

STREAM INVENTORY REPORT

Russell Brook

INTRODUCTION

A stream inventory was conducted beginning July 1, and ending July 9, 2002 on Russell Brook. The survey began at the confluence with Big River and extended upstream 4.06 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Russell Brook.

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

Russell Brook is a tributary to the Big River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Russell Brook's legal description at the confluence with Big River is T17N R15W S26. Its location is 39°30'9" North latitude and 123°49'9" West longitude. Russell Brook is a second order stream and has approximately 4.3 miles of blue line stream according to the USGS Greenough Ridge 7.5 minute quadrangle. Russell Brook drains a watershed of approximately 4.1 square miles. Elevations range from about 400 feet at the mouth of the creek to 1,540 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 logging roads from Highway 20 at mile marker 27.

METHODS

The habitat inventory conducted in Russell Brook follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game Scientific Aides 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

Russell Brook

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 Russell Brook 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". Russell Brook 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.

Russell Brook

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 Russell Brook, 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 Russell Brook, 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Russell Brook, 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 Russell Brook, 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.

Russell Brook

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 six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Excel. Graphics developed for Russell Brook include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 1 through July 9, 2002, was conducted by S. Monday and K. Knechtle (DFG). The total length of the stream surveyed was 21,420 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.081 cfs on September 24, 2002.

Russell Brook is a B3 channel type for the entire 21,420 feet of stream surveyed. B3 channel types are classified as moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks, and cobble-dominated substrate.

Water temperatures taken during the survey period ranged from 56 to 65 degrees Fahrenheit. Air temperatures ranged from 57 to 87 degrees Fahrenheit.

Russell Brook

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% pool units, 38% flatwater units, 17% riffle units, and 3% dry units (Graph 1). Based on total length of Level II habitat types there were 70% flatwater units, 12% riffle units, 14% pool units, and 4% dry units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 34%; step runs, 34%; and low gradient riffles, 15% (Graph 3). Based on percent total length, step runs made up, 67%, low gradient riffles, 12%, and mid-channel pools, 11%,

A total of 118 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 83%, and comprised 82% 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. Forty-two of the 118 pools (36%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 118 pool tail-outs measured, 1 had a value of 1 (1%); 22 had a value of 2 (19%); 42 had a value of 3 (36%); 13 had a value of 4 (11%); and 40 had a value of 5 (34%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Pool habitats had a mean shelter rating of 35, flatwater habitat types had a mean shelter rating of 16, and riffle habitat types had a mean shelter rating of 9 (Table 1). Of the pool types, main channel pools had the highest mean shelter rating at 37. Scour channel pools had a mean shelter rating of 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Russell Brook. Graph 7 describes the pool cover in Russell Brook. Large woody debris is the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 42% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 26% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Russell Brook was 83%. Of the canopy present, the mean percentages of hardwood and coniferous trees were 90% and 10%, respectively. Graph 9 describes the mean percent canopy in Russell Brook.

For the stream reach surveyed, the mean percent right bank vegetated was 62%. The mean percent left bank vegetated was 68%. The dominant elements composing the structure of the stream banks consisted of 75% sand/silt/clay, 13% cobble/gravel, 11% bedrock, and 2% boulder

Russell Brook

(Graph 10). Coniferous trees were the dominant vegetation type observed in 85% of the units surveyed. Additionally, 7% of the units surveyed had brush as the dominant vegetation type, and 6% had deciduous trees as the dominant vegetation (Graph 11).

DISCUSSION

Russell Brook is a B3 channel type for 21,420 feet of stream surveyed, with an additional 814 feet of dry stream. The suitability of B3 channel types for fish habitat improvement structures is as follows: B3 channel types are excellent for plunges weirs, boulder clusters and bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 1 through July 9, 2002 ranged from 56 to 65 degrees Fahrenheit. Air temperatures ranged from 57 to 87 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any 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 70% of the total length of this survey, pools 14%, riffles 12%, and dry 4%. The pools are relatively shallow, with 42 of the 118 (36%) 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. 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. Installing structures that will increase or deepen pool habitat is recommended.

Twenty-three of the 118 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixty of the pool tail-outs had embeddedness ratings of 3 or 4. Forty 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 Russell Brook should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eighty of the 118 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 35. The shelter rating in the flatwater habitats was 16. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in all habitat types. Additionally, small woody debris contributes 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.

Russell Brook

The mean percent canopy density for the stream was 83%. 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 62% and 68%, 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) Russell Brook should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the suitable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.
- 5) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
- 6) There are sections where the stream is being impacted from cattle the riparian zone. Alternatives should be explored with the grazer and developed if possible.

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 75 feet from the confluence with Big River. The channel type is a B3.
110'	Steelhead young-of-the-year (YOY).

