NORTH COAST WATERSHED AND FISHERY IMPROVEMENT PROGRAM

STREAM INVENTORY REPORT

Russell Brook, Big River, 2002

CALIFORNIA DEPARTMENT OF FISH AND GAME

2003

Northern California-North Coast Region

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 Russell Brook inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Russell Brook. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

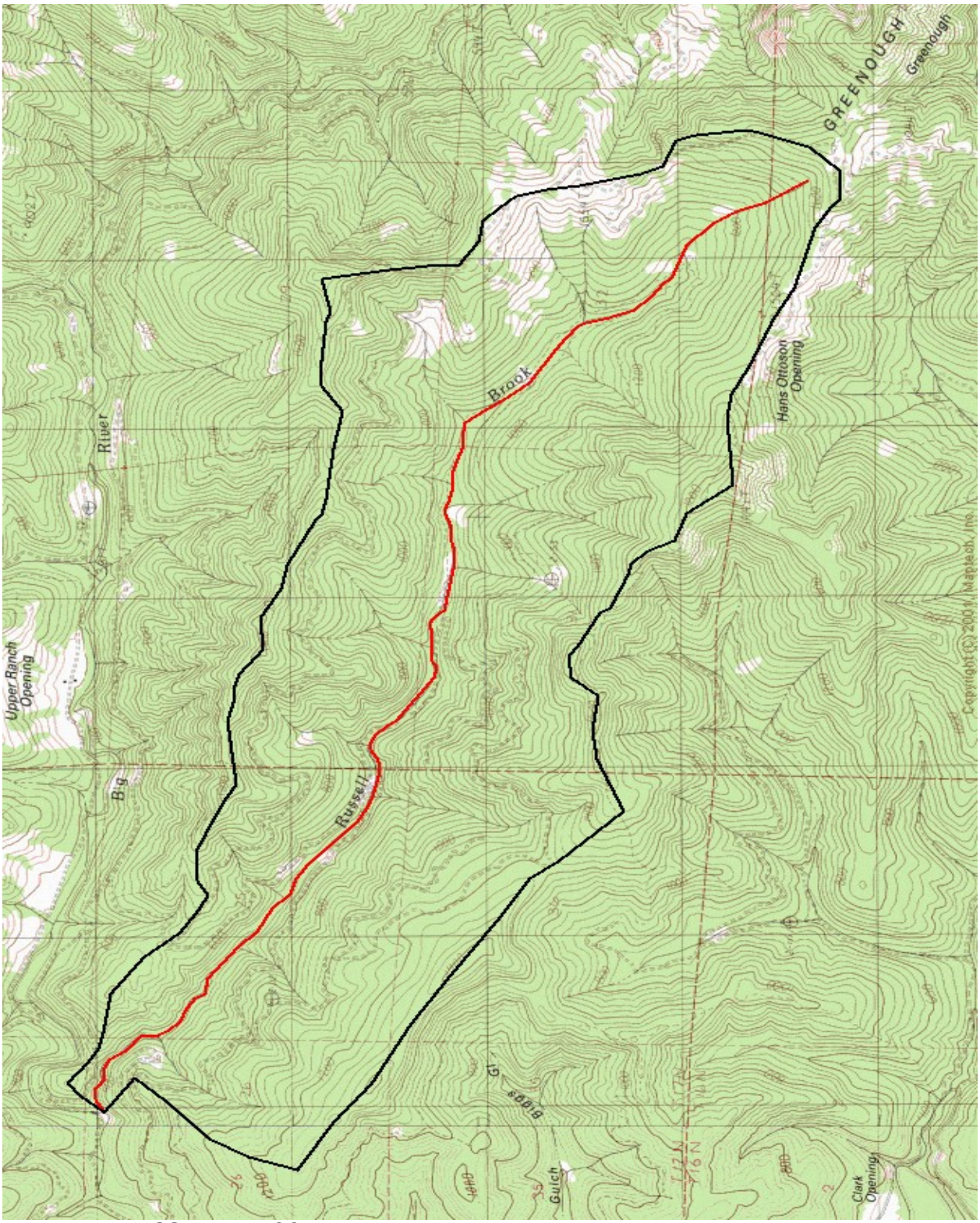
The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Russell Brook is a tributary to the Big River, a tributary 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 solid 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 1540 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 Aids (DFG) and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.



MAP 1. RUSSELL BROOK.

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 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.

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 densiometers 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.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Russell Brook. 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 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 Scott Monday and Kristi 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.

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.

