SECTION TEN:

APPENDICES

APPENDIX A.

Land use history

The La Honda Creek watershed has experienced a series of different land uses, including traditional Native American land management, timber harvest, grazing, horticulture, viticulture, rural residential, and lifestyle development (Table 2-1). Features of the landscape and creek form and function seen today reflect the cumulative effects of land use and land management in the La Honda watershed mainly over the past 150 years and to a lesser extent over the period of Native American settlement (<10,000 years).

Before European contact, the Bay Area was populated by Native Americans, comprising five major language groups, of which, the Costanoan was the most widespread (Milliken, 1995). Portions of the Bay Area, especially the northern and southern portions contained populations of approximately six people per square mile, with villages approximately every three to five miles (Milliken, 1995). However, the coast side of the Peninsula contained a much lower population density, estimated to be approximately two people per square mile, probably due to small seed-plant habitat and mammal populations in the coniferous forests (Milliken, 1995). Although coast-side populations were small, land management, such as controlled burns, likely had some effect on sediment erosion on hillslopes and changes in the sediment supply and water transport in fluvial systems.

In 1769, Captain Gaspar de Portola led an expedition northward up the California coast from Baja California looking for Monte Rey Bay. Likely due to the inaccurate description of the Bay, the expedition continued northward past the Bay, towards the San Francisco Bay area. On November 6, 1769 after crossing the hills near current-day Woodside, they saw the San Francisco Bay for the first time (Richards, 1973). Although the expedition failed to find the previously described Monte Rey Bay, the expedition did lay the foundation for further expeditions and later European settlement and influence in the Bay Area. Due to the success of the mission system elsewhere, the Spanish government colonized and claimed Alta California via the mission system. Missions were established along the southern and central California coast, extending as far north as Sonoma, including missions in San Francisco (1776), Santa Clara (1777), San Jose (1797), San Rafael (1817), and Sonoma (1823). The need for timber began with the building these missions, continually increasing through time with the building of the city of San Francisco, as well as other cities and other ports. The source of timber was found in the old growth forests of *Sequoia sempervirens*, redwood trees in the steep canyons and ravines of the Peninsula. Despite the concern by the Spanish and Mexican governments over the longevity of this natural resource, redwood logging soon became a large industry along the Peninsula.

The first logging operations were completed without any machinery. Logs were felled and cut by hand. William "Bill the sawyer" Smith dug the first sawpit on the Peninsula in the early 1830's (Richards, 1973, p. 9). By 1841 logging was big business for the Peninsula, evidenced by a ten percent duty on export of lumber, however most of it was being cut from the eastern slopes. Later as the timber resource began to decline on the east, logging operations began to explore the US government-owned western slopes where squatting was legal, and milling increasingly profitable. It is estimated that in 1866 along the Peninsula, 13 million board feet of lumber was being taken from these government lands (Stanger, 1967, p. 4). The top of the range, and the western slopes were soon the site of many logging operations.

The San Gregorio watershed, including its tributaries Corte Madera, Harrington, La Honda, and Alpine Creeks, was the site of at least 25 separate identified sawmills, cumulatively in operation from 1853 to sometime after 1906 (Stanger, 1967, p. 73). The La Honda watershed alone contained at least eight separate mill sites, in operation from 1855 to at least 1908 (Stanger, 1967). The following descriptions of individual sawmills are taken from Stanger's book *Sawmills in the Redwoods*. In 1853, Horace Templeton owned a sawmill just northwest of Sky Londa that was damaged by fire two years later, and moved to a site at the top of the La Honda watershed. Another mill located at the headwaters of La Honda Creek was owned by Jones, Mills and Franklin, and was in operation from 1856 to 1859, when the mill was also destroyed by fire. This mill was rebuilt and in operation, when it was sold to George Harrington, later to be moved to the headwaters of Harrington Creek. A third mill, Carter's Mill, is located just below the confluence of La Honda Creek and San Gregorio Creek. It was in operation from 1859 (possibly 1861), and likely was only planned to serve the local community. It was converted to steam power in 1870, and was bought by the Hanson-Ackerson company, and was soon transporting large amounts of lumber out of the area. In 1881, the de Lesseps company placed a large order for lumber to build the Panama Canal, prompting the mill to move upstream to a site along Alpine Creek, where production could be increased.

The middle portions of the La Honda Creek watershed were also targeted for sawmill locations. For example, in 1876, Robinson Weeks opened the Centennial Mill at the mouth of Weeks Creek. His son, Burt Weeks opened a mill in 1898 at the mouth of Woodruff Creek. After three years, he moved the mill just upstream from his father's site, also on the mainstem of La Honda Creek. This mill operated from 1901 to 1906, and included a dam and a millpond. In 1906, part of the machinery from this mill was moved upstream to the Woodhaven area of La Honda Creek, where a shingle mill was opened and operated until at least 1908. Evidence suggests there were other mills on Langley Creek, and other small tributaries to La Honda Creek.

Besides logging, the La Honda Creek watershed also was influenced by the expanding network of roads. After the formation of San Mateo County in 1856, private companies applied to the county to build and maintain toll roads between cities, often following routes of previous logging roads. These included the Redwood City and Pescadero Road (1863), and the Searsville and La Honda Turnpike (1874-1878). The Redwood City and Pescadero Road followed a route from Redwood City to Searsville, where it turned south and west near present day Portola Road, to emerge at the summit, follow Woodruff Creek to La Honda Creek, following La Honda to the confluence with San Gregorio Creek (Richards, 1973, p. 86).

The Searsville and La Honda Turnpike Company began building a road (Old La Honda Road) in 1874, completing the section from the summit to the town of La Honda by 1876. This section descended from Sky Londa along the hills east of La Honda Creek, until the road reached Weeks Creek, following it to La Honda Creek. Only a small section from the town of La Honda to San Gregorio Creek remained unfinished, requiring a gang of Chinese laborers to complete the road in 1877. The turnpike portion of this road was taken over by the county in April, 1878 for a price of 2,500 dollars (Richards, 1973, p. 90). Once this road was completed, the Knights stagecoach service completed a loop between Redwood City and Pescadero twice a week, traveling on this road and the Redwood City and San Gregorio Turnpike. Although many routes existed to travel from the Bay to the coast, the Searsville and La Honda Turnpike was known as the "scenic route" because of its magnificent redwood groves (Richards, 1973). Mr. Knight carried the mail from Redwood City to San Gregorio and Pescadero using this route from 1876 until approximately 1889. Stagecoach service continued until 1906, when the automobile and railroad became more popular and practical.

During the early 1900's, many roads were completed in locations that are still traveled today. For example, the section of New La Honda Road running from Sky Londa to just south of the Woodhaven area along La Honda Creek was completed in 1915. And, after a state senate bill and bond passage, the counties of San Francisco, San Mateo, Santa Clara and Santa Cruz began work on Skyline Drive, beginning in 1920, and completing a stretch from San Francisco to La Honda Road by 1923.

Since the early 1900's, the La Honda Creek watershed has experienced a shift in dominant land uses. Instead of the land being managed by Native Americans, or being logged, greater areas of the watershed began experiencing higher intensity land uses. During the early part of the century, the lowest reaches of the creek (the current La Honda Trailer Park) ran through a campground situated in the redwood grove (Bill Howard, local resident, pers. comm.). For a few years, this area was also used as a local garbage dump; during high flow events, fresh bank erosion usually exposes a few pieces of early century garbage buried along the creek (Bill Howard, local resident, pers. comm.). Anecdotal evidence also suggests that at some point early in the century, La Honda Creek was dammed, creating a small lake in this portion of the watershed.

A large portion of the hillslopes in the middle watershed have been ranch land, with grazing still occurring on the Driscoll Ranch in the La Honda and Harrington Creek watersheds. Small portions of the watershed have been, and currently are still farmed, including land on the Weeks Creek tributary. Since the 1940's, more single-family residences have been built in the watershed, including the suburban residential area of the La Honda Cuesta Guild, just east of Highway 84 in the town of La Honda. Although the watershed does not contain a particularly large number of homes, many homes are located along the channel, increasing the odds of septic system contamination to the creek, or landowner removal of large woody debris to protect their home and property from flood hazards.

The newest land use present in the watershed is a vineyard on the hillslopes surrounding the Woodhams Creek tributary. Intensive agriculture such as vineyards have the potential to significantly modify the timing and volume of local hillslope runoff, and contribute much larger volumes of sediment to the channels surrounding the vineyard.

APPENDIX B.

Tor vane Shear Strength Values

Figure B-1. SoilTest Pilcon DR-393 w/ 0.75" and 1.3" vanes.

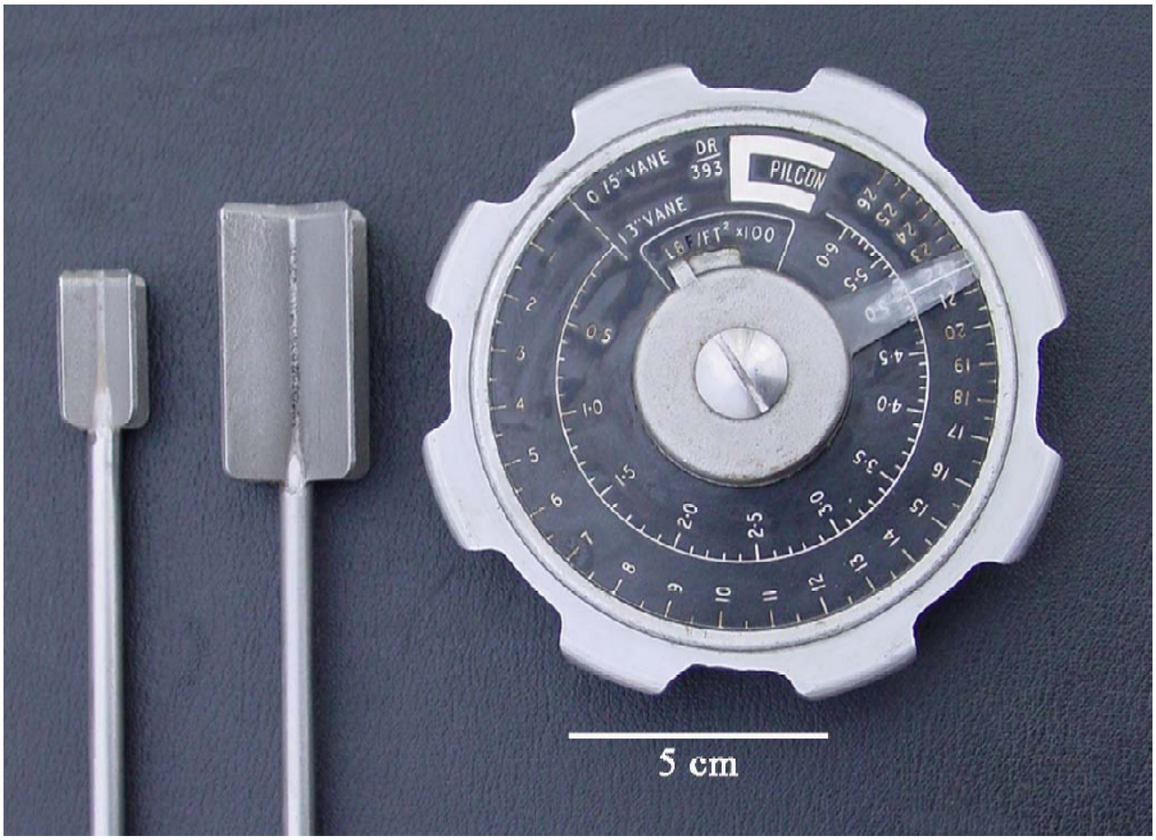


Table B-1. Confluence, La Honda and Weeks Creeks. Values crossed out by diagonal lines are not included in the average.

Unit:	Bedded silt	**Condition:**	Normal		**Moisture:**	Moist	**Average**
Vane size:	1..3"						**Shear**
	Trial #1	**Trial #2**	**Trial#3**	**Trial #4**	**Trial #5**	**Trial #6**	**Strength**
KPa	5.99	10.05	12.35	12.35	12.07	x	**11.71**
psf	125	210	258	258	252	x	**196**

Table B-2. Landslide, 160 m downstream of Weeks Creek.

Unit:	Colluvium	Condition:	Consolidated		Moisture:	Moist	Average
Vane size:	0.75"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	21.55	31.60	27.77	27.29	25.86	x	**28.13**
psf	450	660	580	570	540	x	**588**
Unit:	Colluvium	**Condition:**	Consolidated		**Moisture:**	Wet	
Vane size:	1.3"						
	Trial #1	**Trial #2**	**Trial#3**	**Trial #4**	**Trial #5**	**Trial #6**	
KPa	20.11	22.50	17.24	19.15	18.19	17.72	**18.35**
psf	420	470	360	400	380	370	**383**
Unit:	Colluvium	**Condition:**	Unconsolidated		**Moisture:**	Moist	
Vane size:	1.3"						
Value:	**Trial #1**	**Trial #2**	**Trial#3**	**Trial #4**	**Trial #5**	**Trial #6**	
KPa	10.05	12.45	10.53	10.05	x	x	**11.01**
psf	210	260	220	210	x	x	**230**

Table B-3. 452 m downstream of Weeks Creek.

Unit:	Bedded silt	Condition:	Semiconsolidated		Moisture:	Moist	Average
Vane size:	1.3"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	35.43	35.43	34.95	34.47	35.43	x	**35.31**
psf	740	740	730	720	740	x	**738**

Note: Average shear strength is calculated based on closest four values +/- 15%. Values crossed by diagonal lines were not used in the calculation.

Table B-4. 30 mph Bend pressure point.

Site:	Bank pin # 1						
Unit:	Weathered mudstone	Condition:	Unconsolidated		Moisture:	Saturated	Average
Vane size:	0.75"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	53.63	54.10	60.33	57.93	56.02	x	**56.40**
psf	1120	1130	1260	1210	1170		**1193**

Site:	Bank pin # 2						
Unit:	Fill: sandy silt	Condition:	Unconsolidated		Moisture:	Moist	Average
Vane size:	1.3"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	6.22	9.10	16.76	11.97	11.49	x	**11.11**
psf	130	190	350	250	240	200	**246**

Site:	Bank pin # 3						
Unit:	Fill: sandy silt	Condition:	Semi-consolidated		Moisture:	Saturated	Average
Vane size:	1.3						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	6.22	10.53	10.05	14.36	13.41	x	**10.92**
psf	130	220	210	300	280	310	**264**

Site:	**Bank pin # 4**						
Unit:	Fill: silty clay	Condition:	Semi-consolidated		Moisture:	Saturated	Average
Vane size:	1.3"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	6.22	22.98	23.46	26.81	28.73	x	**21.64**
psf	130	480	490	560	600	580	**542**

Site:	**Below utility pole**						
Unit:	Fill: sandy silt	Condition:	Unconsolidated		Moisture:	Saturated	Average
Vane size:	1.3"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	3.59	4.07	6.94	6.70	4.55	x	**5.17**
psf	75	85	145	140	95	110	**115**

Table B-5. Landslide Bend pressure point.

Site:	Bank pin # 1						
Unit:	Fill: colluvium	Condition:	Unconsolidated		Moisture:	Moist	Average
Vane size:	.75"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	23.94	26.33	29.93	33.52	31.12	x	**28.97**
psf	500	550	625	700	650	x	**631**

Site:	Bank pin # 3						
Unit:	Fill: colluvium	Condition:	Semi-consolidated		Moisture:	Moist	Average
Vane size:	.75"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	23.94	26.33	25.14	27.53	x	x	**25.74**
psf	500	550	525	575	x	x	**538**

Site:	Bank pin # 4						
Unit:	Fill: colluvium	Condition:	Semi-consolidated		Moisture:	Moist	Average
Vane size:	.75"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	22.74	25.14	21.55	20.35	x	x	**22.44**
psf	475	525	450	425	x	x	**469**

Site:	Bank pin # 5						
Unit:	Fill: colluvium	Condition:	Semi-consolidated		Moisture:	Moist	Average
Vane size:	.75"						Shear
	Trial #1	Trial #2	Trial#3	Trial #4	Trial #5	Trial #6	Strength
KPa	22.74	21.55	23.94	25.14	x	x	**23.34**
psf	475	450	500	525	x	x	**488**

APPENDIX C.

Precipitation data

Table C-1. Daily rainfall (inches) at San Gregorio for climatic year 2003.

	Monthly											
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan 2003**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
1	0	0	0	0	0	0	0.15	0.12	0.2	0.18	0.04	0
2	0	0	0	0	0	0	0.13	0.23	0.27	0.05	0.02	0.01
3	0	0.02	0	0	0	0	0.2	0.12	0.16	0.06	0.02	0.02
4	0	0	0	0	0	0	0.32	0.15	0.16	0.07	0.02	0.02
5	0	0	0	0	0	0	0.21	0.16	0.18	0.1	0.05	0
6	0	0	0	0	0	0.06	0.08	0.26	0.11	0.09	0.01	0.02
7	0	0	0	0	1.13	0	0.18	0.24	0.13	0.05	0.07	0
8	0	0	0	0	0.94	0	0.14	0.27	0.21	0.05	0.03	0.03
9	0	0	0	0	0.02	0.45	0.26	0.17	0.13	0.02	0.02	0.01
10	0	0	0	0	0.1	0.18	0.09	0.11	0.23	0.07	0.01	0.01
11	0	0	0	0	0.01	0	0.17	0.11	0.08	0.08	0.01	0
12	0	0	0	0	0	0	0.15	0.36	0.15	0.03	0.03	0
13	0	0	0	0	0.04	2.66	0.18	0.39	0.23	0.07	0.02	0
14	0	0	0	0	0	2.09	0.21	0.34	0.11	0.05	0.01	0
15	0	0	0	0	0	0.42	0.12	0.14	0.2	0.1	0.05	0.02
16	0	0	0	0	0	1.96	0.31	0.23	0.18	0.06	0.03	0.03
17	0.03	0	0	0	0	0.37	0.14	0.23	0.12	0.12	0.02	0
18	0.04	0	0	0	0	0.01	0.31	0.14	0.1	0.06	0.02	0.01
19	0	0	0	0	0	1.25	0.1	0.33	0.07	0.09	0.01	0.01
20	0	0	0	0.03	0	0.35	0.19	0.16	0.14	0.05	0.01	0
21	0	0	0	0	0	0.33	0.09	0.2	0.18	0.03	0.01	0
22	0	0	0	0	0	0.01	0.24	0.08	0.11	0.04	0	0
23	0	0	0	0.06	0	0	0.22	0.13	0.16	0.16	0.04	0.01
24	0	0	0	0	0	0	0.29	0.06	0.13	0.08	0.03	0.01
25	0	0.06	0	0	0	0	0.07	0.09	0.16	0.07	0.01	0
26	0	0	0	0	0	0.06	0.17	0.12	0.18	0.02	0.03	0.01
27	0	0	0.03	0	0	0.15	0.22	0.2	0.15	0.03	0.08	0.01
28	0	0	0	0	0	1.01	0.11	0.14	0.1	0.03	0.1	0.01
29	0	0	0	0	0	0.14	0.14		0.03	0.03	0.01	0.04
30	0	0	0	0	0	0.09	0.09		0.07	0.06	0.03	0.01
31	0	0		0		1.01	0.17		0.17		0.01	

This table is an example of rainfall data available for San Gregorio watershed for the period 1954-present.
Description of SNGRGORO.C (NCDC #7807, San Gregorio 2 SE) **Observer:** GARY ARATA **Location:** About 2 miles southeast of the San Gregorio Post Office. **County:** San Mateo **Nearest City:** San Gregorio **Latitude:** 37 deg 18 min N **Longitude:** 122 deg 22 min W **Elevation:** 275 ft

APPENDIX D.

Discharge data for San Gregorio Creek

Table D-1. Daily average discharge (cfs) at San Gregorio for climatic year 2003.

	Monthly											
Day	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan 2003**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
1	2.7	2.1	1	1.2	1.2	1.6	159	14	22	13	59	13
2	2.7	1.7	1.3	1.1	1.2	1.7	101	13	21	16	59	12
3	2.5	2.1	0.93	0.97	1.1	1.7	73	13	20	17	119	12
4	3	2	0.76	0.46	1.1	1.7	57	12	19	24	83	12
5	3	1.3	1	0.71	1.1	1.8	47	12	18	18	62	11
6	3	1.4	0.71	1	1.2	1.8	40	12	17	15	53	11
7	3.3	1.4	0.93	0.88	2.5	2	34	11	16	14	47	10
8	2.6	0.79	0.92	0.77	40	2.3	29	11	15	14	45	9.9
9	1.9	1.2	0.74	0.81	19	2.6	30	11	15	13	40	10
10	1.7	1.6	0.54	0.63	5.8	4	58	11	14	12	35	10
11	1.8	1.4	0.48	0.77	4.5	4.3	38	10	14	12	32	10
12	1.8	0.9	0.42	1.1	3.2	3.2	32	12	14	121	29	11
13	1.7	0.96	0.33	1.2	2.7	53	28	16	13	400	27	11
14	2.2	1.1	0.77	1.3	2.4	245	26	14	15	132	26	11
15	2.1	1.3	1	1.2	2	164	24	15	99	80	25	11
16	2.4	1.2	1.1	1.2	1.9	815	22	181	43	57	24	10
17	2.4	1.5	0.67	1.2	1.7	195	21	46	34	49	22	9.3
18	2.5	1.4	0.36	1.3	1.7	118	20	32	27	41	21	9.5
19	2.8	1	0.78	1.3	1.7	514	19	28	25	35	20	9.7
20	2.5	1.6	0.84	1.5	1.5	378	18	24	24	31	18	9.3
21	2.2	1.4	0.81	1.6	1.4	212	20	21	22	31	17	9
22	1.7	1.6	0.88	1.6	1.6	113	19	20	20	45	17	9
23	1.5	1.7	0.87	1.7	1.7	72	19	19	20	32	16	8.8
24	2	2.2	0.85	1.7	1.7	52	18	19	19	71	17	8
25	2.3	2.3	0.92	1.7	1.7	41	18	40	17	61	17	8
26	2.4	1.9	0.9	1.4	1.5	35	17	28	17	57	17	8
27	2	1.5	0.88	1.1	1.5	32	16	29	16	47	15	8
28	2	1.2	1	1.2	1.5	235	16	24	15	135	14	8
29	1.5	1.2	1.3	1.4	1.5	294	15		14	112	13	8
30	1.5	0.97	1.3	1.2	1.6	138	14		13	74	14	8
31	2.1	0.79		1.1		506	14		13		14	

This table is an example of discharge data available for San Gregorio watershed for the period 1969-94 and 2001-present.
USGS 11162570 SAN GREGORIO C A SAN GREGORIO CA
LOCATION: Latitude 37°19'33", Longitude 122°23'08" NAD27, San Mateo County, California , Hydrologic Unit 18050006
DRAINAGE AREA: 50.9 square miles **GAGE**: Datum of gage is 11.40 feet above sea level NGVD29.

APPENDIX E.

Discharge data for La Honda Creek

Table E-1. Delay's bridge cross-section survey data, 12/14/2002.

Point	Distance (m)	Elevation (m)	Distance (ft)	Elevation (ft)	Note
0	0.6	1.5	1.97	4.92	Middle of bridge wall
1	0.64	0.27	2.10	0.89	Bridge wall and back edge of footing
2[1]	1.00	0.27	3.28	0.89	Front edge of footing
3	1.05	-0.05	3.44	-0.16	Bottom of footing/left edge of channel bed
4	1.25	-0.05	4.10	-0.16	Channel bed
5	1.50	-0.10	4.92	-0.33	Channel bed
6	1.75	-0.14	5.74	-0.46	Channel bed
7	2.00	-0.17	6.56	-0.56	Channel bed
8	2.25	-0.21	7.38	-0.69	Channel bed
9	2.50	-0.22	8.20	-0.72	Channel bed
10	2.75	-0.25	9.02	-0.82	Channel bed
11	3.00	-0.26	9.84	-0.85	Channel bed
12	3.25	-0.29	10.66	-0.95	Channel bed
13	3.50	-0.33	11.48	-1.08	Channel bed
14	3.75	-0.33	12.30	-1.08	Channel bed
15	4.00	-0.31	13.12	-1.02	Channel bed
16	4.25	-0.29	13.94	-0.95	Channel bed
17	4.50	-0.27	14.76	-0.89	Channel bed
18	4.75	-0.30	15.58	-0.98	Channel bed
19	5.00	-0.32	16.40	-1.05	Channel bed
20	5.25	-0.37	17.22	-1.21	Channel bed
21	5.50	-0.38	18.04	-1.25	Channel bed
22	5.75	-0.39	18.86	-1.28	Channel bed
23	6.00	-0.43	19.68	-1.41	Channel bed
24	6.25	-0.43	20.50	-1.41	Channel bed
25	6.50	-0.46	21.32	-1.51	Channel bed
26	6.75	-0.43	22.14	-1.41	Channel bed
27	7.00	-0.42	22.96	-1.38	Channel bed
28	7.25	-0.41	23.78	-1.34	Channel bed
29	7.50	-0.37	24.60	-1.21	Channel bed
30	7.68	-0.34	25.19	-1.12	Bottom of footing/right edge of channel bed
31	7.69	0.44	25.22	1.44	Front edge of footing
32	7.87	0.44	25.81	1.44	Bridge wall and back edge of footing
33	7.90	1.50	25.91	4.92	Middle of bridge wall

[1] Stationing for future re-survey of the cross-section should be referenced to the front edge of the left bank footing of Delay's bridge at station 1.0 m.

Table E-2. Velocity measurements at Delay's bridge, 12/14/2002 a.

12/14/2002 a
Start time: 11:30am
Stage: 1.00 ft

Station (ft from LB)	Water Depth (ft)	Velocity (ft/sec) 1	2	3	Average Velocity (ft/sec)	Area (ft^2) (widthx depth)	Discharge (cfs) (areaxvelocity)
3.28	0	0	0	0	0.00	0.00	0.00
6.56	0.10	0.70	0.60	0.60	0.63	0.328	0.21
9.84	0.60	1.10	1.10	1.20	1.13	1.968	2.23
13.12	0.65	1.55	1.70	1.45	1.57	2.132	3.34
16.40	0.60	0.80	0.70	0.70	0.73	1.968	1.44
19.69	1.05	0.45	0.55	0.50	0.50	3.444	1.72
22.96	1.00	0.40	0.45	0.25	0.37	3.28	1.20

End time: 11.50am	10.15
Stage: 1.00 ft	Total Discharge (cfs)

Table E-3. Velocity measurements at Delay's bridge, 12/14/2002 b.

12/14/2002 b
Start time: 2:55pm
Stage: 0.92 ft

Station (ft from LB)	Water Depth (ft)	Velocity (ft/sec) 1	2	3	Average Velocity (ft/sec)	Area (ft^2) (widthx depth)	Discharge (cfs) (areaxvelocity)
4.92	0.05						
6.56	0.30	0.90	0.92	0.86	0.89	1.48	1.32
8.20	0.55						
9.84	0.50	2.05	2.12	2.30	2.16	1.64	3.54
11.48	0.70						
13.12	0.80	2.55	2.45	2.30	2.43	2.62	6.39
14.76	0.80						
16.40	0.80	1.00	1.00	0.95	0.98	2.62	2.58
18.04	1.00						
19.68	1.30	0.79	0.75	0.68	0.74	4.26	3.16
21.32	1.30						
22.96	1.20	0.48	0.51	0.55	0.51	3.94	2.02
24.61	1.45						

End time: 3.05pm	19.00
Stage: 0.98 ft	Total Discharge (cfs)

Table E-4. Velocity measurements at Delay's bridge, 12/14/2002 c.

