STREAM INVENTORY REPORT

Chamberlain Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Chamberlain 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 Chamberlain 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

Chamberlain Creek is tributary to the North Fork Big River, tributary to the Big River, tributary Pacific Ocean located in Mendocino County, California (Map 1). Chamberlain Creek's legal description at the confluence with North Fork Big River is T17N R15W S05. Its location is 39°21′10″ north latitude and 123°33′30″ west longitude. Chamberlain Creek is a third order stream and has approximately 18 miles of blue line stream according to the USGS Comptche 7.5 minute quadrangle. Chamberlain Creek drains a watershed of approximately 12.0 square miles. Elevations range from about 350 feet at the mouth of the creek to 1800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely within the Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via State Route 20.

METHODS

The habitat inventory conducted in Chamberlain 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 Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members 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 (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,

depth of pool tail crest, dominant substrate composing the pool tail crest, and embeddedness. 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 Chamberlain 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.

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". Chamberlain 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. 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 Chamberlain 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, 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 Chamberlain 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. In addition the dominant substrate composing the pool tail outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified hand held 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 Chamberlain 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 Chamberlain 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.

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BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Chamberlain Creek 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 Chamberlain 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 pool tail-outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of July 07 through 22, 1997 was conducted by Bethany Reisburger (WSP\AmeriCorps) and Craig Mesman (CCC). The total length of the stream surveyed was 24,587 feet with an additional 297 feet of side channel.

Flow was measured at the bottom of survey reach to be 1.54 cfs on August 6, 1997 with a Marsh-McBirney model 2000.

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Chamberlain Creek is an F4 channel type for the entire 26,587 feet of stream reach surveyed. 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 65 degrees Fahrenheit. Air temperatures ranged from 51 to 81 degrees Fahrenheit.
Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 34% riffle units, 29% flatwater units, and 36% pool units (Graph 1). Based on total **length** of Level II habitat types there were 29% riffle units, 43% flatwater units, and 27% pool units (Graph 2).

Twenty-one Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 30%; mid-channel pools, 19%; and step runs, 17% (Graph 3). Based on percent total **length**, step runs made up 32%, low gradient riffles 27%, and mid-channel pools 13%.

A total of 210 pools were identified (Table 3). Main channel pools were most frequently encountered at 57% and comprised 60% 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. One-hundred-twelve of the 210 pools (53%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 210 pool tail-outs measured, 48 had a value of 1 (23%); 40 had a value of 2 (40%); 24 had a value of 3 (24%); 11 had a value of 4 (5%) and 17 had a value of 5 (8%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning. In Chamberlain Creek, 9 of the pool 17 tail-outs which were valued at 5 had silt/sand/clay or gravel too small to be suitable for spawning as a substrate. The other tail-outs were unsuitable for spawning due to the tail-outs being comprised of large cobble, boulder, bedrock or wood.

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 12, flatwater habitat types had a mean shelter rating of 18, and pool habitats had a mean shelter rating of 25 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 31. Main channel pools had a mean shelter rating of 25. The scour pools had a mean shelter rating of 20 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Of the 19 low gradient riffles fully measured, gravel and small cobble was the dominant substrate. Gravel was the dominant substrate observed in 163 of the 210 pool tail-outs measured (78%). Small cobble was the next

most frequently observed dominant substrate type and occurred in 11% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 73%. The mean percentages of deciduous and coniferous trees were 10% and 90%, respectively. Graph 9 describes the canopy in Chamberlain Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85%. The mean percent left bank vegetated was 85%. The dominant elements composing the structure of the stream banks consisted of 24.4% bedrock, 2.6% boulder, 59.6% cobble/gravel, and 13.5% sand/silt/clay (Graph 10). Coniferous trees, including down trees, logs, and root wads was the dominant vegetation type observed in 42.3% of the units surveyed. Additionally, 33.3% of the units surveyed had brush as the dominant vegetation type, and 15.38% had deciduous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished, one on August 26, 1997 and one on September 10, 1997, in Chamberlain Creek. The sites were sampled by Tara Cooper and Craig Mesman (CCC).

The first site sampled included habitat units 100 through 107, a plunge pool, run, mid-channel pool sequence approximately 6,247 feet from the confluence with North Fork Big River. The site yielded 8 sculpin, 24 Pacific giant salamanders, and 15 steelhead.

The second site included habitat units 272 through 274, a plunge pool, run, mid-channel pool sequence located approximately 16,018 feet above the creek mouth. The site yielded 10 steelhead, 1 sculpin, and 3 salamanders.

DISCUSSION

Chamberlain Creek is a F4 channel type for the entire 26,587 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders; fair for weirs, single and opposing wing deflectors, channel constrictors and log cover; and poor for boulder clusters.

