

STREAM INVENTORY REPORT

Big Rock Creek

INTRODUCTION

A stream inventory was conducted from July 13 to July 22, 2009 on Big Rock Creek. The survey began at the confluence with Tenmile Creek and extended upstream 3.9 miles.

The Big Rock 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 Big Rock 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

Big Rock Creek is a tributary to Tenmile Creek, tributary to South Fork Eel River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Big Rock Creek's legal description at the confluence with Tenmile Creek is T22N R15W S27. Its location is 39.7360 north latitude and 123.5150 west longitude, LLID number 1235139397361. Big Rock Creek is a first order stream and has approximately 4.7 miles of blue line stream according to the USGS Cahto Peak 7.5 minute quadrangle. Big Rock Creek drains a watershed of approximately 3.2 square miles. Elevations range from about 1,480 feet at the mouth of the creek to 2,700 feet in the headwater areas. Mixed hardwood and mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for rangeland, agriculture and recreation. Vehicle access exists via Highway 101, four miles north of Laytonville. A private driveway was used to access the creek.

METHODS

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

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and

Big Rock Creek

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 Big Rock 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". Big Rock 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.

Big Rock Creek

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Big Rock 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 Big Rock 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 densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Big Rock 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 Big Rock 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.

Big Rock Creek

10. Large Woody Debris Count:

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

11. Average Bankfull Width:

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

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Big Rock Creek. In addition, underwater observations were made at 13 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

Big Rock Creek

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Big Rock 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 July 13 to July 22, 2009, was conducted by J. Coombes and J. Ferreira (WSP). The total length of the stream surveyed was 21,020 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.25 cfs on July 13, 2009.

Big Rock Creek is an F4 channel type for 9,777 feet of the stream surveyed (Reach 1), and an A3 channel type for 11,243 feet of the stream surveyed (Reach 2). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A3 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 58 to 68 degrees Fahrenheit. Air temperatures ranged from 54 to 91 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% pool units, 35% riffle units, and 19% flatwater units (Graph 1). Based on total length of Level II habitat types there were 44% pool units, 32% riffle units, and 24% flatwater units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 32%; low gradient riffle units, 22%; run units, 12%; and high gradient riffle units, 12% (Graph 3). Based on percent total length, mid-channel pool units made up 29%, low gradient riffle units 19%, and step run units 13%.

Big Rock Creek

A total of 186 pools were identified (Table 3). Main channel pools were the most frequently encountered at 77% (Graph 4), and comprised 74% 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. Seventy-two of the 186 pools (39%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 186 pool tail-outs measured, 67 had a value of 1 (36%); 76 had a value of 2 (41%); 17 had a value of 3 (9%); 26 had a value of 5 (14%) (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 7, flatwater habitat types had a mean shelter rating of 2, and pool habitats had a mean shelter rating of 27 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 29. Scour pools had a mean shelter rating of 21 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Big Rock Creek. Graph 7 describes the pool cover in Big Rock Creek. Boulders are the dominant pool cover type followed by root mass.

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 40% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 33% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Big Rock Creek was 77%. Twenty-three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 85% and 15%, respectively. Graph 9 describes the mean percent canopy in Big Rock Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 84%. The mean percent left bank vegetated was 87%. The dominant elements composing the structure of the stream banks consisted of 85% sand/silt/clay, 9% bedrock, 4% boulder, and 2% cobble/gravel. (Graph 10). Deciduous trees were the dominant vegetation type observed in 78% of the units surveyed. Additionally, 12% of the units surveyed had coniferous trees as the dominant vegetation type, and 8% had grass as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Thirteen sites were snorkel surveyed for species composition and distribution in Big Rock Creek on July 27, 2009. Water temperatures taken during the snorkeling period of 1211 to 1455 ranged

Big Rock Creek

from 69 to 70 degrees Fahrenheit. Air temperatures ranged from 85 to 92 degrees Fahrenheit. The sites were sampled by I. Mikus (DFG).

In reach 1, which comprised the first 9,777 feet of stream, six sites were sampled. The reach sites yielded 58 young-of-the-year steelhead/rainbow trout (SH/RT), 3 age 1+ SH/RT and 1 age 2+ SH/RT, 16 coho, 1 Sacramento pikeminnow, and 183 California roach.

In reach 2, seven sites were sampled starting approximately 9,777 feet from the confluence with Tenmile creek and continuing upstream 11,243 feet. The reach sites yielded 129 young-of-the-year SH/RT, 8 age 1+ SH/RT, 2 age 2+ SH/RT, 8 coho, and 7 California roach.

The following chart displays the information yielded from these sites:

2009 Big Rock 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: F4 Channel Type									
07/27/09	1	084	4.2	3,633	12	0	0	0	0
07/27/09	2	098	4.2	4,565	11	0	0	0	0
07/27/09	3	105	5.4	5,131	17	0	0	0	0
07/27/09	4	110	4.2	5,611	4	0	0	0	0
07/27/09	5	114	4.2	5,791	6	0	0	2	0
07/27/09	6	151	4.2	8,429	8	3	1	14	0
Reach 2: A3 Channel Type									
07/27/09	7	173	4.2	9,922	10	2	0	8	0
07/27/09	8	229	4.2	12,779	37	0	0	0	0
07/27/09	9	233	4.2	13,008	46	2	0	0	0
07/27/09	10	236	4.2	13,250	6	2	0	0	0
07/27/09	11	238	4.4	13,317	24	1	0	0	0
07/27/09	12	387	4.2	20,242	4	0	0	0	0
07/27/09	13	389	4.2	20,290	2	1	2	0	0

DISCUSSION

Big Rock Creek is an F4 channel type for the first 9,777 feet of stream surveyed and an A3 channel type for the remaining 11,243 feet. The suitability of F4 and A3 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors,

Big Rock Creek

and log cover. A3 channel types are generally not suitable for fish habitat improvement structures due to the high gradient.

The water temperatures recorded on the survey days July 13 to July 22, 2009, ranged from 58 to 68 degrees Fahrenheit. Air temperatures ranged from 54 to 91 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 24% of the total length of this survey, riffles 32%, and pools 44%. Seventy-two of the 186 (39%) 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.

One hundred forty-three of the 186 pool tail-outs measured had embeddedness ratings of 1 or 2. Seventeen of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-six 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.

One hundred thirty-six of the 186 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 27. The shelter rating in the flatwater habitats is 2. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Big Rock Creek. Boulders are the dominant cover type in pools followed by root mass. 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 77%. Reach 1 had a canopy density of 65%, Reach 2 had a canopy density of 87%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 84% and 87%, 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) Big Rock Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are

Big Rock Creek

above those considered optimal for rearing juvenile coho salmon. 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.
- 4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.
- 5) Increase the canopy in Reach 1 on Big Rock Creek by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

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 Tenmile Creek.
25	0002.00	One salmonid young-of-the-year (YOY) observed in this unit.
363	0009.00	Out of influence of confluence with Tenmile Creek.
446	0012.00	There is erosion on the right bank measuring 50' long x 25' high.
560	0014.00	Dry tributary enters the left bank.
634	0017.00	There is erosion on the right bank measuring 70' long x 25' high.
829	0025.00	There is erosion on the left bank measuring 25' long x 20' high.
1368	0038.00	Retaining wall is 2' high x 25' long, consisting of packed large cobble behind chicken wire fence. There is erosion on the left bank measuring 25' long x 15' high. Bank is composed of fines.

