CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Black Rock Creek
Report revised April 14, 2006
Report Completed 2000
Assessment Completed 1996

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Black Rock Creek. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Black Rock Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

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

Black Rock Creek is a tributary to East Austin Creek which flows into Black Rock Creek, a tributary of the Russian River, located in Sonoma County, California (see Black Rock Creek map, page 2). The legal description at the confluence with East Austin Creek is T8N, R10W, S10. Its location is 38°32'58" N. latitude and 123°4'1" W. longitude. Seasonal vehicle access exists from a dirt road located 1 mile north of Cazadero on King Ridge road.

Black Rock Creek and its tributaries drain a basin of approximately 3.3 square miles. Black Rock Creek is a first order stream and has approximately 2 miles of blue line stream, according to the USGS Cazadero 7.5 minute quadrangles. Elevations range from about 160 feet at the mouth of the creek to 800 feet in the headwaters. Black Rock Creek flows through a steep mountainous canyon. There are two narrow gorges, 1.3 miles above the mouth and the other approximately 1.5 miles. The headwaters are oak grassland with scattered conifers, which was logged in the past to open land for cattle grazing. Below the headwaters the watershed is forested with redwoods, Douglas-fir, oak, bay and red alder. The watershed is primarily privately owned with the exception of a small area in Austin Creek State Recreation Area.

No sensitive species were listed in DFG's Natural Diversity Database for Black Rock Creek Watershed.

METHODS

The habitat inventory conducted in Black Rock Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1994). The Americorps Volunteers 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 and was supervised by Bob Coey, Russian River Basin Planner (DFG).

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 Black Rock Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

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.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed.

Temperatures are measured in 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". Black Rock 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 unit lengths were measured, additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (length, mean width, mean depth, maximum depth and pool tail crest depth). All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Black Rock Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (NS) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Black Rock Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully measured habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual, 1998. Canopy density relates to the amount of stream shaded from the sun. In Black Rock 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 visually into percentages of evergreen or deciduous trees.

9. Bank Composition:

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 Black Rock Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE IV 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 tables and appendices:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Shelter by habitat types
- Dominant substrates by habitat types
- Vegetative cover and dominant bank composition
- Fish habitat elements by stream reach

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Black Rock Creek include:

- Level II Habitat Types by % Occurrence and % Total Length
- Level IV Habitat Types by % Occurrence
- Pool Habitat Types by % Occurrence
- Maximum Depth in Pools
- Pool Shelter Types by % Area
- Substrate Composition in Low Gradient Riffles
- Percent Cobble Embeddedness by Reach
- Mean Percent Canopy
- Mean Percent Canopy by Reach
- Percent Bank Composition and Bank Vegetation

Historical Stream Surveys:

The Department of Fish and Game conducted surveys of Black Rock Creek in August 1970, August 1977, and June 1982. In the 1970 survey, flow was estimated to be 0.25 cfs. The average width was 8' for riffles and 4' for pools. The substrate consisted of approximately 10% silt and 10% sand. Spawning area available was estimated to cover only 60% of the stream, due to compact substrate. No pollution was observed and 23 log jams were present.

The 1977 survey started at the mouth and continued to the headwaters. Flows were described as continuous (0.1 cfs) only in a 0.3 mile section near the headwaters, and intermittent or dry in all other areas. The wetted width averaged 1' and ranged from 6" to 8'. The depth averaged .5" to 2" and ranged from .5" to 4'. The channel width averaged 10-20' and ranged from 5-80'. No pollution or diversions were observed, and 3 springs were providing surface flows to the creek.

The substrate consisted of 15% sand and silt, 40% gravel, 15% small rubble, 10% large rubble, 15% boulders, and 5% bedrock. Approximately 60% of the creek was considered to have good spawning gravel, described as "loose and relatively clean".

Pools formed by bedrock, boulders, and undercut banks were common in areas with water, and the average size was 5'x3'x1'. Shelter consisted of roots, boulders, undercut banks, and logs. Canopy was provided 50-80% and air temperatures ranged from 76-79°F, water temperatures ranged from 60-61°F. Aquatic insects were noted to be common. Many of the log jams were modified or removed by landowners since that time.

The 1982 survey was conducted to locate barriers to fish passage. A 4' rock falls and 14 log jams were found. Several of the log jams appeared to be barriers and it was recommended that they be removed. Spawning and rearing habitat were described as plentiful with adequate summer flows of cold water.

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 8 - August 29, 1996 was conducted by Bob Barney, Nancy Barney (NEAP) and Melanie Mattax (DFG) and data analyzed by Ken Bunzel (DFG). The survey began at the confluence with East Austin Creek and extended up Black Rock Creek until springs. The total length of the stream surveyed was 14,888 feet, with an additional 185 feet of side channel.

This section of Black Rock Creek has two channel types in five separate reaches: from the mouth to 2,554 feet an F3; next 1,245 feet an F4; next 5,484 feet an F3; next 3,031 feet an F4 and the upper 2,575 feet an F3.

F3 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly cobble substrate.

F4 types are similar to F3 types but with a predominantly gravel substrate.

A flow of 0.3 cfs was measured 200 feet upstream of the confluence with East Austin Creek on June 8, 1996 using a Marsh-McBirney Model 2000 flowmeter. During the habitat inventory, water temperatures ranged from 58-73°F and air temperatures ranged from 54-88°F. Summer temperatures were also measured using a remote temperature recorder placed in a pool (see Temperature Summary graph at end of report). The recorder was placed in Reach 2 (unit #89) and logged temperatures every 2 hours from July 9 - October 2, 1996. The highest temperature recorded was 67°F in August and the lowest was 56°F in September. The mean of the daily highs was 64°F for the

month of July, 63°F for August and 60°F for September.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 39% pool units, 32% riffle units, 26% flatwater units, and 3% dry streambed units. Based on total **length** there were 42% riffle units, 26% pool units, 24% flatwater units, and 8% dry streambed units (Graph 1).

Four hundred, twenty-two habitat units were measured and 27% were completely sampled. Twenty-one Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles at 30%, glides 13%, mid-channel pools 13% and runs 7% (Graph 2). By percent total **length**, low gradient riffles made up 41%, glides 11%, mid-channel pools 8%, and dry streambed 8%.

One hundred, sixty-five pools were identified (Table 3). Scour pools were most often encountered at 45%, and comprised 40% of the total length of pools. Main channel pools were encountered at 43%, and comprised 51% of the total pool length, (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Thirty-six of the 165 pools (22%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 6% of the total length of stream habitat.

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. Pool types had the highest shelter rating at 20. Riffles had the lowest rating with 4 and flatwater rated 5 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 27, scour pools rated 21, and main channel pools rated 17 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were boulders at 34%, large woody debris 29%, small woody debris 17%, and undercut banks 9%. Graph 5 describes the pool shelter in Black Rock Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in eleven of the eighteen low gradient riffles (61%) measured for substrate. Gravel was the next most frequently observed dominant substrate, and occurred in 22% of the low gradient riffles (Graph 6).

The depth of cobble embeddedness was estimated at pool tail-outs.

Of the 149 pool tail-outs measured, eight had a value of 1 (5%); 88 had a value of 2 (59%); 35 had a value of 3 (23%); and 18 had a value of 4 (12%). On this scale, a value of one is best for fisheries. In a reach comparison, Reach 4 had the best ratings (12% with a 3 or 4) and Reach 5 had the poorest ratings (64% with a 3 or 4). Graph 7 describes percent embeddedness by reach.

The mean percent canopy density for the stream was 79%. The mean percentages of deciduous and evergreen trees were 31% and 69%, respectively. Stream canopy increases in an upstream direction with Reach 1 having 74% canopy and Reach 5 having 91% canopy. Graph 8 describes the canopy for the entire survey and graph 9 describes the canopy by reach.

For the entire stream reach surveyed, the mean percent right bank vegetated was 33% and the mean percent left bank vegetated was 27%. For the habitat units measured, the dominant vegetation types for the stream banks were: 65% evergreen trees, 16% grass, 16% deciduous trees, 2% bare soil and 2% brush. The dominant substrate for the stream banks were: 69% cobble/gravel, 17% boulder, 11% bedrock and 3% silt/clay/sand (Graph 10).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In the 1970 survey, steelhead were described as common and were visually estimated at 50/100' of stream.

In the 1977 survey, steelhead were observed starting 0.1 miles upstream of the mouth to 2.6 miles from the mouth. Fish in the upper area of continuous flow were estimated at 10/100', and in the remaining areas with water at 1/100'. Fish size ranged from 1-8" and all fish were in good condition.

In the 1982 survey, only salmonids were observed in the stream. Larger trout were found all along the creek, and it was thought that many of these were probably residents.

On September 23, 1996 a biological inventory was conducted in Black Rock Creek to document the fish species composition and distribution at two locations. Each site was single pass electrofished using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, and returned to the stream. The air temperature was 68°F and the water temperature was 59°F. The observers were Barney, Barney (NEAP) and Coey.

The inventory of Reach 3 was conducted in habitat units 101-114. In

pool and riffle habitat types 573 0+, 27 1+ and eight 2+ steelhead were observed along with 3 Yellow-legged frogs, 6 unidentified salamanders and 22 unidentified frogs. This section had an approximate length of 1,985 feet, with fish estimated at (31/100')

The inventory of Reach 5 was conducted starting in habitat units 325-336. In pool and riffle habitat types 82 0+, seven 1+ and one 2+ steelhead were observed along with 1 unidentified newt, 3 unidentified salamanders and 8 Yellow-legged frogs. This section had an approximate length of 338 feet, with fish estimated at (27/100')

During the habitat inventory, no salmonids were observed upstream of unit 384, approximately 2 2/3 miles above the confluence with East Austin Creek, where flows are diminished to spring seepage.

