CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Ash Creek

Report Completed 2006
Assessment Completed 2002

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Ash Creek, a stream in the Russian River watershed. 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 Ash 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, after analyzing historical and recent data, 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

Ash Creek is a tributary to the Russian River and is located in Mendocino and Sonoma Counties, California (see Ash Creek map, Appendix A). The legal description at the confluence with Russian River is T12N, R11W, S36. Its location is 38º51'08.64"N latitude and 123º01'42.99"W longitude. Access to Ash Creek, near the mouth, exists north of Cloverdale from Geysers Road off of Hwy 101.

Ash Creek and its tributaries drain a basin of approximately 2448.9 acres (3.83 square miles). Ash Creek is a 3rd order stream that has approximately 25810.4 feet (4.89 miles) of blue line stream, according to the USGS Cloverdale 7.5 minute quadrangles. Ash Creek has three minor unnamed tributaries which were not surveyed. Two dammed reservoirs drain into the tributary which is approximately 3.3 miles from the mouth. Elevations range from 338 feet at the mouth of the creek to 2887 feet in the headwaters. Huge rock slides (small to large cobble size) exist throughout creek, mostly due to unstable geology and steep hillsides. The vegetation is primarily shrubs (45%) and hardwood (41%) with some herbaceous (8%) and mixed conifer/hardwood (5%) and minor amounts of conifer (1%) and barren land (1%). None of the basin is urban and only 3.52 acres are agricultural. The watershed is 100% privately owned.

Salmonid fish species historically found in Ash Creek include steelhead trout. Endangered, threatened, or sensitive species listed include colusa layia (Layia septentrionalis).

METHODS

The habitat inventory conducted in Ash Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi, et al., 1998). The California Department of Fish and Game (DFG) field crew that conducted the inventory was trained in standardized habitat inventory methods by DFG. This inventory was conducted by 2 person teams and was supervised by DFG's Russian River Planner, Derek Acomb.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the California Salmonid Stream Habitat Restoration Manual. This form was used in Ash 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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

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. Temperatures are also recorded using remote temperature recorders which log temperatures every 1.5 hours, 24 hours/day.

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. Ash 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 were in feet to the nearest tenth. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a hip chain, and stadia rod.

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 Ash 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), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 5) 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 Ash 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 ocularly estimated using a list of seven size classes which are defined in the California Salmonid Stream Habitat Restoration Manual.

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 Ash Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the top 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 evergreen 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 Ash 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, including downed trees, logs and rootwads, 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) electro fishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

IMPACT INVENTORY & ANALYSIS

Problems such as migration barriers, streambed erosion, poor water quality or temperatures are noted in the comments and landmarks section. In some cases measurements are taken, an analysis of what caused the problem is made and restoration potential and alternatives are recommended.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat for data storage and analysis. Habitat is a Visual Basic extension to Microsoft Access, developed by Zebulon Young, University of California, Berkeley. This program processes and summarizes the data, and produces the following tables and appendices:
• 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 Ash Creek 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

HISTORICAL STREAM SURVEYS:

On August 8, 1962 a qualitative survey for Ash Creek was conducted by the Department. This report noted that steelhead were “common throughout.” the 1.5 mile survey.

On September 9, 1997 a qualitative survey of Ash creek was conducted by the Department. The report indicated anadromous steelhead were commonly found from the mouth upstream to approximately one mile. Resident coastal rainbow trout (non anadromous steelhead) were found between one mile from the mouth upstream to approximately 2.5 miles from the mouth.

HABITAT INVENTORY RESULTS FOR ASH CREEK

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

The habitat inventory of Ash Creek, 7/3/2002 - 7/17/2002, was conducted by Mitsuko Terry (DFG) and Kate Hall (CCC) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Russian River and extended up Ash Creek 277 feet past a 32 foot vertical falls. The total length of stream surveyed was 8776 feet, with an additional 326 feet of side channel.

Flows were not measured on Ash Creek.

This section of Ash Creek has 3 reaches with 3 distinct channel types: from the mouth to 1660 feet a B4, 2791 feet a B2 and 4325 feet a A2. B4 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly gravel substrate. B2 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly boulder substrate. A2 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly boulder substrate.

Water temperatures ranged from 60ºF to 76ºF. Air temperatures ranged from 59ºF to 97ºF. Summer temperatures were also measured using a remote temperature recorder placed in a pool (see Temperature Summary graphs at end of report). The recorder, in

Reach 1, logged temperatures every 1.5 hours from July 16 to August 6, 2002. The highest temperature recorded was 69.7°F on July 18, 19 and 20 and the lowest was 62.2°F on August 5. The mean of the daily highs was 68.8°F for the month of July and 67.0°F for August.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 42.5% flatwater units, 26.5% pool units, 25.0% riffle units and 6.0% dry units (Graph 1). Based on total length there were 59.0% flatwater units, 20.1% riffle units, 12.5% pool units and 8.5% dry units (Graph 1).

Two hundred habitat units were measured and 33% were completely sampled. Thirteen Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent occurrence were step run at 28%, mid-channel pool at 18%, low gradient riffle at 16%, run at 9%, dry at 6%, glide at 6%, high gradient riffle at 5%, lateral scour pool -boulder formed at 4%, step pool at 4%, bedrock sheet at 4%, cascade at 2%, plunge pool at 1% and channel confluence pool at 1% (Graph 3). By percent total length, step run at 50%, low gradient riffle at 15%, dry at 8%, mid-channel pool at 7%, run at 7%, high gradient riffle at 3%, step pool at 3%, glide at 3%, lateral scour pool -boulder formed at 2%, bedrock sheet at 1%, and cascade at 1%.

