

STREAM INVENTORY REPORT

Mill Creek

INTRODUCTION

A stream inventory was conducted on Mill Creek. The survey began at the confluence with South Fork Eel River and extended upstream 0.3 miles.

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

Mill Creek is a tributary to South Fork Eel River, tributary to the Eel River, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Mill Creek's legal description at the confluence with South Fork Eel River is T24N R17W S33. Its location is 39.8860 north latitude and 123.7445 west longitude, LLID number 1237433398861. Mill Creek is a first order stream and has approximately 2.1 miles of blue line stream according to the USGS Noble Butte 7.5 minute quadrangle. Mill Creek drains a watershed of approximately 2.4 square miles. Elevations range from about 660 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely within the Standish Hickey State Recreation Area and is managed for recreation. Vehicle access exists via Highway 101 near Leggett.

METHODS

The habitat inventory conducted in 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 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.

Mill Creek

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 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". 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.

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 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.

Mill Creek

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 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 densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In 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 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.

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.

Mill Creek

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.

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

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

Mill Creek

HABITAT INVENTORY RESULTS

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

The habitat inventory of September 21, 2010, was conducted by P. Scott and A. Rogers (WSP). The total length of the stream surveyed was 1,765 feet.

Stream flow was not measured on Mill Creek.

Mill Creek is an A3 channel type for 1,765 feet of the stream surveyed (Reach 1). 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 54 to 55 degrees Fahrenheit. Air temperatures ranged from 60 to 61 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45% riffle units, 39% pool units, and 16% flatwater units (Graph 1). Based on total length of Level II habitat types there were 66% riffle units, 19% pool units, and 15% flatwater units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high gradient riffle units, 30%; mid-channel pool units, 20%; and plunge pool units 18% (Graph 3). Based on percent total length, high gradient riffle units made up 43%, low gradient riffle units 22%, and mid-channel pool units 11%.

A total of 17 pools were identified (Table 3). Main channel pools were the most frequently encountered at 53% (Graph 4), and comprised 56% 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. Eight of the 17 pools (47%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 17 pool tail-outs measured, 5 had a value of 1 (29.4%); 5 had a value of 2 (29.4%); 5 had a value of 3 (29.4%); 2 had a value of 5 (11.8%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed 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 11, flatwater habitat types had a mean shelter rating of 8, and pool habitats had a mean shelter rating of 21 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 28. Main channel pools had a mean shelter rating of 15 (Table 3).

Mill Creek

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Mill Creek. Graph 7 describes the pool cover in Mill 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 88% of the pool tail-outs. Bedrock was the next most frequently observed dominant substrate type and occurred in 12% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Mill Creek was 92%. Eight percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 96% and 4%, respectively. Graph 9 describes the mean percent canopy in Mill Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 81%. The mean percent left bank vegetated was 83%. The dominant elements composing the structure of the stream banks consisted of 50% cobble/gravel, 30% bedrock, and 20% boulder (Graph 10). Deciduous trees were the dominant vegetation type observed in 80% of the units surveyed. Additionally, 20% of the units surveyed had coniferous trees as the dominant vegetation type (Graph 11).

DISCUSSION

Mill Creek is an A3 channel type for the entire 1,765 feet of the stream surveyed. A3 channel types are generally not suitable for fish habitat improvement structures.

The water temperatures recorded on the survey days September 21, 2010, ranged from 54 to 55 degrees Fahrenheit. Air temperatures ranged from 60 to 61 degrees Fahrenheit. This is a suitable water temperature range for salmonids. 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 15% of the total length of this survey, riffles 66%, and pools 19%. Eight of the 17 (47%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing large wood that will increase or deepen pool habitat is recommended.

Ten of the 17 pool tail-outs measured had embeddedness ratings of 1 or 2. Five of the pool tail-outs had embeddedness ratings of 3 or 4. Two 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.

Mill Creek

Sediment sources in Mill Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifteen of the 17 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 21. The shelter rating in the flatwater habitats is 8. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Mill 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 92%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 81% and 83%, 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) 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 boulders. 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 the South Fork Eel River. The channel is and A3 for the entire length of the survey, 1,765 feet.

Mill Creek

164	0005.00	A road crosses the channel. The crossing is 20' wide x 60' high x 20' long boxcar bridge. It is not a barrier to salmonids.
378	0008.00	There is a 2.5' high plunge over boulders.
762	0018.00	There is a 2.5' high plunge.
936	0024.00	There is a 3' high plunge.
1037	0027.00	Log debris accumulation (LDA) #01 contains seven pieces of large woody debris (LWD) and measures 12' high x 25' wide x 30' long. There are visible gaps in the LDA and water flows through it. Retained sediment ranges from gravel to large cobble and measures 9' wide x 22' long x 6' deep. Fish were observed above the LDA.
1407	0035.00	LDA #02 contains eight pieces of LWD and measures 7' high x 14' wide x 28' long. There are visible gaps in the LDA and water flows through it. Retained sediment ranges from gravel to large cobble and measures 14' wide x 30' long x 4' deep. It is a possible barrier to juvenile and adult salmonids. No fish were observed above the LDA.
1520	0038.00	There is a 15' high bedrock cascade that forms the potential end of anadromy.
1765	0044.00	End of survey at a 4' high plunge.

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.

