STREAM INVENTORY REPORT

Martin Creek

INTRODUCTION

A stream inventory was conducted beginning July 10 and ending July 29, 2002 on Martin Creek and its tributaries. The survey began at the confluence with Big River and extended upstream 3.78 miles. Stream inventories and sub-sections to this report were also completed for three tributaries to Martin Creek:

The Martin 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 Martin 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

Martin Creek is a tributary to the Big River, which is a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Martin Creek's legal description at the confluence with Big River is T17N R14W S20. Its location is 39°30′10″ north latitude and 123°44′42″ west longitude. Martin Creek is a second order stream and has approximately 23,760 feet of solid blue line stream according to the USGS Greenough Ridge 7.5 minute quadrangle. Martin Creek drains a watershed of approximately 9.2 square miles. Elevations range from about 430 feet at the mouth of the creek to 2,804 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 20 at mile marker 27.

A reconnaissance survey was conducted on Martin Creek by CDFG in 1959 (California Department of Fish and Game 1959). No salmonids were observed in the 1959 survey.

METHODS

The habitat inventory conducted in Martin Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game field crew (DFG) and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) 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 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.

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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 Martin Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at 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 (1985 rev. 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 (1988). 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". Martin 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 Martin 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 particle size, bedrock, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. 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 Martin 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 Martin 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 deciduous 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 Martin 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.

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 Martin Creek. This sampling technique is discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat 8.4, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following seven tables:

- Summary of riffle, flatwater, and pool habitat types
- Summary of habitat types and measured parameters
- Summary of pool types
- Summary of maximum pool depths by pool habitat types
- Summary of shelter by habitat types
- Summary of dominant substrates by habitat types
- Summary of fish habitat elements by stream reach

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Martin Creek and its tributaries include:

- Level II habitat types by % occurrence
- Level II habitat types by % total length
- Level IV habitat types by % occurrence
- Level I pool habitat types by % occurrence
- Maximum depth in pools
- Percent embeddedness estimated in pool tail-outs
- Mean percent cover types in pools
- Substrate composition in pool tail-outs
- Mean percent canopy
- Dominant bank composition in survey reach
- Dominant bank vegetation in survey reach
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type
- Dominant bank vegetation in survey reach

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of July 10 through July 18, 2002, was conducted by S. Monday and K. Knecthle (DFG). The total length of the stream surveyed was 19,973 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.35 cfs on September 24, 2002.

Martin Creek is a B2 channel type for 18,740 feet and an F3 channel type for 1,233 feet of the stream surveyed. B2 channel types are classified as moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile with stable banks, and boulder-dominant substrates. F3 channel types are classified as entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 55 to 69 degrees Fahrenheit. Air temperatures ranged from 59 to 100 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 32% flatwater units, and 31% riffle units (Graph 1). Based on total length of Level II habitat types there were 53% flatwater units, 29% riffle units, and 19% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 29%; low gradient riffles, 28%; step runs, 23%; and runs, 7% (Graph 3). Based on percent total length, step runs made up 47%, low gradient riffles

28%, mid channel pools 6%, and low gradient riffles 5%.

A total of 99 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 83%, and comprised 83% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Seventy-six of the 99 pools (77%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 99 pool tail-outs measured, 10 had a value of 1 (10%); 21 had a value of 2 (21%); 20 had a value of 3 (20%); 7 had a value of 4 (7%); and 41 had a value of 5 (41%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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. Flatwater habitat types had a mean shelter rating of 24, pool habitats had a mean shelter rating of 24, and riffle habitat types had a mean shelter rating of 18 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 25. Scour pools had a mean shelter rating of 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Martin Creek. Graph 7 describes the pool cover in Martin Creek. Boulders are the dominant pool cover type followed by bedrock ledges.

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 27% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 22%.

The mean percent canopy density for the surveyed length of Martin Creek was 81%. The mean percentages of deciduous and coniferous trees were 40% and 60%, respectively. Graph 9 describes the mean percent canopy in Martin Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 54%. The mean percent left bank vegetated was 53%. The dominant elements composing the structure of the stream banks consisted of 43% sand/silt/clay, 28% bedrock, 18% cobble/gravel, and 10% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 72% of the units surveyed. Additionally, 27% of the units surveyed had deciduous trees as the dominant vegetation type, and 1% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

No biological inventory was conducted on Martin Creek. Young-of-the-year salmonid presence was observed from the stream banks in Martin Creek.

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DISCUSSION

Martin Creek is a B2 channel type for 18,740 feet and an F3 channel type for 1,233 feet of the stream surveyed. The suitability of B2 and F3 channel types for fish habitat improvement structures are as follows: B2 channel types are excellent for plunge weirs, single and opposing wing-deflectors and log cover. F3 channel types are good for bank-placed boulders, single and opposing wing deflectors, and fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days July 10 through July 18, 2002 ranged from 55 to 69 degrees Fahrenheit. Air temperatures ranged from 59 to 100 degrees Fahrenheit. The recorded water temperatures of 60 degrees Fahrenheit and below are suitable for salmonids. 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 53% of the total length of this survey, riffles 29%, and pools 9%. The pools are relatively deep, with 76 of the 99 (77%) pools having a maximum 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.

