

STREAM INVENTORY REPORT

Little Juan Creek

INTRODUCTION

A stream inventory was conducted from June 23 to July 28, 2009 on Little Juan Creek. The survey began at the confluence with Juan Creek and extended upstream 2.1 miles.

The Little Juan 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 Little Juan 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

Little Juan Creek is a tributary to Juan Creek, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Little Juan Creek's legal description at the confluence with Juan Creek is T21N R17W S06. Its location is 39.7022 degrees north latitude and 123.7981 degrees west longitude, LLID number 1237970397022. Little Juan Creek is a first order stream and has approximately 2.5 miles of blue line stream according to the USGS Westport 7.5 minute quadrangle. Little Juan Creek drains a watershed of approximately 1.8 square miles. Elevations range from about 30 feet at the mouth of the creek to 1000 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 Highway 1 approximately 20 miles north of Fort Bragg.

METHODS

The habitat inventory conducted in Little Juan Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Pacific States Marine Fisheries (PSMFC) Fisheries Technician and 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.

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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 Little Juan 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". Little Juan 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

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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 Little Juan 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 Little Juan Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Little Juan 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 Little Juan Creek, the dominant composition type and the dominant

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vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

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 Little Juan Creek. In addition, underwater observations were made at ten 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)

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- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Little Juan 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 23 to July 28, 2009, was conducted by N. Bankston and J. Greene (WSP), and W. Holloway (PSMFC). The total length of the stream surveyed was 11,136 feet with an additional 138 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.55 cfs on June 30, 2009.

Little Juan Creek is a F4 channel type for 11,274 feet of the stream surveyed. 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 54 to 57 degrees Fahrenheit. Air temperatures ranged from 56 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% pool units, 41% riffle units, and 15% flatwater units (Graph 1). Based on total length of Level II habitat types there were 65% riffle units, 19% flatwater units, and 13% pool units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 40%; mid-channel pool units, 33%; and step run units 10% (Graph 3). Based on percent total length, low gradient riffle units made up 64%,

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step run units 15%, and mid-channel pool units 10%.

A total of 91 pools were identified (Table 3). Main channel pools were the most frequently encountered at 81% (Graph 4), and comprised 84% 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. Four of the 91 pools (4%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 91 pool tail-outs measured, 25 had a value of 1 (27.5%); 28 had a value of 2 (30.8%); 21 had a value of 3 (23.1%); 10 had a value of 4 (11%); and 7 had a value of 5 (7.7%) (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 18, flatwater habitat types had a mean shelter rating of 64, and pool habitats had a mean shelter rating of 36 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 43. Main channel pools had a mean shelter rating of 35 and backwater pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Little Juan Creek. Graph 7 describes the pool cover in Little Juan Creek. Large woody debris is the dominant pool cover type followed by small 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 75% 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 Little Juan Creek was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 73% and 27%, respectively. Graph 9 describes the mean percent canopy in Little Juan Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 95%. The mean percent left bank vegetated was 95%. The dominant elements composing the structure of the stream banks consisted of 98% sand/silt/clay and 2% bedrock (Graph 10). Brush was the dominant vegetation type observed in 95.3% of the units surveyed. Additionally, 2.8% of the units surveyed had coniferous trees as the dominant vegetation type, and 1.9% had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

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Survey teams conducted a snorkel survey at ten sites for species composition and distribution in Little Juan Creek on July 21, 2010. Water temperatures taken during the survey period ranged from 56 to 57 degrees Fahrenheit. The sites were sampled by I. Mikus (DFG) and M. Groff (WSP).

In Reach 1, which comprised the first 11,136 feet of stream, 10 sites were sampled. The reach sites yielded 26 young-of-the-year steelhead/rainbow trout (SH/RT), one age 1+ SH/RT, and four sculpin.

The following chart displays the information yielded from these sites:

2010 Little Juan Creek underwater observations.

Date	Survey Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: F4 Channel Type									
07/21/10	1	010	3.3	525	2	0	0	0	0
	2	013	5.1	688	4	0	0	0	0
	3	019	5.2	1,002	1	0	0	0	0
	4	025	4.2	1,328	0	0	0	0	0
	5	028	4.2	1,478	1	0	0	0	0
	6	030	5.6	1,670	4	0	0	0	0
	7	038	4.2	2,131	2	0	0	0	0
	8	040	4.2	2,351	4	0	0	0	0
	9	042	4.2	2,431	4	1	0	0	0
	10	045	4.2	2,551	4	0	0	0	0

DISCUSSION

Little Juan Creek is an F4 channel type for 11,274 feet of the stream surveyed (Reach 1). The suitability of F4 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.

The water temperatures recorded on the survey days June 23 to July 28, 2009, ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 56 to 64 degrees Fahrenheit. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

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Flatwater habitat types comprised 19% of the total length of this survey, riffles 65%, and pools 13%. Four of the 91 (4%) 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Fifty-three of the 91 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-one of the pool tail-outs had embeddedness ratings of 3 or 4. Seven 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 Little Juan Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eighty-two of the 91 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 was 36. The shelter rating in the flatwater habitats was 64. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Little Juan Creek. Large woody debris is the dominant cover type in pools followed by small 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 98%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 95% 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) Little Juan 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) Where feasible, design and engineer pool enhancement structures to increase the number

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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 large woody debris. 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.
- 7) There are several log debris accumulations present on Little Juan Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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 #:	Comment:
0	0001.00	Start of survey is 33' upstream from the confluence with Juan Creek. The channel is an F4. No fish were observed in Little Juan Creek.
30	0002.00	A bridge spans the channel. The bridge is in good condition.
170	0007.00	A bridge spans the channel. The bridge is in good condition.
1670	0030.01	Log debris accumulation (LDA) #01 contains eight pieces of large woody debris (LWD) and measures 5.5' high x 22' wide x 13' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from gravel to large cobble and measures 15' wide x 20' long x 3' deep. It is a possible barrier to juvenile and adult salmonids. No fish were seen above the LDA.
1670	0031.00	Right bank failure.

