STREAM INVENTORY REPORT

TANK 4 GULCH

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Tank 4 Gulch. 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 Tank 4 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

Tank 4 Gulch is tributary to Flynn Creek, tributary to the North Fork Navarro River, tributary to the Navarro River, located in Mendocino County, California (Map 1). Tank 4 Gulch's legal description at the confluence with Flynn Creek is T16N R16W S35. Its location is 39°12'11" north latitude and 123°36'19" west longitude. Tank 4 Gulch is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS Navarro 7.5 minute quadrangle. Tank 4 Gulch drains a watershed of approximately 0.73 square miles. Elevations range from about 320 feet at the mouth of the creek to 920 feet in the headwater areas. Redwood/Douglas fir mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Flynn Creek Road from State Route 128.

METHODS

The habitat inventory conducted in Tank 4 Gulch 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 Tank Four 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". Tank 4 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; 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 Tank 4 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 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 Tank 4 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 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 Tank 4 Gulch, 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 Tank 4 Gulch, 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 Tank 4 Gulch fish presence was observed from the stream banks, and two 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 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 Tank 4 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 June 13 through 20, 1996, was conducted by Craig Mesman (CCC) and Andrew MacMillan (WSP\AmeriCorps). The total length of the stream surveyed was 8,290 feet with an additional 187 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.05 cfs on July 9, 1996.

Tank Four Gulch is a B4 channel type for the first 1,069 feet of stream reach surveyed, and the remaining 7,221 feet of stream surveyed is a G4 channel type. B4 channels are moderately entrenched, riffle dominated, moderate gradients with a stable plan and profile, stable banks and gravel dominated substrates. G4 channels are characterized by entrenched "gully" step-pools, low width/depth ratios on moderate gradient.

Water temperatures taken during the survey period ranged from 54 to 56 degrees Fahrenheit. Air temperatures ranged from 52 to 74 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% pool units, 25% flatwater units, 18% riffle, and 10% was dry (Graph 1). Based on total length of Level II habitat types there were 37% pool units, 31% flatwater units, 10% riffle units and 22% was dry (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 26%; step runs, 19%, and low gradient riffles, 16% (Graph 3). Based on percent total length, step runs made up 28%, and mid-channel pools 18%.

A total of 125 pools were identified (Table 3). Main channel pools were most frequently encountered at 87% and comprised 90% 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. Thirty-eight of the 125 pools (30%) had a 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, 2 had a value of 1 (2%); 25 had a value of 2 (20%); 25 had a value of 3 (20%); 21 had a value of 4 (17%); and 52 had a value of 5 (42%)(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. Flatwater habitat types had a mean shelter rating of 46, riffle habitat types 42, and pool habitats 21 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 30. Scour pools had a mean shelter rating of 28. Main channel pools had a mean shelter rating of 18 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Tank 4 Gulch. Large woody debris was lacking from nearly all habitat types. Graph 7 describes the pool cover in Tank 4 Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in all 6 of the low gradient riffles measured (100%).

The mean percent canopy density for the stream reaches surveyed was 93%. The mean percentages of deciduous and coniferous trees were 14% and 86%, respectively. Graph 9 describes the canopy in Tank 4 Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 85.6%. The mean percent left bank vegetated was 83.3%. The dominant elements composing the structure of the stream banks consisted of 6% bedrock, 37% cobble/gravel, and 57% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 34% of the units surveyed. Additionally, 11% of the units surveyed had deciduous trees as the dominant vegetation type, and 26% had coniferous trees as the dominant vegetation, including downed trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 3, 1996, in Tank 4 Gulch. The sites were sampled by Andrew MacMillan and Craig Mesman.

The first site sampled included habitat units 15 through 17, a mid-channel pool, run, mid-channel pool sequence, approximately 558 feet from the confluence with Flynn Creek. The site yielded 7 coho, and 6 Pacific giant salamanders.

The second site included habitat units 49 through 56, a plunge pool, bedrock sheet, trench pool, run, mid-channel pool, bedrock sheet, mid-channel pool, and trench pool sequence, located approximately 1610 feet above the creek mouth. The site yielded 4 steelhead, 2 sculpin, and 2 Pacific giant salamanders.

DISCUSSION

Tank Four Gulch is a B4 channel type for the first 1,069 feet of stream surveyed and a G4 for the remaining 7,221 feet. The suitability of the B4 channel type for fish habitat improvement structures is as follows: excellent for low-stage weirs, boulder clusters, bank placed boulders, single and opposing wing deflectors and log cover, and good for medium-stage weirs. G4 habitat types are good for bank placed boulders, fair for low stage weirs, opposing wing deflectors and log cover, and poor for medium stage weirs, boulder clusters, single wing deflectors and log cover.

The water temperatures recorded on the survey days June 13 through 20 1996, ranged from 54 to 56 degrees Fahrenheit. Air temperatures ranged from 52 to 74 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 31% of the total length of this survey, riffles 10%, and pools 37%. The pools are relatively shallow, with only 38 of the 125 (30%) 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.

Ninety-eight of the 125 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only 2 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 Tank 4 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 low with a rating of 21. The shelter rating in the flatwater habitats was slightly better at 46. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by small woody debris in all habitat types. Root wads contribute the smallest 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 structures provide rearing fry with protection from predation, rest from water velocity, and divides territorial units to reduce density related competition.

All 6 of the low gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 93%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

RECOMMENDATIONS

1) Tank 4 Gulch should be managed as an anadromous, natural production stream.

2) 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.

3) 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.

4) 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.

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 Flynn Creek. Channel type is B4.
303'	Log debris accumulation (LDA).
1,069'	Beginning of G4 channel type.
1,374'	Log debris accumulation, 15' wide x 30' long x 4' high, retaining 3' of sediment. Possible barrier.
2,386'	Channel down-cut to top of pool approximately 4', with 4' jump at head of pool.
4,133'	Left bank dry tributary.
4,818'	Right bank dry tributary.
5,057'	Left bank seep.
5,384'	Right bank dry tributary.
5,394'	Three foot plunge through roots, may impede passage.
6,483'	Three foot jump.
6,565'	Channel becomes overgrown with brush.
6,809'	Multiple dry channels.
7,355'	Right bank seep. Five foot jump at top of unit.
7,752'	Gradient increases to 6.5%. Left bank road turns away from stream.

7,986' Five foot jump. Valley becomes very narrow.

8,290' Gradient increases to 10% to 15%. Sub-surface flow. 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.

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