

STREAM INVENTORY REPORT

Monument Creek

INTRODUCTION

A stream inventory was conducted from July 6 to July 7, 2010 on Monument Creek. The survey began at the confluence with Eel River and extended upstream 1.4 miles.

The Monument 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 Monument 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

Monument Creek is a tributary to Eel River, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Monument Creek's legal description at the confluence with Eel River is T01N R01E S18. Its location is 40.4747 north latitude and 124.1100 west longitude, LLID number 1241086404749. Monument Creek is a first order stream and has approximately 2.3 miles of blue line stream according to the USGS Scotia 7.5 minute quadrangle. Monument Creek drains a watershed of approximately 5.4 square miles. Elevations range from about 40 feet at the mouth of the creek to 2,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via Highway 101 near Scotia.

METHODS

The habitat inventory conducted in Monument 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

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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 Monument 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". Monument 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 Monument Creek, embeddedness

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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 Monument 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 Monument 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 Monument 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 Monument Creek. In addition, underwater observations were made at 23 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Monument 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 6 to July 7, 2010, was conducted by S. McSmith (DFG) and A. Villalobos (WSP). The total length of the stream surveyed was 7,387 feet with an additional 519 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.91 cfs on July 8, 2010.

Monument Creek is a B3 channel type for 5,977 feet of the stream surveyed (Reach 1), and an A4 channel type for 1,410 feet of the stream surveyed (Reach 2). B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and cobble-dominant substrates. A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45% pool units, 40% riffle units, 14% flatwater units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 47% riffle units, 33% pool units, 20% flatwater units, and 1% no survey units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 40%; low gradient riffle units, 20%; and high

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gradient riffle units 19% (Graph 3). Based on percent total length, mid-channel pool units made up 30%, low gradient riffle units 27%, and high gradient riffle units 20%.

A total of 63 pools were identified (Table 3). Main channel pools were the most frequently encountered at 90% (Graph 4), and comprised 94% 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. Twenty-eight of the 63 pools (44%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 63 pool tail-outs measured, 11 had a value of 1 (17.5%); 17 had a value of 2 (27%); 19 had a value of 3 (30.2%); 16 had a value of 4 (25.4%) (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 25, flatwater habitat types had a mean shelter rating of 22, and pool habitats had a mean shelter rating of 38 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 39. Scour pools had a mean shelter rating of 37 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Monument Creek. Graph 7 describes the pool cover in Monument 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 57% of the pool tail-outs. Sand was the next most frequently observed dominant substrate type and occurred in 25% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Monument Creek was 77%. Twenty-three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 57% and 43%, respectively. Graph 9 describes the mean percent canopy in Monument Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 95%. The dominant elements composing the structure of the stream banks consisted of 78% sand/silt/clay, 10% boulder, 9% cobble/gravel, and 3% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 44.4% of the units surveyed. Additionally, 40.3% of the units surveyed had deciduous trees as the dominant vegetation type, and 15.3% had brush as the dominant vegetation type (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 23 sites for species composition and distribution in Monument Creek on July 8, 2010. Water temperatures taken during the survey period of 0945 to 1100 were 55 degrees Fahrenheit. Air temperatures ranged from 61 to 68 degrees Fahrenheit. The sites were sampled by S. McSmith (DFG), and P. Scott (WSP).

In reach 1, which comprised the first 5,977 feet of stream, 10 sites were sampled. The reach sites yielded 100 young-of-the-year steelhead/rainbow trout (SH/RT), 10 age 1+ SH/RT, 1 age 2+ SH/RT, 1 three-spine stickleback, and 4 sculpin.

In reach 2, 13 sites were sampled starting approximately 6,111 feet from the confluence with the Eel River and continuing upstream 1,200 feet. The reach sites yielded 54 young-of-the-year SH/RT, 4 age 1+ SH/RT, and 8 age 2+ SH/RT.

The following chart displays the information yielded from these sites:

2010 Monument 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: B3 Channel Type									
07/08/10	1	004	Pool	236	34	1	0	0	0
	2	010	Pool	703	8	2	0	0	0
	3	016	Pool	1303	8	1	0	0	0
	4	018	Pool	1416	8	0	0	0	0
	5	024	Pool	1917	18	0	0	0	0
	6	031	Pool	2466	5	3	0	0	0
	7	041	Pool	3096	4	0	0	0	0
	8	052	Pool	3703	4	1	0	0	0
	9	069	Pool	4725	9	1	1	0	0
	10	082	Pool	5589	8	1	0	0	0
Reach 2: A4 Channel Type									
07/08/10	11	090	Pool	6111	0	0	0	0	0
	12	093	Pool	6211	7	1	1	0	0
	13	103	Pool	6484	20	1	1	0	0
	14	106	Pool	6627	5	0	0	0	0
	15	111	Pool	6729	0	0	0	0	0
	16	114	Pool	6874	9	0	0	0	0

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	17	117	Pool	6997	8	0	2	0	0
	18	119	Pool	7120	4	0	2	0	0
	19	121	Pool	7160	0	0	0	0	0
	20	123	Pool	7184	0	1	0	0	0
	21	125	Pool	7216	0	0	0	0	0
	22	126	Pool	7251	0	1	1	0	0
	23	128	Pool	7311	1	0	1	0	0

DISCUSSION

Monument Creek is a B3 channel type for the first 5,997 feet of stream surveyed, and an A4 channel type for the remaining 1,410 feet. The suitability of B3 and A4 channel types for fish habitat improvement structures is as follows: B3 channel types are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing-deflectors, and log cover. A4 channel types are not suitable for fish habitat improvement structures.

The water temperatures recorded on the survey days July 6 to July 7, 2010, ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 72 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 20% of the total length of this survey, riffles 47%, and pools 33%. Twenty-eight of the 63 (44%) 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 structures that will increase or deepen pool habitat is recommended.

Twenty-eight of the 63 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-five of the pool tail-outs had embeddedness ratings of 3 or 4. None of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Monument Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Forty-six of the 63 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 38. The shelter rating in the flatwater habitats is 22. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Monument Creek. Boulders are the dominant cover type in

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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 77%. Reach 1 had a canopy density of 79%, Reach 2 had a canopy density of 71%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 94% and 95%, 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) Monument 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) In Reach 1 the B3 channel type, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 4) 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.
- 5) 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.
- 6) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

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COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start survey at confluence with Eel River.
737	0012.00	Log debris accumulation (LDA) #01 contains 22 pieces of large woody debris (LWD) and measures 9' high x 65' wide x 28' long. Water flows through visible gaps. It is not retaining sediment. Fish are present above the LDA.
1725	0022.00	Log debris accumulation (LDA) #02 contains 7 pieces of large woody debris (LWD) and measures 6' high x 47' wide x 22' long. Water flows through visible gaps. There is no sediment being retained. Fish are present above the LDA.
2529	0033.00	The channel is braided with willow growing throughout the length of the unit.
3210	0044.00	Redwood has fallen in the channel leaving the right bank cut 15' high x 40' long contributing silt to cobble.
3411	0046.00	An alder from the left bank and a grand fir from the right bank span the channel.
3682	0052.00	The right bank is cut 10' high for the next 3 habitat units contributing silt to cobble.
3778	0054.00	There is a dry left bank tributary entering this habitat unit.
3811	0055.00	A dry tributary enters this habitat unit from the left bank.
4176	0062.00	Tributary #01 enters on the left bank. It contributes to approximately 5% of Monument Creek's flow. The water temperature downstream of the tributary is 54 degrees Fahrenheit, the water temperature of the tributary is 54 degrees Fahrenheit, and the water temperature upstream of the confluence is 54 degrees Fahrenheit. The slope of the tributary is 70% and fish are not observed. It doesn't not appear to be fish accessible due to the slope of the boulder cascade at the mouth.
5521	0081.00	A dry tributary enters this habitat unit from the left bank.