12/14/2002
Start time: 3:28pm
Stage: 1.04 ft

Station (ft from LB)	**Water** Depth (ft)	**Velocity (ft/sec)** 1	2	3	**Average Velocity (ft/sec)**	**Area (ft^2) (widthx depth)**	**Discharge (cfs)** (areaxvelocity)
4.92	0.25						
6.56	0.45	1.70	1.80	1.81	1.77	2.21	3.92
8.20	0.65						
9.84	0.80	2.45	2.40	2.60	2.48	2.62	6.52
11.48	1.00						
13.12	1.00	3.00	3.10	2.85	2.98	3.28	9.79
14.76	0.90						
16.40	1.05	1.60	1.30	1.45	1.45	3.44	4.99
18.04	1.20						
19.68	1.40	1.20	1.30	1.20	1.23	4.59	5.66
21.32	1.40						
22.96	1.40	0.90	0.80	1.05	0.92	4.59	4.21
24.61	1.10						
End time: 3.44pm							35.09
Stage: 1.15 ft							Total Discharge (cfs)

Table E-5. Velocity measurements at Delay's bridge, 12/16/2002 a.

12/16/2002 a
Start time: 8:16am
Stage: 2.10 ft

Station (ft from LB)	**Water** Depth (ft)	**Velocity (ft/sec)** 1	2	3	**Average Velocity (ft/sec)**	**Area (ft^2) (widthx depth)**	**Discharge (cfs) (areaxvelocity)**
4.92	1.30	2.70	2.70	2.90	2.77	3.20	8.85
6.56	1.70	2.00	1.80	1.60	1.80	2.79	5.02
8.20	1.70	5.60	4.50	4.40	4.83	2.79	13.48
9.84	2.50	6.80	5.60	4.00	5.47	4.10	22.41
11.48	2.50	6.20	5.80	6.40	6.13	4.10	25.15
13.12	1.70	6.20	5.60	5.40	5.73	2.79	15.98
14.76	2.00	6.40	6.00	5.80	6.07	3.28	19.90
16.40	2.00	7.10	7.00	7.10	7.07	3.28	23.18
18.04	2.50	5.40	5.60	5.90	5.63	4.10	23.10
19.68	2.50	5.40	6.00	5.40	5.60	4.10	22.96
21.32	2.00	6.20	6.00	5.70	5.97	3.28	19.57
22.96	2.00	4.60	4.20	4.80	4.53	4.92	22.30

End time: 8:56am	221.89
Stage: 1.9 ft	Total Discharge (cfs)

Table E-6. Velocity measurements at Delay's bridge, 12/16/2002 b.

12/16/2002 b
Start time: 10:00pm
Stage: 1.10 ft

Station	Water	Velocity (ft/sec)			Average Velocity	Area (ft^2)	Discharge (cfs)
(ft from LB)	Depth (ft)	1	2	3	(ft/sec)	(widthxdepth)	(areaxvelocity)
4.92	0.30	0.70	0.80	0.80	0.77	0.74	0.57
6.56	0.60	1.50	1.45	1.45	1.47	0.98	1.44
8.20	0.80	1.80	1.80	1.80	1.80	1.31	2.36
9.84	0.90	2.70	2.70	3.00	2.80	1.48	4.13
11.48	1.00	3.50	3.30	3.40	3.40	1.64	5.58
13.12	1.00	3.60	3.40	3.10	3.37	1.64	5.52
14.76	1.10	3.20	3.00	3.30	3.17	1.80	5.71
16.40	1.10	2.20	2.20	2.30	2.23	1.80	4.03
18.04	1.10	1.60	1.30	1.50	1.47	1.80	2.65
19.68	1.30	1.55	1.60	1.55	1.57	2.13	3.34
21.32	1.40	1.90	2.00	1.90	1.93	2.30	4.44
22.96	2.20	2.40	2.30	2.20	2.30	5.41	12.45

End time: 10:45pm	52.21
Stage: 1.20 ft	Total Discharge (cfs)

Table E-7. Velocity measurements at Delay's bridge, 12/17/2002.

12/17/2002
Start time: 10:30am
Stage: 0.95 ft

Station	**Water**	**Velocity (ft/sec)**			**Average**	**Area (ft^2)**	**Discharge (cfs)**
(ft from LB)	**Depth (ft)**	**1**	**2**	**3**	**Velocity (ft/sec)**	**(widthxdepth)**	**(areaxvelocity)**
4.92	0.30	0.60	0.70	0.65	0.65	0.74	0.48
6.56	0.60	1.30	1.35	1.35	1.33	0.98	1.31
8.20	0.80	1.75	1.80	1.85	1.80	1.31	2.36
9.84	0.90	2.10	2.20	2.40	2.23	1.48	3.30
11.48	1.00	2.70	2.80	2.60	2.70	1.64	4.43
13.12	0.90	2.20	2.40	2.20	2.27	1.48	3.35
14.76	1.10	2.50	2.20	2.35	2.35	1.80	4.24
16.40	0.90	1.50	1.30	1.50	1.43	1.48	2.12
18.04	1.00	1.10	1.10	1.50	1.23	1.64	2.02
19.68	1.30	1.20	1.25	1.25	1.23	2.13	2.63
21.32	1.40	1.20	1.30	1.30	1.27	2.30	2.91
22.96	1.50	2.00	1.90	2.05	1.98	3.69	7.32

End time: 11:05am	36.46
Stage: 1.02 ft	Total Discharge (cfs)

Table E-8. Velocity measurements at Delay's bridge, 12/19/2002.

12/19/2002
Start time: 3:15pm
Stage: 2.50 ft

Station	**Water**	**Velocity (ft/sec)**			**Average Velocity**	**Area (ft^2)**	**Discharge (cfs)**
(ft from LB)	**Depth (ft)**	**1**	**2**	**3**	**(ft/sec)**	**(widthxdepth)**	**(areaxvelocity)**
4.92	2.40	5.60	5.60	6.00	5.73	5.90	33.85
6.56	2.45	5.60	5.50	6.00	5.70	4.02	22.90
8.20	2.50	6.80	6.80	7.00	6.87	4.10	28.15
9.84	2.85	6.80	7.00	7.20	7.00	4.67	32.72
11.48	3.00	6.80	7.40	7.80	7.33	4.92	36.08
13.12	3.05	6.60	6.80	6.60	6.67	5.00	33.35
14.76	2.95	7.20	7.40	6.80	7.13	4.84	34.51
16.40	2.90	7.00	6.80	6.80	6.87	4.76	32.66
18.04	2.90	6.20	6.40	5.80	6.13	4.76	29.17
19.68	3.10	5.40	5.60	5.60	5.53	5.08	28.13
21.32	3.30	4.20	5.80	5.80	5.27	5.41	28.50
22.96	3.30	1.50	2.00	1.60	1.70	8.12	13.80

End time: 3.45pm	353.82
Stage: 2.45 ft	Total Discharge (cfs)

Table E-9. Velocity measurements at Delay's bridge, 12/21/2002.

12/21/2002
Start time: 3:50pm
Stage: 0.90 ft

Station (ft from LB)	Water Depth (ft)	Velocity (ft/sec) 1	2	3	Average Velocity (ft/sec)	Area (ft^2) (widthxdepth)	Discharge (cfs) (areaxvelocity)
0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.7	0.00	0.45	0.50	0.55	0.50	0.00	0.00
2.7	0.25	0.75	0.70	0.65	0.70	0.25	0.18
3.7	0.25	1.05	0.90	0.90	0.95	0.25	0.24
4.7	0.55	1.20	1.20	1.35	1.25	0.55	0.69
5.7	0.70	1.75	2.00	1.75	1.83	0.70	1.28
6.7	0.70	2.20	2.20	2.20	2.20	0.70	1.54
7.7	0.75	2.50	2.65	2.65	2.60	0.75	1.95
8.7	0.70	2.50	2.90	2.70	2.70	0.70	1.89
9.7	0.75	3.00	3.00	3.30	3.10	0.75	2.33
10.7	0.90	3.40	3.40	3.20	3.33	0.90	3.00
11.7	0.85	2.30	2.60	2.50	2.47	0.85	2.10
12.7	0.85	2.70	2.60	2.90	2.73	0.85	2.32
13.7	0.75	2.05	2.10	2.10	2.08	0.75	1.56
14.7	0.65	1.85	1.90	1.85	1.87	0.65	1.21
15.7	0.65	1.45	1.50	1.40	1.45	0.65	0.94
16.7	0.90	1.50	1.45	1.40	1.45	0.90	1.31
17.7	0.95	1.50	1.55	1.45	1.50	0.95	1.43
18.7	1.05	1.50	1.35	1.55	1.47	1.05	1.54
19.7	1.20	1.30	1.50	1.30	1.37	1.20	1.64
20.7	1.20	1.60	1.60	1.35	1.52	1.20	1.82
21.7	1.25	1.65	1.70	1.80	1.72	1.25	2.15

End time: 5:00pm
Stage: 0.93 ft

31.10
Total Discharge (cfs)

Table E-10. Velocity measurements at Delay's bridge, 12/22/2002.

12/22/2002
Start time: 12:40pm
Stage: 0.78 ft

Station (ft from LB)	Water Depth (ft)	Velocity (ft/sec) 1	2	3	Average Velocity (ft/sec)	Area (ft^2) (widthxdepth)	Discharge (cfs) (areaxvelocity)
0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.7	0.15	0.00	0.10	0.10	0.07	0.15	0.01
3.7	0.15	0.70	0.80	0.75	0.75	0.15	0.11
4.7	0.40	1.00	1.10	1.10	1.07	0.40	0.43
5.7	0.60	1.10	1.05	1.00	1.05	0.60	0.63
6.7	0.60	1.70	1.70	1.80	1.73	0.60	1.04
7.7	0.75	1.70	1.90	1.80	1.80	0.75	1.35
8.7	0.60	1.80	2.00	1.90	1.90	0.60	1.14
9.7	0.80	1.90	2.20	1.70	1.93	0.80	1.55
10.7	0.75	1.60	1.50	1.60	1.57	0.75	1.18
11.7	0.65	0.90	0.90	0.90	0.90	0.65	0.59
12.7	0.65	1.30	1.30	1.20	1.27	0.65	0.82
13.7	0.60	0.70	0.90	0.90	0.83	0.60	0.50
14.7	0.50	0.85	0.90	0.85	0.87	0.50	0.43
15.7	0.60	0.70	0.90	0.90	0.83	0.60	0.50
16.7	0.75	0.70	0.80	1.00	0.83	0.75	0.63
17.7	0.80	1.00	1.20	1.25	1.15	0.80	0.92
18.7	0.90	0.75	0.70	0.80	0.75	0.90	0.68
19.7	1.00	0.80	0.90	0.85	0.85	1.00	0.85
20.7	1.00	1.10	1.10	1.20	1.13	1.00	1.13
21.7	1.00	0.90	0.85	0.80	0.85	1.00	0.85

End time: 1:10pm	15.33
Stage: 0.77 ft	Total Discharge (cfs)

Table E-11. Velocity measurements at Delay's bridge, 4/13/2003 a.

4/13/2003 a

Start time: 9:30am
Stage: 1.42 ft

Station (ft from LB)	Water Depth (ft)	Float times (seconds) a	b	c	d	Average time	Average Velocity[1] (ft/sec)	Area (ft^2) (widthx depth)	Discharge[2] (cfs) (areax velocity)
1.6	0.39	11.00	8.00	8.00		9.00	3.28	1.28	4.20
4.9	0.82	6.00	6.50	8.00		6.83	4.32	2.69	11.62
8.2	1.15	6.00	5.00	5.00	6.00	5.50	5.37	4.72	25.32
13.1	1.54	6.00	5.00	5.00	5.00	5.25	5.62	7.58	42.62
18	1.38	5.00	4.00	4.00		4.33	6.81	5.66	38.56
21.3	1.02	6.00	6.00	7.00		6.33	4.66	3.35	15.60
24.6	0.72	8.00	10.00	9.00		9.00	3.28	2.36	7.75

End time: 10:00am	116.53 Total Discharge (cfs)
Stage: 1.36 ft	

[1] Measured with a surface float.

[2] Discharge is sum multiplied by 0.8 to adjust for float (Leopold, Wolman, and Miller, 1964 pg. 167)

Table E-12. Velocity measurements at Delay's bridge, 4/13/2003 b.

4/13/2003 b
Start time: 11:20am
Stage: 1.30 ft

Station (ft from LB)	Water Depth (ft)	Float times (seconds) a	b	c	d	Average time	Average Velocity[1] (ft/sec)	Area (ft^2) (widthxdepth)	Discharge[2] (cfs) (areaxvelocity)
1.6	0.49	8.00	9.00	10.00	11.00	9.50	3.11	1.61	5.00
4.9	0.98	6.00	8.00	8.00		7.33	4.03	3.21	12.94
8.2	1.25	6.00	6.00	6.00		6.00	4.92	5.13	25.22
13.1	1.41	5.00	5.00	6.00	5.50	5.38	5.49	6.94	38.11
18	1.05	5.00	5.00	5.00		5.00	5.91	4.31	25.43
21.3	0.92	6.00	7.00	7.00		6.67	4.43	3.02	13.37
24.6	0.49	9.00	12.00	12.00		11.00	2.68	1.61	4.31

End time: 11:50am	99.51 Total Discharge (cfs)
Stage: 1.26 ft	

[1] Measured with a surface float.

[2] Discharge is sum multiplied by 0.8 to adjust for float (Leopold, Wolman, and Miller, 1964 pg. 167)

Table E-13. Velocity measurements at Delay's bridge, 4/13/2003 c.

4/13/2003 c
Start time: 1:15pm
Stage: 1.20 ft

Station (ft from LB)	Water Depth (ft)	Float times (seconds) a	b	c	d	Average time	Average Velocity[1] (ft/sec)	Area (ft^2) (widthxdepth)	Discharge[2] (cfs) (areaxvelocity)
1.6	0.39	14.00	15.00	11.00		13.33	2.21	1.28	2.83
4.9	0.82	8.00	9.00	9.00		8.67	3.41	2.69	9.16
8.2	1.31	6.00	6.00	7.00		6.33	4.66	5.37	25.04
13.1	1.31	5.00	5.00	5.00	5.00	5.00	5.91	6.45	38.07
18	0.82	6.00	6.00	6.00		6.00	4.92	3.36	16.55
21.3	0.82	7.00	9.00	9.00	9.00	8.50	3.47	2.69	9.34
24.6	0.39	15.00	12.00			13.50	2.19	1.28	2.80

End time: 1:35pm
Stage: 1.19 ft

83.04 Total Discharge (cfs)

[1] Measured with a surface float.

[2] Discharge is sum multiplied by 0.8 to adjust for float (Leopold, Wolman, and Miller, 1964 pg. 167)

APPENDIX F.

La Honda Creek water and air temperature data

Table F-1. **7-Day air and water temperatures measured at La Honda.**

Week Beginning Monday	7 Day Average Air Temperature °F	7 Day Average Water Temperature °F	7 Day Average Air Temperature °C	7 Day Average Water Temperature °C
6/23/03	69.0	59.5	20.5	15.3
9/15/03	67.8	58.8	19.9	14.9
9/8/03	67.6	60.5	19.8	15.9
7/14/03	65.4	59.9	18.6	15.5
7/21/03	64.5	61.4	18.0	16.3
8/18/03	63.9	61.1	17.7	16.2
7/28/03	63.8	61.4	17.7	16.3
10/20/03	63.4	53.9	17.5	12.2
8/4/03	62.2	60.7	16.8	16.0
9/22/03	61.8	59.5	16.5	15.3
9/1/03	61.6	59.3	16.4	15.1
8/11/03	61.3	60.1	16.3	15.6
8/25/03	61.2	60.1	16.2	15.6
10/13/03	61.1	52.3	16.2	11.3
6/2/03	60.3	57.9	15.7	14.4
7/7/03	60.0	58.1	15.6	14.5
5/26/03	59.4	56.4	15.2	13.5
6/30/03	59.3	57.9	15.2	14.4
10/6/03	58.2	53.9	14.6	12.2
5/19/03	58.2	54.7	14.6	12.6
9/29/03	57.9	57.0	14.4	13.9
1/6/03	55.7	51.1	13.1	10.6
1/20/03	54.9	51.9	12.7	11.1
6/16/03	54.9	55.8	12.7	13.2
6/9/03	54.8	55.4	12.7	13.0
3/24/03	54.5	50.3	12.5	10.2
1/13/03	54.2	50.0	12.3	10.0
1/27/03	53.8	51.3	12.1	10.7
3/10/03	53.0	51.3	11.6	10.7
5/12/03	52.4	51.9	11.3	11.0
12/30/02	51.7	49.4	11.0	9.7
4/28/03	51.7	51.3	10.9	10.7
2/10/03	51.1	48.3	10.6	9.1
4/7/03	51.1	50.0	10.6	10.0
5/5/03	50.6	51.1	10.4	10.6
3/17/03	49.7	49.6	9.8	9.8
4/14/03	49.6	49.9	9.8	9.9
4/21/03	49.1	50.1	9.5	10.0
2/24/03	48.8	48.6	9.4	9.2
2/17/03	48.8	47.1	9.3	8.4
3/31/03	48.2	49.2	9.0	9.6
2/3/03	48.2	44.7	9.0	7.1

3/3/03	47.6	47.3	8.7	8.5
12/23/02	47.3	48.1	8.5	9.0
12/16/02	46.2	48.5	7.9	9.2

APPENDIX G.

Macroinvertebrate data

Table G-1. Summary Biological Metrics- Winter 2002

Summary biological metrics and ranking score by reach for macroinvertebrates sampled from the Santa Cruz La Honda Creek Watershed project, Winter, 2002.

StationID	1A	1C	2A	2B	3B
Taxonomic Richness	21	29		31	34
CV	5	11		2	6
Cumulative Taxa	32	38		48	38
Percent Dominant Taxon	70	29		24	23
CV	19	20		21	23
EPT Taxa	14	18		18	19
CV	8	9		13	4
EPT Index (%)	93	90		89	80
CV	3	6		1	5
Sensitive EPT Index (%)	82	82		78	58
CV	12	6		1	11
Cumulative EPT Taxa	19	21		23	21
Percent Chironomidae	2	3		2	9
CV	80	40		33	23
Shannon Diversity	1	2		3	3
CV	34	5		5	3
Tolerance Value	2	1		1	2
CV	20	13		6	4
Percent Intolerant Taxa (0-2)	79	84		80	62
CV	14	4		1	10
Percent Tolerant Taxa (8-10)	0	0		0	0
CV		48		173	141
Percent Collectors	5	18		21	25
CV	48	19		21	6
Percent Filterers	8	6		8	13
CV	67	6		42	52
Percent Grazers	9	32		43	30

CV	65		10		19		25			
Percent Predators	2		7		10		14			
CV	28		13		28		41			
Percent Shredders	77		38		19		17			
CV	17		17		16		41			
Ranking Scores									**Mean**	**SE**
Taxonomic Richness	21		29		31		34		25	2.8284271
		-1.4		1.4		2.1		2.9		
EPT Index	93		90		89		80		91	1.266235
		1.4		-1.4		-1.6		-9.3		
Sensitive EPT Index (TV<4)	82		82		78		58		82	0.0195632
		-1.4		1.4		-220.1		-1244.4		
Shannon Diversity	1.3		2.4		2.6		2.8		2	0.3872882
		-1.4		1.4		1.7		2.3		
Percent Intolerant Organisms	79		84		80		62		81	1.5105193
		-1.4		1.4		-1.2		-13.0		
Percent Tolerant Organisms	0		0		0		0		0	0.1609499
		1.4		-1.4		-0.8		0.4		
Ranking Score		-2.8		2.8		-219.9		-1261.1		
StationID		1A		1C		2B		3B		

Table G-2. Summary Biological Metrics- Spring 2003

Summary biological metrics and ranking score by reach for macroinvertebrates sampled from the Santa Cruz La Honda Creek Watershed project, June, 2003.

StationID	1A	1C	2A	2B	3B
Taxonomic Richness	30	24	27	28	32
CV	20	13	6	6	11
Cumulative Taxa	45	39	39	40	42
Percent Dominant Taxon	37	38	50	25	30
CV	14	40	19	20	5
EPT Taxa	18	11	16	16	17
CV	6	22	7	13	4
EPT Index (%)	81	72	82	75	71
CV	8	12	3	6	4
Sensitive EPT Index (%)	41	31	31	47	36
CV	22	64	23	15	13
Cumulative EPT Taxa	23	17	21	20	23
Percent Chironomidae	8	6	11	11	6
CV	64	51	39	33	33
Shannon Diversity	2.2	2.1	2.0	2.4	2.6
CV	1.6	24.2	11.2	6.5	0.8
Tolerance Value	3.6	3.9	3.8	3.3	3.6
CV	11.5	23.8	7.4	5.6	3.8
Percent Intolerant Taxa (0-2)	39	31	30	46	39
CV	16	64	27	13	13
Percent Tolerant Taxa (8-10)	1	1	0	2	1
CV	117	135	100	122	8
Percent Collectors	59	49	71	43	47
CV	14	32	9	10	0
Percent Filterers	4	14	4	6	5
CV	102	77	59	43	70
Percent Grazers	17	16	8	15	21
CV	37	71	14	24	8
Percent Predators	5	10	7	13	8
CV	24	53	12	31	2

Percent Shredders	14	12	11	24	18
CV	27	77	30	17	28

Ranking Scores						Mean	SE
Taxonomic Richness	30	24	27	28	32	27	1.3443985
	2.3	-2.1	-0.2	0.8	3.4		
EPT Index	81	72	82	75	71	78	2.5193216
	0.9	-2.5	1.6	-1.2	-2.8		
Sensitive EPT Index (TV<4)	41	31	31	47	36	34	2.6630391
	2.6	-1.3	-1.3	4.8	0.6		
Shannon Diversity	2.2	2.1	2.0	2.4	2.6	2.11	0.0631716
	2.0	0.4	-2.4	5.1	7.8		
Percent Intolerant Organisms	39	31	30	46	39	33	2.0296338
	2.6	-1.2	-1.4	6.3	2.7		
Percent Tolerant Organisms	1	1	0	2	1	1	0.1591114
	-2.2	-0.1	2.3	-11.0	-4.8		
Ranking Score	8.2	-6.9	-1.3	4.9	6.9		
StationID	1A	1C	2A	2B	3B		

Table G-3. Five most abundant taxa by reach for macroinvertebrates samples from the La Honda Creek Watershed.

Five most abundant taxa by reach for macroinvertebrates sampled from the Santa Cruz La Honda Creek Watershed project, Winter 2002.

StationID	1	2	3	4	5
1A	Lepidostoma (70.2)	Hydropsyche (7.3)	Malenka (2.8)	Optioservus (2.7)	Gumaga (2.0)
1C	Lepidostoma (28.6)	Rhithrogena (16.4)	Ephemerella (12.4)	Malenka (7.7)	Epeorus (5.5)
2B	Rhithrogena (24.4)	Ephemerella (13.0)	Malenka (12.1)	Epeorus (10.1)	Lepidostoma (5.2)
3B	Rhithrogena (19.0)	Malenka (14.8)	Hydropsyche (7.3)	Calineuria californica (6.2)	Ephemerella (6.2)

Five most abundant taxa by reach for macroinvertebrates sampled from the Santa Cruz La Honda Creek Watershed project, Spring 2003.

StationID	1	2	3	4	5
1A	Baetis (37.3)	Malenka (14.1)	Ephemerella (8.2)	Orthocladiinae (7.9)	Nixe (4.9)
1C	Baetis (41.5)	Simulium (14.0)	Malenka (8.5)	Orthocladiinae (6.9)	Calineuria californica (4.4)
2A	Baetis (49.6)	Malenka (10.4)	Orthocladiinae (10.3)	Ephemerella (5.2)	Serratella (2.7)
2B	Baetis (25.0)	Malenka (24.0)	Orthocladiinae (11.0)	Calineuria californica (5.6)	Epeorus (4.0)
3B	Baetis (29.5)	Malenka (16.7)	Optioservus (8.7)	Nixe (5.5)	Orthocladiinae (4.1)

Table G-4. Taxa list and abundance calculations for benthic macroinvertebrates sampled from the La Honda Creek Watershed- Winter 2002.

