STREAM INVENTORY REPORT

Browns Gulch

INTRODUCTION

A stream inventory was conducted on June 13, 2005 in Browns Gulch. The survey began at the confluence with North Fork Elk River and extended upstream 0.1 miles.

The Browns Gulch 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 Browns 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

Browns Gulch is a tributary to North Fork Elk River, a tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Browns Gulch's legal description at the confluence with North Fork Elk River is T04N R01E S30. Its location is 40.6833 degrees north latitude and 124.1117 degrees west longitude, LLID number 1241116406999. Browns Gulch is an intermittent stream according to the USGS McWhinney Creek 7.5 minute quadrangle. Browns Gulch drains a watershed of approximately 0.9 square miles. Elevations range from about 75 feet at the mouth of the creek to 500 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Elk River Road.

METHODS

The habitat inventory conducted in Browns Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (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.

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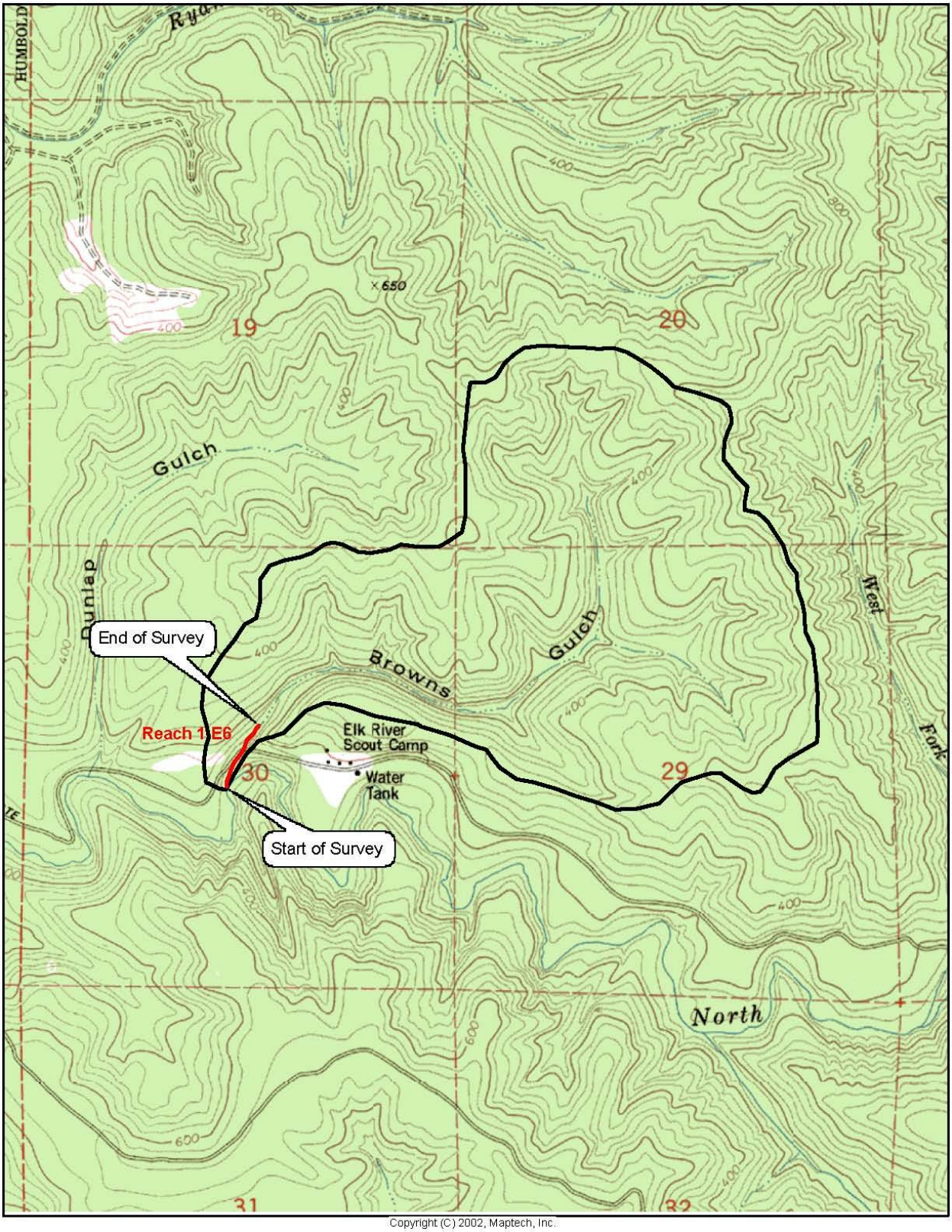
Map 1



SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. 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 (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are 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. All pools except step-pools and pools within the hydrologic influence of the receiving stream are fully sampled.

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 Browns Gulch to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

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 (1990). 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". Browns 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. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Browns 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile 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 for prey. 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 Browns 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. 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 Browns Gulch, 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 hardwood 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 Browns 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 (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Browns Gulch. In addition, seven 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 Stream Habitat 2.0.17, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream

- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Browns Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

The habitat inventory of June 13, 2005 was conducted by M. Liggett and M. Erkel (WSP). The total length of the stream surveyed was 553 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.09 cfs on June 16, 2005.

