

STREAM INVENTORY REPORT

East Fork Mill Creek

INTRODUCTION

A stream inventory was conducted from October 19 to October 22, 2009 on East Fork Mill Creek. The survey began at the confluence with Mill Creek and extended upstream 4.7 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in East Fork Mill Creek.

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

East Fork Mill Creek is a tributary to Mill Creek, tributary to Smith River, which drains to the Pacific Ocean, located in Del Norte County, California (Map 1). East Fork Mill Creek's legal description at the confluence with Mill Creek is T16N R01E S31. Its location is 41.7345 north latitude and 124.1002 west longitude, LLID number 1240987417345. East Fork Mill Creek is a fourth order stream and has approximately 34.7 miles of blue line stream according to the USGS Childs Hill 7.5 minute quadrangle. East Fork Mill Creek drains a watershed of approximately 16.6 square miles. Elevations range from about 241 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is state parkland and is managed for recreation. Vehicle access exists via Highway 101 to the state park entrances.

METHODS

The habitat inventory conducted in East Fork Mill 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

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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 East Fork Mill 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". East Fork Mill 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 East Fork Mill 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 East Fork Mill 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 East Fork Mill 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 East Fork Mill 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 East Fork Mill Creek.

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 East Fork Mill 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 October 19 to October 22, 2009, was conducted by I. Mikus and S. McSmith (DFG), and M. Groff (WSP). The total length of the stream surveyed was 24,778 feet with an additional 701 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 3.7 cfs on October 26, 2009.

East Fork Mill Creek is a F4 channel type for 9,615 feet of the stream surveyed (Reach 1), a C3 channel type for 12,045 feet of the stream surveyed (Reach 2), and a B2 channel type for 3,819 feet of the stream surveyed (Reach 3). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with gravel-dominant substrates. C3 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and cobble-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 50 to 54 degrees Fahrenheit. Air temperatures ranged from 45 to 59 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 38% riffle units, 38% pool units, and 24% flatwater units (Graph 1). Based on total length of Level II habitat types there were 39% pool units, 30% riffle units, and 30% flatwater units (Graph 2).

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Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 32%; mid-channel pool units, 32%; and run units 17% (Graph 3). Based on percent total length, mid-channel pool units made up 35%, low gradient riffle units 28%, and run units 18%.

A total of 127 pools were identified (Table 3). Main channel pools were the most frequently encountered at 87% (Graph 4), and comprised 92% 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. Fifty of the 127 pools (39%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 127 pool tail-outs measured, 54 had a value of 1 (42.5%); 53 had a value of 2 (41.7%); 16 had a value of 3 (12.6%); 4 had a value of 5 (3.1%) (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 5, and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 30. Main channel 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 East Fork Mill Creek. Graph 7 describes the pool cover in East Fork Mill Creek. Large woody debris is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Large cobble was the dominant substrate observed in 31% of the pool tail-outs. Gravel and small cobble were the next most frequently observed dominant substrate types and they each occurred in 23% of the pool tail-outs.

The mean percent canopy density for the surveyed length of East Fork Mill Creek was 86%. Fourteen percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 82% and 18%, respectively. Graph 9 describes the mean percent canopy in East Fork Mill Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 53% sand/silt/clay, 29% cobble/gravel, 12% bedrock, and 6% boulder (Graph 10). Hardwood trees were the dominant vegetation type observed in 89.1% of the units surveyed. Additionally, 9.3% of the units surveyed had coniferous as the dominant vegetation type, and 1.6% had brush as the dominant vegetation type (Graph 11).

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DISCUSSION

East Fork Mill Creek is an F4 channel type for the first 9,615 feet of stream surveyed, a C3 channel type for the next 12,045 feet of stream surveyed, and a B2 channel type for the remaining 3,819 feet of the stream surveyed. The suitability of F4, C3, and B2 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, and log cover. C3 channel types are excellent for bank-placed boulders and good for plunge weirs, boulder clusters, single and opposing wing-deflectors and log cover. B2 channel types excellent for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days October 19 to October 22, 2009, ranged from 50 to 54 degrees Fahrenheit. Air temperatures ranged from 45 to 59 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 30% of the total length of this survey, riffles 30%, and pools 39%. Fifty of the 127 pools (39%) pools had a maximum residual depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing large wood structures that will increase or deepen pool habitat is recommended.

One hundred seven of the 127 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixteen 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.

Fifty-eight of the 127 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 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in East Fork Mill Creek. Large woody debris is the dominant cover type in pools followed by boulders. 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 86%. Reach 1 had a canopy density of 77%, Reach 2 had a canopy density of 88%, Reach 3 had a canopy density of 95%. In general, revegetation projects are considered when canopy density is less than 80%.

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The percentage of right and left bank covered with vegetation was 100% and 100%, 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) East Fork Mill 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 large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Habitat Unit #:	Comments:
0	0001.00	Start of survey at the confluence with Mill Creek.
515	0008.00	There are concrete bridge abutments on both banks of the creek.
866	0009.00	There are log bridge supports on both banks of the creek but no bridge.
1535	0014.00	A tree has fallen off the right bank leaving behind an eroding bank. The erosion measures approximately 15' high x 20' long and is contributing silt, sand, and gravel to the stream.
1802	0017.00	Flow and a channel type were taken at the tail-out of this unit on 10/26/09. Bridge #01 is the Hamilton Road crossing. The bridge is a metal railcar bridge. It is 18' wide x 22' high x 84' long.
3217	0028.00	Tributary #01 enters from the left bank. It is flowing at an estimated 0.1 cubic feet per second (cfs) and contributes to approximately 2% of East Fork Mill Creek's flow. The temperature of the tributary and of East

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Fork Mill upstream and downstream of the tributary was 54 degrees Fahrenheit. The tributary is accessible to fish and fish were observed in it. The slope of the creek was approximately 4%.

- 4374 0038.00 Tributary #02 enters from the right bank. It is flowing at an estimated 0.2 cfs and is contributing to approximately 4% of East Fork Mill Creek's flow. The temperature of the tributary and of East Fork Mill Creek upstream and downstream of the tributary was 54 degrees Fahrenheit. The tributary is accessible to fish but no fish were observed in it. The tributary has an approximate slope of 2%.
- 4686 0042.00 There are multiple seeps entering from the right bank.
- 6125 0054.00 There is a seep on the left bank.
- 8334 0075.00 Tributary #03 enters from the right bank. It is flowing at an estimated 0.2 cfs and is contributing to approximately 3% of East Fork Mill Creek's flow. The temperature of the tributary is 51 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary is 51 and 50 degrees Fahrenheit, respectively. The tributary is accessible to fish and fish were observed in it. The tributary had an approximate slope of 3%.
- 9315 0084.00 The channel type changes from an F4 to a C3.
- 10444 0095.00 Tributary #04 enters from the left bank. The tributary is flowing at an estimated 0.4 cfs and is contributing to approximately 8% of East Fork Mill Creek's flow. The temperature of the tributary was 51 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary was 52 and 51 degrees Fahrenheit. The tributary is accessible to fish and fish were observed in it. The tributary has a slope of approximately 3%.
- 10662 0097.00 There are 10+ young-of-the-year (YOY) salmonids in this pool.
- 10790 0098.05 A road crosses over this unit.
- 11140 0103.00 LDA #01 is 10' high x 95' wide x 15' long and contains 24 pieces of LWD. Water does flow through the LDA, it has no visible gaps. Sediment is being retained and it measures approximately 30' x 50' x 1.5'. The sediment is composed of sand, gravel, and small cobble. Fish were seen above the LDA. Logs marked with roman numerals II, III and IV are in the LDA.
- 11332 0105.00 Bridge #02 is Rock Creek Road. The bridge is a metal railcar and it measures 16' wide x 12.5' high x 85' long.