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 pool tail-outs while small cobble was the next most frequently observed substrate type, at 26%.

The mean percent canopy density for the surveyed length of Russell Brook was 83%. The mean percentages of deciduous 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 11% bedrock, 2% boulder, 13% cobble/gravel, and 75% sand/silt/clay (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).

BIOLOGICAL INVENTORY RESULTS

Young of year salmonids were detected using streambank observation techniques during the Russell Brook stream survey.

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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. However, 60° F, if sustained, is near the threshold stress level for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

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 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.

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. Much of the existing cover is from large woody debris. Adding high quality complexity with log and root wad cover is desirable.

5) 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.

6) 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.

7) Increase the canopy on Russell Brook by planting willow, white alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) Suitable size spawning substrate on Russell Brook is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

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

10) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

11) Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where

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.

0'	BEGIN SURVEY 75 FEET FROM THE CONFLUENCE WITH BIG RIVER. THE CHANNEL TYPE IS A B3.
110'	STEELHEAD YOUNG OF YEAR (YOY).
441'	SMALL WOODY DEBRIS (SWD) PILE TRAPPING SEDIMENT.
613'	SWD PILE ACCUMULATING SEDIMENT AT TOP.
1190'	RIGHT BANK EROSION 40 FEET HIGH AND 60 FEET LONG.
1398'	LARGE BOULDERS THROUGHOUT THE CHANNEL.
1558'	POOL ENHANCED BY THE LWD PILE AT THE TOP OF THE POOL.
1573'	DRY RIGHT BANK TRIBUTARY.
1727'	COHO AND STEELHEAD YOY.
1828'	DRY RIGHT BANK TRIBUTARY.
2200’	DRY RIGHT BANK TRIBUTARY.
2419'	RESTORATION WORK ON THE LEFT BANK. LARGE LOGS CABLED TO THE BANKS. SWD BEGINNING TO PILE UP.
2478'	1 PIECE OF LWD, 30 FEET LONG AT THE TOP OF THE POOL .
2498'	LEFT BANK TRIBUTARTY, SEEPING WATER.
2729'	DRY RIGHT BANK TRIBUTARY.
2773'	RIGHT BANK TRIBUTARY.
2996'	LATERAL ROOT/BOULDER SCOUR WETTED WIDTH IS GREATER THAN 60%.
3011'	LEFT BANK TRIBUTARY. LITTLE WATER FLOWING.
3365'	RECENT LOGGING ON LEFT BANK.
3471'	DRY RIGHT BANK TRIBUTARY. TOOK CHANNEL TYPE IN THIS UNIT. B3.
4019'	LWD PILE WITH SWD COVERING MOST OF THE POOL.
4383'	DRY LEFT BANK TRIBUTARY. RESTORATION WORK.

5033' SCULPIN.

5136' LARGE ROOT MASS ON THE LEFT BANK.

5220' MAN MADE WEIR AT TOP OF POOL CREATING LARGE POOL IN HIGH FLOW.

5382' DRY LEFT BANK TRIBUTARY.

5785' BEGINNING TO SEE MORE SAND AND SEDIMENT.

5812' DRY LEFT BANK TRIBUTARY.

5873' LWD PILE 30 FEET WIDE, 4 FEET HIGH, AND 5 FEET DEEP.

5893' POSSIBLE MAN MADE ROCK WEIRS.

6148' LWD PILE 20 FEET WIDE, 10 FEET HIGH, AND 30 FEET DEEP.

6261' LWD PILE 20 FEET WIDE, 3 FEET HIGH, AND 30 FEET LONG.

6411' FLOW BLOCKED BY LWD ABOVE THE POOL.
LWD PILE 30 FEET WIDE, 30 FEET LONG AND 3 FEET HIGH.

6594' MAN MADE LWD WEIR.

6634' SPRING.

6714' LWD PILE AT THE TOP OF THE UNIT. 4 FEET WIDE, 4 FEET HIGH, AND 20 FEET LONG.

7172' LWD PILE ACROSS STREAM, 5 FEET WIDE, 2 FEET HIGH, AND 2 FEET DEEP. SMALL COBBLE BUILDING UP BEHIND THE PILE.

7472' LWD BACKING UP GRAVEL AND SEDIMENT.

7717' CHANNEL IS MARSHY WITH GRASSES AS THE DOMINANT COVER.

7986' BRIDGE CROSSING.

8120' COHO YOY

8307' CABLE LOOSE ON THE BANKS AND IN THE CHANNEL.

