



CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Little Mill Creek

INTRODUCTION

A stream inventory was conducted from June 8 to June 9, 2015 on Little Mill Creek. The survey began at the confluence with Smith River and extended upstream 1.1 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Little Mill Creek.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Little Mill Creek is a tributary to the Smith River, which drains to the Pacific Ocean. It is located in Del Norte County, California (Map 1). Little Mill Creek's legal description at the confluence with the Smith River is T17N R01W S12. Its location is 41.8732 degrees north latitude and 124.1244 degrees west longitude, LLID number 1241231418732. Little Mill Creek is a second order stream and has approximately 3.2 miles of blue line stream according to the USGS Hiouchi 7.5 minute quadrangle. Little Mill Creek drains a watershed of approximately 3.8 square miles. Elevations range from about 20 feet at the mouth of the creek to 1,400 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 North Bank Road, south of Smith River, CA.

METHODS

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

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

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 Mill Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a 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 Mill Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Little Mill Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuitable 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

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energy, and allow separation of territorial units to reduce density related competition for prey. 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 Mill Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then calculated by multiplying the qualitative shelter value by the percent of the unit covered. 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 Mill Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Little Mill Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

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

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),

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bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, 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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Little Mill Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of June 8 to June 9, 2015 was conducted by J. Lee and J. Guzcek, (WSP). The total length of the stream surveyed was 5,833 feet with an additional 49 feet of side channel.

Stream flow was not measured on Little Mill Creek.

Little Mill Creek is a B3 channel type for 4,228 feet of the stream surveyed (Reach 1) and an A3 channel type for 1,605 feet of the stream surveyed (Reach 2). B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very

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stable plan and profile, stable banks and cobble-dominant substrates. A3 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 55 to 57 degrees Fahrenheit. Air temperatures ranged from 60 to 71 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 47% riffle units, 29% flatwater units, 23% pool units, and 1% culvert units (Graph 1). Based on total length of Level II habitat types there were 59% riffle units, 28% flatwater units, 12% pool units, and 1% culvert units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high gradient riffle units, 24%; mid-channel pool units, 16%; low gradient riffle units, 16%; and step run units, 16% (Graph 3). Based on percent total length, high gradient riffle units made up 30%, low gradient riffle units 22%, and step run units 18%.

A total of 25 pools were identified (Table 3). Main channel pools were the most frequently encountered at 72% (Graph 4), and comprised 79% 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. Eleven of the 25 pools (44%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 25 pool tail-outs measured, three had a value of 1 (12%); nine had a value of 2 (36%); seven had a value of 3 (28%); two had a value of 4 (8%); four had a value of 5 (16%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable 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 34, flatwater habitat types had a mean shelter rating of 18, and pool habitats had a mean shelter rating of 38 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 53. Main channel pools had a mean shelter rating of 32 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Little Mill Creek. Graph 7 describes the pool cover in Little Mill Creek. Whitewater 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 64% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 20% of the pool tail-outs.

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

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 97%. The dominant elements composing the structure of the stream banks consisted of 43% bedrock, 34% cobble/gravel, 19% boulders, and 5% sand/silt/clay (Graph 10). Hardwood trees were the dominant vegetation type observed in 95% of the units surveyed. Additionally, 2% of the units surveyed had coniferous trees as the dominant vegetation type (Graph 11).

DISCUSSION

Little Mill Creek is a B3 channel type for the first 4,228 feet of stream surveyed and an A3 channel type for the remaining 1,605 feet. The suitability of B3 and A3 channel types for fish habitat improvement structures is as follows: B3 channels are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing-deflectors, and log cover. A channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days June 8 to June 9, 2015 ranged from 55 to 57 degrees Fahrenheit. Air temperatures ranged from 60 to 71 degrees Fahrenheit. This is a suitable 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 28% of the total length of this survey, riffles 59%, and pools 12%. Eleven of the 25 (44%) 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 structures that will increase or deepen pool habitat is recommended.

Twelve of the 25 pool tail-outs measured had embeddedness ratings of 1 or 2. Nine of the pool tail-outs had embeddedness ratings of 3 or 4. Four 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 Mill Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-one of the 25 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 38. The shelter rating in the flatwater habitats is 18. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Little Mill Creek. Whitewater is the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and

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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 96%. Reach 1 had a canopy density of 97% and Reach 2 had a canopy density of 95%. The percentage of right and left bank covered with vegetation was 99% and 97%, respectively.

RECOMMENDATIONS

Little Mill Creek should be managed as an anadromous, natural production stream. Recommendations for potential habitat improvement activities are based on target habitat values suitable for salmonids in California's north coast streams. Considering the results from this stream habitat inventory, factors that affect salmonid productivity and CDFW's professional judgment, the following list prioritizes habitat improvement activities in Little Mill Creek. Keep in mind, watershed and stream ecosystem processes, land use alterations, changes in land ownership, and other factors could potentially change the order of these recommendations or create the need to remove/add recommendations in the future.

- 1) Conduct a fish passage assessment on the stream crossing on North Bank Road located 110 feet from the confluence. If the crossing is determined to be a barrier to fish passage replace the culvert with a crossing that will provide unimpeded fish passage.
- 2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from whitewater. Adding high quality complexity with woody cover in the pools is desirable.
- 3) 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.
- 4) 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.
- 5) 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 three to five years.

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.

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Position (ft):	Habitat unit #:	Comments:
110	0005.00	North Bank Road crosses the channel. The crossing is a 14' diameter x 81' long corrugated metal culvert. The slope of the culvert is 2.3% and there is a 2' high plunge at the outlet. The wooden baffles in the culvert are showing signs of rot and there is some rust on the culvert.
1140	0024.00	There is a 1' high plunge over large woody debris (LWD) structure.
1801	0038.00	Tributary #01 enters on the right bank. It contributes less than 1% to Little Mill Creek's flow. The water temperature downstream of the confluence was 57 degrees Fahrenheit and the water temperature upstream of the confluence was 56 degrees Fahrenheit. The slope of the tributary is approximately 10%.
2436	0051.00	Log debris accumulation (LDA) #01 contains eight pieces of large woody debris (LWD) and measures 9' high x 30' wide x 12' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from gravel to cobble and measures 5' wide x 15' long x 0.5' deep. Fish were observed above the LDA.
2502	0053.00	There is a 2' high plunge.
2600	0057.00	Tributary #02 enters on the left bank. It contributes less than 1% to Little Mill Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit; the water temperature downstream and upstream of the confluence was 55 degrees Fahrenheit. The slope of the tributary is approximately 20%.
3105	0061.00	Tributary #03 enters on the right bank. It contributes less than 1% to Little Mill Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit; the water temperature downstream and upstream of the confluence was 55 degrees Fahrenheit. The slope of the tributary is approximately 20%.
4011	0074.00	LDA #02 contains six pieces of LWD and measures 6' high x 32' wide x 10' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from gravel to cobble and measures 30' wide x 20' long x 4' deep. There is a 4' high plunge and a 5' high plunge over the LDA. Fish were observed above it. Tributary #04 enters on the right bank. It contributes approximately 5% to Little Mill Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit, the water temperature downstream of the confluence was 55 degrees Fahrenheit, and the water temperature upstream of the confluence was 56 degrees Fahrenheit. The slope of the tributary is approximately 30% and there are multiple plunges and LWD barriers.