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- 11465 0106.00 There is a habitat structure in this unit. It is spanning the creek and has caught a 1.5' diameter alder tree.
- 13617 0130.00 Tributary #05 enters from the left bank. The tributary is flowing at an estimated 0.05 cfs and contributes to approximately 1% of East Fork Mill Creek's flow. The temperature of the tributary is 50 degrees Fahrenheit. The temperature of East Fork Mill Creek, both upstream and downstream of the tributary is 52 degrees Fahrenheit. The tributary's slope is an estimated 10%. The tributary is not accessible to fish due to plunges and steepness and no fish were observed in it. A log with the Roman numeral I is on top of a left bank boulder.
- 13951 0134.00 There is a road at the top of the right bank.
- 14261 0139.00 Tributary #06 (Bummer Lake Creek) enters from the right bank. It is flowing at an estimated 1.5 cfs and is contributing to approximately 40% of the flow of East Fork Mill Creek. The temperature of the tributary is 53 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary is 54 degrees Fahrenheit. The tributary is accessible to fish and salmonids were observed in it. The tributary had a slope of approximately 3%.
- 15320 0155.00 There is a left bank seep that is contributing silt to the creek.
- 16043 0167.00 A road follows the creek at the top of the right bank.
- 16211 0169.00 There is a habitat structure spanning the creek in this unit.
- 16582 0174.00 Tributary #07 enters from the left bank. It is flowing at an estimated 0.01 cfs and is contributing to approximately 1% of East Fork Mill Creek's flow. The temperature of the tributary was 52 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary is 53 degrees Fahrenheit. The tributary is not accessible to fish as it enters East Fork Mill Creek as a 40' high waterfall.
- 16948 0180.00 Tributary #08 enters from the left bank. It is flowing at an estimated 0.05 cfs and is contributing to approximately 0.5% of East Fork Mill Creek's flow. The temperature of the tributary is 51 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary is 53 degrees Fahrenheit. The tributary is accessible to fish and salmonids were observed in it. The tributary had a slope of approximately 4%.
- 17067 0182.00 There is a rootwad structure on the right bank.

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17348	0186.00	There is a road on the top of the right bank, it is adjacent to the river for over 250'.
17795	0193.00	Tributary #09 enters from the right bank. It is flowing at an estimated 0.01 cfs and is contributing to approximately 0.5% of East Fork Mill Creek's flow. The temperature of the tributary is 52 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary is 53 degrees Fahrenheit. The tributary is accessible to fish although its slope is approximately 8%. No fish were observed in the tributary. About 100' upstream of the tributary's mouth is a culvert that is a possible barrier to salmonid migration. Above the culvert the tributary may be too steep to provide suitable habitat for salmonids.
17856	0194.00	Eight coho YOY are in this pool.
19767	0222.00	Tributary #10 enters from the left bank. It is flowing at an estimated 1 cfs and is contributing to approximately 40% of East Fork Mill Creek's flow. The temperature of the tributary is 53 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary was 53 and 52 degrees Fahrenheit, respectively. The tributary is accessible to fish and salmonids were observed in it. The slope of the tributary was approximately 3%.
19869	0224.00	Bridge #03 is 18' wide x 10' high x 50' long. It is a metal railcar bridge with a soil and gravel surface.
20959	0241.00	The channel type changes from a C3 to a B2.
21761	0258.00	There is a habitat flag from 2006 that reads "top of HU #191".
22384	0271.00	The LDA has a 2' plunge. Fish were seen above the LDA.
22384	0271.00	LDA #02 is 9' high x 44' wide x 11' long and contains 8 pieces of LWD. Water does flow through and there are visible gaps in the LDA. Sediment is being retained in the approximate dimensions of 20' wide x 80' long x 2' deep and it is composed of sand, gravel, and cobble.
22511	0274.00	There is a bedrock and boulder waterfall at the top of this unit. The waterfall is 7' high. This waterfall marks the end of the 2006 habitat inventory of this creek. Fish were observed above the waterfall.
23405	0288.00	There is erosion on the left bank that measures approximately 40' long x 30' tall. The erosion is contributing gravel to the creek. A YOY salmonid was observed in this pool.

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- 23517 0291.00 Tributary #11 enters from the right bank. It is flowing at an estimated 0.05 cfs and is contributing to approximately 3% of East Fork Mill Creek's flow. The temperature of the tributary was 50 degrees Fahrenheit. The temperature of East Fork Mill Creek upstream and downstream of the tributary was 52 degrees Fahrenheit. The tributary is accessible to fish and steelhead were observed in it. The slope of the tributary was approximately 3.5%.
- 23741 0295.00 There is a 1.2' boulder plunge.
- 24456 0312.00 There is erosion on the left bank. The erosion measures approximately 20' long x 15' high and is contributing silt, sand, and gravel to the stream.
- 24539 0314.00 LDA #03 is 5' high x 62' wide x 4' long and contains 14 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 50' wide x 20' long x 2' deep. The sediment ranges in size from silt to boulder. No fish were seen above the LDA.
- 24778 0322.00 End of survey due to possible end of anadromy. Above this unit is a 70' long cascade with multiple plunges and high gradient riffles. The first plunge is 3' high with a 3' max jump pool, the second plunge is 5' high with a 1.2' jump pool, and the third plunge is 3' high with a 1.7' jump pool. The multiple plunges, high gradient and lack of resting pools make this a possible barrier to adult salmonids.

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: East Fork Mill Creek

LLID: 1240987417345 Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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
1	0	DRY	0.3	87	87	0.3									
79	12	FLATWATER	23.8	98	7758	30.4	21.8	0.8	1.5	2869	226650	2412	190559		5
127	127	POOL	38.3	78	9927	39.0	22.9	1.4	3.0	2040	259055	4184	531359	3313	19
125	17	RIFFLE	37.7	62	7707	30.2	19.9	0.5	1.0	1166	145803	538	67196		15
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
332	156				25479					631507			789114		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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 (%)
107	12	LGR	32.2	66	7056	27.7	21	0.5	1.6	1490	159449	675	72250		9	79
17	4	HGR	5.1	37	637	2.5	22	0.5	1.7	476	8096	255	4331		25	86
1	1	BRS	0.3	14	14	0.1	3	0.4	0.8	42	42	17	17		40	90
1	1	POW	0.3	133	133	0.5	38	1.2	2.2	4549	4549	5458	5458		10	75
57	6	RUN	17.2	78	4473	17.6	23	0.7	1.6	2421	137977	1798	102469		5	90
21	5	SRN	6.3	150	3152	12.4	17	0.8	2.2	3071	64492	2540	53344		5	89
107	107	MCP	32.2	84	8952	35.1	23	1.5	8.1	2207	236148	4651	497640	3696	17	87
3	3	CCP	0.9	62	186	0.7	17	0.8	2.1	1158	3474	1879	5638	1125	0	82
1	1	STP	0.3	25	25	0.1	17	1.6	3.3	383	383	689	689	612	75	97
6	6	LSL	1.8	57	343	1.3	32	1.1	3.2	1677	10060	2300	13802	1682	16	89
2	2	LSR	0.6	53	106	0.4	19	0.7	2.7	997	1994	1011	2021	698	40	90
1	1	LSBk	0.3	36	36	0.1	36	1.6	3.7	1296	1296	2592	2592	2074	10	52
2	2	LSBo	0.6	76	153	0.6	28	1.1	2.3	1820	3640	2344	4687	1980	10	89
5	5	PLP	1.5	25	126	0.5	17	1.6	4	412	2061	858	4290	759	55	89
1	0	DRY	0.3	87	87	0.3										

