



**Fish Snorkel Surveys of Priority Streams in
WRIA 44 & 50
Grant No. G0200263
(Step B – Field Implementation)**

Prepared for:

**The Foster Creek Conservation District
and
The WRIA 44 & 50 Planning Unit**

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Fish Snorkel Surveys of Priority Streams in WRIA 44 & 50**Grant No. G0200263****(Step B –Field Implementation)**

This document provides results of late spring and late summer surveys of fish populations using Rock Island and Douglas Creeks in WRIA 44 and Foster Creek in WRIA 50 under the State of Washington Department of Ecology Grant No. G0200263 with the Foster Creek Conservation District. The objectives of this study were to: (1) gather information on species presence and level of abundance at locations near the instream flow study sites in each creek; (2) to assess growth and survival of various life history stages through the summer months for estimating rearing habitat productivity per the Step A Scope of Work; and (3) to review the findings with the WRIA 44/50 Planning Unit (PU) in accordance with their instream flow setting objectives under Ecology Grant No. G0200263.

During fall of 2002, the WRIA 44 & 50 Planning Unit (PU) submitted, and Ecology approved, the instream flow scope of work as the first phase of the grant (Step A) to establish minimum stream flows for priority streams in the watersheds under the watershed planning program, HB 2514 (R2 Resource Consultants, 2002a). The priority streams for this assessment were determined to be Foster, Rock Island and Douglas creeks. The PU commissioned additional site-specific biological surveys in the priority streams since life history information related to fish species use and timing in the creeks is important for establishing seasonal flow regimes under the Grant. This document provides the results of a discrete portion of second phase (Step B) of the Ecology grant, related to biological field studies necessary to support the instream flow assessment.

In addition to snorkel observations of rearing juvenile fishes in WRIs 44 & 50, biological assessments also included spring and fall adult spawning surveys. The results of the spawning surveys will be available under separate cover following completion of the field efforts in June 2004. The biological assessment results will be used to improve the understanding of species use and timing in the creeks under current conditions and to facilitate the use of habitat suitability criteria for various life history stages on a monthly basis for the instream flow modeling purposes.

The document is separated into two major sections including: I) Survey Methods and II) Results.

1. SURVEY METHODS

1.1 LIFE HISTORY STAGES AND PERIODICITY OF USE

Instream flow needs should reflect the seasonal presence of fish species, their life history stages in the priority streams and the general limitations to fish production for each species. Resident and anadromous life history stages of interest in instream flow studies generally include:

Adult Migration/Access/Holding

Adult Spawning

Incubation

Summer Rearing

Winter Rearing

Because flow recommendations produced as part of this instream flow study will be developed on a monthly or semi-monthly basis, the need existed to determine the seasonal presence and absence, or timing of each species and life stage, so instream flow recommendations for a given month reflect appropriate life history stage requirements.

Foster and Rock Island creeks are known to support anadromous fish species rearing and perhaps spawning at least during some seasons of the year (Bartu and Andonaegui 2001, PGG 2002, R2 Resource Consultants, 2002a). Adult steelhead trout (*Oncorhynchus mykiss*) have been documented spawning from late April through early June in Foster Creek, but nowhere else in WRIs 44 & 50. Juvenile anadromous fish rearing, including Chinook salmon (*O. tshawytscha*), has been observed in both creeks, but it is unknown if they are progeny of adults spawning in the creeks or fish from the Columbia River system taking advantage of tributary rearing space. Based on this uncertainty, the PU commissioned anadromous fish spawning and rearing studies in both Foster and Rock Island creeks to supplement species use and life-history information needed in the instream flow study.

Douglas Creek does not support anadromous fish species due to infrequent water connections to the Columbia River. The life history timing for resident rainbow trout will be important for establishing seasonal flow regimes for this stream. Since Douglas Creek runs naturally warmer than other regional streams, the PU determined the life-history timing of resident trout may also

differ from normal patterns. As such, surveys to document the local rearing conditions were warranted to support the instream flow studies.

1.1.1 Field Data Collection

Fish observations were made in each creek with direct underwater snorkel techniques once in early June and once again in late August 2003. The surveys consisted of one diver making observations in an upstream direction from areas downstream of the instream flow study sites progressing to areas upstream of the study transects. The length of stream surveyed and number of habitat units varied between each of the streams. The anadromous fish reaches in Foster and Rock Island were extensively surveyed from the confluence of the creeks with the Columbia River to natural barriers. The area surveyed in Douglas Creek was more limited, consisting primarily of the region encompassing the instream flow study transects. Observations were made in most of the accessible water deep (>7.6 cm; 3 in.) between these points.

The study segments in Foster, Rock Island and Douglas creeks were as follows:

Foster Creek

Segment 1: The alluvial fan and backwater embayment of Lake Pateros, extending from RM 0.00 to RM 0.02,

Segment 2: The step-pool reach extending from RM 0.02 to RM 0.36; and

Segment 3: The pool-riffle reach extending from RM 0.36 to 0.98.

Habitat types surveyed in June 2003 consisted of 13 pools, 6 riffles, 10 runs and various pockets of deep water in the alluvial fan, step-pool and pool-riffle reaches. Approximately 2,400 m² (30% of available habitat), between RM 0.0 and RM 1.0, in Foster Creek was surveyed by underwater snorkel techniques.

Rock Island Creek

Segment 1: The alluvial fan and backwater embayment of Rock Island Pool extending from RM 0.00 to RM 0.08

Segment 2: A pool-riffle section extending from RM 0.08 to 0.31.

Habitat types surveyed in June 2003 consisted of 7 pools, 10 riffles and various pockets of deep water in the riffles. Approximately 1,220 lineal feet (370 m) and a total area of more than 432 m² of Rock Island Creek (34% of available habitat) between RM 0.0 and RM 0.31 was surveyed by underwater snorkel techniques.

Douglas Creek

Segment 1: The pool-riffle section of the Canyon Reach extending between RM 1.6 and RM 1.7 above the confluence with Moses Coulee.

Habitat types surveyed in June 2003 consisted of 8 pools, 4 runs and 2 riffles and various pockets of deep water in the riffle sections. A lineal distance of 153 m (500 ft) and a total area of 664 m² (7,145 ft²) were surveyed, representing approximately 20 percent of the area between the survey start and end points.

The locations and habitat features of the sampling sites are shown in Figures 1-3.

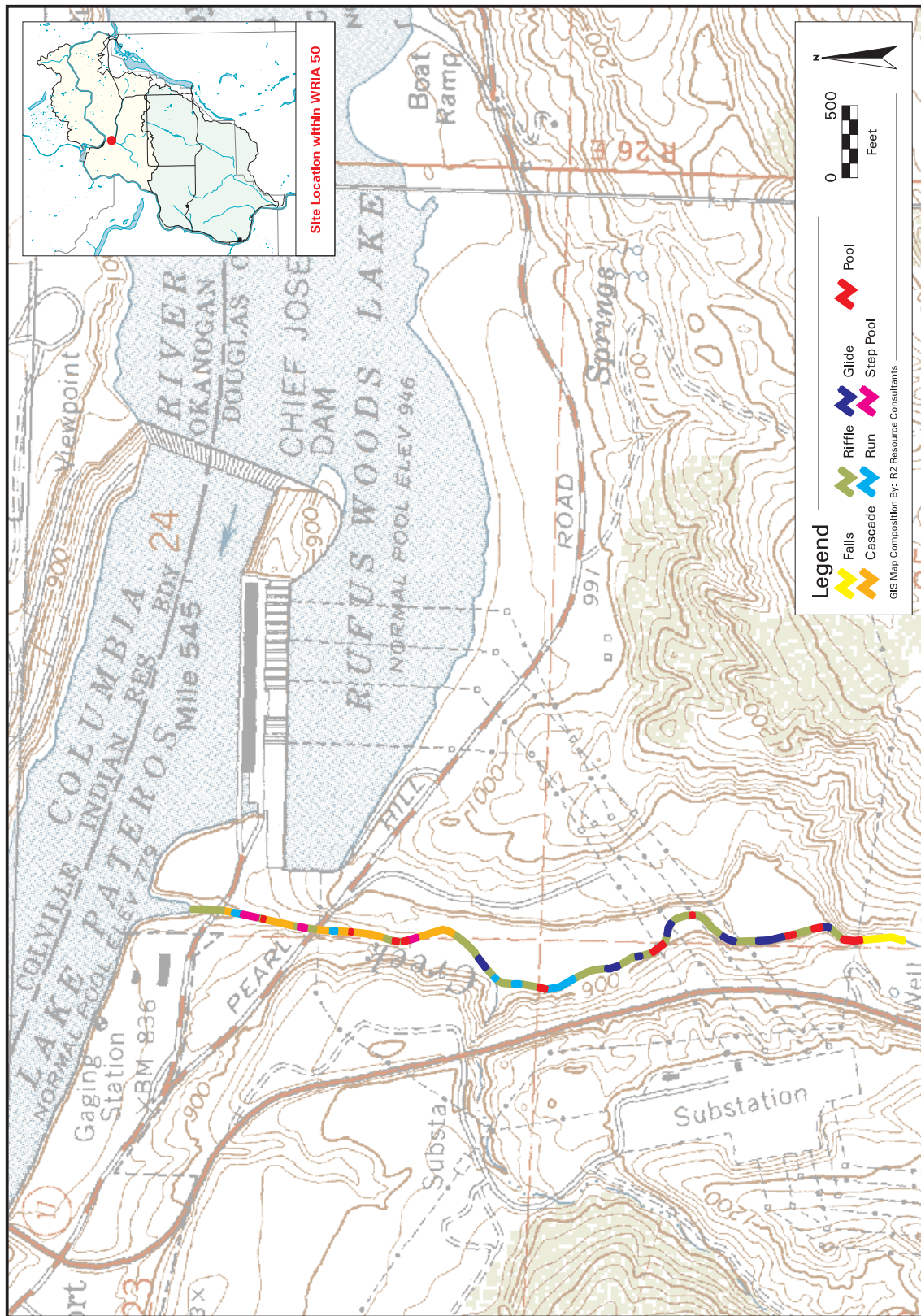


Figure 1. Location of snorkel survey site and associated habitat types in Foster Creek.

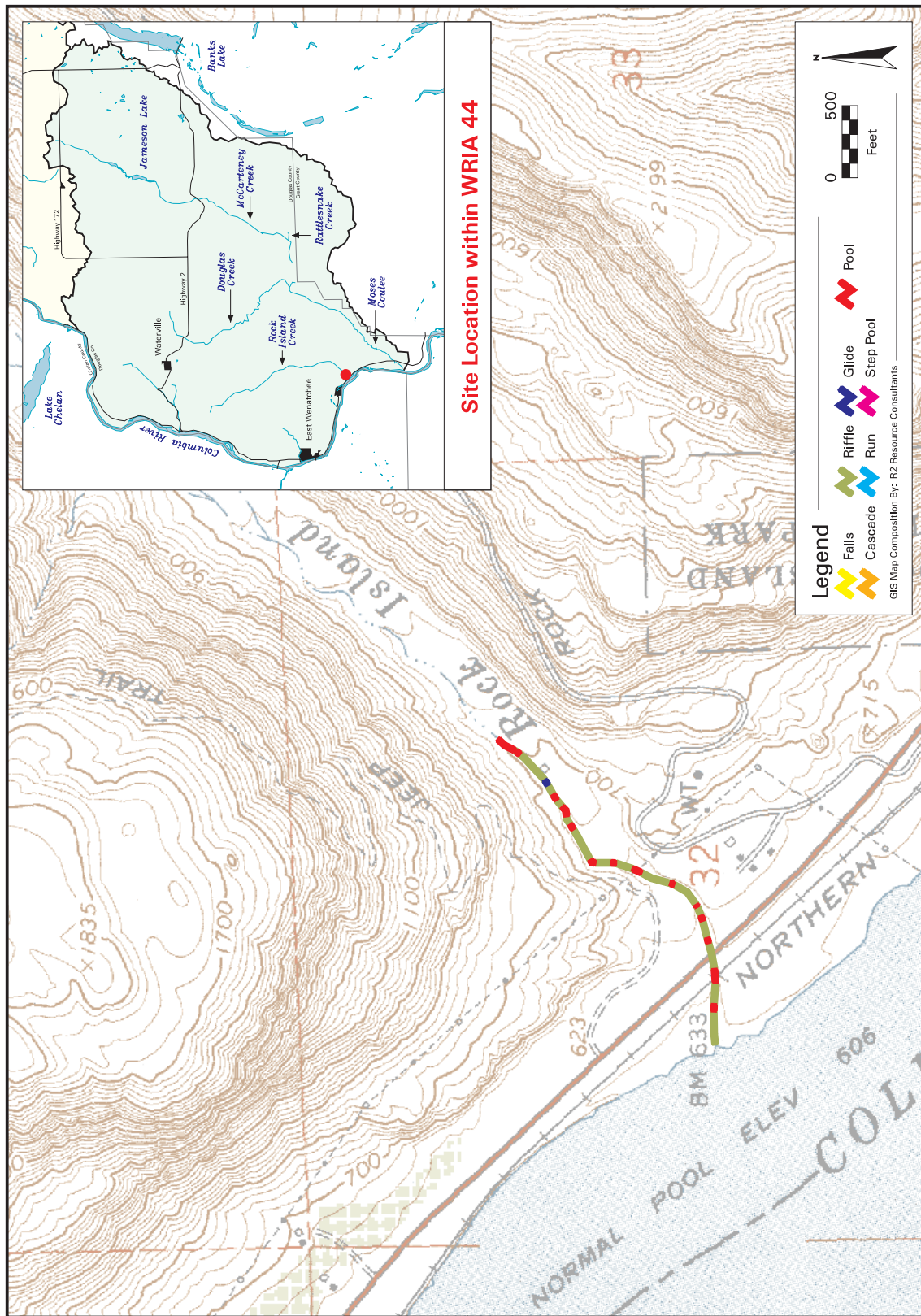


Figure 2. Location of snorkel survey site and associated habitat types in Rock Island Creek.