Fifty-three pools were identified (Table 3). Mid-channel pool pools were most often encountered at 18%, and comprised 59% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Six of the 53 pools (11%) had a depth of three feet or greater (Graph 5). These deeper pools comprised 1% 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. Pools rated 17, flatwater units rated 16 and riffles rated 12 (Table 1). Of the pool types, step pool rated 23, mid-channel pool rated 17, plunge pool rated 15, lateral scour pool -boulder formed rated 14 and channel confluence pool rated 5 (Table 2). Reach 3 had the highest shelter rating and Reach 2 had the lowest shelter rating.

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were boulders at 85%, bedrock at 8%, undercut banks at 4%, and small wood at 2%. Graph 7 describes the pool shelter in Ash Creek.

Table 6 summarizes the dominant substrate by habitat type. In the 31 low-gradient riffles surveyed, the dominant substrate by percent of the area surveyed was: small cobble in 3 riffles.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 50 pool tail-outs measured, 8 had a value of 1 (16%), 30 had a value of 2 (60%) and 10 had a value of 3 (20%). Two (4%) riffles rated a 5 (unsuitable substrate type for spawning). On this scale, a value of one is best for fisheries. Small cobble was the dominant substrate

observed at pool tail-outs (Graph 8). Graph 6 describes percent embeddedness, Table 7 describes percent embeddedness by reach. No mechanical gravel sampling was conducted in 2002 surveys.

The mean percent canopy density for the stream reach surveyed was 54%. The mean percentages of deciduous and evergreen trees were 83% and 14%, respectively. Graph 9 describes the canopy for the entire survey and Table 7 describes the canopy by reach.

For the entire stream reach surveyed, the mean percent right bank vegetated was 22% and the mean percent left bank vegetated was 18%. For the habitat units measured, the dominant vegetation types for the stream banks were: 67% deciduous trees, 16% bare soil, 10% grass, 4% evergreen trees and 4% brush (Graph 11). The dominant substrate for the stream banks were: 56% boulder, 23% cobble & gravel, 20% bedrock and 1% silt, clay & sand (Graph 10).

BIOLOGICAL INVENTORY
JUVENILE SURVEYS:

Department of Fish and Game has not conducted previous biological inventories of Ash Creek nor are there any records of hatchery releases or fish rescues in the Ash Creek watershed. A biological inventory was not conducted in 2002 although surveyors observed many steelhead 0+, 1+ and 2+ as well as other unidentified fishes and newts.

DISCUSSION FOR ASH CREEK

Ash Creek has 3 reaches and 3 channel types: B4, B2 and A2. Many site specific projects can be designed within the B type steam channel, especially to increase pool frequency, volume and shelter. According to the DFG Salmonid Stream Habitat Restoration Manual, B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. They are also good for medium-stage plunge weirs. B2 channel types are excellent for low and medium-stage plunge weirs, single and opposing wing deflectors and bank cover. These 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 high energy, steep gradient A2 channel types have stable stream banks and poor gravel retention capabilities and are generally not suitable for instream enhancement structures.
The water temperatures recorded on the survey days 7/3/2002 7/17/2002 ranged from 60ºF to 76ºF. Air temperatures ranged from 59ºF to 97ºF. The warmest water temperatures were recorded in Reach 2. Water temperatures above 65°F, if sustained, are above the threshold stress level for salmonids.

Summer temperatures measured using a remote temperature recorder in Reach 1 ranged from 62.2° to 69.7°F. The Temperature Summary graph shows that for much of the summer (July through August) the lower watershed exhibited

temperatures above the optimal for salmonids. It is unknown if this thermal regime is typical. To make any further conclusions, temperatures would need to be monitored throughout the critical summer months for a longer period of time and in more locations, and biological sampling would need to be conducted.

Pools comprised 13% of the total length of this survey. In third and fourth order streams a primary pool is defined to have a maximum 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. In Ash Creek, the pools are relatively shallow with 11% having a maximum depth of at least three feet. These pools comprised 1% of the total length of stream habitat. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 17. 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 at 85%, bedrock at 8%, undercut banks at 4%, and small wood at 2%. Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

All 3 of the low gradient riffles measured (100%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Twenty percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 16% had a rating of 1. Cobble embeddedness measured to be 25% or less (a rating of 1) is considered best for the needs of salmon and steelhead. In a reach comparison, Reaches 1 and 2 had the best ratings and Reach 3 had the poorest rating. The mean percent canopy for the survey was 54%. This is a low percentage of canopy, since 80% is generally considered desirable. Cooler water temperatures are desirable in Ash Creek. Elevated water temperatures could be reduced by increasing stream canopy. The large trees required for adequate stream canopy would also eventually provide a long term source of large woody debris needed for instream shelter and bank stability. All three reaches had a canopy less than 80% and numerous bank erosion problems. Areas with bank erosion could benefit from bio-technical re-vegetation techniques using native species.

GENERAL MANAGEMENT RECOMMENDATIONS

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

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

1. Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Fish passage should be monitored and improved where possible. Land owners are encouraged to walk their portion of the stream at least annually, and consult with the Department if any passage problems are discovered.