Total Units
332

Total Units Fully Measured
156

Total Length (ft.)
25479

Total Area (sq.ft.)
633660

Total Volume (cu.ft.)
769229

Table 3 - Summary of Pool Types

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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
111	111	MAIN	87	83	9163	92	22.5	1.5	2162	240005	3599	399489	18
16	16	SCOUR	13	48	764	8	25.6	1.2	1191	19050	1332	21315	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
127	127	9927	259055	420804

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

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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
107	MCP	84	0	0	20	19	42	39	24	22	21	20
3	CCP	2	0	0	2	67	1	33	0	0	0	0
1	STP	1	0	0	0	0	0	0	1	100	0	0
6	LSL	5	0	0	2	33	3	50	1	17	0	0
2	LSR	2	0	0	0	0	2	100	0	0	0	0
1	LSBk	1	0	0	0	0	0	0	1	100	0	0
2	LSBo	2	0	0	1	50	1	50	0	0	0	0
5	PLP	4	0	0	2	40	1	20	1	20	1	20

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
127	0	0	27	21	50	39	28	22	22	17

Mean Maximum Residual Pool Depth (ft.): 3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Dry Units: 1

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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
107	12	LGR	1	1	1	0	6	0	2	90	0
17	4	HGR	0	0	0	0	0	0	26	74	0
1	1	BRS	0	0	0	0	0	0	100	0	0
125	17	TOTAL RIFFLE	0	0	0	0	3	0	18	77	0
1	1	POW	0	0	0	0	0	0	0	100	0
57	6	RUN	0	0	0	0	0	0	0	100	0
21	5	SRN	0	5	0	0	0	0	18	68	10
79	12	TOTAL FLAT	0	2	0	0	0	0	7	87	4
107	107	MCP	4	17	35	8	1	0	1	30	3
3	3	CCP	0	0	0	0	0	0	0	0	0
1	1	STP	0	0	30	0	0	0	35	35	0
6	6	LSL	20	8	52	8	0	0	0	12	0
2	2	LSR	0	20	60	18	0	0	0	3	0
1	1	LSBk	0	0	0	0	0	0	0	100	0
2	2	LSBo	0	0	0	0	0	0	0	100	0
5	5	PLP	17	1	6	2	0	0	27	41	6
127	127	TOTAL POOL	6	15	34	8	1	0	3	30	3
332	156	TOTAL	5	13	29	7	1	0	4	38	3

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Dry Units: 1

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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
107	12	LGR	0	0	17	50	17	17	0
17	4	HGR	0	0	0	25	50	25	0
1	1	BRS	0	0	0	0	0	0	100
1	1	POW	0	0	0	0	100	0	0
57	6	RUN	0	0	33	17	50	0	0
21	5	SRN	0	0	80	0	20	0	0
107	107	MCP	0	2	86	1	8	2	1
3	3	CCP	0	0	33	67	0	0	0
1	1	STP	0	0	0	0	100	0	0
6	6	LSL	0	0	83	17	0	0	0
2	2	LSR	0	0	50	0	50	0	0
1	1	LSBk	0	0	0	0	0	100	0
2	2	LSBo	0	0	100	0	0	0	0
5	5	PLP	0	0	60	0	20	20	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
86	18	82	0	100	100

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: East Fork Mill Creek LLID: 1240987417345 Drainage: Smith River - Lower
 Survey Dates: 10/19/2009 to 10/22/2009 Survey Length (ft.): 25479 Main Channel (ft.): 24778 Side Channel (ft.): 701
 Confluence Location: Quad: CHILDS HILL Legal Description: T15NR01ES03 Latitude: 41:44:04.0N Longitude: 124:05:55.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 77.0	Pools by Stream Length (%): 45.7
Reach Length (ft.): 9315	Coniferous Component (%): 16.8	Pool Frequency (%): 40.0
Riffle/Flatwater Mean Width (ft.): 28.9	Hardwood Component (%): 83.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 3
Range (ft.): 42 to 84	Vegetative Cover (%): 99.9	2 to 2.9 Feet Deep: 32
Mean (ft.): 60	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 26
Std. Dev.: 13	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 38
Base Flow (cfs.): 3.7	Occurrence of LWD (%): 17	Mean Max Residual Pool Depth (ft.): 4.1
Water (F): 50 - 54 Air (F): 50 - 58	LWD per 100 ft.:	Mean Pool Shelter Rating: 9
Dry Channel (ft): 0	Riffles: 1	
	Pools: 2	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 35 Sm Cobble: 38 Lg Cobble: 26 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 100.0 2. 0.0 3. 0.0 4. 0.0 5. 0.0		

STREAM REACH: 2

Channel Type: C3	Canopy Density (%): 87.5	Pools by Stream Length (%): 38.2
Reach Length (ft.): 11644	Coniferous Component (%): 18.4	Pool Frequency (%): 39.4
Riffle/Flatwater Mean Width (ft.): 21.3	Hardwood Component (%): 81.6	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 22
Range (ft.): 32 to 117	Vegetative Cover (%): 99.8	2 to 2.9 Feet Deep: 45
Mean (ft.): 50	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 22
Std. Dev.: 19	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 12
Base Flow (cfs.): 3.7	Occurrence of LWD (%): 27	Mean Max Residual Pool Depth (ft.): 2.8
Water (F): 51 - 54 Air (F): 51 - 59	LWD per 100 ft.:	Mean Pool Shelter Rating: 23
Dry Channel (ft): 87	Riffles: 2	
	Pools: 5	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 25 Sm Cobble: 22 Lg Cobble: 35 Boulder: 15 Bedrock: 3		
Embeddedness Values (%): 1. 30.8 2. 47.7 3. 18.5 4. 0.0 5. 3.1		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B2	Canopy Density (%): 94.9	Pools by Stream Length (%): 24.4
Reach Length (ft.): 3819	Coniferous Component (%): 16.6	Pool Frequency (%): 34.1
Riffle/Flatwater Mean Width (ft.): 12.4	Hardwood Component (%): 83.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 43
Range (ft.): 25 to 37	Vegetative Cover (%): 99.9	2 to 2.9 Feet Deep: 36
Mean (ft.): 31	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 18
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 4
Base Flow (cfs.): 3.7	Occurrence of LWD (%): 17	Mean Max Residual Pool Depth (ft.): 2.3
Water (F): 51 - 53	Air (F): 45 - 58	LWD per 100 ft.:
Dry Channel (ft): 0	Riffles: 2	Pools: 6
	Pools: 6	Flat: 3
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0	Sand: 0	Gravel: 4
	Sm Cobble: 7	Lg Cobble: 25
	Boulder: 61	Bedrock: 4
Embeddedness Values (%): 1. 0.0	2. 78.6	3. 14.3
	4. 0.0	5. 7.1

