



**California Department of Fish and Game**  
**Sonoma Coast Watershed**  
**Stream Habitat Assessment Reports**  
**Furlong Gulch**



## **STREAM INVENTORY REPORT**

### **Furlong Gulch**

*Assessment Completed July 2008*

*Report Completed March 2009*

### INTRODUCTION

A stream inventory was conducted during 7/14/2008 to 7/15/2008 on Furlong Gulch. The survey began at the confluence with Pacific Ocean and extended upstream 1.4 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Furlong Gulch.

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

### WATERSHED OVERVIEW

Furlong Gulch is a tributary to Pacific Ocean, and is located in Sonoma County, California (Map 1). Furlong Gulch's legal description at the confluence with Pacific Ocean is T07N R11 S29. Its location is 38° 24' 48" north latitude and 123° 06' 03" west longitude, LLID number 1231007384132. Furlong Gulch is a second order stream and has approximately 2.13 miles of blue line stream according to the USGS National Hydrography Dataset (NHD). Furlong Gulch drains a watershed of approximately 0.75 square miles. Elevations range from about 20 feet at the mouth of the creek to 1,175 feet in the headwater areas. Grassland or herbaceous land dominates the watershed. The watershed is primarily privately owned. Vehicle access exists via California Highway 1.

### METHODS

The habitat inventory conducted in Furlong Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and 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 fully measured. 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.

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### 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 Furlong 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". Furlong Gulch habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

#### 5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Furlong 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 unsuited for spawning due to inappropriate substrate like bedrock,

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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 Furlong 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. 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 Furlong 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 Furlong Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

### 10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is 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.

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### 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

No Biological inventory was taken on Furlong Gulch.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Furlong 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

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- 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 7/14/2008 to 7/15/2008 was conducted by H. Colton, and T. Pool (WSP). The total length of the stream surveyed was 7,199 feet.

Stream flow was not measured on Furlong Gulch.

Furlong Gulch is an E3 channel type for the entire 7,199 feet of the stream surveyed (Reach 1).

E3 channels are low gradient, meandering riffle/pool streams with low width/depth ratio and little deposition; as well as very efficient and stable with high meander width ratio and a cobble dominant channel.

Water temperatures taken during the survey period ranged from 50 to 54 degrees Fahrenheit. Air temperatures ranged from 51 to 69 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 31% dry units, and 20% flatwater units (Graph 1). Based on total length of Level II habitat types there were 71% dry units, 11% Pool units, and 14% flatwater units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 31% Dry units, 26% Mid-Channel Pool units, 13% Step Run units, (Graph 3). Based on percent total length, there were 71% Dry units, 10% Step Run units and 8.1% Step Pool units.

A total of 20 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 100%, and comprised 100% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. One of the 20 pools (5%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 20 pool tail-outs measured, 1 had a value of 2 (5%); 7 had a value of 3 (35%); and 12 had a value of 4 (60%), (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.

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

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Furlong Gulch. Graph 7 describes the pool cover in Furlong Gulch. Boulders are the dominant pool cover type followed by undercut banks.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 40% of pool tail-outs, and small Cobble was observed in 35% of pool tail-outs.

The mean percent canopy density for the surveyed length of Furlong Gulch was 98%. The mean percentages of hardwood and coniferous trees were 100% and 0%, respectively. Two percent of the canopy was open. Graph 9 describes the mean percent canopy in Furlong Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 95%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 15% boulder, 85% cobble/gravel, (Graph 10). Grass was the dominant vegetation type observed in 52% of the units surveyed. Additionally, 29% of the units surveyed had coniferous trees as the dominant vegetation type, and 19% had brush as the dominant vegetation (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

No biological inventory was taken on Furlong Gulch.

## DISCUSSION

Furlong Gulch is an E3 channel type for the entire 7,199 feet of stream surveyed. The suitability of E3 channel types for fish habitat improvement structures is as follows: they are good for bank placed boulders; fair for opposing wing-deflectors; and poor for plunge weirs, boulder clusters, and single wing-deflectors.

The water temperatures recorded on the survey days 7/14/2008 to 7/15/2008, ranged from 50 to 54 degrees Fahrenheit. Air temperatures ranged from 51 to 69 degrees Fahrenheit. To make any further 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 14% of the total length of this survey, riffles 4%, and pools 11%. The pools are relatively shallow, with only 1 of the 20 (5%) pools having 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

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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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

One of the 20 pool tail-outs measured had embeddedness ratings of 1 or 2. Nineteen of the pool tail-outs had embeddedness ratings of 3 or 4. None 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 Furlong Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifteen of the 20 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 was 3. The shelter rating in the flatwater habitats was 0. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Boulders in Furlong Gulch. Boulders are the dominant cover type in pools followed by undercut banks. 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 98%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 95% and 93%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

### **GENERAL RECOMMENDATIONS**

Furlong Gulch should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.