Thirty-one of the 99 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-seven of the pool tail-outs had embeddedness ratings of 3 or 4. Forty-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. Sediment sources in Martin Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifty of the 99 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good spawning salmonids.

The mean shelter rating for pools was 24. The shelter rating in the flatwater habitats was 24. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, bedrock ledges contribute a small amount. 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 81%. 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 at 54% and 53%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) The limited water temperature data available suggest that maximum temperatures are not 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 the canopy on Johnson Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

4) 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.

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

6) Active and potential sediment sources need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

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):	Comments:
0'	Begin survey 130 feet from the confluence with Big River. The channel type is a B2.
233'	Large woody debris (LWD)- cut stump hanging over and in pool creating shelter.
349'	LWD creating pool and possible old restoration site. Coho, steelhead young-of-the-year (YOY) and stickleback.
718'	Bridge crossing channel 47 feet into the unit. 40 feet by 20 feet and about 20 ft above the stream.
818'	Channel is split with 20 foot high alders and willows.

1024'	Cattle tracks within the stream.
1070'	Pool formed by bedrock greater than 60%.
1124'	Stream splits, but is dry.
1179'	Bedrock on right banking contributing to the scour.
2000'	Left bank scoured by bedrock.
2196'	147 feet into the unit there is a dry right bank tributary with a steep gradient.
2446'	Spring on right bank.
2526'	Left bank spring flowing.
2948'	Dry right bank tributary 46 feet into unit.
3346'	Log weir about 20 feet into the pool. Out of water by about 3 feet. Log is 20 feet by 6 feet.
3541'	Left bank spring 112 feet into unit.
3875'	LWD10 feet by 5 feet within the stream.
4149'	About 60 feet into unit there is a flowing right bank tributary. 30 feet up the tributary is a culvert. No fish observed.
4951'	Root wad on the left bank and boulder on the right creating the scour in this pool.
5415'	Scour created by bedrock greater than 60%.
6537'	LWD and small woody debris (SWD) on left bank about 5 feet high, 20 feet wide, and 10 feet long.
6745'	Old cable wrapped around log within stream about 40 feet long.
6795'	Side pool connected upstream, about 5 steelhead YOY within the pool.
6974'	Flowing left bank tributary about 68 feet into the unit. No fish observed in tributary.
7330'	LWD spanning the channel, 6 feet by 20 feet with a large root wad on the bank.
7521'	LWD 4 feet by 20 feet at the top of the pool. Dry left bank tributary.

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7723'	LWD jam 30 by 10 by 20. Pool situated between 2 large bedrock masses.
7836'	Measured channel type in this unit.
8227'	Flowing right bank tributary enters at top of unit. Gradient increases to about 90%, 10 feet from the confluence.
10296'	Flowing left bank tributary at the beginning of unit.
10580'	Pool is bedrock scour on both sides.
10624'	Short bedrock sheet in this unit.
10885'	Small spring running into pool. Bedrock on both sides of channel.
10986'	Two to three pieces of LWD trapping some SWD.
11316'	Mid channel trench pool. Steelhead yearling and coho YOY.
11392'	Channel dominated by boulders and bedrock.
12096'	Scour created by bedrock.
12135'	Dry left bank tributary 85 feet into unit.
12509'	Bedrock and boulder scour.
12546'	Dry right bank tributary at the bottom of unit.
12907'	20 plus salamander larva. Large debris accumulation (LDA) about 20 feet high, 20 feet long and 40 feet wide. Sediment piled at top.
12979'	Old salmonid redd.
13743'	LDA with rootwad, 12 feet high, 30 feet wide, and 15 feet long. Substrate and sediment piled at top.
13941'	Root scour on both the right and left side with bedrock on the right.
14378'	Flowing right bank tributary. Will need to be surveyed has both coho and steelhead in tributary.
14814'	Rootwad mid-channel 10 x 10 x 6 feet.
15075'	LWD scouring pool underneath.

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15316' Five pieces of LWD each about 20 feet long. Left bank slide about 30 feet wide and 100 feet high.

15332' Large boulder slid in from banks beginning at the top of the unit.

15564' Large bedrock trapping LWD and retaining sediment above the pool.

15592' Dry channel about 10 feet above the pool. Water flows underground.

15644' Large boulders, steelhead stranded. **No coho observed above unit 185.**

15756' Dry left bank tributary 20 feet into unit.

17063' Possible old salmonid redd near tail crest.

17108' Dry left bank tributary 96 feet into unit. Road nears stream about 150 feet into unit. Bridge at 314 feet.

17422' Flowing left bank tributary with yearling steelhead. Need to survey tributary.

17824' Steelhead yearling 4 to 5 inches long.

18316' Scour created by bedrock greater than 60%.

18759' Scour from bedrock on both sides of the channel.

18862' Dried right bank tributary 54 feet into unit.

19056' Channel type taken. Dry left bank tributary at bottom of unit.

19402' SWD pile at the top of unit retaining sediment.

19425' Old wet crossing in channel. Does not appear to be in use.

19491' Dry right bank tributary.

19594' Potential barrier. Water seeping through fines into pool. Two yearling steelhead/residents observed. LDA trapping sediment at top.

19755' Bedrock creating pool.

20008' Dry left bank tributary.