2. Increase the canopy on Ash 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 downstream is affected by upstream conditions. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

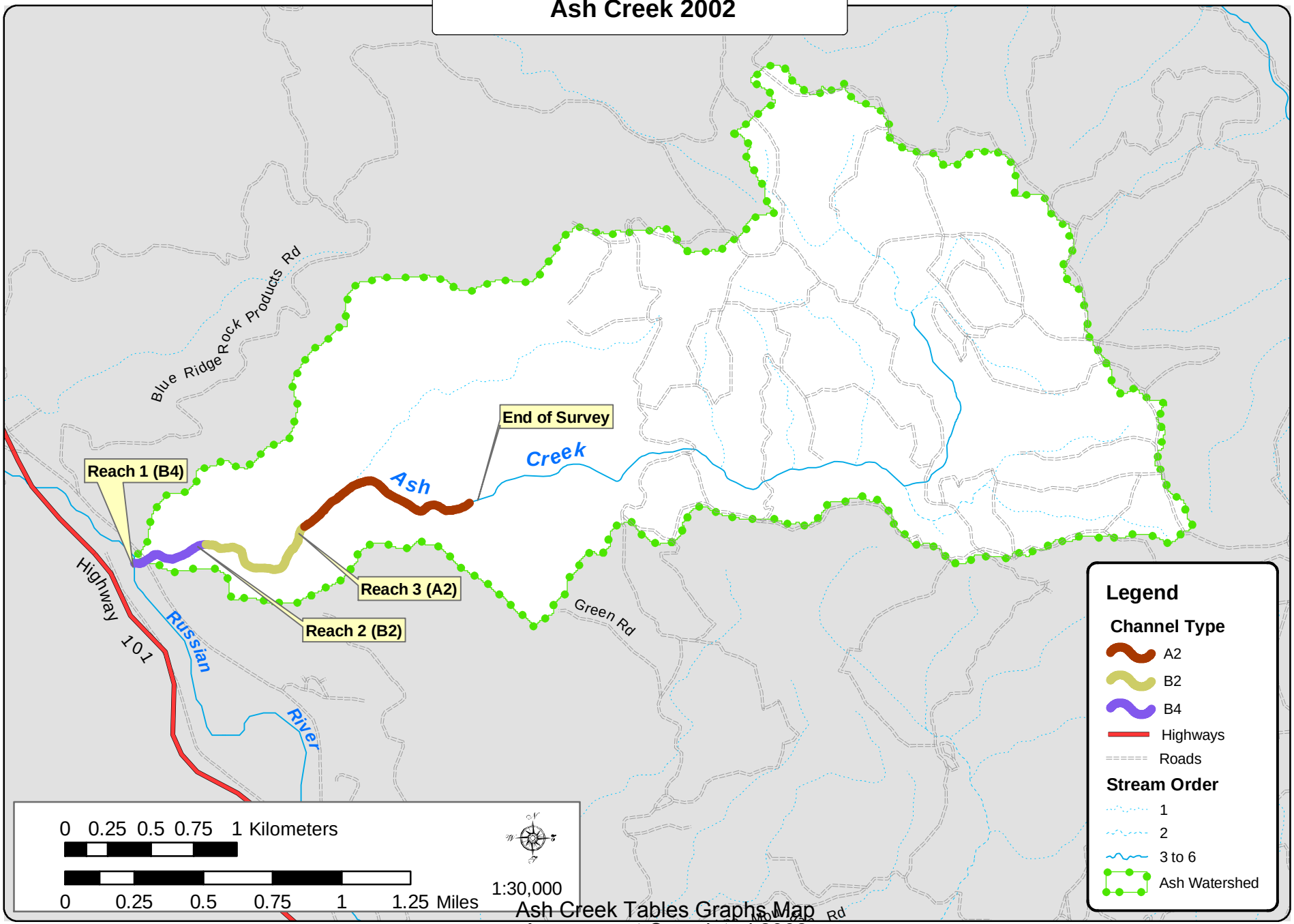
3. Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

4. Inventory and map sources of stream bank 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.

5. 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.

6. 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.

Ash Creek 2002



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Ash Creek Tables Graphs Map
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Prepared by: Ann-Marie Osterback, May 7, 2003

Ash Creek — Drainage: RUSSIAN RIVER BASIN

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 07/03/02 to 07/17/02

Confluence Location: QUAD: Cloverdale LEGAL DESCRIPTION: T12N, R11W, S36 LATITUDE: 38°51'08.64"N LONGITUDE: 123°01'42.99"W

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
50	11	RIFFLE	25	37	1825	20	3.6	0.3	105	5262	28	1419	0	3
85	20	FLATWATER	43	63	5367	59	5.7	0.5	342	29043	105	8956	0	8
53	28	POOL	27	21	1138	13	10.1	1.3	192	10156	282	14930	244	16
12	0	DRY	6	64	772	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.)		
200	59				9102					44461		25305		

Ash Creek — Drainage: RUSSIAN RIVER BASIN

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 07/03/02 to 07/17/02

Confluence Location: QUAD: Cloverdale LEGAL DESCRIPTION: T12N, R11W, S36 LATITUDE: 38°51'08.64"N LONGITUDE: 123°01'42.99"W