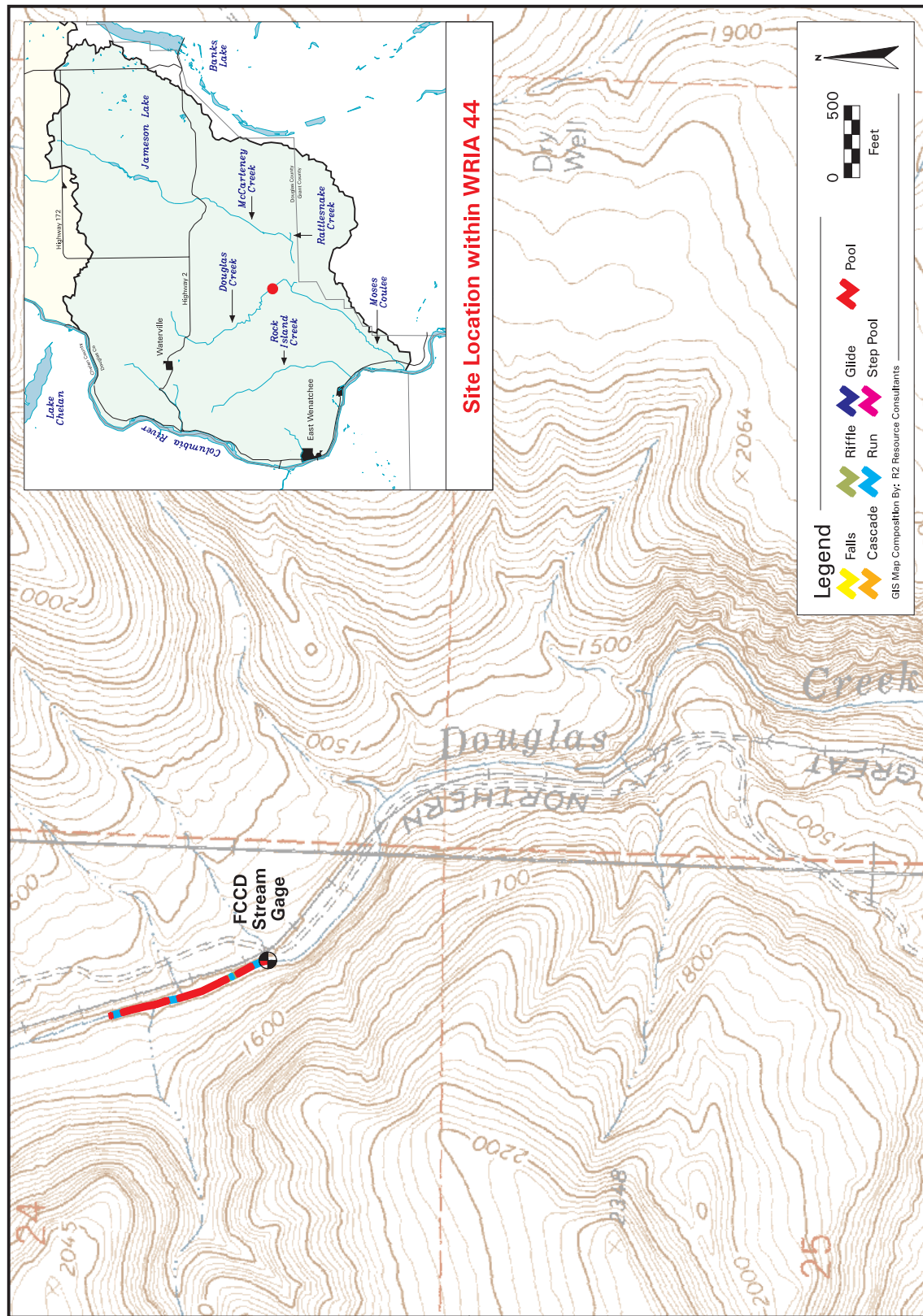


Figure 3. Location of snorkel survey site and associated habitat types in Douglas Creek.

2. RESULTS

Results of the fish rearing surveys are presented below for each stream by survey date.

2.1 FOSTER CREEK

2.1.1 Early June 2003 Snorkel Observations

General Observations: The weather on June 4, 2003 was clear and warm and air temperatures peaked during the afternoon around 32.2°C (90°F). Stream flows were moderate and declining, estimated to be around 5 cfs. Water temperatures were typical for early June, warming from 11°C to 18.5°C as the afternoon progressed. These stream temperatures are approaching the optimum metabolic range for rearing cold water salmonid fishes.

Water clarity was excellent and underwater visibility was around 7 ft. depending on the amount of glare from sunlight. Filamentous periphyton growth was full and lush, covering the streambed. It was flowing in the water currents, making sight observations difficult and providing plenty of hiding spaces for juvenile fishes.

The snorkel survey began at 0830 hrs and continued until 1600 hrs. The survey consisted of one diver making observations in an upstream direction beginning at the creek's confluence with Wells Pool (Lake Pateros at RM 0.0) progressing to the canyon section immediately downstream of the Bridgeport dam at RM 1.0.

Chinook salmon fry (subyearlings), and steelhead trout fry and parr were present in the creek. Chinook salmon were the most numerous of the salmonids observed in early June. Most of the Chinook were recently emerged young-of-the-year (YOY) fry between 25 and 50 mm in size. At this point in time, they were completely buttoned-up (yolk sac adsorbed) fry, but the majority remained very small. Approximately 10 percent of the observed Chinook consisted of a larger size class, between 50 and 75 mm. Chinook salmon were observed upstream as far as RM 0.21, approximately 200 ft downstream of the second bridge crossing. Steelhead trout fry were less abundant but widely distributed in Foster Creek in early June. Only a few trout in the very small size class, 25 to 50 mm (1 to 2 inches) were observed. This finding suggests the survey may have been performed prior to substantial emergence of this year's fry class, which is expected to peak in mid- to late June. Resident trout ranging from 75 mm (3 inches) up to 300 mm (12

inches) were also observed. Most of the trout were in the 50 to 125 mm (2 to 5 inches) size classes (Figure 4) and may represent steelhead parr (yearlings) or 1+ age resident trout. Since adult steelhead trout were observed in the creek during spring spawning surveys, these fish are assumed primarily to be anadromous steelhead trout.

Other aquatic species noted during the surveys included: largescale sucker, carp, sculpin and a river otter. Amphipods, case-building caddisflies and a hatch of small crustaceans were visible as benthic invertebrates during the June 2003 snorkeling survey.

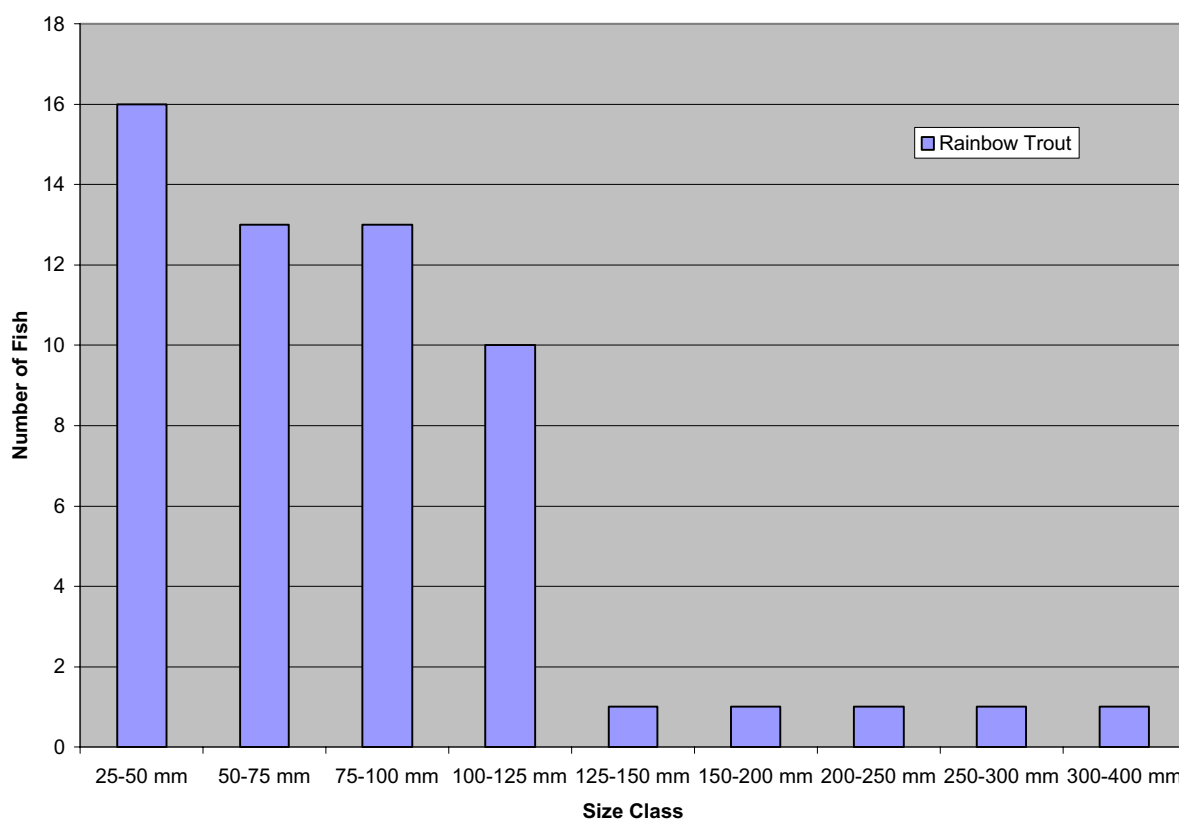


Figure 4. Size class distribution of rainbow (steelhead) trout in Foster Creek; June 2003.

Surveyed sites during this observation period included:

REACH 1 – ALLUVIAL FAN (RM 0.00 to RM 0.02)

Reservoir Embayment. The survey began at the mouth of Foster Creek where the streamflow discharges into a backwater bay of Lake Pateros. The fan at the mouth consists of gravel bar formation on the west bank and riprap shore on the east bank where it is modified to protect facilities at Chief Joseph Dam. The gravel bar is alternatively inundated or exposed depending on the pool elevation and operating characteristics of Chief Joseph and Wells dams.

Deep water (>3 ft) exists in the center of the embayment and along the riprap shore. Water levels shallow along the gravel bar. The bottom is composed of cobble and sand. Emergent vegetation is present along the western shoreline areas.

Schools of Chinook salmon were observed throughout the pool and nearshore areas. Counts of Chinook, 25 to 50 mm in size, were estimated at 500 fry. Ten largescale sucker, 2 carp, a sculpin and a river otter were also noted in the embayment.

REACH 2 – STEP POOL (RM 0.02 to RM 0.36)

Freshwater Stream. Upstream of the mouth, the channel rises relatively steeply in a step pool arrangement. Pockets of deep water were used for spot snorkel observations. We observed 224 Chinook salmon and 13 steelhead trout in the first series of step pools. The carp and sculpin were restricted to the reservoir. None of these species were seen upstream of the mouth in flowing water of Foster Creek.

Between 1st and 2nd Road Bridges. At RM 0.10, the stream flows under the first bridge accessing Chief Joseph Dam in a dual-threaded channel. We snorkeled a pool and subsequently more pocket water and counted 8 Chinook, 6 steelhead and one resident trout, 300 mm (12 in.) in size in the pool and 1 Chinook and 4 steelhead in the pocket water as shown in Appendix A. Approximately 100 to 200 ft. downstream of the second bridge, a series of step pools and a run – pool complex held 4 Chinook fry < 2 inches and 4 steelhead parr, 75 to 100 mm (3 to 4 inches) in length. Chinook salmon were not observed in Foster Creek upstream of this point at RM 0.21.

Instream Flow Study Site T1-T3. Upstream of 2nd Road Bridge at RM 0.26, approximately 60 m² of a pool - riffle - pool complex near the instream flow study site (T-1) was snorkeled. Two recently emerged steelhead fry [40 mm; 1.6 in.] were noted in the depression of a completed redd in the riffle habitat. Further upstream in deep pocket waters of a pool, riffle and run complex, 1

steelhead fry, 2 parr and 2 resident trout up to 5 inches in length were noted. At this point, the channel morphology changes to a low gradient pool-riffle reach that remains consistent until the end of the survey.

REACH 3 – POOL/RIFFLE MORPHOLOGY (RM 0.36 to RM 0.98)

The pool-riffle reach offers a good level of habitat alternating between pools, riffles and run habitat types along shallow stream gradients (<2%). It extends upstream to a series of rock falls immediately prior to the location of the Bridgeport Dam. Few fish were observed in this reach of the creek with the exception of the plunge pool at RM 0.98 where fish were abundant.

Run Habitat downstream of Catwalk. Approximately 55 m of run habitat including a deep, long run and a shallow run was snorkeled. Only 1 rainbow trout between 125 and 150 mm (5 to 6 inches) in size was observed in this section at a density of 0.0125 fish/m².

Catwalk Structure. An aluminum walkway has been placed across the stream at RM 0.46. The influence of the structure in the stream has created upstream backwater and downstream scour. A small, deep pool occurs immediately downstream of the structure that offers available rearing habitat. No fish were noted in the pool and none were observed upstream in run habitat for a distance of 20 m.

Instream Flow Study Site T4-T7. A total of 13 small steelhead fry (25 to 50 mm; 1 to 2 inches) in size and 1 parr (100 to 125 mm; 4 to 5 inches) were noted in a run-riffle-glide complex near and between T4 and T7 [RM 0.50 to 0.63]. This section of creek had many associated active steelhead redds and the concentration of fry may be directly related.

Beaver Dam and Pool. A beaver has been actively working the section of Foster Creek near RM 0.67 and has inundated a small section of creek. The backwater is full of sand and silt and water depths are very shallow. The best habitat supporting potential fish production occurred at the head end of the backwater, however, no fish were observed anywhere within the beaver complex. In run habitat, upstream of the beaver dam pool, one steelhead parr (100 to 125 mm; 4 to 5 inches) was observed near a redd at RM 0.70.

Riffle-Pool, Riffle-Run Habitat. No fish were observed in a 1,000 ft reach of alternating riffle-pool, riffle-run habitat sequences between RM 0.73 to RM 0.91.

Plunge Pool. The large plunge pool below the falls and cascading rocky section of Foster Creek, downstream of the Bridgeport Irrigation dam, offers deep water and some of the best rearing habitat conditions for fish. Three (3) steelhead parr, 2 adult rainbow trout and 4 largescale sucker were observed in the plunge pool during early June 2003.