A summary of historical and recent data collected appears in the table below.

Species Observed in Historical and Recent Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
1970,1977, 1982,1996	Steelhead	DFG	N
1996	Newt (unidentified)	DFG	N
1996	Yellow-legged Frog	DFG	N

Historical records indicate no hatchery plants, or transfers have occurred in Black Rock Creek. However landowners indicate fish are occasionally moved from the dry section into the upstream pools.

ADULT SURVEYS:

In the 1970 survey, the 23 logjams present were recommended for removal.

In the 1977 survey, three incomplete log jams were observed in the lower midsection of the creek and removal was recommended. A rock falls was located in the upper midsection in a narrow gorge. The gorge was described as extending approximately 70 yards, rising 25-30 feet, and forming a natural fish ladder for migrating salmonids. The steep gradient of the headwaters was determined to be the upper

fish limit.

The 1982 survey conducted to locate fish barriers found a 4' rock falls and 14 log jams. Several of the log jams appeared to be barriers and it was recommended that they be removed, to improve fish access.

The landowner, Bob Schneider, indicated through personal conversations that logjams have been removed.

DISCUSSION

Black Rock Creek has five reaches: F3 (2,554 ft.), F4 (1,245 ft.), F3 (5,484 ft.), F4 (3,031 ft.) and F3 (2,575 ft.).

There are 10,613 feet of F3 channel type in Reaches 1, 3 and 5. According to the DFG Salmonid Stream Habitat Restoration Manual, F3 channel types are good for bank-placed boulders as well as single and opposing wing-deflectors. They are fair for low-stage weirs, boulder clusters, channel constrictors and log cover.

There are a total of 4,276 feet of F4 channel type in Reaches 2 and 4. F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover. Both F4 and F3 channel types have suitable gradients and the stable stream banks that are necessary for the installation of instream structures designed to increase pool habitat, trap spawning gravels, and provide protective shelter for fish.

The water temperatures recorded on the survey days July 8 - August 29, 1996 ranged from 58°F to 73°F. Air temperatures ranged from 54°F to 88°F. The warmer water temperatures were recorded in Reach 4. These warmer temperatures, if sustained, are above the threshold stress level (65°F) for salmonids. Downstream, summer temperatures measured using a remote temperature recorder placed in a pool in Reach 2 ranged from 56° to 67°F.

Pools comprised 26% of the total **length** of this survey. In first and second order streams a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Black Rock Creek, the pools are relatively shallow with 22% having a maximum depth of at least 2 feet. These pools comprised only 6% of the total length of stream habitat. However, in coastal coho and steelhead streams, it is generally desirable to

have primary pools comprise approximately 50% of total habitat length. Therefore, installing structures that will increase pool length and depth is recommended for locations where their installation will not jeopardize any unstable stream banks, or subject the structures to high stream energy.

The mean shelter rating for pools was 20. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by boulders, large woody debris, and small woody debris. However, more log and root wad cover structures in the pool and flatwater habitats are needed to improve 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.

Eighty-three percent of the low gradient riffles measured had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Thirty-six percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only five percent had a rating of 1 and 59% had a rating of 2. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. Overall, in Black Rock Creek, the quality of potential spawning habitat is only fair. In Reach 5 the ratings were high with 64% having either a 3 or 4.

The mean percent canopy for the survey was 79%. This is a good percentage of canopy, since 80 percent is generally considered desirable. However, Reaches 1-3 had a lower percent canopy with numerous bank erosion problems. These reaches as well as other areas with bank erosion could benefit from bank stabilization structures followed up with revegetation using native species.

SUMMARY

Biological surveys were conducted to document fish distribution and are not necessarily representative of population information. Steelhead were documented consistently during each past survey year, while coho were not found during any survey. This is likely because physiological and environmental requirements for coho are more stringent than for steelhead, or coho were absent or present only in small numbers. Overall, steelhead were common during the 1970, 1977, and 1982 surveys. The 1996 fall survey documented many 0+ fish indicating successful spawning. However, few 1+ fish were observed indicating poor holding-over conditions in general.

Spawning habitat is fair except in Reach 5 where cobble embeddedness ratings are poor. Riparian canopy is good in Reaches 4-5, but low in Reaches 1-3 where numerous bank erosion problems occur. Stream temperatures are at or above the threshold stress level for salmonids. Although pools are numerous, the lack of deep pools with adequate shelter needed for rearing habitat is likely the limiting factor for salmonid production.

Any work considered in the stream will require careful design, placement, and construction that must include protection for the unstable banks and high stream velocities.

GENERAL RECOMMENDATIONS

Black Rock Creek should be managed as an anadromous, natural production stream.

The winter 1995/96 storms brought down many large trees and other woody debris into the stream, which increased the number and quality of pools since the drought years. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Signs of recent and historic tree and log removal were evident in the active channel during our survey. Efforts to increase flood protection or improve fish access in the short run, may have mobilized stored sediments and led to gravel siltation problems in the system. Landowners should be encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

SPECIFIC FISHERY ENHANCEMENT RECOMMENDATIONS

1) Treat erosion sites in the lower watershed utilizing bank armor (rootwads and boulders) and native riparian species. Combination bank armor, pool scouring projects which promote mid-channel scour could be very successful.

2) Increase the canopy on Black Rock Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels (Reaches 1-3).

3) Map sources of upslope and in-channel erosion, and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

4) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

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

6) Monitor log accumulations in the gorge area of the lower stream channel.

PROBLEM SITES AND LANDMARKS - BLACK ROCK CREEK SURVEY COMMENTS

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

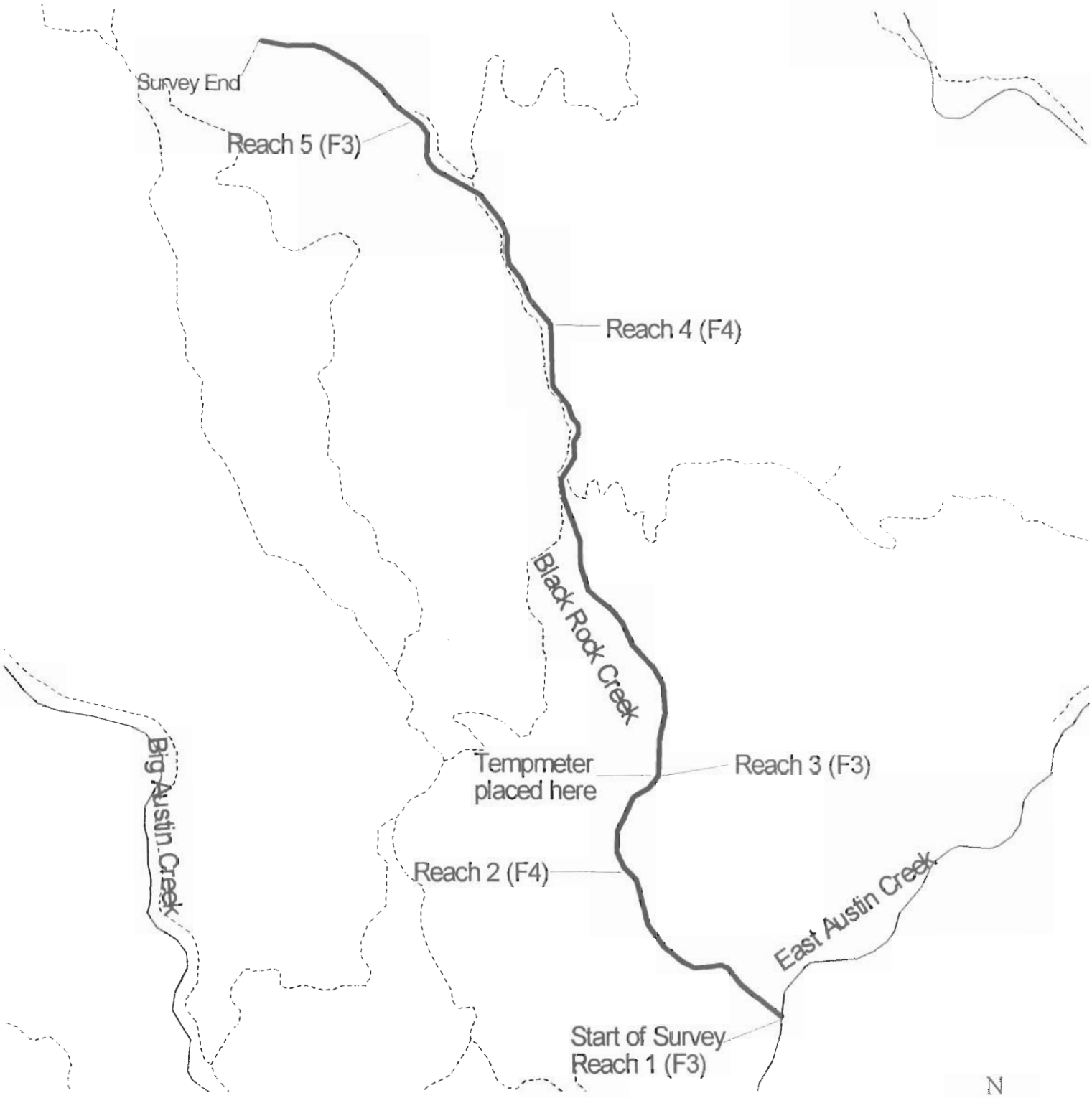
HABITAT UNIT #	STREAM LEN (FT.)	COMMENTS
1.00	93	TEMP FROM E. AUSTIN 65°F
2.00	149	RT & LF BANK EROSION
5.00	255	JUVENILE PIKEMINNOW
7.00	362	ERODIBLE RT BANK
14.00	934	LF BANK HIGH GRADIENT WASH
20.00	1092	LF BANK NOTED SLIPPAGE-SEE FORM
22.00	1204	RT BANK SLIDE-SEE FORM, GOOD EF POOL
22.10	1204	RT BANK SLIDE-SEE FORM
27.00	1452	EF SPOT ,FISH,60% HABITAT,BLOWOUT-SEE FORM
28.00	1509	LARGE LATERAL LOG ACCUMUALTION NOT BLOCKING STREAM-SEE FORM
29.00	1512	GOOD EF SHOCK FISH POOL
30.00	1556	BULLFROG
31.00	1580	GOOD EF FISH POOL, LARGE OLD-GROWTH REDWOOD STUMP
34.00	1711	RT BANK SLIDE-SEE FORM
35.00	1741	DRY TRIB RT BANK
43.00	2147	UNSTABLE LF BANK, GOOD EF POOL
47.00	2294	RT BANK POSS EROSION PROBLEM
49.10	2390	POSS GOOD POOL TO EF

