

STREAM INVENTORY REPORT

Gulch Sixteen

INTRODUCTION

A stream inventory was conducted from May 9 to May 11, 2011 on Gulch Sixteen. The survey began at the confluence with West Chamberlain Creek and extended upstream 0.8 miles.

The Gulch Sixteen 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 Gulch Sixteen. 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

Gulch Sixteen is a tributary to West Chamberlain Creek, tributary to Chamberlain Creek, 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). Gulch Sixteen's legal description at the confluence with West Chamberlain Creek is T18N R15W S31. Its location is 39.37826 degrees north latitude and 123.57805 degrees west longitude, LLID number 1235768393783. Gulch Sixteen is a first order stream and has approximately 0.28 miles of blue line stream according to the USGS Northspur 7.5 minute quadrangle. Gulch Sixteen drains a watershed of approximately 1.24 square miles. Elevations range from about 500 feet at the mouth of the creek to 1,200 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 for timber production. Vehicle access exists via State Route 20.

METHODS

The habitat inventory conducted in Gulch Sixteen 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

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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 Gulch Sixteen 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". Gulch Sixteen 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 Gulch Sixteen, 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 Gulch Sixteen, 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 Gulch Sixteen, 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 Gulch Sixteen, 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 Gulch Sixteen. In addition, underwater observations were made at eight 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 Gulch Sixteen 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 9 to May 11, 2011 was conducted by E. Kantorski and A. Blessing (WSP). The total length of the stream surveyed was 4,225 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.7 cfs on May 24, 2011.

Gulch Sixteen is a B4 channel type for 4,225 feet of the stream surveyed. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 46 to 53 degrees Fahrenheit. Air temperatures ranged from 44 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 48% pool units, 33% flatwater units, 17% riffle units, and 1% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 53% flatwater units, 34% pool units, 12% riffle units, and 1% unsurveyed units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 40%; step run units, 25%; and low gradient riffle units, 17% (Graph 3). Based on percent total length, step run units made up 46%, mid-channel pool units 30%, and low gradient riffle units 12%.

A total of 67 pools were identified (Table 3). Main channel pools were the most frequently encountered at 87% (Graph 4), and comprised 93% of the total length of all pools (Table 3).

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Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Seven of the 67 pools (10%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 67 pool tail-outs measured, 29 had a value of 1 (43.3%); 35 had a value of 2 (52.2%); 2 had a value of 3 (3%); and 1 had a value of 4 (1.5%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 1, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 25 (Table 1). Of the pool types, main channel pools had the highest mean shelter rating at 26. Scour pools had a mean shelter rating of 18 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Gulch Sixteen. Graph 7 describes the pool cover in Gulch Sixteen. Large woody debris is the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 87% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 10% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Gulch Sixteen was 95%. Five percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 11% and 89%, respectively. Graph 9 describes the mean percent canopy in Gulch Sixteen.

For the stream reach surveyed, the mean percent right bank vegetated was 97%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 94% sand/silt/clay, 3% cobble/gravel, and 3% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 84% of the units surveyed. Additionally, 8% of the units surveyed had brush as the dominant vegetation type, and 6% had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at eight sites for species composition and distribution in Gulch Sixteen on July 11, 2011. The water temperature taken during the survey period of 1400 hours to 1440 hours was 56 degrees Fahrenheit. Air temperatures ranged from 65 to 71 degrees Fahrenheit. The sites were sampled by I. Mikus and M. Groff (DFG).

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The survey started at the confluence with West Chamberlain Creek and continued 1,841 feet upstream. The reach sites yielded 12 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), one age 1+ SH/RT, and two coho YOY.

The following chart displays the information yielded from these sites:

2011 Gulch Sixteen underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
B4 Channel Type									
07/11/11	1	001	Pool	31	4	0	0	0	0
	2	006	Pool	193	3	0	0	1	0
	3	015	Pool	475	1	1	0	1	0
	4	024	Pool	744	0	0	0	0	0
	5	033	Pool	983	2	0	0	0	0
	6	041	Step-run	1,229	2	0	0	0	0
	7	051	Pool	1,603	0	0	0	0	0
	8	061	Pool	1,841	0	0	0	0	0

DISCUSSION

Gulch Sixteen is a B4 channel type for the entire 4,225 feet of the stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is as follows: B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days May 9 to May 11, 2011 ranged from 46 to 53 degrees Fahrenheit. Air temperatures ranged from 44 to 60 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 53% of the total length of this survey, riffles 12%, and pools 34%. Seven of the 67 (10%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

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Sixty-four of the 67 pool tail-outs measured had embeddedness ratings of 1 or 2. Three of the pool tail-outs had embeddedness ratings of 3 or 4. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Sixty-five of the 67 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 25. The shelter rating in the flatwater habitats is 4. 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 Gulch Sixteen. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 95%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 97% 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) Gulch Sixteen 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.
- 5) Conduct a fish passage assessment on the culvert on Tributary #01 located at 484 feet from the confluence.

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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 (ft):	Habitat Unit #:	Comment:
0	0001.00	Start of survey with the confluence with West Chamberlain Creek. The channel is a B4 for the entire length of the survey.
256	0009.00	Out of the influence with West Chamberlain Creek.
484	0017.00	Tributary #01 enters on the left bank. It contributes to approximately 50% of Gulch Sixteen's flow. The water temperature downstream of the tributary is 50 degrees Fahrenheit, the water temperature of the tributary is 52 degrees Fahrenheit, and the water temperature upstream of the confluence is 48 degrees Fahrenheit. The slope of the tributary is approximately 2%. The tributary enters through a perched culvert with a 4' high plunge at the outlet. The water is flowing onto a bedrock sheet that is 3' high and 7' long. The culvert has lots of bullet holes in it; some holes are in the bottom of the culvert, allowing water to flow underneath it. There is potential fish habitat above the culvert, but the tributary is not accessible to salmonids.
498	0018.00	Log debris accumulation (LDA) #01 contains six pieces of large woody debris (LWD) and measures 4' high x 9.5' wide x 15' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 7' wide x 11' long x 2' deep.
1014	0035.00	LDA #02 contains three pieces of LWD and measures 3' high x 9' wide x 21' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 7' wide x 21' long x 3' deep.
1106	0039.00	Small woody debris accumulation.
1229	0042.00	LDA #03 contains six pieces of LWD and measures 4' high x 10' wide x 12' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from fines to gravel and measures 9' wide x 7' long x 2' deep.

