STREAM INVENTORY REPORT

BEAR CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Bear Creek, a tributary of the mainstem Eel River. 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 Bear Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

Adult carcass surveys were conducted on Bear Creek by the California Department of Fish and Game (DFG) from 1987 through 2000. The table below describes the results of those surveys:

Bear Creek Carcass Surveys 1987-2000

	Chinook Salmon				Other		
Year	# of Surveys	Live Fish	# of Carcass	AdiposeClipCWT	Redds seen	Coho seen	SH/RT seen
1987-88	3	37	13	0	2	1	1
1988-89	2	0	0	0	0	0	0
1989-90	3	14	7	0	16	0	4
1990-91	0	0	0	0	0	0	0
1991-92	2	0	2	0	52	3	6
1992-93	4	16	1	0	24	2	1
1993-94	3	0	0	0	0	0	1
1994-95	4	0	0	0	7	0	1
1998-99	2	0	0	0	0	0	0
1999-00	4	0	0	0	0	0	0

The drought related low flows during prime migration periods from 1989 through 1992 made Bear Creek, like many Eel River tributaries, inaccessible to most chinook salmon. The objective of this report is to document the current habitat conditions in Bear Creek, and recommend options for the 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

Bear Creek is tributary to the mainstem Eel River located in Humboldt County, California (Map 1). Bear Creek's legal description at the confluence with the mainstem Eel River is T1N R2E S32. Its location is 40°25′53″ north latitude and 123°58′50″ west longitude. Bear Creek is a 3rd order stream and has approximately 3.9 miles of blue line stream according to the USGS Scotia, Weott, Bull Creek, and Redcrest 7.5 minute quadrangles. Bear Creek drains a watershed of approximately 8.5 square miles. Elevations range from about 110 feet at the mouth of the creek to 1,600 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is owned by the Pacific Lumber Company and the State of California and is managed for timber production and as a state park. Vehicle access exists from US 101, via the Holmes/Redcrest exit. Proceeding west from the highway, turn left on Bear Creek Road, which provides access to the Pacific Lumber Company holdings and is blocked by a locked gate about 0.75 miles from the highway.

METHODS

The habitat inventory conducted in Bear Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al., 1998). The AmeriCorps Watershed Stewards Project (WSP) 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, 1995). 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 methodology and data sheet have been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This protocol was used in Bear Creek to record measurements and observations. There are nine components to the inventory data sheet.

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. Additionally, the Pacific Lumber Company had a recording thermograph deployed in Bear Creek (Friedrichsen, 1998).

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". Bear 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 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 Bear 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 Bear 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 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 Bear 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 Bear 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In addition to stream bank observations, fish populations were sampled using the depletion/removal method of electrofishing at 4 sites, using a Smith-Root Model 12 electrofisher, on Bear Creek. 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 Quattro Pro. Graphics developed for Bear 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 the pool tail outs
- 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 May 24, 25, 26 and June 1, 2, 3 1999 was conducted by Greg Larson,

Donn Rehberg, Michelle Anderson, Toni Beaumont, and Paul Ferns (WSP). The total length of the stream surveyed was 17,519 feet with an additional 822 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 7.8 cfs on May 25, 1999.

Bear Creek is a B4 channel type for the first 5,422 feet, a F4 channel type for the next 9,661 feet, and a F3 channel type for the next 2,436 feet of the stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel. F4 channels are entrenched meandering riffle/pool channel on low gradients with high width/depth ratio; gravel channel. F3 channels are entrenched meandering riffle/pool channel on low gradients with high width/depth ratio; cobble channel.

Water temperatures taken during the survey period ranged from 51° to 65° F. Air temperatures ranged from 52° to 80° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% riffle units, 28% flatwater units, and 31% pool units (Graph 1). Based on total length of Level II habitat types there were 69% riffle units, 20% flatwater units, and 11% pool units (Graph 2).

Seventeen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 40%; runs, 25%; and mid-channel pools, 15% (Graph 3). Based on percent total length, low gradient riffle made up 68%, runs 16%, and mid-channel pools 6%.

A total of 76 pools were identified (Table 3). Main channel pools were most frequently encountered at 49% and comprised 50% of the total length of all pools (Graph 4). Scour pools occurred at 45% and comprised 45% of the total length of all pools.

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Sixty-six of the 76 pools (87%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 73 pool tail-outs measured, 8 had a value of 1 (11.0%); 29 had a value of 2 (39.7%); 37 had a value of 3 (37.0%); 4 had a value of 4 (5.5%) and 5 had a value of 5 (6.8%) (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.