				1A				3B			2BA1				1C				2A			
				2BA1	2BA2	2BA3	Total	2BA1	2BA2	Total	2BA1	2BA2	2BA3	Total	2BA1	2BA2	2BA3	Total	1BA1	1BA2	1BA3	Total
Ph Sb Cl O F Sf Ti Taxon	Life Stage	Tol Val	FFG	8360	8361	8362		8363	8364		8365	8366	8367		8368	8369	8370		8371	8372	8373	
Arthropoda																						
Insecta																						
Coleoptera																						
Psephenidae																						
Eubrianax edwardsi	Larvae	--	--	--	--	1	1	6	4	10	1	1	1	3	--	2	--	2	3	1	1	5
Hexapoda																						
Dryopidae																						
Helichus sp.	Adults	5	g	--	--	--	--	1	--	1	1	--	1	2	--	--	--	--	--	--	--	--
Elmidae																						
Narpus sp.	Adults	4	c	1	1	--	2	2	1	3	1	--	2	3	1	1	--	2	2	3	2	7
Optioservus sp.	Adults	4	g	--	5	5	10	3	5	8	1	2	2	5	1	--	--	1	2	2	1	5
Zaitzevia sp.	Adults	4	c	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	1	--	1
Narpus sp.	Larvae	4	c	--	--	2	2	8	--	8	--	--	--	--	1	1	--	2	--	--	--	--
Optioservus sp.	Larvae	4	g	6	6	7	19	14	10	24	7	7	8	22	2	10	13	25	3	6	2	11
Hydraenidae																						
Ochthebius sp.	Adults	5	g	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--
Hydrophilidae																						
Paracymus sp.	Adults	5	c	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ametor sp.	Larvae	5	p	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--
Diptera																						
Ceratopogonidae																						
Bezzia/ Palpomyia		6	p	--	--	1	1	1	--	1	1	2	--	3	--	--	6	6	--	--	--	--
Chironomidae																						
Chironominae																						
Chironomini		6	c	--	1	1	2	2	1	3	--	1	--	1	--	--	1	1	--	--	--	--
Tanytarsini		6	f	--	--	--	--	2	--	2	--	1	--	1	--	--	--	--	--	1	--	1
Diamesinae		6	c	--	--	--	--	--	--	--	--	4	--	4	--	--	--	--	2	--	1	3
Orthocladiinae		5	c	40	22	8	70	4	11	15	11	34	30	75	20	4	26	50	44	19	31	94
Tanypodinae		6	p	--	--	--	--	2	--	2	--	--	--	--	--	--	1	1	--	--	--	--
Dixidae																						
Meringodixa sp.		2	c	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Dolichopodidae		4	p	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--
Empididae																						
Chelifera/ Metachela		--	--	--	--	--	--	--	--	--	--	1	--	1	1	1	--	2	--	--	--	--
Clinocera sp.		6	p	--	1	1	2	2	--	2	1	--	--	1	--	--	--	--	--	--	--	--
Neoplasta sp.		--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	1	1	3	--	--	3
Pelecorhynchidae																						
Glutops sp.		3	p	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--
Psychodidae																						
Maruina lanceolata sp.		1	g	--	--	--	--	--	--	--	--	--	--	--	--	--	2	2	--	--	--	--
Pericoma sp.		4	c	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1
Simuliidae																						
Simulium sp.		6	f	7	25	2	34	2	10	12	6	3	13	22	78	2	22	102	1	12	7	20
Stratiomyidae																						
Caloparyphus/ Euparyphus		--	--	--	--	--	--	--	1	1	--	--	--	--	1	--	3	4	--	--	1	1
Tipulidae		3	s	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--
Antocha sp.		3	c	--	--	2	2	--	--	--	--	--	--	--	1	--	--	1	--	--	--	--
Dicranota sp.		3	p	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexatoma sp.		3	s	--	--	2	2	2	1	3	--	--	--	--	--	--	--	--	--	1	--	1
Limnophila sp.		3	s	--	--	1	1	--	--	--	1	--	--	1	--	1	1	2	--	--	1	1
Ephemeroptera																						
Ameletidae																						
Ameletus sp.		0	g	--	--	2	2	1	--	1	--	1	--	1	--	--	2	2	1	--	--	1
Baetidae																						
Baetis sp.		5	c	92	117	120	329	60	48	108	30	80	60	170	163	28	111	302	123	150	181	454
Diphetor hageni		--	c	--	--	--	--	8	3	11	--	1	1	2	--	2	--	2	1	--	1	2
Ephemerellidae																						
Attenella sp.		3	c	--	--	--	--	--	1	1	--	--	--	--	--	--	1	1	--	--	1	1
Drunella sp.		0	g	2	2	1	5	1	4	5	2	2	--	4	1	--	--	1	1	1	3	5
Ephemerella sp.		1	c	7	10	55	72	9	1	10	--	4	--	4	--	1	6	7	32	5	11	48
Serratella sp.		2	c	6	8	6	20	--	1	1	7	12	3	22	4	1	5	10	4	18	3	25
Heptageniidae																						
Cinygmula sp.		4	g	--	3	4	7	3	1	4	--	1	--	--	--	2	--	2	--	1	2	3
Epeorus sp.		0	g	16	8	6	30	4	6	10	13	6	8	27	10	10	8	28	8	9	8	25
Nixe sp.		2	g	22	7	14	43	13	7	20	2	1	1	4	--	7	16	23	4	--	1	5
Leptohyphidae																						
Tricorythodes sp.		5	c	1	--	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Leptophlebiidae																						
Paraleptophlebia sp.		4	c	1	--	--	1	--	1	1	2	1	1	4	1	1	--	2	--	--	--	--
Odonata																						
Cordulegastridae																						
Cordulegaster dorsalis		0	p	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--	--	1	--	1
Plecoptera																						
Chloroperlidae																						

Suwallia sp.	1	p	2	1	4	7	2	--	2	2	7	3	12	--	4	--	4	9	3	2	14
Sweltsa sp.	1	p	--	--	--	--	--	3	3	--	--	--	--	--	--	--	--	--	--	--	--
Nemouridae																					
Malenka sp.	2	s	51	46	27	124	40	21	61	30	86	47	163	11	25	26	62	34	40	21	95
Peltoperlidae																					
Soliperla sp.	2	s	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--
Perlidae																					
Calineuria californica	1	p	6	2	7	15	7	3	10	16	11	11	38	4	13	15	32	7	11	7	25
Hesperoperla pacifica	--	p	2	1	--	3	--	3	3	--	1	3	4	--	--	--	--	--	2	--	2
Perlodidae																					
Isoperla sp.	2	p	--	1	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Skwala sp.	2	p	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichoptera																					
Brachycentridae																					
Micrasema sp.	1	g	1	1	--	2	1	--	1	1	7	2	10	--	--	--	--	7	2	--	9
Amiocentrus aspilus	3	c	1	--	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Glossosomatidae																					
Agapetus sp.	0	g	1	2	3	6	--	--	--	--	--	--	--	--	--	--	--	2	--	--	2
Hydropsychidae																					
Hydropsyche sp.	4	f	1	2	1	4	--	1	1	3	6	5	14	--	4	8	12	4	4	1	9
Hydroptilidae																					
Ochrotrichia sp.	4	c	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	1	--	--	1
Lepidostomatidae																					
Lepidostoma sp.	1	s	--	--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Odontoceridae																					
Parthina sp.	0	s	--	--	--	--	1	--	1	1	--	--	1	--	--	--	--	--	--	--	--
Philopotamidae																					
Wormaldia sp.	3	f	--	--	--	--	1	--	1	--	--	--	--	--	--	--	--	1	2	--	3
Rhyacophilidae																					
Rhyacophila sp.	0	p	4	1	3	8	2	3	5	5	6	8	19	8	1	--	9	4	6	9	19
Uenoidae																					
Neophylax sp.	3	g	23	--	3	26	--	1	1	1	13	2	16	1	4	3	8	--	2	5	7
Crustacea																					
Malacostraca																					
Isopoda																					
Sphaeromatidae																					
Gnorimosphaeroma	8	c	--	--	--	--	--	--	--	8	2	1	11	1	--	5	6	1	--	1	2
Chelicerata																					
Arachnida																					
Acari																					
Protzia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1
Hygrobatidae																					
Atractides sp.	--	p	--	--	--	--	--	--	--	--	--	--	--	--	--	2	2	--	--	--	--
Hygrobates sp.	--	p	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lebertiidae																					
Lebertia sp.	--	p	--	--	--	--	1	--	1	--	--	--	--	1	--	1	2	--	--	--	--
Torrenticolidae																					
Torrenticola sp.	--	p	1	--	--	--	--	--	--	1	--	--	1	1	--	2	3	--	--	--	--
Annelida																					
Clitellata																					
Oligochaeta																					
Tubificida																					
Enchytraeidae	10	c	--	--	1	1	1	2	3	--	--	--	--	--	--	--	--	--	--	--	--
Naididae	10	c	1	7	--	8	2	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Tubificidae	--	--	--	1	1	2	1	--	1	--	--	--	--	--	1	--	1	2	--	--	2
Mollusca																					
Bivalvia																					
Veneroida																					
Sphaeriidae	8	f	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	1
Gastropoda																					
Basommatophora																					
Physidae																					
Physa sp.	8	g	--	--	--	--	--	--	--	1	1	--	2	--	--	--	--	--	--	--	--
Mesogastropoda																					
Hydrobiidae	--	g	--	--	--	--	--	--	--	--	--	2	2	--	1	--	1	--	--	--	--
Nematoda	5	p	--	--	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Platyhelminthes																					
Turbellaria																					
Tricladida																					
Planariidae	4	p	--	3	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total			295	288	299		210	156		156	305	219		312	127	289		307	303	306	
Abundance Calculations																					
Total Grids			4	4	4		3	3		2	2	3		3	6	4		3	3	3	
Grids Picked			1.75	0.75	2.5		3	3		2	2	3		2.5	6	4		3	1	3	
Organisms ID			295	288	299		210	156		156	305	219		312	127	289		307	303	306	
Extras			9	5	4		0	0		0	0	0		30	0	0		91	24	46	
Organisms ID + Extras			304	293	303		210	156		156	305	219		342	127	289		398	327	352	
Total Organisms per Sample			695	1563	485	2742	210	156	366	156	305	219	680	410	127	289	826	398	981	352	1731

Table G-5. Taxa list and abundance calculations for benthic macroinvertebrates sampled from the La Honda Creek Watershed- Spring 2003.

				1A				3B			2BA1				1C			
				2BA1	2BA2	2BA3		2BA1	2BA2		2BA1	2BA2	2BA3		2BA1	2BA2	2BA3	
Pl Sr Cl C F. St Ti Taxon	Life Stage	Tol Val	FFG	8374	8375	8376	Total	8377	8378	Total	8379	8380	8381	Total	8382	8383	8384	Total
Arthropoda																		
Insecta																		
Coleoptera																		
Psephenidae																		
Eubrianax edwardsi	Larvae	–	–	–	3	–	3	–	7	7	–	1	1	2	7	2	–	9
Hexapoda																		
Dryopidae																		
Helichus sp.	Adults	5	g	–	–	–	–	–	–	–	–	1	1	2	–	–	–	–
Elmidae																		
Optioservus sp.	Adults	4	g	2	1	–	3	3	6	9	–	3	–	3	1	–	–	1
Zaitzevia sp.	Adults	4	c	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
Narpus sp.	Larvae	4	c	–	–	–	–	–	–	–	–	–	1	1	1	–	–	1
Optioservus sp.	Larvae	4	g	4	16	2	22	11	7	18	14	6	8	28	12	5	8	25
Zaitzevia sp.	Larvae	4	c	–	–	–	–	1	1	2	2	–	–	2	–	–	–	–
Diptera																		
Ceratopogonidae																		
Bezzia/Palpomyia		6	p	–	1	–	1	1	2	3	1	1	1	3	5	2	2	9
Chironomidae																		
Chironominae																		
Chironomini		6	c	–	–	–	–	–	–	–	–	1	1	2	–	–	1	1
Tanytarsini		6	f	–	–	2	2	14	9	23	–	8	1	9	7	1	3	11
Orthocladiinae		5	c	10	2	3	15	19	16	35	1	1	4	6	4	3	6	13
Tanypodinae		6	p	1	–	–	1	1	1	2	4	–	1	5	1	1	–	2
Dixidae																		
Meringodixa sp.		2	c	–	–	–	–	–	2	2	–	–	1	1	–	–	–	–
Empididae																		
Neoplasta sp.		–	–	–	–	1	1	–	–	–	–	–	–	–	2	1	–	3
Pelecorynchidae																		
Glutops sp.		3	p	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–
Psychodidae																		
Maruina lanceolata sp.		1	g	1	–	–	1	–	2	2	1	–	–	1	2	3	1	6
Pericoma sp.		4	c	–	–	–	–	–	–	–	–	2	–	2	–	–	–	–
Simuliidae																		
Simulium sp.		6	f	2	–	1	3	12	1	13	2	4	9	15	1	2	–	3
Stratiomyidae																		
Caloparyphus/Euparyphus		–	–	2	2	2	6	1	1	2	–	3	–	3	1	–	1	2
Tipulidae																		
Antocha sp.		3	c	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–
Dicranota sp.		3	p	–	–	–	–	1	1	2	–	–	1	1	–	–	–	–
Hexatoma sp.		3	s	–	–	–	–	–	–	–	1	–	–	1	–	1	–	1
Rhabdomastix sp.		6	s	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
Ephemeroptera																		
Ameletidae																		
Ameletus sp.		0	g	–	1	–	1	–	–	–	2	–	–	2	–	1	1	2
Baetidae																		
Baetis sp.		5	c	–	2	–	2	14	14	28	9	6	16	31	5	10	2	17
Diphetor hageni		–	c	–	–	–	–	12	5	17	2	2	2	6	1	–	2	3
Ephemerellidae																		
Drunella sp.		0	g	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–
Ephemerella sp.		1	c	3	6	3	12	13	27	40	44	53	20	117	40	43	30	113
Heptageniidae																		
Cinygmula sp.		4	g	5	6	4	15	–	–	–	–	–	–	–	–	–	–	–
Epeorus sp.		0	g	3	4	2	9	6	10	16	23	16	52	91	17	18	15	50
Ironodes sp.		4	g	–	–	–	–	2	6	8	–	1	–	1	–	–	–	
Rhithrogena sp.		0	g	7	–	1	8	84	39	123	64	63	93	220	30	66	54	150
Leptohyphidae																		
Tricorythodes sp.		5	c	1	10	2	13	–	–	–	4	–	–	4	2	–	1	3
Leptophlebiidae																		
Paraleptophlebia sp.		4	c	1	1	–	2	15	20	35	2	5	3	10	3	1	2	6
Megaloptera																		
Sialidae																		
Sialis sp.		4	p	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
Odonata																		
Cordulegastridae																		
Cordulegaster dorsalis		0	p	–	–	–	–	2	–	2	–	–	–	–	–	–	–	–
Gomphidae																		
Octogomphus specularis		1	p	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Plecoptera																		
Capniidae		1	s	–	6	3	9	2	2	4	2	1	4	7	–	1	2	3
Chloroperlidae		1	p	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–
Sweltsa sp.		1	p	–	–	–	–	4	1	5	–	–	–	–	1	–	2	3

Leuctridae																	
Despaxia augusta	0	s	–	–	–	–	1	–	1	–	–	1	1	–	–	–	–
Nemouridae																	
Malenka sp.	2	s	11	10	5	26	32	64	96	32	38	39	109	19	26	25	70
Perlidae																	
Calineuria californica	1	p	1	–	1	2	3	37	40	8	8	4	20	4	2	4	10
Hesperoperla pacifica	–	p	–	–	–	–	1	1	2	2	1	2	5	1	–	–	1
Perlodidae	2	p	–	–	2	2	–	–	–	–	–	–	–	–	–	–	–
Isoperla sp.	2	p	–	–	–	–	4	–	4	5	6	3	14	2	5	4	11
Trichoptera																	
Brachycentridae																	
Micrasema sp.	1	g	2	–	–	2	3	8	11	6	19	3	28	19	7	16	42
Hydropsychidae																	
Hydropsyche sp.	4	f	32	33	3	68	30	17	47	10	19	15	44	8	12	16	36
Lepidostomatidae																	
Lepidostoma sp.	1	s	197	182	275	654	3	5	8	23	22	2	47	88	62	111	261
Limnephilidae	4	s	–	–	–	–	–	1	1	1	–	–	1	–	–	–	–
Polycentropodidae																	
Polycentropus sp.	6	p	–	–	–	–	–	2	2	–	–	–	–	–	–	–	–
Rhyacophilidae																	
Rhyacophila sp.	0	p	4	–	–	4	13	13	26	18	9	14	41	4	12	7	23
Sericostomatidae																	
Gumaga sp.	3	s	7	3	9	19	–	–	–	1	–	–	1	1	–	4	5
Uenoidae																	
Farula sp.	0	g	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Neophylax sp.	3	g	1	17	1	19	–	2	2	1	1	1	3	3	1	4	8
Crustacea																	
Malacostraca																	
Isopoda																	
Sphaeromatidae																	
Gnorimosphaeroma	8	c	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Ostracoda																	
Podocopida																	
Cyprididae	8	c	–	–	–	–	–	–	–	2	–	–	2	–	–	1	1
Chelicerata																	
Arachnida																	
Acari																	
Protzia sp.	–	–	–	–	–	–	4	1	5	–	–	1	1	–	–	–	–
Lebertiidae																	
Lebertia sp.	–	p	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–
Annelida																	
Clitellata																	
Oligochaeta																	
Lumbricina	–	c	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–
Tubificida																	
Tubificidae	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–
Mollusca																	
Gastropoda																	
Basommatophora																	
Physidae																	
Physa sp.	8	g	–	–	–	–	–	–	–	1	–	–	1	2	1	–	3
Mesogastropoda																	
Hydrobiidae	–	g	–	–	–	–	–	–	–	1	–	–	1	1	1	–	2
Nemertea																	
Enopla																	
Hoplonemertea																	
Tertastemmatidae																	
Prostoma sp.	–	c	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–
Platyhelminthes																	
Turbellaria																	
Tricladida																	
Planariidae	4	p	–	2	1	3	–	–	–	–	–	–	–	–	–	–	–
		Total	298	310	323		314	333		290	304	306		296	291	325	
Abundance Calculations																	
Total Grids			9	6	9		20	9		6	8	14		5	6	12	
Grids Picked			1.5	1	0.5		1	1		1.5	1.5	2.5		1	1.5	1	
Organisms ID			298	310	323		314	333		290	304	306		296	291	325	
Extras			27	20	9		5	30		34	21	9		21	13	26	
Organisms ID + Extras			325	330	332		319	363		324	325	315		317	304	351	
Total Organisms per Sample			1950	1980	5976	9906	6380	3267	9647	1296	1733	1764	4793	1585	1216	4212	7013

Appendix G-6: Description of reach scale habitat parameters used to document local habitat conditions along the stream corridor of La Honda Creek

Some of the parameters in this procedure do not apply to a single riffle, so this procedure is usually not performed as part of the point source sampling design. The parameters just discussed are usually enough to demonstrate that the riffles used for a point source investigation were homogeneous. Refer to the DFG's California Stream Restoration Manual" if you want to take more quantitative measures of physical/habitat conditions. However, there is no substitute for this assessment; it must be performed as part of a bioassessment program. Read the following procedures taken from the U.S. EPA's Rapid Bioassessment Procedures document before conducting the physical/habitat quality evaluation.

1. Epifaunal Substrate/Available Cover - Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, rearing or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provides macroinvertebrates and fish with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high-gradient streams and serving as spawning, rearing and feeding refugia for certain fish. The extent and quality of the riffle are important factors in the support of healthy biological conditions in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structures for macroinvertebrate colonization and fish refugia in low-gradient streams. However, "new fall" will not yet be prepared for colonization.

2a. (High Gradient) Embeddedness - Refers to the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased. Embeddedness is a result of large-scale sediment movement and deposition, and is a parameter evaluated in the riffles and runs of high-gradient streams. The rating of this parameter may be variable depending on where the observations are taken. To avoid confusion with sediment deposition (another habitat parameter), observations of embeddedness should be taken in the upstream and central portions of riffles and cobble substrate areas.

2b. (Low Gradient) Pool Substrate Characterization - Evaluates the type and condition of bottom substrates found in pools. Firmer sediment types (e.g., gravel, sand) and rooted aquatic plants support a wider variety of organisms than a pool substrate dominated by mud or bedrock and no plants. In addition, a stream that has a uniform substrate in its pools will support far fewer types of organisms than a stream that has a variety of substrate types.

3a. High Gradient) Velocity/Depth Combinations - Patterns of velocity and depth are included for high-gradient streams under this parameter as an important feature of habitat diversity. The best streams in most high-gradient regions will have all four patterns present: (1) slow-deep, (2) slow-shallow, (3) fast-deep, and (4) fast-shallow. The general guidelines are 0.5m depth to separate shallow from deep, and 0.3 m/sec to separate fast from slow. The occurrence of these four patterns relates to the stream's ability to provide and maintain a stable aquatic environment.

3b. (Low Gradient) Pool Variability - Rates the overall mixture of pool types found in streams, according to size and depth. The four basic types of pools are large-shallow, large-deep, small-shallow, and small-deep. A stream with many pool types will support a wide variety of aquatic species. Rivers with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.

4. Sediment Deposition - Measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.

5. Channel Flow Status - Measures the degree to which the channel is filled with water. The flow status will change as the channel enlarges (e.g., aggrading stream beds with actively widening channels) or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, riffles and cobble substrate are exposed; in low-gradient streams, the decrease in water level exposes logs and snags, thereby reducing the areas of good habitat. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when using more than one biological index period for surveys or the timing of sampling is inconsistent among sites or annual periodicity.

6. Channel Alteration - Measures large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, or diverted into concrete channels, often for flood control or irrigation purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present; when the stream is very straight for significant distances; when dams and bridges are present; and when other such changes have occurred. Scouring is often associated with channel alteration.

7a. (High Gradient) Frequency of Riffles (or bends) - Measures the sequence of riffles and thus the heterogeneity occurring in a stream. Riffles are a source of high-quality habitat and diverse fauna, therefore, an increased frequency of occurrence greatly enhances the diversity of the stream community.

7b. (Low Gradient) Channel Sinuosity - For areas where distinct riffles are uncommon, a run/bend ratio can be used as a measure of meandering or sinuosity. A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in some streams, a longer segment or reach than that designated for sampling may be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The "sequencing" pattern of the stream morphology is important in rating this parameter. In headwaters, riffles are usually continuous and the presence of cascades or boulders provides a form of sinuosity and enhances the structure of the stream. In "oxbow" streams of coastal areas and deltas, meanders are highly exaggerated and transient. Natural conditions in these streams are shifting channels and bends, and alteration is usually in the form of flow regulation and diversion. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods.

8. Bank Stability (condition of banks) - Measures whether the stream banks are eroded (or have the potential for erosion). Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks, and are therefore considered to be unstable. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. Eroded banks indicate a problem of sediment movement and deposition, and suggest a scarcity of cover and organic input to streams.

9. Bank Vegetative Protection - Measures the amount of vegetative protection afforded to the stream bank and the near-stream portion of the riparian zone. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur. This parameter supplies information on the ability of the bank to resist erosion as well as some additional information on the uptake of nutrients by the plants, the control of instream scouring, and stream shading. Banks that have full, natural plant growth are better for fish and macroinvertebrates than are banks without vegetative protection or those shored up with concrete or riprap. This parameter is made more effective by defining the natural vegetation for the region and stream type (i.e., shrubs, trees, etc.). In areas of high grazing pressure from livestock or where residential and urban development activities disrupt the riparian zone, the growth of a natural plant community is impeded and the disruption can extend to the bank vegetative protection zone.

10. Riparian Vegetative Zone Width - Measures the width of natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports a robust stream system. Narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Residential developments, urban centers, golf courses, and rangeland are the common causes of anthropogenic degradation of the riparian zone. The presence of "old field" (i.e., a previously developed field not currently in use), paths, and walkways in an otherwise undisturbed riparian zone may be judged to be inconsequential to destruction of the riparian zone. In some regions of the country, an increase in the specified width of a desirable riparian zone is warranted.

APPENDIX H.
Previous CDFG observational stream surveys

Six stream surveys of La Honda Creek covering the 1950's to 1997 describe the channel condition and fish habitat provided during that time frame. In addition, a single fish survey from 1978, and electrofishing as a part of the 1997 survey provide some data on numbers of fish present.

The first stream survey is not dated, however, based upon reading stream surveys of similar style and content from other locations in the Bay Area, this survey was likely completed in the 1950's (Table 6-1). The survey makes a statement about current average annual rainfall measuring 24 inches (610 mm), but ten years earlier, annual rainfall totaled 30 inches (762 mm). An analysis of long-term rainfall records for the area shows a period in the 1940's where rainfall was approximately 30 inches annually, and a period in the mid-1950's where rainfall was near 24 inches annually, following the trend described in the survey, and helping to identify the date of the survey. The survey covers six miles of La Honda Creek, all of which contains flow, with an average of 270 gallons per minute (approximately 0.02 cms, 0.6 cfs), and water temperature of 54° F (12.2° C). The channel is fed by springs, and averages 4 ft (1.2 m) in width, and 4 in (10 cm) in depth. The channel bed consists of gravel and silt, and only a single obstruction (a dam at Troutmere that has a fish ladder) is noted downstream on San Gregorio Creek. The only fish found in the creek were steelhead, however past data indicates that both steelhead and King salmon (stocked in 1932 sourced from an aquarium in San Francisco) were stocked. La Honda Creek and other tributaries are noted for containing good spawning substrate, but heavy fishing pressures typically take fish that were planted in the previous year.

The second survey, a field note from a Department of Fish and Game warden in 1962, is included in the stream surveys. Warden Peek reports that past logging in the watershed is causing a siltation problem for the bed of La Honda Creek. Peek states that perennial flow maintains a fish population, but the numbers returning to spawn have been decreasing, despite reduced fishing pressure. Decreased populations are attributed to the siltation and destruction of habitat. He also notes that Alpine Creek supports a population of steelhead, with adults regularly returning to spawn.

The third survey was completed on August 3, 1964 by two Department of Fish and Game employees, Parker and Primbs. They walked the entire length of La Honda Creek, noting continual flow throughout, fed by eight distinct springs. The surveyors describe the lowest three miles (4.8 km) of creek as a highly productive spawning and nursery area for steelhead and potentially silver salmon. The upper four miles (6.4 km) have larger boulders, more bedrock and many LWD jams that act as migration barriers, thus having a lesser importance as spawning and rearing habitat. Channel width ranges from one to 20 ft (0.3 to 6.1 m), with an average of five feet (1.5 m), while depth ranges from one inch to five ft (0.03 to 1.5 m), with an average of four inches (0.1 m). Stream flow is measured as 0.5 cfs (0.01 cms) at the mouth of the confluence, but evidence of high winter flows (high water mark at eight ft (2.4 m)) is also noted. The channel bed in the lowest three miles is described as consisting of 40% coarse gravel, 40% fine gravel, 5% fine rubble, 10% silt, and 5% sand. Approximately 1/3 of the loose gravel bed appears to be suitable for spawning. Three distinct areas of spawning ground are noted on the map between the Woodruff and Weeks Creek tributaries. Pool development is classified as good, with average pool lengths of 10 ft (3.0 m), widths of five ft (1.5 m), and depths of 1.5 ft (0.5 m). Abundant stream-side vegetation including ferns, vines, alders and redwoods is present, and supports the lizards, salamanders, frogs, deer and raccoons that are observed. Twenty partial log jams and three complete log jams (all upstream of Weeks Creek) are noted along with many undercut banks, logs and roots for shelter. A water temperature of 60° F (15.6 °C) is measured at the headwaters, and 67° F (19.4° C) is measured at the mouth. Stonefly, mayfly and caddisfly nymphs are observed throughout the creek, and algae is observed in the lower gradient, lower velocity areas. Silt from past logging operations is the only pollution source noted. In the lowest three miles, both steelhead and stickleback fish are observed, with an average of 50 steelhead per 100 ft (30.5 m). Steelhead range from 0.5 - 5 in (13 - 127 mm), with good condition, good natural propagation and success noted in the lowest three miles. Recommendations include reducing the silt contributed from logging because it appears to be polluting spawning gravels, establishing a silver salmon run through fish planting, and removing log jams to help fish habitat. Removal of wood was a common practice in many California streams up until the 1970's when its in-stream value was discovered.

The fourth stream survey was completed on September 27, 1973 by Department of Fish and Game personnel Stuparich and Meints. The entire channel length (approximately 7.8 mi, 12.5 km) was surveyed. Perennial flow (fed by springflow), abundant riparian vegetation (alder, bay, tan oak, willow, redwood, ferns, and poison oak), and many short, hardened bank stabilization efforts are observed. Channel width in the lowest three miles (4.8 km) varies from five to 15 ft (1.5 to 4.6 m), while depth varies from one to six inches (0.03 to 0.15 m) in riffles and six to 40 inches (0.15 to 1.02 m) in pools. The channel bed in the middle five miles (8.0 km) consists of coarse sand, fine gravel, coarse gravel, both fine and coarse rubble, boulders, and a high percentage of clay and silt from past logging activities. The lowest 1.5 mi (2.4 km) consists of sand, fine and coarse gravel, fine and coarse rubble, with silt, mud, and clay associated with the construction of the culvert under Entrada Road. The average composition of the channel bed consists of: 15% bedrock, 15% boulders, 15% coarse rubble, 10% fine rubble, 10% coarse gravel, 10% fine gravel, 7% sand, 5% mud, 8% silt, and 5% clay. The channel is noted as providing good to excellent spawning habitat for steelhead and silver salmon, with an abundance of gravel and rubble in the lower four miles (6.4 km). The DFG personnel state that spawning materials were loose, without noticeable compaction, except in the areas where logging operations have destroyed the spawning and nursery habitats. The lowest 2.8 miles (4.5 km) of creek have a pool:riffle ratio of 40:60, with pools three to nine ft (0.9 to 2.7 m) in width, four to 30 ft (1.2 to 9.1 m) in length, six to 48 in (0.15 to 1.22 m) in depth, and spaced 25 to 60 ft (7.6 to 18.3 m) apart. Water flowing over the riffles is between two and eight inches (0.05 to 0.20 m) in depth. Whereas no mention of pool forming process is made for the lower reach, pools in the middle reaches were noted as being formed mainly by logjams and bedrock outcrops. Abundant riparian growth provides nearly complete shading of the stream, while bedrock, boulders, roots, logs and undercut banks provide fish shelter. Eleven barriers in the entire channel length are described, including fencing across the streambed, logjams, a collapsed logging bridge, a landslide, logging slash buildup, silt buildup, a flashboard dam, a small concrete and stone dam, and a landslide caused by logging road construction. Six diversions are observed, most being single small diameter pipes diverting for residential use, but also included diversions for agriculture, and an unused flashboard dam diversion for the Sky-L-Onda Mutual Water Company. Water temperatures range from 11.7 to 15.0° C (53 to 59°F), and are generally warmer near the channel mouth. Numerous aquatic fish foods including caddis flies, caddisfly larvae, centipedes, diptera pupae, earthworms, gnats, isopods, stone flies, water boatman, beetles, and water striders are observed throughout the stream, along with filamentous algae in the lower stream reaches. In-stream pollution includes bath soap and shampoo from people bathing in the stream, silt, log and slash debris from logging activities, fine sediment from a dirt road crossing the channel, and a large amount of urban debris including: auto bodies, domestic garbage, cow dung, refrigerators, oil barrels, and tires. In the lowest 5.5 mi (8.9 km) of channel, numerous juvenile steelhead are observed, with schools of 15 to 20, ranging from two to four inches (0.05 to 0.10 m) in length in the middle reaches, and schools of 20 to 50, ranging from two to four inches (0.05 to 0.10 m) in length, with an occasional six to seven inch (0.15 to 0.18 m) trout in the lower reaches. No other fish species are observed, but many *Pacifastacus leninsculus* crayfish are observed. The personnel conclude that La Honda Creek is an important anadromous fish producing stream, providing ample food, and good to excellent spawning and rearing habitat for steelhead and silver salmon. They also recommend that the stream be managed as a steelhead spawning and rearing stream, existing log jams should be removed, flashboard dam use should be reviewed, residents should be cited for dumping garbage, diversions should be screened, and any new water diversion requests should be protested.