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- 5977 0088.00 The channel changes from a B3 to an A4. Tributary #02 enters on the left bank. It contributes to approximately 1% of Monument Creek's flow. The water temperature downstream of the tributary is 54 degrees Fahrenheit, the water temperature of the tributary is 54 degrees Fahrenheit, and the water temperature upstream of the confluence is 54 degrees Fahrenheit. The slope of the tributary is 20% and fish are not observed in the 100 feet explored. Boulder cascades at the mouth appear to prevent passage to the tributary.
- 6111 0089.01 The side channel has 50% of the flow and is probably impassable due to a plunge at habitat unit #089.03.
- 6111 0089.03 There is a 5' plunge over bedrock, boulder, rootwad and willow into a 0.8' deep pocket of water.
- 6181 0093.00 There is a 6.9' vertical gain over the length of the habitat unit making the slope 23%. Despite the slope there are salmonids upstream.
- 6238 0095.00 There is a 3' boulder plunge.
- 6484 0104.00 Log debris accumulation (LDA) #03 contains 8 pieces of large woody debris (LWD) and measures 7' high x 39' wide x 21' long. Water flows under the LDA through visible gaps. There is no sediment being retained. Fish are present above the LDA.
- 6603 0105.01 There is a right bank slump that is 79' long x 30' high contributing silt to gravel. It is currently 40% vegetated.
- 6691 0110.00 There is a slide on the left bank that is 22' long x 20' high contributing silt to gravel sized sediment.
- 6729 0112.00 The left bank is cut 130' long x 15' high contributing silt to gravel sized sediment.
- 6859 0114.00 Tributary #03 enters on the left bank. It contributes to approximately 5% of Monument Creek's flow. The water temperature downstream of the tributary is 55 degrees Fahrenheit, the water temperature of the tributary is 57 degrees Fahrenheit, and the water temperature upstream of the confluence is 55 degrees Fahrenheit. The slope of the tributary is 90% and fish are not observed in the 30 feet explored. It is not likely to be fish accessible due to the slope of the mouth of the tributary.
- 7091 0119.00 Log debris accumulation (LDA) #04 contains 17 pieces of large woody debris (LWD) and measures 7' high x 33' wide x 8' long. Water flows through large woody debris and small woody debris and there are no

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visible gaps. Retained sediment ranges from silt to cobble and measures 25' wide x 50' long x 1' deep. Fish are present above the LDA.

- 7137 0121.00 Log debris accumulation (LDA) #05 contains 50 pieces of large woody debris (LWD) and measures 6' high x 32' wide x 175' long. Water flows under the LDA through visible gaps. No sediment is currently being retained. Fish are present above the LDA. This LDA spans habitat units #121 to #129.
- 7216 0126.00 Age class 1+ and 2+ salmonids were each observed in this habitat unit.
- 7340 0130.00 Log debris accumulation (LDA) #06 contains 27 pieces of large woody debris (LWD) and measures 11' high x 35' wide x 6' long. Water flows through though there are no visible gaps. Retained sediment ranges from silt to cobbles and measures 35' wide x 100+' long x 11' deep. It is a possible barrier to juvenile and adult salmonids. There is an 11' jump and the maximum depth within 5' is only 2' deep. Fish are present above the LDA. LDA #06 is bedrock with 10' boulders and LWD and is a probable salmonid barrier. There is one redwood that is 1.5' diameter at breast height growing out of the center of the LDA. Upstream of the LDA is ideal salmonid habitat; the stream meanders through clean gravel under a solid redwood canopy. The 1st pool upstream of the LDA has 2 salmonids.
- 7387 0130.00 End of survey.

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: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Confluence Location: Quad: SCOTIA

Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

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
20	3	FLATWATER	14.4	77	1549	19.6	29.3	0.5	1.0	1854	37080	609	12183		22
1	0	NOSURVEY	0.7	58	58	0.7									
63	63	POOL	45.3	41	2582	32.7	15.8	0.6	2.1	672	42336	629	39643	399	38
55	6	RIFFLE	39.6	68	3717	47.0	11.7	0.5	1.1	760	41778	396	21795		25
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
139	72				7906					121194			73621		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Confluence Location: Quad: SCOTIA

Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

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 (%)
28	3	LGR	20.1	75	2109	26.7	11	0.4	1	1032	28900	502	14043		20	66
27	3	HGR	19.4	60	1608	20.3	12	0.6	1.5	487	13151	291	7858		30	68
7	1	RUN	5.0	37	259	3.3	10	0.7	1	209	1463	146	1024		5	98
13	2	SRN	9.4	99	1290	16.3	39	0.4	1	2677	34795	841	10927		30	81
55	55	MCP	39.6	43	2380	30.1	16	0.6	5.6	732	40239	689	37889	429	39	79
1	1	CCP	0.7	13	13	0.2	10	0.9	2.3	104	104	104	104	94	30	94
1	1	STP	0.7	36	36	0.5	11	0.5	1.1	317	317	285	285	158	40	46
1	1	LSR	0.7	33	33	0.4	12	0.6	2.1	376	376	376	376	226	10	83
2	2	LSBk	1.4	23	46	0.6	13	0.1	2.1	286	573	206	412	84	53	59
1	1	LSBo	0.7	37	37	0.5	10	0.2	0.8	352	352	281	281	70	5	95
2	2	PLP	1.4	18	37	0.5	10	0.2	1.9	188	376	148	296	70	50	67
1	0	NS	0.7	58	58	0.7										

Total Units
139

Total Units Fully Measured
72

Total Length (ft.)
7906

Total Area (sq.ft.)
120644

Total Volume (cu.ft.)
73495

Table 3 - Summary of Pool Types

Stream Name: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Confluence Location: Quad: SCOTIA

Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

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
57	57	MAIN	90	43	2429	94	16.3	0.6	713	40660	419	23871	39
6	6	SCOUR	10	26	153	6	11.5	0.2	279	1676	113	450	37

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
63	63	2582	42336	24321

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

Stream Name: Monument Creek LLID: 1241086404749 Drainage: Eel River - Lower
 Survey Dates: 7/6/2010 to 7/7/2010
 Confluence Location: Quad: SCOTIA Legal Description: T01NR01ES18 Latitude: 40:28:30.0N Longitude: 124:06:31.0W

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
55	MCP	87	3	5	27	49	18	33	3	5	4	7
1	CCP	2	0	0	0	0	1	100	0	0	0	0
1	STP	2	0	0	1	100	0	0	0	0	0	0
1	LSR	2	0	0	0	0	1	100	0	0	0	0
2	LSBk	3	0	0	1	50	1	50	0	0	0	0
1	LSBo	2	1	100	0	0	0	0	0	0	0	0
2	PLP	3	0	0	2	100	0	0	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1<2 Foot Max Resid. Depth	Total 1<2 Foot % Occurrence	Total 2<3 Foot Max Resid. Depth	Total 2<3 Foot % Occurrence	Total 3<4 Foot Max Resid. Depth	Total 3<4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
63	4	6	31	49	21	33	3	5	4	6

