

# STREAM INVENTORY REPORT

## Flume Gulch

### INTRODUCTION

A stream inventory was conducted from July 25 to July 27, 2011 on Flume Gulch. The survey began at the confluence with the Navarro River and extended upstream 1.5 miles.

The Flume 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 Flume 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

Flume Gulch is a tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Flume Gulch's legal description at the confluence with the Navarro River is T15N R16W S07. Its location is 39.1738 degrees north latitude and 123.6776 degrees west longitude, LLID number 1236764391738. Flume Gulch is a first order stream and has approximately 2.7 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Flume Gulch drains a watershed of approximately 2.5 square miles. Elevations range from about 15 feet at the mouth of the creek to 1,250 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 a private logging road off Philo-Greenwood Road.

### METHODS

The habitat inventory conducted in Flume Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game (DFG) personnel that conducted the inventory were trained in standardized habitat inventory methods by the 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

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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 Flume 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". Flume 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 Flume Gulch, embeddedness was

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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. In Flume 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. Next, 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. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent 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 Flume 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 Flume 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

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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 Flume Gulch. In addition, underwater observations were made at 18 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, 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 Flume 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

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- 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 July 25 to July 27, 2011 was conducted by M. Groff and I. Mikus (DFG). The total length of the stream surveyed was 7,979 feet with an additional 65 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.33 cfs on August 24, 2011.

Flume Gulch is an F4 channel type for 1,529 feet of the stream surveyed (Reach 1), an A2 channel type for 1,268 feet of the stream surveyed (Reach 2), an F4 channel type for 4,200 feet of the stream surveyed (Reach 3), and a G4 channel type for 1,047 feet of the stream surveyed (Reach 4). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates. G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 52 to 67 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% pool units, 30% riffle units, and 26% flatwater units (Graph 1). Based on total length of Level II habitat types there were 40% pool units, 35% flatwater units, and 26% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 33%; low gradient riffle units, 22%; and run units, 17% (Graph 3). Based on percent total length, mid-channel pool units made up 33%, step run units 19%, and low gradient riffle units 16%.

A total of 122 pools were identified (Table 3). Main channel pools were the most frequently encountered at 81% (Graph 4), and comprised 87% of the total length of all pools (Table 3).

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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. Twenty-nine of the 122 pools (24%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 122 pool tail-outs measured, two had a value of 1 (1.6%); 43 had a value of 2 (35.2%); 57 had a value of 3 (46.7%); 13 had a value of 4 (10.7%); seven had a value of 5 (5.7%); (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. 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 0, and pool habitats had a mean shelter rating of 14 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 14. Scour pools had a mean shelter rating of 11 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Flume Gulch. Graph 7 describes the pool cover in Flume 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 84% of the pool tail-outs. Boulders were the next most frequently observed dominant substrate type and occurred in 7% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Flume Gulch was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 49% and 51%, respectively. Graph 9 describes the mean percent canopy in Flume Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 93%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 85% sand/silt/clay, 8% cobble/gravel, 5% boulder, and 2% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 50% of the units surveyed. Additionally, 30% of the units surveyed had deciduous trees as the dominant vegetation type, and 19% had brush as the dominant vegetation type (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Survey teams conducted a snorkel survey at 18 sites for species composition and distribution in Flume Gulch on August 22, 2011. The water temperature taken during the survey period of 1255 hours to 1410 hours was 56 degrees Fahrenheit. The air temperature ranged was 68 degrees Fahrenheit. The sites were sampled by I. Mikus and M. Groff (DFG).

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In reach 1, which comprised the first 1,529 feet of stream, eight sites were sampled. The reach sites yielded 28 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), two age 1+ SH/RT, one age 2+ SH/RT, two YOY coho salmon, four age 1+ coho salmon, two unknown trout, and 16 sculpin.

In reach 2, eight sites were sampled starting approximately 1,698 feet from the confluence with the Navarro River and continuing upstream 714 feet. The reach sites yielded 63 YOY SH/RT, three age 1+ SH/RT, two age 2+ SH/RT, and one unknown trout.

In reach 3, two sites were sampled starting approximately 2,732 feet from the confluence with the Navarro River and continuing upstream 211 feet. The reach sites yielded 12 young-of-the-year SH/RT and one age 1+ SH/RT.

The following chart displays the information yielded from these sites:

2011 Flume Gulch underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho		Unknown trout
					YOY	1+	2+	YOY	1+	1+
Reach 1: F4 Channel Type										
08/22/11	1	005	Pool	102	7	1	0	1	0	0
	2	013	Pool	316	3	0	0	0	0	0
	3	020	Pool	496	4	0	1	0	0	0
	4	023	Pool	572	4	1	0	0	0	1
	5	032	Pool	876	6	0	0	1	1	0
	6	039	Pool	1,113	3	0	0	0	2	0
	7	048	Pool	1,327	0	0	0	0	1	1
	8	054	Pool	1,529	1	0	0	0	0	0
Reach 2: A2 Channel Type										
8/22/11	9	059	Pool	1,725	26	2	0	0	0	0
	10	063	Pool	1,837	8	0	0	0	0	0
	11	064	Pool	1,851	4	0	0	0	0	0
	12	072	Pool	2,207	3	0	0	0	0	1
	13	073	Pool	2,048	1	0	1	0	0	0
	14	077	Pool	2,236	9	0	0	0	0	0
	15	079	Pool	2,265	7	0	0	0	0	0
	16	088	Pool	2,412	5	1	1	0	0	0
Reach 3: F4 Channel Type										
8/22/11	17	104	Pool	2,754	8	0	0	0	0	0
	18	111	Pool	2,943	4	1	0	0	0	0

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### DISCUSSION

Flume Gulch is an F4 channel type for the first 1,529 feet of stream surveyed, an A2 channel type for the next 1,268 feet, an F4 channel type for the next 4,200 feet, and a G4 channel type for the remaining 1,047 feet. The suitability of F4, A2, and G4 channel types for fish habitat improvement structures is as follows: F4 channels are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. A2 channels are generally not suitable for fish habitat improvement projects. G4 channels are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 25 to July 27, 2011, ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 52 to 67 degrees Fahrenheit. This is a suitable water temperature range for 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 35% of the total length of this survey, riffles 26%, and pools 40%. Twenty-nine of the 122 (24%) pools had a maximum residual 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 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 large wood structures that will deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

Forty-five of the 122 pool tail-outs measured had embeddedness ratings of 1 or 2. Seventy of the pool tail-outs had embeddedness ratings of 3 or 4. Seven 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 Flume Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred five of the 122 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 is 14. The shelter rating in the flatwater habitats is 0. 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 Flume 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 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 98%. Reach 1 had a canopy density of 98%, Reach 2 had a canopy density of 98%, Reach 3 had a canopy density of 98%, and Reach 4 had a canopy density of 97%. In general, revegetation projects are considered when canopy density is less than 80%.



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The percentage of right and left bank covered with vegetation was 93% and 93%, 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) Flume 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.
- 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.

### 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 #:	Comment:
0	0001.00	Start of survey at the confluence with the Navarro River. The channel is an F4.
88	0005.00	An erosion site on the left bank measures approximately 45' long x 10' high; it is contributing silt and sand to the channel.
102	0006.00	Woody debris is accumulating in the channel; it is retaining a volume of silt and sand measuring approximately 1' deep x 10' wide x 30' long.
180	0009.00	An erosion site on the right bank measures approximately 5' high x 50' long; it is contributing silt and sand to the channel.