The fifth stream survey was completed July 19th and 20th, 1985 by Department of Fish and Game aides Ford and Bordenave. Almost the entire channel length was walked, with the exception of a quarter mile (0.4 km) section near the headwaters. Channel width ranges from zero (in dry sections) to 15 ft (4.6 m)(the widest pool), with an average width of three ft (0.9 m), and channel depth ranges from zero (a dry riffle) to eight ft (2.4 m)(a bedrock pool), with an average of 1.5 ft (0.5 m). Stream flow is measured as 0.6 cfs (0.02 cms) at the confluence with San Gregorio Creek. The channel bed consists of rubble and bedrock in riffles and runs, and sand and silt in the pools, especially in the lower reaches. Approximately 25% of the entire channel bed is composed of rubble. The aides classify overall spawning habitat as fair, with poor spawning gravels in most reaches and scattered areas of excellent gravels. They believe that the amount of spawning habitat available is enough to produce numbers of fish that will saturate the available rearing habitat. They classify rearing habitat as fair, with food availability (low flow over riffles) being the limiting factor. Moderate food sources are observed, including caddis fly larvae, water boatman, and water striders throughout the stream, and abundant filamentous algae in the non-shaded lower reaches. Abundant shelter consisting of undercut banks, logs, overhanging vegetation, boulders and water turbulence is observed. Pool frequency in the lower reaches is approximately 18%, increasing to 41% upstream of Woodruff Creek, with many of the pools being created by scour around logs and hard banks throughout the creek. Pools appear to be deep and have associated cover for good rearing habitat. Log jams and other barriers are not noted in the reaches downstream of Woodruff Creek, however four log jams are observed between Woodruff and Weeks Creeks, and many more partial and complete log jams are observed upstream of Weeks Creek. Five diversions are observed, but only one is active (upstream of Weeks Creek). The water temperature at the confluence with San Gregorio is 16.1° C (61° F) at 11:00 AM. One area is identified as a pollution source, inputting sediment from construction, trash, and vegetation clippings into the channel. Fish (likely steelhead) are observed in all reaches of the stream, even up to two miles (3.2 km) upstream of Weeks Creek. In deeper pools, steelhead up to eight inches (0.20 m) in length are observed. The aides also observed crayfish, California newts, frogs, a single red legged frog, and salamander larvae. The aides conclude that La Honda Creek provides spawning and rearing habitat for steelhead downstream of Woodruff Creek, and resident rainbow trout upstream of Woodruff Creek. Removal of the many log jams would not be cost effective, as it would only open a small portion of the creek, and the sediment trapped behind the jam would have to be removed as well.

Table H-1. Bank failure locations noted in the 1995 CDFG La Honda Creek stream assessment. Locations given upstream from confluence of La Honda Creek and San Gregorio Creek.

Location (m)	Location (ft)	Comment
120.1	394.0	Left bank eroded
2286.5	7499.8	Right bank failure, 40 by 60 feet
2504.9	8216.0	Left bank sliding
2645.3	8676.6	Right and left banks failing
2906.2	9532.3	Eroded right bank
2913.2	9555.3	Right bank failing
2976.3	9762.4	Eroded right bank
2992.8	9816.4	Eroded right bank
3166.0	10384.5	Right bank bare and failing
3282.3	10766.1	Right bank failing
3673.7	12049.6	Banks eroding
3713.6	12180.6	Right bank failing
4467.1	14652.0	Left bank failing, 45 by 30 feet
4593.7	15067.2	Left bank with gabion stabilization, still failing
4943.4	16214.2	Eroded left bank
4962.0	16275.2	Right bank failing
5154.9	16908.2	House on left bank. Bank is bare and failing for 80 feet
5187.0	17013.2	Large slide on right bank
5473.4	17952.9	Old bridge, both banks eroding
5497.3	18031.1	Left bank failing
5631.5	18471.4	Right bank eroded
5680.1	18630.7	Right bank eroded
5709.8	18728.1	Right bank eroded
5720.6	18763.7	Right bank eroded
5840.7	19157.6	Right and left banks failing
5863.8	19233.3	Landslide on right bank, 25 by 40 feet
5924.0	19430.6	Right bank failing

6162.6	20213.2	Right bank eroded, 20 by 8 feet
6205.5	20354.2	Right bank eroded, 40 by 8 feet
6285.7	20617.2	Left bank eroded, 47 by 7 feet

The sixth stream survey was completed on February 10, 1997, surveying approximately four miles (6.4 km) of channel, beginning at the confluence with San Gregorio Creek. Habitat in the creek was inventoried following Department of Fish and Game methodologies in September 1995, and fish sampling was conducted in October and November of 1995 to determine the number and species of fish present. Stream flow was measured as 0.33 cfs (0.01 cms) on August 7, 1995 at the confluence with San Gregorio Creek, and 0.33 cfs (0.01 cms) on September 7, 1995 downstream of the confluence with Woodhams Creek. Based upon the inventory of riffle, flatwater, and pool habitat units, habitat in the lower four miles of La Honda Creek is classified and assessed. Riffle habitat constitutes 31% of the total surveyed length, with 172 separate riffles identified, averaging 38 ft (11.6 m) in length, 12 ft (3.7 m) in width, and 0.4 ft (0.1 m) in depth. Substrate consists of 9% gravel, 29% cobble, 45% large cobble, 14% boulder and 3% bedrock. Approximately 24% of the riffle habitat is associated with shelter, including boulders, bubble curtain, small woody debris, undercut banks, overhanging vegetation, and aquatic vegetation. Flatwater habitat constitutes 33% of the total surveyed length, with 131 separate units identified, averaging 55 ft (16.8 m) in length, 10 ft (3.0 m) in width, and 0.5 ft (0.2 m) in depth. Substrate consists of 19% gravel, 28% small cobble, 41% large cobble, 9% boulders, and 3% bedrock. Approximately 16% of the flatwater habitat is associated with shelter, including boulders, undercut banks, woody debris, and overhanging vegetation. Pool habitat constitutes 36% of the total surveyed length, with 139 separate pools identified, averaging 54 ft (16.5 m) in length, 13 ft (4.0 m) in width, and 1.1 ft (0.3 m) in depth. Pool average maximum depth is 2.2 ft (0.7 m), ranging from 0.9 to 4.5 ft (0.3 to 1.4 m). Substrate consists of 69% silt, 22% sand, 7% small cobble, and 2% large cobble. Approximately 27% of pools have associated cover, including undercut banks, roots, woody debris, boulders, overhanging vegetation, and bubble curtains. Substrate at potential spawning locations is also sampled for grain sizes and embeddedness. Substrate consists of 3% sand, 35% gravel, 29% small cobble, 24% large cobble and 9% boulders. Embeddedness is divided into quarters, with 51% of the sites embedded between 26 and 50%, 37% of the sites embedded between 51 and 75%, 10% of the sites embedded between 0 and 25%, and 2% of the sites embedded between 76 and 100%. Riparian canopy cover averages 69%, primarily provided by deciduous trees, bay laurel, and oaks, and secondarily by coniferous trees. Throughout the creek many springs, prolific algae growth in five separate locations, and five in-stream diversions are observed. Pollution in the creek includes observed oil sheen, soapsuds, a sewage odor, and domestic garbage. Many bank stabilization efforts including concrete and boulder riprap are observed, along with four in-stream cobble dams that limit low-flow migration of juvenile fish. A partial logjam is observed at mile 3.8, and 22 bank failures or landslides are found to be contributing sediment to the creek. Water temperatures taken September 5th through 14th, 1995 ranged from 10 to 16° C (50 to 61° F). Fish stocking occurred in San Gregorio Creek up until 1974, but this survey does not report any stocking occurring in La Honda Creek. A fish survey was conducted on the lowest four miles (6.4 km) of creek in 1995, using electrofishing methods. Steelhead, stickleback, sculpin, and one pacific giant salamander were sampled (Table x).

Recommendations for La Honda Creek include maintaining adequate perennial flow levels for migration, spawning and rearing; retaining in-stream cover, especially large woody debris, and only removing log jams that are a complete barrier to fish migration; enhancing and maintaining the riparian corridor; removal of invasive non-native species including Eucalyptus, Acacia, German and English ivy, periwinkle and nasturtiums; reducing the amount of fine sediment supplied to the stream from human land uses and natural bank erosion and landsliding.

In addition to these six stream surveys, a coho salmon survey was conducted on Alpine, La Honda and Mindego Creeks on January 17^{th}, 1978. Although no fish or carcasses were observed, the following measurements were made at the Entrada Road crossing: water temperature 11.7° C (53° F), width 18 ft (5.5 m), average depth 9 in (23 cm), estimated flow of 25 to 30 cfs (0.71 to 0.85 cms).

APPENDIX I.

Longitudinal profile data

Table I-1. La Honda Creek longitudinal profile raw data.

Elevation (ft)	Distance (ft)	Elevation (m)	Distance (m)	Notes
316	0	96.34	0.00	Confluence with San Gregorio Creek
320	397	97.56	121.04	
340	2582	103.66	787.20	Highway 84 crossing near Memory Lane
360	2980	109.76	908.54	
380	4569	115.85	1392.99	Entrada Road crossing
400	5563	121.95	1696.04	
420	6606	128.05	2014.02	Woodhams Creek confluence
440	7848	134.15	2392.68	
480	9238	146.34	2816.46	
500	9536	152.44	2907.32	Highway 84 crossing near the lower stoplight
505	9784	153.96	2982.93	Unnamed tributary confluence
510	10280	155.49	3134.15	Langley Creek confluence
520	10877	158.54	3316.16	
560	12417	170.73	3785.67	
580	12814	176.83	3906.71	Woodruff Creek confluence
600	15596	182.93	4754.88	
625	16440	190.55	5012.20	Weeks Creek Confluence

Elevation is from contours on the 1997 USGS La Honda 7.5' topographic quadrangle. Distance is cumulative upstream from the La Honda Creek confluence with San Gregorio Creek.

APPENDIX J.

Sample reach cross-section data

Table J-1. Reach 1A cross-section raw data (in meters).

Reach 1A Meter 32.5	
Distance	Elevation
1	1.33
1.5	1.02
2	0.93
3	0.65
3.5	0.25
4	0.18
5	0.07
6	-0.2
6.3	-0.38
7	-0.47
8	-0.67
8.3	-0.73
9	-0.85
10	-0.92
11	-0.84
11.6	-0.71
12	-0.61
12.3	-0.43
13	-0.35
13.5	-0.45
14	-0.44
15	-0.28
15.4	0.15
16	0.38

Reach 1A Meter 97.5	
Distance	Elevation
0	2.03
3.6	1.53
4	1.34
5	0.87
6	0.36
6.3	-0.37
7	-0.65
7.5	-0.69
8	-0.61
9	-0.5
9.8	-0.34
10.5	0.01
11	0.09
12	0.01
13	-0.03
14	-0.01
15	0.14
16	0.3
17	0.47
18	0.21
19	0.32
20	0.41
20.3	0.61
21	1.53

Reach 1A Meter 162.5	
Distance	Elevation
1.6	0.63
2.7	0.39
3.3	0.04
6.7	0.03
8.1	-0.59
9	-0.76
10	-0.83
11	-0.8
12	-0.71
13	-0.75
14	-0.82
15	-1.06
16	-1.09
16.5	-1.1
17	-1.17
18	-1.3
19	-1.3
20.1	-1.44
21	-1.54
22	-1.53
23	-1.56
23.3	-1.5
23.5	-1.12
23.7	-0.95
24	-0.92
25	-0.73
25.2	-0.73
26	-0.37
26.8	0.07

Table J-2. Reach 1B cross-section raw data (in meters).

Reach 1B Meter 37.5	
Distance	Elevation
0.5	0.48
1.2	-0.25
1.35	-0.67
1.7	-0.88
2.3	-0.86
3.5	-0.81
3.9	-0.69
5	-0.62
6	-0.47
7	-0.48
8	-0.41
9	-0.38
10	-0.42
10.85	-0.01
12.4	0.65
14.5	1.68

Reach 1B Meter 112.5	
Distance	Elevation
1	-0.82
1.9	-1.12
2.3	-1.72
3.4	-1.92
4.35	-1.86
5.4	-1.72
6.5	-1.57
8	-1.48
9.5	-1.51
11	-1.5
12.5	-1.44
14.5	-1.29
15.5	-0.97
17.3	-0.44
19	-0.01
20.8	0.12
25.6	0.84
28.7	1.53

Reach 1B Meter 187.5	
Distance	Elevation
0.6	0.93
1.8	-0.12
2.4	-0.25
3.3	-0.37
4.2	-0.43
5.9	-0.41
7.5	-0.25
8.3	-0.21
9.15	-0.2
9.95	-0.17
10.2	0.07
10.6	0.13
12.6	1.19

Table J-3. Reach 1C cross-section raw data (in meters).

Reach 1C Meter 35	
Distance	Elevation
0.6	1.53
0.8	-0.55
1	-0.67
2	-0.62
5.8	-0.83
6.8	-0.94
8	-0.81
8.4	-0.55
8.9	-0.36
9.4	-0.02
10	0.14
10.6	0.49

Reach 1C Meter 105	
Distance	Elevation
2	0
4.7	-1.02
8	-1.19
9.7	-1.47
11.9	-1.59
14.6	-1.77
16.1	-2.27
16.7	-1.72
19.8	0.53
20.5	0.63
22	3.03

Reach 1C Meter 175	
Distance	Elevation
3.2	1.09
7.5	0.11
8.2	-0.16
8.8	-0.38
9.9	-0.73
10.8	-0.78
11.8	-0.88
13.8	-0.79
15.4	-0.76
16.7	-0.53
17.2	-0.15
18	0.68
19	1.53

Table J-4. Reach 2A cross-section raw data (in meters).

Reach 2A Meter 32.5	
Distance	Elevation
1.05	0.53
2	-0.07
3	-0.6
3.7	-0.77
4.44	-0.96
5.44	-1.28
5.89	-1.44
6.49	-1.87
6.94	-1.95
6.97	-2.38
7.17	-2.48
7.48	-2.53
8.12	-2.49
8.27	-2.47
8.35	-2.48
8.57	-2.47
9	-2.45
10	-2.42
11	-2.38
12	-2.35
12.95	-2.38
13.52	-2.56
14.6	-2.65
14.8	-2.59
15.1	-1.95
15.2	-1.12

Reach 2A Meter 97.5	
Distance	Elevation
1	1.53
2	0.86
3	0.58
4	0.29
5	0.24
6	0.21
7	0.21
8	0.23
9	0.03
10	-0.12
11	-0.2
12	-0.2
12.71	-0.37
13.35	-0.58
13.87	-0.75
14.49	-0.89
15.23	-0.96
16.1	-0.75
16.13	-0.26
16.5	0.41

Reach 2A Meter 162.5	
Distance	Elevation
0.88	1.03
1.18	0.37
1.47	0.16
2.15	0.11
2.65	0.14
3.25	0.11
4	0.09
4.49	0.04
5	0.08
5.7	0.07
6.4	0.07
7	0.08
7.48	0.14
7.78	0.47
8	1.11
8.7	1.22

Table J-5. Reach 2B cross-section raw data (in meters).

Reach 2B	
Meter 45	
Distance	Elevation
1.6	1.33
1.8	0.5
2.4	0.19
5.2	-0.04
5.6	0.51
6.3	-0.36
6.6	-0.47
7.7	-0.53
8.1	0.15
8.8	-0.58
10	-0.61
11.2	-0.56
11.8	-0.75
12.2	-0.68
12.65	-0.18
13.7	0.66
14.8	0.76

Reach 2B	
Meter 135	
Distance	Elevation
3	1.16
4.5	0.85
3.8	-1.02
4.7	-1.38
6	-1.28
6.8	-1.02
7.2	-0.82
9.5	-0.68
11.3	-0.88
12	-0.74
12.2	-0.57
12.4	-0.22
13	-0.36
15	-0.2
18	0.31
22.6	0.64
24	0.99

Reach 2B	
Meter 225	
Distance	Elevation
1.3	0.63
3.7	0.16
5	-0.05
5.8	-0.25
11	0.17
13	-0.14
16	-0.29
17.1	-0.23
17.8	-0.38
18.2	-0.62
19	-0.73
19.7	-0.63
22.5	-0.56
23	-0.34
25	-0.23
27.3	-0.38
28	-0.63
28.4	-0.7
29	0.26
29.5	1.18

Table J-6. Reach 3A cross-section raw data (in meters).

Reach 3A Meter 25	
Distance	Elevation
0.7	1.53
1.8	1.23
2.8	1.03
3.8	0.81
4.8	0.49
4.9	-2.85
5.4	-2.77
6	-2.69
7.2	-2.58
7.7	-2.47
8.3	-2.44
8.8	-2.52
9.6	-2.66
10.3	-2.75
11.5	-2.72
12.7	-1.73
13.5	-1.47
14	0

Reach 3A Meter 75	
Distance	Elevation
0.4	1.53
1.35	0.53
1.8	0.43
2.7	0.58
3.4	0.54
4.2	0.44
4.9	0.1
5.45	-0.15
6.15	-0.19
7	-0.26
7.8	-0.3
8.5	-0.48
8.9	-0.14
9.6	0.02
10.3	0.59
10.7	1.53

Reach 3A Meter 125	
Distance	Elevation
0.8	1.73
1.7	1.33
2.5	0.08
3	-0.46
3.6	-0.87
4.2	-0.97
5	-1.03
5.4	-1.12
6.2	-1.06
7.2	-0.95
7.9	-0.82
8.7	-0.27
9	-0.18
9.2	0.69

Table J-7. Reach 3B cross-section raw data (in meters).

Reach 3B	
Meter 22.5	
Distance	Elevation
1.3	-1.07
1.5	-1.37
2	-2.63
3	-2.78
4.5	-3.11
5.8	-3.27
6.7	-3.4
7.7	-3.44
8.1	-2.86
8.5	-1.47

Reach 3B	
Meter 67.5	
Distance	Elevation
1.3	0.22
2	-0.11
2.5	-0.45
3	-0.66
3.5	-1.11
3.9	-1.78
4.5	-2.24
5	-2.13
5.5	-2.04
6	-2
6.5	-2.04
7	-2.12
7.2	-2.11
7.5	-1.54
7.9	-0.92

Reach 3B	
Meter 112.5	
Distance	Elevation
2	1.04
4	0.7
4.8	0.39
5.3	-0.47
6	-0.98
6.5	-1.71
7.2	-2.05
7.7	-2.3
8.1	-2.99
9.4	-3.13
10.9	-2.99
11.9	-3.22
13.1	-3
13.4	-2.71
14	-0.66
16	0.62
18	1.06

APPENDIX K.

Bankfull channel width and depth data

Table K-1. Bankfull width and depth measured at each cross-section location. All measurements in meters. The column "Meter" refers to the HipChain distance upstream from the beginning of each sample reach.

Reach	Meter	Bankfull width	Bankfull Depth
1A	32.5	6.3	0.72
1A	97.5	4.4	0.69
1A	162.5	7.0	0.46
1B	37.5	9.0	0.63
1B	112.5	13.1	0.80
1B	187.5	9.0	0.30
1C	35	7.6	0.39
1C	105	8.0	0.80
1C	175	8.4	0.73
2A	32.5	7.9	0.27
2A	97.5	3.4	0.70
2A	162.5	6.6	0.43
2B	45	7.5	0.71
2B	135	8.1	0.81
2B	225	10.9	0.35
3A	25	7.6	1.02
3A	75	6.9	1.02
3A	125	5.5	0.66
3B	22.5	5.1	0.66
3B	67.5	3.6	0.70
3B	112.5	5.5	0.51

APPENDIX L.

Sample reach slope data

Table L-1. Sample reach slope data. Slope is measured every 5 bankfull widths, and reported as reach average slope.

Reach 1A		
	change in elevation (m)	slope in %
meter		
0 to 32.5	0.52	1.60
32.5 to 65	0.02	0.06
65 to 97.5	0.37	1.14
97.5 to 130	0.23	0.71
130 to 162.5	0.75	2.31
total elevation change	1.89	
sample reach total length	162.5	
reach average slope		1.16

Reach 1B		
	change in elevation (m)	slope in %
meter		
0 to 37.5	0.4	2.00
37.5 to 75	0.57	2.85
75 to 112.5	0.22	1.10
112.5 to 150	0.51	2.55
150 to 187.5	0.54	2.70
total elevation change	2.24	11.20
sample reach total length	187.5	
reach average slope		1.19

Reach 1C		
	change in elevation (m)	slope in %
meter		
0 to 35	1.07	3.06
35 to 70	0.53	1.51
70 to 105	0.18	0.51
105 to 140	0.62	1.77
140 to 175	0.44	1.26
total elevation change	2.84	8.11
sample reach total length	175	
reach average slope		1.62

Reach 2A		
	change in elevation (m)	slope in %
meter		
0 to 32.5	0.25	0.77
32.5 to 65	0.57	1.75
65 to 97.5	0.2	0.62
97.5 to 130	1.18	3.63
130 to 162.5	0.69	2.12
total elevation change	2.89	8.89
sample reach total length	162.5	
reach average slope		1.78

Reach 2B		
	change in elevation (m)	slope in %
meter		
0 to 45	1.47	3.27
45 to 90	1.06	2.36
90 to 135	0.9	2.00
135 to 180	0.7	1.56
180 to 225	1.35	3.00
total elevation change	5.48	12.18
sample reach total length	225	
reach average slope		2.44

Reach 3A		
	change in elevation (m)	slope in %
meter		
0 to 25	0.57	2.28
25 to 50	0.26	1.04
50 to 75	0.02	0.08
75 to100	0.46	1.84
100 to 125	0.47	1.88
total elevation change	1.78	7.12
sample reach total length	125	
reach average slope		1.42

Reach 3B		
	change in elevation (m)	slope in %
meter		
0 to 22.5	0.82	4.10
22.5 to 45	-0.11	-0.55
45 to 67.5	0.42	2.10
67.5 to 90	0.46	2.30
90 to 112.5	0.68	3.40
total elevation change	2.27	11.35
sample reach total length	112.5	
reach average slope		2.02

APPENDIX M.

Sample reach bank condition data

Table M-1. Bank characteristics for every fifth bankfull width for each sample reach 1A.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
32.5	Left	Silty terrace deposit	22°	2.0	Blackberry, nettle, young willow, fleshy vines	1-5	Dense
32.5	Right	Plastic silt and clay terrace deposit	35°	2.5	Sedge, young ash	5-10	Sparse
65	Left	Silty and cobble terrace deposit	80°	3.0	Redwood roots	100+	Sparse
65	Right	Silty and gravel terrace deposit	38°	0.8	Young willow, broom, thistle, weeds	1-5	Dense
97.5	Left	Plastic silty terrace deposit	32°	3.0	Blackberry	1-5	Dense
97.5	Right	Plastic silty terrace deposit	80°	1.2	Young willow, broom, fleshy vines, grasses	1-5	Dense
130	Left	Sandy terrace deposit	25°	1.5	Blackberry, young willow, broom	1-5	Dense
130	Right	Plastic silty terrace deposit	30°	2.0	Grasses, redwood rootball	10-20 rootball is 100+	Moderate
162.5	Left	Silty matrix supported terrace deposit	34°	0.8	Blackberry, young maple, willow, grasses	1-5	Dense
162.5	Right	Low plasticity silty to sandy terrace deposit	47°	1.2	Sedge, grasses, broom, young willow, young ash	5-10	Dense

Table M-2. Bank characteristics for every fifth bankfull width for each sample reach 1B.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
37.5	Left	Plastic silty colluvium, some cobbles	60°	7.0	Alder	20-50	Sparse
37.5	Right	Plastic silty to sandy soil	45°	7.0	English ivy, young redwood, alder	20-50	Moderate
75	Left	Massive bedrock	55°	8.0	Moss, fleshy vines	1-5	Moderate
75	Right	Cobble and silty to sandy soil	25°	5.0	English ivy, alder	20-50	Moderate
112.5	Left	Cobble and silty terrace deposit	20°	1.0	Roots of alder, fleshy vines	20-50	Moderate
112.5	Right	Cobble fluvial deposit	10°	2.5	English ivy, young hardwoods, broom	1-5	Moderate
150	Left	Cobble fluvial deposit and silty to sandy terrace deposit	10°	1.5	English ivy, young hardwoods, poison oak	1-5	Moderate
150	Right	Cobble fluvial deposit overlain by silty soil	20°	6.0	Roots of alder, English ivy	10-20	Moderate
187.5	Left	Bedrock overlain by cobble and silty soil	70°	4.0	Roots of redwood and buckeye	20-50	Sparse
187.5	Right	Cobble and silty soil	25°	7.0	English ivy, alder	20-50	Dense

Table M-3. Bank characteristics for every fifth bankfull width for each sample reach 1C.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
35	Left	ML or silty CL	70°	2.5	Roots of alder, oak	20-50	Sparse
35	Right	Well graded matrix supported cobble and silt	25°	2.0	Roots of alder, ferns	20-50	Sparse
70	Left	Matrix supported graded cobble to silt	45°	20	Fleshy ground cover, moss, ferns	1	Moderate
70	Right	Graded low plasticity silt, few cobbles	55°	2.0	Hardwood roots	10-20	Sparse
105	Left	SC	30°	3.0	Forbs, poison oak	1	Moderate
105	Right	GW, sandy to silty matrix	60°	3.0	Roots of alder, maple, bay	10-20	Sparse
140	Left	Cobble and sand fluvial deposit	10°	0.5	Nettle, ferns, grasses	1	Moderate
140	Right	Cobble and sand fluvial deposit	15°	0.6	Young willow, nettle	1	Sparse
175	Left	Well graded boulder and cobble fluvial deposit	20°	1.0	Roots of maple	10-20	Sparse
175	Right	Clayey pebble and sand colluvium with CL matrix	50°	8.0	English ivy, fleshy ground cover, roots of redwood	1	Moderate

Table M-4. Bank characteristics for every fifth bankfull width for each sample reach 2A.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
32.5	Left	Silty and cobble colluvium	25°	1.5	Fleshy vines, equisetum, moss	1	Moderate
32.5	Right	Fractured bedrock	50°	3.0	Roots of ash	20-50	Sparse
65	Left	Silty and cobble colluvium	40°	25	Roots of redwood, equisetum	100+	Sparse
65	Right	Silty colluvium and soil	15°	1.5	Grasses, equisetum, young ash	1	Moderate
97.5	Left	Silty colluvium and soil	35°	25	Willow, fleshy vines, clover	10-20	Moderate
97.5	Right	Bedrock overlain by soil	60°	5.0	Roots of redwood, ferns	100+	Moderate
130	Left	Bedrock	70°	4.0	Moss, ferns, roots of ash	10-20	Moderate
130	Right	Bedrock	60°	10.0	Moss, maple	10-20	Moderate
162.5	Left	Bedrock	60°	6.0	Moss, ferns, woody shrubs	1-5	Moderate
162.5	Right	Bedrock	45°	15	Moss, willow, ferns, roots of redwood	10-20	Moderate

Table M-5. Bank characteristics for every fifth bankfull width for each sample reach 2B.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
45	Left	Silty to sandy colluvium and soil	59°	12.0	Fleshy vines, roots of maple	10-20	Sparse
45	Right	Cobble and silt fluvial deposit	52°	1.5	Fleshy vines, nettle, ferns, roots of alder	1 roots 20-50	Moderate
90	Left	Cobble and boulder fluvial deposit, landslide debris	40°	1.5	Grasses, nettle, sedge, broom, fleshy vines	1	Sparse
90	Right	Landslide debris, weathered bedrock	15°	1.5	Blackberry, fleshy vines, sedge, young ash, equisetum	1-5	Dense
135	Left	Plastic silty soil with some boulders	-20° undercut	2.0	Roots of conifer	100+	Sparse
135	Right	Cobble and boulder fluvial deposit	10°	0.9	Sedge, fleshy vines, nettle, young willow	1-5	Moderate
180	Left	Plastic silty colluvium and soil	55°	8.0	Blackberry, nettle, fleshy vines, equisetum	1-5	Moderate
180	Right	Plastic silty colluvium and soil	35°	2.5	Blackberry, equisetum, fleshy vines, nettle, ferns	1-5	Dense
225	Left	Boulder and cobble fluvial deposit	30°	0.6	Sedge, fleshy ground cover	1	Sparse
225	Right	Weathered bedrock	66°	20	Moss, roots of maple	1	Sparse

Table M-6. Bank characteristics for every fifth bankfull width for each sample reach 3A.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
25	Left	Low plasticity sandy graded soil	80°	3.0	Roots of redwood	100+	Sparse
25	Right	Plastic silty and gravel soil	30°	2.0	Moss, vines, roots of ash	1-5 roots 20-50	Moderate
50	Left	Sacrete wall	45°	4.0	Young alder	5-10	Sparse to none
50	Right	Silt and clay soil	40°	2.5	Roots of alder	10-20	Sparse
75	Left	Sacrete wall	50°	4.0	None	none	None
75	Right	Fractured bedrock and clayey soil	65°	5.0	Roots of ash	20-50	Sparse
100	Left	Plastic silty soil	50°	2.5	Roots of redwood	100+	Sparse
100	Right	Fractured bedrock	30°	6.0	None	none	None
125	Left	Clayey sandy soil	60°	2.5	Roots of redwood	100+	Sparse
125	Right	Clayey soil	35°	2.0	Roots of redwood	100+	Sparse

Table M-7. Bank characteristics for every fifth bankfull width for each sample reach 3B.