In summary, approximately 2,400 m² (30% of available habitat) between RM 0.0 and RM 1.0 in Foster Creek was surveyed by underwater snorkel techniques to assess the relative abundance of fish present during early June 2003. Young-of-the-year (YOY) Chinook salmon fry, steelhead trout fry and parr and resident adult trout dominated the species and age-class compositions. A good number of adult largescale sucker was also seen during the survey. Carp and sculpin were also noted at the mouth of the creek in the backwater embayment of Lake Pateros.

During early June, subyearling Chinook salmon were the most abundant life history stage present in the creek. The greatest abundance of anadromous fish species in the creek was noted at survey sites in pool habitats downstream of the 2nd bridge (RM 0.21) in the step-pool reach, Reach 2.

Chinook fry were observed at a density of 0.113 fry/ m² in the step-pool reach (Reach 2). This level of abundance implies the reach is underseeded with Chinook fry compared to regional literature values for streams of similar size and mineralization.

Steelhead trout were present in Foster Creek in early June. The timing of the survey, however, was prior to the anticipated peak emergence of steelhead fry. Some fry were present, most likely emerging from redds excavated during the early portion of the spawning period in mid- to late April. However, based on the peak number of redd counts in late May, steelhead fry densities are anticipated to peak in late June and perhaps early July, depending upon stream temperatures.

Although steelhead trout spawning was confirmed and fry were currently emerging, the densities for older age classes (1+, 2+ and >2+) of rainbow were quite low in Foster Creek in early June 2003. Although habitat is plentiful, the abundance of rainbow trout in Foster Creek appeared to be low.

Based on habitat frequencies and estimates of steelhead production from the various habitat types, we have estimated an overall smolt yield for Foster Creek under normal circumstances should be on the order of 267 smolts representing the 2+ age-class (Table 1). Under typical spawning and rearing conditions, this level of smolt output could be produced from 11 successful redds. It should support a fry (subyearling) density of approximately 1.117 fry/ m², and a late

summer parr or yearling density of 0.1167 parr/ m². Yearling size classes of rainbow trout observed in Foster Creek in early June were only 0.0096 parr/ m² or an order of magnitude lower than anticipated (Table 2).

The presence of adult largescale sucker in Foster Creek in early June is consistent with the reported spawning timing and preferred spawning locations in reservoir inlet streams for this species.

Table 1. Steelhead production capacity estimates in accordance with the distribution of habitat types in Foster Creek after SERC (1980).

Habitat Type	Habitat Frequency	Habitat Area	Steelhead Smolt Yield	Potential Steelhead Smolts
Reach 1; Alluvial Fan	(%)	(m ²)	(smolts/m ²)	(No.)
Riffle	100	256	0.018	5
Reach 2; Step-Pool	(%)	(m ²)	(smolts/m ²)	(No.)
Pools	20%	661	0.018	12
Runs/Glides	4%	132	0.030	4
Riffles	23%	760	0.030	23
Cascades	53%	1,750	0.060	105
Subtotal	100%	3,303	0.044	144
Reach 3; Pool-Riffle	(%)	(m ²)	(smolts/m ²)	(No.)
Pools	16%	674	0.018	12
Runs/Glides	28%	1,180	0.030	35
Riffles	56%	2,361	0.030	71
Cascades	0%	0	0.060	0
Subtotal	100%	4,216	0.028	118
Total Rearing Habitat Capacity		7,774	0.034	267
				37
				23
				11
				45,327
				9,065
				907
				272

Smolts
Run Size
Escapement
Redds
Embryos
Fry
Parr
Smolts

Table 2. Comparison of steelhead trout densities as fish per m² at various age classes in Foster Creek.

Steelhead Trout	Potential ^{1/}	Measured	
		June	August ^{2/}
Fry	1.1166	0.0121 [#]	0.2283
Parr	0.1167	0.0096	0.0993
Smolts (pre-smolts)	0.0340	0.0012 [*]	0.0198

1) Estimated production potential per distribution of habitat types in Foster Creek as per Table 1 (after SERC 1980).

2) Viewing conditions restricted due to heavy silt load in the creek during the survey.

#) Timing of survey was prior to peak emergence and greater densities are anticipated (note increase in August).

*) Some of the year class may have emigrated as smolts during the spring prior to the survey.

2.1.2 Late August 2003 Snorkel Observations

General Observations. The weather on August 27, 2003 was clear and warm. Mid-day air temperatures ranged between 27°C and 29°C (80 and 85°F). Stream flows were considerably reduced compared to the June survey and estimated to be approximately 1.5 cfs. The water temperature at 0900 hrs was 17°C (63°F), within the optimal range for salmonid fish growth. A heavy suspended silt load in the creek restricted visibility to between 1 and 2 feet, adversely affecting snorkel observations. Although counts were made, the results should not be regarded as quantitative.

Results. Surveyed sites during the August observation period were similar to June 2003. Survey sites included the reservoir embayment, 10 pools, 1 riffle and 2 run/glide habitat types and various pockets of deep water in the Alluvial Fan, Step-pool and Pool-riffle reaches. However, due to lower stream flows and lower visibility in August compared to June, the stream length and surface area covered during August was less. A total of 423 m² of habitat (5% of the available habitat downstream of the Bridgeport Dam) was surveyed in August. The following results are discussed in relation to changes experienced through the summer months compared to June 2003 results.

Chinook salmon were present in Foster Creek in late August with a confirmed sighting immediately downstream of the first bridge at RM 0.10 in pool habitat. Chinook were between 75 and 100 mm (3 to 4 inches) in length indicating a good level of growth since early June.

Numbers of Chinook were substantially lower than in early June, which may be a result of poor viewing conditions or emigration of smolts from the system.

Steelhead (rainbow) trout were the most abundant species in Foster Creek in late August. Even though viewing conditions were poor, the abundance of juvenile steelhead trout was noted to be substantially greater than during early June. This abundance reflects ongoing emergence of young-of-the-year (YOY) fry following the first survey. Fish growth was also noticeable (Figure 5) since most trout were observed between 75 and 100 mm (3 to 4 inches) in size, whereas the most abundant size class of rainbow trout in June was less than 50 mm (2 inches).

Steelhead trout were recorded at a density of 0.108 fish /m² in the step pool reach and an order of magnitude greater in the pool-riffle reach at 1.046 fish /m². Viewing conditions were slightly improved in the pool-riffle reach [3 to 4 ft] in relation to the step pool reach, so comparison of this information is speculative at best. However, it should be noted the pool-riffle reach support the greatest number of steelhead trout redds as well.

The density of late summer steelhead trout parr across all habitat types averaged 0.0993 fish /m². This density is likely a low estimate, based on poor viewing conditions. Nevertheless, the abundance is fairly consistent with the anticipated number of parr the stream should be capable of supporting based on habitat frequencies (Tables 1 and 2 after SERC 1980). Using an estimate of normal overwintering survival of late summer parr to spring smolt of 30 percent (Gibbons et al. 1985), this parr abundance should produce approximately 0.0298 steelhead smolts/m² during the spring of 2004. The anticipated smolt production is in the neighborhood of the values estimated for the smolt carrying capacity in Foster Creek of 0.0340 smolts/m² (SERC 1980). It is slightly higher than estimated smolt densities in tributary stream reaches in 31 coastal and Puget Sound streams that ranged between 0.0018 to 0.0426 smolts/m² and averaged 0.0228 smolts/m² in tributary streams the size of Foster Creek (Gibbons et al. 1985). The variability of observed densities in Gibbons et al. surveys was related to the stream size, gradient and habitat composition of the study reach and the productivity of the stream. Foster Creek during the summer of 2003 is apparently supporting a good number of juvenile steelhead trout compared to average data from coastal and Puget Sound streams.

There is little evidence habitat conditions, during summer months of 2003 in Foster Creek, were having an adverse influence on growth and survival of juvenile steelhead trout. Observed numbers of juvenile fish in late summer are approaching estimates of the anticipated carrying capacity for steelhead trout in Foster Creek.

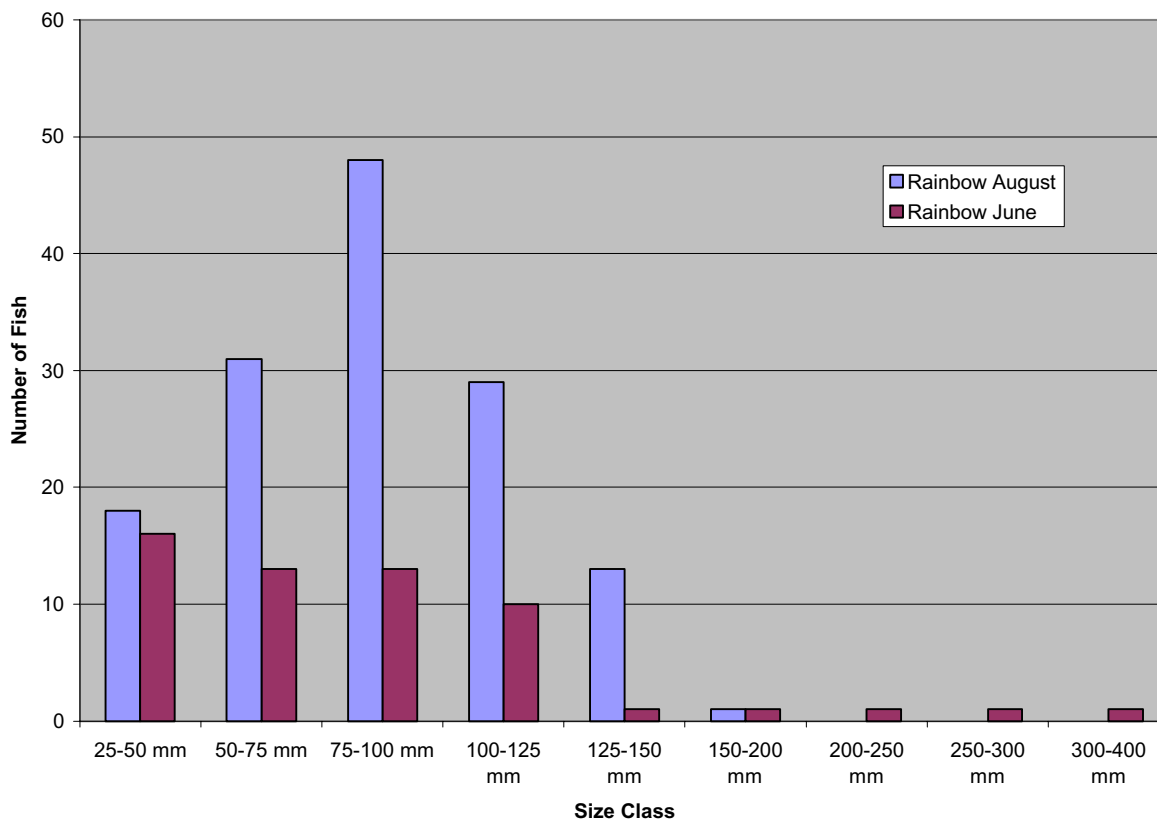


Figure 5. Size class distribution of rainbow (steelhead) trout in Foster Creek; Summer 2003.

2.2 ROCK ISLAND CREEK

2.2.1 Early June 2003 Snorkel Observations

General Observations. The weather was clear and warm and air temperatures peaked during the afternoon around 32.2°C (90°F). Stream flows were relatively high for this time of year, estimated to be around 2 cfs. Water temperatures were typical for early June, warming from 12.5°C to 14°C (55 to 57°F) as the afternoon progressed. These stream temperatures are within the appropriate metabolic range for rearing cold water salmonid fishes.

Water clarity was excellent and underwater visibility was around 10 ft depending on the amount of glare from sunlight. Since Rock Island Creek flows in an east-west orientation, glare is minimal.

The snorkel survey began at 1300 hrs and continued until 1700 hrs. The survey began at the creek's confluence with Rock Island Pool (RM 0.0) and progressed to the fence line in the creek at RM 0.31. All accessible water deep enough (>7.6 cm; 3 in.) to make observations between these points were included in the survey. Habitat types surveyed consisted of the reservoir embayment, 7 pools, 10 riffles and various pockets of deep water in the riffles.

Chinook and coho salmon (*O. kisutch*) fry (subyearlings), coho salmon smolts (yearlings) and resident trout parr and adults were abundant in the creek. Chinook salmon were the most numerous of the salmonid fishes observed in early June. Most of the Chinook were recently emerged young-of-the-year (YOY) fry between 25 and 50 mm in size. At this point in time, they were completely buttoned-up (yolk sac adsorbed) fry, but the majority remained very small. Approximately 10 percent of the observed Chinook consisted of a larger size class, between 50 and 75 mm. Chinook salmon were observed upstream as far as RM 0.25, well upstream of the instream flow study site and above the pumphouse pool at RM 0.17. Coho salmon were also primarily young-of-the-year fry of two size classes; 25 to 50 mm and 50 to 75 mm. Slightly more than one fourth of the coho fry were in the large size class. In addition, one yearling coho smolt, silver in color, in the range of 125 to 150 mm in size was also present in the creek at the instream flow study site at pool transect T3 (RM 0.15). Coho salmon were more limited in abundance and distribution in the creek than the Chinook. They ranged upstream to the Pumphouse pool at RM 0.17. Rainbow trout were the least abundant salmonid fish observed in Rock Island creek in June. No trout in the very small size class, 25 to 50 mm (1 to 2 inches), were observed. This finding suggests the survey may have been performed prior to substantial emergence of this year's fry class. Trout ranging from 50 to 75 mm (2 to 3 inches) upward to 300 mm (12 inches) were observed. Most trout in June were in the 100 to 125 mm (4 to 5 inches) size class (Figure 6). Since steelhead trout have not been observed in the creek to date during spring spawning surveys, these trout are assumed to be resident fish. Other fish species noted during the surveys included: three-spine stickleback and largescale sucker.

