STREAM INVENTORY REPORT

WALDRON CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Waldron Creek. The survey began at the confluence with Hollow Tree Creek and extended upstream 1.4 miles.

The Waldron 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 Waldron 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

Waldron Creek is a tributary to Hollow Tree Creek, a tributary to the South Fork Eel River, located in Mendocino County, California (Map 1). Waldron Creek's legal description at the confluence with Hollow Tree Creek is T22N R17W S14. Its location is 39°45′22.45″ north latitude and 123°43′26.81″ west longitude. Waldron Creek is a first order stream and has approximately 2.4 miles of blue line stream according to the USGS Leggett 7.5 minute quadrangle. Waldron Creek drains a watershed of approximately 3.2 square miles. Elevations range from about 1,388 feet at the mouth of the creek to 1,800 feet in the headwater areas. Mixed hardwood/conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via a locked gate located at Hales Grove off Highway 1 West.

METHODS

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

SAMPLING STRATEGY

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

HABITAT INVENTORY COMPONENTS

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

1. Flow:

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

2. Channel Type:

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

3. Temperatures:

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

Waldron Creek

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". Waldron 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 Waldron 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, bedrock, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Waldron 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 Waldron 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 Waldron Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

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

DATA ANALYSIS

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

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types

- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

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

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

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 5 - 7, 2002, was conducted by Toni Russell and Janelle Breton (WSP). The total length of the stream surveyed was 7,621 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.015 cfs on August 7, 2002.

Waldron Creek is a G1 channel type for the first 672 feet of the stream surveyed, an F4 channel type for the next 6,399 feet, and an F3 for the remaining 550 feet of stream surveyed. G1 channels are entrenched with low width/depth ratios on moderate gradients with boulder-dominant substrates. F4 and F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant and cobble substrates, respectively.

Water temperatures taken during the survey period ranged from 53° to 58° Fahrenheit. Air temperatures ranged from 64° to 70° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 30% riffle units, 26% flatwater units, and 42% pool units (Graph 1). Based on total **length** of Level II habitat types there were 23% riffle

units, 28% flatwater units, and 45% pool units (Graph 2).
Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 39%; runs, 25%; and low gradient riffles, 24% (Graph 3). Based on percent total **length**, mid-channel pools made up 39%, runs 25%, and low gradient riffles 15%.

A total of 101 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 96%, and comprised 98% 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. Fifty-eight of the 101 pools (57.4%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 98 pool tail-outs measured, 38 had a value of 1 (38.8%); 36 had a value of 2 (36.8%); 12 had a value of 3 (12.2%); 2 had a value of 4 (2.0%); and 10 had a value of 5 (10.2%) (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 25, flatwater habitat types had a mean shelter rating of 14, and pool habitats had a mean shelter rating of 46 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 46. Scour pools had a mean shelter rating of 43 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Waldron Creek. Graph 7 describes the pool cover in Waldron 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 the dominant substrate observed in 72.4% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 13.3%.

The mean percent canopy density for the surveyed length of Waldron Creek was 83%. The mean percentages of deciduous and coniferous trees were 32% and 68%, respectively. Graph 9 describes the mean percent canopy in Waldron Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 75.2%.

Waldron Creek

The mean percent left bank vegetated was 72.3%. The dominant elements composing the structure of the stream banks consisted of 17.8% bedrock, 0.8% boulder, 25.6% cobble/gravel, and 56.2% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 51.7% of the units surveyed. Additionally, 44.2% of the units surveyed had coniferous trees as the dominant vegetation, 2.9% had brush as the dominant vegetation and 1.7% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished for species composition and distribution in Waldron Creek on October 21 and 22, 2002. Water temperatures taken during the electrofishing period ranged from 44° to 52° Fahrenheit. Air temperatures ranged from 39° to 58° Fahrenheit. The sites were sampled by Chris Ramsey (DFG), Bob Pagliuco and Lindsay Selvaggio (WSP).

The first site sampled was habitat unit 0003, a mid-channel pool located approximately 242 feet from the confluence with Hollow Tree Creek. The site yielded 17 young-of-the-year coho.

The second site sampled was habitat unit 007, a mid-channel pool located approximately 390 feet above the creek mouth. The site yielded one young-of-the-year steelhead and one young-of-the-year coho.

The third site sampled was habitat unit 010, a mid-channel pool located approximately 612 feet above the creek mouth. The site yielded three young-of-the-year coho and one age two plus steelhead.

The fourth site sampled was habitat unit 191, a mid-channel pool located approximately 6,172 feet from the creek mouth. The site yielded one age one plus steelhead and one age two plus steelhead.

