

# STREAM INVENTORY REPORT

## Water Gulch

### INTRODUCTION

A stream inventory was conducted from May 5 to May 24, 2011 on Water Gulch. The survey began at the confluence with Chamberlain Creek and extended upstream 1.7 miles.

The Water 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 Water 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

Water Gulch is a tributary to Chamberlain Creek, a tributary to North Fork Big River, tributary to Big River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Water Gulch's legal description at the confluence with Chamberlain Creek is T17N R15W S05. Its location is 39.3556 degrees north latitude and 123.5564 degrees west longitude, LLID number 1235550393556. Water Gulch is a first order stream and has approximately 1.1 miles of blue line stream according to the USGS Comptche 7.5 minute quadrangle. Water Gulch drains a watershed of approximately 1.4 square miles. Elevations range from about 300 feet at the mouth of the creek to 800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is in the Jackson Demonstration State Forest and is managed by the California Department of Forestry and Fire Protection. Vehicle access exists via State Route 20.

### METHODS

The habitat inventory conducted in Water 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 and Watershed Stewards Project/AmeriCorps (WSP) Members 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 Water 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". Water 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 Water Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

### 6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. In Water 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Water 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 Water 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.

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### 10. Large Woody Debris Count:

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

### 11. Average Bankfull Width:

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

## BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Water Gulch. In addition, underwater observations were made at 25 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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Water 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 May 5 to May 24, 2011, was conducted by M. McGowan, D. Opalacz, K. Christen, and B. Williams (WSP). The total length of the stream surveyed was 9,001 feet with an additional 33 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.76 cfs on May 24, 2011.

Water Gulch is an F4 channel type for 1,642 feet of the stream surveyed (Reach 1), a G4 channel type for 573 feet of the stream surveyed (Reach 2), and an F4 channel type for 6,819 feet of the stream surveyed (Reach 3). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-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 48 to 52 degrees Fahrenheit. Air temperatures ranged from 42 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 54% pool units, 31% flatwater units, and 15% riffle units (Graph 1). Based on total length of Level II habitat types there were 52% pool units, 37% flatwater units, 9% riffle units, and 3% not surveyed due to marsh units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 48%; run units, 19%; and low gradient riffle

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units, 13% (Graph 3). Based on percent total length, mid-channel pool units made up 48%, step run units 20%, and run units 17%.

A total of 141 pools were identified (Table 3). Main channel pools were the most frequently encountered at 90% (Graph 4), and comprised 95% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-seven of the 141 pools (19%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 141 pool tail-outs measured, 53 had a value of 1 (37.6%); 52 had a value of 2 (36.9%); 16 had a value of 3 (11.3%); 9 had a value of 4 (6.4%); 11 had a value of 5 (7.8%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 9, flatwater habitat types had a mean shelter rating of 6, and pool habitats had a mean shelter rating of 27 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 28. Scour pools had a mean shelter rating of 21. Backwater pools had a mean shelter rating of zero (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Water Gulch. Graph 7 describes the pool cover in Water Gulch. Undercut banks are 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 76% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 11% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Water Gulch was 90%. Ten percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 29% and 71%, respectively. Graph 9 describes the mean percent canopy in Water Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 96%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 73% sand/silt/clay, 15% bedrock, and 12% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 55% of the units surveyed. Additionally, 23% of the units surveyed had deciduous trees as the dominant vegetation type, and 14% had grass as the dominant vegetation type (Graph 11).

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### BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 25 sites for species composition and distribution in Water Gulch on July 5, 2011. The water temperature taken during the survey period of 1335 hours to 1640 hours was 57 degrees Fahrenheit. Air temperatures ranged from 70 to 72 degrees Fahrenheit. The sites were sampled by I. Mikus and M. Groff (DFG).

In reach 1, which comprised the first 1,642 feet of stream, 10 sites were sampled. The reach sites yielded 33 young-of-the-year steelhead/rainbow trout (SH/RT), one age 1+ SH/RT, and four age 2+ SH/RT.

In reach 2, four sites were sampled starting approximately 1,741 feet from the confluence with Chamberlain Creek and continuing upstream 370 feet. The reach sites yielded 25 young-of-the-year SH/RT, and two age 1+ SH/RT.

In reach 3, 10 sites were sampled starting approximately 2,448 feet from the confluence with Chamberlain Creek and continuing upstream 5,318 feet. The reach sites yielded six young-of-the-year SH/RT, and one age 1+ SH/RT.

Additionally, one site was sampled upstream of the end of survey point. No fish were observed.

The following chart displays the information yielded from these sites:

2011 Water Gulch underwater observations.

| Date                     | Survey Site # | Habitat Unit # | Habitat Type | Approx. Dist. from mouth (ft.) | SH/RT |    |    | Coho |    |
|--------------------------|---------------|----------------|--------------|--------------------------------|-------|----|----|------|----|
|                          |               |                |              |                                | YOY   | 1+ | 2+ | YOY  | 1+ |
| Reach 1: F4 Channel Type |               |                |              |                                |       |    |    |      |    |
| 07/05/11                 | 1             | 001            | Pool         | 20                             | 6     | 0  | 0  | 0    | 0  |
|                          | 2             | 006            | Pool         | 109                            | 1     | 0  | 1  | 0    | 0  |
|                          | 3             | 009            | Pool         | 156                            | 2     | 0  | 0  | 0    | 0  |
|                          | 4             | 016            | Pool         | 465                            | 1     | 1  | 0  | 0    | 0  |
|                          | 5             | 023            | Pool         | 646                            | 0     | 0  | 1  | 0    | 0  |
|                          | 6             | 031            | Pool         | 824                            | 6     | 0  | 1  | 0    | 0  |
|                          | 7             | 040            | Pool         | 1,167                          | 5     | 0  | 0  | 0    | 0  |
|                          | 8             | 042            | Pool         | 1,285                          | 3     | 0  | 1  | 0    | 0  |
|                          | 9             | 046            | Pool         | 1,416                          | 6     | 0  | 0  | 0    | 0  |
|                          | 10            | 048            | Pool         | 1,466                          | 3     | 0  | 0  | 0    | 0  |
| Reach 2: G4 Channel Type |               |                |              |                                |       |    |    |      |    |
|                          | 11            | 054            | Pool         | 1,770                          | 1     | 1  | 0  | 0    | 0  |

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|                                  |    |     |      |       |    |   |   |   |   |
|----------------------------------|----|-----|------|-------|----|---|---|---|---|
|                                  | 12 | 058 | Pool | 1,919 | 10 | 0 | 0 | 0 | 0 |
|                                  | 13 | 060 | Pool | 2,021 | 13 | 0 | 0 | 0 | 0 |
|                                  | 14 | 063 | Pool | 2,111 | 1  | 1 | 0 | 0 | 0 |
| Reach 3: F4 Channel Type         |    |     |      |       |    |   |   |   |   |
|                                  | 15 | 071 | Pool | 2,479 | 0  | 0 | 0 | 0 | 0 |
|                                  | 16 | 076 | Pool | 2,751 | 0  | 0 | 0 | 0 | 0 |
|                                  | 17 | 078 | Pool | 2,796 | 0  | 0 | 0 | 0 | 0 |
|                                  | 18 | 187 | Pool | 6,574 | 0  | 0 | 0 | 0 | 0 |
|                                  | 19 | 193 | Pool | 6,732 | 0  | 1 | 0 | 0 | 0 |
|                                  | 20 | 195 | Pool | 6,793 | 1  | 0 | 0 | 0 | 0 |
|                                  | 21 | 202 | Pool | 6,986 | 1  | 0 | 0 | 0 | 0 |
|                                  | 22 | 217 | Pool | 7,300 | 0  | 0 | 0 | 0 | 0 |
|                                  | 23 | 227 | Pool | 7,630 | 0  | 0 | 0 | 0 | 0 |
|                                  | 24 | 232 | Pool | 7,766 | 4  | 0 | 0 | 0 | 0 |
| Upstream of end of survey point: |    |     |      |       |    |   |   |   |   |
|                                  | 25 | --  | Pool | --    | 0  | 0 | 0 | 0 | 0 |

## DISCUSSION

Water Gulch is an F4 channel type for the first 1,642 feet of the stream surveyed, a G4 channel type for the next 573 feet of the stream surveyed, and an F4 channel type for the remaining 6,819 feet of the stream surveyed. The suitability of F4 and G4 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. G4 channel types 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 May 5 to May 24, 2011, ranged from 48 to 52 degrees Fahrenheit. Air temperatures ranged from 42 to 62 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 37% of the total length of this survey, riffles 9%, and pools 52%. Twenty-seven of the 141 (19%) 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



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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.

One hundred five of the 141 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-five of the pool tail-outs had embeddedness ratings of 3 or 4. Eleven 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.

