# STREAM INVENTORY REPORT

## West Fork Sproul Creek

## INTRODUCTION

A stream inventory was conducted during the summer of 2004 on West Fork Sproul Creek. The survey began at the confluence with Sproul Creek and extended upstream 5.04 miles. Stream inventories and reports were also completed for two unnamed tributaries to West Fork Sproul Creek.

The West Fork Sproul 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 West Fork Sproul 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 Chinook salmon, 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

West Fork Sproul Creek is a tributary to Sproul Creek, a tributary to South Fork Eel River, a tributary to Eel River, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). West Fork Sproul Creek legal description at the confluence with Sproul Creek is T5S R3E S5. Its location is 40°02'27.0" north latitude and 123°51'54.0" west longitude, LLID number 1238650400408 West Fork Sproul Creek is a second order stream and has approximately 8.82 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. West Fork Sproul Creek drains a watershed of approximately 8.5 square miles. Elevations range from about 540 feet at the mouth of the creek to 1,400 feet in the headwater areas. Redwood and mixed hardwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 101 to Sproul Creek Road.

## METHODS

The habitat inventory conducted in West Fork Sproul Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) 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 West Fork Sproul Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near 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 (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 (1990). 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". West Fork Sproul 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 West Fork Sproul 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 unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile 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 for prey. 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 West Fork Sproul 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 West Fork Sproul 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 hardwood 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 West Fork Sproul 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.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

## 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 West Fork Sproul Creek. In addition, 16 sites were electrofished using a Smith-Root Model 12 electrofisher and 7 sites were snorkel surveyed. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.9, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream

- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for West Fork Sproul Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

## HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of 7/28/2004 to 8/11/2004 was conducted by Lindsey Selvaggio and Corby Hines (CCC). The total length of the stream surveyed was 26,604 feet with an additional 383 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.38 cfs on 8/16/04.

West Fork Sproul Creek is a F4 channel type for 16,350 feet of the stream surveyed (Reach 1), a B1 channel type for 4,335 feet of the stream surveyed (Reach 2) and a B4 channel type for 5,919 feet of the stream surveyed (Reach 3).

F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B4 and B1 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios. B4 and B1 channels have gravel and boulder dominant substrates respectively.

Water temperatures taken during the survey period ranged from 58 to 68 degrees Fahrenheit. Air temperatures ranged from 58 to 81 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% flatwater units, 34% pool units, 23% riffle units and 2% dry units.

(Graph 1). Based on total length of Level II habitat types there were 53% flatwater units, 31% pool units, 14% riffle units and 1% dry units. (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 31% mid-channel pool units, 27% run units and 23% low gradient riffle units (Graph 3). Based on percent total length there were 28% mid-channel pool units, 27% run units and 26% step run units.

A total of 181 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 91%, and comprised 92% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. One-hundred thirteen of the 180 pools (63%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 180 pool tail-outs measured, 21 had a value of 1 (11.7%); 118 had a value of 2 (65.6%); 22 had a value of 3 (12.2%); 6 had a value of 4 (3.3%); 13 had a value of 5 (7.2%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

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 38, flatwater habitat types had a mean shelter rating of 44 and pool habitats had a mean shelter rating of 67 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 68, scour pools had a mean shelter rating of 51 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in West Fork Sproul Creek. Graph 7 describes the pool cover in West Fork Sproul Creek. Large woody debris is 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. Gravel was observed in 58% of pool tail-outs and small cobble was observed in 22% of the pool tail-outs.

The mean percent canopy density for the surveyed length of West Fork Sproul Creek was 95%. The mean percentages of hardwood and coniferous trees were 85% and 15%, respectively. Five percent of the canopy was open. Graph 9 describes the mean percent canopy in West Fork Sproul Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 81%. The mean percent left bank vegetated was 80%. The dominant elements composing the structure of the stream banks consisted of 48% sand/silt/clay, 30% cobble/gravel, 20% bedrock and 2% boulder. (Graph 10). Deciduous was the dominant vegetation type observed in 72.8% of the units surveyed. Additionally, 12.7% of the units surveyed had Coniferous as the dominant vegetation

type and 13.2% had brush as the dominant vegetation (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Sixteen sites were surveyed for species composition and distribution in West Fork Sproul Creek via electrofishing from August 18, 2004 to August 19, 2004, in addition seven sites were surveyed via underwater observation on September 22, 2004. Water temperatures taken during the electrofishing period 1240 to 1530 ranged from 62 to 66 degrees Fahrenheit. Air temperatures ranged from 72 to 87 degrees Fahrenheit. During underwater observations the water temperature was 50 degrees Fahrenheit. The sites were sampled by Leslie Merrick and Corby Hines (CCC), and Trevor Tollefson, Allan Renger, and Paul Divine (DFG).
In reach 1, which comprised the first 16,350 feet of stream, 10 sites were sampled. The reach sites yielded 89 young-of-the-year steelhead/rainbow trout (SH/RT), 28 age 1+ SH/RT, 51 young-of-the-year coho, and 2 ammocetes.

