

STREAM INVENTORY REPORT

Smith Creek

INTRODUCTION

A stream inventory was conducted from July 30 to August 22, 2012 on Smith Creek. The survey began at the confluence with South Fork Ten Mile River and extended upstream 3.8 miles. A stream inventory and report were also completed for one tributary to Smith Creek.

The Smith 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 Smith 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 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

Smith Creek is a tributary to South Fork Ten Mile River, a tributary to Ten Mile River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Smith Creek's legal description at the confluence with South Fork Ten Mile River is T19N R17W S11. Its location is 39.5254 degrees north latitude and 123.7303 degrees west longitude, LLID number 1237290395254. Smith Creek is a first order stream and has approximately 4.5 miles of blue line stream according to the USGS Dutchmans Knoll 7.5 minute quadrangle. Smith Creek drains a watershed of approximately 5.6 square miles. Elevations range from about five feet at the mouth of the creek to 1,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and as rangeland. Vehicle access exists via Camp 1 Ten Mile Road off Highway 1, north of Fort Bragg, CA.

METHODS

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

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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.

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 Smith 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". Smith 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

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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 Smith 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 not suitable 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 Smith 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 Smith 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 Smith 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

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(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.

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 Smith Creek. In addition, underwater observations were made at 15 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 Wildlife. 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 Smith 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 30 to August 22, 2012 was conducted by B. Leonard (CDFW) and T. Anderson (WSP). The total length of the stream surveyed was 20,073 feet with an additional 44 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.7 cfs on September 4, 2012.

Smith Creek is an F4 channel type for 14,291 feet of the stream surveyed (Reach 1) and a B4 channel type for 5,782 feet of the stream surveyed (Reach 2). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 49 to 55 degrees Fahrenheit. Air temperatures ranged from 44 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% pool units, 28% flatwater units, and 21% riffle units. 1% of the units were not surveyed (Graph 1). Based on total length of Level II habitat types there were 49% pool units, 37% flatwater units, and 14% riffle units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 46%; low gradient riffle units, 21%; and step run units, 15% (Graph 3). Based on percent total length, mid channel pool units made up 46%,

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step run units 26%, and low gradient riffle units 14%.

A total of 267 pools were identified (Table 3). Main channel pools were the most frequently encountered at 96% (Graph 4), and comprised 96% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Seventy-five of the 267 pools (28%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 267 pool tail-outs measured, 259 had a value of 2 (97%); eight had a value of 3 (3%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst.

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 3, flatwater habitat types had a mean shelter rating of 6, and pool habitats had a mean shelter rating of 33 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 65. Main channel pools had a mean shelter rating of 33. Scour pools had a mean shelter rating of 16 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Smith Creek. Graph 7 describes the pool cover in Smith Creek. Small woody debris is 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 82% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 15% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Smith Creek was 93%. Seven 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 Smith Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 54% sand/silt/clay, 40% cobble/gravel, 4% bedrock, and 2% boulders (Graph 10). Brush was the dominant vegetation type observed in 53% of the units surveyed. Additionally, 37% of the units surveyed had deciduous trees as the dominant vegetation type, and 8% had coniferous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 15 sites for species composition and distribution in Smith Creek on October 8, 2012. The sites were sampled by B. Leonard and T. Anderson (CDFW).

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In Reach 1, which comprised the first 14,291 feet of stream, four sites were sampled. The reach sites yielded 17 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), four age 1+ SH/RT, one age 2+ SH/RT, two YOY coho salmon, and one sculpin.

In Reach 2, six sites were sampled starting approximately 14,625 from the confluence with South Fork Ten Mile River and continuing upstream 5,436 feet. The reach sites yielded 38 YOY SH/RT, seven age 1+ SH/RT, one age 2+ SH/RT, and 15 YOY coho salmon.

Additionally, six sites were sampled upstream of the end of survey point, starting approximately 20,073 feet from the confluence with South Fork Ten Mile River. The sample sites yielded 26 YOY SH/RT, and two age 1+ SH/RT.

The following chart displays the information yielded from these sites:

2012 Smith Creek underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: F4 Channel Type									
10/08/12	1	353	Pool	13,695	6	1	0	2	0
	2	357	Pool	13,828	3	0	0	0	0
	3	360	Pool	13,956	2	0	0	0	0
	4	369	Pool	14,260	6	3	1	0	0
Reach 2: B4 Channel Type									
10/08/12	5	382	Pool	14,674	11	4	1	1	0
	6	437	Pool	16,576	6	0	0	5	0
	7	458	Pool	17,326	5	0	0	2	0
	8	462	Pool	17,418	11	3	0	7	0
	9	530	Pool	19,881	5	0	0	0	0
	10	537	Pool	20,061	0	0	0	0	0
Upstream of End of Survey Point									
10/08/12	11	~~	Pool	~~	1	1	0	0	0
	12	~~	Pool	~~	4	1	0	0	0
	13	~~	Pool	~~	7	0	0	0	0
	14	~~	Pool	~~	8	0	0	0	0
	15	~~	Pool	~~	6	0	0	0	0

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DISCUSSION

Smith Creek is an F4 channel type for the first 14,291 feet of stream surveyed and a B4 channel type for the remaining 5,782 feet. The suitability of F4 and B4 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. B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 30 to August 22, 2012 ranged from 49 to 55 degrees Fahrenheit. Air temperatures ranged from 44 to 64 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 37% of the total length of this survey, riffles 14%, and pools 49%. Seventy-five of the 267 (28%) 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.

Two hundred fifty-nine of the 267 pool tail-outs measured had embeddedness ratings of 1 or 2. Eight 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 not suitable 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.

Two hundred fifty-nine of the 267 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 33. The shelter rating in the flatwater habitats is 6. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Smith Creek. Small woody debris is 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 93%. Reach 1 had a canopy density of 94%, Reach 2 had a canopy density of 93%. The percentage of right and left bank covered with vegetation was 99% and 99%, respectively.

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RECOMMENDATIONS

- 1) Smith 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 small 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 South Fork Ten Mile River. The channel is an F4.
134	0005.00	Road 12300/ Camp 1 Ten Mile Road crosses the channel. The crossing is a 9.8' wide x 54' long x 9' high railcar bridge.
962	0027.00	There is a 0.5' diameter corrugated metal pipe on the right bank.
1284	0040.00	A logging road crosses the channel. The crossing is an 18' wide x 10.5' long x 4.5' high railcar bridge.
7348	0187.00	An erosion site on the left bank measures approximately 20' long x 10' high. It is contributing sediment ranging in size from silt to small cobble to the channel.
7448	0190.00	Log debris accumulation (LDA) #01 contains eight pieces of large woody debris (LWD) and measures 4' high x 22' wide x 20' long. Water flows through the LDA and there are visible gaps in it. Retained sediment measures 18' wide x 45' long x 1' deep. Fish were observed above the LDA.
10296	0268.00	A landslide on the right bank measures approximately 20' high x 12' wide.

