STREAM INVENTORY REPORT

KIDWELL GULCH

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Kidwell Gulch. The survey began at the confluence with the Big River and extended upstream 0.9 miles.

The Kidwell 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 Kidwell 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

Kidwell Gulch is a tributary to the Big River, located in Mendocino County, California (Map 1). Kidwell Gulch's legal description at the confluence with the Big River is T17N R16W S22. Its location is 39°18′58″ north latitude and 122°38′25″ west longitude. Kidwell Gulch is a first order stream and has approximately 1.9 miles of blue line stream according to the USGS Mathison Peak 7.5 minute quadrangle. Kidwell Gulch drains a watershed of approximately 0.4 square miles. Elevations range from about 200 feet at the mouth of the creek to 1,100 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 Highway 20.

METHODS

The habitat inventory conducted in Kidwell Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The 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. 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.

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 Kidwell 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 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 (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. 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 (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". Kidwell 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 Kidwell 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, bedrock, 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 Kidwell 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 Kidwell 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 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 Kidwell 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.

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 Kidwell Gulch. In addition, eleven 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 Kidwell 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
- Mean 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 20, 21, 24, and 25, 2002, was conducted by Toni Russell and Janelle Breton (WSP/AmeriCorps). The total length of the stream surveyed was 4,845 feet with an additional 32 feet of side channel.

Stream flow was measured 700 feet upstream of the start of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.02 cfs on June 20, 2002.

Kidwell Gulch is a F4 channel type for the first 3,297 feet of the stream surveyed, a B4 channel type for the next 853 feet, and an A4 channel for the remaining 695 feet. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel dominant substrates. B4 channels are moderately entrenched, moderate gradient, riffle dominated with infrequently spaced pools, very stable plan and profile, stable banks, and gravel dominated substrates. A4 channels are steep, narrow, cascading, step-pool streams, having high energy/debris transport associated with depositional soils and gravel dominated substrates.

Water temperatures taken during the survey period ranged from 53° to 56° Fahrenheit. Air temperatures ranged from 56° to 76° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 34% riffle units, 36% flatwater units, and 24% pool units (Graph 1). Based on total length of Level II habitat types there were 23% riffle units, 37% flatwater units, and 13% pool units (Graph 2).
Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were runs, 35%; low gradient riffles, 28%; and mid-channel pools, 21% (Graph 3). Based on percent total length, runs made up 33%, dry units 28%, and low gradient riffles 20%.

A total of 51 pools were identified (Table 3). Main-channel pools were the most frequently encountered, at 90%, and comprised 93% 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. Four of the 51 pools (7.8%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 50 pool tail-outs measured, 4 had a value of 1 (8%); 16 had a value of 2 (32%); 9 had a value of 3 (18%); 3 had a value of 4 (6%); and 18 had a value of 5 (36%) (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. Riffle habitat types had a mean shelter rating of 7, flatwater habitat types had a mean shelter rating of 26, and pool habitats had a mean shelter rating of 22 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 60. Main-channel pools had a mean shelter rating of 19 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris and small woody

debris are the dominant cover types in Kidwell Gulch. Graph 7 describes the pool cover in Kidwell Gulch. Large woody debris is the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 70% of pool tail-outs while sand was the next most frequently observed substrate type, at 18%.

The mean percent canopy density for the surveyed length of Kidwell Gulch was 97%. The mean percentages of deciduous and coniferous trees were 27% and 73%, respectively. Graph 9 describes the mean percent canopy in Kidwell Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 78.6%. The mean percent left bank vegetated was 75.4%. The dominant elements composing the structure of the stream banks consisted of 7.8% bedrock, 24.4% cobble/gravel, and 67.8% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 71.2% of the units surveyed. Additionally, 24.4% of the units surveyed had deciduous trees as the dominant vegetation type, 3.3% had grass as the dominant vegetation, and 1.1% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Eleven sites were electrofished for species composition and distribution in Kidwell Gulch on July 24, 2002. The water temperature taken during the electrofishing period was 58° Fahrenheit. The sites were sampled by Paul Divine (DFG), Janelle Breton and Ryan Wells (WSP).

The first site sampled included habitat unit 005, a mid-channel pool approximately 85 feet from the confluence with the Big River. The site yielded no fish.

The second site included habitat unit 011, a mid-channel pool located approximately 198 feet above the creek mouth. The site yielded one young-of-the-year steelhead.

The third site sampled included habitat unit 023, a plunge pool located approximately 332 feet above the creek mouth. The site yielded one age one plus steelhead.

The fourth site sampled included habitat unit 042, a mid-channel pool located approximately 658 feet above the creek mouth. The site yielded no fish.

The fifth site sampled included habitat unit 065, a mid-channel pool located approximately 1,075 feet above the creek mouth. The site yielded no fish.