Tributary #02 enters on the right bank. The water temperature downstream and upstream of the tributary is 50 degrees Fahrenheit; the water temperature of the tributary is 40 degrees Fahrenheit. The tributary is accessible to salmonids, but no fish were observed.

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1376	0045.00	There is a 6' high waterfall with an inadequate jump pool. It is a possible barrier to salmonids. It appears that during higher flows some of Gulch 16's flow goes into the channel of tributary #02, possibly providing fish passage.
1622	0053.00	LDA #04 contains six pieces of LWD and measures 4' high x 20' wide x 24' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 9.5' wide x 18' long x 2' deep.
2423	0077.00	LDA #05 contains 10 pieces of LWD and measures 4' high x 14' wide x 20' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment.
2653	0085.00	LWD is accumulating in the channel and retaining sediment. There is a 1.5' high plunge over the debris.
2751	0088.00	LDA #06 contains three pieces of LWD and measures 3' high x 21' wide x 3' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 6' wide x 4' long x 1' deep.
2791	0091.00	LDA #07 contains four pieces of LWD and measures 4' high x 20' wide x 6' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 2' wide x 4' long x 0.3' deep.
2879	0096.00	LDA #08 contains 11 pieces of LWD and measures 4' high x 11' wide x 39' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 3' wide x 9' long x 0.3' deep.
3019	0103.00	Woody debris impedes fish passage.
3052	0105.00	Tributary #03 enters on the left bank. It contributes to approximately 10% of Gulch Sixteen's flow. The water temperature downstream of the tributary is 48 degrees Fahrenheit, the water temperature of the tributary is 48 degrees Fahrenheit, and the water temperature upstream of the confluence is 50 degrees Fahrenheit. Approximately 30' upstream from the confluence with Gulch Sixteen, the tributary splits into three branches, so the tributary enters Gulch Sixteen in Habitat Unit 108 and Habitat Unit 110 as well.
3067	0106.00	There is a 1.5' high plunge.

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3074	0107.00	LWD impedes fish passage.
3094	0108.00	A branch of Tributary #03 enters on the left bank.
3163	0110.00	A branch of Tributary #03 enters on the left bank.
3220	0112.00	LDA #09 contains two pieces of LWD and measures 5' high x 16' wide x 5' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 2' wide x 2.5' long x 0.5' deep.
3395	0115.00	LDA #10 contains nine pieces of LWD and measures 6' high x 19' wide x 13' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from fines to gravel and measures 8' wide x 10' long x 2' deep. There is a 3' high plunge.
3552	0119.00	LDA #11 contains four pieces of LWD and measures 5.5' high x 12' wide x 19' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment.
3658	0123.00	A small woody debris accumulation is impeding fish passage. There is a 2.5' high plunge over it. It is retaining a volume of sediment measuring 20' long x 9' wide x 1' high.
3932	0132.00	LDA #12 contains nine pieces of LWD and measures 8' high x 14' wide x 64' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 6' wide x 40' long x 2' deep. There is a 1.5' high plunge.
4006	0135.00	LDA #13 contains three pieces of LWD and measures 5' high x 7' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 7' wide x 43' long x 2' deep. There is a 3.5' high plunge.
4107	0137.00	Tributary #04 enters on the left bank. It contributes to less than 1% of Gulch Sixteen's flow. The water temperature downstream and upstream of the tributary is 51 degrees Fahrenheit; the water temperature of the tributary is 49 degrees Fahrenheit. The tributary goes dry approximately 20' upstream from the confluence with Gulch Sixteen.
4137	0138.00	There is a 2.5' high plunge.
4225	0139.00	Tributary #05 enters on the left bank at the top of the unit. It contributes to approximately 60% of Gulch Sixteen's flow. The water temperature downstream of the tributary is 51 degrees Fahrenheit, the water temperature of the tributary is 51 degrees Fahrenheit, and the water

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temperature upstream of the confluence is 48 degrees Fahrenheit. The slope of the tributary is approximately 10%. The tributary is accessible to salmonids, but no fish were observed.

End of survey. The channel above the confluence with Tributary #05 has a gradient of 22% for over 200 feet. Approximately 220' upstream from the end of survey there is a 6+ foot high jump over root mass with no jump pool below it. There are no pools, just a series of plunges.

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: Gulch Sixteen

LLID: 1235768393783 Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR Legal Description: T18NR15WS31 Latitude: 39:22:42.0N Longitude: 123:34:36.0

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
46	4	FLATWATER	33.1	48	2228	52.7	6.3	0.6	0.9	337	15485	179	8235		4
2	0	NOSURVEY	1.4	29	58	1.4									
67	67	POOL	48.2	21	1422	33.7	7.0	0.7	1.3	145	9695	150	10045	101	25
24	6	RIFFLE	17.3	22	517	12.2	4.5	0.4	0.7	110	2632	42	1007		1
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
139	77				4225					27812			19287		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

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 (%)
24	6	LGR	17.3	22	517	12.2	4	0.4	1.3	110	2632	42	1007		1	94
11	2	RUN	7.9	25	278	6.6	6	0.6	0.9	145	1590	82	907		0	96
35	2	SRN	25.2	56	1950	46.2	7	0.6	1.1	529	18506	276	9647		8	97
56	56	MCP	40.3	23	1272	30.1	7	0.7	2.1	153	8575	158	8835	105	25	96
2	2	STP	1.4	28	57	1.3	6	0.9	2.1	155	310	186	371	139	30	87
1	1	LSL	0.7	13	13	0.3	8	0.4	1.1	104	104	83	83	42	20	81
1	1	LSR	0.7	16	16	0.4	9	0.5	1.3	144	144	101	101	72	20	97
7	7	PLP	5.0	9	64	1.5	8	0.8	2.1	80	562	94	656	73	18	97
2	0	NS	1.4	29	58	1.4										

