STREAM INVENTORY REPORT

North Fork Garcia River

INTRODUCTION

A stream inventory was conducted beginning August 17 and ending August 31, 2004 on North Fork Garcia River. The survey began at the confluence with Garcia River and extended upstream 6.8 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in North Fork Garcia River.

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

North Fork Garcia River is a tributary to Garcia River, a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). North Fork Garcia River's legal description at the confluence with Garcia River is T12N R16W S10. Its location is 38°55'49" north latitude and 123°37'52" west longitude, LLID number 1236211389238. North Fork Garcia River is a third order stream and has approximately 7.59 miles of blue line stream according to the USGS Eureka Hill 7.5 minute quadrangle. North Fork Garcia River drains a watershed of approximately 10.4 square miles. Elevations range from about 45 feet at the mouth of the creek to 1,464 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 Highway 1 to Point Arena. Travel east on Riverside Road then turn left onto Buckridge Road after 2.8 miles. Travel 1.6 miles to the end of Buckridge Road then south on a trail along Garcia River 0.5 miles. This is the mouth of North Fork Garcia River.

METHODS

The habitat inventory conducted in North Fork Garcia River follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) members 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.

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

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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. All pools are fully sampled.

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 Garcia River 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 Garcia River 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.

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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 Garcia River, 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 North Fork Garcia River, 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 North Fork Garcia River, 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 Garcia River, 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.

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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.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 1.0.37, 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
- 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 North Fork Garcia River 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

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- 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 August 17 to August 31, 2004, was conducted by A. Salyer and S. Thompson (CCC). The total length of the stream surveyed was 35,663 feet with an additional 888 feet of side channel.

Stream flow was subterranean at the mouth of North Fork Garcia during the survey period.

North Fork Garcia River is a B3 channel type for 28,743.5 feet of the stream surveyed (Reach 1), an F2 channel type for 1,548 feet of the stream surveyed (Reach 2), and an F3 channel type for 5,460 feet of the stream surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools; very stable plan and profile; stable banks and cobble-dominant substrates. F2 channels are entrenched, meandering riffle/pool channels on low gradients with high width/depth ratio and boulder-dominant substrates. F3 channels are entrenched, meandering riffle/pool channels on low gradients with a high width/depth ratio and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 58 to 63 degrees Fahrenheit. Air temperatures ranged from 61 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% flatwater units, 32% riffle units, 31% pool units, and 4% dry units (Graph 1). Based on total length of Level II habitat types there were 38% riffle units, 37% flatwater units, 14% pool units, and 11% dry units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 23%; low-gradient riffles, 21%; and step runs, 21% (Graph 3). Based on percent total length, step runs made up 28%, low-gradient riffles 23%, and high-gradient riffles 15%.

A total of 78 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 77%, and comprised 76% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-two of the 78 pools (54%) had a residual depth of three feet or greater (Graph 5).

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The depth of cobble embeddedness was estimated at pool tail-outs. Of the 78 pool tail-outs measured, 37 had a value of 1 (47.4%); 13 had a value of 2 (16.7%); 7 had a value of 3 (9%); 21 had a value of 5 (26.9%) (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 like bedrock, log sills, and boulders.

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 30, flatwater habitat types had a mean shelter rating of 43, and pool habitats had a mean shelter rating of 58 (Table 1). Of the pool types, the main-channel pools had a mean shelter rating of 47, scour pools had a mean shelter rating of 98 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in North Fork Garcia River. Graph 7 describes the pool cover in North Fork Garcia River. Boulders are 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 41% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 21% of pool tail-outs.

The mean percent canopy density for the surveyed length of North Fork Garcia River was 96%. The mean percentages of hardwood and coniferous trees were 81% and 14%, respectively with four percent of the canopy open. Graph 9 describes the mean percent canopy in North Fork Garcia River.

For the stream reach surveyed, the mean percent right bank vegetated was 46%. The mean percent left bank vegetated was 50%. The dominant elements composing the structure of the stream banks consisted of 6% bedrock, 3% boulder, 36% cobble/gravel, 55% sand/silt/clay, (Graph 10). Deciduous trees were the dominant vegetation type observed in 73% of the units surveyed. Additionally, 22% of the units surveyed had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Salmonids were observed up to 28,743 feet by bank observation. No other biological inventory was conducted on North Fork Garcia River.

DISCUSSION

North Fork Garcia River is a B3 channel type for the first 28,743.5 feet of the stream surveyed (Reach 1), an F2 channel type for the next 1,548 feet (Reach 2), and an F3 channel type for the remaining 5,460 feet (Reach 3). The suitability of B3 channel types for fish habitat improvement structures is as follows: Excellent for plunge weirs, boulder clusters and bank placed boulder, single and opposing wing-deflectors and log cover. The suitability of F2 channel types for fish

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habitat improvement structures is as follows: Fair for plunge weirs, single and opposing wing-deflectors, and log cover. The suitability of F3 channel types for fish habitat improvement structures is as follows: Good for bank-placed boulders; single and opposing wing-deflectors. Fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days August 17 to 31, 2004 ranged from 58 to 63 degrees Fahrenheit. Air temperatures ranged from 61 to76 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.