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10766	0284.00	LDA #02 contains four pieces of LWD and measures 4' high x 18' wide x 6' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 12' wide x 48' long x 2' deep. There is a 2.5' high plunge over the LDA. Fish were observed above the LDA.
13067	0339.00	An erosion site on the right bank measures approximately 20' wide x 40' high. LDA #03 contains 20 pieces of LWD and measures 6 high x 60' wide x 14' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 12' wide x 86' long x 4' deep. Fish were observed above the LDA.
13150	0343.00	Tributary #01 enters on the left bank. It contributes less than 1% to Smith Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 51 degrees Fahrenheit. The slope of the tributary is approximately 45%.
14291	0371.00	The channel changes from an F4 to a B4.
14455	0378.00	Tributary #02 enters on the left bank. It contributes less than 1% to Smith Creek's flow. The water temperature of the tributary was 49 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 50 degrees Fahrenheit. The slope of the tributary is approximately 15%. There is a 9' high bedrock waterfall approximately 25' upstream from the mouth.
14503	0380.00	LDA #04 contains 10 pieces of LWD and measures 4' high x 24' wide x 11' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 17' wide x 45' long x 2' deep. Fish were observed above the LDA.
14852	0388.00	LDA #05 contains nine pieces of LWD and measures 4' high x 18' wide x 20' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 10' wide x 100' long x 2' deep. Fish were observed above the LDA.
15330	0401.00	LDA #06 contains 15 pieces of LWD and measures 5' high x 35' wide x 20' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 12' wide x 30' long x 3' deep. Fish were observed above the LDA.
15615	0413.00	An erosion site on the right bank measures approximately 45' high x 30' long. It is contributing sediment ranging in size from sand to large cobble to the channel.
15953	0423.00	Dry left bank tributary.

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16320	0432.00	A partially vegetated slide on the right bank measures approximately 80' high x 50' long.
16576	0438.00	"North Fork Smith Creek" (Tributary #03) enters on the right bank. It contributes approximately 10% to Smith Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit, the water temperature downstream of the tributary was 50 degrees Fahrenheit, and the water temperature upstream of the confluence was 51 degrees Fahrenheit. The slope of the tributary is approximately 8%. No fish were observed in North Fork Smith Creek.
17011	0451.00	LDA #07 contains six pieces of LWD and measures 5' high x 32' wide x 20' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 25' wide x 30' long x 4' deep. Fish were observed above the LDA.
17352	0461.00	LDA #08 contains 14 pieces of LWD and measures 9' high x 30' wide x 18' long. Water flows subsurface through the LDA and there are no visible gaps in it. Retained sediment measures 30' wide x 50' long x 7' deep. Fish were observed above the LDA.
18072	0478.00	There is a 2.5' high plunge over bedrock.
18832	0502.00	Tributary #04 enters on the left bank. It contributes approximately 1% to Smith Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit, the water temperature downstream of the tributary was 50 degrees Fahrenheit, and the water temperature upstream of the confluence was 51 degrees Fahrenheit. The slope of the tributary is approximately 8%. The tributary is not accessible to salmonids.
18858	0503.00	LDA #09 contains one piece of LWD and measures 4' high x 15' wide x 6' long. Most of the mass of the LDA is small woody debris. Water flows through the LDA and there are no visible gaps in it. Retained sediment measures 15' wide x 22' long x 1.5' deep. Fish were observed above the LDA.
20061	0538.00	LWD is accumulating on the remnants of a railroad trestle in the creek, forming LDA #10. LDA #10 contains 13 pieces of LWD and measures 6' high x 15' wide x 15' long. Water flows subsurface through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 15' wide x 100' long x 4' deep. Fish were observed above the LDA. End of survey due to time constraints.

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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: Smith Creek

LLID: 1237290395254 Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T19NR17WS11 Latitude: 39:31:31.0N Longitude: 123:43:44.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
153	23	FLATWATER	28.3	49	7422	36.9	8.5	0.4	0.6	291	44449	112	17159		6
4	0	NOSURVEY	0.7	17	69	0.3									
267	267	POOL	49.4	37	9856	49.0	11.7	0.7	1.6	432	115281	471	125830	353	33
116	9	RIFFLE	21.5	24	2770	13.8	8.6	0.2	0.4	141	16380	37	4236		3
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
540	299				20117					176110			147224		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Smith Creek

LLID: 1237290395254 Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T19NR17WS11 Latitude: 39:31:31.0N Longitude: 123:43:44.0W

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 (%)
113	7	LGR	20.9	24	2716	13.5	9	0.3	0.5	156	17628	41	4649		3	91
2	1	HGR	0.4	20	41	0.2	11	0.3	1	114	228	34	68		10	100
1	1	BRS	0.2	13	13	0.1	5	0.1	0.3	65	65	7	7		0	90
70	14	RUN	13.0	30	2132	10.6	8	0.4	0.9	231	16202	94	6556		6	94
83	9	SRN	15.4	64	5290	26.3	9	0.4	0.9	382	31739	141	11695		7	95
250	250	MCP	46.3	37	9301	46.2	12	0.7	4.9	434	108589	479	119866	360	34	93
5	5	STP	0.9	37	183	0.9	12	0.7	2.1	368	1838	358	1792	270	17	82
2	2	CRP	0.4	32	64	0.3	8	0.6	1.8	276	552	204	408	139	20	98
2	2	LSL	0.4	31	62	0.3	12	0.6	1.5	386	772	323	646	207	8	99
1	1	LSR	0.2	21	21	0.1	9	0.6	1.7	189	189	170	170	113	30	100
2	2	LSBk	0.4	24	47	0.2	10	0.3	1.1	226	451	122	243	49	3	93
1	1	LSBo	0.2	31	31	0.2	13	0.7	2.2	403	403	403	403	282	10	98
2	2	PLP	0.4	20	39	0.2	18	0.6	1.4	298	596	277	554	203	30	100
2	2	BPL	0.4	54	108	0.5	20	0.7	2	946	1891	873	1747	603	65	85
4	0	NS	0.7	17	69	0.3										

Total Units
540

Total Units Fully Measured
299

Total Length (ft.)
20117

Total Area (sq.ft.)
181142

Total Volume (cu.ft.)
148805

Table 3 - Summary of Pool Types

Stream Name: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR17WS11

Latitude: 39:31:31.0N

Longitude: 123:43:44.0W

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
255	255	MAIN	96	37	9484	96	11.6	0.7	433	110427	358	91353	33
10	10	SCOUR	4	26	264	3	11.8	0.5	296	2963	159	1593	16
2	2	BACKWATER	1	54	108	1	20.5	0.7	946	1891	603	1207	65
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
267	267				9856					115281		94153	

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

Stream Name: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR17WS11

Latitude: 39:31:31.0N

Longitude: 123:43:44.0W

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
250	MCP	94	34	14	144	58	59	24	11	4	2	1
5	STP	2	1	20	3	60	1	20	0	0	0	0
2	CRP	1	0	0	2	100	0	0	0	0	0	0
2	LSL	1	0	0	2	100	0	0	0	0	0	0
1	LSR	0	0	0	1	100	0	0	0	0	0	0
2	LSBk	1	0	0	2	100	0	0	0	0	0	0
1	LSBo	0	0	0	0	0	1	100	0	0	0	0
2	PLP	1	1	50	1	50	0	0	0	0	0	0
2	BPL	1	0	0	1	50	1	50	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
267			36	13	156	58	62	23	11	4	2	1

