

# STREAM INVENTORY REPORT

## Ham Canyon

### INTRODUCTION

A stream inventory was conducted from September 28 to October 6, 2010 on Ham Canyon Creek. The survey began at the confluence with Rancheria Creek and extended upstream 2.4 miles.

The Ham Canyon Creek 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 Ham Canyon Creek. 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

Ham Canyon Creek is a tributary to Rancheria Creek, tributary to Navarro River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Ham Canyon Creek's legal description at the confluence with Rancheria Creek is T14N R14W S30. Its location is 39.0369 north latitude and 123.4417 west longitude, LLID number 1234418390370. Ham Canyon Creek is a first order stream and has approximately 2.5 miles of blue line stream according to the USGS Philo 7.5 minute quadrangle. Ham Canyon Creek drains a watershed of approximately 3.1 square miles. Elevations range from about 210 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via Highway 128 to Mountain View Road near Philo.

### METHODS

The habitat inventory conducted in Ham Canyon Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

### 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

## **Han Canyon Creek**

crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

### HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Ham Canyon Creek 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". Ham Canyon Creek 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.

## Han Canyon Creek

### 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 Ham Canyon Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

### 6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Ham Canyon Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

### 7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

### 8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Ham Canyon Creek, 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 Ham Canyon Creek, 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.

## Han Canyon Creek

### 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 Ham Canyon Creek. In addition, underwater observations were made at 11 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

## Han Canyon Creek

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Ham Canyon Creek 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 September 28 to October 6, 2010, was conducted by B. Williams and B. Leonard (WSP). The total length of the stream surveyed was 12,714 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.02 cfs on September 29, 2010.

Ham Canyon Creek is a F4 channel type for 12,714 feet of the stream surveyed. F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 59 degrees Fahrenheit. Air temperatures ranged from 54 to 79 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% riffle units, 32% flatwater units, 29% pool units, and 2% dry units (Graph 1). Based on total length of Level II habitat types there were 41% flatwater units, 35% riffle units, 19% pool units, and 6% dry units Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 35%; mid-channel pool units, 22%; and step run units, 22% (Graph 3). Based on percent total length, step run units made up 34%, low gradient riffle units 33%, and mid-channel pool units 15%.

A total of 92 pools were identified (Table 3). Main channel pools were the most frequently encountered at 78% (Graph 4), and comprised 84% of the total length of all pools (Table 3).

## **Han Canyon Creek**

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 92 pools (29%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 92 pool tail-outs measured, 17 had a value of 1 (18.5%); 46 had a value of 2 (50%); 19 had a value of 3 (20.7%); 1 had a value of 4 (1.1%); 9 had a value of 5 (9.8%) (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 unsuited 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 1, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 20 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 17. Scour pools had a mean shelter rating of 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Ham Canyon Creek. Graph 7 describes the pool cover in Ham Canyon Creek. Large woody debris is the dominant pool cover type followed by boulders.

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 59% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 25% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Ham Canyon Creek was 87%. Thirteen percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 56% and 44%, respectively. Graph 9 describes the mean percent canopy in Ham Canyon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 95%. The mean percent left bank vegetated was 94%. The dominant elements composing the structure of the stream banks consisted of 46% sand/silt/clay, 31% cobble/gravel, 14% bedrock, and 8% boulder (Graph 10). Hardwood trees were the dominant vegetation type observed in 46% of the units surveyed. Additionally, 40% of the units surveyed had coniferous trees as the dominant vegetation type, and 10% had brush as the dominant vegetation type (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Survey teams conducted a snorkel survey at 11 sites for species composition and distribution in Ham Canyon Creek on October 11, 2010. Water temperatures taken during the survey period were 55 degrees Fahrenheit. Air temperatures were 62 degrees Fahrenheit. The sites were sampled by I. Mikus (DFG), and B. Williams (WSP).

## Han Canyon Creek

Eleven sites were sampled. The reach sites yielded 21 young-of-the-year steelhead/rainbow trout (SH/RT), 2 age 1+ SH/RT, and 1 age 2+ SH/RT.

The following chart displays the information yielded from these sites:

2010 Ham Canyon Creek underwater observations.

| Date            | Survey Site # | Habitat Unit # | Habitat Type | Approx. Dist. from mouth (ft.) | SH/RT |    |    | Coho |    |
|-----------------|---------------|----------------|--------------|--------------------------------|-------|----|----|------|----|
|                 |               |                |              |                                | YOY   | 1+ | 2+ | YOY  | 1+ |
| F4 Channel Type |               |                |              |                                |       |    |    |      |    |
| 10/11/10        | 1             | 001            | Riffle       | 77                             | 6     | 1  | 0  | 0    | 0  |
|                 | 2             | 002            | Pool         | 100                            | 4     | 0  | 0  | 0    | 0  |
|                 | 3             | 007            | Pool         | 197                            | 2     | 0  | 0  | 0    | 0  |
|                 | 4             | 008            | Pool         | 218                            | 1     | 0  | 0  | 0    | 0  |
|                 | 5             | 010            | Pool         | 260                            | 2     | 1  | 1  | 0    | 0  |
|                 | 6             | 020            | Pool         | 557                            | 1     | 0  | 0  | 0    | 0  |
|                 | 7             | 023            | Pool         | 626                            | 4     | 0  | 0  | 0    | 0  |
|                 | 8             | 025            | Pool         | 671                            | 1     | 0  | 0  | 0    | 0  |
|                 | 9             | 027            | Pool         | 721                            | 0     | 0  | 0  | 0    | 0  |
|                 | 10            | 030            | Pool         | 783                            | 0     | 0  | 0  | 0    | 0  |
|                 | 11            | 033            | Pool         | 878                            | 0     | 0  | 0  | 0    | 0  |

## DISCUSSION

Ham Canyon Creek is an F4 channel type for the entire 12,714 feet of the stream surveyed. The suitability of F4 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.

The water temperatures recorded on the survey days September 28 to October 6, 2010, ranged from 52 to 59 degrees Fahrenheit. Air temperatures ranged from 54 to 79 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 41% of the total length of this survey, riffles 35%, and pools 19%. Twenty-seven of the 92 (29%) 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

## **Han Canyon Creek**

flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Sixty-three of the 92 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty of the pool tail-outs had embeddedness ratings of 3 or 4. Nine 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 Ham Canyon Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventy-seven of the 92 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 20. The shelter rating in the flatwater habitats is 5. 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 Ham Canyon Creek. Large woody debris is the dominant cover type in pools followed by boulders. 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 87%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 95% and 94%, 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) Ham Canyon Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.