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- 2711 0048.00 Tributary #01 enters from the left bank. It contributes one percent of the flow of Little Juan Creek. The temperature downstream of the tributary is 55.4 degrees Fahrenheit, the temperature of the tributary is 54.5 degrees Fahrenheit, and the temperature upstream of the confluence is 55.4 degrees Fahrenheit. No fish were observed in the tributary.
- LDA #02 contains nine pieces of LWD and measures 5' high x 25' wide x 30' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 12' wide x 18' long x 2' deep. It is not a possible barrier to juvenile and adult salmonids.
- 3102 0052.00 LDA #03 contains five pieces of LWD and measures 6' high x 24' wide x 26' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to large cobble and measures 9' wide x 18' long x 1' deep. It is not a possible barrier to juvenile and adult salmonids.
- 4233 0071.00 LDA #04 contains nine pieces of LWD and measures 5.5' high x 16' wide x 27' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. It is not a possible barrier to juvenile and adult salmonids.
- 4432 0075.00 Stream gradient is increasing.
- 5076 0089.00 There is a failed logging road crossing.
- 6952 0127.00 LDA #05 contains five pieces of LWD and measures 6' high x 18' wide x 24' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to small cobble and measures 8' wide x 40' long x 2.5' deep. It is a possible barrier to juvenile and adult salmonids, because woody debris and sediment are blocking fish passage.
- 7190 0132.00 Tributary #02 enters from the left bank. It contributes two percent of the flow of Little Juan Creek. The temperature downstream of the tributary is 55 degrees Fahrenheit, the temperature of the tributary is 54 degrees Fahrenheit, and the temperature upstream of the confluence is 55degrees Fahrenheit. The tributary is accessible to salmonids, but no fish were observed.
- 7270 0133.00 LDA #06 contains nine pieces of LWD and measures 6.5' high x 20' wide x 45' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. It is not a possible barrier to juvenile and adult salmonids. It is a failed road crossing.

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7359	0135.00	LDA #07 contains 10 pieces of LWD and measures 7' high x 20' wide x 30' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 9' wide x 30' long x 1.5' deep. It is not a possible barrier to juvenile and adult salmonids.
7433	0137.00	LWD forms a 3' foot jump with a 1.5' pool below it. The LWD is notched, but the pool has filled in.
7609	0142.00	There is a 4' high jump with a 1.2' deep pool below. The pool is filled in with sediment.
8526	0165.00	There is a 1.5' high plunge.
8618	0167.00	LDA #08 contains seven pieces of LWD and measures 6' high x 14' wide x 22' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 5' wide x 14' long x 1' deep.
8699	0170.00	There is a 5' high jump with 0.9' of water below it.
8752	0171.00	There is a 2.5' high plunge.
8793	0173.00	LDA #09 contains nine pieces of LWD and measures 8' high x 11' wide x 18' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 9' wide x 14' long x 1' deep. It is a possible barrier to juvenile and adult salmonids because woody debris is blocking fish passage.
9317	0187.00	Tributary #03 enters from the right bank. It contributes five percent of the flow of Little Juan Creek. The temperature downstream of the tributary is 56 degrees Fahrenheit, the temperature of the tributary is 56 degrees Fahrenheit, and the temperature upstream of the confluence is 56 degrees Fahrenheit. The tributary is not accessible to fish.
10124	0196.00	There is a 4' high jump.
10137	0197.00	There is a four foot tall log cascade. There is an old logging bridge next to the creek.
10402	0199.00	LDA #10 contains 13 pieces of LWD and measures 10' high x 16' wide x 33' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 18' wide x 8' long x 3' deep.
11136	0207.00	End of survey.

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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: Little Juan Creek

LLID: 1237970397022 Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT Legal Description: T21NR17WS06 Latitude: 39:42:08.0N Longitude: 123:47:49.0

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
1	0	DRY	0.5	311	311	2.8									
32	4	FLATWATER	15.2	69	2197	19.5	5.1	0.4	0.6	220	7029	84	2701		64
91	91	POOL	43.3	16	1485	13.2	9.4	0.8	1.3	147	13421	162	14741	128	36
86	11	RIFFLE	41.0	85	7281	64.6	6.3	0.3	0.6	435	37439	122	10467		18
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
210	106				11274					57889			27909		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

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 (%)
84	9	LGR	40.0	86	7214	64.0	6	0.3	0.7	489	41087	128	10774		19	97
1	1	HGR	0.5	45	45	0.4	7	0.6	1.4	268	268	161	161		20	100
1	1	CAS	0.5	22	22	0.2	9	0.2	0.7	119	119	24	24		10	100
11	2	RUN	5.2	41	455	4.0	6	0.4	1	165	1816	71	786		115	99
21	2	SRN	10.0	83	1742	15.5	4	0.4	0.6	274	5759	97	2044		13	98
70	70	MCP	33.3	16	1141	10.1	9	0.8	2.5	148	10368	163	11377	129	34	98
4	4	STP	1.9	26	106	0.9	7	0.9	2.3	155	621	189	755	155	48	99
2	2	CRP	1.0	19	38	0.3	9	0.8	1.4	185	371	154	309	121	53	100
3	3	LSL	1.4	14	43	0.4	9	0.6	1.4	124	371	103	310	79	52	99
11	11	PLP	5.2	13	141	1.3	11	0.8	2.1	136	1499	155	1703	121	39	99
1	1	DPL	0.5	16	16	0.1	12	1.2	1.8	192	192	288	288	230	10	98
1	0	DRY	0.5	311	311	2.8										

Total Units Fully Measured
210 106

Total Length (ft.)
11274

Total Area (sq.ft.)
62470

Total Volume (cu.ft.)
28530

Table 3 - Summary of Pool Types

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

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
74	74	MAIN	81	17	1247	84	9.2	0.8	148	10989	130	9638	35
16	16	SCOUR	18	14	222	15	10.3	0.8	140	2241	113	1810	43
1	1	BACKWATER	1	16	16	1	12.0	1.2	192	192	230	230	10