Mill 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: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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
7	2	FLATWATER	15.9	37	261	14.8	7.5	1.0	1.3	240	1679	234	1641		8
17	17	POOL	38.6	20	337	19.1	10.0	1.2	2.1	194	3298	355	6036	269	21
20	4	RIFFLE	45.5	58	1167	66.1	8.3	0.6	1.0	498	9953	313	6263		11
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
44	23				1765					14929			13941		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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 (%)
6	1	LGR	13.6	63	380	21.5	6	0.8	1.5	760	4561	608	3649		30	97
13	2	HGR	29.5	59	763	43.2	8	0.7	1.2	490	6367	310	4026		8	88
1	1	CAS	2.3	24	24	1.4	11	0.1	0.1	251	251	25	25		0	93
3	1	RUN	6.8	26	77	4.4	6	0.9	1.1	107	321	96	289		10	91
4	1	SRN	9.1	46	184	10.4	9	1.0	1.4	373	1490	373	1490		5	92
9	9	MCP	20.5	21	190	10.8	10	1.2	3.1	223	2005	395	3552	299	15	92
8	8	PLP	18.2	18	147	8.3	10	1.1	4.4	162	1293	311	2484	235	28	94

Total Units
44

Total Units Fully Measured
23

Total Length (ft.)
1765

Total Area (sq.ft.)
16288

Total Volume (cu.ft.)
15516

Table 3 - Summary of Pool Types

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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
9	9	MAIN	53	21	190	56	10.4	1.2	223	2005	299	2692	15
8	8	SCOUR	47	18	147	44	9.5	1.1	162	1293	235	1882	28
Total Units	Total Units Fully Measured				Total Length (ft.)				Total Area (sq.ft.)			Total Volume (cu.ft.)	
17	17				337				3298			4574	

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

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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
9	MCP	53	0	0	3	33	4	44	2	22	0	0
8	PLP	47	1	13	5	63	1	13	0	0	1	13

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
17	1	6	8	47	5	29	2	12	1	6

Mean Maximum Residual Pool Depth (ft.): 2.1

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Dry Units: 0

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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
6	1	LGR	0	15	0	0	0	0	0	85	0
13	2	HGR	0	35	15	0	0	0	0	50	0
1	1	CAS	0	0	0	0	0	0	0	0	0
20	4	TOTAL RIFFLE	0	28	10	0	0	0	0	62	0
3	1	RUN	0	15	0	0	0	0	20	25	40
4	1	SRN	0	35	0	0	0	0	0	65	0
7	2	TOTAL FLAT	0	25	0	0	0	0	10	45	20
9	9	MCP	0	21	28	1	0	0	8	29	13
8	8	PLP	0	13	6	0	0	0	26	40	15
17	17	TOTAL POOL	0	17	17	1	0	0	16	34	14
44	23	TOTAL	0	20	15	0	0	0	14	39	13

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Dry Units: 0

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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
6	1	LGR	0	0	0	0	0	100	0
13	2	HGR	0	0	50	50	0	0	0
1	1	CAS	0	0	0	0	0	0	100
3	1	RUN	0	0	0	0	0	0	100
4	1	SRN	0	0	100	0	0	0	0
9	9	MCP	0	0	78	11	11	0	0
8	8	PLP	0	0	38	13	0	38	13

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
92	4	96	0	81	83

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.

Stream Name: Mill Creek	LLID: 1237433398861	Drainage: Eel River - South Fork
Survey Dates: 9/21/2010 to 9/21/2010	Survey Length (ft.): 1765	Main Channel (ft.): 1765
		Side Channel (ft.): 0
Confluence Location: Quad: NOBLE BUTTE	Legal Description: T24NR17WS33	Latitude: 39:53:10.0N
		Longitude: 123:44:36.0W

STREAM REACH: 1										
Channel Type:	A3					Canopy Density (%):	92.4		Pools by Stream Length (%):	19.1
Reach Length (ft.):	1765					Coniferous Component (%):	4.2		Pool Frequency (%):	38.6
Riffle/Flatwater Mean Width (ft.):	8.0					Hardwood Component (%):	95.8		Residual Pool Depth (%):	
BFW:						Dominant Bank Vegetation:	Hardwood Trees		< 2 Feet Deep:	53
Range (ft.):	18	to	26			Vegetative Cover (%):	82.0		2 to 2.9 Feet Deep:	29
Mean (ft.):	22					Dominant Shelter:	Boulders		3 to 3.9 Feet Deep:	12
Std. Dev.:	3					Dominant Bank Substrate Type:	Cobble/Gravel		>= 4 Feet Deep:	6
Base Flow (cfs.):	0.0					Occurrence of LWD (%):	14		Mean Max Residual Pool Depth (ft.):	2.1
Water (F):	54 - 55	Air (F):	60 - 61			LWD per 100 ft.:			Mean Pool Shelter Rating:	21
Dry Channel (ft):	0					Riffles:	4			
						Pools:	16			
						Flat:	4			
Pool Tail Substrate (%):	Silt/Clay: 0	Sand: 0	Gravel: 88	Sm Cobble: 0	Lg Cobble: 0	Boulder: 0	Bedrock: 12			
Embeddedness Values (%):	1. 29.4	2. 29.4	3. 29.4	4. 0.0	5. 11.8					

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

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	7	7	30.4
Boulder	2	7	19.6
Cobble / Gravel	14	9	50.0
Sand / Silt / Clay	0	0	0.0

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	0	0	0.0
Hardwood Trees	19	18	80.4
Coniferous Trees	4	5	19.6
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Mill Creek