Mean Maximum Residual Pool Depth (ft.): 2.1

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Dry Units: 0

Confluence Location: Quad: SCOTIA

Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

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
28	3	LGR	0	0	7	0	0	0	0	93	0
27	3	HGR	0	0	0	0	0	0	0	100	0
55	6	TOTAL RIFFLE	0	0	3	0	0	0	0	97	0
7	1	RUN	0	0	0	0	0	0	0	100	0
13	2	SRN	0	28	28	0	0	0	0	45	0
20	3	TOTAL FLAT	0	18	18	0	0	0	0	63	0
55	55	MCP	4	9	31	13	8	1	4	29	1
1	1	CCP	0	0	0	0	0	0	0	100	0
1	1	STP	0	10	30	0	0	0	0	60	0
1	1	LSR	0	0	0	100	0	0	0	0	0
2	2	LSBk	1	17	17	0	0	0	15	37	15
1	1	LSBo	0	0	0	0	0	0	0	100	0
2	2	PLP	0	0	10	15	0	0	25	50	0
63	63	TOTAL POOL	4	9	28	13	7	1	5	32	1
1	0	NS									
139	72	TOTAL	3	9	26	12	6	1	4	39	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Monument Creek LLID: 1241086404749 Drainage: Eel River - Lower
 Survey Dates: 7/6/2010 to 7/7/2010 Dry Units: 0
 Confluence Location: Quad: SCOTIA Legal Description: T01NR01ES18 Latitude: 40:28:30.0N Longitude: 124:06:31.0W

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
28	3	LGR	0	0	33	33	0	33	0
27	3	HGR	0	0	0	0	33	67	0
7	1	RUN	0	0	100	0	0	0	0
13	2	SRN	0	0	50	0	0	50	0
55	55	MCP	0	27	53	4	4	13	0
1	1	CCP	0	0	0	0	0	100	0
1	1	STP	0	0	100	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
2	2	LSBk	0	0	50	0	0	50	0
1	1	LSBo	0	0	100	0	0	0	0
2	2	PLP	0	0	0	0	0	100	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Confluence Location: Quad: SCOTIA

Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
77	43	57	0	94	95

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: Monument Creek LLID: 1241086404749 Drainage: Eel River - Lower
Survey Dates: 7/6/2010 to 7/7/2010 Survey Length (ft.): 7906 Main Channel (ft.): 7387 Side Channel (ft.): 519
Confluence Location: Quad: SCOTIA Legal Description: T01NR01ES18 Latitude: 40:28:30.0N Longitude: 124:06:31.0W

Summary of Fish Habitat Elements By Stream Reach**STREAM REACH: 1**

Channel Type: B3	Canopy Density (%): 79.6	Pools by Stream Length (%): 34.3
Reach Length (ft.): 5977	Coniferous Component (%): 48.5	Pool Frequency (%): 45.6
Riffle/Flatwater Mean Width (ft.): 24.0	Hardwood Component (%): 51.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 54
Range (ft.): 25 to 71	Vegetative Cover (%): 98.6	2 to 2.9 Feet Deep: 29
Mean (ft.): 40	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 7
Std. Dev.: 13	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 10
Base Flow (cfs.): 1.9	Occurrence of LWD (%): 30	Mean Max Residual Pool Depth (ft.): 2.2
Water (F): 54 - 58 Air (F): 57 - 72	LWD per 100 ft.:	Mean Pool Shelter Rating: 32
Dry Channel (ft): 0	Riffles: 2	
	Pools: 6	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 17 Gravel: 59 Sm Cobble: 22 Lg Cobble: 2 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 24.4 2. 36.6 3. 26.8 4. 12.2 5. 0.0		

STREAM REACH: 2

Channel Type: A4	Canopy Density (%): 71.2	Pools by Stream Length (%): 27.3
Reach Length (ft.): 1410	Coniferous Component (%): 31.5	Pool Frequency (%): 44.9
Riffle/Flatwater Mean Width (ft.): 9.5	Hardwood Component (%): 68.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 59
Range (ft.): 27 to 36	Vegetative Cover (%): 87.3	2 to 2.9 Feet Deep: 41
Mean (ft.): 29	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 4	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.9	Occurrence of LWD (%): 18	Mean Max Residual Pool Depth (ft.): 1.9
Water (F): 53 - 55 Air (F): 54 - 67	LWD per 100 ft.:	Mean Pool Shelter Rating: 50
Dry Channel (ft): 0	Riffles: 5	
	Pools: 10	
	Flat: 6	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 41 Gravel: 55 Sm Cobble: 5 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 4.5 2. 9.1 3. 36.4 4. 50.0 5. 0.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Confluence Location: Quad: SCOTIA

Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

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	0	4	2.8
Boulder	7	7	9.7
Cobble / Gravel	9	4	9.0
Sand / Silt / Clay	56	57	78.5

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	10	12	15.3
Hardwood Trees	28	30	40.3
Coniferous Trees	34	30	44.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Monument Creek