The water temperatures recorded on the survey days July 07 to 22, 1997, ranged from 54 to 65 degrees Fahrenheit. Air temperatures ranged from 51 to 81 degrees Fahrenheit. This is a suitable 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 43% of the total **length** of this survey, riffles 29%, and pools 27%. The pools are relatively deep, with 112 of the 210 (53%) 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-eight of the 210 pool tail-outs measured had an embeddedness rating of 1. Thirty-five pool tail-outs measured had embeddedness ratings of 3 or 4. Seventeen of the pool tail-outs were rated at 5 or were considered to be unsuitable for spawning. Nine of the 17 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel too small to be suitable. 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 25. The shelter rating in the flatwater habitats was slightly lower at 18. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large woody debris and bedrock in all habitat types. Additionally, small woody debris contribute a small amount. Log and root wad cover structure 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.

All of the 19 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 73%. 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 85% and 85%, 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) Chamberlain Creek 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 large woody debris and bedrock. Adding high quality complexity with woody cover is desirable.

3) 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.

4) Increase the canopy on Chamberlain 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.

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'	Begin survey at confluence with North Fork Big River. Channel type is an F4.
45'	Foot bridge crosses approximately 25' above water.
75'	Bridge approximately 40' wide x 35' long, and 25' above the water on the downstream side of Highway 20.
1,111'	Water Gulch enters from the right bank.
2,030'	Conservation Camp office on the right bank, trees and brush cut and removed from banks.
2,455'	Eight inch diameter steel casing in stream bed, going up at an angle on the right bank.
2,756'	Flash-board dam.
2,888'	Park Gulch enters from the left bank.
5,928'	Wooden bridge approximately 30' wide x 15' long and 25' above the water.
6,896'	Electrofishing site #1.
6,931'	West Chamberlain Creek enters from the right bank.
7,668'	Five logs span channel 2.5' above water, retaining some woody debris.
10,764'	Small tributary on right bank. Channel very entrenched, 2 to 3' wide. Flow < 0.10 cubic feet per second (cfs). Approximately 30' upstream is a 6' jump through roots.
11,460'	Small tributary comes in on right bank. Very deeply incised channel. Channel 3 to 5' wide. Large amounts of silt and soil, flow < 0.01 cfs. Approximately 90' upstream there is steeply inclined bedrock wall with a 9' high jump.
12,860'	Small, dry tributary enters the left bank.

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12,917'	Three logs joined together with rebar on the right bank.
13,055'	Left bank erosion, approximately 250' long x 50' high. Contributing all sizes of material to the channel.
14,804'	Log debris accumulation (LDA), 6' high x 22' wide x 15' long, not retaining gravel, not a barrier.
15,024'	Arvola Gulch enters on left bank.
15,617'	Corrugated metal pipe culvert, 8.5' high x 13' wide. No baffles but set on a low gradient.
16,018'	Electrofishing site #2.
16,172'	Small tributary enters from the right bank, flow of <0.05 cfs. Steep and narrow, not accessible to anadromous fish.
16,843'	Right bank vertical erosion 10' high x 20' long.
16,914'	Tributary enters from the right bank. The tributary has a lake.
17,264'	LDA, 30' long x 25' wide x 6' high, not retaining gravel, not a barrier.
17,880'	Left bank tributary with a steep incised channel, not accessible to anadromous fish.
18,226'	LDA, 30' long x 15' wide x 7' high, not retaining gravel, not a barrier.
18,871'	Tributary enters from the left bank, flow < 0.01 cfs. About 100' upstream on the tributary is a 10-12' jump over and into large woody debris.
19,739'	Tributary enters from the right bank, flow of approximately 0.01 cfs. There are two sets of jumps in the first 150 feet. The tributary, gets steeper upstream of the jumps, probably not accessible to anadromous fish past the first 150 feet.
19,827'	LDA, 35' long x 25' wide x 7' high, not retaining gravel, no barrier.
20,266'	LDA, 12' long x 18' wide x 6' high, retaining sediment 4' high, not a barrier.
20,386'	LDA, 12' long x 35' wide x 4.5 high, not a barrier.
20,676'	Bedrock cascade with two jumps, one 4', the other 2.5'.
20,813'	LDA, 12' long x 40' wide x 8.5 high. Well consolidated matrix of small and large woody debris.
20,871'	Jump 6.5'.

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20,901'	Rise of 6.5' over a 13' run.
21,028'	Right bank tributary, accessible to fish.
22,238'	LDA, 20' long x 25' wide x 8' high, with a 6' high jump over the woody debris, possible barrier.
22,915'	Jump through and over roots at the top of the pool, 8.5' high.
23,073'	LDA, 16' long x 18' wide x 7' high, not retaining gravel, not a barrier.
23,965'	Tributary enters from the left bank. Approximately 80' upstream on the tributary is a culvert under Road 250 that is a barrier.
24,315'	LDA, 10' long x 25' wide x 4' high, not retaining gravel, not a barrier.
25,483'	Right bank tributary. Approximately 110' upstream is an LDA with a 8' high increase in elevation over about a 20' run. Probable barrier.
26,025'	Iron bacteria in the stream.
26565'	End of survey at a 5' diameter corrugated metal pipe culvert, with a 6" high jump into the culvert. The culvert has no baffles, but is set at a low gradient. The culvert is approximately 60' long and is in good condition. No fish observed above the LDA at 22,238 feet.