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE	MEAN LENGTH	TOTAL LENGTH	TOTAL LENGTH	MEAN WIDTH	MEAN DEPTH	MAXIMUM DEPTH	MEAN AREA	TOTAL AREA EST.	MEAN VOLUME	TOTAL VOLUME EST.	MEAN RESIDUAL POOL VOL	MEAN SHELTER RATING	MEAN CANOPY
#			%	ft.	ft.	%	ft.	ft.	ft.	sq.ft.	sq.ft.	cu.ft.	cu.ft.	cu.ft.		%
31	3	LGR	16	43	1335	15	4	0.2	0.5	146	4521	38	1175	0	2	45
9	3	HGR	5	33	299	3	4	0.3	0.6	87	785	38	341	0	10	48
3	2	CAS	2	22	67	1	3	0.6	1.6	56	167	38	114	0	0	83
7	3	BRS	4	18	124	1	2	0.2	0.5	38	263	3	21	0	0	56
11	3	GLD	6	21	235	3	6	0.6	1.1	137	1509	88	970	0	2	35
18	7	RUN	9	34	610	7	7	0.4	1.2	211	3791	71	1272	0	6	44
56	10	SRN	28	81	4522	50	5	0.5	1.5	423	23708	138	7752	0	12	58
36	15	MCP	18	19	673	7	10	1.4	3.5	173	6242	253	9106	228	15	67
1	1	CCP	1	9	9	0	7	1.1	1.9	57	57	62	62	57	5	80
7	5	STP	4	39	275	3	9	1.4	3.5	318	2223	491	3440	455	23	63
8	6	LSBo	4	21	169	2	9	1.1	2.9	183	1463	234	1875	137	14	61
1	1	PLP	1	12	12	0	15	2.0	2.8	171	171	342	342	325	15	75
12	0	DRY	6	64	772	8	0	0.0	0.0	0	0	0	0	0	0	59
TOTAL UNITS	TOTAL UNITS				LENGTH (ft.)						AREA (sq.ft)		TOTAL VOL. (cu.ft)			
200	59				9102						44899		26470			

Ash Creek — Drainage: RUSSIAN RIVER BASIN

Table 3 - SUMMARY OF POOL TYPES — Survey Dates: 07/03/02 to 07/17/02

Confluence Location: QUAD: Cloverdale LEGAL DESCRIPTION: T12N, R11W, S36 LATITUDE: 38°51'08.64"N LONGITUDE: 123°01'42.99"W

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
44	21	MAIN	83	22	957	84	10.1	1.4	194	8522	288	12678	258	16
9	7	SCOUR	17	20	181	16	10.0	1.2	182	1634	248	2230	164	14

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
53	28	1138	10156	14909

Ash Creek — Drainage: RUSSIAN RIVER BASIN

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 07/03/02 to 07/17/02

Confluence Location: QUAD: Cloverdale LEGAL DESCRIPTION: T12N, R11W, S36 LATITUDE: 38°51'08.64"N LONGITUDE: 123°01'42.99"W

UNITS MAX DPTH MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPT	1-<2 FT. PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FT. PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FT. PERCENT OCCURRENCE	>=4 FT. MAXIMUM DEPTH	>=4 FT. PERCENT OCCURRENCE
35	MCP	66	0	0	19	54	11	31	5	14	0	0
1	CCP	2	0	0	1	100	0	0	0	0	0	0
7	STP	13	0	0	3	43	3	43	1	14	0	0
8	LSBo	15	0	0	5	63	3	38	0	0	0	0
1	PLP	2	0	0	0	0	1	100	0	0	0	0

TOTAL UNITS
52

Ash Creek Drainage: RUSSIAN RIVER BASIN

Table 5 - Summary of Shelter by Habitat Type Survey Dates: 07/03/02 to 07/17/02

Confluence Location: QUAD: Cloverdale LEGAL DESCRIPTION: T12N, R11W, S36 LATITUDE: 38°51'08.64"N LONGITUDE: 123°01'42.99"W

UNITS MEASURED	UNITS SHELTER MEASURED	HABITAT TYPE	% TOTAL UNDERCUT BANKS	% TOTAL SWD	% TOTAL LWD	% TOTAL ROOT MASS	% TOTAL TERR. VEGETATION	% TOTAL AQUATIC VEGETATION	% TOTAL WHITE WATER	% TOTAL BOULDERS	% TOTAL BEDROCK LEDGES
31	3	LGR	0	0	0	0	0	50	0	50	0
9	3	HGR	0	0	0	0	0	0	1	99	0
3	2	CAS	0	0	0	0	0	0	0	0	0
7	3	BRS	0	0	0	0	0	0	0	0	0
11	3	GLD	0	0	0	0	0	0	0	100	0
18	8	RUN	0	3	0	0	0	0	0	97	0
56	10	SRN	0	0	0	0	0	0	0	0	0
36	35	MCP	0	0	0	0	0	0	0	86	14
1	1	CCP	0	0	0	0	0	0	0	90	10
7	7	STP	12	6	0	0	0	0	0	81	0
8	8	LSBo	0	3	0	4	0	0	0	93	0
1	1	PLP	0	0	0	0	0	0	0	100	0
12	1	DRY	0	0	0	0	0	0	0	0	0
ALL 200	85		***	***	***	***	***	***	***	***	***
HABITAT TYPES POOLS ONLY 53	52		4	2	0	0	0	0	0	85	8

