

STREAM INVENTORY REPORT

Churchman Creek

INTRODUCTION

A stream inventory was conducted from June 19 to July 17, 2012 on Churchman Creek. The survey began at the confluence with South Fork Ten Mile River and extended upstream 3.2 miles. Stream inventories and reports were also completed for two tributaries to Churchman Creek.

The Churchman 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 Churchman 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

Churchman 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). Churchman Creek's legal description at the confluence with South Fork Ten Mile River is T19N R16W S20. Its location is 39.4834 degrees north latitude and 123.6704 degrees west longitude, LLID number 1236690394834. Churchman Creek is a second order stream and has approximately 3.3 miles of blue line stream according to the USGS Noyo Hill 7.5 minute quadrangle. Churchman Creek drains a watershed of approximately 4.0 square miles. Elevations range from about 135 feet at the mouth of the creek to 850 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Little Valley Road off Highway 1, north of Fort Bragg, CA.

METHODS

The habitat inventory conducted in Churchman 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 Wildlife (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 Churchman 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". Churchman 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 Churchman 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 Churchman 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 Churchman 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 Churchman 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 Churchman Creek. In addition, underwater observations were made at 25 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 Churchman 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 June 19 to July 17, 2012 was conducted by A. Blessing and T. Anderson (WSP). The total length of the stream surveyed was 16,886 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.66 cfs on July 9, 2012.

Churchman Creek is an F4 channel type for the entire length of the survey, 16,886 feet. F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 46 to 64 degrees Fahrenheit. Air temperatures ranged from 48 to 69 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 35% pool units, 32% flatwater units, 30% riffle units, 2% unsurveyed units, and 1% dry units (Graph 1). Based on total length of Level II habitat types there were 45% flatwater units, 34% pool units, 19% riffle units, and 2% unsurveyed units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 31%; low gradient riffle units, 30%; step run units, 16%; and run units, 16% (Graph 3). Based on percent total length, step run units made up 33%; mid-channel pool units 30%; and low gradient riffle units 19%.

A total of 194 pools were identified (Table 3). Main channel pools were the most frequently encountered at 96% (Graph 4), and comprised 98% of the total length of all pools (Table 3).

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Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Thirty-four of the 194 pools (18%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 194 pool tail-outs measured, 192 had a value of 2 (99%) two had a value of 5 (1%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable 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 6, flatwater habitat types had a mean shelter rating of 14, and pool habitats had a mean shelter rating of 37 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 54. Main channel pools had a mean shelter rating of 36 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Churchman Creek. Graph 7 describes the pool cover in Churchman 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 88% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 6% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Churchman Creek was 92%. Eight percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 44% and 56%, respectively. Graph 9 describes the mean percent canopy in Churchman Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 57% sand/silt/clay, 38% cobble/gravel, 4% bedrock, and 1% boulders (Graph 10). Deciduous trees were the dominant vegetation type observed in 42% of the units surveyed. Additionally, 35% of the units surveyed had coniferous trees as the dominant vegetation type, and 14% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 25 sites for species composition and distribution in Churchman Creek on August 6 and August 7, 2012. The sites were sampled by B. Leonard and T. Anderson (WSP). The reach sites yielded 75 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), six age 1+ SH/RT, one age 2+ SH/RT, and 95 YOY coho salmon.

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The following chart displays the information yielded from these sites:

2012 Churchman 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									
08/07/12	1	011	pool	329	4	0	0	19	0
	2	017	pool	522	7	0	0	7	0
	3	020	pool	599	2	0	0	2	0
	4	027	pool	825	5	1	0	10	0
	5	032	pool	1,021	6	0	0	8	0
	6	038	pool	1,387	5	0	0	8	0
	7	047	pool	1,683	13	2	0	14	0
	8	058	pool	2,148	2	0	0	9	0
	9	059	pool	2,194	3	0	0	6	0
	10	063	pool	2,329	1	1	0	6	0
08/06/12	11	350	pool	11,568	4	0	0	6	0
	12	366	pool	12,000	3	0	0	0	0
	13	373	pool	12,106	4	0	1	0	0
	14	381	pool	12,294	9	0	0	0	0
	15	391	pool	12,538	3	0	0	0	0
	16	492	pool	14,994	0	0	0	0	0
	17	496	pool	15,068	0	0	0	0	0
	18	503	pool	15,264	0	1	0	0	0
	19	511	pool	15,562	1	0	0	0	0
	20	515	pool	15,652	3	0	0	0	0
	21	517	pool	15,784	0	1	0	0	0
	22	530	pool	16,289	0	0	0	0	0
	23	534	pool	16,368	0	0	0	0	0
	24	539	pool	16,706	0	0	0	0	0
	25	544	pool	16,789	0	0	0	0	0

DISCUSSION

Churchman Creek is an F4 channel type for the entire 16,886 feet of stream surveyed. F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing

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wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey days June 19 to July 17, 2012, ranged from 46 to 64 degrees Fahrenheit. Air temperatures ranged from 48 to 69 degrees Fahrenheit. This is a suitable water temperature range for salmonids. However, 60° F, if sustained, is near the threshold stress level for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 45% of the total length of this survey, riffles 19%, and pools 34%. Thirty-four of the 194 (18%) pools had a maximum residual depth greater than two 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 structures that will increase or deepen pool habitat is recommended.

One hundred ninety-two of the 194 pool tail-outs measured had embeddedness ratings of 1 or 2. Two 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.

One hundred eighty-three of the 194 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 37. The shelter rating in the flatwater habitats is 14. 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 Churchman 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 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%. The percentage of right and left bank covered with vegetation was 100% and 99%, respectively.

RECOMMENDATIONS

- 1) Churchman 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.

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- 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 for the entire length of the survey.
534	0019.00	Log debris accumulation (LDA) #01 contains four pieces of large woody debris (LWD) and measures 4' high x 35' wide x 9' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 14' wide x 7' long x 1' deep. There is a 1.5' high plunge over LDA. Fish were observed above the LDA.
1998	0056.00	There is a slump on the left bank that measures 15' long x 12' high.
2751	0078.00	LDA #02 contains 12 pieces of LWD and measures 5' high x 14' wide x 40' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.
3590	0101.00	Woody debris is accumulating in the channel; the debris has the potential to become an LDA.
5490	0164.00	Tributary #01 enters on the left bank. It contributes approximately 5% to Churchman Creek's flow. The water temperature of the tributary was 49 degrees Fahrenheit, the water temperature downstream of the tributary was 49 degrees Fahrenheit, and the water temperature upstream of the confluence was 52 degrees Fahrenheit. The slope of the tributary is approximately 2%. The tributary is accessible to salmonids, but no fish were observed.
5599	0168.00	There are remnants of railroad trestles on the left bank.
6499	0200.00	LDA #03 contains six pieces of LWD and measures 5' high x 12' wide x 18' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.

