STREAM INVENTORY REPORT

Unnamed Tributary to Howe Creek (Crystal Creek)

INTRODUCTION

A stream habitat inventory was conducted during the summer of 2002 on an unnamed tributary to Howe Creek. This creek locally named and hereafter referred to as Crystal Creek. The survey began at the confluence with Howe Creek and extended upstream 0.49 miles.

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

Crystal Creek is tributary to Howe Creek, which is tributary to the Eel River, located in Humboldt County, California (Map 1). Crystal Creek's legal description at the confluence with Howe Creek is T1N R1W S10. Its location is 40E29N2.79O north latitude and 124E10N11.20O west longitude. Crystal Creek is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS Scotia 7.5 minute quadrangle. Crystal Creek drains a watershed of approximately 1.9 square miles. Elevations range from about 231 feet at the mouth of the creek to 1,509 feet in the headwater areas. Mixed hardwood/mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production/rangeland. Vehicle access exists via Howe Creek Road.

METHODS

The habitat inventory conducted in Crystal Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and AmeriCorps Watershed Stewards Project Members (WSP) 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 Crystal 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 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 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". Crystal 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 hip chain, modified spherical densitometer, 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 Crystal 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 Crystal 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 sand/silt/clay sized particles to cobble/gravel 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 a modified handheld spherical densiometer as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Crystal Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the upstream end 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 Crystal 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.

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 Crystal 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

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- 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 June 25 and 26, 2002, was conducted by Laura Ward (WSP) and Matt Davis (CCC). The total length of the stream surveyed was 2,600 feet.

Stream flow was not measured on Crystal Creek.

Crystal Creek is a G4 channel type for the entire 2,600 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.

Water temperatures taken during the survey period ranged from 58 to 74 degrees Fahrenheit. Air temperatures ranged from 60 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 48% riffle units, 48% flatwater units, 2% pool units, and 1% culvert units (Graph 1). Based on total length of Level II habitat types there were 74% riffle units, 25% flatwater units, 1% pool units, and 1% culvert units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were runs, 45%; low gradient riffles, 43%; and high gradient riffles, 5% (Graph 3). Based on percent total length, low gradient riffles made up 70%, runs 20%, and step-runs 4%.

A total of 2 pools were identified (Table 3). Mid-channel pools were the only pools encountered and therefore comprised 100% 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. Neither of the 2 pools (0%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 2 pool tail-outs measured, both had a value of 2 (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate, while a value of 5 indicates substrate unsuitable for spawning.

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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 11, flatwater habitat types had a mean shelter rating of 11, and the one pool habitat unit for which a shelter rating was calculated had a value of 40 (Table 1).

Table 5 summarizes mean percent cover by habitat type. Boulders and undercut banks are the dominant cover types in Crystal Creek. Large and small woody debris are lacking in all habitat types. Graph 7 describes the pool cover in Crystal Creek. Undercut banks account for most of the cover in pools.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Sand/silt/clay was the dominant substrate in one of the pool tail-outs.

The mean percent canopy density for the surveyed length of Crystal Creek was 77%. The mean percentages of deciduous and coniferous trees were 90% and 10%, respectively. Graph 9 describes the mean percent canopy in Crystal Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85.4%. The mean percent left bank vegetated was 81.2%. The dominant elements composing the structure of the stream banks consisted of 7.7% bedrock and 92.3% silt/clay (Graph 10). Deciduous trees were the dominant vegetation type in 61.5% of the units surveyed. Additionally, 19.2% had grass as the dominant vegetation, and 15.4% had brush as the dominant vegetation type (Graph 11).

DISCUSSION

Crystal Creek is a G4 channel type for the entire 2,600 feet of stream surveyed. The suitability of G4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders; fair for plunge weirs, opposing wing-deflectors, and log cover; poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days June 25 to 26, 2002, ranged from 58 to 74 degrees Fahrenheit. Air temperatures ranged from 60 to 76 degrees Fahrenheit. These water temperatures if sustained are above the threshold stress level for juvenile salmonids.

Flatwater habitat types comprised 25% of the total length of this survey, riffles 74%, pools 1%, and culverts 1%. The pools are shallow, with neither of the two 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.

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Both of the pool tail-outs measured had embeddedness ratings of 2. 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 Crystal Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One of the 2 pool tail-outs had sand/silt/clay as the dominant substrate which is considered unsuitable for spawning salmonids. The other had cobble/gravel as the dominant substrate. This is a preferable spawning substrate for salmonids.

The shelter rating for pools was 40. The shelter rating in the flatwater habitats was 11. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders and undercut banks in all habitat types. Additionally, bedrock ledges contribute a small amount of cover. Log and root wad cover structure 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 77%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 85.4% and 81.2%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) The limited 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) Increase the coniferous component of canopy on Crystal Creek by planting 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.

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 Howe Creek. Channel type is G4.

686’ Corrugated metal pipe (CMP) culvert. Possible juvenile fish passage barrier in low flow.

1,883’ Possible fish passage barrier.

2,600’ End of Survey. Survey ended due to difficult access caused by multiple logs spanning channel covered by dense brush.

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]	