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RECOMMENDATIONS

1. 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.
2. Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from boulders. Adding high quality complexity with woody cover in the pools is desirable.
3. Access for migrating salmonids should be assessed at all road crossings, specifically the culvert under Highway 1. Where needed crossings should be replaced or modified to improve fish passage.
4. Furlong Gulch would benefit from utilizing bio-technical vegetative techniques for bank stabilization and to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.
5. 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.

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.

<u>Position</u>	<u>Habitat Unit #</u>	<u>Comments:</u>
0	0001.00	Start of Survey at confluence with Pacific Ocean.
3751	0039.00	Tributaries: Right bank dry tributary 38 feet into unit. (small)
4092	0042.00	Tributaries: 3 feet into unit left bank dry tributary.
4317	0043.00	Tributaries: Right bank dry tributary at bottom of unit.
4327	0044.00	Structures: 30 feet into unit large debris accumulation (LDA 1) Dimensions: Height 6.2 feet, width 7.7 feet, length 7.5 feet, 7 pieces of wood, There was no water flowing through it and no visible gaps. It was retaining cobble sediment, 4.9 W, 7.4 L, 3.0 D, No fish were observed above LDA 1.
4327	0044.00	Erosion Site: (Bank) Right bank erosion 100 feet into unit.
4485	0045.00	Erosion Site: (Bank) Right bank erosion 3 feet into unit.
4582	0046.00	General Comment: LDA 2 left bank 4 feet into unit. It was 4.2ft tall, 7.8ft wide and 2ft long. There was one piece of LWD. It did not have water flowing through it and there were gaps. There was sediment retention of cobble that was 3.5ft wide, 4ft long and 1.3ft tall.

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<u>Position</u>	<u>Habitat</u> <u>Unit #</u>	<u>Comments:</u>
4682	0049.00	Tributaries: Right bank tributary unable to survey due to thick vegetation.
5150	0052.00	Tributaries: 576 feet into unit right bank tributary (dry)
6286	0054.00	General Comment: Very thick vegetation in creek.
7199	0055.00	End of survey due to thick vegetation. Physically unable to climb through.