One hundred twenty-three of the 140 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 27. The shelter rating in the flatwater habitats is 6. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Water Gulch. Undercut banks are 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 90%. Reach 1 had a canopy density of 89%, Reach 2 had a canopy density of 95%, and Reach 3 had a canopy density of 90%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 96% and 96%, 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) Water 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 undercut banks. Adding high quality complexity with woody cover in the pools is desirable.
- 4) Remove the old dam structure at 824 feet to provide unimpeded fish passage.

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### 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<br>(ft): | Habitat<br>unit #: | Comments:  |
|-------------------|--------------------|--|
| 0                 | 0001.00            | Start of survey at the confluence with Chamberlain Creek. The channel is an F4.  |
| 20                | 0002.00            | Log stringer bridge is collapsing, causing erosion on the left bank.   |
| 94                | 0006.00            | There is a 1.6' high plunge.   |
| 139               | 0009.00            | There is a 1.6' high plunge.   |
| 619               | 0023.00            | A road crosses the channel. The crossing is a 16.3' wide x 14.1' high x 11' long concrete bridge with concrete abutments forming the left and right banks. A notched log spans the wetted width.   |
| 805               | 0031.00            | There is a 1.3' high plunge over concrete base of dam.   |
| 824               | 0032.00            | There is an old dam with a 2' wide x 10.1' high x 31.1 foot metal foot bridge. The dam has a concrete base that measures 10' long and concrete wings on each bank. There is a 1.3' high jump onto the concrete base and then a 1.1' high jump off the concrete base to the stream channel above the dam. The depth of the water flowing over the concrete base is 0.1'. The two concrete wings constrict the channel from 30 feet to 5.6 feet. |
| 1042              | 0037.00            | A decommissioned road crosses the channel. There is a log stringer bridge consisting of 5 redwood logs spanning the channel and logs forming the abutments. The bridge measures 13.2' wide x 6' high x 25' long. The road's surface is made of fine sediment and gravel, which have collapsed into the creek in the gaps between the logs.   |
| 1642              | 0051.00            | The channel changes from an F4 to a G4.  |
| 1919              | 0059.00            | Small woody debris is accumulating in the channel.   |
| 2002              | 0060.00            | A potential log debris accumulation (LDA) is retaining sediment.   |
| 2177              | 0065.00            | A landslide on the right bank measures approximately 60' high x 15' long is contributing woody debris and sediment to the channel.   |

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|      |         |  |
|------|---------|--|
| 2202 | 0066.00 | Bedrock sheet measuring 5.5' tall x 13' long.  |
| 2215 | 0067.00 | The channel changes from a G4 to an F4.  |
| 3183 | 0089.00 | There is a root wad in the channel associated with root mass.  |
| 3416 | 0093.00 | LDA #01 contains eight pieces of large woody debris (LWD) and measures 6' high x 15' wide x 29' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to sand and measures 3' wide x 18' long x 3' deep. Fish were observed above the LDA. |
| 3875 | 0105.00 | LDA #02 contains four pieces of LWD and measures 6' high x 14' wide x 22' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.   |
| 4007 | 0108.00 | There is a culvert on the left bank. The bank below it is armored with rip-rap.  |
| 4478 | 0124.00 | There is a 1.2' high plunge.   |
| 4492 | 0125.00 | There is a culvert on the left bank.   |
| 4589 | 0129.00 | A tributary on the right bank is nearly dry. Woody debris is accumulating in the channel.  |
| 4940 | 0139.00 | LDA #03 contains seven pieces of LWD and measures 5' high x 20' wide x 12' long. Water flows through the LDA and there are no visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.   |
| 5287 | 0151.00 | Woody debris is accumulating in the channel.   |
| 5303 | 0152.00 | LDA #04 contains nine pieces of LWD and measures 2' high x 10' wide x 16' long. Water flows through the LDA and there are no visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.  |
| 5743 | 0161.00 | There is a 2.5' high plunge.   |
| 5756 | 0161.01 | There is a 3' high plunge.   |
| 7691 | 0231.00 | An erosion site measures 15' high x 60' long.  |
| 7938 | 0237.00 | Tributary #01 enters on the left bank. It contributes to approximately 50% of Water Gulch's flow. The water temperature downstream and   |

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upstream of the tributary is 50 degrees Fahrenheit; the water temperature of the tributary is 49 degrees Fahrenheit. The slope of the tributary is approximately 2%. The tributary is accessible to salmonids, but no fish were observed.

|      |         |   |
|------|---------|---|
| 7984 | 0238.00 | Flow is subterranean at a Humboldt crossing.  |
| 8004 | 0239.00 | 250' of stream was not surveyed due to a marsh.   |
| 8760 | 0252.00 | LDA #05 contains five pieces of LWD and measures 6' high x 8' wide x 17' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to sand and measures 2' wide x 12' long x 10' deep. It is a possible barrier to juvenile and adult salmonids. |
| 8821 | 0254.00 | There is a 4' high waterfall.   |
| 9001 | 0259.00 | End of survey due to diminished habitat. There is little flow and the channel is overgrown with brush.  |

## 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: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0

| 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 |
|---------------|----------------------------|--------------|------------------------|--------------------|--------------------|------------------|------------------|------------------|----------------------|---------------------|-------------------------------|-----------------------|---------------------------------|---------------------------------|---------------------|
| 80            | 7                          | FLATWATER    | 30.7                   | 42                 | 3320               | 36.8             | 6.3              | 0.7              | 1.1                  | 318                 | 25478                         | 194                   | 15557                           |                                 | 6                   |
| 1             | 0                          | NOSURVEY     | 0.4                    | 20                 | 20                 | 0.2              |                  |                  |                      |                     |                               |                       |                                 |                                 |                     |
| 1             | 0                          | NOSURVEY_    | 0.4                    | 250                | 250                | 2.8              |                  |                  |                      |                     |                               |                       |                                 |                                 |                     |
| 141           | 141                        | POOL         | 54.0                   | 33                 | 4657               | 51.5             | 6.6              | 0.8              | 1.5                  | 220                 | 31030                         | 254                   | 35820                           | 187                             | 27                  |
| 38            | 9                          | RIFFLE       | 14.6                   | 21                 | 787                | 8.7              | 5.2              | 0.4              | 0.7                  | 96                  | 3656                          | 38                    | 1461                            |                                 | 9                   |
| Total Units   | Total Units Fully Measured |              |                        | Total Length (ft.) |                    |                  |                  |                  |                      | Total Area (sq.ft.) |                               | Total Volume (cu.ft.) |                                 |                                 |                     |
| 261           | 157                        |              |                        | 9034               |                    |                  |                  |                  |                      | 60164               |                               | 52838                 |                                 |                                 |                     |

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

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

| 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 (%) |
|---------------|----------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|------------------|-----------------|--------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|-----------------|
| 33            | 5                    | LGR          | 12.6                   | 21                | 695                | 7.7              | 5                | 0.4              | 1               | 115                | 3786                          | 44                   | 1452                            |                                 | 0                   | 87              |
| 3             | 2                    | HGR          | 1.1                    | 23                | 70                 | 0.8              | 6                | 0.5              | 0.8             | 104                | 312                           | 48                   | 143                             |                                 | 0                   | 98              |
| 2             | 2                    | BRS          | 0.8                    | 11                | 22                 | 0.2              | 4                | 0.4              | 0.8             | 42                 | 84                            | 15                   | 31                              |                                 | 40                  | 84              |
| 49            | 4                    | RUN          | 18.8                   | 31                | 1507               | 16.7             | 6                | 0.7              | 1.3             | 235                | 11521                         | 162                  | 7932                            |                                 | 5                   | 93              |
| 31            | 3                    | SRN          | 11.9                   | 58                | 1813               | 20.1             | 7                | 0.6              | 1.2             | 430                | 13319                         | 238                  | 7376                            |                                 | 7                   | 91              |
| 124           | 124                  | MCP          | 47.5                   | 35                | 4346               | 48.1             | 7                | 0.8              | 3.6             | 233                | 28936                         | 273                  | 33821                           | 201                             | 28                  | 90              |
| 3             | 3                    | STP          | 1.1                    | 20                | 60                 | 0.7              | 6                | 0.4              | 1.1             | 114                | 343                           | 74                   | 222                             | 43                              | 38                  | 95              |
| 2             | 2                    | CRP          | 0.8                    | 26                | 53                 | 0.6              | 6                | 0.7              | 1.6             | 140                | 281                           | 141                  | 281                             | 99                              | 10                  | 90              |
| 1             | 1                    | LSL          | 0.4                    | 15                | 15                 | 0.2              | 5                | 0.6              | 1.2             | 75                 | 75                            | 60                   | 60                              | 45                              | 5                   | 96              |
| 2             | 2                    | LSR          | 0.8                    | 13                | 26                 | 0.3              | 8                | 0.6              | 1.5             | 97                 | 194                           | 103                  | 207                             | 55                              | 55                  | 93              |
| 7             | 7                    | PLP          | 2.7                    | 15                | 107                | 1.2              | 7                | 1.1              | 2.5             | 107                | 751                           | 135                  | 944                             | 102                             | 16                  | 87              |
| 2             | 2                    | DPL          | 0.8                    | 25                | 50                 | 0.6              | 10               | 0.7              | 1.4             | 225                | 450                           | 143                  | 285                             | 120                             | 0                   | 77              |
| 1             | 0                    | NS           | 0.4                    | 20                | 20                 | 0.2              |                  |                  |                 |                    |                               |                      |                                 |                                 |                     |                 |
| 1             | 0                    | MAR          | 0.4                    | 250               | 250                | 2.8              |                  |                  |                 |                    |                               |                      |                                 |                                 |                     |                 |