LLID: 1237433398861

Drainage: Eel River - South Fork

Survey Dates: 9/21/2010 to 9/21/2010

Confluence Location: Quad: NOBLE BUTTE

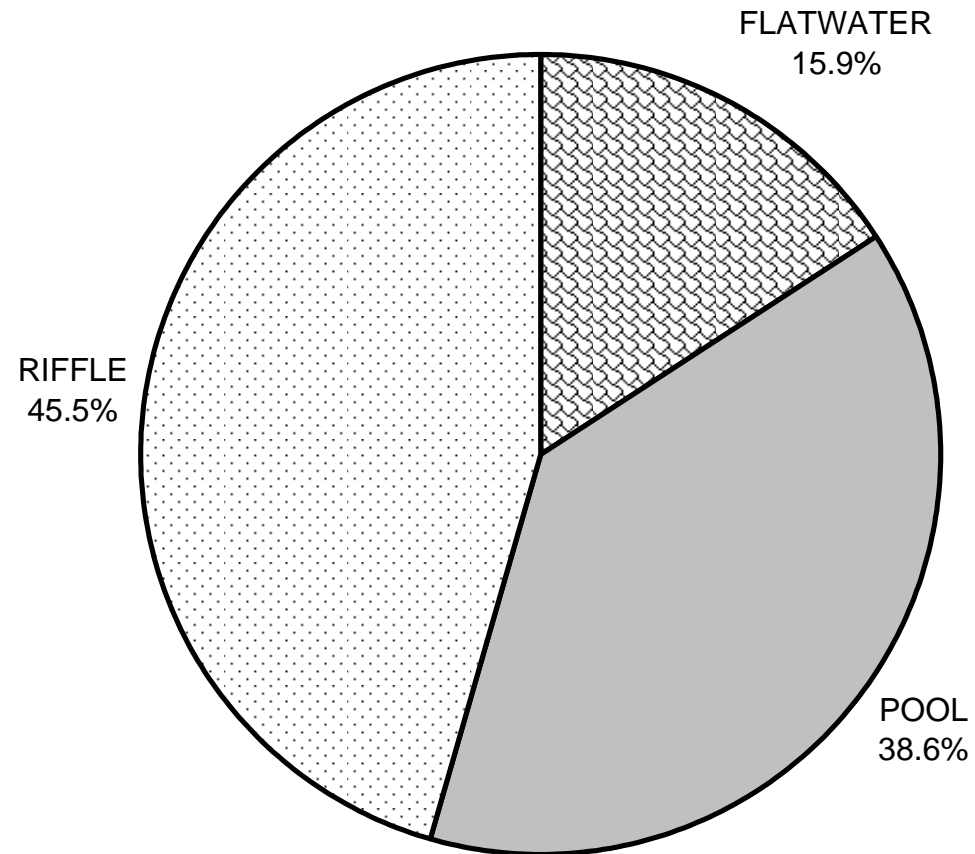
Legal Description: T24NR17WS33

Latitude: 39:53:10.0N

Longitude: 123:44:36.0W

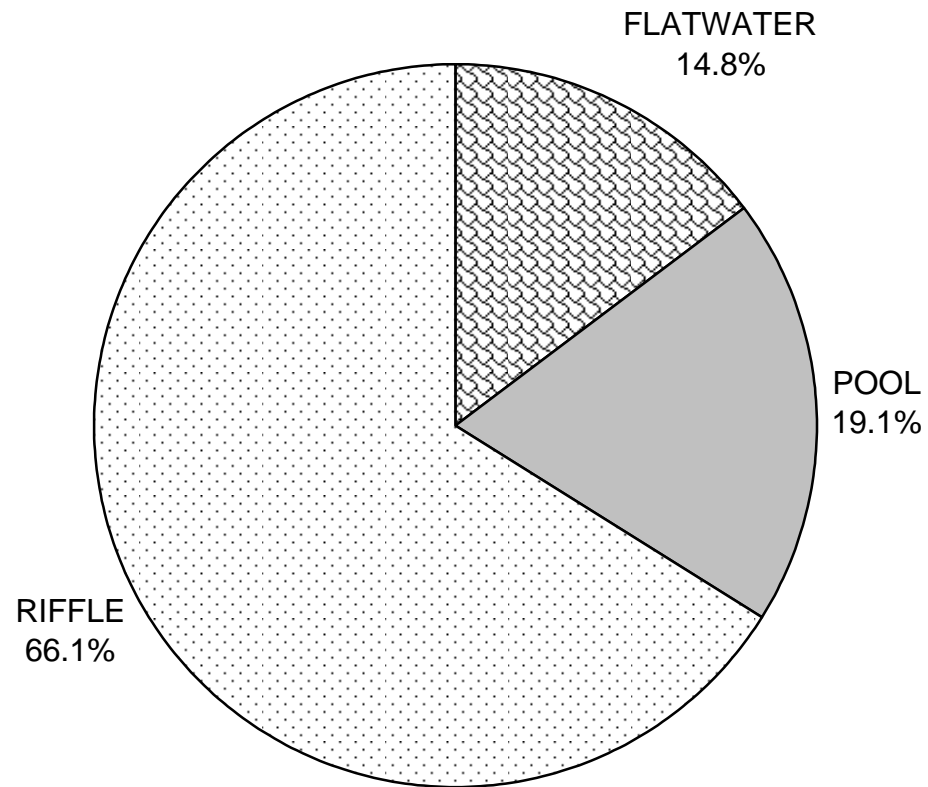
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	0	0
SMALL WOODY DEBRIS (%)	28	25	17
LARGE WOODY DEBRIS (%)	10	0	17
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	10	16
BOULDERS (%)	62	45	34
BEDROCK LEDGES (%)	0	20	14