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

Legal Description: T15NR01ES03

Latitude: 41:44:04.0N

Longitude: 124:05:55.0W

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	17	19	11.5
Boulder	12	6	5.8
Cobble / Gravel	46	46	29.5
Sand / Silt / Clay	81	85	53.2

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	2	3	1.6
Hardwood Trees	136	142	89.1
Coniferous Trees	18	11	9.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: East Fork Mill Creek

LLID: 1240987417345

Drainage: Smith River - Lower

Survey Dates: 10/19/2009 to 10/22/2009

Confluence Location: Quad: CHILDS HILL

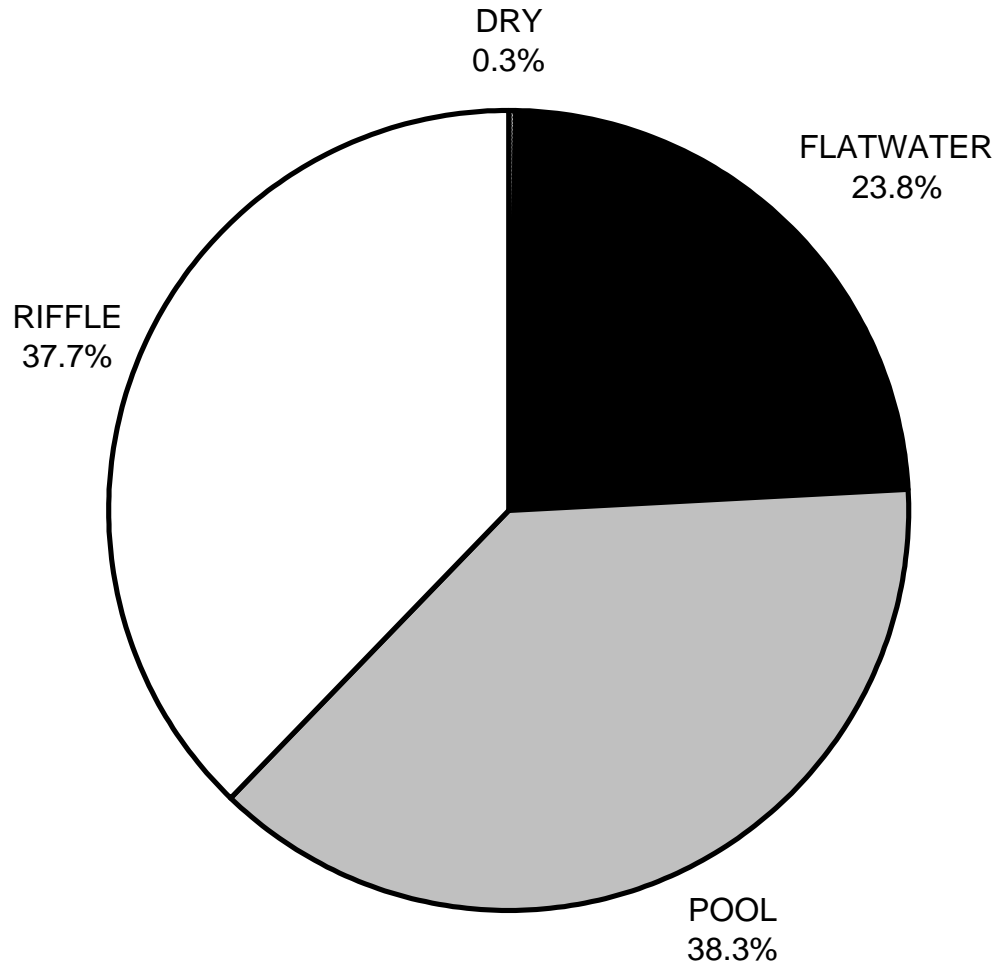
Legal Description: T15NR01ES03

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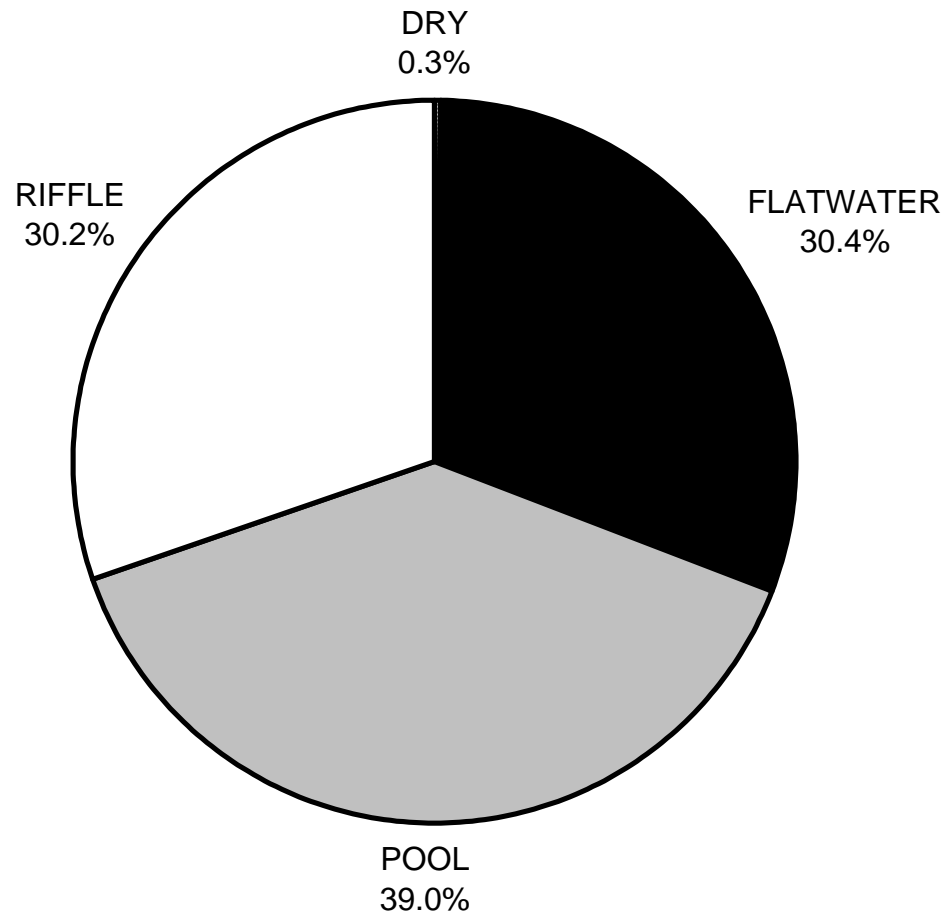
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	6
SMALL WOODY DEBRIS (%)	0	2	15
LARGE WOODY DEBRIS (%)	0	0	34
ROOT MASS (%)	0	0	8
TERRESTRIAL VEGETATION (%)	3	0	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	18	7	3
BOULDERS (%)	77	87	30
BEDROCK LEDGES (%)	0	4	3