Total Units
139

Total Units Fully Measured
77

Total Length (ft.)
4225

Total Area (sq.ft.)
32422

Total Volume (cu.ft.)
21606

Table 3 - Summary of Pool Types

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

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
58	58	MAIN	87	23	1329	93	6.7	0.7	153	8885	106	6149	26
9	9	SCOUR	13	10	93	7	8.4	0.7	90	810	69	623	18

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
67	67	1422	9695	6772

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

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

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
56	MCP	84	13	23	38	68	5	9	0	0	0	0
2	STP	3	0	0	1	50	1	50	0	0	0	0
1	LSL	1	0	0	1	100	0	0	0	0	0	0
1	LSR	1	0	0	1	100	0	0	0	0	0	0
7	PLP	10	0	0	6	86	1	14	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
67	13	19	47	70	7	10	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Dry Units: 0

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

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
24	6	LGR	0	100	0	0	0	0	0	0	0
24	6	TOTAL RIFFLE	0	100	0	0	0	0	0	0	0
11	2	RUN	0	0	0	0	0	0	0	0	0
35	2	SRN	18	38	0	0	0	0	40	3	3
46	4	TOTAL FLAT	18	38	0	0	0	0	40	3	3
56	56	MCP	27	33	38	1	0	0	1	0	0
2	2	STP	25	43	33	0	0	0	0	0	0
1	1	LSL	0	20	80	0	0	0	0	0	0
1	1	LSR	0	40	60	0	0	0	0	0	0
7	7	PLP	1	41	43	0	0	0	9	6	0
67	67	TOTAL POOL	24	34	39	1	0	0	2	1	0
2	0	NS									
139	77	TOTAL	23	35	37	1	0	0	3	1	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Dry Units: 0

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

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
24	6	LGR	0	0	100	0	0	0	0
11	2	RUN	0	0	100	0	0	0	0
35	2	SRN	0	0	50	0	0	0	50
56	56	MCP	5	4	88	2	0	0	2
2	2	STP	0	0	100	0	0	0	0
1	1	LSL	0	0	100	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
7	7	PLP	0	0	71	0	0	14	14

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
95	89	11	0	97	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.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Survey Length (ft.): 4225

Main Channel (ft.): 4225

Side Channel (ft.): 0

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31 Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

Summary of Fish Habitat Elements By Stream Reach**STREAM REACH: 1**

Channel Type: B4

Canopy Density (%): 95.2

Pools by Stream Length (%): 33.7

Reach Length (ft.): 4225

Coniferous Component (%): 89.2

Pool Frequency (%): 48.2

Riffle/Flatwater Mean Width (ft.): 5.2

Hardwood Component (%): 10.8

Residual Pool Depth (%):

BFW:

Dominant Bank Vegetation: Coniferous Trees

< 2 Feet Deep: 90

Range (ft.): 5 to 11

Vegetative Cover (%): 96.5

2 to 2.9 Feet Deep: 10

Mean (ft.): 8

Dominant Shelter: Large Woody Debris

3 to 3.9 Feet Deep: 0

Std. Dev.: 2

Dominant Bank Substrate Type: Sand/Silt/Clay

>= 4 Feet Deep: 0

Base Flow (cfs.): 0.7

Occurrence of LWD (%): 32

Mean Max Residual Pool Depth (ft.): 1.3

Water (F): 46 - 53 Air (F): 44 - 60

LWD per 100 ft.:

Mean Pool Shelter Rating: 25

Dry Channel (ft): 0

Riffles: 5

Pools: 10

Flat: 4

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 87 Sm Cobble: 10 Lg Cobble: 1 Boulder: 0 Bedrock: 1

Embeddedness Values (%): 1. 43.3 2. 52.2 3. 3.0 4. 1.5 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR

Legal Description: T18NR15WS31

Latitude: 39:22:42.0N

Longitude: 123:34:36.0W

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	3	2	3.2
Boulder	0	0	0.0
Cobble / Gravel	2	3	3.2
Sand / Silt / Clay	72	72	93.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	2	1.3
Brush	4	9	8.4
Hardwood Trees	3	6	5.8
Coniferous Trees	70	60	84.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Gulch Sixteen