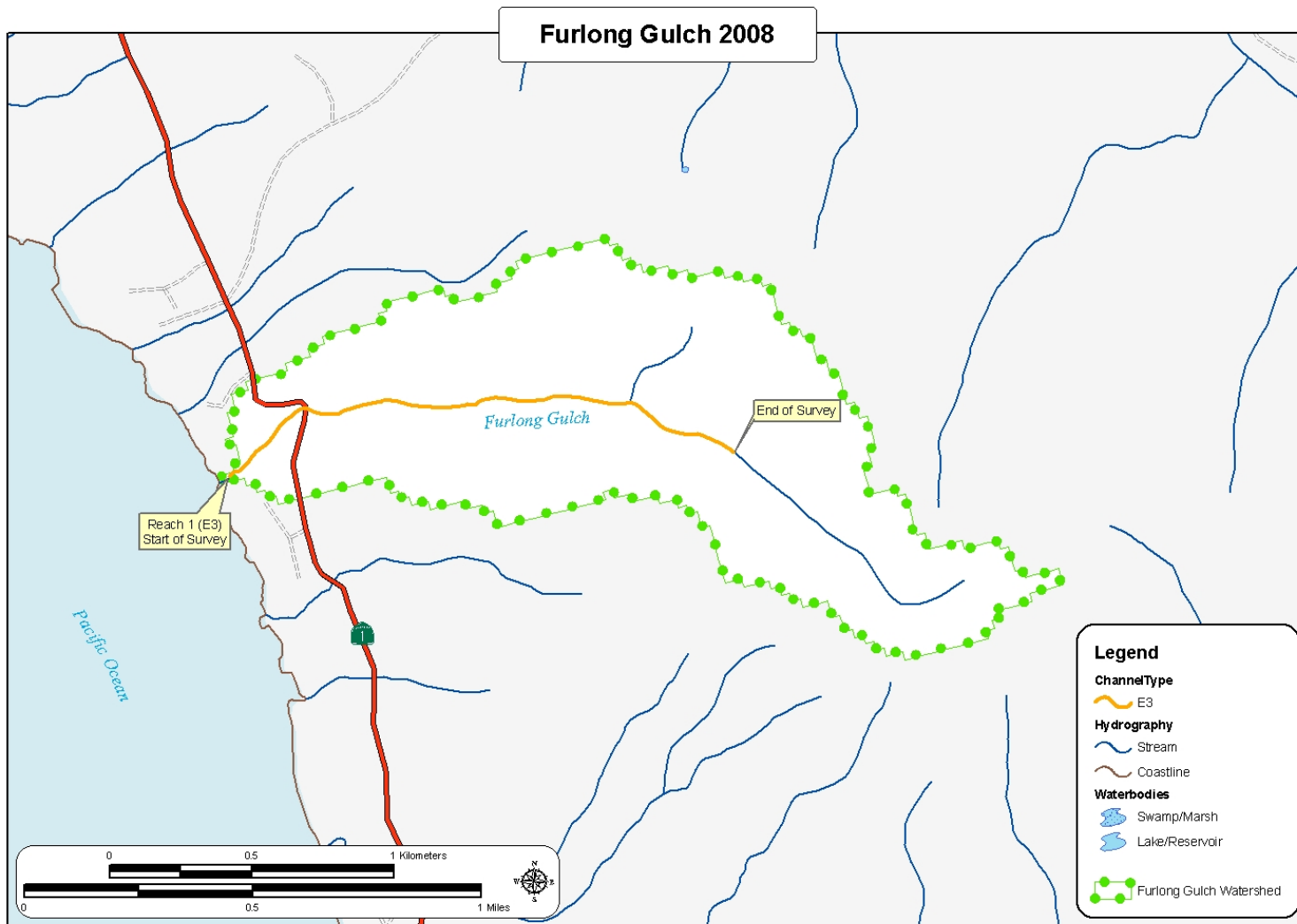
### REFERENCES

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. *Catena*, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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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]	

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

**Stream Name:** Furlong Gulch

**LLID:** 1231007384132

**Drainage:** Salmon Creek

**Survey** 7/14/2008 to 7/15/2008

**Confluence Location: Quad:** DUNCAN MILLS

**Legal Description:** T07NR011S29

**Latitude:** 38:24:48.0N

**Longitude:** 123:06:03.0W

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
2	0	CULVERT	3.7	34	68	0.9									
17	0	DRY	31.5	300	5103	70.5									
11	4	FLATWATER	20.4	88	972	13.5	3.1	0.4	0.6	192	2113	86	948		0
20	20	POOL	37.0	38	762	10.6	7.2	0.8	1.4	269	5383	236	4722	236	3
4	2	RIFFLE	7.4	74	294	4.1	2.5	0.1	0.2	140	559	14	56		0
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)		
54	26				7199						8056		5726		

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

**Stream Name:** Furlong Gulch

**LLID:** 1231007384132

**Drainage:** Salmon Creek

**Survey** 7/14/2008 to 7/15/2008

**Confluence Location: Quad:** DUNCAN MILLS

**Legal Description:** T07NR011S29

**Latitude:** 38:24:48.0N

**Longitude:** 123:06:03.0W

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	Mean Canopy (%)
3	1	LGR	5.6	81	243	3.4	2.0	0.1	0.2	133	400	13	40		0	99
1	1	HGR	1.9	51	51	0.7	3.0	0.1	0.2	146	146	15	15		0	98
3	2	GLD	5.6	51	154	2.1	3.0	0.3	0.8	147	441	44	132		0	99
1	0	RUN	1.9	97	97	1.3										
7	2	SRN	13.0	103	721	10.0	3.0	0.5	0.9	237	1660	128	898		0	99
14	14	MCP	25.9	13	177	2.5	8.0	0.8	2.1	104	1455	92	1292	92	3	98
6	6	STP	11.1	98	585	8.1	6.0	0.8	1.9	655	3929	572	3430	572	3	99
17	0	DRY	31.5	300	5103	70.9										
2	0	CUL	3.7	34	68	0.9										
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume				
54	26				7199					8031		5807(cu.ft.)				

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**Table 3 - Summary of Pool Types**

**Stream Name:** Furlong Gulch

**LLID:** 1231007384132

**Drainage:** Salmon Creek

**Survey** 7/14/2008 to 7/15/2008

**Confluence Location: Quad:** DUNCAN MILLS

**Legal Description:** T07NR011S29

**Latitude:** 38:24:48.0N

**Longitude:** 123:06:03.0W

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
20	20	MAIN	100	38	762	100	7.2	0.8	269	5383	236	4722	3
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
20	20				762					5383		4722	

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

**Stream Name:** Furlong Gulch

**LLID:** 1231007384132

**Drainage:** Salmon Creek

**Survey** 7/14/2008 to 7/15/2008

**Confluence Location: Quad:** DUNCAN MILLS

**Legal Description:** T07NR011S29

**Latitude:** 38:24:48.0N

**Longitude:** 123:06:03.0W

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
14	MCP	70	2	14	11	79	1	7	0	0	0	0
6	STP	30	1	17	5	83	0	0	0	0	0	0
Total Units			Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1 < 2 Feet Max Resid. Depth	Total 1 < 2 Feet % Occurrence	Total 2 < 3 Feet Max Resid. Depth	Total 2 < 3 Feet % Occurrence	Total 3 < 4 Feet Max Resid. Depth	Total 3 < 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
20			3	15	16	80	1	5	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1



