

# STREAM INVENTORY REPORT

## North Fork Redwood Creek

### INTRODUCTION

A stream inventory was conducted from June 11 to June 20, 2012 on North Fork Redwood Creek. The survey began at the confluence with Redwood Creek and extended upstream 1.2 miles.

The North Fork Redwood 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 North Fork Redwood 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 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

North Fork Redwood Creek is a tributary to Redwood Creek, a tributary to South Fork Ten Mile River, a tributary to Ten Mile River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). North Fork Redwood Creek's legal description at the confluence with Redwood Creek is T19N R16W S14. Its location is 39.5043 degrees north latitude and 123.6094 degrees west longitude, LLID number 1236082395043. North Fork Redwood Creek is a first order stream and has approximately 1.4 miles of blue line stream according to the USGS Northspur 7.5 minute quadrangle. North Fork Redwood Creek drains a watershed of approximately 1.7 square miles. Elevations range from about 395 feet at the mouth of the creek to 1,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Camp One Ten Mile Road north of Fort Bragg, CA.

### METHODS

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

## North Fork Redwood Creek

### 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 North Fork 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". North Fork 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

## North Fork Redwood Creek

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 North Fork 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

### 6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is classified according to a list of nine cover types. In North Fork 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. The shelter rating is then calculated for each fully-described habitat unit by multiplying shelter value and percent 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In North Fork 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 North Fork Redwood Creek, the dominant composition type and the

## North Fork Redwood Creek

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 North Fork Redwood Creek. In addition, underwater observations were made at three sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and 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)

## North Fork Redwood Creek

- 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 North Fork 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 June 11 to June 20, 2012 was conducted by M. Zee (WSP) and B. Leonard (CDFW). The total length of the stream surveyed was 6,303 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.35 cfs on June 14, 2012.

North Fork Redwood Creek is a G4 channel type for 5,374 feet of the stream surveyed (Reach 1) and an A4 channel type for 929 feet of the stream surveyed (Reach 2). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios and gravel-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 52 to 57 degrees Fahrenheit. Air temperatures ranged from 50 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% pool units, 27% flatwater units, 21% riffle units, 2% dry units, and 1% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 43% pool units, 37% flatwater units, 11% riffle units, 8% dry units, and 1% unsurveyed units (Graph 2).

## North Fork Redwood Creek

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 43%; step run units, 18%; and low gradient riffle units, 13% (Graph 3). Based on percent total length, mid-channel pool units made up 36%, step run units 30%, and dry units 8%.

A total of 110 pools were identified (Table 3). Main channel pools were the most frequently encountered at 97% (Graph 4), and comprised 97% 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 110 pools (20%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 110 pool tail-outs measured, 45 had a value of 1 (40.9%); 45 had a value of 2 (40.9%); 16 had a value of 3 (14.5%); four had a value of 5 (3.6%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 24, flatwater habitat types had a mean shelter rating of 28, and pool habitats had a mean shelter rating of 31 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 32. Backwater pools had a mean shelter rating of 30 and scour pools had a mean shelter rating of 20 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 87% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 6% of the pool tail-outs.

The mean percent canopy density for the surveyed length of North Fork Redwood Creek was 95%. Five percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 34% and 66%, respectively. Graph 9 describes the mean percent canopy in North Fork Redwood 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 73% sand/silt/clay, 18% cobble/gravel, 5% boulders, and 3% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 82% of the units surveyed. Additionally, 18% of the units surveyed had deciduous trees as the dominant

## North Fork Redwood Creek

vegetation type (Graph 11).

### BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at three sites for species composition and distribution in North Fork Redwood Creek on June 26, 2012. The sites were sampled by I. Mikus and B. Leonard (CDFW).

In Reach 1, which comprised the first 5,374 feet of stream, three sites were sampled. The reach sites yielded 22 young-of-the-year steelhead/rainbow trout (SH/RT), and one age 1+ SH/RT.

The following chart displays the information yielded from these sites:

2012 North Fork Redwood Creek underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: G4 Channel Type									
06/26/12	1	004	Pool	178	5	0	0	0	0
	2	009	Pool	371	10	0	0	0	0
	3	011	Pool	512	7	1	0	0	0

### DISCUSSION

North Fork Redwood Creek is a G4 channel type for the first 5,374 feet of stream surveyed and an A4 channel type for the remaining 929 feet. The suitability of G4 and A4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and fair for plunge weirs, 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 11 to June 20, 2012 ranged from 52 to 57 degrees Fahrenheit. Air temperatures ranged from 50 to 72 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 37% of the total length of this survey, riffles 11%, and pools 43%. Twenty-two of the 110 (20%) 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

## North Fork Redwood Creek

flow channel, and be as long as the low flow channel width. Installing large wood structures that will increase or deepen pool habitat is recommended.

Ninety of the 110 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixteen of the pool tail-outs had embeddedness ratings of 3 or 4. Four of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

One hundred three of the 110 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 31. The shelter rating in the flatwater habitats is 28. 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 North Fork Redwood Creek. Small woody debris is the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 95%. Reach 1 had a canopy density of 95% and Reach 2 had a canopy density of 96%. The percentage of right and left bank covered with vegetation was 100% and 100%, respectively.

## RECOMMENDATIONS

- 1) North Fork Redwood Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) 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.



## North Fork Redwood Creek

### 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. The channel is a G4.
188	0006.00	Remnants of railroad trestle.
483	0011.00	Log debris accumulation (LDA) #01 contains 10 pieces of large woody debris (LWD) and measures 9' high x 18' wide x 24' long. Water does not flow through the LDA; the channel is dry for 43' above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to large cobble and measures 14' wide x 50' long x 4' deep. Fish were observed above the LDA.
1212	0028.00	Remnants of railroad trestle.
1422	0031.00	There is a 1' high plunge.
1732	0039.00	LDA #02 contains seven pieces of LWD and measures 6' high x 17' wide x 11' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 10' wide x 40' long x 4' deep. There is a 4' high plunge over the LDA. Fish were observed above the LDA.
2290	0055.00	LDA #03 contains four pieces of LWD and measures 4' high x 16' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 30' wide x 21' long x 2' deep. Fish were observed above the LDA.
2979	0077.00	LDA #04 contains three pieces of LWD and measures 4' high x 12' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 12' wide x 20' long x 1' deep. Fish were not observed above the LDA.
3664	0103.00	LDA #05 contains 14 pieces of LWD and measures 6' high x 35' wide x 35' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 6' wide x 30' long x 2' deep. There is a 3' high plunge over the LDA.
3762	0105.00	Tributary #01 enters on the left bank. It contributes approximately 30%

## North Fork Redwood Creek

to North Fork Redwood Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit, the water temperature downstream of the tributary was 53 degrees Fahrenheit, and the water temperature upstream of the confluence was 52 degrees Fahrenheit. The slope of the tributary is approximately 2%. The tributary is accessible to salmonids, but no fish were observed.