LLID: 1235768393783

Drainage: Big River

Survey Dates: 5/9/2011 to 5/11/2011

Confluence Location: Quad: NORTHSPUR

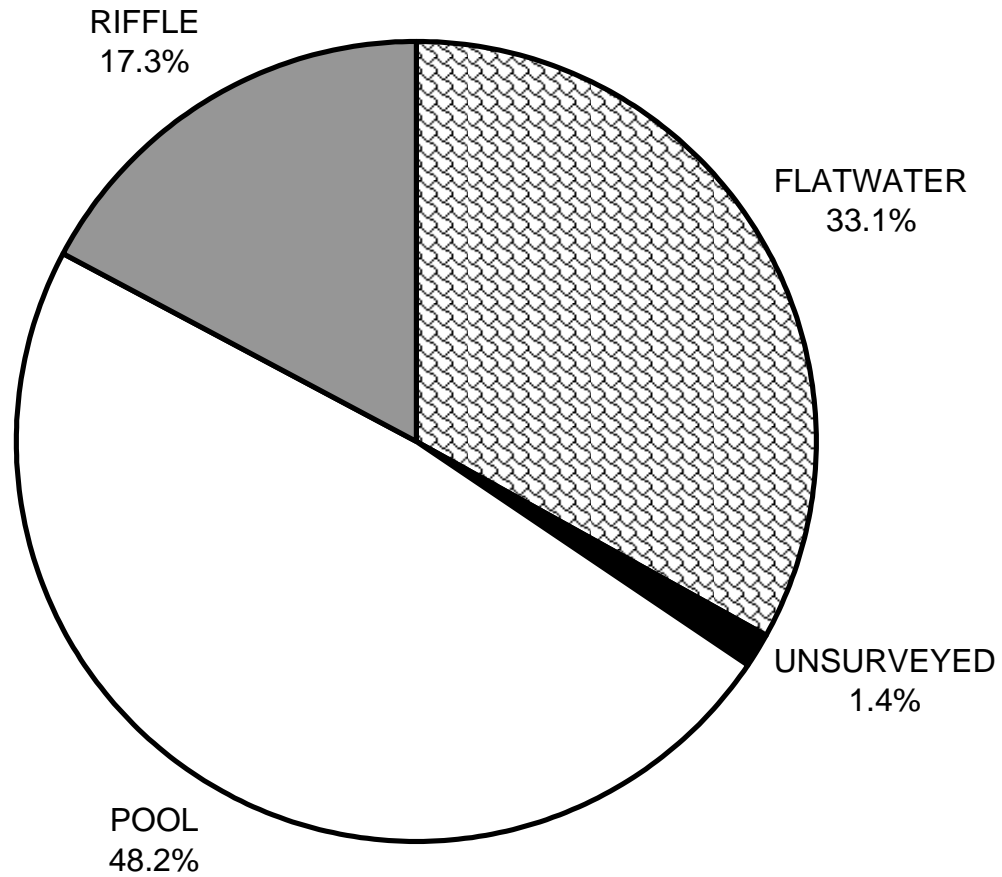
Legal Description: T18NR15WS31

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Longitude: 123:34:36.0W

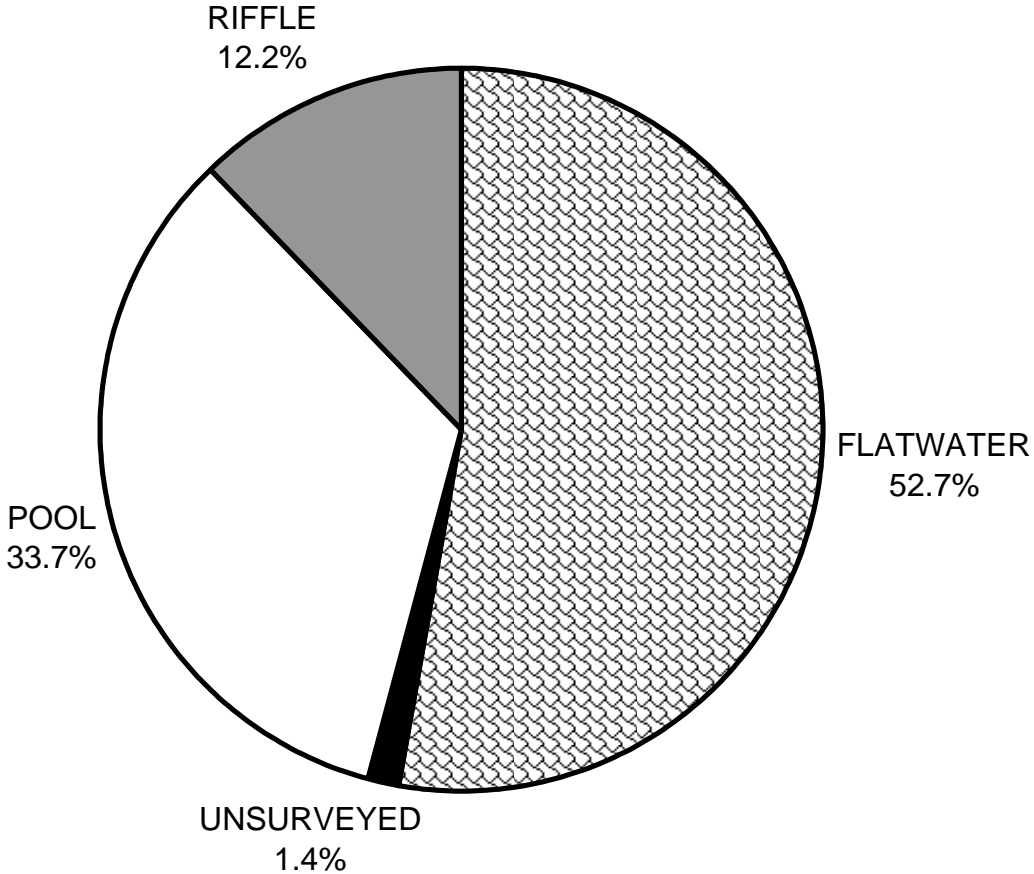
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	18	24