Riffle habitat types comprised 38% of the total length of this survey, flatwater 37%, and pools 14%. The pools are relatively deep, with 42 of the 78 (54%) pools having a maximum residual depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

Fifty of the 78 pool tail-outs measured had embeddedness ratings of 1 or 2. Seven of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-one 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.

Forty-eight of the 78 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 58. The shelter rating in the flatwater habitats was 43. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in North Fork Garcia River. Boulders are 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 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 96%. Reach 1 had a canopy density of 95%, Reach 2 had a canopy density of 98%, and Reach 3 had a canopy density of 98%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate to low at 46% and 50%, 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)   North Fork Garcia River should be managed as an anadromous, natural production stream.

2)   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 and August temperature extreme period should be performed for 3 to 5 years.

3)   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.

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

5)   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.

6)   There are several log debris accumulations present on North Fork Garcia River that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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:
0000	001.00	Start of survey at confluence with Garcia River.
2900	0003.00	Salmonids observed.
1585	0018.00	Salmonids observed.
1949	0020.00	Large debris accumulation (LDA) measures 45' x 8' x 12', not retaining sediment.
2317	0025.00	LDA measures 40' x 7' x 15', not retaining sediment.
2687	0028.00	Left bank tributary.
3098	0033.00	Channel type measured.
3272	0034.00	Salmonids observed.

3821	0040.00	LDA measures 45' x 8' x 20'.
12461	0088.00	Salmonids observed.
12586	0090.00	Right bank tributary, non-fish bearing.
13897	0101.00	Salmonids observed.
13930	0102.00	LDA measures 10' x 10' x 15'.
13930	0102.00	Small waterfall through LDA.
14026	0104.00	LDA measures 50' x 15' x 40', not retaining sediment.
14739	0107.00	Salmonids observed.
16003	0117.00	Salmonids observed.
19381	0142.00	LDA measures 30' x 10' x 40'.
21098	0151.00	LDA measures 30' x 8' x 20'.
21445	0156.00	Right bank tributary.
23536	0164.00	Left bank tributary.
25073	0175.01	LDA measures 20' x 15' x 10'.
25073	0176.00	Left bank tributary, non-fish bearing.
25964	0183.00	Salmonids observed.
26258	0188.00	Dry right bank tributary.
27004	0191.00	LDA measures 50' x 10' x 12', not retaining sediment.
27328	0194.00	Salmonids observed.
27670	0198.00	LDA measures 30' x 7' x 10'.
27670	0198.00	Dry right bank tributary.
27670	0198.00	Waterfall with 8' high plunge. Waterfall with 25' high plunge.
28654	0200.00	Channel type change.

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28743	0202.00	Salmonids observed.
29523	0204.00	Dry or subterranean flow.
29721	0205.00	LDA measures 40' x 6' x 10', retaining sediment..
29979	0206.00	Wooden bridge.
30144	0207.00	Right bank tributary.
30202	0208.00	Channel type change.
30570	0212.00	Channel type measured.
30750	0214.00	Right bank tributary.
31082	0217.00	Left bank tributary.
31886	0223.00	LDA measures 20' x 10' x 20'.
32469	0230.00	Right bank tributary.
33109	0231.00	LDA measures 30' x 12' x 40'. Dry or subterranean flow.
34939	0243.00	Steel culvert at Graphite Road crossing.
35662	0245.00	End of survey. No fish observed since habitat unit 202. Salmonids observed above falls, but not in abundance.

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<u>LEVEL III and LEVEL IV HABITAT TYPES</u>

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}

<u>ADDITIONAL UNIT DESIGNATIONS</u>
Dry	(DRY)	[7.0]
Culvert	(CUL)	[8.0]
Not Surveyed	(NS)	[9.0]
Not Surveyed due to a marsh	(MAR)	[9.1]

TABLES AND GRAPHS

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

Stream Name: North Fork Garcia River LLID: 1236211389238 Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004

Confluence Location: Quad: EUREKA HILL Legal Description: T12NR16WS10 Latitude: 38:55:26.0N Longitude: 123:37:16.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Percent 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
10	1	DRY	3.9	388	3875	10.6									0
84	16	FLATWATER	33.1	161	13548	37.1	14.2	0.7	1.7	1465	123088	1233	103554		43
78	78	POOL	30.7	68	5278.5	14.4	16.5	1.5	3.5	1135	88540	2225	173589	1867	58
82	11	RIFFLE	32.3	169	13849	37.9	10.8	0.6	1.2	555	45540	388	31790		30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
254	106	36550.5	257167.3	306932.3

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: North Fork Garcia River LLID: 1236211389238 Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004

Confluence Location: Quad: EUREKA HILL Legal Description: T12NR16WS10 Latitude: 38:55:26.0N Longitude: 123:37:16.0W

