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DEPARTMENT OF FISH AND WILDLIFE
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CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Somerville Creek

INTRODUCTION

A stream inventory was conducted from August 7 to August 22, 2017 on Somerville Creek. The survey began at the confluence with Redwood Creek and extended upstream 2.8 miles.

The Somerville 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 Somerville 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 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. Report was finalized in April, 2018

WATERSHED OVERVIEW

Somerville Creek is a tributary to Redwood Creek, which is a tributary to the South Fork Eel River, which is a tributary to the Eel River, which is a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Somerville Creek's legal description at the confluence with Redwood Creek is T04S R03E S18. Its location is 40.1081° north latitude and -123.8968° west longitude, LLID number 1238956401082. Somerville Creek is a second order stream and has approximately 2.2 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Somerville Creek drains a watershed of approximately 3.0 square miles. Elevations range from about 560 feet at the mouth of the creek to 1,600 feet in the headwater areas. Grassland, oak woodland, and Douglas fir forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists from State Highway 101 to Redway via Redwood Drive, then west on Briceland Road, to the town Briceland, where Somerville joins Redwood Creek.

METHODS

The habitat inventory conducted in Somerville Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The AmeriCorps Watershed Stewards Project (WSP) members and California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by 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 (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 Somerville 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 (º) 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". Somerville 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 Somerville 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 Somerville 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 Somerville 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 Somerville 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 Somerville Creek. In addition, underwater mask and snorkel observations were made at 11 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 Somerville Creek include the following:

- 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 August 7 to August 22, 2017 was conducted by Chris Tevini (CCC), Angela Cruz and Rachel Karlov (WSP), Joshua Gruver and Ryan Bernstein (CDFW). The total length of the stream surveyed was 15,011 feet.

A stream flow measurement of 0.35 cfs was recorded on August 16, 2017 near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter.

Somerville Creek is a B3 channel type for 13,748 feet of the stream surveyed (Reach 1), and a B2 channel type for 1,263 feet of the stream surveyed (Reach 2). B3 channels are moderately entrenched, moderate gradient, riffle dominated with infrequently spaced pools, and have very stable plan and profile, stable banks and cobble-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated with infrequently spaced pools, and have very stable plan and profile, stable banks, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 56° to 73° Fahrenheit. Air temperatures ranged from 58° to 92° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 34% flatwater units, 33% pool units, 32% riffle units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 54% flatwater units, 21% pool units, 18% riffle units, 3% dry units, and 3% no survey units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units (33%), low gradient riffle units (31%), run units (17%), and step run units (17%) (Graph 3). Based on percent total length, step run units made up 39%, mid-channel pool units 21%, and low gradient riffle units 18%.

A total of 115 pools were identified (Table 3). Main channel pools were the only pool type 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. Nineteen of the 115 pools (17%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 116 pool tail-outs measured, 71 had a value of 1 (61.2%), 33 had a value of 2 (28.4%), 7 had a value of 3 (6%), and 5 had a value of 5 (4.3%) (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 2, flatwater habitat types had a mean shelter rating of 7, and pool habitats had a mean shelter rating of 27 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 27 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks is the dominant cover type in Somerville Creek. Graph 7 describes the pool cover in Somerville Creek. Undercut banks 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 and small cobble were the dominant substrate type, observed in 43% of pool tail-outs.

The mean percent canopy density for the surveyed length of Somerville Creek was 88%. Twelve percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 93% and 7%, respectively. Graph 9 escribes the mean percent canopy in Somerville Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 53% sand/silt/clay, 43% cobble/gravel, and 4% bedrock (Graph 10). Hardwood trees were the dominant vegetation type observed in 70% of the units surveyed. Additionally, 28% of the units surveyed had brush as the dominant vegetation type, and 2% had coniferous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a mask and snorkel survey at 12 sites for species composition and distribution in Somerville Creek on August 23, 2017 (Table A). The sites were sampled by Ryan Bernstein (CDFW) and Chris Tevini (CCC).

In Reach 1, which comprised the first 13,748 feet of stream, 11 sites were sampled. The reach sites yielded 140 young-of-the-year (YOY) steelhead trout (SH), 10 age 1+ SH, and 21 Sacramento pikeminnow (SPM).

In Reach 2, 1 site was sampled, approximately 14,400 feet from the confluence with Redwood Creek. The reach sites yielded 2 young-of-the-year (YOY) steelhead trout (SH).

During the survey, the upstream-most observation of juvenile steelhead trout occurred at 40.0815° north latitude, -123.8913° west longitude, approximately 14,400 feet upstream from the confluence with Redwood Creek (Map 1). No coho salmon were observed during the

biological inventory or during habitat inventory.

Table A. Summary of results for a fish composition and distribution survey within Somerville Creek, August 23, 2017.

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 1: B3 Channel Type										
08/23/17	1	010	Pool	329	12	2	0	0	0	
	2	014	Pool	843	19	4	0	0	0	
	3	016	Pool	529	6	2	0	0	0	SPM
	4	018	Pool	624	0	0	0	0	0	
	5	020	Pool	760	17	0	0	0	0	
	6	022	Pool	832	3	1	0	0	0	
	7	025	Pool	889	7	0	0	0	0	
	8	027	Pool	995	19	0	0	0	0	
	9	032	Pool	1,062	3	0	0	0	0	SPM
	10	041	Pool	1,893	3	0	0	0	0	SPM
	11	102	Pool	4,506	51	1	0	0	0	
Reach 2: B2 Channel Type										
08/23/17	11	349	Pool	14,400	2	0	0	0	0	

Species abbreviations: SPM = Sacramento pikeminnow

DISCUSSION

Somerville Creek is a B3 channel type for the first 13,748 feet of stream surveyed, and a B2 channel type for the remaining 1,263 feet. The suitability of B3 and B2 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. B2 channels excellent for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days August 7 to August 22, 2017 ranged from 56° to 73° Fahrenheit. Air temperatures ranged from 58° to 92° Fahrenheit. On the high end (≥ 66° F), these water temperatures are considered unsuitable for salmonids. However, 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 54% of the total length of this survey, riffles 18%, and pools 21%. 19 of the 115 (17%) 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.

One hundred four of the 116 pool tail-outs measured had embeddedness ratings of 1 or 2. Seven of the pool tail-outs had embeddedness ratings of 3 or 4. Five 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 of the 116 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Sixteen of the 116 pool tail-outs had silt, sand, large cobble, boulders or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools is 27. The shelter rating in the flatwater habitats is 7. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Undercut Banks in Somerville Creek. Undercut Banks are the dominant cover type in pools followed by small woody debris. Log and rootwad 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 88%. Reach 1 had a canopy density of 87.9%, and reach 2 had a canopy density of 100%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 100% and 100%, 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

Somerville 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 Somerville 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 undercut banks. Adding high quality complexity with woody cover in the pools is desirable.

2) Based on observed conditions (upper portion of Somerville Creek was dry) pools may become disconnected. Streamflow should be monitored to determine if it is limiting for salmonids.

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 above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July through September temperature extreme period should be performed for 3 to 5 years.

6) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

7) While overall canopy density is 88% on Somerville Creek, this canopy density is composed predominantly of hardwood tree species (93%). In order to provide more structure to the canopy, reduce water temperatures, and increase LWD recruitment consider planting appropriate native coniferous species like redwood and Douglas fir along the riparian corridor. Also where site conditions are appropriate consider cautious thinning of hardwoods to hasten the development of denser and more extensive coniferous canopy component. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with Redwood Creek.
93	0004.00	The creek is out of the influence of the confluence with Redwood Creek. The channel type is a B3.
329	0011.00	Culvert #1 is a passage under Old Briceland Road, and is 6.2' high x 8' wide x 42' long. It is composed of 1 culvert, and is made of concrete. The culvert's diameter is 8', its plunge height is 0.6', and it has a maximum depth of 0.05' within 5' of the outlet. Its condition is good. It is not a possible barrier to juvenile and adult salmonids.

3047	0075.00	Young of the Year (YOY) steelhead (SH) observed and were seen consistently throughout the survey.
4314	0104.00	Tributary #1 enters on the right bank. The water temperature of the tributary was 72° Fahrenheit, the water temperature downstream of the confluence was 68° Fahrenheit, and the water temperature upstream of the confluence was 69° Fahrenheit. The slope of the tributary is approximately 1%. The tributary is accessible to salmonids. Fish were not observed in the tributary.
5966	0150.00	Tributary #2 enters on the Right bank. The water temperature of the tributary was 63° Fahrenheit, the water temperature downstream of the confluence was 62° Fahrenheit, and the water temperature upstream of the confluence was 62° Fahrenheit. The slope of the tributary is approximately 1%. The tributary is accessible to salmonids. Fish were not observed in the tributary.
8432	0214.00	There is a dry tributary on the left bank.
9082	0229.00	Log debris accumulation (LDA) #1 is 4' high x 23' wide x 12' long and contains 4 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 12' wide x 6' long x 1' deep. The sediment ranges in size from silt to gravel. The LDA is not a possible barrier to salmonids. Fish were observed above the LDA.
9517	0241.00	LDA #2 is 5' high, 14' wide, 12' long and contains 1 piece of LWD. Water flows through the LDA and there are visible gaps in it. Sediment is being retained in the approximate dimensions of 7' wide, 14' long and 1' deep. The sediment ranges in size from silt to sand. The LDA is not a possible barrier to salmonids. Fish were observed above the LDA.
10397	0255.00	There is a landslide on the right and left banks that has deposited lots of trees and debris into the channel.
10805	0260.00	There is a landslide on the right and left bank that has deposited debris and trees into the channel.
13593	0330.00	There is a dry tributary on the right bank.
13748	0336.00	Channel type is a B2. Cross-section location at HU #338.
14543	0349.00	YOY observed until the last pool of the survey.

14554	0350.00	End of survey due to 457' of dry channel. The channel is steep and boulder dominated. The last YOY was observed at HU #349, which was a pool located right before the creek ran dry.

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.

REPORT CONTACT INFORMATION

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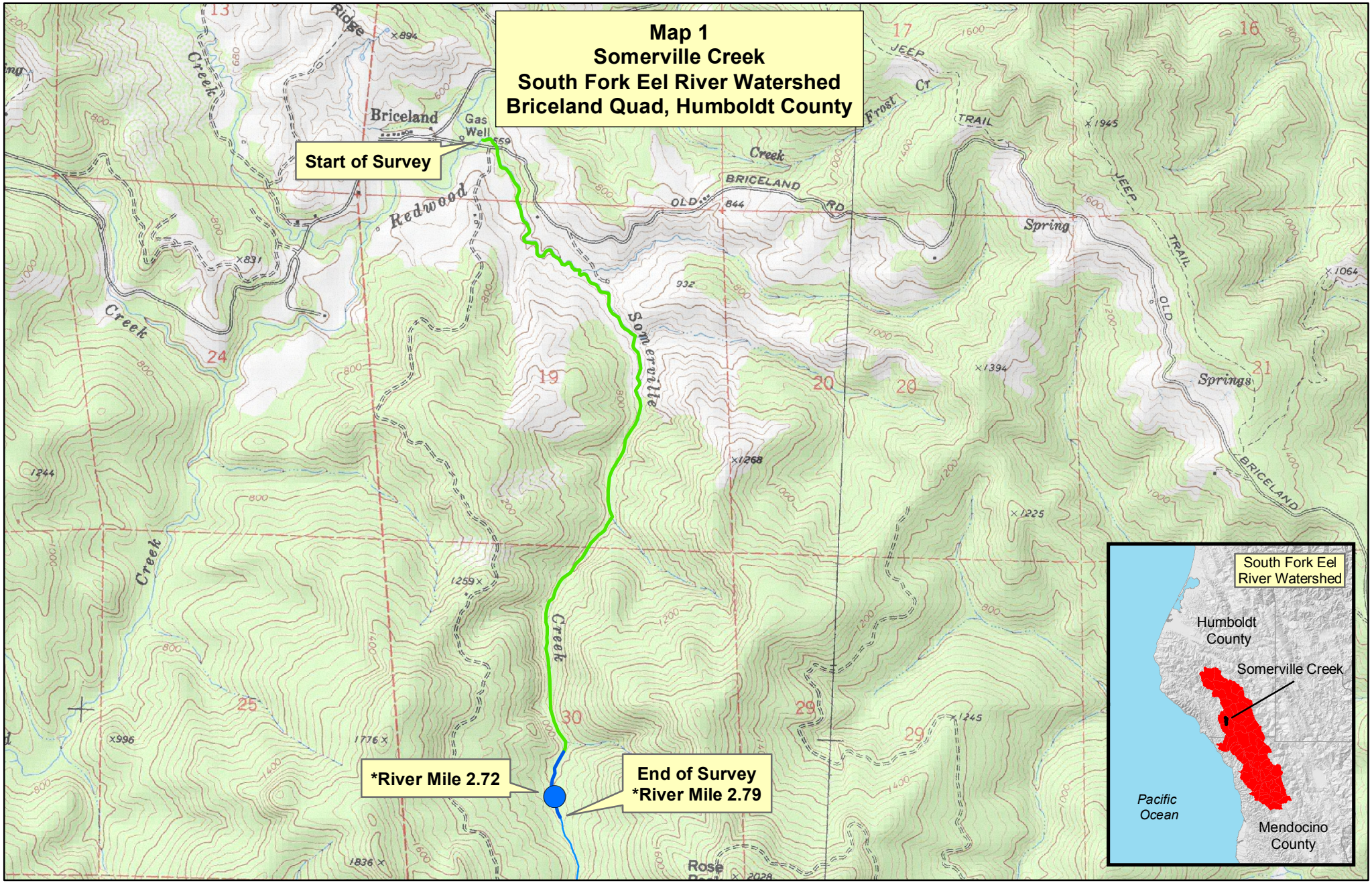
LEVEL III and LEVEL IV HABITAT TYPES

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 - Rootwad 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 - Rootwad 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]	



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Reach 1: B3 Channel Type

Reach 2: B2 Channel Type

Somerville Creek

Last observed juvenile steelhead trout

0 0.15 0.3 0.6 Miles

0 0.3 0.6 1.2 Kilometers

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

Coordinate System: NAD 1983 California Teale Albers
Data Sources: CDFW, USGS, CalWater 2.21, CDF 24k