The sixth site sampled included habitat unit 073, a plunge pool located approximately 1,234 feet above the creek mouth. The site yielded one age one plus steelhead.

The seventh site sampled included habitat unit 121, a mid-channel pool located approximately

2,100 feet above the creek mouth. The site yielded no fish.

The eight site sampled included habitat unit 144, a mid-channel pool located approximately 2,628 feet above the creek mouth. The site yielded no fish.

The ninth site sampled included habitat unit 173, a mid-channel pool located approximately 3,158 feet above the creek mouth. The site yielded no fish.

The tenth site sampled included habitat unit 181, a mid-channel pool located approximately 3,289 feet above the creek mouth. The site yielded no fish.

The eleventh site sampled included habitat unit 187, a mid-channel pool located approximately 4,214 feet above the creek mouth. The site yielded no fish.

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
7/24/02	1	85	0005	4.2	1	F4	0	0	0
7/24/02	2	198	0011	4.2	1	F4	1	0	0
7/24/02	3	332	0023	5.6	1	F4	0	1	0
7/24/02	4	658	0042	4.2	1	F4	0	0	0
7/24/02	5	1,075	0065	4.2	1	F4	0	0	0
7/24/02	6	1,234	0073	5.6	1	F4	0	1	0
7/24/02	7	2,100	0121	4.2	1	F4	0	0	0
7/24/02	8	2,628	0144	4.2	1	F4	0	0	0
7/24/02	9	3,158	0173	4.2	1	F4	0	0	0
7/24/02	10	3,289	0181	4.2	1	F4	0	0	0
7/24/02	11	4,182	0187	4.2	3	A4	0	0	0

DISCUSSION

Kidwell Gulch is a F4 channel type for the first 3,297 feet of stream surveyed, a B4 channel type

for the next 853 feet, and an A4 channel type for the remaining 695 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for boulder clusters. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. The suitability of A4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, opposing wing deflectors, and log cover; poor for boulder clusters and single wing deflectors.

The water temperatures recorded on the survey days June 20, 21, 24 and 25, 2002, ranged from 53° to 56° Fahrenheit. Air temperatures ranged from 56° to 76° 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 37% of the total length of this survey, riffles 23%, and pools 13%. The pools are relatively shallow, with only 4 of the 51 (7.8%) 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.

Twenty of the 50 pool tail-outs measured had embeddedness ratings of 1 or 2. Twelve of the pool tail-outs had embeddedness ratings of 3 or 4. Eighteen of the pool tail-outs had a rating of 5, which is 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. Sediment sources in Kidwell Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty-five of the 50 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 22. The shelter rating in the flatwater habitats 26. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large or small woody debris in all habitat types. Additionally, undercut banks contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 97%. Reach 1 had a canopy density of 96%; Reach 2 had no canopy measurements recorded; and Reach 3 had a canopy density of 98%. 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 at 78.6% and 75.4%, 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) Kidwell 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) 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.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from large woody debris. Adding high quality complexity with woody cover is desirable.

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) There are several log debris accumulations present on Kidwell Gulch that are retaining fine sediment. The modification of these debris accumulations may be desirable. If the LDA's are modified, the wood removed from the site that is not used by the project for habitat enhancement shall be left within the riparian zone so as to provide a source for future recruitment of wood into the stream.

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 Big River. Channel type is F4.

85' Electrofishing site #1.

198' Electrofishing site #2.

332' Electrofishing site #3.

592' Culvert, 4.5' high x 5.5' wide x 40' long.

658' Electrofishing site #4.

820' Log debris accumulation(LDA) of 1 piece: 3' high x 6' wide x 5' long. Stored sediment 2' wide x 4' long x 2' deep. Water flows through this LDA, but there are no visible gaps. Possible barrier to juvenile and adult salmonids.

1,075' Electrofishing site #5.

1,234' Electrofishing site #6.

1,243' LDA of 1 piece: 2' high x 7' wide x 5' long. Stored sediment 3' wide x 3' long x 1' deep. Possible barrier to juvenile salmonids.

1,602' LDA of 2 pieces: 6' high x 7' wide x 9' long. No stored sediment.

1,636' LDA of 1 piece: 4' high x 4' wide x 3' long. Stored sediment 3' wide x 4' long x 4' deep. Possible barrier to juvenile and adult salmonids.

1,832' LDA of 2 pieces: 9' high x 13' wide x 15' long. Stored sediment 5' wide x 8' long x 6' deep.

1,964' LDA of 10 pieces: 10' high x 10' wide x 30' long. Stored sediment 4' wide x 6' long x 6' deep. Possible barrier to juvenile and adult salmonids.

2,014' LDA of 3 pieces: 3' high x 8' wide x 22' long. Stored sediment 5' wide x 6' long x 4' deep.

