

# STREAM INVENTORY REPORT

## Horsetail Gulch

### INTRODUCTION

A stream inventory was conducted from October 17 to October 18, 2012 on Horsetail Gulch. The survey began at the confluence with Middle Fork Ten Mile River and extended upstream 0.3 miles.

The Horsetail Gulch inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Horsetail Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

### WATERSHED OVERVIEW

Horsetail Gulch is a tributary to Middle Fork Ten Mile River, tributary to Ten Mile River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Horsetail Gulch's legal description at the confluence with Middle Fork Ten Mile River is T19N R16W S04. Its location is 39.5444 degrees north latitude and 123.6543 degrees west longitude, LLID number 1236530395444. Horsetail Gulch is a first order stream and has approximately 0.8 miles of blue line stream according to the USGS Dutchmans Knoll 7.5 minute quadrangle. Horsetail Gulch drains a watershed of approximately 0.7 square miles. Elevations range from about 150 feet at the mouth of the creek to 800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Georgia-Pacific Industrial Road north of Fort Bragg, CA.

### METHODS

The habitat inventory conducted in Horsetail Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by the CDFW. This inventory was conducted by a two-person team.

### SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and

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

### 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 Horsetail Gulch to record measurements and observations. There are eleven components to the inventory form.

#### 1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

#### 2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

#### 3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

#### 4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Horsetail Gulch habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

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### 5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Horsetail Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

### 6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is classified according to a list of nine cover types. In Horsetail Gulch, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then 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 Horsetail Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

### 9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Horsetail Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

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### 10. Large Woody Debris Count:

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

### 11. Average Bankfull Width:

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

## BIOLOGICAL INVENTORY

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

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

### HABITAT INVENTORY RESULTS

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

The habitat inventory of October 17 to October 18, 2012 was conducted by R. Spencer and C. Tiffany (CDFW). The total length of the stream surveyed was 1,651 feet.

Stream flow was not measured on Horsetail Gulch.

Horsetail Gulch is a G4 channel type for 1,028 feet of the stream surveyed (Reach 1) and an E4 channel type for 623 feet of the stream surveyed (Reach 2). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios and gravel-dominant substrates. E4 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 54 degrees Fahrenheit. Air temperatures ranged from 52 to 58 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% riffle units, 30% pool units, 29% flatwater units, and 7% dry units (Graph 1). Based on total length of Level II habitat types there were 41% flatwater units, 25% riffle units, 21% pool units, and 13% dry units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 25%; step run units, 23%; and low gradient riffle units, 20% (Graph 3). Based on percent total length, step run units made up 37%, low gradient riffle units 17%, and mid-channel pool units 16%.

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A total of 21 pools were identified (Table 3). Main channel pools were the most frequently encountered at 90% (Graph 4), and comprised 93% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Two of the 21 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 21 pool tail-outs measured, 11 had a value of 1 (52.4%); nine had a value of 2 (42.9%); one had a value of 5 (4.8%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 21, flatwater habitat types had a mean shelter rating of 12, and pool habitats had a mean shelter rating of 31 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 33. Scour pools had a mean shelter rating of 20 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 76% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 14% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Horsetail Gulch was 99%. One percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 43% and 57%, respectively. Graph 9 describes the mean percent canopy in Horsetail Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 54% cobble/gravel, 26% sand/silt/clay, and 19% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 60% of the units surveyed. Additionally, 31% of the units surveyed had deciduous trees as the dominant vegetation type, and 9% had brush as the dominant vegetation type (Graph 11).

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### BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at four sites for species composition and distribution in Horsetail Gulch on October 28, 2012. The sites were sampled by I. Mikus and T. Anderson (CDFW).

In Reach 1, which comprised the first 1,028 feet of stream, four sites were sampled. The reach sites yielded nine young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), one age 1+ SH/RT and one YOY coho salmon.

The following chart displays the information yielded from these sites:

2012 Horsetail Gulch underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: G4 Channel Type									
10/28/12	1	004	Pool	205	1	0	0	1	0
	2	008	Pool	288	1	1	0	0	0
	3	011	Pool	332	2	0	0	0	0
	4	015	Pool	373	5	0	0	0	0

### DISCUSSION

Horsetail Gulch is a G4 channel type for the first 1,028 feet of stream surveyed and an E4 channel type for the remaining 623 feet. The suitability of G4 and E4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. E4 channel types are good for bank-placed boulders and fair for opposing wing-deflectors.

The water temperatures recorded on the survey days October 17 to October 18, 2012 ranged from 51 to 54 degrees Fahrenheit. Air temperatures ranged from 52 to 58 degrees Fahrenheit. This is a good 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 41% of the total length of this survey, riffles 25%, and pools 21%. Two of the 21 (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 large wood structures that will increase or deepen pool habitat is recommended.

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Twenty of the 21 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. One 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.

Nineteen of the 21 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 31. The shelter rating in the flatwater habitats is 12. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Horsetail Gulch. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 99%. Reach 1 had a canopy density of 100% and Reach 2 had a canopy density of 97%. The percentage of right and left bank covered with vegetation was 98% and 96%, respectively.

### RECOMMENDATIONS

- 1) Horsetail Gulch should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

### 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 Middle Fork Ten Mile River. The channel is a G4. The first 121' feet of the channel were dry.



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- 181 0004.00 There is a 2' high plunge over bedrock.
- 319 0011.00 A landslide on the left bank measures 10' wide x 30' high.
- 423 0020.00 Log debris accumulation (LDA) #01 contains one piece of large woody debris (LWD) and measures 4' high x 11' wide x 7' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to boulders and measures 6' wide x 25' long x 2' deep. Fish were observed above the LDA.
- 533 0027.00 LDA #02 contains six pieces of LWD and measures 7' high x 15' wide x 14' long. Water flows does not flow through the LDA; the channel is dry above it. There are visible gaps in the LDA. The LDA is retaining sediment. Fish were observed above the LDA.
- 1019 0047.00 LDA #03 contains eight pieces of LWD and measures 7' high x 8' wide x 13' long. Water flows does not flow through the LDA; the channel is dry above it. There are visible gaps in the LDA. Retained sediment ranges from silt to cobble and measures 7' wide x 60' long x 8' deep. There are two plunges over the LDA, the first is 3' high and the second is 4' high. Fish were observed above the LDA.
- 1028 0048.00 The channel changes from a G4 to an E4.
- 1476 0064.00 LDA #04 contains 16 pieces of LWD and measures 5' high x 7' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to large cobble and measures 15' wide x 50' long x 5' deep. Fish were observed above the LDA.
- 1523 0067.00 Dry left bank tributary. YOY observed.
- 1605 0069.00 End of survey. The channel goes dry.

