STREAM INVENTORY REPORT

Redwood Creek

INTRODUCTION

A stream inventory was conducted from July 23, 2007 to July 26, 2007 on Redwood Creek. The survey began at the Branscomb Road Bridge over Redwood Creek approximately 180 feet upstream from the confluence with South Fork Eel River and extended upstream 2.4 miles.

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

A biological inventory of Redwood Creek was last conducted in 2006 to document the presence and distribution of juvenile salmonid species. Data from that survey will also be included in this report.

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

Redwood Creek is a tributary to South Fork Eel River, tributary to Eel River which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Redwood Creek's legal description at the confluence with South Fork Eel River is T21N R16W S16. Its location is 39.6808 north latitude and 123.6561 west longitude, LLID number 1236560396807. Redwood Creek is a second order stream and has approximately 3.9 miles of blue line stream according to the USGS Lincoln Ridge 7.5 minute quadrangle. Redwood Creek drains a watershed of approximately 4.4 square miles. Elevations range from about 1,450 feet at the mouth of the creek to 2,000 feet in the headwaters. Hardwood forest dominates the watershed. The watershed is entirely privately owned and used for timber production. Vehicle access exists via highway Branscomb Road. From Highway 101 at Laytonville, take Branscomb Road west for about approximately 12.5 miles. Passing the town of Branscomb, continue for 3 miles to a bridge over Redwood Creek. Walk downstream to the confluence with Redwood Creek and South Fork Eel occurs near the intersection of Wilderness Lodge Road and Branscomb Road.

METHODS

The habitat inventory conducted in Redwood Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Pacific States Marine Fisheries Commission (PSMFC) Fisheries Tehcnicians that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

Redwood Creek (Branscomb)

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

1. Flow:

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

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Redwood 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 Redwood 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 unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Redwood Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Redwood 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 Redwood 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 Redwood Creek. Detailed biological sampling (electro-fishing and/or underwater observation) was not conducted on Redwood Creek during the 2007 survey. Data from an electrofishing survey conducted in 2006 is listed in the Biological Inventory Results section of this report. Electrofishing sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type

Redwood Creek (Branscomb)

- 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 Redwood 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 July 23, 2007 to July 26, 2007, was conducted by C. Hines and M. Reneski (PSMFC). The total length of the stream surveyed was 12,854 feet with an additional 56 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.7 cubic feet per second (cfs) on June 24, 2007.

Redwood Creek is a F4 channel type for 11,285 feet of the stream surveyed (Reach 1), and a F6 channel type for 1,569 feet of the stream surveyed (Reach 2).

F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. F6 channels are entrenched meandering riffle/pool channels on low gradients with high width/depth ratio and silt/clay-dominant substrates.

Water temperatures taken during the survey period ranged from 57 to 60 degrees Fahrenheit. Air temperatures ranged from 57 to 75 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of

occurrence there were 47% pool units, 26% riffle units, and 26% flatwater units (Graph 1). Based on total length of Level II habitat types there were 52% pool units, 32% flatwater units, and 16% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 33% mid-channel pool units, 25% low gradient riffle units, and 17% step run units (Graph 3). Based on percent total length, mid-channel pool units made up 38%, step run units 24%, and low gradient riffle units 16%.

A total of 113 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 75% (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. Sixty-two of the 112 pools (55%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 112 pool tail-outs measured, 2 had a value of 1 (1.8%); 24 had a value of 2 (21.4%); 41 had a value of 3 (36.6%); 36 had a value of 4 (32.1%); and 9 had a value of 5 (8%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 18, flatwater habitat types had a mean shelter rating of 35, and pool habitats had a mean shelter rating of 75 (Table 1). Of the pool types, scour pools had a mean shelter rating of 103, main channel pools had a mean shelter rating of 66 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Redwood Creek. Graph 7 describes the pool cover in Redwood Creek. Small woody debris is the dominant pool cover type followed by undercut banks.

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 70% of pool tail-outs while small cobble was observed in 20% of pool tail-outs.

The mean percent canopy density for the surveyed length of Redwood Creek was 97%. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 59% and 41%, respectively. Graph 9 describes the mean percent canopy in Redwood Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 99% sand/silt/clay and 1% boulder (Graph 10). Hardwood trees were the dominant vegetation type observed in 58% of the units surveyed. Additionally, 35% of the

units surveyed had coniferous trees as the dominant vegetation type, and 7% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Redwood Creek was biologically sampled in 2006 by Campbell Timberland Management Company for fish presence and identification. Using an electrofisher, 36 coho and 35 steelhead trout were captured and identified. The survey took place approximately 4,800 feet upstream from the confluence with South Fork Eel River.

DISCUSSION

Redwood Creek is a F4 channel type for the first 11,285 feet of stream surveyed and a F6 channel type for 1,569 feet. The suitability of F4 and F6 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. F6 channel types are good for bank-placed boulders and fair for plunge weirs, boulder clusters, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 23, 2007 to July 26, 2007 ranged from 57 to 60 degrees Fahrenheit. Air temperatures ranged from 57 to 75 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 32% of the total length of this survey, riffles 16%, and pools 52% of the total length. 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.

Twenty-six of the 112 pool tail-outs measured had embeddedness ratings of 1 or 2. Seventy-seven of the pool tail-outs had embeddedness ratings of 3 or 4. Nine 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 Redwood Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred of the 112 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 75. The shelter rating in the flatwater habitats was 35. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Redwood Creek. Small woody debris is the dominant cover type in pools followed by undercut banks. 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 97%. Reach 1 had a canopy density of 97.1%, Reach 2 had a canopy density of 95.7%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 94% and 96%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Redwood Creek should be managed as an anadromous, natural production stream.

2) 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.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from small woody debris. Adding high quality complexity with woody cover in the pools is desirable.

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 #:	Comment:
0	0001.00	Start of survey 180 feet upstream from the confluence with South Fork Eel River at the Branscomb Road Bridge. The channel type for the first reach was F4.
1566	0022.00	There was erosion on the right bank that was 20’ wide X 15’ high.
2542	0040.00	Juvenile salmonids were observed throughout the last ten units.

Redwood Creek (Branscomb)

2597	0041.00	There was a fish passable small woody debris accumulation at the top of the unit. The accumulation had retained sediment measuring 20’ long X 15’ wide X 2’deep.
3658	0056.00	There was a ford at the top of this habitat unit.
5300	0085.00	Tributary #1 entered from the left bank. The estimated flow was 0.04 cubic feet per second (cfs), contributing to 25% of Redwood Creek’s flow. The temperature of the tributary was 58 degrees Fahrenheit, while Redwood upstream of the tributary was 60 degrees Fahrenheit and downstream was 61 degrees Fahrenheit. For the first 100' the tributary was accessible to fish, there was an impassable culvert ~100’ upstream of the confluence. The tributary’s slope was ~10%.
5948	0093.00	A bridge for Branscomb Road crosses the creek 48' into the habitat unit. The concrete car bridge is 35' wide (up to downstream), 21' high x 75' long (bank to bank).
7022	0114.00	There were numerous juvenile salmonids observed here.
7942	0130.00	A dry tributary enters from the right bank
8524	0145.00	Pool tailouts are becoming embedded with silt and clay.
8606	0147.00	There was right bank erosion measuring 25' long X 10' high.
8624	0148.00	Tributary #2, named North Fork Redwood Creek, enters from the left bank. It's estimated the flow was 0.1 cfs contributing to ~40% of Redwood Creek’s flow. The temperature of the tributary was 57 degrees Fahrenheit, Redwood Creek’s temperature upstream was 59 degrees Fahrenheit and downstream of the tributary was 57 degrees Fahrenheit. The slope was 2% and the stream was accessible to fish. Juvenile salmonids were observed in the tributary.
8684	0149.00	The channel becomes entrenched here.
8904	0156.00	There was a 4' plunge.
9409	0167.00	Log debris accumulation (LDA) #1 was comprised of 16 pieces of large woody debris and measured 4' high X 15' wide X 30' long. Water does flow through it, though there were no visible gaps. Stored sediment consisting primarily of gravel measured 10' wide X 20' long X 3' deep. Fish were observed upstream of the LDA.