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316	0014.00	An erosion site on the right bank measures approximately 15' high x 30' long; it is contributing silt and sand to the channel.
496	0021.00	A logging road crosses the channel. The crossing is a 14' wide x 51' long x 10.8' high railcar bridge with an old log-stringer bridge below it. One of the logs from the stringer bridge below has partially collapsed into the channel.
1007	0037.00	Dry tributary on the left bank.
1084	0039.00	An erosion site on the left bank measures approximately 6' high x 30' long; it is contributing silt, sand and gravel to the channel.
1167	0042.00	An old 3' diameter corrugated metal culvert is embedded in the right bank. The culvert is mostly in line with the creek channel. It is partially filled with silt and sand. Water will flow into the culvert during high flow events.
1529	0055.00	Dry tributary on the left bank. The channel changes from an F4 to an A2.
1675	0058.00	Log debris accumulation (LDA) #01 contains 11 pieces of large woody debris (LWD) and measures 6' high x 31' wide x 10' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 10' wide x 40' long x 3' deep. The LDA has two plunges: the first is 2' high; the second is 3' high. Fish are present above the LDA.
1744	0061.00	A landslide on the left bank measures approximately 50' long x 50' high; it is contributing woody debris and sediment ranging in size from silt to small cobble to the channel.
1820	0062.01	Boulders and large woody debris have accumulated mid-stream, creating a side-channel. In the side-channel the water flows beneath the debris accumulation, plunges 4' down over boulders and then flows to meet the main channel 50' downstream. A fish was observed in the side-channel.
2027	0073.00	An erosion site on the right bank measures approximately 10' high x 15' long; it is contributing silt, sand, and gravel to the channel.
2222	0077.00	Tributary #01 enters on the left bank. It contributes approximately 1% to Flume Gulch's flow. The water temperature of the tributary is 56 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 54 degrees Fahrenheit. The slope of the tributary is approximately 18%.
2285	0081.00	There is a 1' high plunge.

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2398	0088.00	There is a 1.5' high plunge.
2732	0104.00	The channel changes from an A2 to an F4.
2823	0108.00	Woody debris is accumulating in a pool; it has the potential to become an LDA.
3091	0119.00	Large woody debris is accumulating in the channel; it has the potential to become an LDA. The debris is retaining a volume of silt, sand, and gravel measuring approximately 15' long x 5' wide x 2' deep.
3217	0123.00	LDA #02 contains nine pieces of LWD and measures 7' high x 34' wide x 16' long. Water flows through the LDA and there are visible gaps in it. The LDA is retaining silt measuring 4' wide x 15' long x 2' deep. Fish are present above the LDA.
3495	0135.00	Old road crossing.
4043	0151.00	LDA #03 contains eight pieces of LWD and measures 7' high x 30' wide x 15' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 15' wide x 30' long x 2' deep. Fish are present above the LDA.
4228	0158.00	There is a 2' high plunge over a log.
4252	0159.00	LDA #04 contains eight pieces of LWD and measures 6' high x 45' wide x 7' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to sand and measures 20' wide x 25' long x 2' deep. Fish are present above the LDA.
4371	0162.00	Woody debris is accumulating in the channel.
4894	0180.00	Woody debris is accumulating in the channel; it has the potential to become an LDA.
5015	0185.00	An erosion site on the right bank measures approximately 8' high x 20' long; it appears to be inactive, it is covered with moss.
5427	0197.00	Right bank seep.
5459	0198.00	LDA #05 contains 12 pieces of LWD and measures 4' high x 32' wide x 23' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to sand and measures 18' wide x 40' long x 1.5' deep. Fish are present above the LDA.
5620	0204.00	There is a 1' high plunge.

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- 5830 0212.00 An erosion site on the right bank measures approximately 15' high x 15' long; it is contributing silt, sand, and gravel to the channel.
- 5962 0216.00 LDA #06 contains five pieces of LWD and measures 3' high x 34' wide x 27' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to sand and measures 15' wide x 30' long x 1.5' deep. There is a 3' high plunge over the LDA. Fish are present above the LDA.
- 6067 0220.00 LDA #07 contains 10 pieces of LWD and measures 7' high x 16' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 10' wide x 10' long x 2' deep. Fish are present above the LDA. The LDA is associated with an old road crossing.
- 6701 0236.00 LDA #08 contains over 20 pieces of LWD and measures 6' high x 31' wide x 25' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 15' wide x 50' long x 3' deep. Fish are present above the LDA.
- 6932 0244.00 The channel changes from an F4 to a G4.
- 7037 0246.00 The channel is split around a large rootwad and associated boulders. On the left bank side there is a series of plunges: the first and second are 2' high, the third is 3' high. None of the plunges have jump pools. On the right bank side there is a 5' high plunge onto boulders and woody debris.
- 7178 0252.00 LDA #09 contains 10 pieces of LWD and measures 6' high x 29' wide x 11' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to sand and measures 10' wide x 10' long x 2' deep. Fish are present above the LDA.
- Tributary #02 enters on the left bank. It contributes approximately 1% to Flume Gulch's flow. The water temperature of the tributary is 54 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 55 degrees Fahrenheit. The slope of the tributary is over 20%.
- 7280 0255.00 LDA #10 contains five pieces of LWD and measures 5' high x 16' wide x 26' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to sand and measures 10' wide x 20' long x 3' deep. There is a 5' high plunge over the LDA. Fish are present above the LDA.
- 7343 0257.00 There is a 2' high plunge.

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7425	0260.00	LDA #11 contains seven pieces of LWD and measures 3' high x 21' wide x 11' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to sand and measures 5' wide x 20' long x 1' deep. Fish are present above the LDA.
7549	0265.00	LDA #12 contains six pieces of LWD and measures 5' high x 18' wide x 12' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to sand and measures 5' wide x 50' long x 3' deep. There is a 5' high plunge over the LDA. Fish are present above the LDA.
7617	0268.00	Dry tributary on the left bank.
7797	0274.00	Tributary #03 enters on the right bank. It contributes approximately 2% to Flume Gulch's flow. The water temperature of the tributary is 57 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 55 degrees Fahrenheit. The tributary is not accessible to fish because there are two 4' high jumps at the mouth.
7845	0276.00	Tributary #04 enters on the left bank. It contributes approximately 1% to Flume Gulch's flow. The water temperature of the tributary is 56 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 55 degrees Fahrenheit. The slope of the tributary is approximately 18%.
7946	0281.00	End of survey due to an 82' long series of plunges with a 21% slope. The first plunge is 3' high with a 1.4' deep pool below it. The second plunge is 6' high; the water pours onto boulders. The pool beneath it is 1.5' deep. There are three more plunges: a 3' high plunge, a 3' high plunge, and, finally, a 6' high plunge over LWD. The series of plunges is a barrier to salmonids, but fish, possibly residents, were observed above it.