20048' 7 to 8 inch resident/steelhead.

20083' Flowing right bank tributary 46 feet into unit.

20147' 8 inch steelhead/resident and three yearling steelhead. Old bridge broken down - three logs in channel, two-three logs still laying across channel.

20165' LDA about 8 feet high, 20 feet wide, 5 feet long retaining sediment at top.

20175' One steelhead yearling.

20254' End of survey at end of anadromy. Old landslide dumped huge boulders into channel. Channel narrows to a foot in width in some locations with boulders/bedrock on both sides. Gradient greatly increases. Slide is about 70 feet wide and 40 feet high.

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.

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - 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]	

TABLES AND GRAPHS

TABLE 8. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: MARTIN CREEK
SAMPLE DATES: 07/10/02 to 07/18/02
STREAM LENGTH: 19973 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: GREENOUGH — Latitude: 39°30'10"
Legal Description: T17NR14WS20 — Longitude: 123°44'42"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: B2	Canopy Density: 80%
Channel Length: 18740 ft.	Coniferous Component: 56%
Riffle/flatwater Mean Width: 10 ft.	Deciduous Component: 44%
Total Pool Mean Depth: 1.5 ft.	Pools by Stream Length: 19%
Base Flow: 0.2 cfs	Pools >=3 ft.deep: 30%
Water: 055- 069°F Air: 059-100°F	Mean Pool Shelter Rtn: 24
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 52%	Occurrence of LOD: 11%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

Embeddness Value: 1. 9% 2.21% 3. 22% 4. 8% 5. 39%

STREAM REACH 02

Channel Type: F3	Canopy Density: 93%
Channel Length: 1233 ft.	Coniferous Component: 89%
Riffle/flatwater Mean Width: 5 ft.	Deciduous Component: 11%
Total Pool Mean Depth: 0.8 ft.	Pools by Stream Length: 20%
Base Flow: 0.2 cfs	Pools >=3 ft.deep: 0%
Water: 056- 059°F Air: 061-076°F	Mean Pool Shelter Rtn: 23
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 66%	Occurrence of LOD: 13%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

Embeddness Value: 1. 20% 2.20% 3. 0% 4. 0% 5. 60%

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MARTIN CREEK — Drainage: SF BIG RIVER

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 07/10/02 to 07/18/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR14WS20 LATITUDE:39°30'10" LONGITUDE:123°44'42"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN 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
83	13	RIFFLE	31	70	5826	29	9.4	0.7	292	24242	163	13495	0	18
84	11	FLATWATER	32	127	10701	53	9.1	0.7	453	38042	339	28446	0	24
99	99	POOL	37	38	3762	19	11.9	1.4	481	47607	812	80388	616	24

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
266	123	20289	109890	122329

MARTIN CREEK — Drainage: SF BIG RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 07/10/02 to 07/18/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR14WS20 LATITUDE:39°30'10" LONGITUDE:123°44'42"

HABITAT UNITS #	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA EST. sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME EST. cu.ft.	MEAN RESIDUAL POOL VOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
75	11	LGR	28	75	5591	28	10	0.7	10.0	333	25004	188	14093	0	20	79
5	1	HGR	2	36	178	1	6	0.5	1.1	70	348	35	174	0	5	80
3	1	BRS	1	19	57	0	3	0.2	0.6	60	180	12	36	0	10	67
4	1	GLD	2	44	177	1	12	0.5	0.9	319	1277	160	638	0	0	83
18	5	RUN	7	52	927	5	11	0.8	2.0	641	11536	544	9789	0	24	81
62	5	SRN	23	155	9597	47	7	0.6	2.0	292	18080	169	10495	0	28	86
1	1	TRP	0	42	42	0	12	1.5	2.7	479	479	718	718	383	30	80
78	78	MCP	29	38	2948	15	12	1.5	9.0	488	38027	858	66956	666	24	83
1	1	CCP	0	47	47	0	14	1.3	2.4	658	658	855	855	658	20	95
2	2	STP	1	43	85	0	9	1.5	2.6	448	895	592	1185	290	30	65
1	1	CRP	0	36	36	0	16	2.2	3.7	576	576	1267	1267	979	50	85
2	2	LSL	1	35	69	0	17	1.3	3.0	592	1184	782	1565	546	38	55
2	2	LSR	1	33	65	0	8	0.9	1.6	263	525	221	441	89	25	100
11	11	LSBk	4	39	430	2	10	1.2	2.9	406	4462	527	5801	337	11	73
1	1	LSBo	0	40	40	0	20	2.0	3.8	800	800	1600	1600	1440	50	0

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
266	123	20289	104032	115613

Martin Creek

MARTIN CREEK — Drainage: SF BIG RIVER

Table 3 - SUMMARY OF POOL TYPES — Survey Dates: 07/10/02 to 07/18/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR14WS20 LATITUDE:39°30'10" LONGITUDE:123°44'42"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA EST. (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME EST. (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHELTER RATING
82	82	MAIN	83	38	3122	83	11.9	1.5	489	40059	850	69714	653	25
17	17	SCOUR	17	38	640	17	11.7	1.3	444	7547	628	10674	435	20