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

Stream Name:		Furlong Gulch		Dry Units:		17		LLID:		1231007384132		Drainage:		Salmon Creek													
Survey		7/14/2008 to 7/15/2008		Confluence Location: Quad:		DUNCAN MILLS		Legal Description:		T07NR011S29		Latitude:		38:24:48.0N													
Longitude:		123:06:03.0W		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	
3	1	LGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	HGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2	GLD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	RUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2	SRN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	4	TOTAL FLAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	14	MCP	42	0	0	6	0	0	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	6	STP	0	0	0	0	0	0	0	0	0	0	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	20	TOTAL POOL	30	0	0	4	0	0	0	0	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	CUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	NS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	26	TOTAL	23	0	0	3	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Furlong Gulch*

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

**Stream Name:** Furlong Gulch      **Dry Units:** 17      **LLID:** 1231007384132      **Drainage:** Salmon Creek  
**Survey** 7/14/2008 to 7/15/2008

**Confluence Location:** Quad: DUNCAN MILLS      **Legal Description:** T07NR011S29      **Latitude:** 38:24:48.0N      **Longitude:** 123:06:03.0W

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
3	1	LGR	0	0	0	0	100	0	0
1	1	HGR	0	0	0	0	100	0	0
3	2	GLD	0	0	50	50	0	0	0
1	0	RUN	0	0	0	0	0	0	0
7	2	SRN	0	0	50	0	50	0	0
14	14	MCP	7	14	36	21	14	7	0
6	6	STP	0	0	0	17	33	33	17
2	0	CUL	0	0	0	0	0	0	0

*Furlong Gulch*

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

<b>Stream Name:</b>	Furlong Gulch	<b>LLID:</b>	1231007384132	<b>Drainage:</b>	Salmon Creek		
<b>Survey</b>	7/14/2008 to 7/15/2008						
<b>Confluence Location:</b>	<b>Quad:</b>	<b>Legal Description:</b>	T07NR011S29	<b>Latitude:</b>	38:24:48.0N	<b>Longitude:</b>	123:06:03.0W
Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover		
98	0	100	0	95	93		

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

Open units represent habitat units with zero canopy cover.

***Furlong Gulch***

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

Stream Furlong Gulch LLID: 1231007384132 Drainage Salmon Creek  
 Survey Dates: 7/14/2008 to 7/15/2008 Survey Length (ft.): 7199 Main Channel (ft.): 7199 Side Channel (ft.): 0  
 Confluence Location: Quad DUNCAN MILLS Legal Description: T07NR011S29 Latitude: 38:24:48.0N Longitude: 123:06:03.0W

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

**STREAM REACH: 1**

Channel Type: E3	Canopy Density (%): 98.3	Pools by Stream Length: 6.8
Reach Length (ft.): 7,199	Coniferous Component (%): 0.0	Pool Frequency (%): 36.4
Riffle/Flatwater Mean Width (ft.): 2.9	Hardwood Component: 100.0	Residual Pool Depth (%):
BFW:	Dominant Bank: Grass	< 2 Feet Deep: 95.0
Range (ft.): 12 to 20	Vegetative Cover (%): 93.9	2 to 2.9 Feet Deep: 5.0
Mean (ft.): 13.98	Dominant: Boulders	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 2.38	Dominant Bank Substrate: Cobble/Gravel	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth: 1.39
Water (F): 50 - 54 Air (F): 51 - 69	LWD per 100 ft.:	Mean Pool Shelter: 3
Dry Channel (ft.): 5103	Riffles: 0	
	Pools: 0	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 15.0 Sand: 0.0 Gravel: 40.0 Sm Cobble: 35.0 Lg Cobble: 5.0 Boulder: 0.0 Bedrock: 5.0		
Embeddedness Values (%): 1. 0.0 2. 5.0 3. 35.0 4. 60.0 5. 0.0		

## *Furlong Gulch*

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

**Stream Name:** Furlong Gulch

**LLID:** 1231007384132

**Drainage:** Salmon Creek

**Survey** 7/14/2008 to 7/15/2008

**Confluence Location: Quad:** DUNCAN MILLS

**Legal Description:** T07NR011S29

**Latitude:** 38:24:48.0N

**Longitude:** 123:06:03.0W

### **Mean Percentage of Dominant Stream Bank Substrate**

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	0	0	0.0
Boulder	4	4	15.4
Cobble/Gravel	22	22	84.6
Sand/Silt/Clay	0	0	0.0

