STREAM INVENTORY REPORT

UNNAMED TRIBUTARY TO THE SOUTH FORK EEL RIVER (WOOD CREEK)

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on an unnamed tributary to the South Fork Eel River, locally known as Wood Creek. The inventory was conducted in two parts: habitat inventory and biological inventory. The survey began at the confluence with the South Fork Eel River and extended upstream 0.8 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Wood 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

Wood Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Humboldt County, California (Map 1). Wood Creek′s legal description at the confluence with South Fork Eel River is T04S R03E S02. Its location is 40°08'30" north latitude and 123°48'41" west longitude. Wood Creek is a first order stream and has approximately 2.0 miles of blue line stream according to the USGS Miranda 7.5 minute quadrangle. Wood Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 260 feet at the mouth of the creek to 590 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via Highway 101 to Redwood Drive.

METHODS

The habitat inventory conducted in Wood Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). 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, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further 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 Wood 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 standard flow measuring equipment, if available. In some cases flows are estimated.

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.

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:

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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". Wood 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Wood 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 particle size, having a bedrock tail-out, 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 Wood 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 Wood 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 Wood 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Wood Creek fish presence was observed from the stream banks, and 17 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

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Graphics are produced from the tables using Quattro Pro. Graphics developed for Wood 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 the pool tail outs
- Mean Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of September 9th and 10th, 2002, was conducted by Hillary Kleeb and Laura Ward (WSP/AmeriCorps). The total length of the stream surveyed was 4,404 feet.

Stream flow was not measured on Wood Creek.

Wood Creek is an F4 channel type for the first 2,683 feet of stream reach surveyed and a B1 channel types for the remaining 1,721 feet. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B1 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently-spaced pools, stable plans and profiles, stable banks, and bedrock dominated channel.

Water temperatures taken during the survey period ranged from 57° to 62° Fahrenheit. Air temperatures ranged from 66° to 82° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 26% riffle units, 37% flatwater units, and 33% pool units (Graph 1). Based on total length of Level II habitat types there were 19% riffle units, 50% flatwater units, and 26% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were runs, 36%; mid-channel pools, 29%; and low gradient

riffles, 19% (Graph 3). Based on percent total length, runs made up 48%, mid-channel pools 22%, and low gradient riffles 14%.

A total of 33 pools were identified (Table 3). Main channel pools were most frequently encountered at 91% and comprised 92% 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. Nine of the 33 pools (27%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 32 pool tail-outs measured, nine had a value of 1 (28.1%); ten had a value of 2 (31.3%); six had a value of 3 (18.8%); two had a value of 4 (6.3%) and five had a value of 5 (15.6%) (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 15, flatwater habitat types had a mean shelter rating of 16, and pool habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the backwater pool-log formed had the highest mean shelter rating at 60. Backwater pools had a mean shelter rating of 60 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Wood Creek followed by boulders. Graph 7 describes the pool cover in Wood Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 14 of the 32 pool tail outs measured (43.75%). Small cobble was the next most frequently observed dominant substrate type and occurred in 34.4% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 85%. The mean percentages of deciduous and coniferous trees were 54% and 46%, respectively. Graph 9 describes the canopy in Wood Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 62.6%. The mean percent left bank vegetated was 61.2%. The dominant elements composing the structure of the stream banks consisted of 54.3% bedrock, 3.2% boulder, 21.3% cobble/gravel, and 21.3% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 38.3% of the units surveyed. Additionally, 35.11% of the units surveyed had coniferous trees as the dominant vegetation type, and 11.7% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Seventeen sites were electrofished for species composition and distribution in Wood Creek on October 24, 2002. Water temperature was 54° Fahrenheit during the electrofishing period. Air temperatures ranged from 56° to 64° degrees Fahrenheit. The sites were sampled by Trevor Tollefson (DFG), Ryan Wells, Kevin Lucey, and Lindsay Selvaggio (CCC).

The first site sampled included habitat unit 013, a mid-channel pool approximately 518 feet from the confluence with South Fork Eel River. The site yielded three young of the year steelhead.

The second site sampled included habitat unit 019, a mid-channel pool located approximately 757 feet above the creek mouth. The site yielded two young of the year steelhead.

The third site sampled included habitat unit 023, a corner pool located approximately 1,000 feet above the creek mouth. The site yielded two young of the year steelhead.

The fourth site sampled included habitat unit 027, a mid-channel pool located approximately 1,193 feet above the creek mouth. The site yielded three young of the year
steelhead.

The fifth site sampled included habitat unit 033, a mid-channel pool located approximately 1,449 feet above the creek mouth. The site yielded five young of the year steelhead.

The sixth site sampled included habitat unit 043, a mid-channel pool located approximately 1,820 feet above the creek mouth. The site yielded no fish and one Pacific giant salmander.

The seventh site sampled included habitat unit 049, a mid-channel pool located approximately 2,088 feet above the creek mouth. The site yielded one age two plus steelhead.

The eighth site sampled included habitat unit 052, a run located approximately 2,157 feet above the creek mouth. The site yielded one young of the year steelhead.

The ninth site sampled included habitat unit 056, a mid-channel pool located approximately 2,332 feet above the creek mouth. The site yielded three young of the

year steelhead.

