



CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Little Sproul Creek

INTRODUCTION

A stream inventory was conducted from June 26 to July 7, 2018 on Little Sproul Creek. The survey began at the confluence with Sproul Creek and extended upstream 2.9 miles.

The Little Sproul 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 Sproul Creek. The biological inventory documents 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 and 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. This report was finalized in April, 2019.

WATERSHED OVERVIEW

Little Sproul Creek, located in southern Humboldt County, is a tributary to Sproul Creek, which is a tributary to South Fork Eel River, a tributary to the Eel River which drains to the Pacific Ocean in northern California (Map 1). Little Sproul Creek's legal description at the confluence with Sproul Creek is T04S R03E S34. Its location is 40.06723° north latitude and -123.83573° west longitude, LLID number 1238348400675. Little Sproul Creek is a first order stream and has approximately 1.9 miles of blue line stream according to the USGS Garberville 7.5 minute quadrangle. Little Sproul Creek drains a watershed of approximately 3.9 square miles. Elevations range from about 353 feet at the mouth of the creek to 900 feet in the headwater areas. Redwood/mixed hardwood forests dominates the watershed. The watershed is entirely privately owned and is predominately managed for timber production. Vehicle access exists via Highway 101 to Sproul Creek Road.

METHODS

The habitat inventory conducted in Little Sproul 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). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the

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. Surveyors also take photos to document general habitat conditions, significant features (landslides, potential barriers, etc.), and end of survey (Appendix II).

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 Sproul 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:

Water and air temperatures are measured and recorded at every tenth habitat unit using a hand-held thermometer. Both temperatures are taken in degrees (°) Fahrenheit and the time of the measurement is also recorded. Air temperatures are recorded within one foot of the water surface, while water temperatures are recorded (where possible) in flowing water within the habitat unit.

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 Sproul 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 Sproul 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 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 Sproul 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Little Sproul 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 Sproul 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), 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 Sproul Creek. In addition, underwater mask and snorkel observations were made at 13 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 2.0.18, 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 Sproul 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 IN APPENDIX I *

The habitat inventory of June 26 to July 7, 2018 was conducted by Ellen Hensel (WSP) and Ted Masters (WSP). The total length of the stream surveyed was 15,565 feet.

Stream flow measurement of 1.33 cfs was recorded on July 17, 2018 near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter.

Little Sproul Creek is a B3 channel type for approximately 10,980 feet of stream surveyed (Reach 1) and an A4 channel type for approximately 4,585 feet of the stream surveyed (Reach 2). B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and cobble-dominant substrates. A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 53° to 64° Fahrenheit. Air temperatures ranged from 53° to 77° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% riffle units, 33% pool units, 27% flatwater units, and 4% dry units (Graph 1). Based on total length of Level II habitat types there were 35% riffle units, 34% pool units, 28% flatwater units, and 3% dry units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 33% low gradient riffle units, 33% mid-channel pool units, and 19% run units (Graph 3). Based on percent total length, 34% mid-channel pool units, 32% low gradient riffle units, and 16% run units.

A total of 212 pools were identified (Table 3). Main channel pools were the most frequently encountered at 100% (Graph 4), and comprised 100% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-two of the 212 pools (10%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 212 pool tail-outs measured, 152 had a value of 1 (71.4%), 32 had a value of 2 (15%), 6 had a value of 3 (2.8%), 1 had a value of 4 (0.5%) and 22 had a value of 5 (10.3%) (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 20, flatwater habitat types had a mean shelter rating of 16, and pool habitats had a mean shelter rating of 30 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Little Sproul Creek. Graph 7 describes the pool cover in Little Sproul Creek. Boulders are 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 67% of the pool tail-outs. Cobble was the next most dominant substrate type, observed in 23% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Little Sproul Creek was 93%. Seven percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 71% and 29%, respectively. Graph 9 describes the mean percent canopy in Little Sproul Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 90%. The mean percent left bank vegetated was 86%. The dominant elements composing the structure of the stream banks consisted of 82% sand/silt/clay, 13% bedrock, and 5% cobble/gravel (Graph 10). Hardwood trees were the dominant vegetation type observed in 48% of the units surveyed. Additionally, 30% of the units surveyed had coniferous trees as the dominant vegetation type, and 22% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a mask and snorkel survey at 13 sites for species composition and distribution in Little Sproul Creek on July 18, 2018 (Table A). The sites were sampled by Ellen Hensel (WSP) and Teddy Masters (WSP).

The survey yielded 18 young-of-the-year (YOY) coho salmon, 32 YOY steelhead/rainbow trout (SH), and 2 age 1+ SH.

During the survey, the upstream-most observation of coho salmon occurred at 40.0887° north latitude, -123.8574° west longitude, approximately 10,988 feet upstream from the confluence with Sproul Creek. The upstream-most observation of steelhead trout occurred at 40.09044° north latitude, -123.85893° west longitude, approximately 11,673 feet upstream from the confluence with Sproul Creek (Map 1).

Table A. Summary of results for a fish composition and distribution survey within Little Sproul Creek, July 18, 2018

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from Mouth (ft.)	Steelhead Trout			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
Reach 2: A4 Channel Type										
07/18/18	1	329	pool	9,513	2	0	0	4	0	
	2	372	pool	10,277	5	0	0	5	0	
	3	376	pool	10,390	1	0	0	4	0	
	4	390	pool	10,706	4	0	0	3	0	
	5	400	pool	10,945	6	0	0	0	0	
	6	403	pool	10,988	6	0	0	2	0	
	7	412	pool	11,013	0	1	0	0	0	
	8	425	pool	11,513	1	0	0	0	0	
	9	429	pool	11,556	2	0	0	0	0	
	10	431	step run	11,634	0	0	0	0	0	
	11	432	poo	11,645	3	1	0	0	0	
	12	433	riffle	11,655	1	0	0	0	0	
	13	434	run	11,673	1	0	0	0	0	

DISCUSSION

Little Sproul Creek is a B3 channel type for approximately the first 10,980 feet of stream surveyed and an A4 channel type for the remaining 4,585 feet. The suitability of B3 and A4 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. A4 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days June 26 to July 7, 2018 ranged from 53° to 64° Fahrenheit. Air temperatures ranged from 53° to 77° Fahrenheit. This is a suitable water temperature range for salmonids. However, 64° Fahrenheit, if sustained, is near the threshold stress level 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 35%, and pools 35%. Twenty-two of the 212 (10%) 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.

One hundred eighty-three of the 212 pool tail-outs measured had embeddedness ratings of 1 or 2. Seven of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-two 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.

One hundred eighty-nine of the 212 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 30. The shelter rating in the flatwater habitats is 16. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Little Sproul Creek. Boulders are 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 93%. Reach 1 had a canopy density of 93%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 90% and 86%, 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

Little Sproul 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 Sproul 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from boulders. Adding high quality complexity with woody cover in the pools is desirable.
- 2) Based on the results of the Little Sproul Creek stream habitat inventory, stream habitat structures should be installed to increase pool frequency and residual depth, increase shelter ratings, increase aggradation leading to floodplain connectivity, and increase velocity and temperature refugia.
- 3) Pools are disconnected or sections of the stream are dry/subsurface. Streamflow should be monitored to determine if it is limiting for salmonids and treatment options should be

investigated.

- 4) 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.