In reach 2, six sites were sampled starting approximately 16,350 from the confluence with Sproul Creek and continuing upstream 3,409 feet. The reach sites yielded 43 young-of-the-year SH/RT, 18 age 1+ SH/RT, 41 young-of-the-year coho, and 4 age 1+ coho.

In reach 3, seven sites were sampled starting approximately 24,718 from the confluence with Sproul Creek and continuing upstream 3,086 feet. The reach sites yielded 17 young-of-the-year SH/RT, and 11 young-of-the-year coho.

The following chart displays the information yielded from these sites:

2003 West Fork Sproul Creek Biological observations.

| Date | Site # | Hab. Unit # | Hab. Type | Approx Dist. from mouth (ft.) | Sample Method Electrofished (E)/ Underwater Observation (U) | SH/RT | | Coho | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | YOY | 1+ | YOY | 1+ |
| Reach 1 F4 Channel Type | | | | | | | | | |
| 08/18/04 | 1 | 007 | 4.2 | 385 | E | 20 | 1 | 4 | 0 |
| 08/18/04 | 2 | 012 | 4.2 | 635 | E | 9 | 5 | 0 | 0 |
| 08/18/04 | 3 | 021 | 4.2 | 1,236 | E | 12 | 3 | 0 | 0 |
| 08/18/04 | 4 | 148 | 5.6 | 8,941 | E | 10 | 5 | 3 | 0 |
| 08/18/04 | 5 | 151 | 4.2 | 9,107 | E | 5 | 4 | 8 | 0 |
| 08/18/04 | 6 | 159 | 4.2 | 9,684 | E | 0 | 2 | 7 | 0 |

## West Fork Sproul Creek

2003 West Fork Sproul Creek Biological observations.

| Date | Site # | Hab. Unit # | Hab. Type | Approx Dist. from mouth (ft.) | Sample Method Electrofished (E)/ Underwater Observation (U) | SH/RT | | Coho | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | YOY | 1+ | YOY | 1+ |
| 08/18/04 | 7 | 162 | 4.2 | 9,942 | E | 11 | 4 | 1 | 0 |
| 08/18/04 | 8 | 247 | 4.2 | 15,345 | E | 4 | 3 | 13 | 0 |
| 08/18/04 | 9 | 259 | 4.2 | 16,055 | E | 12 | 1 | 8 | 0 |
| 08/18/04 | 10 | 263 | 4.2 | 16,279 | E | 7 | 1 | 10 | 0 |
| Reach 2 B1 Channel Type | | | | | | | | | |
| 08/18/04 | 11 | 289 | 4.2 | 17,528 | E | 8 | 4 | 10 | 2 |
| 08/19/04 | 12 | 291 | 4.2 | 17,580 | E | 11 | 1 | 2 | 0 |
| 08/19/04 | 13 | 296 | 4.2 | 17,819 | E | 10 | 5 | 8 | 0 |
| 08/19/04 | 14 | 299 | 4.2 | 17,925 | E | 6 | 3 | 4 | 2 |
| 08/19/04 | 15 | 339 | 4.2 | 19,463 | E | 5 | 2 | 9 | 0 |
| 08/19/04 | 16 | 345 | 4.2 | 19,759 | E | 3 | 2 | 8 | 0 |
| Reach 3 B4 Channel Type | | | | | | | | | |
| 09/22/04 | 17 | 481 | 4.2 | 24,718 | U | 1 | 0 | 10 | 0 |
| 09/22/04 | 18 | 496 | 3.3 | 25,449 | U | 1 | 0 | 1 | 0 |
| 09/22/04 | 19 | 500 | 4.2 | 25,675 | U | 2 | 0 | 0 | 0 |
| 09/22/04 | 20 | 504 | 4.2 | 25,862 | U | 2 | 0 | 0 | 0 |
| 09/22/04 | 21 | 509 | 4.2 | 26,132 | U | 6 | 0 | 0 | 0 |
| 09/22/04 | 22 | 512 | 4.2 | 26,272 | U | 3 | 0 | 0 | 0 |
| 09/22/04 | 23 | Above End of Survey | 4.2 | 27,804 | U | 2 | 0 | 0 | 0 |

DISCUSSION

West Fork Sproul Creek is an F4 channel type for the first 16,350 feet of stream surveyed and a B1 channel type for the next 4,335 feet and a B4 channel type for the remaining 5,919 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders, fair for plunge weirs, single and opposing wing deflectors, channel constrictors, log cover, and poor for boulder clusters.