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Dry Units: 0

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR17WS11

Latitude: 39:31:31.0N

Longitude: 123:43:44.0W

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
113	7	LGR	0	50	50	0	0	0	0	0	0
2	1	HGR	0	70	0	0	0	0	0	30	0
1	1	BRS	0	0	0	0	0	0	0	0	0
116	9	TOTAL RIFFLE	0	57	33	0	0	0	0	10	0
70	14	RUN	24	21	26	7	17	0	0	5	0
83	9	SRN	25	30	5	5	5	0	0	30	0
153	23	TOTAL FLAT	24	25	17	7	12	0	0	15	0
250	250	MCP	13	34	31	11	4	0	0	6	0
5	5	STP	2	23	44	0	2	0	0	29	0
2	2	CRP	75	18	0	8	0	0	0	0	0
2	2	LSL	5	15	75	5	0	0	0	0	0
1	1	LSR	0	10	0	90	0	0	0	0	0
2	2	LSBk	0	0	0	0	0	0	0	0	100
1	1	LSBo	0	10	40	0	0	0	0	50	0
2	2	PLP	18	23	43	5	0	0	10	3	0
2	2	BPL	15	20	55	0	10	0	0	0	0
267	267	TOTAL POOL	13	33	31	11	4	0	0	6	1
4	0	NS									
540	299	TOTAL	14	33	30	10	5	0	0	7	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Dry Units: 0

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR17WS11

Latitude: 39:31:31.0N

Longitude: 123:43:44.0W

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
113	7	LGR	0	0	86	14	0	0	0
2	1	HGR	0	0	0	100	0	0	0
1	1	BRS	0	0	0	0	0	0	100
70	14	RUN	0	0	100	0	0	0	0
83	9	SRN	0	0	89	11	0	0	0
250	250	MCP	0	1	98	1	0	0	0
5	5	STP	0	0	100	0	0	0	0
2	2	CRP	0	0	100	0	0	0	0
2	2	LSL	0	0	100	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
2	2	LSBk	0	0	100	0	0	0	0
1	1	LSBo	0	0	100	0	0	0	0
2	2	PLP	0	0	100	0	0	0	0
2	2	BPL	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR17WS11

Latitude: 39:31:31.0N

Longitude: 123:43:44.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
93	43	57	0	99	99

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: Smith Creek LLID: 1237290395254 Drainage: Rockport
 Survey Dates: 7/30/2012 to 8/22/2012 Survey Length (ft.): 20117 Main Channel (ft.): 20073 Side Channel (ft.): 44
 Confluence Location: Quad: DUTCHMANS Legal Description: T19NR17WS11 Latitude: 39:31:31.0N Longitude: 123:43:44.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 93.7	Pools by Stream Length (%): 51.7
Reach Length (ft.): 14291	Coniferous Component (%): 47.6	Pool Frequency (%): 51.4
Riffle/Flatwater Mean Width (ft.): 8.6	Hardwood Component (%): 52.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 72
Range (ft.): 8 to 27	Vegetative Cover (%): 98.8	2 to 2.9 Feet Deep: 23
Mean (ft.): 18	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 4
Std. Dev.: 4	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 1
Base Flow (cfs.): 0.7	Occurrence of LWD (%): 28	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 49 - 55 Air (F): 44 - 64	LWD per 100 ft.:	Mean Pool Shelter Rating: 35
Dry Channel (ft): 0	Riffles: 2	
	Pools: 6	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 2 Gravel: 84 Sm Cobble: 15 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 100.0 3. 0.0 4. 0.0 5. 0.0		

STREAM REACH: 2

Channel Type: B4	Canopy Density (%): 92.7	Pools by Stream Length (%): 42.4
Reach Length (ft.): 5782	Coniferous Component (%): 32.6	Pool Frequency (%): 45.3
Riffle/Flatwater Mean Width (ft.): 8.5	Hardwood Component (%): 67.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 73
Range (ft.): 9 to 21	Vegetative Cover (%): 98.6	2 to 2.9 Feet Deep: 23
Mean (ft.): 16	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 4
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.7	Occurrence of LWD (%): 32	Mean Max Residual Pool Depth (ft.): 1.6
Water (F): 50 - 51 Air (F): 49 - 61	LWD per 100 ft.:	Mean Pool Shelter Rating: 28
Dry Channel (ft): 0	Riffles: 4	
	Pools: 10	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 3 Gravel: 77 Sm Cobble: 17 Lg Cobble: 3 Boulder: 1 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 89.6 3. 10.4 4. 0.0 5. 0.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR17WS11

Latitude: 39:31:31.0N

Longitude: 123:43:44.0W

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	11	12	3.8
Boulder	7	6	2.2
Cobble / Gravel	125	115	40.1
Sand / Silt / Clay	156	166	53.8

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	10	3	2.2
Brush	156	158	52.5
Hardwood Trees	118	105	37.3
Coniferous Trees	15	33	8.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Smith Creek