Russell Brook

- 441' Large woody debris accumulation (LDA) retaining sediment.
- 613' LDA retaining sediment.
- 1190' Right bank erosion 40 feet high x 60 feet long.
- 1558' Pool enhanced by large woody debris (LWD).
- 1727' Coho and steelhead YOY.
- 2419' Restoration work on the left bank. Large logs cabled to the banks. Small woody debris accumulation.
- 2478' One piece of LWD, 30 feet long at the top of the pool.
- 2498' Left bank tributary.
- 2729' Dry right bank tributary.
- 2773' Right bank tributary.
- 3011' Left bank tributary. Little water flowing.
- 3471' Dry right bank tributary. Channel type taken in this unit and it is a B3.
- 4019' LDA covering most of the pool.
- 5033' Sculpin observed.
- 5220' Rock weir at top of pool creating large pool.
- 5785' Fine sediment in channel.
- 5873' LDA 30 feet wide x 4 feet high x 5 feet deep.
- 5893' Rock weirs.
- 6148' LDA 20 feet wide x 10 feet high x 30 feet deep.
- 6261' LDA 20 feet wide x 3 feet high x 30 feet long.
- 6411' Flow blocked by large wood above the pool. LDA is 30 feet wide x 30 feet long x 3 feet high.
- 6594' Log weir.

Russell Brook

- 6714' LDA at the top of the unit is 4 feet wide x 4 feet high x 20 feet long.
- 7172' LDA across stream is 5 feet wide x 2 feet high x 2 feet deep.
- 7472' LDA is retaining sediment.
- 7717' Channel is marshy with grass as the dominant cover.
- 7986' Bridge crossing.
- 8120' Coho YOY.
- 8537' Stream substrate is silt.
- 8844' LDA is 40 feet wide x 10 feet high x 40 feet long.
- 9398' LDA is 15 feet wide, 3 feet high, and 3 feet long.
- 10421' Bridge crossing. The bridge is in good shape.
- 10714' Fish present in the pool.
- 10979' Left bank tributary with flowing water. Tributary has about a 45% gradient with a culvert a short way up. Not anadromous.
- 11014' Four foot bedrock above pool. Coho and steelhead YOY in pool.
- 11434' Dry left bank tributary. Culvert is approximately 20' up the bank from the stream.
- 12043' Flowing right bank tributary.
- 12103' Logging cable tangled throughout the channel.
- 12252' Coho and steelhead YOY.
- 12435' Plunge is 3.5 feet.
- 12450' Left bank erosion contributing fines to stream. Erosion is 40' long x 20' high.
- 12681' Railroad car bridge.
- 12913' Five pieces of LWD cabled together in channel.
- 13044' Steelhead and coho YOY.

Russell Brook

- 13420' LDA is 15' wide x 10' high x 30' wide.
- 13527' Flowing left bank tributary. There is a potential wood barrier in this unit.
- 13615' LDA is 100' long and retaining sediment.
- 13767' Cattle accessing stream from road.
- 13792' Cattle trails down the banks and into the stream.
- 14064' Sediment built up behind two large boulders and LWD.
- 14083' LDA is 20' wide x 6' high x 20' long.
- 14582' Pool surrounded by LDA which is 20' wide x 8' high x 20' long.
- 14793' LDA across stream.
- 15013' Flowing left bank tributary, no fish observed.
- 15120' The channel is dry. There are signs of cattle within the stream.
- 15420' Right bank tributary. LDA covering the unit.
- 15710' Steelhead yearling. LDA is 10' wide x 20' long x 10' high. Root wad is retaining sediment.
- 15742' LDA at 44' into unit is 10' wide x 10' long x 5' high.
- 15927' LDA is 30' wide x 10' high x 20' long.
- 15955' LDA is 10' wide x 20' long x 5' high. Second LDA is 10' wide x 10' long x 5' high. Dry left bank tributary.
- 16200' LDA is 10' wide x 4' long x 3' high.
- 16376' Dry right bank tributary. Culvert.
- 16840' Boulder with LWD retaining sediment. This is a potential barrier to YOY.
- 16855' Steelhead YOY observed.
- 16983' Potential LDA barrier.
- 17113' Large sediment buildup behind LDA.

Russell Brook

- 17248' Restoration site potentially failed and moved from the bank into the channel.
- 17771' Three foot plunge.
- 17870 Four foot plunge.
- 18037' Bridge crosses the stream.
- 18707' Evidence of cattle in stream. Steelhead YOY.
- 18799' Five to 10 steelhead YOY. Dry left bank tributary.
- 18849' Two to 3 pieces of LWD retaining sediment and small wood. Four foot jump over LDA to next unit.
- 18869' Evidence of cattle in stream channel.
- 19084' Cattle degrading stream banks.
- 19189' High cattle traffic.
- 19206' Steelhead YOY. Still seeing signs of cattle traffic.
- 19333' Left bank tributary flowing with a 4' culvert. Left bank erosion contributing large amounts of sediment into the stream. The erosion is 15' high x 100' long. A road is about 50' up the bank from the channel.
- 19411' Steelhead observed. Manure and sulfur smell coming from stream.
- 19651' Steelhead yearling.
- 19705' LDA over pool retaining sediment.
- 19832' Large stump/root wad over pool.
- 19947' Three foot jump to next unit.
- 19965' Cattle grazing in the channel.
- 20322' LDA over pool retaining sediment.
- 20517' Evidence of cattle grazing on the left bank.
- 20720' LDA is 8' high x 20' wide x 30' long.
- 20739' Poor canopy throughout unit.

Russell Brook

21054' End of survey due to dry channel and no fish observed. Water flow has continued to decline. Small stagnant pools are separated by long sections of dry channel. There are many signs of cattle grazing on the upper sections of this stream.