*River Mile indicates distance from confluence with Redwood Creek

APPENDIX I

TABLES AND GRAPHS

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

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
1	1	CULVERT	0.3	42	42	0.3	8.0	0.1	0.1	134	134	7	7		0
1	0	DRY	0.3	457	457	3.0									
119	9	FLATWATER	34.0	68	8114	54.1	6.7	0.4	0.7	384	45676	127	15167		7
2	0	NOSURVEY	0.6	250	500	3.3									
115	115	POOL	32.9	27	3148	21.0	9.3	0.6	1.4	259	29812	248	28258	182	27
112	10	RIFFLE	32.0	25	2750	18.3	8.2	0.3	0.6	253	28326	68	7594		2

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
350	135	15011	103949	51025

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
108	9	LGR	30.9	24	2635	17.6	8	0.3	0.7	259	27973	69	7423		2	83
4	1	HGR	1.1	29	115	0.8	11	0.3	0.5	198	792	59	238		0	95
60	6	RUN	17.1	37	2227	14.8	6	0.5	0.9	192	11505	82	4931		7	85
59	3	SRN	16.9	100	5887	39.2	7	0.3	0.8	768	45312	218	12862		7	100
115	115	MCP	32.9	27	3148	21.0	9	0.6	2.8	259	29812	248	28258	182	27	89
1	0	DRY	0.3	457	457	3.0										
1	1	CUL	0.3	42	42	0.3	8	0.1	0.05	134	134	7	7		0	0
2	0	NS	0.6	250	500	3.3										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
350	135	15011	115529	53718

Table 3 - Summary of Pool Types

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
115	115	MAIN	100	27	3148	100	9.3	0.6	259	29812	182	20723	27

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
115	115	3148	29812	20723

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

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
115	MCP	100	27	23	69	60	19	17	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
115	27	23	69	60	19	17	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.4

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Somerville Creek LLID: 1238956401082 Drainage:South Fork Eel River

Survey Dates: 8//7/2017 to 8/22/2017 Dry Units: 1

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
108	9	LGR	0	0	0	0	0	0	0	100	0
4	1	HGR	0	0	0	0	0	0	0	0	0
112	10	TOTAL RIFFLE	0	0	0	0	0	0	0	100	0
60	6	RUN	66	0	0	0	0	0	0	34	0
59	3	SRN	100	0	0	0	0	0	0	0	0
119	9	TOTAL FLAT	75	0	0	0	0	0	0	25	0
115	115	MCP	31	30	2	1	1	0	0	27	7
115	115	TOTAL POOL	31	30	2	1	1	0	0	27	7
1	1	CUL	0	0	0	0	0	0	0	0	0
2	0	NS	0	0	0	0	0	0	0	0	0
350	135	TOTAL	33	30	1	0	0	0	0	29	7

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017 Dry Units: 1

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
108	9	LGR	0	0	11	11	56	22	0
4	1	HGR	0	0	0	0	100	0	0
60	7	RUN	0	14	14	57	14	0	0
59	3	SRN	0	0	33	67	0	0	0
115	115	MCP	0	0	28	24	24	21	3

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
88	7	93	9	100	100

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: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017 Survey Length (ft.): 15011 Main Channel (ft.): 15011 Side Channel (ft.): 0

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B3
Reach Length (ft.): 13748
Riffle/Flatwater Mean Width (ft.): 7.3
BFW:
Range (ft.): 9 to 31
Mean (ft.): 18
Std. Dev.: 5
Base Flow (cfs.): 0.4
Water (F): 56 - 73 Air (F): 58 - 92
Dry Channel (ft): 0

Canopy Density (%): 87.9
Coniferous Component (%): 5.2
Hardwood Component (%): 94.8
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 100.0
Dominant Shelter: Undercut Banks
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 1
LWD per 100 ft.:
Riffles: 0
Pools: 2
Flat: 1

Pools by Stream Length (%): 22.2
Pool Frequency (%): 32.8
Residual Pool Depth (%):
< 2 Feet Deep: 84
2 to 2.9 Feet Deep: 16
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.4
Mean Pool Shelter Rating: 27

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 1 Gravel: 43 Sm Cobble: 42 Lg Cobble: 6 Boulder: 6 Bedrock: 1

Embeddedness Values (%): 1. 62.2 2. 28.8 3. 4.5 4. 0.0 5. 4.5

STREAM REACH: 2

Channel Type: B3
Reach Length (ft.): 1263
Riffle/Flatwater Mean Width (ft.): 11.0
BFW:
Range (ft.): 14 to 17
Mean (ft.): 16
Std. Dev.: 1
Base Flow (cfs.): 0.4
Water (F): 57 - 58 Air (F): 64 - 66
Dry Channel (ft): 457

Canopy Density (%): 100.0
Coniferous Component (%): 38.3
Hardwood Component (%): 61.7
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 100.0
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0
LWD per 100 ft.:
Riffles: 1
Pools: 0
Flat: 2

Pools by Stream Length (%): 7.2
Pool Frequency (%): 33.3
Residual Pool Depth (%):
< 2 Feet Deep: 80
2 to 2.9 Feet Deep: 20
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.2
Mean Pool Shelter Rating: 23

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 40 Sm Cobble: 60 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 40.0 2. 20.0 3. 40.0 4. 0.0 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Somerville Creek LLID: 1238956401082 Drainage: Eel River - South Fork

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	8	2	3.7
Boulder	0	0	0.0
Cobble / Gravel	56	61	43.0
Sand / Silt / Clay	72	73	53.3

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	38	37	27.6
Hardwood Trees	93	96	69.5
Coniferous Trees	5	3	2.9
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