EAST FORK MILL CREEK 2009 HABITAT TYPES BY PERCENT OCCURRENCE



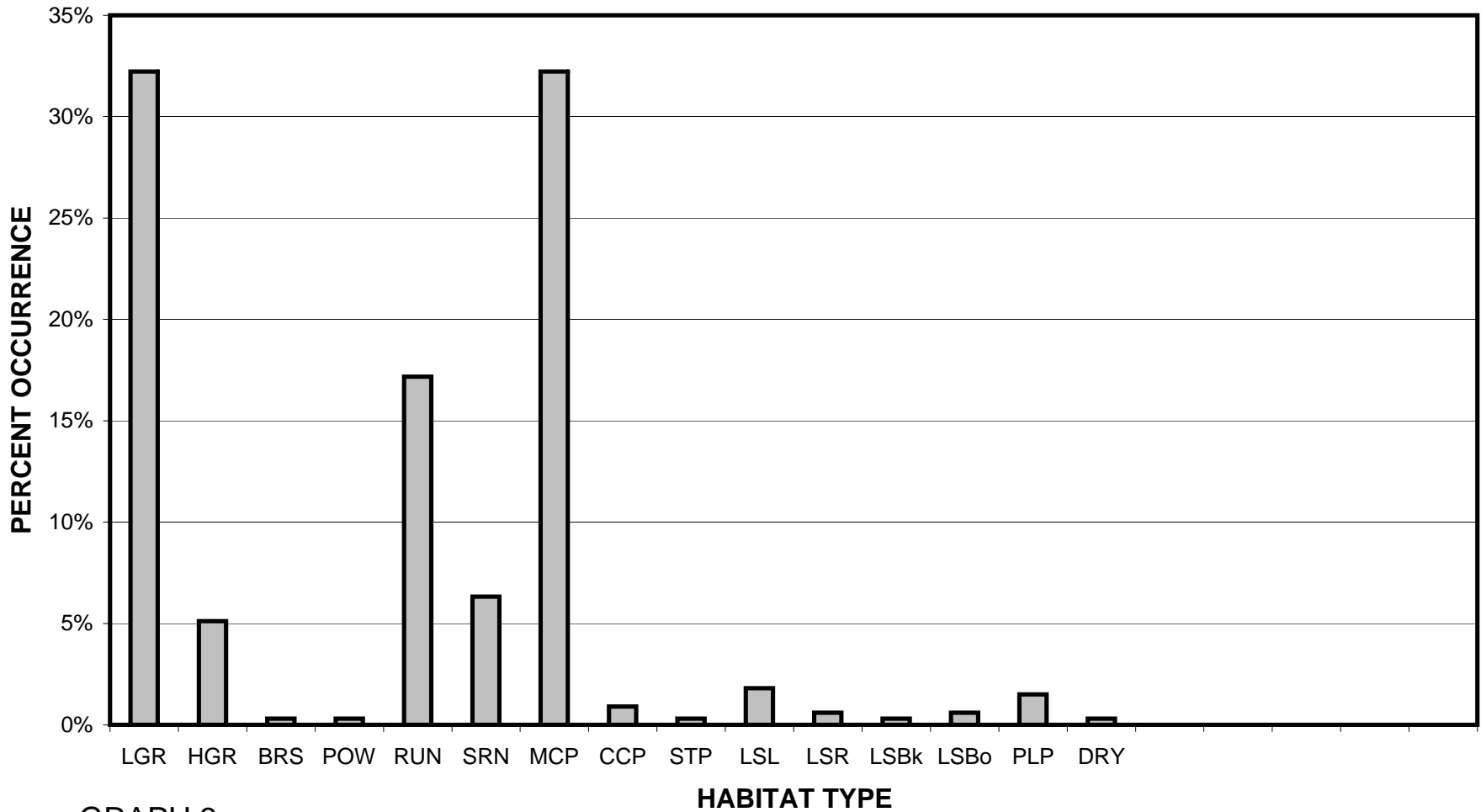
GRAPH 1

EAST FORK MILL CREEK 2009 HABITAT TYPES BY PERCENT TOTAL LENGTH



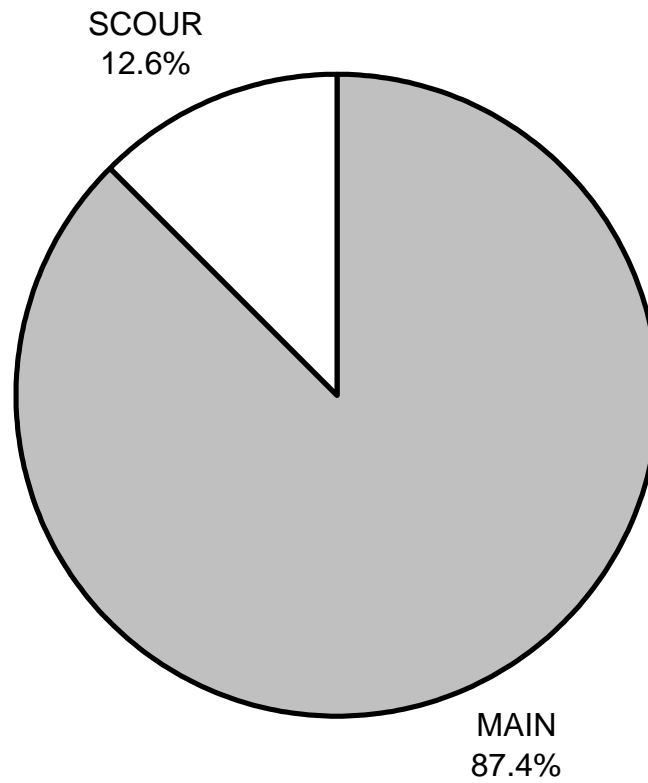
GRAPH 2

EAST FORK MILL CREEK 2009 HABITAT TYPES BY PERCENT OCCURRENCE



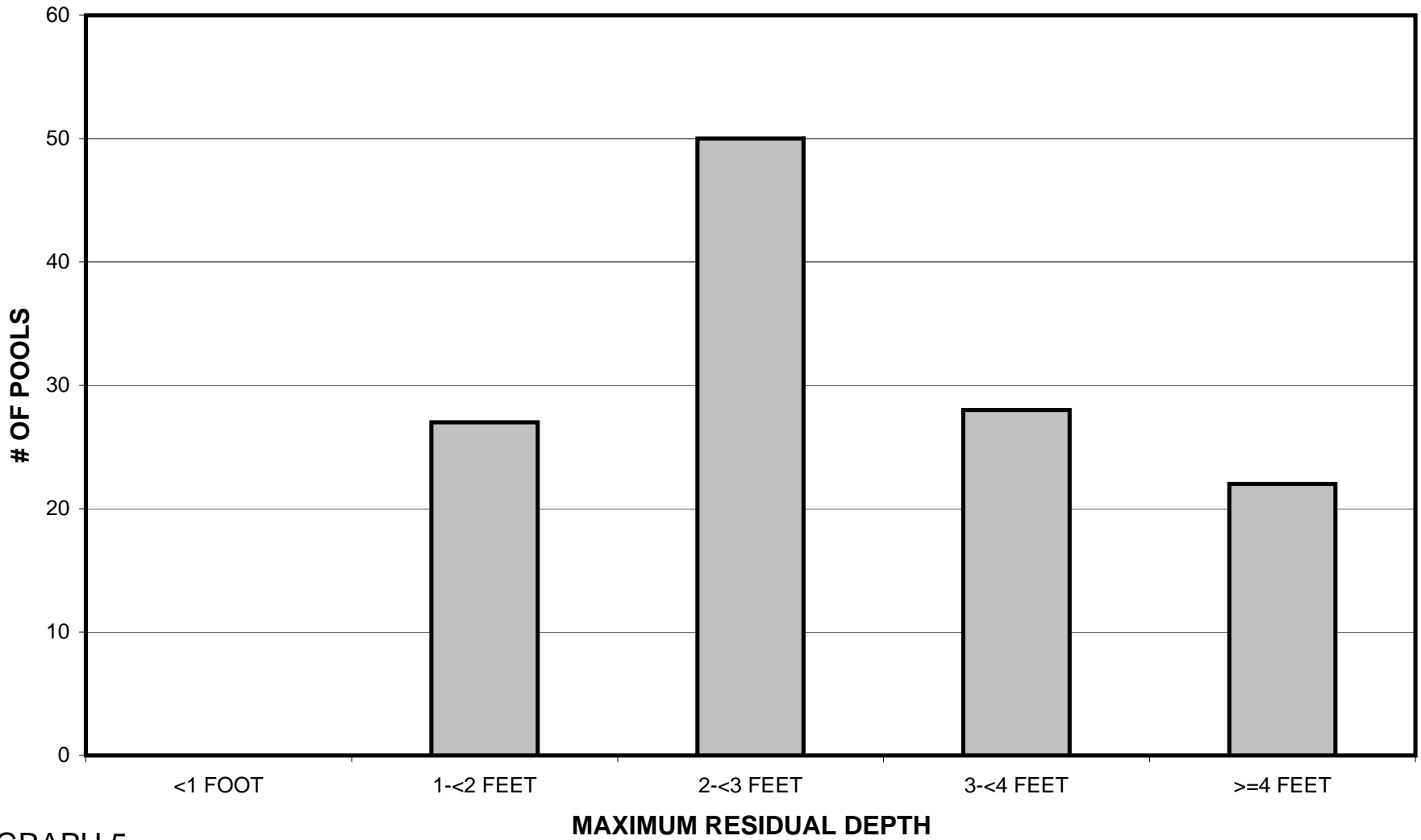
GRAPH 3