## 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.

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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]	

**Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types**

Stream Name: Flume Gulch

LLID: 1236764391738 Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
1	0	DRY	0.4	14	14	0.2									
74	13	FLATWATER	26.1	38	2777	34.5	6.8	0.4	0.9	306	22671	145	10709		0
122	122	POOL	43.1	26	3197	39.7	11.5	0.7	1.6	286	34875	279	34015	214	14
86	13	RIFFLE	30.4	24	2056	25.6	7.7	0.2	0.6	216	18598	50	4265		0
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>					<b>Total Area (sq.ft.)</b>			<b>Total Volume (cu.ft.)</b>		
283	148				8044					76144			48988		

**Table 2 - Summary of Habitat Types and Measured Parameters**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
61	8	LGR	21.6	22	1324	16.5	7	0.2	0.9	148	8999	30	1836		0	97
25	5	HGR	8.8	29	732	9.1	9	0.3	0.9	326	8156	81	2019		0	97
48	9	RUN	17.0	25	1214	15.1	7	0.4	1.1	154	7402	65	3114		0	96
26	4	SRN	9.2	60	1563	19.4	7	0.5	1.3	649	16867	324	8433		1	99
94	94	MCP	33.2	28	2663	33.1	11	0.7	3.8	302	28341	289	27195	223	15	98
1	1	CCP	0.4	10	10	0.1	5	0.6	1.3	50	50	35	35	30	0	92
4	4	STP	1.4	26	106	1.3	16	0.4	3.1	357	1427	290	1161	154	18	99
1	1	LSL	0.4	13	13	0.2	7	0.4	0.9	91	91	55	55	36	10	97
4	4	LSR	1.4	24	94	1.2	10	0.4	1.4	227	909	124	496	69	8	98
1	1	LSBk	0.4	16	16	0.2	12	0.6	1.6	192	192	154	154	115	5	99
1	1	LSBo	0.4	10	10	0.1	12	0.3	1.7	90	90	45	45	27	5	100
16	16	PLP	5.7	18	285	3.5	14	0.9	4.7	236	3775	305	4874	249	13	97
1	0	DRY	0.4	14	14	0.2										

Total Units  
283

Total Units Fully Measured  
148

Total Length (ft.)  
8044

Total Area (sq.ft.)  
76299

Total Volume (cu.ft.)  
49417



**Table 3 - Summary of Pool Types**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
99	99	MAIN	81	28	2779	87	11.2	0.7	301	29818	219	21652	14
23	23	SCOUR	19	18	418	13	12.7	0.7	220	5056	193	4443	11

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
122	122	3197	34875	26095

**Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
94	MCP	77	8	9	65	69	16	17	5	5	0	0
1	CCP	1	0	0	1	100	0	0	0	0	0	0
4	STP	3	0	0	3	75	0	0	1	25	0	0
1	LSL	1	1	100	0	0	0	0	0	0	0	0
4	LSR	3	0	0	4	100	0	0	0	0	0	0
1	LSBk	1	0	0	1	100	0	0	0	0	0	0
1	LSBo	1	0	0	1	100	0	0	0	0	0	0
16	PLP	13	1	6	8	50	5	31	0	0	2	13

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
122	10	8	83	68	21	17	6	5	2	2

Mean Maximum Residual Pool Depth (ft.): 1.6

**Table 5 - Summary of Mean Percent Cover By Habitat Type**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Dry Units: 1

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
61	8	LGR	0	0	0	0	0	0	0	0	0
25	5	HGR	0	0	0	0	0	0	0	0	0
86	13	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
48	9	RUN	0	0	0	0	0	0	0	0	0
26	4	SRN	0	100	0	0	0	0	0	0	0
74	13	TOTAL FLAT	0	100	0	0	0	0	0	0	0
94	94	MCP	13	31	41	2	1	0	3	9	0
1	1	CCP	0	0	0	0	0	0	0	0	0
4	4	STP	0	6	20	0	0	0	25	49	0
1	1	LSL	0	50	50	0	0	0	0	0	0
4	4	LSR	55	15	13	18	0	0	0	0	0
1	1	LSBk	70	10	20	0	0	0	0	0	0
1	1	LSBo	0	0	0	0	0	0	0	100	0
16	16	PLP	5	20	34	0	1	0	9	29	1
122	122	TOTAL POOL	13	28	37	2	1	0	4	14	0
283	148	TOTAL	13	28	37	2	1	0	4	14	0

**Table 6 - Summary of Dominant Substrates By Habitat Type**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Dry Units: 1

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
61	8	LGR	0	0	100	0	0	0	0
25	5	HGR	0	0	60	40	0	0	0
48	9	RUN	0	0	89	11	0	0	0
26	4	SRN	0	25	75	0	0	0	0
94	94	MCP	0	39	60	0	0	1	0
1	1	CCP	0	100	0	0	0	0	0
4	4	STP	0	0	75	0	0	25	0
1	1	LSL	0	0	100	0	0	0	0
4	4	LSR	0	50	50	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
1	1	LSBo	0	0	100	0	0	0	0
16	16	PLP	0	44	50	0	6	0	0

**Table 7 - Summary of Mean Percent Canopy for Entire Stream**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

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Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	51	49	0	93	93

---

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

**Table 8 - Fish Habitat Inventory Data Summary**

Stream Name: Flume Gulch LLID: 1236764391738 Drainage: Navarro River  
 Survey Dates: 7/25/2011 to 7/27/2011 Survey Length (ft.): 8044 Main Channel (ft.): 7979 Side Channel (ft.): 65  
 Confluence Location: Quad: ELK Legal Description: T15NR16WS07 Latitude: 39:10:26.0N Longitude: 123:40:35.0W

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 1**

Channel Type: F4	Canopy Density (%): 97.8	Pools by Stream Length (%): 32.6
Reach Length (ft.): 1529	Coniferous Component (%): 55.2	Pool Frequency (%): 38.9
Riffle/Flatwater Mean Width (ft.): 8.4	Hardwood Component (%): 44.8	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 90
Range (ft.): 15 to 22	Vegetative Cover (%): 83.4	2 to 2.9 Feet Deep: 10
Mean (ft.): 18	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 12	Mean Max Residual Pool Depth (ft.): 1.4
Water (F): 54 - 57 Air (F): 60 - 67	LWD per 100 ft.:	Mean Pool Shelter Rating: 8
Dry Channel (ft): 0	Riffles: 1	
	Pools: 4	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 10 Gravel: 81 Sm Cobble: 10 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 38.1 3. 38.1 4. 23.8 5. 0.0		

**STREAM REACH: 2**

Channel Type: A2	Canopy Density (%): 98.1	Pools by Stream Length (%): 32.6
Reach Length (ft.): 1203	Coniferous Component (%): 35.6	Pool Frequency (%): 43.1
Riffle/Flatwater Mean Width (ft.): 8.8	Hardwood Component (%): 64.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 91
Range (ft.): 16 to 23	Vegetative Cover (%): 94.9	2 to 2.9 Feet Deep: 9
Mean (ft.): 19	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 14	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 54 - 55 Air (F): 59 - 65	LWD per 100 ft.:	Mean Pool Shelter Rating: 11
Dry Channel (ft): 14	Riffles: 4	
	Pools: 11	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 9 Gravel: 50 Sm Cobble: 0 Lg Cobble: 9 Boulder: 32 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 13.6 3. 50.0 4. 13.6 5. 22.7		

