STREAM INVENTORY REPORT

West Side Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on West Side Creek and an unnamed tributary to West Side Creek. 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 West Side 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 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

West Side Creek is a tributary to Bear River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Figure 1). West Side Creek's legal description at the confluence with Bear River is T01N R02W S23. Its location is 40.4508 degrees north latitude and 124.2536 degrees west longitude. West Side Creek is a third order stream and has approximately 5.5 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. West Side Creek drains a watershed of approximately 5.3 square miles. Elevations range from about 280 feet at the mouth of the creek to 1,240 feet in the headwater areas. Grassland dominates the watershed. The watershed is entirely privately owned and is managed for rangeland.

METHODS

The habitat inventory conducted in West Side 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 the AmeriCorps Watershed Stewards Project (WSP\AmeriCorps) Members who 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 (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 West Side 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. Additionally, a recording thermograph was deployed in West Side Creek from June 16 to October 17, 1996 to record temperatures on a 24 hour basis during warm summer months.

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". West Side 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 (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 West Side 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 not suitable 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 West Side 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 densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In West Side Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the end of approximately every third unit in addition to every fully-described unit, giving approximately a 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 West Side 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 West Side Creek fish presence was observed from the stream banks, and one site 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 West Side 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 habitat inventory of July 31 through August 2, 1996 was conducted by Bill Malinowski (WSP\AmeriCorps) and Craig Mesman (CCC). The total length of the stream surveyed was 10,163 feet with an additional 635 feet of side channel.

West Side Creek

Flow was measured 6,415' upstream from the confluence with Bear River, with a Marsh-McBirney Model 2000 flowmeter, at 0.02 cfs on August 30, 1996.

West Side Creek is a B3 channel type for the entire 10,163 feet of stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels, with infrequently spaced pools, very stable plan and profile, stable banks, and a cobble channel.

Water temperatures taken during the survey period ranged from 57 to 79 degrees Fahrenheit. Air temperatures ranged from 52 to 75 degrees Fahrenheit. Additionally, a recording thermograph was deployed in West Side Creek from June 16 to October 17, 1996. Temperatures ranged from 47 to 77 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 47% pool units, 43% flatwater units, and 5% riffle units (Graph 1). Based on total length of Level II habitat types there were 71% flatwater units, 23% pool units, and 2% riffle units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step runs, 43%; mid-channel pools, 39%; and low gradient riffles, 5% (Graph 3). Based on percent total length, step runs made up 71%, mid-channel pools 18%, and low gradient riffles 2%.

A total of eighty-two pools were identified (Table 3). Main channel pools were most frequently encountered at 85% and comprised 82% 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. Four of the 82 pools (5%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 82 pool tail-outs measured, 46 had a value of 1 (56%); 31 had a value of 2 (38%); two had a value of 3 (2%); and 3 had a value of 5 (4%); (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 20, flatwater habitats had a mean shelter rating of 33 and pool habitats had a mean shelter rating of 13 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 14. Main channel pools had a mean shelter rating of 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in West Side Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in West Side Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in the one low gradient riffle measured (Graph 8). Of the eight step runs measured, two (25%) had small cobble as the dominant substrate and six (75%) had boulders as

the dominant substrate.

The mean percent canopy density for the stream reach surveyed was 43%. The mean percentages of deciduous and coniferous trees were 73% and 27%, respectively. Graph 9 describes the canopy in West Side Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 48%. The mean percent left bank vegetated was 46%. The dominant elements composing the structure of the stream banks consisted of 52% boulders, 27% cobble/gravel, 15% bedrock, and 6% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 27% of the units surveyed and 17% had deciduous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on August 30, 1996 in West Side Creek. The site was sampled by Bill Malinowski and Craig Mesman.

The site sampled was Habitat Unit #005, a mid-channel pool approximately 462 feet from the confluence with Bear River. This site had an area of 1,616 square feet and a volume of 14,544 cubic feet. The site yielded thirty-seven steelhead/rainbow trout, seven stickleback, one yellow-legged frog, one tadpole and one Pacific giant salamander.

DISCUSSION

West Side Creek is a B3 channel type for the entire 10,163 feet of stream surveyed. The suitability of B3 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 temperatures recorded on the survey days July 31 through August 2, 1996 ranged from 57 to 79 degrees Fahrenheit. Air temperatures ranged from 52 to 75 degrees Fahrenheit. Temperatures from the recording thermograph that was deployed in West Side Creek from June 16 to October 17, 1996 ranged from 47 to 77 degrees Fahrenheit. This is above the acceptable water temperature range for salmonids. Sixty-nine degrees Fahrenheit, if sustained, is near the threshold stress level for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 71% of the total length of this survey, riffles 2%, and pools 23%. The pools are relatively shallow, with only four of the 82 pools having a maximum depth greater than three feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three 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.

Five of the 82 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Forty-six had embeddedness ratings of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was low with a rating of 13. The shelter rating in the flatwater habitats was slightly higher at 33. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and divide territorial units to reduce density related competition.

The low gradient riffle measured had small cobble as the dominant substrate. Of the eight step runs measured, two had small cobble (2.5" to 5") as the dominant substrate and six had boulders (> 10") as the dominant substrate. Gravel and small cobble are the preferred substrate for spawning steelhead and coho salmon. Projects should be designed to trap and sort suitable spawning substrate in West Side Creek.

The mean percent canopy density for the stream was 43%. This is a relatively low 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 moderate at 48% and 46%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) West Side Creek should be managed as an anadromous, natural production stream.

2) The water temperature data available suggest that maximum temperatures are above 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 boulders. 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.

6) Increase the canopy on West Side Creek by planting 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 effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

7) There are sections of the creek where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

8) Suitable spawning substrate on West Side Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel in order to expand redd site distribution in the stream.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Comments:
0'	Start of survey at confluence with Bear River. Channel type is a B3.
382'	Thermograph placement site.
1,016'	Right bank tributary.
2,501'	Left bank erosion site measures 500' long x 80' wide.
3,268'	Wire fence crosses stream. Dry tributary enters from the right bank.
3,340'	Right bank erosion site measures 20' high and is contributing "blue goo" to the channel.
3,647'	Right bank erosion site measures 20’ high and is contributing “blue goo” to the channel.
3,696'	Right bank erosion site measures 15" high and is contributing "blue goo" to the channel.

West Side Creek

4,135' Left bank erosion site measures 150' long x 100' high.

4,227' Right bank erosion site measures 180' long and is contributing "blue goo" to the channel.

5,301' Right bank erosion site measures 25' high and is contributing "blue goo" to the channel.

5,539' Left bank erosion site measures 85' long x 30' high.

5,216' Dry right bank tributary.

5,420' Left bank tributary.

5,530' Right bank erosion site measures 100' long x 20' high and is contributing “blue goo” to the channel. Dry left bank tributary.

6,030' Right bank erosion site measures 100' long x 20' high and is contributing "blue goo" to the channel.

6,191' Power line crosses stream.

6,319' Old road crossing used by cows, old barbed wire fence crosses stream.

6,415' Left bank tributary approximately half the flow of West Side Creek (see subsection report).

9,210' Right bank, old road to Green Pond.

10,163' End of survey. A number of small diameter trees have fallen across the channel catching small woody debris and creating a dam. This dam is creating a 9' high plunge and is backing up substrate to a depth of 9'. The 9' high plunge is through a tangle of small woody debris. The surveyors walked at least a 1,000' of stream above and have observed only one large steelhead. The young-of-the-year steelhead in West Side Creek end right at the base of this debris accumulation. Beyond this the channel above becomes narrow and only offers marginal habitat.

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.

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