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4228	0079.00	The channel changes from a B3 to an A3.
4283	0081.00	Tributary #05 enters on the left bank. It contributes less than 1% to Little Mill Creek's flow. The water temperature of the tributary was 55 degrees Fahrenheit; the water temperature downstream and upstream of the confluence was 56 degrees Fahrenheit. The slope of the tributary is approximately 30%.
4416	0083.00	LDA #03 contains 12 pieces of LWD and measures 5' high x 30' wide x 6' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from gravel to cobble and measures 30' wide x 25' long x 5' deep. There is a 3.5' high plunge over the LDA. Fish were observed above it.
4707	0090.00	LDA #04 contains 24 pieces of LWD and measures 10' high x 23' wide x 29' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 20' wide x 50' long x 10' deep. There is a 5' high plunge over the LDA. Fish were observed above it.
4757	0092.00	Right bank slide. Tributary #06 enters on the right bank. It contributes less than 1% to Little Mill Creek's flow. The water temperature downstream of the confluence was 55 degrees Fahrenheit and the water temperature upstream of the confluence was 56 degrees Fahrenheit. The slope of the tributary is approximately 80%.
5202	0098.00	Tributary #07 enters on the right bank. It contributes less than 1% to Little Mill Creek's flow. The water temperature of the tributary was 56 degrees Fahrenheit, the water temperature downstream of the confluence was 55 degrees Fahrenheit, and the water temperature upstream of the confluence was 56 degrees Fahrenheit. The slope of the tributary is approximately 20%.
5628	0106.00	LDA #05 contains 14 pieces of LWD and measures 8' high x 42' wide x 19' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from cobble to boulders and measures 40' wide x 50' long x 5' deep. There is a 3' high plunge over the LDA. Fish were not observed above it.
5805	0108.00	LDA #06 contains 26 pieces of LWD and measures 12' high x 43' wide x 30' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to boulders and measures 40' wide x 70' long x 10' deep. There is a 9' high plunge over the LDA. End of survey. The gradient increases over the 1,000 above the LDA.

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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]	

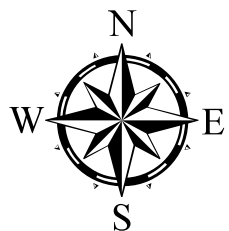
Map 1
Little Mill Creek
Smith River Watershed
Hiouchi Quad, Del Norte County

Smith River Watershed

Start of Survey

End of Survey

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- Reach 1: B3 Channel Type
- - - Reach 2: A3 Channel Type

0 0.275 0.55 1.1 Miles



Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0

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	CULVERT	0.9	81	81	1.4									
32	6	FLATWATER	29.1	51	1645	28.0	13.6	1.0	1.6	658	21048	625	20006		18
25	25	POOL	22.7	27	674	11.5	14.0	1.3	2.3	374	9355	719	17985	537	38
52	12	RIFFLE	47.3	67	3482	59.2	15.8	0.7	1.3	494	25672	339	17634		34
Total Units	Total Units Fully Measured			Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)			
110	43			5882						56074		55625			

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

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 (%)
17	3	LGR	15.5	74	1263	21.5	13	0.6	1.3	332	5645	247	4192		13	96
26	5	HGR	23.6	67	1748	29.7	14	0.7	2	801	20821	535	13913		44	96
7	2	CAS	6.4	59	413	7.0	11	1.0	2.2	144	1008	153	1071		45	98
2	2	BRS	1.8	29	58	1.0	28	0.6	1.5	318	636	174	348		30	99
15	3	RUN	13.6	38	569	9.7	12	0.9	1.5	411	6161	342	5133		10	99
17	3	SRN	15.5	63	1076	18.3	16	1.1	2.3	905	15380	908	15439		27	95
18	18	MCP	16.4	29	530	9.0	13	1.0	3.7	385	6921	644	11588	449	33	96
1	1	LSBk	0.9	9	9	0.2	8	1.1	2.5	72	72	122	122	79	20	99
6	6	PLP	5.5	22	135	2.3	17	2.0	4.7	394	2362	1046	6274	878	58	94
1	0	CUL	0.9	81	81	1.4										

Total Units
110

Total Units Fully Measured
43

Total Length (ft.)
5882

Total Area (sq.ft.)
59007

Total Volume (cu.ft.)
58081

Table 3 - Summary of Pool Types

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

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
18	18	MAIN	72	29	530	79	13.2	1.0	385	6921	449	8074	33
7	7	SCOUR	28	21	144	21	16.0	1.9	348	2434	764	5348	53
Total Units	Total Units Fully Measured			Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)		
25	25			674					9355		13423		

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

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

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
18	MCP	72	1	6	11	61	5	28	1	6	0	0
1	LSBk	4	0	0	0	0	1	100	0	0	0	0
6	PLP	24	0	0	2	33	0	0	1	17	3	50

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
25	1	4	13	52	6	24	2	8	3	12

Mean Maximum Residual Pool Depth (ft.): 2.3

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Dry Units: 0

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

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
17	3	LGR	0	0	67	33	0	0	0
26	5	HGR	0	0	40	20	0	40	0
7	2	CAS	0	0	0	0	0	50	50
2	2	BRS	0	0	0	0	0	0	100
15	3	RUN	0	33	33	33	0	0	0
17	3	SRN	0	33	67	0	0	0	0
18	18	MCP	6	61	22	0	0	0	11
1	1	LSBk	0	0	0	0	100	0	0
6	6	PLP	0	17	33	0	17	0	33