Redwood Creek (Branscomb)

10442	0189.00	A dry tributary entered the channel on the right bank. For the first 150' an 8% slope was measured with a clinometer. There was a high gradient section right before a culvert that was perched 1' above the water's surface with no jump pool. The culvert was possibly a barrier to upstream migration.
10559	0192.00	LDA #2 consisted of 7 pieces of large woody debris, and measured 6' high X 16' wide X 12' long. Water flowed through visible gaps in the LDA. Retained sediment, primarily silt, measured 10' wide X 12' long X 2' deep.
11023	0201.00	The channel was very entrenched here, and the water very turbid.
11147	0203.00	LDA #3 consisted of 6 pieces of large woody debris and measured 7' high X 16' wide X 20' long. Water flows through gaps and the LDA was not retaining sediment.
11285	0206.01	The channel type changed at the bottom of this unit. Redwood creek's channel type was F6 and thus reach 2 began here.
11925	0222.00	The water ran subsurface for 6' near the top of this habitat unit.
12555	0233.00	There was a culvert at this unit. The winter high water level mark fills 1/3 of the 5' diameter, 50' long culvert. There is no plunge at the downstream end. There was a rusty hole in the middle of the culvert.
12622	0235.00	There were four juvenile salmonids observed in this habitat unit.
12796	0238.00	Culvert #2 was 33' long with a 5' diameter, 2' of which was filled with sediment, making the interior height 3'.
12854	0239.00	End of survey due to deteriorating habitat and low flows. Ended at the confluence of headwater tributaries.

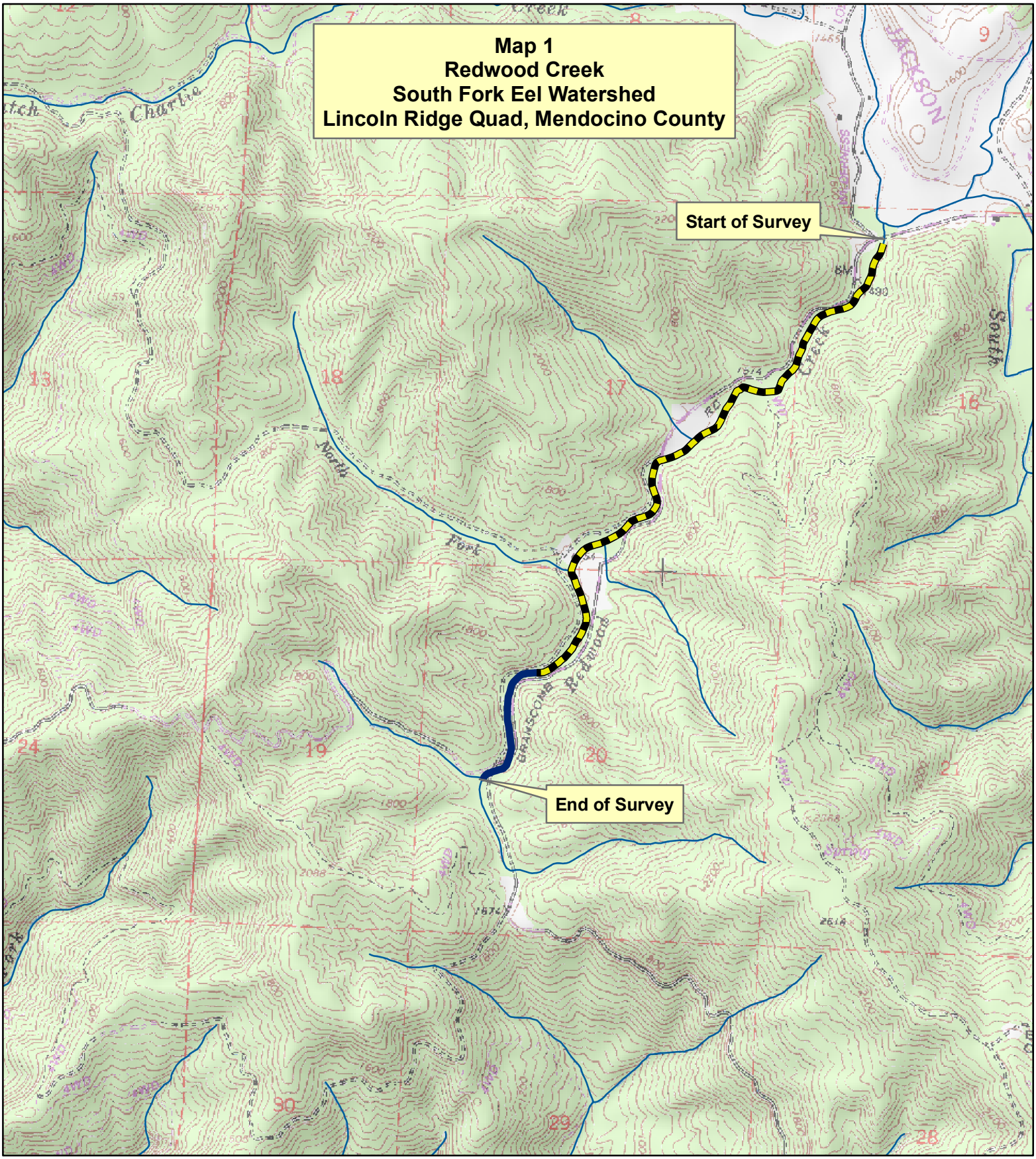
REFERENCES

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.