- |      |         |   |
|------|---------|---|
| 3797 | 0107.00 | There is a 2' high plunge.  |
| 3894 | 0112.00 | LDA #06 contains eight pieces of LWD and measures 2' high x 9' wide x 12' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 9' wide x 15' long x 2' deep. There is a 2' high plunge over the LDA. |
| 4218 | 0124.00 | There is a 1.5' high plunge.  |
| 5374 | 0171.00 | The channel changes from a G4 to an A4.   |
| 5486 | 0177.00 | There is a 4' high plunge.  |
| 5590 | 0182.00 | There is a 3' high plunge.  |
| 5659 | 0184.00 | LDA #07 contains five pieces of LWD and measures 4' high x 7' wide x 10' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 10' wide x 25' long x 3' deep. There is a 3' high plunge over the LDA. |
| 5713 | 0187.00 | There is a 2' high plunge.  |
| 5888 | 0200.00 | There is a 3' high plunge.  |
| 6287 | 0223.00 | LDA #08 contains three pieces of LWD and measures 8' high x 13' wide x 7' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from gravel to cobble and measures 20' wide x 25' long x 5' deep.                                   |

Tributary #02 enters on the right bank. It contributes approximately 5% to North Fork Redwood Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit, the water temperature downstream of the tributary was 56 degrees Fahrenheit, and the water temperature upstream of the confluence was 54 degrees Fahrenheit. The slope of the tributary is approximately 15% and it goes dry 30' upstream from the mouth. The tributary is not accessible to salmonids.

End of survey at 8' high plunge woody debris and root mass. The channel is dry for 20' upstream of the plunge.

## North Fork Redwood Creek

### 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.

## North Fork Redwood Creek

### LEVEL III and LEVEL IV HABITAT TYPES

#### RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

#### CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

#### FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

#### MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

#### SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

#### BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

#### ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

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

Stream Name: North Fork Redwood Creek

LLID: 1236082395043 Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T19NR16WS14 Latitude: 39:30:15.0N Longitude: 123:36:30.0

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
4	0	DRY	1.8	121	483	7.7									
60	20	FLATWATER	26.9	39	2345	37.2	5.7	0.3	0.6	196	11780	70	4218		28
3	0	NOSURVEY	1.3	18	55	0.9									
110	110	POOL	49.3	25	2727	43.3	7.4	0.7	1.4	182	20037	167	18357	134	31
46	11	RIFFLE	20.6	15	693	11.0	6.1	0.2	0.4	74	3396	17	790		24
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>					<b>Total Area (sq.ft.)</b>			<b>Total Volume (cu.ft.)</b>		
223	141				6303					35212			23365		

**Table 2 - Summary of Habitat Types and Measured Parameters**

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

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 (%)
28	7	LGR	12.6	14	390	6.2	5	0.2	0.5	75	2107	16	459		13	94
17	3	HGR	7.6	17	288	4.6	8	0.2	0.8	67	1141	11	182		30	96
1	1	CAS	0.4	15	15	0.2	7	0.5	0.9	84	84	42	42		80	95
21	9	RUN	9.4	21	434	6.9	5	0.4	1	105	2211	39	828		11	97
39	11	SRN	17.5	49	1911	30.3	6	0.3	0.9	271	10562	96	3726		41	96
96	96	MCP	43.0	24	2259	35.8	7	0.7	2.9	171	16374	156	14933	123	33	95
2	2	CCP	0.9	14	27	0.4	8	0.4	1.1	117	234	68	135	53	13	98
9	9	STP	4.0	41	365	5.8	7	0.7	2.8	312	2808	288	2592	237	24	95
2	2	CRP	0.9	32	64	1.0	8	0.8	2.5	263	525	286	573	254	20	98
1	1	DPL	0.4	12	12	0.2	8	1.3	2	96	96	125	125	125	30	96
4	0	DRY	1.8	121	483	7.7										
3	0	NS	1.3	18	55	0.9										

Total Units  
223

Total Units Fully Measured  
141

Total Length (ft.)  
6303

Total Area (sq.ft.)  
36141

Total Volume (cu.ft.)  
23595

**Table 3 - Summary of Pool Types**

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

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
107	107	MAIN	97	25	2651	97	7.4	0.7	181	19416	131	14060	32
2	2	SCOUR	2	32	64	2	7.5	0.8	263	525	254	509	20
1	1	BACKWATER	1	12	12	0	8.0	1.3	96	96	125	125	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
110	110	2727	20037	14693

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

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

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
96	MCP	87	15	16	63	66	18	19	0	0	0	0
2	CCP	2	1	50	1	50	0	0	0	0	0	0
9	STP	8	2	22	5	56	2	22	0	0	0	0
2	CRP	2	1	50	0	0	1	50	0	0	0	0
1	DPL	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
110	19	17	69	63	22	20	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.4



**Table 5 - Summary of Mean Percent Cover By Habitat Type**

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Dry Units: 4

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14 Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

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
28	7	LGR	0	0	0	0	10	0	0	90	0
17	3	HGR	0	35	0	0	0	0	5	60	0
1	1	CAS	0	10	20	0	0	0	15	55	0
46	11	TOTAL RIFFLE	0	16	4	0	4	0	5	71	0
21	9	RUN	17	18	5	0	17	0	0	43	0
39	11	SRN	4	9	3	0	19	1	1	63	0
60	20	TOTAL FLAT	10	13	4	0	18	1	1	54	0
96	96	MCP	18	30	26	0	3	1	2	18	2
2	2	CCP	25	0	30	0	10	0	0	35	0
9	9	STP	10	37	24	0	1	0	2	26	0
2	2	CRP	60	25	0	0	5	0	0	10	0
1	1	DPL	0	10	90	0	0	0	0	0	0
110	110	TOTAL POOL	18	30	26	0	3	1	2	19	1
3	0	NS									
223	141	TOTAL	16	28	23	0	4	1	2	24	1