## Han Canyon Creek

- 5) 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.
- 6) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

### COMMENTS AND LANDMARKS

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

| Position (ft): | Habitat unit #: | Comments:  |
|----------------|-----------------|--|
| 0              | 0001.00         | Start of survey at the confluence with Rancheria Creek. The channel is an F4 for the entire length of the survey, 12,713 feet. Ham Canyon splits into two channels 30' upstream of the confluence and both channels drain into Rancheria Creek. The first 260' of the creek are characterized by large plunges and cascades. |
| 117            | 0004.00         | There is a 3' high plunge with a 0.7' maximum depth beneath it.  |
| 144            | 0005.00         | There is a 6' high plunge with 0.3' maximum depth below it.  |
| 176            | 0007.00         | There is a 1.5' high plunge.   |
| 229            | 0010.00         | There is a 7' high plunge.   |
| 260            | 0011.00         | Vertical bedrock sheet is 7' high x 6' long.   |
| 396            | 0017.00         | An erosion site is contributing fine sediment to the channel.  |
| 847            | 0033.00         | There are left bank and right bank landslides.   |
| 916            | 0036.00         | Log debris accumulation (LDA) #01 contains 100 pieces of large woody debris (LWD) and measures 20' high x 35' wide x 87' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to boulders and measures 50' wide x 450' long x 8' deep. Fish are present above the LDA.  |
| 1506           | 0040.00         | An erosion site is contributing fine sediment to the channel.  |

## Han Canyon Creek

|      |         |  |
|------|---------|--|
| 1711 | 0045.00 | An erosion site on the left bank is 35' high x 60' long and is contributing fine sediment to the channel.  |
| 2612 | 0064.00 | LDA #02 contains six pieces of LWD and is 6' high x 15' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to large cobble and measures 15' wide x 15' long x 3' deep. Fish are present above the LDA.   |
| 2789 | 0070.00 | A road crosses the channel. The crossing is a 14' wide x 11' high x 40' long railcar bridge.   |
| 2977 | 0073.00 | An erosion site on the right bank is contributing sediment ranging in size from silt to gravel.  |
| 3931 | 0101.00 | Dry tributary on the left bank.  |
| 4183 | 0108.00 | An erosion site in contributing fine sediment to the channel.  |
| 5168 | 0130.00 | LDA #03 contains seven pieces of LWD and measures 7' high x 14' wide x 14' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish are present above the LDA.  |
| 6081 | 0160.00 | Tributary #01 enters on the left bank. It contributes to approximately 5% of Ham Canyon's flow. The water temperature downstream and upstream of the tributary is 58 degrees Fahrenheit; the water temperature of the tributary is 57 degrees Fahrenheit. The slope of the tributary is greater than 20%, making it too steep for salmonids.                       |
| 8498 | 0215.00 | Tributary #02 enters on the right bank. It contributes to approximately 25% of Ham Canyon's flow. The water temperature downstream and upstream of the tributary is 56 degrees Fahrenheit; the water temperature of the tributary is 54 degrees Fahrenheit. The slope of the tributary is 2%. The tributary is accessible to salmonids, but no fish were observed. |
| 8732 | 0221.00 | Dry tributary on left bank.  |
| 9323 | 0229.00 | Left bank seep.  |
| 9556 | 0236.00 | Right bank seep.   |
| 9908 | 0240.00 | There is a 4' high plunge with no pool below it.   |
| 9979 | 0241.00 | LDA #04 contains 11 pieces of LWD and measures 5' high x 14' wide x 14' long. Water flows through the LDA and there are no visible gaps in   |

## Han Canyon Creek

- it. Retained sediment ranges from gravel to boulders and measures 20' wide x 30' long x 3' deep. Fish are present above the LDA.
- 10044 0244.00 An erosion site on the left bank measures 150' long x 75' high and is contributing sediment ranging in size from silt to boulders.
- 10140 0249.00 LDA #05 contains three pieces of LWD and measures 4' high x 11' wide x 6' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from gravel to boulders and measures 15' wide x 18' long x 3' deep. Fish are present above the LDA.
- 10158 0250.00 LDA #06 contains nine pieces of LWD and measures 8' high x 20' wide x 12' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from gravel to boulders and measures 20' wide x 20' long x 3' deep. It is a possible barrier to juvenile and adult salmonids. Fish were not observed above the LDA.
- 10339 0253.00 An erosion site on the left bank measures 150' long x 100' high and is contributing sediment ranging in size from silt to boulders.
- 10923 0273.00 LDA #07 contains seven pieces of LWD and measures 5' high x 17' wide x 8' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from gravel to cobble and measures 10' wide x 10' long x 2' deep. It is a possible barrier to juvenile and adult salmonids. Fish were not observed above the LDA.
- 11793 0296.00 Dry tributary on the right bank.
- 12304 0306.00 There is a 4' high plunge with 1.7' maximum depth beneath it.
- 12614 0315.00 LDA #08 contains 10 pieces of LWD and measures 6' high x 18' wide x 2' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures 15' wide x 20' long x 3' deep. It is a possible barrier to juvenile and adult salmonids.
- 12714 0320.00 End of survey. LDA #09 contains four pieces of LWD and measures 8' high x 10' wide x 4' long. There is an 8' high plunge over the LDA with a maximum depth of 1.3'. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to cobble and measures 5' wide x 30' long x 5' deep. It is a possible barrier to juvenile and adult salmonids. Habitat is diminished above the LDA.

## **Han Canyon Creek**

### 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.

## Han Canyon Creek

### 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: 1234418390370

LLID: 1234418390370 Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

| 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 |
|--------------------|-----------------------------------|--------------|------------------------|-------------------|---------------------------|------------------|------------------|------------------|----------------------|----------------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|
| 6                  | 0                                 | DRY          | 1.9                    | 119               | 713                       | 5.6              |                  |                  |                      |                            |                               |                      |                                 |                                 |                     |
| 104                | 11                                | FLATWATER    | 32.5                   | 50                | 5217                      | 41.0             | 6.8              | 0.5              | 0.9                  | 207                        | 21558                         | 94                   | 9729                            |                                 | 5                   |
| 92                 | 92                                | POOL         | 28.8                   | 26                | 2384                      | 18.8             | 9.4              | 0.8              | 1.7                  | 235                        | 21579                         | 262                  | 24108                           | 214                             | 20                  |
| 118                | 11                                | RIFFLE       | 36.9                   | 37                | 4400                      | 34.6             | 5.8              | 0.2              | 0.4                  | 102                        | 12050                         | 25                   | 2716                            |                                 | 1                   |
| <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>    |                                 |                     |
| 320                | 114                               |              |                        |                   | 12714                     |                  |                  |                  |                      | 55188                      |                               |                      | 36553                           |                                 |                     |

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

Stream Name: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

| 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 (%) |
|---------------|----------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|------------------|-----------------|--------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|-----------------|
| 111           | 8                    | LGR          | 34.7                   | 38                | 4166               | 32.8             | 7                | 0.2              | 0.6             | 132                | 14643                         | 34                   | 3279                            |                                 | 1                   | 78              |
| 5             | 1                    | HGR          | 1.6                    | 44                | 222                | 1.7              | 5                | 0.3              | 0.6             | 50                 | 250                           | 15                   | 75                              |                                 | 0                   | 98              |
| 2             | 2                    | BRS          | 0.6                    | 6                 | 12                 | 0.1              | 2                | 0.1              | 0.2             | 9                  | 18                            | 1                    | 2                               |                                 | 0                   | 97              |
| 35            | 6                    | RUN          | 10.9                   | 24                | 831                | 6.5              | 7                | 0.5              | 1               | 163                | 5722                          | 72                   | 2511                            |                                 | 6                   | 93              |
| 69            | 5                    | SRN          | 21.6                   | 64                | 4386               | 34.5             | 7                | 0.5              | 1.2             | 260                | 17930                         | 120                  | 8259                            |                                 | 4                   | 87              |
| 70            | 70                   | MCP          | 21.9                   | 28                | 1936               | 15.2             | 9                | 0.8              | 3.3             | 252                | 17666                         | 274                  | 19191                           | 224                             | 17                  | 87              |
| 2             | 2                    | STP          | 0.6                    | 32                | 64                 | 0.5              | 12               | 0.8              | 2               | 311                | 622                           | 314                  | 629                             | 252                             | 15                  | 77              |
| 2             | 2                    | CRP          | 0.6                    | 22                | 44                 | 0.3              | 5                | 0.6              | 1.3             | 117                | 234                           | 82                   | 164                             | 67                              | 25                  | 94              |
| 5             | 5                    | LSL          | 1.6                    | 26                | 128                | 1.0              | 9                | 0.7              | 3.1             | 254                | 1269                          | 279                  | 1393                            | 228                             | 24                  | 86              |
| 2             | 2                    | LSR          | 0.6                    | 20                | 40                 | 0.3              | 8                | 0.5              | 1.6             | 144                | 288                           | 96                   | 193                             | 76                              | 15                  | 90              |
| 11            | 11                   | PLP          | 3.4                    | 16                | 172                | 1.4              | 10               | 1.2              | 5.4             | 136                | 1500                          | 231                  | 2539                            | 195                             | 35                  | 94              |
| 6             | 0                    | DRY          | 1.9                    | 119               | 713                | 5.6              |                  |                  |                 |                    |                               |                      |                                 |                                 |                     |                 |