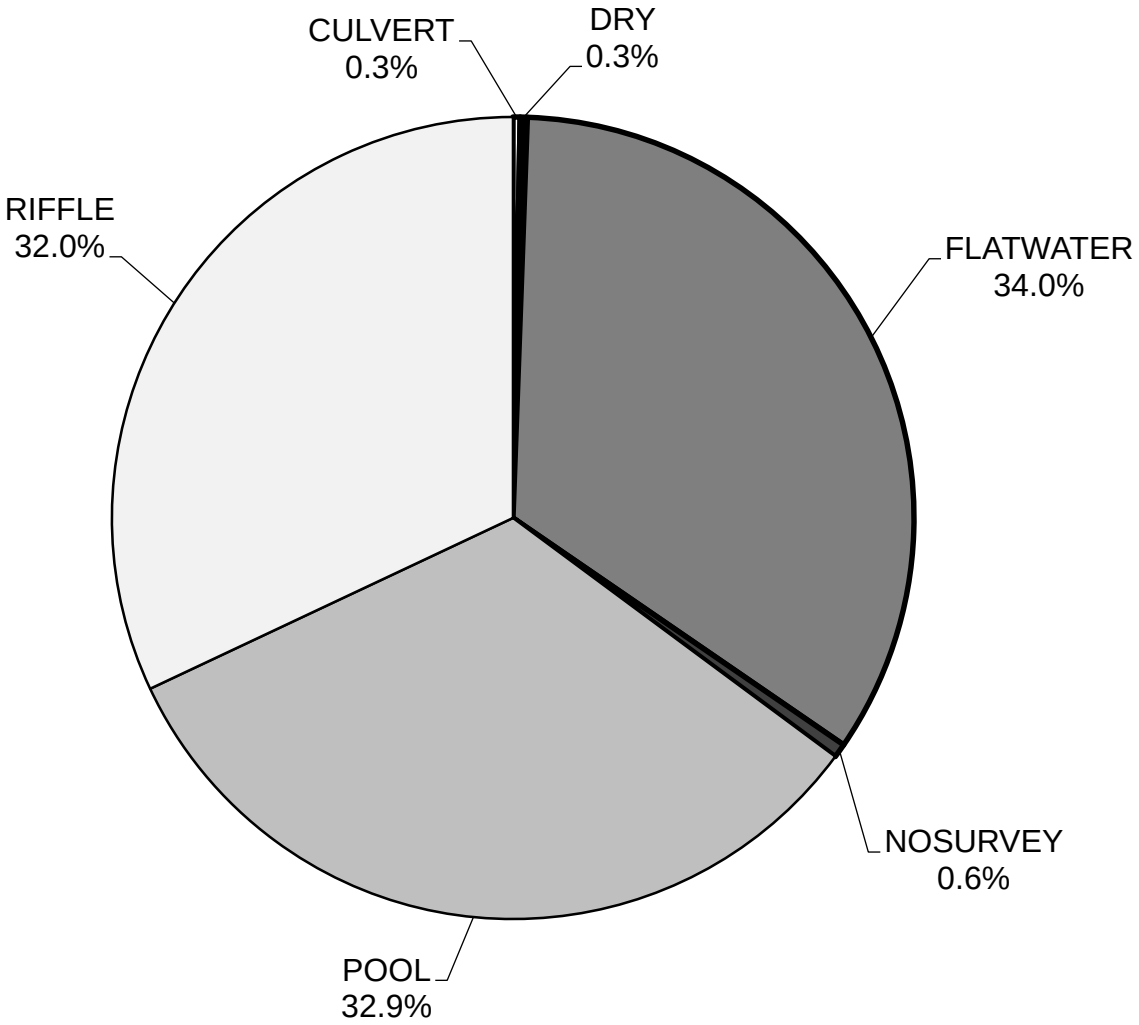
StreamName: Somerville Creek LLID: 1238956401082 Drainage: South Fork Eel River

Survey Dates: 8/7/2017 to 8/22/2017

Confluence Location: Quad: BRICELAND Legal Description: T04SR03ES18 Latitude: 40:06:30.0N Longitude: 123:53:44.0W

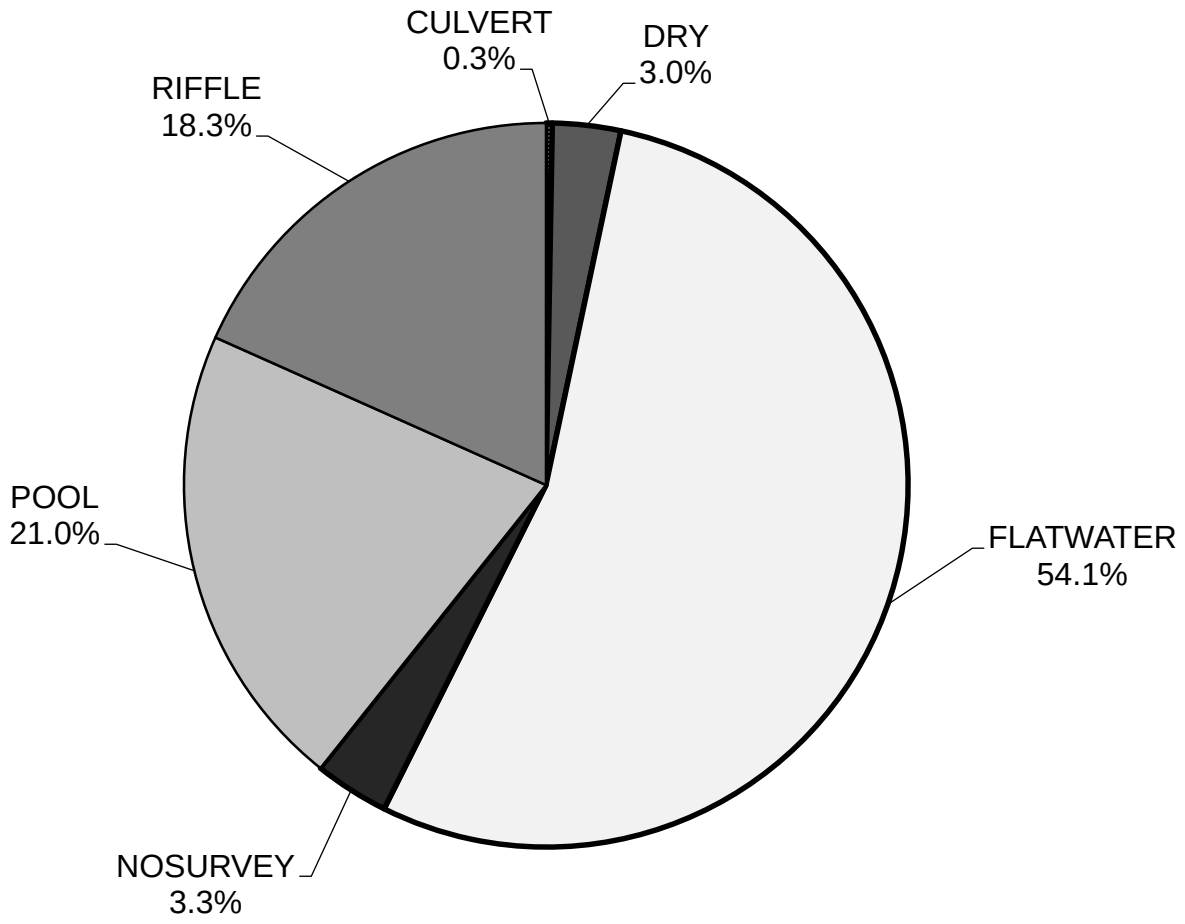
	Riffles	Flatwater	Pools
UNDERCUT BANKS(%)	0	75	31
SMALL WOODY DEBRIS (%)	0	0	30
LARGE WOODY DEBRIS (%)	0	0	2
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	0	0	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	100	25	27
BEDROCK LEDGES (%)	0	0	7