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6727	0212.00	LDA #04 contains eight pieces of LWD and measures 4' high x 12' wide x 12' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 10' wide x 25' long x 1' deep. There is a 2' high plunge over the LDA. Fish were observed above the LDA.
7502	0233.00	Tributary #02 enters on the left bank. It contributes approximately 5% to Churchman Creek's flow. The water temperature of the tributary was 51 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 50 degrees Fahrenheit. The slope of the tributary is 1-2%. Salmonids were observed in the tributary.
8437	0257.00	LDA #05 contains four pieces of LWD and measures 4' high x 14' wide x 17' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from gravel to cobble and measures 6' wide x 12' long x 1' deep. Fish were observed above the LDA.
8865	0271.00	Tributary #03 enters on the right bank. It contributes approximately 1% to Churchman Creek's flow. The water temperature of the tributary was 49 degrees Fahrenheit, the water temperature downstream of the tributary was 50 degrees Fahrenheit, and the water temperature upstream of the confluence was 52 degrees Fahrenheit. The slope of the tributary is approximately 20%. There is a 6' high plunge at the mouth of the tributary.
8947	0274.00	LDA #06 contains six pieces of LWD and measures 4' high x 18' wide x 11' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to cobble and measures 12' wide x 60' long x 1' deep. Fish were observed above the LDA.
9671	0296.00	LDA #07 contains four pieces of LWD and measures 4.5' high x 18' wide x 22' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 5' wide x 15' long x 1' deep. Fish were observed above the LDA.
9753	0299.00	LDA #08 contains five pieces of LWD and measures 4.5' high x 17.5' wide x 11' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to cobble and measures 10' wide x 60' long x 1.5' deep. Fish were observed above the LDA.
11172	0337.00	Tributary #04 enters on the left bank. It contributes 5-10% to Churchman 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 1-2%. Salmonids were observed in the tributary.

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11689	0356.00	LDA #09 contains five pieces of LWD and measures 4.5' high x 14' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 4' wide x 10' long x 1' deep. Fish were observed above the LDA.
11979	0365.00	Tributary #05 enters on the right bank. It contributes less than 1% to Churchman Creek's flow. The water temperature of the tributary was 51 degrees Fahrenheit, the water temperature downstream of the tributary was 50 degrees Fahrenheit, and the water temperature upstream of the confluence was 50 degrees Fahrenheit. The slope of the tributary is approximately 5%. The flow went subsurface approximately 30' upstream from the mouth.
12000	0367.00	LDA #10 contains four pieces of LWD and measures 5' high x 18' wide x 11' long. Water does not flow through the LDA; the flow goes subsurface before it. There are visible gaps in the LDA. Retained sediment ranges from sand to cobble and measures 10' wide x 65' long x 1.5' deep. Fish were observed above the LDA.
12031	0368.00	There is a 9' high plunge with a 4' deep pool below. No coho were observed above the plunge.
12759	0402.00	LDA #11 contains six pieces of LWD and measures 5.5' high x 15' wide x 16' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 14' wide x 70' long x 1' deep. There is a 4' high plunge over the LDA. Fish were observed above the LDA.
12994	0411.00	LDA #12 contains 13 pieces of LWD and measures 4.5' high x 17' wide x 17' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to cobble and measures 5' wide x 10' long x 1' deep. No fish were observed above the LDA.
14507	0476.00	A landslide on the right bank measures approximately 20' long x 15' high; it is contributing fine sediment to the channel.
14714	0485.00	LDA #13 contains eight pieces of LWD and measures 6' high x 22' wide x 17' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 12' wide x 35' long x 1' deep.
15499	0509.00	1' high plunge.
16750	0542.00	Lake Gulch (tributary #06) enters on the left bank. It contributes approximately 80% to Churchman Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 50 degrees Fahrenheit.

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For more information, see the 2012 Lake Gulch Stream Habitat Inventory Report.

16875 0550.00 End of survey at 6' high plunge with no jump pool below it. Above the plunge the creek goes dry for 125 feet. The slope increases to 7%.

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: Churchman Creek

LLID: 1236690394834 Drainage: Rockport

Survey Dates: 6/19/2012 to 7/17/2012

Confluence Location: Quad: NOYO HILL Legal Description: T19NR16WS20 Latitude: 39:29:00.0N Longitude: 123:40:08.0

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
5	0	DRY	0.9	14	69	0.4									
175	17	FLATWATER	31.8	43	7581	44.9	5.7	0.4	0.6	146	25573	54	9374		14
11	0	NOSURVEY	2.0	23	257	1.5									180
194	194	POOL	35.3	30	5801	34.4	9.9	0.8	1.5	292	56688	297	57623	225	37
165	26	RIFFLE	30.0	19	3178	18.8	6.3	0.3	0.4	110	18228	29	4855		6
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
550	237				16886					100489			71853		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Churchman Creek

LLID: 1236690394834

Drainage: Rockport

Survey Dates: 6/19/2012 to 7/17/2012

Confluence Location: Quad: NOYO HILL

Legal Description: T19NR16WS20

Latitude: 39:29:00.0N

Longitude: 123:40:08.0W

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 (%)
164	25	LGR	29.8	19	3147	18.6	6	0.2	0.6	106	17378	24	3994		5	94
1	1	CAS	0.2	31	31	0.2	8	0.7	1	223	223	156	156		15	98
87	11	RUN	15.8	24	2073	12.3	5	0.4	1	110	9538	38	3332		12	95
88	6	SRN	16.0	63	5508	32.6	7	0.3	0.9	213	18749	82	7178		16	91
172	172	MCP	31.3	29	5068	30.0	10	0.7	3.9	288	49453	290	49938	220	37	92
4	4	CCP	0.7	32	126	0.7	10	0.7	2.4	294	1175	290	1161	207	25	91
11	11	STP	2.0	45	493	2.9	10	0.7	2.4	398	4375	370	4073	279	24	93
7	7	PLP	1.3	16	114	0.7	13	1.2	3.9	241	1684	350	2451	288	54	94
5	0	DRY	0.9	14	69	0.4										
11	0	NS	2.0	23	257	1.5									180	98

Total Units
550

Total Units Fully Measured
237

Total Length (ft.)
16886

Total Area (sq.ft.)
102576

Total Volume (cu.ft.)
72283

Table 3 - Summary of Pool Types

Stream Name: Churchman Creek

LLID: 1236690394834

Drainage: Rockport

Survey Dates: 6/19/2012 to 7/17/2012

Confluence Location: Quad: NOYO HILL

Legal Description: T19NR16WS20

Latitude: 39:29:00.0N

Longitude: 123:40:08.0W

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
187	187	MAIN	96	30	5687	98	9.8	0.7	294	55004	223	41681	36
7	7	SCOUR	4	16	114	2	12.9	1.2	241	1684	288	2014	54

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
194	194	5801	56688	43695

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

Stream Name: Churchman Creek LLID: 1236690394834 Drainage: Rockport
 Survey Dates: 6/19/2012 to 7/17/2012
 Confluence Location: Quad: NOYO HILL Legal Description: T19NR16WS20 Latitude: 39:29:00.0N Longitude: 123:40:08.0W

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
172	MCP	89	20	12	123	72	24	14	5	3	0	0
4	CCP	2	2	50	1	25	1	25	0	0	0	0
11	STP	6	0	0	10	91	1	9	0	0	0	0
7	PLP	4	2	29	2	29	2	29	1	14	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
194	24	12	136	70	28	14	6	3	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Churchman Creek LLID: 1236690394834 Drainage: Rockport
 Survey Dates: 6/19/2012 to 7/17/2012 Dry Units: 5
 Confluence Location: Quad: NOYO HILL Legal Description: T19NR16WS20 Latitude: 39:29:00.0N Longitude: 123:40:08.0W

