

STREAM INVENTORY REPORT

“South Fork Bear Canyon Creek”

INTRODUCTION

A stream inventory was conducted from June 1, 2009 to June 11, 2009 on an unnamed tributary to Bear Canyon Creek commonly known as and hereinafter referred to as South Fork Bear Canyon Creek. The survey began at the confluence with Bear Canyon Creek and extended upstream 0.8 miles.

The South Fork Bear Canyon Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in South Fork Bear Canyon Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, 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

South Fork Bear Canyon Creek is a tributary to Bear Canyon Creek, tributary to South Fork Eel River, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). South Fork Bear Canyon Creek's legal description at the confluence with Bear Canyon is T04S R03E S24. Its location is 40.1028 north latitude and 123.7866 west longitude, LLID number 1237854401029. South Fork Bear Canyon Creek is a second order stream and has approximately 1.6 miles of blue line stream according to the USGS Garberville 7.5 minute quadrangle. South Fork Bear Canyon Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 300 feet at the mouth of the creek to 900 feet in the headwater areas. Mixed hardwood forest dominates the watershed. The watershed is primarily privately owned. Vehicle access exists via Highway 101 to Redwood Drive to Bear Canyon Road to the South Fork Eel River Bar.

METHODS

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

SAMPLING STRATEGY

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

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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 South Fork Bear Canyon Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

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

3. Temperatures:

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

4. Habitat Type:

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

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

6. Shelter Rating:

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

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In South Fork Bear Canyon Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

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

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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 South Fork Bear Canyon Creek. In addition, underwater observations were made at 31 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 South Fork Bear Canyon Creek include:

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

HABITAT INVENTORY RESULTS

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

The habitat inventory of June 1, 2009 and June 11, 2009 was conducted by J. Coombes, R. Okey and N. Talkington (WSP), and S. McSmith and I. Mikus (DFG). The total length of the stream surveyed was 4,259 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.11 cfs on June 2, 2009.

South Fork Bear Canyon Creek is a G4 channel type for 1,422 feet of the stream surveyed (Reach 1), an A2 channel type for 1,013 feet of the stream surveyed (Reach 2), and a G4 channel type for 1,824 feet of the stream surveyed (Reach 3). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios, very stable with gravel-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 54 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 32% riffle units, and 30% flatwater units (Graph 1). Based on total length of Level II habitat types there were 41% flatwater units, 33% riffle units, and 25% pool units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 23%; low gradient riffle units, 23%; and run

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units, 16% (Graph 3). Based on percent total length, step run units made up 25%; low gradient riffle units 21%; and run units 17%.

A total of 53 pools were identified (Table 3). Main channel pools were the most frequently encountered at 75% (Graph 4), and comprised 78% 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. Four of the 53 pools (8%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 53 pool tail-outs measured, 23 had a value of 1 (43.4%); 19 had a value of 2 (35.8%); 5 had a value of 3 (9.4%); 2 had a value of 4 (3.8%); 4 had a value of 5 (7.5%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 15, flatwater habitat types had a mean shelter rating of 11, and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating of 19. Scour pools had a mean shelter rating of 18 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in South Fork Bear Canyon Creek. Graph 7 describes the pool cover in South Fork Bear Canyon Creek. Boulders are the dominant pool cover type followed by large 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 62% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 25% of the pool tail-outs.

The mean percent canopy density for the surveyed length of South Fork Bear Canyon Creek was 87%. Thirteen percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 84% and 16%, respectively. Graph 9 describes the mean percent canopy in South Fork Bear Canyon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85%. The mean percent left bank vegetated was 88%. The dominant elements composing the structure of the stream banks consisted of 56% sand/silt/clay, 27% bedrock, 9% boulder, and 7% cobble/gravel (Graph 10). Hardwood trees were the dominant vegetation type observed in 63.3% of the units surveyed. Additionally, 27.3% of the units surveyed had brush as the dominant vegetation type, 8% of the units surveyed had coniferous trees as the dominant vegetation type and 1.3% had no vegetation (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

Thirty-one sites were snorkel sampled for species composition and distribution in South Fork Bear Canyon Creek on June 3, 2009 and June 15, 2009. Water temperatures taken during the snorkel survey period of 0940 to 1235 ranged from 56 to 60 degrees Fahrenheit. Air temperatures ranged from 58 to 63 degrees Fahrenheit. The sites were sampled by J. Coombes, N. Talkington (WSP), and I. Mikus (DFG).

In reach 1, which comprised the first 1,422 feet of stream, 11 sites were sampled. The reach sites yielded 2 age 1+ SH/RT and 10 rough skinned newts.

In reach 2, 10 sites were sampled starting approximately 1,423 from the confluence with Bear Canyon Creek and continuing upstream 1,013 feet. The reach sites yielded 1 age 1+ SH/RT, 12 rough skinned newts, and 3 Pacific giant salamanders.

In reach 3, 9 sites were sampled, as well as one above the end of survey, starting approximately 2,436 from the confluence with Bear Canyon Creek and continuing upstream 1,824 feet. The reach sites yielded 1 age 1+ SH/RT and 29 rough skinned newts.

The following chart displays the information yielded from these sites:

2009 South Fork Bear Canyon Creek 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									
06/03/09	1	007	4.2	195	0	1	0	0	0
06/03/09	2	009	4.4	282	0	0	0	0	0
06/03/09	3	020	4.2	758	0	0	0	0	0
06/03/09	4	022	4.2	790	0	0	0	0	0
06/03/09	5	025	4.2	872	0	0	0	0	0
06/03/09	6	026	5.4	897	0	0	0	0	0
06/03/09	7	029	4.2	954	0	0	0	0	0
06/03/09	8	034	5.4	1113	0	0	0	0	0
06/03/09	9	036	4.2	1152	0	0	0	0	0
06/03/09	10	037	4.2	1181	0	0	0	0	0
06/03/09	11	040	4.2	1422	0	1	0	0	0
Reach 2: A2 Channel Type									
06/15/09	12	046	4.4	1617	0	0	0	0	0
06/15/09	13	048	4.4	1725	0	0	0	0	0

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06/15/09	14	052	4.4	1914	0	0	0	0	0
06/15/09	15	055	4.4	2054	0	0	0	0	0
06/15/09	16	061	4.2	2140.5	0	0	0	0	0
06/15/09	17	062	4.4	2163	0	0	0	0	0
06/15/09	18	063	4.2	2187	0	0	0	0	0
06/15/09	19	066	4.2	2271	0	0	0	0	0
06/15/09	20	069	4.2	2332	0	1	0	0	0
06/15/09	21	070	4.2	2357	0	0	0	0	0
Reach 3: G4 Channel Type									
06/15/09	22	079	4.2	2651	0	0	0	0	0
06/15/09	23	082	4.2	2732	0	0	0	0	0
06/15/09	24	091	4.2	2962	0	1	0	0	0
06/15/09	25	112	4.2	3524	0	0	0	0	0
06/15/09	26	113	5.3	3546	0	0	0	0	0
06/15/09	27	120	4.2	3737	0	0	0	0	0
06/15/09	28	128	5.2	3893	0	0	0	0	0
06/15/09	29	130	4.2	3953	0	0	0	0	0
06/15/09	30	133	4.2	4004	0	0	0	0	0
06/15/09	31	*	4.2	4279	0	0	0	0	0

* pool sampled approximately 20' upstream of the end of survey.