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
96	4	96	0	99	97

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 Mill Creek		LLID: 1241231418732		Drainage: Smith River - Lower	
Survey Dates: 6/8/2015 to 6/9/2015		Survey Length (ft.): 5882	Main Channel (ft.): 5833	Side Channel (ft.): 49	
Confluence Location: Quad: HIGH DIVIDE	Legal Description: T17NR01WS12		Latitude: 41:52:24.0N	Longitude: 124:07:23.0W	

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B3

Reach Length (ft.): 4228

Riffle/Flatwater Mean Width (ft.): 14.2

BFW:

Range (ft.): 25 to 30

Mean (ft.): 28

Std. Dev.: 2

Base Flow (cfs.): 0.0

Water (F): 55 - 57

Air (F): 60 - 66

Dry Channel (ft): 0

Canopy Density (%): 96.8

Coniferous Component (%): 4.2

Hardwood Component (%): 95.8

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 97.8

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Bedrock

Occurrence of LWD (%): 23

LWD per 100 ft.:

Riffles: 4

Pools: 7

Flat: 4

Pools by Stream Length (%): 12.9

Pool Frequency (%): 22.5

Residual Pool Depth (%):

< 2 Feet Deep: 50

2 to 2.9 Feet Deep: 28

3 to 3.9 Feet Deep: 11

>= 4 Feet Deep: 11

Mean Max Residual Pool Depth (ft.): 2.3

Mean Pool Shelter Rating: 32

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 6

Gravel: 61

Sm Cobble: 17

Lg Cobble: 6

Boulder: 6

Bedrock: 6

Embeddedness Values (%): 1. 11.1

2. 33.3

3. 27.8

4. 11.1

5. 16.7

STREAM REACH: 2

Channel Type: A3

Reach Length (ft.): 1605

Riffle/Flatwater Mean Width (ft.): 16.3

BFW:

Range (ft.): 22 to 27

Mean (ft.): 24

Std. Dev.: 2

Base Flow (cfs.): 0.0

Water (F): 55 - 56

Air (F): 66 - 71

Dry Channel (ft): 0

Canopy Density (%): 94.6

Coniferous Component (%): 3.8

Hardwood Component (%): 96.3

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 99.5

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Boulder

Occurrence of LWD (%): 21

LWD per 100 ft.:

Riffles: 7

Pools: 34

Flat: 7

Pools by Stream Length (%): 7.7

Pool Frequency (%): 23.3

Residual Pool Depth (%):

< 2 Feet Deep: 71

2 to 2.9 Feet Deep: 14

3 to 3.9 Feet Deep: 0

>= 4 Feet Deep: 14

Mean Max Residual Pool Depth (ft.): 2.2

Mean Pool Shelter Rating: 55

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 71

Sm Cobble: 29

Lg Cobble: 0

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 14.3

2. 42.9

3. 28.6

4. 0.0

5. 14.3

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

Legal Description: T17NR01WS12

Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

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	21	16	43.0
Boulder	6	10	18.6
Cobble / Gravel	14	15	33.7
Sand / Silt / Clay	2	2	4.7

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	1	1.2
Brush	0	1	1.2
Hardwood Trees	43	39	95.3
Coniferous Trees	0	2	2.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Little Mill Creek

LLID: 1241231418732

Drainage: Smith River - Lower

Survey Dates: 6/8/2015 to 6/9/2015

Confluence Location: Quad: HIGH DIVIDE

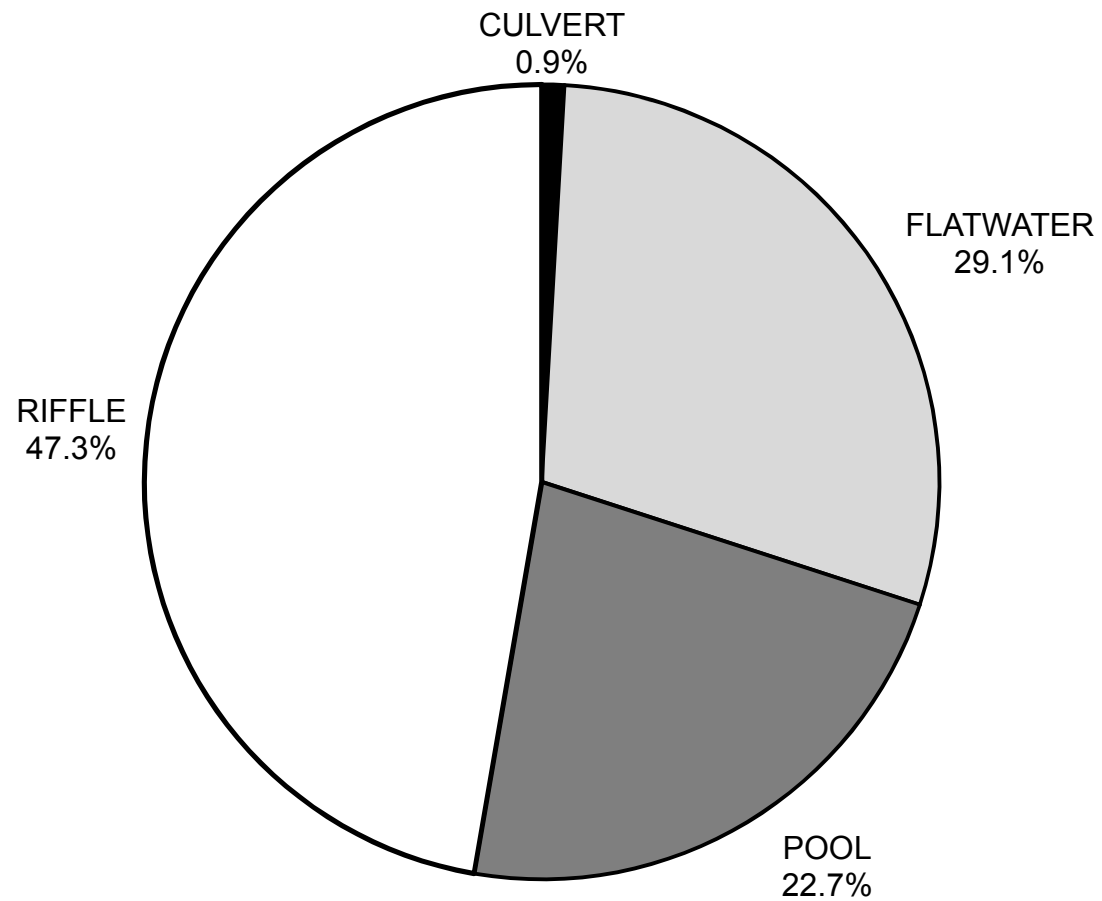
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Latitude: 41:52:24.0N