Redwood Creek (Branscomb)

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]	



Legend

Reach 1, F4 Channel Type

Reach 2, F6 Channel Type

0 700 1,400 2,800 Feet

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

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0

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
2	0	CULVERT	0.8	42	83	0.6									
1	0	DRY	0.4	15	15	0.1									
62	16	FLATWATER	25.8	66	4086	31.6	7.7	0.6	1.0	528	32710	387	23969		35
113	113	POOL	47.1	59	6661	51.6	10.4	1.2	2.2	626	70722	972	108820	792	75
62	14	RIFFLE	25.8	33	2065	16.0	6.8	0.4	0.7	282	17486	140	8684		18

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
240	143	12910	120918	141474

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

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 (%)
61	13	LGR	25.4	33	2027	15.7	7	0.3	1.3	286	17457	144	8774		13	97
1	1	HGR	0.4	38	38	0.3	8	0.4	0.6	228	228	91	91		80	96
22	10	RUN	9.2	44	960	7.4	8	0.6	1.3	387	8511	224	4919		32	96
40	6	SRN	16.7	78	3126	24.2	6	0.6	1.8	762	30485	658	26331		42	96
5	5	TRP	2.1	65	326	2.5	6	1.3	3.4	392	1960	695	2779	530	65	97
80	80	MCP	33.3	62	4963	38.4	11	1.2	4.7	696	55669	1117	89367	912	66	97
2	2	CRP	0.8	73	146	1.1	8	1.6	3.2	516	1032	986	1972	826	95	99
17	17	LSL	7.1	49	838	6.5	10	1.0	3.5	500	8505	644	10953	531	124	98
3	3	LSR	1.3	54	162	1.3	9	0.9	2.6	524	1571	569	1707	464	67	95
1	1	LSBk	0.4	32	32	0.2	8	0.8	1.8	256	256	256	256	205	20	100
4	4	LSBo	1.7	44	178	1.4	10	0.7	2.4	403	1614	409	1636	288	69	95
1	1	PLP	0.4	16	16	0.1	8	1.1	2.2	115	115	150	150	127	100	98
1	0	DRY	0.4	15	15	0.1										98
2	0	CUL	0.8	42	83	0.6										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
240	143	12910	127403	148935

Table 3 - Summary of Pool Types

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

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
85	85	MAIN	75	62	5289	79	10.6	1.2	678	57629	894	75104	66
28	28	SCOUR	25	49	1372	21	9.8	1.0	468	13093	484	13550	103

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
113	113	6661	70722	88653

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

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

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
4	TRP	4	0	0	1	25	1	25	2	50	0	0
80	MCP	71	3	4	31	39	28	35	13	16	5	6
2	CRP	2	0	0	0	0	1	50	1	50	0	0
17	LSL	15	0	0	11	65	4	24	2	12	0	0
3	LSR	3	0	0	1	33	2	67	0	0	0	0
1	LSBk	1	0	0	1	100	0	0	0	0	0	0
4	LSBo	4	0	0	2	50	2	50	0	0	0	0
1	PLP	1	0	0	0	0	1	100	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
112	3	3	47	42	39	35	18	16	5	4

Mean Maximum Residual Pool Depth (ft.): 2.2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007 Dry Units: 1

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

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
61	13	LGR	23	27	7	0	14	0	0	29	0
1	1	HGR	0	0	30	0	0	0	0	70	0
62	14	TOTAL RIFFLE	20	24	10	0	12	0	0	34	0
22	10	RUN	26	16	4	0	49	0	0	6	0
40	6	SRN	34	28	0	0	28	0	0	10	0
62	16	TOTAL FLAT	30	21	2	0	39	0	0	8	0
5	5	TRP	27	41	6	0	26	0	0	0	0
80	80	MCP	36	35	18	2	7	0	0	3	0
2	2	CRP	45	15	0	0	40	0	0	0	0
17	17	LSL	15	28	54	0	3	0	0	0	0
3	3	LSR	10	3	0	73	7	0	0	7	0
1	1	LSBk	0	60	0	0	0	0	0	0	40
4	4	LSBo	18	3	8	0	0	0	0	73	0
1	1	PLP	0	60	0	0	0	0	0	40	0
113	113	TOTAL POOL	30	32	21	4	7	0	0	5	0
2	0	CUL									
240	143	TOTAL	30	31	19	3	11	0	0	7	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007 Dry Units: 1

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

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
61	13	LGR	8	0	69	8	8	8	0
1	1	HGR	0	0	0	0	100	0	0
22	10	RUN	30	0	70	0	0	0	0
40	6	SRN	50	0	50	0	0	0	0
5	5	TRP	80	0	20	0	0	0	0
80	80	MCP	30	0	66	4	0	0	0
2	2	CRP	50	0	50	0	0	0	0
17	17	LSL	18	0	82	0	0	0	0
3	3	LSR	0	0	100	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
4	4	LSBo	0	0	50	25	25	0	0
1	1	PLP	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	41	59	0	94	96

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: Redwood Creek | LLID: 1236560396807 | Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007 | Survey Length (ft.): 12910 | Main Channel (ft.): 12854 | Side Channel (ft.): 56

Confluence Location: Quad: LINCOLN RIDGE | Legal Description: T21NR16WS16 | Latitude: 39:40:51.0N | Longitude: 123:39:22.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 11285
Riffle/Flatwater Mean Width (ft.): 7.9
BFW:
Range (ft.): 6 to 29
Mean (ft.): 13
Std. Dev.: 5
Base Flow (cfs.): 0.7
Water (F): 57 - 60 Air (F): 57 - 75
Dry Channel (ft): 0

Canopy Density (%): 97.1
Coniferous Component (%): 37.9
Hardwood Component (%): 62.1
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 94.9
Dominant Shelter: Undercut Banks
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 19
LWD per 100 ft.:
Riffles: 0
Pools: 2
Flat: 1

Pools by Stream Length (%): 52.1
Pool Frequency (%): 48.1
Residual Pool Depth (%):
< 2 Feet Deep: 39
2 to 2.9 Feet Deep: 38
3 to 3.9 Feet Deep: 17
>= 4 Feet Deep: 5
Mean Max Residual Pool Depth (ft.): 2.3
Mean Pool Shelter Rating: 79

Pool Tail Substrate (%): Silt/Clay: 2 Sand: 1 Gravel: 72 Sm Cobble: 22 Lg Cobble: 3 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 2.0 2. 24.2 3. 41.4 4. 29.3 5. 3.0

STREAM REACH: 2

Channel Type: F6
Reach Length (ft.): 1569
Riffle/Flatwater Mean Width (ft.): 4.3
BFW:
Range (ft.): 5 to 8
Mean (ft.): 6
Std. Dev.: 1
Base Flow (cfs.): 0.7
Water (F): 57 - 59 Air (F): 57 - 62
Dry Channel (ft): 15

Canopy Density (%): 95.6
Coniferous Component (%): 58.4
Hardwood Component (%): 41.6
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 97.0
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 8
LWD per 100 ft.:
Riffles: 0
Pools: 1
Flat: 1

Pools by Stream Length (%): 48.4
Pool Frequency (%): 41.2
Residual Pool Depth (%):
< 2 Feet Deep: 85
2 to 2.9 Feet Deep: 8
3 to 3.9 Feet Deep: 8
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.6
Mean Pool Shelter Rating: 49

Pool Tail Substrate (%): Silt/Clay: 46 Sand: 0 Gravel: 54 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 0.0 2. 0.0 3. 0.0 4. 53.8 5. 46.2

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

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	0	0	0.0
Boulder	2	1	1.0
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	141	142	99.0

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	11	9	7.0
Hardwood Trees	80	86	58.0
Coniferous Trees	52	48	35.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