Ash Creek Drainage: RUSSIAN RIVER BASIN

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE Survey Dates: 07/03/02 to 07/17/02

Confluence Location: QUAD: Cloverdale LEGAL DESCRIPTION: T12N, R11W, S36 LATITUDE: 38°51'08.64"N LONGITUDE: 123°01'42.99"W

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
31	3	LGR	0	0	0	100	0	0	0
9	3	HGR	0	0	0	33	33	0	33
3	3	CAS	0	0	0	0	0	33	67
7	3	BRS	0	0	0	0	0	0	100
11	4	GLD	50	0	25	25	0	0	0
18	10	RUN	20	0	30	30	10	10	0
56	10	SRN	10	0	30	10	10	40	0
36	31	MCP	26	23	23	16	3	10	0
1	1	CCP	100	0	0	0	0	0	0
7	7	STP	0	14	43	14	0	29	0
8	7	LSBo	29	14	43	0	0	0	14
1	1	PLP	0	0	0	0	100	0	0
12	1	DRY	0	0	0	0	0	100	0

APPENDIX A. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Ash Creek
SAMPLE DATES: 07/03/2002 to 07/17/2002
SURVEY LENGTH:
MAIN CHANNEL: 8776.1 ft. SIDE CHANNEL 326 ft.
LOCATION OF STREAM MOUTH
USGS Quad Map: Latitude:
Legal Description: Longitude:

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01 (Units 1-91)

Channel Type: B4	Mean Canopy Density: 50 %
Main Channel Length: 1660 ft.	Evergreen Component: 3 %
Side Channel Length: 80 ft.	Deciduous Component: 97 %
Riffle/Flatwater Mean Width: 6.2 ft.	Pools by Stream Length: 9 %
Pool Mean Depth: 1.2 ft.	Pools >=2 ft. Deep: 29 %
Base Flow: cfs	Pools >=3 ft. Deep: 0 %
Water: 62-70°F Air: 59-78°F	Mean Pool Shelter Rtn: 14
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 15 %	LOD Pool Shelter: 3 %
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 72 ft.

Embeddness Value: 1. 29 % 2. 71 % 3. 0 % 4. 0 % 5. 0 %

STREAM REACH 02 (Units 38-90)

Channel Type: B2	Mean Canopy Density: 48 %
Main Channel Length: 2791 ft.	Evergreen Component: 29 %
Side Channel Length: 234 ft.	Deciduous Component: 71 %
Riffle/Flatwater Mean Width: 6.4 ft.	Pools by Stream Length: 13 %
Pool Mean Depth: 1.3 ft.	Pools >=2 ft. Deep: 40 %
Base Flow: cfs	Pools >=3 ft. Deep: 7 %
Water: 66-76°F Air: 77-95°F	Mean Pool Shelter Rtn: 12
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 26 %	LOD Pool Shelter: 0 %
Dom. Bank Substrate: Cobble/Gravel	Dry Channel: 0 ft.

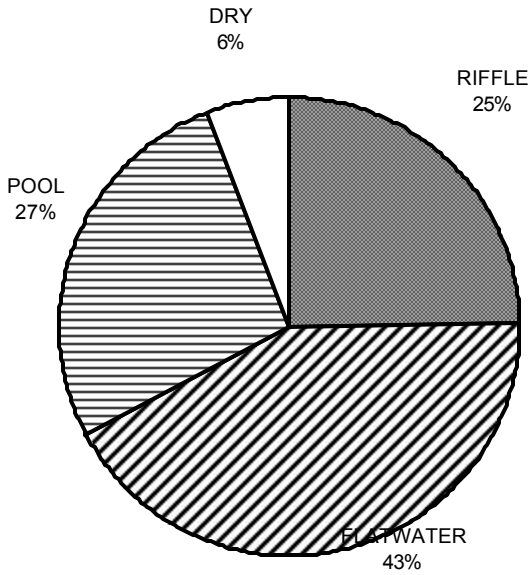
Embeddness Value: 1. 33 % 2. 42 % 3. 25 % 4. 0 % 5. 0 %

STREAM REACH 03 (Units 92-190)

Channel Type: A2	Mean Canopy Density: 65 %
Main Channel Length: 4325 ft.	Evergreen Component: 19 %
Side Channel Length: 12 ft.	Deciduous Component: 79 %
Riffle/Flatwater Mean Width: 3.8 ft.	Pools by Stream Length: 17 %
Pool Mean Depth: 1.4 ft.	Pools >=2 ft. Deep: 53 %
Base Flow: cfs	Pools >=3 ft. Deep: 17 %
Water: 60-75°F Air: 70-97°F	Mean Pool Shelter Rtn: 21
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 19 %	LOD Pool Shelter: 0 %
Dom. Bank Substrate: Boulder	Dry Channel: 661 ft.