### **Mean Percentage of Dominant Stream Bank Vegetation**

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	13	14	51.9
Brush	6	4	19.2
Hardwood	0	0	0.0
Coniferous	7	8	28.8
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 4

## *Furlong Gulch*

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

**Stream Name:** Furlong Gulch

**LLID:** 1231007384132

**Drainage:** Salmon Creek

**Survey** 7/14/2008 to 7/15/2008

**Confluence Location: Quad:** DUNCAN MILLS

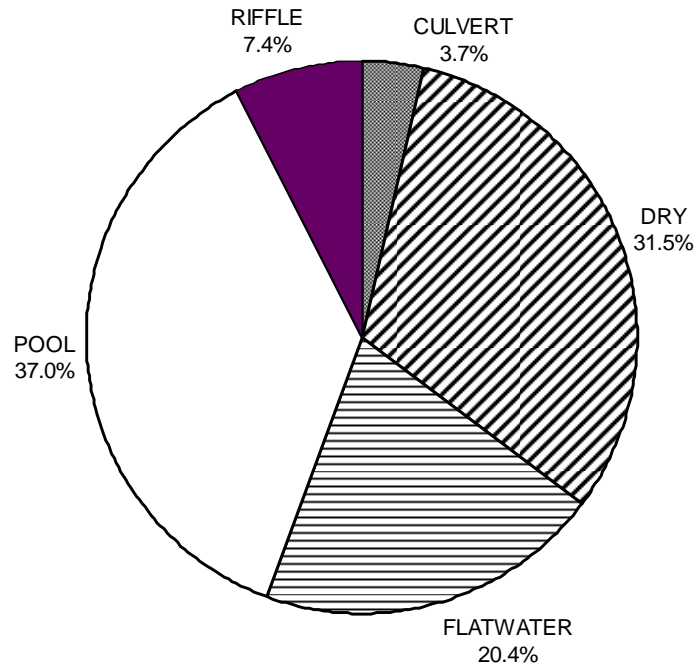
**Legal Description:** T07NR011S29

**Latitude:** 38:24:48.0N

**Longitude:** 123:06:03.0W

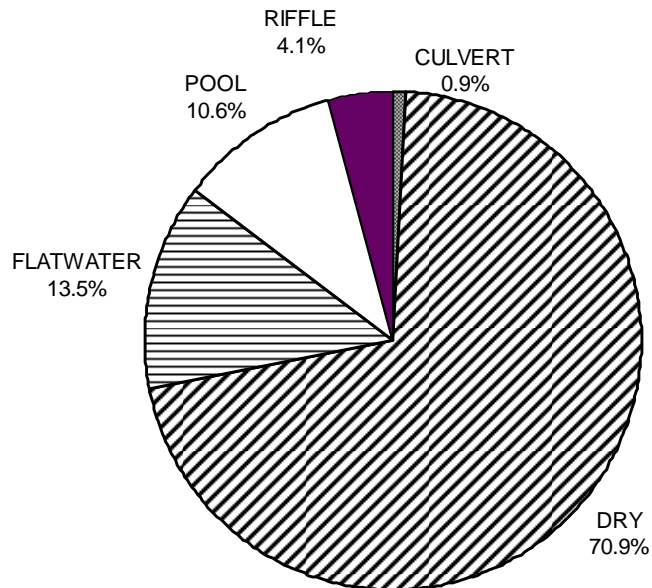
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	0	30
SMALL WOODY DEBRIS (%)	0	0	0
LARGE WOODY DEBRIS (%)	0	0	0
ROOT MASS (%)	0	0	4
TERRESTRIAL VEGETATION	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	52
BEDROCK LEDGES (%)	0	0	0