LLID: 1237290395254

Drainage: Rockport

Survey Dates: 7/30/2012 to 8/22/2012

Confluence Location: Quad: DUTCHMANS

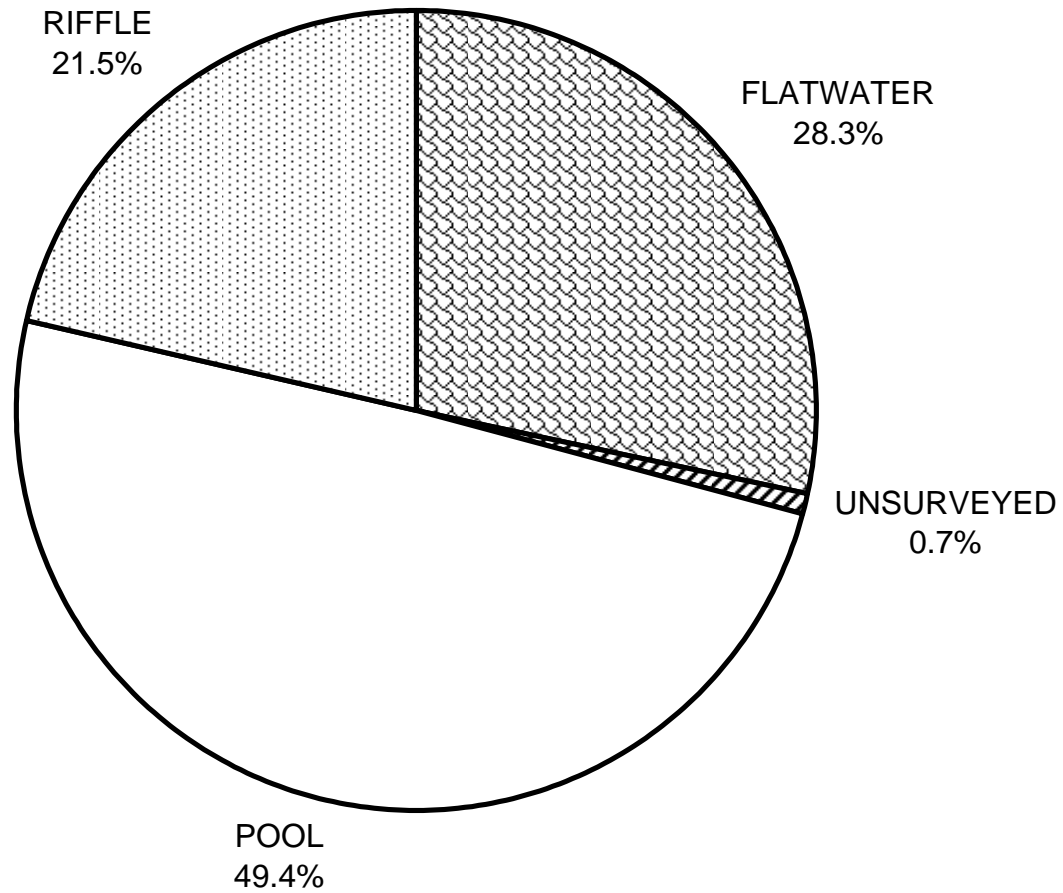
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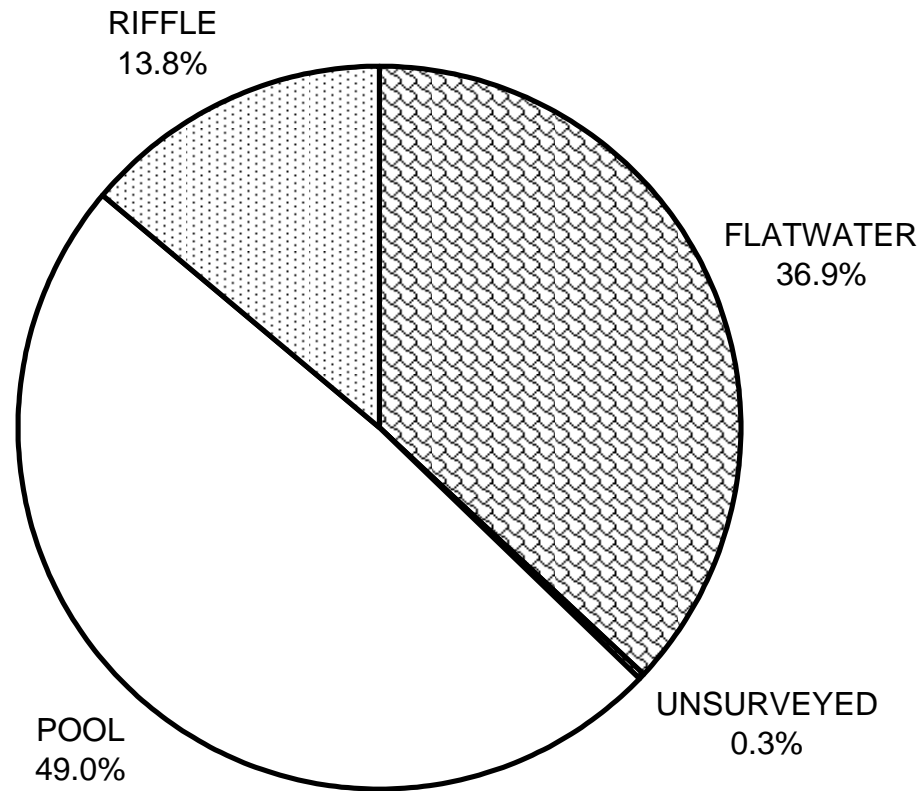
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	24	13
SMALL WOODY DEBRIS (%)	57	25	33
LARGE WOODY DEBRIS (%)	33	17	31
ROOT MASS (%)	0	7	11
TERRESTRIAL VEGETATION (%)	0	12	4
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	10	15	6
BEDROCK LEDGES (%)	0	0	1

