

## **STREAM INVENTORY REPORT**

### **MORRISON GULCH (aka Cascade Creek)**

#### INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Morrison Gulch (aka Cascade 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 Morrison Gulch. 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

Morrison Gulch is tributary to Jacoby Creek, tributary to Humboldt Bay, located in Humboldt County, California (Map 1). Morrison Gulch's legal description at the confluence with Jacoby Creek is T05N R01E S11. Its location is 40°49'29" north latitude and 124°02'11" west longitude. Morrison Gulch is a first order stream and has approximately 1.75 miles of blue line stream according to the USGS Arcata South 7.5 minute quadrangle. Elevations range from about 30 feet at the mouth of the creek to 1,040 feet in the headwater areas. Mixed hardwood and conifer forest dominates the watershed. The watershed is entirely privately owned. The upper watershed is managed for timber production. Vehicle access exists via South Quarry Road.

#### METHODS

The habitat inventory conducted in Morrison Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The Northwest Emergency Assistance Program (NEAP), Watershed Stewards Project/ AmeriCorps (WSP/AmeriCorps) Members, Humboldt Fish Action Council (HFAC) and Pacific Coast Fish, Wildlife, and Wetlands Restoration Association (PCFWWRA) 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 100% of the habitat units within the survey reach. All habitat units are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest, and embeddedness. Habitat unit

types are further measured for all the parameters and characteristics on the field form.

## 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 Morrison Gulch 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". Morrison Gulch 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. 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 Morrison Gulch, 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, 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 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 Morrison Gulch, 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 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 Morrison Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the center of every unit. 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 Morrison Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each 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 Morrison Gulch fish presence was observed from the stream banks, and one site was 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 Morrison Gulch 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

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

The habitat inventory of September 3 and 4, 1995, was conducted by Hugh Holt and Jan Friederichsen (NEAP). The total length of the stream surveyed was 5,596 feet with an additional 84 feet of side channel.

Flows were not measured on Morrison Gulch.

Morrison Gulch is a C4 channel type for the entire 5,596 feet of stream reach surveyed. C4

channels are low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 47 to 69 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 4% riffle units, 49% flatwater units, 44% pool units, 2% dry units and 1% culvert units (Graph 1). Based on total length of Level II habitat types there were 2% riffle units, 64% flatwater units, 21% pool units, 12% dry units, and 2% culverts (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were runs (39%); mid-channel pools, 15%; and lateral scour pools - log enhanced, 13% (Graph 3).

A total of 61 pools were identified (Table 3). Scour pools were most frequently encountered at 62% and comprised 56% 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. Sixteen of the 61 pools (26%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 61 pool tail-outs measured, none had a value of 1; 15 had a value of 2 (25%); 27 had a value of 3 (44%); 19 had a value of 4 (31%) and none had a value of 5 (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 10, flatwater habitat types had a mean shelter rating of 44, and pool habitats had a mean shelter rating of 69 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 72. Scour pools had a mean shelter rating of 69. Backwater pools had a mean shelter rating of 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation is the dominant cover type in Morrison Gulch. Graph 7 describes the pool cover in Morrison Gulch.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 3 of the 4 low gradient riffles measured (75%). Sand was the dominant substrate type in the other low gradient riffle measured (Graph 8).

The mean percent canopy density for the stream reach surveyed was 84%. The mean percentages of deciduous and coniferous trees were 74% and 26%, respectively. Graph 9 describes the canopy in Morrison Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 91%. The mean

percent left bank vegetated was 91%. The dominant elements composing the structure of the stream banks consisted of 3% bedrock, 3.3% boulder, 4.8% cobble/gravel, and 88.9% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 46% of the units surveyed. Additionally, 24.4% of the units surveyed had brush as the dominant vegetation type, and 24.4% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

One site was electrofished on September 23, 1996, in Morrison Gulch. The site was sampled by Hugh Holt (NEAP) and Kevin McKernan (WSP\AmeriCorps).

The site sampled included habitat units 26 and 27, a reach approximately 850 feet from the confluence with Jacoby Creek. The site yielded 11 coho, 1 steelhead, 1 cutthroat trout and 1 red-legged frog.

## DISCUSSION

Morrison Gulch is a C4 channel type for the entire 5,596 feet of stream surveyed. The suitability of C4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders and log cover, and fair for low stage weirs, single and opposing wing deflectors and channel constrictors.

The water temperatures recorded on the survey days September 3 and 4, 1996, ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 47 to 69 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 64% of the total length of this survey, riffles 2%, and pools 21%. The pools are relatively shallow, with only 16 of the 61 (26%) 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.

Forty-six (46) of the 61 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. None 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 Morrison Gulch, 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 moderately low with a rating of 69. The shelter rating in the flatwater habitats was slightly lower at 44. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by terrestrial vegetation in all habitat types. Additionally, large and small woody debris 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.

Three of the 4 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 84%. 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 91.2% and 91.1%, 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) Morrison Gulch 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) 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 terrestrial vegetation, but adding high quality complexity with woody cover is desirable.
- 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 Jacoby Creek. Channel type is a C4.
- 791' Rusted culvert. Water flowing under the culvert.
- 1,010' Right bank tributary, ephemeral.
- 2,108' Root wad / log jam, with water flowing through.
- 2,989' Rusted corrugated metal pipe double culvert, 36" diameter.
- 3,011' Culvert under road.
- 5,596' End of survey. Five foot boulder cascade.

#### REFERENCES

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



### **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