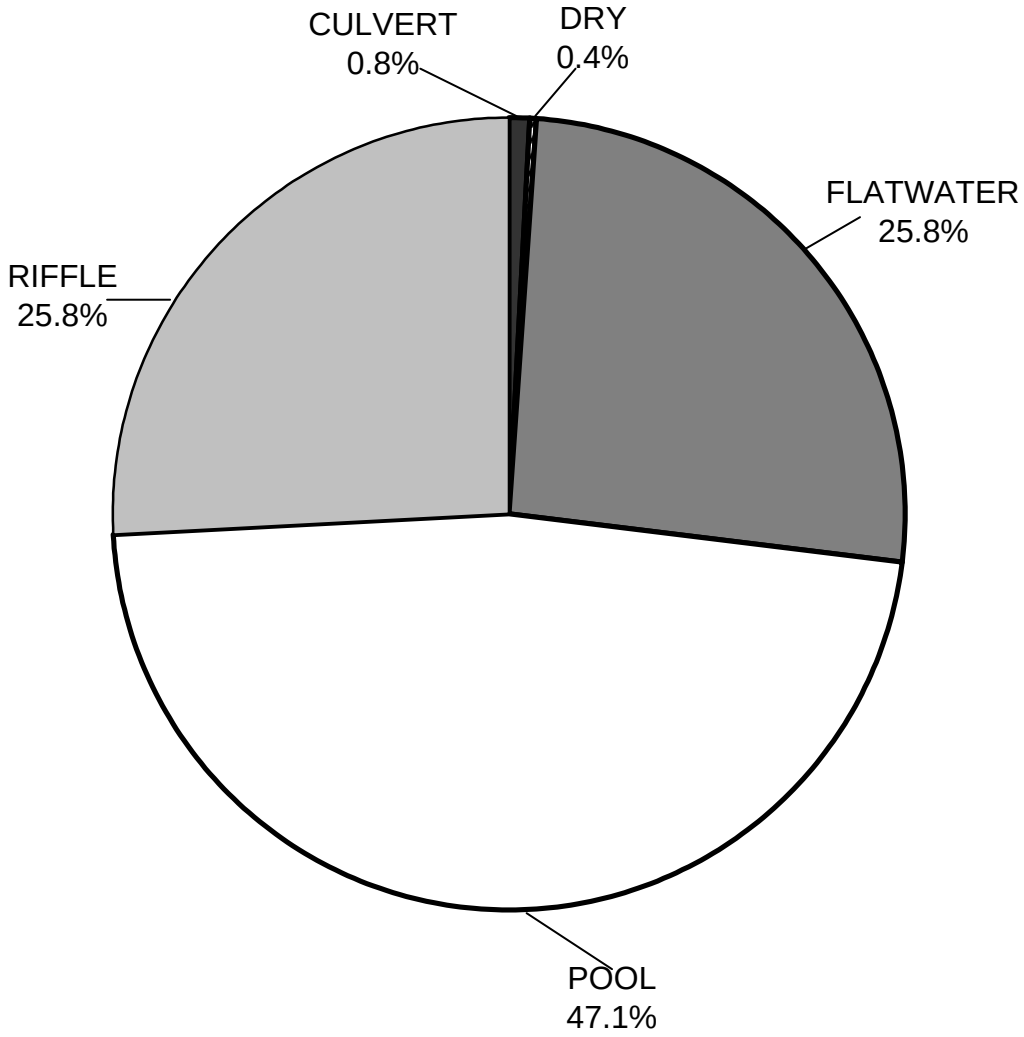
StreamName: Redwood Creek LLID: 1236560396807 Drainage: Eel River - South Fork

Survey Dates: 7/23/2007 to 7/26/2007

Confluence Location: Quad: LINCOLN RIDGE Legal Description: T21NR16WS16 Latitude: 39:40:51.0N Longitude: 123:39:22.0W

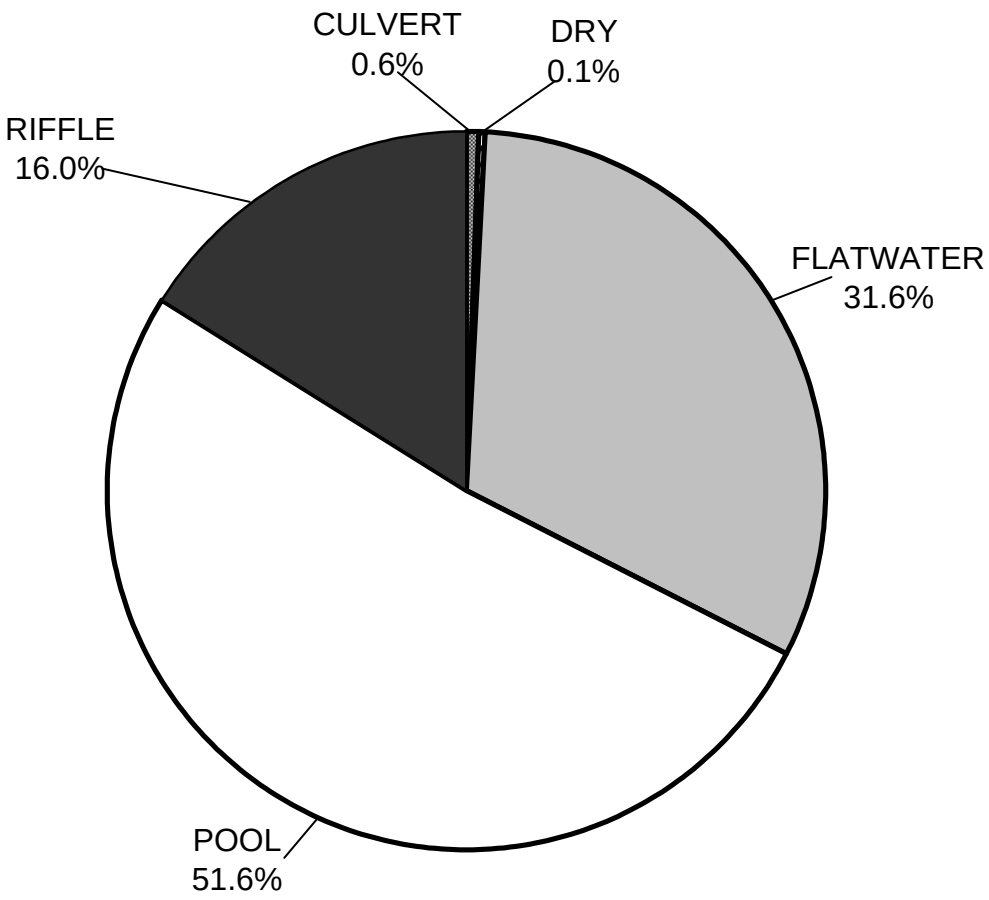
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	20	30	30
SMALL WOODY DEBRIS (%)	24	21	32
LARGE WOODY DEBRIS (%)	10	2	21
ROOT MASS (%)	0	0	4
TERRESTRIAL VEGETATION (%)	12	39	7
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	34	8	5
BEDROCK LEDGES (%)	0	0	0