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 (%)
54	8	LGR	21.3	153	8268	22.6	10	0.5	2.2	537	29025	357	19302		26	95
28	3	HGR	11.0	199	5583	15.3	14	0.6	1.7	603	16884	468	13112		38	96
31	5	RUN	12.2	105	3267	8.9	16	0.7	2.8	1138	35272	920	28516		31	96
53	11	SRN	20.9	194	10261	28.1	13	0.6	4.5	1614	85553	1375	72875		49	96
59	59	MCP	23.2	67	3929	10.7	16	1.5	6.8	1090	64334	2070	122122	1705	47	96
1	1	CCP	0.4	65	65	0.2	20	1.2	2.9	1300	1300	1950	1950	1560	80	97
7	7	CRP	2.8	73	513	1.4	16	1.6	5.2	1200	8398	2491	17436	2120	56	94
5	5	LSL	2.0	76	382	1.0	19	1.5	4.4	1487	7435	2321	11606	1958	118	97
5	5	LSR	2.0	73	364	1.0	19	2.3	6.3	1354	6769	3961	19805	3659	137	96
1	1	PLP	0.4	26	26	0.1	13	1.8	3.8	304	304	669	669	548		100
10	1	DRY	3.9	388	3875	10.6	0			0	0		.		0	69

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
254	106	36550.5	255273.6	307395.3

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Table 3 - Summary of Pool Types

Stream Name: North Fork Garcia River   LLID: 1236211389238   Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004

Confluence Location: Quad: EUREKA HILL   Legal Description: T12NR16WS10   Latitude: 38:55:26.0N   Longitude: 123:37:16.0W

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
60	60	MAIN	77	67	3994	76	16.2	1.5	1094	65634	1702	102150	47
18	18	SCOUR	23	71	1285	24	17.6	1.8	1273	22906	2415	43474	98

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
78	78	5278.5	88539.66	145624.1

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

Stream Name: North Fork Garcia River   LLID: 1236211389238   Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004

Confluence Location: Quad: EUREKA HILL   Legal Description: T12NR16WS10   Latitude: 38:55:26.0N   Longitude: 123:37:16.0W

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
59	MCP	76	0	0	2	3	29	49	16	27	12	20
1	CCP	1	0	0	0	0	1	100	0	0	0	0
7	CRP	9	0	0	1	14	2	29	0	0	4	57
5	LSL	6	0	0	0	0	0	0	4	80	1	20
5	LSR	6	0	0	1	20	0	0	0	0	4	80
1	PLP	1	0	0	0	0	0	0	1	100	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
78		0	0	4	5	32	41	21	27	21	27

Mean Maximum Residual Pool Depth (ft.): 3.5

North Fork Garcia River

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: North Fork Garcia River   LLID: 1236211389238   Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004   Dry Units: 10

Confluence Location: Quad: EUREKA HILL   Legal Description: T12NR16WS10   Latitude: 38:55:26.0N   Longitude: 123:37:16.0W

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
54	8	LGR	0	3	4	0	0	0	0	56	0
28	3	HGR	0	0	0	0	0	0	3	97	0
82	11	TOTAL RIFFLE	0	2	3	0	0	0	1	67	0
31	5	RUN	0	14	8	0	4	0	14	40	0
53	11	SRN	0	21	8	1	5	0	1	32	4
84	16	TOTAL FLAT	0	19	8	1	5	0	5	35	3
59	59	MCP	4	8	14	4	1	0	1	55	6
1	1	CCP	0	0	0	0	0	0	0	100	0
7	7	CRP	1	17	36	11	0	0	0	34	0
5	5	LSL	4	28	54	8	6	0	0	0	0
5	5	LSR	7	21	23	39	2	0	0	8	0
1	0	PLP									
78	77	TOTAL POOL	4	11	19	7	2	0	1	47	5
254	105	TOTAL	3	11	16	5	2	0	1	47	4

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: North Fork Garcia River   LLID: 1236211389238   Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004   Dry Units: 10

Confluence Location: Quad: EUREKA HILL   Legal Description: T12NR16WS10   Latitude: 38:55:26.0N   Longitude: 123:37:16.0W

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
54	8	LGR	0	0	25	50	25	0	0
28	3	HGR	0	0	0	67	0	33	0
31	5	RUN	0	0	40	40	20	0	0
53	11	SRN	0	0	9	55	36	0	0
59	59	MCP	0	22	37	25	12	3	0
1	1	CCP	0	0	0	0	100	0	0
7	7	CRP	0	14	71	0	14	0	0
5	5	LSL	0	20	40	40	0	0	0
5	5	LSR	0	20	80	0	0	0	0
1	1	PLP	0	0	100	0	0	0	0

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Table 8 - Fish Habitat Inventory Data Summary

Stream Name: North Fork Garcia River   LLID: 1236211389238   Drainage: Garcia River

Survey Dates: 8/17/2004 to 8/31/2004   Survey Length (ft.): 36550.5   Main Channel (ft.): 35662.5   Side Channel (ft.): 888

Confluence Location: Quad: EUREKA HILL   Legal Description: T12NR16WS10   Latitude: 38:55:26.0N   Longitude: 123:37:16.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B3	Canopy Density (%): 95	Pools by Stream Length (%): 16
Reach Length (ft.): 28654.5	Coniferous Component (%): 12	Pool Frequency (%): 32
Riffle/Flatwater Mean Width (ft.): 13.5	Deciduous Component (%): 88	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Deciduous Trees	< 2 Feet Deep: 5
Range (ft.): 18 to 47	Vegetative Cover (%): 72	2 to 2.9 Feet Deep: 36
Mean (ft.): 36	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 29
Std. Dev.: 6	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 30
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 14	Mean Max Residual Pool Depth (ft.): 3.7
Water (F): 58 - 63 Air (F): 61 - 75	LWD per 100 ft.:	Mean Pool Shelter Rating: 64
Dry Channel (ft): 3525	Riffles: 1	
	Pools: 3	
	Flat: 1	