Total Units  
261

Total Units Fully Measured  
157

Total Length (ft.)  
9034

Total Area (sq.ft.)  
60051

Total Volume (cu.ft.)  
52753

**Table 3 - Summary of Pool Types**

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

| 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   |
|---------------|----------------------------|--------------|------------------------|--------------------|--------------------|------------------|------------------|---------------------------|--------------------|-------------------------------|---------------------------------|--------------------------------------|-----------------------|
| 127           | 127                        | MAIN         | 90                     | 35                 | 4406               | 95               | 6.5              | 0.7                       | 231                | 29279                         | 197                             | 25074                                | 28                    |
| 12            | 12                         | SCOUR        | 9                      | 17                 | 201                | 4                | 6.6              | 0.9                       | 108                | 1301                          | 89                              | 1064                                 | 21                    |
| 2             | 2                          | BACKWATER    | 1                      | 25                 | 50                 | 1                | 10.0             | 0.7                       | 225                | 450                           | 120                             | 240                                  | 0                     |
|               |                            |              |                        |                    |                    |                  |                  |                           |                    |                               |                                 |                                      |                       |
| Total Units   | Total Units Fully Measured |              |                        | Total Length (ft.) |                    |                  |                  |                           |                    | Total Area (sq.ft.)           |                                 |                                      | Total Volume (cu.ft.) |
| 141           | 141                        |              |                        | 4657               |                    |                  |                  |                           |                    | 31030                         |                                 |                                      | 26378                 |



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

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

| 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 |
|---------------|--------------|------------------------|---------------------------------|-----------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|----------------------------------|------------------------------|
| 124           | MCP          | 88                     | 24                              | 19                          | 75                                | 60                            | 22                                | 18                            | 3                                 | 2                             | 0                                | 0                            |
| 3             | STP          | 2                      | 0                               | 0                           | 3                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 2             | CRP          | 1                      | 0                               | 0                           | 2                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 1             | LSL          | 1                      | 0                               | 0                           | 1                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 2             | LSR          | 1                      | 0                               | 0                           | 2                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 7             | PLP          | 5                      | 0                               | 0                           | 5                                 | 71                            | 2                                 | 29                            | 0                                 | 0                             | 0                                | 0                            |
| 2             | DPL          | 1                      | 0                               | 0                           | 2                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 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 |
| 141           |              |                        | 24                              | 17                          | 90                                | 64                            | 24                                | 17                            | 3                                 | 2                             | 0                                | 0                            |

Mean Maximum Residual Pool Depth (ft.): 1.5

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

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Dry Units: 0

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

| 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 |
|---------------|----------------------|--------------|-----------------------|------------|------------|------------------|-------------------------|---------------------------|--------------------|-----------------|-----------------------|
| 33            | 5                    | LGR          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 3             | 2                    | HGR          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 2             | 2                    | BRS          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 100                | 0               | 0                     |
| 38            | 9                    | TOTAL RIFFLE | 0                     | 0          | 0          | 0                | 0                       | 0                         | 100                | 0               | 0                     |
| 49            | 4                    | RUN          | 77                    | 20         | 3          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 31            | 3                    | SRN          | 0                     | 40         | 0          | 0                | 0                       | 0                         | 40                 | 20              | 0                     |
| 80            | 7                    | TOTAL FLAT   | 58                    | 25         | 3          | 0                | 0                       | 0                         | 10                 | 5               | 0                     |
| 124           | 124                  | MCP          | 37                    | 22         | 21         | 2                | 8                       | 2                         | 1                  | 3               | 4                     |
| 3             | 3                    | STP          | 0                     | 43         | 17         | 0                | 0                       | 0                         | 23                 | 17              | 0                     |
| 2             | 2                    | CRP          | 45                    | 50         | 0          | 5                | 0                       | 0                         | 0                  | 0               | 0                     |
| 1             | 1                    | LSL          | 0                     | 0          | 100        | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 2             | 2                    | LSR          | 0                     | 20         | 35         | 45               | 0                       | 0                         | 0                  | 0               | 0                     |
| 7             | 7                    | PLP          | 29                    | 13         | 0          | 6                | 1                       | 0                         | 49                 | 1               | 1                     |
| 2             | 2                    | DPL          |                       |            |            |                  |                         |                           |                    |                 |                       |
| 141           | 141                  | TOTAL POOL   | 34                    | 22         | 20         | 3                | 7                       | 2                         | 5                  | 3               | 3                     |
| 1             | 0                    | NS           |                       |            |            |                  |                         |                           |                    |                 |                       |
| 1             | 0                    | MAR          |                       |            |            |                  |                         |                           |                    |                 |                       |
| 261           | 157                  | TOTAL        | 35                    | 22         | 19         | 3                | 7                       | 2                         | 6                  | 3               | 3                     |

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

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Dry Units: 0

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

| 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 |
|---------------|----------------------|--------------|----------------------------|-----------------------|-------------------------|-------------------------------|-------------------------------|--------------------------|--------------------------|
| 33            | 6                    | LGR          | 0                          | 0                     | 67                      | 33                            | 0                             | 0                        | 0                        |
| 3             | 2                    | HGR          | 0                          | 0                     | 0                       | 50                            | 50                            | 0                        | 0                        |
| 2             | 2                    | BRS          | 0                          | 0                     | 0                       | 0                             | 0                             | 0                        | 100                      |
| 49            | 4                    | RUN          | 0                          | 0                     | 50                      | 50                            | 0                             | 0                        | 0                        |
| 31            | 3                    | SRN          | 0                          | 0                     | 67                      | 33                            | 0                             | 0                        | 0                        |
| 124           | 124                  | MCP          | 14                         | 10                    | 70                      | 4                             | 0                             | 0                        | 2                        |
| 3             | 3                    | STP          | 33                         | 0                     | 33                      | 33                            | 0                             | 0                        | 0                        |
| 2             | 2                    | CRP          | 0                          | 50                    | 50                      | 0                             | 0                             | 0                        | 0                        |
| 1             | 1                    | LSL          | 0                          | 0                     | 100                     | 0                             | 0                             | 0                        | 0                        |
| 2             | 2                    | LSR          | 0                          | 0                     | 100                     | 0                             | 0                             | 0                        | 0                        |
| 7             | 7                    | PLP          | 29                         | 14                    | 57                      | 0                             | 0                             | 0                        | 0                        |
| 2             | 2                    | DPL          | 0                          | 0                     | 100                     | 0                             | 0                             | 0                        | 0                        |

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

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

| Mean<br>Percent<br>Canopy | Mean<br>Percent<br>Conifer | Mean<br>Percent<br>Hardwood | Mean<br>Percent<br>Open Units | Mean Right<br>Bank %<br>Cover | Mean Left<br>Bank %<br>Cover |
|---------------------------|----------------------------|-----------------------------|-------------------------------|-------------------------------|------------------------------|
| 90                        | 71                         | 29                          | 0                             | 96                            | 96                           |

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.