## 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: Horsetail Gulch

LLID: 1236530395444 Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T19NR16WS04 Latitude: 39:32:40.0N Longitude: 123:39:11.0

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
5	0	DRY	7.2	43	214	13.0									
20	5	FLATWATER	29.0	34	676	40.9	4.4	0.4	0.7	159	3186	60	1197		12
21	21	POOL	30.4	17	352	21.3	7.0	0.6	1.3	112	2346	97	2047	74	31
23	8	RIFFLE	33.3	18	409	24.8	3.3	0.1	0.3	22	511	3	71		21
<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>		
69	34				1651					6043			3315		

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

Stream Name: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

Latitude: 39:32:40.0N

Longitude: 123:39:11.0W

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 (%)
14	4	LGR	20.3	21	288	17.4	4	0.2	0.5	30	415	4	60		5	96
5	3	HGR	7.2	17	84	5.1	2	0.1	0.3	18	90	2	11		50	98
4	1	BRS	5.8	9	37	2.2	1	0.1	0.3	5	22	1	2		0	100
4	1	RUN	5.8	15	59	3.6	5	0.4	0.7	62	247	25	99		10	100
16	4	SRN	23.2	39	617	37.4	4	0.4	0.8	184	2939	69	1098		13	100
17	17	MCP	24.6	16	271	16.4	7	0.5	1.9	101	1719	77	1310	56	34	99
2	2	STP	2.9	28	57	3.5	6	0.5	1	165	330	121	243	88	25	99
2	2	PLP	2.9	12	24	1.5	12	1.6	2.5	148	297	247	494	213	20	100
5	0	DRY	7.2	43	214	13.0										

Total Units  
69

Total Units Fully Measured  
34

Total Length (ft.)  
1651

Total Area (sq.ft.)  
6058

Total Volume (cu.ft.)  
3318

**Table 3 - Summary of Pool Types**

Stream Name: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

Latitude: 39:32:40.0N

Longitude: 123:39:11.0W

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
19	19	MAIN	90	17	328	93	6.5	0.5	108	2049	59	1127	33
2	2	SCOUR	10	12	24	7	12.5	1.6	148	297	213	425	20

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
21	21	352	2346	1552

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

Stream Name: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

Latitude: 39:32:40.0N

Longitude: 123:39:11.0W

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
17	MCP	81	5	29	12	71	0	0	0	0	0	0
2	STP	10	1	50	1	50	0	0	0	0	0	0
2	PLP	10	0	0	0	0	2	100	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
21	6	29	13	62	2	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: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Dry Units: 5

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

Latitude: 39:32:40.0N

Longitude: 123:39:11.0W

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
14	4	LGR	0	58	0	8	0	33	0	0	0
5	3	HGR	0	5	0	0	0	90	0	5	0
4	1	BRS	0	0	0	0	0	0	0	0	0
23	8	TOTAL RIFFLE	0	45	0	6	0	48	0	1	0
4	1	RUN	0	100	0	0	0	0	0	0	0
16	4	SRN	0	61	13	3	0	24	0	0	0
20	5	TOTAL FLAT	0	69	10	2	0	19	0	0	0
17	17	MCP	0	40	45	7	1	1	0	6	0
2	2	STP	0	30	70	0	0	0	0	0	0
2	2	PLP	0	15	80	0	0	0	0	5	0
21	21	TOTAL POOL	0	37	51	6	1	1	0	5	0
69	34	TOTAL	0	43	37	5	1	10	0	4	0

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

Stream Name: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Dry Units: 5

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

Latitude: 39:32:40.0N

Longitude: 123:39:11.0W

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
14	4	LGR	0	0	100	0	0	0	0
5	3	HGR	0	0	0	100	0	0	0
4	1	BRS	0	0	0	0	0	0	100
4	1	RUN	0	0	100	0	0	0	0
16	4	SRN	25	0	75	0	0	0	0
17	17	MCP	47	0	35	0	12	0	6
2	2	STP	100	0	0	0	0	0	0
2	2	PLP	50	0	0	50	0	0	0



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

Stream Name: Horsetail Gulch

LLID: 1236530395444      Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS      Legal Description: T19NR16WS04      Latitude: 39:32:40.0N      Longitude: 123:39:11.0W

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Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
99	57	43	0	98	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: Horsetail Gulch LLID: 1236530395444 Drainage: Rockport  
 Survey Dates: 10/17/2012 to 10/18/2012 Survey Length (ft.): 1651 Main Channel (ft.): 1651 Side Channel (ft.): 0  
 Confluence Location: Quad: DUTCHMANS Legal Description: T19NR16WS04 Latitude: 39:32:40.0N Longitude: 123:39:11.0W

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

**STREAM REACH: 1**

Channel Type: G4	Canopy Density (%): 99.7	Pools by Stream Length (%): 28.5
Reach Length (ft.): 1028	Coniferous Component (%): 47.1	Pool Frequency (%): 36.2
Riffle/Flatwater Mean Width (ft.): 4.3	Hardwood Component (%): 52.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 88
Range (ft.): 8 to 18	Vegetative Cover (%): 95.5	2 to 2.9 Feet Deep: 12
Mean (ft.): 14	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 34	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 54 - 54 Air (F): 57 - 58	LWD per 100 ft.:	Mean Pool Shelter Rating: 34
Dry Channel (ft): 184	Riffles: 3	
	Pools: 13	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 6 Sand: 0 Gravel: 82 Sm Cobble: 6 Lg Cobble: 0 Boulder: 0 Bedrock: 6		
Embeddedness Values (%): 1. 58.8 2. 35.3 3. 0.0 4. 0.0 5. 5.9		