8342' LWD WITHIN THE STREAM DOES NOT LOOK NATURAL. DRY LEFT BANK TRIBUTARY

8537' STREAM VERY SILTY.

8572' DRY LEFT BANK TRIBUTARY.

8844' LWD PILE 40 FEET WIDE, 10 FEET HIGH, AND 40 FEET LONG.

9104' DRY LEFT BANK TRIBUTARY.

9398' LWD PILE 15 FEET WIDE, 3 FEET HIGH, AND 3 FEET LONG.

9419' LWD PLACED INTO CHANNEL.

10421' BRIDGE CROSSING. BRIDGE IS IN GOOD SHAPE.

10646' SCOUR IN POOL IS FROM BEDROCK.

10714' LWD PILE IN THE CORNER OF THE POOL ASSOCIATED WITH SWD. FISH PRESENT IN THE POOL.

10945' SCOUR FROM BEDROCK AND LOG.

10979' LEFT BANK TRIBUTARY WITH WATER. TRIBUTARY HAS ABOUT A 45% GRADIENT WITH A CULVERT A SHORT WAY UP. NOT ANADROMOUS.

11014' 4 FOOT BEDROCK SHEET INTO POOL. COHO AND STEELHEAD YOY.

11434' DRY LEFT BANK TRIBUTARY. CULVERT ABOUT 20 FEET UP FROM STREAM.

11783' CHANNEL TYPE TAKEN IN THIS UNIT. NO CHANNEL CHANGE. STILL B3.

12043' FLOWING RIGHT BANK TRIBUTARY.

12103' OLD LOGGING CABLE TANGLED THROUGHOUT THE CHANNEL.

12252' COHO AND STEELHEAD YOY AND ROUGH SKINNED NEWTS.

12435' 3.5 FOOT PLUNGE INTO POOL. LAYER OF SEDIMENT COVERING THE SUBSTRATE OF THE POOL.

12450' LEFT BANK EROSION CONTRIBUTING FINES INTO STREAM. ABOUT 40 FEET LONG AND 20 FEET HIGH.

12681' BRIDGE CROSSING. RAILROAD CAR BRIDGE.

12913' RIGHT BANK RESTORATION. 5 PIECES OF LWD CABLED TOGETHER IN CHANNEL.

13044' STEELHEAD AND COHO YOY. LWD CREATING THE SCOUR.

13420' LWD PILE 15 FEET WIDE, 10 FEET HIGH, AND 30 FEET WIDE. LARGE ROOTWAD ALSO IN THE STREAM.

13527' FLOWING LEFT BANK TRIBUTARY. LARGE POTENTIAL BARRIER.

13615' 100 FEET OF LWD WITHIN THE STREAM WITH SEDIMENT BUILDUP BEHIND IT.

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' LWD PILE 20 FEET WIDE, 6 FEET HIGH, AND 20 FEET LONG.

14582' POOL SURROUNDED BY LWD ON RIGHT BANK. 20 FEET WIDE, 8 FEET HIGH, AND 20 FEET LONG.

14793' LWD ACROSS STREAM.

15013' FLOWING LEFT BANK TRIBUTARY, NO FISH OBSERVED.

15120' DRY CHANNEL. CONTINUING SIGNS OF CATTLE WITHIN THE STREAM.

15157' SALMONIDS PRESENT.

15420' RIGHT BANK TRIBUTARY. LWD COVERING 90% OF THE UNIT.

15710' YEARLING STEELHEAD. LWD PILE 10 FEET WIDE, 20 FEET LONG, AND 10 FEET HIGH. ROOTWAD HAS BACKED UP SEDIMENT UPSTREAM.

15742' LWD PILE 44 FEET INTO UNIT 10 FEET WIDE, 10 FEET LONG, AND 5 FEET HIGH.

15927' LWD PILE 30 FEET WIDE, 10 FEET HIGH, AND 20 FEET LONG.

15955' LWD - 10 FEET WIDE, 20 FEET LONG AND 5 FEET HIGH. ANOTHER LWD PILE. 10 FEET WIDE, 10 FEET LONG, AND 5 FEET HIGH. DRY LEFT BANK TRIBUTARY.

16183' SCOUR IN POOL ENHANCED BY ROOTWAD.

16200' LWD CROSSING THE STREAM 10 FEET WIDE, 4 FEET LONG, AND 3 FEET HIGH.

16376' DRY RIGHT BANK TRIBUTARY. CULVERT. OLD LOGGING CABLE IN CHANNEL.