51.00	2457	LARGE TREE FALLEN OVER UNIT
52.00	2468	SEVERAL 3" FISH
55.00	2522	EROSION RT & LF BANKS
57.00	2558	GOOD EF POOL
63.00	2763	SEVERAL TREES & BRUSH OVER STREAM, NOT OBSTRUCTING
64.00	2777	BRUSH OVER STREAM, NOT OBSTRUCTING
74.00	3151	DRY TRIB
78.00	3304	NOT MANY FISH FOR DEPTH/SIZE OF POOL-NEEDS MORE SHELTER
86.00	3687	DRY TRIB LF BANK
89.00	3776	TEMP METER RT BANK- UNDER TREE ROOT
91.00	3845	SEVERAL LARGE 3-3.5"
104.00	4529	LF BANK SLIDE; IN FUTURE COULD IMPACT STREAM-SEE FORM.
106.00	4616	RT BANK BLOWOUT-SEE FORM
108.00	4646	LF BANK BLOWOUT-SEE FORM
117.00	4870	STABLE OLDER BLOWOUT ON RT BANK
121.00	5162	DRY TRIB LF BANK
128.00	5364	SPOTTED 6" FISH
140.00	5695	LOW FLOW TRIB. LF BANK, NO FISH NOTED 100 YDS UP.
141.00	5758	SMALL DRY TRIB. RT BANK
142.00	5794	STABLE OLDER BLOWOUT LF BANK
145.00	5867	SOME SHELTER VALUE, UNDERCUT BANK
146.00	5891	4-5' SHELTER UNDER BOULDER, GOOD EF HOLE-SEE FORM
149.00	5981	PILE OF DEBRIS ON LF BANK, NOT OBSTRUCTING STREAM
155.00	6228	RT BANK UNSTABLE BIG LOGS OVER STREAM NOT HINDERING, LF BANK DRY TRIB
157.00	6278	LOGS OVER STREAM, NOT HINDERING POOL, GOOD EF HOLE, NO TAIL CREST DUE TO DRY UNIT BELOW
167.00	6534	LARGE POOL OUTSIDE CHANNEL- NO FLOW
168.00	6564	LF BANK UNSTABLE
174.00	6736	DRY TRIB RT BANK
178.00	6849	GOOD EF POOL, SEVERAL 6" FISH
185.00	7039	RT BANK CUT, VERY LITTLE WATER FLOW
186.00	7304	SKID RD RT BANK
189.00	7507	EF POOL
196.00	7756	VERY UNSTABLE LF BANK-SEE FORM
205.00	7971	LOG ACCUMULATION RETAINING GRAVEL AND DOWNCUTTING, NOT A FISH BARRIER. SEVERAL LARGER FISH, GOOD EF POOL
206.00	8023	CUT LF BANK
214.00	8260	CULVERT EMPTYING INTO POOL ALSO

		CAUSED SCOUR-SEE FORM
215.00	8286	BOTTOM SILT FROM RD CROSSING APPROX. 20' UPSTREAM
216.00	8323	RD CUTS ACROSS STREAM
219.00	8412	NO TAIL CREST , NO SHELTER, NO FISH
220.00	8430	NICE POOL TO EF
222.00	8490	HUGE BOULDERS IN STREAM CHANNEL
223.00	8501	HUGE BOULDERS IN & AROUND STREAM
224.00	8523	HUGE BOULDERS IN & AROUND STREAM
225.00	8533	DRY TRIB LF BANK
228.00	8643	EXTREMELY HIGH GRADIENT STREAM UNDER BOULDERS, NO ACCESS
233.00	8770	DRY CUT LF BANK
237.00	8887	NO FISH , IN BETWEEN DRY SECTIONS OF STREAM
241.00	8971	2 FISH
243.00	9054	POOL BETWEEN TWO DRY SECTIONS OF STREAM, SEVERAL 3+" FISH, LOG ACCUMULATION OVER STREAM
257.00	9693	NICE POOL, SEVERAL FISH.
263.00	10205	331.5' INTO UNIT IS DRY TRIB LF BANK W/ OLD BRIDGE
264.00	10215	DRY STREAM BOTH SIDES, TWO 4" FISH
270.00	10767	POOL WITH FISH IN BETWEEN DRY STREAM
279.00	11036	FISH PRESENT
283.00	11191	DRY TRIB LF BANK
292.00	11468	NICE POOL TO EF, BIG FISH.
297.00	11602	DRY TRIB & CULVERT RT BANK-SEE FORM
298.00	11652	LARGE NUMBER OF FISH
299.00	11728	DRY TRIB ON LF BANK
309.00	12012	CUT RT BANK DRY
313.00	12077	RT BANK UNSTABLE, BEDROCK STREAM BED, DEAD 3" FISH
317.00	12152	OLD CUTTING ON LF BANK
319.00	12209	BEDROCK STREAM BED
320.00	12236	BEDROCK STREAM BED
322.00	12300	LOG ACCUMULATION RETAINING GRAVEL AND CAUSING CUT IN RIGHT BANK, BUT NOT DOWNCUTTING AND NOT A FISH BARRIER SEE FORM FOR MORE NOTES
325.00	12349	DRY TRIB LF BANK
336.00	12669	DRY TRIB LF BANK, SEE FORM-BRIDGE
356.00	13146	DRY TRIB RT BANK
357.00	13174	SEE FORM- CULVERT RT BANK
358.00	13194	FEW FISH
359.00	13216	SEE FORM RT BANK WOOD CULVERT
360.00	13257	ONE FISH
366.00	13424	SEE FORM, CULVERT RT BANK

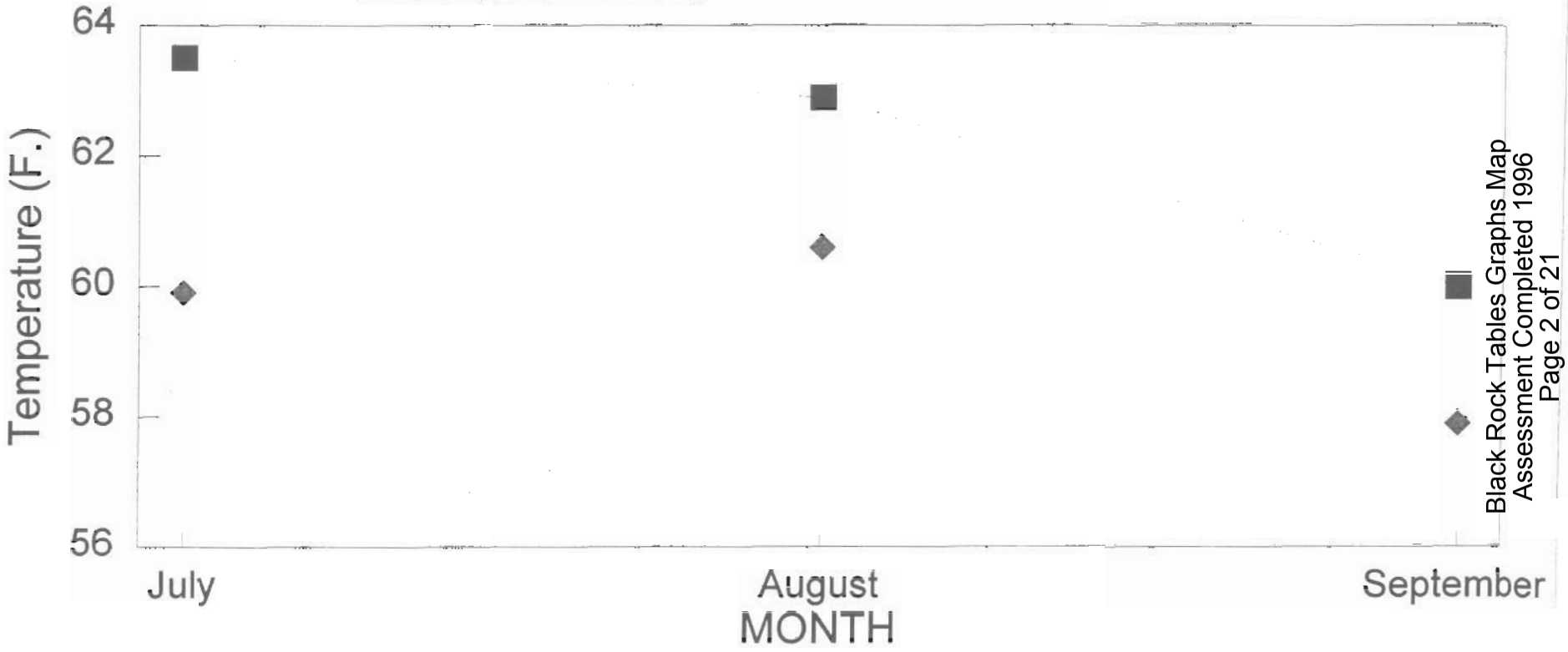
374.00	13652	DRY TRIB LF BANK
378.00	13797	SEE FORM- BRIDGE
384.00	13994	FEW FISH
407.00	14678	DRY TRIB RT BANK, NO FISH
408.00	14714	NO FISH, TRIB LEFT BANK
412.00	14933	NO FISH, NOTHING ABOVE EXCEPT SPRINGS FEEDING STREAM. END BLACK ROCK SURVEY