REDWOOD CREEK 2007
HABITAT TYPES BY PERCENT OCCURRENCE



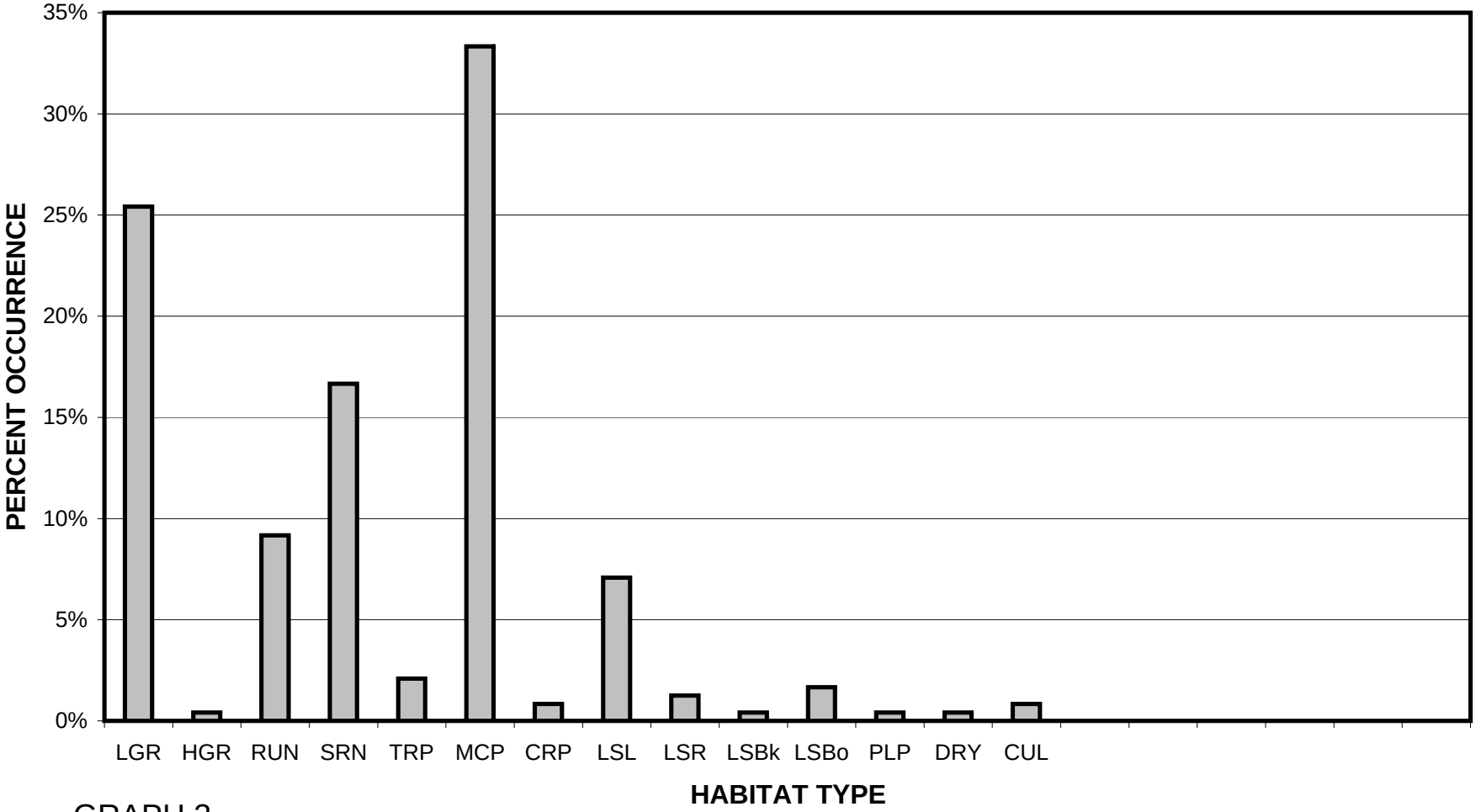
GRAPH 1

REDWOOD CREEK 2007
HABITAT TYPES BY PERCENT TOTAL LENGTH



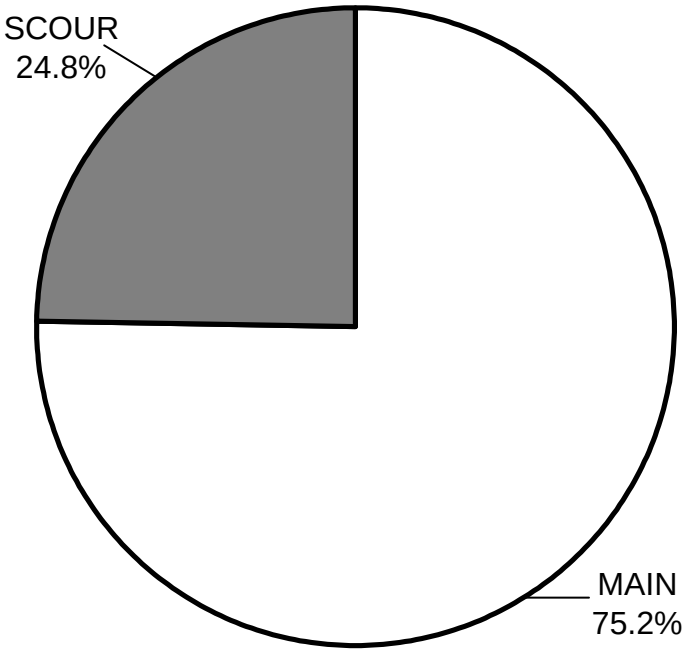
GRAPH 2

REDWOOD CREEK 2007
HABITAT TYPES BY PERCENT OCCURRENCE