SMITH CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



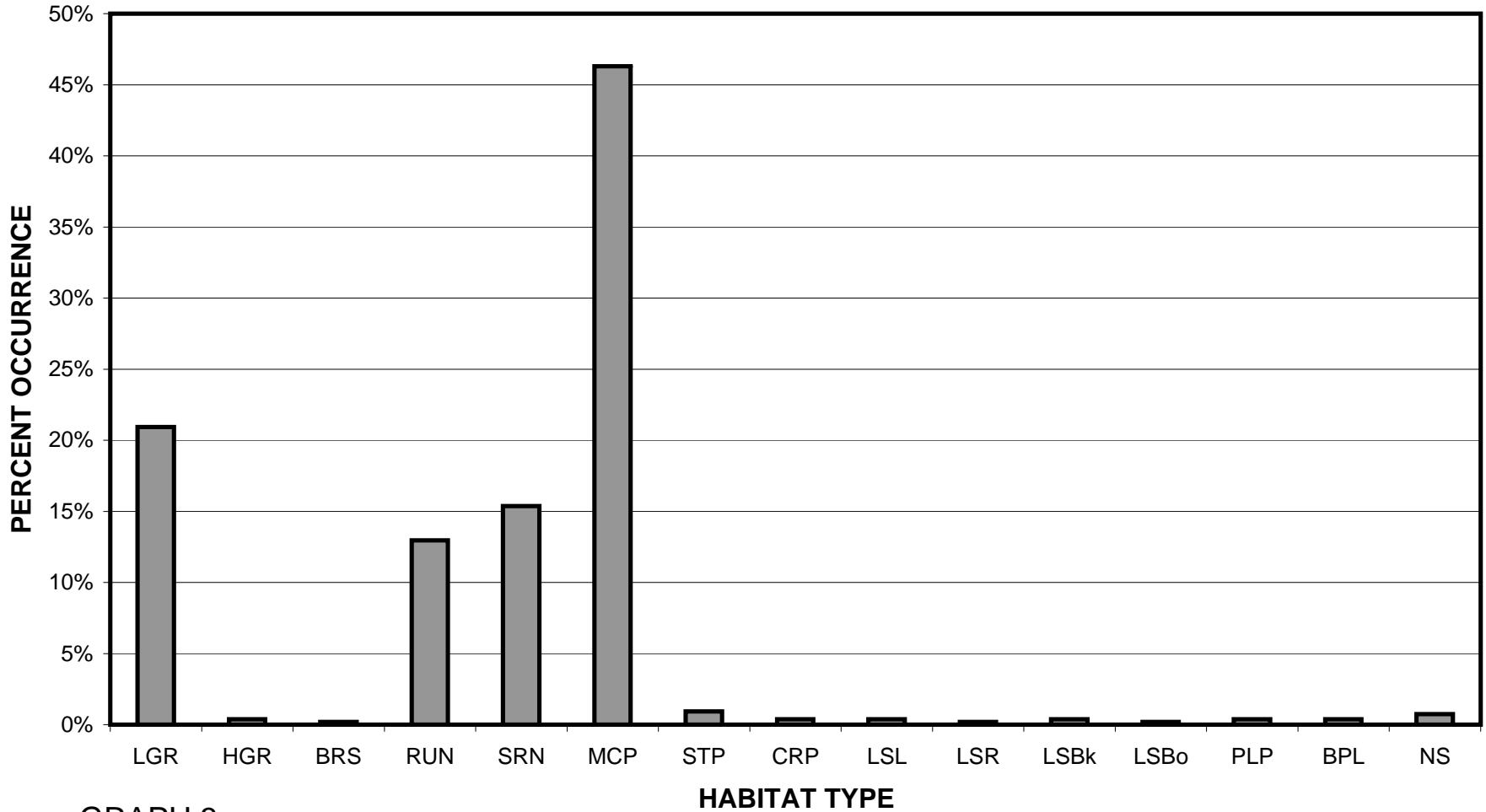
GRAPH 1

SMITH CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



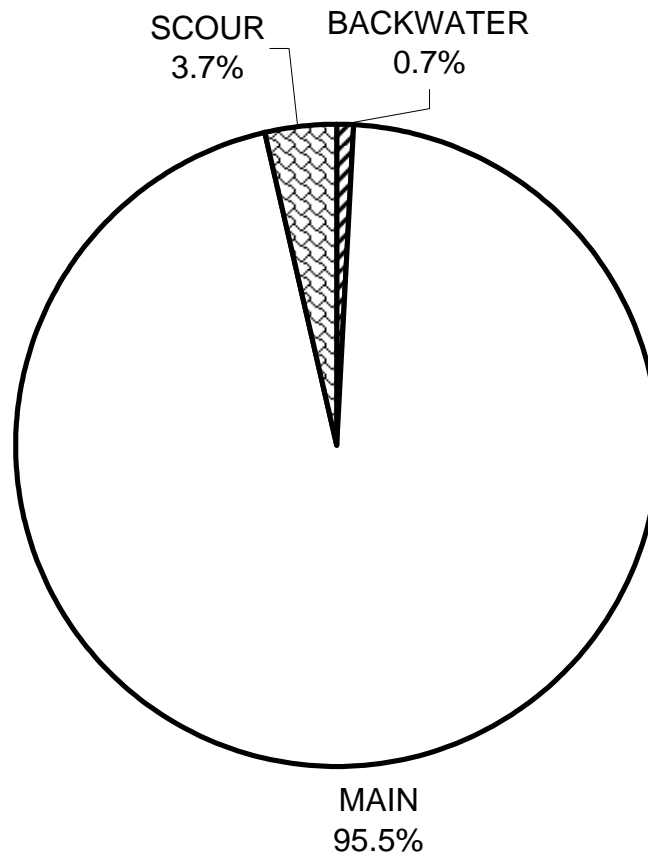
GRAPH 2

SMITH CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



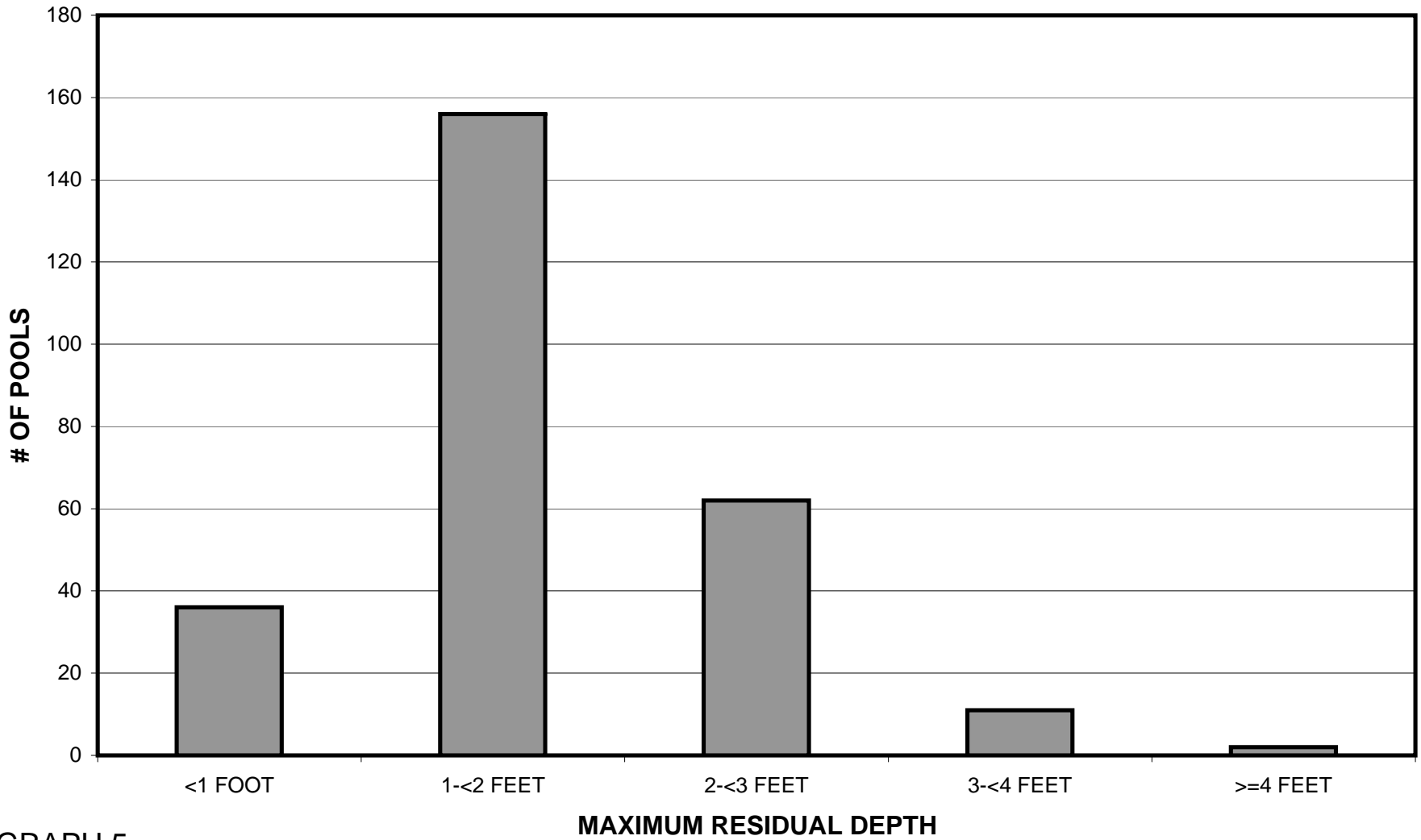