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
91	91	1485	13421	11678

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

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

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
70	MCP	77	11	16	57	81	2	3	0	0	0	0
4	STP	4	0	0	3	75	1	25	0	0	0	0
2	CRP	2	0	0	2	100	0	0	0	0	0	0
3	LSL	3	0	0	3	100	0	0	0	0	0	0
11	PLP	12	3	27	7	64	1	9	0	0	0	0
1	DPL	1	0	0	1	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
91	14	15	73	80	4	4	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Dry Units: 1

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

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
84	9	LGR	0	29	37	0	30	0	0	4	0
1	1	HGR	0	0	0	0	0	0	25	75	0
1	1	CAS	0	60	10	0	30	0	0	0	0
86	11	TOTAL RIFFLE	0	29	30	0	27	0	3	12	0
11	2	RUN	0	50	45	0	5	0	0	0	0
21	2	SRN	0	10	20	0	70	0	0	0	0
32	4	TOTAL FLAT	0	30	33	0	38	0	0	0	0
70	70	MCP	3	13	60	2	13	0	3	6	0
4	4	STP	0	14	39	0	3	0	40	5	0
2	2	CRP	0	65	25	0	10	0	0	0	0
3	3	LSL	7	32	55	0	7	0	0	0	0
11	11	PLP	0	10	59	0	10	0	18	3	0
1	1	DPL	0	0	60	0	40	0	0	0	0
91	91	TOTAL POOL	2	14	58	1	12	0	7	6	0
210	106	TOTAL	2	16	55	1	14	0	6	6	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Dry Units: 1

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

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
84	9	LGR	0	11	67	22	0	0	0
1	1	HGR	0	0	100	0	0	0	0
1	1	CAS	0	0	0	0	0	0	100
11	2	RUN	0	50	50	0	0	0	0
21	2	SRN	0	0	50	50	0	0	0
70	70	MCP	7	59	34	0	0	0	0
4	4	STP	25	0	50	25	0	0	0
2	2	CRP	0	50	50	0	0	0	0
3	3	LSL	0	67	33	0	0	0	0
11	11	PLP	0	82	18	0	0	0	0
1	1	DPL	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	27	73	0	95	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: Little Juan Creek LLID: 1237970397022 Drainage: Rockport
Survey Dates: 6/23/2009 to 7/28/2009 Survey Length (ft.): 11274 Main Channel (ft.): 11136 Side Channel (ft.): 138
Confluence Location: Quad: WESTPORT Legal Description: T21NR17WS06 Latitude: 39:42:08.0N Longitude: 123:47:49.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1										
Channel Type:	F4	Canopy Density (%):	97.8	Pools by Stream Length (%):	13.2					
Reach Length (ft.):	11136	Coniferous Component (%):	26.7	Pool Frequency (%):	43.3					
Riffle/Flatwater Mean Width (ft.):	6.0	Hardwood Component (%):	73.3	Residual Pool Depth (%):						
BFW:		Dominant Bank Vegetation:	Brush	< 2 Feet Deep:	96					
Range (ft.):	6 to 15	Vegetative Cover (%):	95.0	2 to 2.9 Feet Deep:	4					
Mean (ft.):	11	Dominant Shelter:	Large Woody Debris	3 to 3.9 Feet Deep:	0					
Std. Dev.:	3	Dominant Bank Substrate Type:	Sand/Silt/Clay	>= 4 Feet Deep:	0					
Base Flow (cfs.):	0.0	Occurrence of LWD (%):	53	Mean Max Residual Pool Depth (ft.):	1.3					
Water (F):	54 - 57	Air (F):	56 - 64	LWD per 100 ft.:						
Dry Channel (ft):	311	Riffles:	5	Mean Pool Shelter Rating:	36					
		Pools:	12							
		Flat:	3							
Pool Tail Substrate (%):	Silt/Clay: 5	Sand: 0	Gravel: 75	Sm Cobble: 15	Lg Cobble: 2	Boulder: 2	Bedrock: 0			
Embeddedness Values (%):	1. 27.5	2. 30.8	3. 23.1	4. 11.0	5. 7.7					

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT

Legal Description: T21NR17WS06

Latitude: 39:42:08.0N

Longitude: 123:47:49.0W

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	1	3	1.9
Boulder	0	0	0.0
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	105	103	98.1

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	99	103	95.3
Hardwood Trees	3	1	1.9
Coniferous Trees	4	2	2.8
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Little Juan Creek

LLID: 1237970397022

Drainage: Rockport

Survey Dates: 6/23/2009 to 7/28/2009

Confluence Location: Quad: WESTPORT

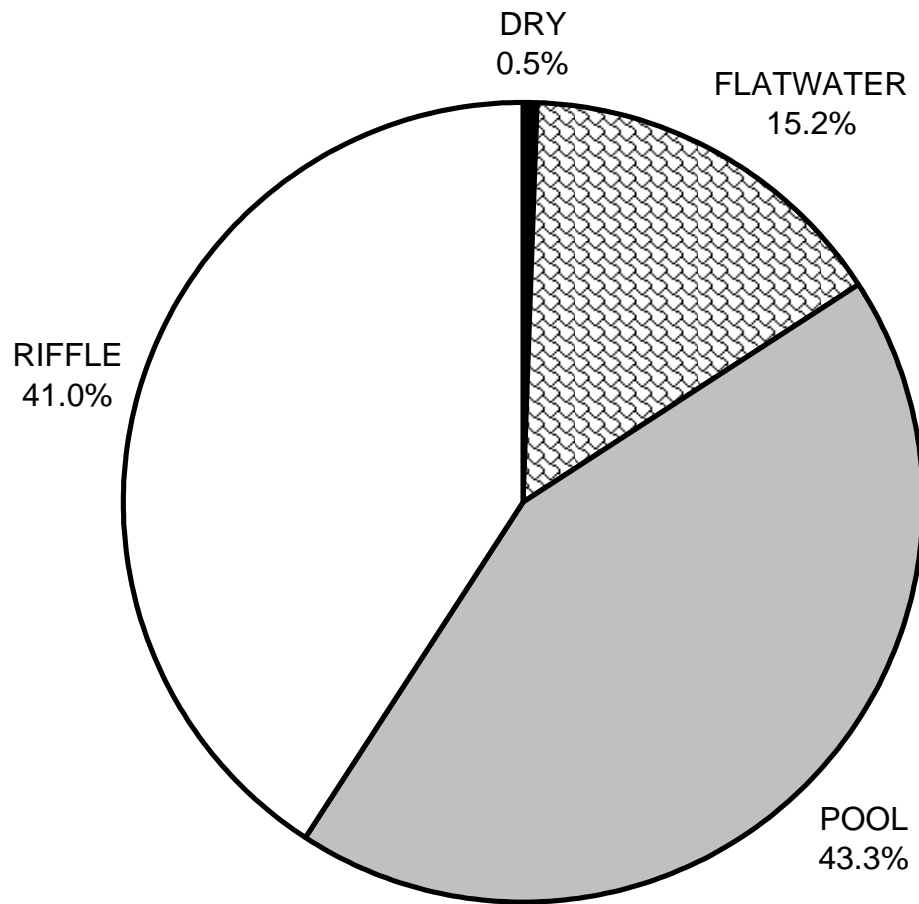
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Longitude: 123:47:49.0W