**STREAM REACH: 2**

Channel Type: E4	Canopy Density (%): 97.3	Pools by Stream Length (%): 9.5
Reach Length (ft.): 623	Coniferous Component (%): 81.0	Pool Frequency (%): 18.2
Riffle/Flatwater Mean Width (ft.): 3.0	Hardwood Component (%): 19.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 100
Range (ft.): 8 to 8	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 0
Mean (ft.): 8	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 0	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 26	Mean Max Residual Pool Depth (ft.): 1.2
Water (F): 51 - 54 Air (F): 52 - 57	LWD per 100 ft.:	Mean Pool Shelter Rating: 20
Dry Channel (ft): 30	Riffles: 0	
	Pools: 8	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 50 Sm Cobble: 50 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 25.0 2. 75.0 3. 0.0 4. 0.0 5. 0.0		

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

Stream Name: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

Latitude: 39:32:40.0N

Longitude: 123:39:11.0W

**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	6	7	19.1
Boulder	0	0	0.0
Cobble / Gravel	15	22	54.4
Sand / Silt / Clay	13	5	26.5

**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	0	0.0
Brush	4	2	8.8
Hardwood Trees	11	10	30.9
Coniferous Trees	19	22	60.3
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 2

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

StreamName: Horsetail Gulch

LLID: 1236530395444

Drainage: Rockport

Survey Dates: 10/17/2012 to 10/18/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS04

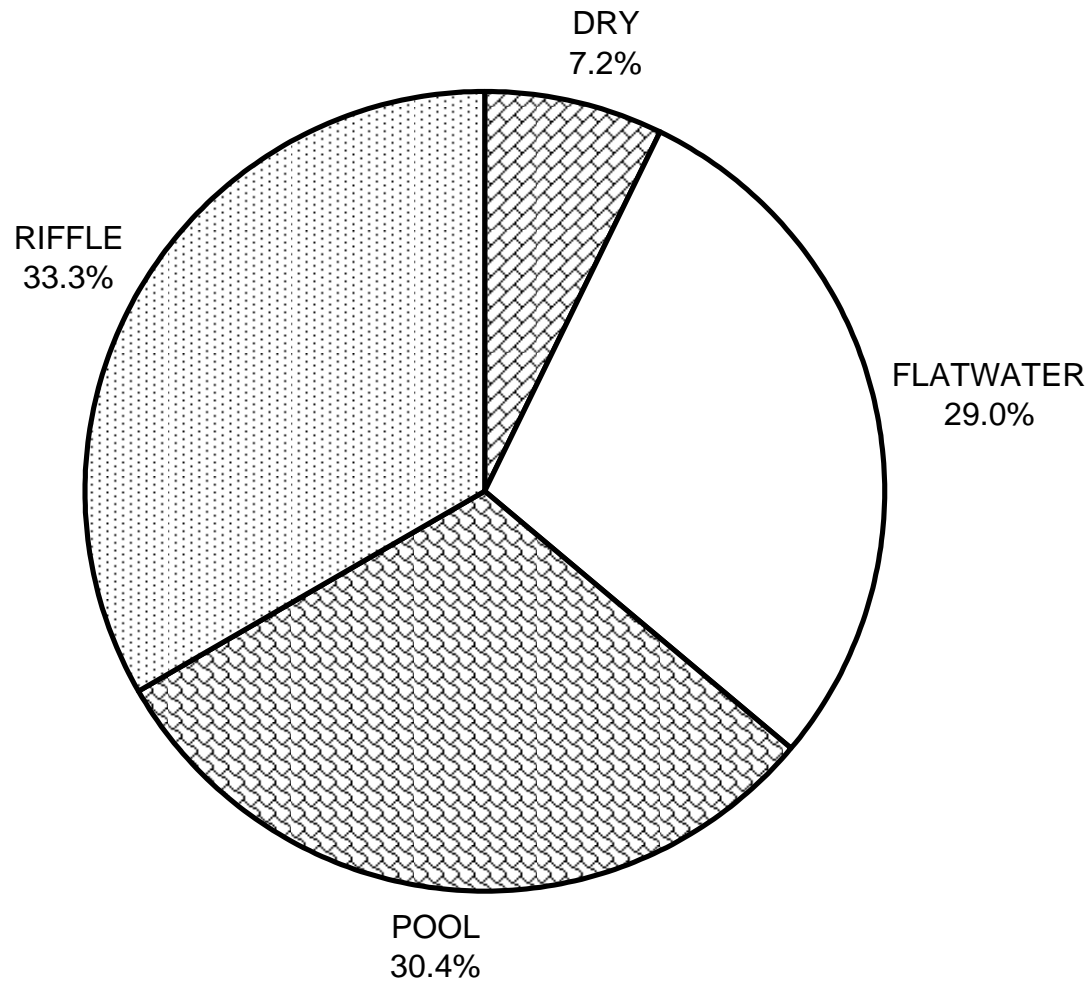
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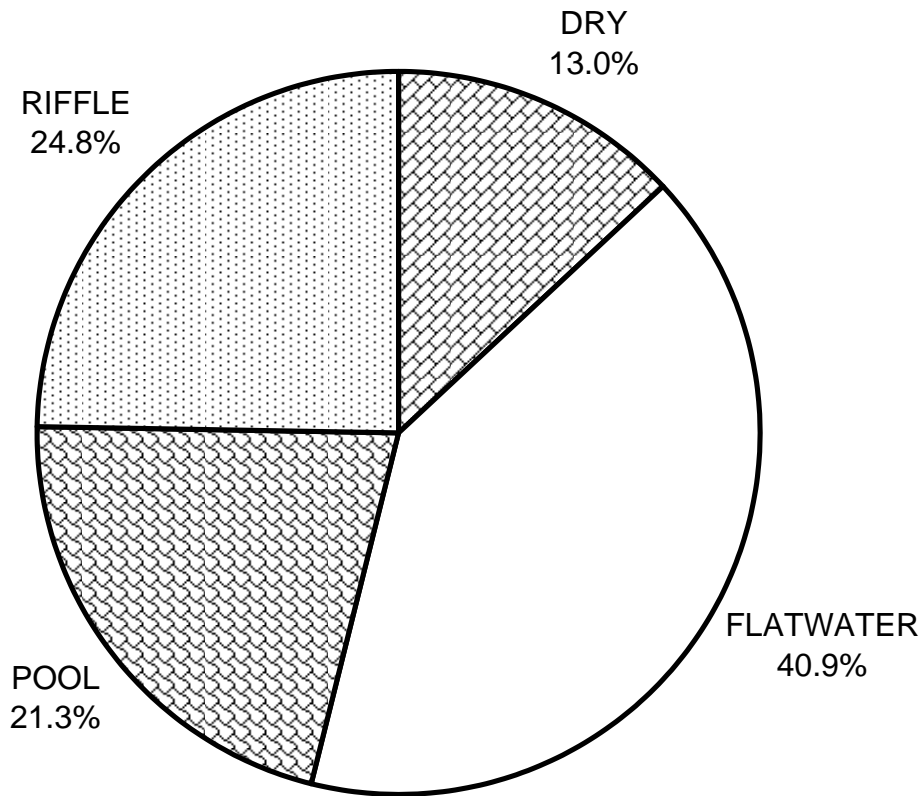
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	0	0
SMALL WOODY DEBRIS (%)	45	69	37
LARGE WOODY DEBRIS (%)	0	10	51
ROOT MASS (%)	6	2	6
TERRESTRIAL VEGETATION (%)	0	0	1
AQUATIC VEGETATION (%)	48	19	1
WHITEWATER (%)	0	0	0
BOULDERS (%)	1	0	5
BEDROCK LEDGES (%)	0	0	0