**EAST FORK MILL CREEK 2009
POOL TYPES BY PERCENT OCCURRENCE**



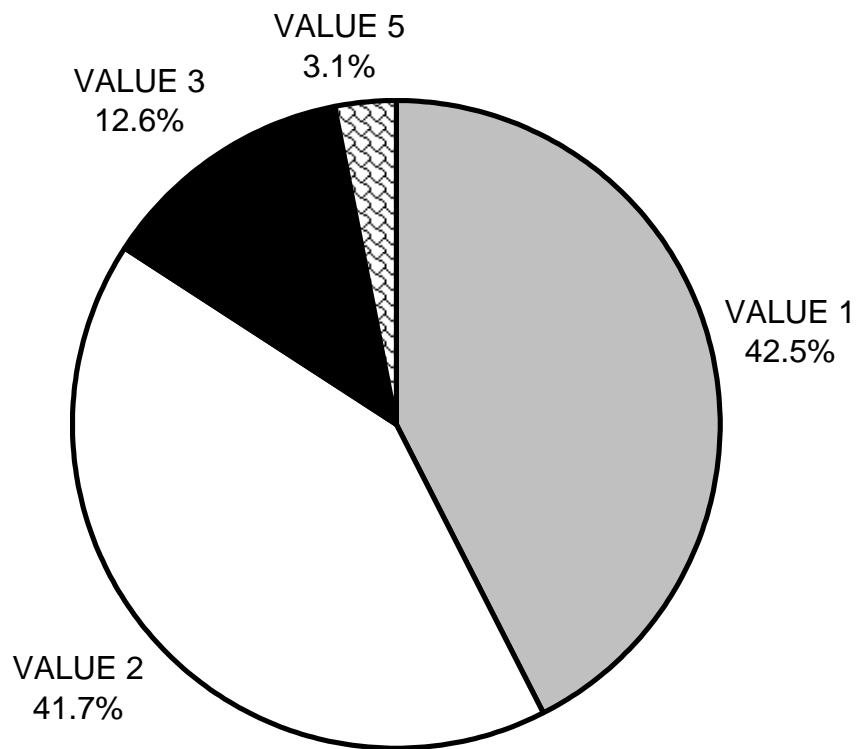
GRAPH 4

EAST FORK MILL CREEK 2009 MAXIMUM DEPTH IN POOLS



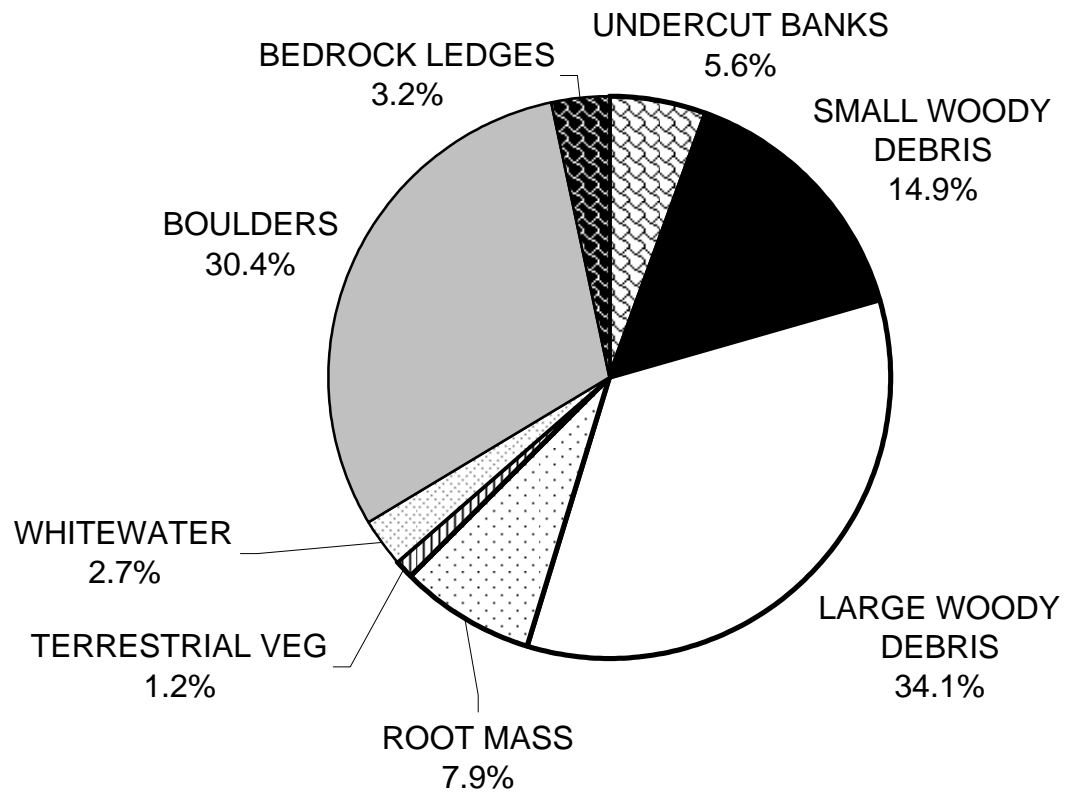
GRAPH 5

EAST FORK MILL CREEK 2009 PERCENT EMBEDDEDNESS



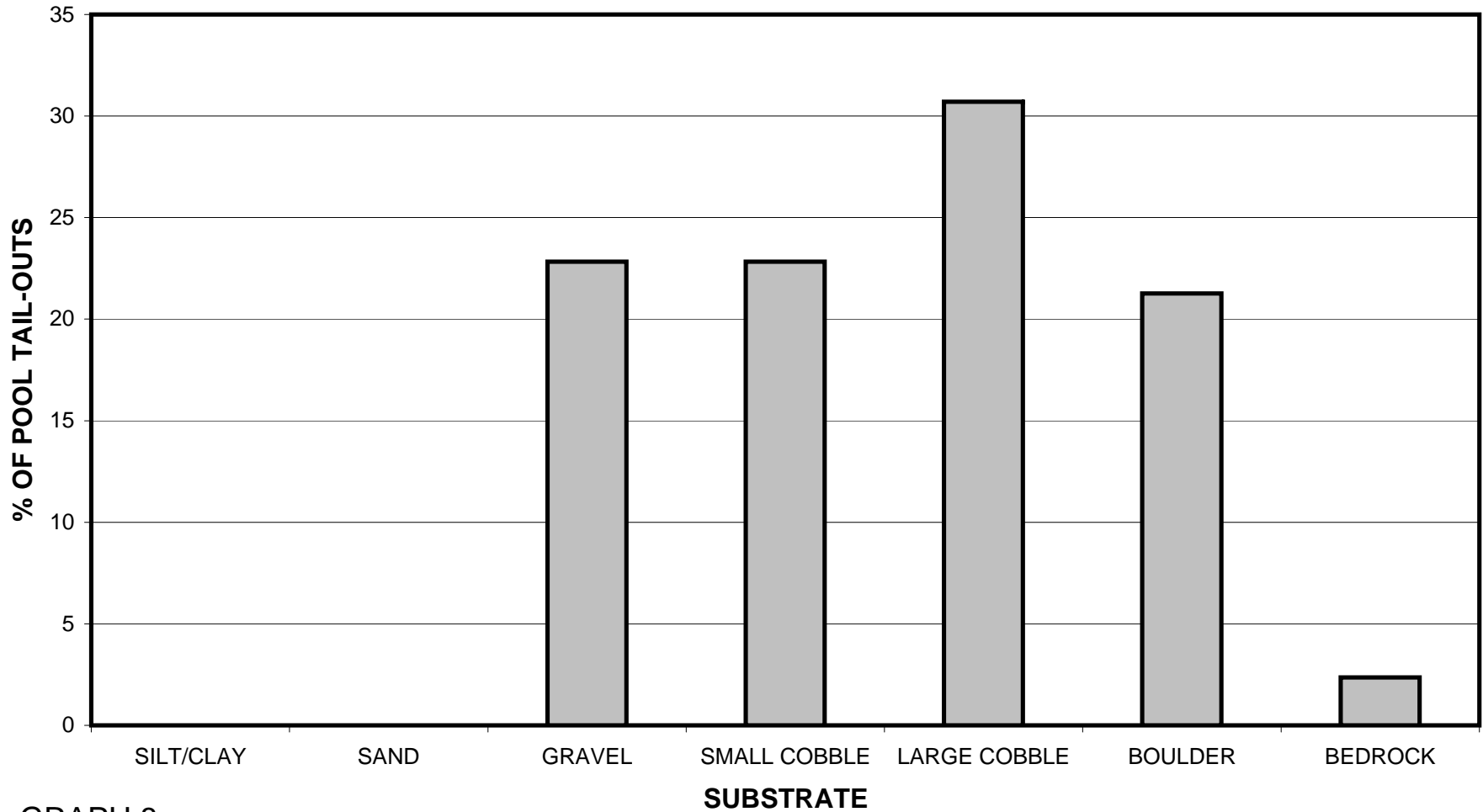
GRAPH 6

EAST FORK MILL CREEK 2009 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