The following chart displays the information yielded from these sites:

Waldron Creek

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	SH Coho 1+ yoy	SH 2+	
10/21/02	1	242	0003	4.2	1	G1	0	0	17
10/21/02	2	390	007	4.2	1	G1	1	0	1
10/22/02	3	612	010	4.2	1	G1	1	0	3
10/22/03	4	6,172	191	4.2	2	F4	1	1	0

DISCUSSION

Waldron Creek is a G1 channel type for the first 672 feet of stream surveyed, an F4 channel type for the next 6,399 feet, and an F3 for the remaining 550. The suitability of G1 channel types for fish habitat improvement structures is as follows: fair for log cover; poor for boulder clusters. The suitability of F4 channel types 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 F3 channel types is as follows: good for bank-placed boulders, and single and opposing wing-deflectors; fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days August 5 -7, 2002 ranged from 53° to 58° Fahrenheit. Air temperatures ranged from 64° to 70° 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 28% of the total **length** of this survey, riffles 23%, and pools 45%. The pools are relatively deep, with 58 of the 101 (57.4%) 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.

Seventy-four of the 98 pool tail-outs measured had embeddedness ratings of 1 or 2. Fourteen of the pool tail-outs had embeddedness ratings of 3 or 4. Ten 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 Waldron Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.
Eighty-four of the 98 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 46. The shelter rating in the flatwater habitats was 14. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in almost all habitat types. Additionally, small woody debris contribute a large amount. 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 83%. Reach 1 had a canopy density of 94%, while Reaches 2 and 3 had canopy densities of 82% and 85%, respectively. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 75.2% and 72.3%, 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

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

4) 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.

5) 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.

0' Begin survey at confluence with Hollow Tree Creek. Channel type is G1.

170' Log debris accumulation (LDA) of 2 pieces, 5' high x 9' wide x 25' long.

242' Out of influence of Hollow Tree Creek. LDA of 7 pieces, 7' high x 10' wide x 20' long. Stored sediment 9' wide x 6' long x 4' deep. Left bank erosion contributing sediment, 10' long x 30' high. Electrofishing site #1.

390' Bridge crosses 20' above Waldron Creek and is 22' wide x 32' long.

415' Juvenile salmonids observed.

612' Location of channel type cross-section. Electrofishing site #2.

672' Channel type changes from G1 to F4

707' LDA of 5 pieces, 6' high x 18' wide x 12' long. Stored sediment 5' wide x 5' long x 1' deep.

813' LDA, 1.5' high x 8' wide x 2' long. Stored sediment 7' wide x 4' long x 1.5 ' deep.

1,738' LDA of 3 pieces, 4' high x 12' wide x 7' long. Stored large sediment 5' wide x 5' long x 2' deep.

Waldron Creek

2,374' Juvenile salmonids observed.

2,691' LDA of 2 pieces, 4' high x 16' wide x 18' long.

2,974' LDA of 6 pieces, 6' high x 15' wide x 19' long. Stored sediment 15' wide x 15' long x 6' deep.

3,536' LDA of 4 pieces, 6' high x 18' wide x 15' long. Stored sediment 6' wide x 6' long x 5' deep.

4,816' LDA of 4 pieces, 6' high x 7' wide x 30' long. Stored gravel sediment 5' wide x 6' long x 3' deep.

5,156' Left bank erosion contributing sediment, 40' long x 12' high.

5,252' Tributary enters on right bank. Dry at the time of the survey.

5,886' LDA of 5 pieces, 5' high x 15' wide x12' long. Stored sediment 5' wide x 5' long x 3' deep.

5,956' LDA of 10 pieces, 6' high x 14' wide x 18' long. Stored sediment 12' wide x 8' long x 4' deep.

6,054' LDA of 2 pieces, 3' high x 11' wide x 4' long. Stored sediment 4' wide x 4' long x 1' deep.

6,131' LDA of 6 pieces, 6' high x 20' wide x 8' long. Stored sediment 15' wide x 10' long x 2' deep.

6,172 Electrofishing site #4.

6,200' Old culvert enters creek where road runoff has bypassed culvert. Washed out road above creek.

6,334' LDA, 6' high x 20' wide x 8' long. Stored sediment 15' wide x 4' long x 1' deep.

6,532' Left bank erosion, 30' long x 12' high.

6,633' Juvenile salmonids observed.

Waldron Creek

6,714' Left bank erosion, 25' long x 7' high.

6,950' LDA of 2 pieces, 5' high x 10' wide x 6' long. Stored sediment 6' wide x 4' long x 2' deep.

6,979' LDA of 4 pieces, 4' high x 15' wide x 45' long. Stored sediment 9' wide x 9' long x 4' deep. Possible barrier to juvenile salmonids.

7,071' Left bank erosion contributing sediment, 50' long x 12' high.

7,141' Channel type changes from F4 to F3. Left bank erosion contributing sediment, 60' long x 20' high.

7,203' LDA of 4 pieces, 7' high x 30' wide x 25' deep. Stored sediment 17' wide x 13' long x 3' deep.

7,621' LDA of 5 pieces, 10' high x 18' wide x 12' long. Stored sediment 15' wide x 40' long x 6' deep. There are visible gaps but water does not flow through the LDA. Possible barrier to salmonids. End of survey due to lack of fish observed.

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]				