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
164	25	LGR	0	47	6	0	6	0	4	37	0
1	1	CAS	0	80	0	0	0	0	0	20	0
165	26	TOTAL RIFFLE	0	48	6	0	5	0	4	36	0
87	11	RUN	10	73	4	0	11	0	0	3	0
88	6	SRN	8	70	8	11	3	0	0	0	0
175	17	TOTAL FLAT	9	72	5	4	9	0	0	2	0
172	172	MCP	13	43	32	3	4	0	1	3	1
4	4	CCP	10	69	10	4	0	0	8	0	0
11	11	STP	16	53	18	5	2	0	4	0	2
7	7	PLP	24	30	16	5	0	0	17	2	6
194	194	TOTAL POOL	14	44	30	3	3	0	2	3	2
11	1	NS	0	50	50	0	0	0	0	0	0
550	238	TOTAL	12	46	26	3	4	0	2	5	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Churchman Creek LLID: 1236690394834 Drainage: Rockport
 Survey Dates: 6/19/2012 to 7/17/2012 Dry Units: 5
 Confluence Location: Quad: NOYO HILL Legal Description: T19NR16WS20 Latitude: 39:29:00.0N Longitude: 123:40:08.0W

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
164	25	LGR	0	0	96	4	0	0	0
1	1	CAS	0	0	0	0	0	0	100
87	11	RUN	0	9	82	9	0	0	0
88	6	SRN	0	0	100	0	0	0	0
172	172	MCP	0	5	94	1	0	1	0
4	4	CCP	0	0	100	0	0	0	0
11	11	STP	0	0	100	0	0	0	0
7	7	PLP	0	14	71	0	0	0	14

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Churchman Creek

LLID: 1236690394834

Drainage: Rockport

Survey Dates: 6/19/2012 to 7/17/2012

Confluence Location: Quad: NOYO HILL

Legal Description: T19NR16WS20

Latitude: 39:29:00.0N

Longitude: 123:40:08.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
92	56	44	0	100	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: Churchman Creek LLID: 1236690394834 Drainage: Rockport
 Survey Dates: 6/19/2012 to 7/17/2012 Survey Length (ft.): 16886 Main Channel (ft.): 16886 Side Channel (ft.): 0
 Confluence Location: Quad: NOYO HILL Legal Description: T19NR16WS20 Latitude: 39:29:00.0N Longitude: 123:40:08.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 92.4	Pools by Stream Length (%): 34.4
Reach Length (ft.): 16886	Coniferous Component (%): 56.2	Pool Frequency (%): 35.3
Riffle/Flatwater Mean Width (ft.): 6.1	Hardwood Component (%): 43.8	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 82
Range (ft.): 9 to 19	Vegetative Cover (%): 99.5	2 to 2.9 Feet Deep: 14
Mean (ft.): 14	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 3
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.7	Occurrence of LWD (%): 26	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 46 - 64 Air (F): 48 - 69	LWD per 100 ft.:	Mean Pool Shelter Rating: 37
Dry Channel (ft): 69	Riffles: 2	
	Pools: 7	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 1 Sand: 4 Gravel: 88 Sm Cobble: 6 Lg Cobble: 1 Boulder: 0 Bedrock: 1		
Embeddedness Values (%): 1. 0.0 2. 99.0 3. 0.0 4. 0.0 5. 1.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Churchman Creek

LLID: 1236690394834

Drainage: Rockport

Survey Dates: 6/19/2012 to 7/17/2012

Confluence Location: Quad: NOYO HILL

Legal Description: T19NR16WS20

Latitude: 39:29:00.0N

Longitude: 123:40:08.0W

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	7	3.8
Boulder	2	4	1.3
Cobble / Gravel	95	85	38.0
Sand / Silt / Clay	129	141	57.0

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	19	26	9.5
Brush	33	35	14.3
Hardwood Trees	116	81	41.6
Coniferous Trees	69	95	34.6
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Churchman Creek