Meter	Bank	Bank composition	Bank slope	Bank height (m)	Bank vegetation type	Bank vegetation age (years)	Bank vegetation condition
22.5	Left	Sandy colluvium and soil	50°	5.0	Roots of redwood	20-50	Sparse
22.5	Right	Bedrock overlain by silty soil	75°	6.0	Roots of redwood	100+	Dense in soil profile
45	Left	Landslide debris	30°	15.0	Grasses, weeds	1	Moderate
45	Right	Sandy to silty colluvium and soil	15°	3.0	Grasses, fleshy vines, blackberry, willow	10-20	Dense
67.5	Left	Silty to sandy colluvium	40°	2.0	Moss, roots of willow, equisetum, sedge, fleshy vines	1-5	Moderate
67.5	Right	Bedrock	80°	4.0	Moss, ferns	1	Sparse
90	Left	Cobble and silt fluvial deposit	15°	1.5	Sedge	1	Sparse
90	Right	Landslide debris	20°	1.5	Grasses, equisetum, ferns, fleshy vines	1	Moderate
112.5	Left	Cobble and silty colluvium and soil	40°	4.5	Roots of redwood and willow	20-50	Sparse
112.5	Right	Cobble and silty colluvium and soil	60°	5.0	Roots of redwood, moss, ferns	100+	Moderate

APPENDIX N.

Sample reach riparian condition data

Table N-1. Riparian characteristics at every fifth bankfull width for sample reach 1A.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
32.5	Left	Bay, maple, redwood	Broom, blackberry, nettle, young willow	20-50	1-5	Natural terrace and highway 84	50	4-6
32.5	Right	Ash, redwood	Fleshy vines	100+	5-10	Natural terrace	50	4-6
65	Left	Redwood, ash	Young redwood	100+	1-5	Natural terrace	50	4-6
65	Right	Redwood	Grasses	100+	1	Cleared terrace	50	1-3
97.5	Left	Redwood	Blackberry	100+	1-5	Natural terrace	25	1-3
97.5	Right	Redwood	Young willow, broom, grasses	100+	1	Cleared terrace, recreation	25	1-3
130	Left	Redwood	Blackberry, grasses	100+	1-5	Natural terrace	25	1-3
130	Right	Redwood	Young willow	50-100	1	Cleared terrace, recreation	25	1-3
162.5	Left	Maple	Blackberry, fleshy vines	20-50	1-5	Natural terrace	25	4-6
162.5	Right	Alder, ash, redwood	Grasses, blackberry, vines, broom	20-50	1-5	Trailer park	25	4-6

Table N-2. Riparian characteristics at every fifth bankfull width for sample reach 1B.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
37.5	Left	Alder, redwood, maple	Sedge, ferns, vines	100+	5-10	Natural hillslope	100	4-6
37.5	Right	Alder, maple	English ivy, young redwood, young hardwood	20-50	2	Channel bank and highway 84	100	7-9
75	Left	Ash, redwood	Sedge, ferns, vines, moss, young hardwood	100+	5-10	Natural hillslope	50	1-3
75	Right	Maple, alder, redwood	English ivy, young maple, young redwood	100+	1-5	Channel bank and highway 84	50	4-6
112.5	Left	Alder, redwood	Young redwood, young hardwoods	100+	5-10	Park	75	4-6
112.5	Right	Alder, redwood	Woody shrubs, English ivy, broom	100+	1-5	Natural terrace, channel bank and highway 84	75	4-6
150	Left	Redwood, alder	English ivy, woody shrubs, young maple	20-50	5-10	Park	100	4-6
150	Right	Alder, ash, maple, buckeye	English ivy, young maple, woody shrubs, young redwood	20-50	2	Channel bank and highway 84	100	1-3
187.5	Left	Redwood, buckeye, ash	English ivy, ferns, woody shrubs	50-100	5-10	Park	100	4-6
187.5	Right	Alder, maple, redwood	English ivy, young hardwoods	20-50	2	Channel bank and highway 84	100	1-3

Table N-3. Riparian characteristics at every fifth bankfull width for sample reach 1C.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
35	Left	Alder, bay, redwood, oak	Woody shrubs, ferns, fleshy vines	50-100	20+	Natural hillslope	75	1-3
35	Right	Alder, maple, ash	Woody shrubs, ferns, fleshy vines	20-50	10-20	Natural terrace	75	1-3
70	Left	Maple, alder, redwood, bay	Ferns	20-50	20+	Natural hillslope	75	4-6
70	Right	Bay, ash, redwood	Woody shrubs, moss	10-20, redwood 100+	10-20	Dirt road, recreation	75	1-3
105	Left	Conifer, alder, oak, bay	Forbs, poison oak, woody shrubs	20-50	10-20	Natural hillslope	75	4-6
105	Right	Bay, alder, maple	Woody shrubs, vines	10-20	1-5	Recreation, natural	75	7-9
140	Left	Redwood, bay	Young willow, woody shrubs	100+	5-10	Natural hillslope	75	1-3
140	Right	Alder, maple, bay	Young hardwoods	20-50	5-10	Natural terrace	75	4-6
175	Left	Maple, alder, redwood	Woody shrubs, fleshy vines	100+	10-20	Natural hillslope	50	7-9
175	Right	Redwood, maple	Fleshy vines, woody shrubs	100+	1-5	Dirt pulloff	50	1-3

Table N-4. Riparian characteristics at every fifth bankfull width for sample reach 2A.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
32.5	Left	Oak, redwood, bay	Equisetum, ferns	20-50, redwood 100+	5-10	Natural hillslope	50	7-9
32.5	Right	Ash, bay	Ferns, woody shrubs, clover	20-50	1-5	Bank and highway 84	50	1-3
65	Left	Redwood, ash	Ferns, young maple	100+	5-10	Natural hillslope	50	4-6
65	Right	Bay, redwood	Young bay, ferns, clover	20-50, redwood 100+	1-5	Bank and highway 84	50	7-9
97.5	Left	Bay, willow, redwood	Ferns, vines, moss, woody shrubs	20-50, redwood 100+	5-10	Natural hillslope	25	7-9
97.5	Right	Redwood	Ferns, clover, woody shrubs	100+	1-5	Natural hillslope	25	4-6
130	Left	Ash, redwood	Ferns, moss, woody shrubs	100+	10-20	Natural hillslope	75	7-9
130	Right	Redwood, maple, bay	Moss, woody shrubs, ferns	100+	1	Bank and highway 84	75	1-3
162.5	Left	Alder, redwood, bay, oak	Ferns, woody shrubs, young redwood, young bay	20-50	5-10	Natural hillslope	75	1-3
162.5	Right	Bay, redwood	Ferns, woody shrubs, young ash	20-50, redwood 100+	1-5	Bank and highway 84	75	4-6

Table N-5. Riparian characteristics at every fifth bankfull width for sample reach 2B.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
45	Left	Bay, maple, redwood	Ferns, fleshy vines	20-50, redwood 100+	1-5	Natural hillslope and highway 84	25	4-6
45	Right	Alder	Young maple, young ash, fleshy vines	20-50	5-10	Natural terrace and hillslope	25	4-6
90	Left	Alder, conifer	Blackberry, broom, fleshy vines, young hardwoods	20-50	1-5	Natural terrace	25	4-6
90	Right	Alder, redwood	Moss, sedge, vines, nettle, equisetum, ferns	20-50	1	Toe of landslide	25	1-3
135	Left	Conifer, ash, alder	Fleshy vines, young hardwoods, moss	100+	1-5	Natural terrace	75	4-6
135	Right	Ash, alder, redwood	Sedge, fleshy vines	100+	5-10	Natural hillslope	75	4-6
180	Left	Bay, maple, redwood	Woody shrubs, fleshy vines, blackberry	20-50	1	Natural hillslope and highway 84	25	1-3
180	Right	Bay, willow, redwood	Blackberry, ferns, vines	50-100	5-10	Natural hillslope	25	1-3
225	Left	Alder, conifer, redwood	Broom, young alder, nettle, blackberry, fleshy vines	50-100	1-5	Natural terrace and highway 84	75	7-9
225	Right	Maple, bay, redwood	Moss, woody shrubs	20-50, redwood 100+	5-10	Natural hillslope	75	4-6

Table N-6. Riparian characteristics at every fifth bankfull width for sample reach 3A.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
25	Left	Redwood, alder, maple, ash	Ferns, clover, fleshy vines	100+	5-10	Natural terrace	100	1-3
25	Right	Ash, redwood	Ferns, moss, woody shrubs	100+	10-20	Natural terrace and hillslope	100	4-6
50	Left	Alder	Young maples	1-5	0	Abandoned road	100	0
50	Right	Alder, redwood	Ferns, woody shrubs	100+	5-10	Natural hillslope	100	4-6
75	Left	Redwood	Grasses	100+	1-5	Abandoned road	50	7-9
75	Right	Ash	Ferns, woody shrubs	20-50	5-10	Natural hillslope	50	4-6
100	Left	Redwood	Woody shrubs	100+	1-5	Cleared terrace, recreation	75	7-9
100	Right	Ash, redwood	Ferns, woody shrubs	50-100	5-10	Natural hillslope	75	7-9
125	Left	Redwood	Ferns, woody shrubs	100+	1-5	Terrace, recreation	75	4-6
125	Right	Redwood, ash	Ferns	100+	20+	Natural hillslope	75	1-3

Table N-7. Riparian characteristics at every fifth bankfull width for sample reach 3B.

Meter	Bank	Riparian vegetation overstory	Riparian vegetation understory	Riparian vegetation age (years)	Riparian width (bankfull widths)	Terrace/ Hillslope land use	% canopy cover	Potential # of LWD recruits
22.5	Left	Redwood	Ferns, young redwood	20-50	1-5	Natural hillslope	75	1-3
22.5	Right	Redwood, maple	Ferns, young redwood	100+	10-20	Natural hillslope	75	7-9
45	Left	None	Grasses	Na	Na	Landslide	25	0
45	Right	Willow, redwood	Blackberry, fern, sedge, rush	10-20, redwood 100+	5-10	Natural terrace	25	1-3
67.5	Left	Willow	Ferns, sedge, blackberry, vines, woody shrubs	20-50	5-10	Natural terrace	50	1-3
67.5	Right	Willow, redwood	Snowberry, ferns, young maple	100+	1-5	Natural terrace, ranch road	50	1-3
90	Left	Willow, redwood	Oak	20-50, redwood 100+	5-10	Natural terrace and hillslope	50	1-3
90	Right	Willow	Vines, grasses, ferns	20-50	1	Natural hillslope	50	1-3
112.5	Left	Redwood, willow	Young ash, ferns	100+	1-5	Natural terrace	100	4-6
112.5	Right	Redwood	Ferns, young redwood	100+	5-10	Natural hillslope	100	7-9

APPENDIX O.

Sediment deposit data

Each table contains raw data on each sediment deposit measured in every sample reach. All measurements are in meters. The columns "Start" and "End" refer to distances measured on the HipChain, and denote the length of each sediment deposit. "Stability" refers to the assigned age class of each sediment deposit, in years. Type refers to what type of deposit was measured: point bar, lateral bar, medial bar, forced bar, alternate bar, secondary channel bar, pool deposit, and active channel deposit. "Area" is simply the deposit width multiplied by its length. "Volume" is simply area multiplied by depth, and is only intended to represent an index of deposit volume.

Table O-3. **Reach 1A sediment deposit raw data.**

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
1A	-21	7	4.5	1	5	point	126	126
1A	-4.5	15	3	0.3	1	pool	58.5	17.6
1A	-4.5	15	3	0.3	1	pool	58.5	17.6
1A	6.1	35.5	4	0.5	5	forced	117.6	58.8
1A	15	46.5	3	0.15	1	act	94.5	14.2
1A	25.7	47	2.7	0.35	1	lat	57.5	20.1
1A	26	98.6	4.2	0.7	5	lat	304.9	213.4
1A	26	46	1	0.2	1	lat	20	4
1A	47	70	3.5	0.2	1	pool	80.5	16.1
1A	66.5	85.6	2	0.3	1	lat	38.2	11.5
1A	73	124	2.7	0.2	1	act	137.7	27.5
1A	85.6	130	6.5	0.4	1	lat	288.6	115.4
1A	127.3	144	2	0.35	1	pool	33.4	11.7
1A	126	191	7	0.8	5	forced	455	364
1A	136	176.6	3.2	0.5	1	point	129.9	65
1A	149	161.5	3	0.15	1	act	37.5	5.6
1A	154	161.5	2	0.25	1	forced	15	3.8
1A	154	160.5	3.5	1.1	5	forced	22.8	25
1A	162	164.2	1.4	0.15	1	pool	3.1	0.5

Table O-4. **Reach 1B sediment deposit raw data.**

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
1B	-34.9	4.1	4	0.25	5	forced	156	39
1B	-34.9	0	6.5	0.6	5	forced	226.9	136.1
1B	0	4	2.5	0.1	1	pool	10	1
1B	4.8	19	3.6	0.55	5	act	51.1	28.1
1B	4	14	2.7	1.3	20	forced	27	35.1
1B	6.6	26	6	0.5	5	forced	116.4	58.2
1B	21	27.9	2.5	0.5	1	pool	17.3	8.6
1B	23.5	46.2	6	0.4	5	alt	136.2	54.5
1B	32	50.6	2.5	0.1	1	act	46.5	4.7
1B	41.1	50.6	3.5	0.2	1	lat	33.3	6.7
1B	41.1	64.4	4	1	5	forced	93.2	93.2
1B	52	81.1	6	0.8	5	lat	174.6	139.7
1B	52.5	62.5	2	0.4	1	pool	20	8
1B	67.5	83.4	3	0.2	1	act	47.7	9.5
1B	70.7	91.8	3	0.25	5	forced	63.3	15.8
1B	91	115	5.6	0.65	5	point	134.4	87.4
1B	86.5	130	9.3	2.4	10	point	404.6	970.9
1B	85	102	2	0.4	1	pool	34	13.6
1B	115	188.2	4.5	0.2	1	act	329.4	65.9
1B	123	178	2.6	0.25	5	lat	143	35.8
1B	129	162.3	3.5	1.2	20	lat	116.6	139.9
1B	168	201	2	0.2	5	lat	66	13.2

Table O-5. **Reach 1C sediment deposit raw data.**

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
1C	-16	11.7	5	1	5	point	138.5	138.5
1C	-4	8	2.5	0.8	5	medial	30	24
1C	9	30	2.8	0.6	5	medial	58.8	35.3
1C	8	42	6	0.3	1	act	204	61.2
1C	43	51	2	0.25	1	pool	16	4
1C	44	60.9	2	1.05	5	lat	33.8	35.5
1C	52.9	68	6.5	0.3	1	act	98.2	29.4
1C	68.5	78.8	5	0.1	1	pool	51.5	5.2
1C	80	120	5	0.2	1	act	200	40
1C	81	114.7	5.5	1.2	10	forced	185.4	222.4
1C	113	118	4	1	5	point	20	20
1C	124	136	2	0.15	1	pool	24	3.6
1C	136	144	4.5	0.2	1	act	36	7.2
1C	136	163	9	0.7	5	point	243	170.1
1C	145	159	1	0.1	1	pool	14	1.4
1C	156	176	5	0.9	5	point	100	90
1C	166	173	1.5	0.1	1	pool	10.5	1.1

Table O-6. Reach 2A sediment deposit raw data.

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
2A	-12.1	37.0	5.5	0.55	5	lat	270.1	148.5
2A	0.0	17.5	3.5	0.25	1	act	61.3	15.3
2A	17.5	26.3	2.0	0.20	1	pool	17.6	3.5
2A	27.6	37.9	0.8	0.10	1	act	8.2	0.8
2A	34.0	44.5	1.8	0.35	1	pool	18.9	6.6
2A	46.0	60.5	2.9	0.55	5	forced	42.1	23.1
2A	47.0	76.5	3.0	0.50	5	forced	88.5	44.3
2A	49.5	70.0	3.0	0.25	1	act	61.5	15.4
2A	64.5	80.0	2.5	0.42	5	forced	38.8	16.3
2A	72.8	81.0	2.5	0.50	1	pool	20.5	10.3
2A	77.2	131.7	8.5	1.00	5	lat	463.3	463.3
2A	83.0	134.0	2.5	0.20	1	act	127.5	25.5
2A	118.8	156.1	3.5	0.60	5	point	130.6	78.3
2A	134.3	144.0	2.0	0.40	1	pool	19.4	7.8
2A	144.5	161.5	3.2	0.25	1	act	54.4	13.6
2A	145.4	157.4	2.0	0.50	5	lat	24.0	12.0

Table O-7. Reach 2B sediment deposit raw data.

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
2B	-2.6	1.0	2.8	1.20	1	pool	10.1	12.1
2B	-3.0	4.7	1.2	1.30	5	forced	9.2	12.0
2B	4.7	21.5	8.0	0.90	5	forced	134.4	121.0
2B	4.9	6.0	0.5	0.20	1	pool	0.6	0.1
2B	22.1	47.5	6.0	1.35	5	forced	152.4	205.7
2B	25.0	40.0	2.0	0.25	1	pool	30.0	7.5
2B	47.2	84.0	5.5	0.90	5	medial	202.4	182.2
2B	50.0	78.2	2.5	0.30	1	act	70.5	21.2
2B	54.0	126.6	4.0	1.00	1	point	290.4	290.4
2B	70.5	102.5	10.0	1.30	20	forced	320.0	416.0
2B	77.0	82.0	0.8	0.40	1	pool	3.8	1.5
2B	81.0	98.0	3.0	0.35	1	pool	51.0	17.9
2B	85.0	100.0	15.0	1.30	20	medial	225.0	292.5
2B	112.0	126.8	2.0	0.20	1	act	29.6	5.9
2B	123.5	137.2	5.0	0.65	5	forced	68.5	44.5
2B	127.0	146.2	2.0	0.15	1	pool	38.4	5.8
2B	138.1	146.3	5.5	0.65	5	forced	45.1	29.3
2B	147.8	180.1	9.0	1.00	5	lat	290.7	290.7
2B	149.0	168.0	3.0	0.10	1	pool	57.0	5.7
2B	172.5	199.2	4.0	0.69	5	lat	106.8	73.7
2B	172.2	182.0	3.0	0.20	5	act	29.4	5.9
2B	182.3	190.0	1.5	0.10	1	pool	11.6	1.2
2B	195.6	231.4	6.0	0.50	5	forced	214.8	107.4
2B	199.6	213.3	3.3	0.75	5	medial	45.2	33.9
2B	197.0	201.2	0.8	0.30	1	pool	3.4	1.0
2B	201.3	209.3	1.5	0.20	1	act	12.0	2.4
2B	211.0	215.0	2.0	0.10	1	pool	8.0	0.8
2B	215.2	226.9	5.5	1.00	5	forced	64.4	64.4
2B	217.0	220.0	3.0	0.20	1	act	9.0	1.8

Table O-8. Reach 3A sediment deposit raw data.

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
3A	-12.0	3.1	3.0	0.35	1	pool	45.3	15.9
3A	0.0	12.5	2.5	0.35	5	lat	31.3	10.9
3A	1.8	12.3	3.8	0.30	1	medial	39.4	11.8
3A	13.9	22.0	2.5	0.20	1	pool	20.3	4.1
3A	18.5	23.2	2.0	0.70	5	point	9.4	6.6
3A	23.2	33.8	4.3	0.30	1	medial	45.6	13.7
3A	28.8	48.5	3.0	1.20	5	point	59.1	70.9
3A	35.7	47.5	1.5	0.35	1	pool	17.7	6.2
3A	43.1	84.0	3.0	0.50	1	forced	122.7	61.4
3A	48.5	71.1	3.0	0.25	1	act	67.8	17.0
3A	66.6	75.0	2.3	0.30	1	lat	19.3	5.8
3A	71.8	81.5	2.0	0.25	1	pool	19.4	4.9
3A	84.0	87.0	1.5	0.35	1	pool	4.5	1.6
3A	85.2	108.0	4.7	1.20	5	point	107.2	128.6
3A	90.4	103.0	2.0	0.40	1	point	25.2	10.1
3A	90.0	102.1	1.0	0.15	1	pool	12.1	1.8
3A	108.2	120.0	4.5	0.90	5	forced	53.1	47.8
3A	109.0	122.1	2.0	0.30	1	pool	26.2	7.9
3A	123.1	128.0	2.3	0.50	5	forced	11.3	5.6

Table O-9. Reach 3B sediment deposit raw data.

Reach	Start	End	Width	Depth	Stability	Type	Area	Volume Index
3B	-5.2	4.0	3.0	0.25	1	pool	27.6	6.9
3B	1.8	11.4	2.6	0.50	5	forced	25.0	12.5
3B	7.0	27.3	2.8	0.25	1	act	56.8	14.2
3B	14.6	39.9	3.8	0.60	5	lat	94.9	56.9
3B	36.2	56.0	2.7	0.40	5	point	53.5	21.4
3B	35.7	39.8	3.1	0.20	1	act	12.7	2.5
3B	40.0	59.1	2.5	0.40	1	pool	47.8	19.1
3B	61.7	66.6	3.5	0.25	1	act	17.2	4.3
3B	67.0	75.0	2.0	0.20	1	pool	16.0	3.2
3B	81.0	86.0	1.0	0.10	1	pool	5.0	0.5
3B	84.0	113.9	3.6	0.70	5	point	107.6	75.3
3B	86.7	107.6	1.5	0.20	1	act	31.4	6.3
3B	108.0	136.3	1.0	0.10	1	pool	28.3	2.8

APPENDIX P.

Surface grain size data- pebble count methodology

Table P-1. Percent by count of each grain size class in surface grain size distributions for each sample reach. Data <8 mm are likely affected by sampling methodology (see section 6.3 for discussion). Grain sizes <2 mm represent sand and finer sized fractions.

Grain size (mm)	1A	1B	1C	2A	2B	3A	3B
<2	10.28	28.48	17.85	9.15	27.47	17.25	6.42
2	2.43	7.27	8.39	4.88	7.08	6.40	9.14
4	3.36	4.24	3.44	3.05	2.15	5.62	3.50
5.6	3.55	2.22	5.16	3.86	2.79	5.04	3.11
8	1.87	4.24	5.59	4.47	3.86	4.84	5.84
11	7.85	3.64	7.31	5.49	5.15	6.78	5.84
16	5.98	4.85	5.81	6.71	5.58	7.95	7.98
22	9.16	6.67	9.68	7.72	6.01	5.04	8.95
32	10.28	7.88	6.24	8.54	4.72	6.20	7.00
45	12.52	7.88	6.24	9.76	6.44	7.95	7.20
64	9.35	6.46	5.59	11.18	5.79	7.36	9.92
90	8.97	10.91	6.02	9.15	5.58	8.53	9.14
128	7.66	4.04	2.15	9.15	3.86	6.40	8.37
180	4.86	1.01	1.94	3.46	3.43	2.33	3.31
256	0.93	0.20	0.43	0.61	3.00	1.94	1.36
360	0.37	0.00	0.22	0.00	0.86	0.39	0.58
512	0.00	0.00	0.00	0.20	0.64	0.00	0.00
1024	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2056	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bedrock	0.00	0.00	5.59	2.24	4.72	0.00	1.95

Table P-2. Cumulative percent finer than (% passing) by count for each sample reach

Grain size (mm)	1A	1B	1C	2A	2B	3A	3B
<2	28.48	9.39	10.34	6.57	17.25	19.39	29.09
2	35.76	14.41	12.78	15.94	23.64	28.50	36.59
4	40.00	17.54	16.17	19.52	29.26	32.24	38.86
5.6	42.22	21.50	19.74	22.71	34.30	37.85	41.82
8	46.46	26.10	21.62	28.69	39.15	43.93	45.91
11	50.10	31.73	29.51	34.66	45.93	51.87	51.36
16	54.95	38.62	35.53	42.83	53.88	58.18	57.27
22	61.62	46.56	44.74	51.99	58.91	68.69	63.64
32	69.49	55.32	55.08	59.16	65.12	75.47	68.64
45	77.37	65.34	67.67	66.53	73.06	82.24	75.45
64	83.84	76.83	77.07	76.69	80.43	88.32	81.59
90	94.75	86.22	86.09	86.06	88.95	94.86	87.50
128	98.79	95.62	93.80	94.62	95.35	97.20	91.59
180	99.80	99.16	98.68	98.01	97.67	99.30	95.23
256	100.00	99.79	99.62	99.40	99.61	99.77	98.41
360	100.00	99.79	100.00	100.00	100.00	100.00	99.32
512	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1024	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2056	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table P-3. Reach 1A number of grains counted in each size class.