16840' LARGE POTENTIAL BARRIER, BOULDER WITH DEBRIS PILED BEHIND. SHOULD REMOVE DEBRIS FOR FISH ACCESS.

16855' POSSIBLE CHANNEL TYPE CHANGE. STEELHEAD OBSERVED.

16983' POTENTIAL LWD BARRIER.

17113' LARGE SEDIMENT BUILDUP BEHIND SOME LWD.

17248' OLD RESTORATION SITE POTENTIALLY FAILED AND MOVED FROM THE BANK INTO THE CHANNEL.

17771' 3 FOOT DROP

17870 4 FOOT DROP.

18037' BRIDGE CROSSES THE STREAM.

18707' EVIDENCE OF CATTLE IN STREAM. STEELHEAD YOY.

18799' 5 TO 10 STEELHEAD YOY. DRY LEFT BANK TRIBUTARY.

18849' 2 TO 3 PIECES OF LWD TRAPPING SEDIMENT AND SWD. 4 FOOT ELEVATION CHANGE TO TOP OF LWD PILE.

18869' MORE EVIDENCE OF CATTLE IN STREAM CHANNEL.

19068' 2 PIECES OF LWD MAKING THE POOL.

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 FOOT CULVERT. LEFT BANK EROSION PUTTING LARGE AMOUNTS OF SEDIMENT INTO THE STREAM. 15 FEET HIGH AND 100 FEET LONG. ROAD ABOUT 50 FEET FROM CHANNEL.

19411' STEELHEAD. BAD MANURE AND SULFUR SMELL COMING FROM STREAM.

19651' STEELHEAD YEARLING.

19669' DRY RIGHT BANK TRIBUTARY.

19705' LWD AND SWD PILE OVER POOL. TRAPPING SEDIMENT AT THE TOP.

19832' LARGE STUMP/ROOTWAD OVER POOL.

19947' SEDIMENT PILE. 3 FOOT ELEVATION CHANGE.

19965' SALAMANDER. CATTLE GRAZING IN THE CHANNEL. DRIED RIGHT BANK TRIBUTARY

20322' LWD WITH SWD PILE OVER POOL. SEDIMENT PILED BEHIND.

20517' EVIDENCE OF CATTLE GRAZING ON THE LEFT BANK.

20720' LWD PILE 8 FEET HIGH, 20 FEET WIDE, AND 30 FEET LONG.

20739' POOR CANOPY THROUGHOUT UNIT.

21043' WATER STAGNANT.

21054' DRY CHANNEL - END OF SURVEY - NO FISH. WATER FLOW HAS CONTINUED TO DECLINE. SMALL STAGNENT POOLS ARE SEPERATED BY LONG SECTIONS OF DRY CHANNEL. MANY CATTLE GRAZING CURRENTLY 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.

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]	

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 — 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	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
46	12	RIFFLE	17	58	2663	12	6.8	0.3	259	11903	93	4259	0	9
106	19	FLATWATER	38	141	14957	70	7.5	0.5	518	54938	286	30316	0	16
118	118	POOL	43	26	3020	14	8.7	1.0	232	27380	246	29007	179	35
7	0	DRY	3	116	814	4	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.)
277	149	21454	94221	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: T17NR15WS26 LATITUDE:39°30'9" LONGITUDE:123°49'9"

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 %
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	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
277	149	21454	96697	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: T17NR15WS26 LATITUDE:39°30'9" LONGITUDE:123°49'9"

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
98	98	MAIN	83	25	2477	82	8.7	1.0	231	22634	250	24489	182	37
19	19	SCOUR	16	28	528	17	8.6	0.9	243	4626	233	4422	169	30
1	1	BACKWATER	1	15	15	0	8.0	0.8	120	120	96	96	72	10

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
118	118	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 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
3	TRP	3	0	0	2	67	1	33	0	0	0	0
95	MCP	81	1	1	61	64	27	28	4	4	2	2
2	CRP	2	0	0	2	100	0	0	0	0	0	0
4	LSL	3	0	0	2	50	2	50	0	0	0	0
6	LSR	5	0	0	3	50	3	50	0	0	0	0
5	LSBk	4	0	0	3	60	2	40	0	0	0	0
2	PLP	2	0	0	1	50	1	50	0	0	0	0
1	SCP	1	0	0	1	100	0	0	0	0	0	0

TOTAL UNITS
118

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°30'9" LONGITUDE:123°49'9"