Total Units  
320

Total Units Fully Measured  
114

Total Length (ft.)  
12714

Total Area (sq.ft.)  
60143

Total Volume (cu.ft.)  
38235

**Table 3 - Summary of Pool Types**

Stream Name: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

| 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 |
|---------------|----------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|---------------------------|--------------------|-------------------------------|---------------------------------|--------------------------------------|---------------------|
| 72            | 72                   | MAIN         | 78                     | 28                | 2000               | 84               | 9.4              | 0.8                       | 254                | 18288                         | 224                             | 16160                                | 17                  |
| 20            | 20                   | SCOUR        | 22                     | 19                | 384                | 16               | 9.2              | 0.9                       | 165                | 3291                          | 178                             | 3568                                 | 30                  |

| Total Units | Total Units Fully Measured | Total Length (ft.) | Total Area (sq.ft.) | Total Volume (cu.ft.) |
|-------------|----------------------------|--------------------|---------------------|-----------------------|
| 92          | 92                         | 2384               | 21579               | 19727                 |



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

Stream Name: 1234418390370 LLID: 1234418390370 Drainage: Navarro River  
 Survey Dates: 9/28/2010 to 10/6/2010  
 Confluence Location: Quad: PHILO Legal Description: T14NR14WS30 Latitude: 39:02:13.0N Longitude: 123:26:30.0W

| 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 |
|---------------|--------------|------------------------|---------------------------------|-----------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|----------------------------------|------------------------------|
| 70            | MCP          | 76                     | 0                               | 0                           | 49                                | 70                            | 19                                | 27                            | 2                                 | 3                             | 0                                | 0                            |
| 2             | STP          | 2                      | 0                               | 0                           | 1                                 | 50                            | 1                                 | 50                            | 0                                 | 0                             | 0                                | 0                            |
| 2             | CRP          | 2                      | 0                               | 0                           | 2                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 5             | LSL          | 5                      | 0                               | 0                           | 3                                 | 60                            | 1                                 | 20                            | 1                                 | 20                            | 0                                | 0                            |
| 2             | LSR          | 2                      | 0                               | 0                           | 2                                 | 100                           | 0                                 | 0                             | 0                                 | 0                             | 0                                | 0                            |
| 11            | PLP          | 12                     | 1                               | 9                           | 7                                 | 64                            | 1                                 | 9                             | 0                                 | 0                             | 2                                | 18                           |

| 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 |
|-------------|---------------------------------|-----------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|
| 92          | 1                               | 1                           | 64                               | 70                           | 22                               | 24                           | 3                                | 3                            | 2                                | 2                            |

Mean Maximum Residual Pool Depth (ft.): 1.7

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

Stream Name: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Dry Units: 6

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

| 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 |
|---------------|----------------------|--------------|-----------------------|------------|------------|------------------|-------------------------|---------------------------|--------------------|-----------------|-----------------------|
| 111           | 8                    | LGR          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 100             | 0                     |
| 5             | 1                    | HGR          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 2             | 1                    | BRS          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 118           | 10                   | TOTAL RIFFLE | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 100             | 0                     |
| 35            | 6                    | RUN          | 5                     | 0          | 0          | 0                | 45                      | 0                         | 0                  | 0               | 50                    |
| 69            | 5                    | SRN          | 0                     | 0          | 20         | 0                | 0                       | 0                         | 30                 | 50              | 0                     |
| 104           | 11                   | TOTAL FLAT   | 3                     | 0          | 10         | 0                | 22                      | 0                         | 15                 | 25              | 25                    |
| 70            | 70                   | MCP          | 4                     | 17         | 34         | 12               | 3                       | 0                         | 0                  | 21              | 9                     |
| 2             | 2                    | STP          | 20                    | 0          | 35         | 15               | 0                       | 0                         | 0                  | 30              | 0                     |
| 2             | 2                    | CRP          | 73                    | 0          | 0          | 23               | 5                       | 0                         | 0                  | 0               | 0                     |
| 5             | 5                    | LSL          | 12                    | 18         | 63         | 2                | 0                       | 0                         | 0                  | 5               | 0                     |
| 2             | 2                    | LSR          | 10                    | 15         | 0          | 75               | 0                       | 0                         | 0                  | 0               | 0                     |
| 11            | 11                   | PLP          | 4                     | 6          | 9          | 15               | 0                       | 0                         | 21                 | 34              | 12                    |
| 92            | 92                   | TOTAL POOL   | 7                     | 15         | 30         | 14               | 2                       | 0                         | 3                  | 21              | 8                     |
| 320           | 113                  | TOTAL        | 6                     | 14         | 29         | 13               | 3                       | 0                         | 4                  | 23              | 9                     |

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

Stream Name: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Dry Units: 6

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

| 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 |
|---------------|----------------------|--------------|----------------------------|-----------------------|-------------------------|-------------------------------|-------------------------------|--------------------------|--------------------------|
| 111           | 8                    | LGR          | 0                          | 0                     | 25                      | 38                            | 38                            | 0                        | 0                        |
| 5             | 1                    | HGR          | 0                          | 0                     | 0                       | 0                             | 100                           | 0                        | 0                        |
| 2             | 2                    | BRS          | 0                          | 0                     | 0                       | 0                             | 0                             | 0                        | 100                      |
| 35            | 6                    | RUN          | 17                         | 0                     | 17                      | 33                            | 17                            | 0                        | 17                       |
| 69            | 5                    | SRN          | 20                         | 0                     | 20                      | 0                             | 60                            | 0                        | 0                        |
| 70            | 70                   | MCP          | 4                          | 1                     | 47                      | 16                            | 20                            | 3                        | 9                        |
| 2             | 2                    | STP          | 50                         | 0                     | 50                      | 0                             | 0                             | 0                        | 0                        |
| 2             | 2                    | CRP          | 0                          | 0                     | 50                      | 0                             | 50                            | 0                        | 0                        |
| 5             | 5                    | LSL          | 0                          | 0                     | 100                     | 0                             | 0                             | 0                        | 0                        |
| 2             | 2                    | LSR          | 0                          | 0                     | 50                      | 0                             | 50                            | 0                        | 0                        |
| 11            | 11                   | PLP          | 9                          | 0                     | 27                      | 0                             | 9                             | 18                       | 36                       |