SMALL WOODY DEBRIS (%)	100	38	34
LARGE WOODY DEBRIS (%)	0	0	39
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	40	2
BOULDERS (%)	0	3	1
BEDROCK LEDGES (%)	0	3	0

**GULCH SIXTEEN 2011
HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 1

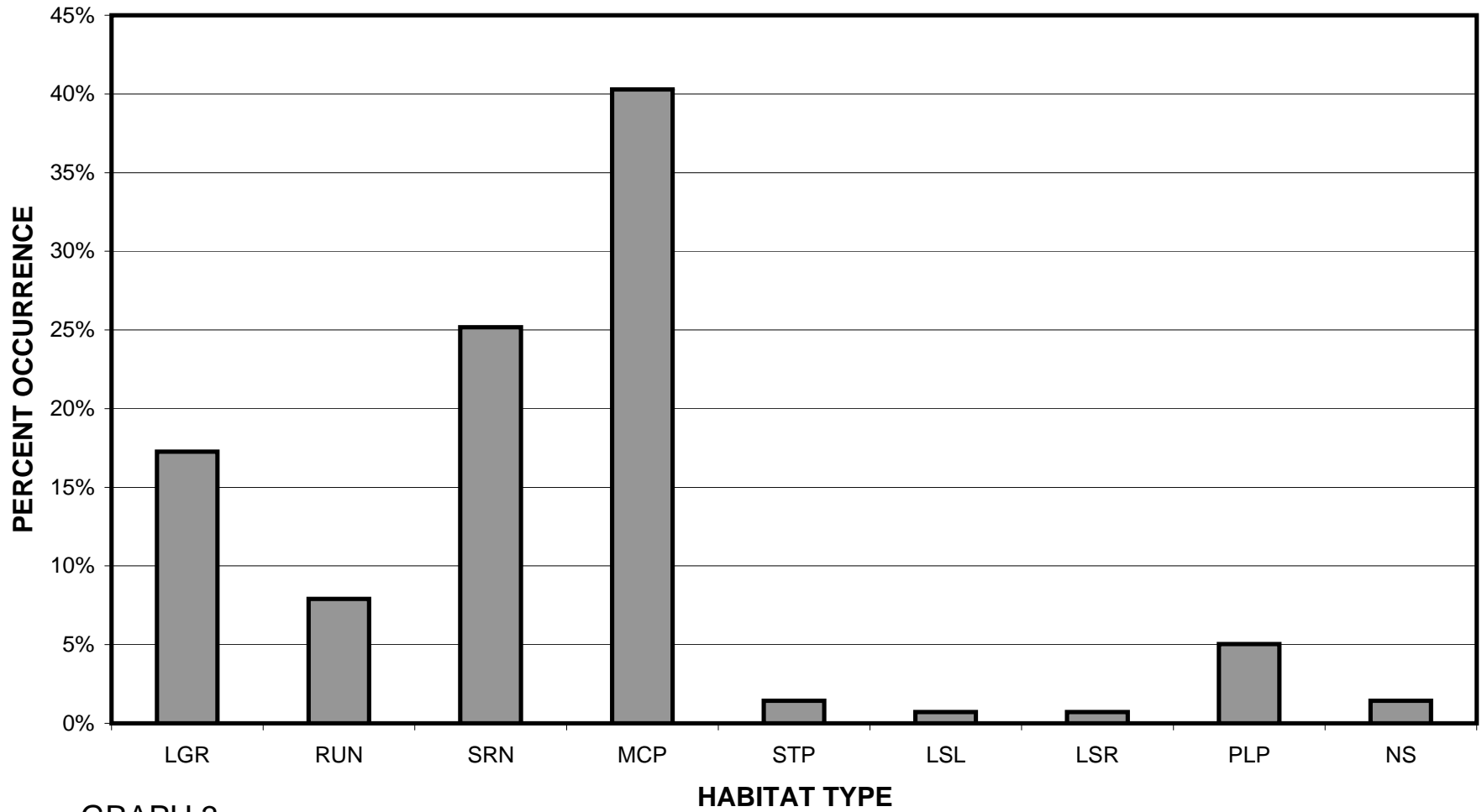
**GULCH SIXTEEN 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH**