LLID: 1236690394834

Drainage: Rockport

Survey Dates: 6/19/2012 to 7/17/2012

Confluence Location: Quad: NOYO HILL

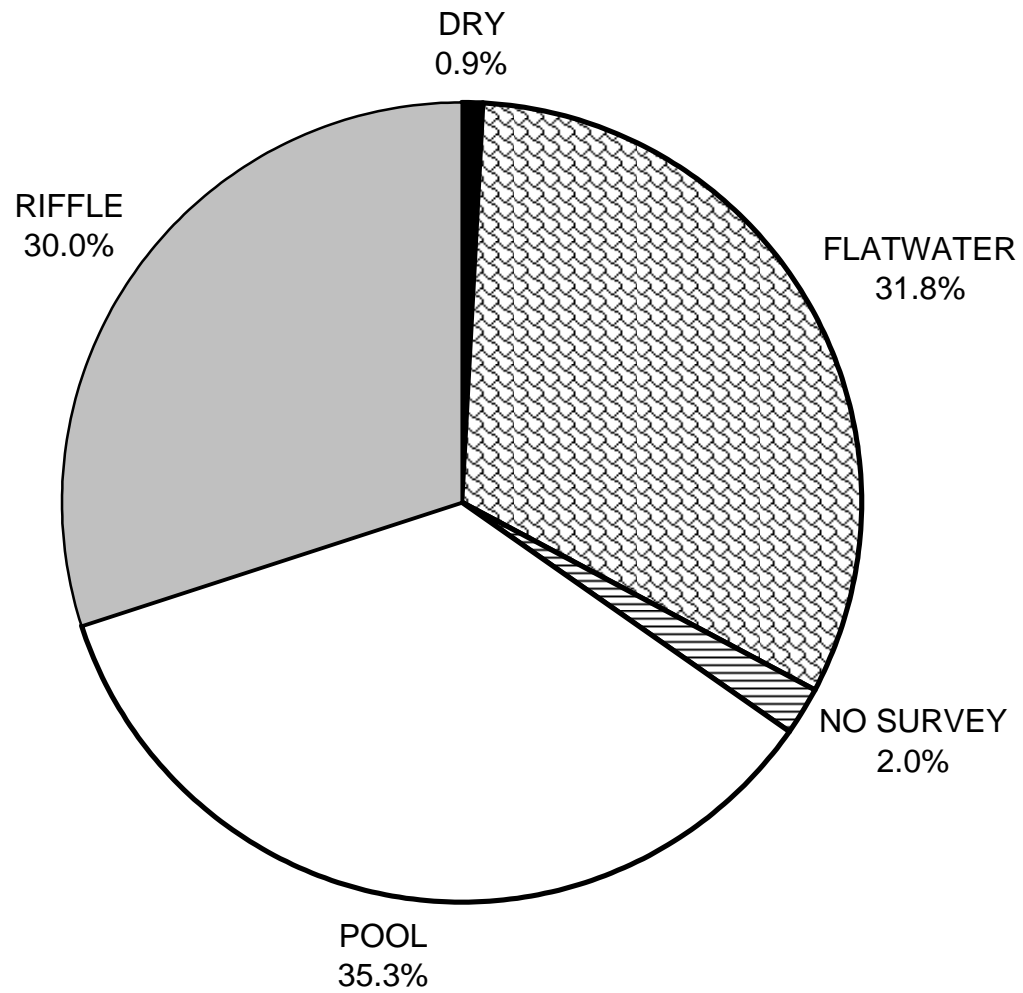
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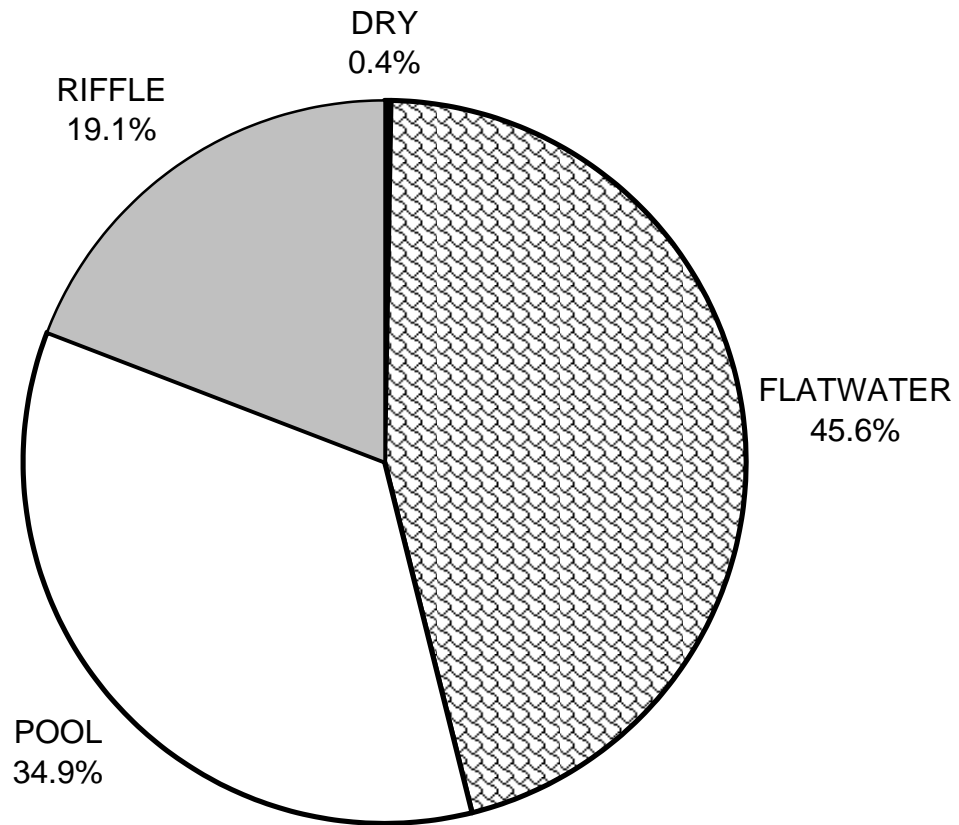
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	9	14
SMALL WOODY DEBRIS (%)	48	72	44
LARGE WOODY DEBRIS (%)	6	5	30
ROOT MASS (%)	0	4	3
TERRESTRIAL VEGETATION (%)	5	9	3
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	4	0	2
BOULDERS (%)	36	2	3
BEDROCK LEDGES (%)	0	0	2