**Table 6 - Summary of Dominant Substrates By Habitat Type**

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Dry Units: 4

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

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
28	7	LGR	0	0	14	71	14	0	0
17	3	HGR	0	0	0	67	33	0	0
1	1	CAS	0	0	0	0	0	100	0
21	9	RUN	0	11	56	22	11	0	0
39	11	SRN	0	9	27	55	0	9	0
96	96	MCP	11	28	29	23	6	2	0
2	2	CCP	0	50	0	50	0	0	0
9	9	STP	11	33	11	33	11	0	0
2	2	CRP	0	100	0	0	0	0	0
1	1	DPL	0	0	100	0	0	0	0

**Table 7 - Summary of Mean Percent Canopy for Entire Stream**

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

---

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
95	66	34	0	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: North Fork Redwood Creek LLID: 1236082395043 Drainage: Rockport  
 Survey Dates: 6/11/2012 to 6/20/2012 Survey Length (ft.): 6303 Main Channel (ft.): 6303 Side Channel (ft.): 0  
 Confluence Location: Quad: DUTCHMANS Legal Description: T19NR16WS14 Latitude: 39:30:15.0N Longitude: 123:36:30.0W

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 1**

Channel Type: G4	Canopy Density (%): 94.8	Pools by Stream Length (%): 45.0
Reach Length (ft.): 5374	Coniferous Component (%): 63.6	Pool Frequency (%): 51.8
Riffle/Flatwater Mean Width (ft.): 5.8	Hardwood Component (%): 36.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 77
Range (ft.): 6 to 17	Vegetative Cover (%): 99.6	2 to 2.9 Feet Deep: 23
Mean (ft.): 10	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.4	Occurrence of LWD (%): 19	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 52 - 57 Air (F): 50 - 69	LWD per 100 ft.:	Mean Pool Shelter Rating: 30
Dry Channel (ft): 483	Riffles: 4	
	Pools: 9	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 1 Sand: 2 Gravel: 89 Sm Cobble: 5 Lg Cobble: 2 Boulder: 1 Bedrock: 0		
Embeddedness Values (%): 1. 40.9 2. 43.2 3. 13.6 4. 0.0 5. 2.3		

**STREAM REACH: 2**

Channel Type: A4	Canopy Density (%): 96.1	Pools by Stream Length (%): 33.2
Reach Length (ft.): 929	Coniferous Component (%): 76.9	Pool Frequency (%): 41.5
Riffle/Flatwater Mean Width (ft.): 5.8	Hardwood Component (%): 23.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 91
Range (ft.): 6 to 11	Vegetative Cover (%): 99.4	2 to 2.9 Feet Deep: 9
Mean (ft.): 9	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.4	Occurrence of LWD (%): 22	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 55 - 56 Air (F): 56 - 72	LWD per 100 ft.:	Mean Pool Shelter Rating: 36
Dry Channel (ft): 0	Riffles: 10	
	Pools: 18	
	Flat: 9	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 82 Sm Cobble: 14 Lg Cobble: 0 Boulder: 5 Bedrock: 0		
Embeddedness Values (%): 1. 40.9 2. 31.8 3. 18.2 4. 0.0 5. 9.1		

**Table 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

**Mean Percentage of Dominant Stream Bank Substrate**

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	1	8	3.2
Boulder	9	6	5.3
Cobble / Gravel	29	23	18.4
Sand / Silt / Clay	102	104	73.0

**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	0	0	0.0
Hardwood Trees	30	20	17.7
Coniferous Trees	111	121	82.3
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 2

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

StreamName: North Fork Redwood Creek

LLID: 1236082395043

Drainage: Rockport

Survey Dates: 6/11/2012 to 6/20/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T19NR16WS14