DISCUSSION

South Fork Bear Canyon Creek is a G4 channel type for the first 1,422 feet of stream surveyed, an A2 channel type for the next 1,013 feet, and a G4 channel type for the remaining 1,824 feet. The suitability of G4 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. A2 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days June 1, 2009 to June 11, 2009 ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 54 to 70 degrees Fahrenheit. To make any conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 41% of the total length of this survey, riffles 33%, and pools 25%. Four of the 53 (8%) 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

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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.

Forty-two of the 53 pool tail-outs measured had embeddedness ratings of 1 or 2. Seven of the pool tail-outs had embeddedness ratings of 3 or 4. Four 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.

Forty-six of the 53 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 19. The shelter rating in the flatwater habitats is 11. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in South Fork Bear Canyon Creek. Boulders are the dominant cover type in pools followed by large 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 87%. Reach 1 had a canopy density of 90%, Reach 2 had a canopy density of 87% and Reach 3 had a canopy density of 85%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 85% and 88%, 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) South Fork Bear Canyon Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) 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.

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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 #:	Comments
0	0001.00	Start of survey at confluence with Bear Canyon Creek. The channel is a G4.
87	0005.00	There is erosion on left bank approximately 56' long x 8' high. This is the first unit outside the influence of Bear Canyon Creek.
897	0027.00	There is a 1.7' log plunge. Log debris accumulation (LDA) #01 is 3' high x 21' wide x 3.5' long and consists of 5 pieces of large woody debris (LWD). There are gaps visible in the LDA and water flows through. It is not retaining sediment. Fish were observed above the LDA.
930	0029.00	There is a left bank seep.
1136	0036.00	There are large boulders that are 5' high x 33' wide in the channel are forcing flow to the left bank. The bank is cut approximately 50' long x 30' high and contributing fine sediment to gravel. The boulders are retaining sediment including gravel and cobble which is approximately 21' long x 34' wide.
1422	0041.00	The channel changes from a G4 channel type to an A2 channel type.
1568	0045.00	There is a slump on left bank approximately 30' long x 15' high. The bank is composed of clay.
2435	0072.00	The channel changes from an A2 channel type to a G4 channel type.
2559	0076.00	This section is unsurveyed due to a LDA covering the pool. LDA #02 is 3.8' high x 20.8' wide x 9' long and consists of 3 pieces of LWD. There are no gaps visible in the LDA and water flows through. The retained sediment ranges from silt to small cobble and measures 10' wide x 13' long x 2' deep. Fish are upstream of the LDA.
3083	0095.00	There is a landslide on right bank approximately 60' long x 15' high contributing silt to cobble.
3158	0098.00	The section of the stream is unsurveyable due to an LDA. LDA #03 is 3.5' high x 35' wide x 25' long and consists of 3 pieces of LWD. There

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are gaps visible in the LDA and water flows through. The retained sediment ranges from silt to large cobble and measures 9' wide x 27' long x 2' deep. Fish are above the LDA.

- | | | |
|------|---------|--|
| 3216 | 0100.00 | Tributary #01 enters on the right bank, the flow estimated to be less than 0.05 cfs, and it contributes to 40% of the downstream flow. The temperature downstream of the tributary is 58 degrees Fahrenheit; the temperature of the tributary is 57 degrees Fahrenheit, and the temperature upstream of the confluence is 57 degrees Fahrenheit. The slope of the tributary was 3.5% and fish were not observed in the 500' explored. The tributary is accessible to fish. |
| 3650 | 0118.00 | LDA #04 is 3.6' high x 32' wide x 2.8' long and consists of 4 pieces of LWD. There are gaps visible in the LDA and the flow is subsurface. The retained sediment ranges from silt to small cobble and measures 5' wide x 10' long x 1' deep. Fish are above the LDA. |
| 4259 | 0145.00 | Survey was ended due to length of time required to hike in. Visual observation approximately 100' upstream showed a decrease in gradient and the presence of pool habitat. |

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: 1237854401029

LLID: 1237854401029 Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE Legal Description: T04SR03ES24 Latitude: 40:06:10.0N Longitude: 123:47:07.0W

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
44	8	FLATWATER	30.3	40	1757	41.3	5.3	0.4	0.8	181	7975	91	4009		11
2	0	NOSURVEY	1.4	17	34	0.8									
53	53	POOL	36.6	20	1051	24.7	7.3	0.7	1.4	130	6885	119	6329	95	19
46	14	RIFFLE	31.7	31	1417	33.3	5.5	0.4	0.7	150	6894	65	2991		15
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
145	75				4259					21754			13329		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

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 (%)
34	9	LGR	23.4	27	906	21.3	5	0.3	0.8	140	4772	50	1684		0	89
10	4	HGR	6.9	33	326	7.7	6	0.5	1.2	141	1406	82	820		46	91
2	1	CAS	1.4	92	185	4.3	5	0.5	1.3	273	545	136	273		20	90
23	5	RUN	15.9	31	705	16.6	5	0.4	1	90	2075	37	851		16	88
21	3	SRN	14.5	50	1052	24.7	6	0.5	1.3	333	6992	181	3808		2	88
34	34	MCP	23.4	20	693	16.3	8	0.7	2.25	139	4714	132	4485	106	20	86
6	6	STP	4.1	22	130	3.0	7	0.6	2.2	143	859	140	840	113	14	86
2	2	LSL	1.4	18	37	0.9	6	0.7	1.5	102	204	82	163	71	13	91
1	1	LSR	0.7	22	22	0.5	6	0.5	1.1	119	119	71	71	59	30	90
4	4	LSBk	2.8	23	93	2.2	5	0.6	1.8	121	483	101	403	68	3	85
3	3	LSBo	2.1	12	37	0.9	10	0.6	1.2	100	300	77	230	58	28	81
3	3	PLP	2.1	13	40	0.9	6	0.5	1.7	69	207	46	137	34	27	89
2	0	NS	1.4	17	34	0.8										82