2,035' LDA of 5 pieces: 7' high x 6' wide x 18' long. Stored sediment 7' wide x 10' long x 4' deep.

2,100' Electrofishing site #7.

2,131' LDA of 2 pieces: 5' high x 8' wide x 9' long. Stored sediment 4' wide x 6' long x 6' deep. Possible barrier to juvenile and adult salmonids.

2,160' LDA of 5 pieces: 5' high x 12' wide x 34' long. Stored sediment 10' wide x 5' long x 2' deep. Possible barrier to juvenile and adult salmonids.

2,546' LDA of 3 pieces: 8' high x 8' wide x 12' long. Stored sediment 4' wide x 6' long x 6' deep. Possible barrier to juvenile and adult salmonids.

2,576' LDA of 3 pieces: 5' high x 8' wide x 22' long. Stored sediment 6' wide x 8' long x 2' deep.

2,628' Electrofishing site #8.

2,628' LDA of 4 pieces: 6' high x 7' wide x 20' long. Stored sediment 5' wide x 5' long x 3' deep. Water flows through this LDA, with no visible gaps. Possible barrier to juvenile and adult salmonids.

2,788' LDA of 1 piece: 4' high x 8' wide x 5' long. Stored sediment 3' wide x 4' long x 4' deep.

2,921' LDA 3' high x 10' wide x 15' long. Stored sediment 5' wide x 2' long x 3' deep.

3,017' Right bank erosion contributing sediment, 40 long x 30 high.

3,035' LDA of 3 pieces: 6' high x 8' wide x 10' long. Stored sediment 5' wide x 6' long x 3' deep. Possible barrier to juvenile and adult salmonids.

3,061' LDA of 6 pieces: 8' high x 14' wide x 20' long. Stored sediment 4' wide x 5' long x 3' deep.

3,078' LDA of 4 pieces: 10' high x 20' wide x 28' long. Stored sediment 3' wide x 6' long x 2' deep.

3,158' LDA of 2 pieces: 6' high x 15' wide x 18' long. Stored sediment 3' wide x 6' long x 4' deep. Possible barrier to juvenile and adult salmonids.

3,158' Electrofishing site #9.

3,201' LDA of 3 pieces: 3' high x 6' wide x 18' long. Stored sediment 5' wide x 12' long x 3' deep.

3,246' Spring enters on left bank, contributing less than 0.01 cfs.

3,269' LDA of 2 pieces: 6' high x 10' wide x 12' long. Stored sediment 3' wide x 9' long x 1' deep.

3,289' Electrofishing site #10.

3,297' Channel type changes from F4 to B4.

4,150' Channel type changes from B4 to A4.

4,182' Electrofishing site #11.

4,255' LDA of 3 pieces: 7' high x 15' wide x 15' long. Stored sediment 5' wide x 8' long x 3' deep. Possible barrier to juvenile salmonids.

4,345' Left bank erosion contributing sediment, 80 long x 30 high.

4,363' LDA of 1 piece: 5' high x 6' wide x 33' long. Stored sediment 4' wide x 6' long x 2' deep. Possible barrier to juvenile salmonids.

4,399' LDA of 4 pieces: 7' high x 7' wide x 30' long. Stored sediment 5' wide x 15' long x 4' deep.

4,444' LDA of 4 pieces: 12' high x 13' wide x 30' long. Stored sediment 5' wide x 20' long x 7' deep. Possible barrier to juvenile and adult salmonids. Jump for fish, three feet high with only one foot of water below.

4,481' LDA of 3 pieces: 15' high x 15' wide x 10' long. Stored sediment 4' wide x 5' long x 1' deep.

4,537' LDA of 5 pieces: 6' high x 9' wide x 30' long. Stored gravels sediment 5' wide x 10' long x 4' deep. Possible barrier to juvenile and adult salmonids. Jump height is three feet during high flows with one foot pool below.

4,543' LDA of 13 pieces: 12' high x 15' wide x 30' long. Stored sediment 4' wide x 6' long x 1' deep. Water flows through this LDA, with visible gaps. Possible barrier to juvenile salmonids. Water seeps underground.

4,581' Many logs in creek.

4,638' LDA of 10 pieces: 14' high x 12' wide x 45' long. Stored sediment 6' wide x 12' long x 8' deep. Water flows through this LDA, with visible gaps. Possible barrier to juvenile and adult salmonids at low flows.

4,684' LDA of 16 pieces: 15' high x 20' wide x 70' long. Stored sediment 6' wide x 10' long x 10' deep. Possible barrier to juvenile salmonids at low flows.

4,684' LDA of 3 pieces: 8' high x 12' wide x 25' long. Stored sediment 15' wide x 7' long x 8' deep. Possible barrier to juvenile and adult salmonids, six or seven feet of jump height required without much pool below.

4,845' End of survey due to continuation of dry channel.

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]	