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

Stream Name: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

| Mean Percent Canopy | Mean Percent Conifer | Mean Percent Hardwood | Mean Percent Open Units | Mean Right Bank % Cover | Mean Left Bank % Cover |
|---------------------|----------------------|-----------------------|-------------------------|-------------------------|------------------------|
| 87                  | 44                   | 56                    | 0                       | 95                      | 94                     |

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: 1234418390370 LLID: 1234418390370 Drainage: Navarro River  
 Survey Dates: 9/28/2010 to 10/6/2010 Survey Length (ft.): 12714 Main Channel (ft.): 12714 Side Channel (ft.): 0  
 Confluence Location: Quad: PHILO Legal Description: T14NR14WS30 Latitude: 39:02:13.0N Longitude: 123:26:30.0W

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

**STREAM REACH: 1**

|   |  |   |
|---|--|---|
| Channel Type: F4  | Canopy Density (%): 87.4                     | Pools by Stream Length (%): 18.8        |
| Reach Length (ft.): 12714   | Coniferous Component (%): 44.2               | Pool Frequency (%): 28.8                |
| Riffle/Flatwater Mean Width (ft.): 6.3  | Hardwood Component (%): 55.8                 | Residual Pool Depth (%):                |
| BFW:  | Dominant Bank Vegetation: Hardwood Trees     | < 2 Feet Deep: 71                       |
| Range (ft.): 8 to 30  | Vegetative Cover (%): 94.7                   | 2 to 2.9 Feet Deep: 24                  |
| Mean (ft.): 16  | Dominant Shelter: Large Woody Debris         | 3 to 3.9 Feet Deep: 3                   |
| Std. Dev.: 4  | Dominant Bank Substrate Type: Sand/Silt/Clay | >= 4 Feet Deep: 2                       |
| Base Flow (cfs.): 0.0   | Occurrence of LWD (%): 21                    | Mean Max Residual Pool Depth (ft.): 1.7 |
| Water (F): 52 - 59 Air (F): 54 - 79   | LWD per 100 ft.:                             | Mean Pool Shelter Rating: 20            |
| Dry Channel (ft): 713   | Riffles: 3                                   |   |
|   | Pools: 9                                     |   |
|   | Flat: 3                                      |   |
| Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 59 Sm Cobble: 25 Lg Cobble: 7 Boulder: 4 Bedrock: 5 |  |   |
| Embeddedness Values (%): 1. 18.5 2. 50.0 3. 20.7 4. 1.1 5. 9.8  |  |   |

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

Stream Name: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

Latitude: 39:02:13.0N

Longitude: 123:26:30.0W

**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                     | 16                         | 17                        | 14.5                   |
| Boulder                     | 12                         | 7                         | 8.3                    |
| Cobble / Gravel             | 33                         | 38                        | 31.1                   |
| Sand / Silt / Clay          | 53                         | 52                        | 46.1                   |

**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                        | 6                          | 3                         | 3.9                    |
| Brush                        | 8                          | 15                        | 10.1                   |
| Hardwood Trees               | 60                         | 45                        | 46.1                   |
| Coniferous Trees             | 40                         | 51                        | 39.9                   |
| No Vegetation                | 0                          | 0                         | 0.0                    |

**Total Stream Cobble Embeddedness Values:** 2

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

StreamName: 1234418390370

LLID: 1234418390370

Drainage: Navarro River

Survey Dates: 9/28/2010 to 10/6/2010

Confluence Location: Quad: PHILO

Legal Description: T14NR14WS30

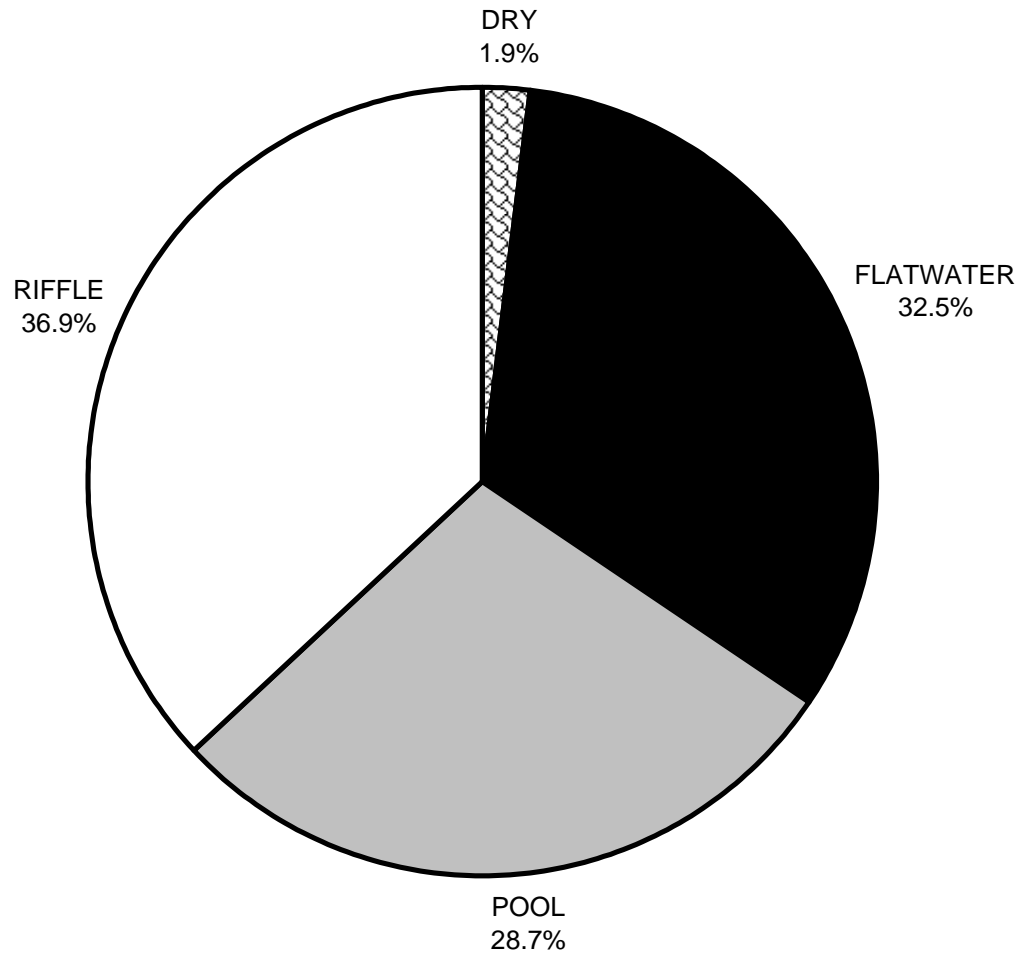
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Longitude: 123:26:30.0W

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|                            | <b>Riffles</b> | <b>Flatwater</b> | <b>Pools</b> |
|----------------------------|----------------|------------------|--------------|
| UNDERCUT BANKS (%)         | 0              | 3                | 7            |
| SMALL WOODY DEBRIS (%)     | 0              | 0                | 15           |
| LARGE WOODY DEBRIS (%)     | 0              | 10               | 30           |
| ROOT MASS (%)              | 0              | 0                | 14           |
| TERRESTRIAL VEGETATION (%) | 0              | 22               | 2            |
| AQUATIC VEGETATION (%)     | 0              | 0                | 0            |
| WHITEWATER (%)             | 0              | 15               | 3            |
| BOULDERS (%)               | 100            | 25               | 21           |
| BEDROCK LEDGES (%)         | 0              | 25               | 8            |