**MILL CREEK 2010
HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 1

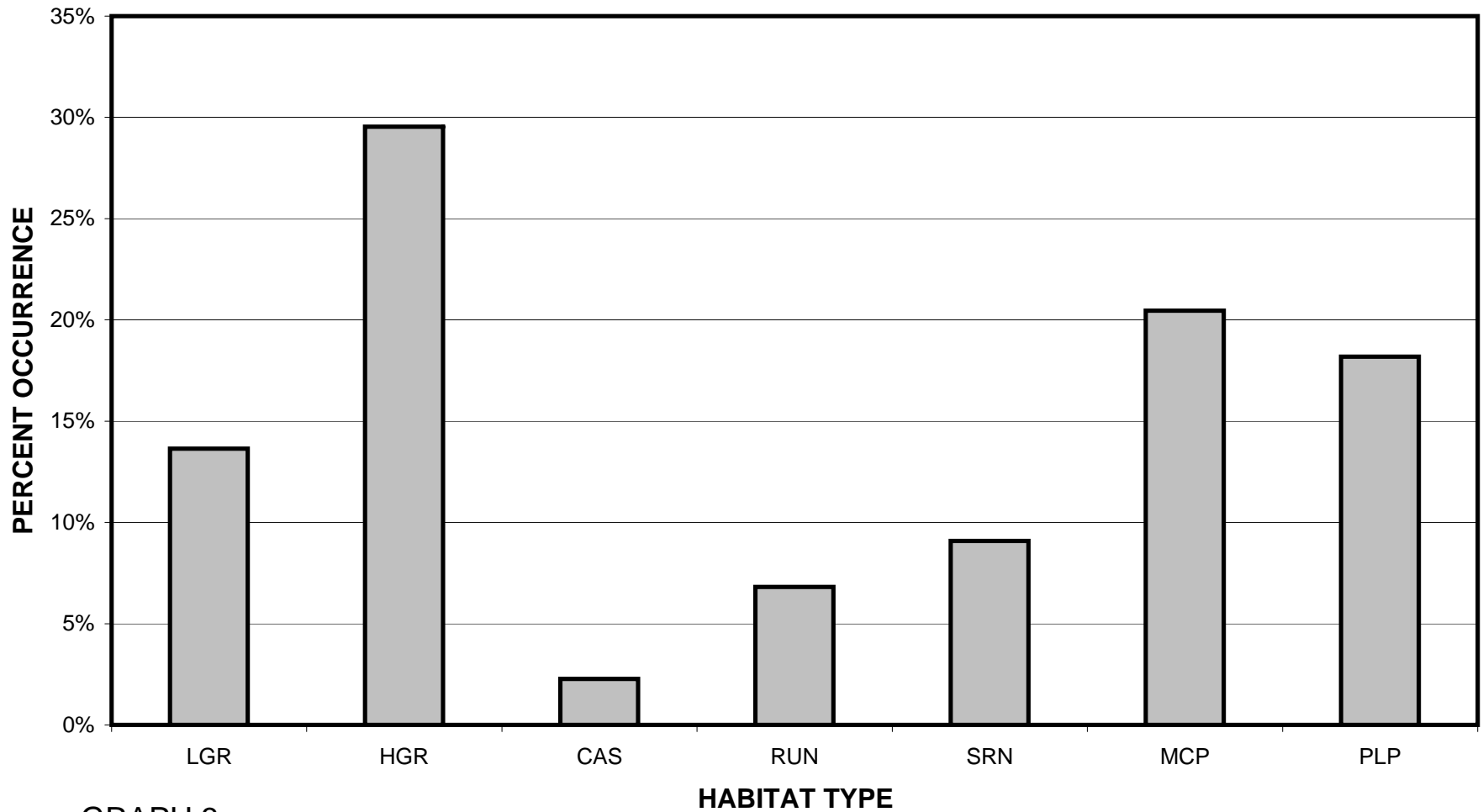
MILL CREEK 2010
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