Pool Tail Substrate (%): Silt/Clay: 0   Sand: 0   Gravel: 36   Sm Cobble: 20   Lg Cobble: 14   Boulder: 24   Bedrock: 6

Embeddedness Values (%): 1. 42   2. 15   3. 11   4. 0   5. 32

STREAM REACH: 2

Channel Type: F2	Canopy Density (%): 98	Pools by Stream Length (%): 6
Reach Length (ft.): 1636	Coniferous Component (%): 2	Pool Frequency (%): 22
Riffle/Flatwater Mean Width (ft.): 12.0	Deciduous Component (%): 98	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Deciduous Trees	< 2 Feet Deep: 0
Range (ft.): 30 to 32	Vegetative Cover (%): 71	2 to 2.9 Feet Deep: 100
Mean (ft.): 31	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 1	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 0	Mean Max Residual Pool Depth (ft.): 2.7
Water (F): 59 - 60 Air (F): 62 - 71	LWD per 100 ft.:	Mean Pool Shelter Rating: 5
Dry Channel (ft): 198	Riffles: 1	
	Pools: 0	
	Flat: 12	

Pool Tail Substrate (%): Silt/Clay: 0   Sand: 0   Gravel: 100   Sm Cobble: 0   Lg Cobble: 0   Boulder: 0   Bedrock: 0

Embeddedness Values (%): 1. 100   2. 0   3. 0   4. 0   5. 0

North Fork Garcia River

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: F3	Canopy Density (%): 98	Pools by Stream Length (%): 11
Reach Length (ft.): 5372	Coniferous Component (%): 33	Pool Frequency (%): 27
Riffle/Flatwater Mean Width (ft.): 11.5	Deciduous Component (%): 67	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Deciduous Trees	< 2 Feet Deep: 10
Range (ft.): 25 to 31	Vegetative Cover (%): 95	2 to 2.9 Feet Deep: 60
Mean (ft.): 29	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 20
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 10
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 29	Mean Max Residual Pool Depth (ft.): 2.8
Water (F): 58 - 61 Air (F): 62 - 76	LWD per 100 ft.:	Mean Pool Shelter Rating: 31
Dry Channel (ft): 152	Riffles: 0	
	Pools: 3	
	Flat: 3	

Pool Tail Substrate (%):   Silt/Clay: 0   Sand: 0   Gravel: 60   Sm Cobble: 30   Lg Cobble: 10   Boulder: 0   Bedrock: 0

Embeddedness Values (%):   1. 70   2. 30   3. 0   4. 0   5. 0

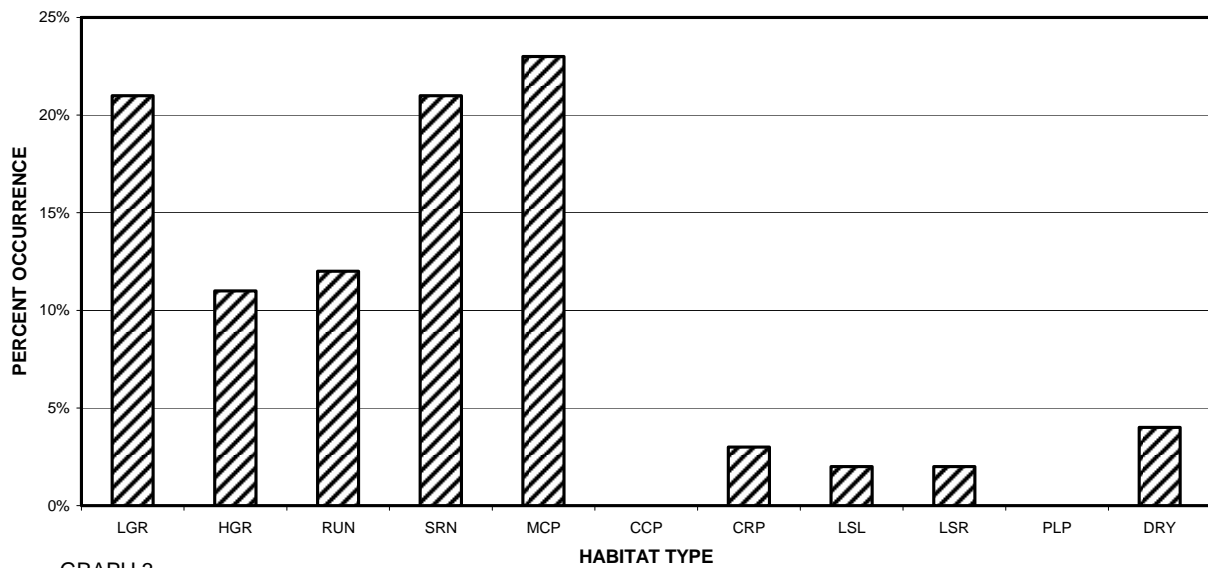**Garcia River, North Fork 2004**
HABITAT TYPES BY PERCENT OCCURRENCE