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	001	Start of survey at the confluence with Sproul Creek.
33	003	Bridge # 1 is the crossing for Barnum Timber Land road, and is 12.2' high x 15' wide x 43' long. It is an automobile bridge made of metal and wood and is not a barrier to salmonids.
120	007	The creek is out of the influence of the confluence with Sproul creek.
375	022	YOY coho salmonid present.
929	049	A dry tributary is on the right bank.
1888	072	Tributary # 1 enters on the right bank. It contributes to less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 54.5° F, the water temperature downstream of the confluence was 55.4° F, and the water temperature upstream of the confluence was 55.4° F. The slope of the tributary is 3% or greater. The tributary is not accessible to salmonids due to it being very steep, narrow, entrenched and having a small waterfall. Fish were not observed in the tributary.
2627	101	Boulder in this data refers to the chunks of concrete instream.
3364	129	Tributary # 2 enters on the right bank. It contributes to less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 55.4° F, the water temperature downstream of the confluence was 60.8°F, and the water temperature upstream of the confluence was 60.8° F. The slope of the tributary is 2-4 %. The tributary is accessible to salmonids. Fish were not observed in the tributary.
3773	143	Tributary # 3 enters on the left bank. It contributes to less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was

55.4° F, the water temperature downstream of the confluence was 61.7° F, and the water temperature upstream of the confluence was 61.7° F.

The slope of the tributary is approximately 2 %. The tributary is accessible to salmonids. Fish were observed in the tributary.

4328	162	There is erosion on the right bank, it measures 50' long x 20' high.
5172	186	A dry tributary is on the left bank.
6100	219	Tributary # 4 enters on the right bank. It contributes to less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 55.4° F, the water temperature downstream of the confluence was 55.4° F, and the water temperature upstream of the confluence was 55.4° F. The slope of the tributary is 2-3%. The tributary is accessible to salmonids until step/plunge approximately 150' up the tributary. Fish were not observed in the tributary.
6344	226	Steelhead 2+ present.
6953	244	Right bank landslide.
7137	249	Left bank landslide.
7576	268	Tributary #5 enters on the left bank. It contributes to less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 59° F, the water temperature downstream of the confluence was 59.9° F, and the water temperature upstream of the confluence was 60.8° F. The slope of the tributary is approximately 2%. The tributary is accessible to salmonids. Fish were observed in the tributary.
7971	278	Tributary #6 enters on the right bank. It contributes to less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 57.2° F, the water temperature downstream of the confluence was 61.7° F, and the water temperature upstream of the confluence was 61.7° F. The slope of the tributary is 4% or greater. The tributary is accessible to salmonids. Fish were not observed in the tributary.
9352	324	Tributary # 7 enters on the right bank. It contributes to approximately less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was not recorded due to a lack of thermometer that day, the water temperature downstream of the confluence was also not recorded, and the water temperature upstream of the confluence was not recorded. The slope of the tributary is 4% or greater. The tributary is not accessible to salmonids due to a cascade approximately 20 feet from the

mouth of the tributary. Fish were not observed in the tributary.

9449	327	Tributary # 8 enters on the right bank. It contributes to approximately 1% of Little Sproul Creek's flow. The water temperature of the tributary was not recorded because the thermometer was left at base camp, the water temperature downstream of the confluence was not recorded, and the water temperature upstream of the confluence was not recorded. The slope of the tributary is 4% or greater. The tributary is accessible to salmonids. Steelhead and coho fish were observed in the tributary.
9799	347	Log debris accumulation (LDA) # 1 is 7' high, 33.5' wide, 5' long and contains 6 pieces of large woody debris (LWD). Water flows through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 30' wide, 20' long and 6.5' deep. The sediment ranges in size from silt to boulder. Fish were observed above the LDA.
9814	348	Dry channel.
10215	368	Log debris accumulation (LDA) #2 is 7' high, 23' wide, 40' long and contains 7 pieces of large woody debris (LWD). Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 23' wide, 50' long and 5' deep. The sediment ranges in size from silt to large cobble. The LDA is a possible barrier to juvenile salmonids as it has approximately 30 feet of dry creek upstream of the LDA. Fish were observed above the LDA.
10419	378	Tributary # 9 enters on the left bank. It contributes to approximately less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 56.3° F, the water temperature downstream of the confluence was 59.9° F, and the water temperature upstream of the confluence was 60.8° F. The slope of the tributary is 4 % or greater. The tributary is not accessible to salmonids due to steep plunge at mouth. Fish were not observed in the tributary.
10873	399	Tributary #10 enters on the left bank. It contributes to approximately less than 1% of Little Sproul Creek's flow. The water temperature of the tributary was 59° F, the water temperature downstream of the confluence was 60.8° F, and the water temperature upstream of the confluence was 61.7° F. The slope of the tributary is 2-3 %. The tributary is accessible to salmonids. Fish were not observed in the tributary.
11673	435	LDA # 3 is 7.5' high, 31' wide, 60' long and contains 10 pieces of LWD. Water does not flow through the LDA and there are no visible gaps in it.

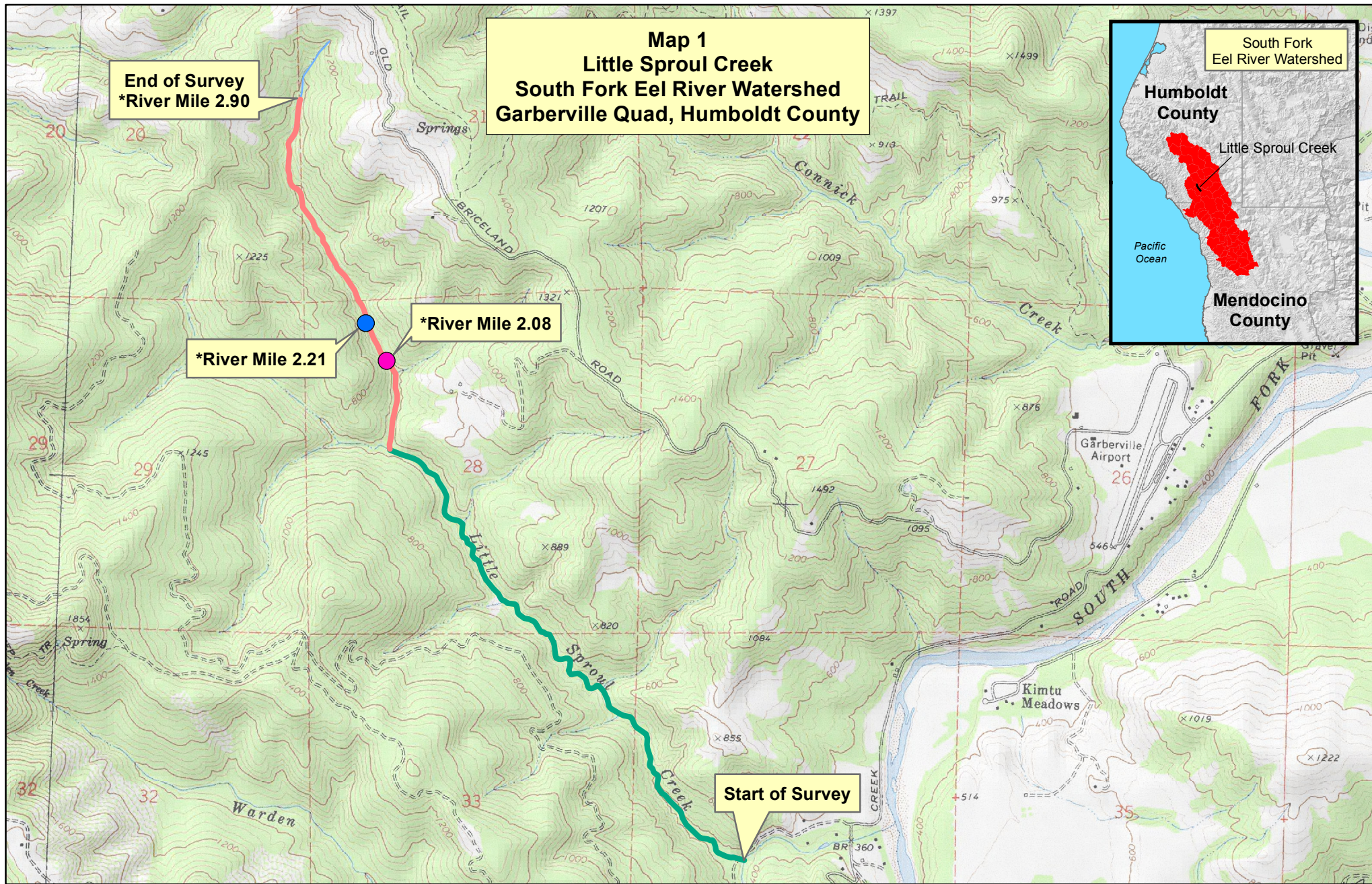
Sediment is being retained in the approximate dimensions of 50' wide, 30' long and 3' deep. The sediment ranges in size from silt to small cobble. The LDA is a possible barrier to juvenile salmonids as it has a