Grain size (mm)	Meter 32.5 # counted	Meter 65 # counted	Meter 97.5 # counted	Meter 130 # counted	Meter 162.5 # counted
<2	7	40	31	55	8
2	5	4	6	9	12
4	6	3	1	4	7
5.6	1	0	2	6	2
8	4	0	7	4	6
11	5	5	6	2	0
16	4	1	8	3	8
22	5	7	11	5	5
32	7	10	10	2	10
45	12	6	5	4	12
64	9	5	4	2	12
90	19	7	9	3	16
128	13	1	4	1	1
180	3	0	1	0	1
256	0	0	1	0	0
360	0	0	0	0	0
512	0	0	0	0	0
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	0	0	0	0	0
no count	0	0	0	0	0
SUM	**100**	**89**	**106**	**100**	**100**

Table P-4. Reach 1B number of grains counted in each size class.

Grain size (mm)	Meter 37.5 # counted	Meter 75 # counted	Meter 112.5 # counted	Meter 150 # counted	Meter 187.5 # counted
<2	8	2	14	10	11
2	1	6	5	10	2
4	3	3	7	1	1
5.6	3	3	4	6	3
8	3	5	4	6	4
11	7	7	5	5	3
16	9	2	12	5	5
22	4	11	5	10	8
32	12	8	7	5	10
45	12	7	10	12	7
64	21	11	7	6	10
90	12	9	9	6	9
128	4	15	8	10	8
180	0	4	1	7	5
256	0	0	1	1	1
360	0	0	0	0	0
512	0	1	0	0	0
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	0	0	0	0	11
no count	0	1	0	0	1
SUM	**99**	**95**	**99**	**100**	**99**

Table P-5. Reach 1C number of grains counted in each size class.

Grain size (mm)	Meter 35 # counted	Meter 70 # counted	Meter 105 # counted	Meter 140 # counted	Meter 175 # counted
<2	19	14	1	3	18
2	4	0	4	3	2
4	3	1	4	6	4
5.6	5	3	6	4	1
8	1	6	3	0	0
11	5	12	6	10	9
16	7	13	2	3	7
22	15	14	8	5	7
32	15	14	10	6	10
45	20	14	15	14	4
64	11	7	7	9	16
90	6	14	13	10	5
128	4	4	12	15	6
180	6	1	8	6	5
256	0	0	0	4	1
360	0	0	0	1	1
512	0	0	0	0	0
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	0	0	0	0	0
no count	1	0	0	1	1
SUM	**122**	**117**	**99**	**100**	**97**

Table P-6. Reach 2A number of grains counted in each size class.

Grain size (mm)	Meter 32.5 # counted	Meter 65 # counted	Meter 97.5 # counted	Meter 130 # counted	Meter 162.5 # counted
<2	15	4	8	4	2
2	9	3	22	9	4
4	8	2	0	1	7
5.6	10	0	1	3	2
8	13	4	1	5	7
11	15	4	1	2	8
16	7	2	4	12	16
22	6	4	4	11	21
32	4	3	6	7	16
45	1	13	5	5	13
64	1	21	9	11	9
90	1	12	9	19	6
128	0	13	17	11	2
180	0	7	7	3	0
256	0	3	2	2	0
360	0	2	1	0	0
512	0	0	0	0	0
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	8	0	0	0	2
no count	0	0	1	1	0
SUM	**98**	**97**	**98**	**106**	**115**

Table P-7. Reach 2B number of grains counted in each size class.

Grain size (mm)	Meter 45 # counted	Meter 90 # counted	Meter 135 # counted	Meter 180 # counted	Meter 225 # counted
<2	9	41	21	7	11
2	4	13	9	4	3
4	4	7	10	3	5
5.6	4	6	11	2	3
8	5	5	7	6	2
11	4	7	16	3	5
16	5	8	5	6	17
22	6	4	5	4	7
32	6	1	3	10	12
45	14	1	5	11	10
64	14	1	3	12	8
90	11	0	1	17	15
128	7	1	0	13	12
180	3	1	0	3	5
256	5	0	0	0	5
360	0	0	0	0	2
512	0	0	0	0	0
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	0	0	0	0	0
no count	0	0	0	0	0
SUM	**101**	**96**	**96**	**101**	**122**

Table P-8. Reach 3A number of grains counted in each size class.

Grain size (mm)	Meter 25 # counted	Meter 50 # counted	Meter 75 # counted	Meter 100 # counted	Meter 125 # counted
<2	6	16	31	16	14
2	3	3	11	18	4
4	3	1	7	3	2
5.6	6	2	7	6	3
8	9	4	8	4	1
11	11	5	8	5	5
16	13	5	2	2	5
22	16	11	3	4	11
32	15	2	1	7	4
45	10	3	1	3	12
64	5	13	0	1	7
90	3	7	0	5	13
128	2	5	0	3	0
180	1	2	0	0	6
256	0	0	0	0	2
360	0	0	0	0	1
512	0	0	0	0	0
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	0	0	23	3	0
no count	0	0	0	0	11
SUM	**103**	**79**	**102**	**80**	**101**

Table P-9. Reach 3B number of grains counted in each size class.

Grain size (mm)	Meter 22.5 # counted	Meter 45 # counted	Meter 67.5 # counted	Meter 90 # counted	Meter 112.5 # counted
<2	19	44	10	26	29
2	2	6	17	4	4
4	1	2	2	2	3
5.6	2	1	4	4	2
8	3	2	6	5	2
11	4	4	5	4	7
16	4	1	4	4	13
22	7	1	6	6	8
32	7	3	5	5	2
45	7	0	9	5	9
64	13	0	6	5	3
90	4	0	7	12	3
128	7	0	5	3	3
180	2	0	3	5	6
256	1	0	0	5	8
360	1	0	1	1	1
512	1	0	1	0	1
1024	0	0	0	0	0
2056	0	0	0	0	0
BR	11	0	11	0	0
no count	1	0	2	0	1
SUM	**97**	**64**	**104**	**96**	**105**

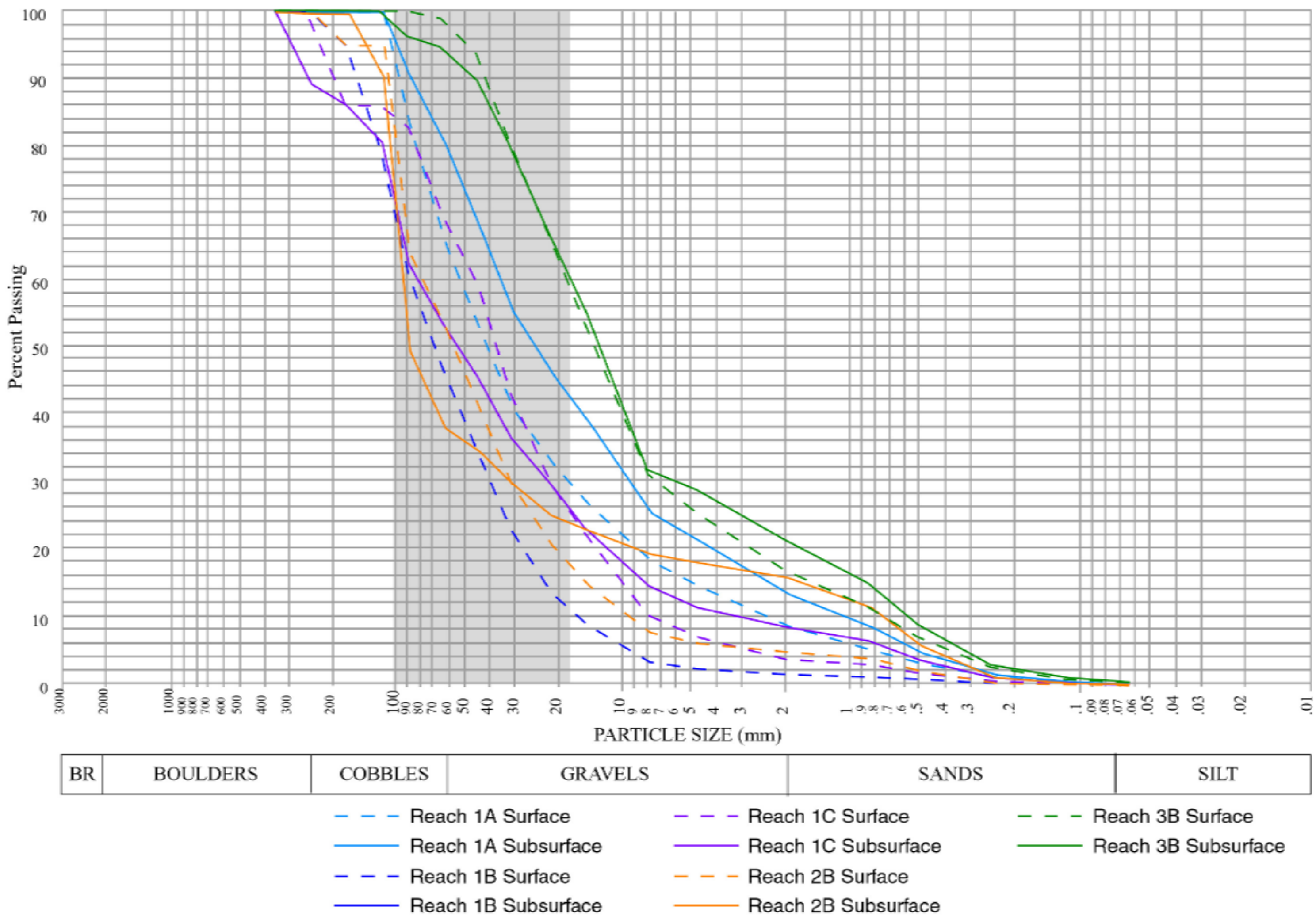
APPENDIX Q.

Subsurface bulk grain size data

Table Q-1. Bulk sediment sample percent passing by weight.

mm	Sieve #	Phi size	Wentworth Size class	1A Surface	1A Subsurface	1B Surface	1B Subsurface	1C Surface	1C Subsurface	2B Surface	2B Subsurface	3B Surface	3B Subsurface
> 256	10"	-8	boulder	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
256 - 180	7"	-7.5	cobble	100.0	100.0	100.0	100.0	100.0	89.4	100.0	100.0	100.0	100.0
180 - 128	5"	-7	cobble	100.0	100.0	95.4	100.0	86.1	86.1	95.6	100.0	100.0	100.0
128 - 90	3 1/2"	-6.5	cobble	100.0	100.0	79.8	91.9	86.1	81.1	95.6	90.8	100.0	100.0
90 - 64	2 1/2"	-6	cobble	82.4	90.9	61.6	75.1	83.2	62.6	64.2	49.7	100.0	96.2
64 - 45	1 3/4"	-5.5	cobble	64.9	80.7	46.7	62.3	69.5	53.8	53.6	38.2	98.8	94.8
45 - 32	1 1/4"	-5	cobble	52.4	67.4	34.1	48.3	59.4	45.6	41.0	34.9	93.9	89.8
32 - 22	7/8"	-4.5	cobble	40.7	55.5	23.3	38.9	43.0	36.6	30.4	30.3	81.4	80.6
22 - 16	5/8"	-4	cobble	32.3	45.6	13.9	30.1	29.5	29.3	21.2	25.7	66.4	67.5
16 - 8	5/16"	-3	pebble	26.6	38.2	9.0	24.6	22.0	23.5	14.9	23.2	53.8	55.1
4.75	#4	-2	pebble	18.1	25.4	3.4	16.4	10.5	14.4	8.0	19.5	31.1	31.6
2	#10	-1	granule	14.4	21.1	2.1	13.7	7.1	11.8	6.3	18.1	25.3	28.5
0.84	#20	0.25	very coarse sand	8.7	13.5	1.3	10.3	3.9	8.5	5.3	16.1	16.8	21.4
0.5	#35	1	coarse sand	5.3	8.3	1.1	8.5	3.0	6.6	4.0	12.0	11.5	14.9
0.25	#60	2	medium sand	3.2	4.7	0.7	5.5	1.9	3.9	2.3	6.2	7.0	8.8
0.125	#120	3	fine sand	1.1	1.5	0.3	2.1	0.7	1.1	0.6	1.6	2.4	2.9
0.074	#200	3.75	very fine sand	0.4	0.4	0.1	0.6	0.2	0.2	0.1	0.4	0.9	0.9
0.0625	#230	4	very fine sand	0.2	0.2	0.0	0.2	0.1	0.1	0.1	0.2	0.4	0.4
< 0.0625	pan		silt and clay	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.3	0.3

Figure Q-1. Particle size distribution curves for the surface and subsurface component of each bulk sediment sample. Shaded area highlights framework grain sizes utilized by steelhead for spawning (Kondolf and Wolman, 1993). BR = bedrock.


Percent Passing
100
90
80
70
60
50
40
30
20
10
0
PARTICLE SIZE (mm)
BR
BOULDERS
COBBLES
GRAVELS
SANDS
SILT
Reach 1A Surface
Reach 1A Subsurface
Reach 1B Surface
Reach 1B Subsurface
Reach 1C Surface
Reach 1C Subsurface
Reach 2B Surface
Reach 2B Subsurface
Reach 3B Surface
Reach 3B Subsurface

APPENDIX R.
Pool data

Table R-1. La Honda Creek measured pool raw data. All measures in meters.

Reach	Start	End	Width	Residual Depth	Type	Surface Area (m^2)
1A	-4.5	24.2	4.7	0.60	BR lateral	134.9
1A	46.6	72.1	4.5	0.55	Lateral	114.8
1A	124	149	4.0	0.69	LWD lateral	100.0
1A	159	166	2.5	0.32	LWD lateral	17.5
1B	-5.6	4.1	4.0	0.28	LWD lateral	38.8
1B	4.8	16.3	2.2	0.43	LWD lateral	25.3
1B	19.3	29.6	4.0	0.90	LWD lateral	41.2
1B	46.3	50	1.4	0.36	LWD lateral	5.2
1B	51.5	67.5	4.0	0.55	BR lateral	64.0
1B	83.4	105.3	3.9	0.49	BR lateral	85.4
1C	-10	8	3.0	0.34	Lateral	54.0
1C	42.3	55.4	2.6	0.75	BR lateral	34.1
1C	59	66.6	1.6	0.20	BR lateral	12.2
1C	68	81.2	5.5	0.40	Lateral	72.6
1C	118	136	3.0	0.60	BR lateral	54.0
1C	144	161.5	2.5	0.37	Lateral	43.8
1C	163	174	3.5	0.46	LWD lateral	38.5
2A	17.5	27.6	2.0	0.30	BR lateral	20.2
2A	33.2	47.4	3.0	0.48	LWD lateral	42.6
2A	70.4	82.5	4.0	0.64	LWD lateral	48.4
2A	134.3	144.2	2.8	0.59	BR lateral	27.7
2B	-7.6	3	7.5	1.05	Plunge	79.5
2B	4.9	10.7	3.0	0.41	LWD lateral	17.4
2B	22.1	44.4	3.5	0.72	LWD lateral	78.1
2B	49.5	52	1.1	0.21	LWD lateral	2.8
2B	76	83.5	1.5	0.42	LWD lateral	11.3
2B	80.5	101.5	3.5	0.43	LWD lateral	73.5
2B	101.6	111.4	3.0	0.47	LWD lateral	29.4
2B	126.8	152.1	2.5	0.34	Lateral	63.3
2B	147.8	172.2	3.5	0.39	Main	85.4
2B	182.3	192.9	2.5	0.38	LWD lateral	26.5
2B	195.4	210.9	2.5	0.41	BR lateral	38.8
2B	209.3	217.2	2.8	0.52	LWD lateral	22.1
3A	-15.2	3.5	3.8	0.63	LWD lateral	70.1

3A	12.3	27.1	4.0	0.66	Lateral	59.2
3A	33.7	48.1	2.3	0.47	Lateral	33.1
3A	71.4	82	2.5	1.03	Plunge	26.5
3A	82	87.8	2.5	0.41	LWD lateral	14.5
3A	89.7	103.5	1.9	0.33	BR lateral	26.2
3A	108.5	124	2.5	0.40	LWD lateral	38.8
3B	-5.2	5.6	3.5	0.49	LWD lateral	37.8
3B	27.3	33.6	2.6	0.27	BR lateral	16.4
3B	39.8	61.5	3.0	0.68	Lateral	65.1
3B	66.6	76.5	2.8	0.44	BR lateral	27.7
3B	79.2	86.2	3.5	0.28	LWD lateral	24.5
3B	107.7	136.3	3.0	0.36	Main	85.8

APPENDIX S.

Large woody debris (LWD) data

Table S-1. Large woody debris (LWD) field survey abbreviation key.

LWD Survey Abbreviation Key
(minimum LWD dimension = >20 cm diameter and 1.8 m length)

Mid-point diameter Length Distance fell from Position	Type	Species
1 = in low-flow channel (LF) 2 = portions in both LF & BF 3 = in bankfull channel (BF) 4 = portions in both BF & above BF 5 = above the BF channel 6 = portions in LF, BF & above BF	1 = log 2 = snag 4 = live log up 5 = rootwad 6 = live log down 7 = log with rootwad	1 = redwood 2 = conifer 3 = maple 4 = alder 5 = buckeye 6 = willow 7 = oak 8 = bay laurel 9 = unknown hardwood 10 = ash

Decay Class	Pools (2 letter code)
1 = bark intact, limbs, twigs, and needles present 2 = bark intact, limbs and twigs present 3 = bark intact, limbs absent 4 = bark loose or absent 5 = bark absent, surface slightly rotted 6 = surface extensively rotted 7 = surface completely rotted, center solid 8 = surface and center completely rotted	First letter A = LWD associated F = formed by LWD NN = no pool Second letter S = shallow, depth < 1 m D = deep, depth > 1 m

Entry Process	Key Piece / Debris Jam
If logging debris (sawmark) add 0.5 1 = bank erosion 2 = windthrow 3 = mortality 4 = landslide 5 = enhancement structure 6 = unknown	**Key Piece** Independently stable and in bankfull width or is retaining other pieces of organic debris **Debris Jam** (must satisfy 3 criteria below) 1 = contains at least one key piece 2 = spans at least half the bankfull channel 3 = contains 10 or more LWD pieces

Table S-2. Reach 1A large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
1A	7	2	7	9	5	0.31	2.9	2.9	N	U	U	N	N	0.22
1A	7	2	7	9	5	0.22	2.9	2.9	N	U	U	N	N	0.11
1A	15.5	1	1	1	7	0.36	2	2	N	5	1	N	N	0.20
1A	16.1	5	7	9	5	0.47	1.8	1.8	N	5	1	N	N	0.31
1A	15.9	5	7	9	5	0.36	1.8	1.8	N	5	1	N	N	0.18
1A	16.2	5	7	9	5	0.2	2.5	2.5	N	5	1	N	N	0.08
1A	16.2	5	7	9	5	0.35	1.8	1.8	N	5	1	N	N	0.17
1A	23	2	7	9	4	0.34	3.8	3.8	N	U	U	N	N	0.34
1A	23.8	2	7	9	5	0.27	2.7	2.7	N	U	U	N	N	0.15
1A	23.9	3	1	9	5	0.2	2.5	2.5	N	U	U	N	N	0.08
1A	24	2	1	9	7	0.3	1.9	1.9	N	U	U	N	N	0.13
1A	26	4	1	9	4	0.45	5.5	5.5	N	U	U	N	N	0.87
1A	58	6	1	4	0	1.8	2+	0	AS	NA	NA	N	N	0.00
1A	103	4	7	6	3	0.26	10	10	N	0	3	N	N	0.53
1A	108.6	5	1.5	1	4	0.76	5.5	5.5	N	U	U	N	N	2.49
1A	109.3	5	1	1	6	0.7	2.6	2.6	N	U	U	N	N	1.00
1A	111.1	5	1	6	4	0.25	2.6	2.6	N	U	U	N	N	0.13
1A	124	2	1	6	4	0.24	3.1	3.1	N	U	U	N	N	0.14
1A	135	6	4	1	0	0.5	2+	0	AS	NA	NA	N	N	0.00
1A	138.9	2	1	1	4	0.37	2.5	2.5	N	U	U	N	N	0.27
1A	143.6	2	5	6	4	0.22	1.9	1.9	AS	2	1	N	N	0.07
1A	145.6	1	1	1	4	0.56	3.5	3.5	AS	U	U	N	N	0.86
1A	148.7	2	4	6	3	0.72	2+	0	AS	NA	NA	N	N	0.00
1A	152.1	3	1	6	4	0.33	2.2	2.2	N	U	U	N	N	0.19
1A	164.6	4	1	1	8	0.32	3.6	3.6	N	U	U	N	N	0.29

Table S-3. Reach 1B large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
1B	0	2	1	1	3	0.6	3.7	3.7	AS	U	4	N	N	1.05
1B	0	3	5	1	5	1	1	1	N	U	4	N	N	0.79
1B	1	4	5	1	5	1	1	1	N	U	4	N	N	0.79
1B	4.2	2	5	4	5	0.36	2	2	AS	U	4	N	N	0.20
1B	4.2	2	5	4	5	0.22	2	2	AS	U	5	N	N	0.08
1B	6.5	4	1	1	3	0.68	20	20	N	U	4	N	N	7.26
1B	11.9	6	4	4	0	0.38	2+	0	AS	NA	NA	N	N	0.00
1B	10	1	1	2	7	0.26	2.8	2.8	N	U	U	N	N	0.15
1B	15.6	1	1	2	7	0.48	2.6	2.6	N	U	U	N	N	0.47
1B	23	6	5	1	5	3.5	1+	1	FD	3	1	N	N	9.62
1B	25	5	1	4	4	0.37	2.2	2.2	N	U	U	N	N	0.24
1B	25.7	5	1	4	4	0.26	1.8	1.8	N	U	U	N	N	0.10
1B	26	5	7	4	6	0.2	1.8	1.8	N	U	U	N	N	0.06
1B	27	3	1	1	6	0.3	7	7	N	U	U	N	N	0.49
1B	27	3	1	1	4	0.53	5	5	N	U	U	N	N	1.10
1B	32	4	1	3	2	0.3	12	12	N	U	U	N	N	0.85
1B	32.5	4	1	1	3	0.44	6	6	N	U	U	N	N	0.91
1B	40	6	4	4	0	0.28	2+	0	N	NA	NA	N	N	0.00
1B	47	4	7	4	3	0.32	9.5	9.5	AS	U	U	N	N	0.76
1B	47	5	1	4	4	0.22	6	6	N	U	U	N	N	0.23
1B	46.8	4	4	4	0	0.4	2+	0	N	NA	NA	N	N	0.00
1B	46.8	4	4	4	0	0.32	2+	0	N	NA	NA	N	N	0.00
1B	53	6	4	4	0	0.47	2+	0	N	NA	NA	N	N	0.00
1B	55	6	4	4	0	0.45	2+	0	AS	NA	NA	N	N	0.00
1B	58.3	6	1	4	4	0.34	7.3	7.3	N	U	U	N	N	0.66
1B	60	5	1	1	3	0.45	15	15	N	U	U	N	N	2.39
1B	67.5	6	4	4	0	0.44	2+	0	N	NA	NA	N	N	0.00
1B	69	6	4	4	0	0.45	2+	0	N	NA	NA	N	N	0.00

1B	69	5	1	1	6	0.48	4	4	N	U	U	N	N	0.72
1B	77.2	6	4	4	0	0.6	2+	0	N	NA	NA	N	N	0.00
1B	69	5	1	1	6	0.21	3.4	3.4	N	U	U	N	N	0.12
1B	75	2	1	4	5	0.25	4.2	4.2	N	U	U	N	N	0.21
1B	101.6	2	1	4	4	0.31	16.5	16.5	N	U	U	N	N	1.25
1B	112	6	4	4	0	0.32	2+	0	N	NA	NA	U	U	0.00
1B	117	6	4	4	0	0.47	2+	0	N	NA	NA	U	U	0.00
1B	122	1	1	4	4	0.21	3.5	3.5	N	U	U	N	N	0.12
1B	128.9	6	4	4	0	0.54	2+	0	N	NA	NA	N	N	0.00
1B	134.3	6	4	4	0	0.29	2+	0	N	NA	NA	N	N	0.00
1B	138	5	7	1	4	0.85	8.5	8.5	N	U	U	N	N	4.82
1B	142	6	4	4	0	0.28	2+	0	N	NA	NA	N	N	0.00
1B	147.7	6	4	4	0	0.39	2+	0	N	NA	NA	N	N	0.00
1B	149.2	6	4	4	0	0.28	2+	0	N	NA	NA	N	N	0.00
1B	158.2	6	4	4	0	0.7	2+	0	N	NA	NA	N	N	0.00
1B	165	6	4	4	0	0.34	2+	0	N	NA	NA	N	N	0.00
1B	168.9	6	4	4	0	0.34	2+	0	N	NA	NA	N	N	0.00
1B	172	6	4	4	0	0.39	2+	0	N	NA	NA	N	N	0.00
1B	180	6	4	4	0	0.48	2+	0	N	NA	NA	N	N	0.00
1B	188.2	6	4	4	0	0.48	2+	0	N	NA	NA	N	N	0.00

Table S-4. Reach 1C large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
1C	11.7	4	4	4	0	0.3	2+	0	N	NA	NA	NA	N	0.00
1C	12	1	1	1	6	0.6	8	8	N	1	1	N	N	2.26
1C	18	3	1	3	3	0.35	15	15	N	2	1	N	N	1.44
1C	18.5	3	1	3	3	0.34	15	15	N	2	1	N	N	1.36

1C	40	4	4	4	0	0.22	2+	0	N	0	NA	N	N	0.00
1C	49	4	4	9	0	0.2	2+	0	N	0	NA	N	N	0.00
1C	74	4	1	4	5	0.45	7	7	AS	U	U	Y	N	1.11
1C	74	6	1	4	5	0.3	5	5	AS	U	U	Y	N	0.35
1C	74	6	1	4	5	0.23	6.7	6.7	AS	U	U	Y	N	0.28
1C	75.2	4	1	9	5	0.5	12.5	12.5	AS	0	4	Y	Y	2.45
1C	75.5	6	1	9	3	0.2	4.5	4.5	AS	U	U	Y	N	0.14
1C	75.5	4	1	9	4	0.25	8.5	8.5	AS	U	U	Y	N	0.42
1C	76	5	1	1	5	0.42	3	3	AS	U	U	Y	N	0.42
1C	76	5	1	1	5	0.28	4.3	4.3	AS	U	U	Y	N	0.26
1C	77.4	2	1	9	3	0.29	8.5	8.5	AS	U	U	Y	N	0.56
1C	76	1	1	9	3	0.32	5	5	AS	U	U	Y	N	0.40
1C	77.5	3	1	9	5	0.2	9.7	9.7	AS	U	U	Y	N	0.30
1C	77.5	2	1	1	7	0.3	3.2	3.2	AS	U	U	Y	N	0.23
1C	78	5	1	9	4	0.28	12	12	N	U	U	N	N	0.74
1C	87.5	1	1	9	5	0.32	3.5	3.5	N	U	U	N	N	0.28
1C	93	6	7	9	4	0.26	8.5	8.5	N	U	U	N	N	0.45
1C	98	6	5	1	6	0.2	6	6	N	U	U	N	N	0.19
1C	103	5	1	1	5	0.65	9.5	9.5	N	1	1	N	N	3.15
1C	103	4	4	4	0	0.4	2+	0	N	NA	NA	N	N	0.00
1C	103	5	1	1	5	0.57	4.5	4.5	N	U	U	N	N	1.15
1C	110	1	1	1	4	0.5	4.5	4.5	N	U	U	N	N	0.88
1C	119	4	4	4	0	0.45	2+	0	N	NA	NA	N	N	0.00
1C	144	5	4	4	0	0.5	2+	0	N	0	NA	N	N	0.00