Big Rock Creek

1686	0045.00	There is erosion on the left bank measuring 40' long x 20' high.
1861	0048.00	There is erosion on the right bank measuring 50' long x 25' high.
1940	0050.00	Dry tributary enters the left bank.
2036	0052.00	There is a left bank slump measuring 60' long x 11' high. Within the left bank slump there is a recent landslide, measuring 6' long x 11' high. It is depositing fines.
2138	0055.00	There is erosion on the right bank measuring 233' long x 10' high.
2659	0065.00	There is erosion on the left bank measuring 30' long x 6' high.
2857	0067.00	There is erosion on the right bank measuring 268' long x 6' high.
3125	0073.00	There is erosion on the left bank measuring 117' long x 10' high.
3242	0076.00	There is erosion on the left bank measuring 40' long x 10' high.
3573	0083.00	There is erosion on the left bank measuring 25' long x 7' high.
3776	0088.00	There is erosion on the right bank measuring 50' long x 12' high.
4013	0091.00	There is erosion on the right bank measuring 30' long x 15' high. It is contributing fine sediment.
4155	0093.00	There is erosion on the right bank measuring 80' long x 7' high.
4426	0097.00	There is erosion on the left bank measuring 70' long x 6' high.
5473	0110.00	There is a private road with a ford which is 11' wide x 22' long that is in use and not a barrier to salmonids.
6016	0117.00	There is erosion on the right bank measuring 105' long x 4' high.
6327	0122.00	There is erosion on the right bank measuring 50' long x 75' high. It is depositing fines to large cobble, and is vegetated 15% with grass and brush.
6476	0126.00	Dry tributary enters left bank. An unnamed road fords the creek. It is not in use and is not a barrier to salmonids.
6558	0127.00	A metal fence crosses the creek, and it is serving as a property divider. It is not a barrier to fish passage.

Big Rock Creek

6617	0128.00	There is erosion on the left bank measuring 20' long x 8' high.
7216	0136.00	An unnamed road fords creek. It is not a barrier to salmonids.
7933	0146.00	There is erosion on the right bank measuring 100' long x 8' high. It is depositing fines to large cobble, and is vegetated 30% with hardwood and brush.
9085	0161.00	Bridge #02 is a private road named Five Oaks Road, and is 7.5' high x 9' wide x 85' long. It is a rail car bridge made of metal and is not a barrier to salmonids.
9222	0163.00	There is erosion on the right bank; it measures 101' long x 10' high.
9777	0171.00	Channel type is an A3 for the rest of the survey. Channel type cross-section location is at Habitat Unit (HU) #378.
9922	0174.00	Dry tributary enters left bank.
10795	0193.00	There is a small woody debris accumulation. Retained sediment ranges from fines to large cobble and measures 10' wide x 20' long x 4' high. Water is seeping through debris accumulation.
10843	0195.00	Dry tributary enters left bank.
10997	0197.00	Log debris accumulation (LDA) 001 contains 6 pieces of large woody debris (LWD) and measures 3' high x 15' wide x 20' long with water flowing through and visible gaps. Retaining sediment ranges from fines to large cobble and measures 4' wide x 20' long x 6' deep. Fish are seen above the LDA, and it is not a barrier to juvenile and adult salmonids.
11031	0198.00	Dry tributary enters left bank.
11690	0210.00	There is erosion on the left bank; it measures 40' long x 4' high.
11777	0212.00	There is erosion on the right bank; it measures 70' long x 6' high.
11966	0215.00	There is erosion on the left bank; it measures 20' long x 10' high. It is depositing fines to large cobble.
12311	0222.00	There is erosion on the right bank it measures 200' long x 8' high.
12511	0224.00	Bridge #03 is a private road named Green Bridge Road, and is 12.5' high x 8' wide x 85' long. It is a rail car bridge made of metal and it is not a barrier to salmonids.

Big Rock Creek

12756	0229.00	Dry tributary enters left bank.
12922	0232.00	There is erosion on the left bank; it measures 50' long x 6' high.
13008	0234.00	There is erosion on the left bank; it measures 50' long x 30' high.
13271	0238.00	There is erosion on the right bank; it measures 30' long x 40' high. It is depositing fines to large cobble, and is vegetated 60% with grass and hardwood.
13420	0240.00	Tributary #01 enters on the right bank, the flow is 0.01 cfs, and it contributes to <5% of the downstream flow. The temperature downstream of the tributary is 64 degrees Fahrenheit, the temperature of the tributary is 59 degrees Fahrenheit, and the temperature upstream of the confluence is 65 degrees Fahrenheit. The slope of the tributary is 30% and fish are not observed in the 100 feet surveyed.
13676	0244.00	There is erosion on the right bank that measures 30' long x 50' high. It is depositing fines to large cobble, and is vegetated 5% with brush.
13834	0248.00	There is erosion on the left bank; it measures 15' long x 5' high. It is depositing fines to large cobble.
14064	0252.00	There is erosion on the right bank that measures 30' long x 20' high. It is depositing fines to boulder, and is vegetated 25% with grass.
14728	0263.00	There is erosion on the right bank that measures 20' long x 30' high. It is depositing fines to large cobble, and is vegetated 0%.
16071	0286.00	There is erosion on the right bank that measures 20' long x 30' high. It is depositing fines to boulder, and is vegetated 0%.
16153	0288.00	An private road ford is 9' wide x 11' long and is not in use and is not a barrier to salmonids.
16979	0303.00	LDA #02 contains 3 pieces of LWD and measures 6' high x 30' wide x 3' long with water flowing through and visible gaps. Retained sediment ranges from fines to boulder and measures 5' wide x 10' long x 4' deep. Fish are seen above the LDA and it is not a barrier to juvenile and adult salmonids.
17711	0320.00	Dry tributary enters the right bank.
17859	0323.00	There is erosion on the right bank that measures 15' long x 10' high. It is depositing fines to small cobble.

Big Rock Creek

17994	0327.00	There is erosion on the left bank that measures 80' long x 40' high. It is depositing fines to boulders and is vegetated 5% with brush.
18074	0328.00	There is a 3' plunge at the top of this unit. It is not a barrier to salmonids.
18093	0329.00	There is a 2.5' plunge at the top of this unit. It is not a barrier to salmonids.
18268	0335.00	There is a 2' plunge at the top of this unit. It is not a barrier to salmonids.
18420	0338.00	There is a 2' plunge at the top of this unit. It is not a barrier to salmonids.
18569	0344.00	There is a 2.5' plunge at the top of this unit. It is not a barrier to salmonids.
18602	0345.00	There is five pieces of LWD partially blocking the channel. Retained sediment ranges from fines to small cobble and measures 3' wide x 6' long x 2' deep.
18976	0356.00	There is erosion on the left bank that measures 40' long x 30' high. It is depositing fines to boulder and is vegetated 40% with grass.
19195	0358.00	There is a 4.7' plunge at the top of this unit. It is not a barrier to salmonids.
19397	0363.00	Dry tributary enters the left bank.
19768	0376.00	Dry tributary enters the left bank.
20215	0387.00	There is a 3' at the top of this unit. It is not a barrier to salmonids.
20290	0390.00	Dry tributary enters left bank.
21020	0401.00	End of survey due to 15' high bedrock waterfall with a 4' pool at base of falls. It appears to be a natural barrier. An unknown 1+ is observed in the pool.

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.