dry creek approximately 20 feet upstream from the LDA. Fish were not observed above the LDA.

12161	458	Tributary # 11 enters on the left bank. It contributes to approximately 5 % of Little Sproul Creek's flow. The water temperature of the tributary was 58.1° F, the water temperature downstream of the confluence was 59° F, and the water temperature upstream of the confluence was 59° F. The slope of the tributary is greater than 4 %. The tributary is accessible to salmonids. Fish were not observed in the tributary.
13367	517	Left bank landslide.
14140	565	A dry tributary is on the left bank.
15264	633	A dry tributary is on the left bank.
15502	649	There is a 2.5' plunge at the top of this unit.
15560	650	End of survey due to steep slope, long dry stretches of stream, small isolated puddles and no fish observed for 2070'. Channel is narrow, bushy and steep with a slope of 40%.

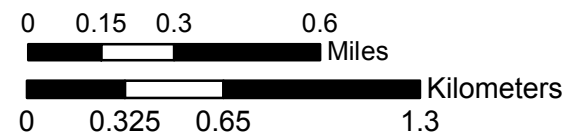
REFERENCES

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.



- Reach 1: Channel Type B3
- Reach 2: Channel Type A4
- Little Sproul Creek

- Last observed juvenile Steelhead trout
- Last observed juvenile Coho



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]	

APPENDIX I

TABLES AND GRAPHS

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

Stream Name: Little Sproul Creek

LLID: 1238348400675

Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES34

Latitude: 40:04:03.0N

Longitude: 123:50:05.0

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
24	2	DRY	3.7	22	516	3.3	5.0	0.0							40
178	14	FLATWATER	27.4	24	4344	27.9	5.4	0.4	0.7	128	22748	47	8369		16
212	210	POOL	32.6	25	5264	33.8	10.8	0.4	1.2	264	55886	234	49507	139	30
236	21	RIFFLE	36.3	23	5441	35.0	8.6	0.3	0.6	147	34587	63	14909		20
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
650	247				15565					113221			72785		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Little Sproul Creek

LLID: 1238348400675

Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES34

Latitude: 40:04:03.0N

Longitude: 123:50:05.0W

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 (%)
214	20	LGR	32.9	23	4997	32.1	9	0.3	1.6	153	32819	66	14173		21	91
18	0	HGR	2.8	23	409	2.6										94
4	1	BRS	0.6	9	35	0.2	2	0.2	0.3	11	42	2	8		0	96
122	9	RUN	18.8	20	2485	16.0	6	0.4	1	164	19954	64	7825		15	91
56	5	SRN	8.6	33	1859	11.9	3	0.3	0.8	63	3552	16	907		19	90
212	210	MCP	32.6	25	5264	33.8	11	0.4	7.8	264	55886	234	49507	139	30	94
24	2	DRY	3.7	22	516	3.3	5	0.0		0	0				40	86

Total Units
650

Total Units Fully Measured
247

Total Length (ft.)
15565

Total Area (sq.ft.)
112253

Total Volume (cu.ft.)
72420

Table 3 - Summary of Pool Types

Stream Name: Little Sproul Creek

LLID: 1238348400675

Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES34

Latitude: 40:04:03.0N

Longitude: 123:50:05.0W

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
212	210	MAIN	100	25	5264	100	10.8	0.4	264	55886	139	28383	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
212	210	5264	55886	28383

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

Stream Name: Little Sproul Creek LLID: 1238348400675 Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Confluence Location: Quad: GARBERVILLE Legal Description: T04SR03ES34 Latitude: 40:04:03.0N Longitude: 123:50:05.0W

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
212	MCP	100	85	40	105	50	18	8	3	1	1	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
212	85	40	105	50	18	8	3	1	1	0

Mean Maximum Residual Pool Depth (ft.): 1.2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Little Sproul Creek LLID: 1238348400675 Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018 Dry Units: 24

Confluence Location: Quad: GARBERVILLE Legal Description: T04SR03ES34 Latitude: 40:04:03.0N Longitude: 123:50:05.0W

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
214	20	LGR	2	32	5	3	7	4	0	46	0
18	0	HGR									
4	1	BRS	0	0	0	0	0	0	0	0	0
236	21	TOTAL RIFFLE	2	33	4	2	6	2	0	49	0
122	9	RUN	0	9	0	5	11	0	0	69	5
56	5	SRN	0	35	8	0	1	0	0	54	2
178	14	TOTAL FLAT	0	19	3	3	7	0	0	63	4
212	210	MCP	7	23	13	5	1	0	1	42	8
212	210	TOTAL POOL	7	23	13	5	1	0	1	42	8
650	247	TOTAL	7	23	12	4	2	0	1	43	8

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Little Sproul Creek

LLID: 1238348400675

Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Dry Units: 24

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES34

Latitude: 40:04:03.0N

Longitude: 123:50:05.0W

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
214	20	LGR	0	0	45	35	15	5	0
18	0	HGR	0	0	0	0	0	0	0
4	1	BRS	0	0	0	0	0	0	100
122	9	RUN	0	0	78	11	11	0	0
56	5	SRN	0	0	40	20	20	20	0
212	212	MCP	2	6	59	18	10	1	4

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Little Sproul Creek LLID: 1238348400675 Drainage: Eel River - South Fork
Survey Dates: 6/26/2018 to 7/17/2018
Confluence Location: Quad: GARBERVILLE Legal Description: T04SR03ES34 Latitude: 40:04:03.0N Longitude: 123:50:05.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
93	29	71	0	90	86

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 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Little Sproul Creek

LLID: 1238348400675

Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Confluence Location: Quad: GARBERVILLE

Legal Description: T04SR03ES34

Latitude: 40:04:03.0N

Longitude: 123:50:05.0W

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	27	37	13.0
Boulder	2	0	0.4
Cobble / Gravel	12	13	5.1
Sand / Silt / Clay	205	196	81.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	50	59	22.2
Hardwood Trees	123	114	48.2
Coniferous Trees	73	73	29.7
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 Sproul Creek