Table S-5. Reach 2A large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
2A	30.2	2	1	1	7	0.37	2	2	N	U	U	N	N	0.22
2A	42.1	6	1	1	1	1.05	25	25	FS	3	1	N	Y	21.64
2A	41.5	2	1	9	7	0.2	2.6	2.6	AS	U	U	N	N	0.08
2A	41.5	2	7	4	5	0.35	4.4	4.4	AS	U	U	N	N	0.42
2A	42.5	2	1	4	4	0.35	3.9	3.9	AS	U	U	N	N	0.38
2A	45.5	3	1	1	8	0.22	1.8	1.8	N	U	U	N	N	0.07
2A	48	4	1	1	3	0.48	10	10	N	U	U	N	N	1.81
2A	47.2	1	1	1	5	0.2	1.9	1.9	N	U	U	N	N	0.06
2A	46	1	5	1	6	0.3	1.8	1.8	AS	U	U	N	N	0.13
2A	50.7	6	7	2	2	0.77	23	23	N	0	1	N	N	10.71
2A	52.2	1	1	4	5	0.25	6	6	N	U	U	N	N	0.29
2A	59	4	7	1	2	0.8	15	15	N	0	1	N	N	7.54
2A	61	4	1	1	4	1	10	10	N	U	U	N	N	7.85
2A	61	4	6	8	1	0.32	15	15	N	0	1	N	N	1.21
2A	73	2	1	2	6	0.28	3.5	3.5	N	U	U	N	N	0.22
2A	74.7	5	7	9	6	0.27	7	7	N	U	U	N	N	0.40
2A	74.7	4	1	8	5	0.35	4	4	N	U	U	N	N	0.38
2A	74.7	4	1	1	4	0.7	15	15	N	U	U	N	N	5.77
2A	76.5	6	5.5	1	4	1.25	2	2	FS	U	4	N	Y	2.45
2A	78.2	6	1	9	8	0.25	2.1	2.1	AS	U	U	N	N	0.10
2A	79	4	1	1	3	0.34	10	10	N	U	U	N	N	0.91
2A	78.5	5	1	2	4	0.41	7.5	7.5	N	U	U	N	N	0.99
2A	113.7	4	1	9	7	0.29	2.3	2.3	N	U	U	N	N	0.15
2A	138.9	4	1	1	3	0.23	6.5	6.5	N	U	U	N	N	0.27
2A	139.5	6	2	10	1	0.23	5.5	5.5	N	U	U	N	N	0.23
2A	142.9	4	1	9	3	0.35	15	15	N	U	1	N	N	1.44

Table S-6. Reach 2B large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
2B	1	6	7	1	1	1	35	35	FD	2	1	N	Y	27.49
2B	3.7	4	1	4	6	0.24	3.5	3.5	N	U	U	N	N	0.16
2B	8.3	6	7	1	1	0.75	25	25	FS	3	4	N	N	11.04
2B	1.5	4	4	4	0	0.29	2+	0	N	NA	NA	N	N	0.00
2B	22	4	4	4	0	0.37	2+	0	N	NA	NA	N	N	0.00
2B	22	4	4	1	0	0.72	2+	0	N	NA	NA	N	N	0.00
2B	17	1	1	1	7	0.7	10	10	N	U	U	N	N	3.85
2B	28	4	4	4	0	0.3	2+	0	N	NA	NA	N	N	0.00
2B	32.3	6	1	4	4	0.25	13	13	N	U	U	N	N	0.64
2B	39.8	5	1	4	7	0.2	6	6	N	U	U	Y	N	0.19
2B	40	4	1	4	4	0.4	15	15	N	U	U	Y	N	1.88
2B	40	2	1	4	4	0.2	5.5	5.5	N	U	U	Y	N	0.17
2B	41	2	1	4	4	0.2	1.8	1.8	N	U	U	Y	N	0.06
2B	41.1	2	7	1	7	0.42	2	2	FS	U	U	Y	N	0.28
2B	41.9	2	1	4	5	0.35	7	7	FS	U	U	Y	N	0.67
2B	42	4	1	4	5	0.28	14	14	N	U	U	Y	N	0.86
2B	42.5	6	1	4	3	0.24	17	17	N	U	U	Y	N	0.77
2B	43	2	1	1	7	0.4	1.8	1.8	N	U	U	Y	N	0.23
2B	43.1	2	1	1	7	0.27	2.4	2.4	N	U	U	Y	N	0.14
2B	43.1	6	5	1	6	1.5	1.5	1.5	N	U	U	Y	N	2.65
2B	44	6	1	1	3	0.98	16.5	16.5	AS	U	U	Y	Y	12.44
2B	45	3	1	4	5	0.23	7	7	N	U	U	Y	N	0.29
2B	45.5	2	1	1	5	0.82	6.8	6.8	N	U	U	Y	N	3.59
2B	50.7	4	4	4	0	0.28	2+	0	AS	NA	NA	N	N	0.00
2B	66.6	4	4	4	0	0.63	2+	0	N	NA	NA	N	N	0.00
2B	69.1	3	1	1	7	0.65	2	2	N	U	U	N	N	0.66
2B	70.5	2	5	1	6	2	2.5	2.5	N	U	U	N	N	7.85
2B	70.5	5	1	1	8	0.45	12	12	N	3	3	N	N	1.91

2B	75	1	1	1	6	0.45	2.3	2.3	N	U	U	N	N	0.37
2B	76	1	1	4	6	0.2	4	4	N	U	U	N	N	0.13
2B	80.5	1	1	4	5	0.23	4	4	N	U	U	N	N	0.17
2B	85.3	6	4	4	0	0.7	2+	0	AS	NA	NA	Y	Y	0.00
2B	85.5	4	5	1	6	1.6	2	2	AS	U	U	Y	N	4.02
2B	86	1	1	1	7	0.26	2.4	2.4	AS	U	U	N	N	0.13
2B	85.7	6	1	1	8	0.4	2	2	N	U	U	Y	N	0.25
2B	84	4	1	4	4	0.2	4.1	4.1	N	U	4	N	N	0.13
2B	85	4	1	2	4	0.26	3.1	3.1	N	U	4	Y	N	0.16
2B	85.5	4	1	1	4	0.23	1.8	1.8	N	U	4	Y	N	0.07
2B	86	4	1	4	3	0.36	3.5	3.5	N	U	4	Y	N	0.36
2B	86.5	4	1	1	8	0.45	1.8	1.8	N	U	4	Y	N	0.29
2B	87	4	1	4	4	0.25	3.8	3.8	N	U	4	N	N	0.19
2B	87	4	1	1	6	0.35	3	3	N	U	4	Y	N	0.29
2B	87	4	1	4	5	0.4	5	5	N	U	4	Y	Y	0.63
2B	88	5	1	1	8	0.32	2.5	2.5	N	U	4	Y	N	0.20
2B	88	4	1	4	5	0.4	6.8	6.8	N	U	4	Y	N	0.85
2B	88	4	1	1	7	0.5	5	5	N	U	4	Y	Y	0.98
2B	90	5	1	9	8	0.22	2.1	2.1	N	U	4	Y	N	0.08
2B	90	4	1	1	6	0.3	2.5	2.5	N	U	4	Y	N	0.18
2B	91	4	7	4	4	0.45	12	12	N	U	4	Y	Y	1.91
2B	92	4	1	1	6	0.35	5	5	N	U	4	Y	N	0.48
2B	92	4	1	1	7	0.21	3.4	3.4	N	U	4	Y	N	0.12
2B	92.5	4	1	1	6	0.3	3.5	3.5	N	U	4	Y	N	0.25
2B	92	4	1	1	6	0.33	3.5	3.5	N	U	4	Y	N	0.30
2B	93	4	1	9	7	0.32	4.5	4.5	N	U	4	Y	N	0.36
2B	93	4	1	1	7	0.35	5	5	N	U	4	Y	N	0.48
2B	93.5	4	1	1	7	0.3	2.4	2.4	N	U	4	Y	N	0.17
2B	93	4	1	1	7	0.4	1.8	1.8	N	U	4	Y	N	0.23
2B	93	4	1	1	7	0.6	2	2	N	U	4	Y	N	0.57
2B	95	4	1	1	6	0.33	2.6	2.6	N	U	4	Y	N	0.22
2B	95	4	1	1	6	0.5	2.2	2.2	N	U	4	Y	N	0.43

2B	95	4	7	2	5	0.55	12	12	N	U	4	Y	Y	2.85
2B	95	4	1	1	8	0.24	3.4	3.4	N	U	4	Y	N	0.15
2B	98	4	1	4	5	0.5	20	20	N	U	4	N	N	3.93
2B	97	4	1	1	6	0.6	4	4	N	U	4	Y	N	1.13
2B	100	4	1	1	6	1.35	3.4	3.4	N	U	4	Y	N	4.87
2B	101	4	1	4	3	0.25	10	10	N	U	4	Y	N	0.49
2B	101	4	1	4	5	0.34	16	16	N	U	4	Y	N	1.45
2B	101	4	4	4	0	0.68	2+	0	N	NA	NA	Y	Y	0.00
2B	102	4	1	4	5	0.3	7	7	N	U	4	Y	N	0.49
2B	102	2	1	4	5	0.37	15	15	N	U	4	Y	Y	1.61
2B	104	6	7	4	2	0.3	12	12	FS	U	4	Y	Y	0.85
2B	104.5	6	7	4	3	0.3	20	20	FS	U	4	Y	Y	1.41
2B	100	3	1	1	8	0.26	2.2	2.2	N	U	4	Y	N	0.12
2B	98	4	1	1	8	0.52	2.3	2.3	N	U	4	Y	N	0.49
2B	110.8	5	1	1	8	0.55	6	6	N	U	4	Y	N	1.43
2B	110.5	5	1	1	6	0.4	2.6	2.6	N	U	4	Y	N	0.33
2B	113.6	6	7	9	3	0.35	10.3	10.3	N	U	4	Y	N	0.99
2B	118	2	1	4	3	0.33	16.5	16.5	N	U	U	N	N	1.41
2B	119.2	6	1	4	2	0.23	18.5	18.5	N	U	U	N	N	0.77
2B	123.2	4	4	4	0	0.22	2+	0	N	NA	NA	N	N	0.00
2B	131.7	3	1	1	4	0.55	3.8	3.8	N	U	U	N	N	0.90
2B	133.5	3	7	9	4	0.47	6	6	N	U	U	N	N	1.04
2B	137	4	4	4	0	0.3	2+	0	N	NA	NA	N	N	0.00
2B	137.3	4	6	4	3	0.37	10	10	N	0	U	N	N	1.08
2B	137.3	6	1	4	5	0.2	7.5	7.5	N	U	U	N	N	0.24
2B	144.1	2	1	1	4	0.33	7.8	7.8	N	0	U	N	N	0.67
2B	150	2	1	4	4	0.42	12.5	12.5	N	U	U	N	N	1.73
2B	150	4	4	4	0	0.5	2+	0	N	NA	NA	N	N	0.00
2B	166	4	6	8	1	0.42	15	15	N	3	4	N	N	2.08
2B	182.3	4	4	1	0	0.7	2+	0	AS	NA	NA	N	N	0.00
2B	189.2	4	4	4	0	0.58	2+	0	AS	NA	NA	N	N	0.00
2B	189.2	4	4	4	0	0.46	2+	0	AS	NA	NA	N	N	0.00

2B	213	4	4	4	0	0.67	2+	0	AS	NA	NA	N	N	0.00
2B	213.5	2	1	2	4	0.28	10	10	N	U	U	N	N	0.62
2B	213.5	2	1	1	7	0.6	9	9	N	U	U	N	N	2.54
2B	214	5	1	4	3	0.24	6	6	N	U	U	N	N	0.27
2B	214.5	2	5	1	4	2.4	2	2	AS	U	U	N	N	9.05
2B	217.5	6	1	2	1	0.57	36	36	N	0	3	N	N	9.19
2B	221	4	7	4	4	0.26	10.5	10.5	N	U	U	N	N	0.56

Table S-7. Reach 3A large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
3A	0	1	1	1	6	0.61	3.8	3.8	FS	U	U	N	N	1.11
3A	16	4	4	4	0	0.42	2+	0	N	NA	NA	N	N	0.00
3A	20.7	1	1	1	8	0.49	2.1	2.1	N	U	U	N	N	0.40
3A	22.3	1	1	1	8	0.38	3.4	3.4	N	U	U	N	N	0.39
3A	54.5	4	4	4	0	0.29	2+	0	N	NA	NA	N	N	0.00
3A	79	4	1	1	6	0.47	4.1	4.1	N	U	U	Y	N	0.71
3A	79	4	1	1	5	0.3	2.7	2.7	N	U	U	Y	N	0.19
3A	79	4	1	9	4	0.2	6	6	N	U	U	Y	N	0.19
3A	79	4	1	1	5	0.2	5.5	5.5	N	U	U	Y	N	0.17
3A	79	4	1	1	5	0.41	4	4	N	U	U	Y	N	0.53
3A	80	4	5	1	3	1.1	2	2	N	10	1	Y	Y	1.90
3A	80	5	4	1	0	0.32	2+	0	N	10	1	Y	N	0.00
3A	84	5	7	1	4	0.9	13.5	13.5	N	U	U	Y	N	8.59
3A	84	4	1	1	5	0.29	3.5	3.5	N	U	U	Y	N	0.23
3A	84	5	1	1	8	0.3	3.3	3.3	N	U	U	Y	N	0.23
3A	98	1	1	1	8	0.65	2.4	2.4	N	U	U	N	N	0.80
3A	102	5	1	4	5	0.25	5	5	N	U	U	N	N	0.25
3A	103.7	1	1	2	5	0.2	3	3	N	U	U	N	N	0.09
3A	110	2	7	2	3	0.73	16	16	N	U	U	N	N	6.70
3A	107.9	2	1	1	7	0.57	3.6	3.6	N	U	U	N	N	0.92
3A	108.5	2	1	1	8	0.41	3.4	3.4	N	U	U	N	N	0.45
3A	122.3	2	1	1	8	0.38	3.9	3.9	AS	U	U	N	N	0.44
3A	125	3	7	1	5	0.34	3.7	3.7	N	U	U	N	N	0.34
3A	125	3	7	1	5	0.26	3.7	3.7	N	U	U	N	N	0.20

Table S-8. Reach 3B large woody debris data.

Reach	Meter	Position	Type	Species	Decay Class	Diameter (m)	Length (m)	Length (not including live upright trees)	Pool	Distance fell from	Entry process	Debris jam	Key piece	Volume
3B	0	6	5	1	5	3	2	2	FS	0	4	N	N	14.14
3B	0	6	7	1	4	0.8	31	31	N	10	1	Y	Y	15.58
3B	0	2	1	1	4	0.38	17	17	N	U	1	Y	N	1.93
3B	1.4	6	5	1	5	1.3	3	3	N	U	U	Y	Y	3.98
3B	0	3	5	1	6	0.37	2	2	N	U	U	Y	N	0.22
3B	6.4	4	5	1	7	1.2	2.5	2.5	N	U	U	Y	N	2.83
3B	36.4	4	1	1	5	0.41	3	3	N	U	U	N	N	0.40
3B	84.5	6	7	9	4	0.25	10	10	FS	U	4	N	N	0.49
3B	84.5	3	5	1	7	0.52	4	4	FS	U	4	N	N	0.85
3B	84.5	3	5	1	7	0.75	4	4	FS	U	4	N	N	1.77

APPENDIX T.

Bank Pin (BP) and Riprap Marker (RM) Data

Table T-1. Landslide Bend pressure point, bank pin and riprap marker data.

Type	Distance (m)	Bearing	Material	Exposed (cm)
BP				
LB-1	18.6	114	Colluvium	1.9
LB-2	14.2	093	Fill	2.2
LB-3	14	063	Fill	2.5
LB-4	12.5	012	Fill	2.5
LB-5	13.7	0	Colluvium	2.2
RM				
LB-1	16.6	145	Cement	
LB-2	13.1	101	Redwood log	
LB-3	11.9	345	Volcanic rock	
LB-4	15.5	334	Volcanic rock	

Table T-2. Riprap Bend pressure point, bank pin and riprap marker data.

Type	Distance (m)	Bearing	Material	Exposed (cm)
BP				
RB-1	15.9	135	Weathered mudstone	5
RB-2	12.7	240	Silt	2.9
RM				
RB-1	11.1	128	Volcanic	
RB-2	12.6	153	Volcanic	
RB-3	12.9	171	Volcanic	
RB-4	9.9	196	Volcanic	
RB-5	11.6	230	Volcanic	

Table T-3. Sackrete Bend pressure point, bank pin and riprap marker data.

Type	Distance (m)	Bearing	Material	Exposed (cm)
BP				
SB-1	14.6	220	Fill	5
SB-2	11.7	254	Fill	3.2
SB-3	10.7	289	Fill	4.1
SB-4	14.3	300	Fill	3.5
SB-5	12.9	332	Alluvium	5
SB-6	11.8	030	Alluvium	3.8
RM				
SB-1	17.3	211	Sackrete block	
SB-2	14.3	060	Sackrete block	

Table T-4. Apple Jack's Bend pressure point, bank pin and riprap marker data.

Type	Distance (m)	Bearing	Material	Length exposed (cm)
BP				
AB-1	12.9	250	Fill	3.2
AB-2	16.4	316	Fill	4.4
RM				
AB-1	14.5	225	Volcanic rock	
AB-2	22	357	Volcanic rock	

Table T-5. Green House Bend pressure point, bank pin and riprap marker data.

Type	Distance (m)	Bearing	Material	Length exposed (cm)
BP				
GB-1	8.9	154	Fill	6
GB-2	8.5	135	Fill	4.5
GB-3	9.2	095	Fill	4.5
GB-4	10.7	065	Alluvium	4
GB-5	11.4	052	Alluvium	4.5
RM				
GB-1	10.5	088	Volcanic rock	
GB-2	11.5	080	Volcanic rock	
GB-3	14.8	060	Volcanic rock	

Table T-6. 30 mph Bend pressure point, bank pin data.

Type	Distance (m)	Bearing	Material	Length exposed (cm)
BP				
30-1	14.8	154	Fill	3.2
30-2	17.8	145	Fill	2.5
30-3	17.1	144	Fill	3.0
30-4	41.7	133	Fill	4.8

APPENDIX U.

Pressure Point Cross Section Data

Table U-1. Landslide Bend pressure point, cross section data.

Cross section # 1		Cross section # 2		Cross section # 3	
Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)
25.0	1.65	0	12.3	17.1	0.91
24.5	1.50	12	3.6	15.2	0.26
20.9	1.53	11.6	0.00	14.1	0.71
20.6	1.26	12.1	0.00	13.9	0.00
18.5	0.70	13.6	0.27	12.5	0.03
15.3	0.11	18.7	0.68	9.9	0.17
14.5	0.00	22.6	0.55	5.2	0.71
14.1	0.23	23.4	0.94	4.0	1.45
11.7	0.03	23.8	1.06	2.2	1.58
8.6	0.35	24.1	1.53	0.0	3.64
5.0	0.05	24.1	1.68		
4.1	0.17	24.3	1.68		
2.6	0.87	25.0	1.94		
1.9	1.59				
0.0	1.93				

Table U-2. Riprap Bend pressure point, cross section data.

Cross section # 1		Cross section # 2		Cross section # 3	
Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)
0.0	2.24	0.0	2.24	0.0	2.00
0.9	2.09	1.1	2.15	1.2	1.94
1.7	1.85	2.2	1.15	2.7	0.85
2.8	1.09	3.4	0.91	3.2	0.61
3.8	0.91	3.8	0.70	4.3	0.45
4.3	0.55	6.9	0.52	5.7	0.18
6.5	0.58	9.2	0.00	9.7	0.48
6.9	0.33	10.7	0.45	10.6	0.00
7.4	0.18	13.1	1.97	12.4	0.76
8.3	0.64	13.6	2.00	14.9	4.21
9.1	0.33	20.4	7.7	21.1	6.64
9.9	0.00	21.5	7.21	24.4	6.45
12.5	0.06				
13.1	0.45				
14.6	1.06				
20.0	6.30				
22.5	7.67				
25.0	7.06				

Table U-3. Sackrete Bend pressure point, cross section data.

Cross section # 1		Cross section # 2		Cross section # 3	
Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)
17.1	4.4	28.7	6.1	22.5	4.1
15.4	4.1	28.1	5.8	22	3.8
14.6	3.6	24.6	1.1	18.5	3.4
13.4	2.8	21.9	0.6	16.5	2.1
12.9	2.4	21.5	0.6	15.5	1.8
12.8	1.4	20.9	0.3	14.9	1.4
12.1	1.2	19.9	1.0	12.5	1.0
11.1	0.7	18.9	0.0	10.5	0.5
10.4	0.4	17.9	0.1	8.7	0.3
10.2	0.2	16.9	0.4	3.5	0.3
9.3	0.0	16.1	0.6	2.3	0.1
9.1	0.1	15.9	0.6	1.9	0.0
8	0.2	14.9	0.8	0.8	2.2
7.2	0.2	12.9	1.0	0	2.6
6.8	0.5	10.9	1.2		
6.1	0.6	9.2	1.4		
5.1	0.4	8.9	1.3		
4.1	0.9	6.9	1.4		
3.1	1.2	5.5	1.2		
3.1	1.5	5.0	1.4		
1.5	1.7	4.0	1.8		
1.1	2.7	3.0	2.1		
0.1	3.3	2.4	2.2		
0	3.3	2.0	2.5		
		1.0	3.7		
		0.0	3.9		

Table U-4. Apple Jack's Bend pressure point, cross section data.

Cross section # 1		Cross section # 2		Cross section # 3	
Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)
0.0	1.76	0.0	1.33	0.0	1.45
2.6	1.42	2.0	1.23	5.9	1.36
3.8	0.78	3.0	0.92	7.6	1.18
4.6	1.24	5.8	0.80	10.2	0.45
6.8	0.98	7.6	0.23	13.3	0.00
10.0	0.34	10.9	0.00	15.4	0.33
12.2	0.00	12.7	0.20	17.8	1.09
14.2	0.33	12.9	2.47	19.1	3.09
15.9	1.15	17.7	3.92	20.7	3.58
18.9	5.24	18.2	5.20	23.2	7.06
21.3	5.64	18.9	5.80	25.6	6.64
25.8	6.30	19.4	6.00	26.5	6.70

Table U-5. Green House Bend pressure point, cross section data.

Cross section # 1		Cross section # 2		Cross section # 3		Cross section # 4	
Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)
26.2	1.27	15.9	1.24	26.1	0.88	23.9	0.9
24.5	1.15	14.6	1.15	22.8	0.73	18.5	0.8
19.9	0.70	12.1	0.52	21.2	0.24	16.8	0.6
19.7	0.52	8.0	0	14.8	0	16.2	0.3
18.9	0.21	7.2	0.27	13.7	0.33	8.3	0.0
17.2	0.00	6.2	2.79	13.1	0.45	7.5	0.2
15	0.00	1.4	5.36	10.8	3.55	6.9	0.5
13.6	2.18	0.0	5.48	0	5.27	5.9	0.7
11.2	2.09					3.7	1.5
1.8	5.06					3.3	1.8
0	5.12					0.0	2.7

Table U-6. 30 mph Bend pressure point, cross section data.

Cross section # 1		Cross section # 2		Cross section # 3	
Distance (m)	Elevation(m)	Distance (m)	Elevation(m)	Distance (m)	Elevation(m)
20.8	3.00	22.8	2.58	24.5	2.27
19.2	2.36	21.6	2.24	23.7	2.24
17.9	1.91	20.9	2.15	22.0	2.21
17.2	1.42	19.6	1.67	21.1	1.91
16.0	1.09	19.2	1.30	20.4	0.00
15.5	0.24	18.6	1.03	18.4	0.09
13.1	0.18	18.3	0.06	16.4	0.30
11.9	0.18	17.9	0.00	16.1	0.42
10.5	0.00	17.1	0.06	14.8	1.06
8.3	0.39	16.3	0.18	9.7	1.73
8.1	0.58	14.4	0.03	7.3	2.61
7.2	0.76	13.7	0.18	2.2	5.18
6.2	1.24	13.4	0.33	0.0	5.27
5.0	1.42	13.0	0.64		
3.7	3.36	8.7	1.06		
1.4	4.61	3.4	6.00		
1.1	5.21	2.1	5.21		
0.0	5.45	0.0	5.21		

APPENDIX V.

Sample reach bank erosion data

Table V-1. Bank erosion raw data for each sample reach.