Black Rock Creek



Tempmentor Summary

Black rock creek



Sample Period: Jul 11 - Sep 23, 1996
Location: Habitat unit # 89

Black Rock Creek — Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 07/08/96 to 08/29/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8N R10W S10 LATITUDE: 38°32'58" LONGITUDE: 123°4'1"

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
135	22	RIFFLE	32	47	6380	42	5.4	0.2	173	23382	42	5604	0	4
111	34	FLATWATER	26	32	3571	24	5.8	0.4	184	20423	82	9083	0	5
165	56	POOL	39	24	3924	26	7.4	0.8	167	27579	152	25140	128	20
11	0	DRY	3	109	1198	8	0.0	0.0	0	0	0	0	0	0

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
422	112	15073	71384	39828

Black Rock Creek — Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 07/08/96 to 08/29/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8N R10W S10 LATITUDE: 38°32'58" LONGITUDE: 123°4'1"

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 %
125	15	LGR	30	49	6119	41	5	0.2	40.0	207	25902	47	5929	0	4	75
8	6	HGR	2	20	158	1	5	0.2	40.0	69	548	16	127	0	1	86
1	1	CAS	0	45	45	0	7	0.5	1.4	189	189	95	95	0	10	70
1	0	BRS	0	58	58	0	0	0.0	0.0	0	0	0	0	0	0	0
10	5	POW	2	33	332	2	7	0.4	1.1	186	1859	85	850	0	4	83
56	8	GLD	13	31	1727	11	6	0.4	1.9	224	12555	108	6024	0	4	75
29	12	RUN	7	25	715	5	6	0.4	1.2	150	4347	64	1860	0	3	76
16	9	SRN	4	50	799	5	4	0.4	13.0	188	3008	76	1222	0	10	82
55	12	MCP	13	22	1208	8	8	0.7	3.7	183	10043	160	8811	129	16	84
16	7	STP	4	50	803	5	5	0.6	2.8	214	3419	134	2137	97	20	87
4	1	CRP	1	21	84	1	6	0.7	1.7	130	520	93	374	77	21	75
8	4	LSL	2	23	182	1	9	0.9	3.6	212	1699	238	1907	219	56	84
11	4	LSR	3	18	193	1	7	0.8	3.5	125	1380	106	1167	94	19	88
29	10	LSBk	7	26	740	5	7	0.8	4.0	192	5562	185	5362	159	6	82
12	4	LSBo	3	19	225	1	7	0.8	3.2	142	1705	137	1643	120	20	79
11	5	PLP	3	15	165	1	9	0.9	4.8	152	1673	196	2151	174	37	81
9	4	SCP	2	13	118	1	5	0.5	1.6	62	559	32	292	28	7	76
2	1	BPB	0	12	24	0	9	0.7	1.7	116	232	97	194	84	0	90
3	1	BPR	1	14	42	0	9	0.8	1.9	130	390	105	315	71	57	78
5	3	BPL	1	29	143	1	7	0.9	2.8	142	708	147	734	124	45	76
11	0	DRY	3	109	1198	8	0	0.0	0.0	0	0	0	0	0	0	0

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
422	112	15073	76297	41192

Black Rock Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 07/08/96 to 08/29/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8N R10W S10 LATITUDE: 38°32'58" LONGITUDE: 123°4'1"

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
71	19	MAIN	43	28	2010	51	7.5	0.7	188	13363	155	11033	123	17
75	28	SCOUR	45	21	1588	40	7.6	0.8	167	12538	168	12603	147	21
19	9	BACKWATER	12	17	327	8	6.6	0.7	99	1889	81	1534	68	27

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
165	56	3924	27790	25171

Black Rock Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES

Survey Dates: 07/08/96 to 08/29/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8N R10W S10 LATITUDE: 38°32'58" LONGITUDE: 123°4'1"

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
55	MCP	33	10	18	35	64	9	16	1	2	0	0
16	STP	10	10	63	5	31	1	6	0	0	0	0
4	CRP	2	0	0	4	100	0	0	0	0	0	0
8	LSL	5	0	0	4	50	2	25	2	25	0	0
11	LSR	7	2	18	4	36	3	27	2	18	0	0
29	LSBk	18	3	10	20	69	5	17	0	0	1	3
12	LSBo	7	0	0	8	67	2	17	2	17	0	0
11	PLP	7	1	9	5	45	4	36	0	0	1	9
9	SCP	5	4	44	5	56	0	0	0	0	0	0
2	BPB	1	0	0	2	100	0	0	0	0	0	0
3	BPR	2	0	0	3	100	0	0	0	0	0	0
5	BPL	3	0	0	4	80	1	20	0	0	0	0

TOTAL UNITS 165

Black Rock Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 5 - Summary of Shelter by Habitat Type

Survey Dates: 07/08/96 to 08/29/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8N R10W S10 LATITUDE: 38°32'58" LONGITUDE: 123°4'1"

	UNITS MEASURED	UNITS SHELTER MEASURED	HABITAT TYPE	SQ. FT. UNDERCUT BANKS	SQ. FT. SWD	SQ. FT. LWD	SQ. FT. ROOT MASS	SQ. FT. TERR. VEGETATION	SQ. FT. AQUATIC VEGETATION	SQ. FT. WHITE WATER	SQ. FT. BOULDERS	SQ. FT. BEDROCK LEDGES
	125	19	LGR	0	7	0	0	22	0	0	170	0
	8	6	HGR	0	0	0	0	0	0	0	6	0
	1	1	CAS	0	0	0	0	0	0	13	19	0
	1	0	BRS	0	0	0	0	0	0	0	0	0
	10	6	POW	0	0	0	0	0	0	5	63	0
	56	10	GLD	22	34	0	0	5	0	0	45	0
	29	13	RUN	0	0	0	13	14	0	1	25	0
	16	11	SRN	0	0	22	29	0	0	4	27	0
	55	53	MCP	70	162	106	45	3	0	9	388	0
	16	12	STP	19	0	134	0	17	0	7	304	18
	4	4	CRP	0	25	24	0	8	0	0	13	0
	8	8	LSL	52	205	269	0	0	0	0	33	0
	11	11	LSR	24	39	21	93	0	0	6	9	0
	29	29	LSBk	41	29	28	0	1	0	0	81	67
	12	12	LSBo	10	10	7	10	0	0	0	89	15
	11	10	PLP	65	20	100	6	0	0	1	134	0
	9	8	SCP	6	1	12	0	0	0	0	6	0
	2	2	BPB	0	0	0	0	0	0	0	0	0
	3	3	BPR	0	0	92	17	0	0	0	0	0
	5	5	BPL	0	28	120	0	0	0	0	13	0
	11	0	DRY	0	0	0	0	0	0	0	0	0
TOTAL	422	223		309	560	935	213	70	0	46	1425	100
				8%	15%	26%	6%	2%	0%	1%	39%	3%
TOTAL FOR POOLS	165	157		287	519	913	171	29	0	23	1070	100
				9%	17%	29%	5%	1%	0%	1%	34%	3%

Black Rock Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 07/08/96 to 08/29/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8N R10W S10 LATITUDE: 38°32'58" LONGITUDE: 123°4'1"

TOTAL HABITAT UNITS	UNITS SUBSTRATE 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
125	18	LGR	0	0	22	61	11	0	6
8	6	HGR	0	0	17	0	17	67	0
1	1	CAS	0	0	0	0	0	0	100
0	0	BRS	0	0	0	0	0	0	0
5	5	POW	0	20	20	20	40	0	0
10	10	GLD	0	0	50	40	10	0	0
13	13	RUN	0	0	46	31	23	0	0
11	11	SRN	0	0	0	27	27	18	27
21	21	MCP	0	14	33	33	10	5	5
9	9	STP	0	0	11	0	22	33	33
1	1	CRP	0	0	0	100	0	0	0
4	4	LSL	0	0	100	0	0	0	0
4	4	LSR	0	25	25	50	0	0	0
15	15	LSBk	0	13	27	27	13	0	20
5	5	LSBo	0	20	40	40	0	0	0
7	7	PLP	0	14	57	0	14	14	0
7	7	SCP	0	43	29	0	0	14	14
2	2	BPB	0	50	0	0	0	50	0
3	2	BPR	50	50	0	0	0	0	0
5	4	BPL	0	50	25	25	0	0	0
11	0	DRY	0	0	0	0	0	0	0

APPENDIX A. Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Evergreen	Mean Percent Decidous	Mean Right bank % Cover	Mean Left Bank % Cover
79.21	69.47	30.53	33.26	26.74

APPENDIX B.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	6	23	11.15
Boulder	22	21	16.54
Cobble/Gravel	97	83	69.23
Silt/clay	5	3	3.08

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	22	19	15.83
Brush	1	3	1.54
Deciduous Trees	18	23	15.83
Evergreen Trees	87	81	64.86
No Vegetation	2	3	1.93

APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Black Rock Creek
SAMPLE DATES: 07/08/96 to 08/29/96
STREAM LENGTH: 14888 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: CAZADERO — Latitude: 38°32'58"
Legal Description: 8N 10W 10 — Longitude: 123°4'1"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: F3	Canopy Density: 74%
Channel Length: 2554 ft.	Evergreen Component: 61%
Riffle/Flatwater Mean Width: 7 ft.	Deciduous Component: 39%
Total Pool Mean Depth: 1.0 ft.	Pools by Stream Length: 26%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 9%
Water: 60 - 66 °F Air: 57 - 80 °F	Mean Pool Shelter Rtn: 26
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Vegetative Cover: 33%	Occurrence of LOD: 82%
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 0 ft.
Embeddness Value: 1. 0% 2. 63% 3. 29% 4. 8%	

STREAM REACH 02

Channel Type: F4	Canopy Density: 75%
Channel Length: 1245 ft.	Evergreen Component: 50%
Riffle/Flatwater Mean Width: 5 ft.	Deciduous Component: 50%
Total Pool Mean Depth: 0.9 ft.	Pools by Stream Length: 24%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 15%
Water: 58 - 68 °F Air: 56 - 82 °F	Mean Pool Shelter Rtn: 8
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Root masses
Vegetative Cover: 26%	Occurrence of LOD: 60%
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 0 ft.
Embeddness Value: 1. 0% 2. 69% 3. 31% 4. 0%	

STREAM REACH 03

Channel Type: F3	Canopy Density: 77%
Channel Length: 5484 ft.	Evergreen Component: 69%
Riffle/Flatwater Mean Width: 6 ft.	Deciduous Component: 31%
Total Pool Mean Depth: 0.8 ft.	Pools by Stream Length: 27%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 7%
Water: 58 - 67 °F Air: 56 - 78 °F	Mean Pool Shelter Rtn: 17
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Vegetative Cover: 29%	Occurrence of LOD: 45%
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 353 ft.
Embeddness Value: 1. 2% 2. 70% 3. 20% 4. 7%	

STREAM REACH 04

Channel Type: F4	Canopy Density: 81%
Channel Length: 3031 ft.	Evergreen Component: 60%
Riffle/Flatwater Mean Width: 4 ft.	Deciduous Component: 40%
Total Pool Mean Depth: 0.6 ft.	Pools by Stream Length: 18%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 4%
Water: 58 - 73 °F Air: 54 - 78 °F	Mean Pool Shelter Rtn: 9
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Root masses
Vegetative Cover: 32%	Occurrence of LOD: 40%
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 845 ft.
Embeddness Value: 1. 17% 2. 71% 3. 4% 4. 8%	

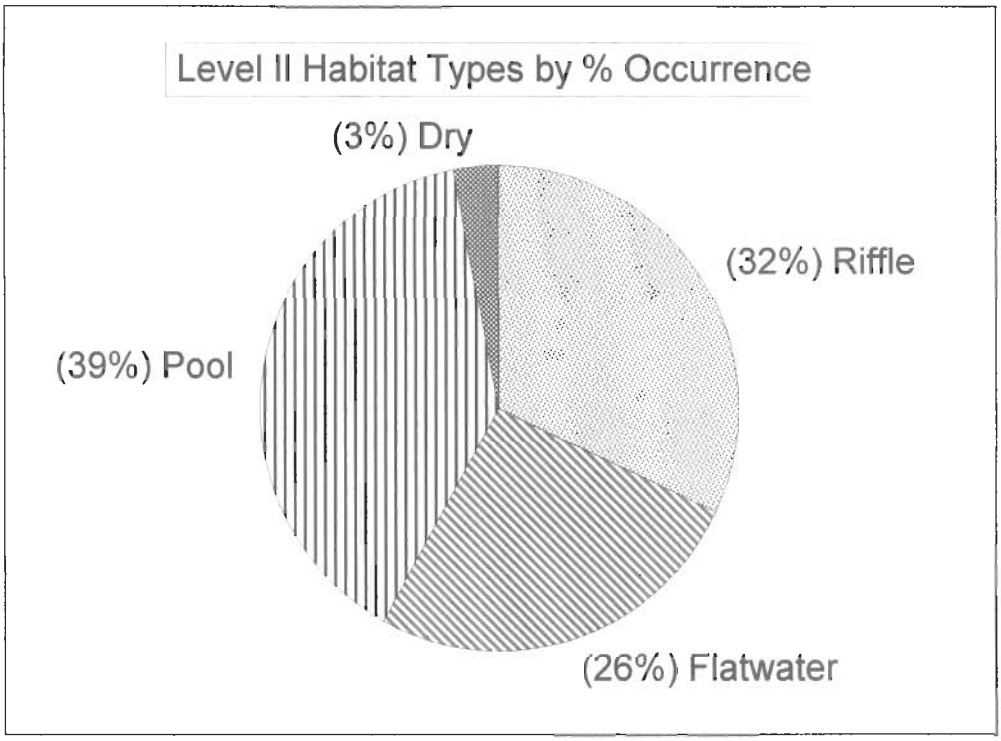
STREAM REACH 05

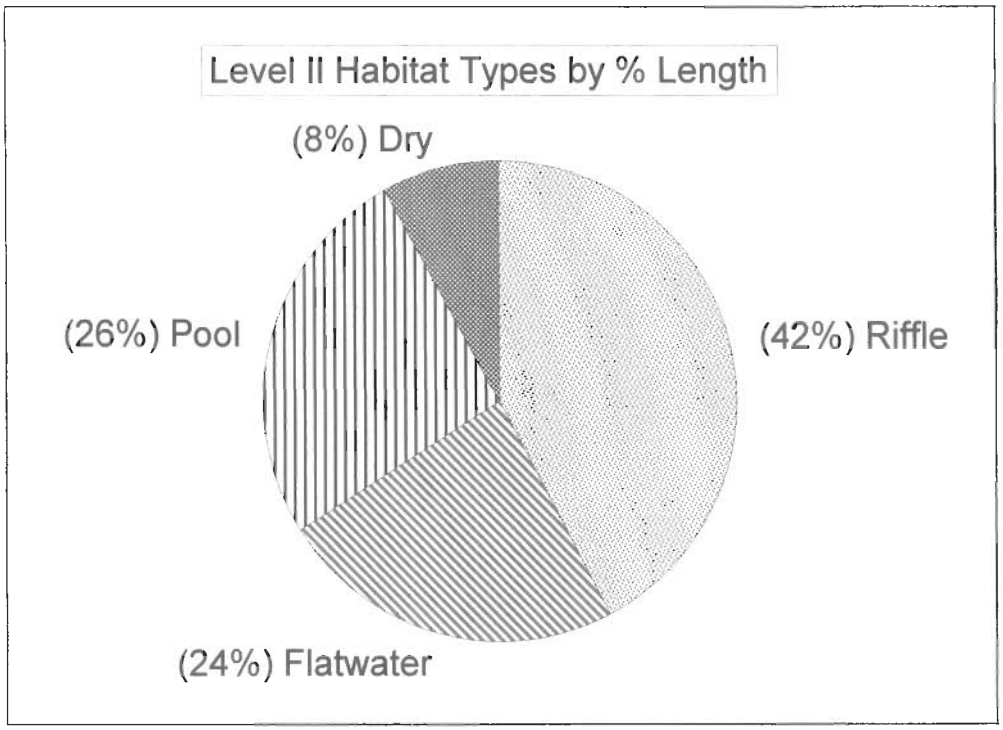
Channel Type: F3	Canopy Density: 91%
Channel Length: 2575 ft.	Evergreen Component: 97%
Riffle/Flatwater Mean Width: 4 ft.	Deciduous Component: 3%
Total Pool Mean Depth: 0.6 ft.	Pools by Stream Length: 29%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 0%
Water: 59 - 64 °F Air: 61 - 88 °F	Mean Pool Shelter Rtn: 27
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Vegetative Cover: 26%	Occurrence of LOD: 40%
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 0 ft.