|                                     |                                |                          |
|-------------------------------------|--------------------------------|--------------------------|
| Stream Name: Water Gulch            | LLID: 1235550393556            | Drainage: Big River      |
| Survey Dates: 5/9/2011 to 5/24/2011 | Survey Length (ft.): 9034      | Main Channel (ft.): 9001 |
|                                     |                                | Side Channel (ft.): 33   |
| Confluence Location: Quad: COMPTCHE | Legal Description: T17NR15WS05 | Latitude: 39:21:20.0N    |
|                                     |                                | Longitude: 123:33:18.0W  |

|                                    |  |         |              |                           |                               |               |                |                                     |             |      |
|------------------------------------|--|---------|--------------|---------------------------|-------------------------------|---------------|----------------|-------------------------------------|-------------|------|
| <b>STREAM REACH: 1</b>             |  |         |              |                           |                               |               |                |                                     |             |      |
| Channel Type:                      |  |         | F4           | Canopy Density (%):       |                               |               | 89.0           | Pools by Stream Length (%):         |             | 47.3 |
| Reach Length (ft.):                |  |         | 1642         | Coniferous Component (%): |                               |               | 58.3           | Pool Frequency (%):                 |             | 52.0 |
| Riffle/Flatwater Mean Width (ft.): |  |         | 7.0          | Hardwood Component (%):   |                               |               | 41.7           | Residual Pool Depth (%):            |             |      |
| BFW:                               |  |         |              | Dominant Bank Vegetation: |                               |               | Hardwood Trees | < 2 Feet Deep:                      |             | 85   |
| Range (ft.):                       |  | 8       | to           | 15                        | Vegetative Cover (%):         |               | 95.0           | 2 to 2.9 Feet Deep:                 |             | 15   |
| Mean (ft.):                        |  | 12      |              |                           | Dominant Shelter:             |               | Undercut Banks | 3 to 3.9 Feet Deep:                 |             | 0    |
| Std. Dev.:                         |  | 2       |              |                           | Dominant Bank Substrate Type: |               | Bedrock        | >= 4 Feet Deep:                     |             | 0    |
| Base Flow (cfs.):                  |  |         | 0.8          | Occurrence of LWD (%):    |                               |               | 6              | Mean Max Residual Pool Depth (ft.): |             | 1.4  |
| Water (F):                         |  | 48 - 52 | Air (F):     | 42 - 60                   | LWD per 100 ft.:              |               |                | Mean Pool Shelter Rating:           |             | 14   |
| Dry Channel (ft):                  |  | 0       |              |                           | Riffles:                      |               | 1              |                                     |             |      |
|                                    |  |         |              |                           | Pools:                        |               | 1              |                                     |             |      |
|                                    |  |         |              |                           | Flat:                         |               | 1              |                                     |             |      |
| Pool Tail Substrate (%):           |  |         | Silt/Clay: 0 | Sand: 0                   | Gravel: 58                    | Sm Cobble: 23 | Lg Cobble: 0   | Boulder: 0                          | Bedrock: 19 |      |
| Embeddedness Values (%):           |  |         | 1. 26.9      | 2. 53.8                   | 3. 3.8                        | 4. 0.0        | 5. 15.4        |                                     |             |      |

|                                    |            |      |       |          |                               |                |            |                                     |                           |     |          |   |          |   |
|------------------------------------|------------|------|-------|----------|-------------------------------|----------------|------------|-------------------------------------|---------------------------|-----|----------|---|----------|---|
| Channel Type:                      | G4         |      |       |          | Canopy Density (%):           | 94.8           |            | Pools by Stream Length (%):         | 30.5                      |     |          |   |          |   |
| Reach Length (ft.):                | 573        |      |       |          | Coniferous Component (%):     | 55.0           |            | Pool Frequency (%):                 | 43.8                      |     |          |   |          |   |
| Riffle/Flatwater Mean Width (ft.): | 5.3        |      |       |          | Hardwood Component (%):       | 45.0           |            | Residual Pool Depth (%):            |                           |     |          |   |          |   |
| BFW:                               |            |      |       |          | Dominant Bank Vegetation:     | Hardwood Trees |            | < 2 Feet Deep:                      | 86                        |     |          |   |          |   |
| Range (ft.):                       | 10         | to   |       | 10       | Vegetative Cover (%):         | 98.0           |            | 2 to 2.9 Feet Deep:                 | 14                        |     |          |   |          |   |
| Mean (ft.):                        | 10         |      |       |          | Dominant Shelter:             | Boulders       |            | 3 to 3.9 Feet Deep:                 | 0                         |     |          |   |          |   |
| Std. Dev.:                         | 0          |      |       |          | Dominant Bank Substrate Type: | Bedrock        |            | >= 4 Feet Deep:                     | 0                         |     |          |   |          |   |
| Base Flow (cfs.):                  | 0.8        |      |       |          | Occurrence of LWD (%):        | 2              |            | Mean Max Residual Pool Depth (ft.): | 1.4                       |     |          |   |          |   |
| Water (F):                         | 49         | -    | 51    | Air (F): | 56                            | -              | 59         | LWD per 100 ft.:                    | Mean Pool Shelter Rating: |     | 26       |   |          |   |
| Dry Channel (ft):                  | 0          |      |       |          | Riffles:                      | 0              |            |                                     |                           |     |          |   |          |   |
|                                    |            |      |       |          | Pools:                        | 3              |            |                                     |                           |     |          |   |          |   |
|                                    |            |      |       |          | Flat:                         | 3              |            |                                     |                           |     |          |   |          |   |
| Pool Tail Substrate (%):           | Silt/Clay: | 0    | Sand: | 0        | Gravel:                       | 86             | Sm Cobble: | 14                                  | Lg Cobble:                | 0   | Boulder: | 0 | Bedrock: | 0 |
| Embeddedness Values (%):           | 1.         | 42.9 | 2.    | 28.6     | 3.                            | 28.6           | 4.         | 0.0                                 | 5.                        | 0.0 |          |   |          |   |

## Summary of Fish Habitat Elements By Stream Reach

### STREAM REACH: 3

|  |  |   |
|--|--|---|
| Channel Type: F4   | Canopy Density (%): 89.6                     | Pools by Stream Length (%): 54.3        |
| Reach Length (ft.): 6786   | Coniferous Component (%): 76.2               | Pool Frequency (%): 55.4                |
| Riffle/Flatwater Mean Width (ft.): 5.3   | Hardwood Component (%): 23.8                 | Residual Pool Depth (%):                |
| BFW:   | Dominant Bank Vegetation: Coniferous Trees   | < 2 Feet Deep: 80                       |
| Range (ft.): 8 to 11   | Vegetative Cover (%): 96.0                   | 2 to 2.9 Feet Deep: 18                  |
| Mean (ft.): 10   | Dominant Shelter: Undercut Banks             | 3 to 3.9 Feet Deep: 3                   |
| Std. Dev.: 1   | Dominant Bank Substrate Type: Sand/Silt/Clay | >= 4 Feet Deep: 0                       |
| Base Flow (cfs.): 0.8  | Occurrence of LWD (%): 19                    | Mean Max Residual Pool Depth (ft.): 1.6 |
| Water (F): 50 - 52 Air (F): 44 - 62  | LWD per 100 ft.:                             | Mean Pool Shelter Rating: 30            |
| Dry Channel (ft): 0  | Riffles: 1                                   |   |
|  | Pools: 6                                     |   |
|  | Flat: 2                                      |   |
| Pool Tail Substrate (%): Silt/Clay: 9 Sand: 0 Gravel: 80 Sm Cobble: 8 Lg Cobble: 0 Boulder: 0 Bedrock: 2 |  |   |
| Embeddedness Values (%): 1. 39.8 2. 33.3 3. 12.0 4. 8.3 5. 6.5   |  |   |

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

Stream Name: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

**Mean Percentage of Dominant Stream Bank Substrate**

| Dominant Class<br>of Substrate | Number of Units<br>Right Bank | Number of Units<br>Left Bank | Total Mean<br>Percent (%) |
|--------------------------------|-------------------------------|------------------------------|---------------------------|
| Bedrock                        | 20                            | 26                           | 14.6                      |
| Boulder                        | 0                             | 0                            | 0.0                       |
| Cobble / Gravel                | 20                            | 18                           | 12.1                      |
| Sand / Silt / Clay             | 117                           | 113                          | 73.2                      |

**Mean Percentage of Dominant Stream Bank Vegetation**

| Dominant Class<br>of Vegetation | Number of Units<br>Right Bank | Number of Units<br>Left Bank | Total Mean<br>Percent (%) |
|---------------------------------|-------------------------------|------------------------------|---------------------------|
| Grass                           | 25                            | 19                           | 14.0                      |
| Brush                           | 12                            | 15                           | 8.6                       |
| Hardwood Trees                  | 40                            | 31                           | 22.6                      |
| Coniferous Trees                | 80                            | 92                           | 54.8                      |
| No Vegetation                   | 0                             | 0                            | 0.0                       |