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 13, flatwater habitat types had a mean shelter rating of 23, and pool habitats had a mean shelter rating of 41 (Table 1). Of the Level III pool types, the scour pools had the highest mean

shelter rating at 51, backwater pools had a mean shelter rating of 47, and main channel pools had a mean shelter rating of 23 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders and large woody debris are the dominant cover type in Bear Creek. Graph 7 describes the pool cover in Bear Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 36 of the 73 pool tail outs measured (49%). Small cobble was the next most frequently observed dominant substrate type and occurred in 37% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 26%. The mean percentages of conifer and deciduous trees were 63% and 37%, respectively. Graph 9 describes the canopy in Bear Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 54.9%. The mean percent left bank vegetated was 46.5%. The dominant elements composing the structure of the stream banks consisted of 2.0% bedrock, 1.7% boulder, 43.2% cobble/gravel, and 53.1% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 47% of the units surveyed. Additionally, 47% of the units surveyed had deciduous trees as the dominant vegetation type, and 15% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites on Bear Creek were sampled using multiple pass depletion electrofishing on August 8/23 and 8/26/1999. Sites 1 and 2 were sampled by Barry Collins, Glenn Yoshioka, (DFG), Paul Ferns, and Donn Rehberg (WSP). Site 3 was sampled by Barry Collins, Paul Ferns, and Britt Hornbeck (SCOPAC). Site 4 was sampled by Glenn Yoshioka, Bernie Bowman, and Kris Sundeen (SCOPAC) assisted with the sampling of Sites 3 and 4.

Five habitat units (3 low gradient riffles, 1 run, and 1 mid-channel pool) comprised Site 1, which began 212 feet upstream from the confluence with the mainstem Eel River. This site had an area of 2,537 sq ft and a volume of 1996 cu ft. The site yielded 57 juvenile steeelhead rainbow trout. There were 43 young-of-the-year (YOY) and 14 age 1+ juvenile steelhead captured, ranging from 54 to 152 mm fork length (FL).

Six habitat units (2 low gradient riffles, 1 run, and 3 mid-channel pools) comprised Site 2, which began 101 feet upstream from the Pacific Lumber Company log bridge. This site had an area of 4,090 sq ft and a volume of 3,138 cu ft. The site yielded 273 juvenile steelhead rainbow trout. There were 226 YOY and 47 age 1+ and older juvenile steelhead captured, ranging from 47 to 167 mm FL.

Three habitat units (1 low gradient riffle and 2 mid-channel pools) comprised Site 3, which was located downstream from the confluence with South Fork Bear Creek. This site had an area of

1,395 sq ft and a volume of 1,238 cu ft. The site yielded 137 juvenile steelhead rainbow trout. There were 101 YOY and 36 age 1+ and older juvenile steelhead captured, ranging from 45 to 216 mm FL.

Four habitat units (2 low gradient riffles, 1 high gradient riffle, and 1 mid-channel pool) comprised Site 4, which was located upstream from the confluence with South Fork Bear Creek. This site had an area of 2,100 sq ft and a volume of 1,266 cu ft. The site yielded 172 juvenile steelhead rainbow trout. There were 165 YOY and 7 age 1+ juvenile steelhead captured, ranging from 45 to 216 mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Bear Creek.

DISCUSSION

Bear Creek is a B4 channel type for the first 5,422 feet of stream surveyed, a F4 channel for the next 9,661 feet, and a F3 channel for the next 2,436 feet. The suitability of B4, F4, and F3 channel types for fish habitat improvement structures is as follows: B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. F4 channels are good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters. F3 channels are good for bank-placed boulders and single and opposing wing-deflectors; fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days May 24-26th and June 1-3, 1999, ranged from 51° to 65° F. Air temperatures ranged from 52° to 80° F. This is a satisfactory water temperature range for steelhead. However, 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.

Pools comprised only 11% of the total habitat length of this survey while riffles and flatwater types comprised 69% and 20%, respectively. Although scarce, the pools are relatively deep, with 66 of 76 (87%) of pools having a maximum depth greater than 2 feet. However, only 25% are greater than 3 feet in depth. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third order streams, a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Primary pools comprised less than 3% of the total stream length surveyed. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with any needed modification of log debris accumulations (LDA) in the stream. The LDAs in the system could be retaining needed gravel. Any necessary modifications to them should be done with the intent

of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Eight of the 73 (11%) pool tail-outs measured had an embeddedness rating of 1, 40% had a rating of 2, 43% had ratings of 3 or 4, and 7% had a rating of 5 and were considered unsuitable for spawning. 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 Bear 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 41. The shelter rating in the flatwater habitats was lower at 23. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by either boulders and large woody debris in most habitat types. Additionally, small woody debris contributes some cover. 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.
Eighty-six percent of the pool tail-outs 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 26%. This is a low 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 moderate at 55% and 47%, 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) Bear Creek 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) Canopy cover only averaged 26%. Increase the canopy on Bear 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.