Results. Surveyed sites during this observation period, in the order they were surveyed, included:

REACH 1 – ALLUVIAL FAN (RM 0.00 to RM 0.08)

Reservoir Wetland. The survey began at the mouth of Rock Island creek where the streamflow discharges into a backwater wetland of Rock Island Reservoir. The fan at the mouth consists of many small distributary channels. At least three channels were wet and showed evidence of recent flows. However, the northernmost channel carries the largest volume of water. A deep

pool exists where the northernmost channel discharges to the wetland. The bottom is very soft sand and mud and emergent vegetation is present along adjacent shoreline areas. Numerous small fish milling about in the pool were observed from the shore prior to snorkeling. They appeared to be stickleback and Chinook salmon fry. Snorkel observations confirmed the species identification made along the shore. Thick schools of both three-spine sticklebacks (*Gasterosteus aculeatus*) and Chinook salmon were intermingling throughout the pool and nearshore areas. Interwoven within the two most abundant species were juvenile coho salmon. Counts of Chinook and stickleback numbered in the 1,000 each, while coho were on the order of 10 percent of that level.

Freshwater Stream. Upstream of the mouth, the channel is overgrown with willow thickets. Occasional entry points in the thicket-strewn channel were used for spot snorkel observations. Six (6) Chinook salmon were observed in one small area totaling 1.0 m² of riffle habitat at RM 0.01. Three-spine stickleback were restricted to the reservoir. No stickleback were observed upstream of the mouth in flowing water of Rock Island Creek.

At RM 0.03 the stream flows in a single-threaded channel upstream of the thicket. Approximately 9 m² of riffle habitat was snorkeled at two spots. Seventy two (72) Chinook and one coho in this section were counted as shown on the data tables for Rock Island Creek in Appendix B. Further upstream at RM 0.07 a shallow pool below the railroad bridge held 120 Chinook (< 75 mm) and 4 resident trout 75 to 150 mm (3 to 6 inches) in length. Pool habitats offer greater space for rearing Chinook than riffle habitat. Similarly, trout were only observed in pools or in pockets of deep water residing in riffles. An additional riffle underneath the railroad bridge, with pocket pools up to 0.3 m (1 ft) deep, was snorkeled in this section. Up to 65 juvenile Chinook were observed.

Substantial bedload is depositing between the railroad bridge and SR highway 28 bridge effectively flattening the channel gradient at this point. The stream changes upstream to a pool-riffle morphology and it remains consistent through the endpoint of the survey as discussed in the next section.

REACH 2 – POOL/RIFFLE MORPHOLOGY (RM 0.08 to RM 0.31)

Pool-Riffle Complex Between the RR Bridge and SR 28 Bridge. A fair number (>250) of juvenile Chinook (25 to 75 mm), and five resident trout fry (75 to 150 mm) were noted distributed amongst the pools, pool-riffle and pocket water habitat. The greatest abundance was present in the largest, lowermost pool (Appendix B data summary tables).

Upstream of SR 28 Bridge. A pool/riffle-complex exists in a heavily silted section of creek immediately upstream of the bridge. We noted 120 Chinook salmon and 3 coho salmon fry in this complex. Beaver had developed a relatively new dam across the creek at RM 0.10 creating a nice backwater pool with mostly a sandy bottom. Fish were plentiful in the pool including 60 Chinook salmon fry, 8 resident trout and 7 adult largescale sucker (>400 mm; 16 inches). The sucker had undoubtedly moved upstream from the reservoir for spawning purposes. They prefer deep water with sandy bottoms for spawning between mid-May and late June (McPhail and Lindsey 1970). Sucker fry are anticipated to hatch approximately two weeks following spawning. No fry were observed during the surveys.

Instream Flow Study Site T1-T3. Transects T1 and T2 are riffles, while T3 is a pool defining sequential habitat types in an upstream direction between RM 0.12 and RM 0.15. Anadromous and resident salmonid fish remained the dominant species in this reach of stream. Eighty (80) Chinook salmon fry, 8 resident trout and 1 coho smolt were counted. More fish were observed in the pool habitat than in the riffles. It was interesting to note the presence of a coho salmon yearling (125 – 150 mm in length) in the pool at T3. Based on its silver color, the coho may have been in the process of smolting and getting ready to emigrate. The spring outmigration of yearling coho smolts past Rock Island Dam historically occurred in May with 90 percent of the run passing by the end of the month (Peven 1992, FPC 1995). Naturally spawned coho smolts at Rock Island dam were between 160 and 190 mm in length during the 1986 outmigration period (Fielder and Peven 1986). It is possible the coho smolt observed in Rock Island Creek may be waiting for further growth prior to emigrating.

Pumphouse Pool (T4). This relatively large pool (33 m²) at RM 0.17 is one of the deepest in the creek (2.5 ft). A concrete abutment protrudes into the pool on the right bank and large boulders and bedrock line the bottom. Twelve (12) Chinook and 2 coho salmon as well as 4 rainbow trout were observed in the pool.

Series of Small Pools and Pocket Water. Upstream of the pumphouse pool a series of small pools and pocket water totaling 98 m² of habitat was snorkeled to assess fish presence. Anadromous fish abundance declined, while resident trout abundance increased in this reach compared to numbers of fish downstream of the pumphouse pool. Only six (6) Chinook fry and no coho salmon were noted, yet 18 rainbow trout 75 to 300 mm (3 to 12 inches) were recorded. In addition, one of the spawning adult largescale suckers was observed in a small pocket pool.

In summary, approximately 1,220 lineal feet (370 m) of Rock Island Creek (75% of available habitat) between RM 0.0 and RM 0.31 was surveyed by underwater snorkel techniques to assess the relative abundance of fish present during early June 2003. Young-of-the-year (YOY) Chinook and coho salmon fry, coho yearling smolts, trout parr and resident adult trout dominated the species and age-class compositions. A good number of spawning adult largescale sucker was also seen during the survey. Three-spine stickleback were noted at the mouth of the creek in the backwater wetland of Rock Island Reservoir.

During early June, subyearling Chinook salmon were the most abundant life history stage present in the creek. The greatest abundance of anadromous fish species in the creek was noted at survey sites in pool habitats downstream of the pumphouse pool (RM 0.17). Conversely, the highest density of resident trout was observed upstream of the pumphouse pool. Chinook fry were observed at densities that potentially represent fully seeded conditions for the creek. Conversely, coho salmon subyearlings and resident rainbow trout appeared at low densities. The presence of adult largescale sucker in Rock Island Creek in early June is consistent with the reported spawning timing and preferred locations in reservoir inlet streams for this species.

Observations of coho salmon in the mid-Columbia region are rare since repeated efforts to re-introduce coho over time with lower Columbia River stock have failed. Endemic stocks of coho salmon in this area are considered extinct since the development of mainstem Columbia River hydroelectric projects originally precluded upriver passage for multiple generations and subsequent re-introductions have not produced self-sustaining populations. Although low in abundance, the presence of two age-classes (subyearlings and yearlings) suggests coho salmon are currently using Rock Island Creek for year-round rearing.

2.2.2 Late August 2003 Snorkel Observations

General Observations. The weather was clear and warm and air temperatures peaked during the afternoon around 29°C (85°F). Stream flows were very low, estimated to be around 0.3 cfs. Although low, the water was clear with underwater visibility ranging between 8 and 10 feet. Water temperatures were typical for late August, around 15°C (59°F) at 1100 hrs. This stream temperature is within the appropriate metabolic range for rearing cold water salmonid fishes.

Results. Surveyed sites during the August observation period were similar to June 2003. Survey sites included the reservoir embayment at the mouth of Rock Island Creek as well as 5 pools and 1 run habitat types and various pockets of deep water in the Alluvial Fan and Pool-riffle reaches.

However, due to substantially lower stream flows in August compared to June, the stream length and surface area covered during August were less. A total of 72 m² of habitat (6% of the habitat available downstream of RM 0.31 under bankfull stream flows) was surveyed in August. The following results are discussed in relation to changes experienced through the summer months compared to June 2003 results.

The species composition and dominance remained the same in late August as in early June. Juvenile subyearling Chinook salmon were the most abundant species and life history stage in the creek. These fish ranged in size from 75 to 125 mm (3 to 5 in.) exhibiting 50 mm (2 in.) or more of growth in 85 days. The densities of Chinook, however, were less than half the densities observed in June implying reductions from either instream mortality/predation, or emigrations due to lower streamflows or normal smoltification and outmigration. Chapman et al. (1994) implied most summer/fall chinook subyearlings leave tributary streams in the Mid-Columbia region by mid-July. The authors reported subyearling Chinook salmon passing Priest Rapids Dam in late July and August at well over 100 mm in length increasing in size in August to 120 to 135 mm (around 5 inches). Regardless of the decline, the late summer densities of Chinook salmon in Rock Island Creek remained high, averaging 0.722 fish/m² across all habitat types. This density compares well with other abundance levels in other interior streams where production is typically twice as high as coastal streams due to high level of stream mineralization. Eleven years of data in the upper Lemhi River system in Idaho indicated average chinook smolt densities of 0.450 fish/m² of autumn and yearling migrants with a maximum of 0.750 fish/m² (SERC 1980). Conductivity levels are moderately high in Rock Island Creek (230 to 260 µmhos/cm) due to arid conditions and groundwater contributions. This level of mineralization offers a good level of salmonid fish production potential compared to waters of lower mineralization.

Juvenile rainbow trout increased in relative abundance through the summer months most likely as a result of ongoing emergence of fry since early June. The dominant size class in August was between 75 and 100 mm compared to 100 to 125 mm in June. This shift in peak abundance to a lower size class indicates recruitment of smaller, young-of-the-year fish (Figure 6). Densities of late summer rainbow trout averaged 0.625 trout/m² across all habitat types in Rock Island Creek. As shown in Table 3, the densities per size class are in the range of normal densities for wild trout in Pacific Northwest streams (Olson 1983). This finding is true for subyearling fry and yearling trout, but the numbers of adult trout are fairly low at least in the lowermost portion of the creek downstream of the pumphouse pool. As shown in June, the abundance of trout increases upstream of the pumphouse likely as a result of less competition for food and space with anadromous fish species.

Subyearling coho salmon remained in the creek at a similar low density as in June, 0.014 fish/m². The size of the fish had grown 25 to 50 mm since June, 2003. Yearling coho were no longer observed and assumed to have emigrated.

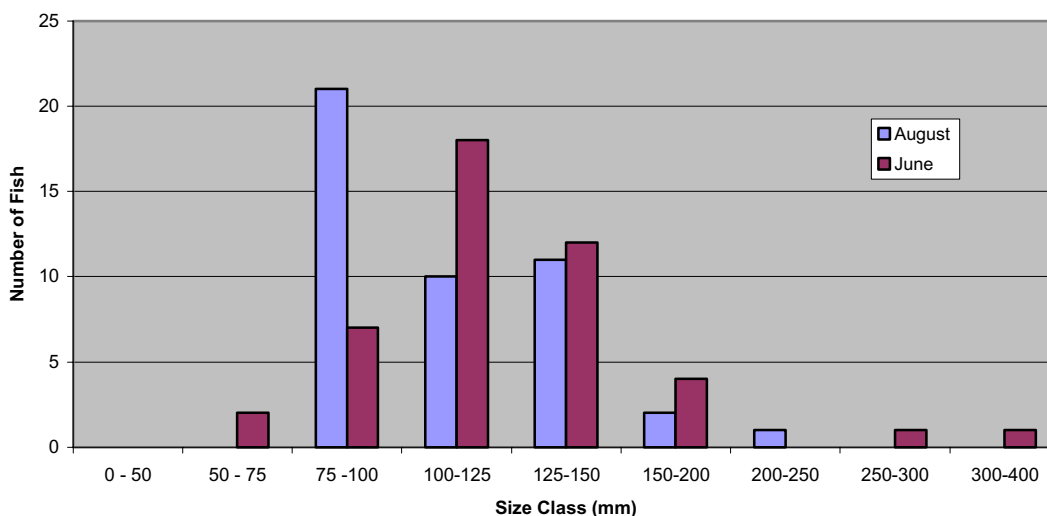


Figure 6. Size class distribution of rainbow trout in Rock Island Creek; Summer 2003

2.3 DOUGLAS CREEK

2.3.1 Early June 2003 Snorkel Observations

General Observations. The weather on June 5, 2003 was clear and warm and air temperatures peaked during the afternoon around 32.2°C (90°F). Stream flows were steady, estimated to be around 11 cfs. Water temperatures were typical for early June in Douglas Creek, around 16°C (61°F) at 0845 hrs. Pegg Canyon, a warmwater, east bank tributary to Douglas Creek, was contributing a good volume of 18°C (64°F) water as of 0815 hrs. The daily fluctuation in temperature is very narrow in Douglas Creek, generally less than 3C, typical of groundwater fed streams. These stream temperatures are approaching the upper optimum metabolic range for rearing cold water salmonid fishes.

Water clarity was excellent and underwater visibility was around 15 ft depending on the amount of glare from sunlight. Given the degree of water clarity, fish were extremely wary of divers.

Nevertheless, during underwater observations you could watch fish rising to the surface in pools while feeding.

The instream flow study site (RM 1.5 to RM 1.6) lies within the canyon reach of Douglas Creek. It occurs upstream of the deep canyon section in shallow stream gradients. Although the local channel gradient is low ($< 2\%$), the study site occurs within a tightly confined, narrow draw. Lateral movement of the creek is also constrained by layers of bedrock and the county road. Water flow and channel depths are controlled by a mixture of bedrock and boulders. The stream substrate consists mostly of gravel and cobbles with plenty of large boulders present. The boulders provide substantial velocity and visual cover for enhanced fish feeding opportunities compared to open stream reaches.

The snorkel survey began at 0900 hrs and continued until 1200 hrs. The survey consisted of one diver making observations in an upstream direction beginning at the instream flow study transect T1 progressing upstream to pools approximately 60 m (200 ft) upstream of transect T3. Most of the accessible water, deep enough (> 7.6 cm; 3 in.) to make observations between these points, was included in the survey. Habitat types surveyed consisted of 8 pools, 4 runs and 2 riffles and various pockets of deep water in the riffle sections. A lineal distance of 153 m (500 ft) and a total area of 664 m^2 ($7,145 \text{ ft}^2$) was surveyed, representing approximately 80 percent of the area between the survey start and end points.