Reach	Start	End	Bank	Retreat	Height	Based on	< Age	Volume (m^3)	Erosion per unit channel length
1A	0.0	7.0	LB	1.5	4.0	Redwood roots	100	42.00	
	12.3	30.0	RB	1.2	2.0	Ash roots	20	42.48	
Total length	45.0	80.5	LB	1.3	1.7	Redwood roots	100	78.46	
162.5 m	76.5	77.0	LB	1.8	2.5	Culvert erosion	50	2.25	
								165.19	1.017
1B	-5.0	12.0	LB	5.0	3.0	Landslide	20	255.00	
	9.0	14.6	RB	0.5	0.8	Alder roots	50	2.24	
Total length	12.0	30.0	LB	3.0	3.4	Redwood roots	20	183.60	
187.5 m	32.8	50.8	LB	0.3	0.5	Alder roots	10	2.70	
	51.0	58.3	RB	0.6	0.8	Alder roots	50	3.50	
	106.0	115.0	LB	0.9	0.7	Alder roots	50	5.67	
	125.5	165.0	RB	0.4	0.4	Alder roots	50	6.32	
	165.0	188.2	LB	0.7	1.8	Redwood roots	100	29.23	
								488.27	2.604

Reach	Start	End	Bank	Retreat	Height	Based on	< Age	Volume (m^3)	Erosion per unit channel length
1C	0.0	20.5	LB	1.5	2.5	Redwood roots	100	76.88	
	9.0	12.0	RB	1.4	0.4	Alder roots	20	1.68	
Total length	20.0	40.5	LB	0.8	2.0	Bay and Ash roots	50	32.80	
175 m	32.5	61.0	RB	1.1	0.6	Alder roots	20	18.81	
	59.0	68.0	LB	0.4	0.8	Bay and Maple roots	20	2.88	
	67.6	95.3	RB	1.0	1.8	Hardwood roots	20	49.86	
	95.3	100.5	RB	1.5	1.2	Bay roots	20	9.36	
	100.5	124.0	RB	1.5	2.2	Bay roots	20	77.55	
	124.0	129.0	LB	0.5	1.0	Overhanging fine roots	20	2.50	
	144.0	151.0	RB	0.8	1.6	Bay, Maple, Alder roots	20	8.96	
	151.0	166.0	RB	1.8	2.0	Bay roots	20	54.00	
	166.8	174.0	RB	2.0	5.0	Landslide slump	20	72.00	
								407.28	2.327

2A	0.0	26.3	RB	0.8	0.5	Bay roots	50	10.52	
	0.0	61.0	LB	0.2	0.7	Willow roots	20	8.54	
Total length	27.6	47.0	RB	1.5	2.7	Ash and Bay roots	50	78.57	
162.5 m	86.8	98.4	RB	0.7	2.1	Ash and hardwood roots	50	17.05	
								114.68	0.71

Reach	Start	End	Bank	Retreat	Height	Based on	< Age	Volume (m^3)	Erosion per unit channel length
2B	0.0	4.7	RB	2.0	0.5	Redwood roots	100	4.70	
	0.0	16.1	LB	1.0	2.2	Redwood roots	100	35.42	
Total length	22.1	48.0	LB	0.2	2.0	Redwood roots	100	10.36	
225 m	33.0	51.0	RB	1.1	0.5	Alder roots	50	9.90	
	80.0	85.0	RB	3.5	4.0	Redwood roots	100	70.00	
	74.0	88.0	LB	1.0	1.5	Redwood roots	100	21.00	
	85.0	105.0	RB	3.0	10.0	Landslide scarp	100	600.00	
	105.0	123.3	RB	0.3	1.6	Fine roots	5	8.78	
	129.0	158.2	LB	1.8	2.6	Redwood roots	100	136.66	
	150.0	171.0	RB	0.7	0.6	Alder roots	50	8.82	
	158.8	171.5	LB	2.0	30.0	Landslide scarp	10	762.00	
	172.2	195.6	LB	0.9	2.0	Redwood roots	100	42.12	
	182.3	206.8	RB	0.8	1.8	Fine roots	20	35.28	
	207.0	231.4	RB	3.0	40.0	Landslide scarp	50	2928.00	
								4673.04	20.77

3A	0.0	16.1	RB	2.8	3.0	Redwood roots	100	135.24	
	14.0	42.5	LB	2.0	3.3	Alder roots	50	188.10	
Total length	16.5	27.6	RB	1.5	1.0	Redwood roots	100	16.65	
125 m	55.0	80.0	RB	1.9	3.5	Ash and alder roots	50	166.25	
	80.0	104.0	RB	0.2	7.0	Exposed fresh bedrock	10	33.60	
	104.0	127.0	RB	2.5	3.5	Redwood roots	100	201.25	
	108.5	127.0	LB	0.1	2.2	Redwood roots	100	4.07	
								745.16	5.96

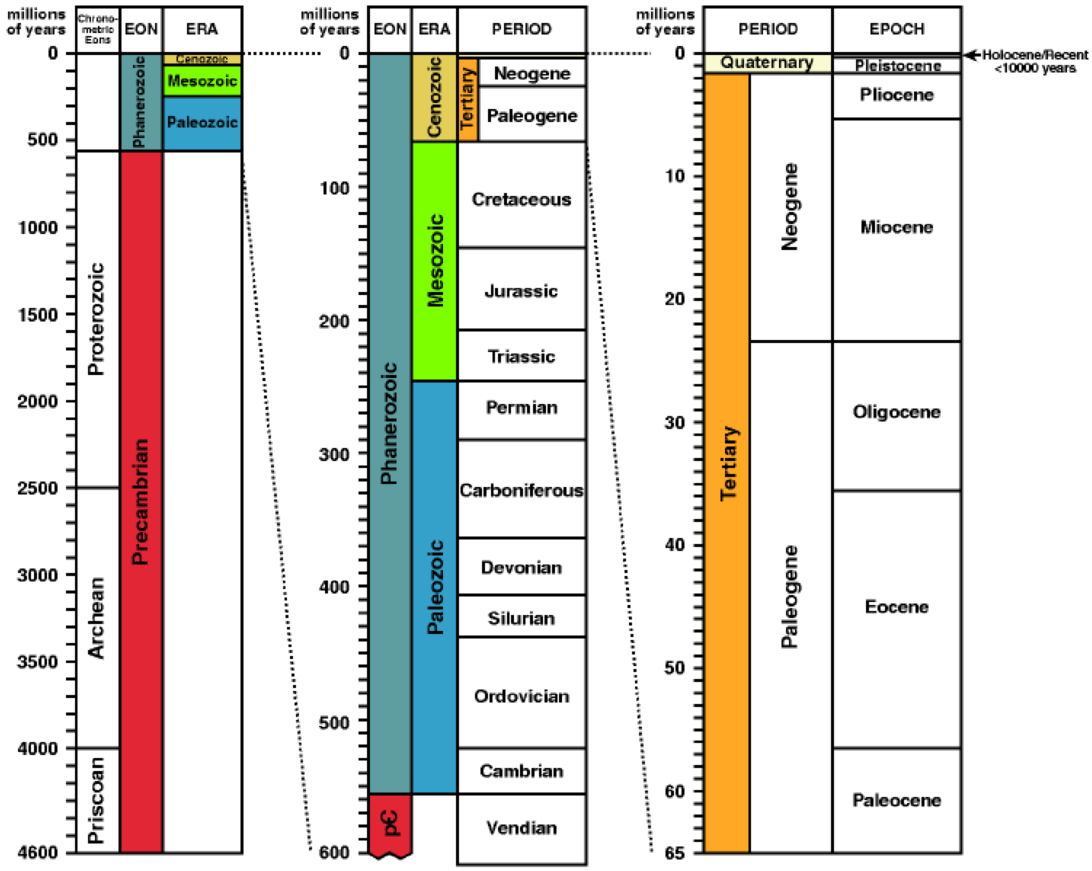
Reach	Start	End	Bank	Retreat	Height	Based on	< Age	Volume (m^3)	Erosion per unit channel length
3B	13.0	30.1	LB	0.4	1.6	Redwood roots	50	10.94	
	19.2	36.2	RB	1.6	4.0	Redwood roots	100	108.80	
Total length	30.1	52.0	LB	3.0	3.8	Landslide, active	20	249.66	
112.5 m	56.0	79.3	RB	1.0	3.5	Willow and Redwood roots	50	81.55	
	68.7	79.3	LB	0.3	0.7	Willow roots	20	2.23	
	79.3	101.6	RB	2.0	0.5	Landslide	20	22.30	
	101.6	114.1	RB	1.8	2.7	Redwood roots	100	60.75	
								536.23	4.77

All measurements in meters. “Start” and “End” refer to the distance measured on the HipChain, denoting the total length of erosion. “Retreat” refers to the distance into the bank that erosion was measured. “< Age” refers to the age class each erosion was assigned (in years). “Volume” is simply length times retreat times height.

APPENDIX W.

Geologic Time Scale

Table W-1. Geologic time scale. Most of the rock units in the La Honda watershed are in the right-hand (orange) column.



APPENDIX X.

Unified Rock Classification System (URCS)

Table X-1. Unified Rock Classification System. Schmidt rebound hammer test values given in text refer to element denoted as "Estimated Strength" below.

UNIFIED ROCK CLASSIFICATION

DEGREE OF WEATHERING

REPRESENTATIVE		ALTERED	WEATHERED	
			>GRAVEL SIZE	<SAND SIZE
Micro Fresh State (MFS) A	Visually Fresh State (VFS) B	Stained State (STS) C	Partly Decomposed State (PDS) D	Completely Decomposed State (CDS) E
UNIT WEIGHT RELATIVE ABSORPTION		COMPARE TO FRESH STATE	NON-PLASTIC / PLASTIC	NON-PLASTIC / PLASTIC

ESTIMATED STRENGTH

REACTION TO IMPACT OF 1 LB. BALLPEEN HAMMER				REMOLDING[1]
"Rebounds" (Elastic) (RQ) A	"Pits" (Tensional) (PQ) B	"Dents" (Compression) (DQ) C	"Craters" (Shears) (CQ) D	Moldable (Friable) (MQ) E
>15000 psi[2] >103 MPa	8000-15000 psi[2] 55-103 MPa	3000-8000 psi[2] 21-55 MPa	1000-3000 psi[2] 7-21 MPa	<1000 psi[2] <7 MPa

(1) Strength Estimated by Soil Mechanics Techniques
(2) Approximate Unconfined Compressive Strength

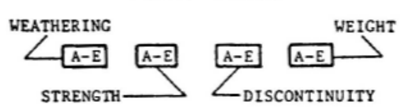
DISCONTINUITIES

VERY LOW PERMEABILITY			MAY TRANSMIT WATER	
Solid (Random Breakage) (SRB) A	Solid (Preferred Breakage) (SPB) B	Solid (Latent Planes Of Separation) (LPS) C	Nonintersecting Open Planes (2-D) D	Intersecting Open Planes (3-D) E
			ATTITUDE	INTERLOCK

UNIT WEIGHT

Greater Than 160 pcf 2.55 g/cc A	150-160 pcf 2.40-2.55 g/cc B	140-150 pcf 2.25-240 g/cc C	130-140 pcf 2.10-2.25 g/cc D	Less Than 130 pcf 2.10 g/cc E

DESIGN NOTATION



From Williamson (1984)Association of Engineering Geologists Bulletin v. 21, p. 345-354.

APPENDIX Y.

Mercalli Scale

Table Y-1. Modified Mercalli Intensity (MMI) scale based on observations of effects during earthquakes.

I. People do not feel any Earth movement.

II. A few people might notice movement if they are at rest and/or on the upper floors of tall buildings.

III. Many people indoors feel movement. Hanging objects swing back and forth. People outdoors might not realize that an earthquake is occurring.

IV. Most people indoors feel movement. Hanging objects swing. Dishes, windows, and doors rattle. The earthquake feels like a heavy truck hitting the walls. A few people outdoors may feel movement. Parked cars rock.

V. Almost everyone feels movement. Sleeping people are awakened. Doors swing open or close. Dishes are broken. Pictures on the wall move. Small objects move or are turned over. Trees might shake. Liquids might spill out of open containers.

VI. Everyone feels movement. People have trouble walking. Objects fall from shelves. Pictures fall off walls. Furniture moves. Plaster in walls might crack. Trees and bushes shake. Damage is slight in poorly built buildings. No structural damage.

VII. People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.

VIII. Drivers have trouble steering. Houses that are not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Tree branches break. Hillsides might crack if the ground is wet. Water levels in wells might change.

IX. Well-built buildings suffer considerable damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks. Reservoirs suffer serious damage.

X. Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas. Railroad tracks are bent slightly.

XI. Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed. Railroad tracks are badly bent.

XII. Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

APPENDIX Z.

Daily Rainfall

Daily rainfall is available for San Gregorio (047807) from January 1, 1954 to present. Given that the record is complete and that the relationship between annual rainfall of this and other local stations is consistent, the quality of the daily record is assumed to be high. The maximum rainfall for a 24-hour period at San Gregorio was 162 mm (6.37 in) and occurred on October 13, 1962. This storm was estimated to have a return period of 50 years (Figure Z-1). Recent notable storms occurred in 1982, 1992, 1996, 1998, and 2000 (Table Z-1). There is no consistent relationship between rainfall at San Gregorio in the day or several days before a discharge peak at least in part, because the rain gauge at San Gregorio does not represent the upper watershed. Runoff magnitude is influenced by a combination of antecedent conditions, rainfall magnitude and intensity, and local variations in rainfall across the watershed.

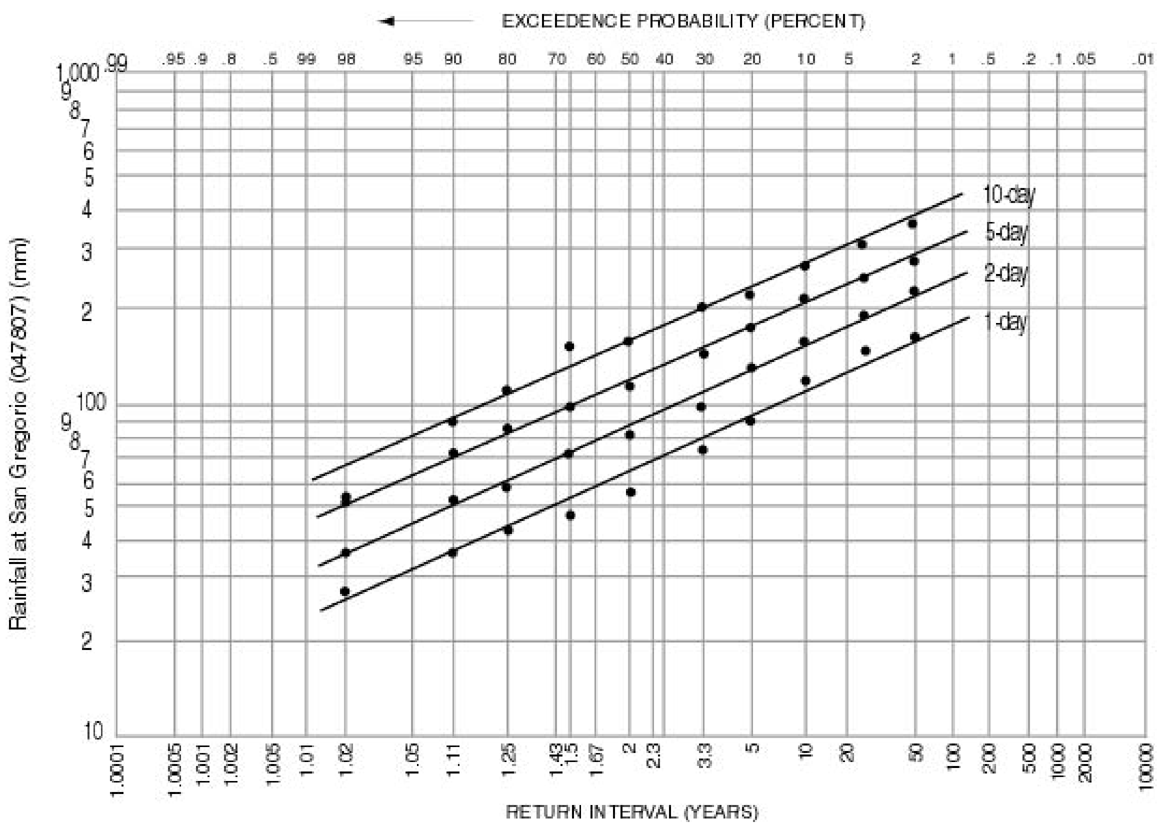


Figure Z-1. Storm rainfall magnitude-duration-frequency curves for San Gregorio (047807).

Table Z-1. Recent storm rainfalls and floods at San Gregorio. The rank is based on available data in the USGS gauge record (1970-1997).

		Rainfall at San Gregorio (047807)										Discharge at San Gregorio (11162570)		
Date	**Water Year**	**1-day**		**2-day**		**5-day**		**10-day**		**Season to date**		**Discharge**	**Gauge height**	**Rank**
		(mm)	**(in)**	**(mm)**	**(in)**	**(mm)**	**(in)**	**(mm)**	**(in)**	**(mm)**	**(in)**	**[m^3/s (cfs)]**	**[m (ft)]**	**(xth largest flood)**
1/4/1982	1982	152	6.23	168	6.62	196	7.70	255	10.05	623	24.54	735 (7910)	6.49 (21.28)	1
1/9/1995	1995	72	2.85	82	3.22	115	4.54	158	6.23	471	18.54	613 (6600)	5.93 (19.44)	2
1/1/1997	1997	47	1.85	55	2.17	80	3.14	96	3.79	411	16.19	567 (6100)	5.71 (18.74)	3
2/12/1992	1992	111	4.38	132	5.19	180	7.10	187	7.35	483	19.01	483 (5200)	5.33 (17.48)	5
1/13/1993	1993	45	1.78	72	2.83	85	3.33	150	5.91	435	17.14	328 (3530)	4.59 (15.07)	9
1/13/1980	1980	34	1.34	52	2.03	98	3.87	102	4.00	491	19.32	246 (2650)	4.23 (14.51)	10
2/2/1998	1998	98	3.85	140	5.50	150	5.90	172	6.76	693	27.29	-	-	1*
1/24/2000	2000	95	3.73	128	5.03	130	5.11	193	7.59	391	15.38	-	-	-
12/16/2002	2003	50	1.96	60	2.38	181	7.13	197	7.76	262	10.33	279 (3000)**	3.69 (12.1)**	13

*This flood is the largest on record for Pescadero Creek, the neighboring watershed.
**USGS preliminary data

APPENDIX AA.

San Gregorio Creek Runoff

San Gregorio Annual Runoff

Annual runoff has been measured by the USGS at San Gregorio (11162570) for the period water year (WY) 1971 – 1994 and from WY 2002 – present. A water year begins October 1 and runs to September 30; for example, water year 2004 begins October 1, 2003 and ends September 30, 2004. Annual runoff has varied from 1.1 Mm^3 (million cubic meters) or 895 ac-ft in 1977 to 99.5 Mm^3 or 80,638 ac-ft in 1983. This corresponds to 8 – 755 mm (0.33 – 29.71 in) of rainfall (Figure AA-1). Average annual discharge for the 26 years of record was 31.2 Mm^3 (25,321 acre-feet). This corresponds to 237 mm (9.33 in) of rainfall. Based on isopluvial maps (Rantz, 1971a), annual average rainfall for the San Gregorio watershed is estimated to be 787 mm (31 in). Given the La Honda rainfall data (station 044660) averages 794 mm (31.3 in), the annual rainfall and variability in La Honda can be used as a proxy for average conditions across the watershed and used for understanding rainfall-runoff relationships under different climatic conditions. Using these assumptions, the estimated annual runoff coefficient for San Gregorio (the percentage of rainfall manifested as runoff) varies from 2% in 1977 to 52% in 1983 (Figure AA-2) and averages 26%. A greater than expected runoff occurring during WY 1984 was probably due to residual soil moisture from the very wet 1982 and 1983 water years. Runoff characteristics of La Honda are probably similar to those of the greater San Gregorio system because their annual rainfall is about the same.

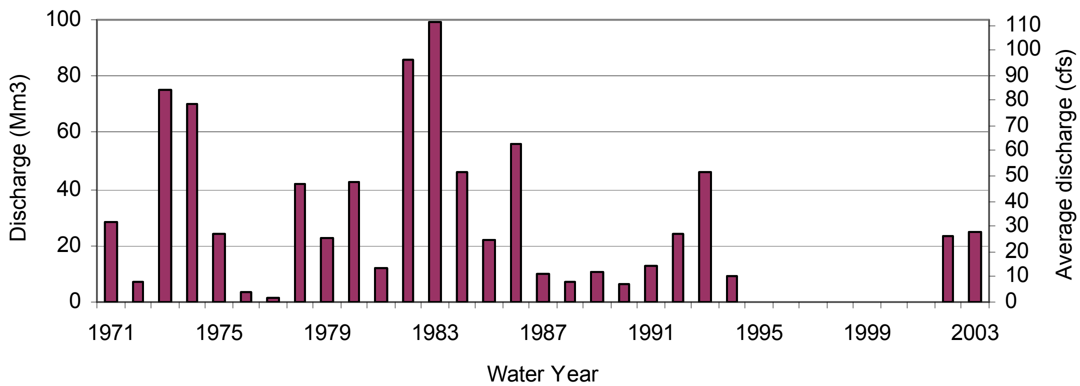


Figure AA-1. Annual runoff at San Gregorio (11162570) for the period on record.

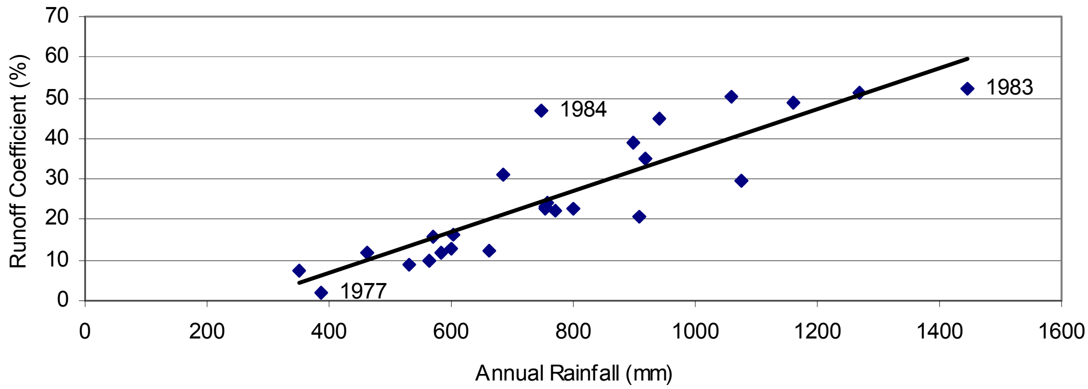


Figure AA-2. Rainfall-runoff relationships in the San Gregorio watershed based on water years for the period of data (1971-1994 and 2002-present).

San Gregorio Creek Seasonal Runoff Character

Runoff during the summer and fall is particularly important for maintaining water quality and abundant pool habitat for salmonids and other native fish species. No data are available for La Honda Creek, but inferences can be made from discharge measurements at San Gregorio, drawing upon summer surveys conducted by DFG from the 1950s to present, and from discussions with landowners.

On average, discharge is greatest in February (24% of the annual) and least in September (0.3% of the annual) (Figure AA-3). Most (94%) of the annual discharge occurs between November and April. This is a typical of watersheds in the Bay Area that have little or no flow regulation or augmentation (McKee et al., 2002). During the period of record (1969-1994), there were five months of zero flow recorded at San Gregorio; three occurred during the drought of 1977 and two during the drought of 1988. In all, there were 16 months where discharge was >0.003 m^3/s (>0.1 cfs: 13 occurred during WYs 1976, 1977 and early 1978, and WYs 1987, 1988 and early 1989. DFG recorded areas of zero flow within La Honda on July 19, 1985. Discharge at San Gregorio averaged 1.1 cfs during July 1985. Monthly average discharges of >0.03 m^3/s (<1.1 cfs) occurred 60 times over the period of record for an average of five months every two years (20% of the time). Landowners have observed zero flow in La Honda especially during dry years. Those having lived in the area for 30 years or more reported that this has not changed appreciably over time.

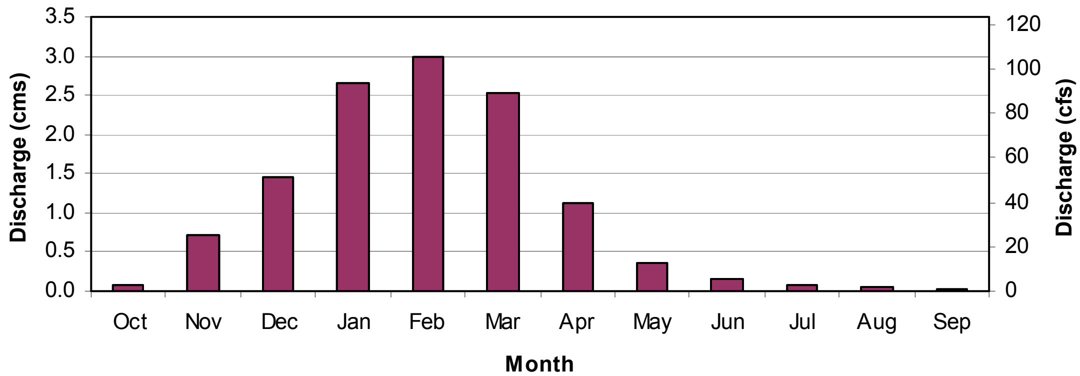


Figure AA-3. Average monthly discharge at San Gregorio (11162570) based upon the period of record (1969-1994).

San Gregorio Creek Runoff Magnitude-frequency Relationships

An analysis of magnitude and frequency was completed using the largest storm peaks for each water year on record (the annual series) for San Gregorio watershed. San Gregorio watershed has an area of 134.83 km^2 (52.06 mi^2) (CALWATER 1997) and an average annual rainfall of about 787 mm (31 in).

The largest local storm on record appears to have occurred in February 1998 (Figure AA-4). The estimated recurrence interval of this storm is about 50 years.

Discharge at San Gregorio for WY 2003 peaked at 85 m^3/s (3,000 cfs) (USGS provisional data) on December 16, 2002. The estimated recurrence interval of this peak is about 3 years (Figure AA-4). The estimated recurrence interval for the December flood on San Gregorio compares closely with the 3.3 years value estimated using the annual rainfall series (Figure 4-2).

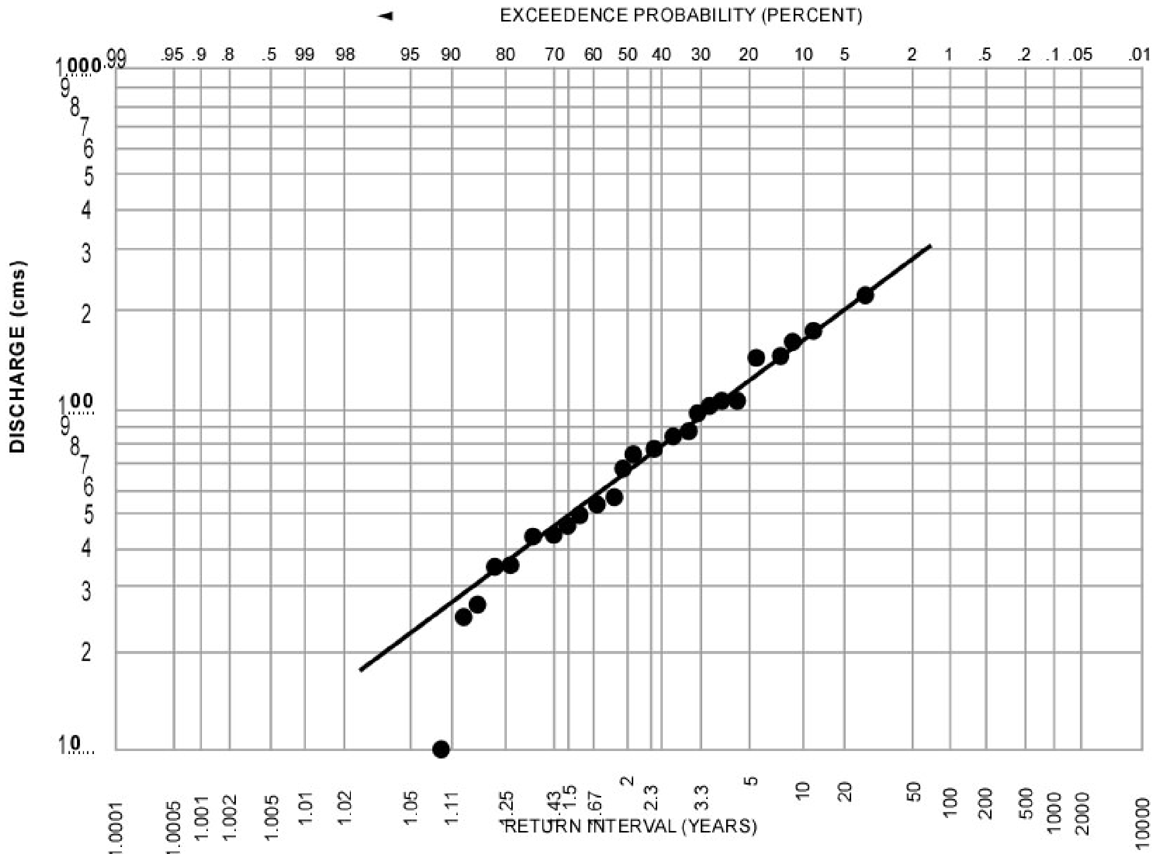


Figure AA-4. Magnitude and frequency analysis for San Gregorio (11162570) based on peak annual series data for the period 1970-1997. Note that peak that occurred during the 1977 water year was <10 cms (m^3/s) (<353.15 cfs) and did not plot using the scale on this graph.