Total Units
145

Total Units Fully Measured
75

Total Length (ft.)
4259

Total Area (sq.ft.)
22675

Total Volume (cu.ft.)
13765

Table 3 - Summary of Pool Types

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

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
40	40	MAIN	75	21	822	78	7.4	0.7	139	5573	107	4293	19
13	13	SCOUR	25	18	229	22	6.7	0.6	101	1312	58	750	18

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
53	53	1051	6885	5043

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

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

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
34	MCP	64	5	15	26	76	3	9	0	0	0	0
6	STP	11	1	17	4	67	1	17	0	0	0	0
2	LSL	4	0	0	2	100	0	0	0	0	0	0
1	LSR	2	0	0	1	100	0	0	0	0	0	0
4	LSBk	8	1	25	3	75	0	0	0	0	0	0
3	LSBo	6	1	33	2	67	0	0	0	0	0	0
3	PLP	6	0	0	3	100	0	0	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1<2 Foot Max Resid. Depth	Total 1<2 Foot % Occurrence	Total 2<3 Foot Max Resid. Depth	Total 2<3 Foot % Occurrence	Total 3<4 Foot Max Resid. Depth	Total 3<4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
53	8	15	41	77	4	8	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.4

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Dry Units: 0

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

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
34	9	LGR	0	0	0	0	0	0	0	0	0
10	4	HGR	5	20	25	0	3	3	0	45	0
2	1	CAS	0	0	0	0	0	0	30	70	0
46	14	TOTAL RIFFLE	4	16	20	0	2	2	6	50	0
23	5	RUN	0	10	33	0	0	0	0	58	0
21	3	SRN	0	0	5	0	0	0	10	85	0
44	8	TOTAL FLAT	0	7	23	0	0	0	3	67	0
34	34	MCP	3	7	16	7	4	0	2	61	0
6	6	STP	3	0	2	0	0	0	1	95	0
2	2	LSL	0	10	70	0	0	20	0	0	0
1	1	LSR	80	0	0	10	0	0	0	10	0
4	4	LSBk	0	0	0	0	0	0	0	100	0
3	3	LSBo	0	50	10	0	0	0	0	40	0
3	3	PLP	0	25	0	0	0	0	0	75	0
53	53	TOTAL POOL	4	10	14	5	2	1	1	63	0
2	0	NS									
145	75	TOTAL	4	10	15	4	2	1	2	62	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Dry Units: 0

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

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
34	9	LGR	0	0	44	44	11	0	0
10	4	HGR	0	0	50	25	0	25	0
2	1	CAS	0	0	0	0	0	0	100
23	5	RUN	0	0	60	40	0	0	0
21	3	SRN	0	0	0	67	0	33	0
34	34	MCP	0	35	56	6	0	0	3
6	6	STP	0	0	50	17	0	0	33
2	2	LSL	0	0	100	0	0	0	0
1	1	LSR	0	100	0	0	0	0	0
4	4	LSBk	0	25	50	25	0	0	0
3	3	LSBo	0	0	100	0	0	0	0
3	3	PLP	0	33	33	0	0	33	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
87	16	84	0	85	88

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: 1237854401029 LLID: 1237854401029 Drainage: Eel River - South Fork
 Survey Dates: 6/1/2009 to 6/11/2009 Survey Length (ft.): 4259 Main Channel (ft.): 4259 Side Channel (ft.): 0
 Confluence Location: Quad: GARBERVILLE Legal Description: T04SR03ES24 Latitude: 40:06:10.0N Longitude: 123:47:07.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: G4	Canopy Density (%): 90.3	Pools by Stream Length (%): 21.6
Reach Length (ft.): 1422	Coniferous Component (%): 16.2	Pool Frequency (%): 32.5
Riffle/Flatwater Mean Width (ft.): 7.4	Hardwood Component (%): 83.8	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 85
Range (ft.): 18 to 22	Vegetative Cover (%): 90.0	2 to 2.9 Feet Deep: 15
Mean (ft.): 19	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.1	Occurrence of LWD (%): 10	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 54 - 58 Air (F): 56 - 61	LWD per 100 ft.:	Mean Pool Shelter Rating: 22
Dry Channel (ft): 0	Riffles: 2	
	Pools: 3	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 15 Gravel: 77 Sm Cobble: 8 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 23.1 2. 53.8 3. 7.7 4. 15.4 5. 0.0		

STREAM REACH: 2

Channel Type: A2	Canopy Density (%): 87.4	Pools by Stream Length (%): 23.1
Reach Length (ft.): 1013	Coniferous Component (%): 16.0	Pool Frequency (%): 38.7
Riffle/Flatwater Mean Width (ft.): 5.7	Hardwood Component (%): 84.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 92
Range (ft.): 13 to 21	Vegetative Cover (%): 83.7	2 to 2.9 Feet Deep: 8
Mean (ft.): 17	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.1	Occurrence of LWD (%): 3	Mean Max Residual Pool Depth (ft.): 1.4
Water (F): 56 - 60 Air (F): 54 - 64	LWD per 100 ft.:	Mean Pool Shelter Rating: 15
Dry Channel (ft): 0	Riffles: 4	
	Pools: 3	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 58 Lg Cobble: 17 Boulder: 17 Bedrock: 8		
Embeddedness Values (%): 1. 50.0 2. 25.0 3. 0.0 4. 0.0 5. 25.0		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: G4	Canopy Density (%): 85.6	Pools by Stream Length (%): 28.0
Reach Length (ft.): 1824	Coniferous Component (%): 15.9	Pool Frequency (%): 37.8
Riffle/Flatwater Mean Width (ft.): 3.8	Hardwood Component (%): 84.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 96
Range (ft.): 12 to 32	Vegetative Cover (%): 86.0	2 to 2.9 Feet Deep: 4
Mean (ft.): 23	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 5	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.1	Occurrence of LWD (%): 13	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 57 - 64	Air (F): 58 - 70	LWD per 100 ft.:
Dry Channel (ft): 0	Riffles: 2	Pools: 6
	Pools: 6	Flat: 2
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0	Sand: 0	Gravel: 82
	Sm Cobble: 18	Lg Cobble: 0
	Boulder: 0	Bedrock: 0
Embeddedness Values (%): 1. 50.0	2. 32.1	3. 14.3
	4. 0.0	5. 3.6

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES24

Latitude: 40:06:10.0N

Longitude: 123:47:07.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	16	25	27.3
Boulder	8	6	9.3
Cobble / Gravel	7	4	7.3
Sand / Silt / Clay	44	40	56.0

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	24	17	27.3
Hardwood Trees	47	48	63.3
Coniferous Trees	4	8	8.0
No Vegetation	0	2	1.3