Browns Gulch is an E6 channel type for 553 feet of the stream surveyed. E6 channels are low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. They are very efficient and stable with a high meander width ratio and a silt/clay channel.

Water temperatures taken during the survey period ranged from 53 to 54 degrees Fahrenheit. Air temperatures ranged from 55 to 56 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% riffle units, 30% pool units, 17% dry units, 17% flatwater units, and 3% culvert units (Graph 1). Based on total length of Level II habitat types there were 34% pool units, 20% riffle units, 21% dry units, 16% flatwater units and 9% culvert units (Graph 2).

Four Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 33% low gradient riffle units, 30% mid-channel pool units, 17% dry units, and 17% run units (Graph 3). Based on percent total length 34% were mid-channel pool units, 21% were dry units, and 20% were low gradient riffle units.

A total of nine pools were identified (Table 3). All of the pools encountered were main channel pools (Graph 4).

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Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Three of the seven fully sampled pools (43%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the seven pool tail-outs measured, one had a value of 3 (14%); three had a value of 4 (43%); three had a value of 5 (43%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

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 0, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 32 (Table 1).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Browns Gulch. Graph 7 describes the pool cover in Browns Gulch. Small woody debris is the dominant pool cover type followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs, silt/clay was observed in 43% of pool tail-outs and bedrock was observed in 29% of pool tail-outs.

The mean percent canopy density for the surveyed length of Browns Gulch was 90%. Ten percent of the canopy was open (Table 7). Of the mean percent canopy density, the mean percentages of hardwood and coniferous trees were 58% and 42%, respectively. Graph 9 describes the mean percent canopy in Browns Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 89%. The mean percent left bank vegetated was 91%. The dominant elements composing the structure of the stream banks consisted of 83% sand/silt/clay, 11% cobble/gravel, and 6% bedrock (Graph 10). Grass was the dominant vegetation type observed in 44% of the units surveyed. Additionally, 28% of the units surveyed had coniferous trees as the dominant vegetation type, and 22% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Seven sites were electrofished for species composition and distribution in Browns Gulch on July 28, 2005. Water temperatures taken during the electrofishing period ranged from 61 to 65 degrees Fahrenheit. Air temperatures ranged from 66 to 72 degrees Fahrenheit. The sites were sampled by C. Marston (WSP), A. Nelson (WSP) and Paul Divine (DFG). Combined, the sample sites within the reach yielded one age 1+ steelhead/rainbow trout (SH/RT), one age 2+ SH/RT; twenty-six young-of-the-year coho salmon, and six age 1+ coho salmon.

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The following chart displays the information yielded from these sites:

2003 Browns Gulch electrofishing observations

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 1 E6 Channel Type									
7/28/05	1	2	4.2	8	3	0	0	0	0
7/28/05	2	3	4.2	34	2	0	0	0	0
7/28/05	3	10	3.3	110	9	0	0	0	0
7/28/05	4	12	4.2	167	11	0	0	0	0
7/28/05	5	15	4.2	251	1	6	0	0	1
7/28/05	6	18	4.2	364	0	0	0	1	0
7/28/05	7	30	4.2	542	0	0	0	0	0

DISCUSSION

Browns Gulch is an E6 channel type for the entire 553 feet of stream surveyed. The suitability of E6 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for opposing wing-deflectors; and poor for plunge weirs, boulder clusters, and single wing-deflectors.

The water temperatures recorded on the survey day June 13, 2005 ranged from 53 to 54 degrees Fahrenheit. Air temperatures ranged from 55 to 56 degrees Fahrenheit. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 16% of the total length of this survey, riffles 20%, and pools 34%. Three of the seven pools measured (43%) had a maximum residual depth greater than two 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 residual 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..

None of the seven pool tail-outs measured had an embeddedness rating of 1 or 2. Four of the pool tail-outs had embeddedness ratings of 3 or 4. Three of the pool tail-outs had a rating of 5, which is considered not suitable 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. Sediment sources in Browns Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Five of the seven pool tail-outs had silt, sand, or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 32. The shelter rating in the flatwater habitats was 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Browns Gulch. Small woody debris is the dominant cover type in pools followed by large woody debris. Log and root wad cover structure in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 90%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 89% and 91%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence of North Fork Elk River. There is a 1' high plunge at the start of the survey.

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8	0002.00	A left bank tributary goes dry approximately 20' upstream from its mouth. First electrofishing site.
34	0003.00	Second electrofishing site.
39	0004.00	Flow goes subsurface.
62	0005.00	Out of influence of North Fork Elk River.
110	0010.00	Third electrofishing site.
167	0012.00	Fourth electrofishing site.
200	0014.00	Culvert under the main haul road is 7.3’ high x 7.3’ wide x 50’ long, with a diameter of 7.3’ and has no plunge. The culvert is metal with no baffles or weirs. The culvert is in the channel in good condition, however near the upstream end it is slightly flattened on the top.
251	0015.00	Old railroad bridge supports, 7' tall, and a retaining a wall of logs on the right bank 4' high x 10' long. Fifth electrofishing site.
364	0018.00	Sixth electrofishing site.
523	0028.00	Dry side channel enters at the start of the unit. Flow goes subsurface.
553	0030.00	End of survey due to dry units; the next unit was dry for 84’. Seventh electrofishing site.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	