STREAM INVENTORY REPORT

West Fork Sproul Creek Unnamed Left Bank Tributary

INTRODUCTION

A stream inventory was conducted during August 2004 on an unnamed left bank tributary to West Fork Sproul Creek. The survey began at the confluence with West Fork Sproul Creek and extended upstream 1.5 miles.

The unnamed left bank tributary 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 unnamed left bank tributary. 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

Unnamed left bank tributary is a tributary to West Fork Sproul Creek, 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). Unnamed left bank tributary's legal description at the confluence with West Fork Sproul Creek is T5S R2E S00. Its location is 40°02'59.0" north latitude and 123°54'27.0" west longitude, LLID number 1239074400497. Unnamed left bank tributary is a first order stream and has approximately 0.95 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Unnamed left bank tributary drains a watershed of approximately 1.49 square miles. Elevations range from about 756 feet at the mouth of the creek to 1,630 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 unnamed left bank tributary 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. All pools except step-pools are fully sampled.

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 unnamed left bank tributary 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". Unnamed left bank

tributary 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 unnamed left bank tributary, 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 unnamed left bank tributary, 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 unnamed left bank tributary, 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 unnamed left bank tributary, 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 unnamed left bank tributary. In addition, underwater observations were made at 5 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual.*

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.10, 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 unnamed left bank tributary 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 8/16/2004 to 8/17/2004 was conducted by Lindsay Selvaggio and Corby Hines (CCC). The total length of the stream surveyed was 8,115 feet with an additional 39 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.09 cfs on 08/16/2004.

Unnamed left bank tributary is a F4 channel type for the entire 8,115 feet of the stream surveyed (Reach 1). F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 60 to 62 degrees Fahrenheit. Air temperatures ranged from 64 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 15% riffle units, 36% pool units, 39% flatwater units and 10% dry units (Graph 1). Based on total length of Level II habitat types there were 8% riffle units, 17% pool units, 71% flatwater units and 3% dry units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by

percent occurrence were 34% mid-channel pool units, 29% step run units and 15% low gradient riffle units (Graph 3). Based on percent total length there were 66% step run units, 16% mid-channel pool units and 8% low gradient riffle units.

A total of 57 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 96%, and comprised 97% 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. Thirty-two of the 57 pools (56%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 57 pool tail-outs measured, 4 had a value of 1 (7%); 40 had a value of 2 (70.2%); 10 had a value of 3 (17.5%); 1 had a value of 4 (1.8%); 2 had a value of 5 (3.5%) (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 17, flatwater habitat types had a mean shelter rating of 27, and pool habitats had a mean shelter rating of 75 (Table 1). Of the pool types, the scour pools had a mean shelter rating of 20, main channel pools had a mean shelter rating of 77 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover types in unnamed left bank tributary. Graph 7 describes the pool cover in unnamed left bank tributary. Small woody debris is the dominant pool cover type followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. A gravel substrate type was observed in 40% of pool tail-outs, and large cobble was observed in 28% of pool tail-outs.

The mean percent canopy density for the surveyed length of unnamed left bank tributary was 98%. Two percent of the canopy was open (Graph 9). Of the mean percent canopy the mean percentages of hardwood and coniferous trees were 74% and 26%, respectively.

For the stream reach surveyed, the mean percent right bank vegetated was 83%. The mean percent left bank vegetated was 85%. The dominant elements composing the structure of the stream banks consisted of 13% bedrock, 12% cobble/gravel and 75% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 41% of the units surveyed. Additionally, 34% of the units surveyed had brush as the dominant vegetation type, and 23% had coniferous trees as the dominant vegetation (Graph 11).

West Fork Sproul Creek Unnamed Left Bank Tributary

BIOLOGICAL INVENTORY RESULTS

Five sites were electrofished for species composition and distribution in unnamed left bank tributary on August 16, 2004. Water temperatures taken during the electrofishing period 1400 to 1615 were 54 degrees Fahrenheit. Air temperature was 55 degrees Fahrenheit. The sites were sampled by Corby Hines (CCC) and Trevor Tollefson (DFG).

In reach 1, which comprised the entire 8,115 feet of stream, 5 sites were sampled. The reach sites yielded 10 young-of-the-year steelhead/rainbow trout (SH/RT), 92 young-of-the-year coho.

The following chart displays the information yielded from these sites:

2003 unnamed left bank tributary dive observations.

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 1 F4 Channel Type									
09/22/04	1	006	4.2	157	17	0	0	0	0
09/22/04	2	025	4.2	1042	23	0	3	0	0
09/22/04	3	027	4.2	1130	18	0	2	0	0
09/22/04	4	042	4.2	1933	13	0	0	0	0
09/22/04	5	069	4.2	3575	21	0	5	0	0

DISCUSSION

Unnamed left bank tributary is a F4 channel type for the entire 8,115 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: It is good for bank placed boulders, fair for plunge weirs, single and opposing wing deflectors, channel constrictors, and log cover, and it is poor for boulder clusters.