**Total Stream Cobble Embeddedness Values:**

2

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

StreamName: Water Gulch

LLID: 1235550393556

Drainage: Big River

Survey Dates: 5/9/2011 to 5/24/2011

Confluence Location: Quad: COMPTCHE

Legal Description: T17NR15WS05

Latitude: 39:21:20.0N

Longitude: 123:33:18.0W

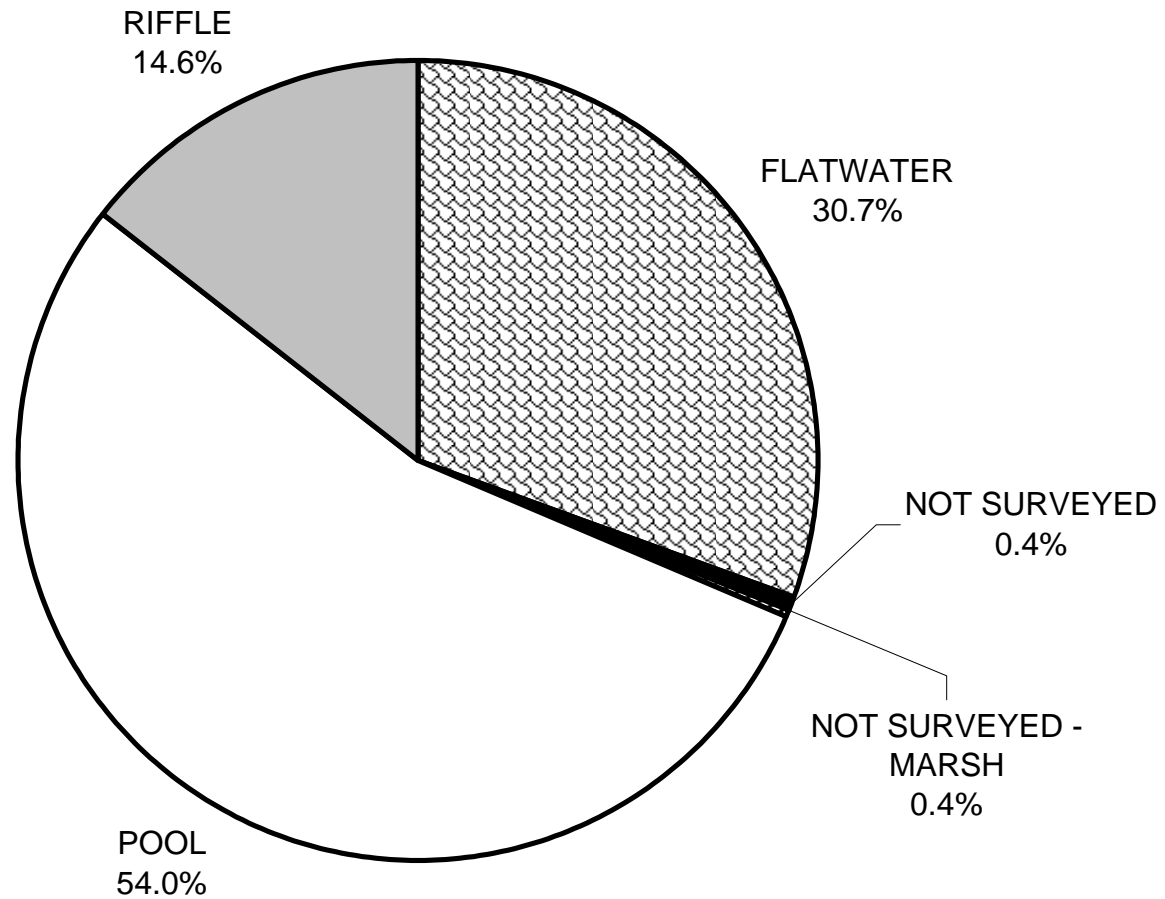
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|                            | <b>Riffles</b> | <b>Flatwater</b> | <b>Pools</b> |
|----------------------------|----------------|------------------|--------------|
| <hr/>                      |                |                  |              |
| UNDERCUT BANKS (%)         | 0              | 58               | 34           |
| SMALL WOODY DEBRIS (%)     | 0              | 25               | 22           |
| LARGE WOODY DEBRIS (%)     | 0              | 3                | 20           |
| ROOT MASS (%)              | 0              | 0                | 3            |
| TERRESTRIAL VEGETATION (%) | 0              | 0                | 7            |
| AQUATIC VEGETATION (%)     | 0              | 0                | 2            |
| WHITEWATER (%)             | 100            | 10               | 5            |
| BOULDERS (%)               | 0              | 5                | 3            |
| BEDROCK LEDGES (%)         | 0              | 0                | 3            |



# WATER GULCH 2011

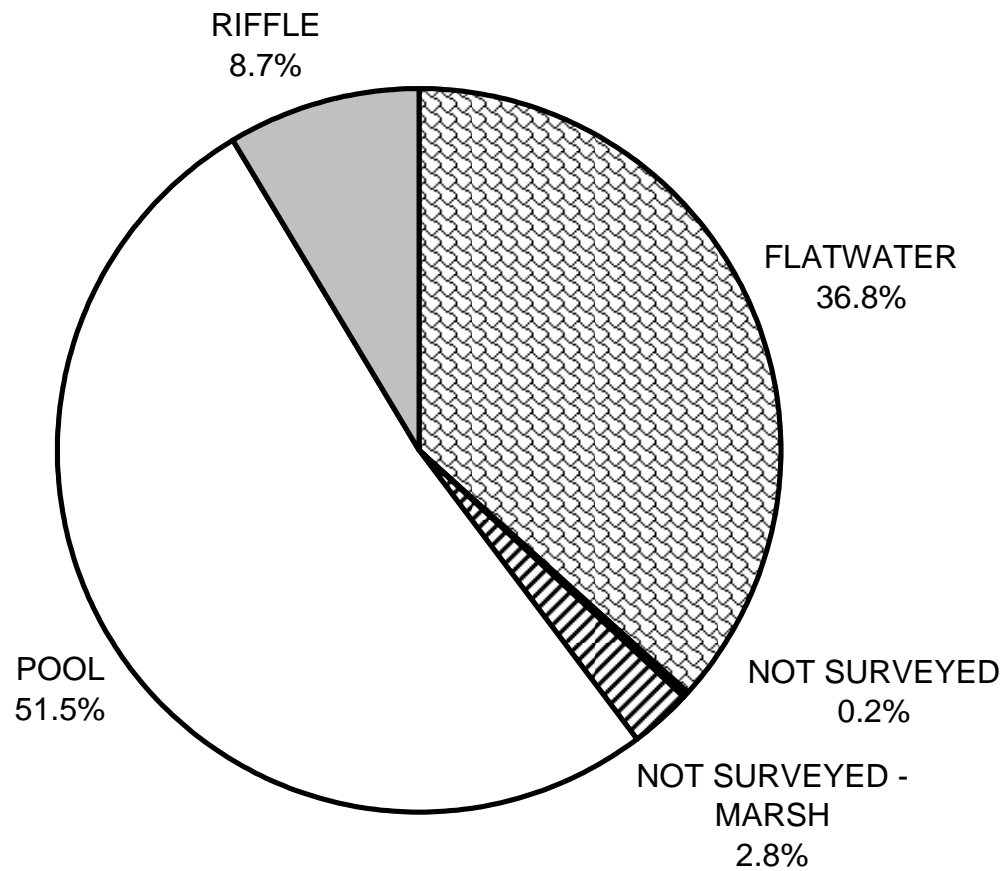
## HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

# WATER GULCH 2011

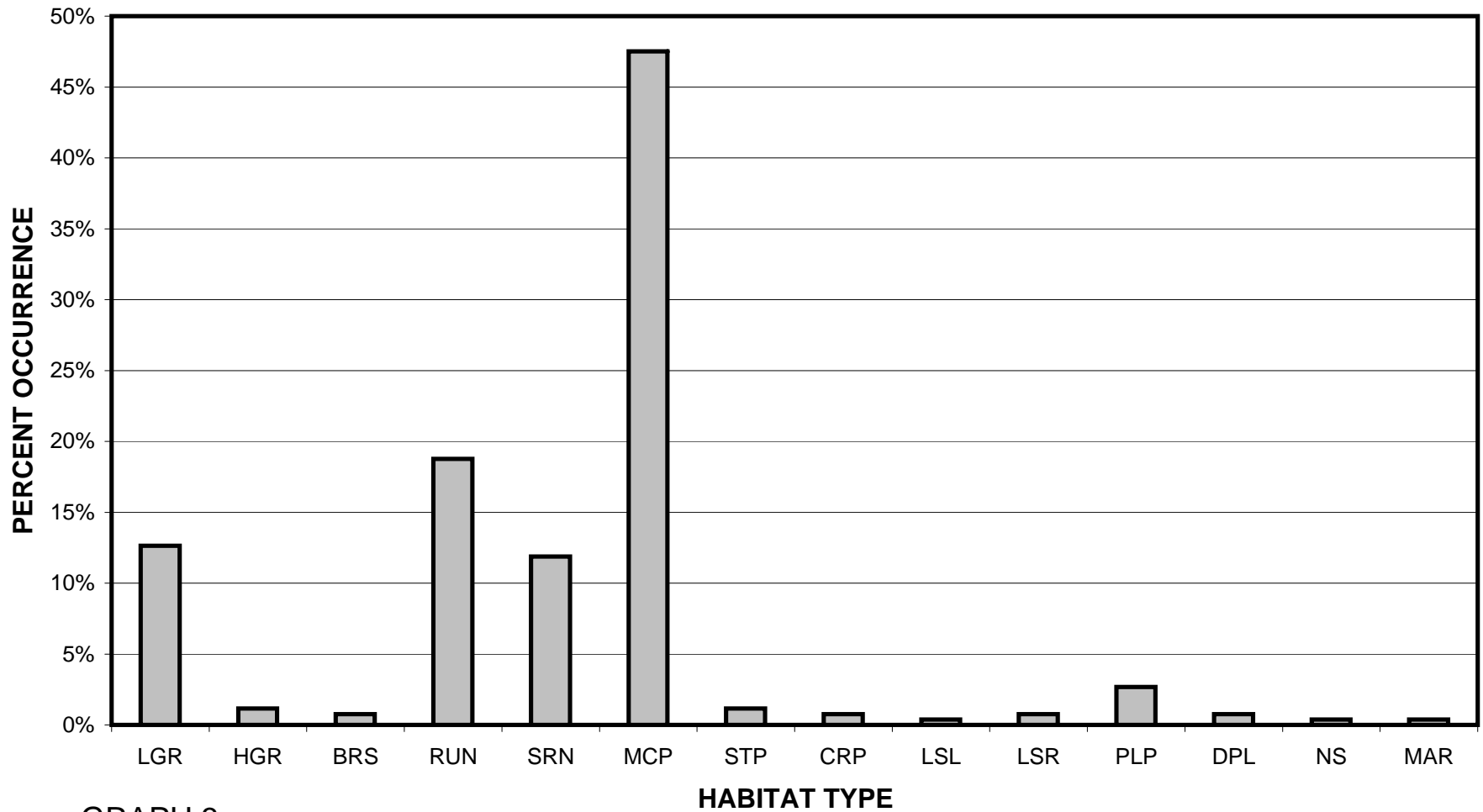
## HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