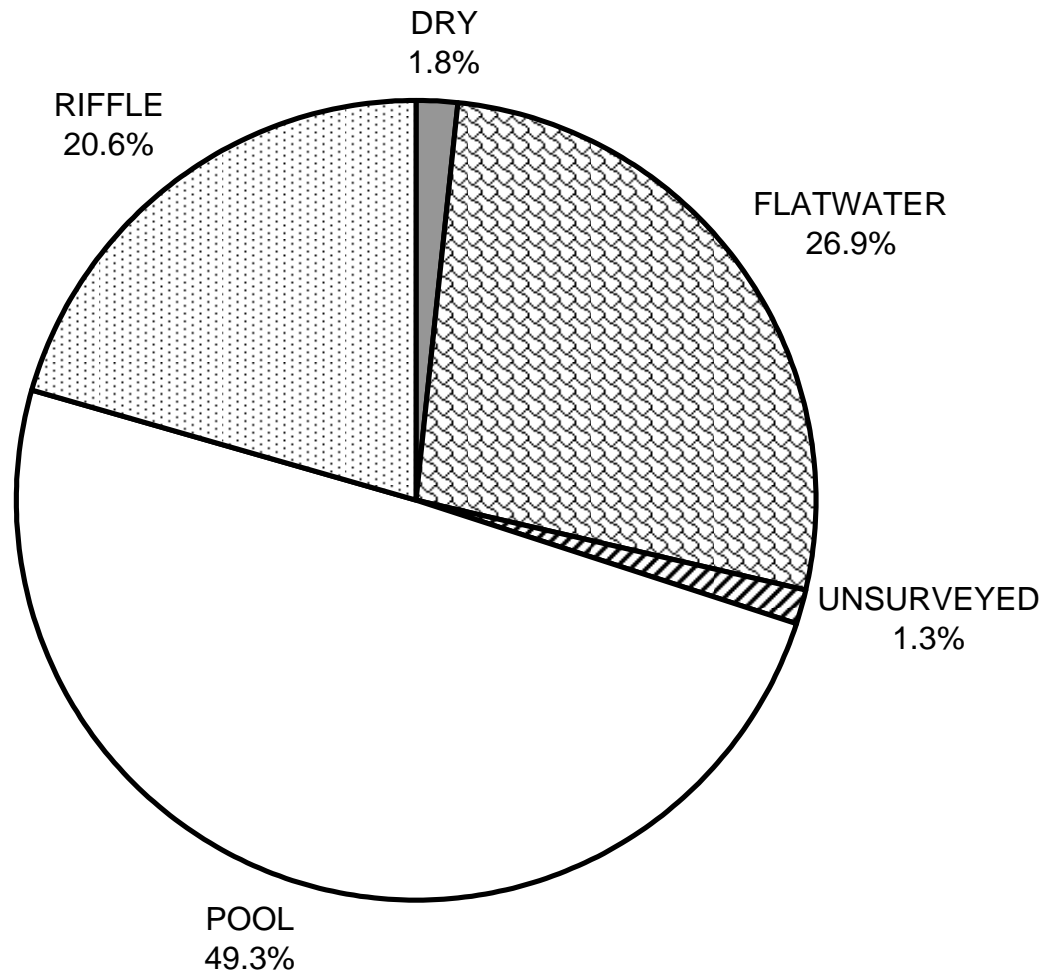
Latitude: 39:30:15.0N

Longitude: 123:36:30.0W

---

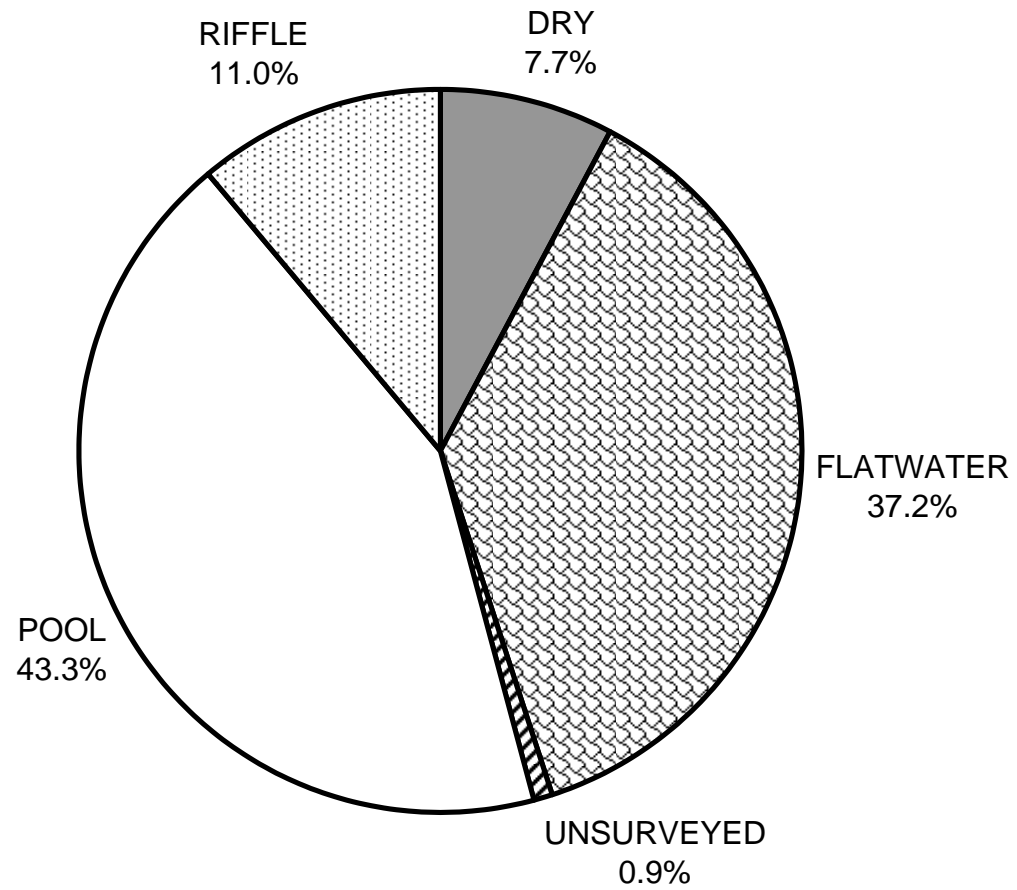
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	10	18
SMALL WOODY DEBRIS (%)	16	13	30
LARGE WOODY DEBRIS (%)	4	4	26
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	4	18	3
AQUATIC VEGETATION (%)	0	1	1
WHITEWATER (%)	5	1	2
BOULDERS (%)	71	54	19
BEDROCK LEDGES (%)	0	0	1

# NORTH FORK REDWOOD CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

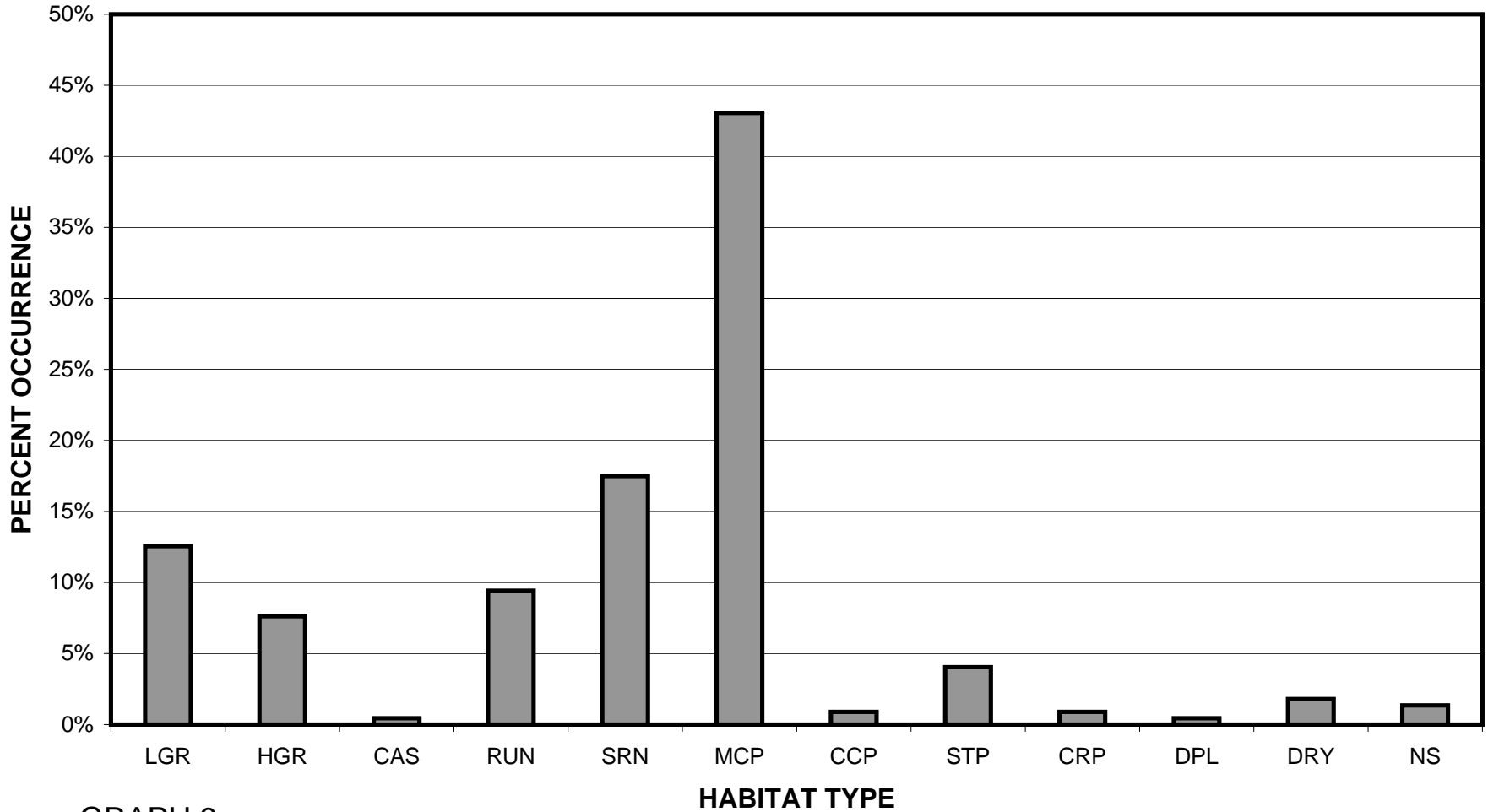
# NORTH FORK REDWOOD CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