Big Rock Creek

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{1}
High Gradient Riffle	(HGR)	[1.2]	{2}

CASCADE

Cascade	(CAS)	[2.1]	{3}
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{9}

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{7}
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

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

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0

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
76	10	FLATWATER	19.0	68	5142	24.5	7.5	0.5	0.9	466	35438	211	16008		2
186	186	POOL	46.4	49	9177	43.7	10.5	0.9	2.0	531	98821	679	126257	561	27
139	21	RIFFLE	34.7	48	6701	31.9	8.2	0.4	0.8	298	41435	113	15751		7
Total Units 401	Total Units Fully Measured 217				Total Length (ft.) 21020					Total Area (sq.ft.) 175693			Total Volume (cu.ft.) 158016		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

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 (%)
90	15	LGR	22.4	45	4069	19.4	9	0.4	1.1	358	32239	130	11679		3	78
48	5	HGR	12.0	54	2615	12.4	7	0.5	1.1	161	7714	78	3758		20	84
1	1	CAS	0.2	17	17	0.1	7	0.5	1.1	83	83	42	42		5	94
47	7	RUN	11.7	52	2423	11.5	7	0.5	1.4	239	11244	112	5271		2	70
29	3	SRN	7.2	94	2719	12.9	8	0.5	1.1	996	28886	440	12773		2	65
130	130	MCP	32.4	47	6161	29.3	11	0.9	5.8	524	68184	688	89432	572	28	77
14	14	STP	3.5	48	667	3.2	8	0.7	2.4	354	4962	343	4807	251	38	83
1	1	CRP	0.2	40	40	0.2	14	0.6	1.5	532	532	532	532	319	5	73
1	1	LSL	0.2	31	31	0.1	6	0.3	1.1	186	186	93	93	56	80	37
16	16	LSR	4.0	67	1068	5.1	11	0.7	3.8	831	13292	955	15279	786	32	86
20	20	LSBk	5.0	51	1021	4.9	9	1.0	5.2	506	10119	723	14470	617	7	70
3	3	LSBo	0.7	53	159	0.8	7	0.5	1.9	432	1295	296	887	201	33	69
1	1	PLP	0.2	30	30	0.1	14	2.6	5.6	252	252	756	756	655	40	85

Total Units
401

Total Units Fully Measured
217

Total Length (ft.)
21020

Total Area (sq.ft.)
178987

Total Volume (cu.ft.)
159779

Table 3 - Summary of Pool Types

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

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
144	144	MAIN	77	47	6828	74	10.7	0.9	508	73146	541	77843	29
42	42	SCOUR	23	56	2349	26	10.0	0.9	611	25676	632	26554	21
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
186	186				9177					98821		104397	

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

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

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
130	MCP	70	1	1	76	58	33	25	16	12	4	3
14	STP	8	0	0	11	79	3	21	0	0	0	0
1	CRP	1	0	0	1	100	0	0	0	0	0	0
1	LSL	1	0	0	1	100	0	0	0	0	0	0
16	LSR	9	0	0	9	56	4	25	3	19	0	0
20	LSBk	11	0	0	12	60	3	15	4	20	1	5
3	LSBo	2	0	0	3	100	0	0	0	0	0	0
1	PLP	1	0	0	0	0	0	0	0	0	1	100
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
186			1	1	113	61	43	23	23	12	6	3

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Dry Units: 0

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

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
90	15	LGR	0	5	0	20	0	0	0	75	0
48	5	HGR	0	0	0	0	0	0	10	90	0
1	1	CAS	0	0	0	0	0	0	0	100	0
139	21	TOTAL RIFFLE	0	3	0	13	0	0	2	81	0
47	7	RUN	0	0	50	0	0	0	0	50	0
29	3	SRN	40	0	0	0	0	0	0	60	0
76	10	TOTAL FLAT	13	0	33	0	0	0	0	53	0
130	130	MCP	13	0	33	0	0	0	0	53	0
14	14	STP	10	15	12	17	0	1	2	41	3
1	1	CRP	0	0	0	0	0	0	0	100	0
1	1	LSL	0	20	80	0	0	0	0	0	0
16	16	LSR	34	8	10	41	0	3	0	4	0
20	20	LSBk	9	7	9	12	0	0	0	50	14
3	3	LSBo	0	7	13	0	0	0	0	80	0
1	1	PLP	0	0	0	0	0	0	20	60	20
186	186	TOTAL POOL	12	13	11	18	0	1	2	40	3
401	217	TOTAL	11	12	11	17	0	1	2	42	3

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Dry Units: 0

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

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
90	15	LGR	0	0	0	20	53	20	7
48	5	HGR	0	0	0	20	40	40	0
1	1	CAS	0	0	0	0	0	0	100
47	7	RUN	0	14	0	43	29	14	0
29	3	SRN	0	0	0	67	0	33	0
130	130	MCP	0	12	25	14	23	23	4
14	14	STP	0	7	7	14	7	50	14
1	1	CRP	0	0	0	0	100	0	0
1	1	LSL	0	0	0	100	0	0	0
16	16	LSR	0	0	50	31	19	0	0
20	20	LSBk	0	20	20	10	25	15	10
3	3	LSBo	0	0	0	33	0	67	0
1	1	PLP	0	0	0	0	0	100	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Big Rock Creek LLID: 1235139397361 Drainage: Eel River - South Fork
Survey Dates: 7/13/2009 to 7/22/2009
Confluence Location: Quad: CAHTO PEAK Legal Description: T22NR15WS27 Latitude: 39:44:10.0N Longitude: 123:30:50.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
77	15	85	0	84	87

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: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Survey Length (ft.): 21020

Main Channel (ft.): 21020

Side Channel (ft.): 0

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4

Reach Length (ft.): 9777

Riffle/Flatwater Mean Width (ft.): 8.7

BFW:

Range (ft.): 26 to 123

Mean (ft.): 47

Std. Dev.: 22

Base Flow (cfs.): 0.3

Water (F): 58 - 68

Air (F): 54 - 91

Dry Channel (ft): 0

Canopy Density (%): 64.8

Coniferous Component (%): 29.5

Hardwood Component (%): 70.5

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 81.6

Dominant Shelter: Root masses

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 11

LWD per 100 ft.:

Riffles: 1

Pools: 2

Flat: 1

Pools by Stream Length (%): 55.9

Pool Frequency (%): 50.6

Residual Pool Depth (%):

< 2 Feet Deep: 50

2 to 2.9 Feet Deep: 28

3 to 3.9 Feet Deep: 17

>= 4 Feet Deep: 5

Mean Max Residual Pool Depth (ft.): 2.2

Mean Pool Shelter Rating: 22

Pool Tail Substrate (%): Silt/Clay: 1

Sand: 0

Gravel: 49

Sm Cobble: 37

Lg Cobble: 9

Boulder: 1

Bedrock: 2

Embeddedness Values (%): 1. 55.8

2. 38.4

3. 2.3

4. 0.0

5. 3.5

STREAM REACH: 2

Channel Type: A3

Reach Length (ft.): 11243

Riffle/Flatwater Mean Width (ft.): 7.4

BFW:

Range (ft.): 14 to 45

Mean (ft.): 28

Std. Dev.: 7

Base Flow (cfs.): 0.3

Water (F): 60 - 68

Air (F): 64 - 89

Dry Channel (ft): 0

Canopy Density (%): 87.1

Coniferous Component (%): 3.7

Hardwood Component (%): 96.3

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 88.6

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 7

LWD per 100 ft.:

Riffles: 2

Pools: 4

Flat: 2

Pools by Stream Length (%): 33.0

Pool Frequency (%): 43.3

Residual Pool Depth (%):

< 2 Feet Deep: 71

2 to 2.9 Feet Deep: 19

3 to 3.9 Feet Deep: 8

>= 4 Feet Deep: 2

Mean Max Residual Pool Depth (ft.): 1.8

Mean Pool Shelter Rating: 32

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 32

Sm Cobble: 30

Lg Cobble: 16

Boulder: 18

Bedrock: 4

Embeddedness Values (%): 1. 19.0

2. 43.0

3. 15.0

4. 0.0

5. 23.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

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	20	18	8.8
Boulder	14	5	4.4
Cobble / Gravel	4	6	2.3
Sand / Silt / Clay	179	188	84.6

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	9	25	7.8
Brush	1	6	1.6
Hardwood Trees	171	169	78.3
Coniferous Trees	36	16	12.0
No Vegetation	0	1	0.2