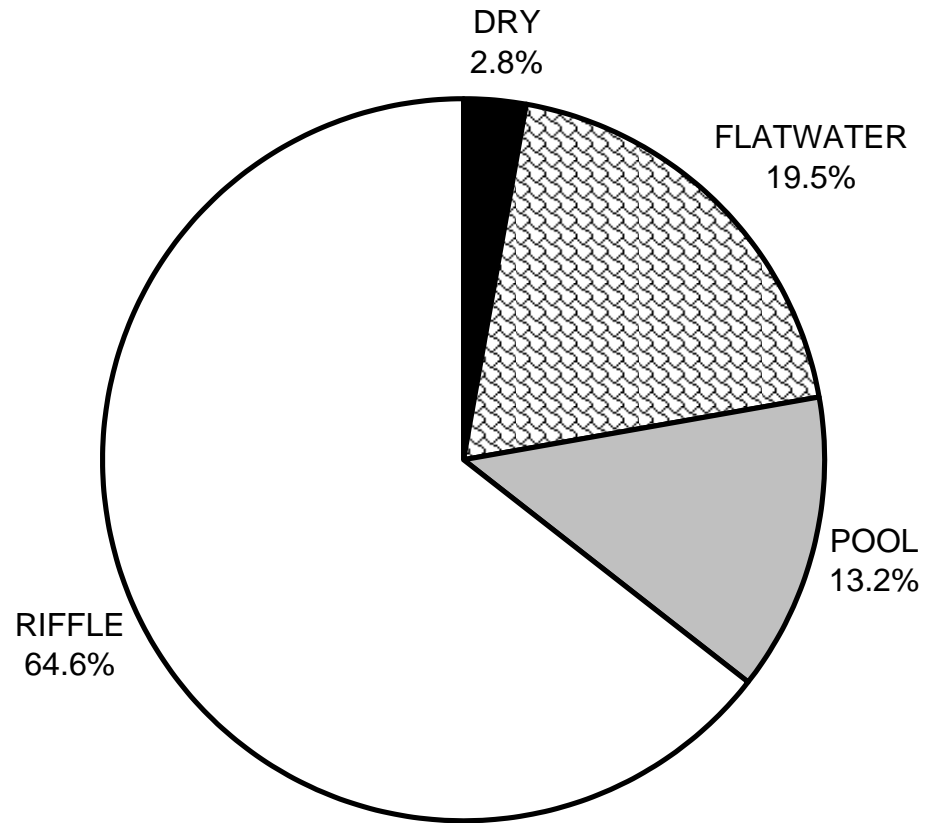
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	3
SMALL WOODY DEBRIS (%)	29	30	14
LARGE WOODY DEBRIS (%)	30	33	58
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	27	38	12
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	3	0	7
BOULDERS (%)	12	0	6
BEDROCK LEDGES (%)	0	0	0