4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

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.

6) Primary pools comprised less than 3% of the total stream length surveyed. 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. Structures that would deepen pools and collect woody debris to increase complex cover would also be beneficial.

7) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders and woody debris but is not abundant. Adding high quality complexity with woody cover is desirable.

8) Several of the debris accumulations present on Bear Creek are retaining sediment. Modification of these debris accumulations may be desirable, but must be done carefully, over time, to meter sediment downstream to spawning sites. Furthermore, care must be taken to not mobilize excessive amounts of stored fine sediments in order to prevent downstream siltation.

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 the mainstem Eel River. Channel type is a B4.
206'	Under Avenue of the Giants bridge.
347'	Under Highway 101 bridge.
817'	Site of channel type measurement.
2174'	CCC habitat structure in unit, out of position but still in wetted perimeter.
3577'	Landslides near top of unit (approx. +876') on left bank. Approx. 120' wide, 20' high.

4453'	Right bank -exposed soil, with potential for failure. Left bank also.
4554'	Tailout unrecognizable, wood accumulation causes pool.
5422'	Begin Reach 2, channel changes to a F4 type.
5610'	Under bridge; site of flow measurement.
5720'	Left bank- soil exposed, a potential failure site.
6709'	Soil exposed, right bank, at start of unit.
6999'	Remnant CCC structures.
7617'	Bank material exposed.
7876'	Left bank tributary enters 107' into unit.
7940'	Remains of an old habitat structure.
7998'	Saw one fry (species unidentified). Left bank eroded silt wall, 16' high.
8168'	Silt wall continues along left bank.
8297'	Right bank wall is silt.
8544'	Debris slide above the right bank.
8935'	Right bank slide into creek, 92' into unit.
9365'	Left bank tributary enters pool; water temperature is 51° F. There is a 4' jump from the pool into the tributary. YOY (species unidentified) observed in pool.
9509'	Right bank slide 25' high, enters stream.
10588'	A tributary enters; water temperature is 55° F.
11648'	Right bank, soil is exposed up 30 high'.
11968'	Left bank erosion extending 90' in length and about 30' up.
13278'	Bank erosion on right bank begins 200' into unit, extending 50' long and 20' upslope. Tributary enters right bank 259' into unit; water temperature is 52° F.
13683'	Left bank eroded area extending from 40' into unit to the top of next unit.

14300'	Right bank eroded area extending from bottom of unit up 41' into unit..
14995'	Small tributary enters on the left bank 14' into the unit.
15083'	Water goes under LWD accumulation, 25' x 75' x 15', for about 20' before joining the main channel. Channel type changes to a F3 reach; Reach 3.
15295'	Tributary enters on right bank 23' into unit. There is a LWD accumulation, retaining gravel, on the right bank tributary.
15337'	Much LWD and SWD accumulated on both banks, as well as fine sediment and gravel, beginning at the tributary confluence and continuing for 300+ feet.
15747'	Begin 100% occurrence.
15809'	At 45' into the unit, a LDA, 15' x 15' x 15', retaining boulder, cobble, gravel. Left bank LDA 110' into unit, 40' x 10' x 5', partially in stream.
15907'	YOY observed above last plunge pool.
16143'	LDA at 55' into unit, 40' x 30' x 6', retaining SWD and gravel.
16408'	LDA right bank, 20' x 15' x 4, retaining gravel. Erosion on right bank beginning 5' into unit, 15' high and long.
16469'	Tributary enters left bank 18' into the unit.
16890'	Possible channel type change, begin 100% survey.
17001'	Landslide on left bank begins at bottom of this unit; 100' high and 300' deep back from bankfull.
17073'	Juvenile salmonid observed. Root formed 7' drop with 2 cascading steps 7' wide.
17116'	Left bank slide; major debris accumulation.
17136'	Left bank landslide.
17281'	Left bank LDA.
17450'	8' LDA in this and last unit.
17519'	End Of Survey. 3 large debris accumulations encountered, each 8-10' in height. The second and third have subsurface flow occurring. Walked 1000-1500' above

accumulations and saw no fish. Debris along this section occurs continuously.

REFERENCES

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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
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**