SOMERVILLE CREEK 2017
HABITAT TYPES BY PERCENT OCCURRENCE



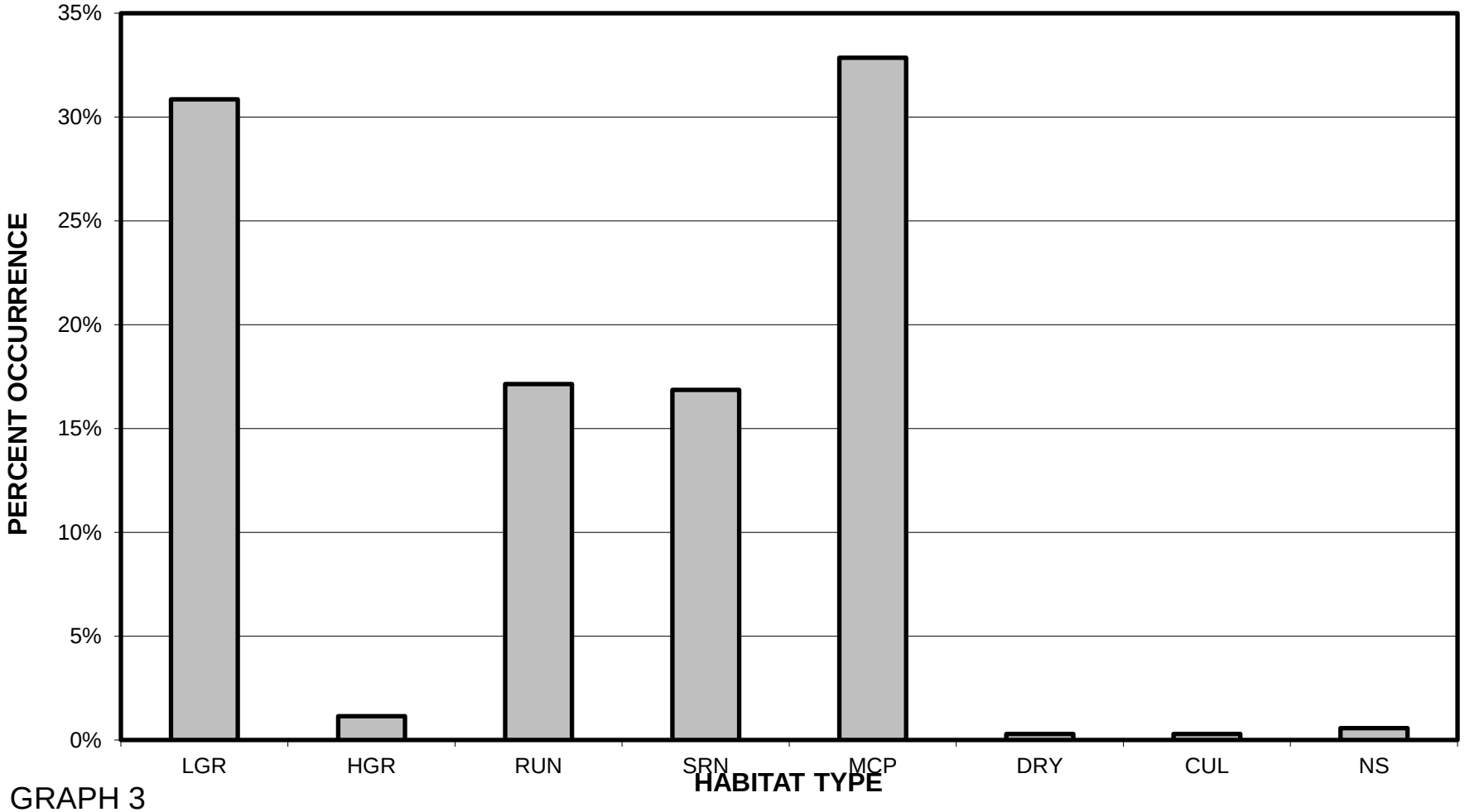
GRAPH 1

SOMERVILLE CREEK 2017
HABITAT TYPES BY PERCENT TOTAL LENGTH



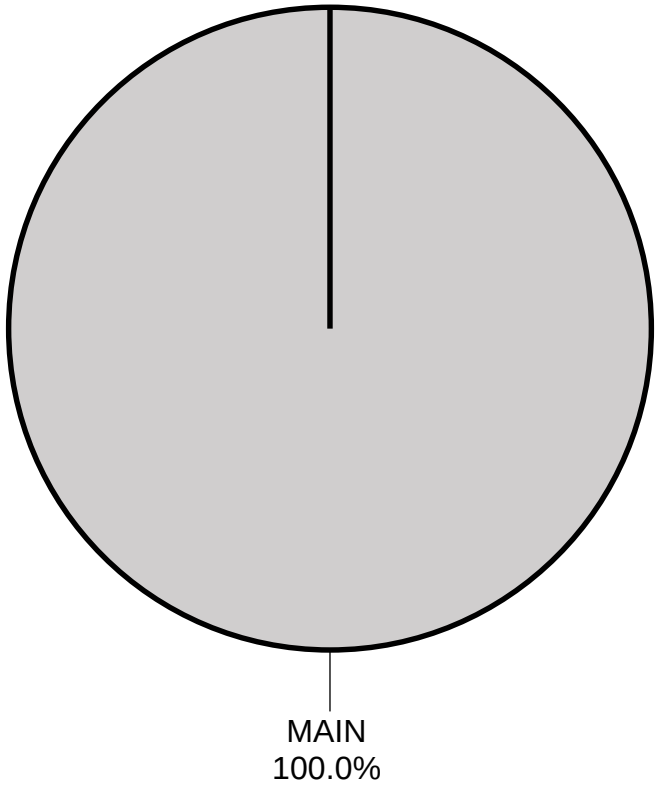
GRAPH 2

SOMERVILLE CREEK 2017
HABITAT TYPES BY PERCENT OCCURRENCE



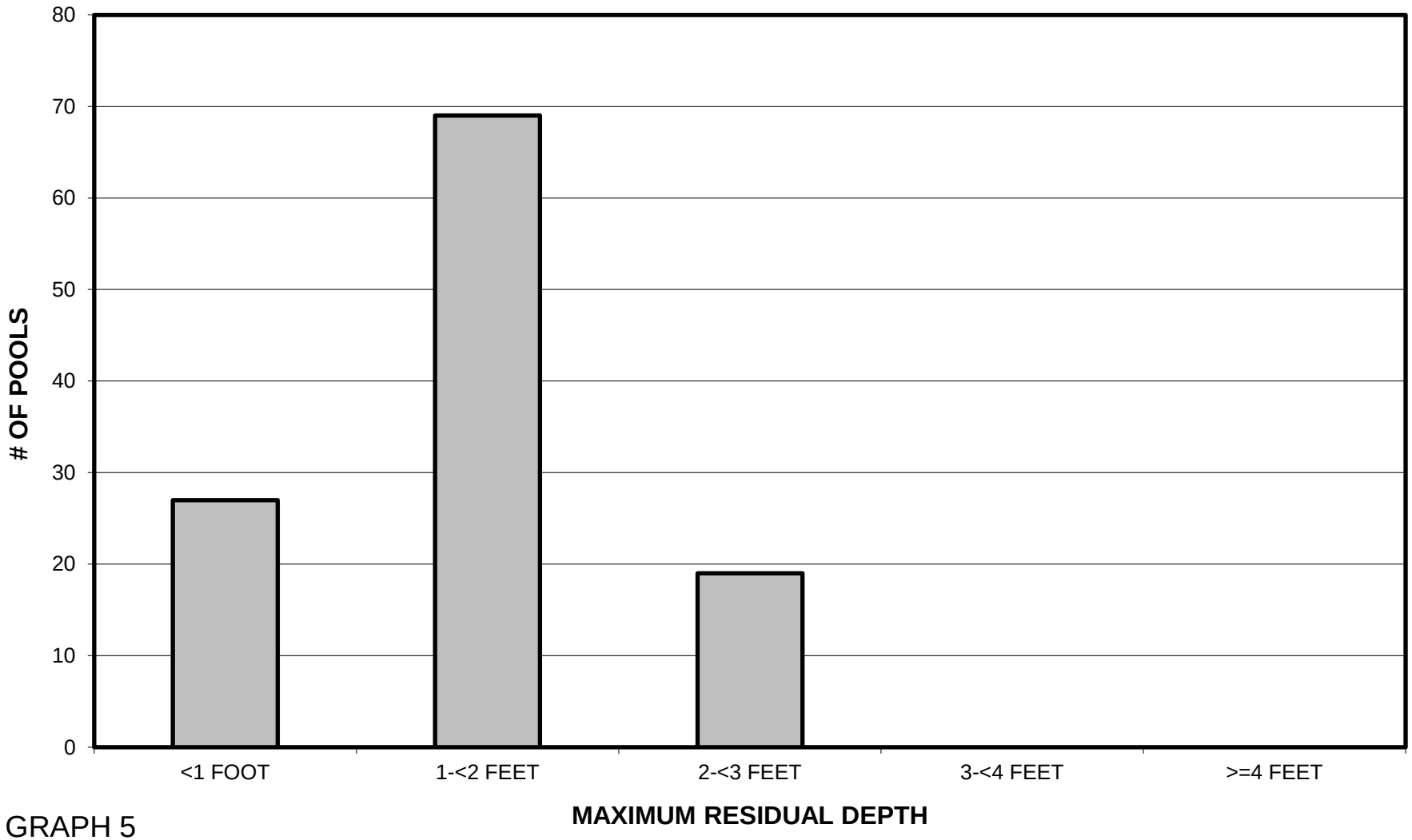
GRAPH 3