Rainbow trout of various size classes were abundant in the creek throughout the instream flow study reach. Since anadromous steelhead trout do not have access to Douglas Creek, these fish are assumed to be entirely resident rainbow trout. Most of the trout were recently emerged young-of-the-year (YOY) fry between 25 and 50 mm (1 to 2 inches) in size. At this point in time, they were completely buttoned-up (yolk sac adsorbed) fry, but the majority of fish remained in the small size category. Approximately 15 percent of the observed YOY year-class consisted of a larger size of fry, between 50 and 75 mm (2 to 3 inches), implying that some amount of growth had occurred by early June. The survey may have been performed prior to complete emergence of this year's fry class, which was expected to peak in mid-June.

Resident trout ranging from 75 mm (3 inches) upward to 300 mm (12 inches) were also observed. A break in the size classes is evident at 150 mm (6 inches) suggesting fish larger than 150 mm are likely two years of age or older (Figure 7). For the purposes of this assessment, it is assumed yearling fish as of June 5th range between 75 and 150 mm (3 to 6 inches) in length.

Other aquatic species noted during the surveys included an abundance of crayfish throughout the study reach.

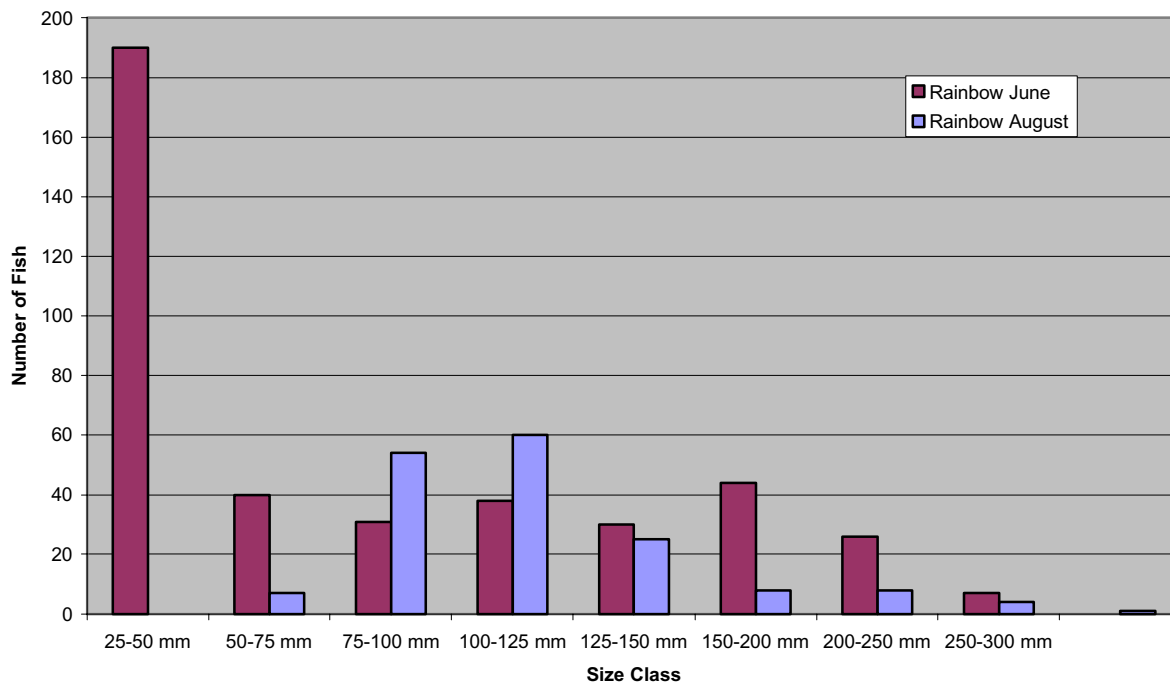


Figure 7. Size class distribution of rainbow trout in Douglas Creek; Summer 2003.

Surveyed sites during this observation period included:

INSTREAM FLOW STUDY REACH T1 – T3

The survey began at T1 in riffle and run habitat upstream of the Foster Creek Conservation District (FCCD) flow-gaging site at RM 1.5, as measured from Douglas Creek's confluence with Moses Coulee. The survey progressed 500 ft upstream past T3 through various sequences of run, riffle and pool habitats. Pools in this section were plentiful but not extremely deep. The maximum depth of pools in the study reach ranged between 0.6 to 1.0 m (2 and 3 ft) deep. Plunge pools of depths up to 2 to 3 m (6.5 to 10 ft) are available and plentiful in the Douglas Creek canyon section offering substantial habitat for resident trout. However, none of the deep plunge pools were located in the study reach.

The trout size class distribution and use of the various habitat types were not substantially different between the sites to warrant discussions on a site-by-site basis (Appendix Table C-1). From the small amount of information, it appears resident trout in early June are using run

habitats in the study reach more frequently, and riffles least frequently, compared to other habitat types. Densities of trout in runs ranged from 0.260 to 2.217 fish/m² while averaging 1.106 fish/m². Trout densities in pools were similar but slightly less than the runs, ranging between 0.250 and 1.500 fish/m² with a mean of 0.697 fish/m². Riffles supported the lowest fish densities ranging between 0.083 and 1.028 fish/m², while averaging 0.556 fish/m².

A breakdown of fish sizes into anticipated year-classes and the density of the subsequent ages are provided in Table 3. The data indicate a strong year class of fry is present in early June. Since the survey occurred during the period of fry emergence, the total number of available fry for the year may not be included in these estimates. It is interesting to note the abundance of yearling trout is consistent with average densities of wild rainbow trout in other Pacific Northwest streams as reported by Olson (1983). As such, Douglas Creek might be considered fully seeded with trout (Table 3).

Although Douglas Creek data represented average numbers of trout yearlings in June, it supported twice the density of older age classes indicating survival to 2+ age fish is greater than most PNW streams (Table 4 per Olson 1983). Stable, year-round stream flows and warm water temperatures may be overcoming either low flow summer rearing or winter rearing limitations to overall fish production in Douglas Creek.

In summary, approximately 664 m² of available habitat between RM 1.6 and RM 1.7 in Douglas Creek was surveyed by underwater snorkel techniques to assess the relative abundance of fish present during early June 2003. Young-of-the-year (YOY) resident rainbow trout fry dominated the species and age-class compositions, although trout of many size classes up to 300 mm (12 inches) were observed in the creek.

During early June, subyearling trout were the most abundant life history stage present in the creek. Yearling trout were found in densities consistent with average seeding rates in other Pacific Northwest streams. Higher densities of older trout size classes, than those found in other regional streams, suggest habitat conditions are good for fish survival and growth in Douglas Creek. Warm, stable stream flows from groundwater sources are speculated to provide enhanced fish production in Douglas Creek in comparison to other streams in the region.

Table 3. Size and age-class distribution of rainbow trout in Douglas Creek during early June 2003.

Size Class	Trout Age-Class	Douglas Creek		PNW Streams	
		Rainbow Trout Count [#] (No.)	Trout Density Fish/m ²	Mean Wild Trout Densities Olson (1983) Fish/m ²	Combined Age-Class
25-50 mm	0+	190			
50-75 mm	0+	40	0.4275	0.6600	0+ age-class
75-100 mm	1+	31			
100-125 mm	1+	38			
125-150 mm	1+	30	0.1840	0.1500	1+ age-class
150-200 mm	2+	44			
200-250 mm	2+	26			
250-300 mm	2+	7	0.1431	0.0500	2+ age-class
Total		406	0.7546	0.8740	

#) June 5th survey date occurred during the spring emergence period for young-of-the-year fry. Counts and density estimates for the 0+ age year-class may not represent peak emergence and, hence, the total numbers of fry in Douglas Creek.

2.3.2 Late August 2003 Snorkel Observations

General Observations. The weather on August 26, 2003 was clear and warm and air temperatures peaked during the afternoon around 29°C (85°F). Stream flows were stable, estimated to be around 10 cfs. The water was clear with underwater visibility ranging between 8 and 10 feet. Water temperatures were typical for late August, around 18.5°C (65°F) at 1400 hrs. This stream temperature is approaching the upper metabolic range for rearing cold water salmonid fishes.

Results. Surveyed sites during the August observation period were similar to June. Survey sites included the area between instream flow transects T1 – T3 including pool, run and riffle habitat types and various pockets of deep water in the riffle reaches. However, stream length and surface area covered during the August survey were less. A total of 538 m² (5,789 ft²) of habitat (65% of the habitat available between the survey start and end points) was surveyed in August.

The following results are discussed in relation to changes experienced through the summer months compared to June 2003 results.

The species composition and size class structure remained similar in late August as in early June, with the exception of the small (< 50 mm) size class. Young-of-the-year trout fry had grown since June, and subyearling fish from this year's fry class were mostly between 75 and 125 mm (3 to 5 inches) in length. The abundance of yearling and older size classes were less than observed in June. The resulting estimated densities for these age-classes in August were half the reported densities for wild trout in regional streams (Table 4). It is possible the lower tally of fish was a result of reduced visibility and less stream area covered compared to June, 2003. The availability of the site to fishermen may also have shown an influence. Although the total number of observed fish were down in August, the estimate of the largest size class was higher than during the survey in June. Fish larger than 300 mm [12 inches] were noted in the study reach.

Table 4. Size and age-class distribution of rainbow trout in Douglas Creek during late-August 2003.

Size Class	Trout Age-Class	Douglas Creek		PNW Streams	
		Rainbow Trout Count [#] (No.)	Trout Density Fish/m ²	Mean Wild Trout Densities Olson (1983) Fish/m ²	Combined Age-Class
25-50 mm	0+	0			
50-75 mm	0+	7			
75-100 mm	0+	54			
100-125 mm	0+	60	0.2249	0.6600	0+ age-class
125-150 mm	1+	25			
150-200 mm	1+	8	0.0706	0.1500	1+ age-class
200-250 mm	2+	8			
250-300 mm	2+	4			
300-400 mm	3+	1	0.0242	0.0500	2/3+ age-class
Total		167	0.3104	0.8740	

3. DISCUSSION

The results of snorkel surveys conducted during late spring and summer of 2003 in WRIA 44 & 50 priority streams for setting minimum instream flow regimes under Ecology Grant No. G0200263, indicate the presence of juvenile rearing salmonid fishes including steelhead (rainbow) trout [*Oncorhynchus mykiss*] and Chinook salmon [*O. tshawytscha*] in Foster Creek, Chinook and coho salmon [*O. kisutch*] and rainbow trout in Rock Island Creek and resident rainbow trout in Douglas Creek. The various size classes of fish, their seasonal presence and water temperature data help in determining the life-history stage periodicity charts for these species in the priority streams as shown in Tables 5 through 7.

Spawning of adult steelhead trout has been previously documented in Foster Creek and confirmed during spring 2003 spawning surveys conducted under Step B of this Grant. A total of 11 redds were recorded during the 2003 spawning period which began mid-April and ended in mid-June (Behne, FCCD pers. comm. June 2003 data summary). The first redds were observed during a survey of April 21st and the latest redd development occurred on June 6th. As such, the summer steelhead trout spawning period in Foster Creek for Instream Flow Modeling purposes is established as April 15th to June 15th (Table 7). Given the water temperatures experienced in Foster Creek (Appendix D), it is anticipated fry emergence would peak in late June and could continue into mid-July. Summer steelhead trout rearing was established between June and mid-November based on water temperature data. From mid-November through mid-April water temperatures in Foster Creek are generally below 5°C. This season represents a period of winter refuge behavior in salmonid fishes with diminished metabolic activity and swimming capabilities.

Fall and winter spawning surveys were performed in the priority streams. There have been no observations of adult anadromous salmon species in either Foster or Rock Island Creeks (Behne, FCCD pers. comm. March 2004). Stream flow conditions are typically very low during the fall spawning season and sporadic during the winter months. Stream flows capable of offering sufficient water depths to support deep-bodied Chinook and coho salmon are very spotty. Given the survey information collected to date, it is assumed salmon spawning does not routinely occur in the priority streams. It is further assumed that observations of juvenile Chinook salmon in Foster and Rock Island creeks and coho salmon in Rock Island Creek are the result of Columbia River fish taking advantage of seasonal rearing opportunities in these tributary streams.

Noted occurrences of non-salmonid fishes and other aquatic species included adult largescale sucker staging for spawning in both Rock Island and Foster Creek as well as carp, sculpin, stickleback, river otter and crayfish species. The carp, sculpin, stickleback and river otter were only observed at the confluence of the streams with the respective Columbia River reservoirs.