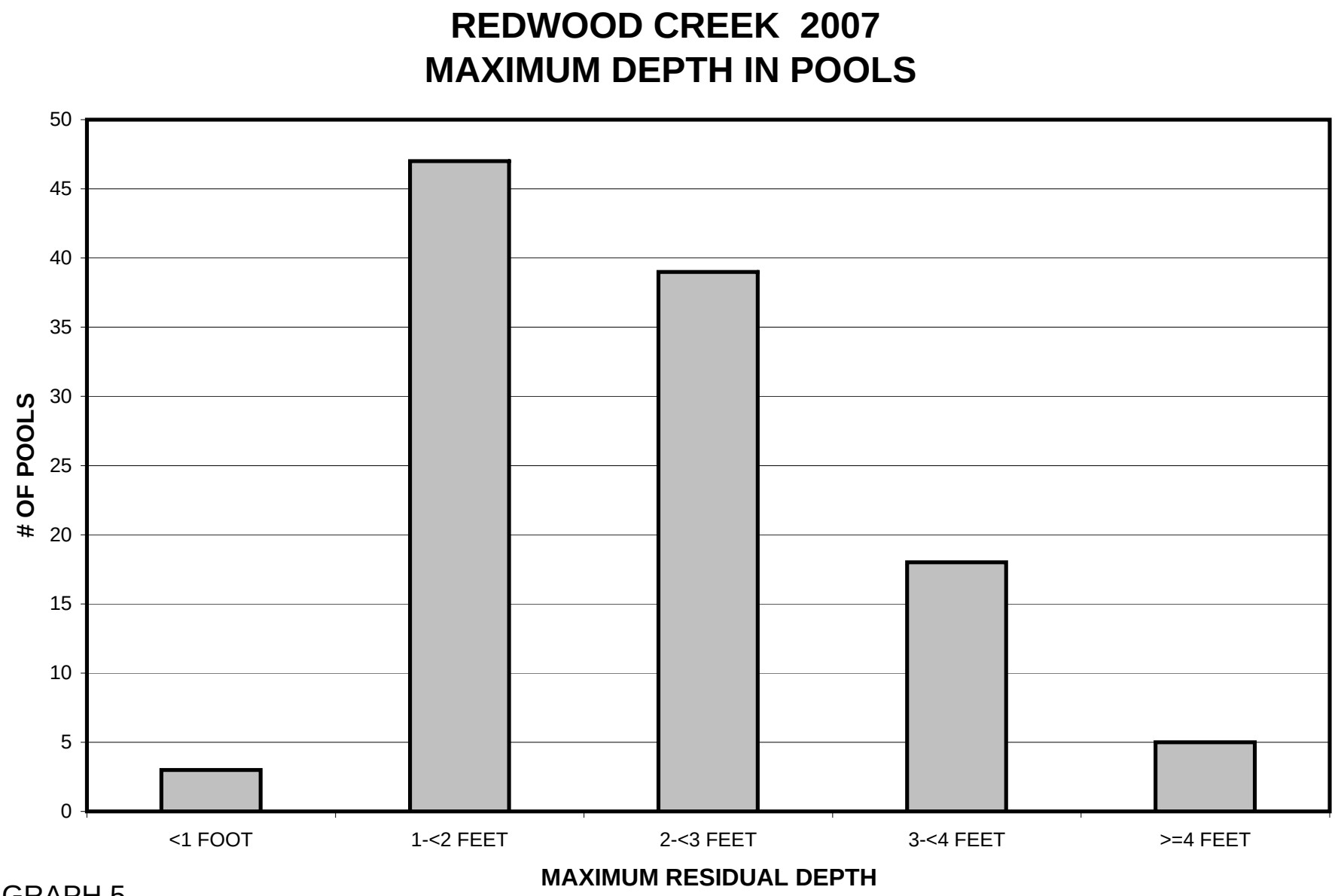


GRAPH 3

REDWOOD CREEK 2007
POOL TYPES BY PERCENT OCCURRENCE

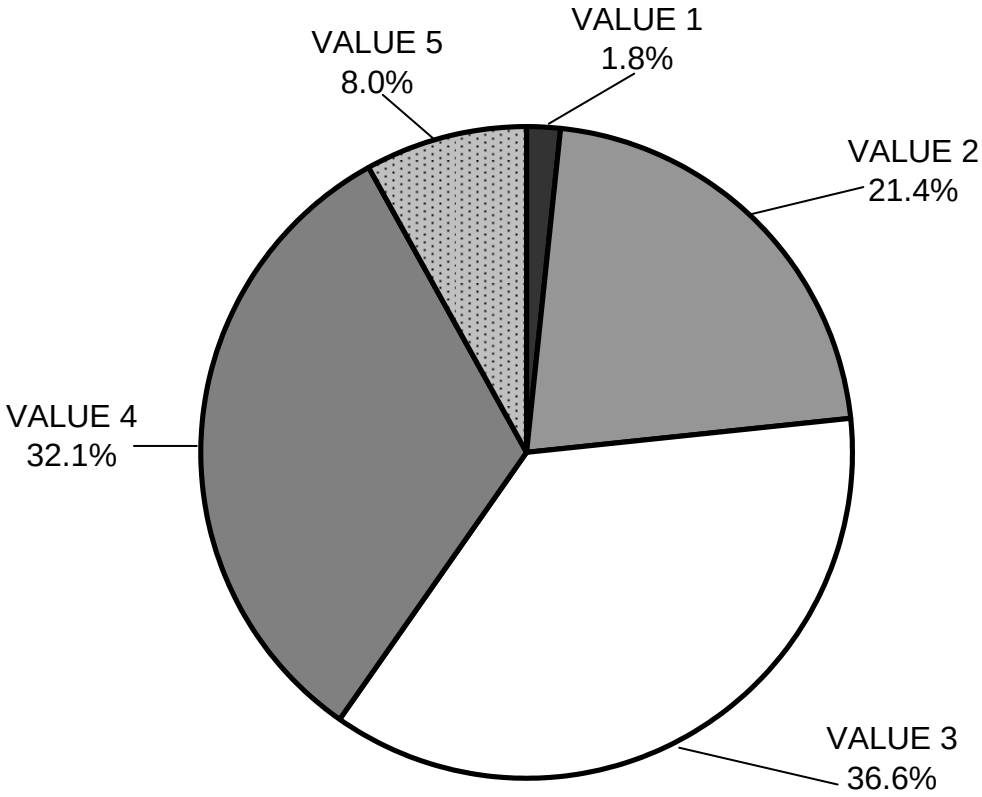


GRAPH 4


REDWOOD CREEK 2007
MAXIMUM DEPTH IN POOLS
OF POOLS
50
45
40
35
30
25
20
15
10
5
0
<1 FOOT
1-<2 FEET
2-<3 FEET
3-<4 FEET
>=4 FEET
MAXIMUM RESIDUAL DEPTH