CHURCHMAN CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



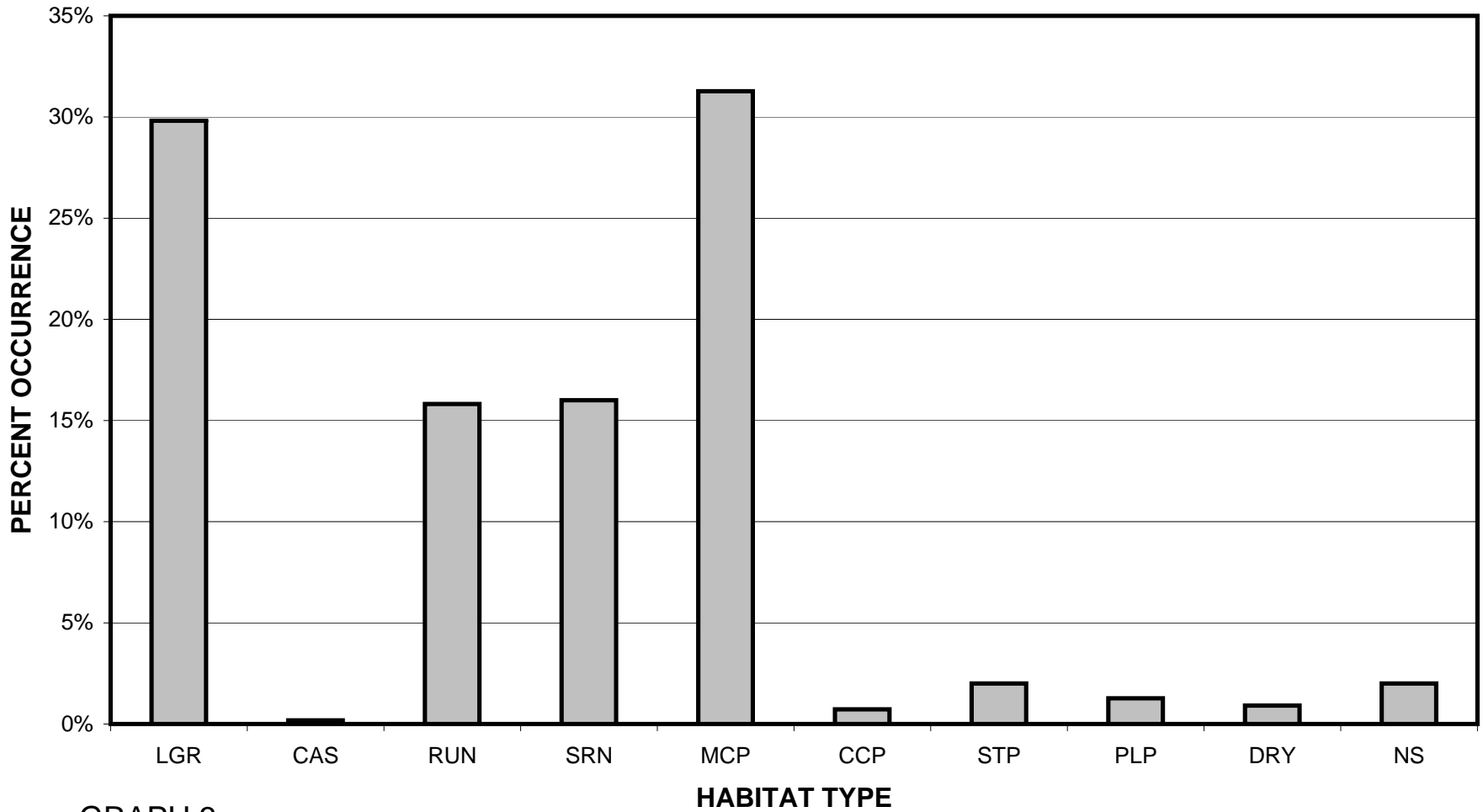
GRAPH 1

CHURCHMAN CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



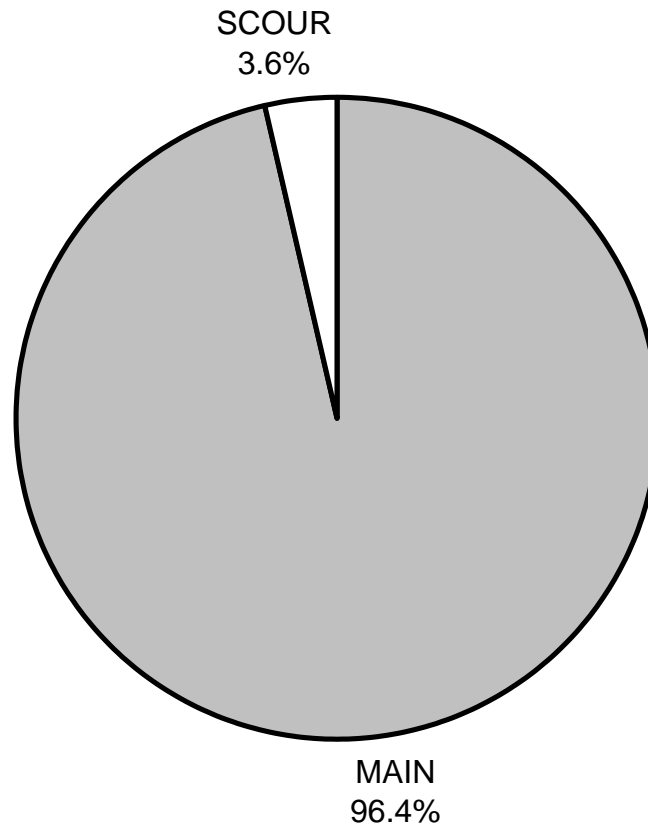
GRAPH 2

CHURCHMAN CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



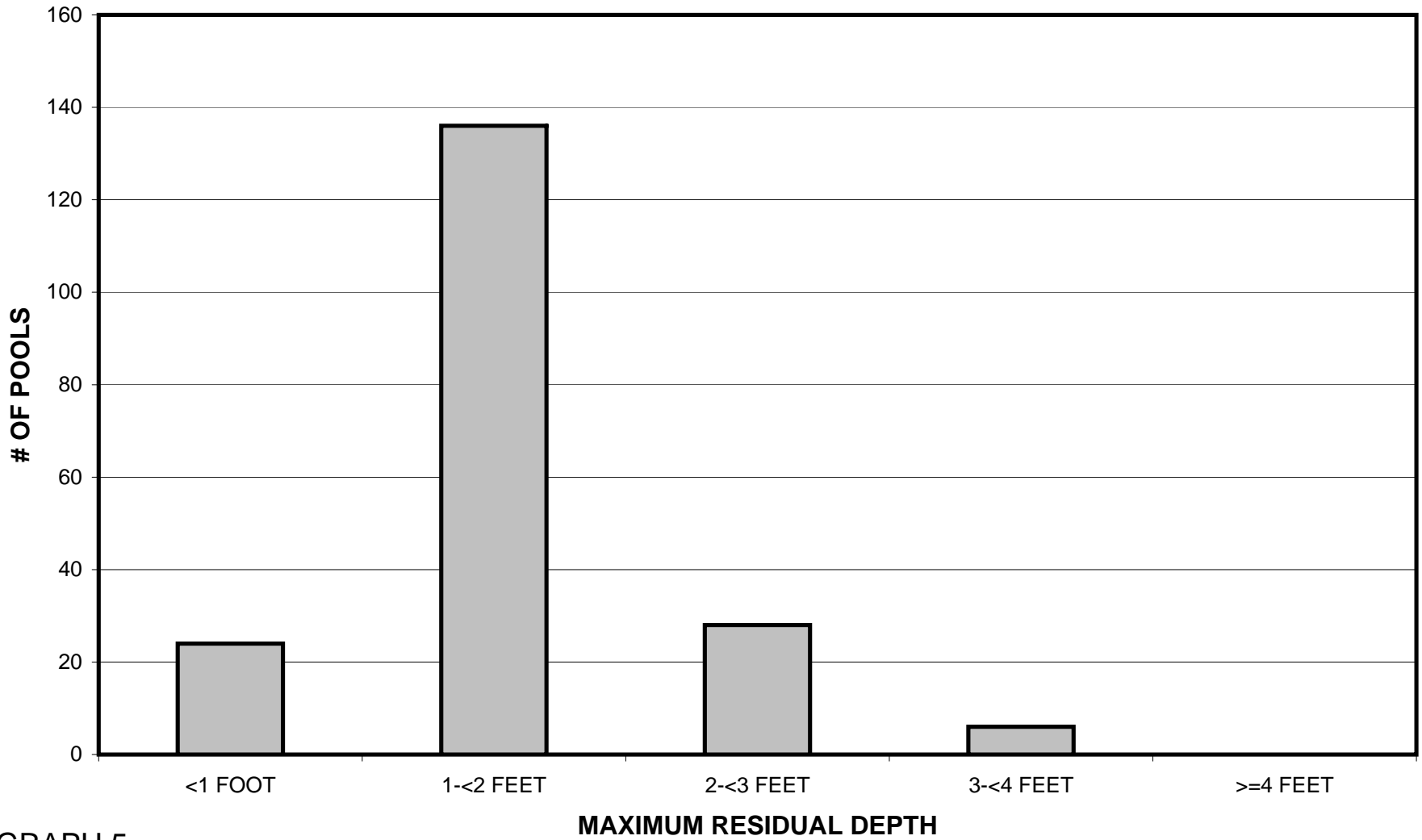