### Summary of Fish Habitat Elements By Stream Reach

#### STREAM REACH: 3

Channel Type: F4	Canopy Density (%): 97.5	Pools by Stream Length (%): 43.8
Reach Length (ft.): 4200	Coniferous Component (%): 50.1	Pool Frequency (%): 43.6
Riffle/Flatwater Mean Width (ft.): 5.8	Hardwood Component (%): 49.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 67
Range (ft.): 12 to 22	Vegetative Cover (%): 95.3	2 to 2.9 Feet Deep: 21
Mean (ft.): 17	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 8
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 3
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 34	Mean Max Residual Pool Depth (ft.): 1.9
Water (F): 53 - 56    Air (F): 52 - 67	LWD per 100 ft.:	Mean Pool Shelter Rating: 18
Dry Channel (ft): 0	Riffles: 3	
	Pools: 12	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0    Sand: 2    Gravel: 97    Sm Cobble: 2    Lg Cobble: 0    Boulder: 0    Bedrock: 0		
Embeddedness Values (%): 1. 1.6    2. 41.0    3. 54.1    4. 3.3    5. 0.0		

#### STREAM REACH: 4

Channel Type: G4	Canopy Density (%): 96.8	Pools by Stream Length (%): 42.3
Reach Length (ft.): 1047	Coniferous Component (%): 71.2	Pool Frequency (%): 47.4
Riffle/Flatwater Mean Width (ft.): 7.2	Hardwood Component (%): 28.8	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 72
Range (ft.): 15 to 21	Vegetative Cover (%): 96.4	2 to 2.9 Feet Deep: 22
Mean (ft.): 19	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 6
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 28	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 54 - 55    Air (F): 61 - 67	LWD per 100 ft.:	Mean Pool Shelter Rating: 8
Dry Channel (ft): 0	Riffles: 8	
	Pools: 19	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0    Sand: 6    Gravel: 83    Sm Cobble: 0    Lg Cobble: 0    Boulder: 11    Bedrock: 0		
Embeddedness Values (%): 1. 5.6    2. 38.9    3. 27.8    4. 16.7    5. 11.1		

**Table 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:26.0N

Longitude: 123:40:35.0W

**Mean Percentage of Dominant Stream Bank Substrate**

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	5	2	2.4
Boulder	9	5	4.7
Cobble / Gravel	10	13	7.8
Sand / Silt / Clay	124	128	85.1

**Mean Percentage of Dominant Stream Bank Vegetation**

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	1	0.3
Brush	24	32	18.9
Hardwood Trees	42	46	29.7
Coniferous Trees	81	67	50.0
No Vegetation	1	2	1.0

**Total Stream Cobble Embeddedness Values:** 3



**Table 10 - Mean Percent of Shelter Cover Types For Entire Stream**

StreamName: Flume Gulch

LLID: 1236764391738

Drainage: Navarro River

Survey Dates: 7/25/2011 to 7/27/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

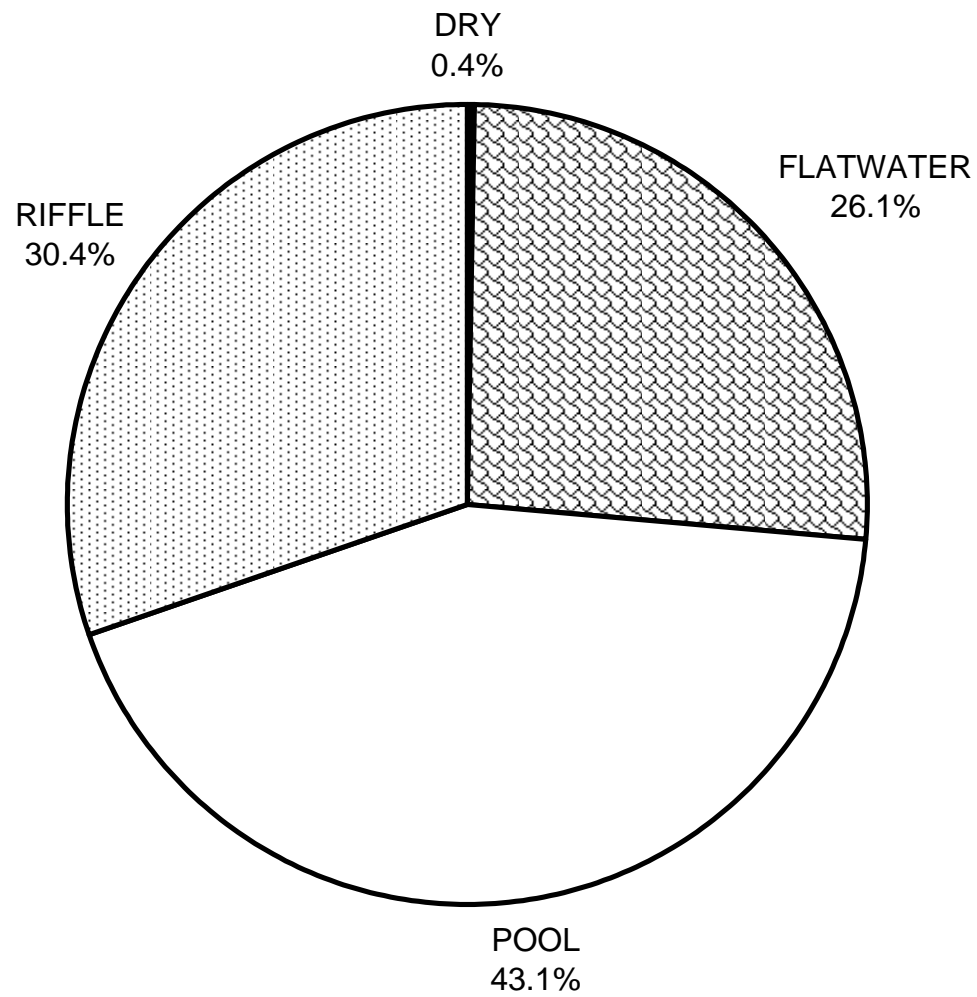
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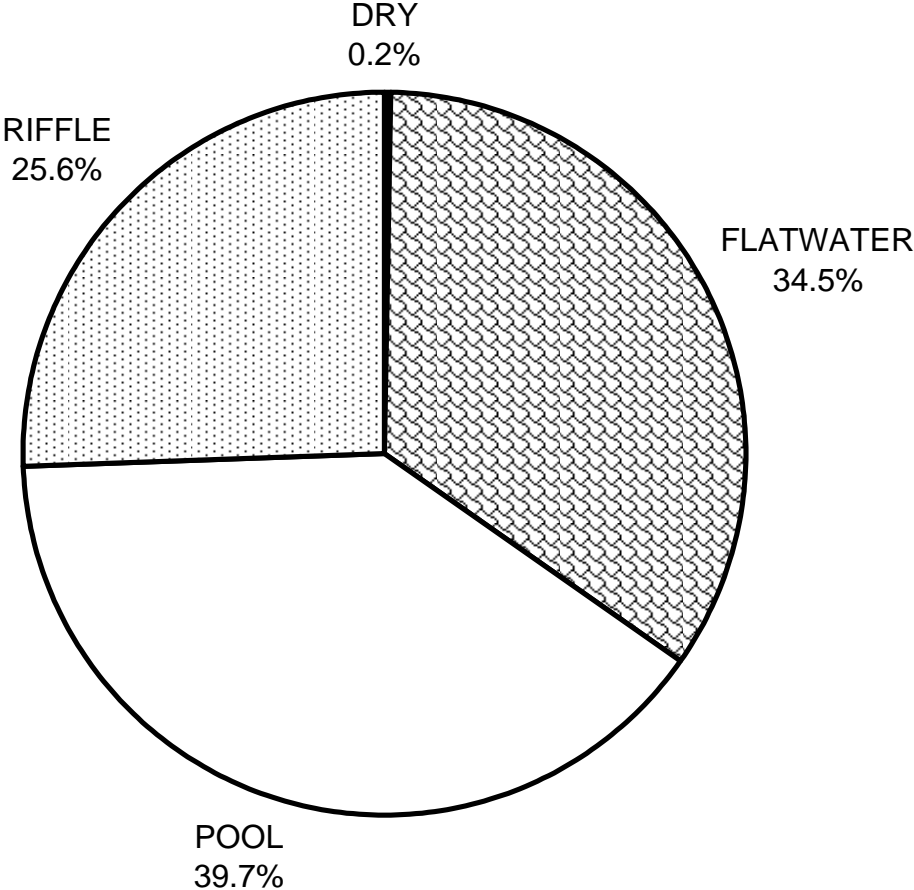
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	0	13
SMALL WOODY DEBRIS (%)	0	100	28
LARGE WOODY DEBRIS (%)	0	0	37
ROOT MASS (%)	0	0	2
TERRESTRIAL VEGETATION (%)	0	0	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	4
BOULDERS (%)	0	0	14
BEDROCK LEDGES (%)	0	0	0