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Big Rock Creek

LLID: 1235139397361

Drainage: Eel River - South Fork

Survey Dates: 7/13/2009 to 7/22/2009

Confluence Location: Quad: CAHTO PEAK

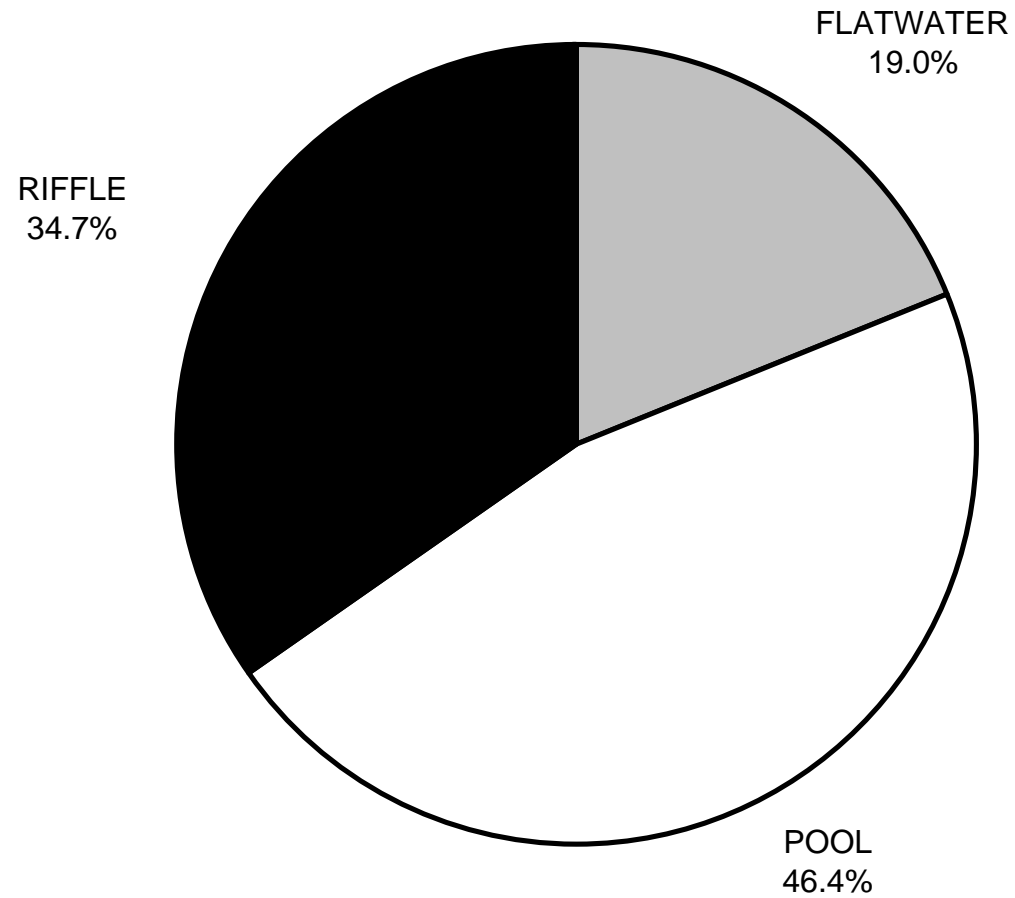
Legal Description: T22NR15WS27

Latitude: 39:44:10.0N

Longitude: 123:30:50.0W

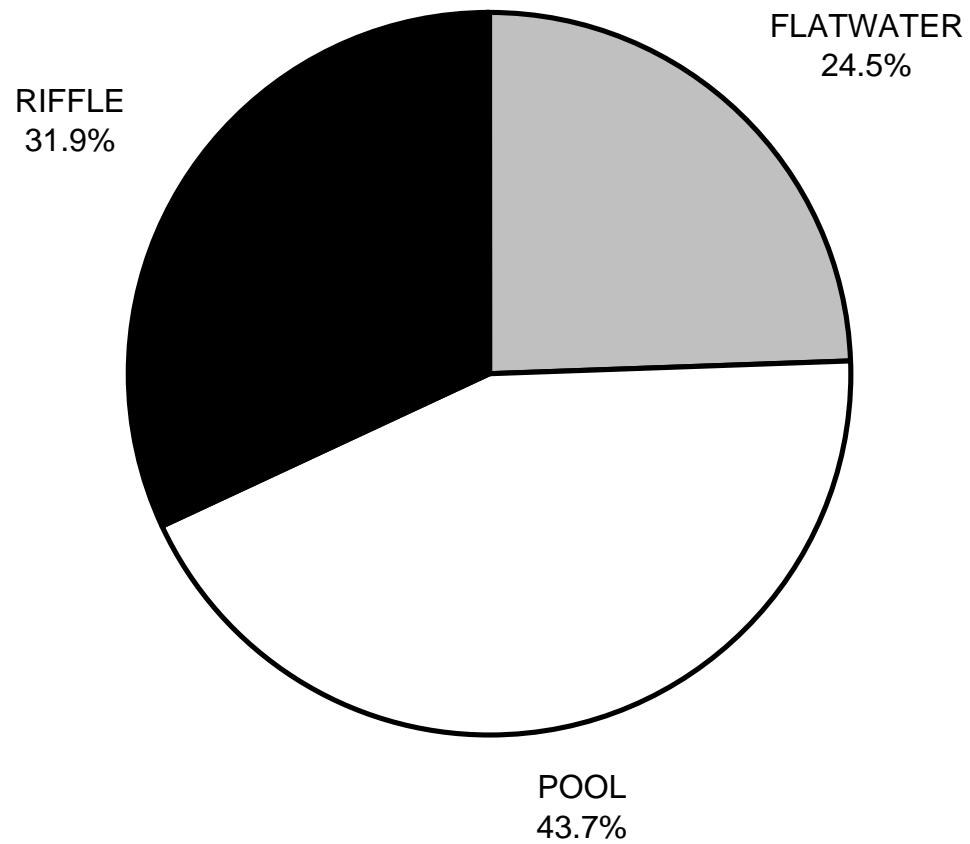
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	13	12
SMALL WOODY DEBRIS (%)	3	0	13
LARGE WOODY DEBRIS (%)	0	33	11
ROOT MASS (%)	13	0	18
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	1
WHITEWATER (%)	2	0	2
BOULDERS (%)	81	53	40
BEDROCK LEDGES (%)	0	0	3