UNITS MEASURED	UNITS FULLY MEASURED	HABITAT TYPE	MEAN % UNDERCUT BANKS	MEAN % SWD	MEAN % LWD	MEAN % ROOT MASS	MEAN % TERR. VEGETATION	MEAN % AQUATIC VEGETATION	MEAN % WHITE WATER	MEAN % BOULDERS	MEAN % BEDROCK LEDGES
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	MCP	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

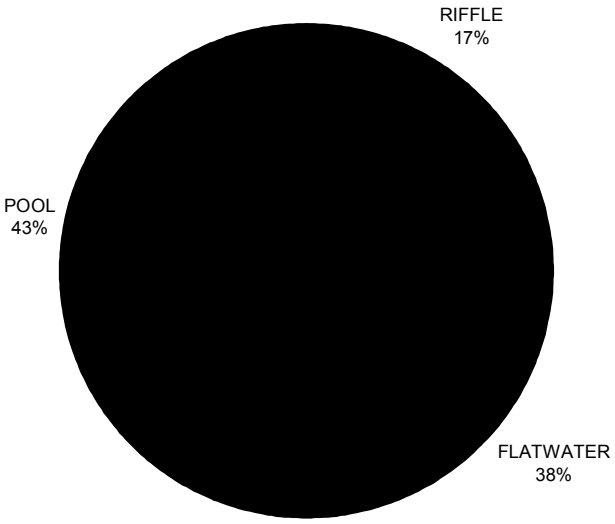
RUSSELL BROOK Drainage: BIG RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE Survey Dates: 07/01/02 to 07/09/02

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

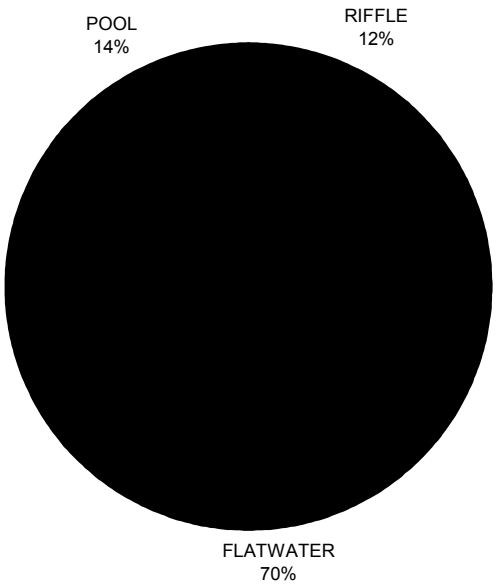
TOTAL HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
42	10	LGR	0	0	20	20	40	20	0
2	1	HGR	0	0	0	0	0	0	100
2	1	BRS	0	0	0	0	0	0	100
4	1	GLD	0	0	0	100	0	0	0
7	4	RUN	0	0	100	0	0	0	0
95	14	SRN	0	7	36	29	21	7	0
3	0	TRP	0	0	0	0	0	0	0
95	9	MCP	0	33	11	11	11	11	22
2	2	CRP	0	50	0	50	0	0	0
4	2	LSL	0	0	50	50	0	0	0
6	4	LSR	0	75	0	25	0	0	0
5	2	LSBk	0	0	50	50	0	0	0
2	1	PLP	0	0	100	0	0	0	0
1	1	SCP	0	100	0	0	0	0	0
7	0	DRY	0	0	0	0	0	0	0