**FURLONG GULCH 2008  
HABITAT TYPES BY PERCENT OCCURRENCE**



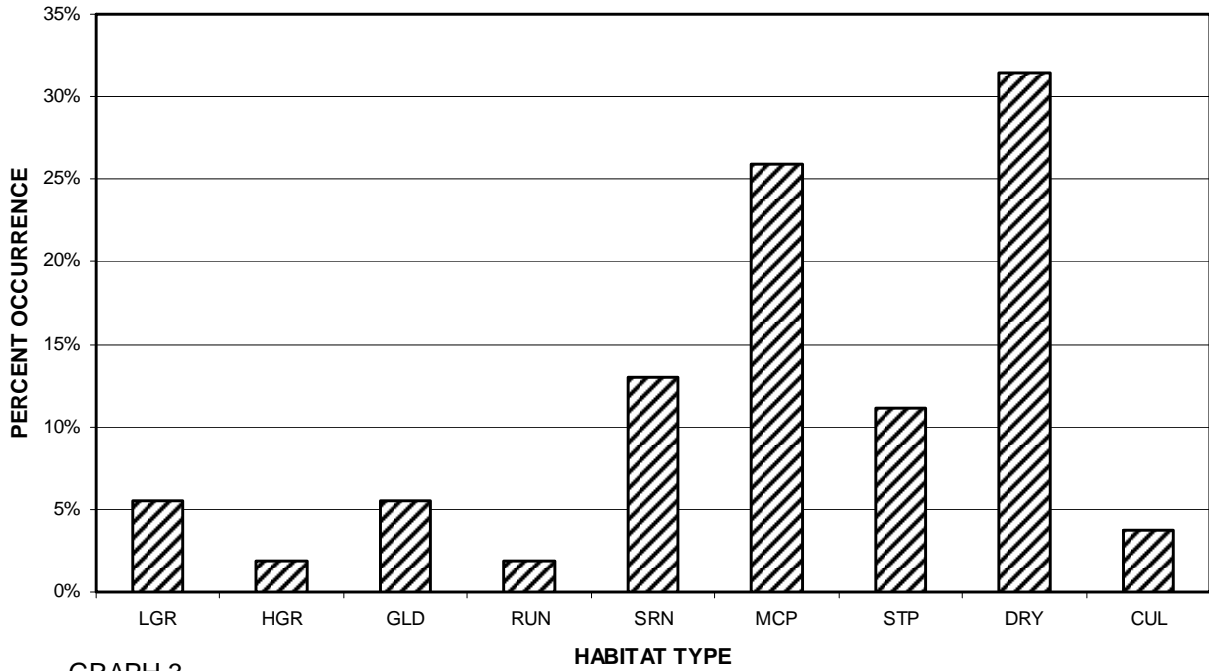
GRAPH 1

**FURLONG GULCH 2008  
HABITAT TYPES BY PERCENT TOTAL LENGTH**



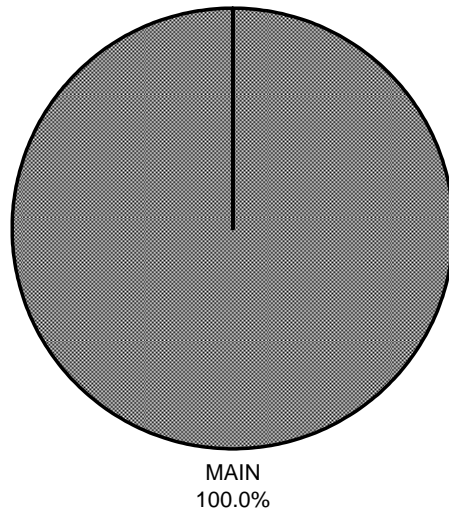
GRAPH 2

**FURLONG GULCH 2008  
HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 3

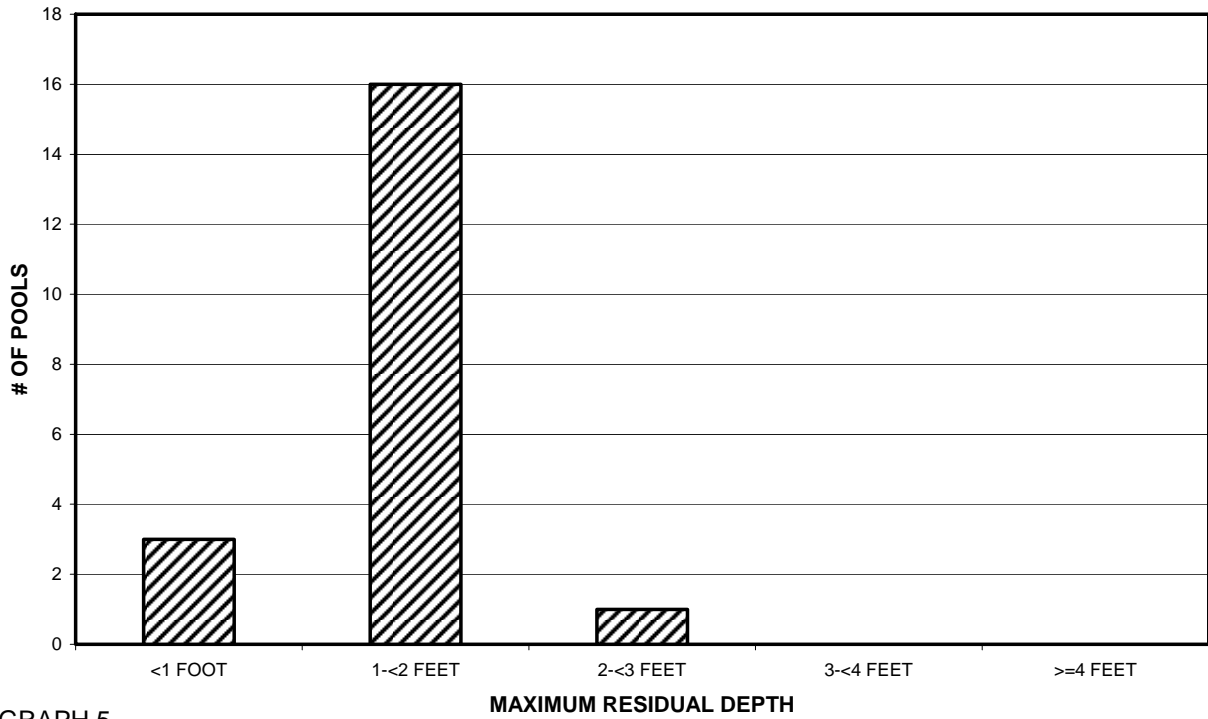
**Furlong Gulch 2008  
POOL TYPES BY PERCENT OCCURRENCE**