LLID: 1241086404749

Drainage: Eel River - Lower

Survey Dates: 7/6/2010 to 7/7/2010

Confluence Location: Quad: SCOTIA

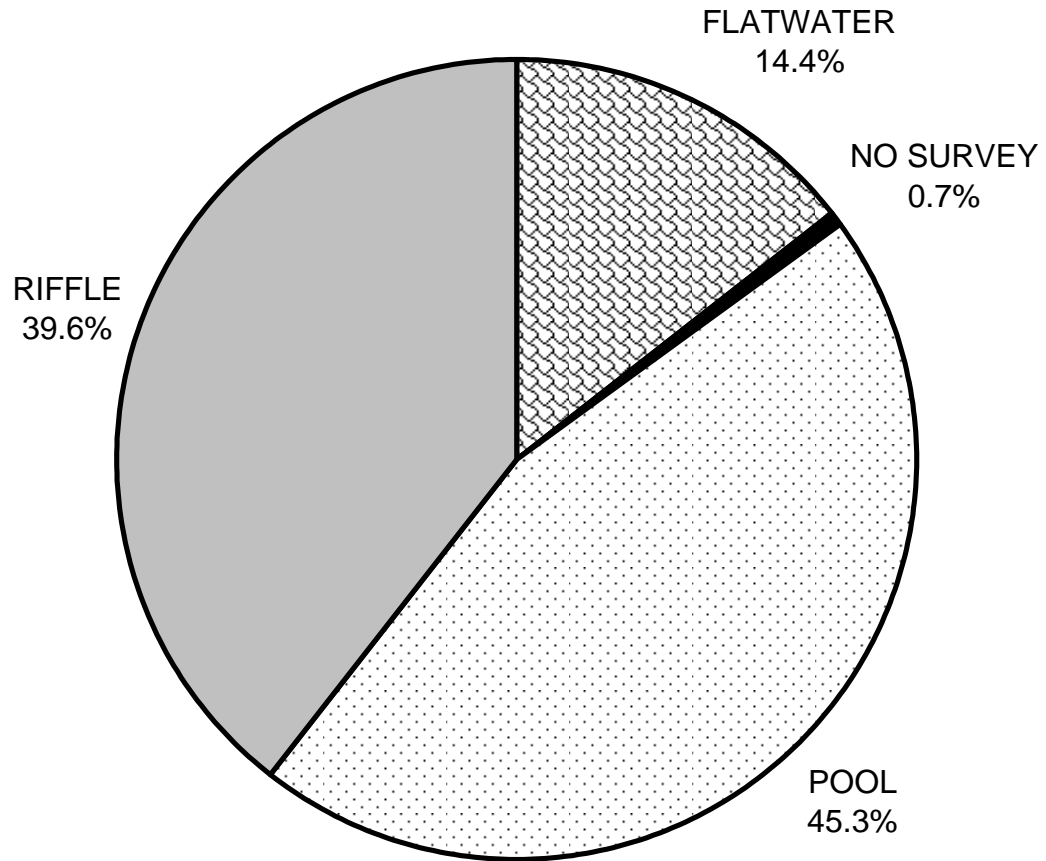
Legal Description: T01NR01ES18

Latitude: 40:28:30.0N

Longitude: 124:06:31.0W

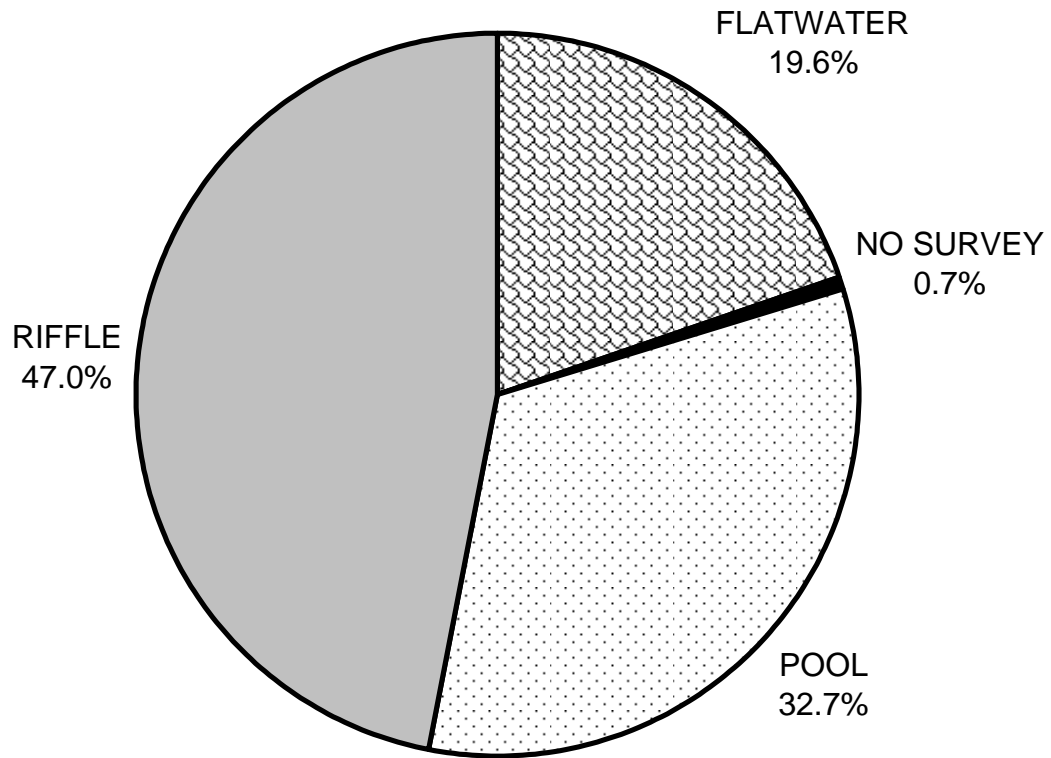
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	4
SMALL WOODY DEBRIS (%)	0	18	9
LARGE WOODY DEBRIS (%)	3	18	28
ROOT MASS (%)	0	0	13
TERRESTRIAL VEGETATION (%)	0	0	7
AQUATIC VEGETATION (%)	0	0	1
WHITEWATER (%)	0	0	5
BOULDERS (%)	97	63	32
BEDROCK LEDGES (%)	0	0	1