# FLUME GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



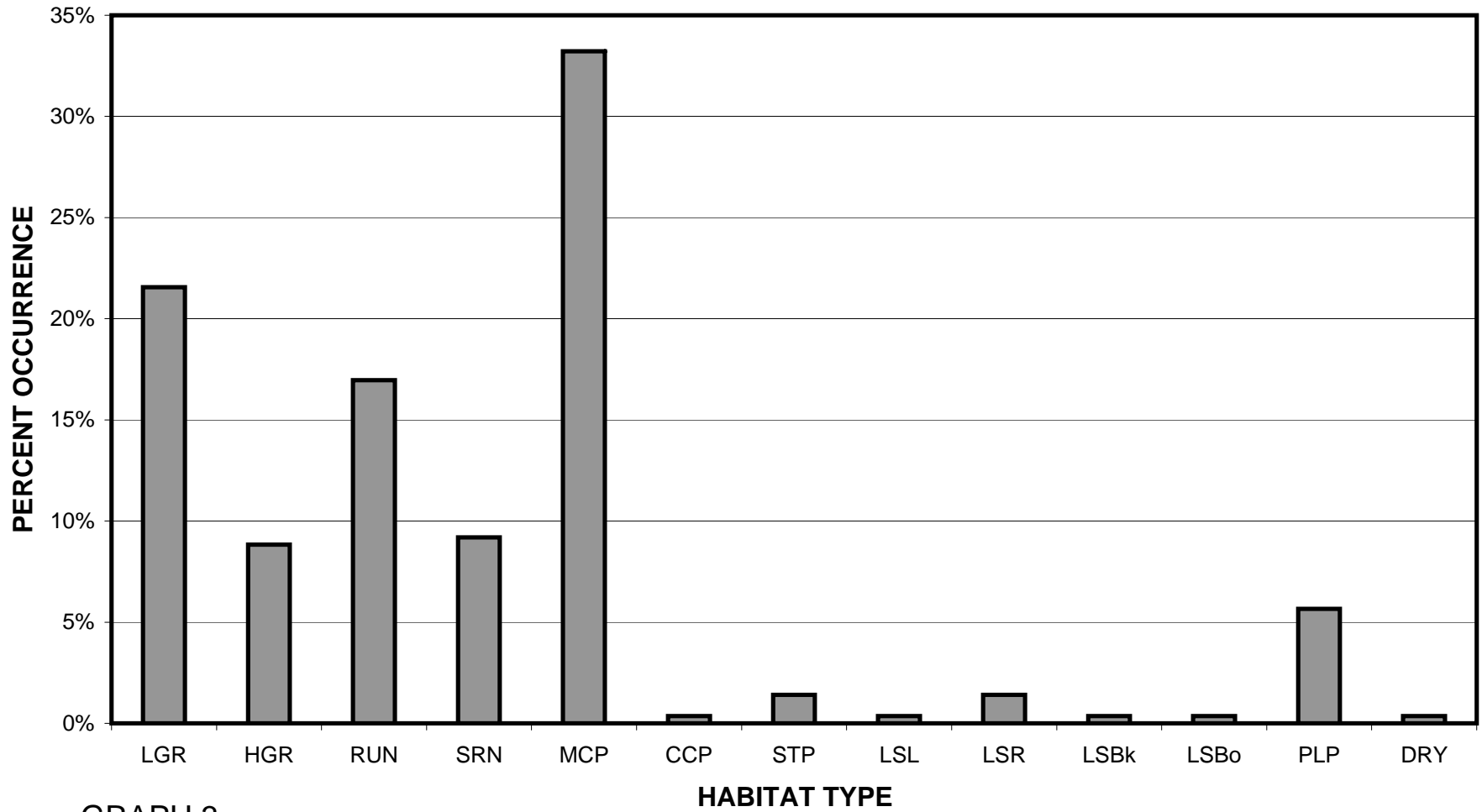
GRAPH 1

**FLUME GULCH 2011  
HABITAT TYPES BY PERCENT TOTAL LENGTH**



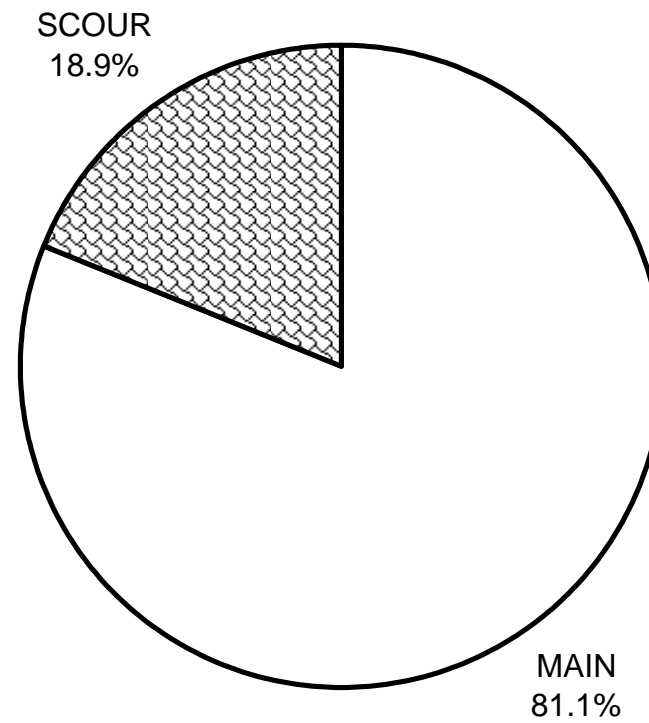
GRAPH 2