Total Stream Cobble Embeddedness Values: 2

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

StreamName: 1237854401029

LLID: 1237854401029

Drainage: Eel River - South Fork

Survey Dates: 6/1/2009 to 6/11/2009

Confluence Location: Quad: GARBERVILLE

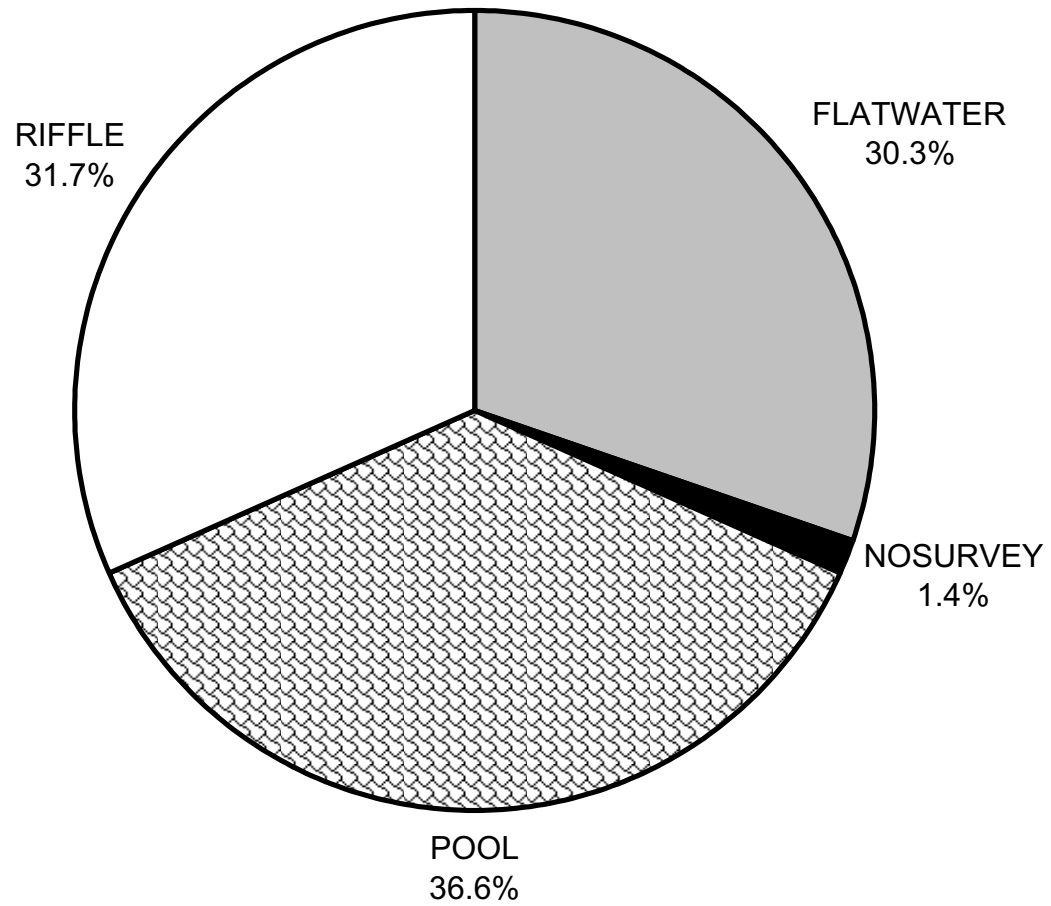
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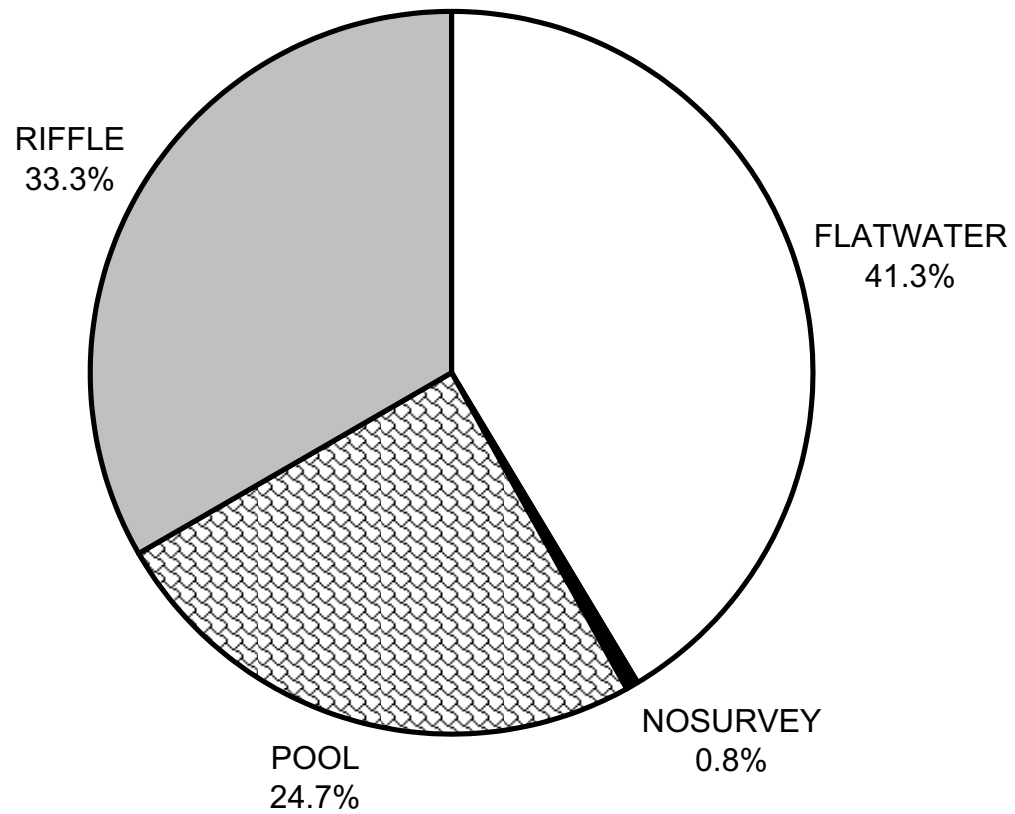
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	4	0	4
SMALL WOODY DEBRIS (%)	16	7	10
LARGE WOODY DEBRIS (%)	20	23	14
ROOT MASS (%)	0	0	5
TERRESTRIAL VEGETATION (%)	2	0	2
AQUATIC VEGETATION (%)	2	0	1
WHITEWATER (%)	6	3	1
BOULDERS (%)	50	67	63
BEDROCK LEDGES (%)	0	0	0