GRAPH 3

SMITH CREEK 2012 POOL TYPES BY PERCENT OCCURRENCE



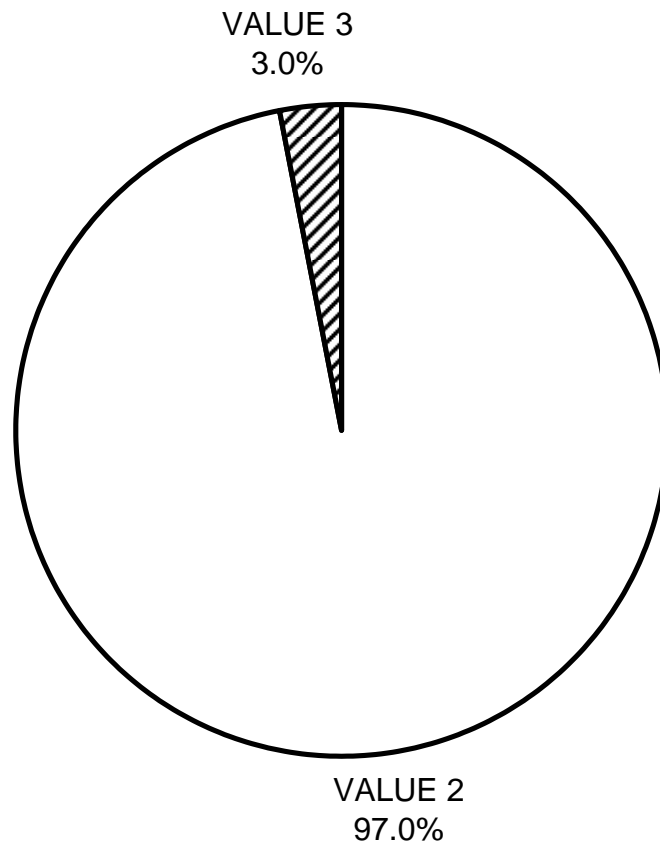
GRAPH 4

SMITH CREEK 2012 MAXIMUM DEPTH IN POOLS



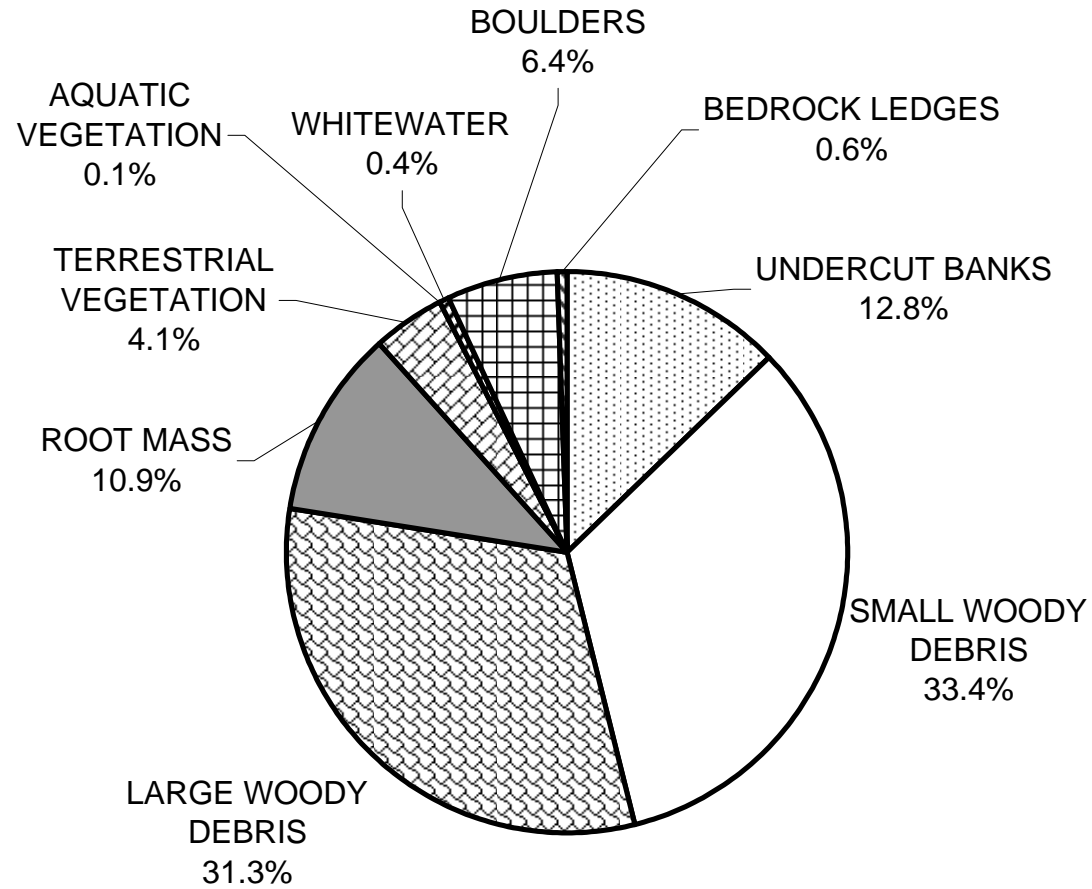
GRAPH 5

SMITH CREEK 2012 PERCENT EMBEDDEDNESS



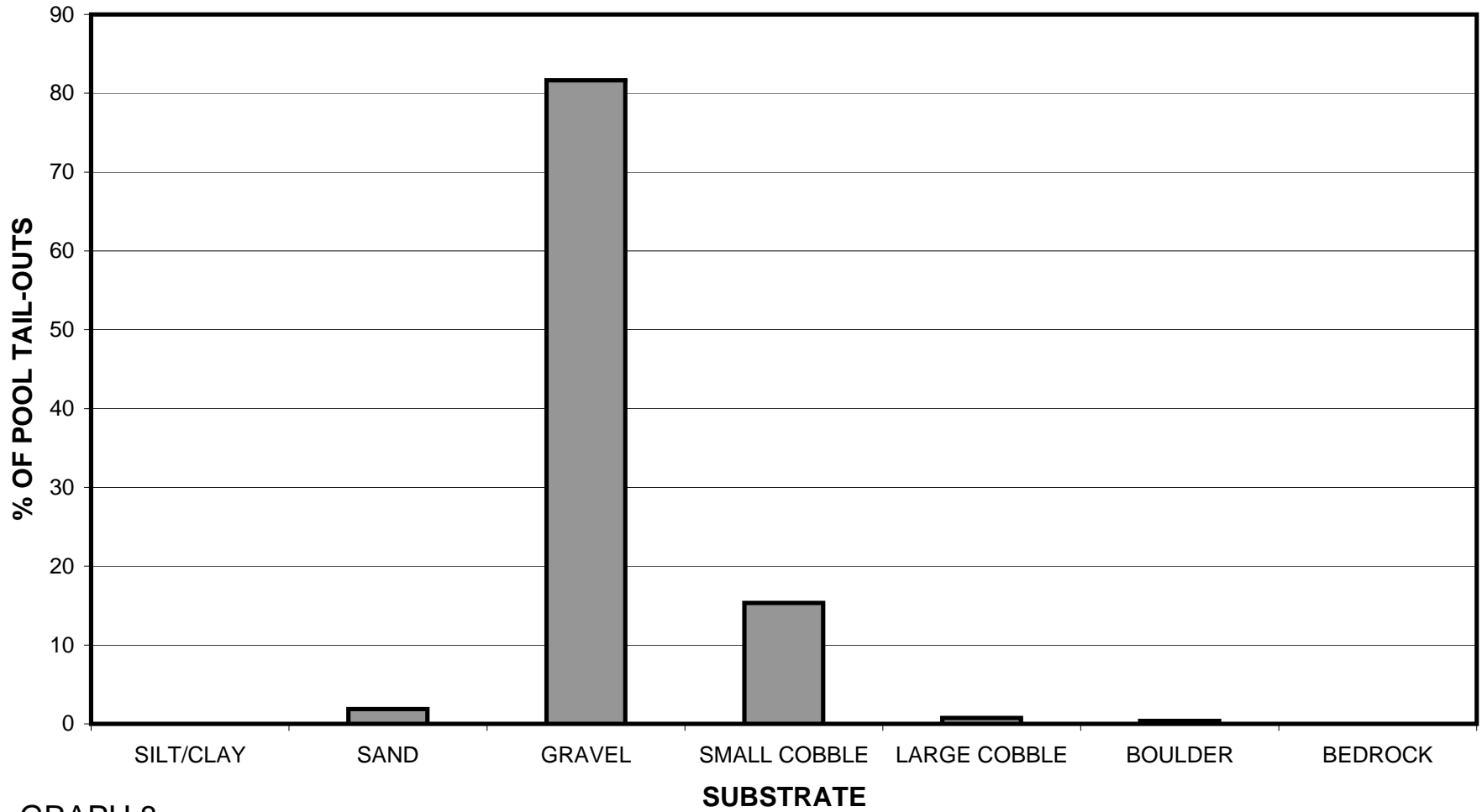
GRAPH 6

SMITH CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