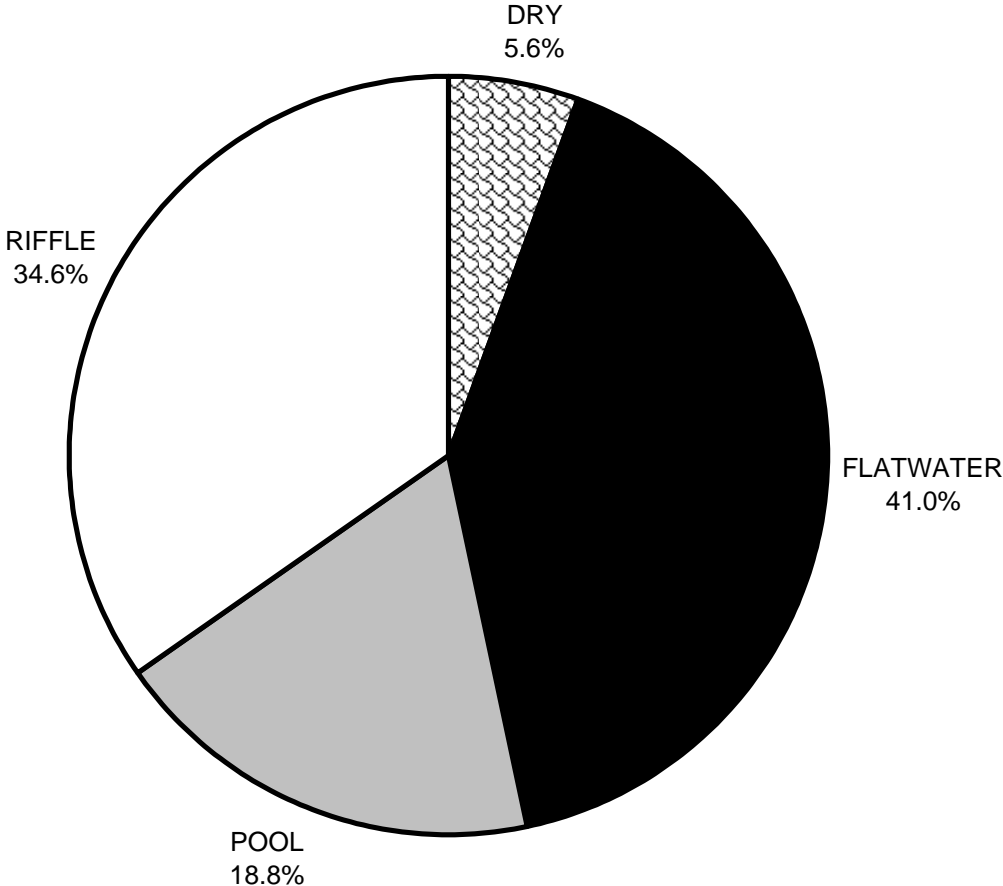
# Ham Canyon 2010 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1



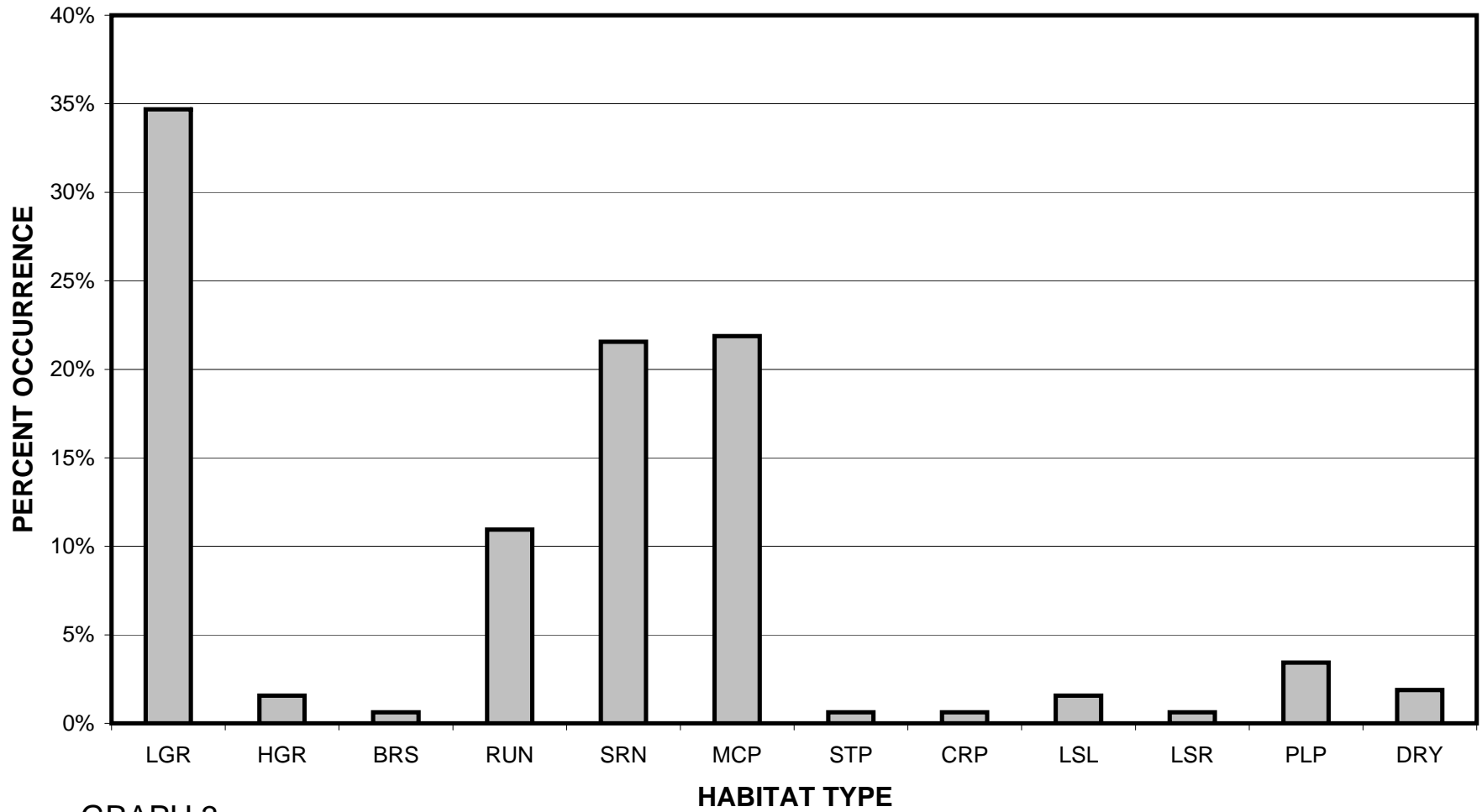
**Ham Canyon 2010**  
**HABITAT TYPES BY PERCENT TOTAL LENGTH**



