STREAM INVENTORY REPORT

Falls Gulch

INTRODUCTION

A stream inventory was conducted in June 2004 on Falls Gulch. The survey began at the confluence with Cloney Gulch and extended upstream 0.3 miles. The Falls 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 Falls 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

Falls Gulch is a tributary to Cloney Gulch, a tributary to Freshwater Creek, a tributary to Freshwater Slough, a tributary to Eureka Slough, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Falls Gulch's legal description at the confluence with Cloney Gulch is T04N R01E S02. Its location is 40.7633 degrees north latitude and 124.0386 degrees west longitude, LLID number 1240385407633. Falls Gulch is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS Arcata South 7.5 minute quadrangle. Falls Gulch drains a watershed of approximately 1.8 square miles. Elevations range from about 105 feet at the mouth of the creek to 815 feet in the headwater areas. Redwood and Douglas mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Old Arcata Road to Freshwater–Kneeland Road.

METHODS

The habitat inventory conducted in Falls 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/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

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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 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 Falls 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." Falls 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.

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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 Falls Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), and 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 Falls 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 Falls 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 Falls 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:

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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 Falls Gulch. In addition, selected sites were sampled using a Smith-Root Model 12 electrofisher as discussed in unpublished data from the Juvenile Salmonid Abundance Summer Survey Report, 2004 (Richer, S., McCanne, D. 2004).

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 1.0.40, 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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Falls 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

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of June 9 to June 10, 2004 was conducted by Janelle Breton and Wendy Cole (DFG). The total length of the stream surveyed was 1,680 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.03 cfs on June 9, 2004.

Falls Gulch is an F4 channel type for 287 feet of the stream surveyed (Reach 1), and a B4 channel type for 1,393 feet of the stream surveyed (Reach 2). 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 riffle dominated channels with infrequently spaced pools, very stable plane and profile, stable banks on moderate gradients with low width /depth ratios and gravel dominant substrates.

Water temperatures taken during the survey period ranged from 56 to 58 degrees Fahrenheit. Air temperatures ranged from 57 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% pool units, 34% riffle units, 23% flatwater units, and 2% dry units (Graph 1). Based on total length of Level II habitat types there were 41% pool units, 33% riffle units, 25% flatwater units, and 1% dry units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 29% mid-channel pool units, 27% low gradient riffle units, and 23% run units (Graph 3). Based on percent total length, the most frequent habitat types were 28% mid-channel pool units, 25% run units, and 23% low gradient riffle units.

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A total of 23 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 78%, and comprised 87% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Three of the 23 pools (13%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 22 pool tail-outs measured, 10 had a value of 1 (46%); seven had a value of 2 (32%); five had a value of 3 (23%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst.

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 19, flatwater habitat types had a mean shelter rating of 33, and pool habitats had a mean shelter rating of 55 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 57. Scour pools had a mean shelter rating of 49 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover types in Falls Gulch. Graph 7 describes the pool cover in Falls 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 observed in 50% of pool tail-outs, and small cobble was observed in 27% of pool tail-outs.

The mean percent canopy density for the surveyed length of Falls Gulch was 91%. The mean percentages of hardwood and coniferous trees were 28% and 72%, respectively. Nine percent of the canopy was open. Graph 9 describes the mean percent canopy in Falls Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 91%. The mean percent left bank vegetated was 92%. The dominant elements composing the structure of the stream banks consisted of 41% sand/silt/clay, 38% cobble/gravel, 11% boulder, and 10% bedrock (Graph 10). Coniferous trees were the dominant vegetation type, observed in 44% of the units surveyed. Additionally, 29% of the units surveyed had hardwood trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

A biological survey was conducted by the Institute for River Ecosystems (IRE) in cooperation with the Department of Fish and Game. The sample reach included 1,680 feet. Coho salmon were observed throughout Reach 1 and 1,110 feet of Reach 2, a total length of about 1,400 feet. Trout were observed throughout the entire 1,680 feet of the sample reach. In this survey trout species were not distinguished and include cutthroat and rainbow, both resident and anadromous forms. (Ricker, S., McCanne, D. Unpublished Data, 2004). Juvenile salmonids were also observed from the stream banks throughout the entire 1,680 feet of habitat surveyed.