**BIG ROCK CREEK 2009
HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 1

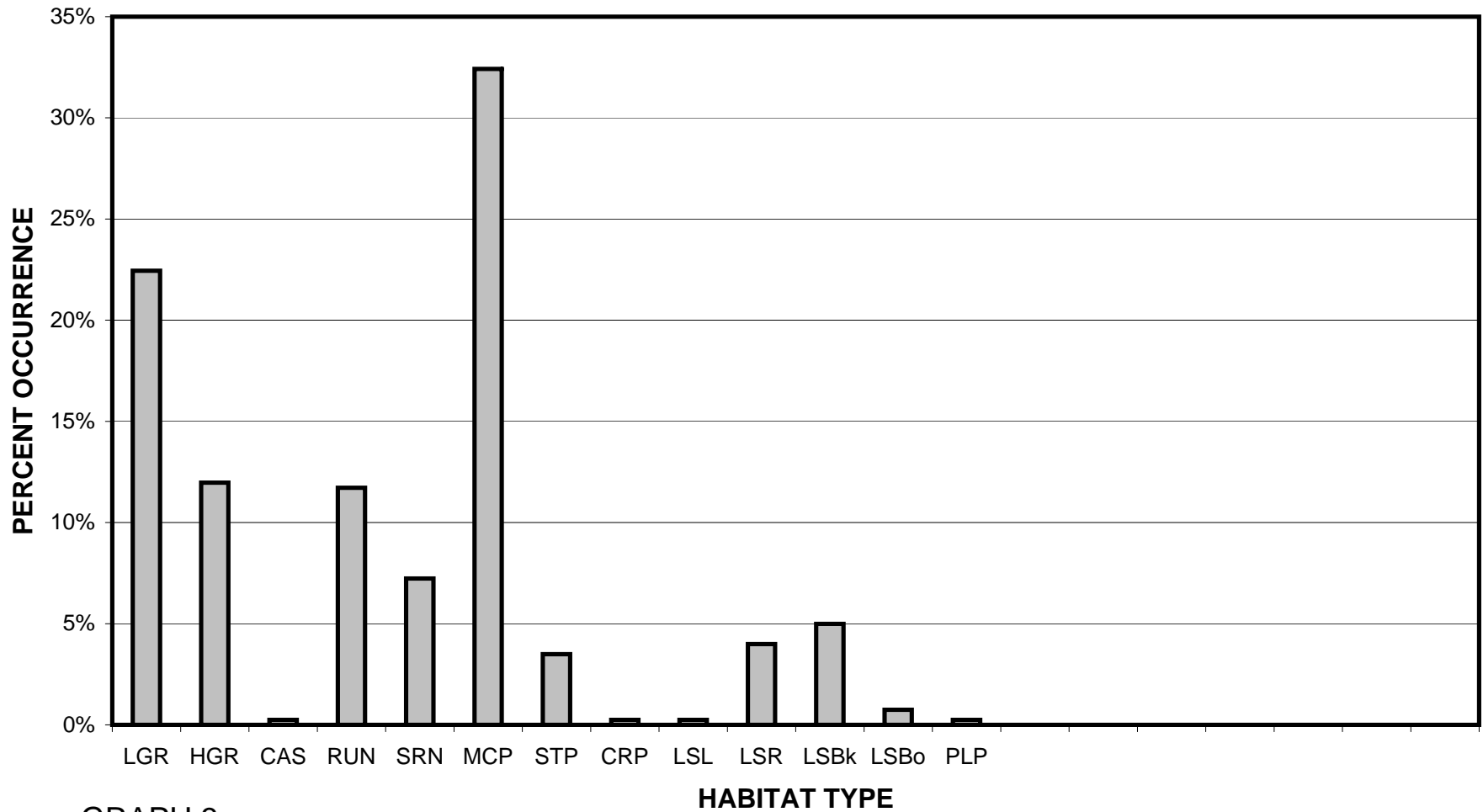
BIG ROCK CREEK 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