GRAPH 3

CHURCHMAN CREEK 2012 POOL TYPES BY PERCENT OCCURRENCE



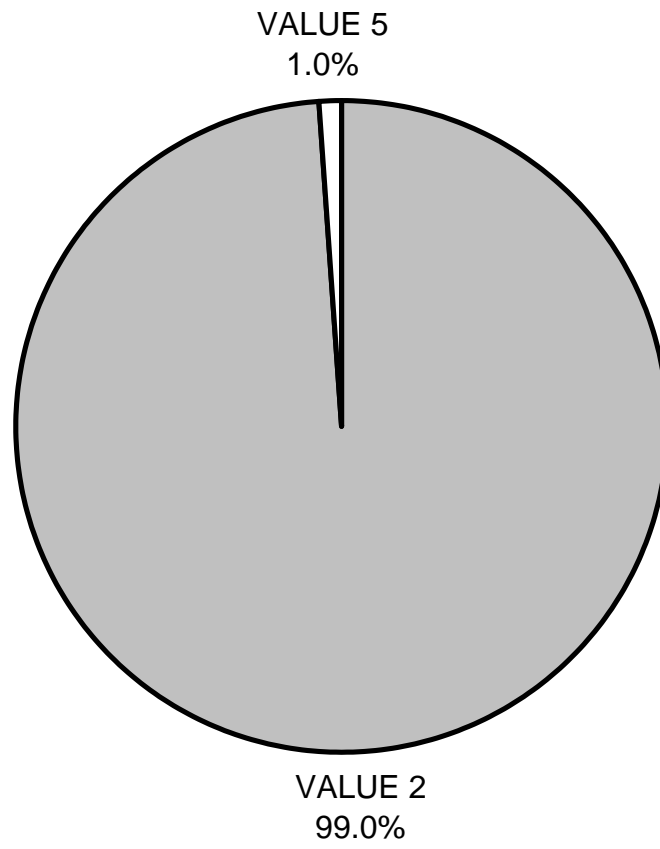
GRAPH 4

CHURCHMAN CREEK 2012 MAXIMUM DEPTH IN POOLS



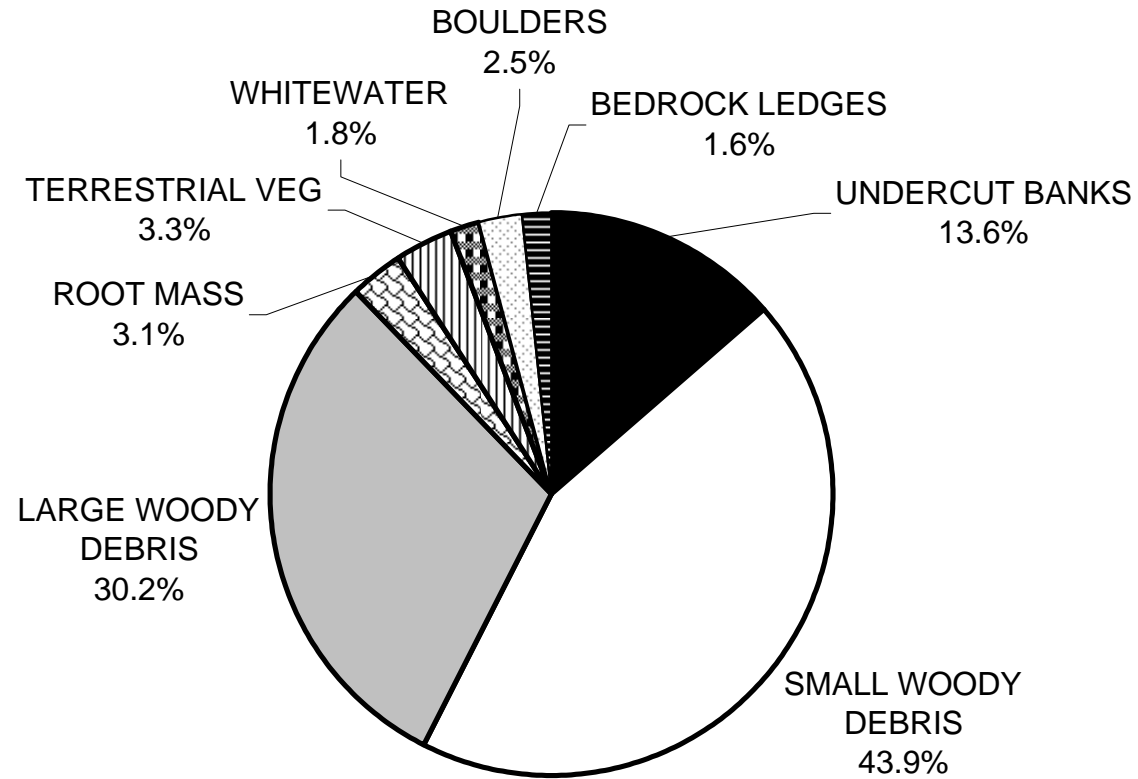
GRAPH 5

CHURCHMAN CREEK 2012 PERCENT EMBEDDEDNESS



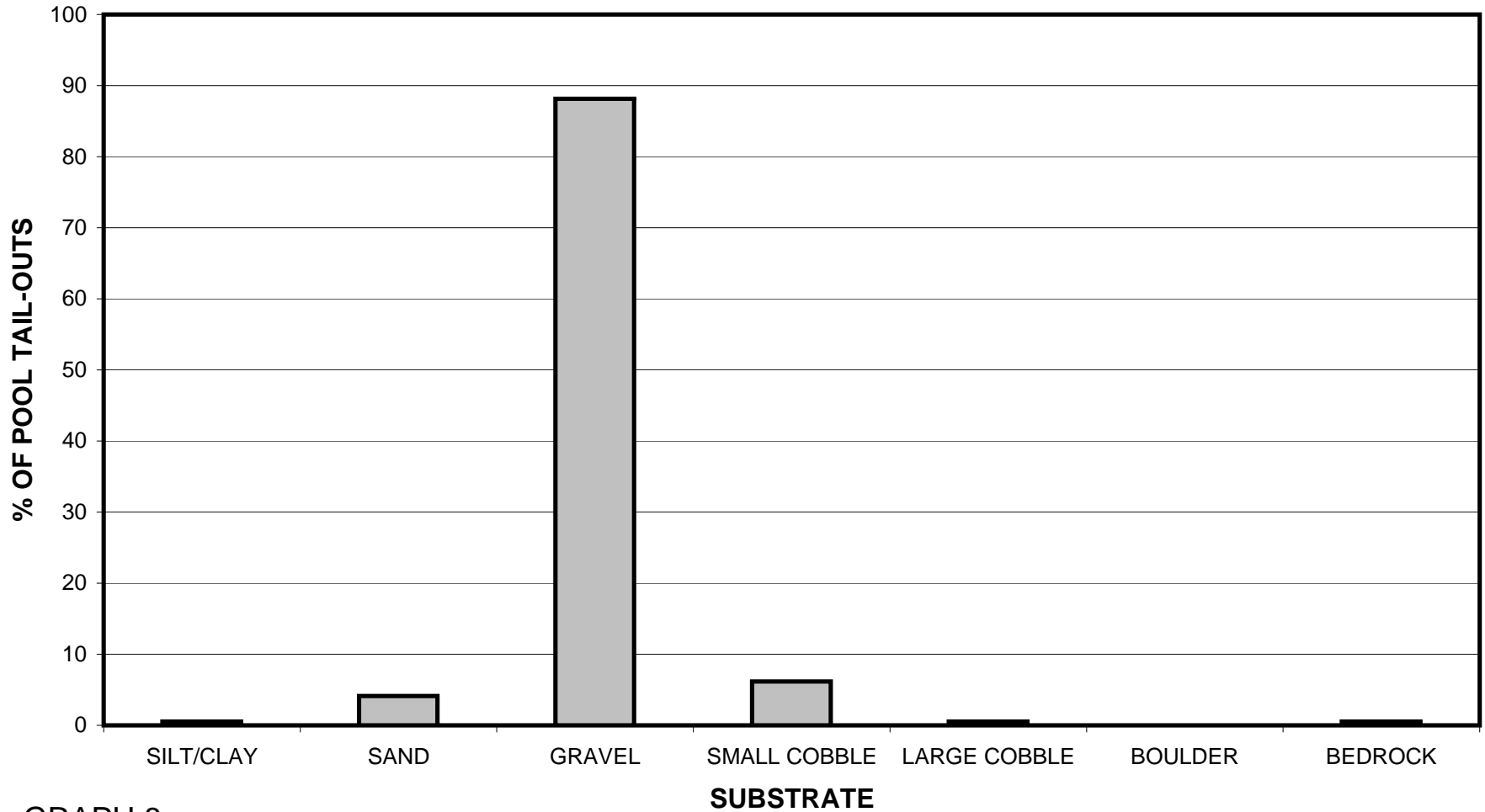
GRAPH 6