1237854401029 2009
HABITAT TYPES BY PERCENT OCCURRENCE



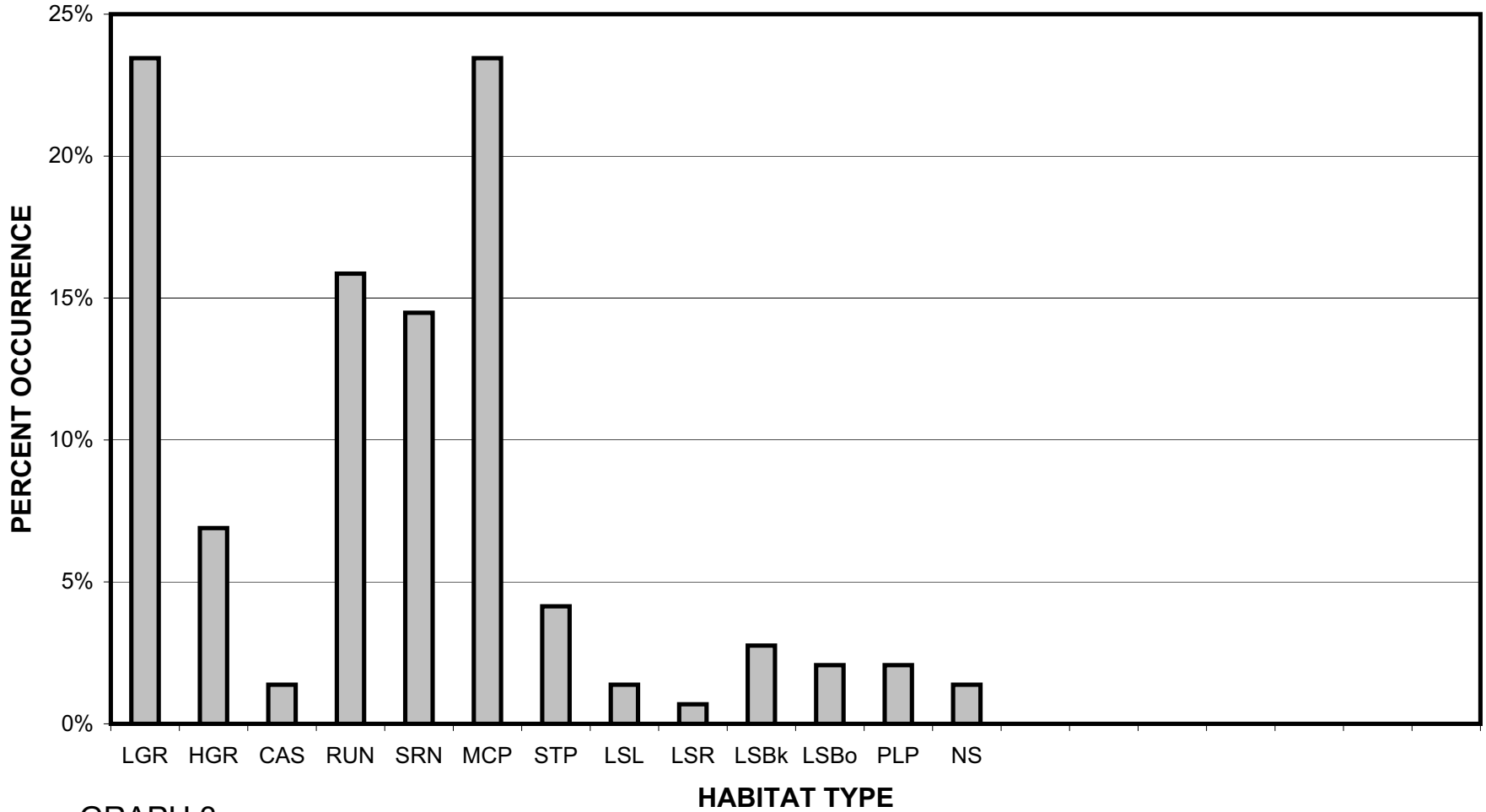
GRAPH 1

1237854401029 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH



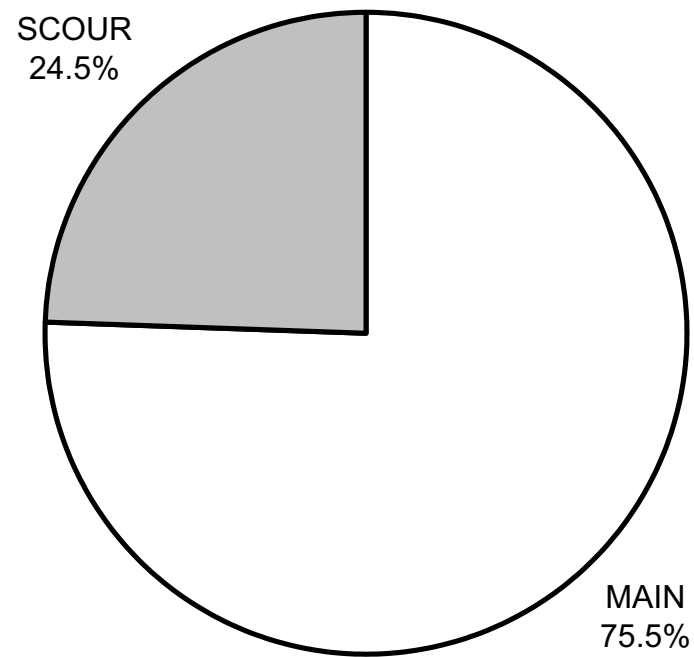
GRAPH 2

1237854401029 2009
HABITAT TYPES BY PERCENT OCCURRENCE



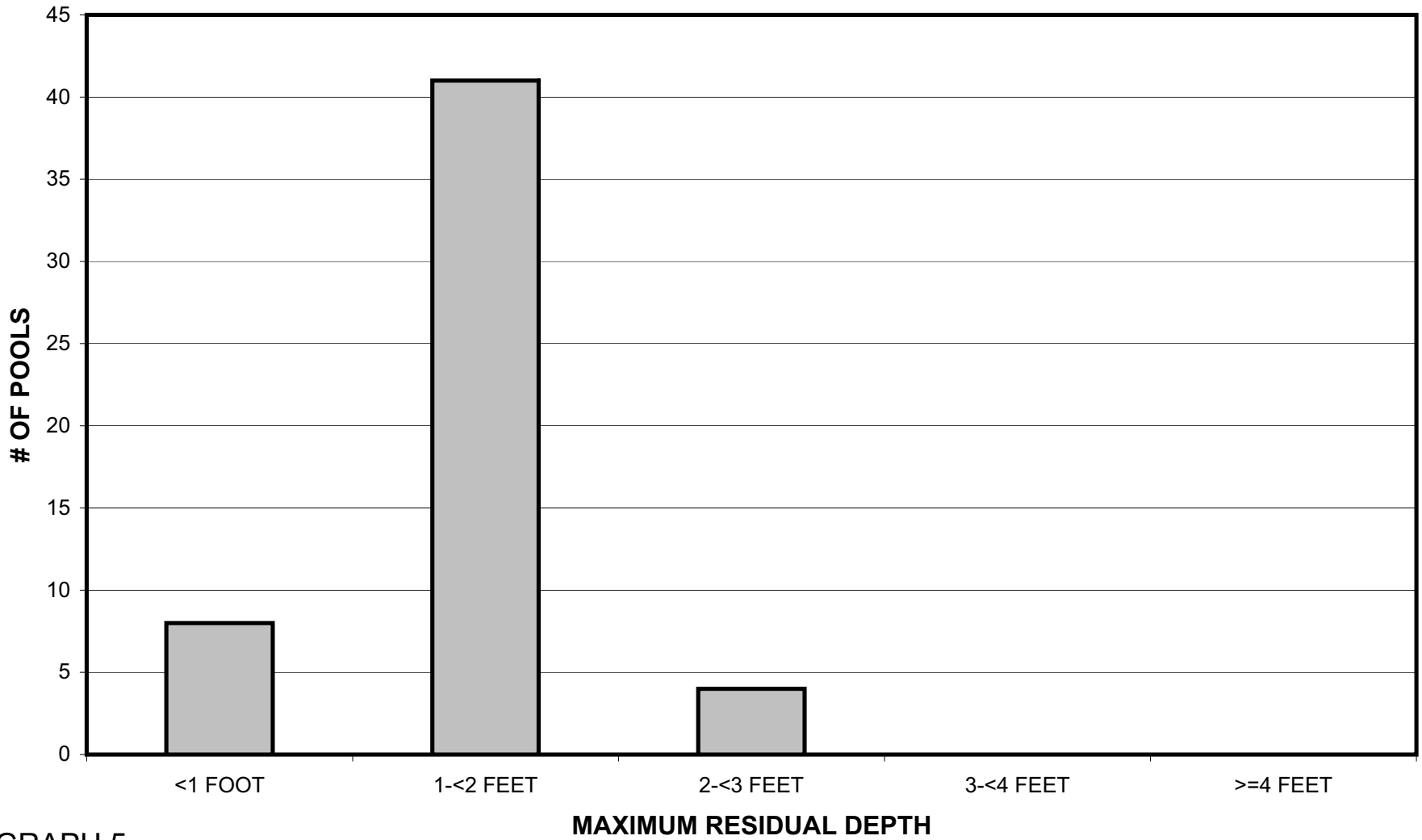
