STREAM INVENTORY REPORT

Williams Creek

INTRODUCTION

A stream inventory was conducted from 6/2/2003 to 6/16/2003 on Williams Creek. The survey began at the Grizzly Bluff Road Bridge and extended upstream 4.1 miles. The Williams 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 Williams 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

Williams Creek is historically a tributary to the Salt River, a tributary to the Eel River, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Williams Creek's legal description at the confluence with Salt River is T02N R02W S01. Its location is 40°35'21.0" north latitude and 124°14'16.0" west longitude. Williams Creek is a second order stream and has approximately 8.3 miles of blue line stream according to the USGS Ferndale 7.5 minute quadrangle. Williams Creek drains a watershed of approximately 6.8 square miles. Elevations range from about 30 feet at the mouth of the creek to 750 feet in the headwater areas. Grass, mixed hardwood and Redwood/Douglas Fir forest dominate the watershed. The watershed is entirely privately owned and is managed for rangeland and timber production. Vehicle access exists via Grizzly Bluff Road.

METHODS

The habitat inventory conducted in Williams 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. 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 Williams Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

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

3. Temperatures:

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

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Williams 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 Williams 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 such as log sills, bedrock, boulders 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 Williams 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 Williams Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Williams Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the

elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

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

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Williams Creek. In addition, eleven 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 Stream Habitat 1.0.35, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission, 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 Williams Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length

Williams Creek

- 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 6/2/2003 to 6/16/2003, was conducted by Elizabeth Pope and Hillary Kleeb (WSP). The total length of the stream surveyed was 21,881 feet.

Stream flow was measured near the bottom of the survey reach 40 feet below the Williams Creek Road Bridge, with a Marsh-McBirney Model 2000 flowmeter at 2.53 cfs on 6/2/2003.

Williams Creek is a G4 channel type for the first 2,011 feet of the stream surveyed, an F4 channel type for the next 17,607 feet of the stream surveyed and an A1 channel type for the remaining 2,263 feet of the stream surveyed. G4 channels are entrenched "gully" step-pool channels on moderate gradients with low width /depth ratios and gravel dominant substrates. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A1 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and a very stable bedrock channel.

Water temperatures taken during the survey period ranged from 54 to 66 degrees Fahrenheit. Air temperatures ranged from 54 to 71 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% flatwater units, 33% riffle units, 30% pool units. Based on total length of Level II habitat types there were, 43% flatwater units, 33% pool units, 23% riffle units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were: 35% run units, 30% low gradient riffle units and 29% mid-channel pool units (Graph 3). Based on percent total length; run units made up 43%, mid-channel pool units 31% and low gradient riffle units 20%.

A total of 125 pools were identified (Table 3). Main channel pools were the most frequently encountered at 96%, and comprised 95% 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. Eighty-seven of the 125 pools (70%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 125 pool tail-outs measured, 17 had a value of 1 (13.5%); 13 had a value of 2 (10.3%); 24 had a value of 3 (19.8%); 70 had a value of 4 (55.6%); 1 had a value of 5 (0.8%); (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. A value of 5 is assigned when the substrate is considered unsuited for spawning.

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 5, flatwater habitat types had a mean shelter rating of 31, and pool habitats had a mean shelter rating of 34 (Table 1). Of the pool types, scour pools had the highest mean shelter rating at 57. Main channel and backwater pools had a mean shelter rating of 33 and 23, respectively (Table 3).

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

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 67% of pool tail-outs, small cobble observed in 13% of pool tail-outs and large cobble observed in 7% of pool tail-outs.

The mean percent canopy density for the surveyed length of Williams Creek was 63%. The mean percentages of hardwood and coniferous trees were 97% and 3%, respectively. Five percent of the units measured were open. Graph 9 describes the mean percent canopy in Williams Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 55%. The mean percent left bank vegetated was 54%. The dominant elements composing the structure of the stream banks consisted of 86% of sand/silt/clay and 10% of bedrock (Graph 10). Hardwood trees were the dominant vegetation type observed in 47% of the units surveyed. Additionally, 0.3% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Eleven sites were electrofished for species composition and distribution in Williams Creek on August 20, 2003. Water temperatures taken during the electrofishing period (0940-1500) ranged from 62 to 67 degrees Fahrenheit. Air temperatures ranged from 60 to 71 degrees Fahrenheit. The sites were sampled by C. Hines, L. Merrick and E. Pope (WSP) and T. Tollefson (DFG).

The biological survey started at the Grizzly Bluff Road Bridge and extended upstream 12,797' where a lack of flow ended the survey. Eleven sites were sampled yielding a total of 84 Sacramento pike minnow and four threespine stickleback. Sacramento pikeminnow were found throughout the reach. No salmonids were captured or observed.

DISCUSSION

Williams Creek is a G4 channel type for the first 2,011 feet of the stream surveyed, an F4 channel type for the next 17,607 feet of the stream surveyed and an A1 channel type for the remaining 2,263 feet of the stream surveyed. The suitability of G4, F4 and A1 channel types for fish habitat improvement structures is as follows: G4 good for bank-placed boulders, fair for plunge weirs; opposing wing deflectors and log cover, poor for boulder clusters; single wing deflectors. F4 good for bank-placed boulders, fair for plunge weirs; single and opposing wing-deflectors; channel constrictors; log cover, poor for boulders. A1 channel types are generally not suitable high energy streams with stable stream banks and poor gravel retention capabilities.