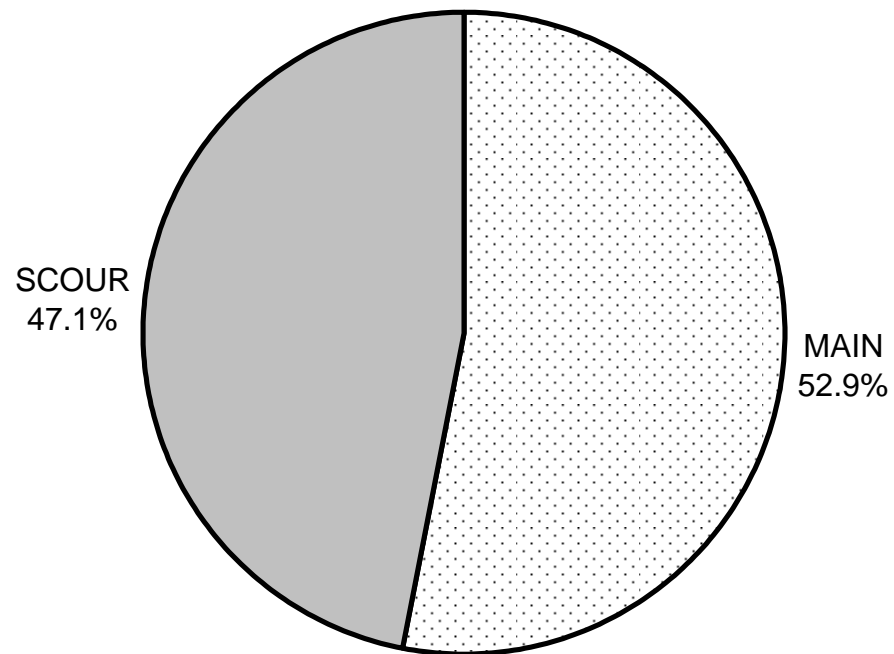
MILL CREEK 2010

HABITAT TYPES BY PERCENT OCCURRENCE



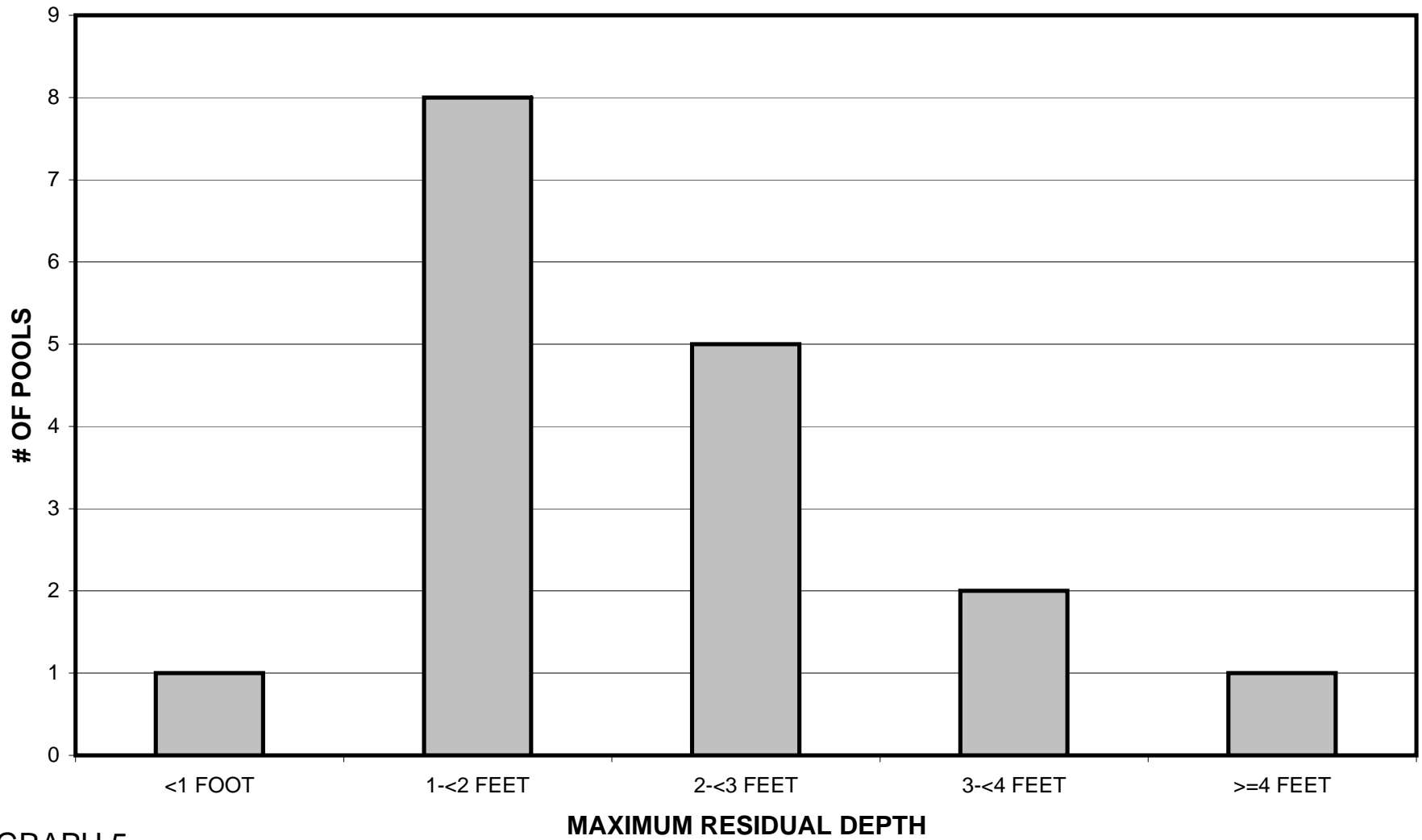
GRAPH 3

**MILL CREEK 2010
POOL TYPES BY PERCENT OCCURRENCE**



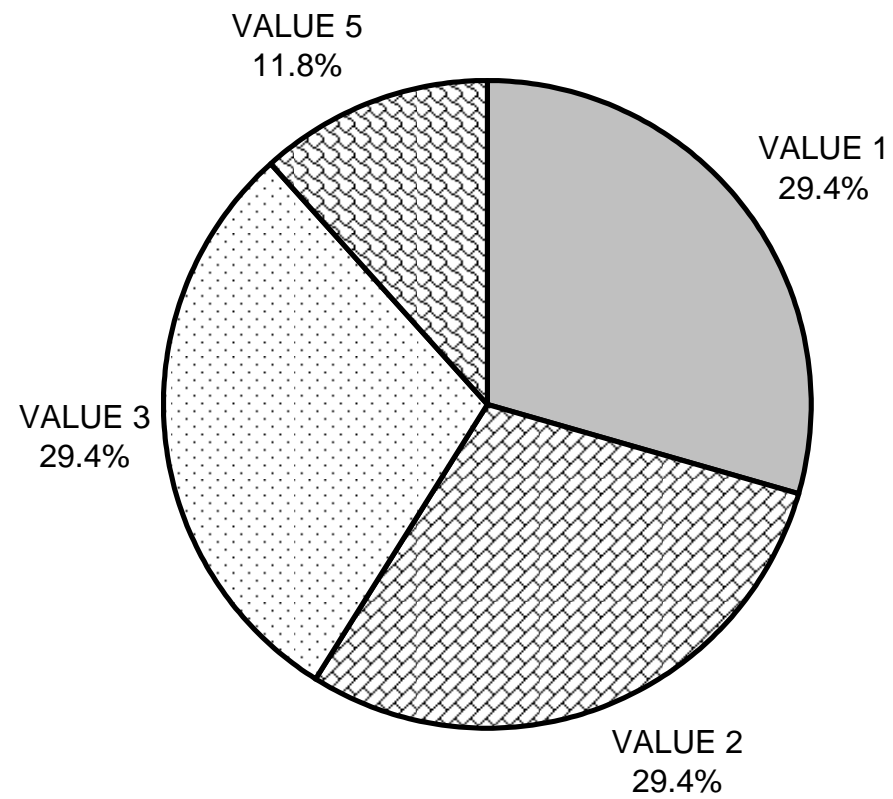
GRAPH 4

MILL CREEK 2010 MAXIMUM DEPTH IN POOLS