Embeddness Value: 1. 9% 2. 26% 3. 35% 4. 29%

Black Rock Creek

Level II Habitat Types

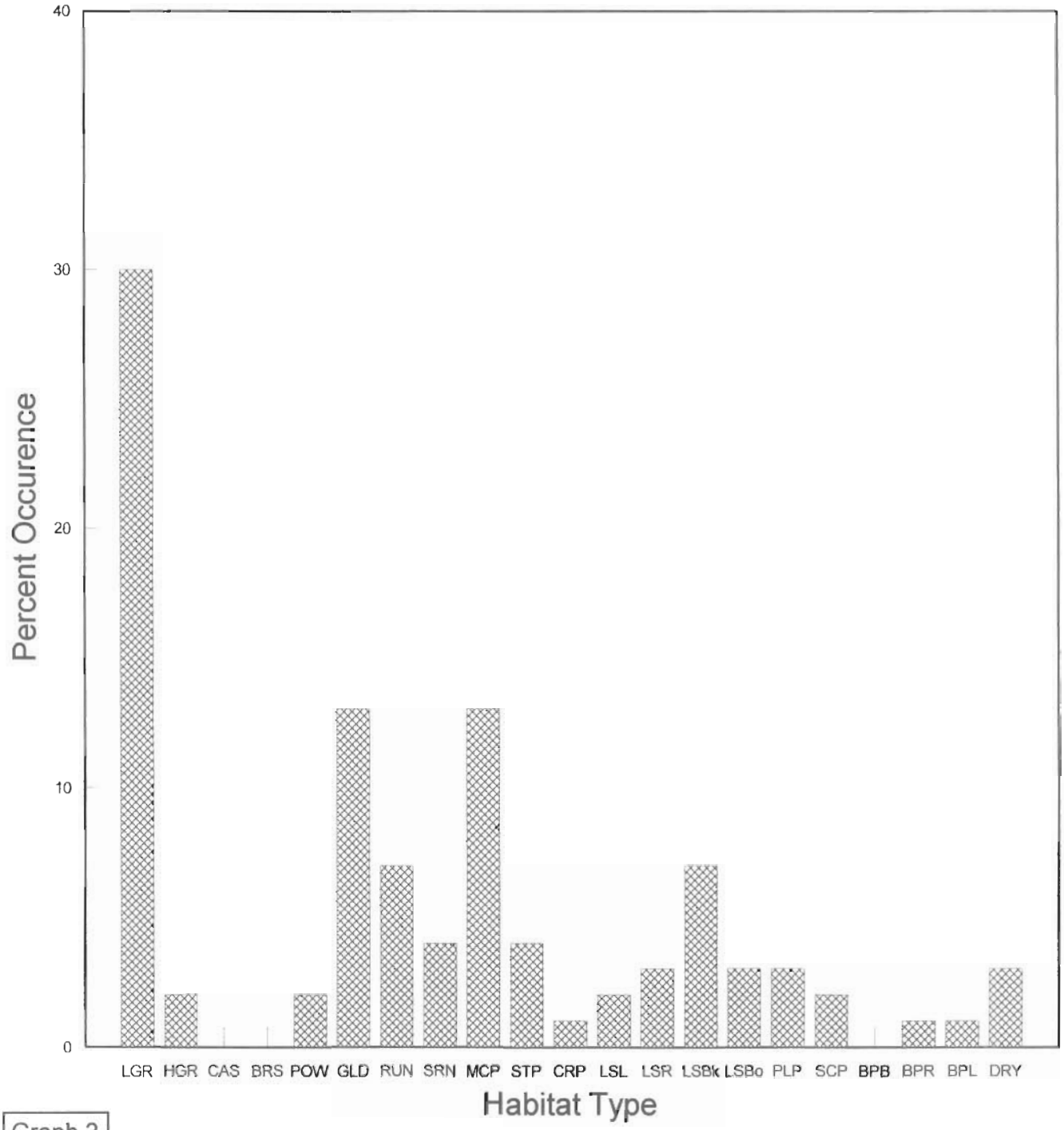




Graph 1

Black Rock Creek

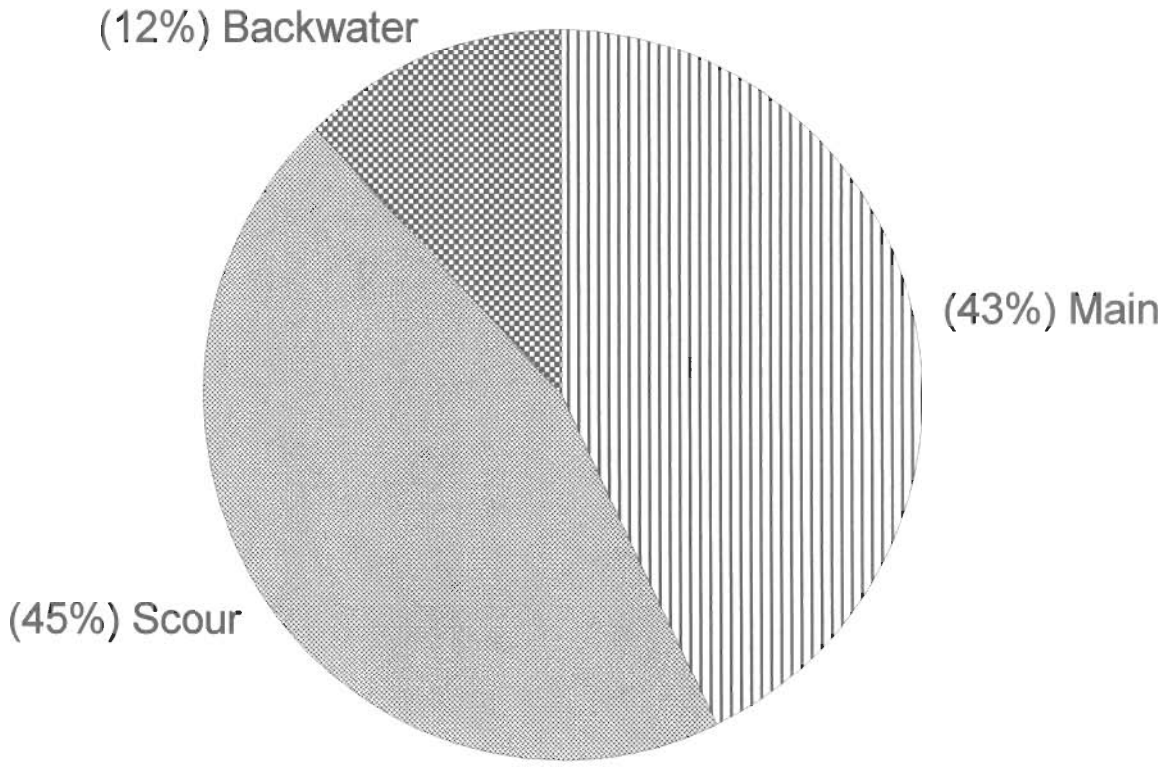
Level IV Habitat Types by Percent Occurrence