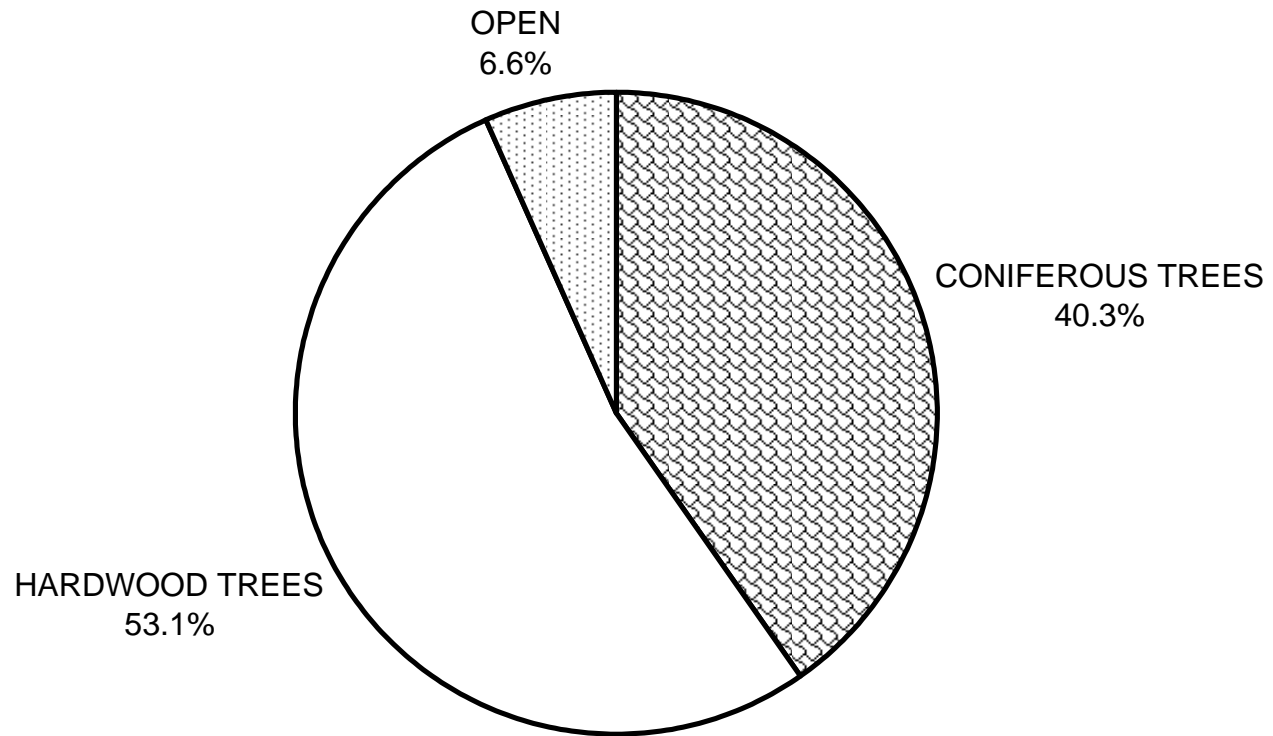
GRAPH 7

SMITH CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



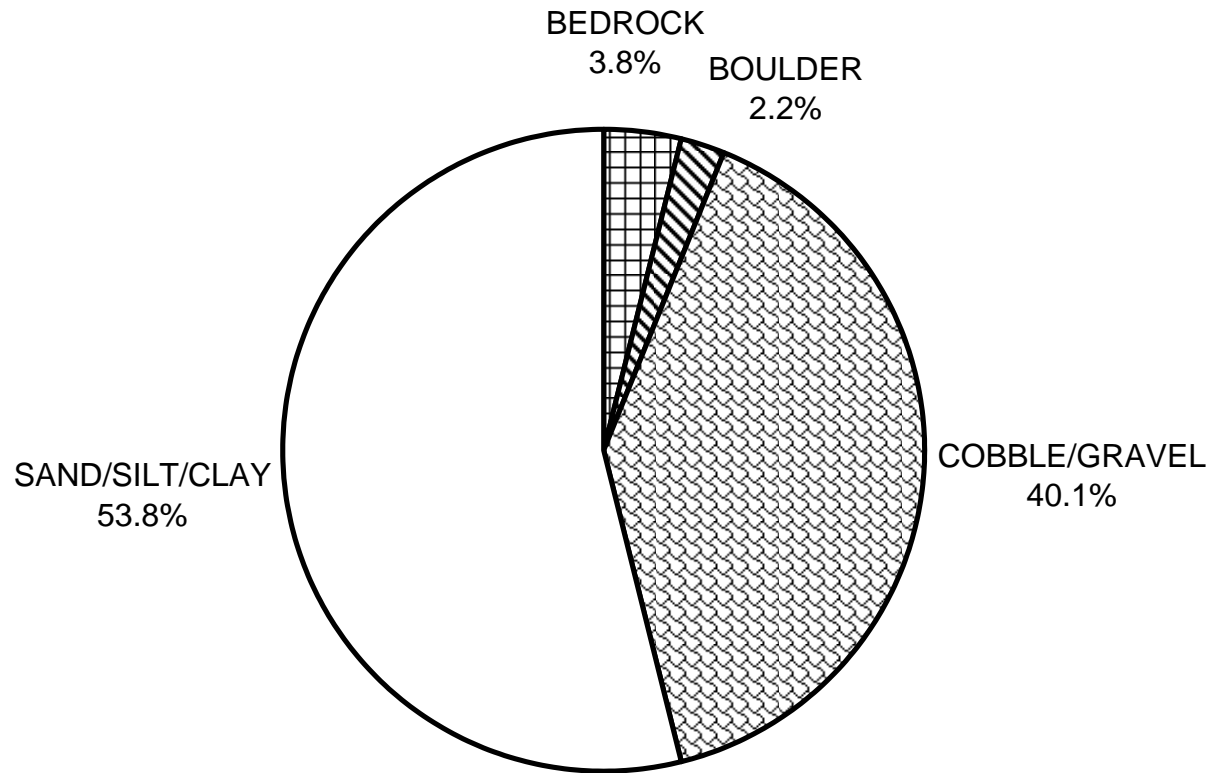
GRAPH 8

SMITH CREEK 2012 MEAN PERCENT CANOPY



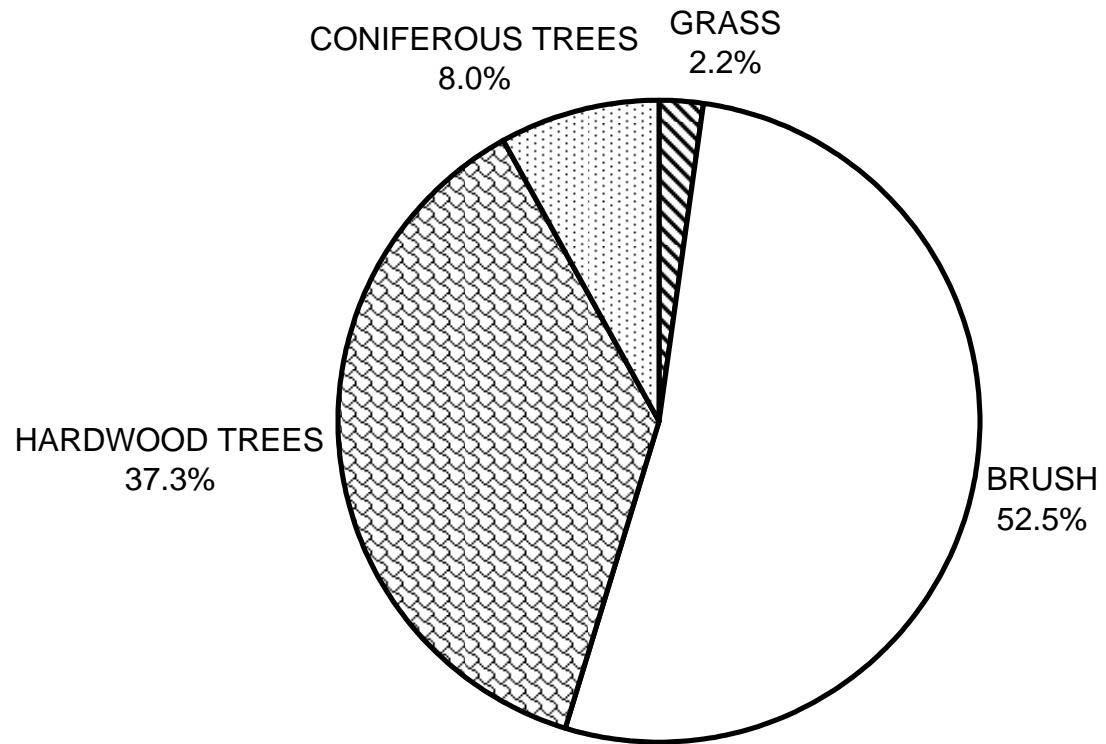
GRAPH 9

SMITH CREEK 2012 DOMINANT BANK COMPOSITION IN SURVEY REACH