The water temperatures recorded on the survey days 8/16/2004 to 8/17/2004, ranged from 60 to 62 degrees Fahrenheit. Air temperatures ranged from 64 to 76 degrees Fahrenheit. This is a good water temperature for juvenile 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 71% of the total length of this survey, riffles 8%, and pools 17%. The pools are relatively deep, with 32 of the 57 (56%) 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 conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Forty-four of the 57 pool tail-outs measured had embeddedness ratings of 1 or 2. Eleven of the pool tail-outs had embeddedness ratings of 3 or 4. Two 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 unnamed left bank tributary should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty-eight of the 57 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 75. The shelter rating in the flatwater habitats was 27. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in unnamed left bank tributary. Small woody debris is the dominant cover type in pools followed by large 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 98%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 83% and 85%, 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) Unnamed left bank tributary should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within 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 small woody debris. 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.

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 (feet)	Habitat unit #	Comments:
0	0001.00	Start at confluence with West Fork Sproul. Channel type is a F4.
157	0006.00	Underwater observation site #1.
641	0021.00	Log debris accumulation (LDA) #1 10' long x 10' wide x 5' high, containing 4 pieces of large wood. Not a barrier to fish passage.
1042	0025.00	LDA #2 35' long x 23' wide x 12' high, containing 13 pieces of large wood. Not a barrier to fish passage.
1042	0025.00	Underwater observation site #2.
1130	0027.00	Underwater observation site #3.
1809	0040.00	Left bank erosion 25' long x 35' high x 15' wide.
1933	0042.00	Underwater observation site #4.
2221	0049.00	LDA #3 53' into habitat unit, 19' long x 27' wide x 5' high, composed of 6 pieces large wood. Not a barrier to fish passage.
2584	0055.00	Channel type recorded.

West Fork Sproul Creek Unnamed Left Bank Tributary

Position (feet)	Habitat unit #	Comments:
3044	0056.00	Half pipe culvert on right bank.
3301	0062.00	Left bank tributary #1 emerges 36' into habitat unit. It was not flowing, it is accessible to fish 20' up the tributary, and had a 9% slope using the clinometer. No fish were observed.
3369	0064.00	LDA #4 10' long x 38’ wide x 7’ high, composed of 7 pieces of large wood. Sediment retention two feet high. There were fish seen above the LDA.
3409	0066.00	Log stringer bridge, 46' into habitat unit 13’ long x 40' wide x 5' high.
3575	0069.00	Underwater observation site #5.
3600	0070.00	LDA #5 25' long x 15' wide x 6' high, composed of 6 pieces large wood. Sediment retention two feet high. Fish were seen above the LDA.
3917	0077.00	Salmonids observed the last 10 units.
4286	0087.00	Eight foot diameter tree fallen from the right bank to the left bank, 256' into the habitat unit.
4687	0093.00	LDA #6 27' long x 25' wide x 8' high, containing 6 pieces of large wood. Not a barrier to salmonids.
4833	0094.00	Right bank erosion causing a tree and a large amount of sediment to fall into the stream.
4885	0096.00	Large amount of large wood on right bank.
5106	0099.00	Right bank landslide 40’ long x 40' high x 20' deep, contributing sediment and a large number of trees.
5131	0100.00	Sediment retained instream 15' wide x 30' long x 3’ deep. Sediment retained for 70' upstream of landslide.
5523	0107.00	Left bank tributary enters 120' into habitat unit. It is not flowing, not accessible to fish, and has a 7% slope measured with the clinometer. No fish were observed.

West Fork Sproul Creek Unnamed Left Bank Tributary

Position (feet)	Habitat unit #	Comments:
5523	0107.00	Right bank erosion causing tree and sediment to fall into stream 15' long x 9' high x 5' deep.
5714	0108.00	LDA #7 8' long x 8' wide x 5' high, composed of 4 pieces large wood. Not a barrier to salmonids.
6125	0119.00	LDA #8 12' long x 10' wide x 6' high, containing 7 pieces of large wood. Possible barrier to salmonids.
6403	0126.00	Water plunges over a 5' diameter log.
6810	0134.00	LDA #9 40' long x 18' wide x 6' high, containing 6 pieces large wood. Possible barrier to salmonids.
6985	0136.00	Several salmonids observed in pool.
7583	0148.00	Right bank tributary #3 enters 13' into habitat unit.
7932	0151.00	Stream is extremely clogged with large and small woody debris.
7932	0151.00	Seven foot diameter log in channel.
7932	0151.00	LDA #10 7' high x 19' wide x 8' long, containing 4 pieces large wood. Sediment retention two feet deep. There were no fish seen above the LDA and it is a possible barrier to salmonids.
8095	0157.00	No salmonids observed since Habitat Unit #136 at 6,985'.
8115	0157.00	End of survey due to multiple subsurface units, a decreasing amount of water, and LDA #10 at 7,932.

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.

West Fork Sproul Creek Unnamed Left Bank Tributary

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]	