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
99	99	3762	47607	80388

MARTIN CREEK — Drainage: SF BIG RIVER

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 07/10/02 to 07/18/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR14WS20 LATITUDE:39°30'10" LONGITUDE:123°44'42"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
1	TRP	1	0	0	0	0	1	100	0	0	0	0
78	MCP	79	0	0	23	29	32	41	15	19	8	10
1	CCP	1	0	0	0	0	1	100	0	0	0	0
2	STP	2	0	0	0	0	2	100	0	0	0	0
1	CRP	1	0	0	0	0	0	0	1	100	0	0
2	LSL	2	0	0	0	0	1	50	1	50	0	0
2	LSR	2	0	0	2	100	0	0	0	0	0	0
11	LSBk	11	0	0	3	27	8	73	0	0	0	0
1	LSBo	1	0	0	0	0	0	0	1	100	0	0

TOTAL UNITS
99

MARTIN CREEK — Drainage: SF BIG RIVER

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE — Survey Dates: 07/10/02 to 07/18/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR14WS20 LATITUDE:39°30'10" LONGITUDE:123°44'42"

UNITS MEASURED	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
75	10	LGR	1	1	0	0	19	0	8	66	7
5	1	HGR	0	0	0	0	0	0	0	100	0
3	1	BRS	0	0	0	0	0	0	0	100	0
4	0	GLD	0	0	0	0	0	0	0	0	0
18	5	RUN	0	0	0	0	2	0	0	59	39
62	5	SRN	1	5	5	5	4	0	0	78	2
1	1	TRP	0	0	0	0	0	0	0	10	90
78	78	MCP	8	8	13	4	3	1	1	31	32
1	1	CCP	70	0	0	0	0	0	0	30	0
2	2	STP	23	0	0	0	3	0	0	65	10
1	1	CRP	0	15	80	0	0	0	5	0	0
2	2	LSL	0	5	80	0	0	0	0	15	0
2	2	LSR	18	13	13	38	0	0	0	20	0
11	11	LSBk	2	1	5	5	5	0	1	38	45
1	1	LSBo	10	25	25	10	0	0	0	20	10

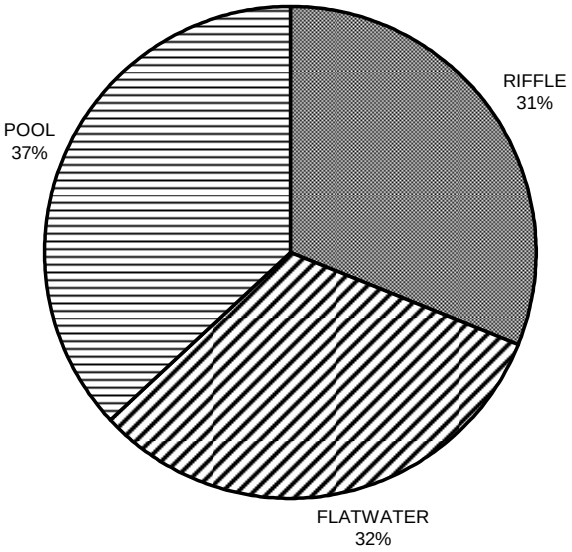
MARTIN CREEK — Drainage: SF BIG RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE — Survey Dates: 07/10/02 to 07/18/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR14WS20 LATITUDE:39°30'10" LONGITUDE:123°44'42"

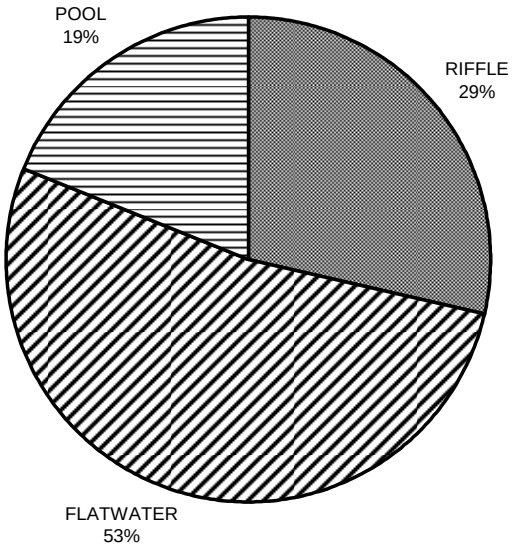
TOTAL HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
75	11	LGR	0	0	9	9	18	64	0
5	1	HGR	0	0	0	0	0	100	0
3	1	BRS	0	0	0	0	0	0	100
4	1	GLD	0	0	0	0	100	0	0
18	5	RUN	0	20	0	20	40	20	0
62	5	SRN	0	0	0	0	0	100	0
1	1	TRP	0	0	0	0	0	0	100
78	13	MCP	0	38	15	0	0	15	31
1	1	CCP	0	0	100	0	0	0	0
2	0	STP	0	0	0	0	0	0	0
1	1	CRP	0	100	0	0	0	0	0
2	1	LSL	0	0	0	0	0	100	0
2	1	LSR	0	100	0	0	0	0	0
11	2	LSBk	0	100	0	0	0	0	0
1	0	LSBo	0	0	0	0	0	0	0