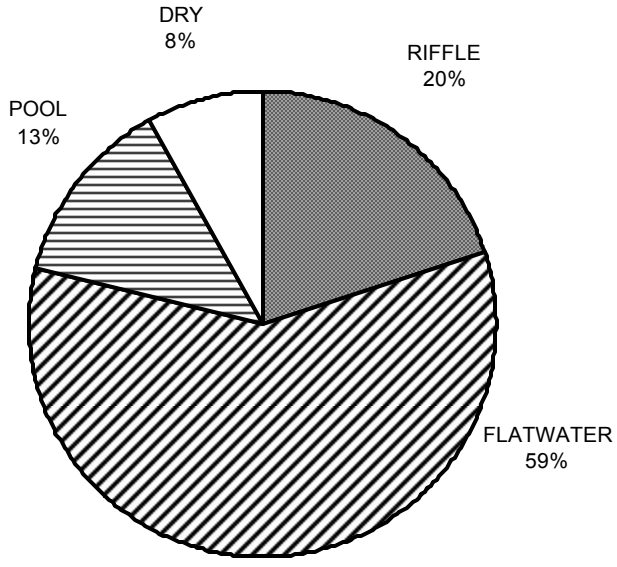
Embeddness Value: 1. 6 % 2. 65 % 3. 23 % 4. 0 % 5. 6 %

ASH CREEK
HABITAT TYPES BY PERCENT OCCURRENCE



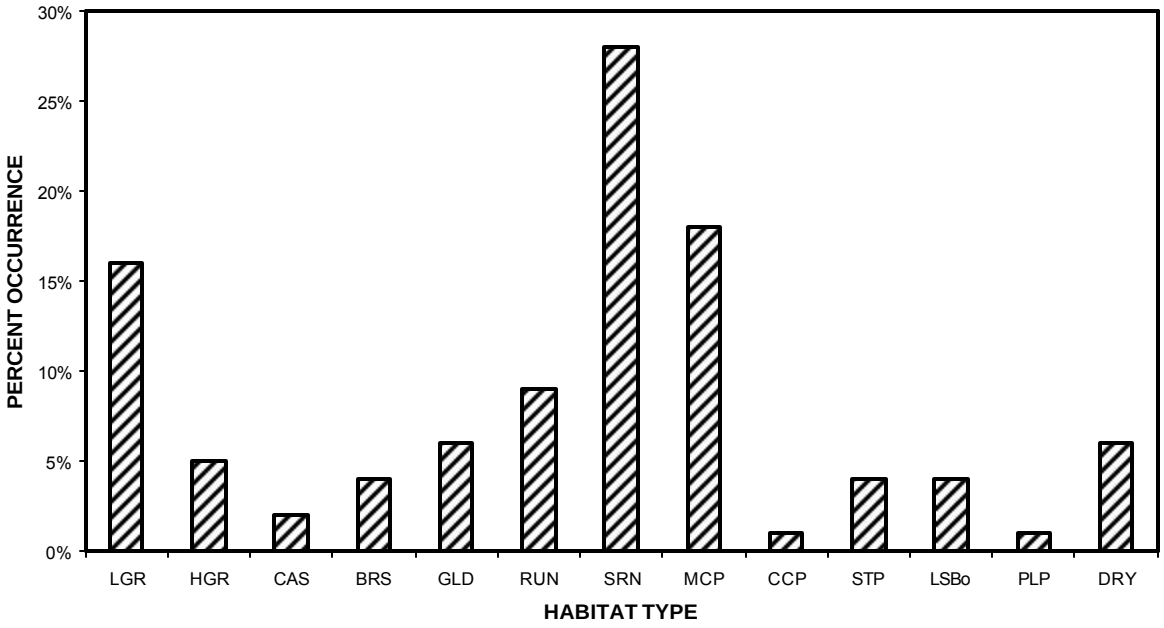
GRAPH 1. Level II habitat types by percent occurrence.

ASH CREEK
HABITAT TYPES BY PERCENT TOTAL LENGTH



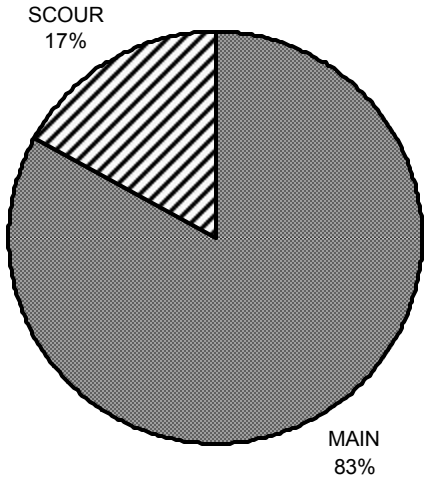
GRAPH 2. Level II habitat types by percent total length.