RUSSELL BROOK CREEK
HABITAT TYPES BY PERCENT OCCURENCE



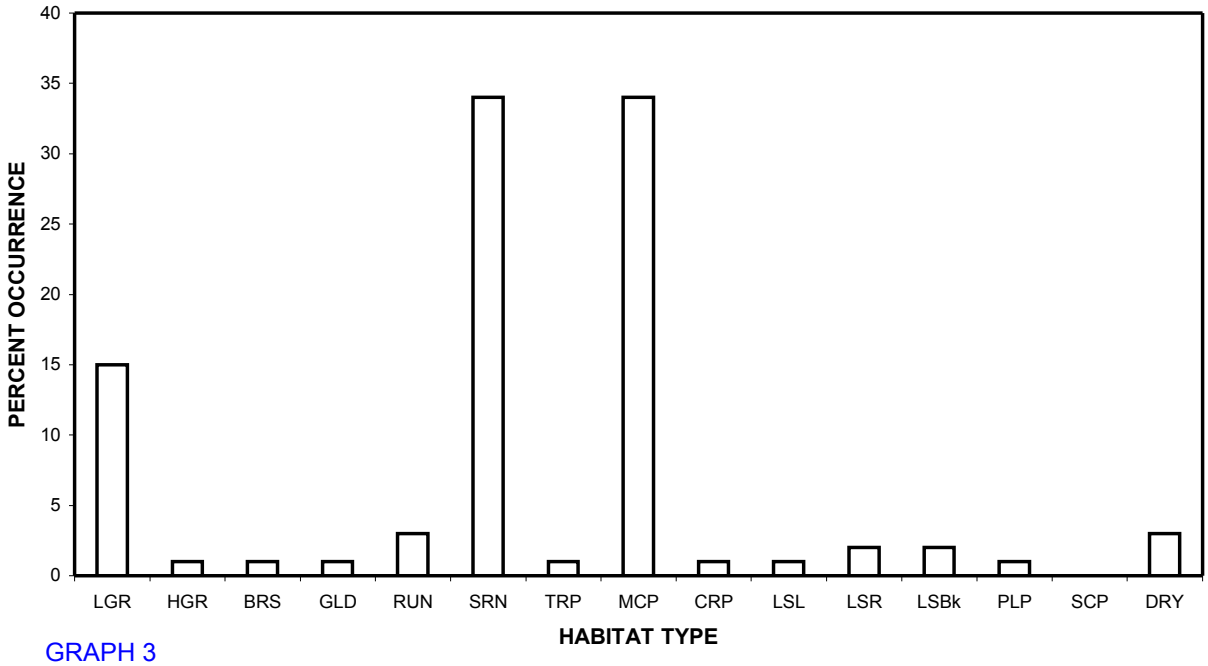
GRAPH 1

RUSSELL BROOK CREEK
HABITAT TYPES BY PERCENT TOTAL LENGTH



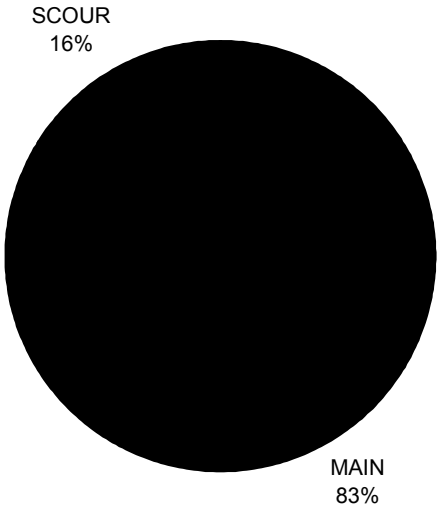
GRAPH 2

RUSSELL BROOK CREEK
HABITAT TYPES BY PERCENT OCCURRENCE



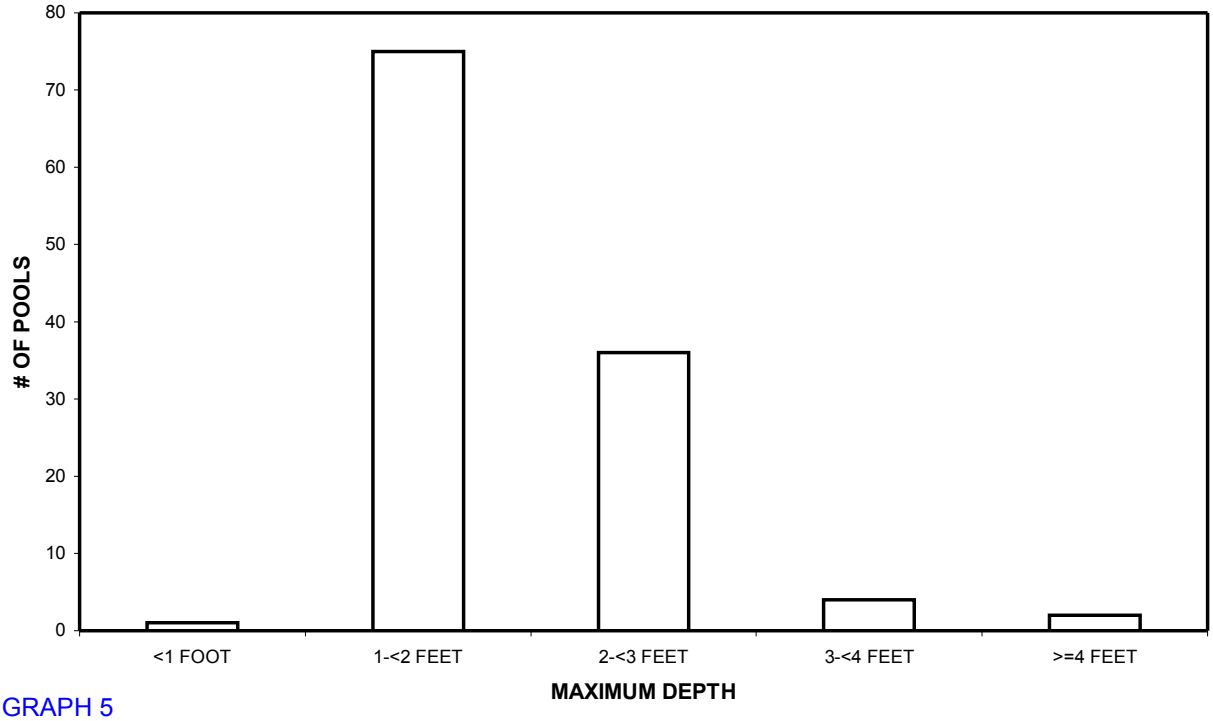
GRAPH 3

RUSSELL BROOK CREEK