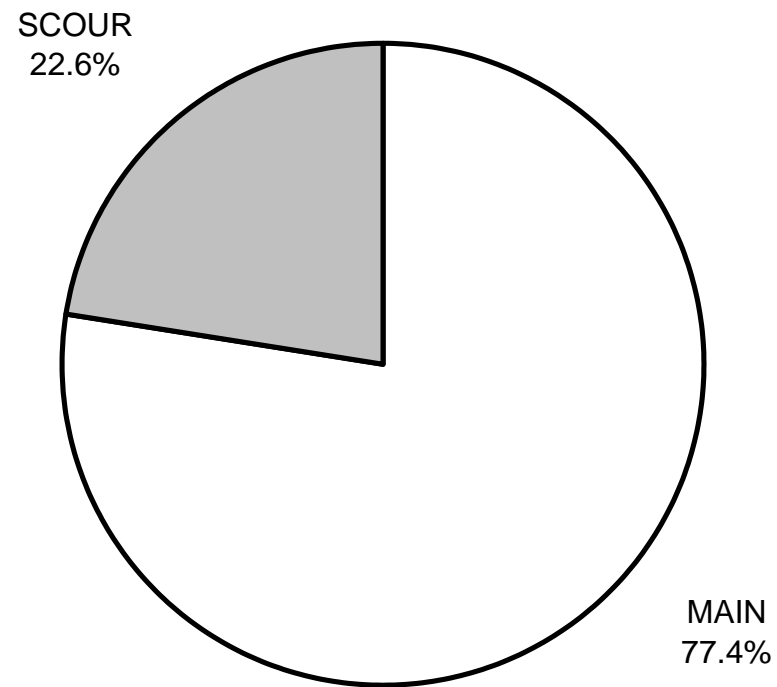
BIG ROCK CREEK 2009

HABITAT TYPES BY PERCENT OCCURRENCE



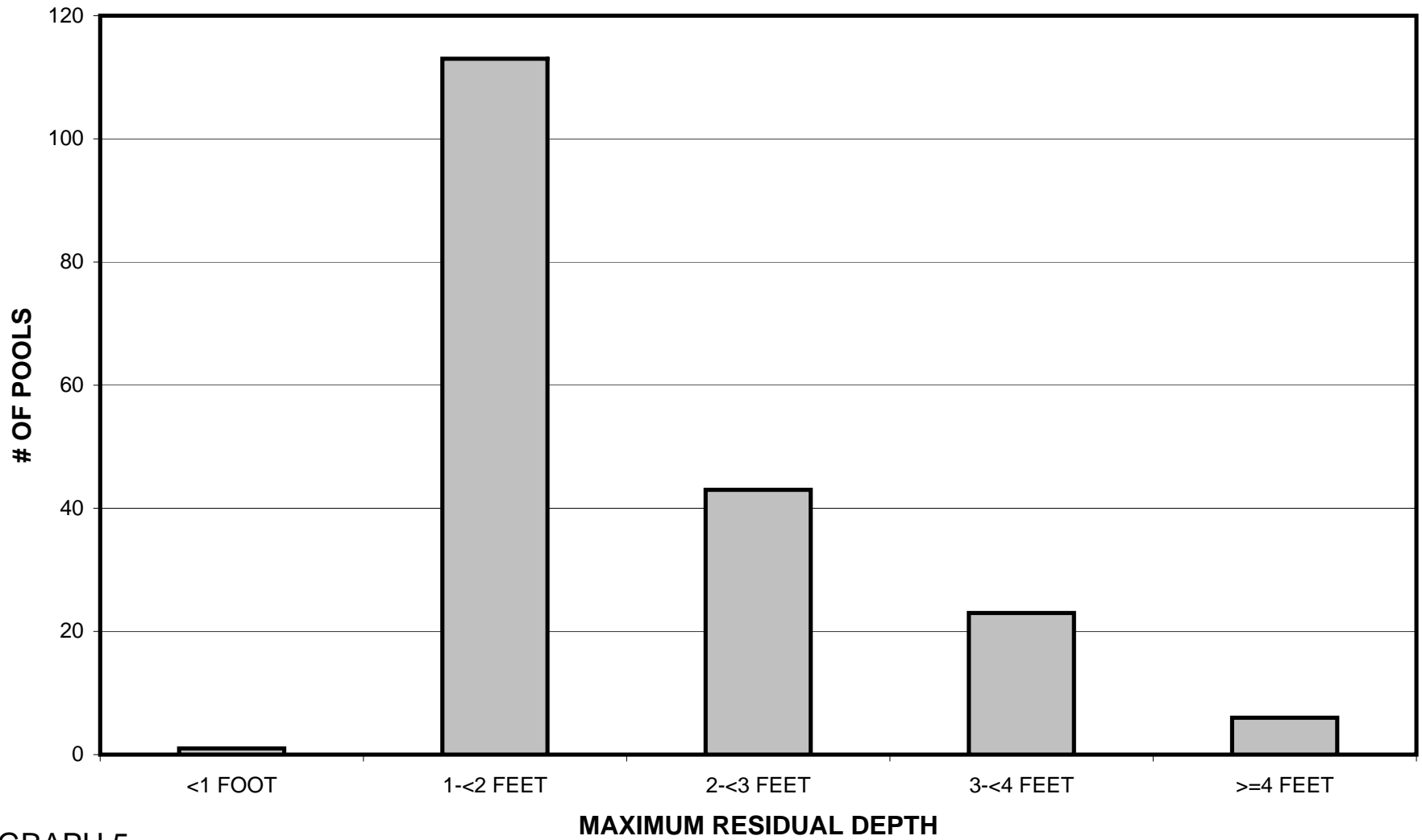
GRAPH 3

**BIG ROCK CREEK 2009
POOL TYPES BY PERCENT OCCURRENCE**



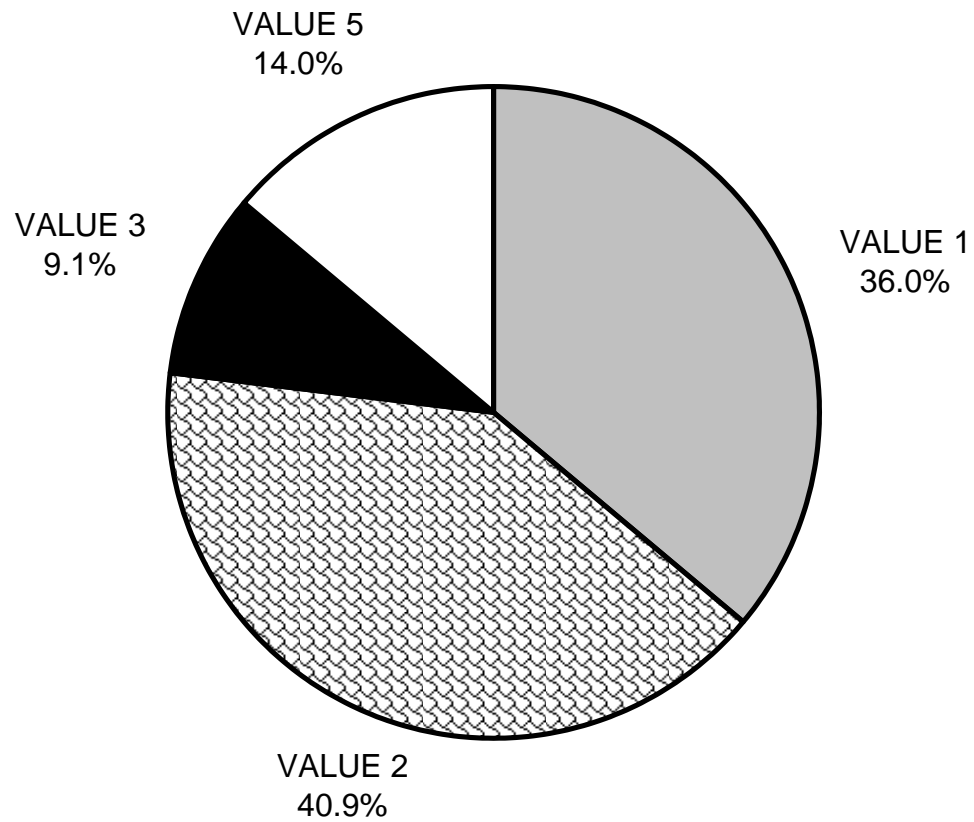
GRAPH 4

BIG ROCK CREEK 2009 MAXIMUM DEPTH IN POOLS



GRAPH 5

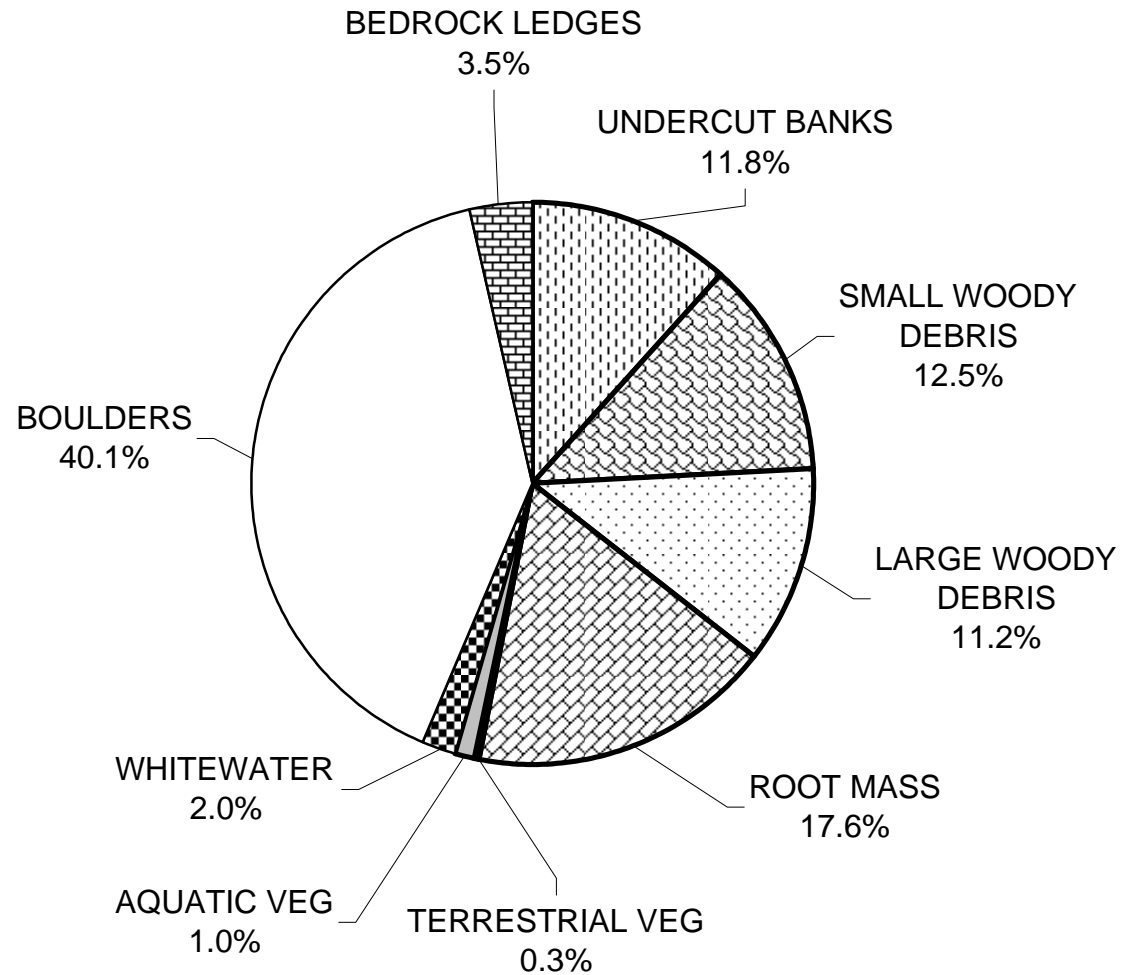
BIG ROCK CREEK 2009 PERCENT EMBEDDEDNESS