Table 5. Life-history stage periodicity chart for species of interest in Rock Island Creek.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Trout												
Spawning			X	X	X							
Incubation			X	X	X	X						
Summer Rearing						X	X	X	X	X		
Winter Rearing	X	X									X	X
Spring Chinook Salmon												
Summer Rearing				X	X	X	X	X	X	X		
Winter Rearing	X	X	X								X	X
Juvenile outmigration				X	X	X						
Su/Fall Chinook Salmon												
Summer Rearing				X	X	X	X	X	X			
Coho Salmon												
Summer Rearing				X	X	X	X	X	X	X		
Winter Rearing	X	X	X								X	X
Juvenile outmigration					X	X						

Table 6. Life-history stage periodicity chart for species of interest in Foster Creek.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Trout												
Spawning				X	X	X						
Incubation					X	X	X					
Summer Rearing						X	X	X	X	X	X	
Winter Rearing	X	X	X								X	X
Summer Steelhead Trout												
Adult migration				X	X	X	X					
Spawning				X	X	X						
Incubation				X	X	X	X					
Summer Rearing						X	X	X	X	X	X	
Winter Rearing	X	X	X								X	X
Juvenile outmigration				X	X							
Spring Chinook Salmon												
Summer Rearing				X	X	X	X	X	X	X	X	
Winter Rearing	X	X	X								X	X
Juvenile outmigration				X	X	X						
Su/Fall Chinook Salmon												
Summer Rearing				X	X	X	X	X	X			

Table 7. Life-history stage periodicity chart for species of interest in Douglas Creek.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Trout												
Spawning			X	X	X							
Incubation				X	X	X						
Summer Rearing	X	X	X	X	X	X	X	X	X	X	X	X

4. REFERENCES

- Bartu, K., and C. Andonaegui. 2001. Salmon and Steelhead Habitat Limiting Factors Report for the Foster and Moses Coulee Watersheds Water Resource Inventory Areas (WRIA) 50 and 44. Report prepared by the Washington State Conservation Commission, Olympia, WA, and the Foster Creek Conservation District, Waterville, WA. Final Report. March, 2001 114p + app.
- Beak Consultants, Inc. 1995. Mid-Columbia Mainstem Conservation Plan; Overview Document. Report prepared for the Public Utility District No. 1 of Douglas County; Public Utility District No. 1 of Chelan County; Public Utility District No. 2 of Grant County; by Beak Consultants, Inc., Kirkland, WA in association with FishPro, Inc., Port Orchard, WA. August, 1995.
- Fielder, P.C. and C.M. Peven. 1986. Juvenile salmonid monitoring at Rock Island dam bypass sampler – annual report. Contract No. DE-AI79-86BP61748, Project No 84-54. U.S. Department of Energy, Bonneville Power Administration, and Division of Fish and Wildlife. Wenatchee, WA, 21 pp.
- FPC. 1995. Fish Passage Center 1994 annual report. Portland, OR.
- Federal Register for the listing of the following species under the ESA:
Upper Columbia River Steelhead Trout (*Oncorhynchus mykiss*) ESU– Endangered – 1997
Columbia Basin Bull Trout (*Salvelinus confluentus*) DPS – Threatened – 1998
Upper Columbia River Spring Chinook (*O. tshawytscha*) ESU– Endangered – 1999
- Gibbons, R.G., P.K.J. Hahn and T.H. Johnson. 1985. Methodology for determining MSH steelhead spawning escapement requirements. Washington Department of Game (WDG) Report. 39 pp. + app.
- McPhail J.D. and C.C. Lindsey. 1970. Freshwater Fishes of Northwestern Canada and Alaska. Bulletin 173, Fisheries Research Board of Canada, Ottawa, 381 pp.
- Olson, D. E. 1983. Average population statistics for wild trout in Pacific Northwest streams: A literature review and summary. Prepared for Puget Sound Power and Light Company. 19 p.
- Peven, C.M. 1992. Populations status of selected stocks of salmonids from the mid-Columbia River Basin. Chelan County Public Utility District Fish and Wildlife Operations, Wenatchee, WA.

- PGG. 2002. WRIAs 44/50 Interim Phase 2 Draft Technical Assessment. Draft report prepared for the Foster Creek Conservation District, Waterville, Washington by Pacific Groundwater Group, Seattle, Washington. 236 pp. March 2002.
- R2 Resource Consultants. 2002. Draft Instream Flow Study Recommendations for WRIA 44 and 50. Report prepared for the Foster Creek Conservation District, Waterville, Washington by R2 Resource Consultants, Inc. Redmond, Washington. 32 pp. March 26, 2002. Appendix F *in* PGG 2002.
- SERC. 1980. Preliminary review of the predictability of smolt yield for wild stocks of chinook salmon, steelhead trout and coho salmon. Report of the British Columbia Stream Enhancement Research Committee (SERC), (Chairman P. Slaney; Authors: Marshall, D., H. Mundie, P. Slaney, and G. Taylor.) based on a Workshop held in Vancouver B.C. 17 June 1980 and subsequent data compilation. 19 pp + app.
- Washington Department of Ecology (Ecology). 2002. Grant No. G0200263 with the Foster Creek Conservation District.
- Washington Department of Ecology (Ecology). 2000. Instream flows in Washington State past, present, and future. Water Resources Program, Washington Department of Ecology, Olympia, WA.
- Washington Department of Ecology (Ecology). 2002. A guide to instream flow setting in Washington State. Water Resources Program, Washington Department of Ecology, Olympia, WA.
- Washington Department of Fish and Wildlife (WDFW). 1996. State of Washington for establishing instream flows including Fallback HSI curve set (WA).

APPENDIX A

Foster Creek Snorkel Survey; Species and Size Class Tally (June and August 2003)

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	Date: 6/4/03 Surveyor: R. Campbell and Warren Coughlin								
1	Location: Mouth Habitat Type: Bay #1 m ² : 256 Size class: 25-50 (mm) 50-75 >400 Milling Total Count	Chinook	Coho	Steelhead	Rainbow Trout	Largescale Sucker	Carp	Sculpin	Total
		500						1	500
						10	2		12
		500	0	0	0	10	2	1	513
2	Location: Stream Habitat Type: Step pools #2/3 m ² : 429 Size class: 25-50 (mm) 50-75 75 - 100 100 - 125 Total Count	Chinook	Coho	Steelhead	Rainbow Trout		Other		Total
		140							140
		50							50
				6					
				4					
		190	0	10	0	0	0		200
3	Location: Habitat Item #5 Habitat Type: Pocket Pools m ² : 182 Size class: 25-50 (mm) 50-75 150 - 200 Total Count	Chinook	Coho	Steelhead	Rainbow Trout		Other		Total
		24							24
		10		3					13
					1				
		34	0	3	1	0	0		38

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	Date: 6/4/03 Surveyor: R. Campbell and Warren Coughlin						
4	Location: 1st Bridge				Rainbow		
	Habitat Type: Pool #7	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 35						
	Size class: 25-50	6					6
	(mm) 50-75	2		6			8
	300 - 400				1		
	Total Count	8	0	6	1	0	15
5	Location: u/s Bridge # 9				Rainbow		
	Habitat Type: pocket pools	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 35						
	Size class: 25-50						0
	(mm) 50-75	1		4			5
	75-100						0
	100-125						0
	125-150						0
	Total Count	1	0	4	0	0	5
6	Location: 150' < Bridge with redd				Rainbow		
	Habitat Type: Step Pools #10	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 92						
	Size class: 25-50	1					1
	(mm) 50-75	1					1
	75-100						
	Total Count	2	0	0	0	0	2

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	Date: 6/4/03 Surveyor: R. Campbell and Warren Coughlin						
7 - 8	Location: Lateral Pool d/s 100' to 200' of 2nd Bridge				Rainbow		
	Habitat Type: Run / Pool #13-15	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 76						
	Size class: 25-50	2					2
	(mm) 50-75						0
	75-100			4			4
	Total Count	2	0	4	0	0	6
9 - 10	Location: u/s of 2nd Bridge with redds; T1 # 18 - 20				Rainbow		
	Habitat Type: pool/riffle/pool	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 60						
	Size class: 25-50			2			2
	(mm) 50-75						0
	75-100						0
	Total Count	0	0	2	0	0	2
11	Location: u/s in a pool, riffle, run sequence #23				Rainbow		
	Habitat Type: Pocket Pools	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 280						
	Size class: 25-50			1			1
	(mm) 50-75						0
	75-100			2	1		3
	100 - 125				1		
	Total Count	0	0	3	2	0	5

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	Date: 6/4/03 Surveyor: R. Campbell and Warren Coughlin						
12	Location: Long, deep run				Rainbow		
	Habitat Type: Run #24	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 50						
	Size class: 25-50						0
	(mm) 50-75						0
	Total Count	0	0	0	0	0	0
13	Location: 1000' Flag				Rainbow		
	Habitat Type: Shallow run #26	Chinook	Coho	Steelhead	Trout	Sucker	Total
	m ² : 30						
	Size class: 25-50						0
	(mm) 50-75						0
	75-100						0
	100-125						0
	125-150				1		1
	Total Count	0	0	0	1	0	1
14	Location: Catwalk				Rainbow		
	Habitat Type: Pool # 27	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 3						
	Size class: 25-50						0
	(mm) 50-75						0
	Total Count	0	0	0	0	0	0
15	Location: u/s of catwalk structure				Rainbow		
	Habitat Type: Run #28	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 20						
	Size class: 25-50						0
	(mm) 50-75						0

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	<u>Date: 6/4/03</u> <u>Surveyor: R. Campbell and Warren Coughlin</u>							
16 - 17	Total Count	0	0	0	0	0	0	0
	Location: d/s of T4	Rainbow						
	Habitat Type: Run / riffle #29	Chinook	Coho	Steelhead	Trout	Sucker	Other	Total
	m ² : 27							
	Size class: 25-50			2				2
18	(mm) 50-75							0
	Total Count	0	0	2	0	0	0	2
	Location: T4 and upstream	Rainbow						
	Habitat Type: Run #30	Chinook	Coho	Steelhead	Trout	Sucker		Total
	m ² : 90							
19	Size class: 25-50			10				10
	(mm) 50-75							0
	Total Count	0	0	10	0	0	0	10
	Location: u/s at ~1400' flag	Rainbow						
	Habitat Type: Run #31	Chinook	Coho	Steelhead	Trout		Other	Total
20	m ² : 15							
	Size class: 25-50			1				1
	(mm) 50-75							0
	Total Count	0	0	1	0	0	0	1
	Location: u/s of T7	Rainbow						
	Habitat Type: Run #33	Chinook	Coho	Steelhead	Trout		Other	Total
	m ² : 80							
	Size class: 100 - 125				1			1
	(mm)							0
	Total Count	0	0	0	1	0	0	1

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	Date: 6/4/03 Surveyor: R. Campbell and Warren Coughlin						
21	Location: Beaver Pond #37; Sand filled				Rainbow		
	Habitat Type: shallow pool	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 100						
	Size class: 25-50						0
	(mm) 50-75						0
	Total Count	0	0	0	0	0	0
22	Location: u/s of 2400' redd				Rainbow		
	Habitat Type: Run #39	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 60						
	Size class: 100 - 125				1		1
	(mm)						0
	Total Count	0	0	0	1	0	1
23 - 28	Location: 2500 to redds at 3500' #40 - 48				Rainbow		
	Habitat Type: Riffle/pool/riffle	Chinook	Coho	Steelhead	Trout	Other	Total
	m ² : 450						
	Size class: 25-50						0
	(mm) 50-75						0
	Total Count	0	0	0	0	0	0

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey Number</u>	<u>Date: 6/4/03</u> <u>Surveyor: R. Campbell and Warren Coughlin</u>								
29	Location: Plunge Pool at 3900'				Rainbow	LS			
	Habitat Type: Pool #52	Chinook	Coho	Steelhead	Trout	Sucker	Carp	Sculpin	Total
	m ² : 30								
	Size class: 100 - 125			3					3
	(mm) 200 - 250				1	1			2
	250 - 300				1	1			2
	300 - 400					1			1
	>400					1			1
	Total Count	0	0	3	2	4	0		9
	Total Count	737	0	48	9	14	2	1	811
	Count - Embayment	237	0	48	9	4	0	0	298
	Step Pool Reach	237	0	27	2	0	0	0	266
	Pool-Riffle Reach	0	0	21	7	4	0	0	32
	Observation								
	Numbers								
	divided by								
	2400 all habitat	0.313		0.020	0.004	0.006	0.001	0.000	0.345
	area <	0.113							0.142
	RM 0.21 =			0.020	0.004	0.002			0.124
	2352 m2								
	1295								
	1105 But only								
	observed								
	1105 m2 of								
	habitat < RM 0.21								
	2.1	0.667	0.000	0.043	0.008	0.013	0.002		0.734
	28% 47%	0.241	0.000	0.071	0.013	0.006			0.303
	total survey Total Salmonid density								0.719

Table A-1. Foster Creek Snorkel Survey; Species and Size Class Tally; June 4, 2003.

<u>Survey</u> <u>Number</u>		Date: 6/4/03 Surveyor: R. Campbell and Warren Coughlin							
Densities per Reach		Chinook	Coho	Steelhead	Trout	Sucker	Carp	Sculpin	Total
Total Count		0.313		0.020	0.004	0.006	0.001	0.000	0.338
Count - Embayment				0.022	0.004	0.002			0.139
Step Pool Reach		0.113		0.024	0.002	0.000			0.241
Pool-Riffle Reach		0.000		0.016	0.005	0.003			0.025
Chinook:		Underseeded: the number of fish observed could be supported from the successful development of 1 to 4 redds.							
Trout		Underseeded; trout densities for 1+ and 2+ age classes are half report literature values for resident trout, but prior to full emergence							
Freshwater Stream Count		Chinook		Steelhead	RBT	Combined Rainbow	Total Salmonid		
Size class: 25-50 mm		173		16		16	189		
(mm) 50-75 mm		64		13		13	77		
75-100 mm				12	1	13	13		
100-125 mm				7	3	10	10		
125-150 mm					1	1	1		
150-200 mm					1	1	1		
200-250 mm					1	1	1		
250-300 mm					1	1	1		
300-400 mm					1	1	1		
>400									
		237		48	9	57	294		
Density									
0+ age		0.1131		0.0121		0.0121	0.1252		
1+ age				0.0079	0.0017	0.0096	0.0096		
2+ age					0.0008	0.0008	0.0008		
> 2+ age					0.0004	0.0004	0.0004		

Table A-2. Foster Creek Snorkel Survey; Species and Size Class Tally August 27, 2003.

		Date: 8/27/03											
<u>Survey</u>		Surveyor: A. Weybright											
<u>Number</u>		Visibility: 1-2 ft; high levels of suspended sediment in stream											
1	Location: Mouth												
	Habitat Type: Bay #1												
	Visibility 2 ft	Chinook	Coho	Steelhead	Rainbow Trout	Largescale Sucker	Carp	Sculpin	Total	Total Fish f/m ²	Chinook f/m2	Steelhead f/m2	Rainbow Trout f/m2
	m ² : 256												
	Size class: 25-50 (mm)								0	NA			
	50-75								0	NA			
Total Count		0	0	0	0	0	0	0	0	-	-	-	-
2	Location: stream d/s 1st bridge												
	Habitat Type: pool												
	Visibility 2 ft	Chinook	Coho	Steelhead	Rainbow Trout	Other			Total				
	m ² : 7												
	Size class: 25-50 (mm)								0				
	50-75								0				
75 - 100		1											
Total Count		1	0	0	0	0	0		1	0.14	0.14	-	-
3	Location: trib at 1st bridge												
	Habitat Type: Pocket Pools												
	Visibility 1 ft	Chinook	Coho	Steelhead	Rainbow Trout	Unknown			Total	Comments			
	m ² : 14												
	Size class: 25-50 (mm)								0				
	50-75			8		8			8	Species unknown (rnbw?) due to low vis assumed to be steelhead			
Total Count		0	0	8	0	0	0		8	0.57	-	-	0.57

Table A-2. Foster Creek Snorkel Survey; Species and Size Class Tally August 27, 2003.