MARTIN CREEK
HABITAT TYPES BY PERCENT OCCURRENCE



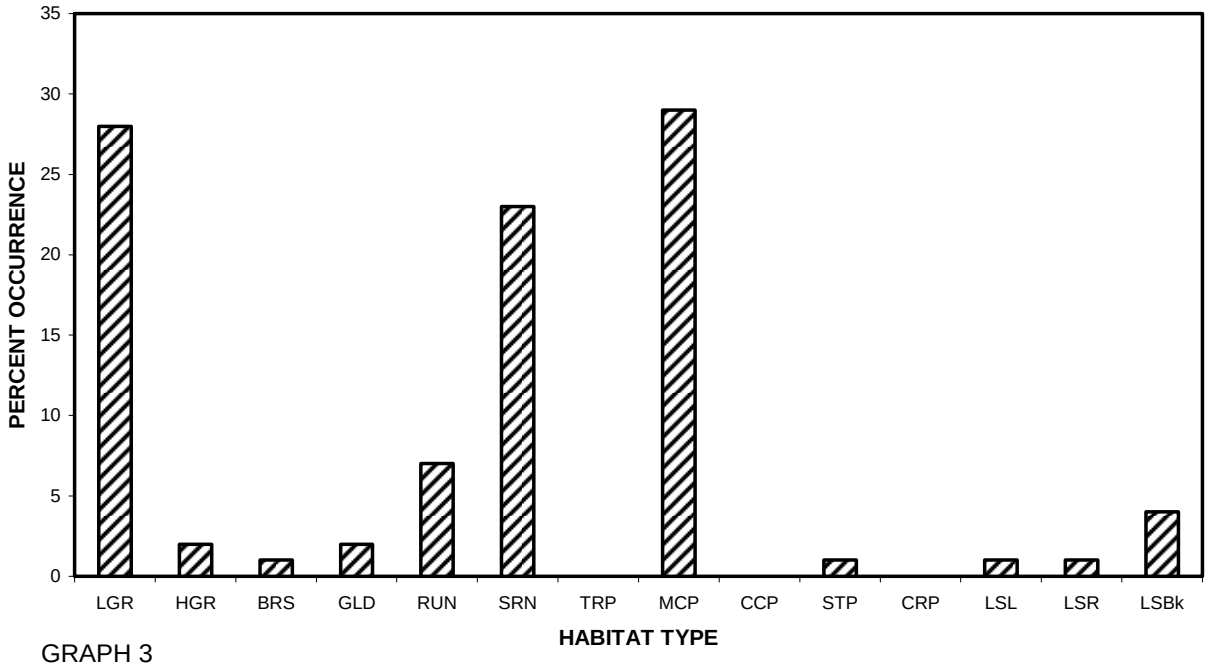
GRAPH 1

MARTIN CREEK
HABITAT TYPES BY PERCENT TOTAL LENGTH



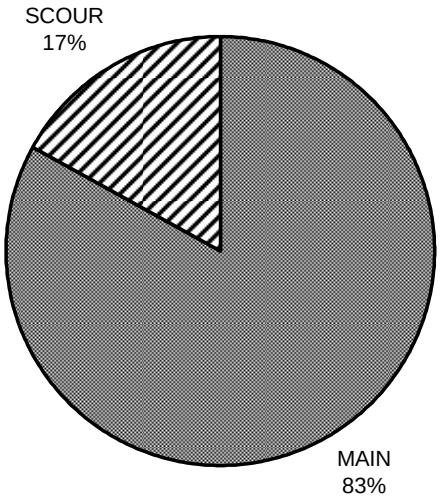
GRAPH 2