The tenth site sampled included habitat unit 058, a mid-channel pool located approximately 2,576 feet above the creek mouth. The site yielded two young of the year steelhead and one Pacific giant salamander.

The eleventh site sampled included habitat unit 060, a mid-channel pool located approximately 2,624 feet above the creek mouth. The site yielded three young of the year steelhead and one age two plus steelhead.

The twelfth site sampled included habitat unit 070, a step pool located approximately 3,079 feet above the creek mouth. The site yielded one age two plus steelhead.

The thirteenth site sampled included habitat unit 079, a mid-channel pool located approximately 3,639 feet above the creek mouth. The site yielded no fish.

The fourteenth site sampled included habitat unit 081, a backwater pool located approximately 3,668 feet above the creek mouth. The site yielded no fish.

The fifteenth site sampled included habitat unit 090, a mid-channel pool located approximately 4,028 feet above the creek mouth. The site yielded no fish.

The sixteenth site sampled included habitat unit 096, a mid-channel pool located approximately 4,180 feet above the creek mouth. The site yielded no fish.

The seventeenth site sampled included habitat unit 099, a mid-channel pool located approximately 4,336 feet above the creek mouth. The site yielded no fish.

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 0+	1+	2+
10/24/02	1	518	0013	4.2	1	F4	3	0	0
10/24/02	2	757	019	4.2	1	F4	2	0	0
10/24/02	3	1,000	023	5.1	1	F4	2	0	0

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Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead 0+	1+	2+
10/24/02	4	1,193	027	4.2	1	F4	3	0	0
10/24/02	5	1,449	033	4.2	1	F4	5	0	0
10/24/02	6	1,820	043	4.2	1	F4	0	0	0
10/24/02	7	2,088	049	4.2	1	F4	0	0	1
10/24/02	8	2,157	052	3.3	1	F4	1	0	0
10/24/02	9	2,332	056	4.2	1	F4	3	0	0
10/24/02	10	2,576	058	4.2	1	F4	2	0	0
10/24/02	11	2,624	060	4.2	2	B1	3	0	1
10/24/02	12	3,079	070	4.4	2	B1	0	0	1
10/24/02	13	3,639	079	4.2	2	B1	0	0	0
10/24/02	14	3,668	081	6.1	2	B1	0	0	0
10/24/02	15	4,028	090	4.2	2	B1	0	0	0
10/24/02	16	4,180	096	4.2	2	B1	0	0	0
10/24/02	**17**	**4,336**	**099**	**4.2**	**2**	**B1**	**0**	**0**	**0**

DISCUSSION

Wood Creek is an F4 channel type for the first 2,624 feet of stream surveyed and a B1 for the remaining 1,780 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, and log cover; 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 cover; poor for plunge weirs, single and opposing wing-deflectors, and boulder clusters.

The water temperatures recorded on the survey days September 9th and 10th, 2002, ranged from 57° to 62° Fahrenheit. Air temperatures ranged from 66° to 82°

Fahrenheit. This is an acceptable water temperature range 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 50% of the total length of this survey, riffles 19%, and pools 26%. The pools are relatively shallow, with only nine of the 33 (27%) pools having a maximum 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 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.

Nine of the 32 pool tail-outs measured had an embeddedness rating of 1. Eight of the pool tail-outs had embeddedness ratings of 3 or 4. Five of the pool tail-outs had a rating of 5 or were 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. In Wood Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-five of the 32 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 12. The shelter rating in the flatwater habitats was 16. 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 all habitat types. Additionally, boulders contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve 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 85%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 62.6% and 61.2%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

Wood Creek

1) Wood Creek 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 is from small woody debris. Adding high quality complexity with woody cover 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.

0' Begin survey at confluence with South Fork Eel River. Channel type is F4.

29' Log debris accumulation (LDA) of 8 pieces: 4' high x 11' wide x 6' long. Stored sediment 2' deep.

81' Out of influence of South Fork Eel River.

518' Electrofishing site #1.

757' Electrofishing site #2.

1,000' Electrofishing site #3.

1,193' Electrofishing site #4.

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1,215' LDA of 4 pieces: 4' high x 12' wide x 15' long; no stored sediment.

1,449' Electrofishing site #5.

1,820' Electrofishing site #6.

2,088' Electrofishing site #7.

2,157' Electrofishing site #8.

2,332' Electrofishing site #9

2,576' Electrofishing site #10.

2,624' Right bank erosion, 25' long. Electrofishing site #11.

2,998' Left bank erosion, 23' long.
3,079' Electrofishing site #12.

3,410' LDA of 15-20 pieces: 25' high x 30' wide x 25' long. Stored sediment 25' deep. There are no visible gaps, but water flows through. Possible barrier to salmonids.

3,639' Electrofishing site #13.

3,668' Electrofishing site #14.

4,028' LDA of 7 pieces: 7' high x 16' wide x 9' long. Stored sediment 2' deep. Electrofishing site #15.

4,180' Electrofishing site #15.

4,336' Electrofishing site #16.

4,404' End of survey due to unsafe survey conditions.

REFERENCES

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

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5