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.

Russell Brook

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]	

Russell Brook

RUSSELL BROOK

Drainage: BIG RIVER

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES Survey Dates: 07/01/02 to 07/09/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR15WS26 LATITUDE: 39°30'9" LONGITUDE: 123°49'9"

HABITAT UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	MEAN WIDTH (ft.)	TOTAL WIDTH (ft.)	MEAN DEPTH (ft.)	TOTAL DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA (sq.ft.)	MEAN ESTIMATED VOLUME (cu.ft.)	TOTAL ESTIMATED VOLUME (cu.ft.)	MEAN RESIDUAL POOL VOL (cu.ft.)	TOTAL RESIDUAL POOL VOL (cu.ft.)	MEAN SHELTER RATING
46	12	17	58	2663	12	6.8	0.3	259	11903	93	4259	0	0	9	
106	19	38	141	14957	70	7.5	0.5	518	54938	286	30316	0	0	16	
118	118	43	26	3020	14	8.7	1.0	232	27380	246	29007	179	179	35	
7	0	3	116	814	4	0.0	0.0	0	0	0	0	0	0	0	
TOTAL UNITS	277	149	TOTAL LENGTH (ft.)	21454	TOTAL AREA (sq. ft.)	94221	TOTAL VOL. (cu. ft.)	63582							

RUSSELL BROOK

Drainage: BIG RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 07/01/02 to 07/09/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T11NR15WS26 LATITUDE:39°30'9" LONGITUDE:123°49'19"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE	#	ft.	MEAN LENGTH	TOTAL LENGTH	#	ft.	MEAN WIDTH	TOTAL WIDTH	ft.	MEAN DEPTH	TOTAL DEPTH	ft.	MEAN MAXIMUM DEPTH	TOTAL DEPTH	sq.ft.	MEAN AREA	TOTAL AREA	sq.ft.	EST. VOLUME	MEAN VOLUME	TOTAL VOLUME	cu.ft.	MEAN RESIDUAL VOLUME	EST. POOL VOLUME	MEAN SHLTER. CANOPY	#
42	10	LGR	15	60	2524	12	7	0.3	2.0	303	12720	109	4572	0	10	90													
2	1	HGR	1	56	111	1	2	0.2	0.5	5	9	1	2	0	0	90													
2	1	BRS	1	14	28	0	6	0.3	0.6	72	144	22	43	0	5	80													
4	1	GLD	1	51	203	1	9	0.5	0.9	324	1296	162	648	0	5	85													
7	4	RUN	3	56	389	2	9	0.5	1.8	470	3293	218	1524	0	8	64													
95	14	SRN	34	151	14365	67	7	0.5	1.5	546	51855	314	29865	0	19	84													
3	3	TRP	1	16	48	0	5	1.0	2.5	75	225	69	206	24	98	73													
95	95	MCP	34	26	2429	11	9	1.0	4.5	236	22409	256	24284	188	35	85													
2	2	CRP	1	25	49	0	8	1.0	1.9	196	392	196	392	118	35	78													
4	4	LSL	1	23	90	0	10	0.9	2.2	219	875	205	818	162	34	68													
6	6	LSR	2	30	180	1	9	0.9	2.4	292	1750	298	1789	221	33	86													
5	5	LSBK	2	35	176	1	8	0.9	2.4	269	1345	230	1149	157	15	66													
2	2	PLP	1	17	33	0	8	1.1	2.4	132	264	137	274	109	50	58													
1	1	SCP	0	15	15	0	8	0.8	1.5	120	120	96	96	72	10	60													
7	0	DRY	3	116	814	4	0	0.0	0.0	0	0	0	0	0	0	82													

TOTAL UNITS	277	TOTAL LENGTH (ft.)	21454	TOTAL AREA (sq.ft.)	96697	TOTAL VOLUME (cu.ft.)	65661
-------------	-----	--------------------	-------	---------------------	-------	-----------------------	-------

RUSSELL BROOK

Drainage: BIG RIVER

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 07/01/02 to 07/09/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR15NS26 LATITUDE: 39°30'9" LONGITUDE: 123°49'9"

HABITAT UNITS MEASURED	HABITAT FULLY TYPES	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME (cu.ft.)	MEAN RESIDUAL SHELTER RATING
98	MAIN	83	25	2477	8.7	1.0	231	22634	250	24489	182
19	SCOUR	16	28	528	8.6	0.9	243	4626	233	4422	169
1	BACKWATER	1	15	15	8.0	0.8	120	120	96	96	72
TOTAL UNITS			118	3020			TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)		TOTAL VOL. (cu.ft.)	
			118	3020			3020	27380		29007	