DRY 4%
RIFFLE 32%
FLATWATER 33%
POOL 31%

GRAPH 1

16
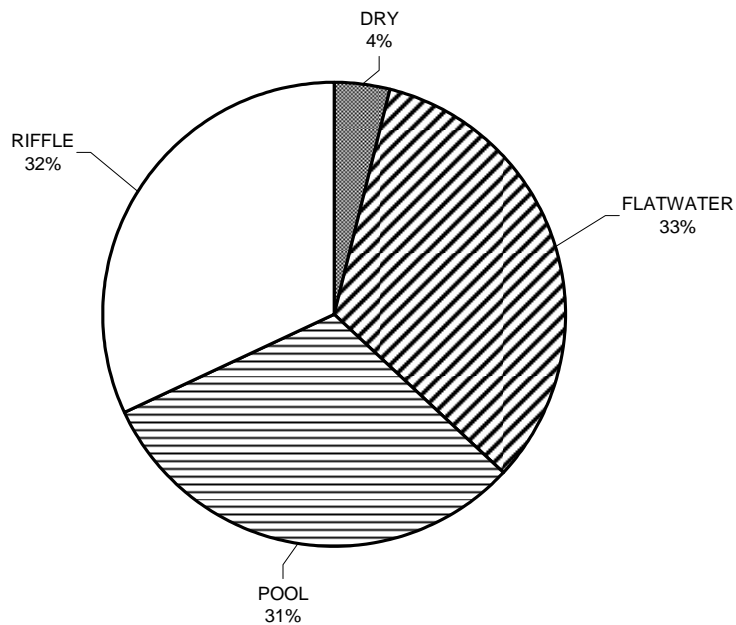
North Fork Garcia River

Garcia River, North Fork 2004
HABITAT TYPES BY PERCENT TOTAL LENGTH

DRY
11%

RIFFLE
38%

FLATWATER
37%
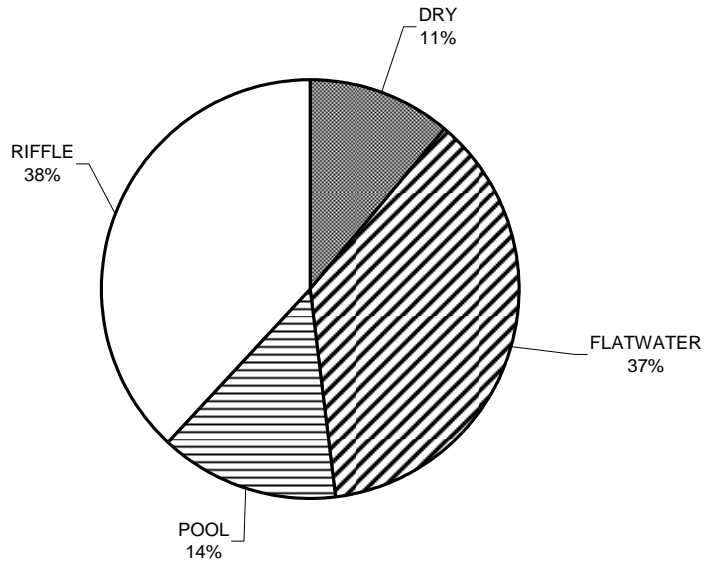
POOL
14%

GRAPH 2
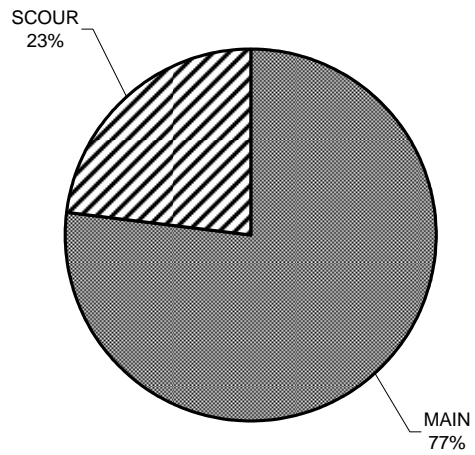
Garcia River, North Fork 2004
HABITAT TYPES BY PERCENT OCCURRENCE