# HORSETAIL GULCH 2012 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

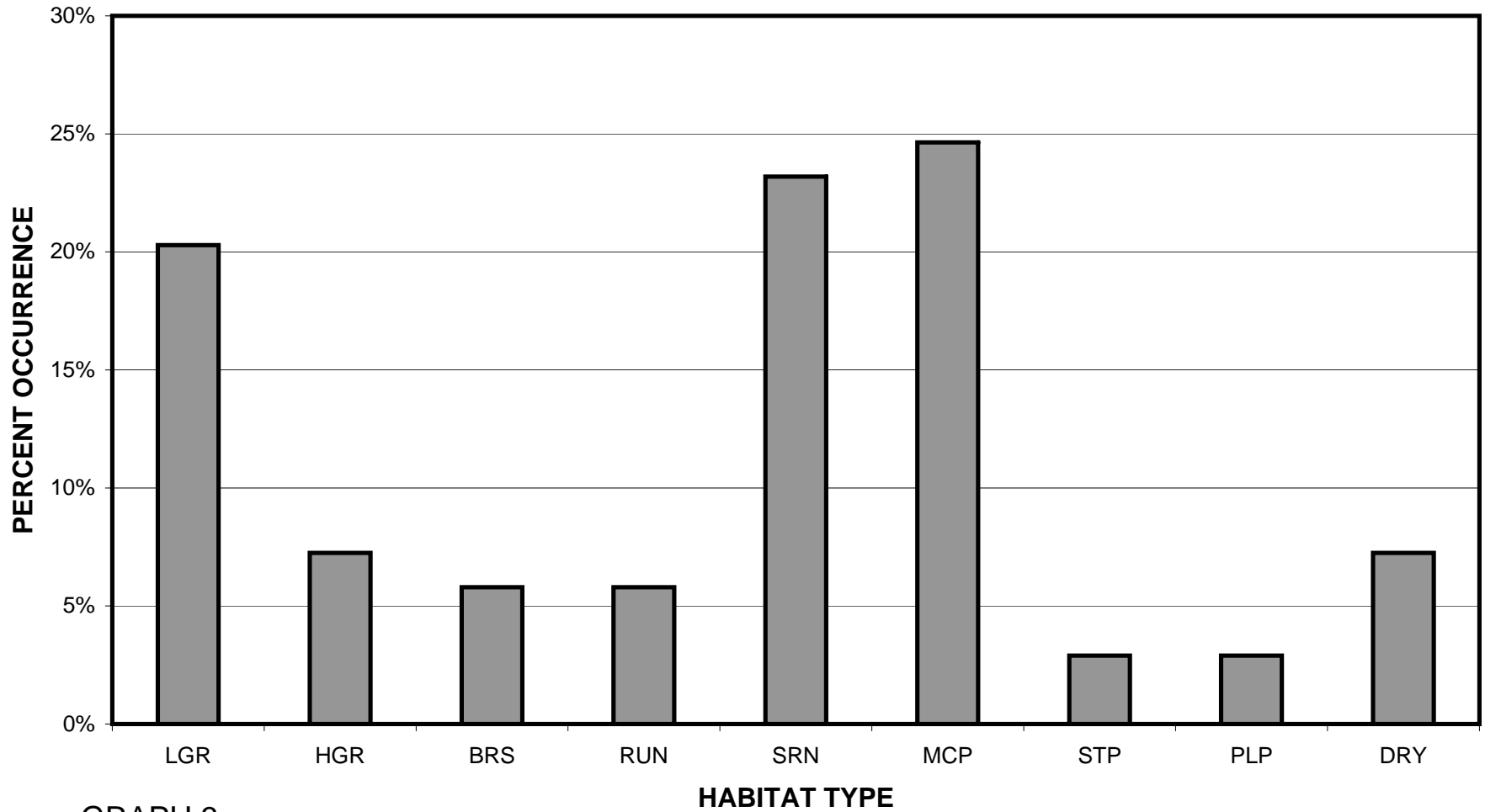
# HORSETAIL GULCH 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