Graph 2

Black Rock Creek

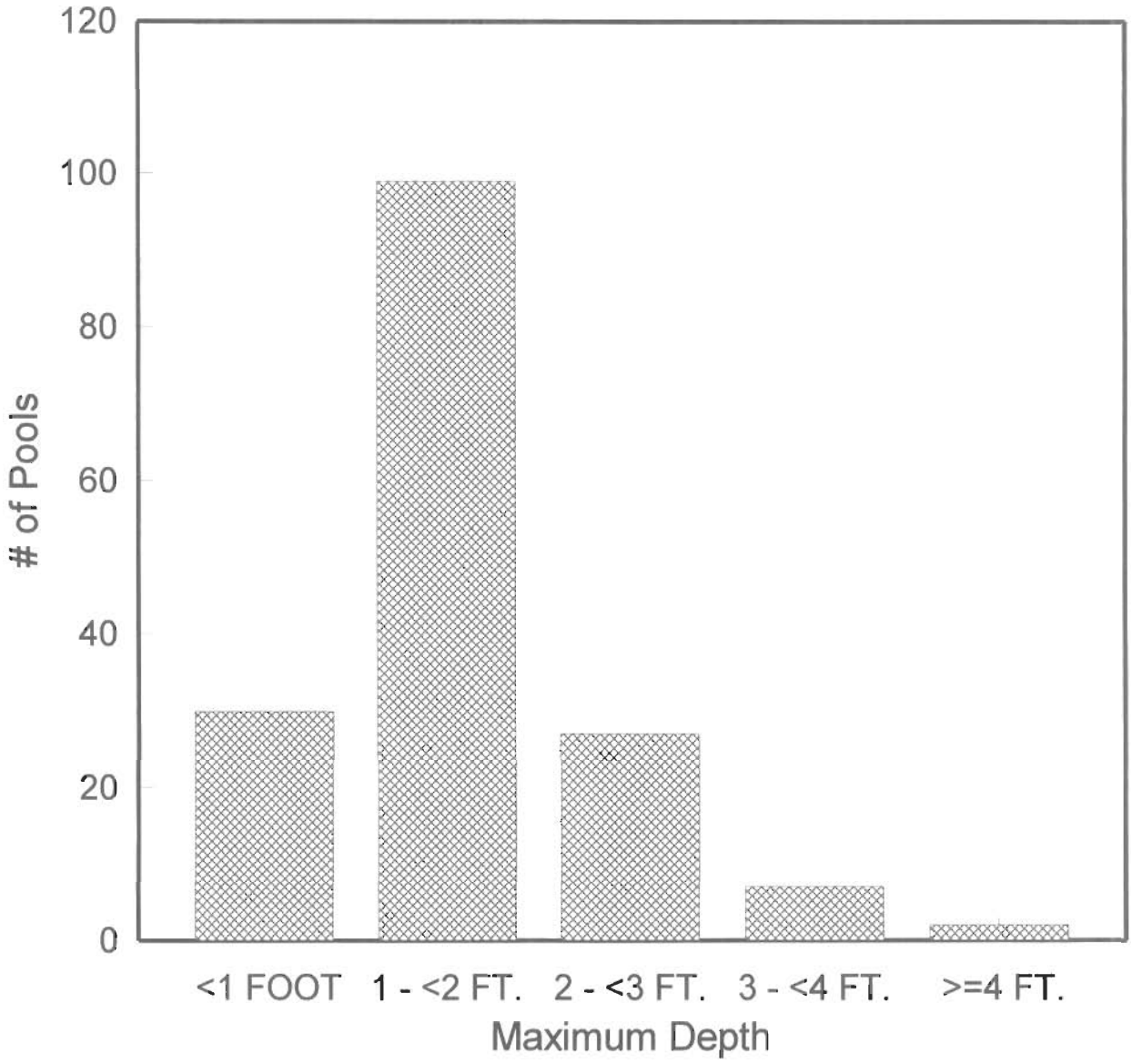
Pool Habitat Types by % Occurrence



Graph 3

Black Rock Creek

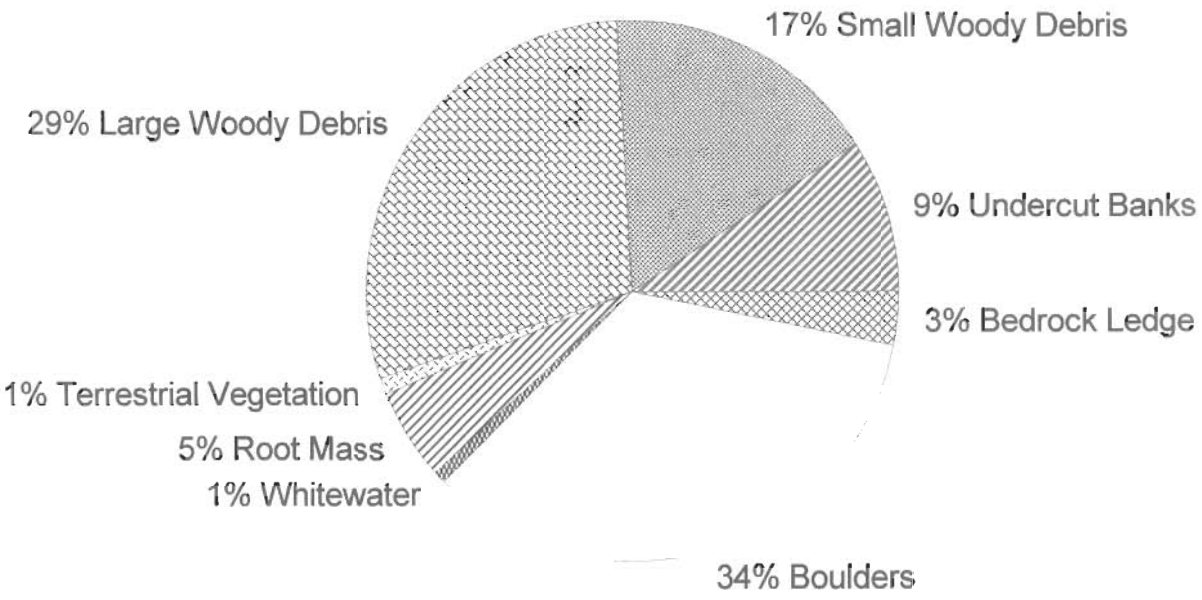
Maximum Depth in Pools



Graph 4

Black Rock Creek

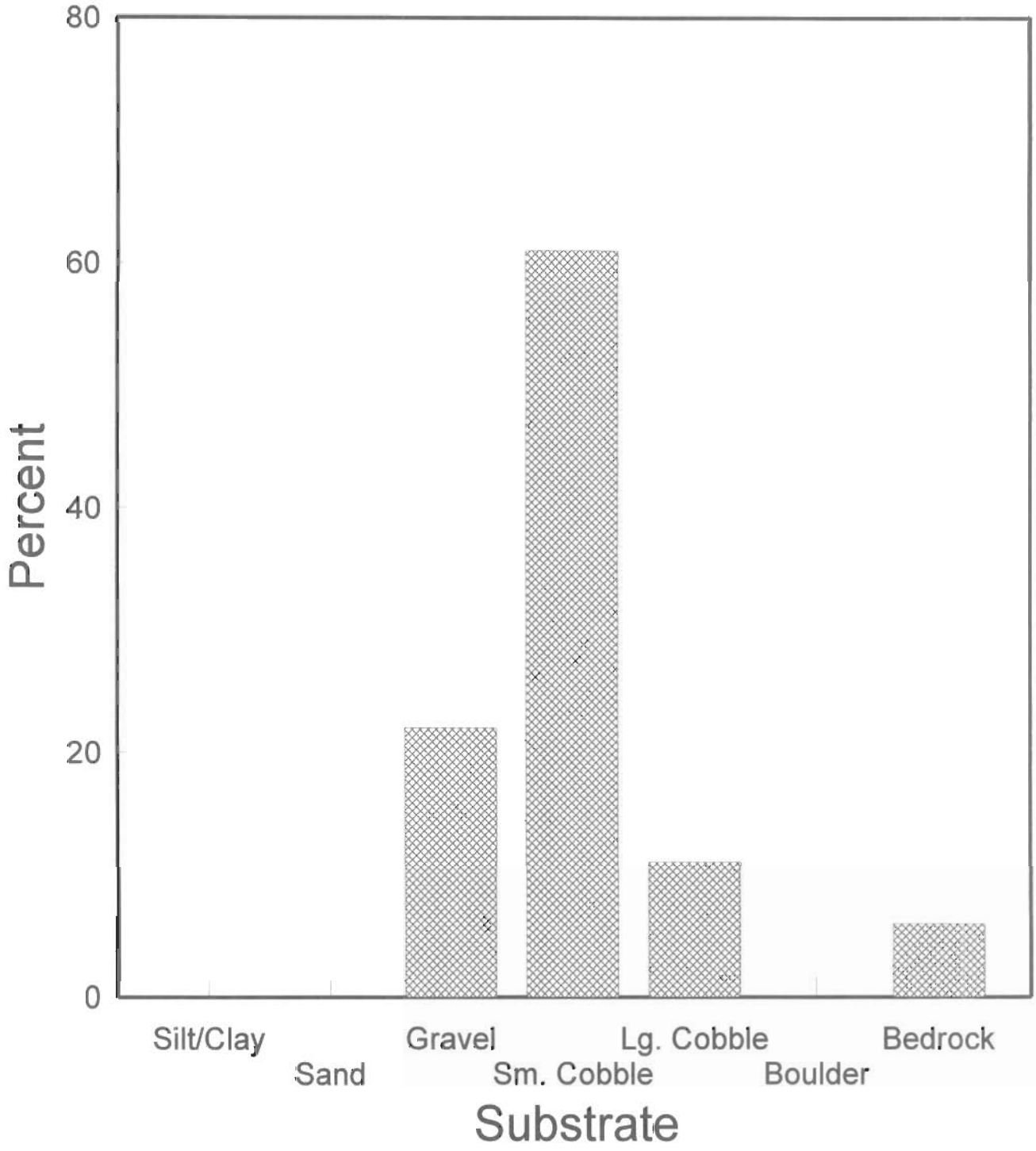
Pool Shelter Types by % Area



Graph 5

Black Rock Creek

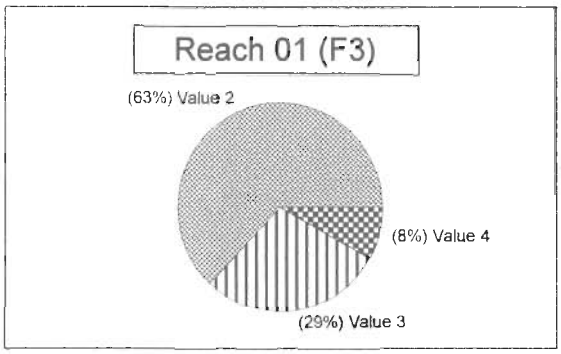
Substrate Composition in Low Gradient Riffles