GRAPH 4

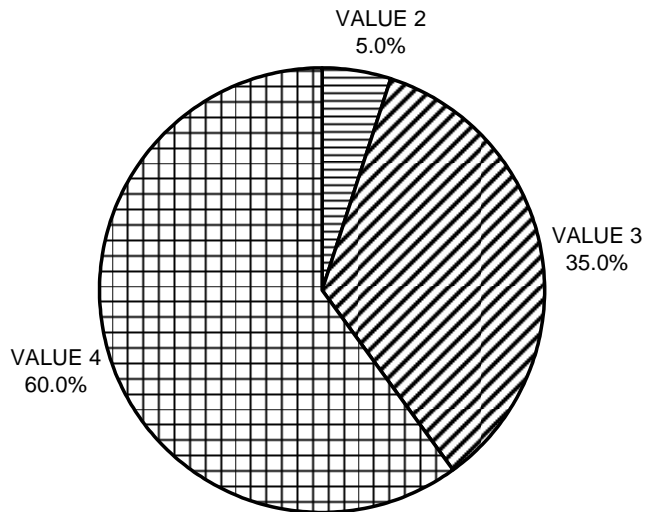


**Furlong Gulch 2008  
MAXIMUM DEPTH IN POOLS**



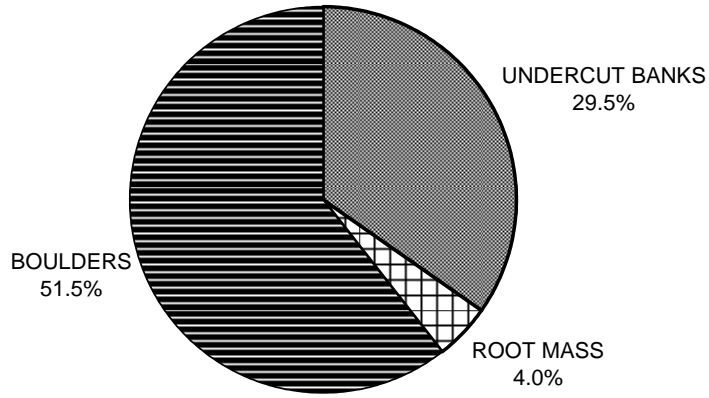
GRAPH 5

**Furlong Gulch 2008  
PERCENT EMBEDDEDNESS**



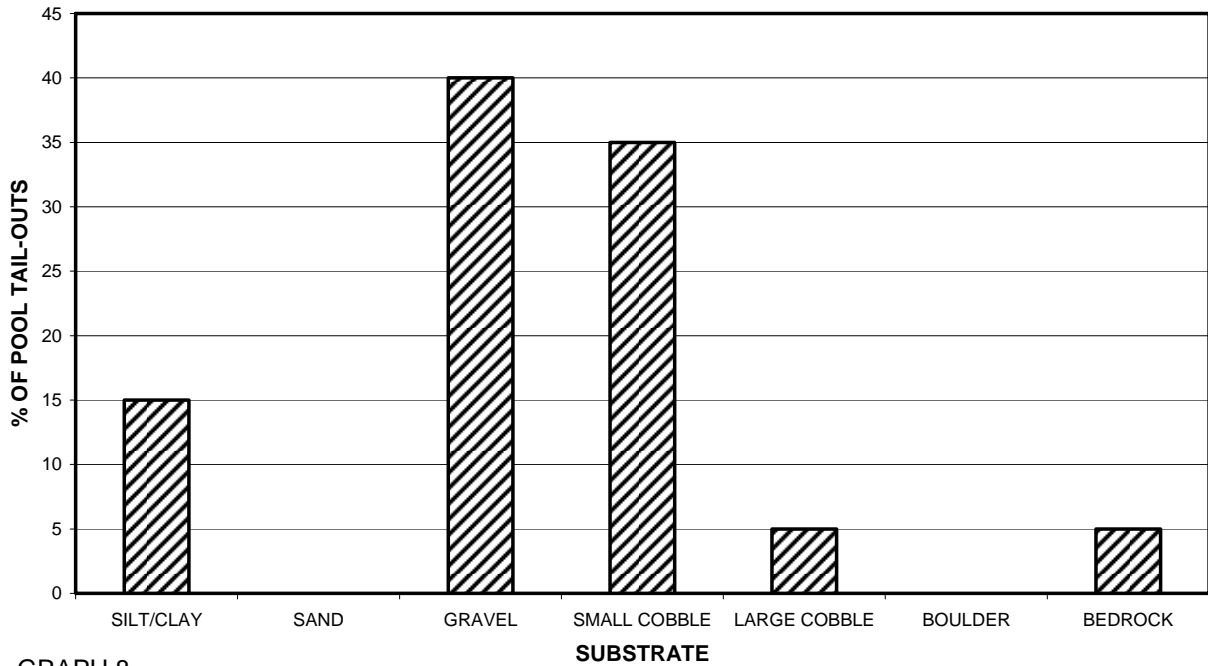
GRAPH 6

**Furlong Gulch 2008  
MEAN PERCENT COVER TYPES IN POOLS**



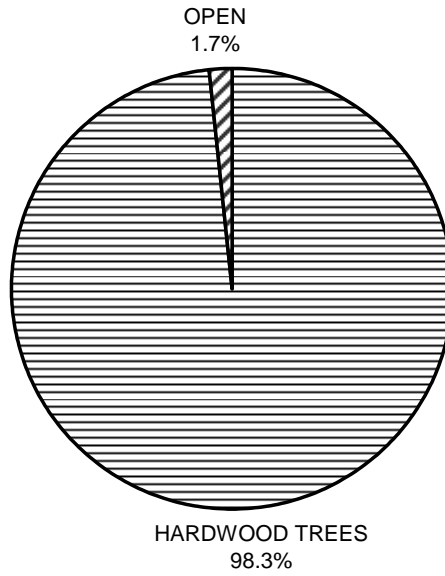
GRAPH 7