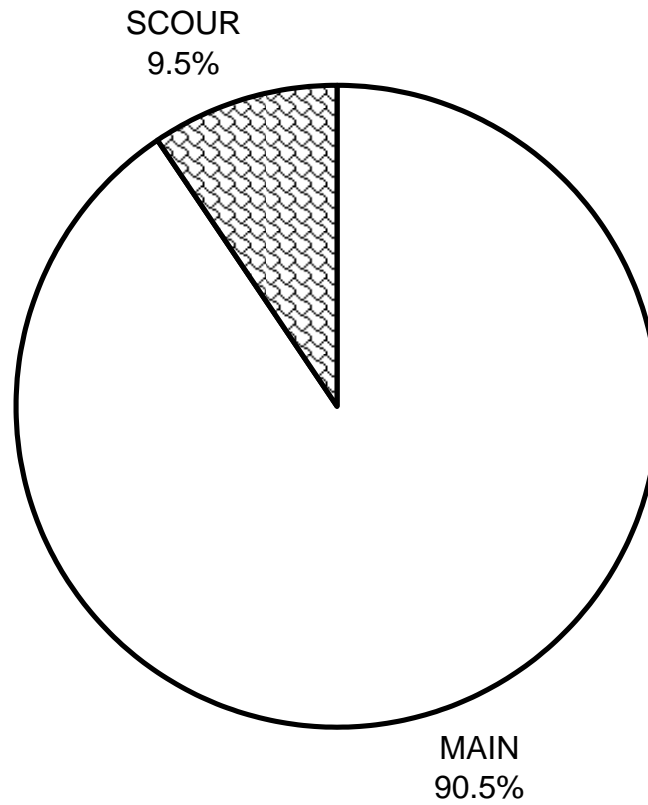
# HORSETAIL GULCH 2012

## HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

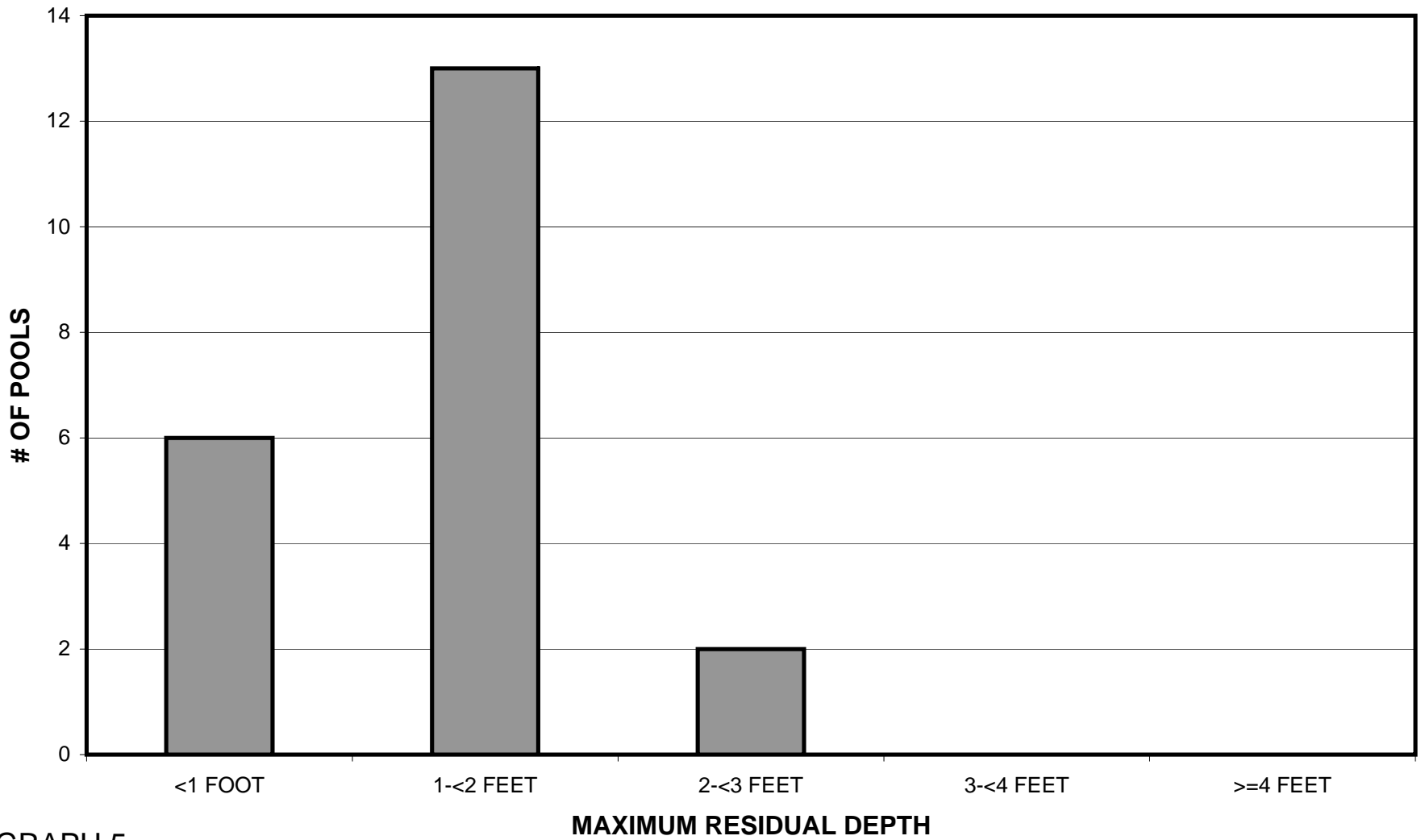
# HORSETAIL GULCH 2012 POOL TYPES BY PERCENT OCCURRENCE



GRAPH 4

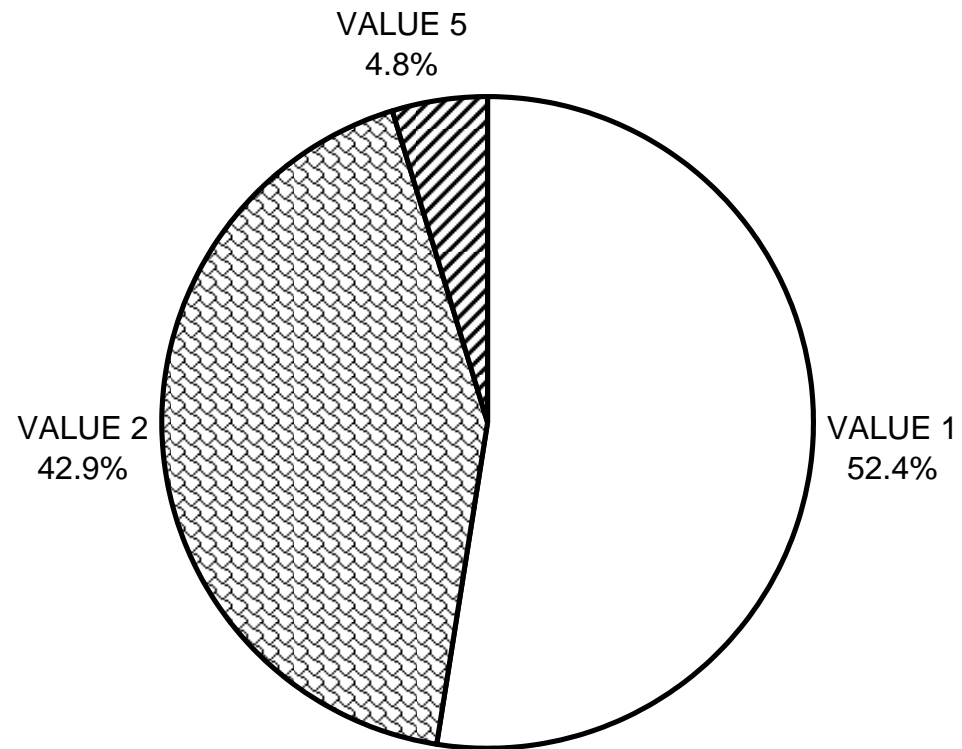