GRAPH 2

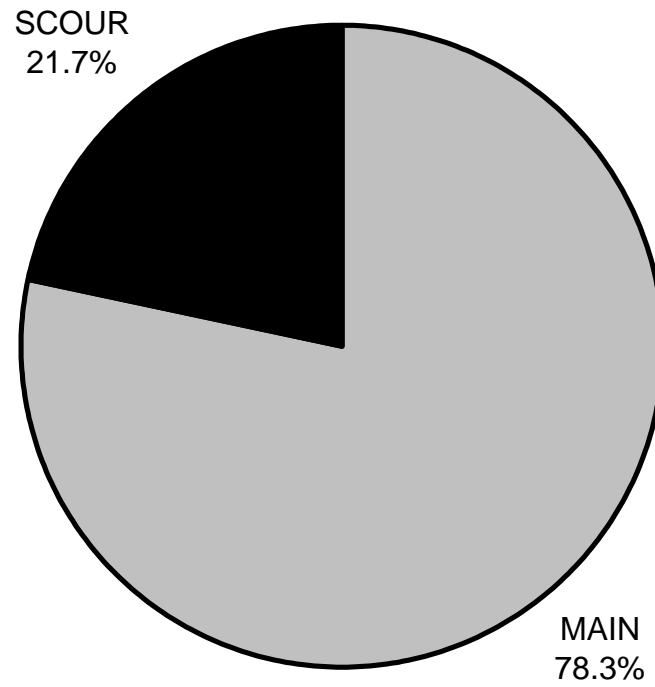
# Ham Canyon 2010

## HABITAT TYPES BY PERCENT OCCURRENCE



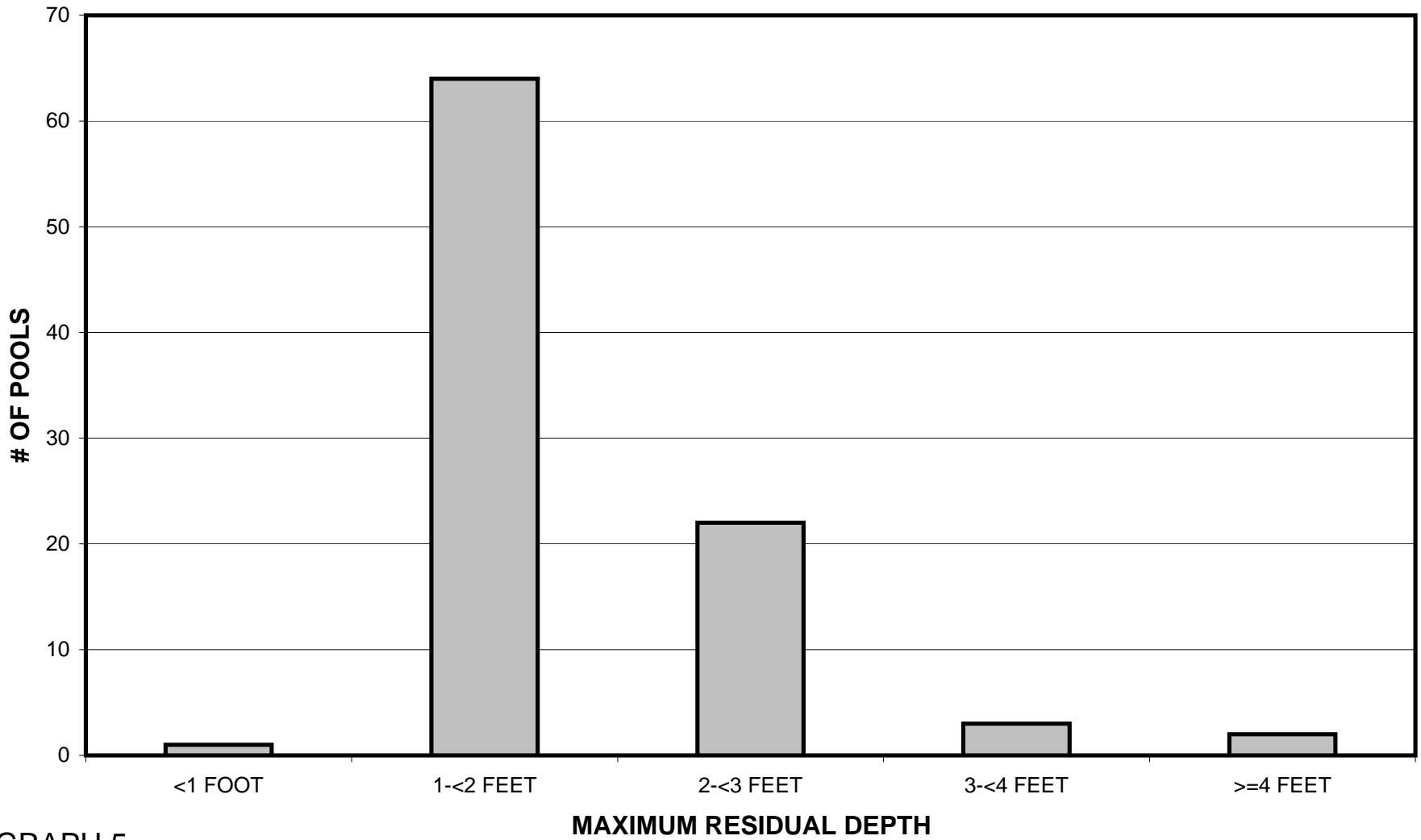
GRAPH 3

**Ham Canyon 2010  
POOL TYPES BY PERCENT OCCURRENCE**



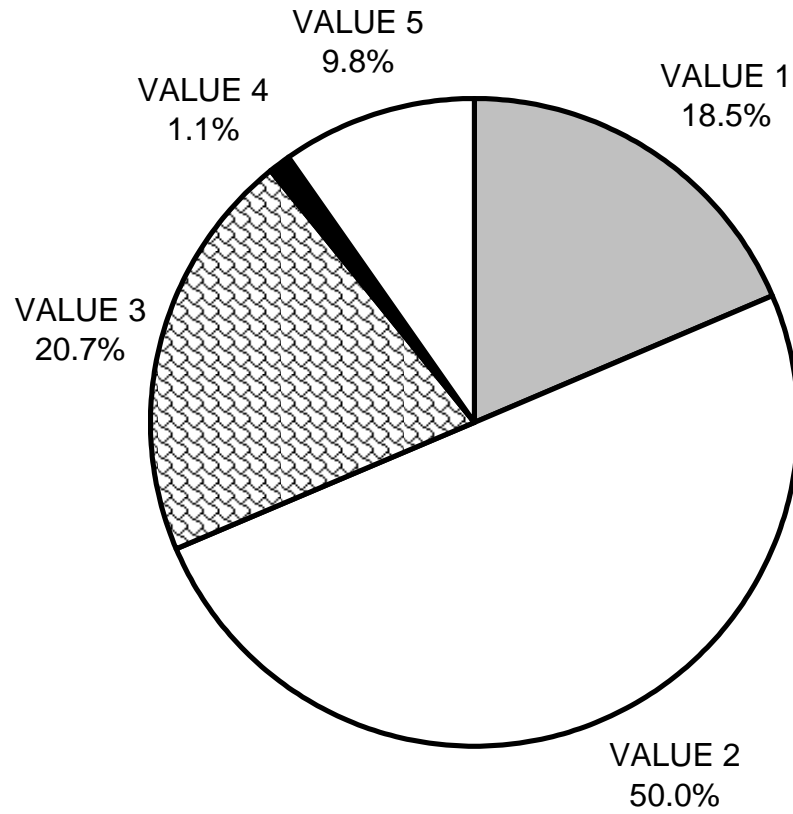