GRAPH 6

BIG ROCK CREEK 2009

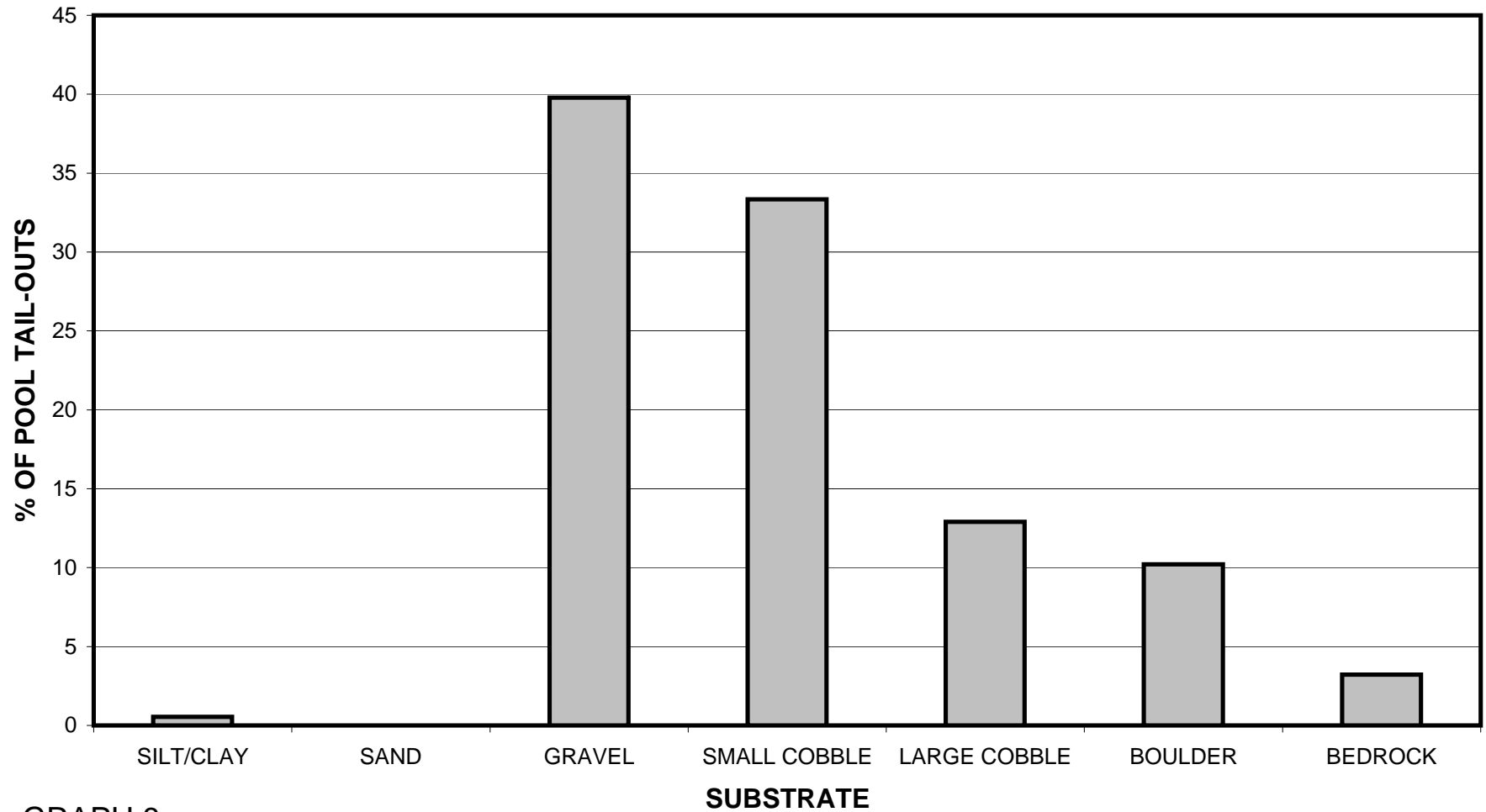
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