**Furlong Gulch 2008  
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



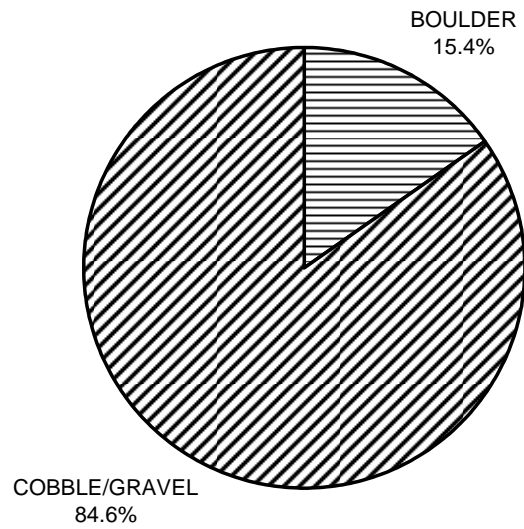
GRAPH 8

**Furlong Gulch 2008  
MEAN PERCENT CANOPY**



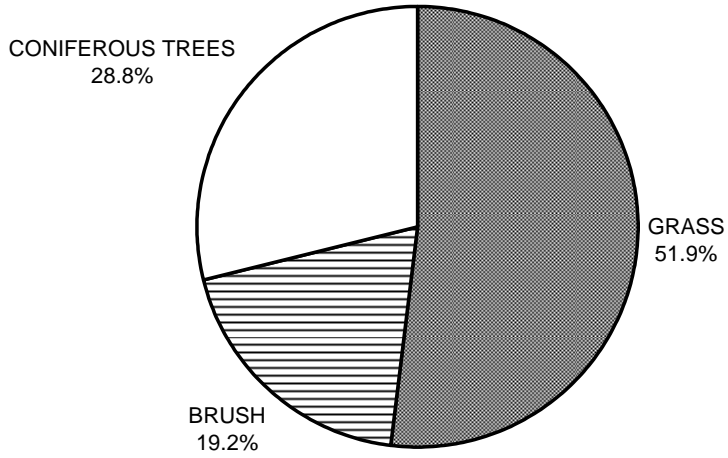
GRAPH 9

**Furlong Gulch 2008  
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**Furlong Gulch 2008  
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11