STREAM INVENTORY REPORT

Lacks Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Lacks Creek. The survey began at the confluence with Redwood Creek and extended upstream 4.6 miles.

The Lacks Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Lacks Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Lacks Creek is a tributary to Redwood Creek, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Lacks Creek's legal description at the confluence with Redwood Creek is T08N R03E S19. Its location is 41.0529 degrees north latitude and 123.8722 degrees west longitude. Lacks Creek is a third order stream and has approximately 18.6 miles of blue line stream according to the USGS Hupa Mountain 7.5 minute quadrangle. Lacks Creek drains a watershed of approximately 17.4 square miles. Elevations range from about 440 feet at the mouth of the creek to 3,200 feet in the headwater areas. Redwood forest, Douglas fir forest, and mixed hardwood forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 299 to Redwood Valley Road.

METHODS

The habitat inventory conducted in Lacks Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Lacks Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Lacks Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Lacks Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate particle size, bedrock, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Lacks Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Lacks Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Lacks Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Lacks Creek. In addition, twenty sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. Graphics developed for Lacks Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of June 28 through July 31, 2001 was conducted by D. Resnik and T. Saunders (WSP/AmeriCorps). The total length of the stream surveyed was 24,262 feet with an additional 968 feet of side channel.

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Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 6.9 cfs on June 27, 2001.

Lacks Creek is a B3 channel type for 1,882 feet of the stream surveyed (Reach 1), a B2 channel type for 5,175 feet (Reach 2), an A2 channel type for 2,133 feet (Reach 3), an F2 channel type for 2,090 feet (Reach 4), a B2 channel type for 990 feet (Reach 5), a B3 channel type for 2,022 (Reach 6), a B2 channel type for 8,384 feet (Reach 7), and an A1 channel type for 1,586 feet (Reach 8). Channel types classified as “B” are moderately entrenched, with a moderate gradient, riffle dominated channel with infrequently spaced pools, a very stable plan and profile, and stable banks. B3 channel types are dominated by cobble substrate and B2 channel types are dominated by boulder substrate. Channel types classified as “A” are steep, narrow, cascading, step pool streams; high energy/debris transport associated with depositional soils. A2 channel types are dominated by boulder substrate and A1 channel types are dominated by bedrock. F2 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and boulder dominated channel.

Water temperatures taken during the survey period ranged from 57 to 65 degrees Fahrenheit. Air temperatures ranged from 61 to 83 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 52% riffle units, 33% flatwater units, and 15% pool units (Graph 1). Based on total length of Level II habitat types there were 63% riffle units, 29% flatwater units, and 8% pool units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 39%; runs, 25%; and high gradient riffles, 11% (Graph 3). Based on percent total length, low gradient riffles made up 55%, runs made up 18%, and step runs made up 11%.

A total of forty-four pools were identified (Table 3). Main channel pools were the most frequently encountered, at 70%, and comprised 75% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-nine of the forty-four pools (66%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 44 pool tail-outs measured, thirteen had a value of 1 (29.5%); three had a value of 2 (6.8%); two had a value of 3 (4.5%); and twenty-six had a value of 5 (59%); (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 48, flatwater habitat types had a mean shelter rating of 37, and pool habitats had a mean shelter rating of 56 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 60. Main channel pools had a mean shelter rating of 59 (Table 3).

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Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Lacks Creek. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in Lacks Creek. Boulders are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Boulders were the dominant substrate observed in 47% of pool tail-outs while gravel was the next most frequently observed substrate type, at 34%.

The mean percent canopy density for the surveyed length of Lacks Creek was 77%. The mean percentages of deciduous and coniferous trees were 88% and 12%, respectively. Graph 9 describes the mean percent canopy in Lacks Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 76%. The mean percent left bank vegetated was 85%. The dominant elements composing the structure of the stream banks consisted of 57% cobble/gravel, 31% boulders, 9% bedrock, and 4% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 79% of the units surveyed. Additionally, 10% of the units surveyed had brush as the dominant vegetation type, and 7% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Twenty sites were electrofished for species composition and distribution in Lacks Creek on September 10 and 13, 2001. Water temperatures taken during the electrofishing period ranged from 59 to 60 degrees Fahrenheit. Air temperatures ranged from 60 to 62 degrees Fahrenheit. The sites were sampled by T. Tollefson (DFG), and D. Resnik and D. Best (WSP/AmeriCorps).

The first site sampled was Habitat Unit #007, a run approximately 688 feet from the confluence with Redwood Creek. The site yielded seven young-of-the-year (YOY) steelhead.

The second site was Habitat Unit #009, a run located approximately 1,002 feet above the creek mouth. The site yielded seven young-of-the-year (YOY) steelhead and four age 1+ steelhead.

The third site sampled was Habitat Unit #015, a step run located approximately 1,687 feet above the creek mouth. The site yielded 12 YOY steelhead and two age 1+ steelhead.

The fourth site sampled was Habitat Unit #017, a step run located approximately 1,882 feet above the creek mouth. The site yielded six YOY steelhead and one age 1+ steelhead.