GRAPH 3

Garcia River, North Fork 2004
POOL TYPES BY PERCENT OCCURRENCE

SCOUR
23%

MAIN
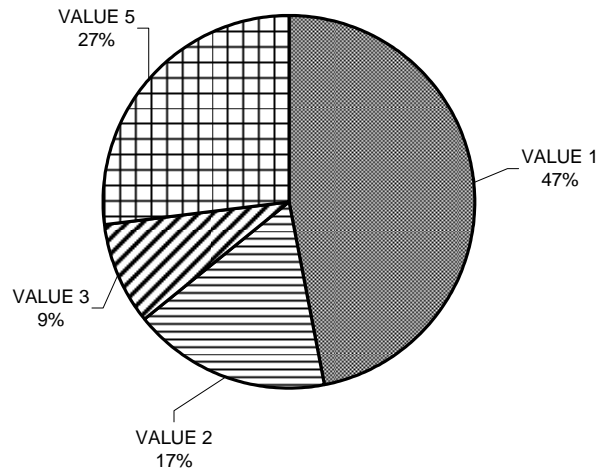77%

GRAPH 4

Garcia River, North Fork 2004
MAXIMUM DEPTH IN POOLS

GRAPH 5

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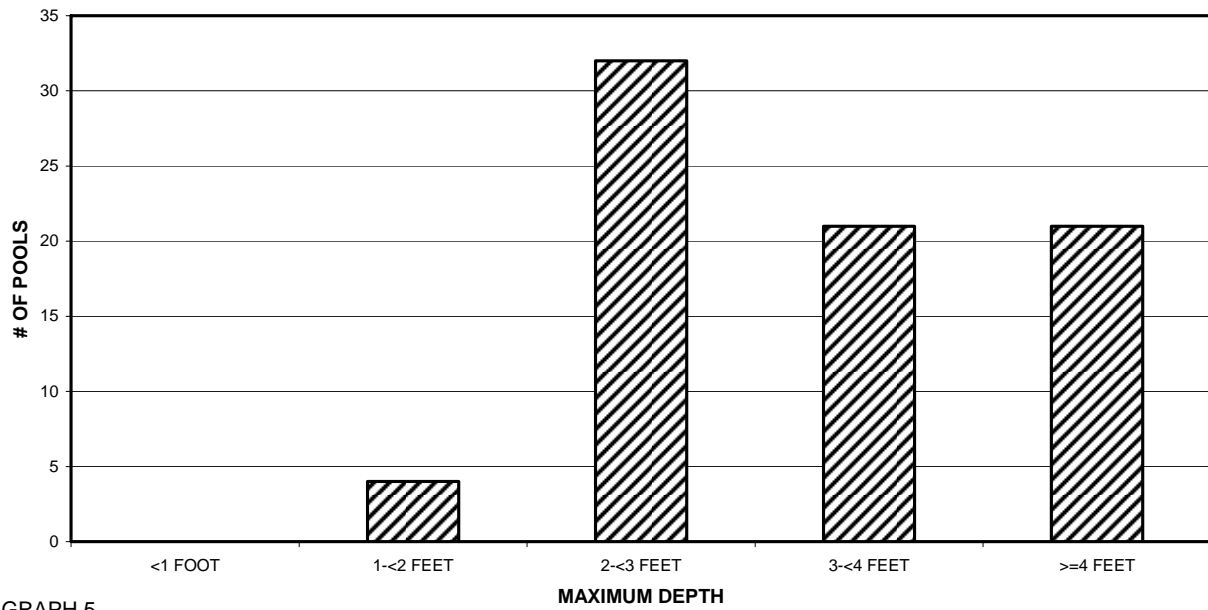
North Fork Garcia River

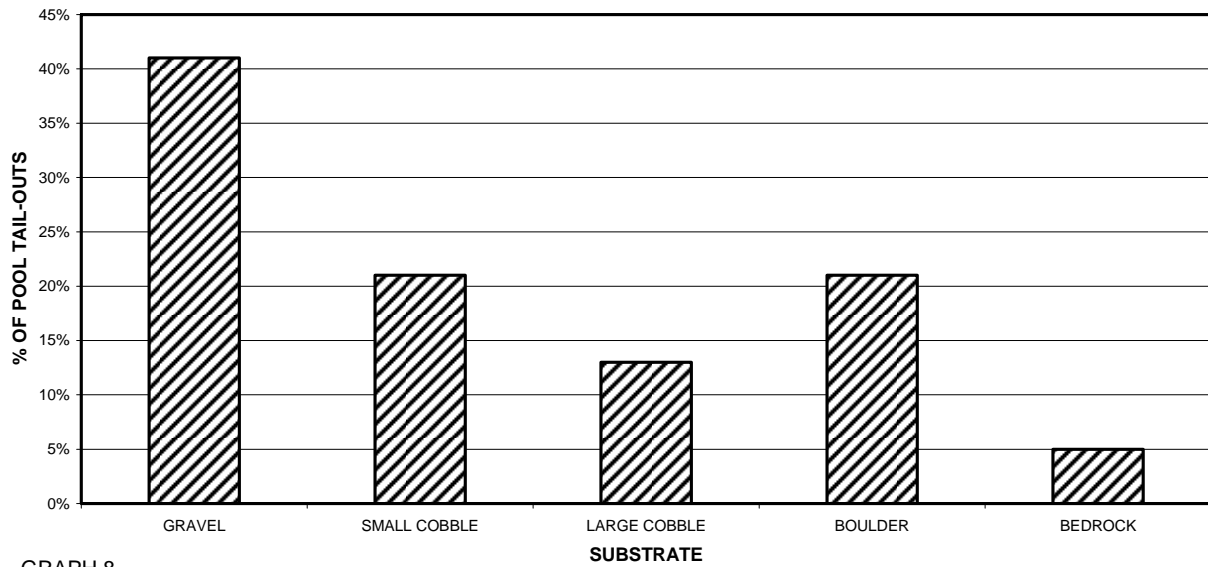**Garcia River, North Fork 2004**
PERCENT EMBEDDEDNESS