MONUMENT CREEK 2010 HABITAT TYPES BY PERCENT OCCURRENCE



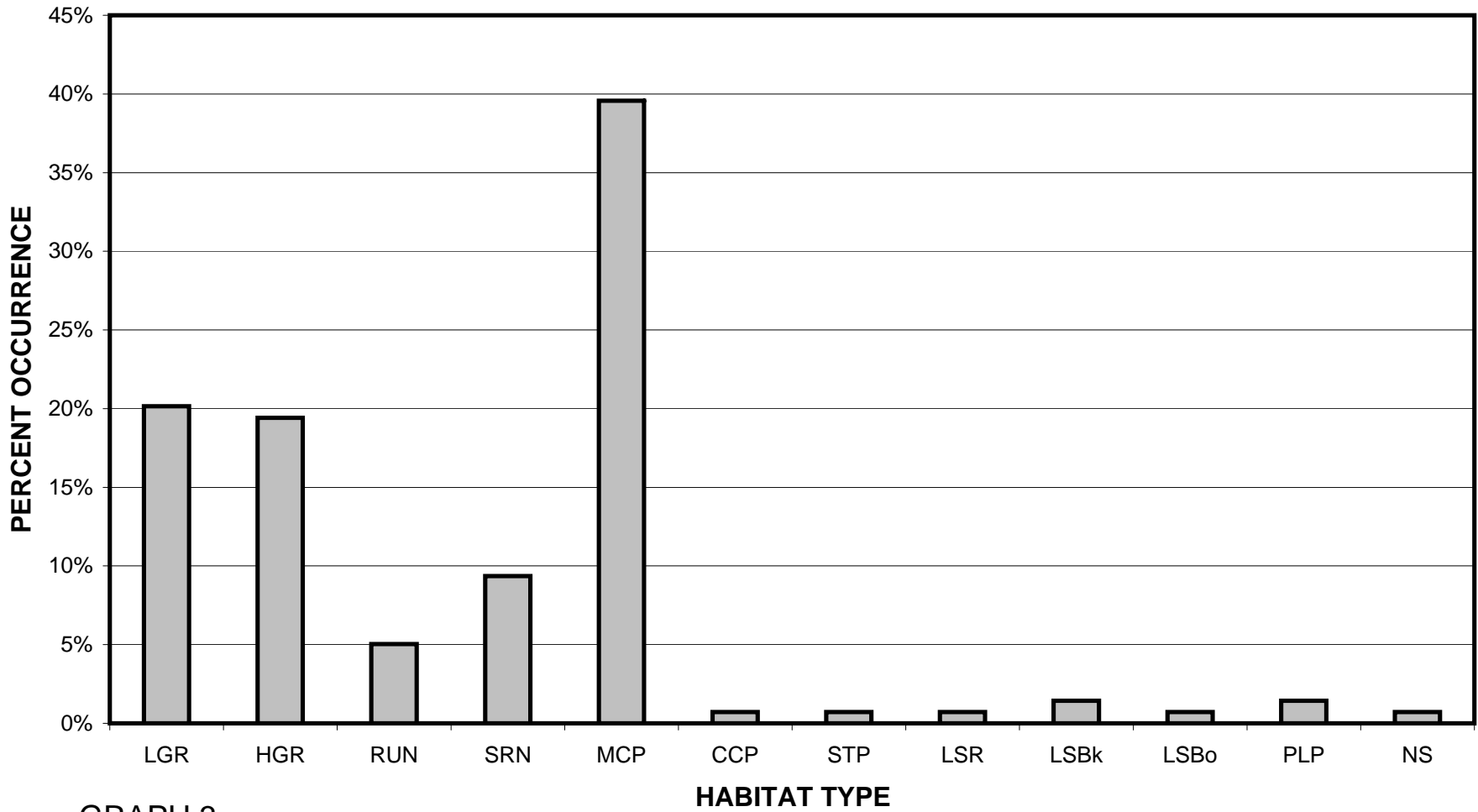
GRAPH 1

MONUMENT CREEK 2010 HABITAT TYPES BY PERCENT TOTAL LENGTH



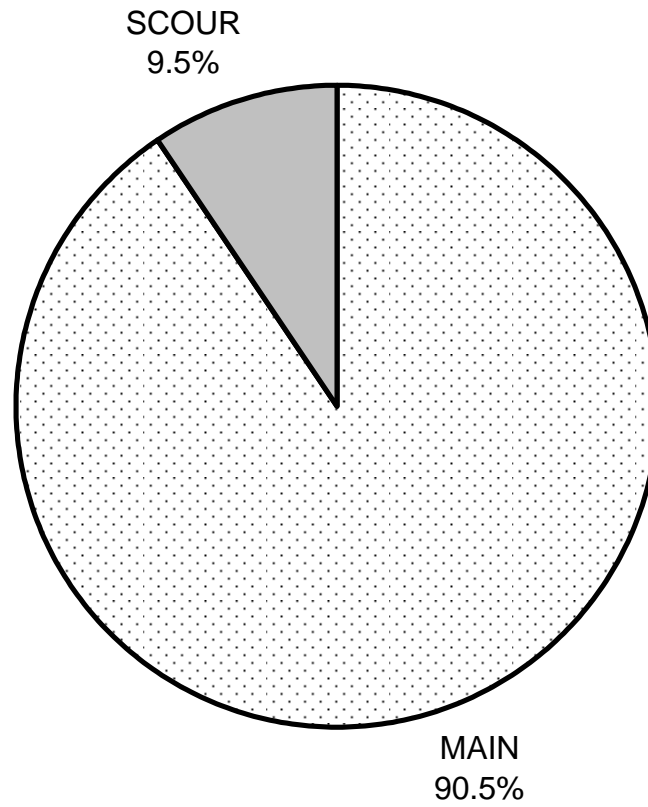
GRAPH 2

MONUMENT CREEK 2010 HABITAT TYPES BY PERCENT OCCURRENCE



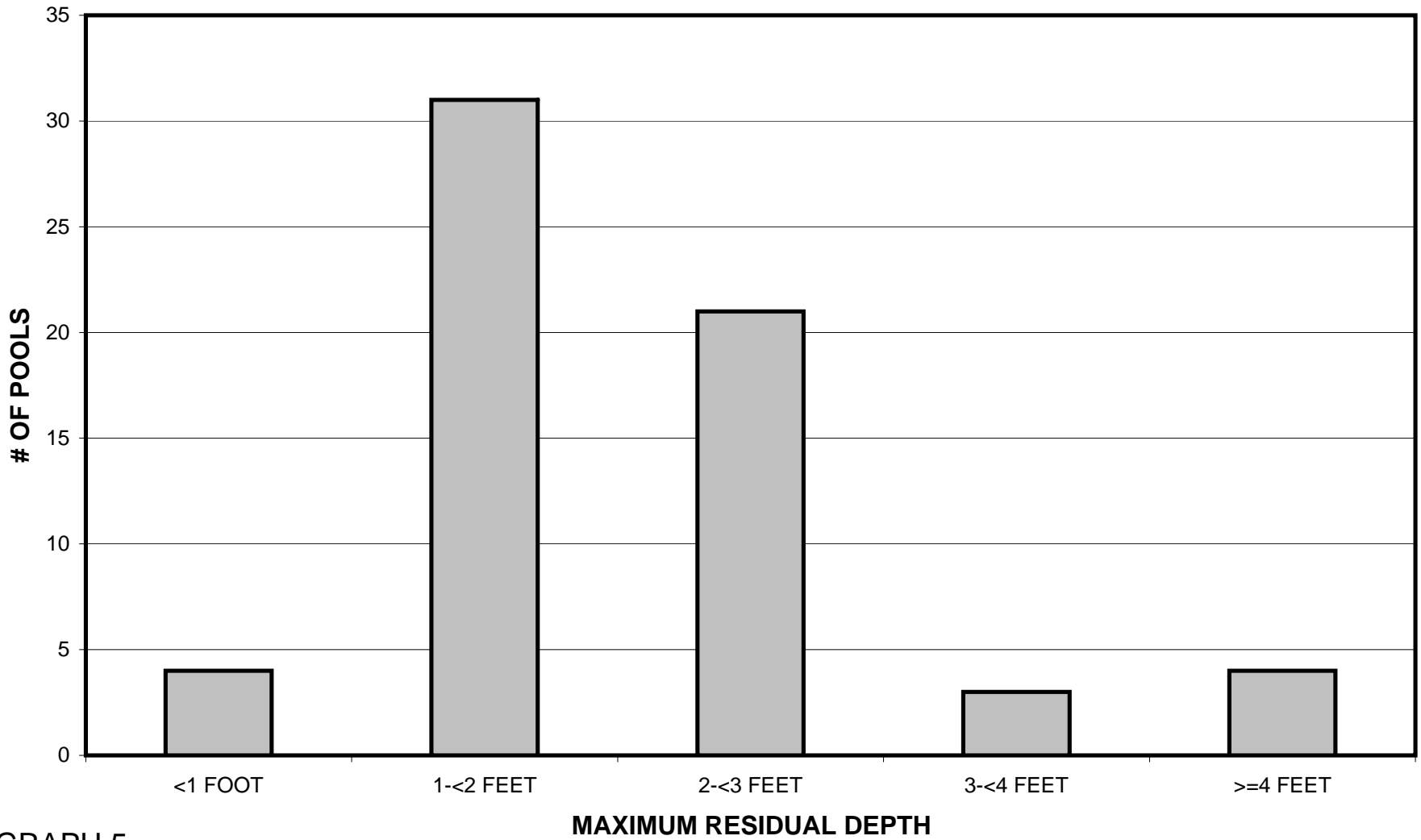
GRAPH 3