GRAPH 4

# Ham Canyon 2010 MAXIMUM DEPTH IN POOLS



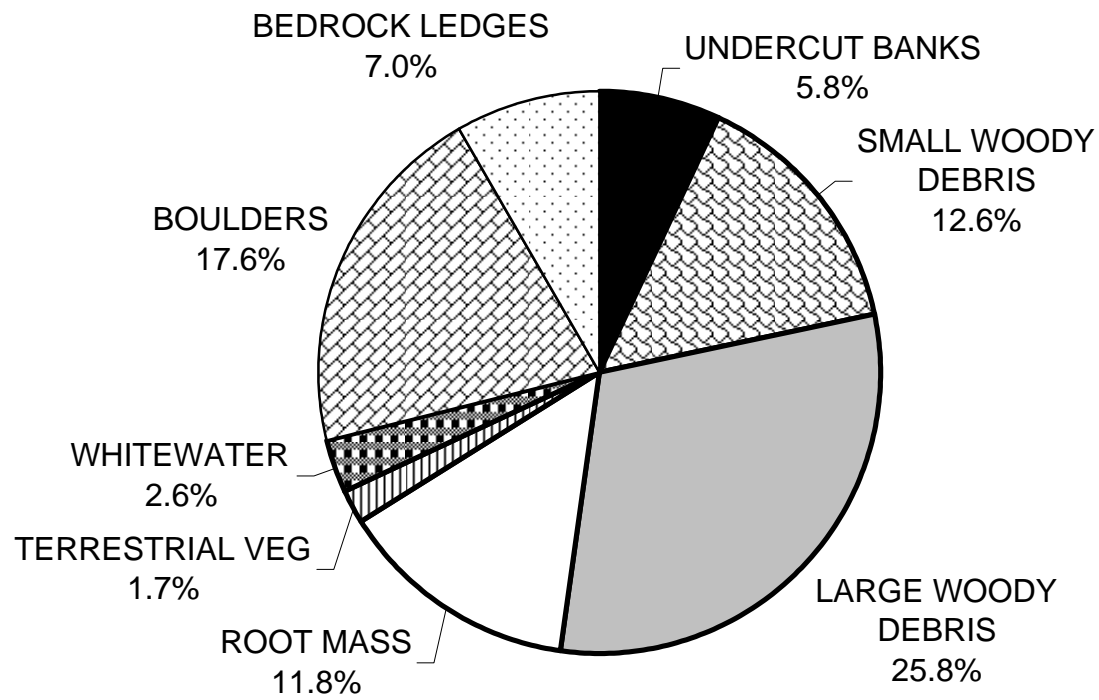
GRAPH 5

# Ham Canyon 2010 PERCENT EMBEDDEDNESS



GRAPH 6

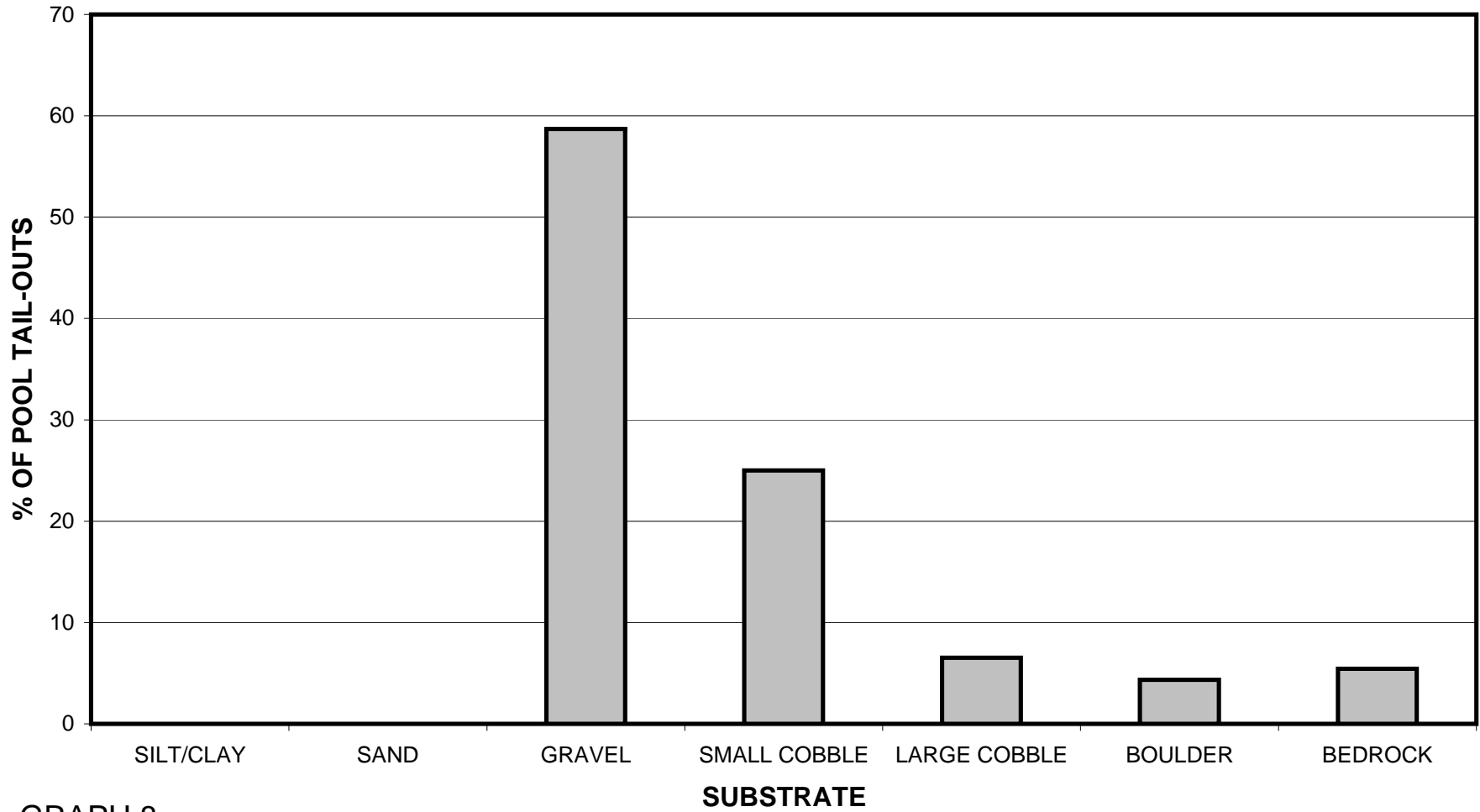
# Ham Canyon 2010 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