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DISCUSSION

Falls Gulch is an F4 channel type for 287 feet of the stream surveyed, and a B4 channel type for 1,393 feet of the stream surveyed.

The water temperatures recorded on the survey days June 9 to June 10, 2004 ranged from 56 to 58 degrees Fahrenheit. Air temperatures ranged from 57 to 62 degrees Fahrenheit. This is a good water temperature range for juvenile salmonids. 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 25% of the total length of this survey, riffles 33%, and pools 41%. The pools are relatively shallow, with only three of the 23 (13%) pools having 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. Installing structures that will deepen existing pool habitat is recommended.

Seventeen of the 22 pool tail-outs measured had embeddedness ratings of 1 or 2. Five of the pool tail-outs had embeddedness ratings of 3 or 4. None 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.

Seventeen of the 22 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 55. The shelter rating in the flatwater habitats was 33. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Falls Gulch. Large woody debris is the dominant cover type in pools followed by small woody debris. 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 91%. Reach 1 had a canopy density of 94%, while Reach 2 had a canopy density of 91%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 91% and 92%, 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.

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RECOMMENDATIONS

1)   Falls 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 deepen the existing 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)   There are several log debris accumulations present on Falls Gulch that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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'	Start of survey at confluence with Cloney Creek. Channel type is F4. Bridge
14'	Juvenile salmonids observed.
26'	Six inch salmonid observed.
97'	Log debris accumulation (LDA) consisting of one log spanning the channel 4.5' in diameter.
153'	LDA consisting of 25 pieces of wood.
287'	Channel type change to B4.
398'	Juvenile salmonid observed.
435'	LDA measures 10' long x 20' wide x 2' deep and is retaining sediment.

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525'   LDA consisting of 12 pieces of wood with a 4.5' diameter log spanning the channel.

640'   LDA consisting of 30 pieces of large wood, possible juvenile salmonid barrier.

1,017'   LDA consisting of nine pieces of large wood.

1,210'   LDA consisting of 12 pieces of large wood.

1,283'   LDA consisting of 11 pieces of large wood.

1,410'   Creek clogged with wood.

1,680'   End of survey due to a 40' falls in a bedrock canyon.

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.

Richer, S., McCanne, D., 2004. Unpublished data from the *Juvenile Salmonid Abundance Summer Survey Report 2004.* Anadromous Fisheries Research and Monitoring Program (AFRAMP), California Department of Fish and Game and Institute for River Ecosystems (IRE), Humboldt State University, Arcata, California.

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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]

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Appendix A

California Department of Fish & Game

Large Woody Debris (LWD) Riparian Inventory

Freshwater Basin, Humboldt County

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BACKGROUND

The importance of large woody debris (LWD) in the development of a stream's morphological and biological productivity has been well documented. It strongly influences stream habitat characteristics and biotic composition. Large woody debris is often the structural element associated with pool formation and is considered one of the major elements that create complex fish habitat vital for juvenile salmonid survival. Habitat complexity is particularly important for coho salmon and steelhead trout juveniles because these salmonids remain in the stream for at least one year before migrating to the ocean.

Large woody debris inventories describe the present relative abundance of LWD elements providing, or with the potential to provide, fish habitat within the stream channel. Large woody debris inventories also describe the relative abundance of "recruitable" LWD. Recruitable LWD is the large wood existing out of the stream channel that has a high potential of entering the stream channel in the future.

METHODS

Prior to conducting the LWD inventory, the stream was habitat-typed employing the methods described by Flosi, et al (1998). The Falls Gulch habitat-typing survey delineated two stream reaches. The start and end points for the LWD inventory reaches correspond to stream reach start and end points of the habitat survey.