# WATER GULCH 2011

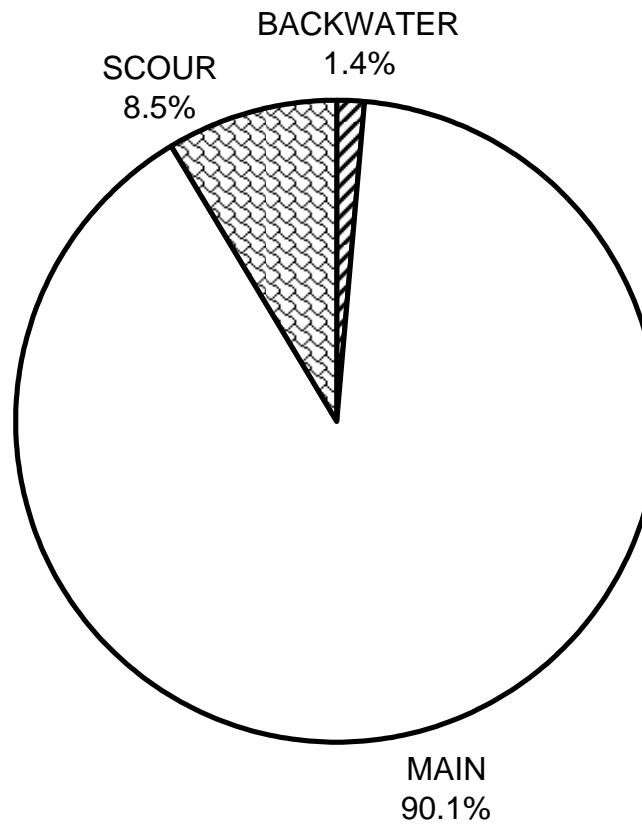
## HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