GRAPH 5

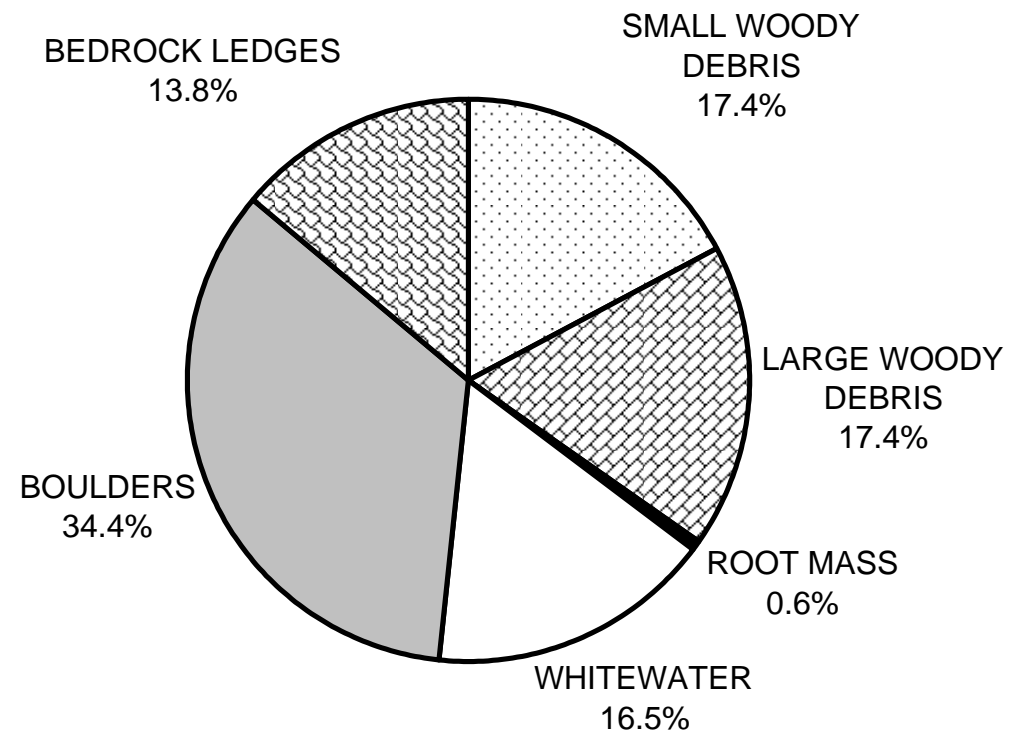
MILL CREEK 2010 PERCENT EMBEDDEDNESS



GRAPH 6

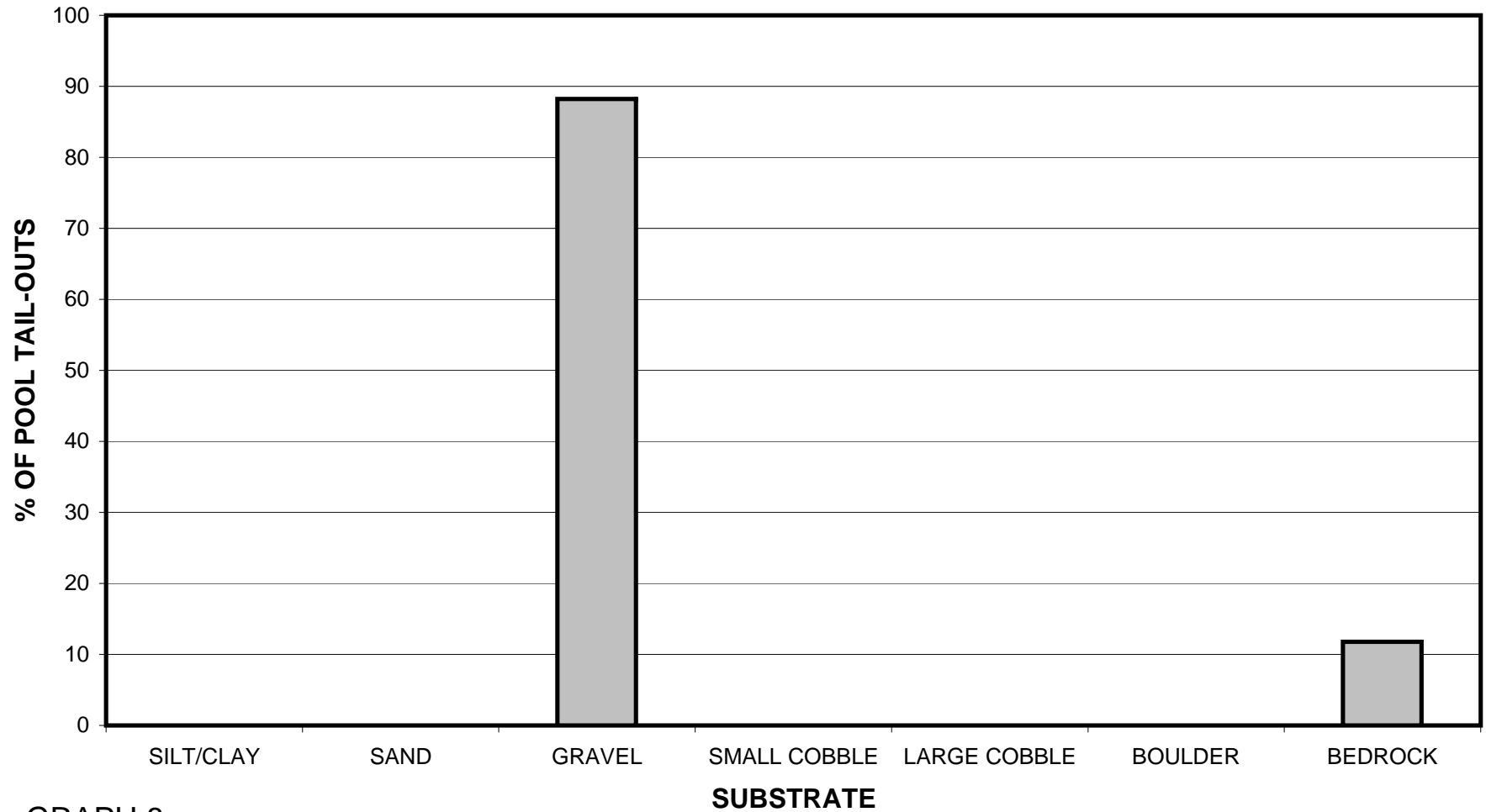
MILL CREEK 2010

MEAN PERCENT COVER TYPES IN POOLS



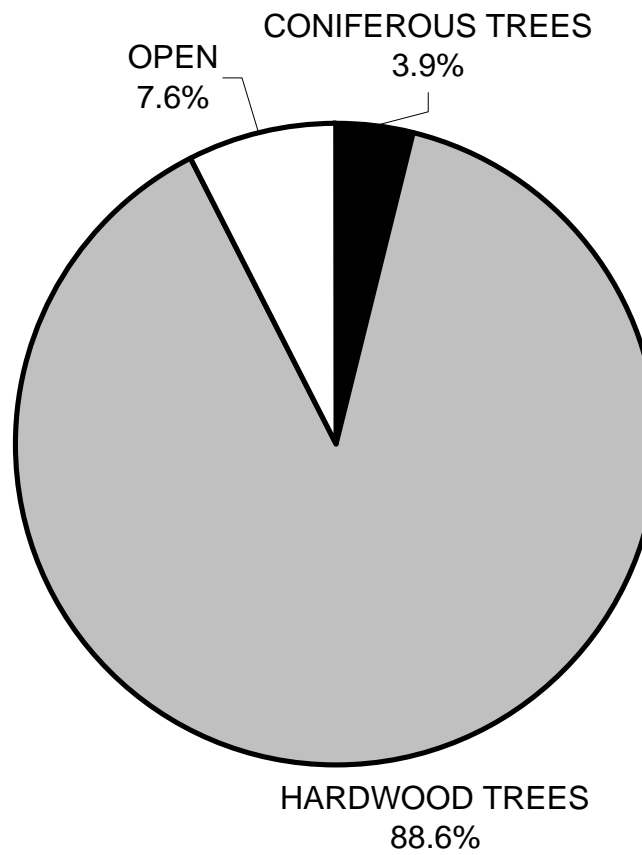
GRAPH 7

MILL CREEK 2010 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