MARTIN CREEK
HABITAT TYPES BY PERCENT OCCURRENCE

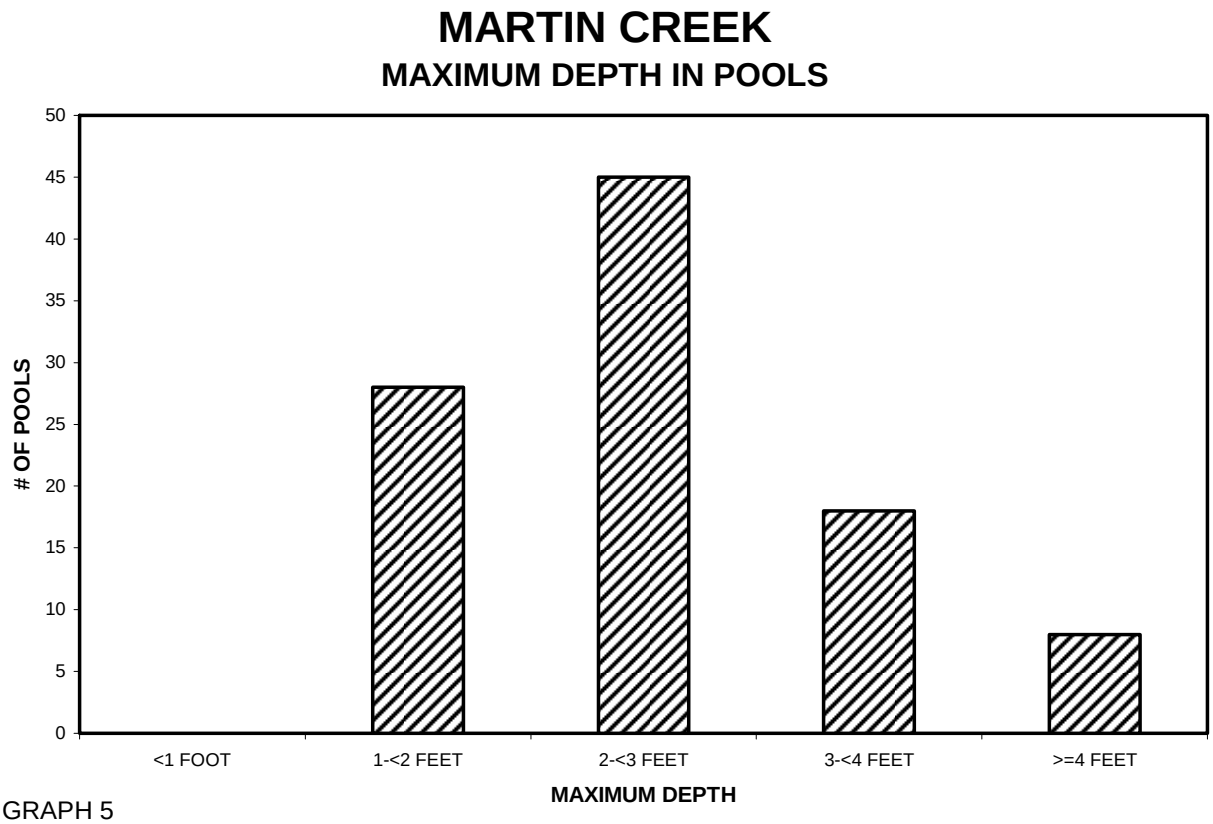


GRAPH 3

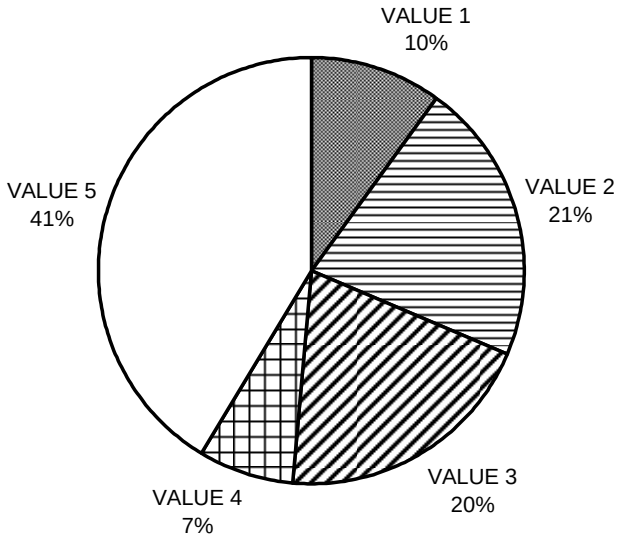
MARTIN CREEK
POOL HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 4