The suitability of B1 channel types for fish habitat improvement structures is as follows: excellent for bank-placed boulders, good for log covers, poor for plunge weirs, single and opposing wing deflectors, and boulder clusters. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing deflectors, and log cover.

The water temperatures recorded on the survey days 7/28/2004 to 8/11/2004, ranged from 58 to 68 degrees Fahrenheit. Air temperatures ranged from 58 to 81 degrees Fahrenheit. This water temperature is suitable for steelhead but nearing the threshold stress level for coho salmon. 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 53% of the total length of this survey, pools units 31%, riffles units 14%, and dry units 1%. The pools are relatively deep, with 113 of the 180 (63%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

One-hundred-thirty-nine of the 180 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-eight of the pool tail-outs had embeddedness ratings of 3 or 4. Thirteen of the pool tail-outs had a rating of 5, which is considered unsuitable 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. Sediment sources in West Fork Sproul Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One-hundred-forty-four of the 180 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 67. The shelter rating in the flatwater habitats was 44. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in West Fork Sproul Creek. Large woody debris is the

dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 95%. Reach 1 had a canopy density of 96%. Reach 2 had a canopy density of 98% and Reach 3 had a canopy density of 91%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 81% and 80%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

## RECOMMENDATIONS

1) West Fork Sproul Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are nearing the upper limits of the acceptable range 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) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

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

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) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

## 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.

**West Fork Sproul Creek**

| Position | Habitat Unit # | Comments |
|---|---|---|
| 0 | 0001.00 | Start of survey at confluence with Sproul Creek |
| 116 | 0004.00 | Downstream migrant trap pipe 15' into unit extending through next unit. |
| 385 | 0007.00 | Electrofishing reach 1, site 1. |
| 478 | 0010.00 | Left bank erosion 40' into unit, 40' long x 20' high x 5' deep. |
| 635 | 0012.00 | Electrofishing reach 1, site 2. |
| 715 | 0015.00 | Right bank erosion 40' into unit, 25' long x 40' high x 15' deep. |
| 1236 | 0021.00 | Electrofishing reach 1, site 3. |
| 2548 | 0046.00 | Left bank erosion, 40' long x 15' high x 5' deep. |
| 3179 | 0055.00 | Left bank tributary enters 55' into unit. Dry and not accessible to fish. |
| 4797 | 0081.00 | Left bank erosion 35' long x 25' high x 7' deep. |
| 5310 | 0089.00 | Right bank tributary enters 64' into unit. Dry and not accessible to fish. |
| 5546 | 0093.00 | Right bank erosion, 30' long x 18' high x 10' deep. |
| 5546 | 0093.00 | LDA 6' high x 28' wide x 19' long, composed of 5 pieces of large wood. Not a barrier. |
| 5686 | 0098.00 | Left bank erosion 35' into unit, 35' long x 25' high x 5' deep. |
| 6702 | 0114.00 | Access to road on left bank. |
| 6934 | 0121.00 | Massive railroad on right bank. |
| 7860 | 0136.00 | Left bank tributary enters 250' into unit. It is flowing but only contributes 1% to flow of West Fork Sproul. Creek. Temperature of West Fork Sproul is 60° F above and below, temperature of tributary is 61° F. |
| 8496 | 0143.00 | Access to road. |
| 8589 | 0144.00 | Right bank tributary #4 enters 7' into unit. It is not flowing and is not accessible to fish. at least 20' upstream. |
| 8911 | 0148.00 | Old bridge fallen across creek. |
| 8941 | 0148.00 | Electrofishing reach 1, site 4. |
| 9107 | 0151.00 | Electrofishing reach 1, site 5. |