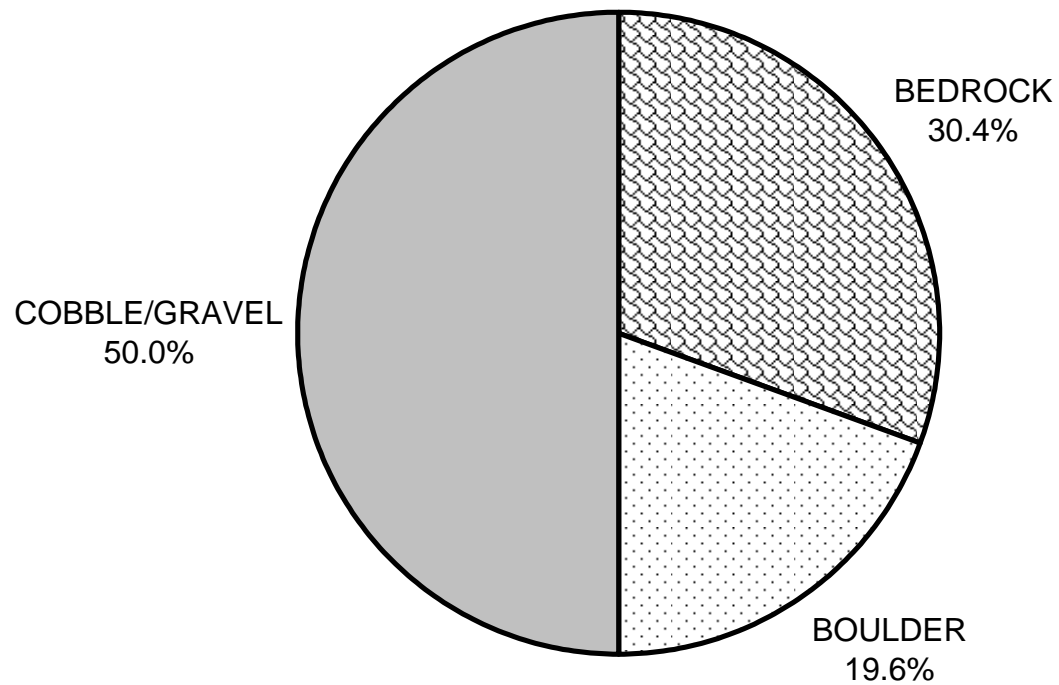
GRAPH 8

**MILL CREEK 2010
MEAN PERCENT CANOPY**



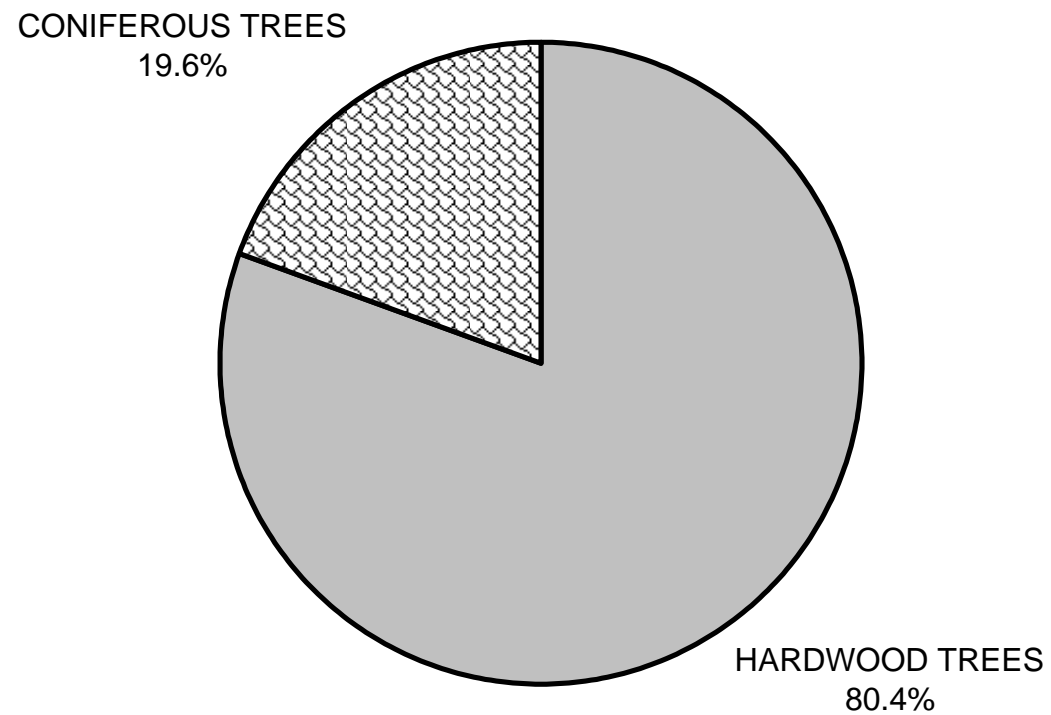
GRAPH 9

**MILL CREEK 2010
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**MILL CREEK 2010