# HORSETAIL GULCH 2012 MAXIMUM DEPTH IN POOLS



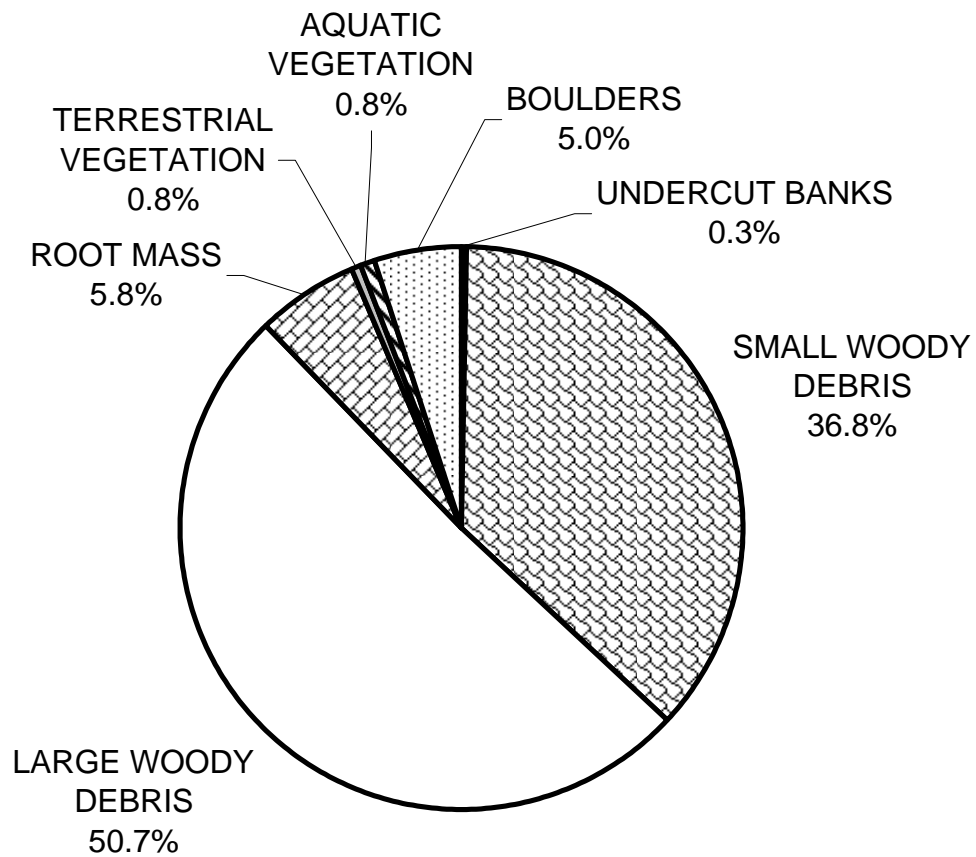
GRAPH 5

# HORSETAIL GULCH 2012 PERCENT EMBEDDEDNESS



GRAPH 6

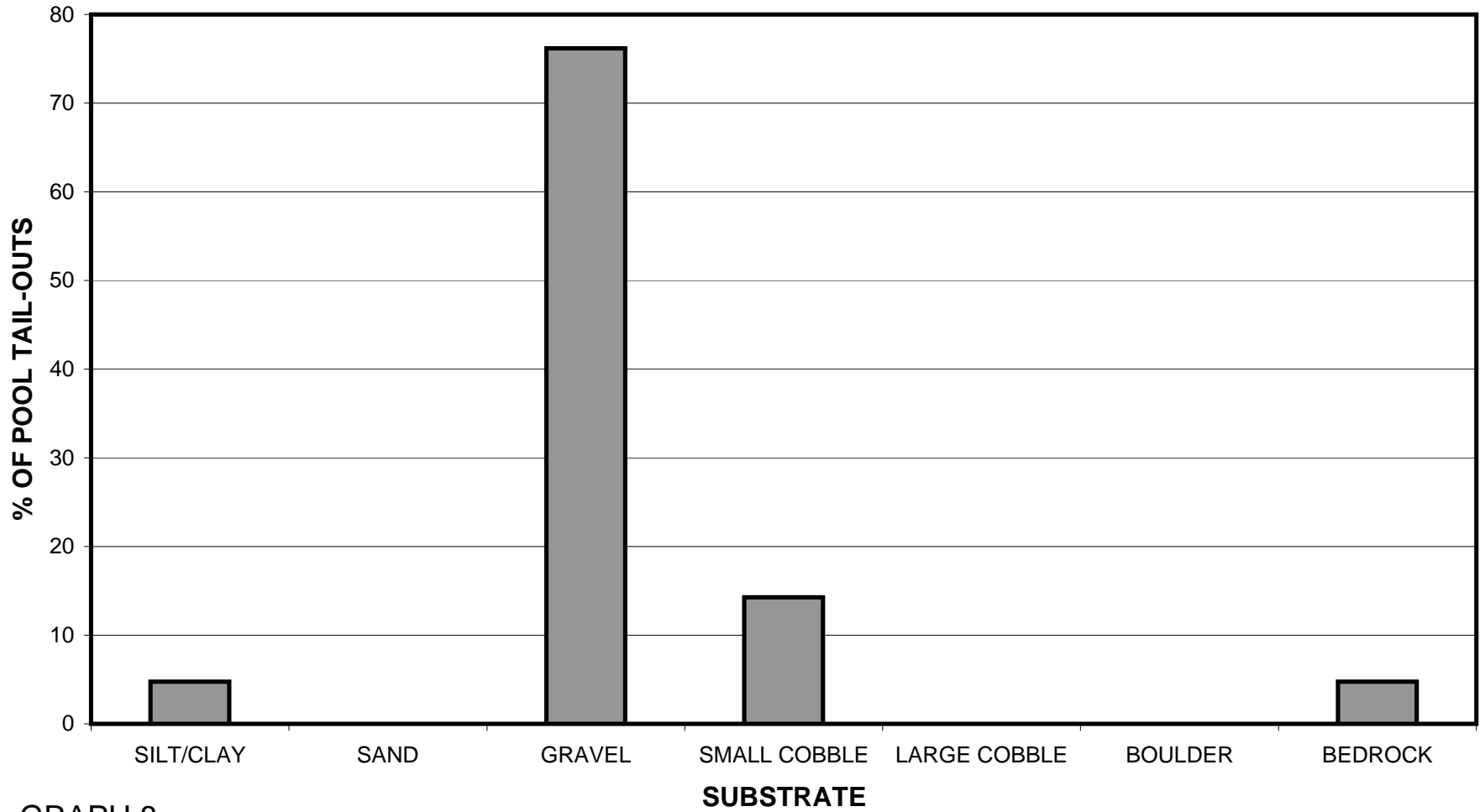
# HORSETAIL GULCH 2012 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