**West Fork Sproul Creek**

| Position | Habitat Unit # | Comments |
|---|---|---|
| 9471 | 0158.00 | Left bank tributary enters 15' into unit. It is not flowing and is not accessible to fish. |
| 9684 | 0159.00 | Electrofishing reach 1, site 6. |
| 9684 | 0160.00 | Right bank tributary enters 34' into unit. |
| 9942 | 0162.00 | Electrofishing reach 1, site 7. |
| 9981 | 0164.00 | Left bank tributary enters 5' into unit. It is not flowing and is not accessible to fish. |
| 11630 | 0187.00 | Left bank erosion 115' into unit, 15' long x 40' high x 15' deep. |
| 12376 | 0198.00 | Left bank tributary #7 enters 50’ into the unit. The temperature of the tributary is 59°. Salmonids were observed until the 16' waterfall approximately 50' upstream which is a barrier to salmonids. |
| 13023 | 0213.00 | Log spanning channel. |
| 13996 | 0226.00 | LDA 8' high x 18' wide x 8' long, composed of 8 pieces of large wood. Not a barrier to salmonids. |
| 14113 | 0229.00 | Right bank tributary #8 contributing approx. 20% to flow of West Fork Sproul. The temperature of the tributary is 61° F. The temperature of West Fork Sproul upstream is 64° F and 62° F downstream. A stream inventory report was generated for this tributary. |
| 15345 | 0247.00 | Electrofishing reach 1, site 8. |
| 15468 | 0251.00 | Right bank landslide 40' into unit contributing massive amounts sediment, small and large woody debris, 55' long x 60' high x 60' deep. Retaining sediment 25' long x 15' wide x 2' deep. Approximately 340' of stream is affected by landslide. |
| 15468 | 0251.00 | LDA 10' high x 25' wide x 55' long composed of 15 pieces of large wood and a large amount of small woody debris. Not a barrier to salmonids. |
| 16055 | 0259.00 | Electrofishing reach 1, site 9. |
| 16279 | 0263.00 | Electrofishing reach 1, site 10. |
| 16860 | 0273.00 | Channel type change to a B1. |

**West Fork Sproul Creek**

| Position | Habitat Unit # | Comments |
|---|---|---|
| 17461 | 0287.00 | Bridge at bottom of unit, 12' long x 47' wide x 23' high. Start of spawner survey reach. |
| 17528 | 0289.00 | Electrofishing reach 2, site 11. |
| 17580 | 0291.00 | Electrofishing reach 2, site 12. |
| 17654 | 0293.00 | LDA, 7' high x 18' wide x 10' long composed of 6 pieces of large wood. Not a barrier to salmonids. |
| 17819 | 0296.00 | Electrofishing reach 2, site 13. |
| 17925 | 0299.00 | Electrofishing reach 2, site 14. |
| 18454 | 0313.00 | LDA, 8' high x 15' wide x 7' long, composed of 6 pieces of large wood. Not a barrier to salmonids. |
| 19334 | 0338.00 | Left bank tributary #9 enters 50' into unit contributing approximately 45% to the flow of West Fork Sproul. The temperature of West Fork Sproul upstream and downstream is 61° F. A stream inventory report was generated for this tributary. |
| 19334 | 0338.00 | Road on right bank. |
| 19463 | 0339.00 | Electrofishing reach 2, site 15. |
| 19463 | 0340.00 | Bridge 4' into unit, 20' long x 50' wide x 23' high. |
| 19759 | 0345.00 | Electrofishing reach 2, site 16. |
| 19821 | 0348.00 | LDA 7' high x 20' wide x 18' long composed of 9 pieces of large wood. Not a barrier to salmonids. |
| 19924 | 0351.00 | LDA 6' high x 20' wide x 20' long composed of 10 pieces of large wood. Not a barrier to salmonids. |
| 20141 | 0359.00 | Right bank tributary enters 100' into unit contributing approximately 10% to the flow of West Fork Sproul. Temperature of West Fork Sproul upstream and Downstream is 62° F. Temperature of tributary is 60° F. |
| 20602 | 0370.00 | Right bank erosion, 20' long x 10' high x 5' deep. |
| 20620 | 0371.00 | LDA 10' high x 20' wide x 15' long, composed of 10 pieces of large wood. Not a barrier to salmonids. |