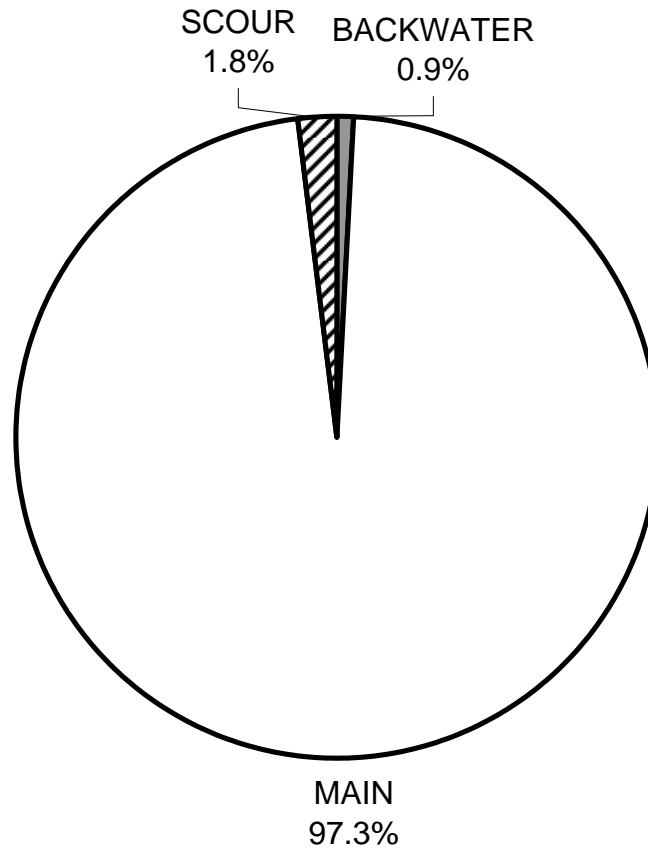


# NORTH FORK REDWOOD CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



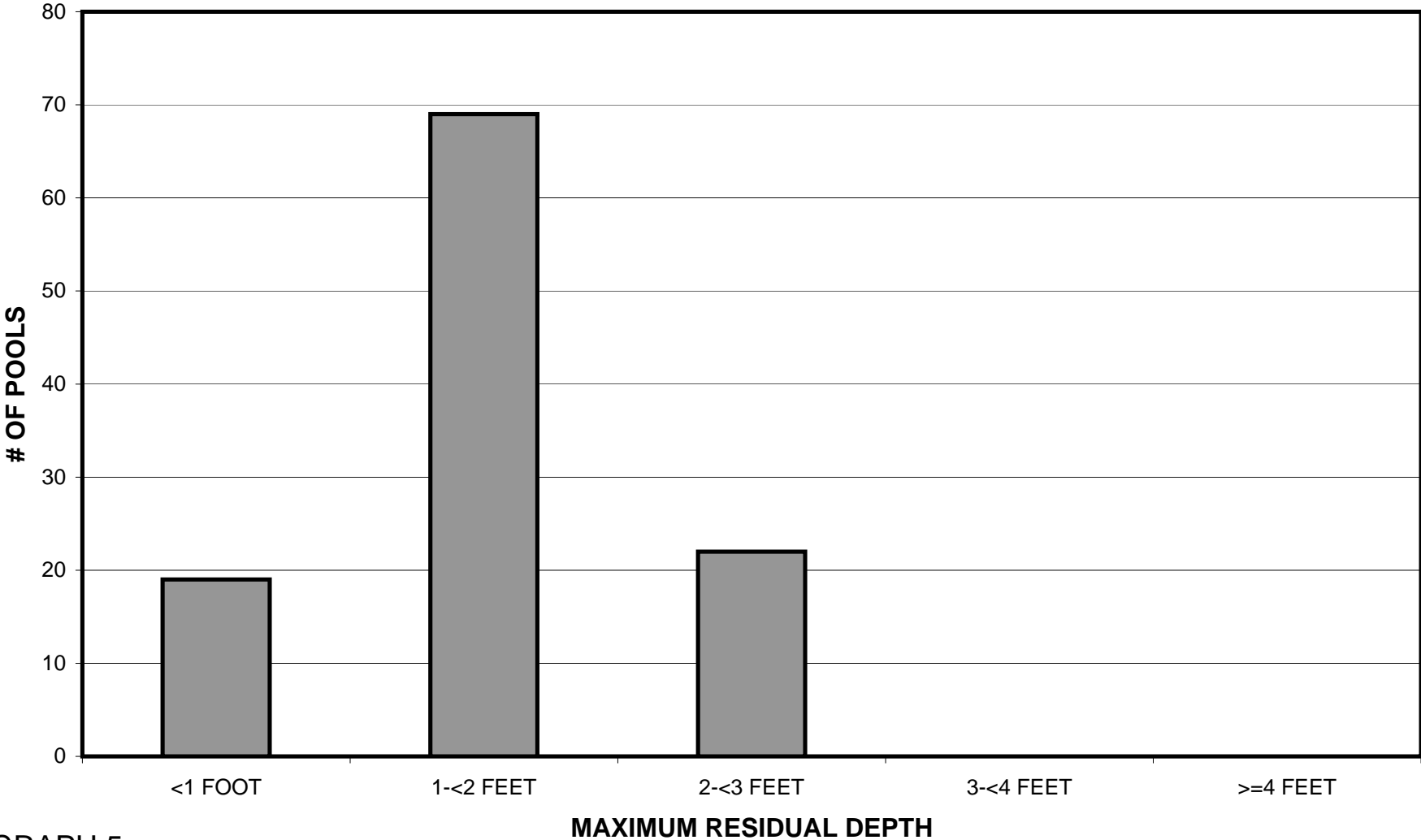
GRAPH 3

# NORTH FORK REDWOOD CREEK 2012 POOL TYPES BY PERCENT OCCURRENCE



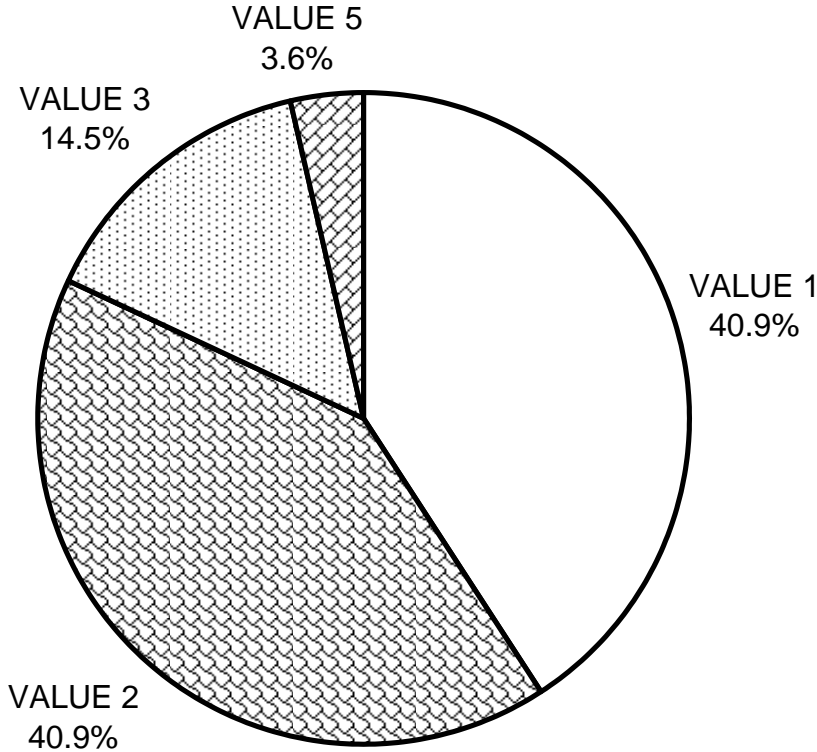
GRAPH 4

**NORTH FORK REDWOOD CREEK 2012  
MAXIMUM DEPTH IN POOLS**