VALUE 5
27%

VALUE 1
47%

VALUE 3
9%

VALUE 2
17%

GRAPH 6

Garcia River, North Fork 2004
MEAN PERCENT COVER TYPES IN POOLS

BEDROCK LEDGES
5.0%

UNDERCUT BANKS
4.0%

SMALL WOODY DEBRIS
11.0%

LARGE WOODY DEBRIS
19.0%

BOULDERS
47.0%

ROOT MASS
7.0%

TERRESTRIAL VEG
2.0%

WHITEWATER
1.0%
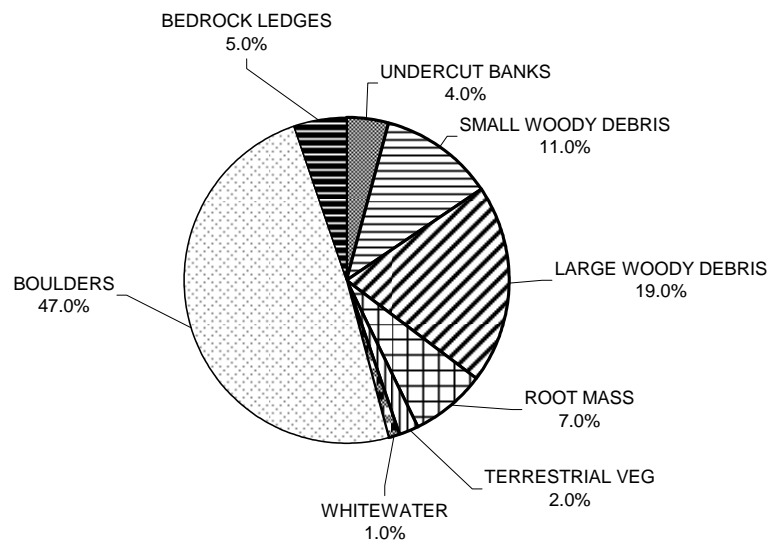
GRAPH 7

North Fork Garcia River

Garcia River, North Fork 2004
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

GRAPH 8

Garcia River, North Fork 2004
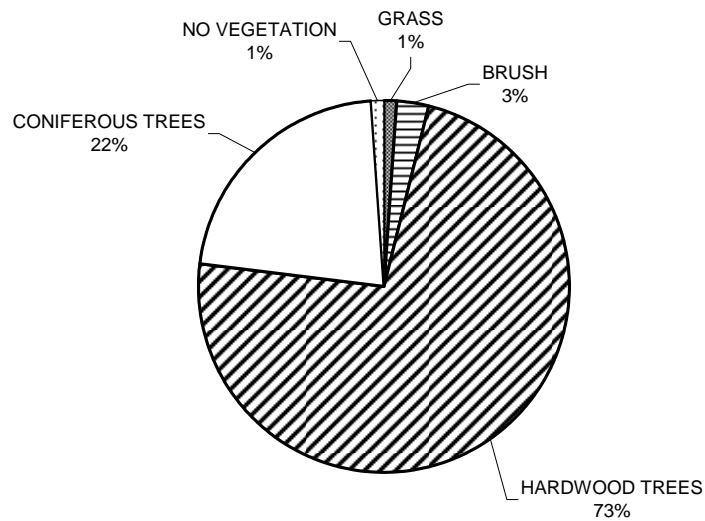**MEAN PERCENT CANOPY**