MONUMENT CREEK 2010 POOL TYPES BY PERCENT OCCURRENCE



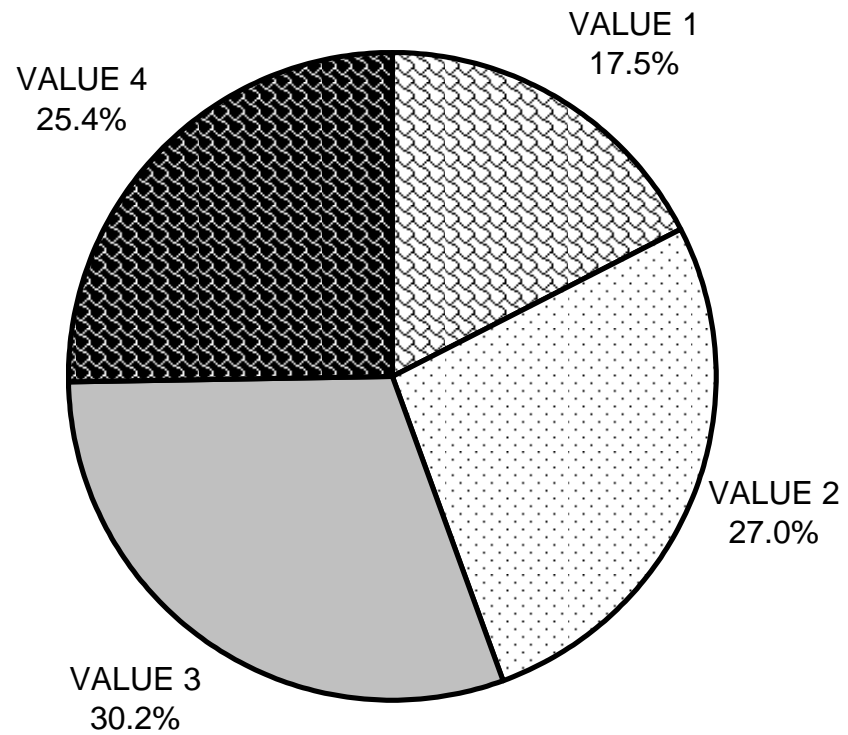
GRAPH 4

MONUMENT CREEK 2010 MAXIMUM DEPTH IN POOLS



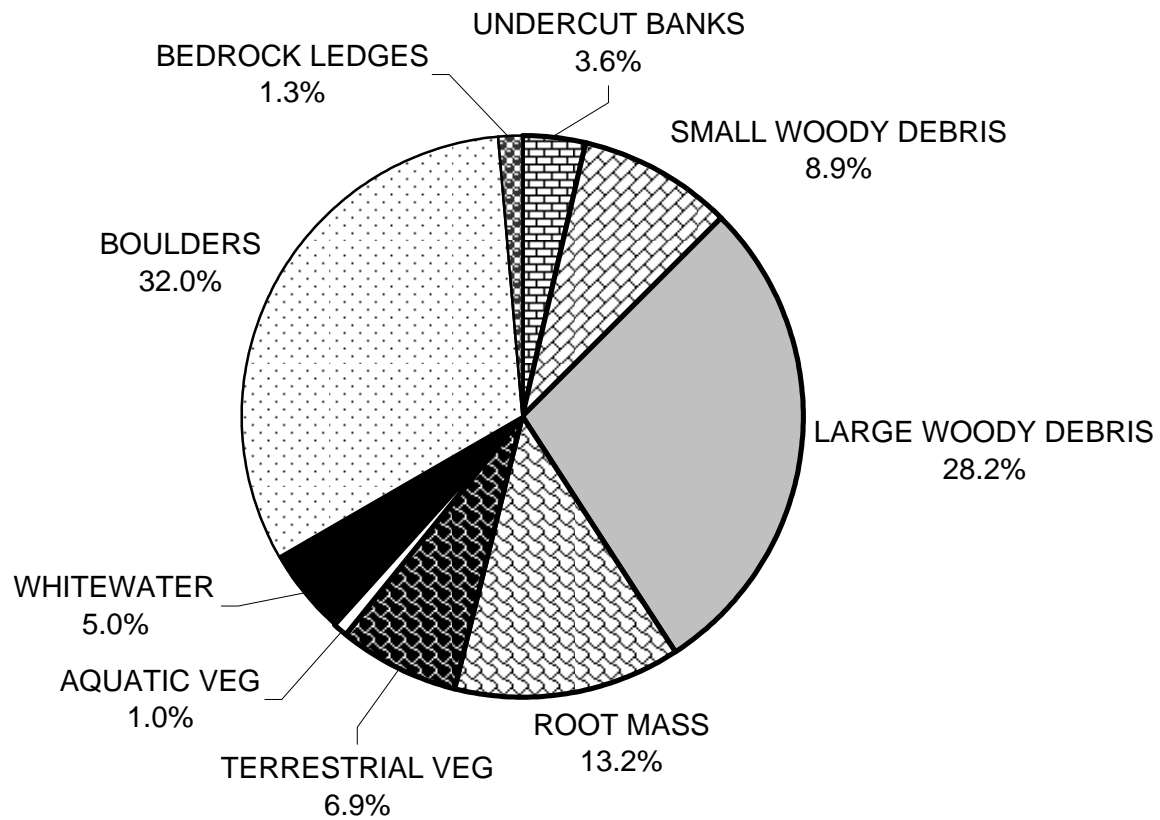
GRAPH 5

MONUMENT CREEK 2010 PERCENT EMBEDDEDNESS



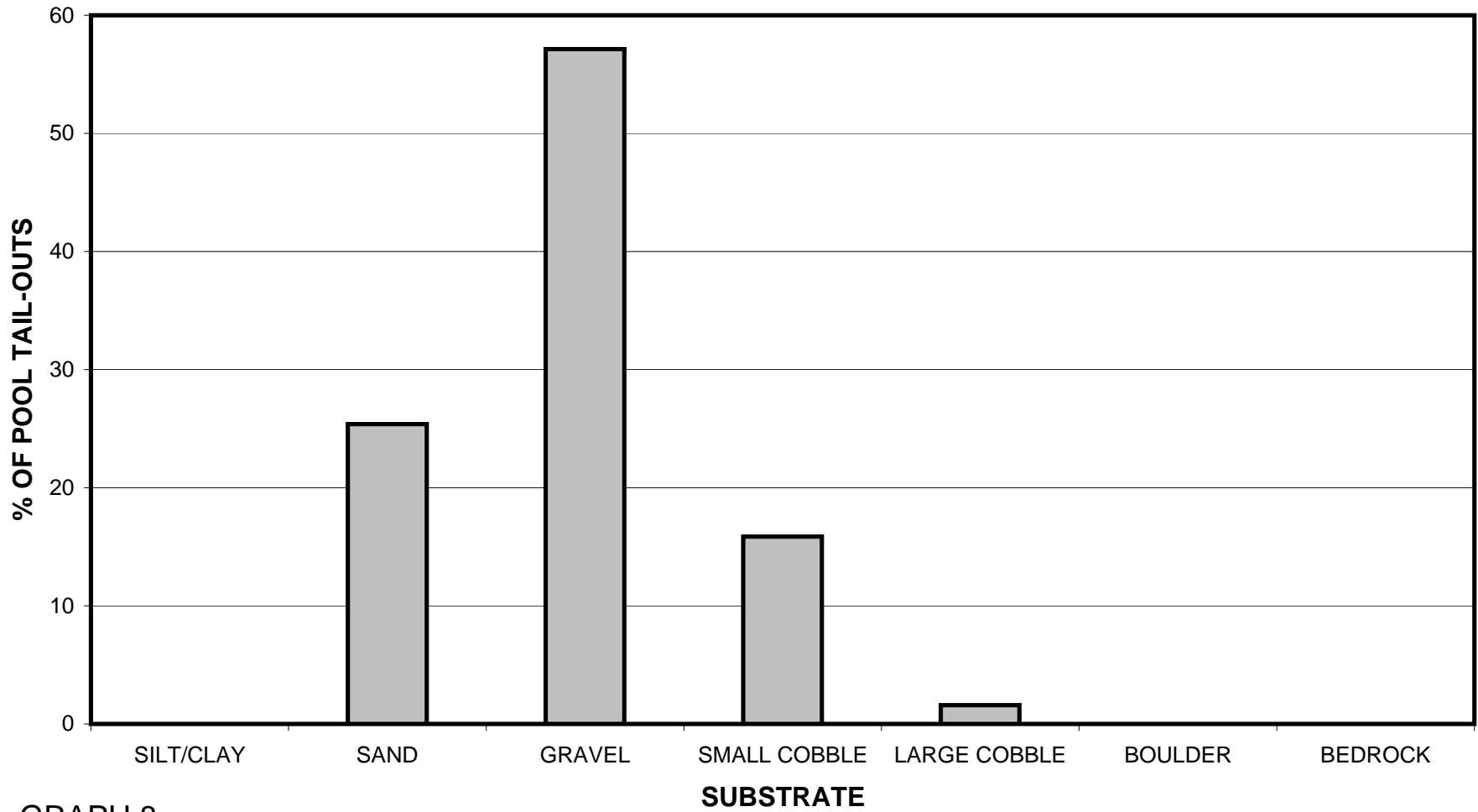
GRAPH 6

MONUMENT CREEK 2010 MEAN PERCENT COVER TYPES IN POOLS