GRAPH 2

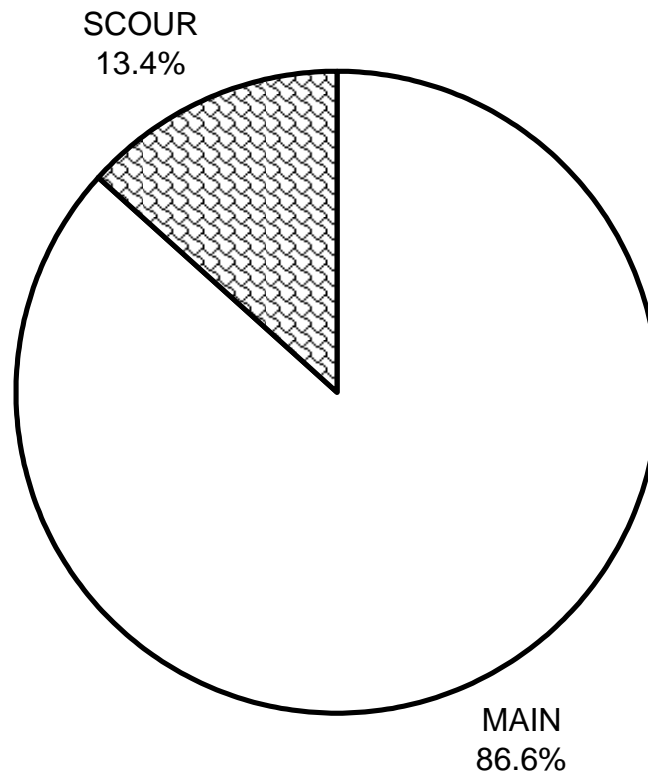
GULCH SIXTEEN 2011

HABITAT TYPES BY PERCENT OCCURRENCE



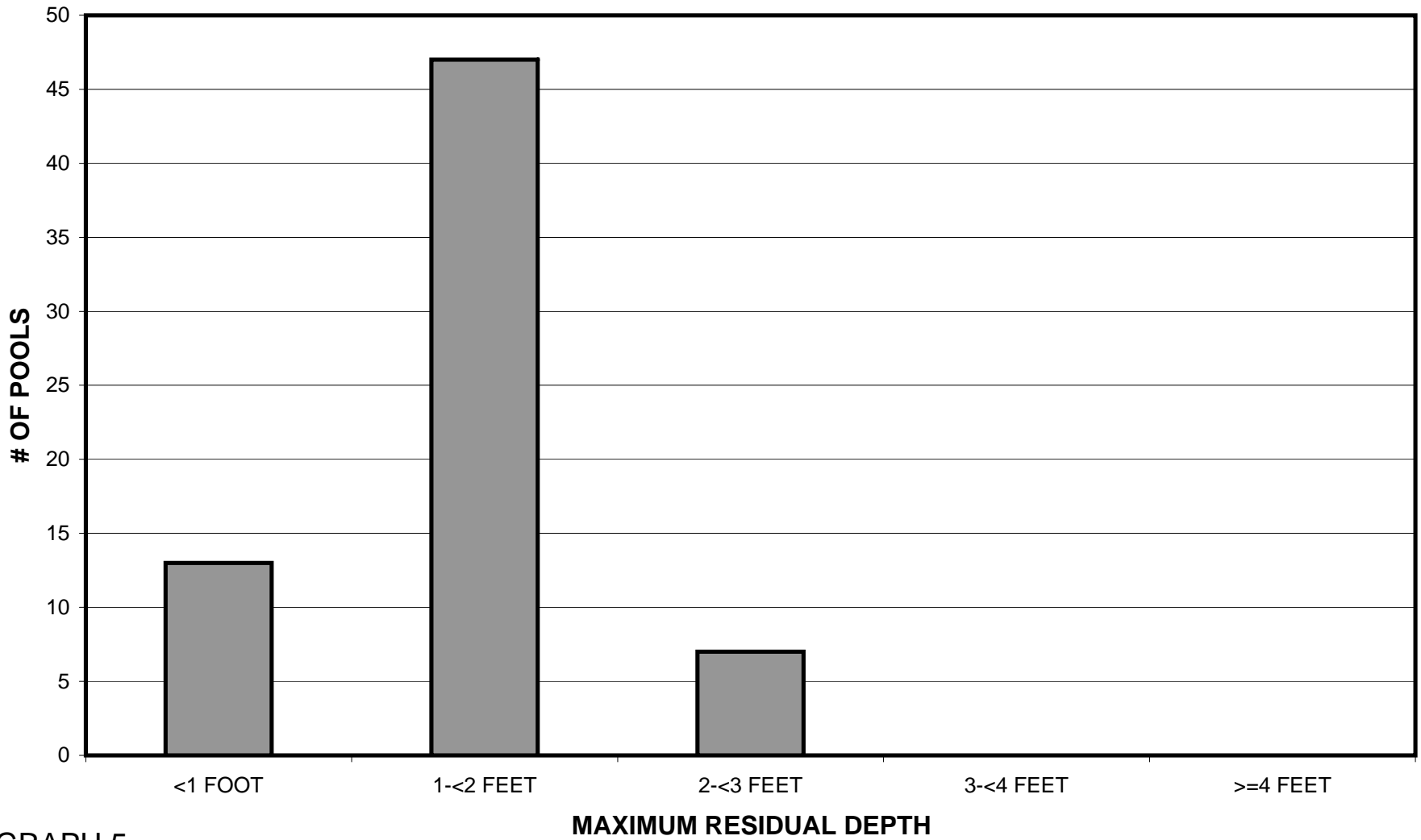
GRAPH 3

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



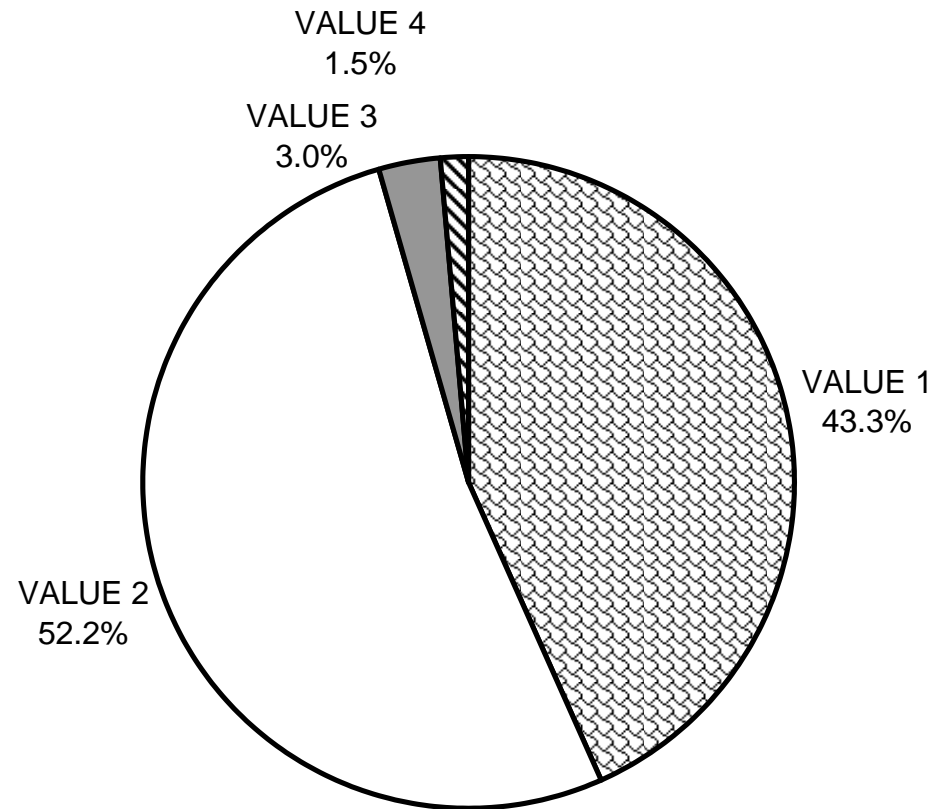
GRAPH 4