LLID: 1238348400675

Drainage: Eel River - South Fork

Survey Dates: 6/26/2018 to 7/17/2018

Confluence Location: Quad: GARBERVILLE

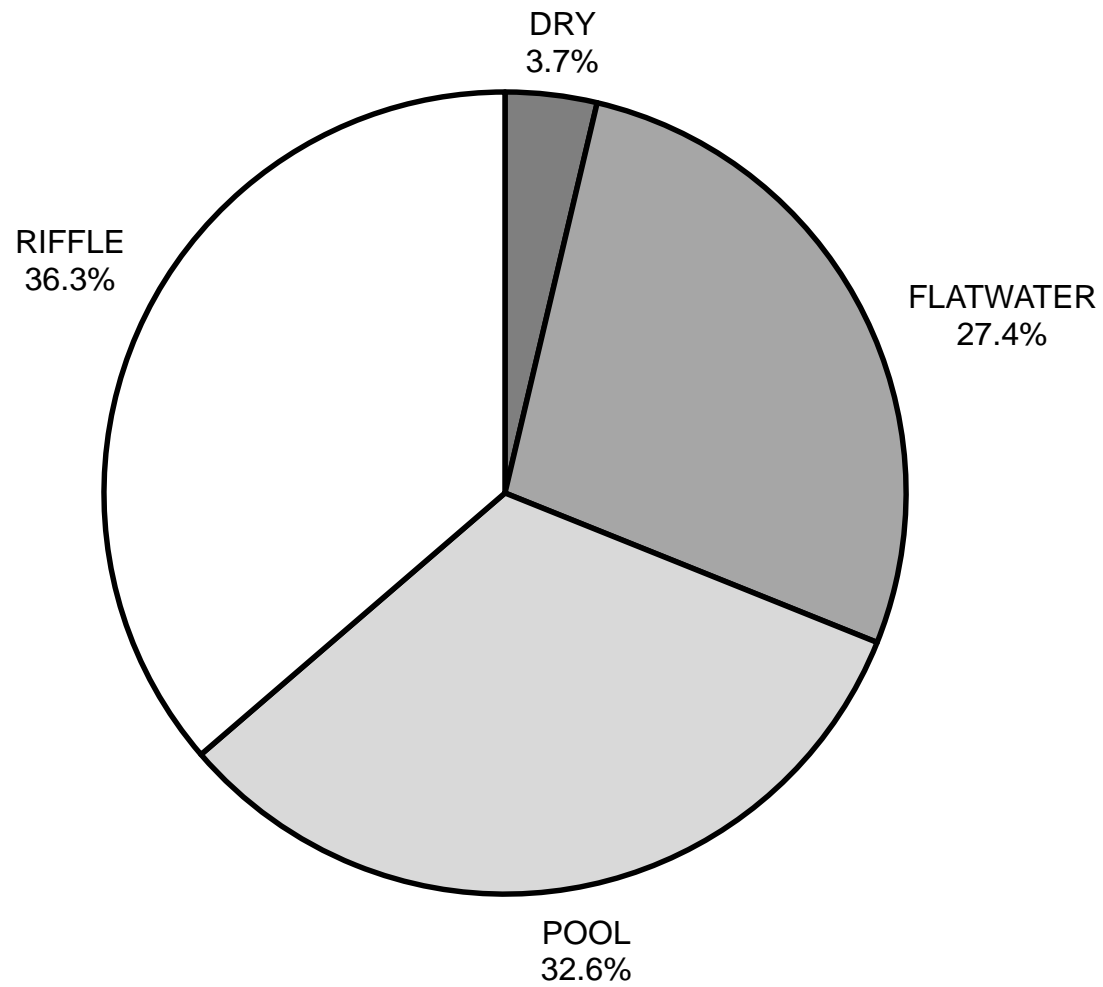
Legal Description: T04SR03ES34

Latitude: 40:04:03.0N

Longitude: 123:50:05.0W

	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	2	0	7
SMALL WOODY DEBRIS (%)	33	19	23
LARGE WOODY DEBRIS (%)	4	3	13
ROOT MASS (%)	4	3	5
TERRESTRIAL VEGETATION (%)	6	7	1
AQUATIC VEGETATION (%)	2	0	0
WHITEWATER (%)	0	0	1
BOULDERS (%)	49	63	42
BEDROCK LEDGES (%)	0	4	8

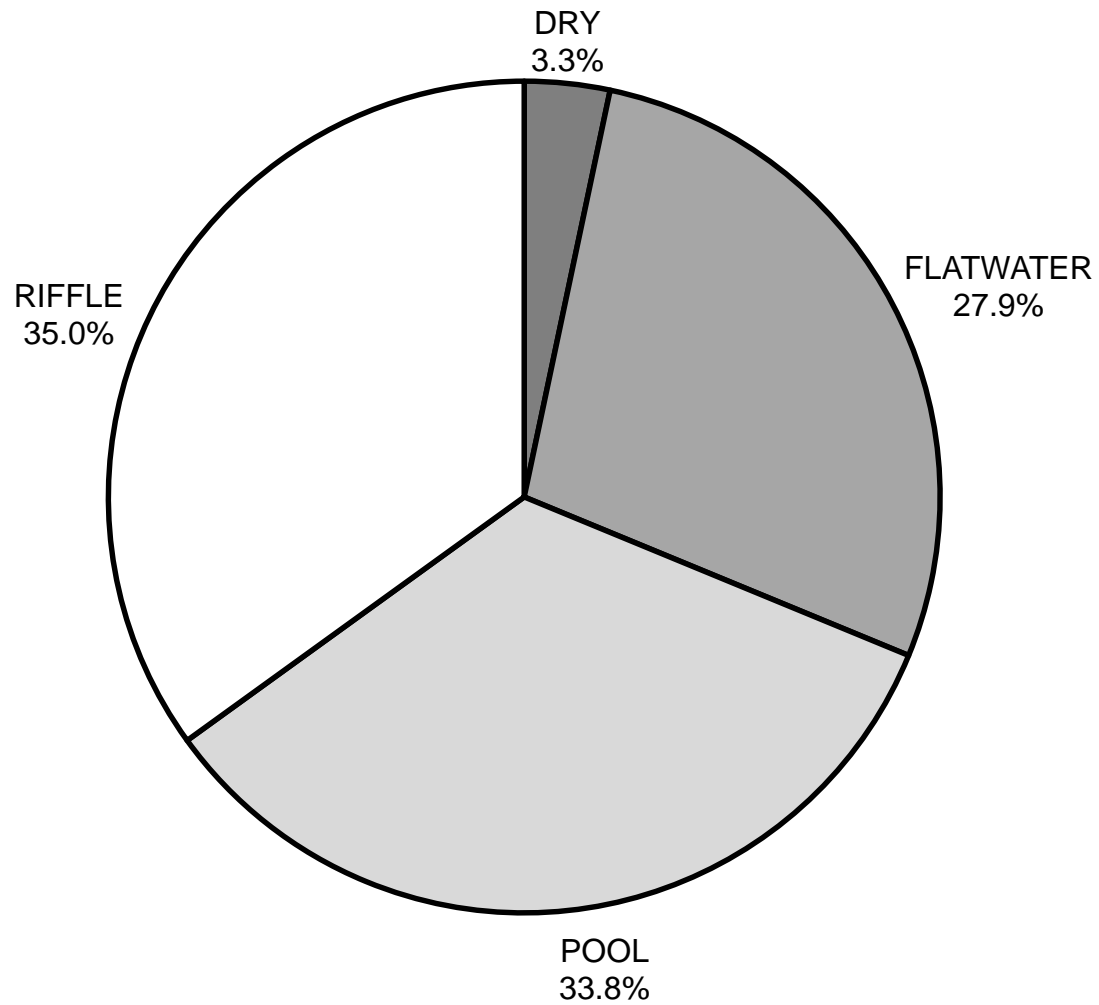
LITTLE SPROUL CREEK 2018 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