	Date: 8/27/03												
<u>Survey</u>	Surveyor: A. Weybright												
<u>Number</u>	Visibility: 1-2 ft; high levels of suspended sediment in stream												
4	Location: 1st br - 2nd br												
	Habitat Type: pool/glide												
	Visibility	2 ft.	Chinook	Coho	Steelhead	Trout		Other		Total			
		m ² : 10											
	Size class: 25-50									0			
	(mm) 125-150									1			
	Total Count	0	0	1	0	0	0	0	1	0.10	-	0.10	-
5	Location: u/s T1												
	Habitat Type: pool												
	visibility	1+ ft	Chinook	Coho	Steelhead	Trout		Other		Total	Comments		
		m ² : 14											
	Size class: 25-50									0	6 to 8 total fish, sp unknown due to low vis		
	(mm) 50-75									0	Assumed to be steelhead		
	Total Count	0	0	7	0	0	0	0	7	0.50	-	0.50	-
6	Location:												
	Habitat Type: pool												
	visibility		Chinook	Coho	Steelhead	Trout		Other		Total			
		m ² : 14											
	Size class: 25-50									0			
	(mm) 75-100									3			
	100-125									9			
	125-150									5			
	150-200									1			
		Total Count	0	0	18	0	0	0	0	18	1.29	-	1.29

Table A-2. Foster Creek Snorkel Survey; Species and Size Class Tally August 27, 2003.

<u>Survey Number</u>	Date: 8/27/03											
	Surveyor: A. Weybright											
	Visibility: 1-2 ft; high levels of suspended sediment in stream											
7	Location: pool above beaver dam above T6											
	Habitat Type: pool	Chinook	Coho	Steelhead	Trout		Other		Total			
	m ² : 14											
	Size class: 25-50								0			
	(mm) 75-100				8				8			
	100-125				18				18			
	125-150				5				5			
	Total Count	0	0	31	0	0	0		31	2.21	-	2.21
8	Location: T5											
	Habitat Type: pool/riffle/pool	Chinook	Coho	Steelhead	Trout		Other		Total			
	m ² : 31											
	Size class: 25-50				18				18			
	(mm) 50-75				16				16			
	75-100				6				6			
	Total Count	0	0	40	0	0	0		40	1.29	-	1.29
9	Location: pool above 2nd beaver dam											
	Habitat Type: Pocket Pools	Chinook	Coho	Steelhead	Trout		Other		Total			
	visibility 3-4 ft											
	m ² : 33											
	Size class: 25-50								0			
	(mm) 50-75								0			
	75-100				18				18			
	Total Count	0	0	18	0	0	0		18	0.55	-	0.55

Table A-2. Foster Creek Snorkel Survey; Species and Size Class Tally August 27, 2003.

Survey Number	Date: 8/27/03											
	Surveyor: A. Weybright											
Visibility: 1-2 ft; high levels of suspended sediment in stream												
10	Location: glide											
	Habitat Type: glide											
	visibility	3-4 ft	Chinook	Coho	Steelhead	Rainbow Trout	Other			Total		
	m ² : 12											
	Size class: 50-75				4					4		
	(mm) 75-100				8					8		
	Total Count											
11	Location: T8											
	Habitat Type: pool (big bldr)											
	m ² : 18											
	Size class: 25-50											
	(mm) 50-75				3					0		
	75-100				5					3		
	100-125				2					5		
	125-150				2					2		
	Total Count											
	Total Count											
Count - Embayment												
Step Pool Reach												
Pool-Riffle Reach												

Table A-2. Foster Creek Snorkel Survey; Species and Size Class Tally August 27, 2003.

		Date: 8/27/03								
<u>Survey</u>		Surveyor: A. Weybright								
<u>Number</u>		Visibility: 1-2 ft; high levels of suspended sediment in stream								
		Observation								
		Numbers								
		divided by								
		423 all habitat								
Step Pool	Reach 2	area < RM 0.21 = 2352 m2	0.003	0.000	0.108	0.000	0.000	0.000	0.000	0.111
		108								
		315 Observed								
		315 m2 of habitat < RM 0.21		7.5	13%					
		< RM 1.0	423/7774	18	5%					
Densities per Reach		Chinook	Coho	Steelhead	Trout	Sucker	Carp	Sculpin	Total	
Total Count		0.002	0.000	0.348	0.000	0.000	0.000	0.000	0.350	Total Salmonid density
Step Pool		0.003	0.000	0.108	0.000	0.000	0.000	0.000	0.111	
Reach										
Pool-Riffle		0.000	0.000	1.046	0.000	0.000	0.000	0.000	1.046	
Reach										

Table A-2. Foster Creek Snorkel Survey; Species and Size Class Tally August 27, 2003.

Date: 8/27/03					
<u>Survey</u>	Surveyor: A. Weybright				
<u>Number</u>	Visibility: 1-2 ft; high levels of suspended sediment in stream				

Aug-03					Combined	Total
Freshwater Stream Count	Chinook	Steelhead	RBT	Rainbow	Salmonid	
Size class: 25-50 mm	0	18		18		18
(mm) 50-75 mm	1	31		31		32
75-100 mm		48		48		48
100-125 mm		29		29		29
125-150 mm		13		13		13
150-200 mm			1	1		1
200-250 mm						0
250-300 mm						0
300-400 mm						0
>400						0
Unknown		7		7		7
	1	146	1	147		148
Density						
0+ age	0.0024	0.2293				
1+ age		0.0993				
2+ age				0.0189		
> 2+ age						
				0.3475	0.3475	18

Chinook: Underseeded: the number of fish observed could be supported from the successful development of 1 redd.
Trout Underseeded; trout densities for 0+, 1+ and 2+ age classes are half report literature values for resident trout, but poor viewing conditions precluded quantitative assessment

APPENDIX B

Rock Island Creek Snorkel Survey; Species and Size Class Tally (June and August 2003)

Table B-1. Rock Island Snorkel Survey; Species and Size Class Tally, June 3, 2003.

Date: 6/3/03
Surveyor: R. Campbell

		Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total	Total Fish f/m2	Chinook f/m2	Coho f/m2	Rainbow Trout f/m2
1	Location: Mouth Habitat Type: Wetland Milling											
	Size class: 25-50 (mm)	1,000	75			1,000		2,075	NA			
	Size class: 50-75 (mm)	100	25					125	NA			
	Total Count	1,100	100	0	0	1,000	0	2,200				
2	Location: Jump in Pt. RM 0.01 Habitat Type: Riffle m2: 1											
	Size class: 25-50 (mm)	5						5				
	Size class: 50-75 (mm)	1						1				
	Total Count	6	0	0	0	0	0	6	6.00	6.00	-	-
3	Location: Daylight Pt. RM 0.03 Habitat Type: Riffle m2: 5											
	Size class: 25-50 (mm)	50						50				
	Size class: 50-75 (mm)	10	1					11				
	Total Count	60	1	0	0	0	0	61	12.20	12.00	0.20	-
4	Location: Upstream Habitat Type: Riffle m2: 4											
	Size class: 25-50 (mm)	10						10				
	Size class: 50-75 (mm)	2						2				
	Total Count	12	0	0	0	0	0	12	3.00	3.00	-	-

Table B-1. Rock Island Snorkel Survey; Species and Size Class Tally, June 3, 2003.

Date: 6/3/03
Surveyor: R. Campbell

5	Location: Below RR Bridge 0.07		Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	Habitat Type: Pool	m2: 12											
	Size class: 25-50 (mm)		100						100				
	50-75		20						20				
	75-100					1			1				
	100-125					2			2				
	125-150					1			1				
	Total Count		120	0	0	4	0	0	124	10.33	10.00	-	0.33
6	Location: Under RR Bridge 0.08		Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	Habitat Type: Riffle												
	Pocket water~1 ft. deep												
	Size class: 25-50 (mm)		50						50				
	50-75		15						15				
	Total Count		65	0	0	0	0	0	65				
7	Location: Above RR Bridge 0.085		Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	Habitat Type: Pool												
	m2: 24												
	Size class: 25-50 (mm)		200						200				
	50-75		50						50				
	75-100					1			1				
	Total Count		250	0	0	1	0	0	251	10.46	10.42	-	0.04
8	Location: Below Hwy Bridge 0.0875		Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	Habitat Type: Riffle/Pool												
	m2: 100												
	Size class: 25-50 (mm)		10						10				
	50-75		2			1			3				
	75-100					1			1				
	Total Count		12	0	0	2	0	0	14	0.14	0.12	-	0.02

Table B-1. Rock Island Snorkel Survey; Species and Size Class Tally, June 3, 2003.

Date: 6/3/03												
Surveyor: R. Campbell												
9	Location: Near Hwy Bridge 0.09											
	Habitat Type: Pocket Pools	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	m2:	1										
	Size class: 25-50							0				
	(mm) 50-75				1			1				
	75-100				1			1				
	Total Count	0	0	0	2	0	0	2	2.00	-	-	2.00
10	Location: Above Hwy Bridge											
	Habitat Type: Pool-Riffle	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	Heavily Silted	82										
	Size class: 25-50	100	1					101				
	(mm) 50-75	20	2					22				
	Total Count	120	3	0	0	0	0	123	1.50	1.46	0.04	-
11	Location: Beaver Dam											
	Habitat Type: Pool	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Sucker	Total				
	m2:	36										
	Size class: 25-50	50						50				
	(mm) 50-75	10						10				
	75-100				2			2				
	100-125				3			3				
	125-150				2			2				
	150-200				1			1				
	>400						7	7				
	Total Count	60	0	0	8	0	7	75	2.08	1.67	-	0.22

Table B-1. Rock Island Snorkel Survey; Species and Size Class Tally, June 3, 2003.

Date: 6/3/03													
Surveyor: R. Campbell													
12	Location: Instream Flow Study Reach T-1/T-3												
	Habitat Type:	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total					
	m2:	36											
	Size class: 25-50	70						70					
	(mm) 50-75	10						10					
	75-100							0					
	100-125				2			2					
	125-150		1		3			4					
	150-200				1			1					
	Total Count	80	1	0	6	0	0	87	2.42	2.22	0.03	0.17	
13	Location: Pumphouse T-4												
	Habitat Type: Pool	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total					
	m2:	33											
	Size class: 25-50	10	1					11					
	(mm) 50-75	2	1					3					
	75-100							0					
	100-125				3			3					
	125-150							0					
	150-200				1			1					
	Total Count	12	2	0	4	0	0	18	0.55	0.36	0.06	0.12	
14	Location: Upstream in Big Boulders												
	Habitat Type: Pocket Pools	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Sucker	Total					
	m2:	34											
	Size class: 25-50	2						2					
	(mm) 50-75	1						1					
	75-100							0					
	100-125				2			2					
	125-150							0					
	300-400				1			1					
	Total Count	3	0	0	3	0	0	6	0.18	0.09	-	0.09	

Table B-1. Rock Island Snorkel Survey; Species and Size Class Tally, June 3, 2003.

Date: 6/3/03												
Surveyor: R. Campbell												
15	Location: Upstream				Rainbow	3-spined						
	Habitat Type: Pockets	Chinook	Coho	Steelhead	Trout	Stickleback	Sucker	Total				
	m2:	34										
	Size class: 25-50	2						2				
	(mm) 50-75							0				
	75-100							0				
	100-125				2			2				
	125-150				2			2				
	250-300				1							
	300-400						1	1				
	Total Count	2	0	0	5	0	1	8	0.24	0.06	-	0.15
16	Location: Upstream				Rainbow	3-spined						
	Habitat Type: Sm. Pool	Chinook	Coho	Steelhead	Trout	Stickleback	Other	Total				
	m2:	10										
	Size class: 25-50	1						1				
	(mm) 50-75							0				
	75-100				1			1				
	100-125				2			2				
	125-150				2			2				
	Total Count	1	0	0	5	0	0	6	0.60	0.10	-	0.50
17	Location: Upstream				Rainbow	3-spined						
	Habitat Type: Sm Pool	Chinook	Coho	Steelhead	Trout	Stickleback	Other	Total				
	m2:	20										
	Size class: 25-50							0				
	(mm) 50-75							0				
	75-100							0				
	100-125				2			2				
	125-150				2			2				
	150-200				1			1				
	200-250							0				
	250-300							0				
	300-400							0				
	>400							0				
	Total Count	0	0	0	5	0	0	5	0.25	-	-	0.25

Table B-1. Rock Island Snorkel Survey; Species and Size Class Tally, June 3, 2003.

Date: 6/3/03
Surveyor: R. Campbell

		1,903	107	0	45	1,000	8	3,063	51.9 3.463	47.5 3.167	0.3 0.022	3.9 0.259
432	Observation Numbers divided by all habitat area < RM 0.31 = 1285 m2	0.625 1.859	0.005 0.016	0.000 0.000	0.035 0.104	0.000 0.000	0.006 0.019	0.672 1.998				
	Observed 432 m2 of habitat	3.0	34% of total area < RM 0.31									
		1.859	0.016	0.000	0.104	0.000	0.019	1.998				
	Total Salmonid density							1.979				
	Chinook:	Fully seeded; the number of fish observed could be supported from the successful development of 3 redds.										
	Coho	Underseeded; coho densities are two orders of magnitude lower than literature values										
	Trout	Underseeded; trout densities for 1+ and 2+ age classes are half report literature values for resident trout.										