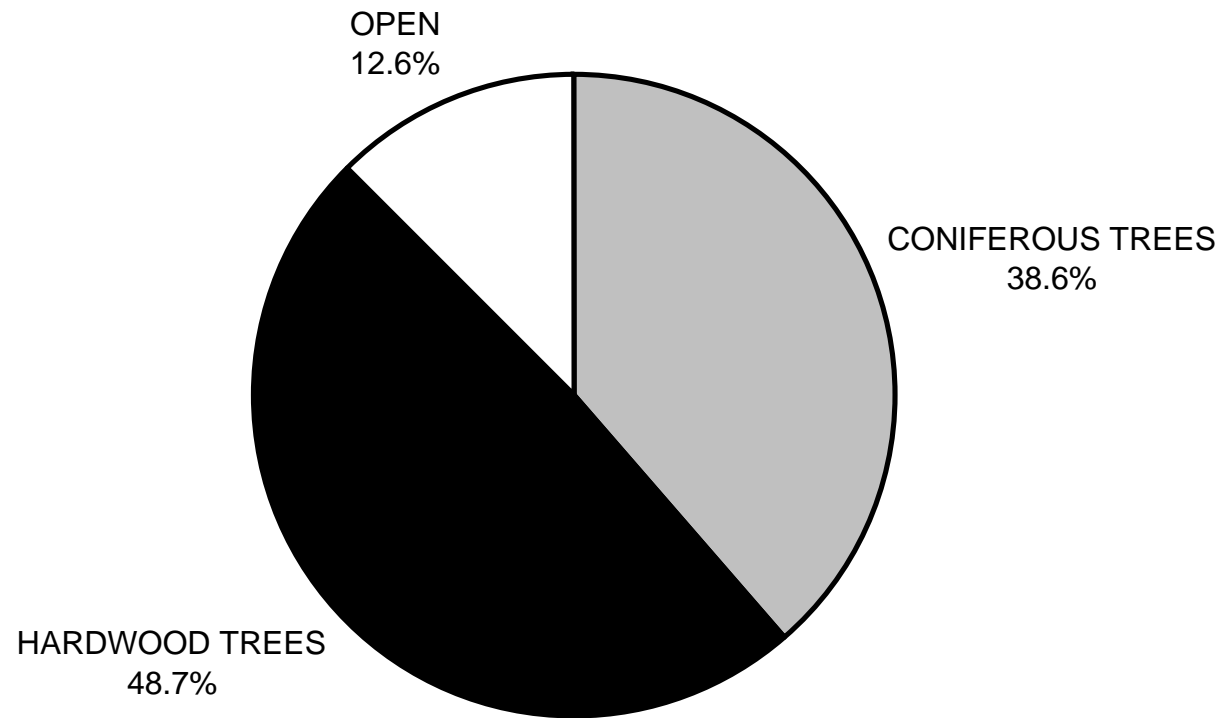
# Ham Canyon 2010

## SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

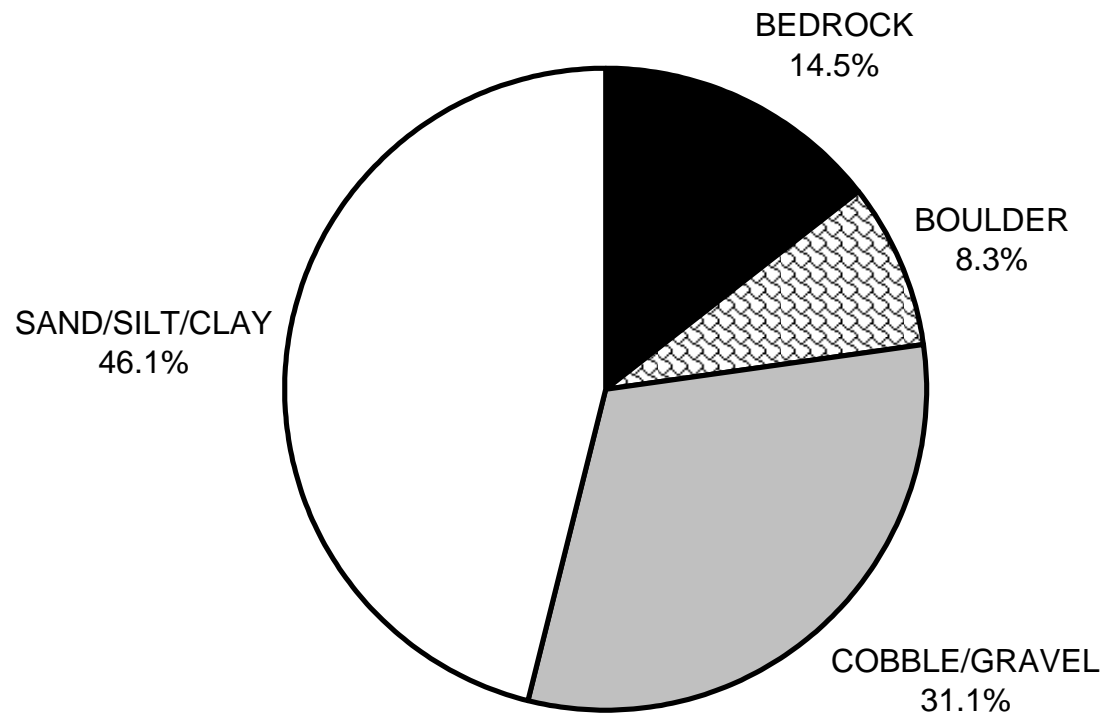
# Ham Canyon 2010 MEAN PERCENT CANOPY



GRAPH 9

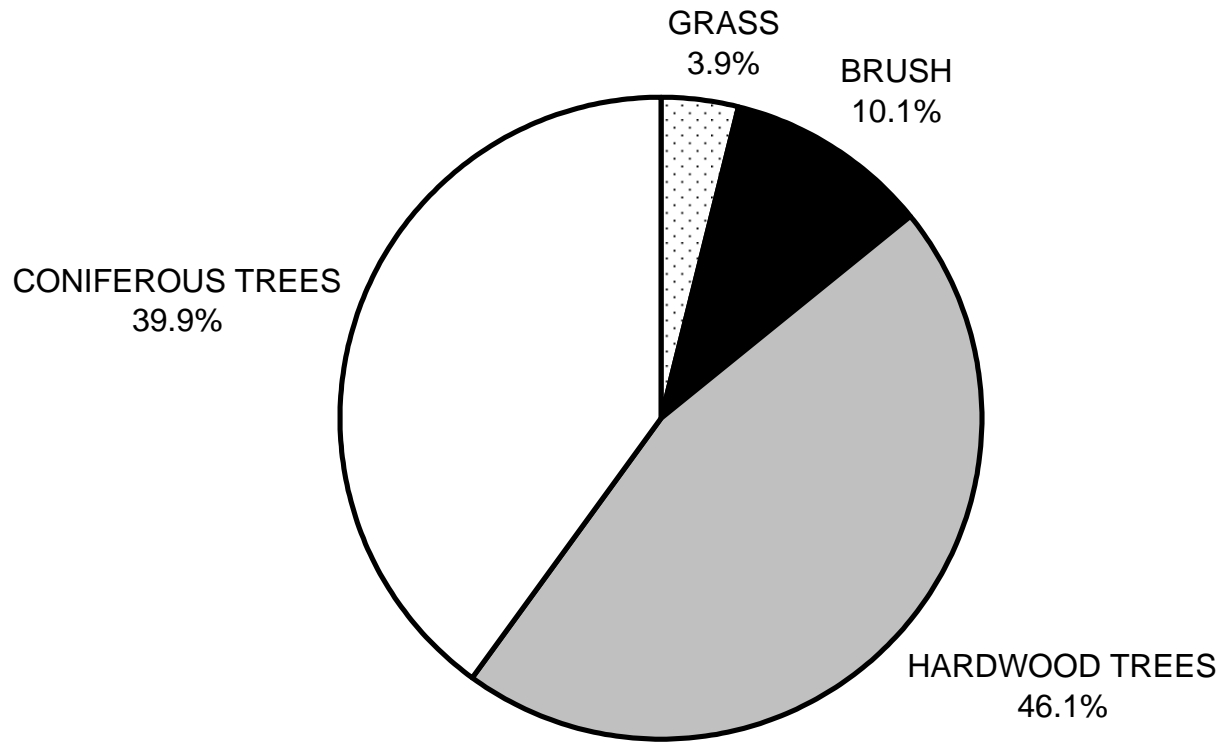


**Ham Canyon 2010**  
**DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

# Ham Canyon 2010 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