LITTLE SPROUL CREEK 2018

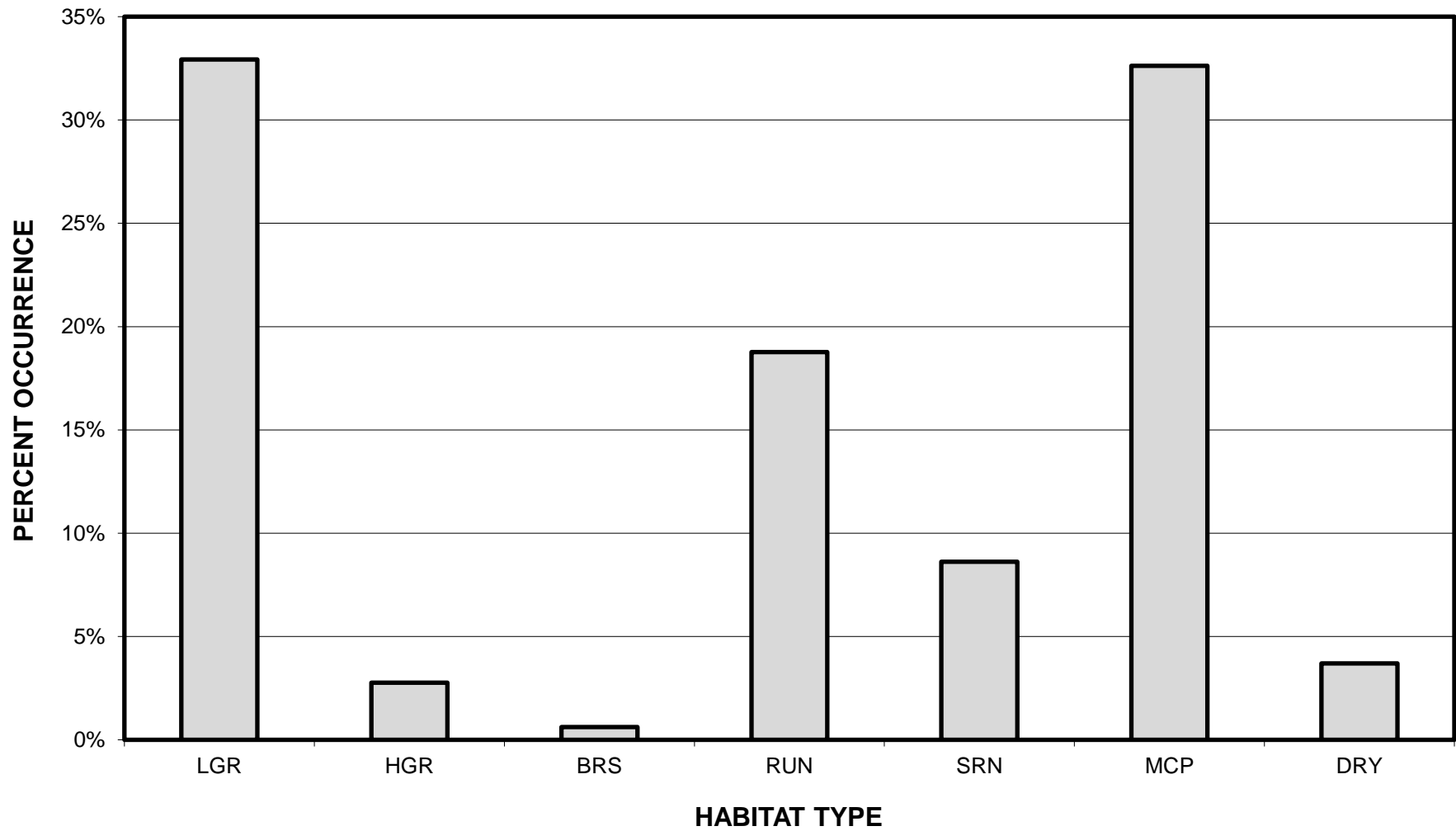
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