GULCH SIXTEEN 2011 MAXIMUM DEPTH IN POOLS



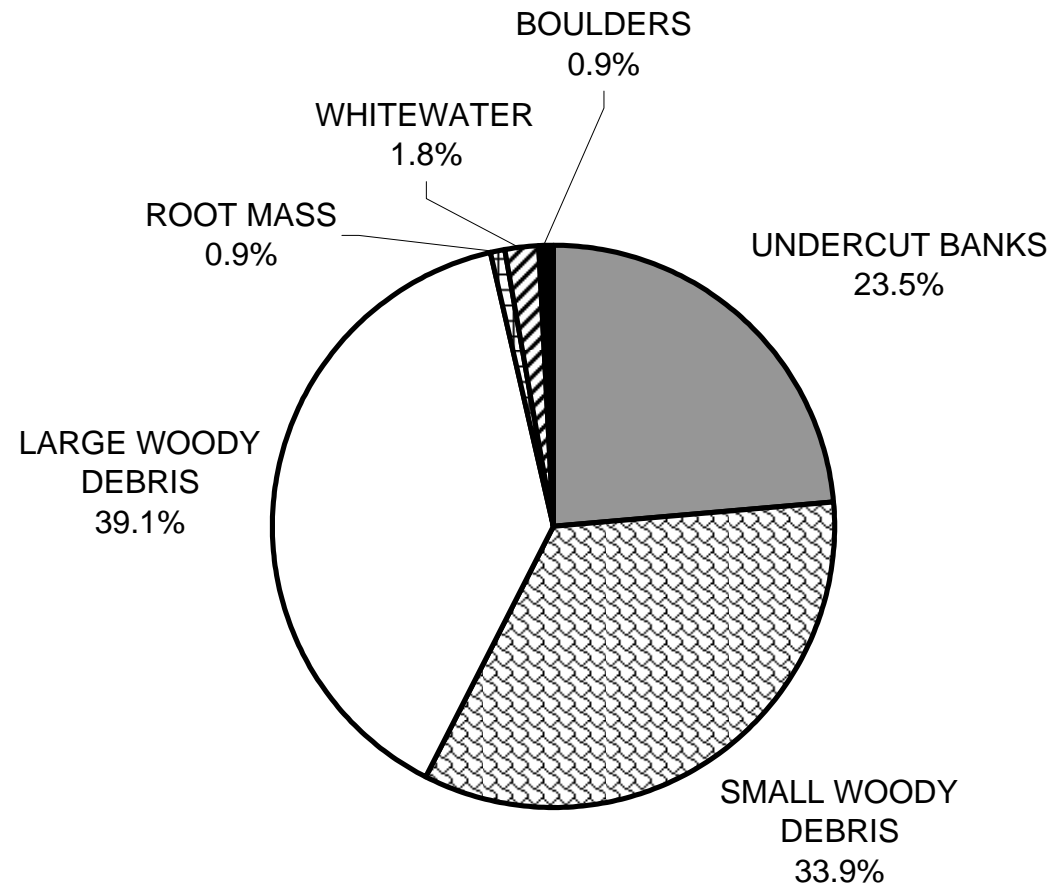
GRAPH 5

GULCH SIXTEEN 2011 PERCENT EMBEDDEDNESS



GRAPH 6

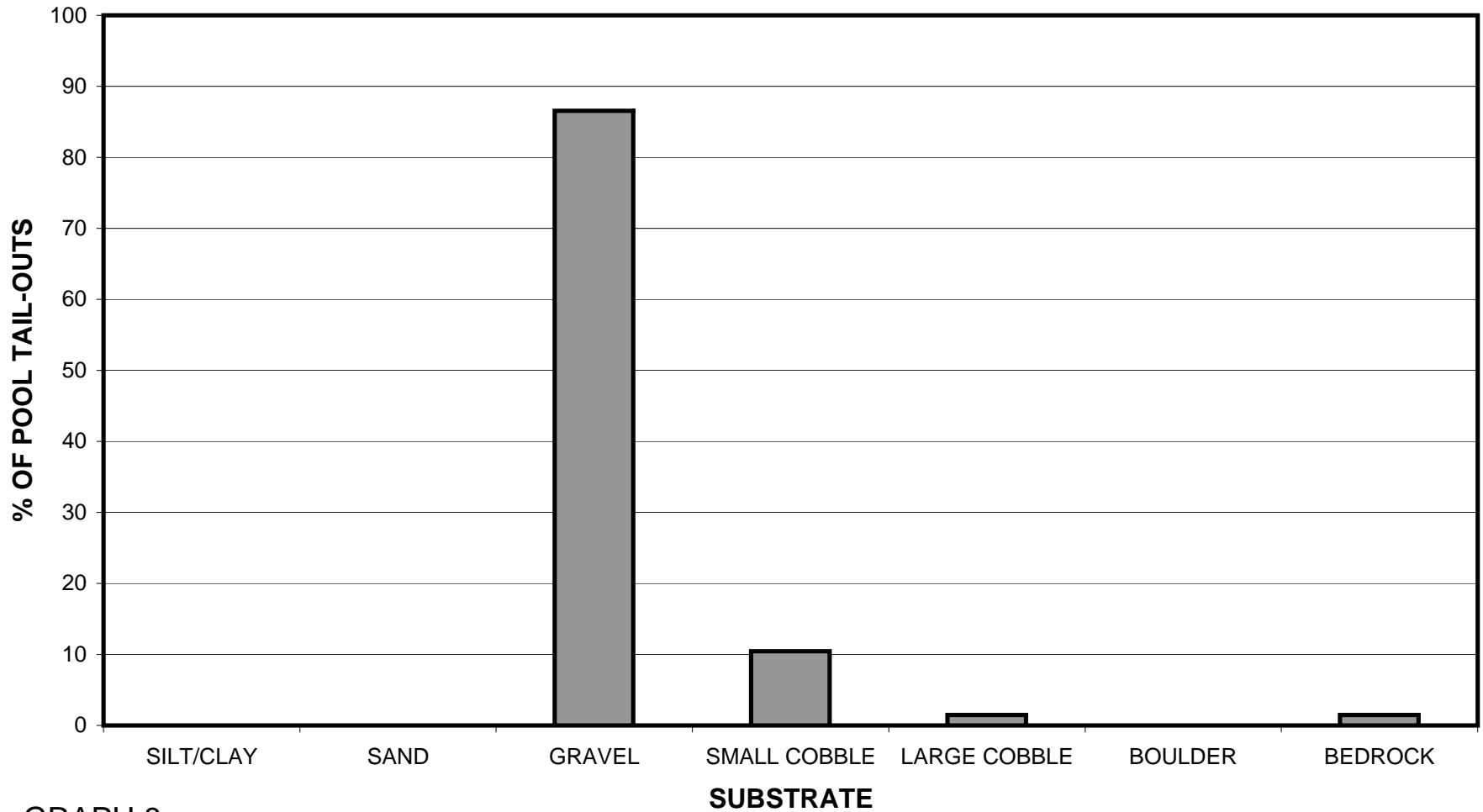
GULCH SIXTEEN 2011 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