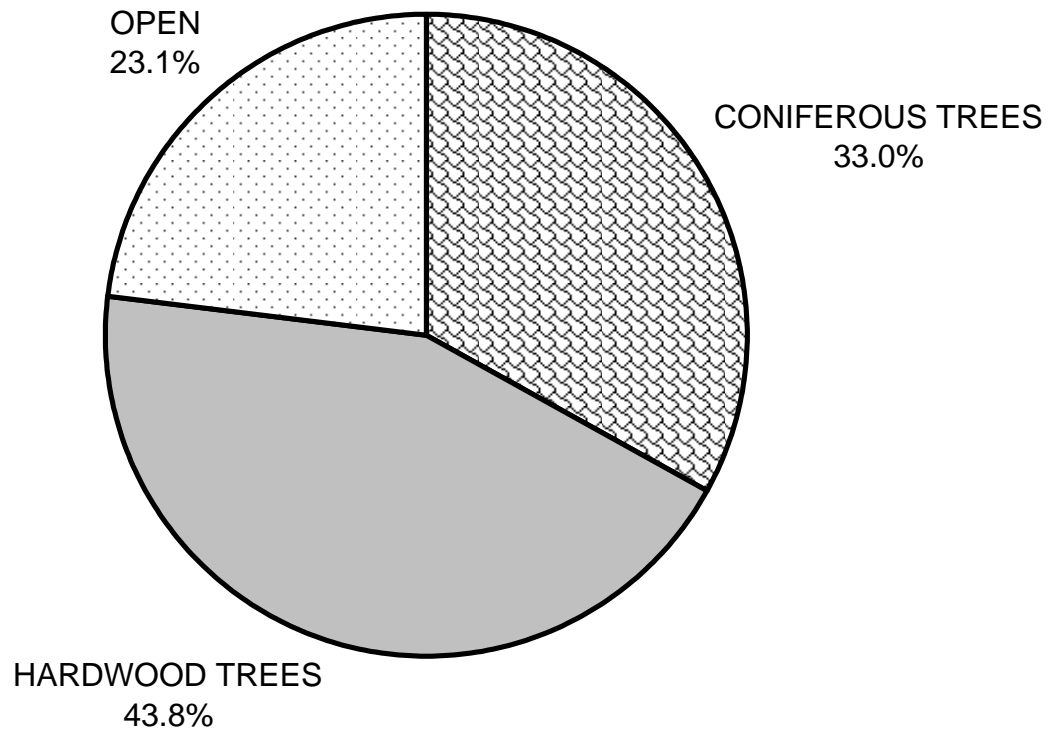
GRAPH 7

MONUMENT CREEK 2010 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



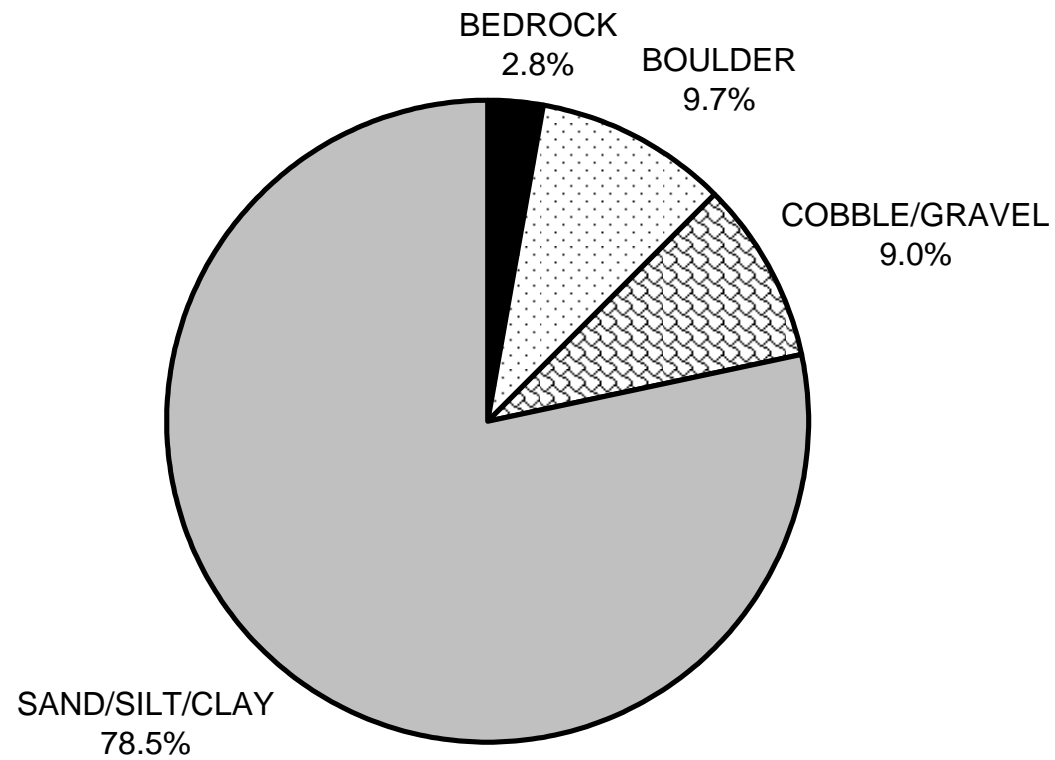
GRAPH 8

MONUMENT CREEK 2010 MEAN PERCENT CANOPY



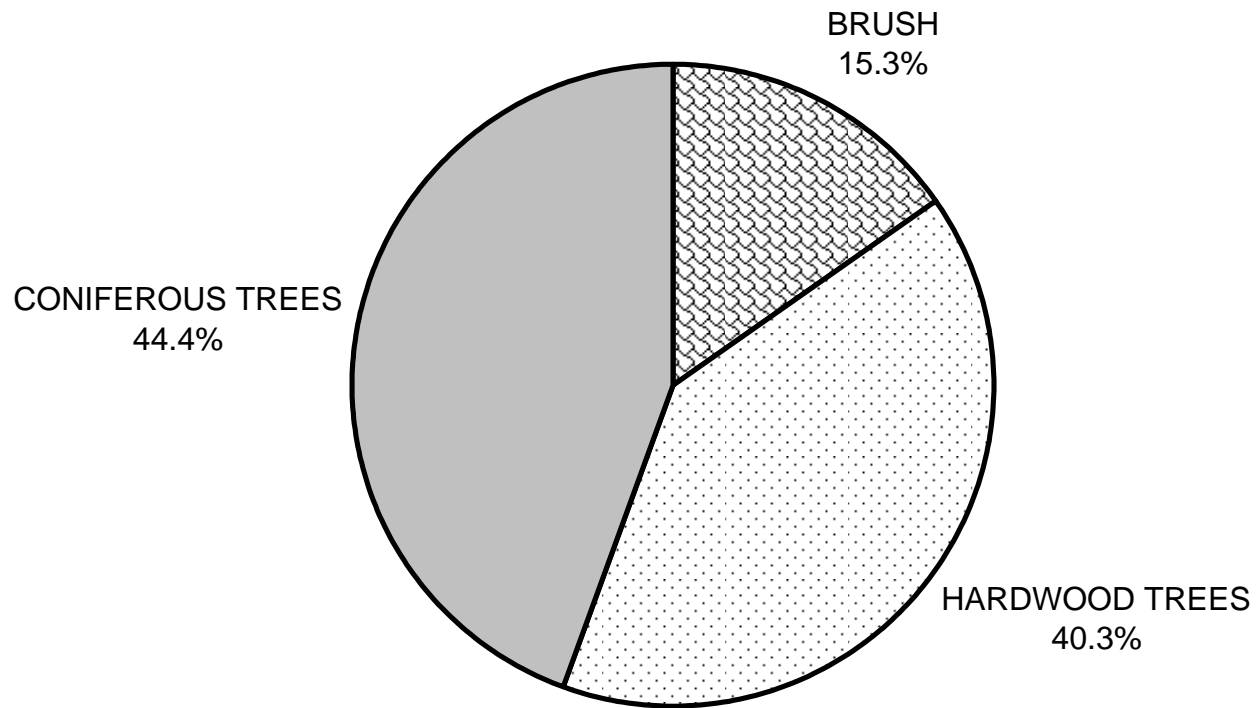
GRAPH 9

MONUMENT CREEK 2010 DOMINANT BANK COMPOSITION IN SURVEY REACH