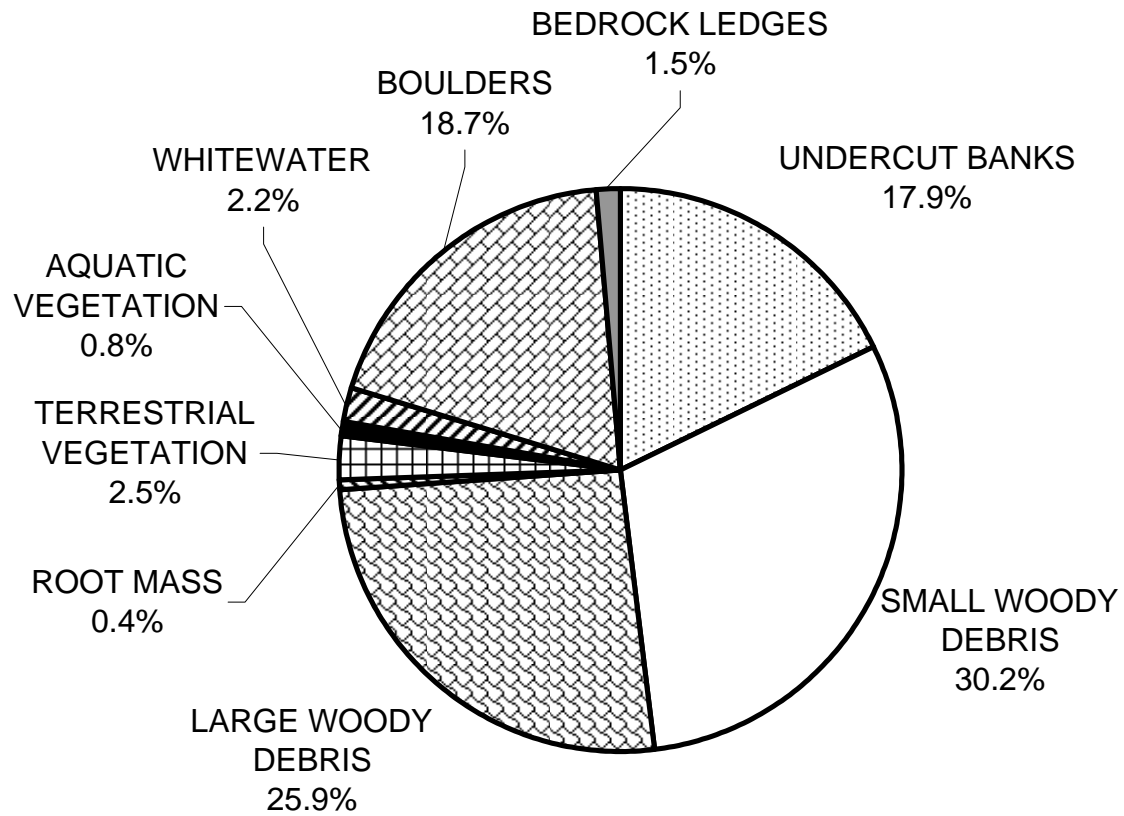
GRAPH 5

# NORTH FORK REDWOOD CREEK 2012 PERCENT EMBEDDEDNESS



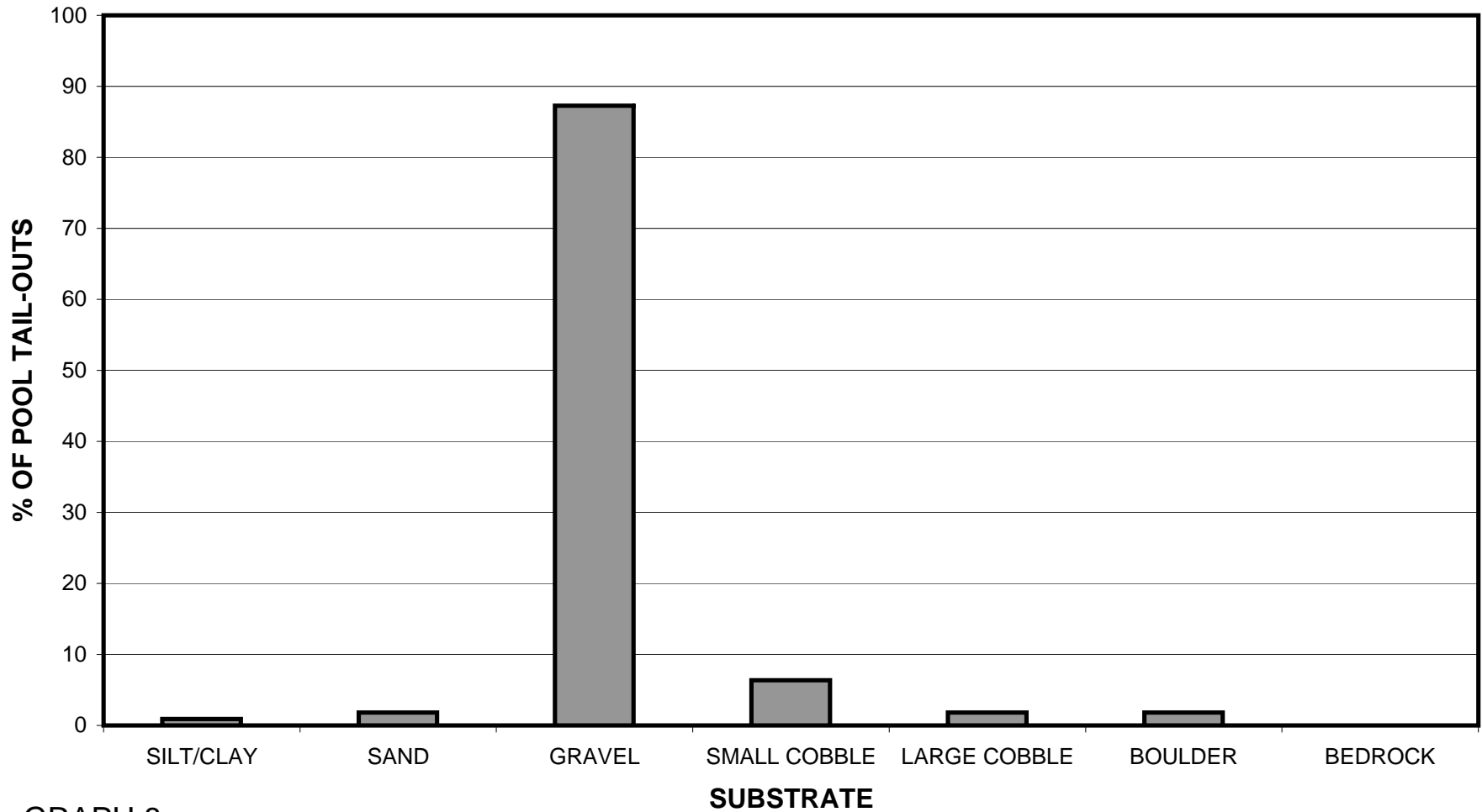
GRAPH 6

# NORTH FORK REDWOOD CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



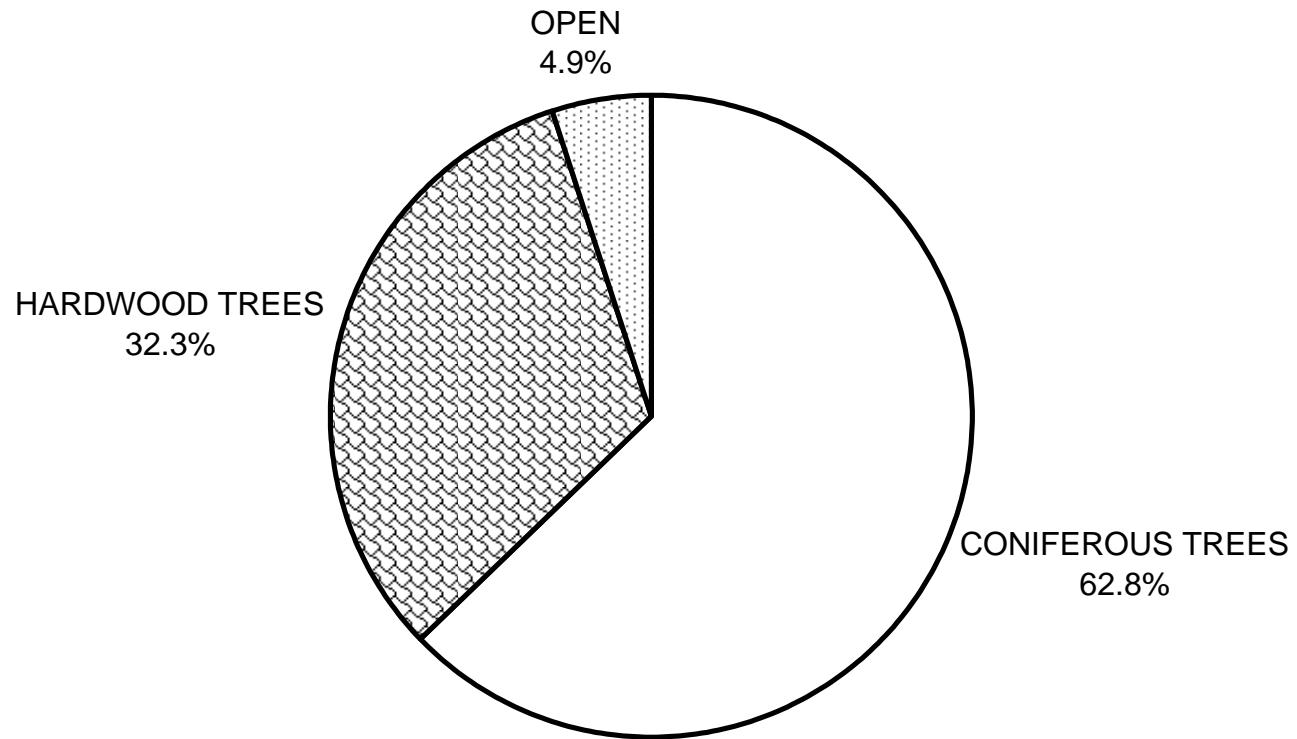
GRAPH 7