The fifth site sampled was Habitat Unit #022, a mid-channel pool located approximately 2,315 feet above the creek mouth. The site yielded three YOY steelhead, three age 1+ steelhead, one age 2+ steelhead, and one age 3+ steelhead.

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The sixth site sampled was Habitat Unit #027, a mid-channel pool located approximately 2,636 feet above the creek mouth. The site yielded 19 YOY steelhead.

The seventh site sampled was Habitat Unit #029, a run located approximately 3,002 feet above the creek mouth. The site yielded two YOY steelhead and one age 1+ steelhead.

The eighth site sampled was Habitat Unit #031, a plunge pool located approximately 3,389 feet above the creek mouth. The site yielded four YOY steelhead, two age 1+ steelhead, and one age 2+ steelhead.

The ninth site sampled was Habitat Unit #041, a mid-channel pool located approximately 4,323 feet above the creek mouth. The site yielded 18 YOY steelhead and four age 1+ steelhead.

The tenth site sampled was Habitat Unit #049, a step run, located approximately 4,937 feet above the creek mouth. The site yielded seven YOY steelhead, and five age 1+ steelhead.

The eleventh site sampled was Habitat Unit #050, a boulder enhanced lateral scour pool located approximately 5,097 feet above the creek mouth. The site yielded six YOY steelhead and one age 1+ steelhead.

The twelfth site sampled was Habitat Unit #064, a boulder enhanced lateral scour pool, located approximately 6,574 feet above the creek mouth. The site yielded three YOY steelhead and two age 1+ steelhead.

The thirteenth site sampled was Habitat Unit #066, a mid-channel pool located approximately 6,757 feet above the creek mouth. The site yielded 23 YOY steelhead and two age 1+ steelhead trout.

The fourteenth site sampled was Habitat Unit #070, a step pool located approximately 7,134 feet above the creek mouth. The site yielded 19 YOY steelhead, two age 1+ steelhead, and one age 2+ steelhead.

The fifteenth site sampled was Habitat Unit #072, a plunge pool located approximately 7,241 feet above the creek mouth. The site yielded nine YOY steelhead, four age 1+ steelhead, and one age 2+ steelhead trout.

The sixteenth site sampled was Habitat Unit #079, a dammed pool located approximately 7,547 feet above the creek mouth. The site yielded 19 YOY steelhead and two age 1+ steelhead.

The seventeenth site sampled was Habitat Unit #082, a plunge pool located approximately 7,796 feet above the creek mouth. The site yielded two YOY steelhead, four age 1+ steelhead, and two age 2+ steelhead.

The eighteenth site sampled was Habitat Unit #086, a mid-channel pool located approximately 8,055 feet above the creek mouth. The site yielded one YOY steelhead and two age 1+ steelhead.

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The nineteenth site sampled was Habitat Unit #091, a mid-channel pool located approximately 8,419 feet above the creek mouth. The site yielded three YOY steelhead, one age 1+ steelhead and one age 2+ steelhead.

The twentieth site sampled was Habitat Unit #097, a run located approximately 8,811 feet above the creek mouth. The site yielded seven YOY steelhead, and two age 1+ steelhead.

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
9/10/01	1	688	0007	3.3	1	B3	7	0	0
9/10/01	2	1,002	0009	3.3	1	B3	7	4	0
9/10/01	3	1,687	0015	3.4	1	B3	12	2	0
9/10/01	4	1,882	0017	3.4	2	B2	6	1	0
9/10/01	5	2,315	0022	4.2	2	B2	3	1	1
9/10/01	6	2,636	0027	4.2	2	B2	19	0	0
9/10/01	7	3,002	0029	3.3	2	B2	2	1	0
9/10/01	8	3,389	0031	5.6	2	B2	4	2	1
9/10/01	9	4,323	0041	4.2	2	B2	18	4	0
9/10/01	10	4,937	0049	43.4	2	B2	1	1	2
9/10/01	11	5,097	00050	5.5	2	B2	6	0	1
9/10/01	12	6,574	0064	5.5	2	B2	3	2	0
9/13/01	13	6,757	0066	4.2	2	B2	23	2	0
9/13/01	14	7,134	0070	4.4	3	A2	19	2	1
9/13/01	15	7,241	0072	5.6	3	A2	9	4	1
9/13/00	16	7,547	0079	6.5	3	A2	19	2	0
9/13/01	17	7,797	0082	5.6	3	A2	2	4	2
9/13/01	18	8,055	0086	4.2	3	A2	1	2	0

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9/13/01	19	8,419	0091	4.2	3	A2	3	1	1
9/13/01	20	8,811	0097	3.3	3	A2	7	2	0

DISCUSSION

Lacks Creek is a B3 channel type for 3,904 feet of stream surveyed, a B2 channel type for 14,549 feet, an A2 channel type for 2,133 feet, a F2 channel type for 2,090 feet, and an A1 channel type for the remaining 1,586 feet. The suitability of these channel types for fish habitat improvement structures is as follows: B3 channel types are excellent for plunge weirs, boulder clusters, bank placed boulders, single and opposing wing deflectors, and log cover. B2 channel types are excellent for log cover. Channel types classified as “A” are generally not suitable for fish habitat improvement structures because they are high energy streams with stable banks and poor gravel retention capabilities. F2 channel types are fair for plunge weirs, single and opposing wing deflectors, and log cover.