RUSSELL BROOK

Drainage: BIG RIVER

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES Survey Dates: 07/01/02 to 07/09/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR15WS26 LATITUDE:39°30'9" LONGITUDE:123°49'9"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT		1-<2 FT.		2-<3 FT.		3-<4 FT.		3-<4 FOOT		>=4 FEET	
			MAXIMUM DEPTH OCCURRENCE	PERCENT OCCURRENCE	MAXIMUM DEPTH OCCURRENCE	PERCENT OCCURRENCE	MAXIMUM DEPTH OCCURRENCE	PERCENT OCCURRENCE	MAXIMUM DEPTH OCCURRENCE	PERCENT OCCURRENCE	MAXIMUM DEPTH OCCURRENCE	PERCENT OCCURRENCE	MAXIMUM DEPTH OCCURRENCE	PERCENT OCCURRENCE
3	TRP	3	0	0	2	67	1	33	0	0	0	0	0	0
95	MCP	81	1	1	61	64	27	28	4	4	2	2	2	2
2	CRP	2	0	0	2	100	0	0	0	0	0	0	0	0
4	LSL	3	0	0	2	50	2	50	0	0	0	0	0	0
6	LSR	5	0	0	3	50	3	50	0	0	0	0	0	0
5	LSBK	4	0	0	3	60	2	40	0	0	0	0	0	0
2	PLP	2	0	0	1	50	1	50	0	0	0	0	0	0
1	SCP	1	0	0	1	100	0	0	0	0	0	0	0	0

TOTAL
UNITS
118

Russell Brook

RUSSELL BROOK		Drainage: BIG RIVER									
Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE		Survey Dates: 07/01/02 to 07/09/02									
Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17NR15WS26 LATITUDE:39°30'19" LONGITUDE:123°49'19"											
UNITS MEASURED	UNITS FULLY MEASURED	HABITAT TYPE	MEAN % UNDERCUT BANKS	MEAN % SWD	MEAN % LWD	MEAN % ROOT MASS VEGETATION	MEAN % TERR. VEGETATION	MEAN % AQUATIC VEGETATION	MEAN % WHITE WATER	MEAN % BOULDERS	MEAN % BEDROCK LEDGES
42	10	LGR	0	14	8	3	15	3	5	53	1
2	0	HGR	0	0	0	0	0	0	0	0	0
2	1	BRS	0	0	0	0	10	0	0	0	90
4	1	GLD	20	0	0	0	0	0	0	0	80
7	4	RUN	0	25	6	0	3	4	3	53	8
95	14	SRN	4	20	12	10	14	1	1	31	6
3	3	TRP	13	0	0	0	53	13	0	13	7
95	94	NCP	8	18	34	11	4	0	1	17	8
2	2	CRP	0	25	23	0	0	0	0	13	40
4	4	LSL	3	5	73	5	3	3	0	8	3
6	6	LSR	17	13	22	43	2	0	0	4	0
5	5	LSBk	5	12	10	5	4	0	2	30	32
2	2	PLP	15	10	65	0	0	0	0	5	5
1	1	SCP	0	0	100	0	0	0	0	0	0
7	0	DRY	0	0	0	0	0	0	0	0	0

Russell Brook

RUSSELL BROOK

Drainage: BIG RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 07/01/02 to 07/09/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T17N215W26 LATITUDE:39°30'9" LONGITUDE:123°49'9"

TOTAL HABITAT UNITS 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
42	LGR	0	0	20	20	40	20	0
2	RGR	0	0	0	0	0	0	100
2	BRS	0	0	0	0	0	0	100
4	GLD	0	0	0	100	0	0	0
7	RUN	0	0	100	0	0	0	0
95	SRN	0	7	36	29	21	7	0
3	TRP	0	0	0	0	0	0	0
95	MCP	0	33	11	11	11	11	22
2	CRP	0	50	0	50	0	0	0
4	LSL	0	0	50	50	0	0	0
6	LSR	0	75	0	25	0	0	0
5	LSEK	0	0	50	50	0	0	0
2	PLP	0	0	100	0	0	0	0
1	SCP	0	100	0	0	0	0	0
7	DRY	0	0	0	0	0	0	0

Russell Brook

TABLE 8. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: RUSSELL BROOK
SAMPLE DATES: 07/01/02 to 07/09/02
STREAM LENGTH: 21420 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: GREENOUGH Latitude: 39°30'9"
Legal Description: T17NR15WS26 Longitude: 123°49'9"

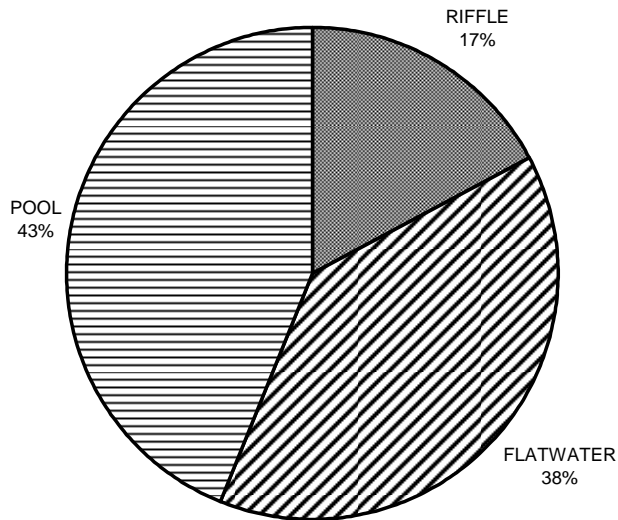
SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: B3	Canopy Density: 83%
Channel Length: 21420 ft.	Coniferous Component: 90%
Riffle/flatwater Mean Width: 7 ft.	Deciduous Component: 10%
Total Pool Mean Depth: 1.0 ft.	Pools by Stream Length: 14%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 5%
Water: 056- 065°F Air: 057-087°F	Mean Pool Shelter Rtn: 36
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Large Woody Debris
Vegetative Cover: 65%	Occurrence of LOD: 29%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 814 ft.