GRAPH 3

1237854401029 2009
POOL TYPES BY PERCENT OCCURRENCE



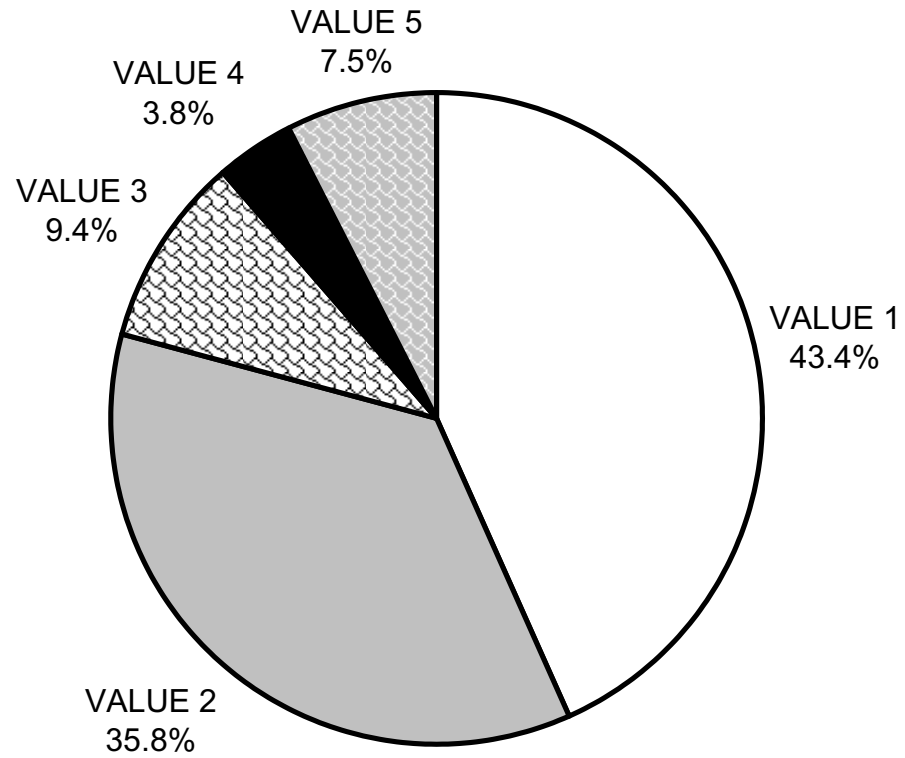
GRAPH 4

1237854401029 2009
MAXIMUM DEPTH IN POOLS



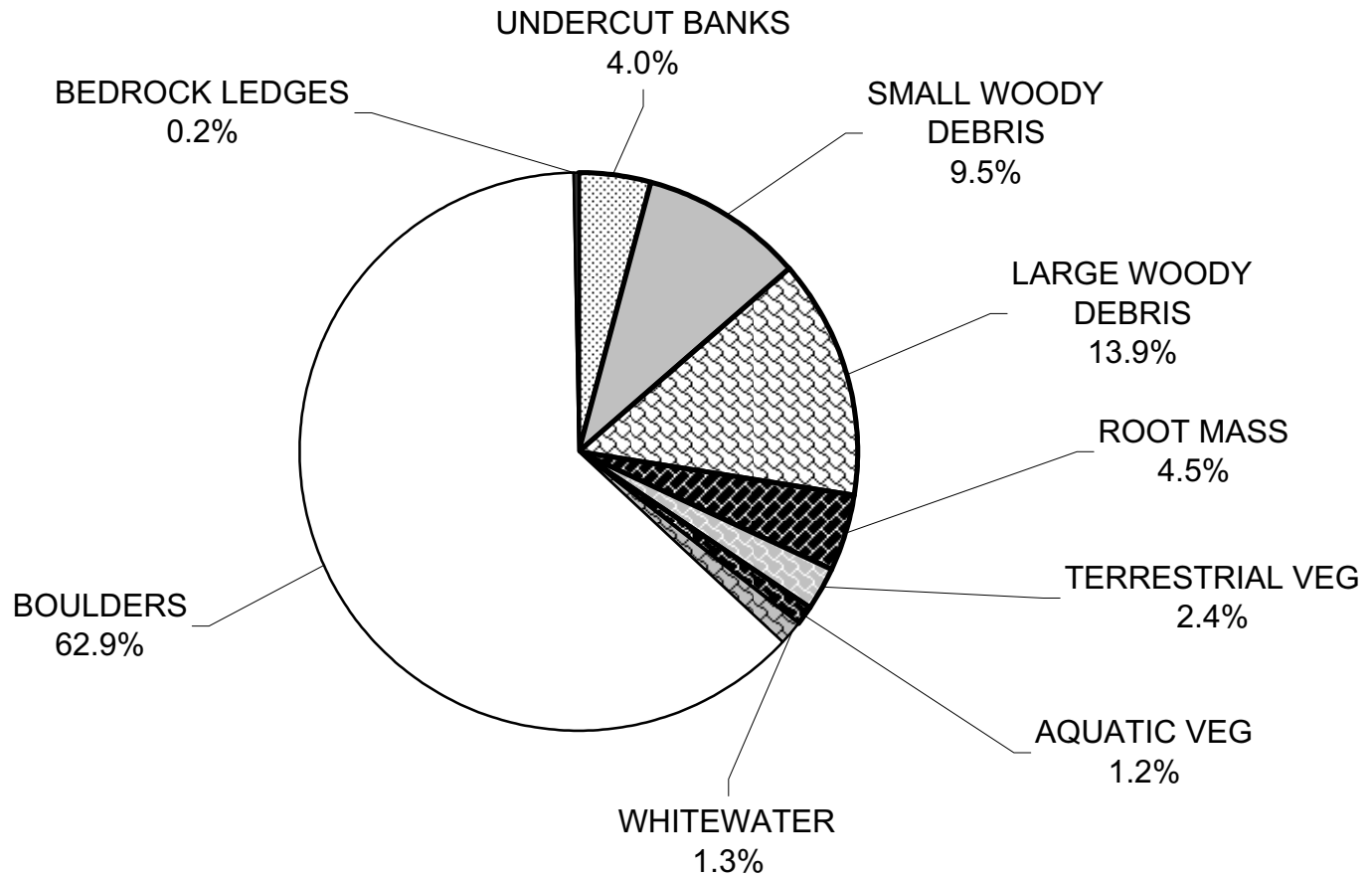
GRAPH 5

1237854401029 2009
PERCENT EMBEDDEDNESS



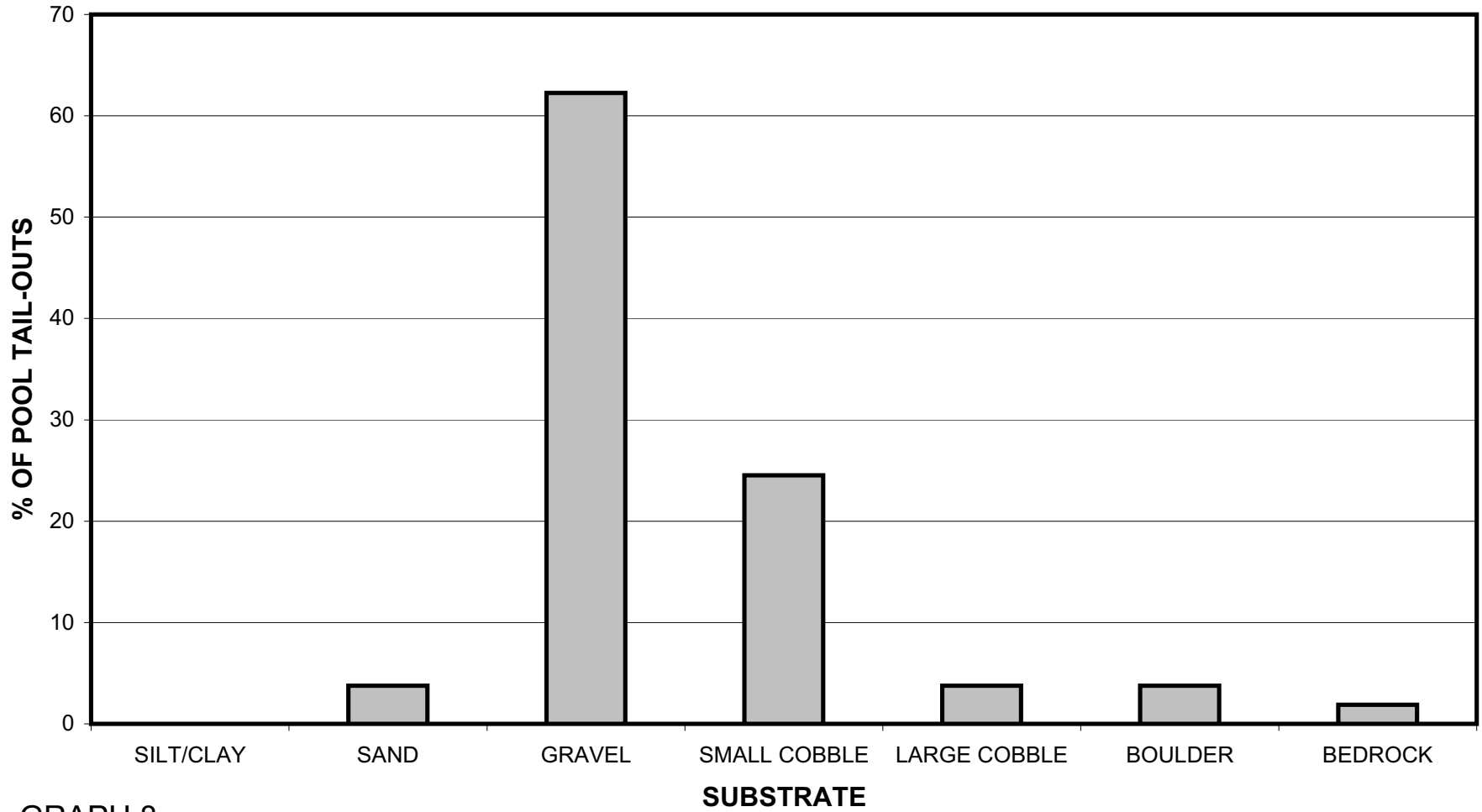
GRAPH 6

1237854401029 2009