ASH CREEK
HABITAT UNIT TYPES BY PERCENT OCCURRENCE

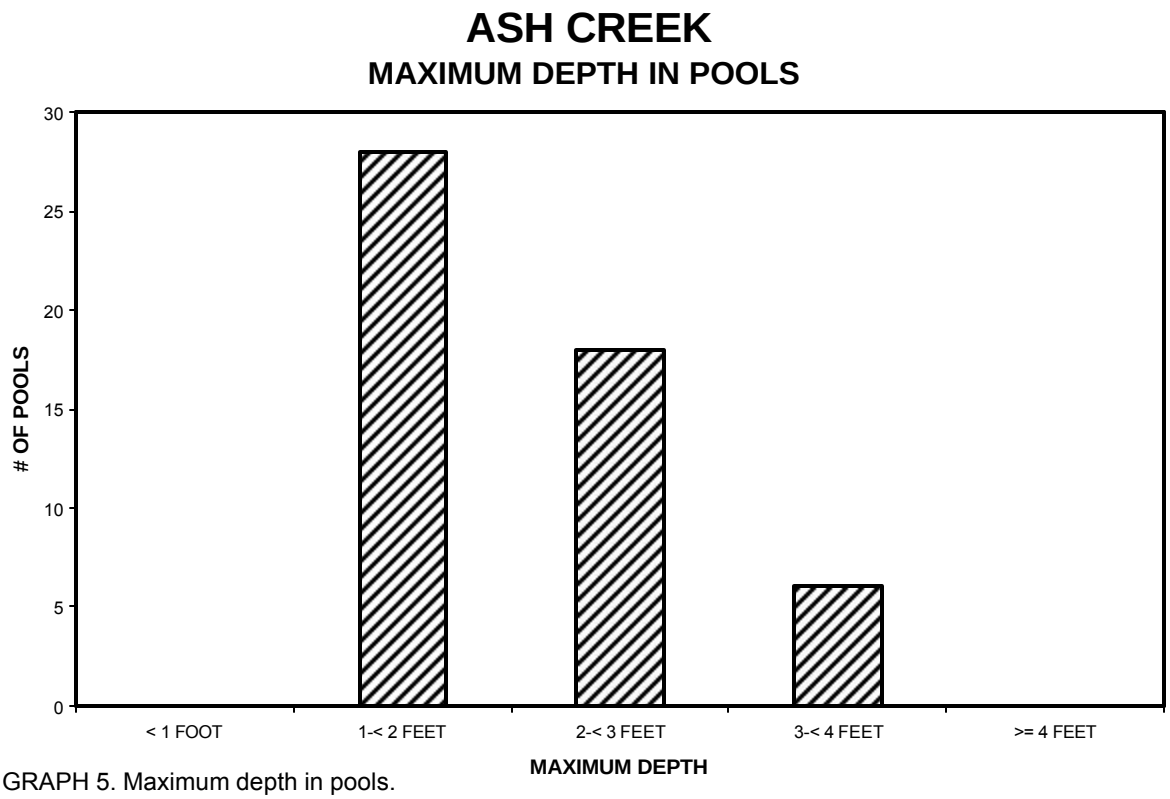


GRAPH 3. Level IV habitat unit types by percent occurrence.

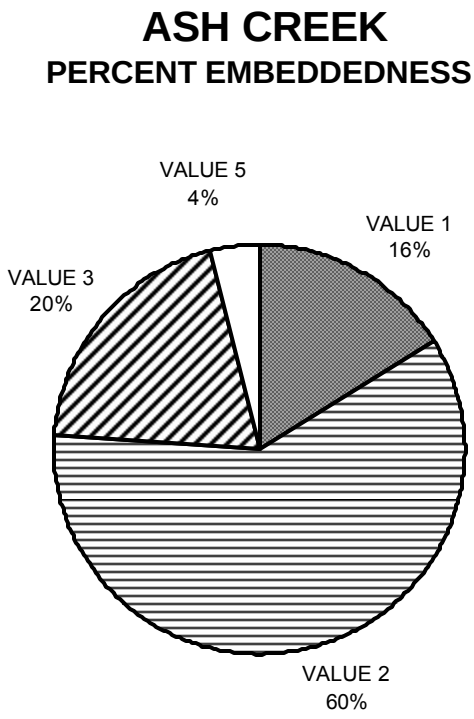
ASH CREEK
POOL HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 4. Level I pool habitat types by percent occurrence.

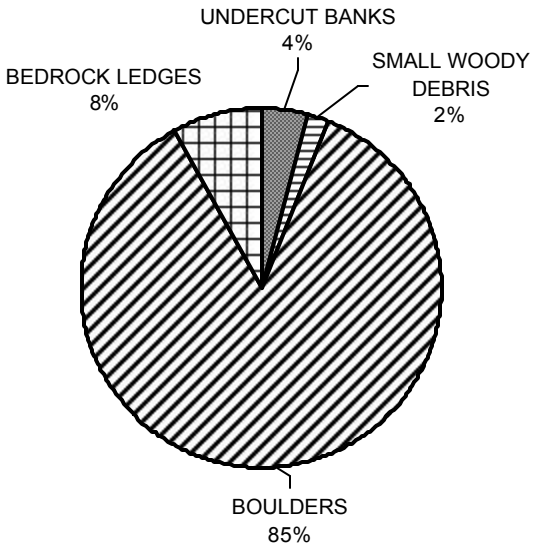


GRAPH 5. Maximum depth in pools.



