

# STREAM INVENTORY REPORT

## Julias Creek

### INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Julias Creek and on one of its unnamed tributaries. The 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 Julias Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on Julias Creek.

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

Julias Creek is tributary to South Fork Usal Creek, tributary to Usal Creek, located in Mendocino County, California (Figure 1). Julias Creek's legal description at the confluence with South Fork Usal Creek is T23N R18W. Its location is 39°50'07" north latitude and 123°48'22" west longitude. Julias Creek is a first order stream and has approximately 1.1 miles of blue line stream according to the USGS Hales Grove 7.5 minute quadrangle. Julias Creek drains a watershed of approximately 2.8 square miles. Summer base runoff is approximately 0.8 cubic feet per second (cfs) at the mouth. Elevations range from about 155 feet at the mouth of the creek to 1800 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via private road.

### METHODS

The habitat inventory conducted in Julias Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors and 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). Julias Creek personnel were trained in May, 1995, by Gary Flosi. This inventory was conducted by a two-person team.

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### SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1994). 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. 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 Julias 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:

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". Julias 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

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all features on the sampling form (*Sampling Levels for Fish Habitat Inventory*, Hopelain, 1995). 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 Julias 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), 76 - 100% (value 4). Additionally, a rating of "not suitable" (NS) 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 Julias 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.

### 8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Julias 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 Julias Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) of both the right and left banks for each fully-described

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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 Julias Creek fish presence was observed from the stream banks, and one site was electrofished using one 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 Lotus 1,2,3. Graphics developed for Julias 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
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

### HABITAT INVENTORY RESULTS

The following results and discussion are for mainstem Julias Creek. Results and discussion for Unnamed Julias Creek Tributary follow the main body of this report as a subsection.

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The habitat inventory of July 17-19, 1995, was conducted by Heidi Hicketier (WSP/AmeriCorps) and Don Hicketier (CCC). The total length of the stream surveyed was 7,196 feet with an additional 304 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.78 cfs on August 1, 1995.

Julias Creek is an F4 channel type for the entire 7,196 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures ranged from 58 to 60 degrees Fahrenheit. Air temperatures ranged from 62 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 39% pool units, 32% riffle units, and 28% flatwater units (Graph 1). Based on total **length** of Level II habitat types there were 40% flatwater units, 32% riffle units, and 27% pool units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low-gradient riffles, 32%; mid-channel pools, 22%; and step runs, 16% (Graph 3). Based on percent total **length**, low-gradient riffles made up 30%, step runs 29%, and mid-channel pools 17%.

A total of 123 pools were identified (Table 3). Main channel pools were most frequently encountered at 59% and comprised 62% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Twenty-seven of the 123 pools (22%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 97 pool tail-outs measured, 5 had a value of 1 (5%); 22 had a value of 2 (23%); 38 had a value of 3 (39%); and 32 had a value of 4 (33%) (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. Pool habitat types had a mean shelter rating of 36, and riffle habitats had a mean shelter rating of 17 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 90. Main channel pools had a mean shelter rating of 37 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Julias Creek. Graph 7 describes the pool cover in Julias Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 8 of the 11 low-gradient riffles measured (73%). Small cobble was the next most frequently observed dominant substrate type and occurred in 27% of the low-gradient riffles

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(Graph 8).

The mean percent canopy density for the stream reach surveyed was 98%. The mean percentages of deciduous and coniferous trees were 58% and 42%, respectively. Graph 9 describes the canopy in Julias Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 76%. The mean percent left bank vegetated was 72%. The dominant elements composing the structure of the stream banks consisted of 9% bedrock, 2% boulder, 44% cobble/gravel, and 44% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 81% of the units surveyed. Additionally, 6% of the units surveyed had deciduous trees as the dominant vegetation type, and 8% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

One site was electrofished on August 1, 1995, in Julias Creek. The site was sampled by Craig Mesman (CCC) and Kyle Young (WSP/AmeriCorps).