LITTLE JUAN CREEK 2009 HABITAT TYPES BY PERCENT OCCURRENCE



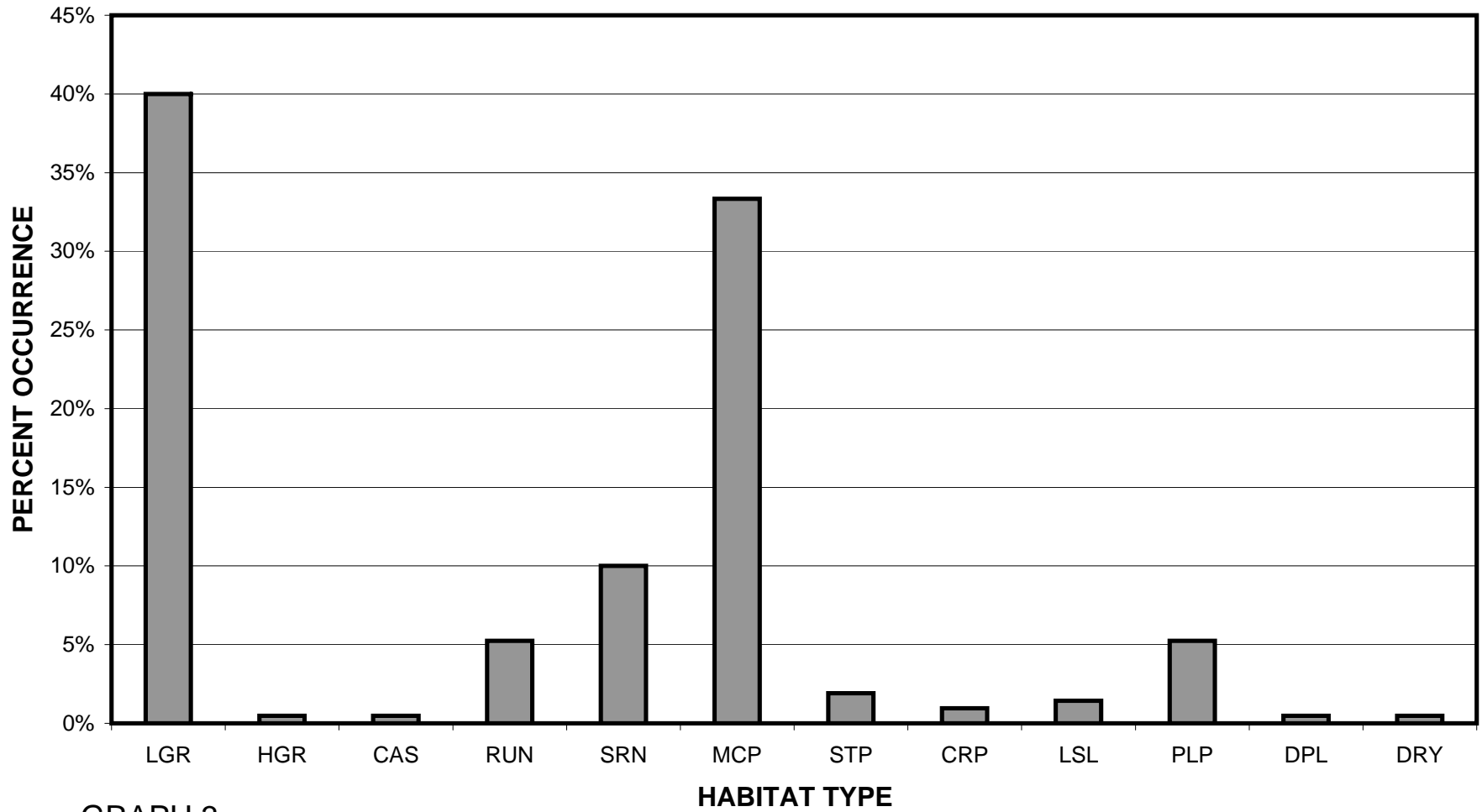
GRAPH 1

**LITTLE JUAN CREEK 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH**



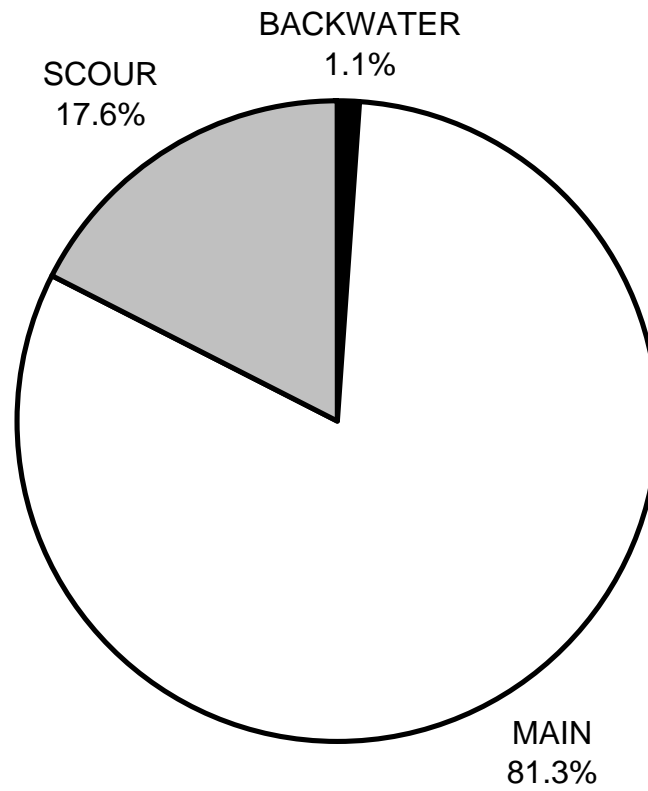
GRAPH 2

LITTLE JUAN CREEK 2009 HABITAT TYPES BY PERCENT OCCURRENCE