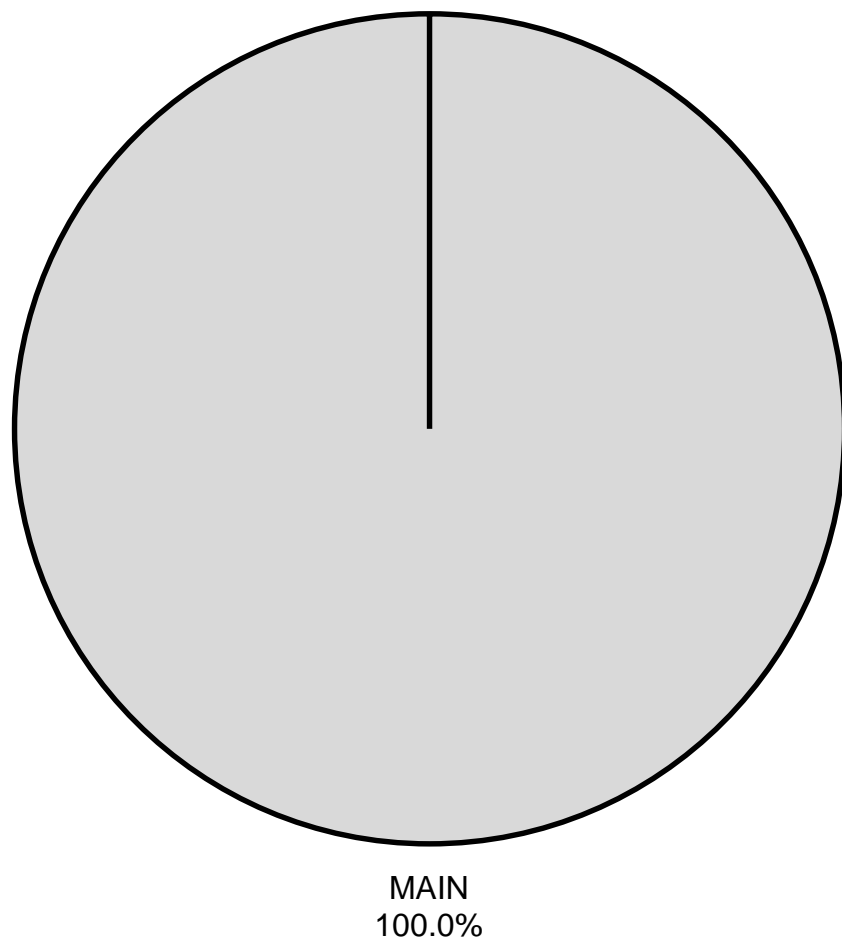
LITTLE SPROUL CREEK 2018

HABITAT TYPES BY PERCENT OCCURRENCE



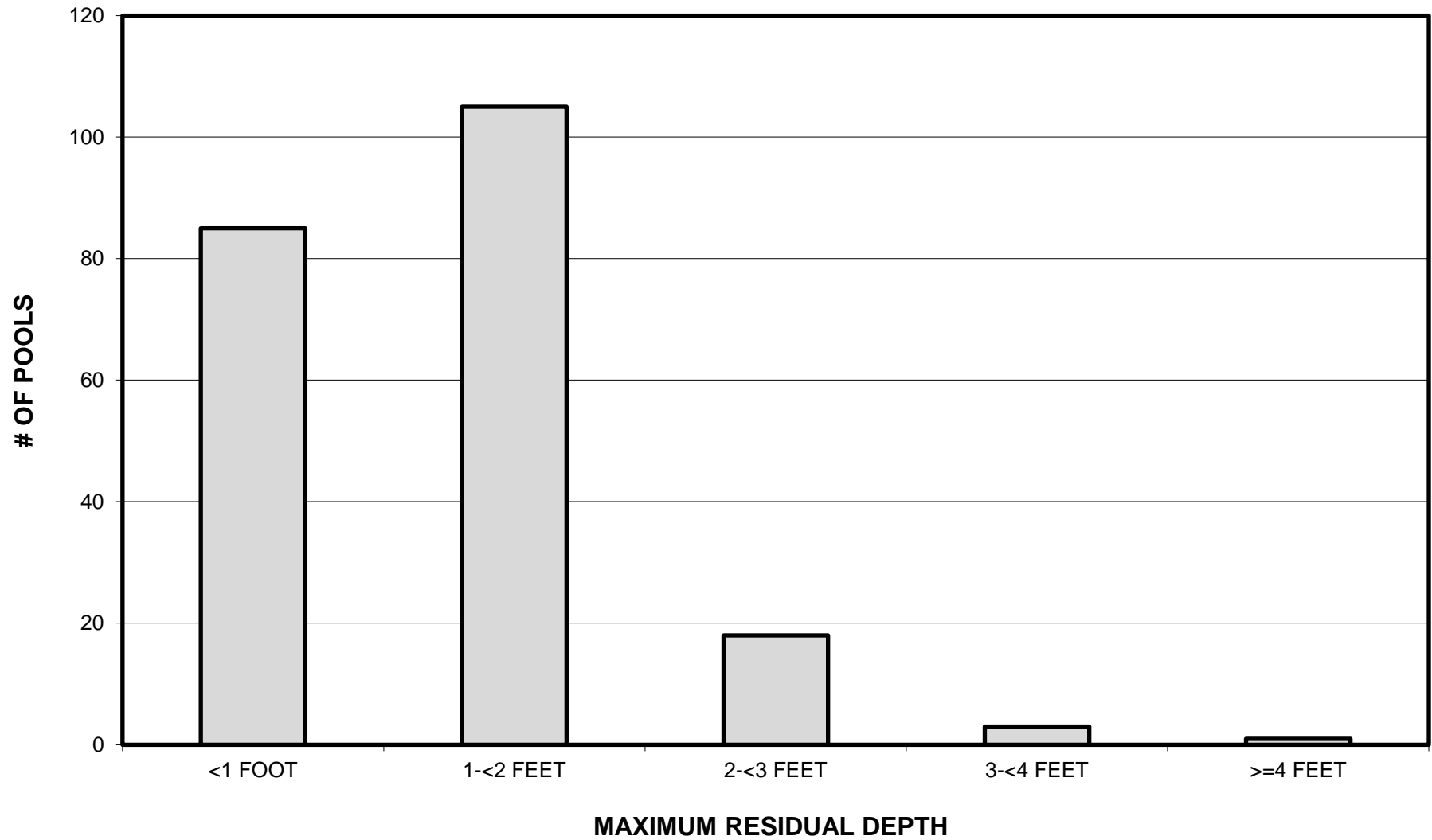
GRAPH 3

**LITTLE SPROUL CREEK 2018
POOL TYPES BY PERCENT OCCURRENCE**



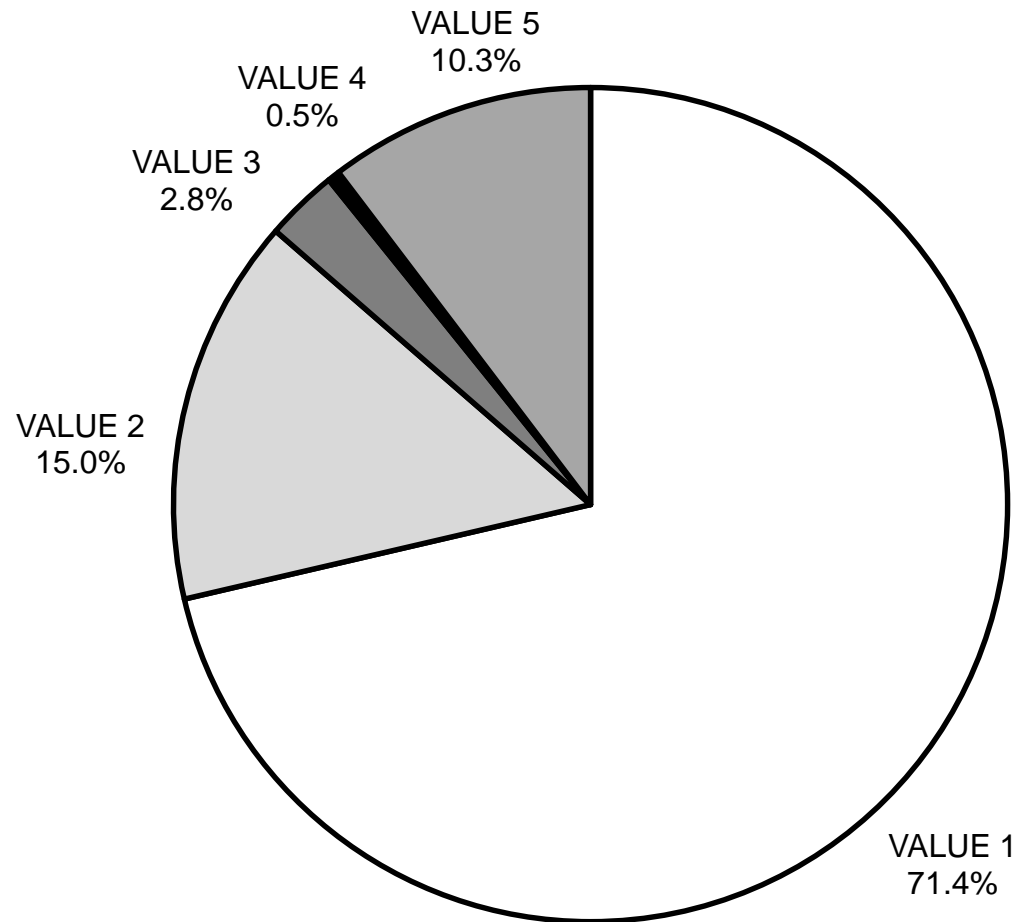
GRAPH 4

LITTLE SPROUL CREEK 2018 MAXIMUM DEPTH IN POOLS



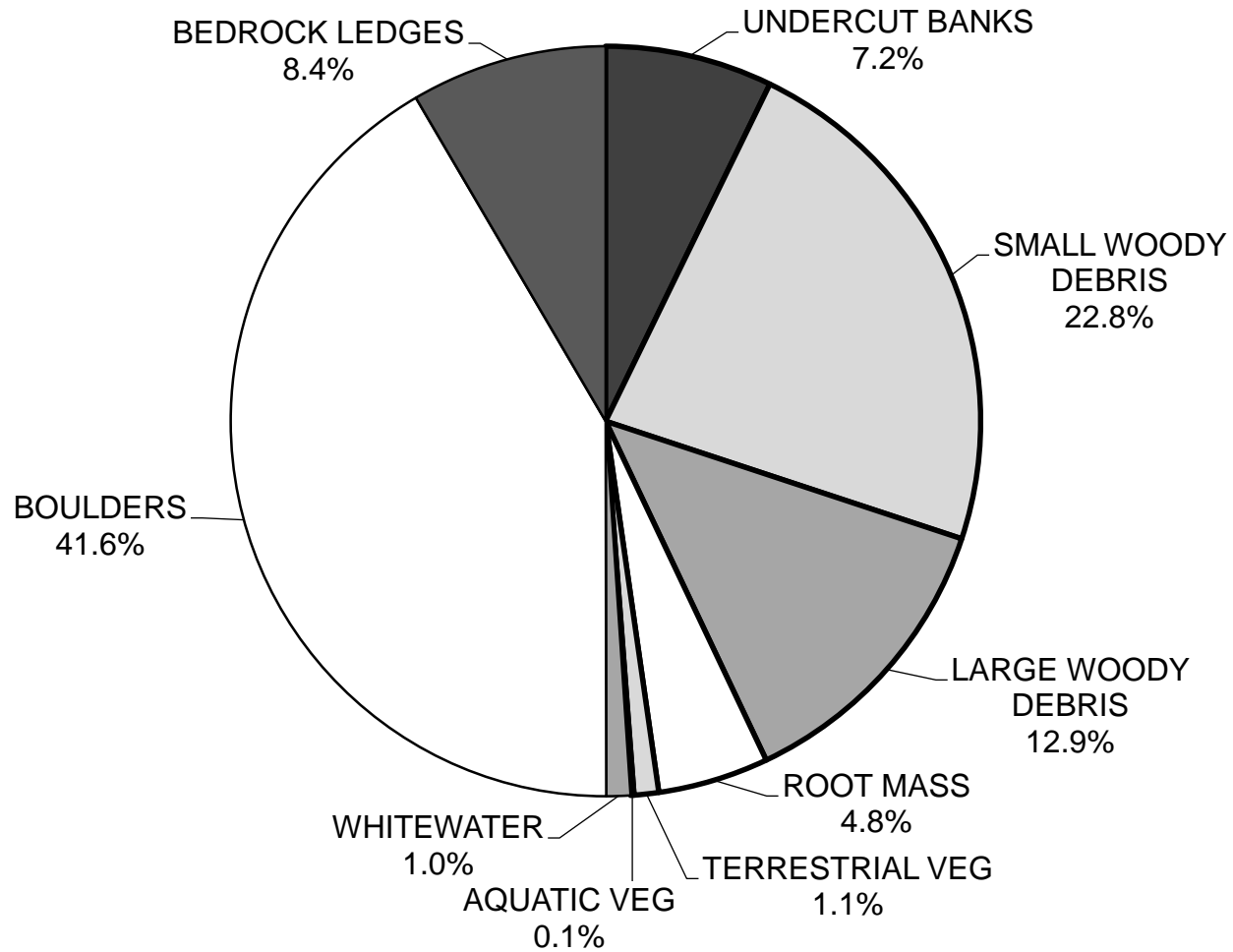
GRAPH 5

LITTLE SPROUL CREEK 2018 PERCENT EMBEDDEDNESS



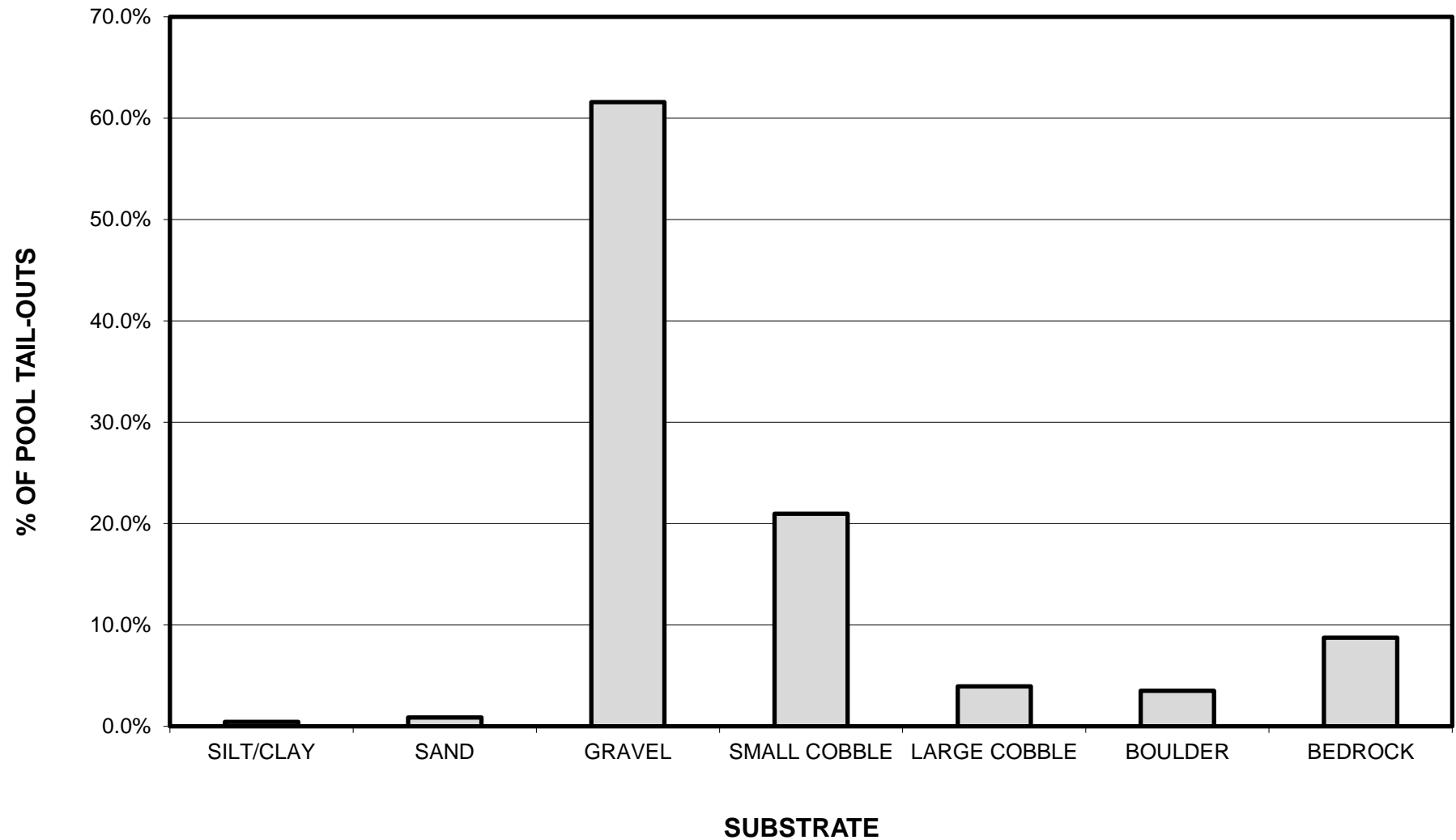