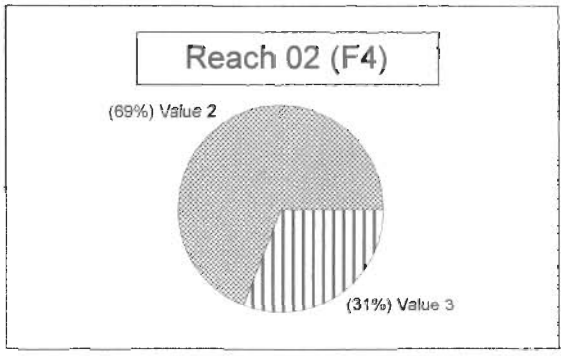


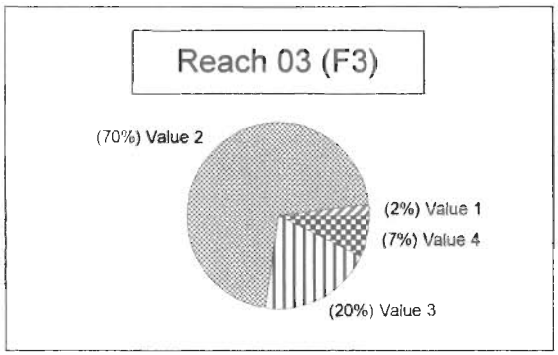
Graph 6

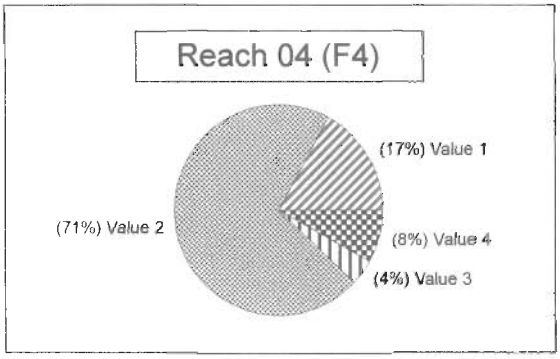
Black Rock Creek

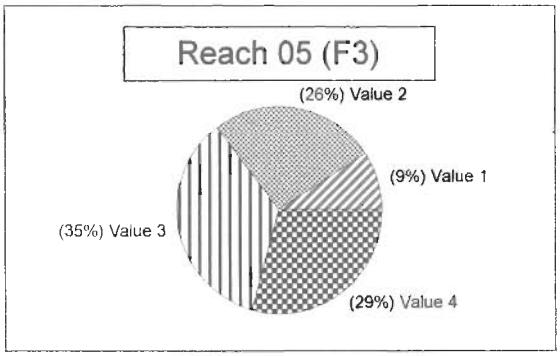
Percent Cobble Embeddedness by Reach









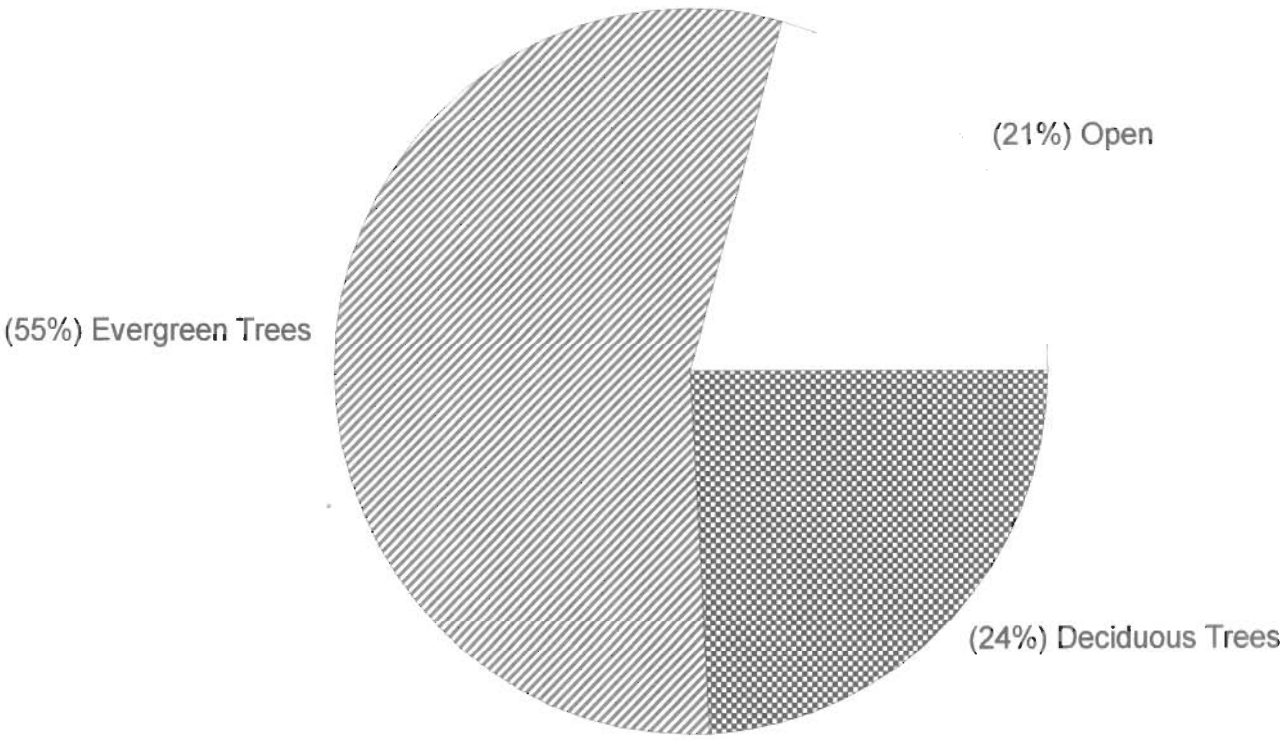


Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 7

Black Rock Creek

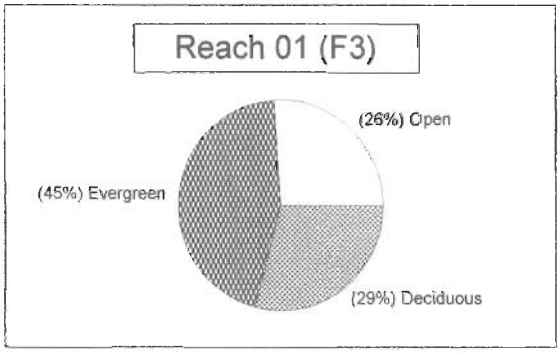
Mean Percent Canopy

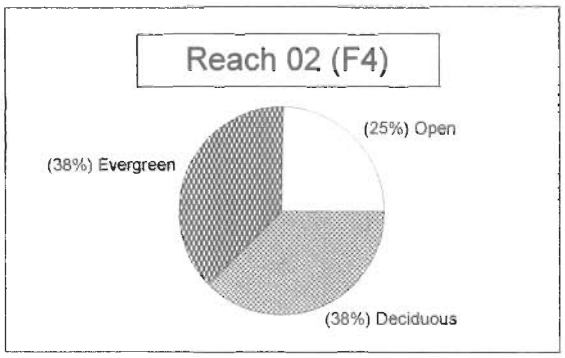


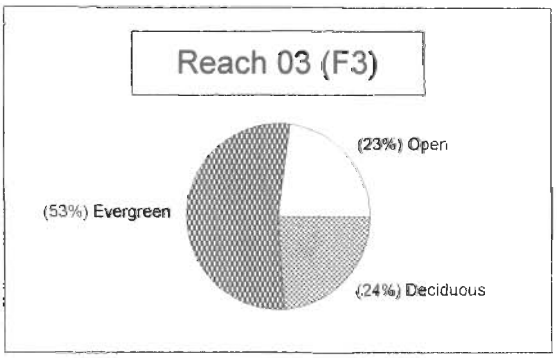
Graph 8

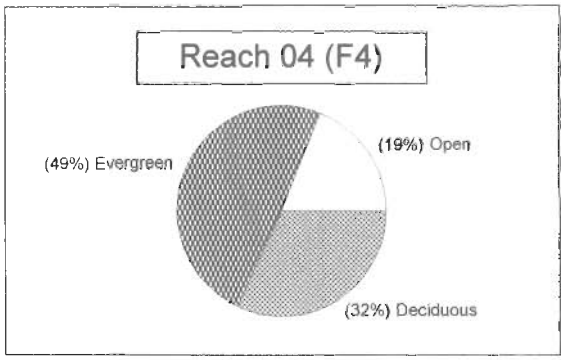
Black Rock Creek

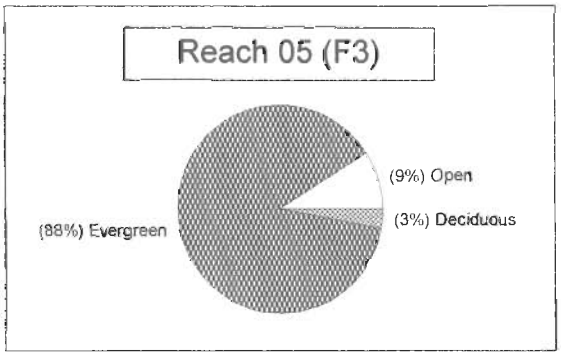
Percent Canopy by Reach







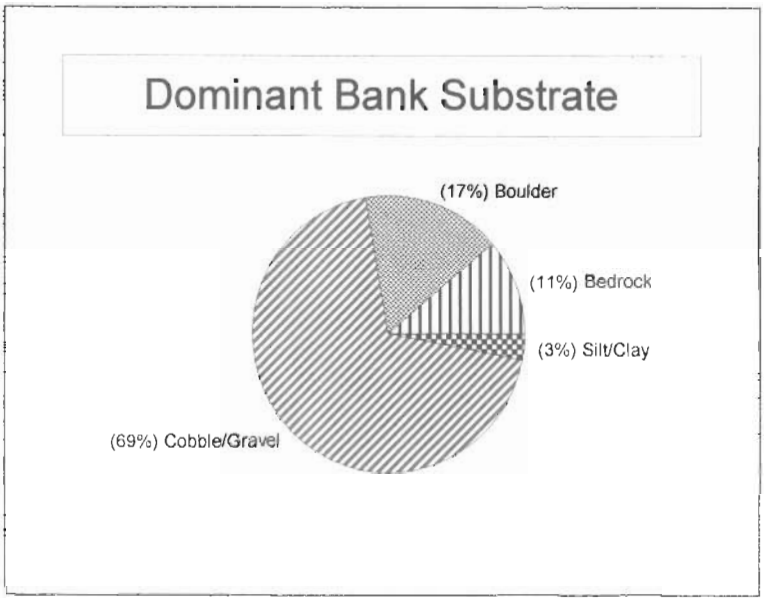


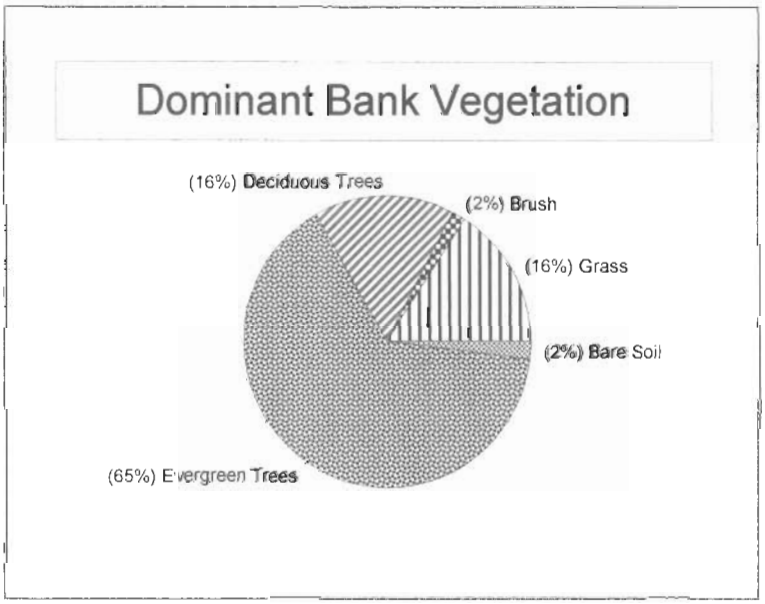


Graph 9

Black Rock Creek

Percent Bank Composition





Graph 10