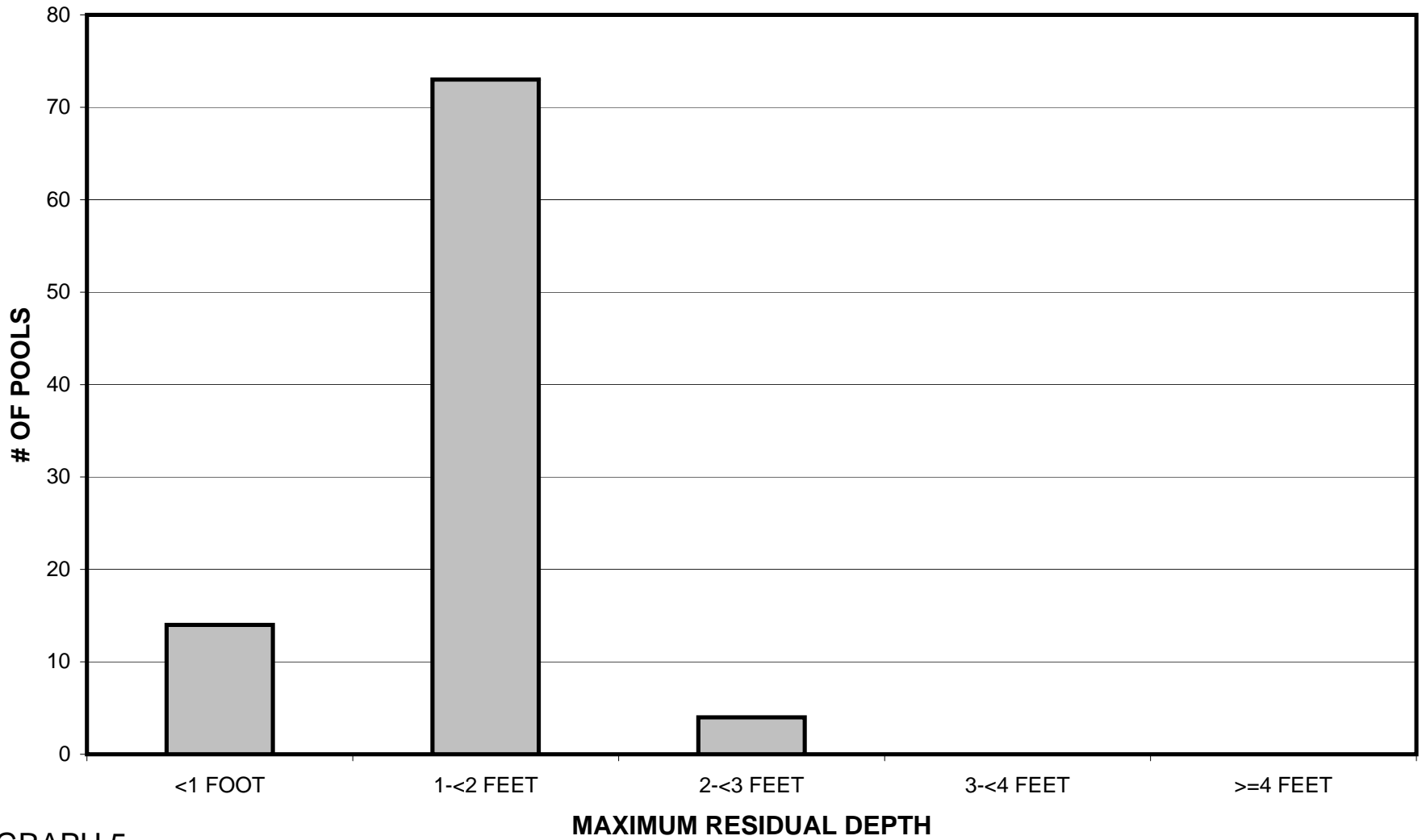
GRAPH 3

LITTLE JUAN CREEK 2009 POOL TYPES BY PERCENT OCCURRENCE



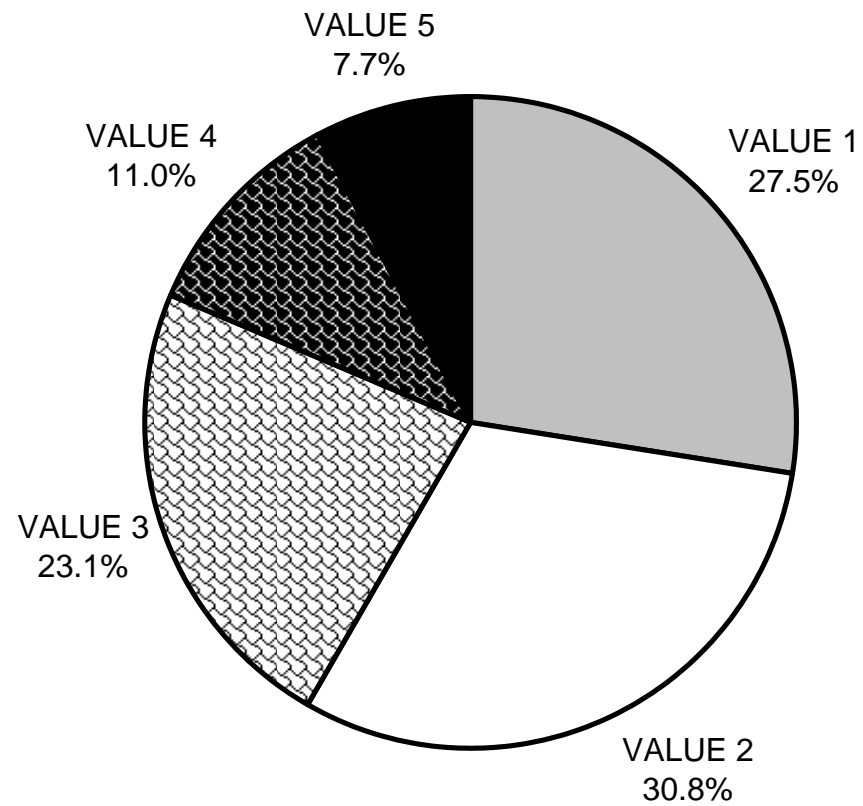
GRAPH 4

LITTLE JUAN CREEK 2009 MAXIMUM DEPTH IN POOLS



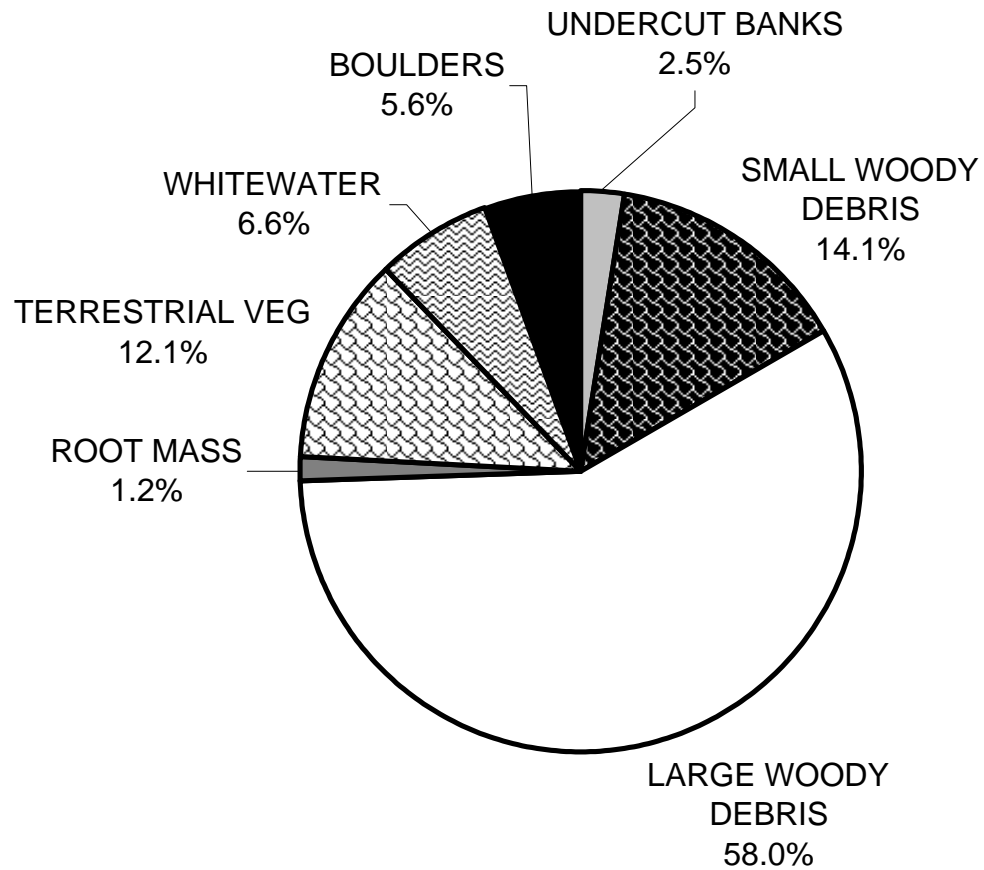
GRAPH 5