**West Fork Sproul Creek**

| Position | Habitat Unit # | Comments |
|---|---|---|
| 20660 | 0372.00 | Small trees spanning channel. |
| 20685 | 0373.00 | Channel type change to a B4. |
| 21316 | 0385.00 | LDA 7' high x 15' wide x 30' long composed of 8 pieces of large wood. Not a barrier to salmonids. |
| 21677 | 0394.00 | Left bank erosion at top of unit, 80' long x 35' high x 7' deep. |
| 22126 | 0406.00 | LDA 7' high x 18' wide x 22' long composed of 8 pieces of large wood. Not a barrier to salmonids. |
| 22509 | 0418.00 | LDA 10' high x 20' wide x 63' long composed of 16 pieces of large wood. Not a barrier to salmonids. |
| 22590 | 0422.00 | Stream becoming narrow and overgrown. |
| 22922 | 0433.00 | LDA 7' high x 28' wide x 32' long composed of 10 pieces of large wood. Not a barrier to salmonids. |
| 22952 | 0434.00 | Right bank erosion 18' long x 15' high x 7' deep. |
| 23193 | 0441.00 | Right bank erosion 27' into unit, 33' long x 25' high x 8' deep. Trees fallen from landslide spanning channel. |
| 23241 | 0443.00 | Rust- colored algae observed. |
| 23390 | 0447.00 | Left bank tributary enters at bottom of unit. It is dry and not accessible to fish. |
| 23434 | 0448.00 | LDA 5' high x 36' wide x 21' long composed of 12 pieces of large wood. Not a barrier to salmonids. |
| 23679 | 0454.00 | LDA 4' high x 18' wide x 24' long composed of 9 pieces of large wood. Not a barrier to salmonids. |
| 23944 | 0462.00 | Right bank erosion 12' long x 20' high x 6' deep. |
| 23944 | 0462.00 | LDA 8' high x 36' wide x 10' long composed of 6 pieces of large wood. Not a barrier to salmonids. |
| 24097 | 0467.00 | LDA 6' high x 12' wide x 42' long composed of 17 pieces of large wood. Not a barrier to salmonids. |
| 24483 | 0475.00 | Access to the road. |

**West Fork Sproul Creek**

| Position | Habitat Unit # | Comments |
|---|---|---|
| 24718 | 0481.00 | Underwater observation, reach 3, site 17. |
| 24744 | 0483.00 | LDA 4' high x 20' wide x 23' long composed of 6 pieces of large wood. Not a barrier to salmonids. |
| 24948 | 0490.00 | LDA 6' high x 23' wide x 20' long composed of 10 pieces of large wood. Not a barrier to salmonids. |
| 24988 | 0491.00 | Right bank tributary enters 100' into unit contributing approximatley 40% to the flow of West Fork Sproul. The temperature of West Fork Sproul upstream is 63° F, and downstream 62° F. The temperature of tributary is 61° F. No fish were observed. |
| 25449 | 0496.00 | Underwater observation, reach 3, site 18. |
| 25449 | 0497.00 | LDA 6' high x 30' wide x 4' long composed of 6 pieces of large wood. Not a barrier to salmonids. |
| 25675 | 0500.00 | Underwater observation, reach 3, site 19. |
| 25675 | 0501.00 | Right bank erosion 46' long x 29' high x 11' deep contributing sediment. |
| 25862 | 0504.00 | Underwater observation, reach 3, site 20. |
| 25862 | 0505.00 | LDA 9' high x 18' wide x 25' long composed of 14 pieces of large wood. Not a barrier to salmonids. |
| 25937 | 0506.00 | Two fish observed from the bank one steelhead and one coho salmon. |
| 26132 | 0509.00 | Underwater observation, reach 3, site 21. |
| 26272 | 0512.00 | Underwater observation, reach 3, site 22. |
| 26291 | 0514.00 | LDA 7' high x 20' wide x 36' long composed of 4 pieces of large wood. Not a barrier to salmonids. |
| 26333 | 0515.00 | Spring enters left bank 25' into unit, with very little water. Temperature upstream of spring is 61° F. |
| 26443 | 0518.00 | LDA 6' high x 6' wide x 32' long, composed of four 3' diameter pieces of large wood. Not a barrier to salmonids. |
| 26548 | 0519.00 | Fish observed. |
| 26572 | 0520.00 | Although a steelhead/rainbow trout was observed in the previous unit, |

| Position | Habitat Unit # | Comments |
|---|---|---|
| | | the number of salmonids was significantly decreased by each LDA. The last coho salmon recorded was at 25,937'. |
| 26604 | 0520.00 | End of survey after 32' due to access constraints. Stream became impassible due to wall of brush in stream, as well as on the banks. There was very little water left in the stream which was mostly full of algae. |

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] | |