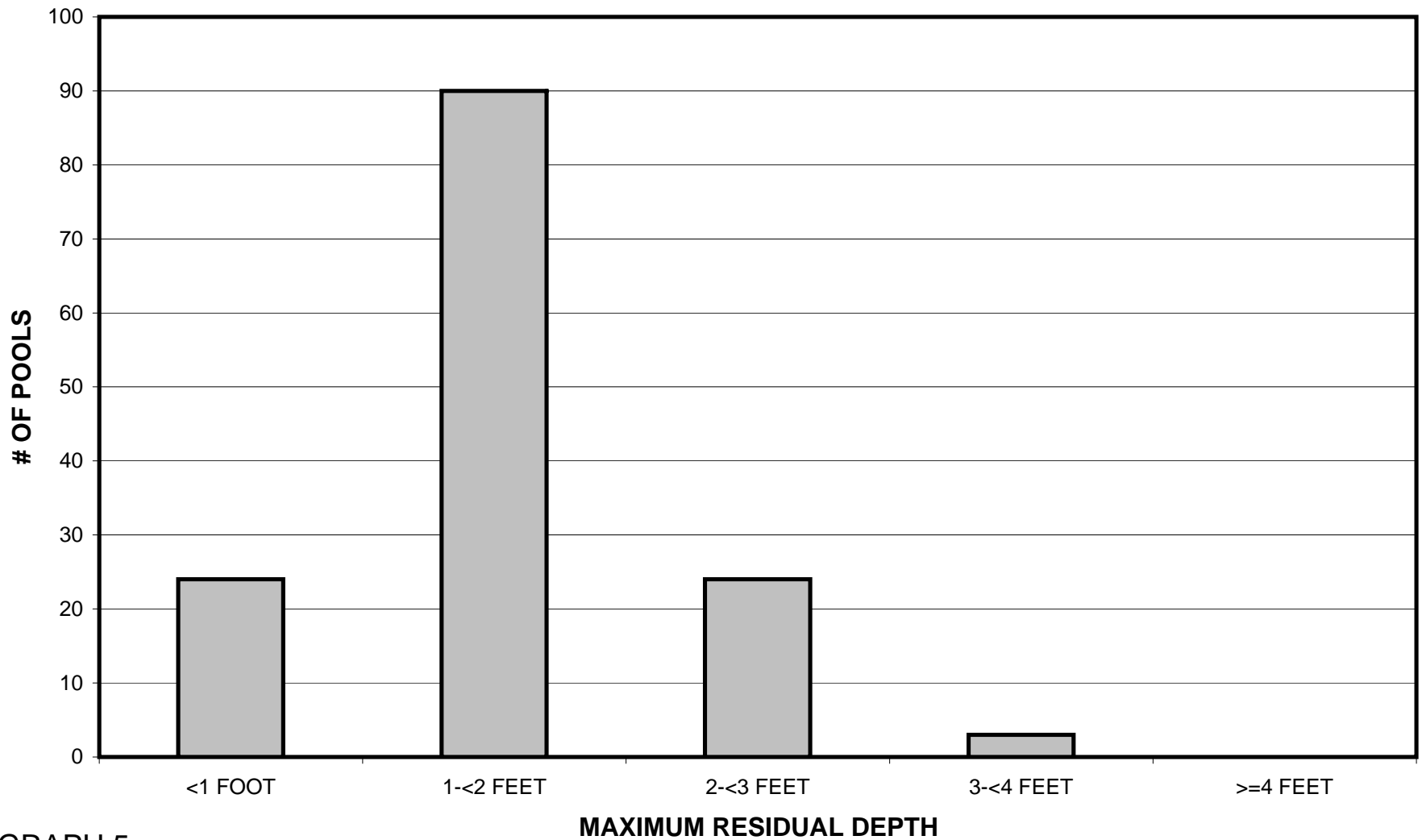
# WATER GULCH 2011

## POOL TYPES BY PERCENT OCCURRENCE



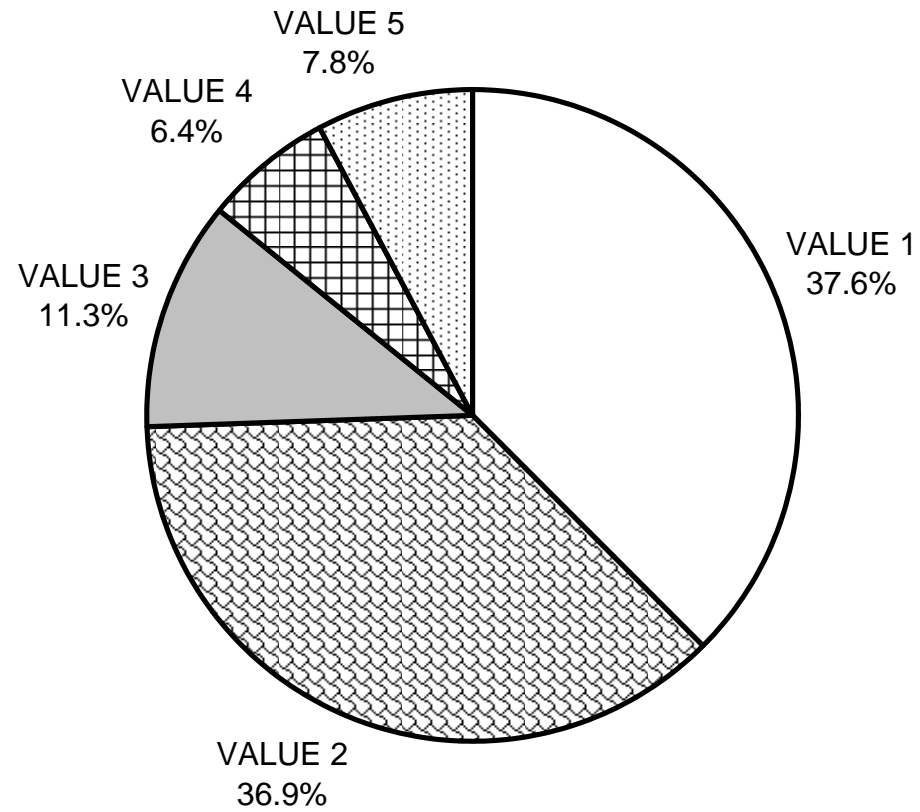
GRAPH 4

# WATER GULCH 2011 MAXIMUM DEPTH IN POOLS



GRAPH 5

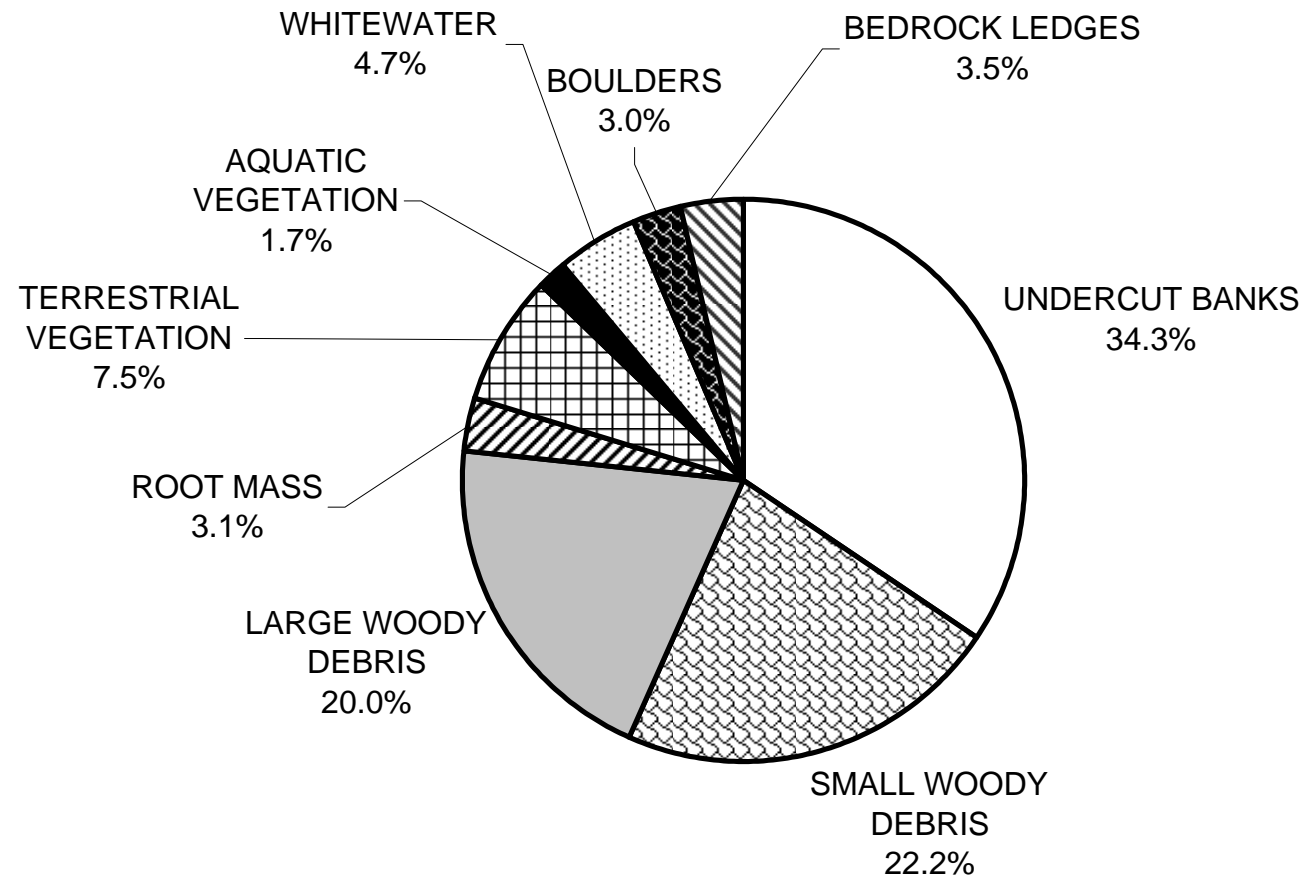
# WATER GULCH 2011 PERCENT EMBEDDEDNESS



GRAPH 6

# WATER GULCH 2011

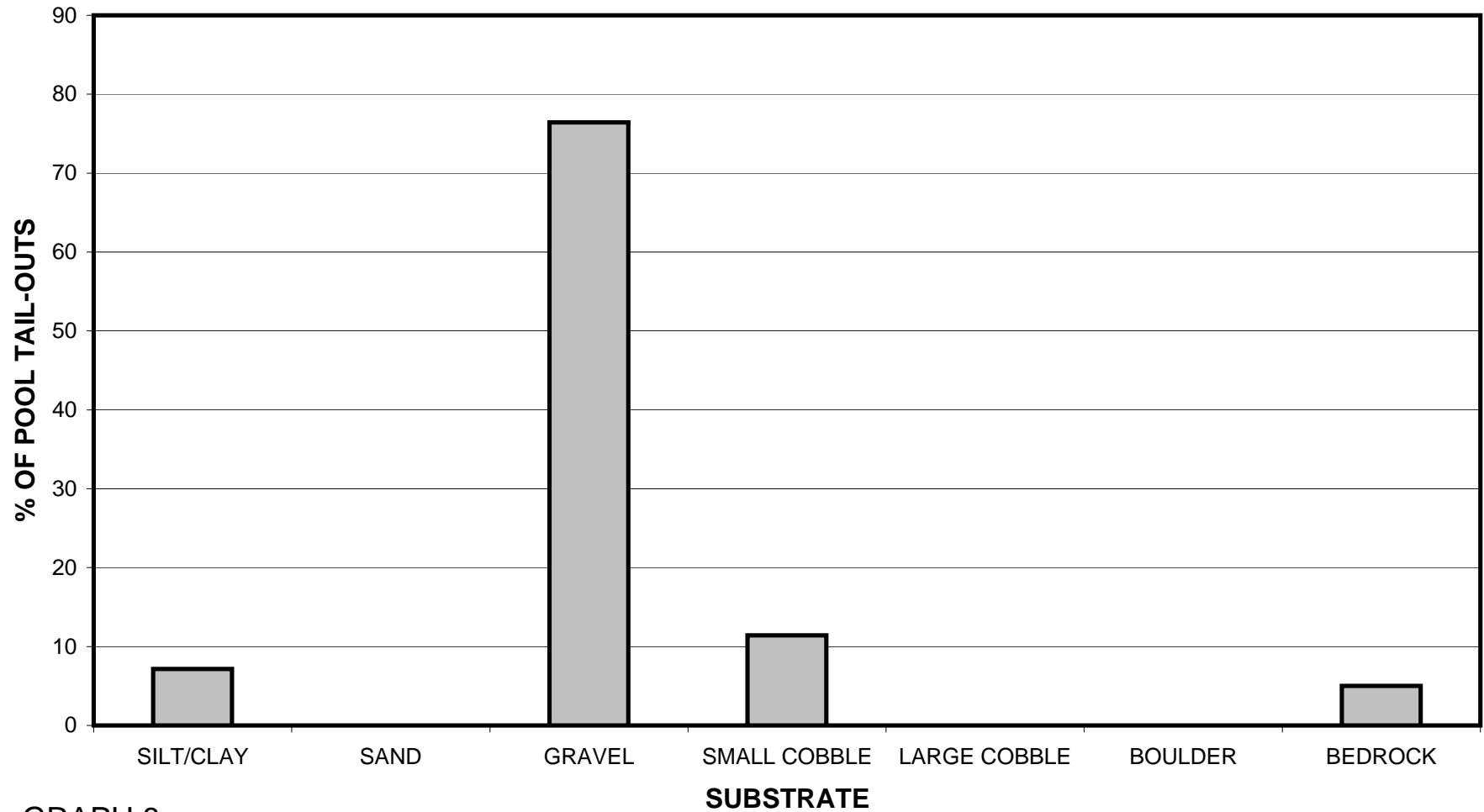
## MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