Large woody debris inventory methods, data recording forms, and database structure are described in Flosi, et al (1998). Large woody debris minimum size criteria was 12-inches in diameter and 6 feet in length. Root wads had the 12-inch minimum diameter criteria but had no minimum length requirement. Diameter and length categories consisted of the following:

Diameter Category	Length Category
1. 1-2 feet	1. 6-20 feet
2. 2-3 feet	2. Over 20 feet
3. 3-4 feet	
4. Over 4 feet	

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Condition or status categories included:
  a) dead and down
  b) dead and standing
  c) perched for imminent delivery to the stream channel
  d) live coniferous trees
  e) live broadleaf trees (a.k.a. deciduous/hardwood)

The sampling strategy consisted of selecting a random starting point near the beginning of the LWD survey reach, and then systematically sampling 200 foot sections out of every 1,000 feet of stream length surveyed. The first 1,200 feet of the LWD survey reach was segmented into 200 foot sections and consecutively numbered 1 through 6. One of these six 200 foot sections was randomly selected as the beginning of the *first* sample section. After conducting the inventory survey in the initial 200 foot section, surveyors proceeded upstream 800 feet and surveyed the next 200 feet as the *second* sample section. The *third* sample section began 800 feet upstream of the end of the second sample section and the next 200 feet were surveyed, and so on. Systematic sampling continued upstream until the end of the LWD survey reach. This method produced a sampling level of approximately 20 percent. For channel type reaches that were less than 1000 feet, the entire reach was surveyed.

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RESULTS

*Tables 1 and 2 are located at the end of this report.

Table 3. Large Woody Debris Inventory for Falls Gulch, Humboldt County, California 2004.

REACH	CHANNEL TYPE	TOTAL LENGTH	DEAD DOWN	DEAD STANDING	PERCHED	--LIVE TREES-- CONIFER	BROADLEAF	TOTAL
			Number of pieces per 100 linear feet of stream out of channel on right and left banks					
1	F4	287	3.5	0.5	0	6.5	1.5	12
2	B4	1393	3	0.5	0	4.5	6.5	14.5
			Number of pieces per 100 linear feet of stream within the bankfull channel					
1	F4	287	16	0.5		0	0	16.5
2	B4	1393	10	0		0	2	12
			Number of pieces per 100 linear feet of stream out of channel on right and left banks and within the bankfull channel					
1	F4	287	19.5	1	0	6.5	1.5	28.5
2	B4	1393	13	0.5	0	4.5	8.5	26.5
			Percentage of LWD pieces found out of channel on right and left banks					
1	F4	287	29.1	4.1	0	54.1	12.5	99.8
2	B4	1393	20.6	3.4	0	31	44.8	99.8
			Percentage of LWD pieces found within the bankfull channel					
1	F4	287	97.0	3.0	0.0	0.0	0.0	100
2	B4	1393	83.3	0.0	0.0	0.0	16.7	100
			Percentage of LWD pieces found out of channel on right and left banks and within the bankfull channel					
1	F4	287	68.4	3.5	0.0	22.8	5.3	100
2	B4	1393	49.1	1.9	0.0	17.0	32.1	100

The Falls Gulch LWD inventory consisted of two inventory reaches.

Reach 1, a F4 channel type extended upstream approximately 287 feet from the mouth. This reach contained 12 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 54.1% live coniferous, 29.1% dead and down, 12.5% live broadleaf, 4.1% dead and standing, and 0% perched (Table 3). Within the bankfull channel, reach 1 contained 16.5 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 97% dead and down, 3% dead and standing, 0% live coniferous, 0% live broadleaf, and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 28.5, of which 68.4% were dead and down, 22.8% were live coniferous, 5.3% live broadleaf, 3.5% dead and standing, and 0% perched. Of the pieces in reach 1, 54.4% were in LWD size category of 1-2 feet in diameter, 22.8% were in the 2-3 foot category, 14% were in the 3-4 foot category, and 8.8% were in the >4 foot category (Figure 1).