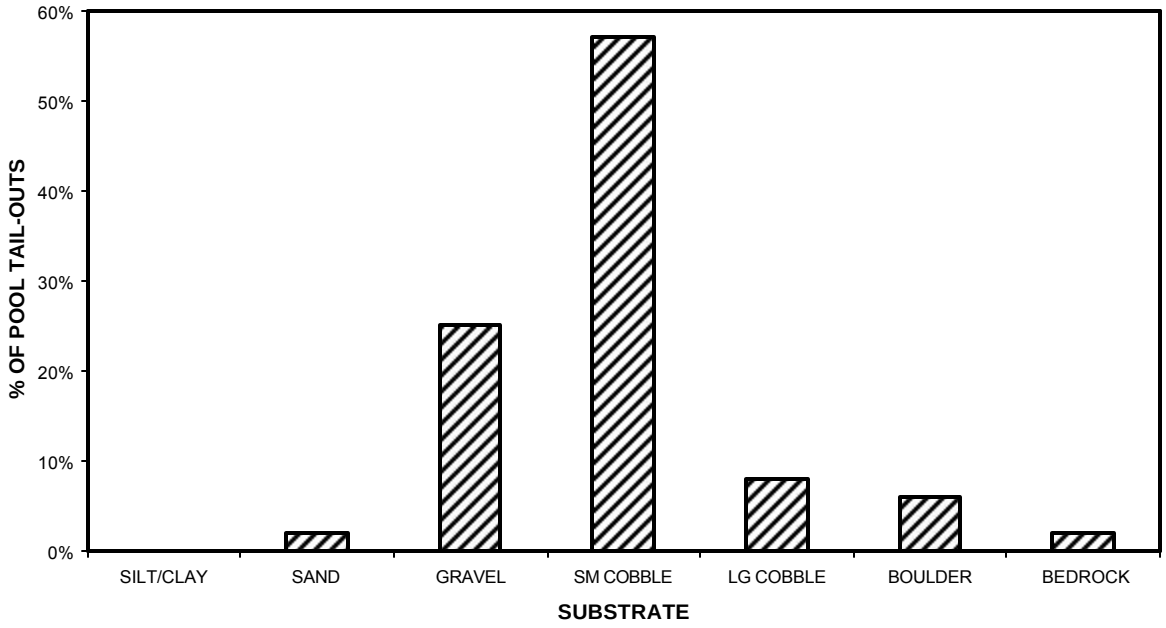
GRAPH 6. Percent embeddedness estimated at pool tail-outs.

ASH CREEK
MEAN PERCENT COVER TYPES IN POOLS



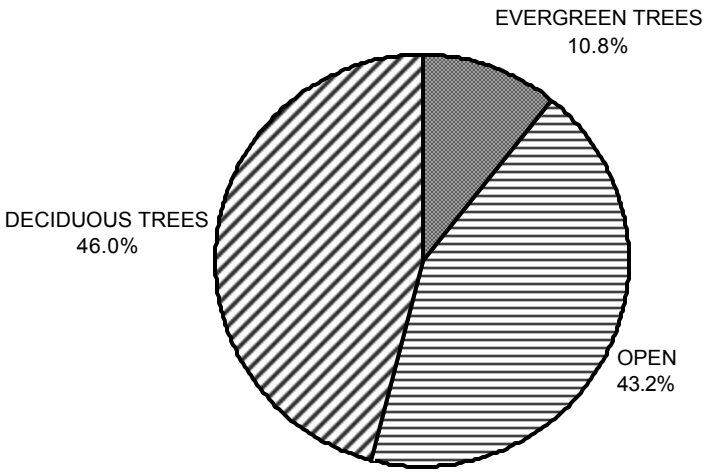
GRAPH 7. Mean percent cover types in pools.

ASH CREEK
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



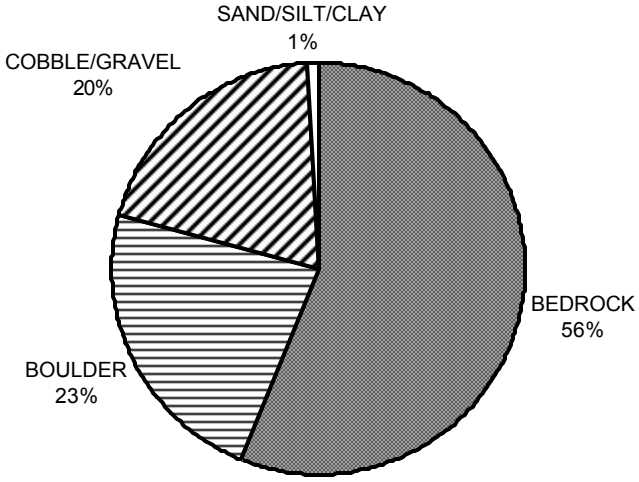
GRAPH 8. Substrate composition in pool tail-outs.

ASH CREEK
MEAN PERCENT CANOPY



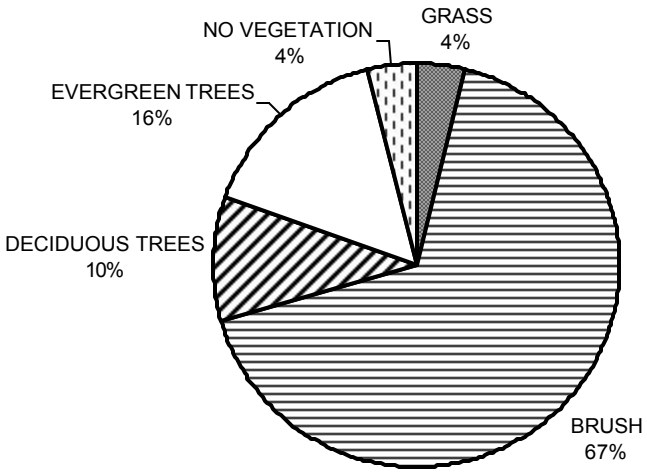
GRAPH 9. Mean percent canopy.

ASH CREEK
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10. Dominant bank composition in survey reach.

ASH CREEK
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11. Dominant bank vegetation in survey reach.

Ash Creek Water Temperature 2002