# FLUME GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



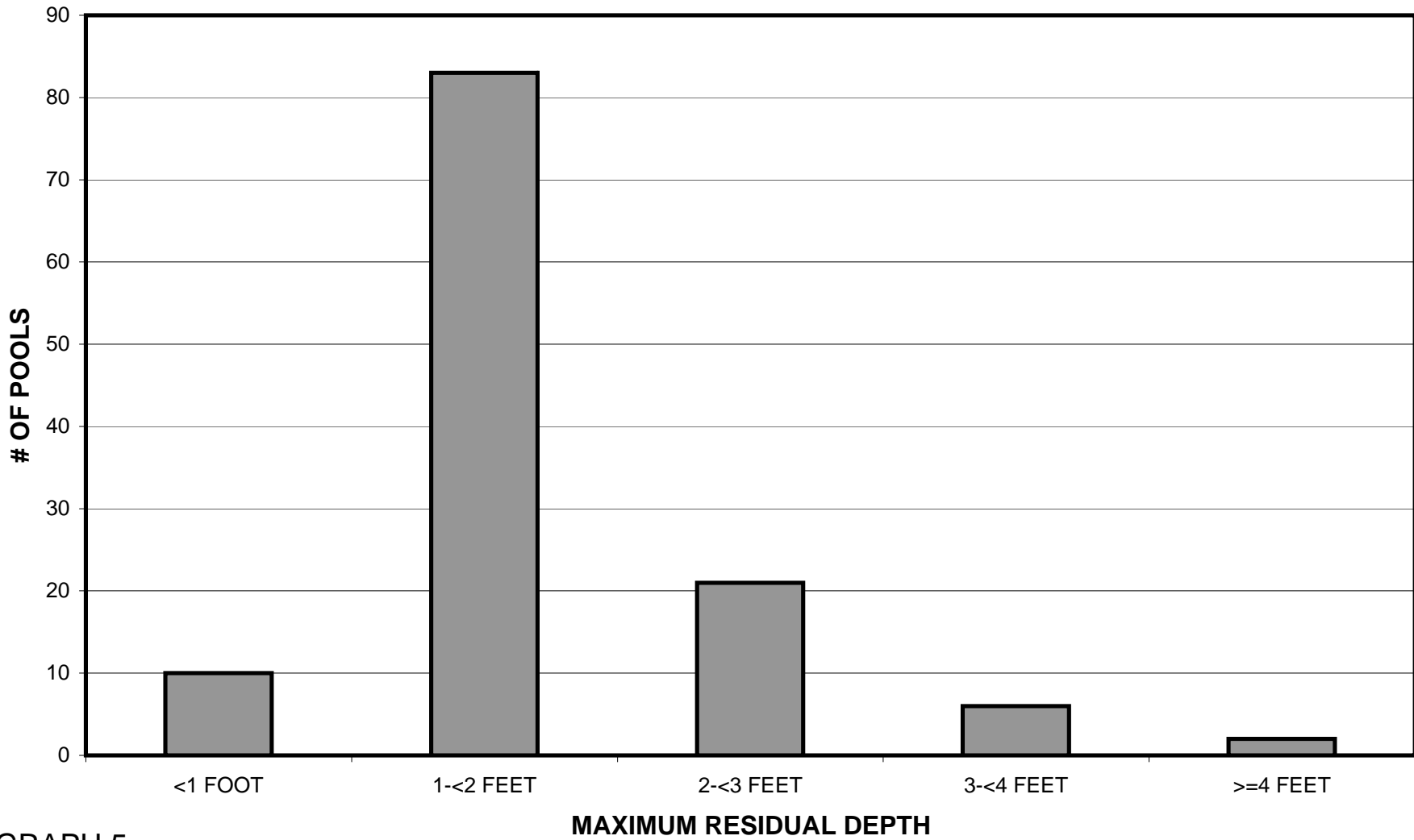
GRAPH 3

**FLUME GULCH 2011  
POOL TYPES BY PERCENT OCCURRENCE**



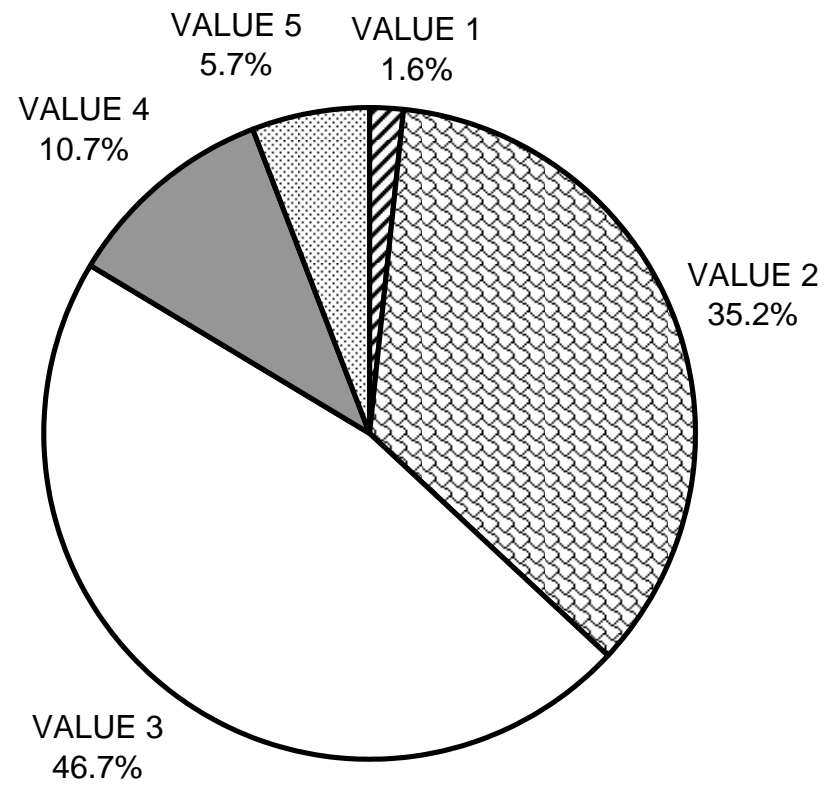
GRAPH 4