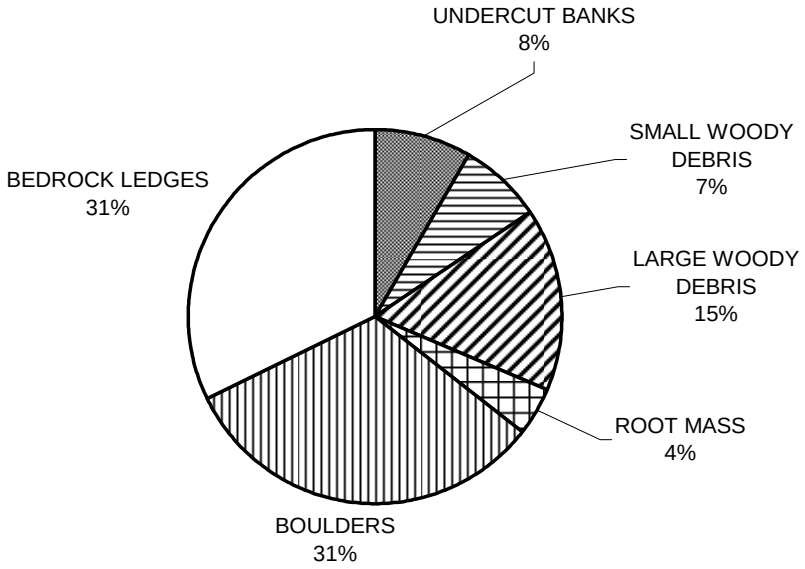


GRAPH 5



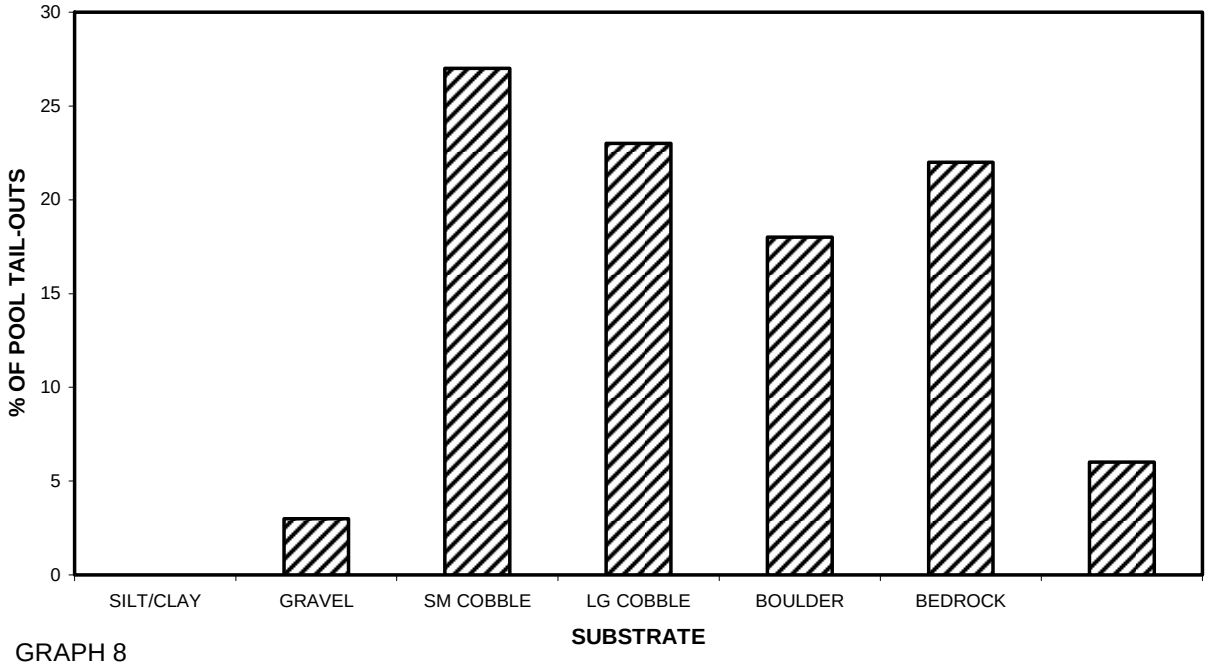
GRAPH 6

MARTIN CREEK
MEAN PERCENT COVER TYPES IN POOLS



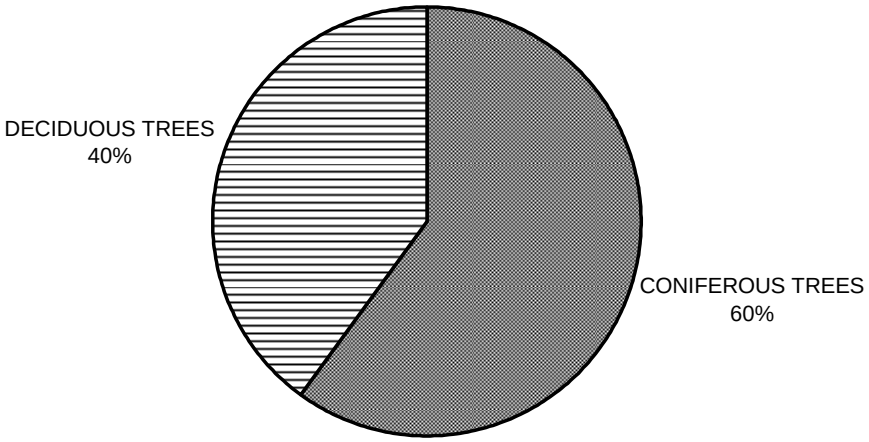
GRAPH 7

MARTIN CREEK
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



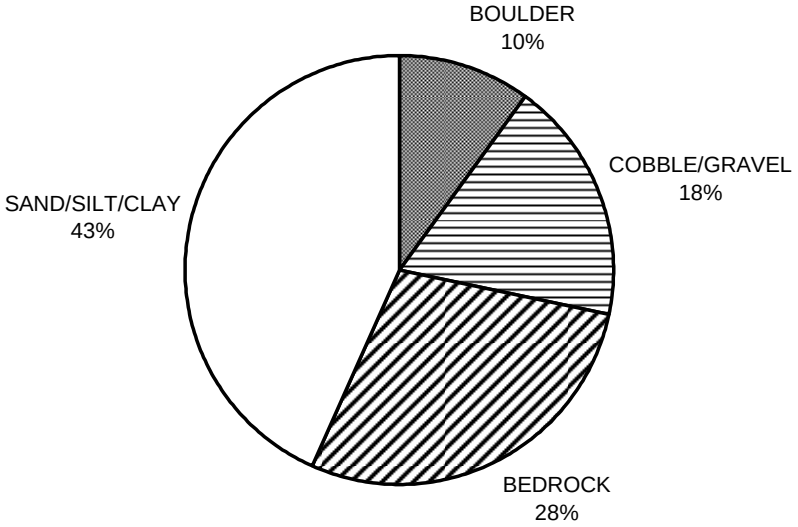
GRAPH 8

MARTIN CREEK