SOMERVILLE CREEK 2017
POOL TYPES BY PERCENT OCCURRENCE



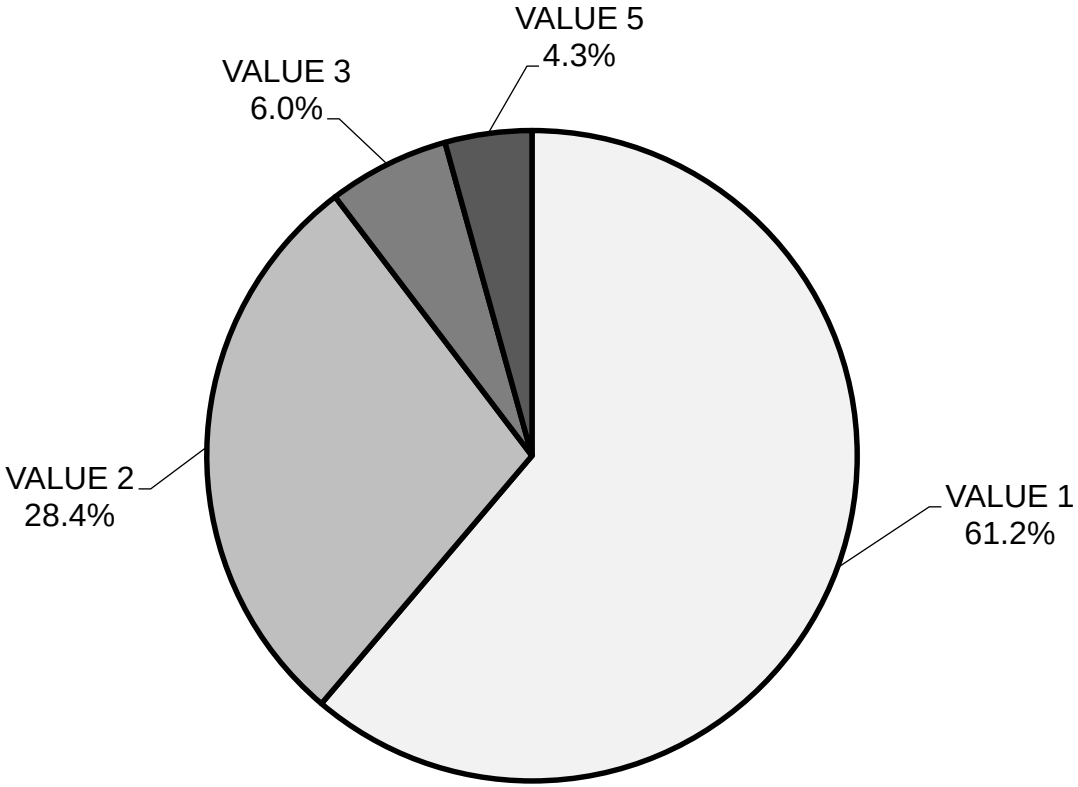
GRAPH 4

SOMERVILLE CREEK 2017
MAXIMUM DEPTH IN POOLS



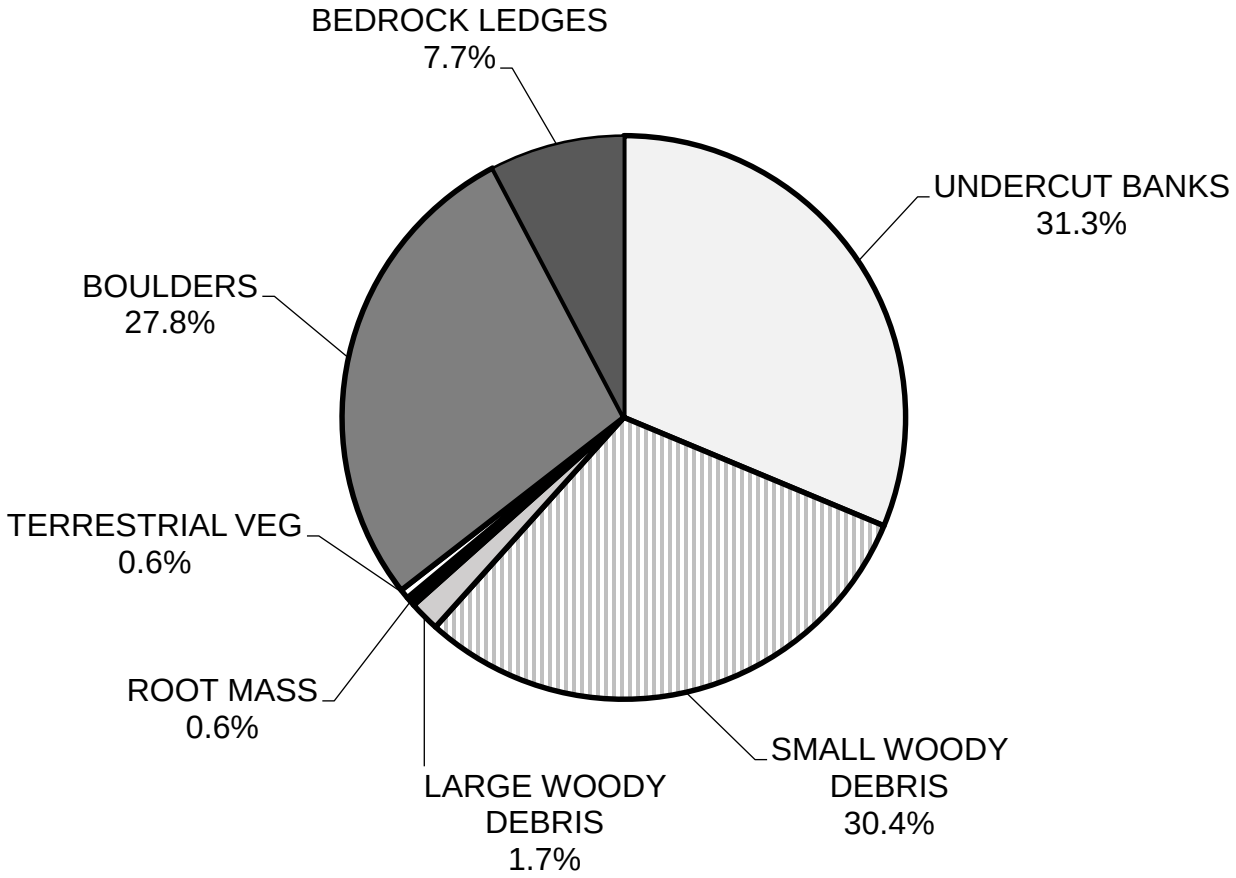
GRAPH 5

SOMERVILLE CREEK 2017
PERCENT EMBEDDEDNESS



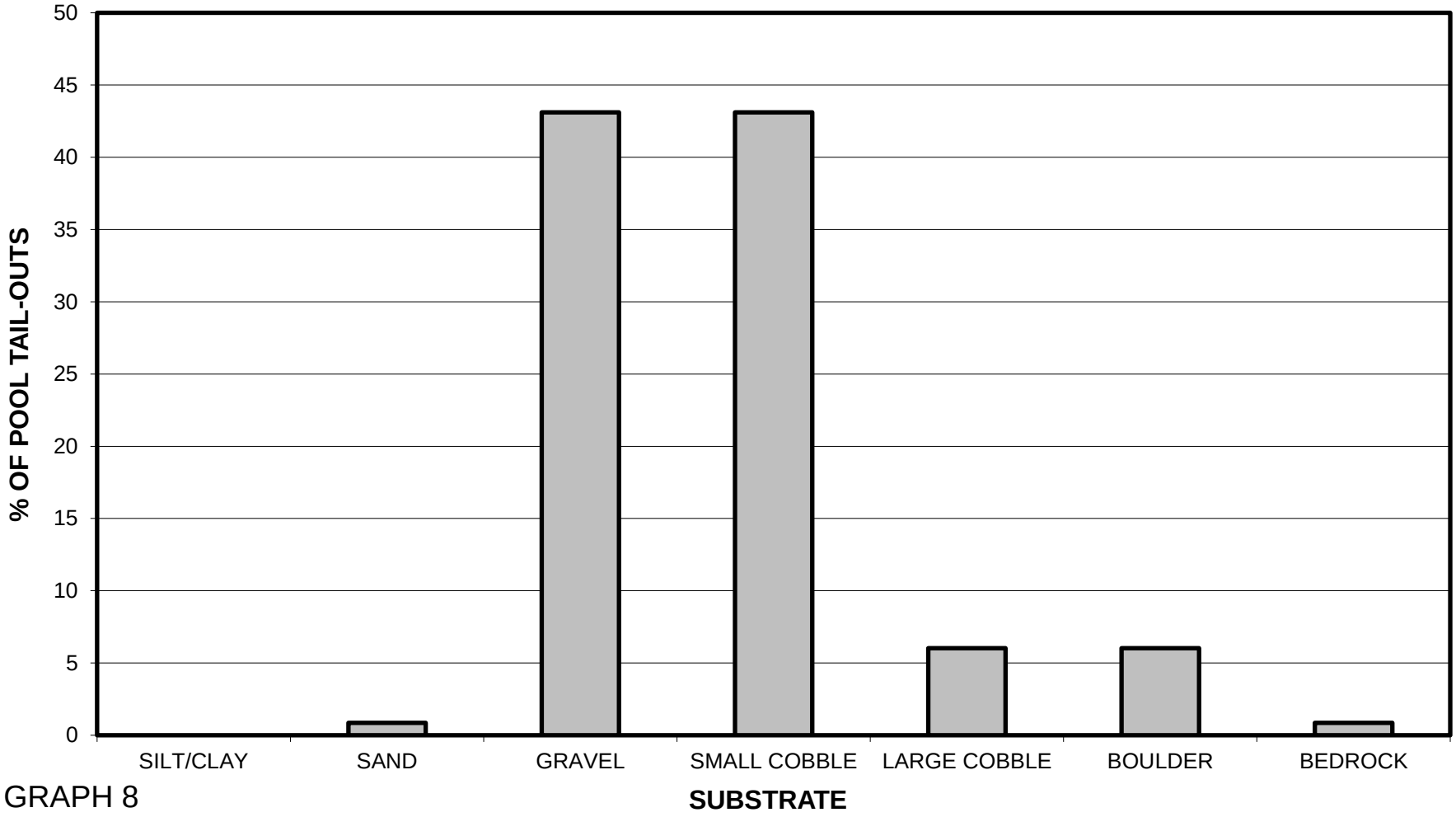
GRAPH 6

SOMERVILLE CREEK 2017
MEAN PERCENT COVER TYPES IN POOLS