The site sampled included habitat units 192-202, a series of pools, runs, and riffles approximately 4,237 feet from the confluence with South Fork Usal Creek. This site had a length of 285 feet. The site yielded twenty-four 0+ steelhead, five 1+ steelhead, and one Pacific giant salamander.

## DISCUSSION

Julias Creek is an F4 channel type for the entire 7,196 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters.

The water temperatures recorded on the survey days July 17-19, 1995, ranged from 58 to 60 degrees Fahrenheit. Air temperatures ranged from 62 to 72 degrees Fahrenheit. This is a good 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 40% of the total **length** of this survey, riffles 32%, and pools 27%. The pools are relatively shallow, with only 27 of the 123 (22%) 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 for locations where their installation will not conflict with the modification of the numerous log debris accumulations

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(LDA's) in the stream. The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use.

Seventy of the 97 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 5 had a 1 rating. 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 Julias Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 36. The shelter rating in the flatwater habitats was lower at 14. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large woody debris in all habitat types. Additionally, small woody debris and 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.

All of the 11 low-gradient riffles measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 98%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 76% and 72%, 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.

Young-of-the-year salmonids were observed through habitat unit 276, just downstream from the slide and LDA at 6,566 feet.

## **RECOMMENDATIONS**

- 1) Julias 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) 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.

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- 4) 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.
- 5) Increase woody cover in the pools and flatwater habitat units. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.
- 6) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 6,566', should then be treated to reduce the amount of fine sediments entering the stream.
- 7) There are several log debris accumulations present on Julias Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

### PROBLEM SITES 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:

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0'	Begin survey at confluence with South Fork Usal Creek. Channel type is F4.
395'	Right bank tributary. Estimated flow <0.2 cfs.
1132'	LDA 8' high x 20' wide x 16' long retaining sediment. 5.5' plunge.
1400'	Left bank tributary. Estimated flow <0.3 cfs. Not accessible to fish (NAF).
891'	Left bank tributary. Estimated flow <0.2 cfs. NAF.
2356'	LDA 8' high x 50' wide x 15' long retaining some sediment.
3175'	Right bank tributary. Estimated flow <0.3 cfs. Culvert 60' up tributary.
3444'	Old bridge 26' long x 4' clearance.
3724'	Left bank tributary. Estimated flow <0.3 cfs. NAF.
4003'	LDA 5' high x 20' wide x 15' long. No gravel retained.

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- 4499' LDA 8' high x 25' wide x 15' long retaining sediment. Not a barrier.
- 5017' Unnamed Julias Creek Tributary enters right bank (see subsection).
- 5149' Four foot plunge over boulders and large wood retaining sediment 4' deep.
- 5300' LDA 5' high x 20' wide x 3' long retaining sediment 5' deep at base. Possible barrier.
- 5427' LDA 6' high x 30' wide x 5' long retaining sediment 5.5' deep at base. 3' plunge. Possible barrier.
- 5555' Series of step pools with jumps up to 6'.
- 5919' LDA 4' high x 15' wide x 15' long. Not a barrier.
- 6493' Left bank seep.
- 6566' Slide 45' high x 80' long contributing gravel and sand.
- 6596' LDA 6' high x 30' wide x 20' long retaining gravel 6' deep at base. Possible barrier.
- 6628' Left bank seep.
- 6648' LDA 5' high x 10' wide x 5' long retaining gravel 4.5' deep at base. Possible barrier.
- 6712' LDA 7' high x 20' wide x 20' long causing 5' plunge.
- 6714' Left bank erosion 80' high x 150' long contributing gravel, boulders, and debris.
- 6755' Left bank seep.
- 6821' LDA 6' high x 15' wide x 5' long retaining gravel and sand 6' deep at base. Scattered LDA's averaging 4' high for next 80 feet.
- 6925' Right bank tributary.
- 6986' LDA 4' high x 20' wide x 6' long retaining sediment 4' deep at base.
- 7013' Left bank tributary. NAF.
- 7143' Left bank tributary. Estimated flow <0.02 cfs.
- 7196' Fourteen foot diameter boulder blocking channel and creating waterfall. End of