DOMINANT BANK VEGETATION IN SURVEY REACH**

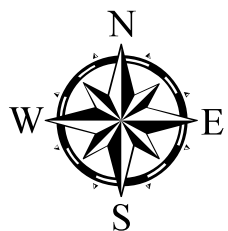
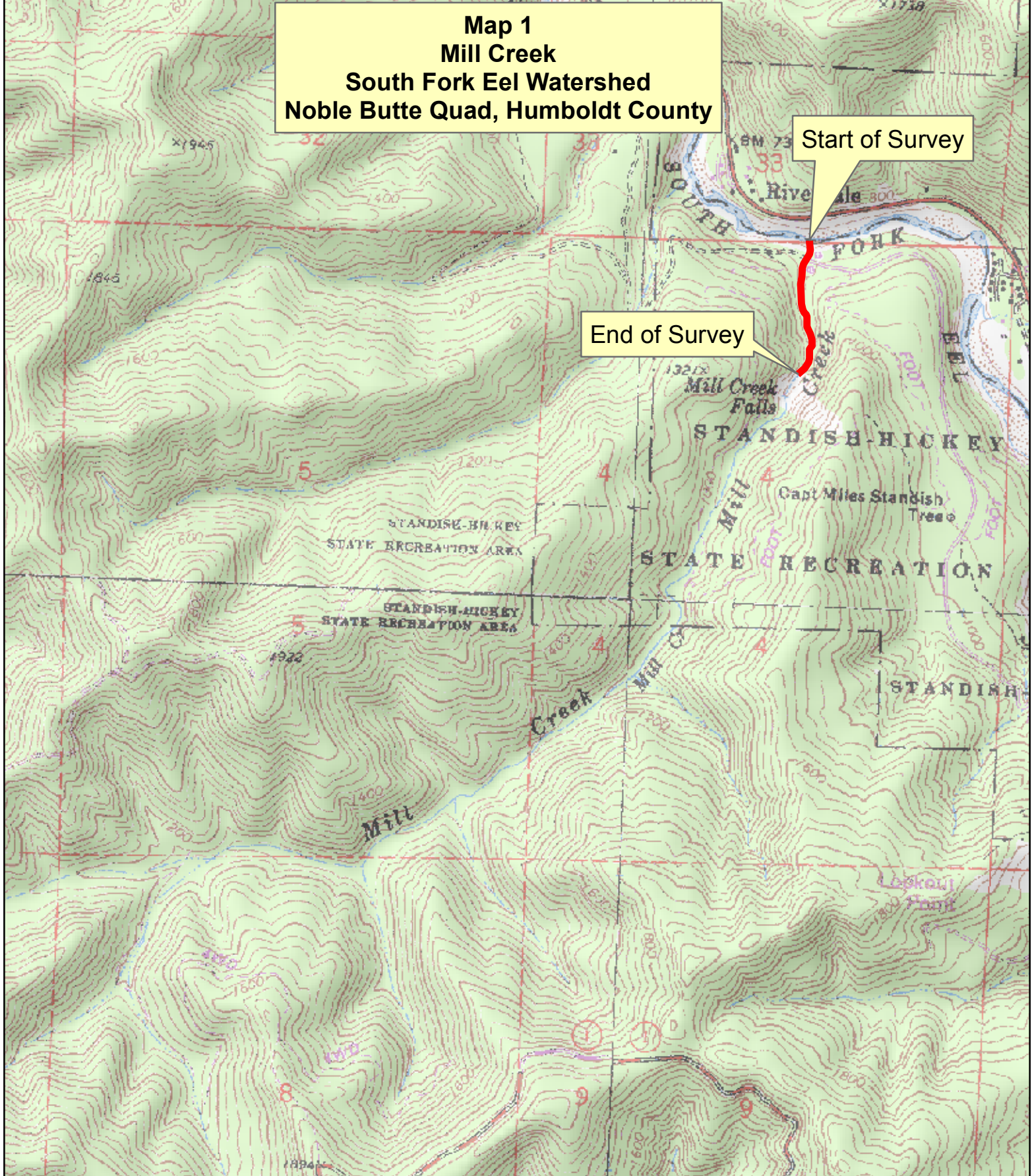


GRAPH 11

Map 1
Mill Creek
South Fork Eel Watershed
Noble Butte Quad, Humboldt County

Start of Survey

End of Survey



Legend

— Reach 1, A3 Channel Type

0 1,500 Feet
| | | | |