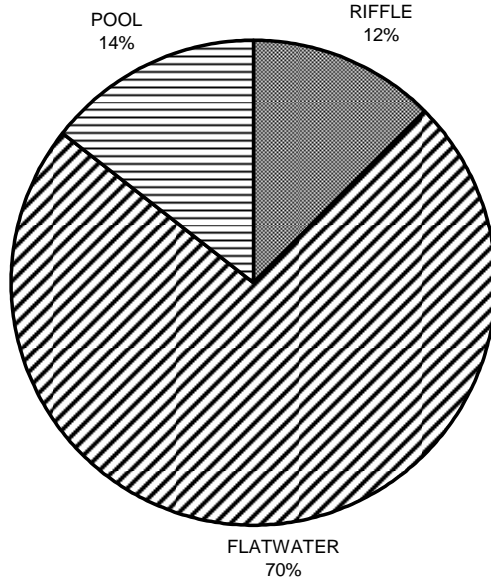
Embeddness Value: 1. 1% 2. 19% 3. 36% 4. 11% 5. 33%

RUSSELL BROOK CREEK HABITAT TYPES BY PERCENT OCCURENCE



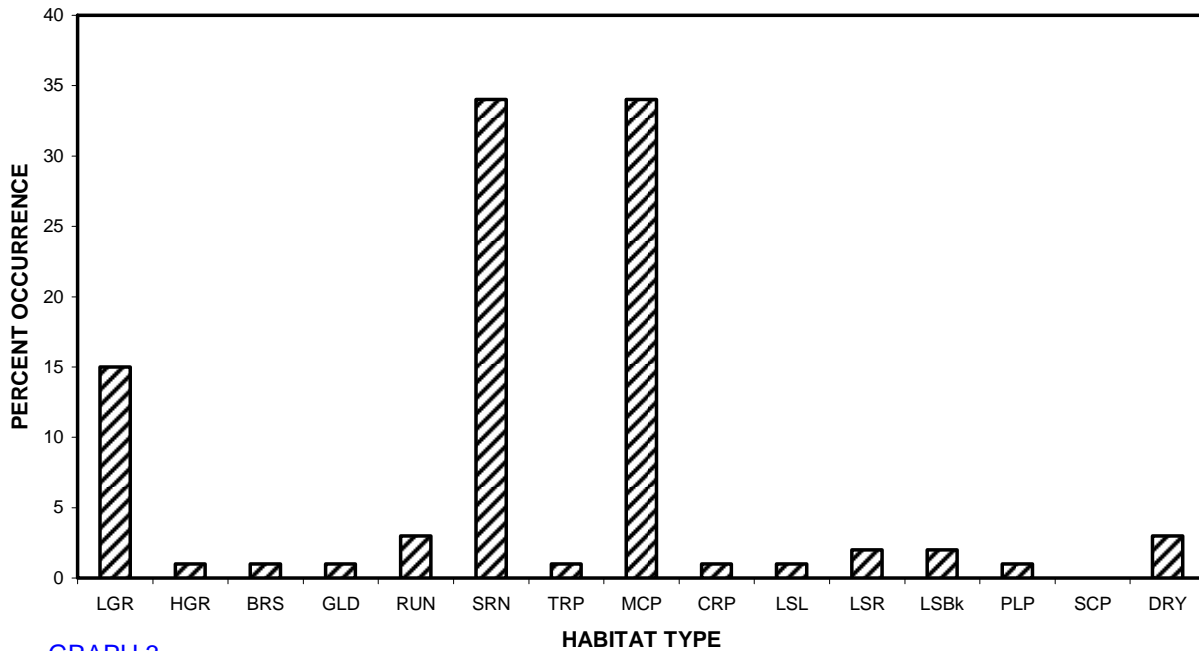
GRAPH 1

RUSSELL BROOK CREEK HABITAT TYPES BY PERCENT TOTAL LENGTH



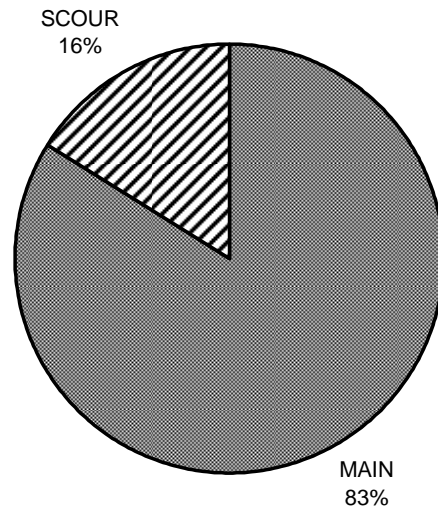
GRAPH 2