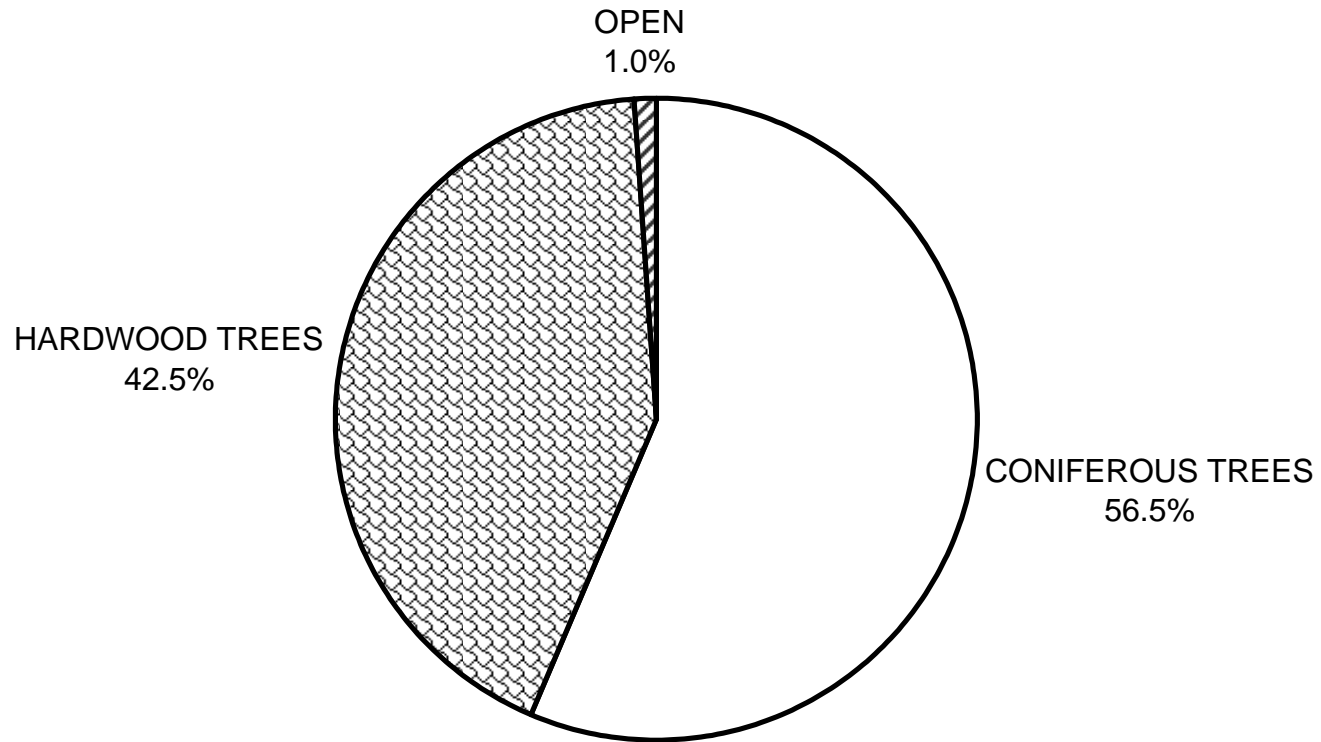
# HORSETAIL GULCH 2012

## SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



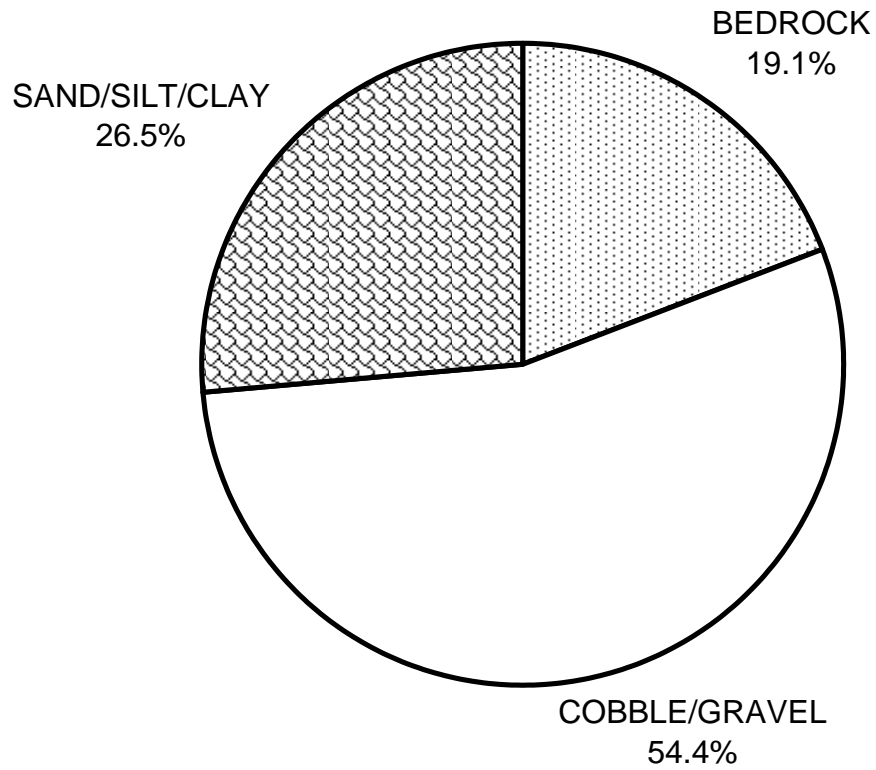
GRAPH 8

# HORSETAIL GULCH 2012 MEAN PERCENT CANOPY



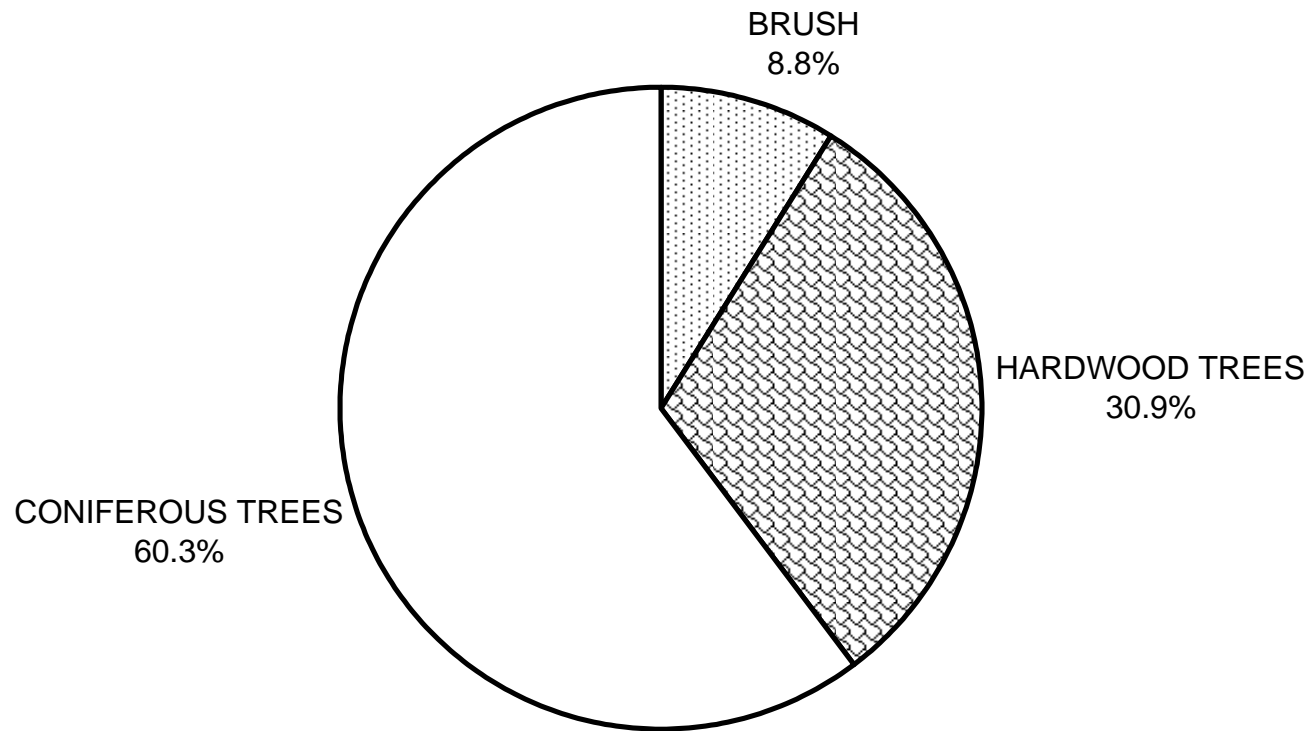
GRAPH 9

# HORSETAIL GULCH 2012 DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

# HORSETAIL GULCH 2012 DOMINANT BANK VEGETATION IN SURVEY REACH





GRAPH 11

**Map 1  
Horsetail Gulch  
Ten Mile River Watershed  
Dutchmans Knoll Quad, Mendocino County**

Start of Survey

End of Survey



-  Reach 1, Channel Type G4
-  Reach 2, Channel Type E4