EAST FORK MILL CREEK 2009 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



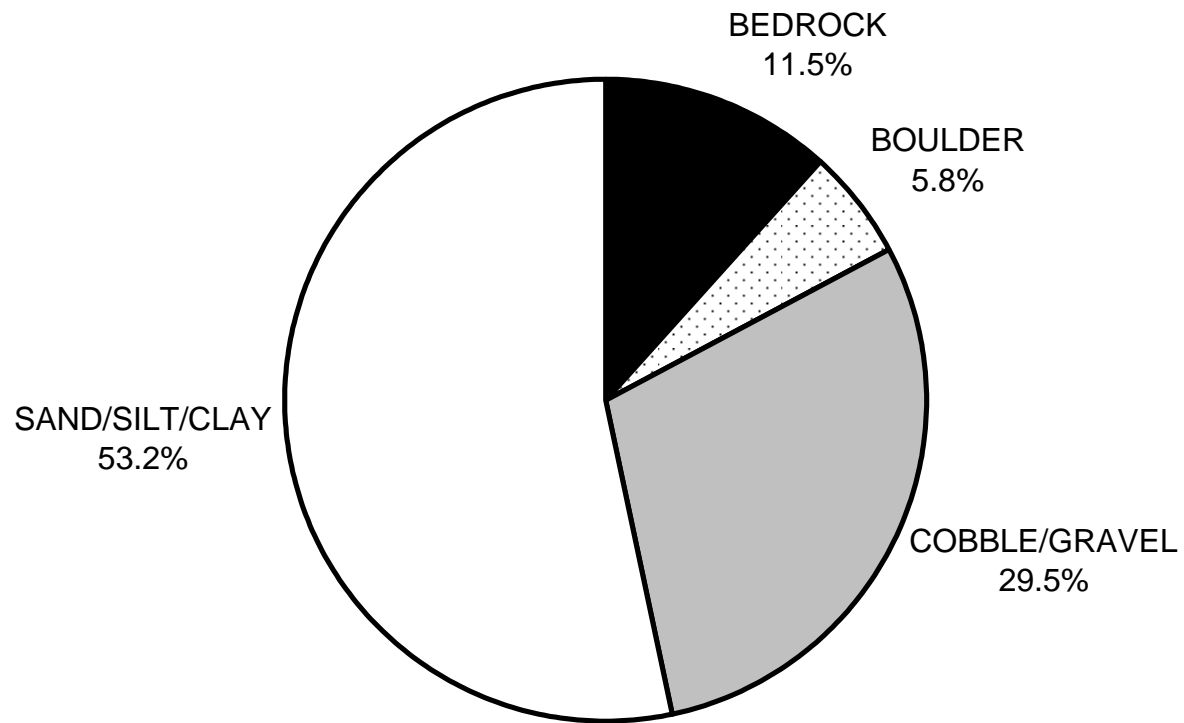
GRAPH 8

**EAST FORK MILL CREEK 2009
MEAN PERCENT CANOPY**



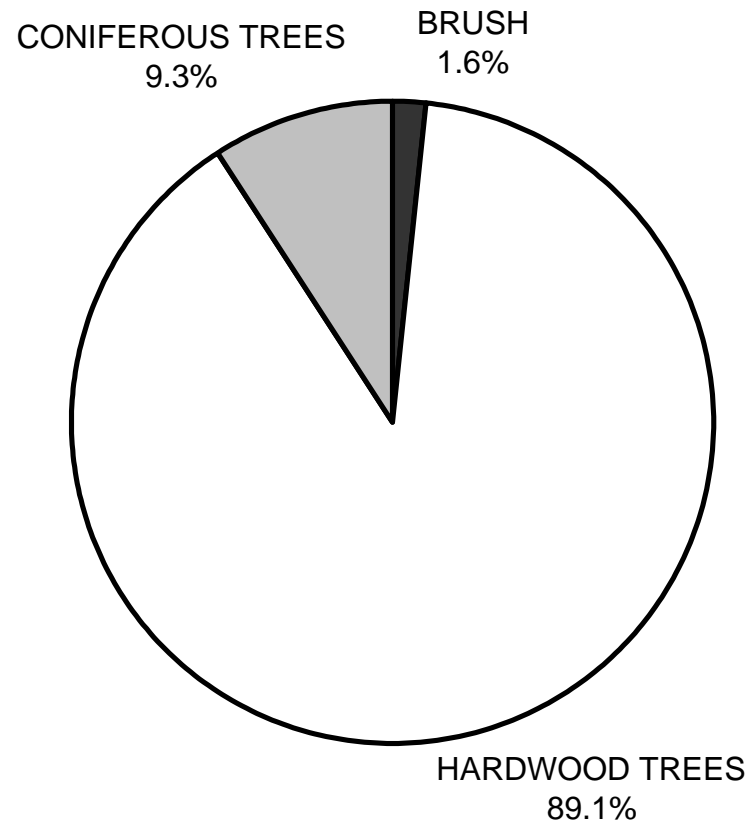
GRAPH 9

**EAST FORK MILL CREEK 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH**



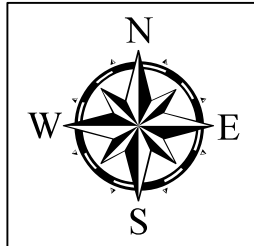