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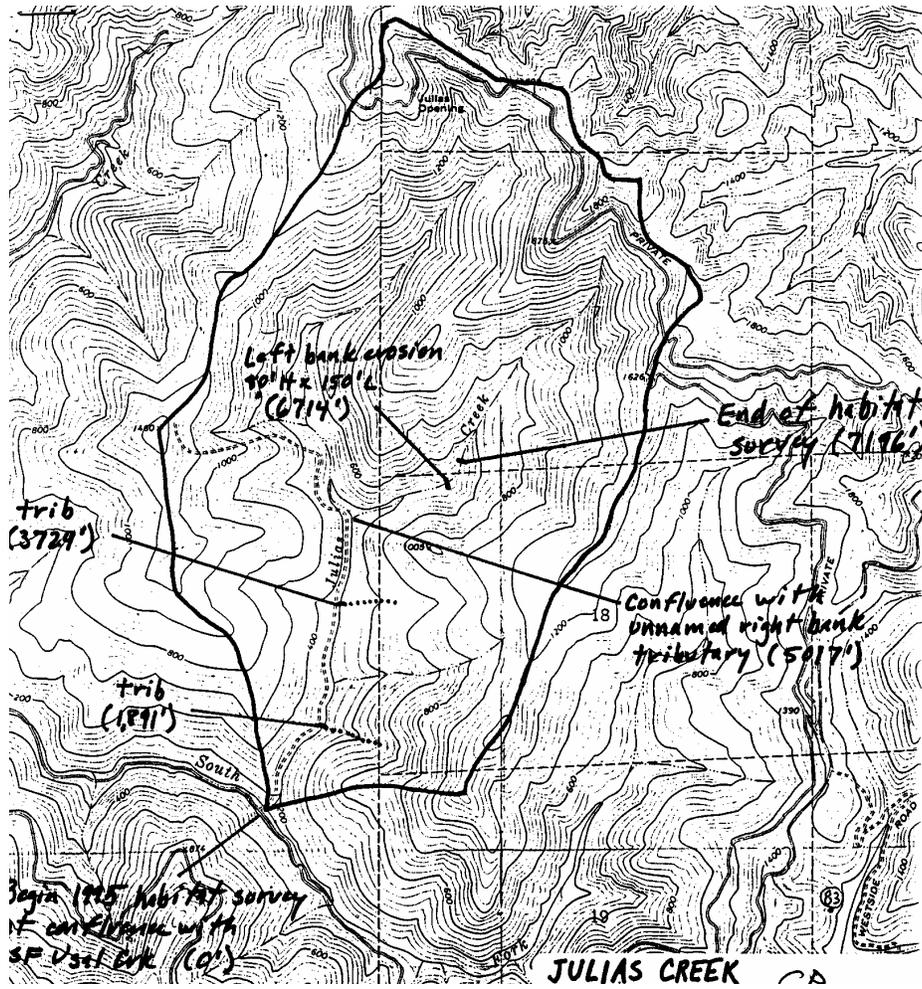
survey.

### REFERENCES

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

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### STREAM INVENTORY REPORT

#### Unnamed Tributary to Julias Creek

#### WATERSHED OVERVIEW

The unnamed tributary is a tributary to Julias Creek, a tributary to South Fork Usal Creek, located in Mendocino County, California (Figure 1). The unnamed tributary's legal description at the confluence with Julias Creek is T23N R18W. Its location is 39°50'57" north latitude and 123°48'04" west longitude. The unnamed tributary is an intermittent stream according to the USGS Hales Grove 7.5 minute quadrangle. The unnamed tributary drains a watershed of approximately 1.0 square miles. Summer base runoff is approximately 0.5 cubic feet per second (cfs) at the mouth. Elevations range from about 355 feet at the mouth of the creek to 1800 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via private road.