CHURCHMAN CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



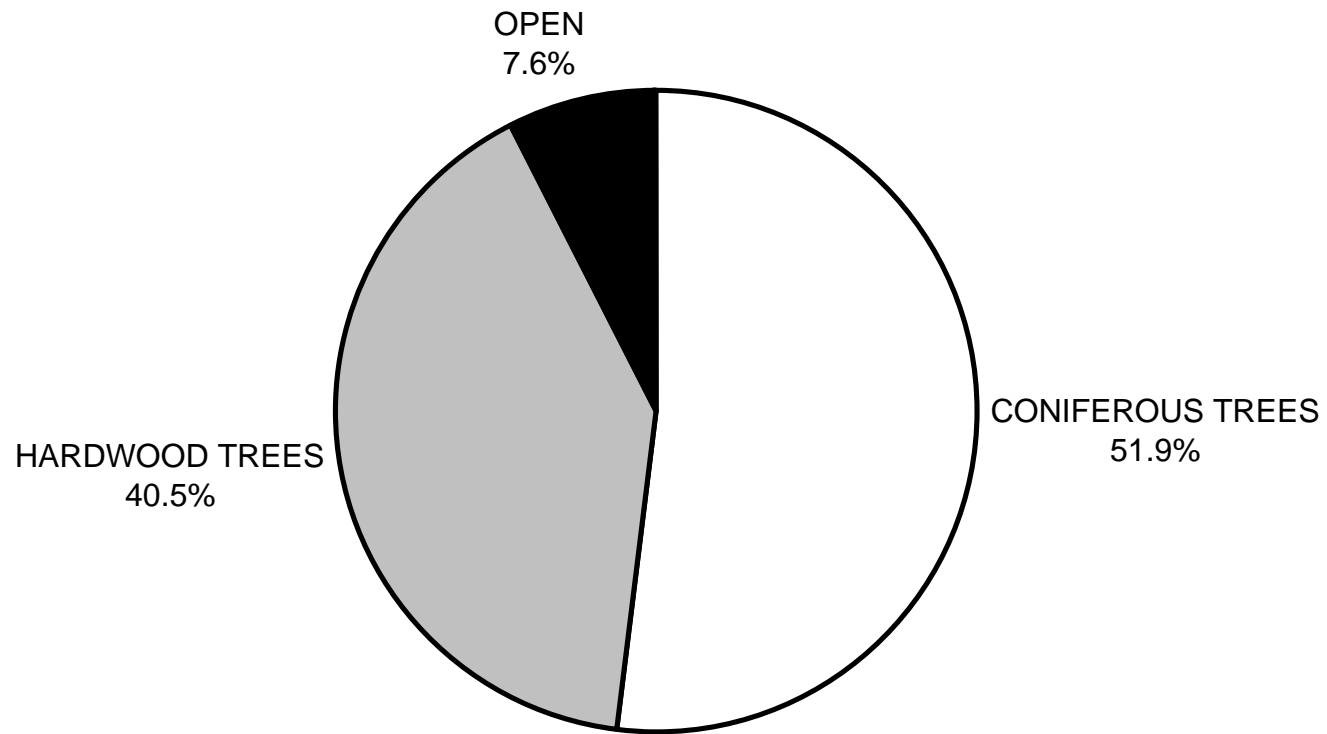
GRAPH 7

CHURCHMAN CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



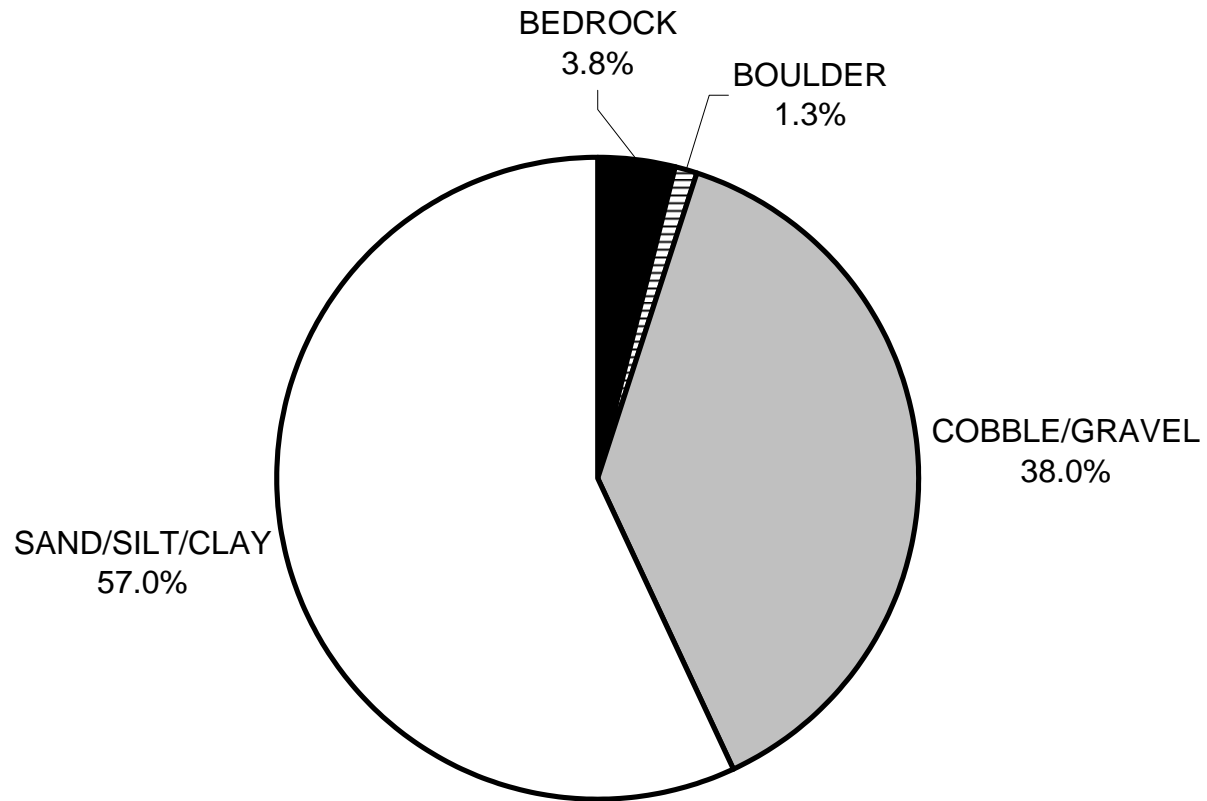
GRAPH 8

CHURCHMAN CREEK 2012 MEAN PERCENT CANOPY



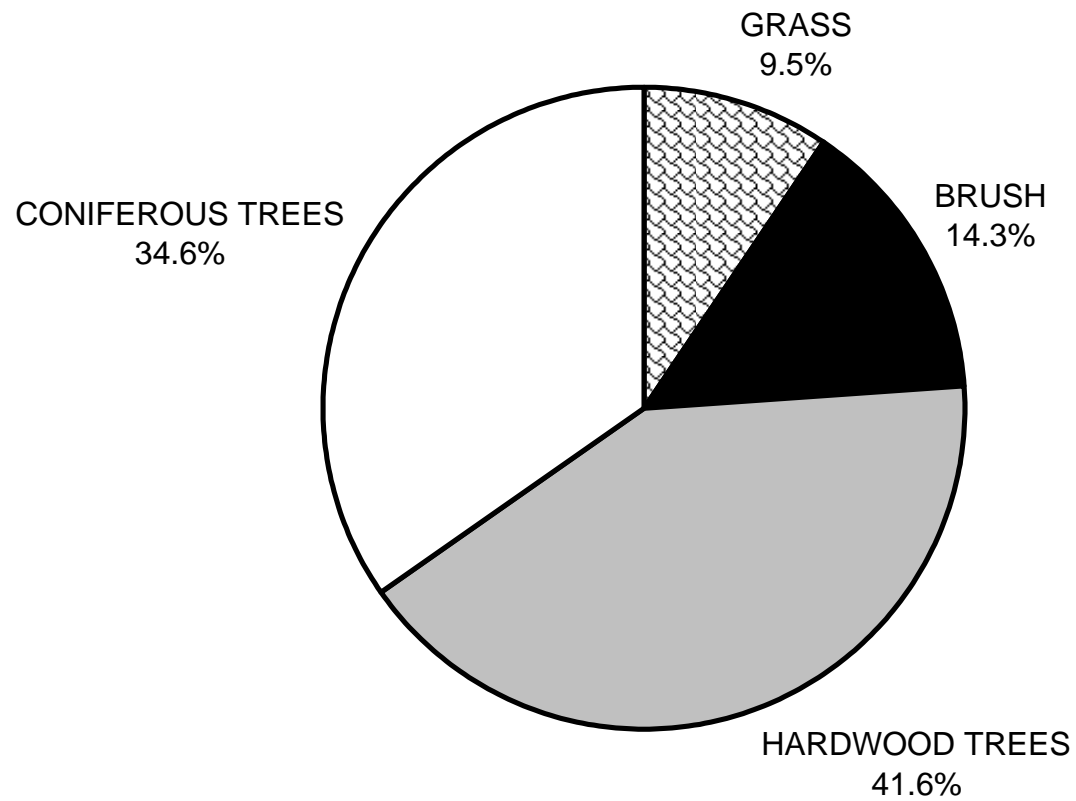
GRAPH 9