Longitude: 124:07:23.0W

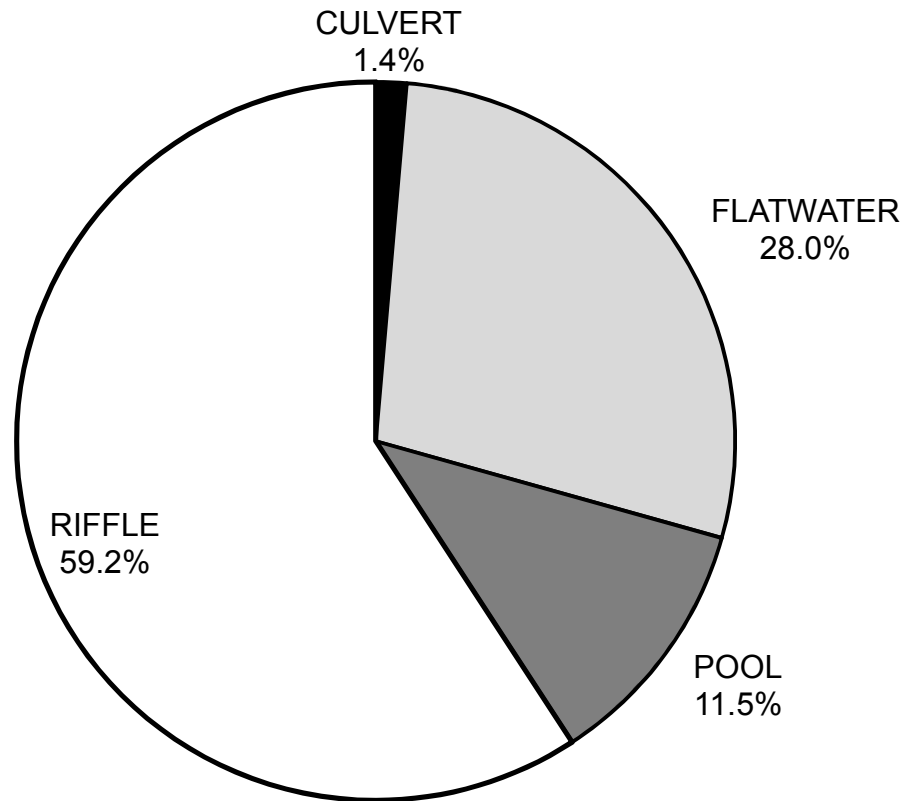
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	0	0
SMALL WOODY DEBRIS (%)	8	4	3
LARGE WOODY DEBRIS (%)	18	10	28
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	2	14	6
AQUATIC VEGETATION (%)	0	0	1
WHITEWATER (%)	30	10	34
BOULDERS (%)	42	62	25
BEDROCK LEDGES (%)	0	0	2