RUSSELL BROOK CREEK HABITAT TYPES BY PERCENT OCCURRENCE



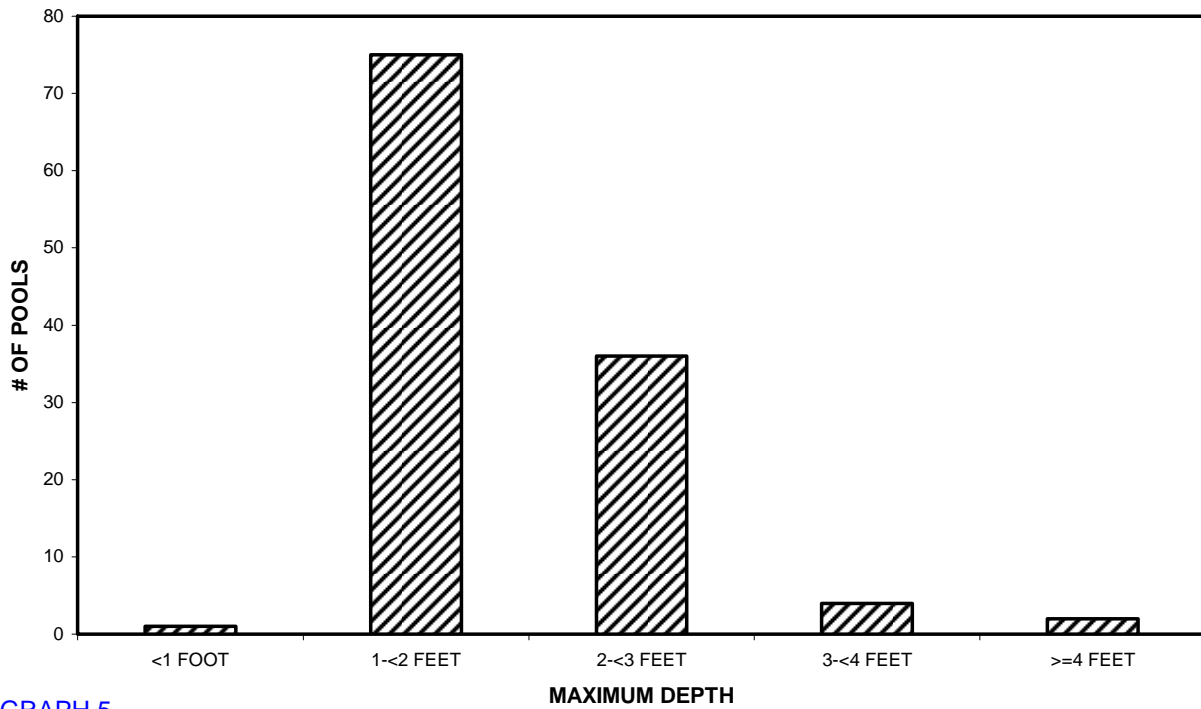
GRAPH 3

RUSSELL BROOK CREEK POOL HABITAT TYPES BY PERCENT OCCURRENCE



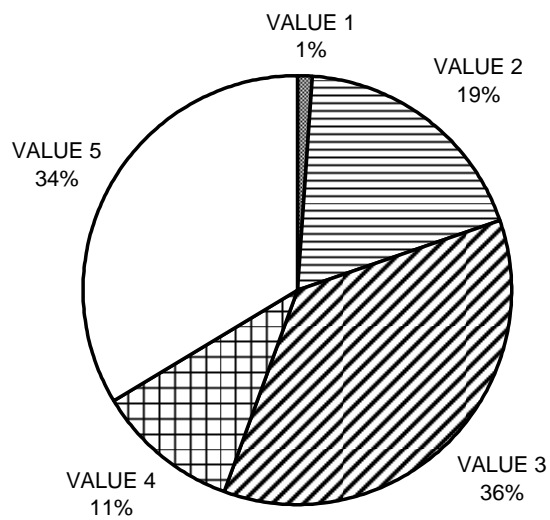
GRAPH 4

RUSSELL BROOK CREEK MAXIMUM DEPTH IN POOLS



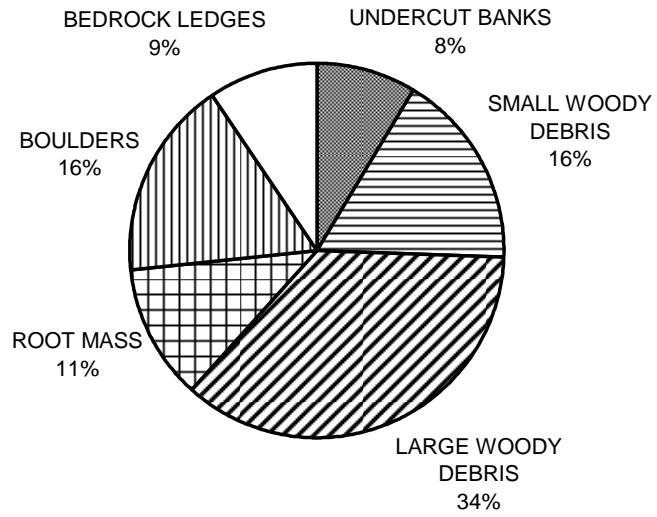
GRAPH 5