# **WATER GULCH 2011**

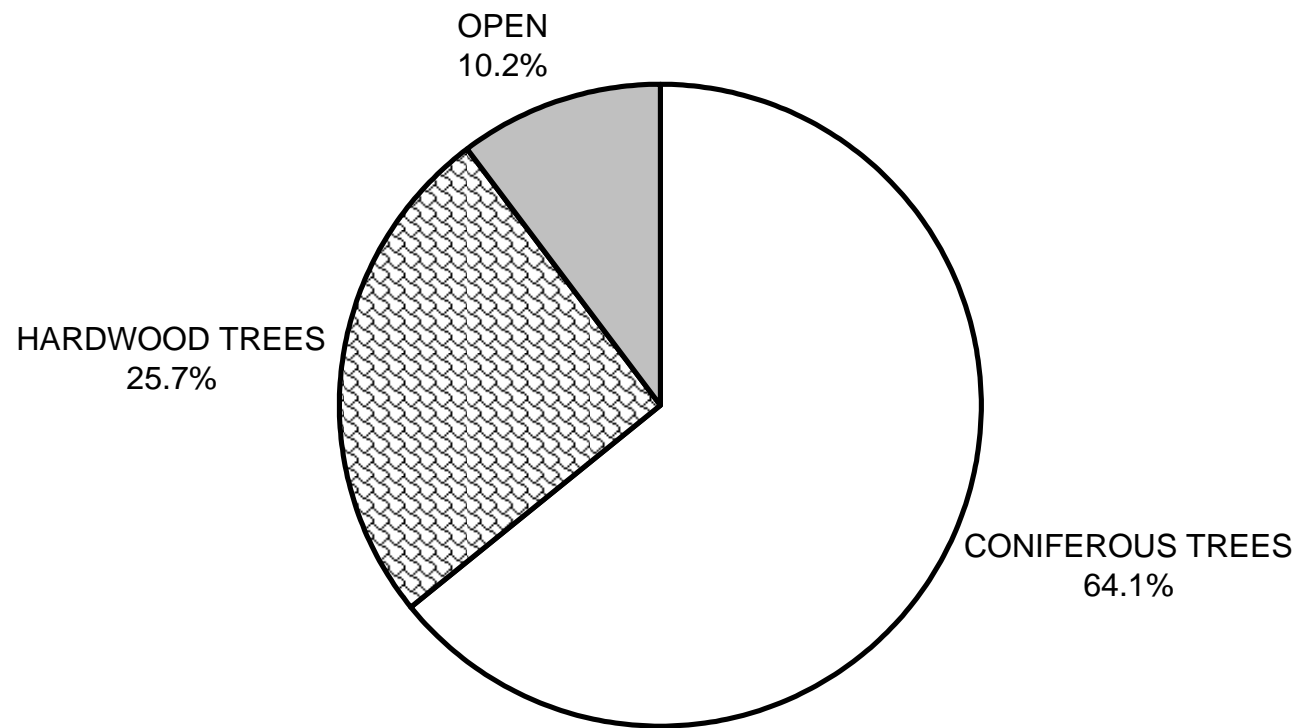
## **SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



GRAPH 8

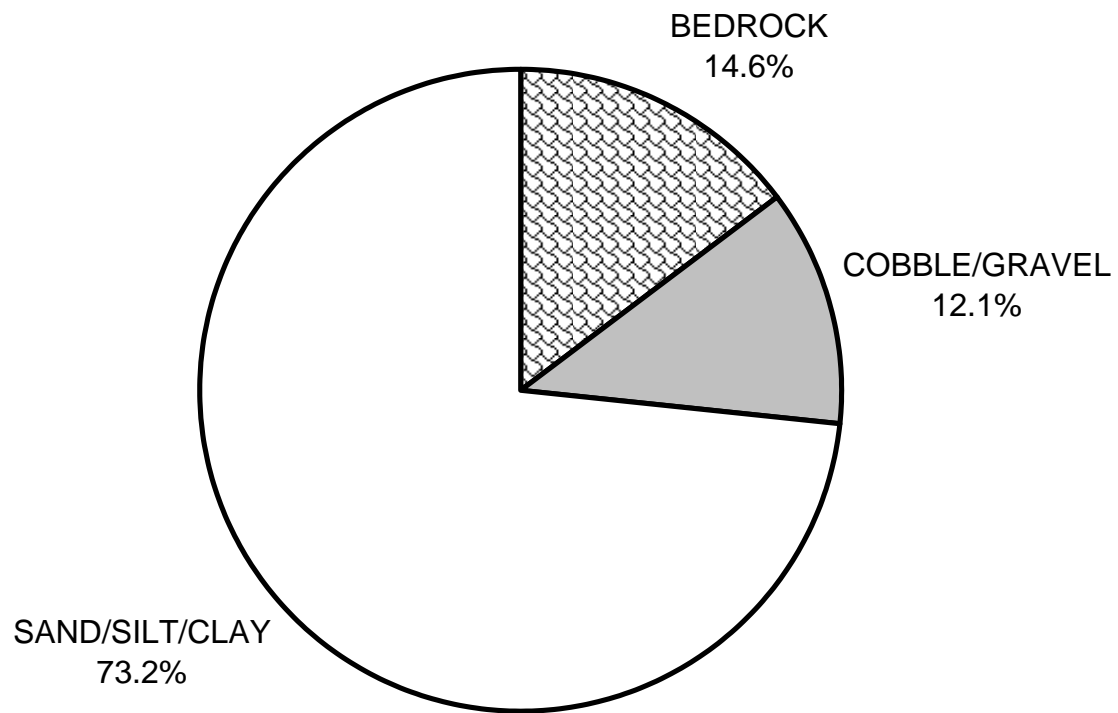


# WATER GULCH 2011 MEAN PERCENT CANOPY



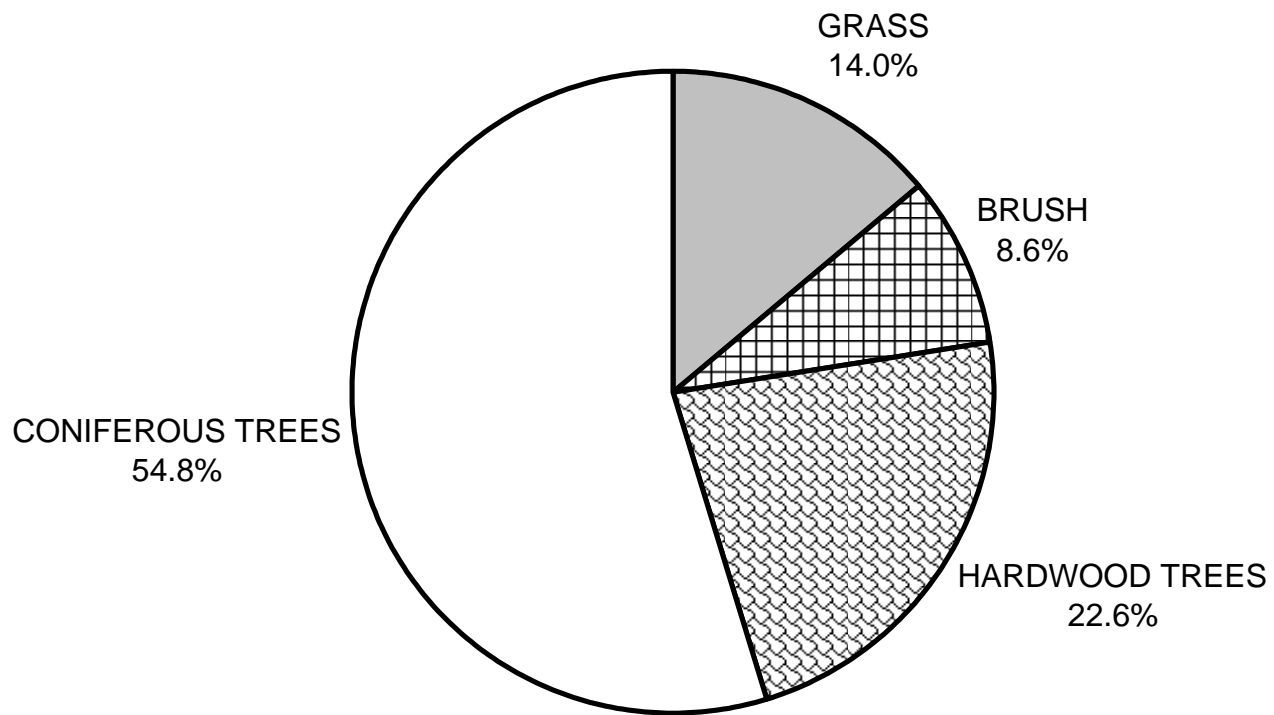
GRAPH 9

**WATER GULCH 2011**  
**DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**WATER GULCH 2011**  
**DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

**Map 1**  
**Water Gulch**  
**Big River Watershed**  
**Comptche Quad, Mendocino County**

End of Survey

Start of Survey

**Legend**

- Reach 1, F4 Channel Type
- Reach 2, G4 Channel Type
- Reach 3, F4 Channel Type

0 1,000 2,000 Feet