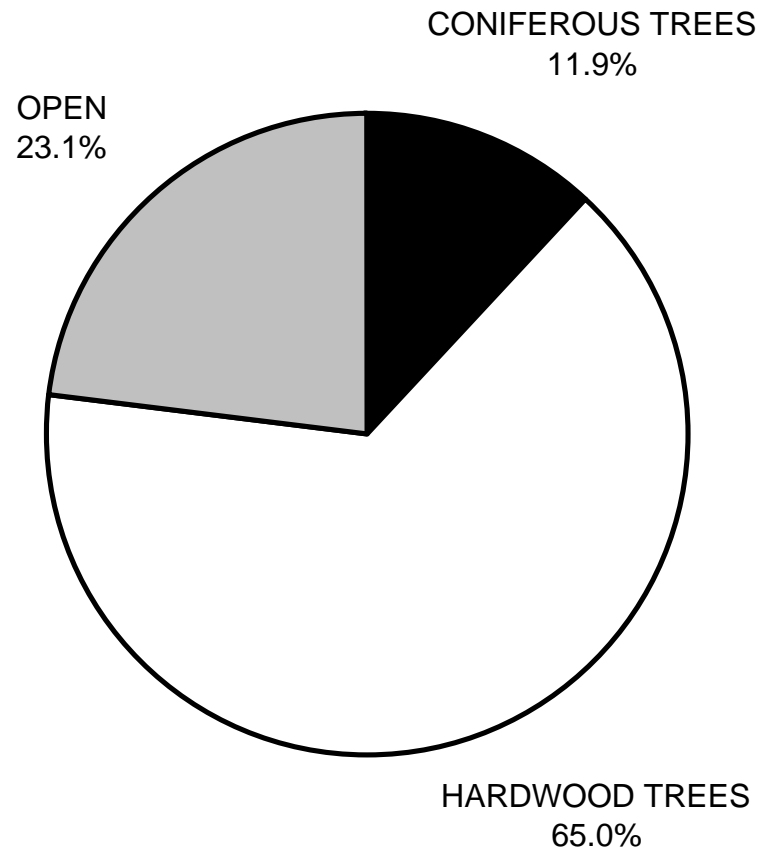
BIG ROCK CREEK 2009

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



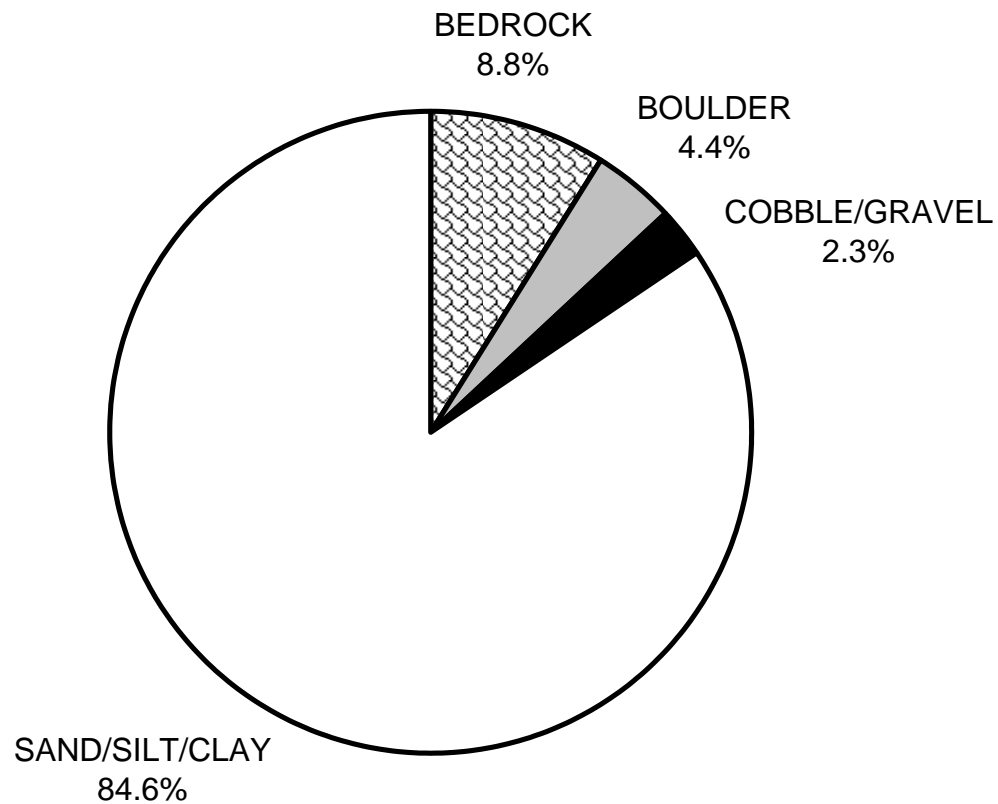
GRAPH 8

BIG ROCK CREEK 2009 MEAN PERCENT CANOPY



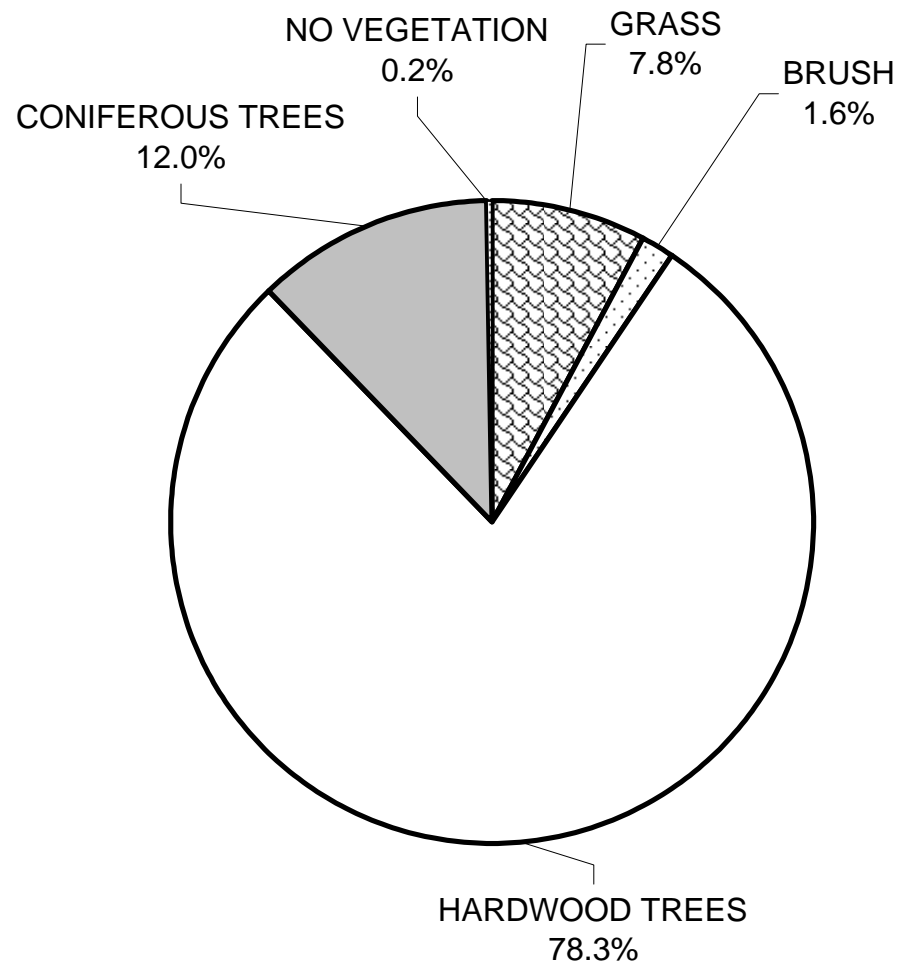
GRAPH 9

**BIG ROCK CREEK 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH**



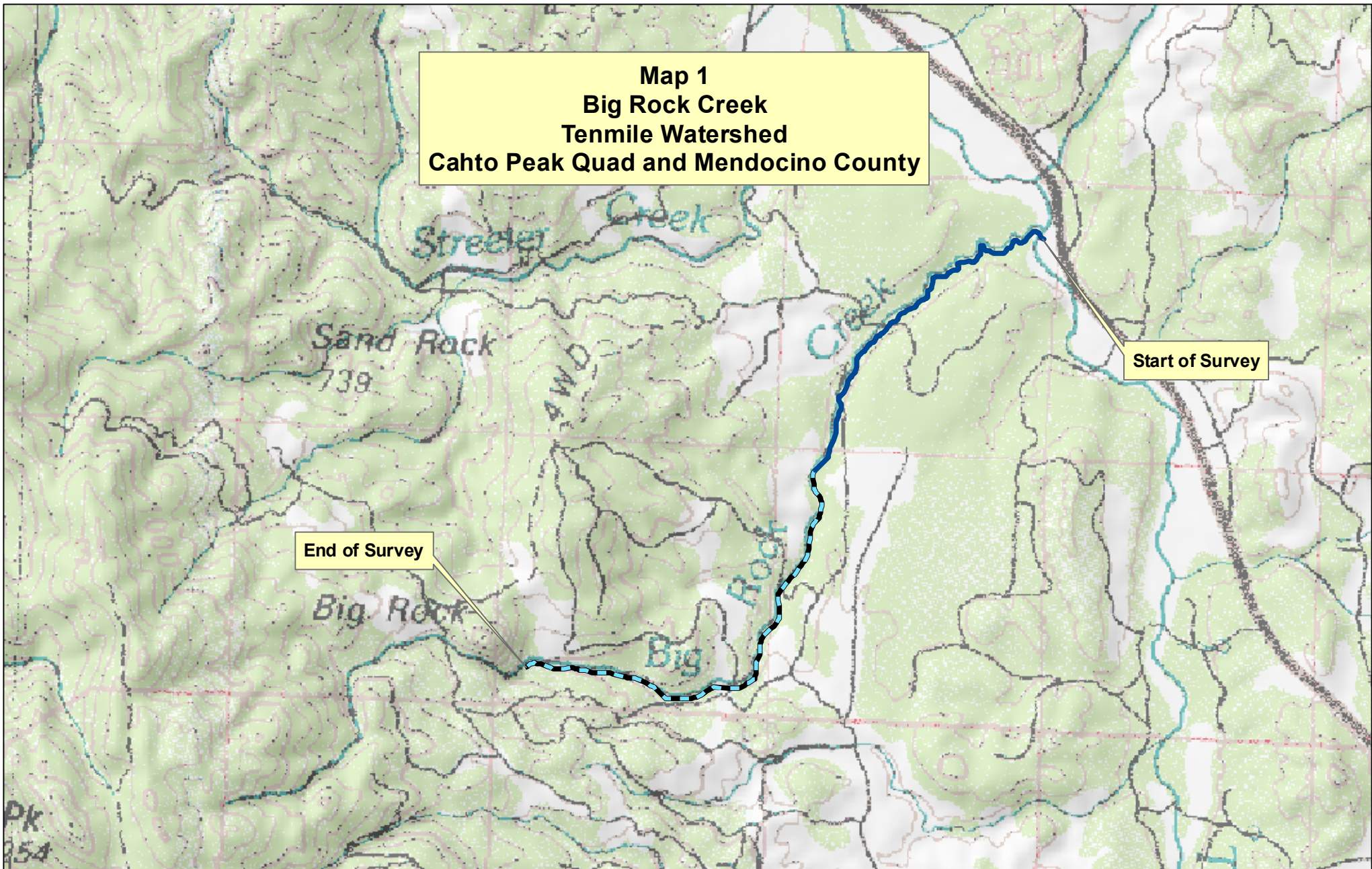
GRAPH 10

BIG ROCK CREEK 2009 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Map 1
Big Rock Creek
Tenmile Watershed
Cahto Peak Quad and Mendocino County



End of Survey

Start of Survey

Legend

- Reach 1, F4 Channel Type
- - - Reach 2, A3 Channel Type

0 1,750 3,500 Feet