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

1237854401029 2009
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



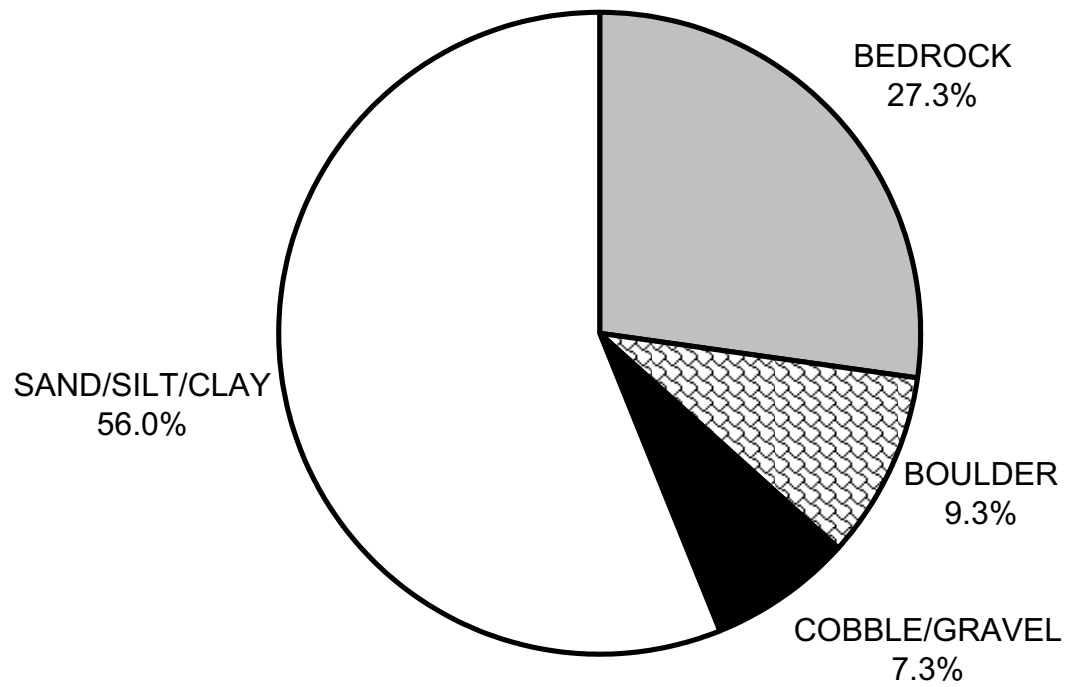
GRAPH 8

**1237854401029 2009
MEAN PERCENT CANOPY**



GRAPH 9

1237854401029 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH



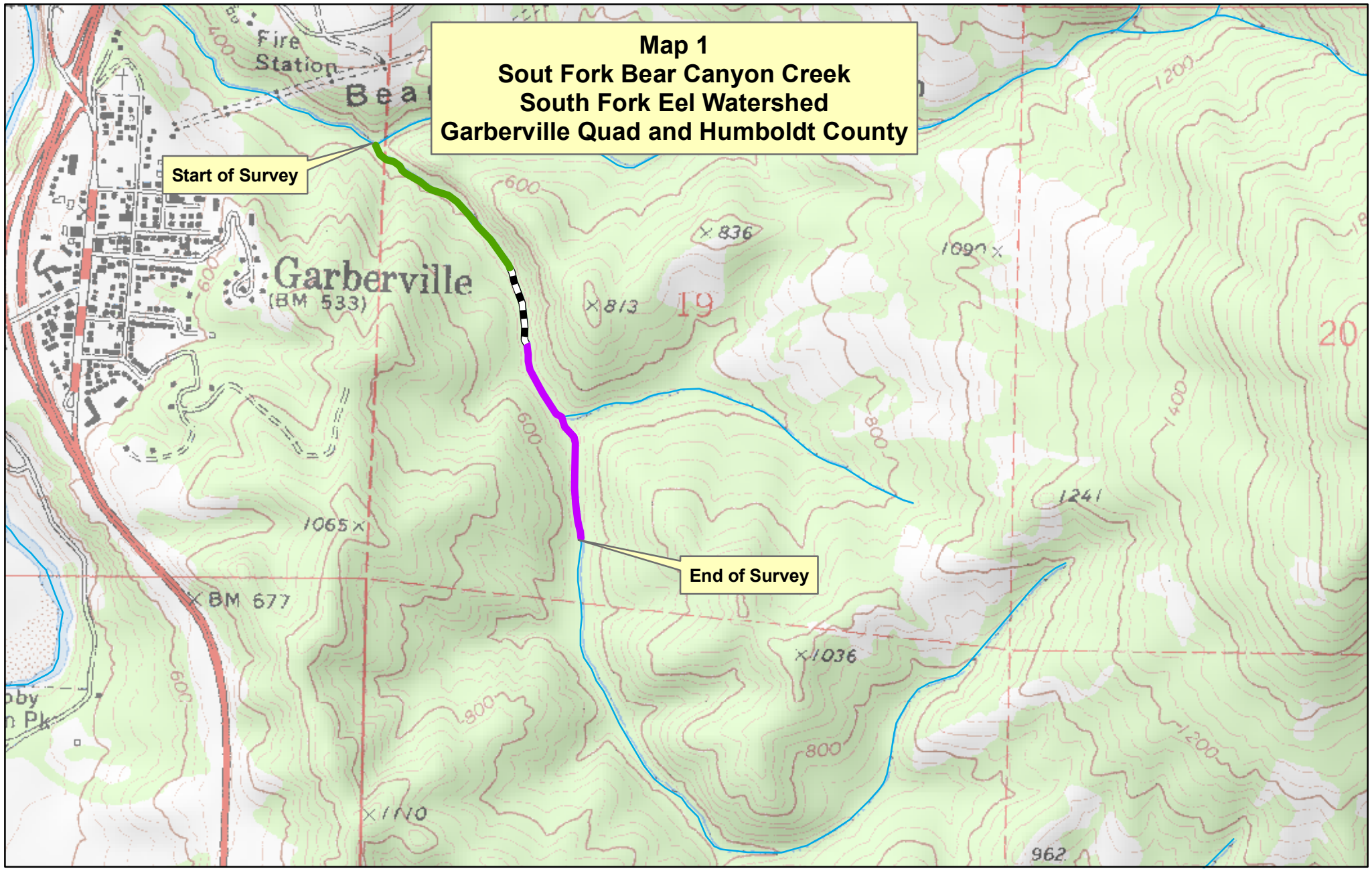
GRAPH 10

1237854401029 2009
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11




Map 1
Sout Fork Bear Canyon Creek
South Fork Eel Watershed
Garberville Quad and Humboldt County



Start of Survey

End of Survey

Legend

-  Reach 1, G4 Channel Type
-  Reach 2, A2 Channel Type
-  Reach 3, G4 Channel Type