#### HABITAT INVENTORY RESULTS AND DISCUSSION

The habitat inventory of July 19 and 20, 1995, was conducted by Heidi Hickethier (WSP/AmeriCorps) and Don Hickethier (CCC). The total length of the stream surveyed was 3,629 feet with an additional 109 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.46 cfs on August 1, 1995.

The unnamed tributary is a B4 channel type for the entire 3,629 feet of stream surveyed. 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; and good for medium-stage plunge weirs.

The water temperature recorded on the survey days July 19 and 20, 1995, was 58 degrees Fahrenheit. Air temperatures ranged from 64 to 68 degrees Fahrenheit. This is a good water temperature for salmonids, but water temperature data for the warm summer months are lacking. For a more complete and accurate water temperature profile, 24-hour temperatures would need to be monitored throughout the warm summer months.

Based on the total **length** of this survey, Level II habitat units consisted of 35% riffle units, 34% flatwater units, and 31% pool units. The pools are relatively shallow, with only 13 of the 72 pools having a maximum depth greater than 2 feet.

Twenty-one of the 59 pool tail-outs measured had embeddedness ratings of 3 or 4. Fourteen had a 1 rating. Cobble embeddedness of 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In the unnamed tributary, sediment sources should be mapped and rated according to their potential sediment yields, and control measures

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should be taken.

The mean shelter rating for pools was moderate with a rating of 46. The shelter rating in the flatwater habitats was 26. A pool shelter rating of approximately 100 is desirable. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat.

All of the three low-gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 96%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 81% and 80%, 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.

Young-of-the-year salmonids were observed through habitat unit 116, approximately 2,633 feet above the confluence with Julias Creek.

### **BIOLOGICAL INVENTORY RESULTS**

One site was electrofished on August 1, 1995, in the unnamed tributary. The unit was sampled by Craig Mesman (CCC) and Kyle Young (WSP/AmeriCorps).

The site sampled included habitat units 16-23, a series of pools, runs, and riffles 337 feet from the confluence with Julias Creek. This site had an approximate length of 154 feet. The site yielded seventeen 0+ steelhead, nine 1+ steelhead, and two Pacific giant salamanders.

### **RECOMMENDATIONS**

- 1) Unnamed Julias Creek Tributary should be managed as an anadromous, natural production stream.
- 2) The limited water temperature available suggest that the 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.

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- 4) Increase woody cover in the pools and flatwater habitat units. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.
- 5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 1,950', 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.
- 7) There are several log debris accumulations present on Unnamed Julias Creek Tributary that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

### PROBLEM SITES 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'	Begin survey at confluence with Julias Creek. Channel type is B4.
491'	LDA 14' high x 40' wide x 15' long retaining sediment 6' deep at base. Passable.
680'	Plunge over 3' diameter embedded log.
786'	LDA 5' high x 10' wide x 15' long. No sediment retention.
897'	Right bank tributary. Estimated flow <0.3 cfs. Accessible to fish.
1554'	LDA 10' high x 40' wide x 20' long retaining sediment 4' deep at base. Not a barrier.
1812'	LDA 7' high x 8' wide x 10' long retaining sediment 6' deep at base.
1821'	LDA 10' high x 30' wide x 50' long causing series of step runs and pools.
1950'	Right bank failure 40' high x 70' long contributing gravel and debris.
2110'	LDA 12' high x 30' wide x 100' long retaining gravel.

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- 3192' LDA 6' high x 20' wide x 5' long retaining sediment 3' deep at base.
- 3328' LDA 70' high x 10' wide x 250' long. Stream steps through accumulation.
- 3447' Boulder roughs with steps 4' to 7' high.
- 3629' End of survey due to continued increased gradient.

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### LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
<b>RIFFLE</b>		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
<b>CASCADE</b>		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
<b>FLATWATER</b>		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
<b>MAIN CHANNEL POOLS</b>		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
<b>SCOUR POOLS</b>		
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
<b>BACKWATER POOLS</b>		
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

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