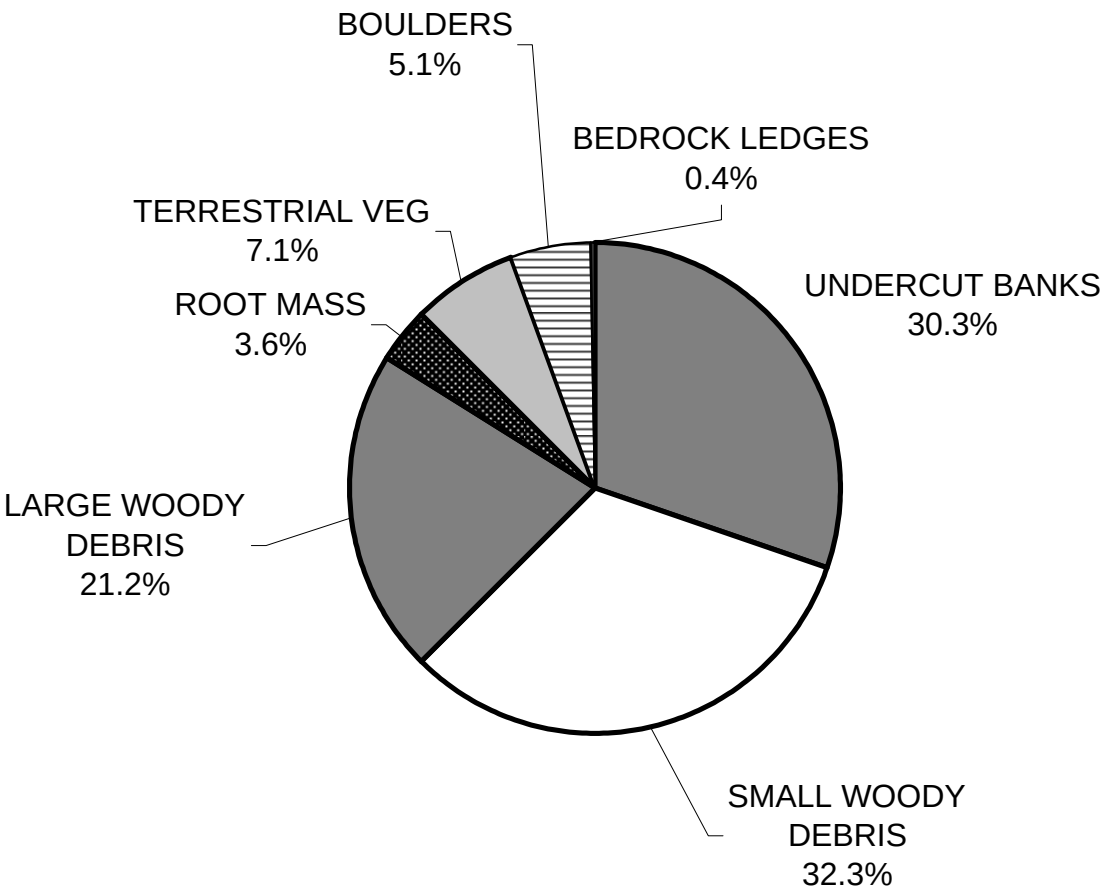
GRAPH 5

REDWOOD CREEK 2007
PERCENT EMBEDDEDNESS



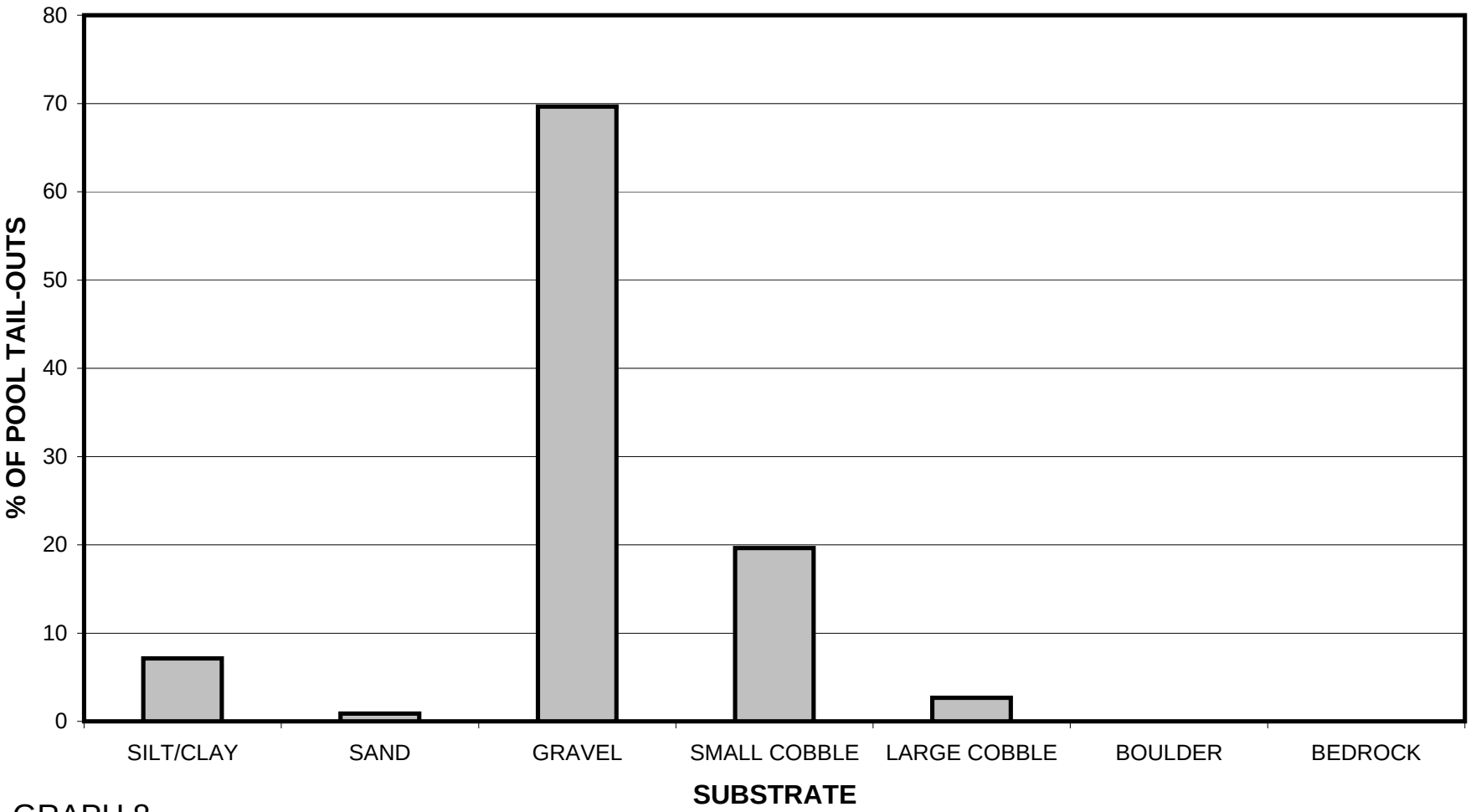
GRAPH 6

REDWOOD CREEK 2007
MEAN PERCENT COVER TYPES IN POOLS



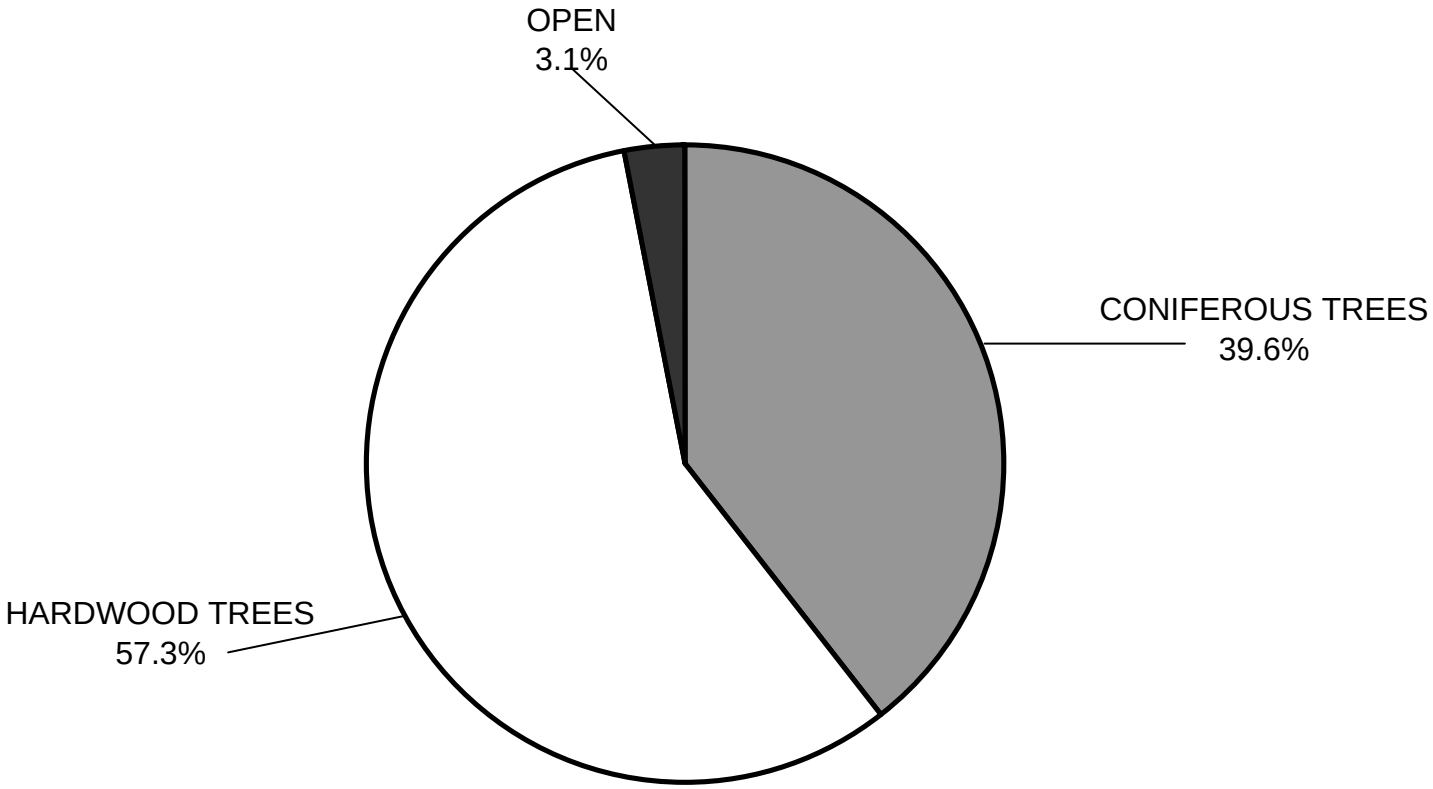
GRAPH 7

REDWOOD CREEK 2007
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