CHURCHMAN CREEK 2012 DOMINANT BANK COMPOSITION IN SURVEY REACH



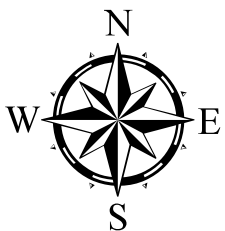
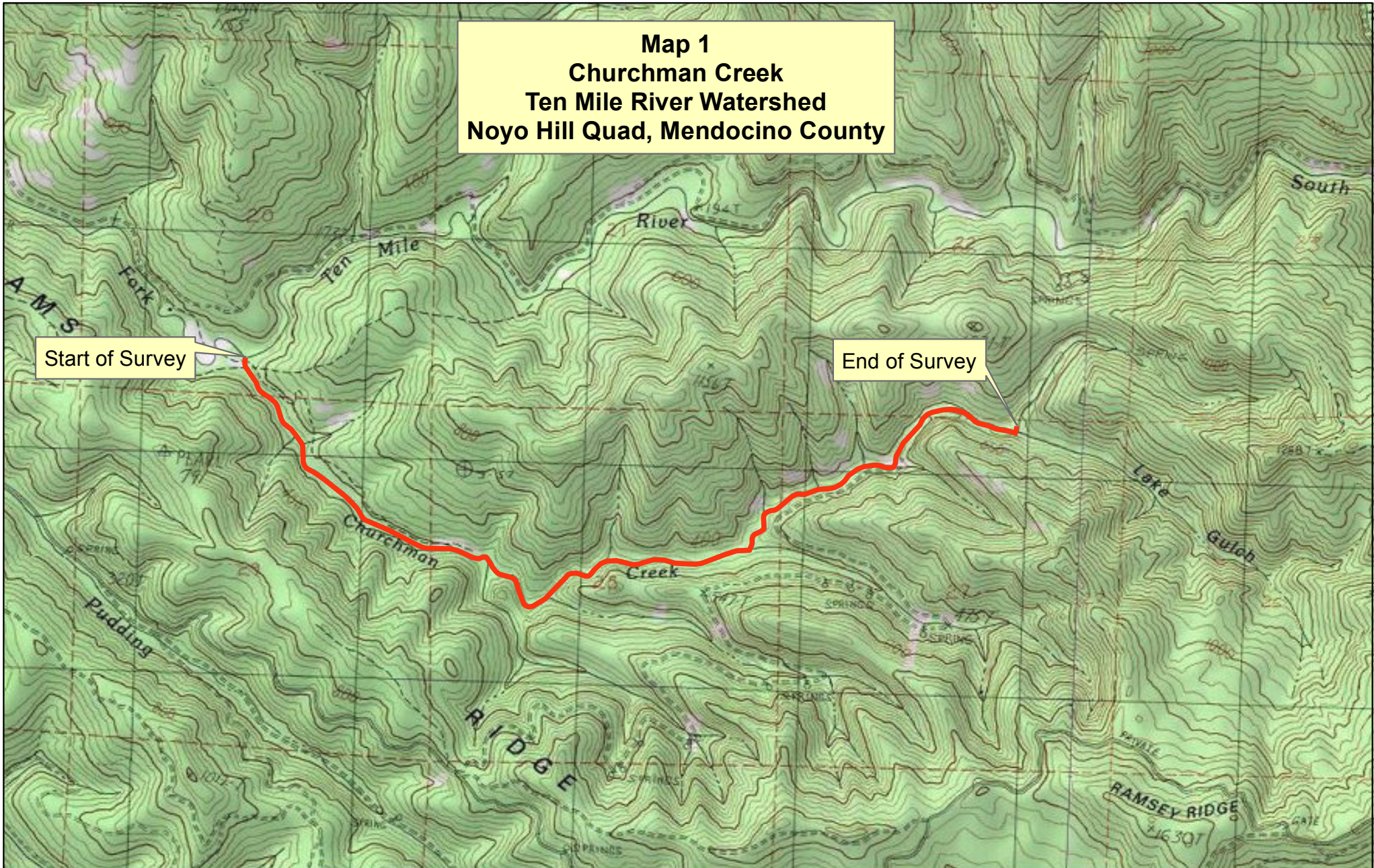
GRAPH 10

CHURCHMAN CREEK 2012 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Map 1
Churchman Creek
Ten Mile River Watershed
Noyo Hill Quad, Mendocino County



— Reach 1, Channel Type F4