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Reach 2, a B4 channel type started approximately 287 feet from the mouth and extended up stream approximately 1680 feet from the mouth. This reach contained 14.5 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 44.8% live broadleaf, 31% live coniferous, 20.6% dead and down, 3.4% dead and standing, and 0% perched (Table 3). Within the bankfull channel, reach 2 contained 12 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 83.3% dead and down, 16.7% live broadleaf, 0% live coniferous, 0% dead and standing, and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 26.5, of which 49.1% were dead and down, 32.1% live broadleaf, 17% live coniferous, 1.9% dead and standing, and 0% perched. Of the pieces in reach 2, 67.9% were in the LWD size category of 1-2 feet in diameter, 15.1% were in the 2-3 foot category, 13.2% were in the 3-4 foot category, and 3.8% were in the >4 foot category (Figure 1).
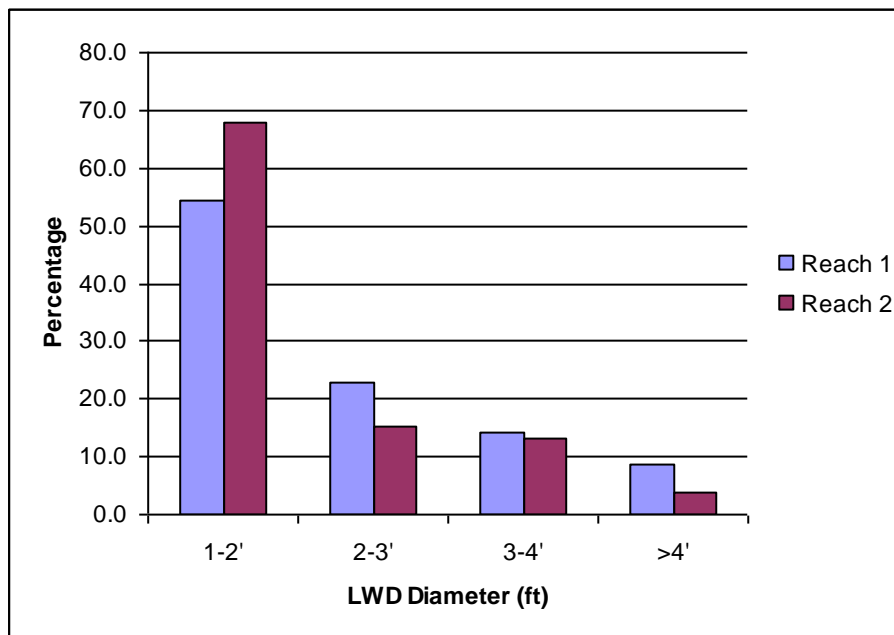

Figure 1. Percent of LWD according to diameter size class and stream reach.

DISCUSSION

Reach 1, a F4 channel type had a bankfull width of 17 feet. LWD on the banks was dominated by live coniferous, greater than 20 feet long, and 1-2 feet in diameter. While dead and down, less than 20 feet long, and 1-2 feet in diameter dominated the stream channel. The 1-2 diameter size class was the most common for all LWD pieces in both the stream channel and the bank zones (Table 1). In the stream channel, there were 16 pieces of dead and down LWD per 100 linear feet of stream observed (Table 2).

Reach 2, a B4 channel type had a bankfull width of 14 feet. LWD on the banks was dominated by live deciduous, greater than 20 feet long, and 1-2 feet in diameter. While dead and down, less than 20 feet long, and 1-2 feet in diameter dominated the stream channel. The 1-2 diameter size

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class was the most common for all LWD pieces in both the stream channel and the bank zones (Table 1). IN the stream channel, there were 10 pieces of dead and down LWD per 100 linear feet of stream observed (Table 2).

One goal of conducting LWD inventories is to provide data that, along with fish population and habitat type data, will enable resource managers to characterize the quality of available and potential fish habitat. Although, the relationship between the number, size, and type of LWD pieces per 100 feet, and quality of fish habitat has not been fully established, it is generally accepted that LWD in the stream channel plays a vital role in contributing to the quality of fish habitat. Large woody debris within the bank zone is the source for future instream LWD and addresses the issue of LWD recruitment to the stream channel. Information in this report will enable resource managers to identify areas lacking in LWD, subsequently leading to planning and prioritizing prescriptions for improvement. This information will also be useful in detecting changes in LWD relative abundance with relation to land use practices or riparian zone restoration projects.