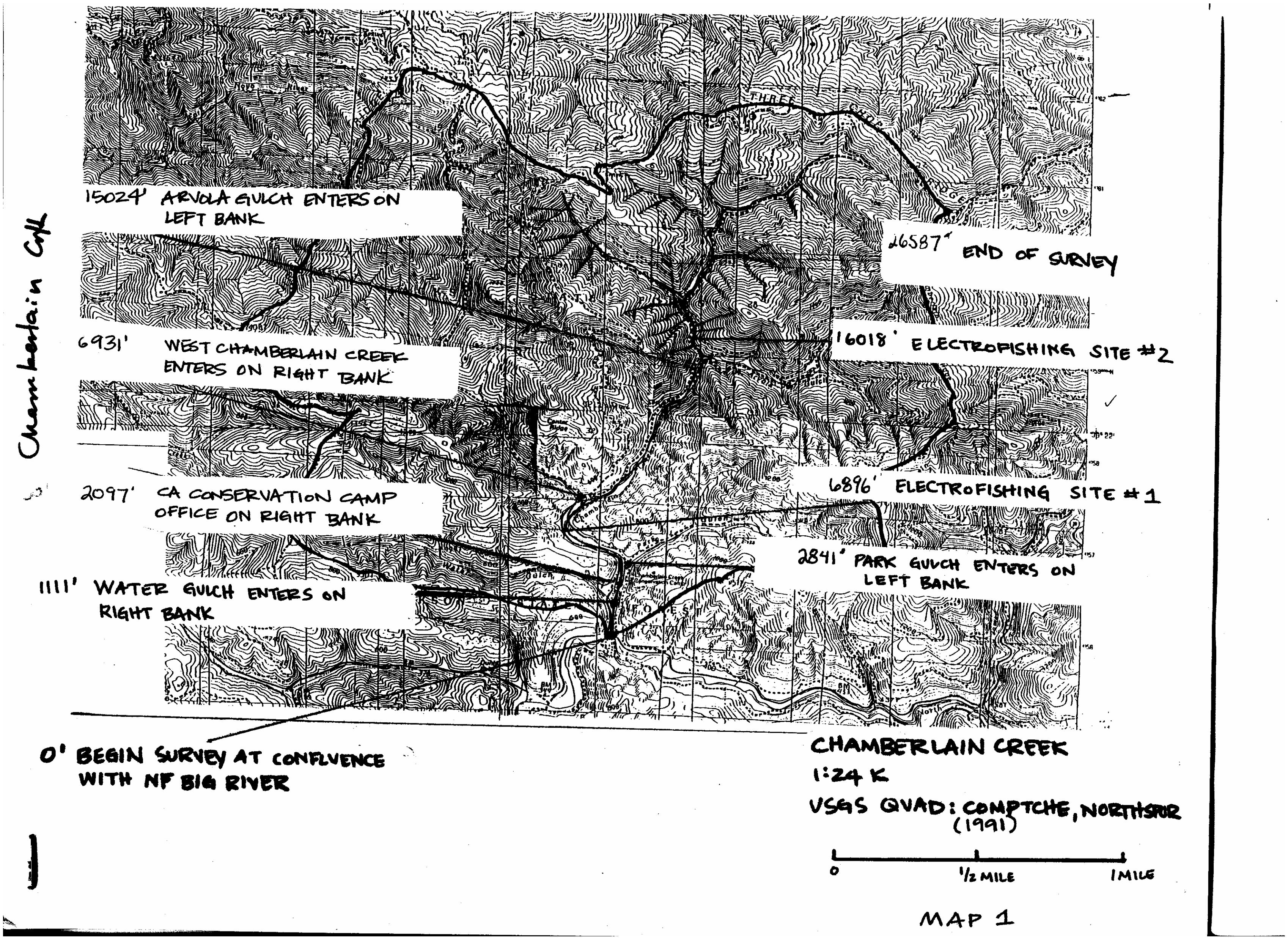
REFERENCES

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


Chamberlain Crk
15024' ARVOLA GULCH ENTERS ON LEFT BANK
26587' END OF SURVEY
6931' WEST CHAMBERLAIN CREEK ENTERS ON RIGHT BANK
16018' ELECTROFISHING SITE #2
2097' CA CONSERVATION CAMP OFFICE ON RIGHT BANK
6896' ELECTROFISHING SITE #1
2841' PARK GULCH ENTERS ON LEFT BANK
1111' WATER GULCH ENTERS ON RIGHT BANK
0' BEGIN SURVEY AT CONFLUENCE WITH NF BIG RIVER
CHAMBERLAIN CREEK
1:24 K
USGS QUAD: COMPTCHE, NORTHSPUR (1991)
0
1/2 MILE
1 MILE

MAP 1