry' sampling date (September). The increase in discharge may have diluted ammonium and SRP concentrations, while increased SSC may have caused a slight increase of nitrate + nitrite concentrations. Nutrient concentrations in 2017 remained at or well below drinking water standards and/or recommended stream nutrient levels.

The change in water quality laboratories in 2014 caused a shift in lab methods, analytes tested, reporting limits and detection limits. Beginning in 2015, MBAS tested for the dissolved nutrient ammonia, instead of ammonium, and had higher reporting and detection limits for ammonia and phosphate. Few analyte concentrations were above both the reporting and detection limit in 2017, though most sites had a '0' concentration for each analyte.

Water quality monitoring parameters indicate that there are no significant impacts at this time, in keeping with previous monitoring results. Subsequent sampling years will indicate if elevated SSC and nitrate + nitrite concentrations observed in 2017 are solely caused by high runoff or are the beginning of new trends in SLP water quality.

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
March 2017				**September 2017**			
Upper Garzas	0.352	764.095	268.961	Upper Garzas	0.932	16.049	14.955
Mid Garzas	0.065	862.994	56.525	Mid Garzas	2.103	11.756	24.725
Lower Garzas	0.065	1406.690	90.786	Lower Garzas	0.337	10.925	3.682
Potrero	1.313	126.699	166.356	Potrero	2.668	1.055	2.816
Upper San Clemente	8.364	284.398	2378.69	Upper San Clemente	18.028	2.369	42.704
San Clemente	11.078	542.718	6012.08	San Clemente	3.313	4.793	15.881
Upper San Jose	Lab error	727.495	Lab error	Upper San Jose	6.238	8.968	55.941
San Jose	0.215	196.999	42.355	San Jose	14.540	42.490	617.790

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, where testing of ammonia began. **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	Ammonia (ppm)	SRP (ppm)	Nitrate + Nitrite (ppm)	Location	Ammonia (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
March 2017				**September 2017**			
Upper Garzas	0.000	0.000	0.300	Upper Garzas	0.000	0.000	0.100
Mid Garzas	0.000	0.000	0.000	Mid Garzas	0.000	0.000	0.100
Lower Garzas	0.000	0.000	0.300	Lower Garzas	0.000	0.000	0.100
Potrero	0.000	0.100	0.100	Potrero	0.000	0.000	0.100
Upper San Clemente	0.000	0.000	0.000	Upper San Clemente	0.000	0.000	0.100
San Clemente	0.000	0.000	0.000	San Clemente	0.000	0.000	0.100
Upper San Jose	0.000	0.000	0.300	Upper San Jose	0.000	0.000	0.000
San Jose	0.000	0.000	0.400	San Jose	0.000	0.000	0.100

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 sit 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°WDriving 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.