MEAN PERCENT CANOPY



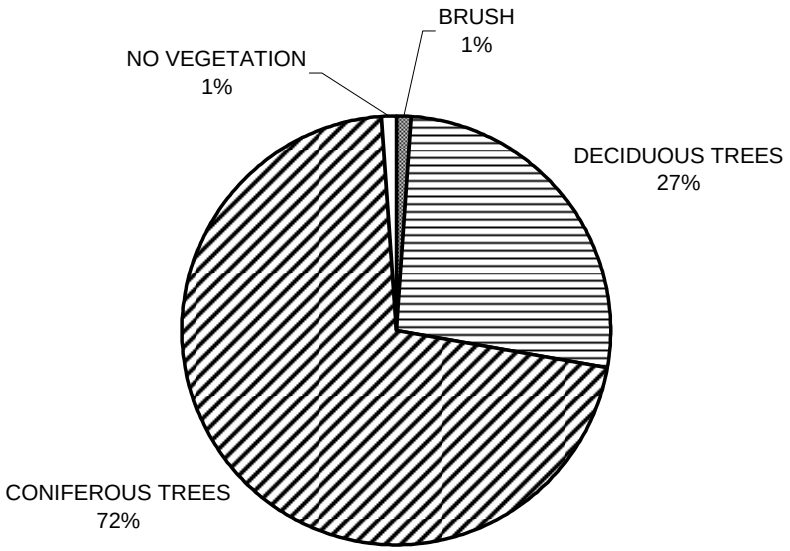
GRAPH 9

MARTIN CREEK
DOMINANT BANK COMPOSITION IN SURVEY REACH

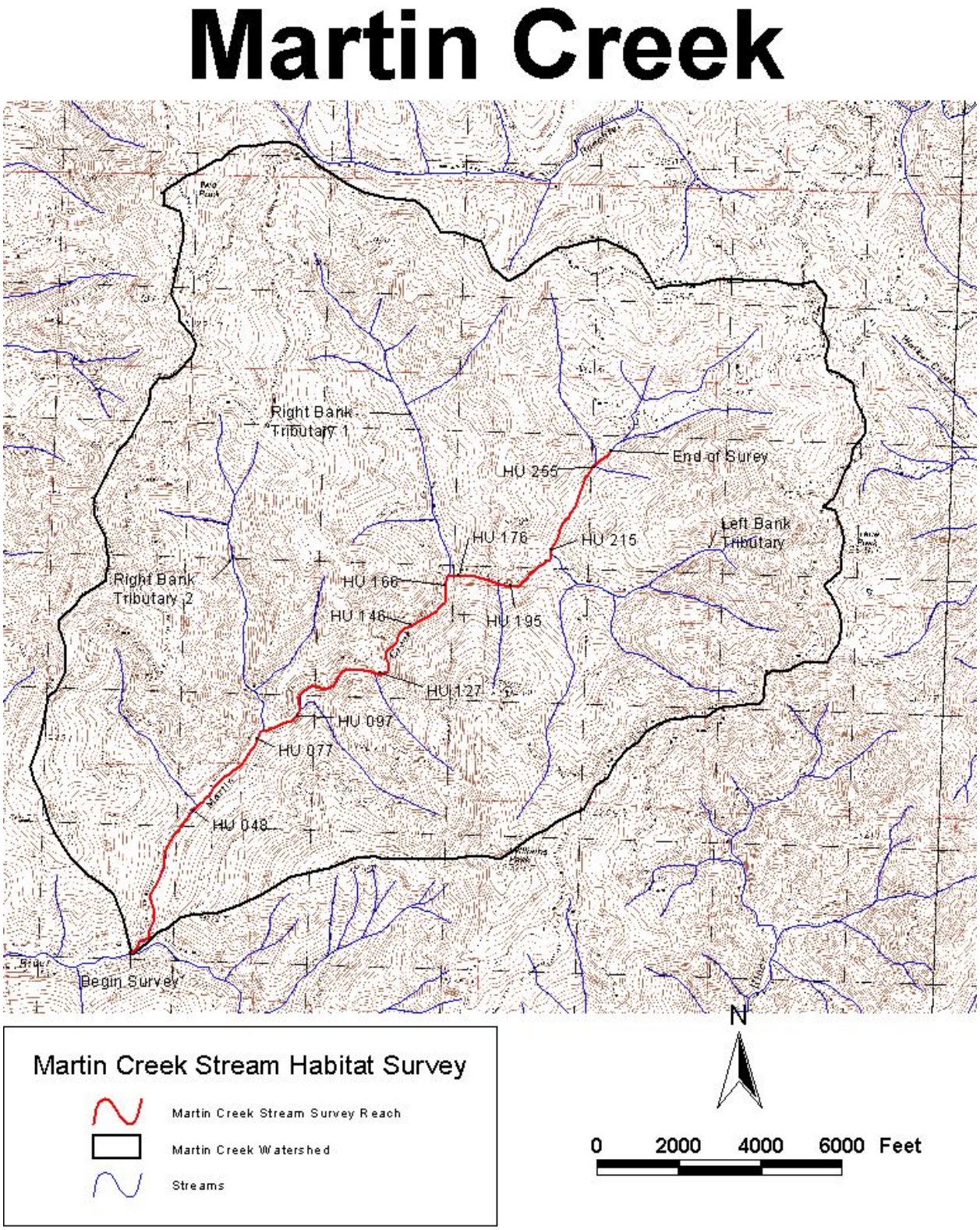


GRAPH 10

MARTIN CREEK
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11



Map 1. Map showing Martin Creek stream habitat survey reach and watershed.