LITTLE MILL CREEK 2015 HABITAT TYPES BY PERCENT OCCURRENCE



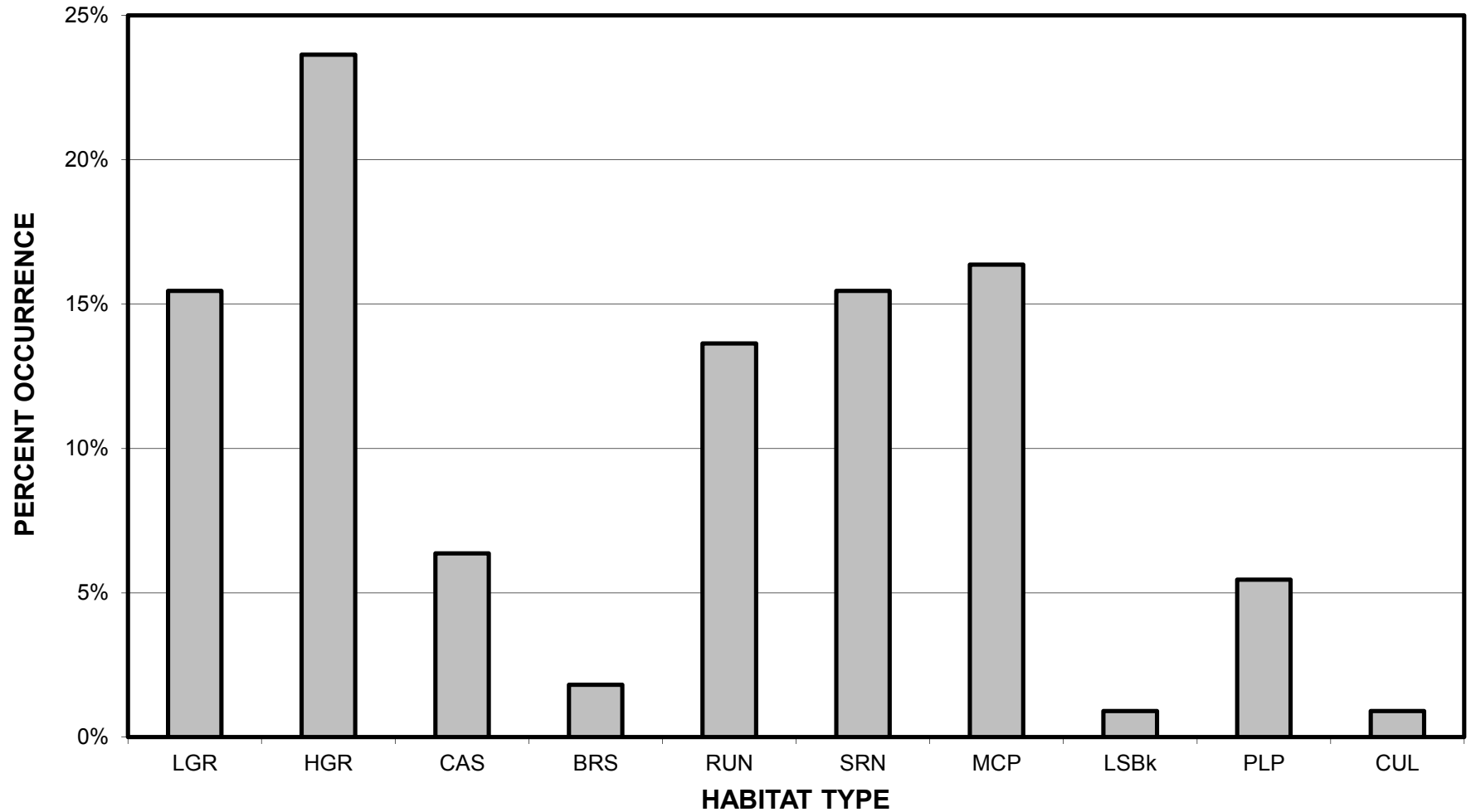
GRAPH 1

LITTLE MILL CREEK 2015 HABITAT TYPES BY PERCENT TOTAL LENGTH



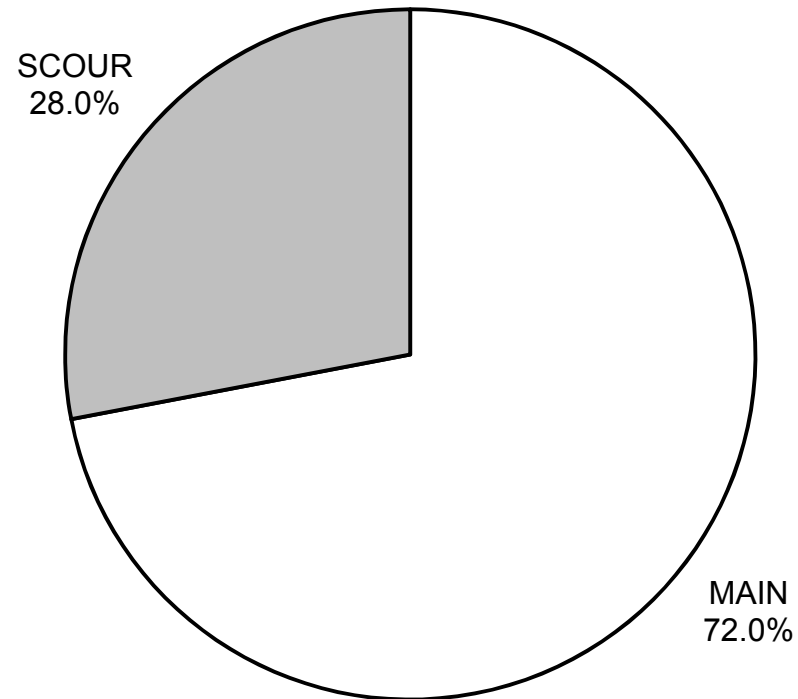
GRAPH 2