The water temperatures recorded on the survey days 6/2/2003 to 6/16/2003, ranged from 54 to 66 degrees Fahrenheit. Air temperatures ranged from 54 to 71 degrees Fahrenheit.

Flatwater habitat types comprised 43% of the total length of this survey, riffles 24%, and pools 33%. The pools are relatively deep, with 87 of the 125 (70%) 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's width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Thirty of the 125 pool tail-outs measured had embeddedness ratings of 1 or 2. Ninety-four of the pool tail-outs had embeddedness ratings of 3 or 4. One 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 Williams Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Ninety-nine of the 125 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 34. The shelter rating in the flatwater habitats was 31. 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 Williams Creek. 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 63%. Reach 1 had a canopy density of 78%, Reach 2 had a canopy density of 60%, and Reach 3 had a canopy density of 65%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 55% and 54%, 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) Williams Creek should be managed as a restorable, anadromous, natural production stream.

2) Conduct a habitat survey of Williams Creek between its current confluence with Perry Slough and Grizzly Bluff Road.

3) The limited water temperature data available suggest that maximum temperatures are suitable 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.

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.

6) Increase the canopy on Williams Creek by planting native species such as willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

7) 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.

8) 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.

COMMENTS AND LANDMARKS

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of survey at Grizzly Bluff Road Bridge.
102	0003.00	Electrofishing site at a mid-channel pool, 13 Sacramento pikeminnow captured.
190	0005.00	Electrofishing site at a mid-channel pool, 17 Sacramento pikeminnow captured.
271	0007.00	Electrofishing site at a mid-channel pool, 2 Sacramento pikeminnow captured.
471	0009.00	Electrofishing site at a mid-channel pool, 2 Sacramento pikeminnow captured.
641	0011.00	Electrofishing site at a mid-channel pool, 15 Sacramento pikeminnow captured.
1045	0018.00	Log debris accumulation (LDA), 35' long x 20' wide x 6' high, composed of 4 pieces of large woody debris. LDA is retaining sediment 12' long x 10' wide x 1' high.
1144	0021.00	Spring enters from left bank.
1942	0032.00	Electrofishing site at a mid-channel pool, 1 Sacramento pikeminnow and 1 threespine stickleback captured.
1988	0033.00	Channel Type change to F4.
2557	0040.00	LDA, 25' long x 25' wide x 12' high, composed of 10 visible pieces of large woody debris. LDA is not retaining sediment.
2697	0041.00	Electrofishing site at a mid-channel pool, 7 Sacramento pikeminnow captured.
2911	0043.00	Unnamed spring.

Williams Creek

Position (ft.)	Habitat Unit #	Comments:
2911	0043.00	Electrofishing site at a mid-channel pool, 6 Sacramento pikeminnow and 1 threespine stickleback captured.
3388	0051.00	Electrofishing site at a mid-channel pool, 4 Sacramento pikeminnow captured.
3913	0059.00	Right bank failure, 50' long x 10' wide x 12' high.
3944	0060.00	LDA, 12' long x 20' wide x 10' high, composed of 5 pieces of large wood, passes water through visible gaps, but is retaining sediment.
4975	0076.00	Unnamed spring enters from left bank.
6647	0107.00	Unnamed spring enters from left bank.
7130	0117.00	Unnamed spring enters from right bank.
7433	0124.00	Steel railroad bridge 30' long x 10' wide x 6' high. GPS point N 40.5586 W 124.24029.
8072	0135.00	Unnamed spring enters from left bank.
8336	0139.00	Unnamed spring enters from right bank
12331	0214.00	Plastic drainage pipe on left bank, 2' high x 3’ wide, with a plunge height of 3'. Pipe and rock armor are in good condition.
12702	0221.00	Williams Creek county road bridge crossing.
12702	0221.00	Electrofishing site at a mid-channel pool, 4 Sacramento pikeminnow captured.
12797	0224.00	Electrofishing site at a mid-channel pool, 13 Sacramento pikeminnow captured.
15406	0278.00	Metal drainage pipe on right bank 2' high x 3' wide with a plunge height of 8'. Pipe bottom is rusted out, leaking and causing erosion.
15941	0291.00	Private bridge 25' long x 10' wide x 15' high.

Williams Creek

Position (ft.)	Habitat Unit #	Comments:
17076	0311.00	LDA on right bank 20' long x 20' high x 15' wide.
17750	0325.00	Unnamed spring enters from left bank.
17924	0327.00	Right bank failure, 20' long x 12' wide x 30' high.
18820	0345.00	Steve's Creek enters from right bank with approx 5% of downstream flow. LDA at confluence, 35' long x 25' wide x 20' high. Possible fish passage barrier. Walked approximately 500' upstream and no fish were observed.
18917	0347.00	Bridge (Humboldt crossing) 20' long x 15' wide x 10' high provides access to both Steve's Creek and Williams Creek.
19024	0349.00	LDA, 10' long x 20' wide x 6' high with 3 pieces of large wood, passes water but is retaining sediment, 6' high.
19618	0361.00	Channel type change to A1.
19953	0370.00	Unnamed spring enters from left bank.
21364	0403.00	Unnamed spring enters.
21522	0404.00	LDA with a three foot cascade, retaining 3-4' of sediment.
21583	0406.00	Left and right bank failures. Start of LDA which continues over 200 feet.
21881	0412.00	End of survey due to a 7' bedrock cascade, a possible fish passage barrier.

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.

Williams Creek

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]	