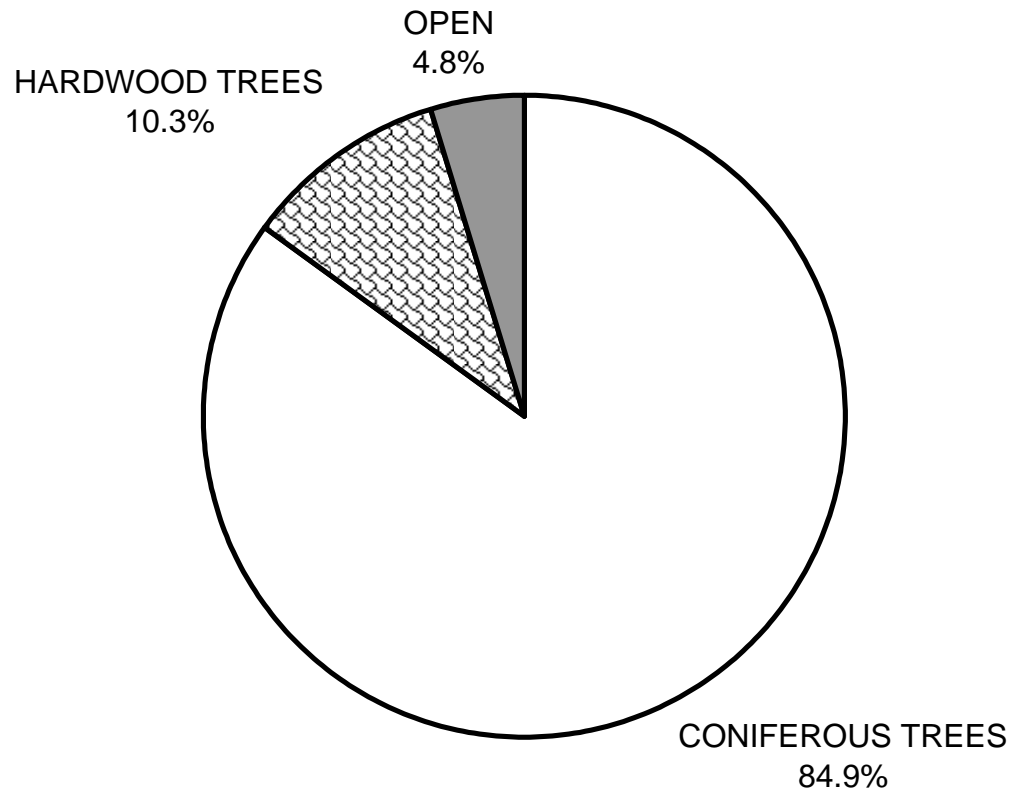
GULCH SIXTEEN 2011

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



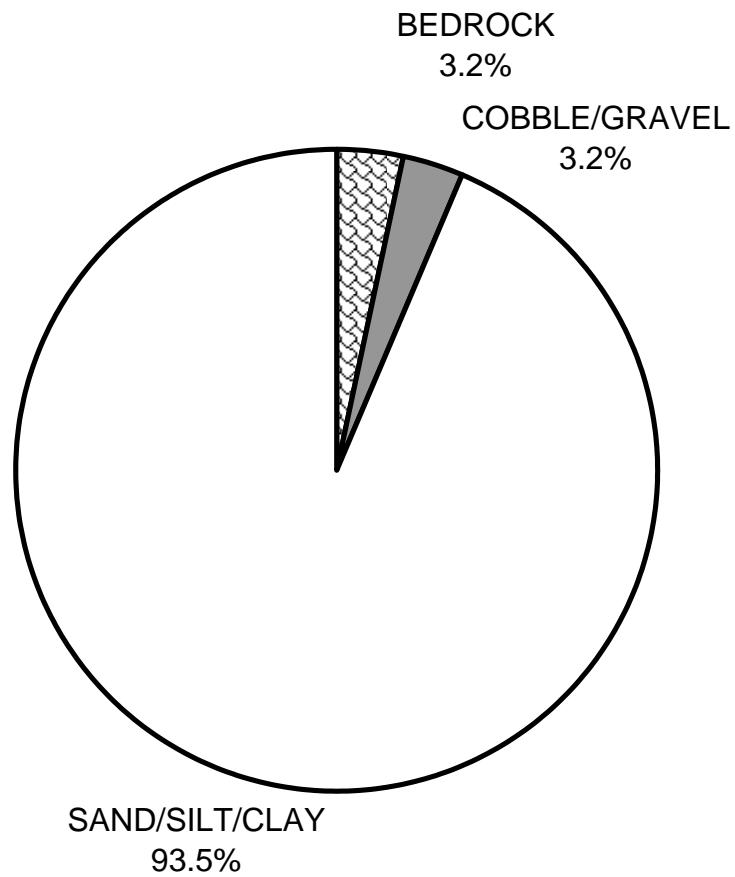
GRAPH 8

GULCH SIXTEEN 2011 MEAN PERCENT CANOPY



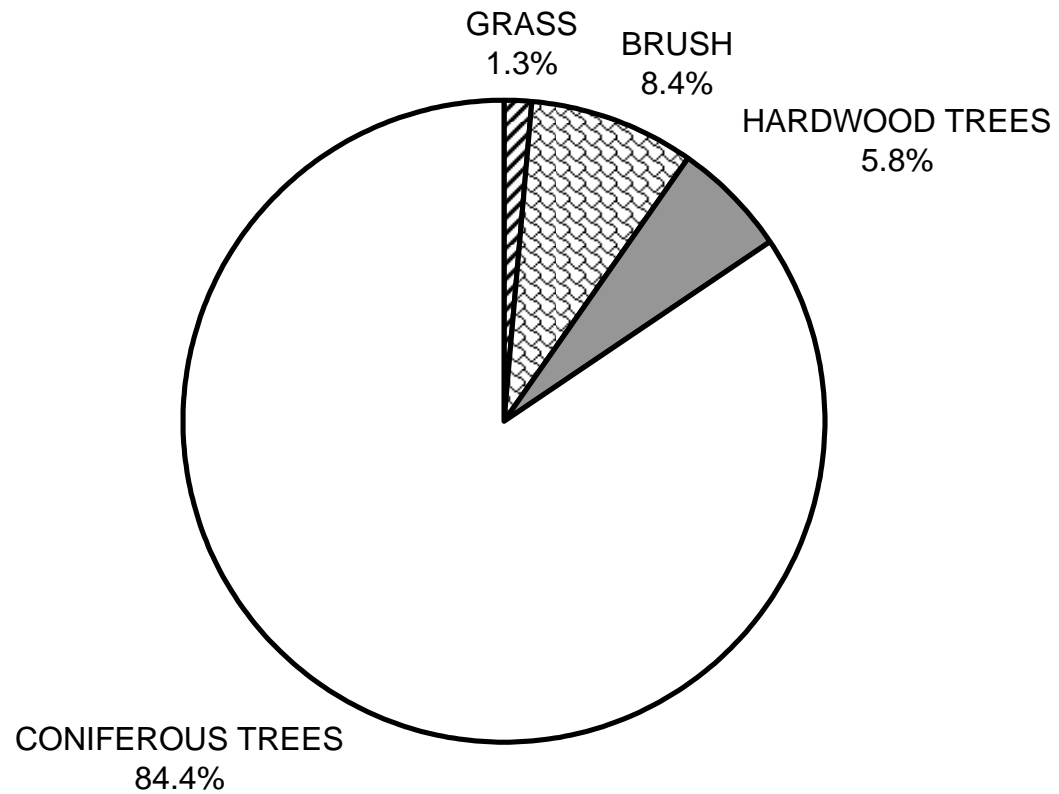
GRAPH 9

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



GRAPH 10

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



GRAPH 11