The water temperatures recorded on the survey days June 28 through July 31, 2001 ranged from 57 to 65 degrees Fahrenheit. Air temperatures ranged from 61 to 83 degrees Fahrenheit. A water temperature of 65 degrees Fahrenheit is nearing the threshold stress level for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 29% of the total length of this survey, riffles 63%, and pools 8%. The pools are relatively deep, with 29 of the 44 (66%) pools having a maximum depth greater than three feet. If the channel type is suitable, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

Sixteen of the forty-four pool tail-outs measured had embeddedness ratings of 1 or 2. Two of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-six of the pool tail-outs had a rating of 5, which is considered not suitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Eighteen of the 44 pool tail-outs measured had gravel or small cobble as the dominant substrate. Spawning substrate for salmonids is limited in Lacks Creek.

The mean shelter rating for pools was 56. The shelter rating in the flatwater habitats was 37. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, small woody debris contributes a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 77%. Reach 1 had a canopy density of 90%, Reach 2 had a canopy density of 72%, Reach 3 had a canopy density of 76%, Reach 4 had a canopy density of 89%, Reach 5 had a canopy density of 62%, Reach 6 had a canopy density of 82%, Reach 7 had a canopy density of 74%, and Reach 8 had canopy density of 78%.. In general, revegetation projects are considered when canopy density is less than 80% or the canopy composition is dominated by deciduous trees.

The percentage of right and left bank covered with vegetation was high at 76% and 85%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Lacks Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are nearing the threshold stress level for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

4) Increase the canopy on Lacks Creek by planting redwood, Douglas fir or other native conifers within the riparian zone. Tributaries to Lacks Creek and the reaches above this survey section should be inventoried and planted as well, since the water flowing here is effected from upstream.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) In the B3 channel type, design and engineer pool enhancement structures to increase the number of pools, or deepen existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

7) Suitable size spawning substrate on Lacks Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

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COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Comments:
0'	Start of survey at the confluence with Redwood Creek. The channel type is a B3.
688'	Electrofishing site #1.
1,002'	Electrofishing site #2.
1,687'	Electrofishing site #3.
1,882'	Electrofishing site #4. Left bank erosion site measures approximately 100' high x 100' long. It is possibly associated with old culvert.
2,315'	Electrofishing site #5. Bridge crosses creek. The bridge measures 20' high x 30' long x 15' wide.
2,375'	The channel type changes from B3 to B2.
2,636'	Electrofishing site #6.
3,002'	Electrofishing site #7.
3,389'	Electrofishing site #8.
3,445'	Left bank erosion site measures approximately 15' high x 150' long.
4,323'	Electrofishing site #9.
4,854'	Left bank erosion site measures approximately 80' high x 150' long. It is contributing fine sediment into creek.
4,937'	Electrofishing site #10.
5,999'	Tributary enters on right bank. The water temperature was 59 degrees Fahrenheit.
6,165'	Tributary enters on right bank. The water temperature was 57 degrees Fahrenheit.
6,574'	Electrofishing site #11.

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6,757'	Electrofishing site #12. Erosion site on right bank measures approximately 150' high x 250' long. It is contributing sediment and large woody debris to creek.
7,057'	The channel type changes from B2 to A2.
7,134'	Electrofishing site #13.
7,241'	Electrofishing site #14.
7,547'	Electrofishing site #15.
7,797'	Electrofishing site #16.
8,055'	Electrofishing site #17.
8,419'	Electrofishing site #18.
8,811'	Electrofishing site #19.
8,993'	The channel type changes from A2 to F2.
10,781'	Tributary enters on the left bank. The water temperature was 58 degrees Fahrenheit. Erosion site on the left bank measures 50' high x 50' long.
12,458'	Tributary enters on the left bank. The water temperature was 55 degrees Fahrenheit.
14,292'	The channel type changes from F2 to B3.
14,386'	Tributary enters on right bank. The water temperature was 58 degrees Fahrenheit.
16,088'	Tributary enters on right bank. The water temperature was 57 degrees Fahrenheit.
17,086'	Erosion site on the left bank measures approximately 80' high x 80' long.
17,369'	Erosion site on the right bank measures approximately 30' high x 40' long. It is contributing sediment to creek.
17,745'	Erosion site on the right bank measures approximately 60' high x 50' long.
18,415'	Tributary enters on the right bank. The water temperature was 59 degrees Fahrenheit.
19,053'	Erosion site on the left bank measures approximately 250' high x 150' long. It is contributing sediment and woody debris into creek.
19,225'	Tributary enters the stream. The water temperature was 56 degrees Fahrenheit.

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22,676' The channel type changes from B2 to A1.

24,143' Log debris accumulation (LDA) measures 15' high x 100' wide x 50' long.

24,262' End of survey due to possible barrier from LDA at 24,143'. The LDA causes the stream to go subsurface and has created a significant jump.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	