OPEN
4%

CONIFEROUS TREES
14%

HARDWOOD TREES
81%
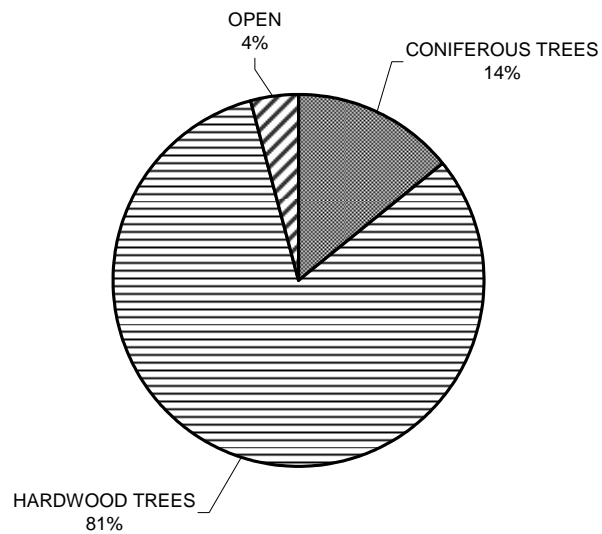
GRAPH 9

Garcia River, North Fork 2004
DOMINANT BANK COMPOSITION IN SURVEY REACH

BEDROCK
6%

BOULDER
3%

COBBLE/GRAVEL
36%

SAND/SILT/CLAY
55%
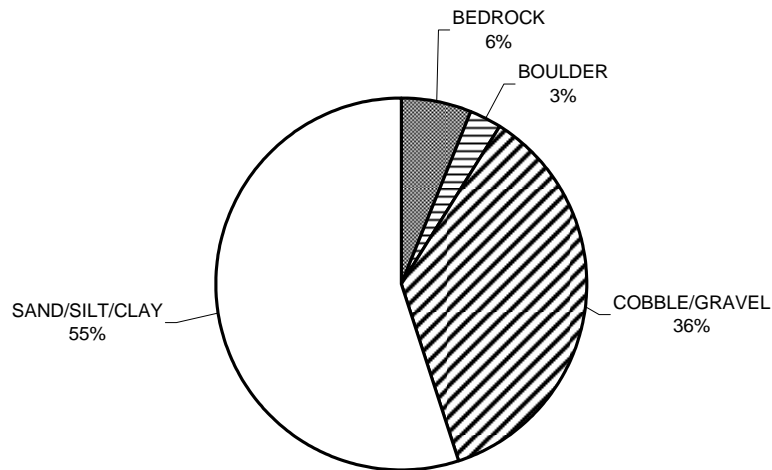
GRAPH 10

Garcia River, North Fork 2004
DOMINANT BANK VEGETATION IN SURVEY REACH

NO VEGETATION
1%

GRASS
1%

BRUSH
3%

CONIFEROUS TREES
22%

HARDWOOD TREES
73%

GRAPH 11

North Fork Garcia River
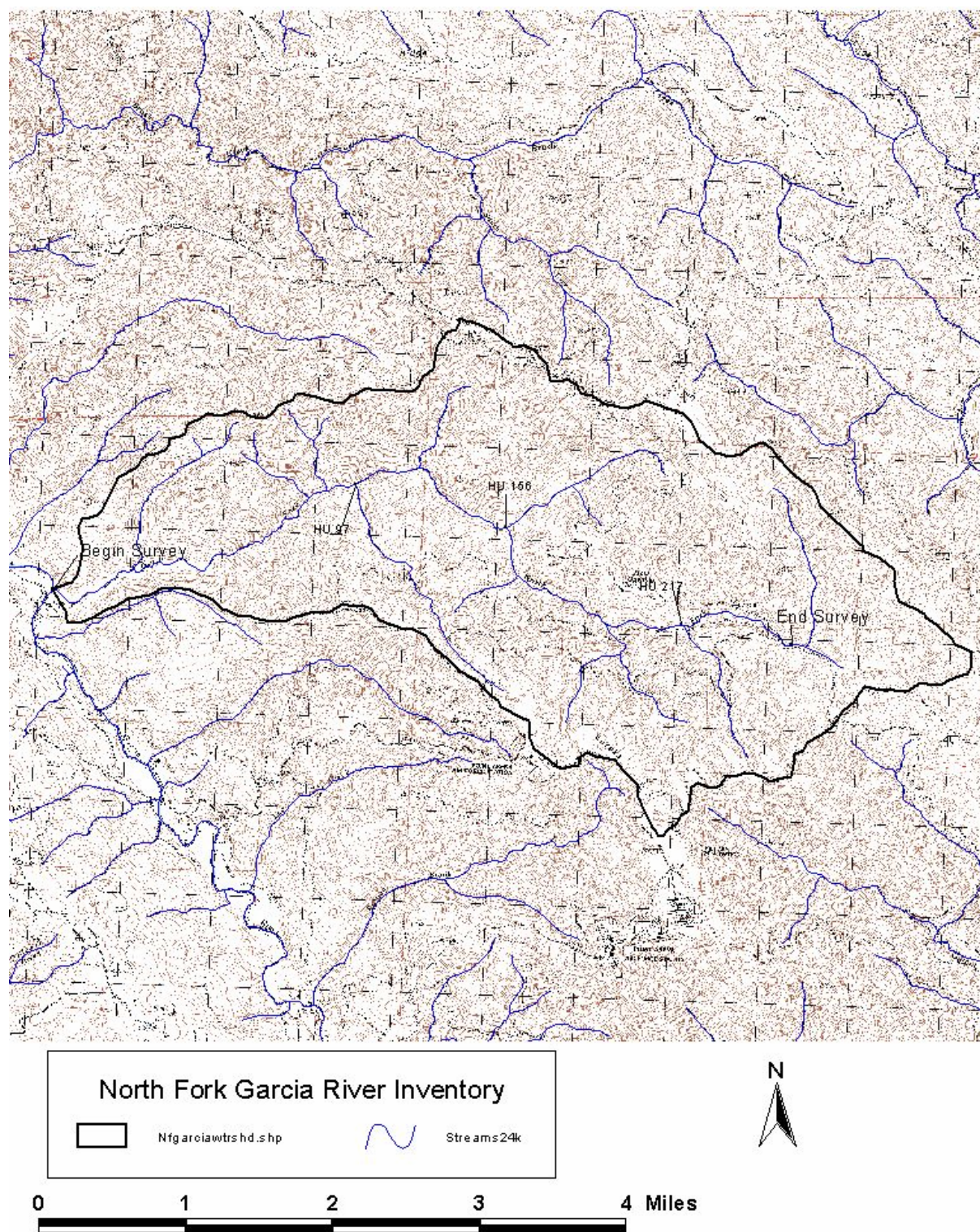
Map 1. Map of North Fork Garcia River showing the stream habitat inventory reach and watershed boundary.

North Fork Garcia River

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McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.