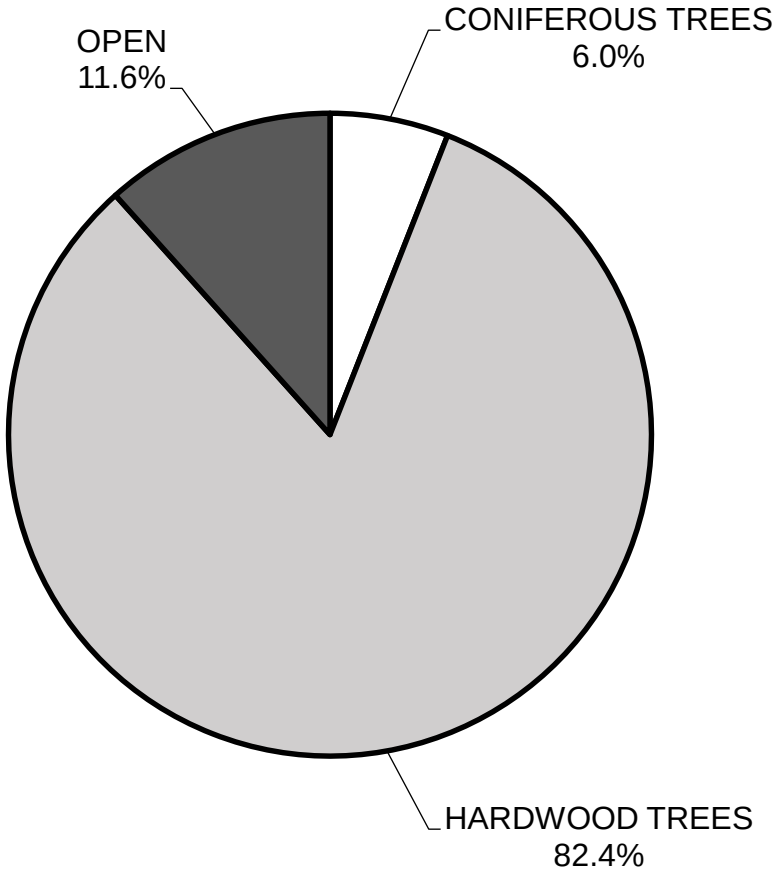
GRAPH 7

SOMERVILLE CREEK 2017
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



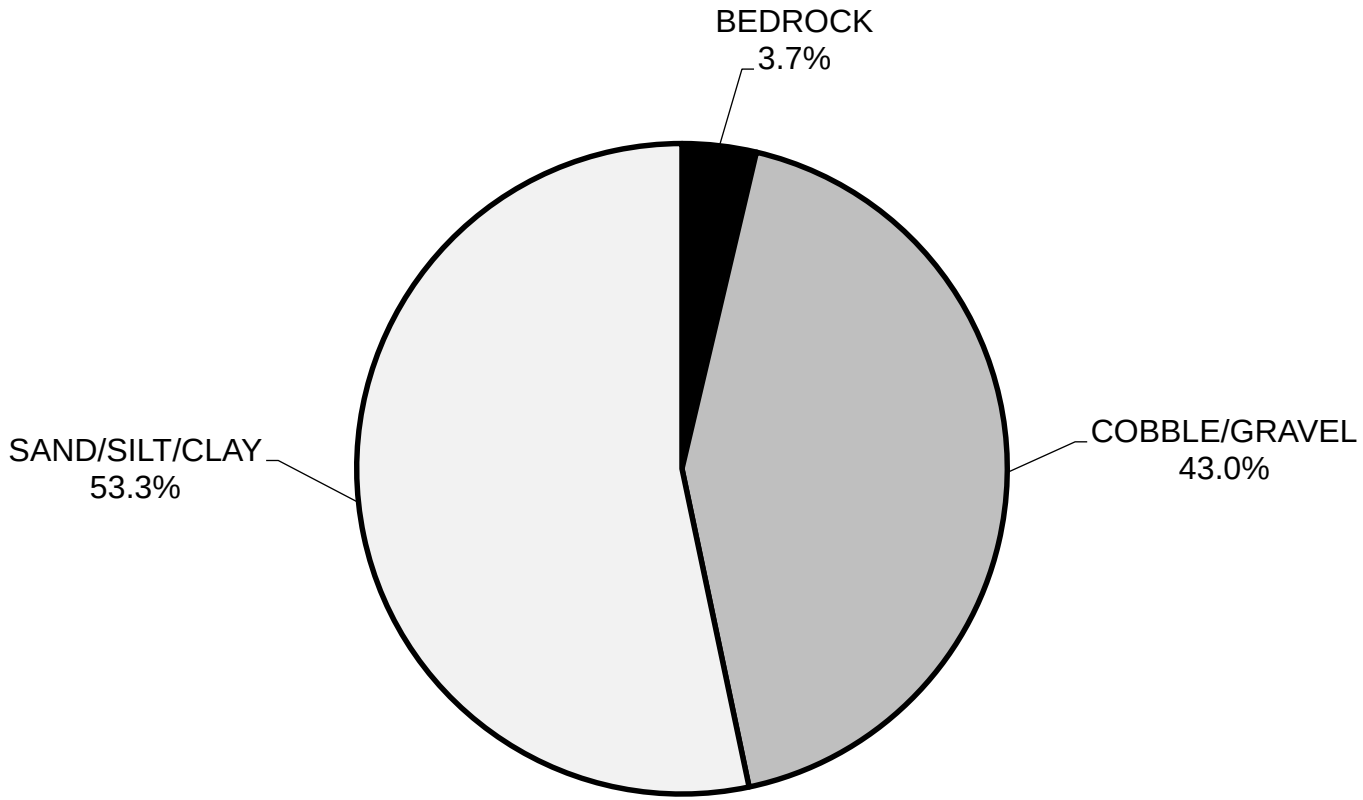
GRAPH 8

SOMERVILLE CREEK 2017
MEAN PERCENT CANOPY



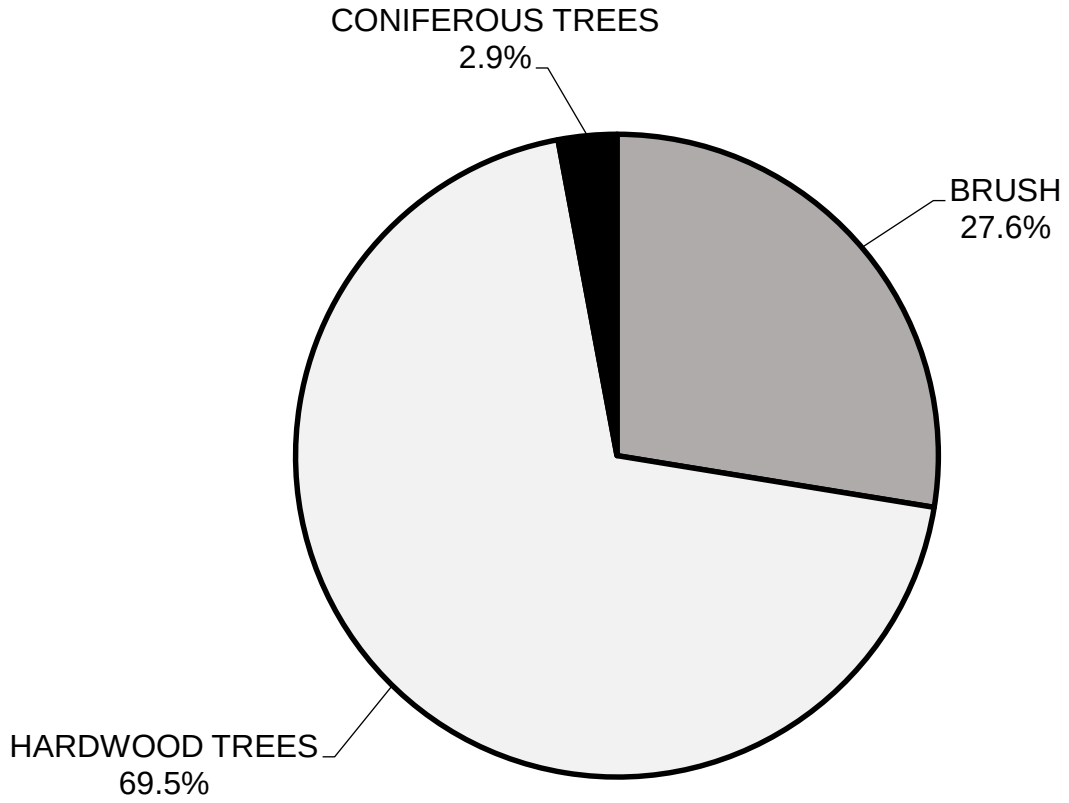
GRAPH 9

SOMERVILLE CREEK 2017
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

SOMERVILLE CREEK 2017
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

APPENDIX II

STREAM INVENTORY PHOTOS

Photo 1: Dry channel at unknown habitat unit. (Photo taken 8/22/17)

Photo 2: End of survey due to dry 457’ of dry channel. Photo taken at habitat unit 350, 14,812’ upstream of start of survey. (Photo taken 8/22/17)