LITTLE JUAN CREEK 2009 PERCENT EMBEDDEDNESS



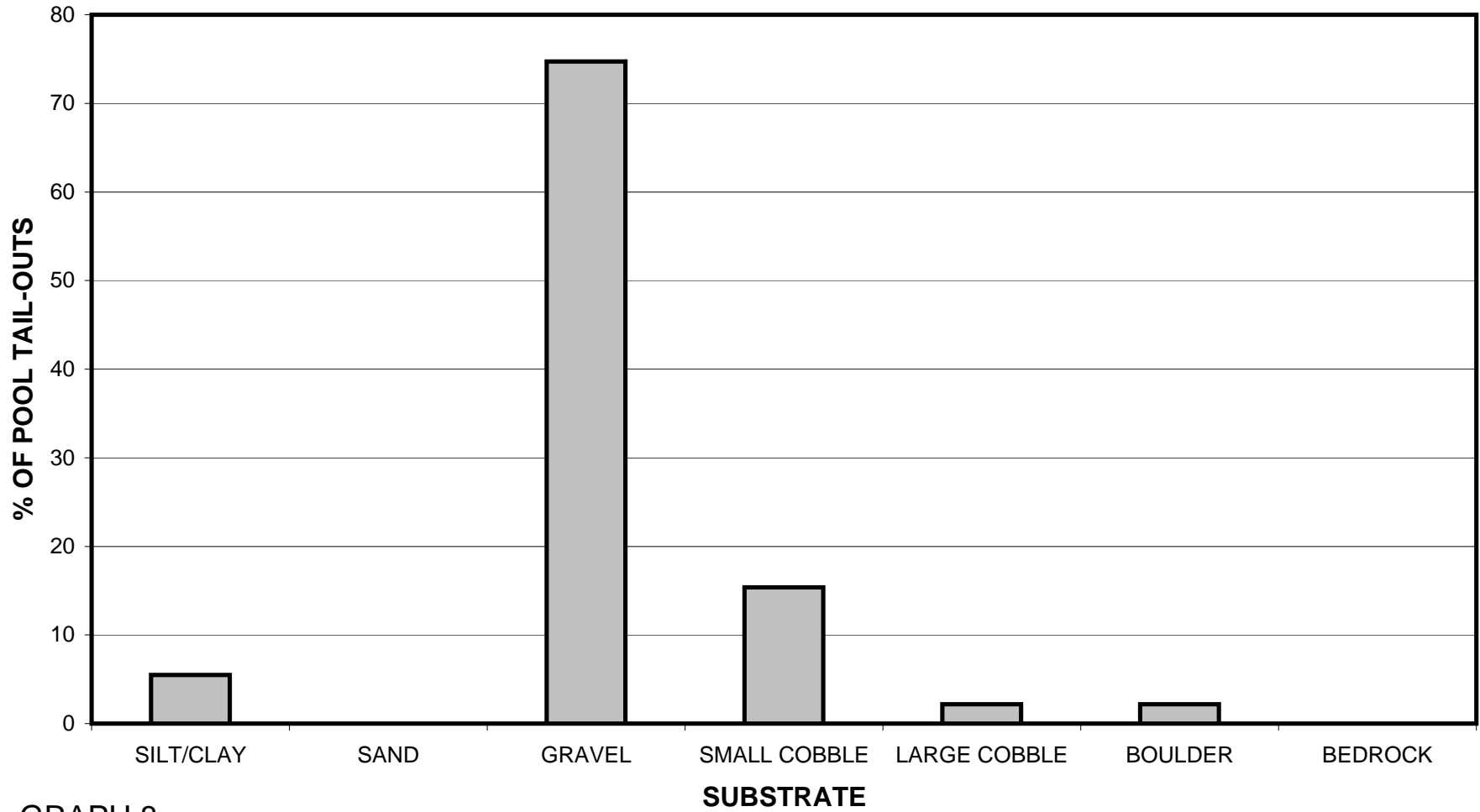
GRAPH 6

LITTLE JUAN CREEK 2009 MEAN PERCENT COVER TYPES IN POOLS



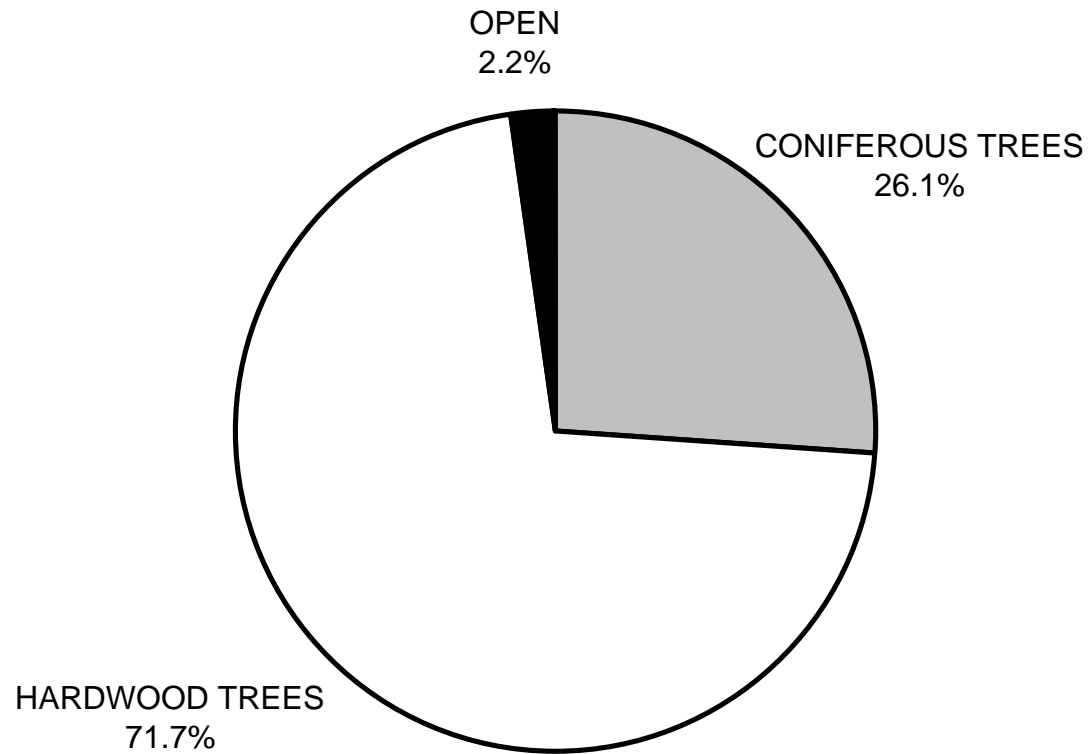
GRAPH 7

LITTLE JUAN CREEK 2009 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