# FLUME GULCH 2011 MAXIMUM DEPTH IN POOLS



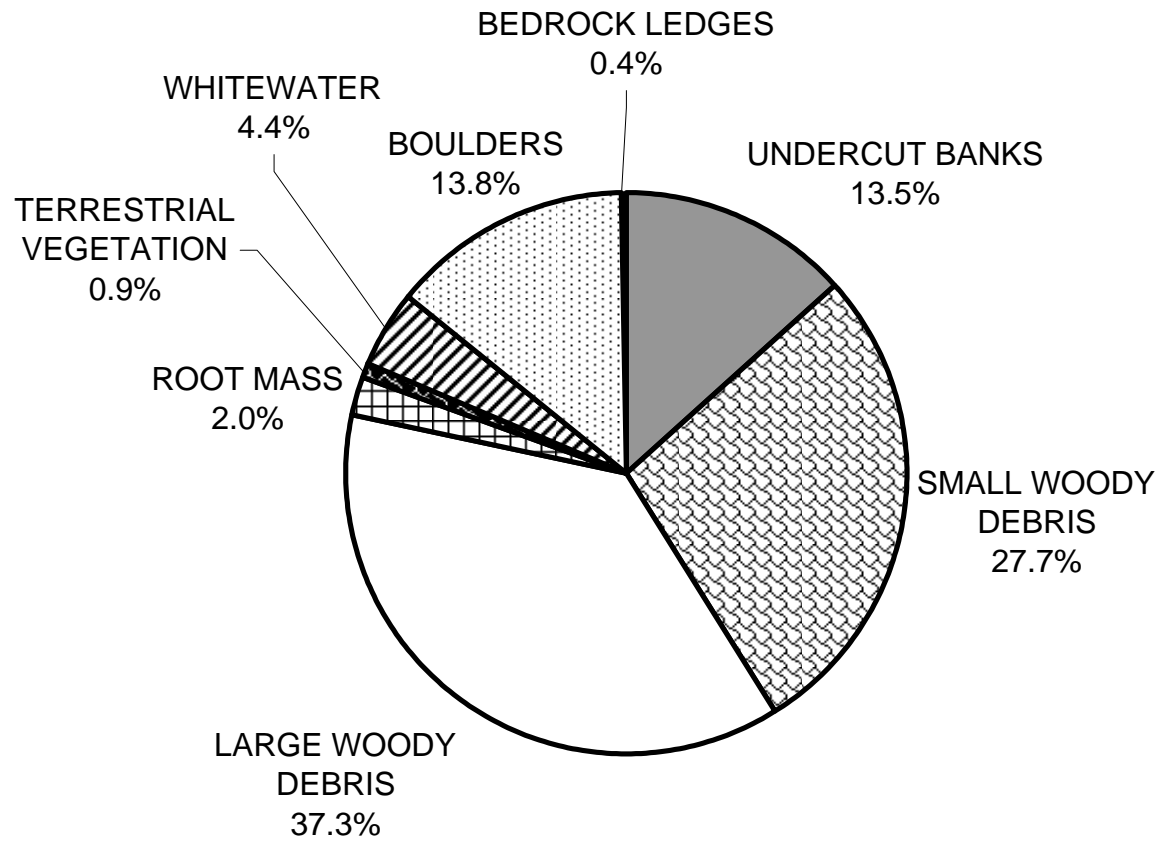
GRAPH 5

# FLUME GULCH 2011 PERCENT EMBEDDEDNESS



GRAPH 6

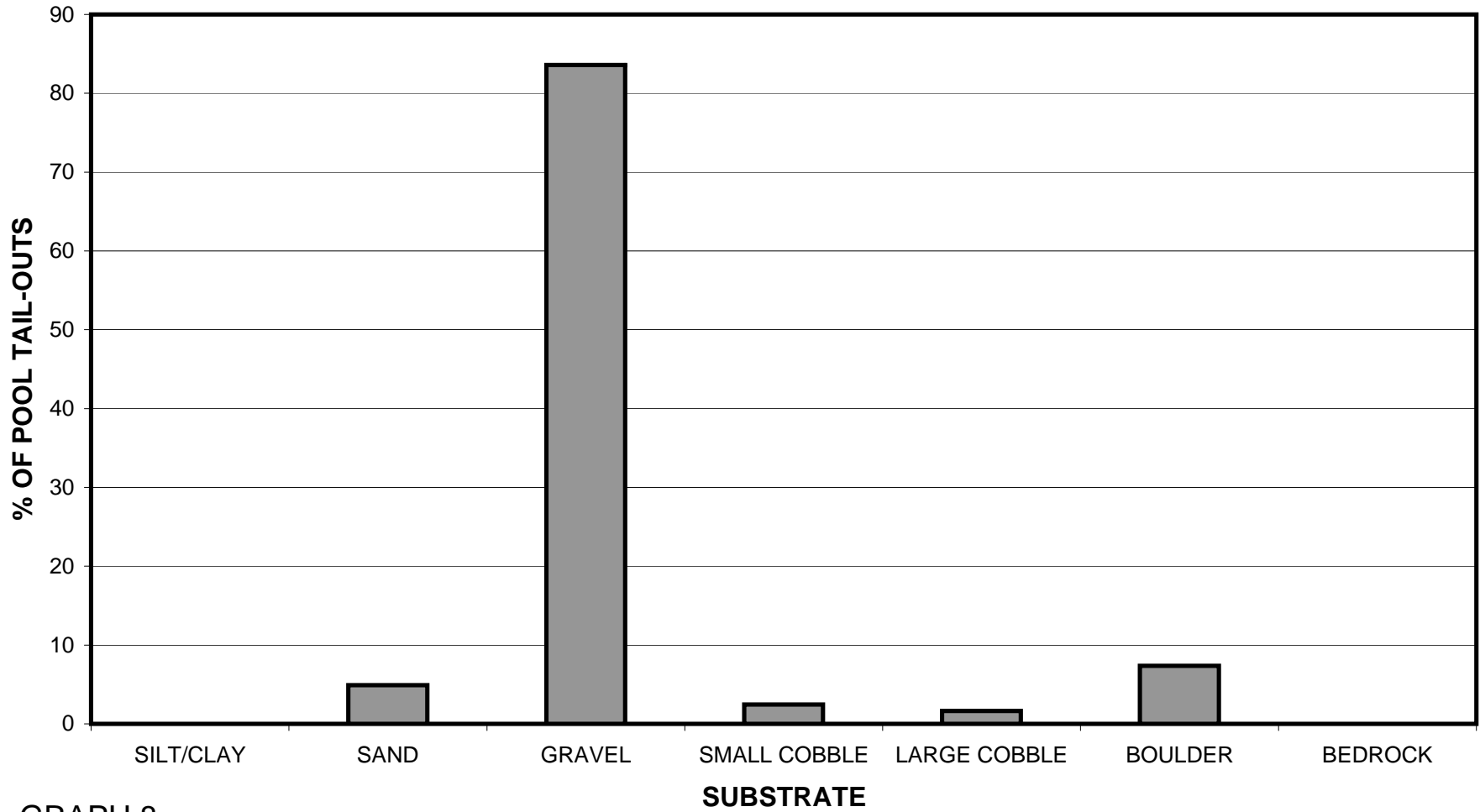
# FLUME GULCH 2011 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