RUSSELL BROOK CREEK PERCENT EMBEDDEDNESS



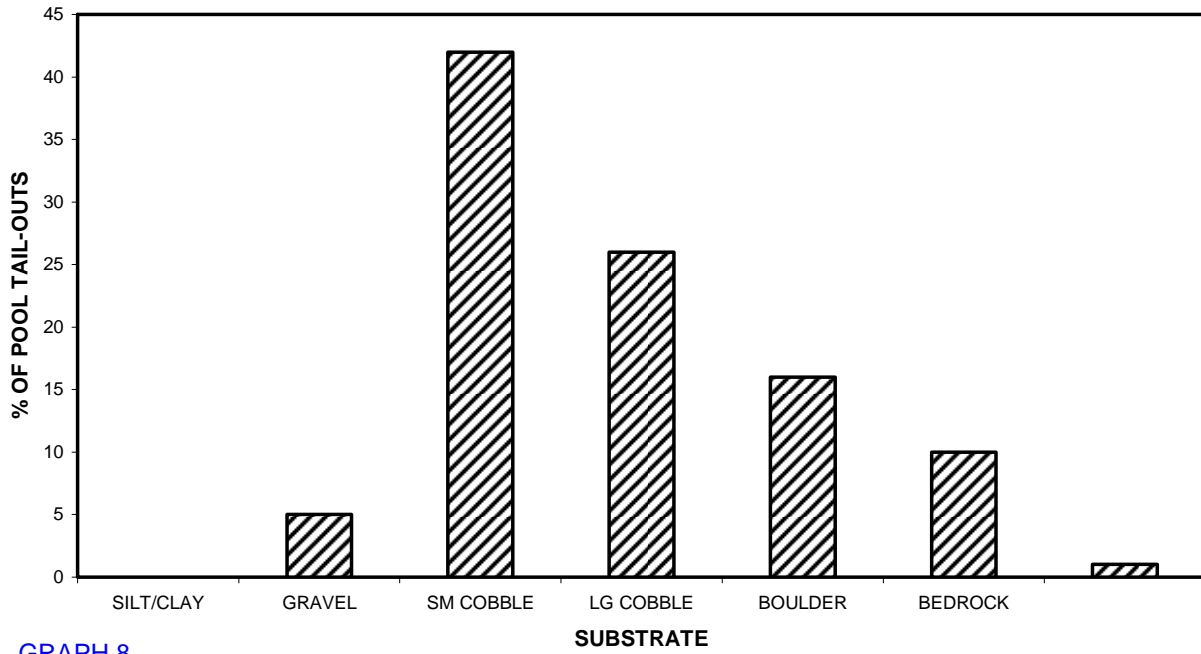
GRAPH 6

RUSSELL BROOK CREEK MEAN PERCENT COVER TYPES IN POOLS



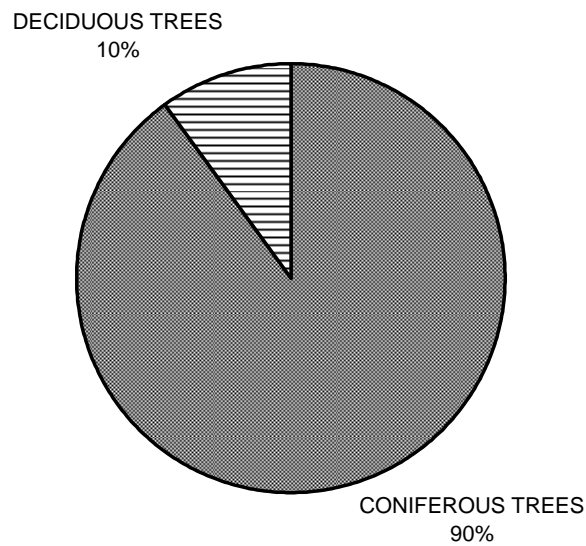
GRAPH 7

RUSSELL BROOK CREEK SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



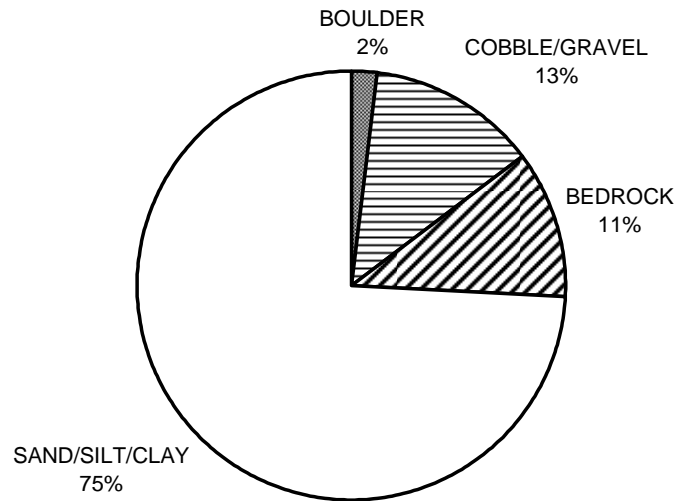
GRAPH 8