GRAPH 6

LITTLE SPROUL CREEK 2018 MEAN PERCENT COVER TYPES IN POOLS



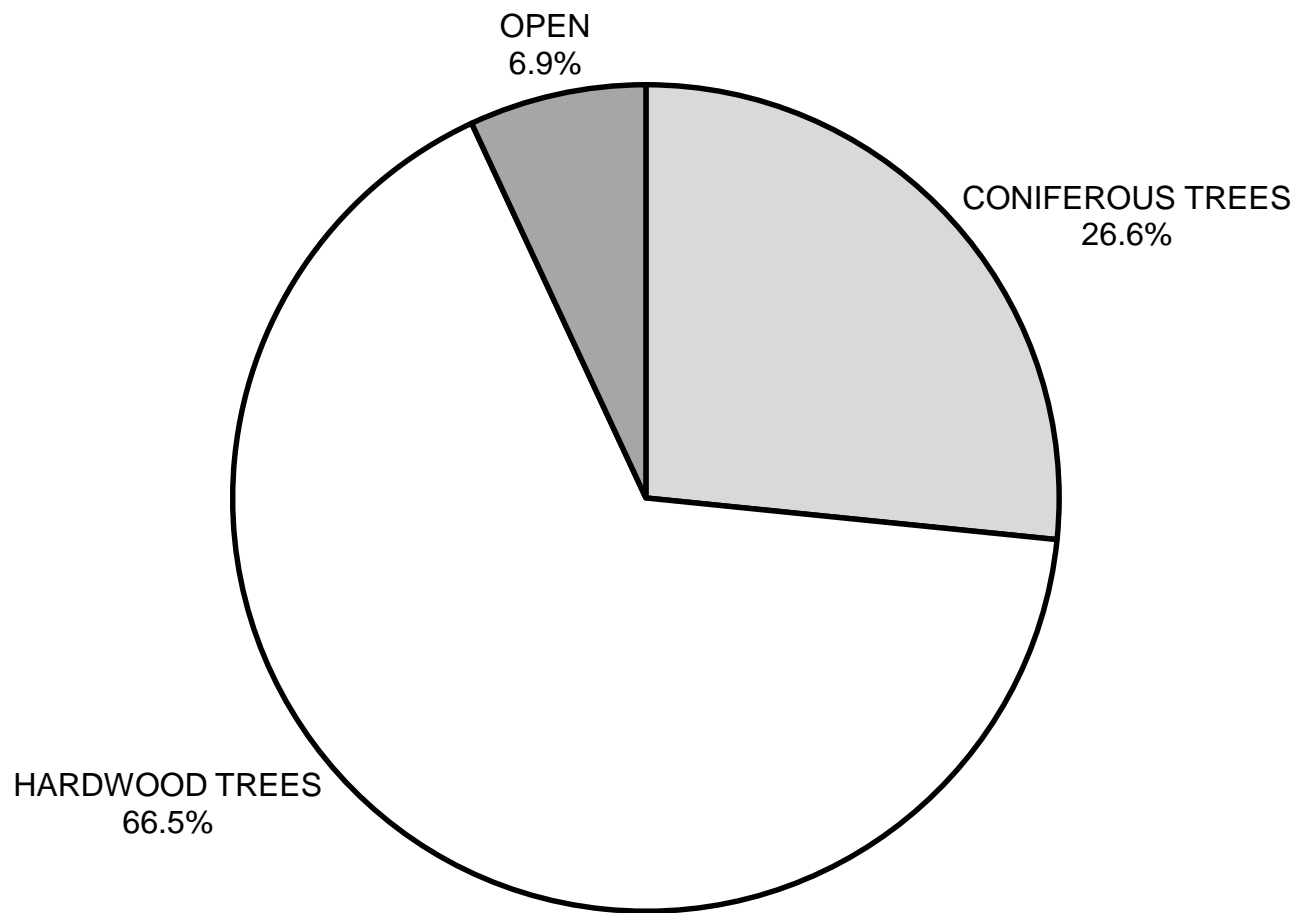
GRAPH 7

LITTLE SPROUL CREEK 2018 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



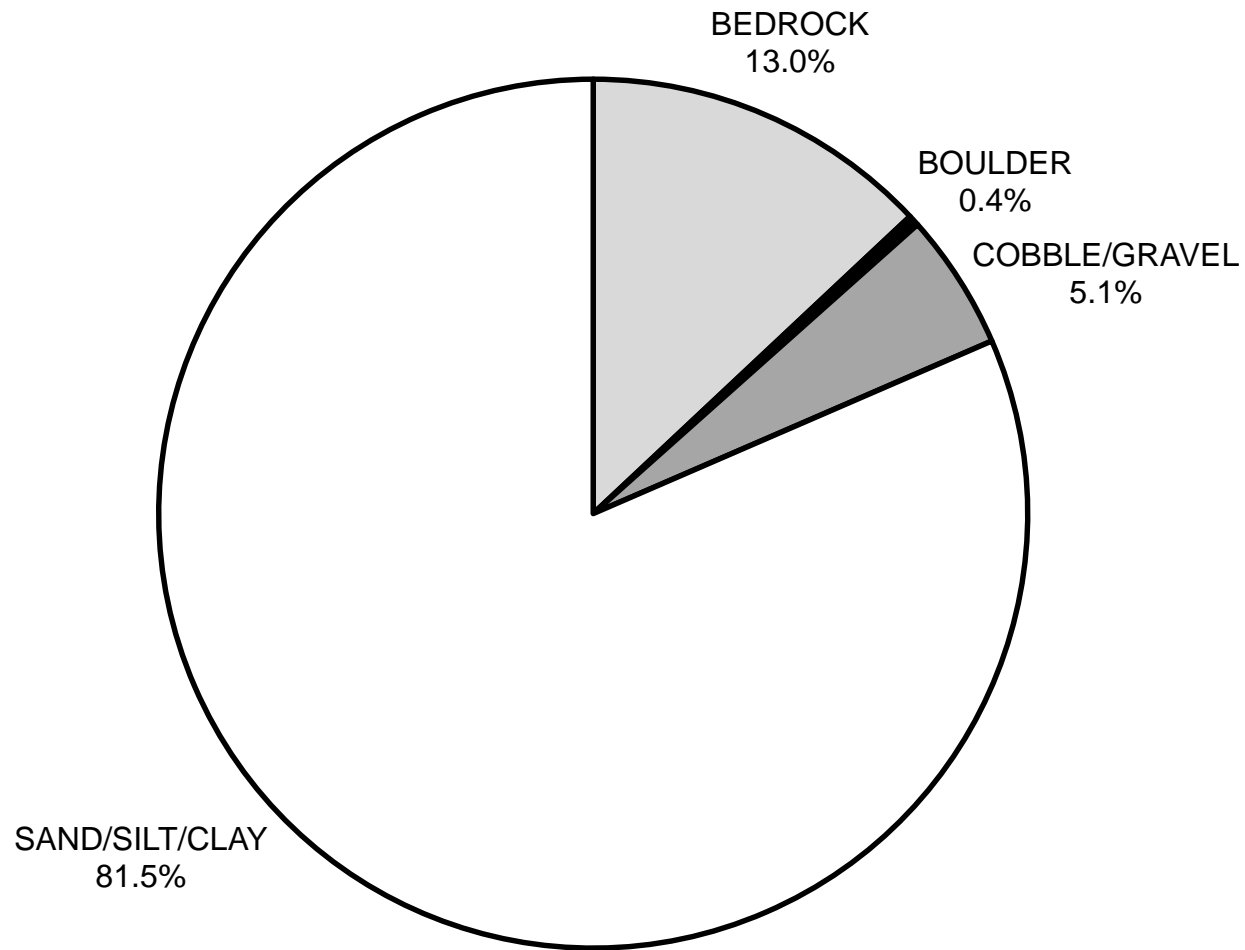
GRAPH 8

LITTLE SPROUL CREEK 2018 MEAN PERCENT CANOPY



GRAPH 9

**LITTLE SPROUL CREEK 2018
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

LITTLE SPROUL CREEK 2018 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

APPENDIX II

STREAM INVENTORY PHOTOS



Photo 1: Tributary #2 at HU#129, 3,364 feet upstream from start of survey (Photo taken 6/27/18).



Photo 2: Typical channel in reach 1 at HU#130, 3,421 feet upstream from the start of survey (Photo taken 6/27/18).



Photo 3: LDA #1 at HU#347, 9,799 feet upstream from start of survey (Photo taken 7/11/18).



Photo 4: End of survey at HU#650, 15,522 feet upstream from start of survey (Photo taken 7/17/18).