POOL HABITAT TYPES BY PERCENT OCCURRENCE



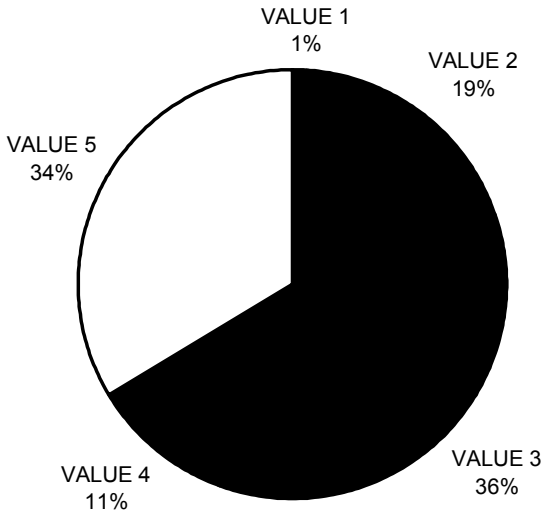
GRAPH 4

RUSSELL BROOK CREEK
MAXIMUM DEPTH IN POOLS



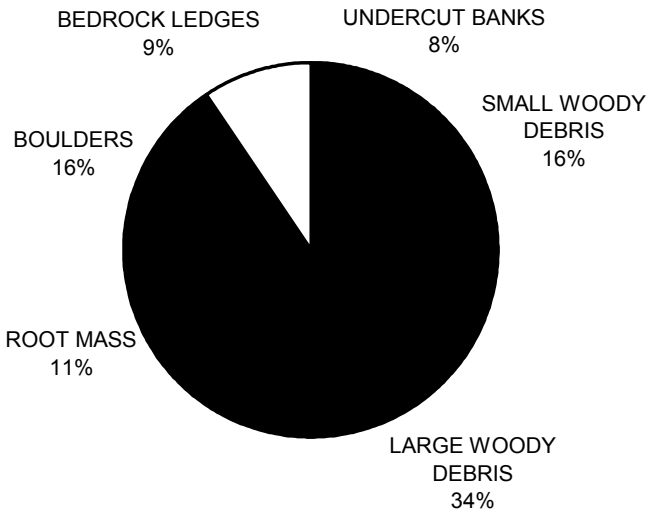
GRAPH 5

RUSSELL BROOK CREEK
PERCENT EMBEDDEDNESS



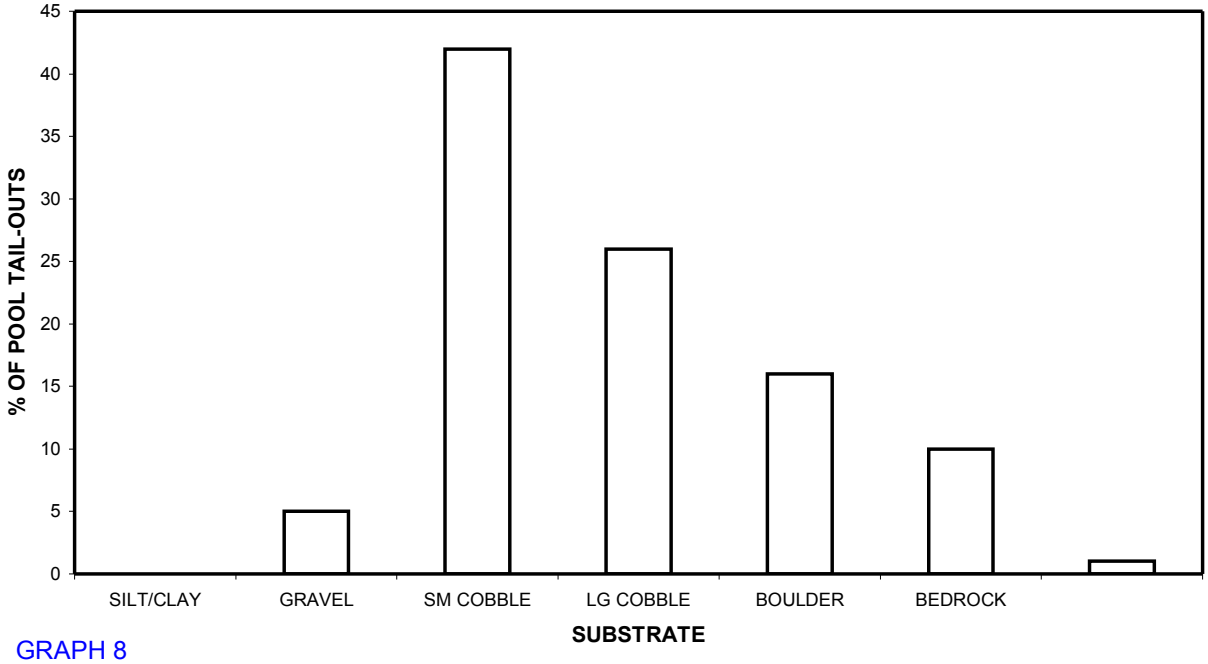
GRAPH 6

RUSSELL BROOK CREEK
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