RUSSELL BROOK CREEK MEAN PERCENT CANOPY



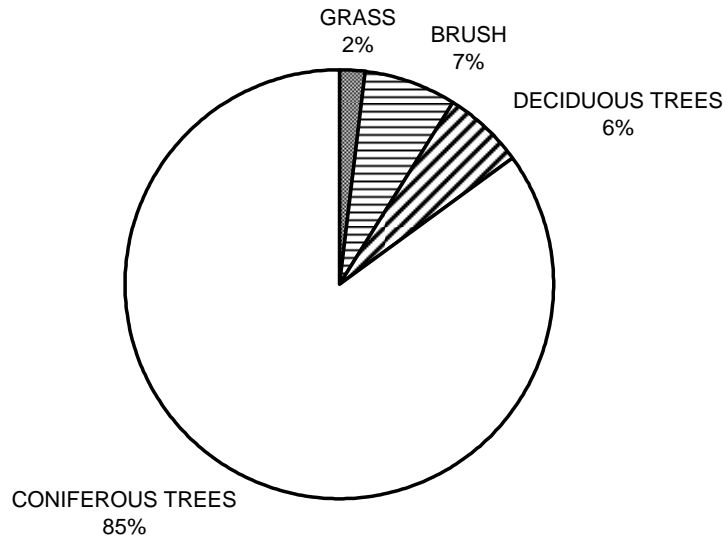
GRAPH 9

RUSSELL BROOK CREEK DOMINANT BANK COMPOSITION IN SURVEY REACH



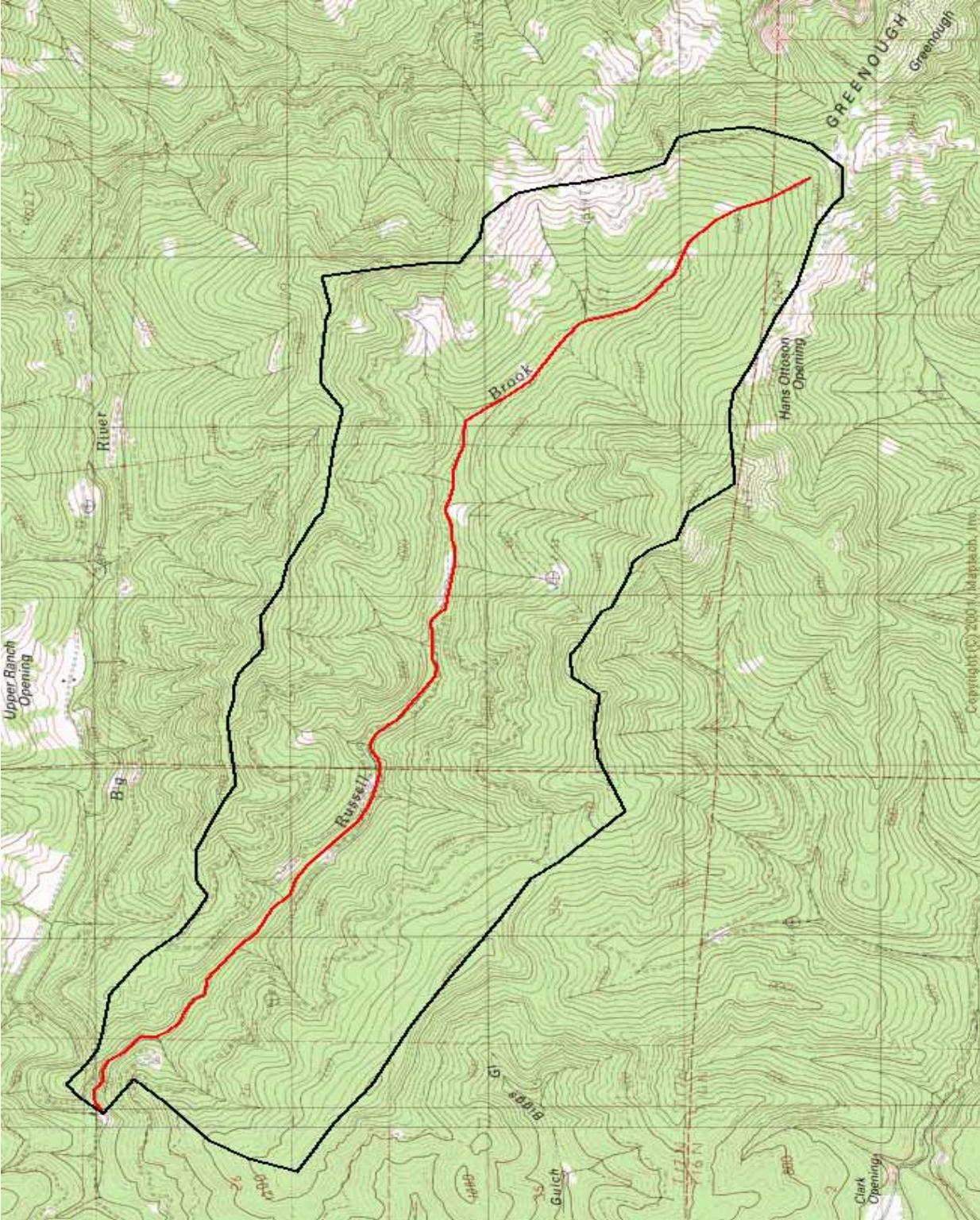
GRAPH 10

RUSSELL BROOK CREEK DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Russell Brook



Map 1. Russell Brook.