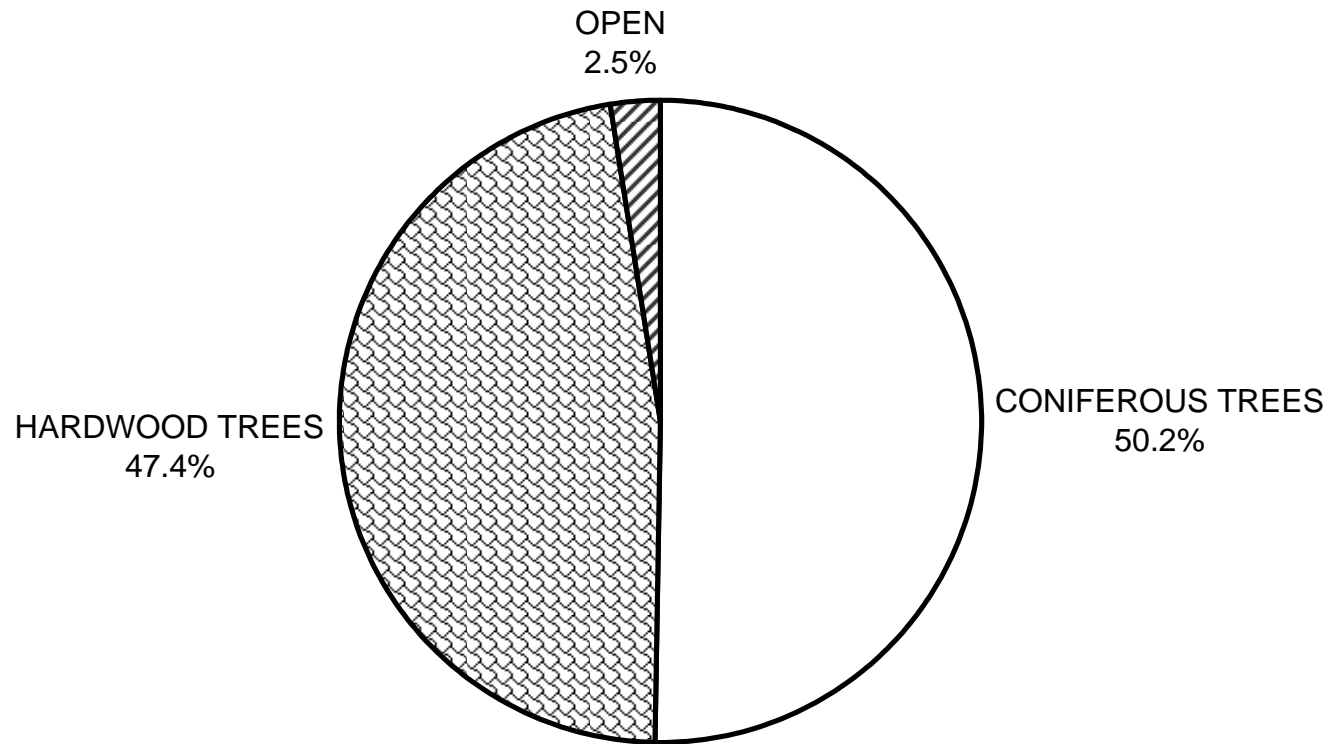


# FLUME GULCH 2011 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



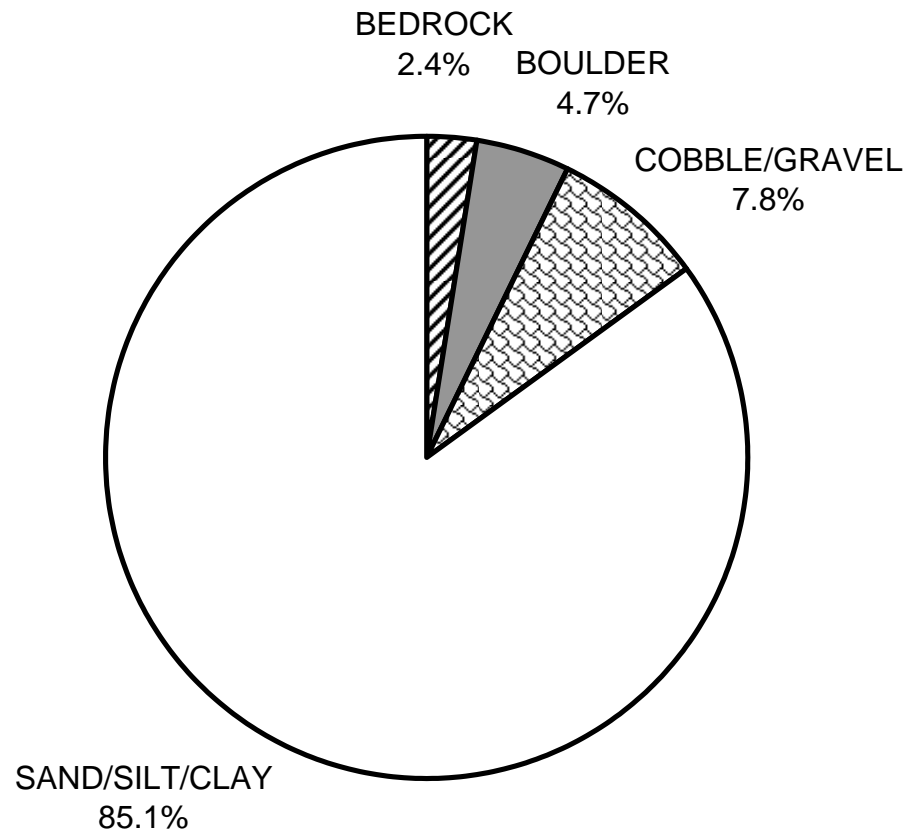
GRAPH 8

# FLUME GULCH 2011 MEAN PERCENT CANOPY



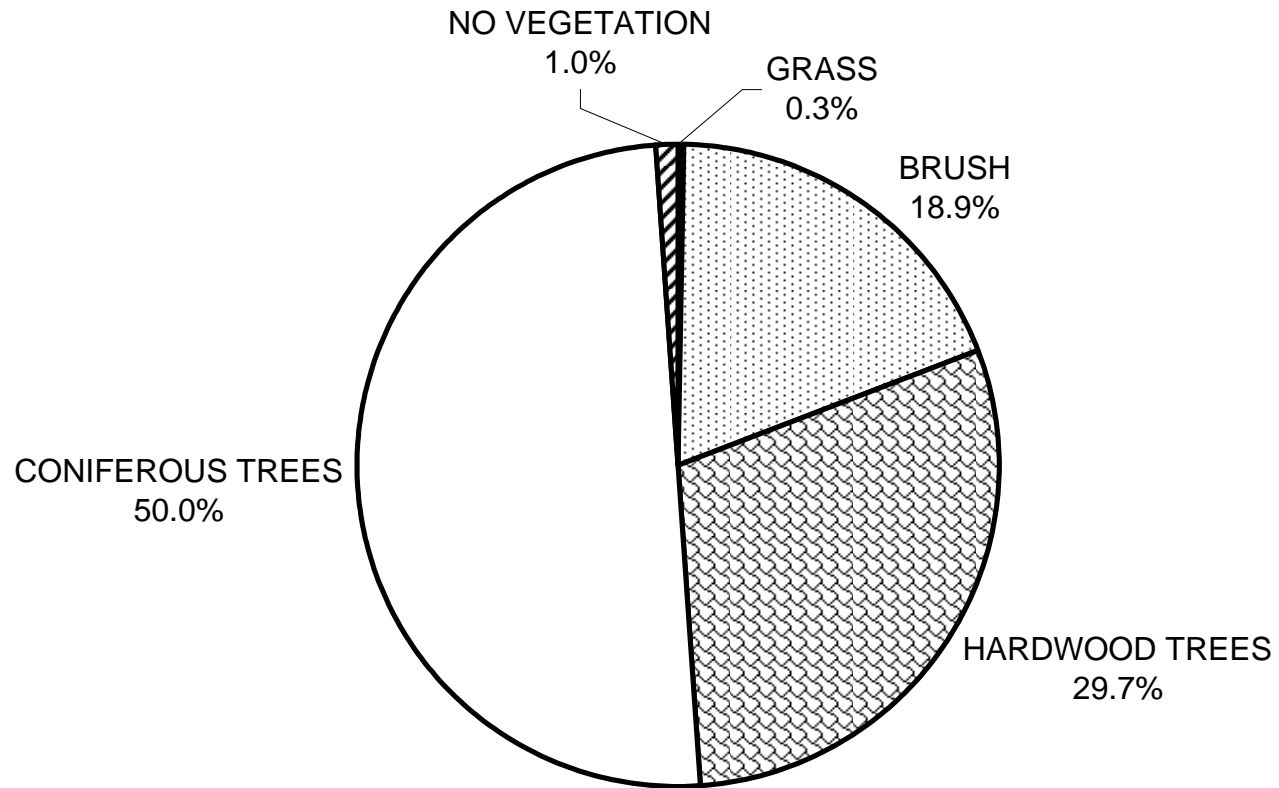
GRAPH 9

# FLUME GULCH 2011 DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

# FLUME GULCH 2011 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