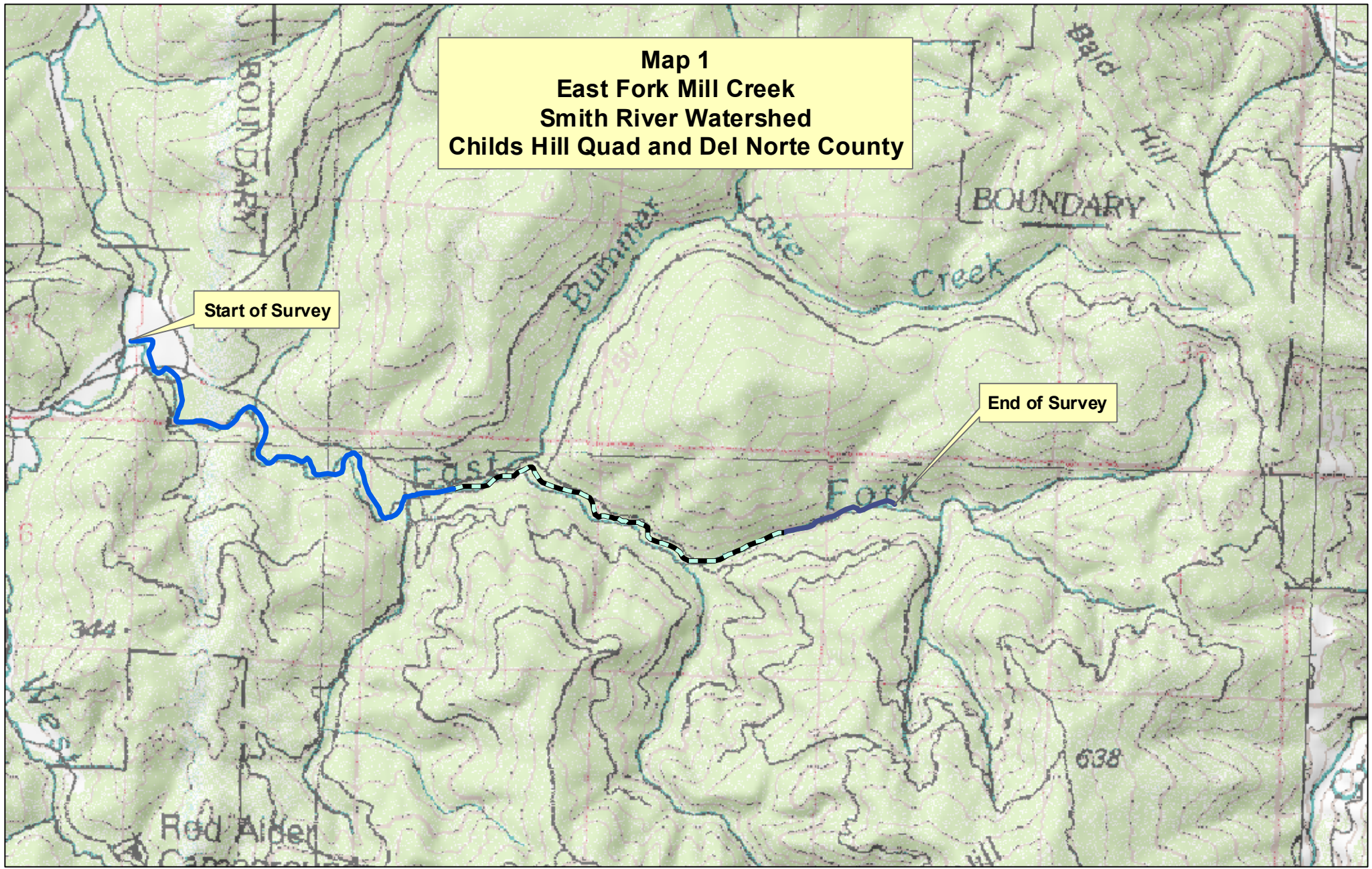
GRAPH 10

**EAST FORK MILL CREEK 2009
DOMINANT BANK VEGETATION IN SURVEY REACH**






GRAPH 11

Map 1
East Fork Mill Creek
Smith River Watershed
Childs Hill Quad and Del Norte County



Legend

-  Reach 1, F4 Channel Type
-  Reach 2, C3 Channel Type
-  Reach 3, B2 Channel Type

