

## STREAM INVENTORY REPORT

### **McKee Creek**

#### INTRODUCTION

A stream inventory was conducted during the summer of 1996 on McKee 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 McKee Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on McKee 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

McKee Creek is tributary to the Mattole River, located in Humboldt County, California. McKee Creek's legal description at the confluence with the Mattole River is T04S R02E S33. Its location is 40°03'44" North latitude and 123°57'50" West longitude. McKee Creek is a second order stream and has approximately 2.2 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. McKee Creek drains a watershed of approximately 2.1 square miles. Summer base flow is approximately 1.0 cubic feet per second (cfs) at the mouth, but over 25 cfs is not unusual during winter storms. Elevations range from about 900 feet at the mouth of the creek to 1,450 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is primarily managed for private rural residence. Vehicle access exists via Briceland Road from Redway to Thorn Junction. Walk approximately 700 feet downstream to the mouth of McKee Creek.

#### METHODS

The habitat inventory conducted in McKee Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The Pacific Coast Fisheries, Wetlands, and Wildlife Restoration Association

(PCFWWRA) members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). McKee Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. 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 McKee 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 taken 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". McKee 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 taken 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 McKee 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), 76 - 100% (value 4). Additionally, a rating of "not suitable" (NS) 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 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 McKee 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In McKee 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 McKee Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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 McKee Creek fish presence was observed from the stream banks, and two sites were electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes: 25.4, 12.5, 4.7, 2.37,

and 0.85 mm (Valentine, 1995).

#### 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 Lotus 1,2,3. Graphics developed for McKee 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

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

The habitat inventory of July 3 through 15, 1996, was conducted by Rick Abbey and Mike Mezlin (PCFWWRA). The total length of the stream surveyed was 11,779 feet with an additional 87 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.1 cfs on July 1, 1996.

McKee Creek is a B3 channel type for the first 3,814 feet of stream reach surveyed, and an F4 channel type for the remaining 7,965 feet of surveyed stream. B3 channels are moderately entrenched, moderate gradient, riffle-dominated channels with

cobble-dominant substrates. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 54 to 62 degrees Fahrenheit. Air temperatures ranged from 58 to 77 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 50% flatwater units, 32% pool units, and 17% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 57% flatwater units, 29% pool units, and 14% riffle units (Graph 2).

Eighteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were runs, 29%; low gradient riffles, 17%; and glides, 15% (Graph 3). Based on percent total **length**, runs made up 35%, glides 15%, and low gradient riffles 13%.

A total of one hundred and forty pools were identified (Table 3). Scour pools were most frequently encountered at 58% and comprised 34% 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-five of the 140 pools (39%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 139 pool tail-outs measured, 21 had a value of 1 (15%); 77 had a value of 2 (55%); 33 had a value of 3 (24%); and none had a value of 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. Pool habitat types had a mean shelter rating of 30, and flatwater habitats had a mean shelter rating of 15 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 45. Scour pools had a mean shelter rating of 31 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in five of the 11 low

gradient riffles measured (45%). Small cobble was the next most frequently observed dominant substrate type and occurred in 27% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 85%. The mean percentages of deciduous and coniferous trees were 79% and 6%, respectively. Graph 9 describes the canopy in McKee Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 71%. The mean percent left bank vegetated was 70%. The dominant elements composing the structure of the stream banks consisted of 10.7% bedrock, 0% boulder, 2.3% cobble/gravel, and 87.1% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 52% of the units surveyed. Additionally, 11.8% of the units surveyed had deciduous trees as the dominant vegetation type, and 3.4% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

#### BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 1, 1996, in McKee Creek. The sites were sampled by Ruth Goodfield (DFG) and Kelley Garrett (WSP/AmeriCorps).

The first site sampled included habitat units 0024-0025, a riffle/pool sequence approximately 692 feet from the confluence with the Mattole River. This site had an area of 320 sq ft and a volume of 256 cu ft. The site yielded four young-of-the-year (YOY) steelhead rainbow trout.

The second site included habitat units 0111-0112, a run/pool sequence located approximately 4,138 feet above the creek mouth. This site had an area of 350 sq ft and a volume of 283 cu ft. The site yielded three YOY steelhead rainbow trout.

#### GRAVEL SAMPLING RESULTS

No gravel samples were taken on McKee Creek.

#### DISCUSSION

McKee Creek is a B3 channel type for the first 3,814 feet of stream surveyed and an F4 for the remaining 7,965 feet. The suitability of B3 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder

clusters, and log cover; and good for medium-stage plunge weirs. The suitability of F4 channel types for fish habitat improvement structures is good for bank-placed boulders; fair for low-stage weirs, single and opposing wing-deflectors; and poor for medium-stage plunge weirs and boulder clusters.

The water temperatures recorded on the survey days July 3 - 15, 1996, ranged from 54 to 62 degrees Fahrenheit. Air temperatures ranged from 58 to 77 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 57% of the total **length** of this survey, riffles 14%, and pools 29%. The pools are relatively shallow, with only 55 of the 140 (39%) 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.

Thirty-three of the 139 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 21 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 McKee Creek, 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 low with a rating of 30. The shelter rating in the flatwater habitats was slightly lower at 15. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by undercut banks in all habitat types. Additionally, rootwads 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.

Seven of the 11 low gradient riffles fully measured had gravel or small cobble as the dominant substrate. This is generally considered suitable for spawning salmonids.

The mean percent canopy density for the stream was 85%. This is a relatively high percentage of canopy. In general, re-



vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 70% and 71%, 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) McKee Creek should be managed as an anadromous, natural production stream.
- 2) 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.
- 3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from undercut banks. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.
- 4) Streambank sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.
- 5) Sediment sources related to the road drainage system should be mapped and rated according to their potential sediment yields, and control measures should be taken.

#### PROBLEM SITES AND LANDMARKS

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

- |      |  |
|------|--|
| 0'   | Begin survey above 30' long fishway at confluence with Mattole River. Channel type is B3 for the first 3,814' of the survey. |
| 118' | Young-of-the-year (YOY) salmonids observed.  |
| 692' | Bioinventory site # 1, habitat unit 025.   |
| 742' | Whitethorn Road bridge covers upper part of unit.  |

2977' Painter Creek enters from the right bank (RB) .5 cfs.  
3538' Large debris accumulation (LDA).  
3814' Channel changes from a B3 to an F4.  
4070' House on RB, wooden bridge spans creek.  
4138' Juvenile salmonid approximately 8" length.  
4183' Houses on both banks; vehicle bridge spans stream.  
4238' Wetted tributary from the LB; 57°F; wooden dam  
tributary approximately 70' above confluence.  
5409' Significant tributary from LB; 58°F; YOY observed in  
the tributary. Habitat typing of tributary begun.  
6986' Small tributary from RB from road culvert.  
7093' Many YOY observed.  
7722' Log bridge and logs form LDA.  
9114 ' Tributary from RB.  
10601' Culvert on RB under Shelter Cove road.  
11245' Tributary from LB; 56°; YOY observed in tributary.  
11779' Rootwad plunge 5' high; no fish observed above it.  
End of Survey.

## **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.
- Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, 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