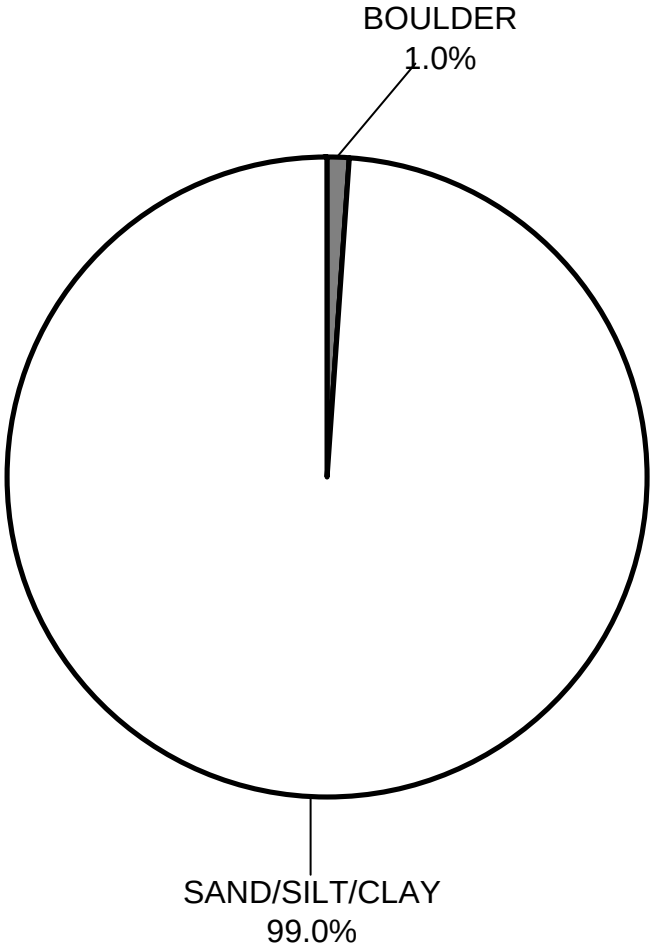
GRAPH 8

REDWOOD CREEK 2007
MEAN PERCENT CANOPY



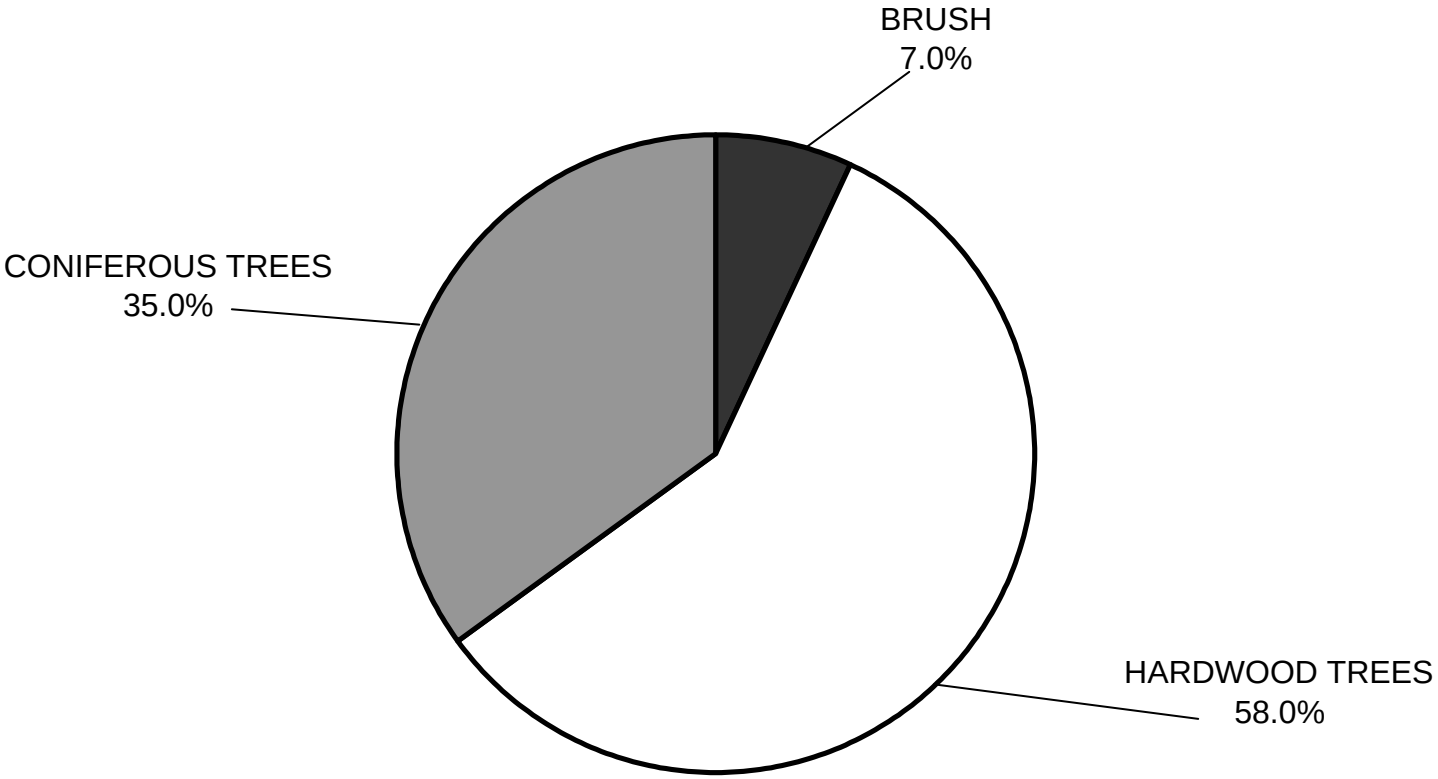
GRAPH 9

REDWOOD CREEK 2007
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

REDWOOD CREEK 2007
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11