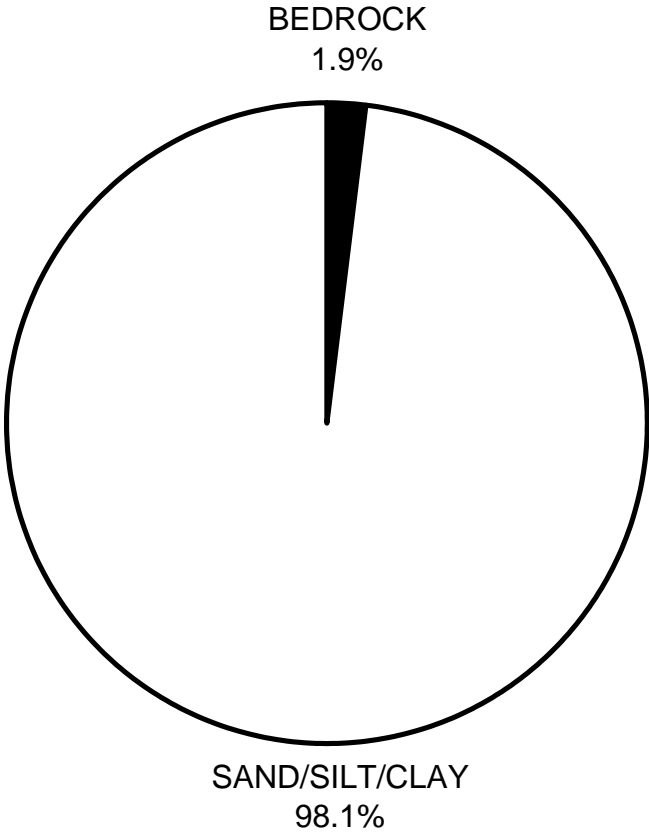
GRAPH 8

LITTLE JUAN CREEK 2009 MEAN PERCENT CANOPY



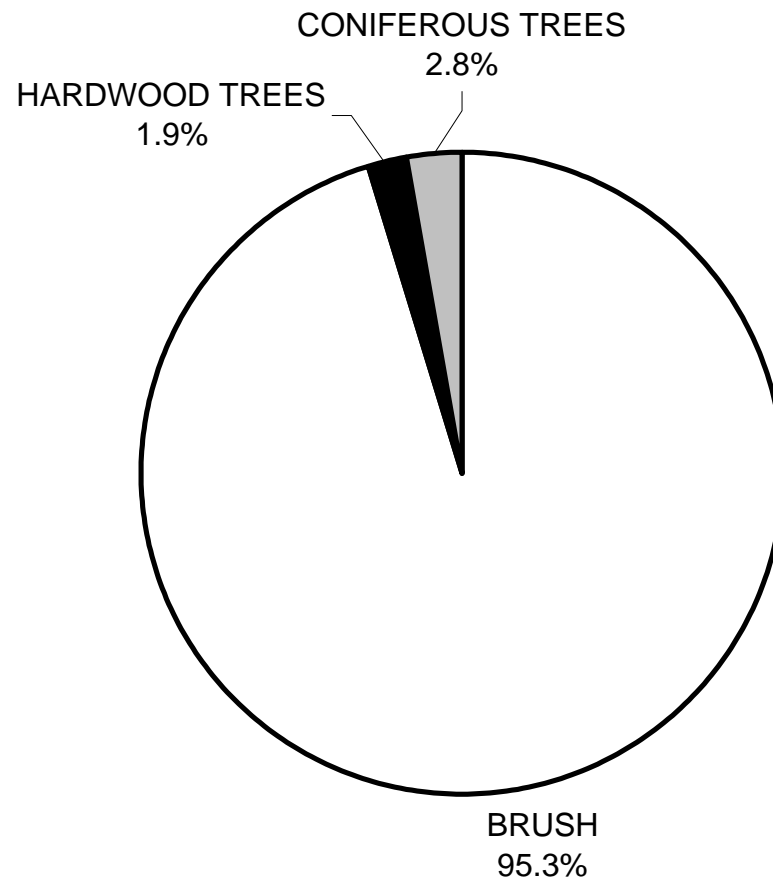
GRAPH 9

**LITTLE JUAN CREEK 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

LITTLE JUAN CREEK 2009 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