# NORTH FORK REDWOOD CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



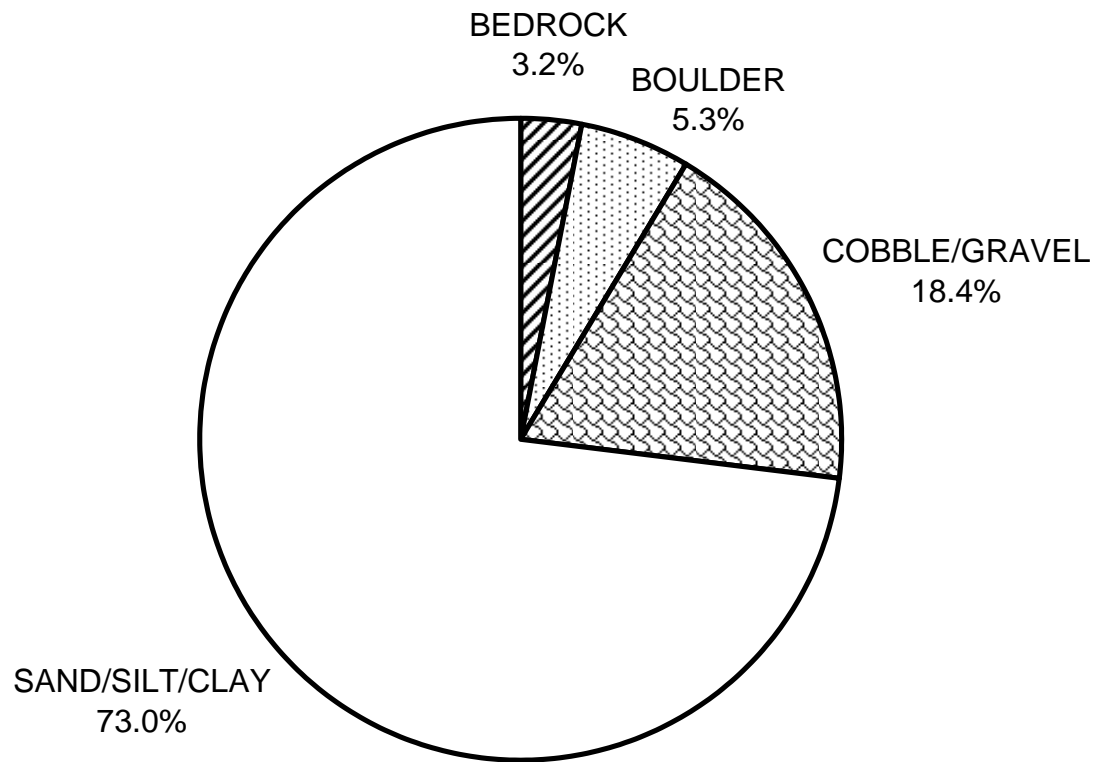
GRAPH 8

# NORTH FORK REDWOOD CREEK 2012 MEAN PERCENT CANOPY



GRAPH 9

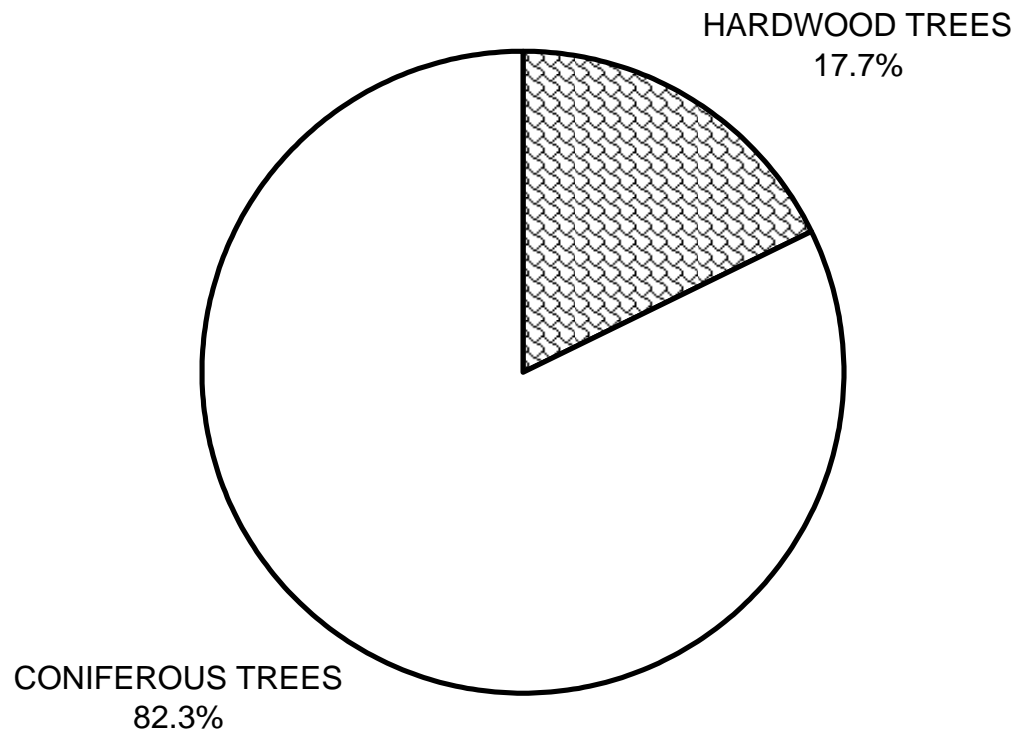
# NORTH FORK REDWOOD CREEK 2012 DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10



**NORTH FORK REDWOOD CREEK 2012  
DOMINANT BANK VEGETATION IN SURVEY REACH**



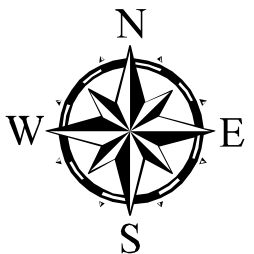
GRAPH 11

**Map 1**  
**North Fork Redwood Creek**  
**Ten Mile River Watershed**  
**Northspur Quad, Mendocino County**



End Survey

Start Survey



- Reach 1, Channel Type G4
- - - Reach 2, Channel Type A4