LITTLE MILL CREEK 2015 **HABITAT TYPES BY PERCENT OCCURRENCE**



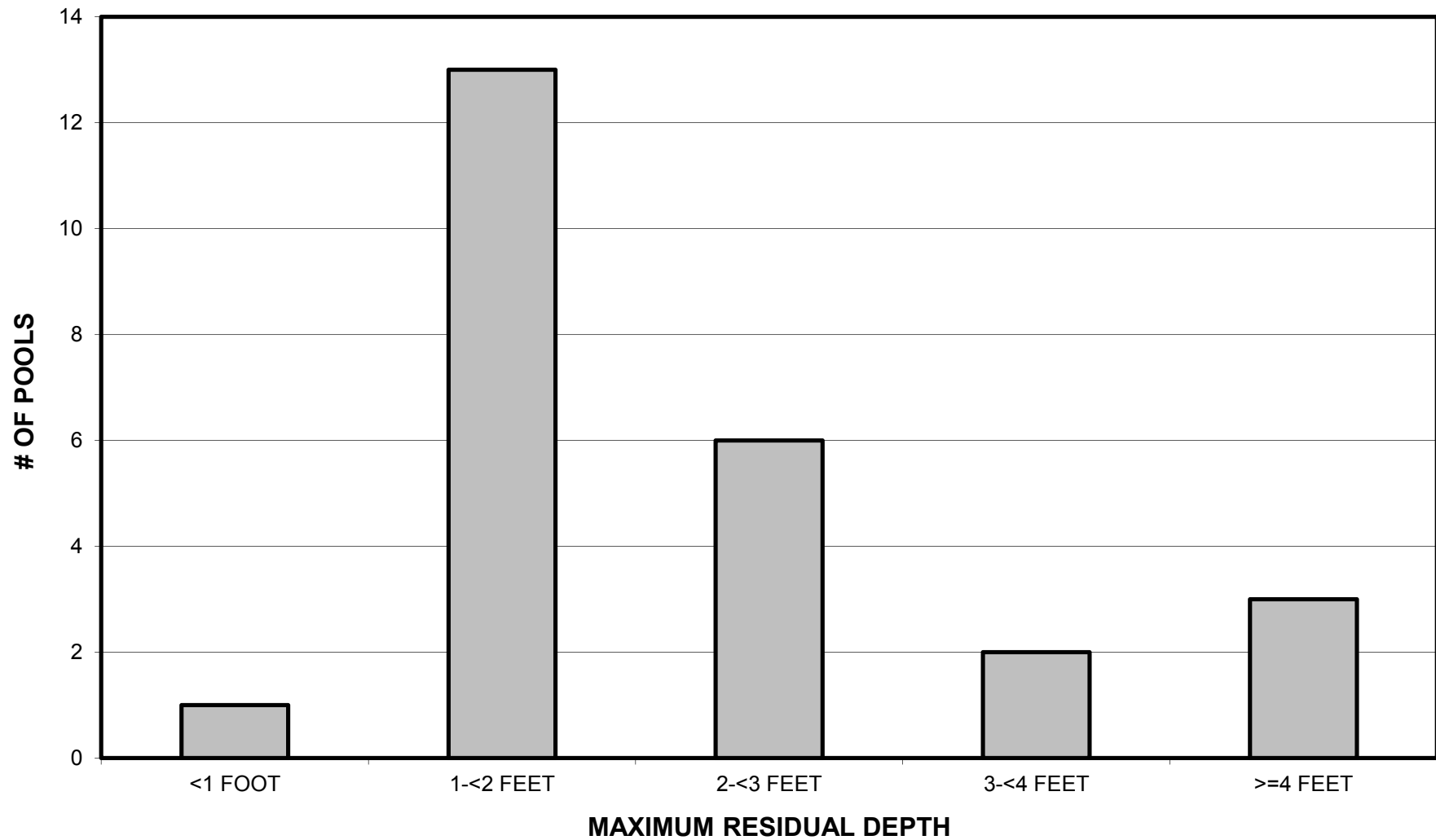
GRAPH 3

**LITTLE MILL CREEK 2015
POOL TYPES BY PERCENT OCCURRENCE**



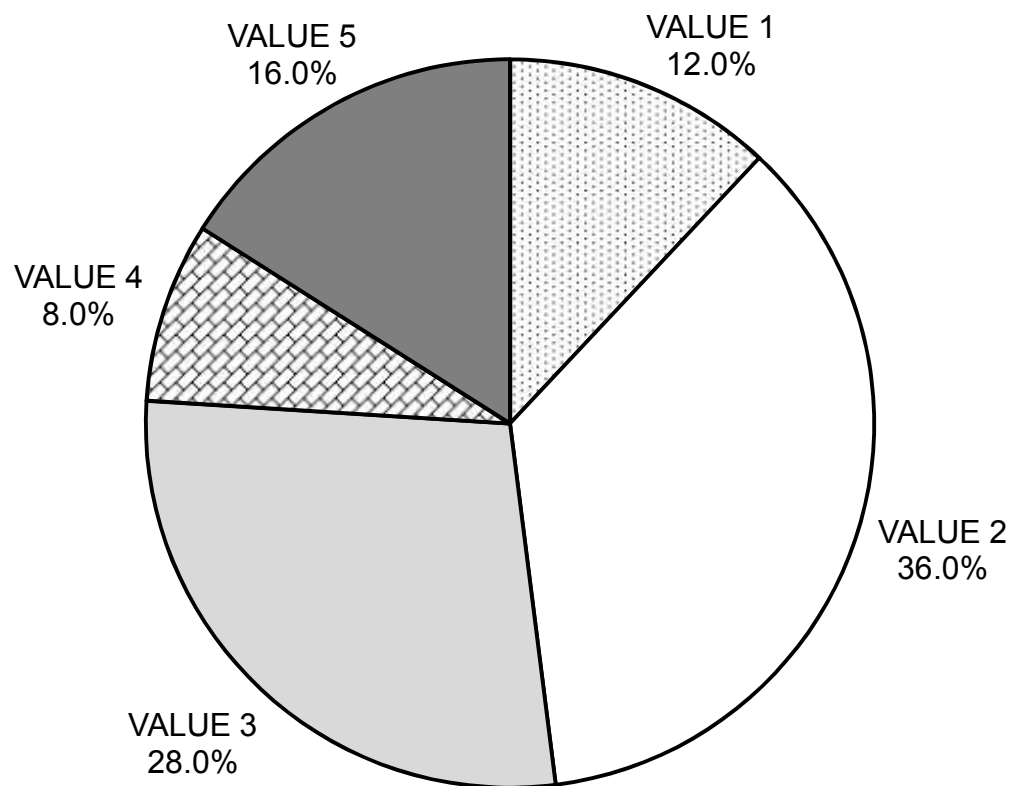
GRAPH 4

LITTLE MILL CREEK 2015 MAXIMUM DEPTH IN POOLS