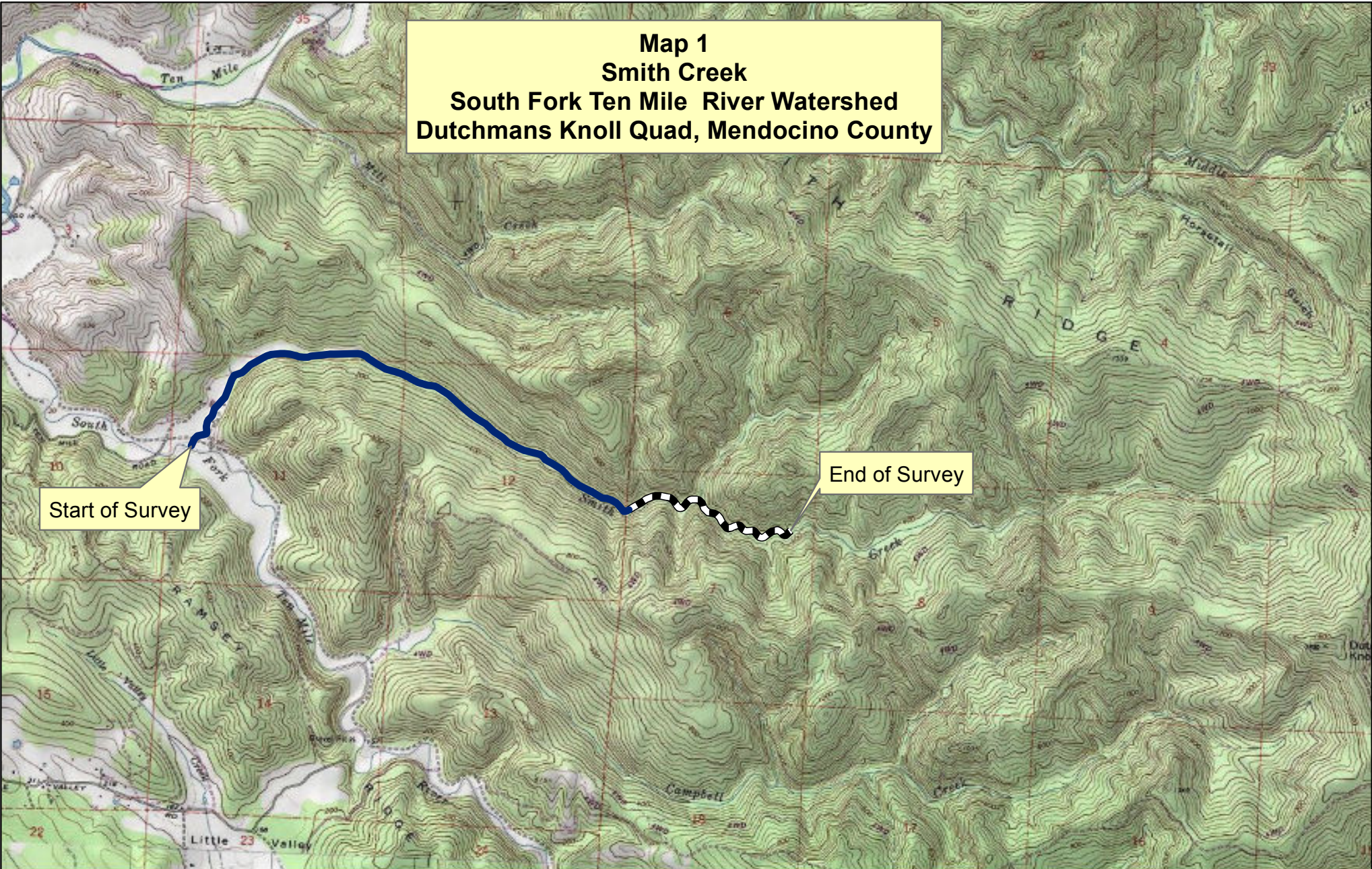
GRAPH 10

SMITH CREEK 2012 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11



Map 1
Smith Creek
South Fork Ten Mile River Watershed
Dutchmans Knoll Quad, Mendocino County



Start of Survey

End of Survey

Legend

-  Reach1, F4 Channel Type
-  Reach2, B4 Channel Type