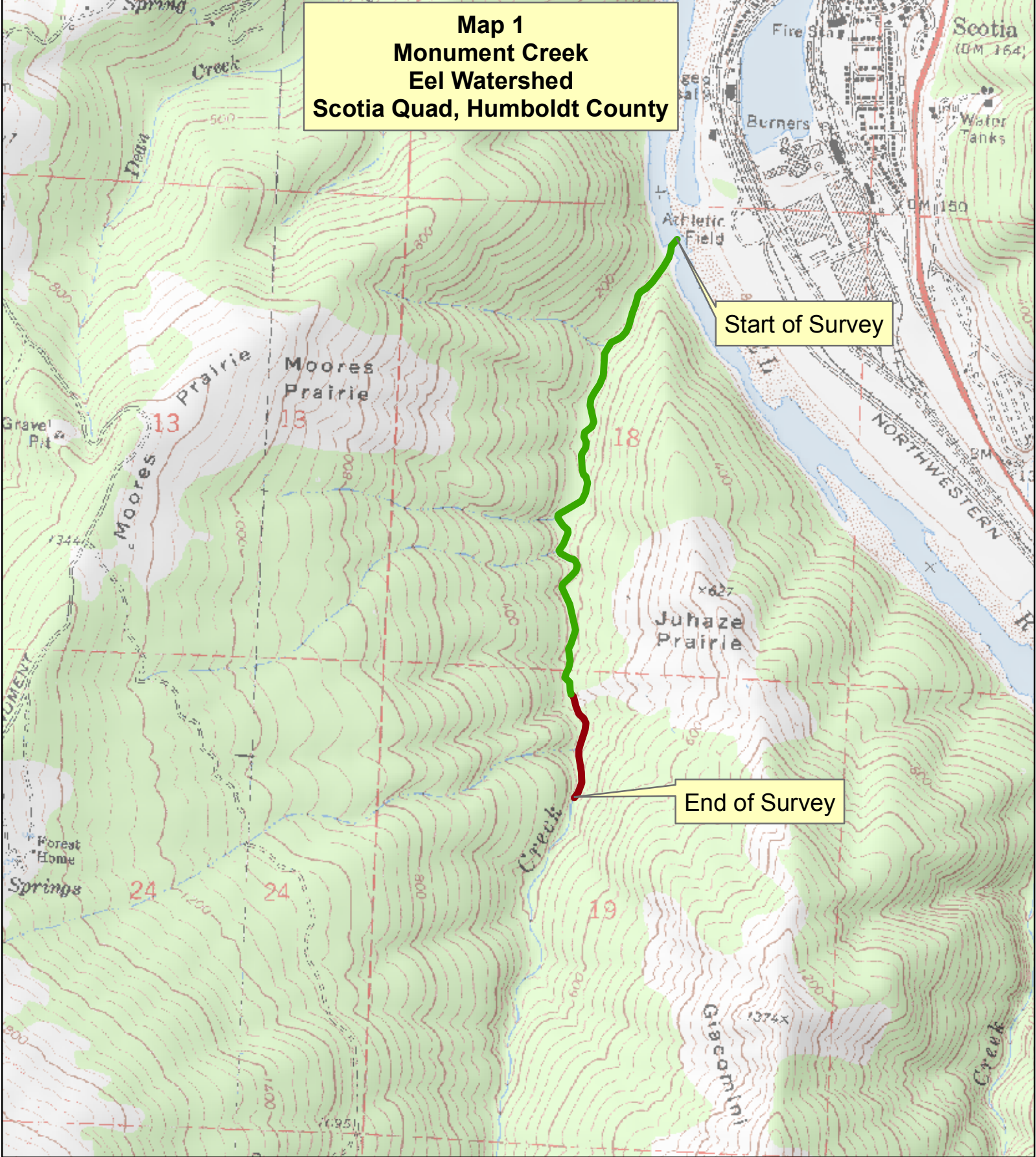
GRAPH 10

MONUMENT CREEK 2010 DOMINANT BANK VEGETATION IN SURVEY REACH



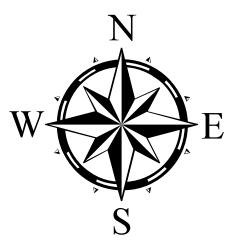
GRAPH 11

**Map 1
Monument Creek
Eel Watershed
Scotia Quad, Humboldt County**





Start of Survey

End of Survey



Legend

-  Reach 1, B3 Channel Type
-  Reach 2, A4 Channel Type