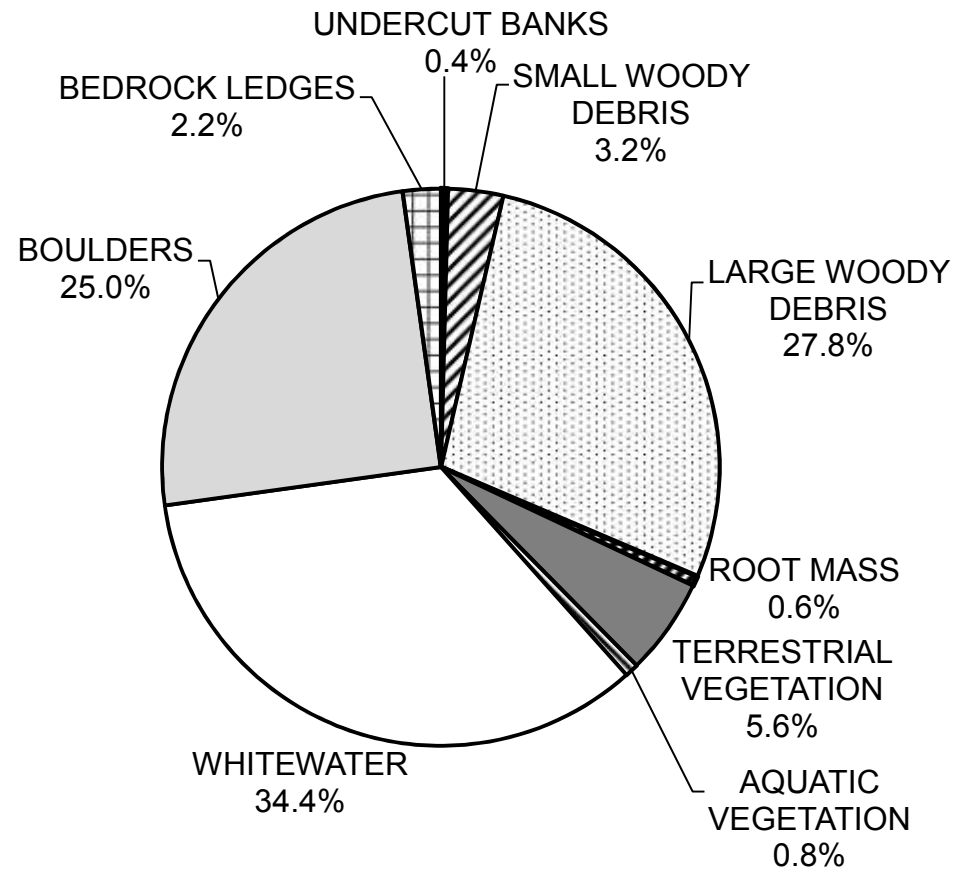
GRAPH 5

LITTLE MILL CREEK 2015 PERCENT EMBEDDEDNESS



GRAPH 6

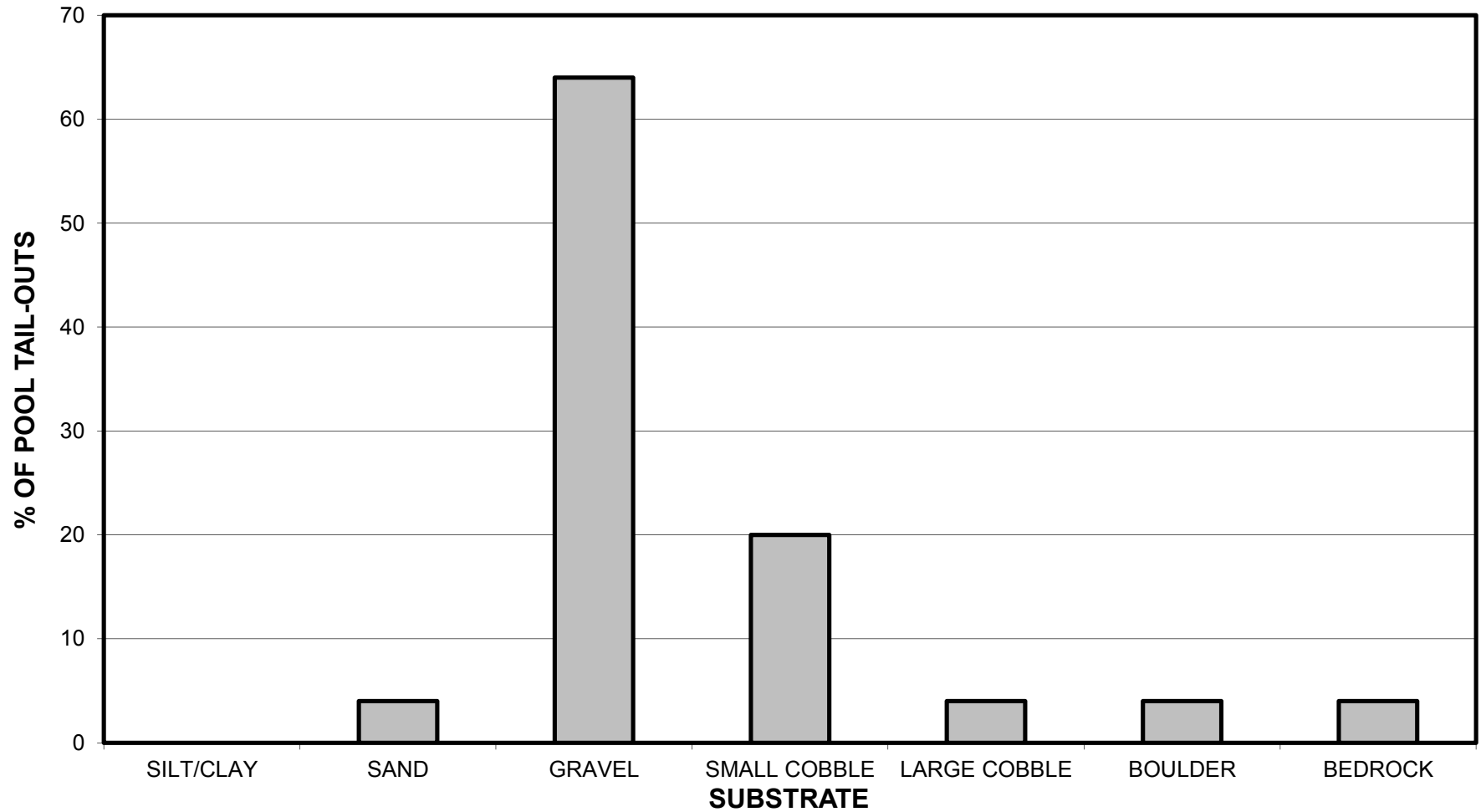
LITTLE MILL CREEK 2015 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