RUSSELL BROOK CREEK
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

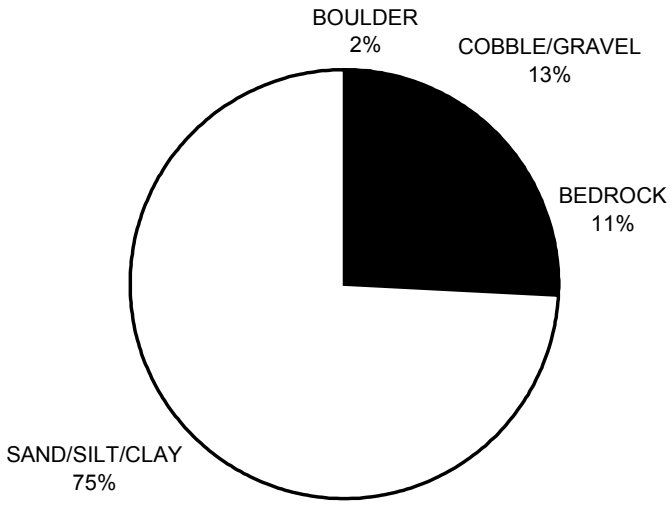


GRAPH 8

RUSSELL BROOK CREEK
MEAN PERCENT CANOPY

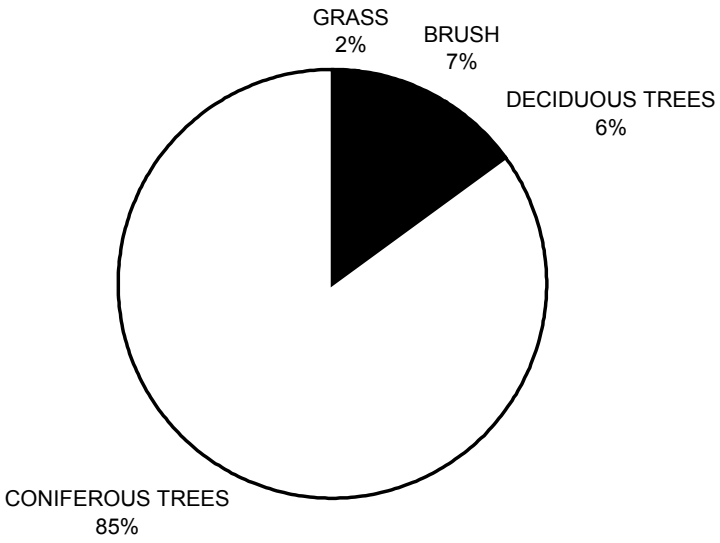
GRAPH 9

RUSSELL BROOK CREEK
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

RUSSELL BROOK CREEK
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11