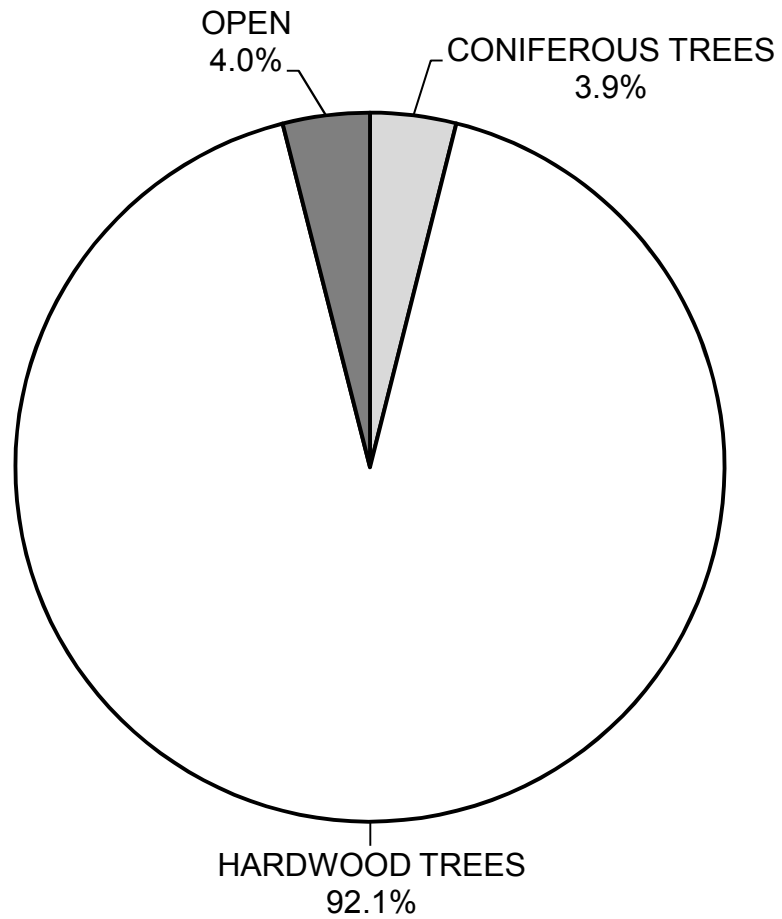
LITTLE MILL CREEK 2015

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



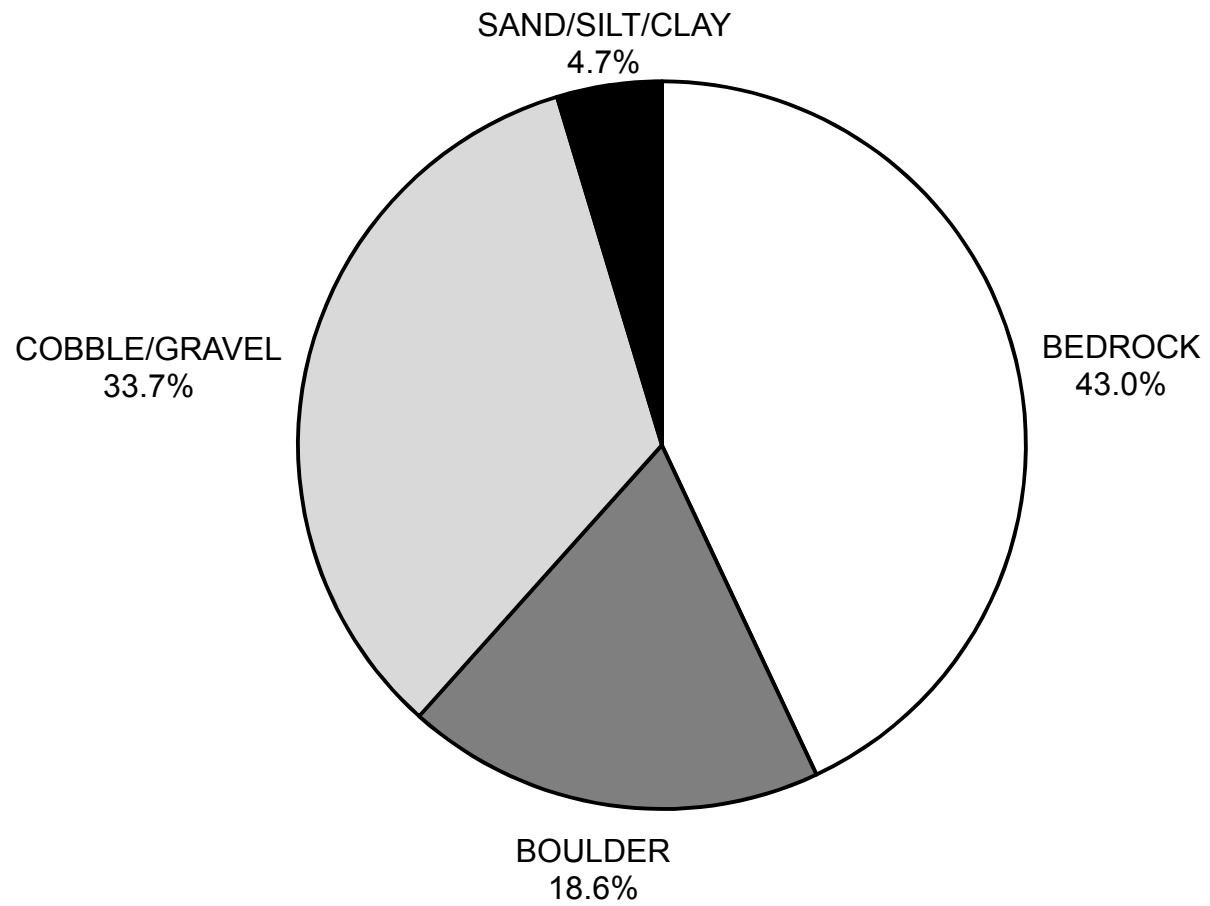
GRAPH 8

LITTLE MILL CREEK 2015 MEAN PERCENT CANOPY



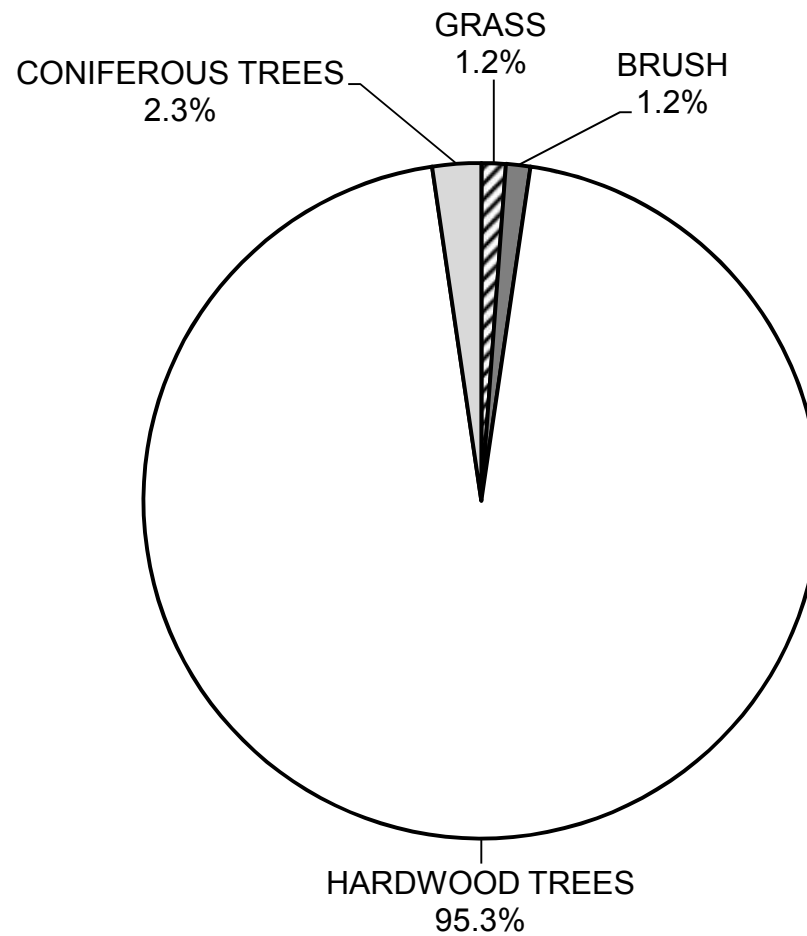
GRAPH 9

**LITTLE MILL CREEK 2015
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

LITTLE MILL CREEK 2015 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11