Table B-2. Rock Island Snorkel Survey; Species and Size Class Tally, August 26, 2003

Date: 8/26/03
 Surveyor: A. Weybright
 Visibility: 8-10 ft

Water Temperature:												
1	Location: Mouth Habitat Type: Wetland Milling Size class: 25-50	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total	Total Fish f/m2	Chinook f/m2	Coho f/m2	Rainbow Trout f/m2
						200		200	NA			
	Total Count	0	0	0	0	200	0	200				
2	Location: d/s of RR br Habitat Type: pool m2: 1 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
								0				
								0				
		4			2			6				
		2						2				
					1			1				
	Total Count	6	0	0	3	0	0	9	9.00	#DIV/0!	#DIV/0!	#DIV/0!
3	Location: d/s RR (duckweed) Habitat Type: pool m2: 11 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
								0				
								0				
		5			3			8				
		5			2			7				
					4			4				
	Total Count	10	0	0	9	0	0	19	1.73	#DIV/0!	#DIV/0!	#DIV/0!
4	Location: under RR Habitat Type: run m2: 3	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				

Table B-2. Rock Island Snorkel Survey; Species and Size Class Tally, August 26, 2003

Date: 8/26/03
 Surveyor: A. Weybright
 Visibility: 8-10 ft

Size class: 25-50								0				
(mm) 50-75								0				
Total Count		0	0	0	0	0	0	0	-	#DIV/0!	#DIV/0!	#DIV/0!
5	Location: u/s of RR br											
	Habitat Type: Pool	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	m2: 31											
	Size class: 25-50							0				
	(mm) 50-75							0				
	75-100	12	1		10			23				
	100-125	10			6			16				
	125-150				2			2				
	150-200				2			2				
	200-250				1			1				
	Total Count	22	1	0	21	0	0	44	1.42	#DIV/0!	#DIV/0!	#DIV/0!
6	Location: beavr pond u/s of road bridge											
	Habitat Type: pool	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	m2: 22											
	Size class: 25-50							0				
	(mm) 50-75							0				
	75-100	7			5			12				
	100-125	6			2			8				
	125-150				3			3				
	Total Count	13	0	0	10	0	0	23	1.05	#DIV/0!	#DIV/0!	#DIV/0!
7	Location: pool at T8											
	Habitat Type: Pool	Chinook	Coho	Steelhead	Rainbow Trout	3-spined Stickleback	Other	Total				
	m2: 4											
	Size class: 25-50							0				
	(mm) 50-75							0				

Table B-2. Rock Island Snorkel Survey; Species and Size Class Tally, August 26, 2003

Date: 8/26/03
 Surveyor: A. Weybright
 Visibility: 8-10 ft

	75-100	1			1			2				
	125-150				1							
	Total Count	1	0	0	2	0	0	3	0.75	#DIV/0!	#DIV/0!	#DIV/0!
	72	52	1	0	45	200	0	298	14	#DIV/0!	#DIV/0!	#DIV/0!
Total Salmonid density		0.722	1.000	0.000	45.000			1.361				
	RM 0.31 = 1285 m2											
	Observed 72 m2 of habitat	17.8	6%	of available habitat due to low flows								
	Chinook:	Fully seeded; the number of fish observed could be supported from the successful development of 3 redds.										
	Coho	Underseeded; coho densities are an order of magnitude lower than literature values										
	Trout	Underseeded; trout densities for 1+ and 2+ age classes are half report literature values for resident trout.										

APPENDIX C

Douglas Creek Snorkel Survey; Species and Size Class Tally (June and August 2003)

Table C-1. Douglas Creek Snorkel Survey; Species and Size Class Tally, June 5, 2003.

Survey Number	Date: 6/5/03 Surveyor: R. Campbell and Warren Coughlin		8:45 am		16C			
1	Location: T1 & upstream Habitat Type: Riffle - Run m ² : 36 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 300-400 Total Count	Rainbow Trout 20 5 2 0 0 4 4 2 37	0	0	0	37	Total Fish f/m ² 1.0278	Rainbow Trout f/m ² 1.0278
2	Location: Habitat Type: Riffle m ² : 12 Size class: (mm) 150-200 Total Count	Rainbow Trout 1 1	0	0	0	1	0.0833	0.0833
3	Location: Habitat Type: Pool m ² : 80 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 300-400 Total Count	Rainbow Trout 50 10 5 5 4 4 2 80	0	0	0	80	1.0000	1.0000
4	Location: Habitat Type: Pocket Pools m ² : 4 Size class: 25-50 (mm) 50-75 Total Count	Rainbow Trout 1 1	0	0	0	1	0.2500	0.2500

Table C-1. Douglas Creek Snorkel Survey; Species and Size Class Tally, June 5, 2003.

<u>Survey Number</u>	Date: 6/5/03 Surveyor: R. Campbell and Warren Coughlin	8:45 am	16C					
5	Location: w/ boulders Habitat Type: pocket pools m ² : 4 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 Total Count	Rainbow Trout		Other	Total			
					0			
		1			1			
		1			1			
					0			
					0			
		2			2			
		2			2			
		6	0	0	6	1.5000	1.5000	
6	Location: T2 Habitat Type: Run - Pool m ² : 100 Size class: 25-50 (mm) 50-75 75 - 100 125-150 150-200 200-250 Total Count	Rainbow Trout		Other	Total			
		20			20			
		2			2			
					0			
		2			2			
		1			1			
		1			1			
		26	0	0	26	0.2600	0.2600	
7	Location: Lateral Scour Habitat Type: Pool m ² : 60 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 Total Count	Rainbow Trout		Other	Total			
		30			30			
		10			10			
		4			4			
		2			2			
		4			4			
		4			4			
		4			4			
		58	0	0	58	0.9667	0.9667	
8	Location: T3 Habitat Type: pool/run tailout m ² : 60 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 Total Count	Rainbow Trout		Other	Total			
		25			25			
		6			6			
		2			2			
		2			2			
		2			2			
		10			10			
		6			6			
		2			2			
		55	0	0	55	0.9167	0.9167	

Table C-1. Douglas Creek Snorkel Survey; Species and Size Class Tally, June 5, 2003.

<u>Survey Number</u>	Date: 6/5/03 Surveyor: R. Campbell and Warren Coughlin	8:45 am	16C					
9	Location: Wide shallow Habitat Type: Bldr Pool m ² : 175 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 Total Count	Rainbow Trout		Other		Total		
		15				15		
		5				5		
		2				2		
		7				7		
		3				3		
		5				5		
		5				5		
		2				2		
		44	0	0	0	44	0.2514	0.2514
10	Location: Wide, shallow Habitat Type: Pool m ² : 110 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 Total Count	Rainbow Trout	w/silty bottom	Other		Total		
		10				10		
						0		
		15				15		
		12				12		
		5				5		
		3				3		
		2				2		
		47	0	0	0	47	0.4273	0.4273
11	Location: Habitat Type: Run m ² : 23 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 Total Count	Rainbow Trout		Other		Total		
		20				20		
						0		
						0		
		10				10		
		10				10		
		10				10		
						0		
		1				1		
		51	0	0	0	51	2.2174	2.2174
	Total Count	406	0	0	0	406	0.6114	0.6114
Area snorkeled =		664	m ²	7145	ft ²			

Table C-2. Douglas Creek Snorkel Survey; Species and Size Class Tally, August 26, 2003.

<u>Survey Number</u>	Date: 8/26/03 Surveyor: A Weybright	2:00 pm	18.5 C					
							Total Fish f/m ²	Rainbow Trout f/m ²
1	Location: d/s of gage (d/s of TRs) Habitat Type: pool m ² : 39 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 300-400 Total Count	Rainbow Trout		Other		Total		
						0		
						0		
		2				2		
		6				6		
		3				3		
						0		
		1				1		
						0		
		12	0	0	0	12	0.3077	0.3077
2	Location: at gage (d/s of TRs) Habitat Type: pool m ² : 62 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 300-400 Total Count	Rainbow Trout		Other		Total		
						0		
						0		
		8				8		
		12				12		
		5				5		
		3				3		
		3				3		
		4				4		
		35	0	0	0	35	0.5645	0.5645
3	Location: run above gage (d/s of TRs) Habitat Type: run m ² : 28 Size class: 25-50 (mm) 50-75 75-100 100-125 Total Count	Rainbow Trout		Other		Total		
						0		
						0		
		1						
		1						
		2	0	0	0	2	0.0714	0.0714
4	Habitat Type: Pool m ² : 39 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 Total Count	Location: Rainbow Trout		Other		Total		
						0		
						0		
		5						
		10						
		1						
		16	0	0	0	16	0.4103	0.4103

Table C-2. Douglas Creek Snorkel Survey; Species and Size Class Tally, August 26, 2003.

<u>Survey Number</u>	Date: 8/26/03 Surveyor: A Weybright	2:00 pm	18.5 C					
5	Location: Rainbow							
	Habitat Type: run/glide	Trout		Other		Total		
	m ² : 53							
	Size class: 25-50					0		
	(mm) 50-75					0		
	75-100	8				8		
	100-125	6				6		
	125-150					0		
	150-200	1				1		
	200-250					0		
	Total Count	15	0	0	0	15	0.2830	0.2830
6	Location: T2	Rainbow						
	Habitat Type: Run - Pool	Trout		Other		Total		
	m ² : 80							
	Size class: 25-50					0		
	(mm) 50-75					0		
	75 - 100	6				6		
	100-125	4				4		
	125-150	2				2		
	150-200					0		
	Total Count	12	0	0	0	12	0.1500	0.1500
7	Location: T3	Rainbow						
	Habitat Type: Pool	Trout		Other		Total		
	m ² : 62							
	Size class: 25-50					0		
	(mm) 50-75					0		
	75-100	5				5		
	100-125	5				5		
	125-150	6				6		
	150-200	2				2		
	200-250	3				3		
	>300	1				1		
	Total Count	22	0	0	0	22	0.3548	0.3548
8	Location: pool u/s T3	Rainbow						
	Habitat Type: pool	Trout		Other		Total		
	m ² : 60							
	Size class: 25-50					0		
	(mm) 50-75					0		
	75-100	2				2		
	100-125	3				3		
	125-150	5				5		
	150-200	2				2		
	200-250	1				1		
	250-300					0		
	Total Count	13	0	0	0	13	0.2167	0.2167

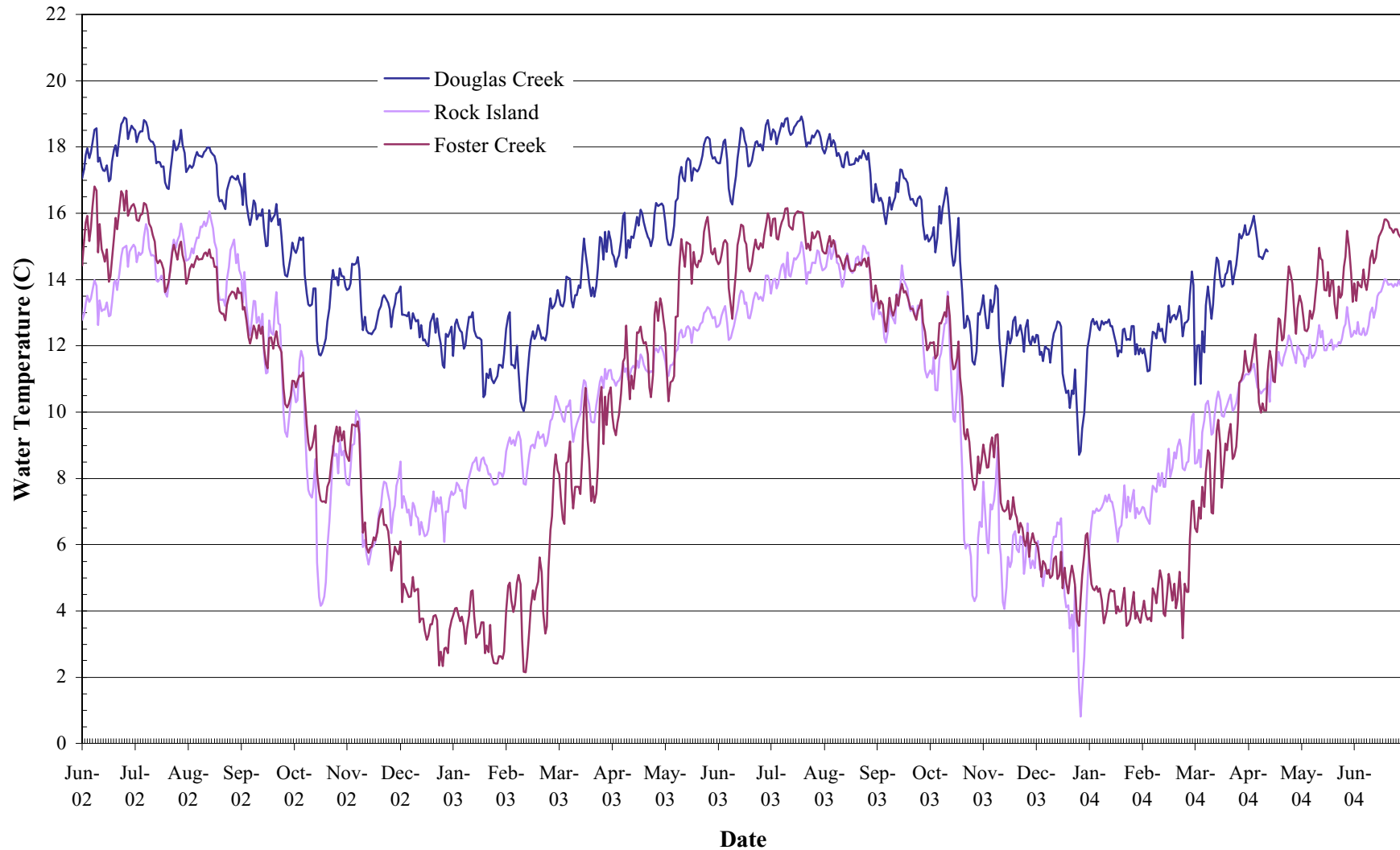
Table C-2. Douglas Creek Snorkel Survey; Species and Size Class Tally, August 26, 2003.

<u>Survey Number</u>	Date: 8/26/03 Surveyor: A Weybright	2:00 pm	18.5 C					
9	Location: pool+glide Habitat Type: pool+glide m ² : 71 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 250-300 Total Count	Rainbow Trout		Other		Total		
						0		
		4				4		
		10				10		
		10				10		
		3				3		
						0		
						0		
						0		
		27	0	0	0	27	0.3803	0.3803
10	Location: Habitat Type: Pool m ² : 44 Size class: 25-50 (mm) 50-75 75-100 100-125 125-150 150-200 200-250 Total Count	Rainbow w/silty bottom Trout		Other		Total		
						0		
		3				3		
		7				7		
		3				3		
						0		
						0		
						0		
		13	0	0	0	13	0.2955	0.2955
	Total Count	167	0	0	0	167	0.3104	0.3104
Area snorkeled = 538		m ²						

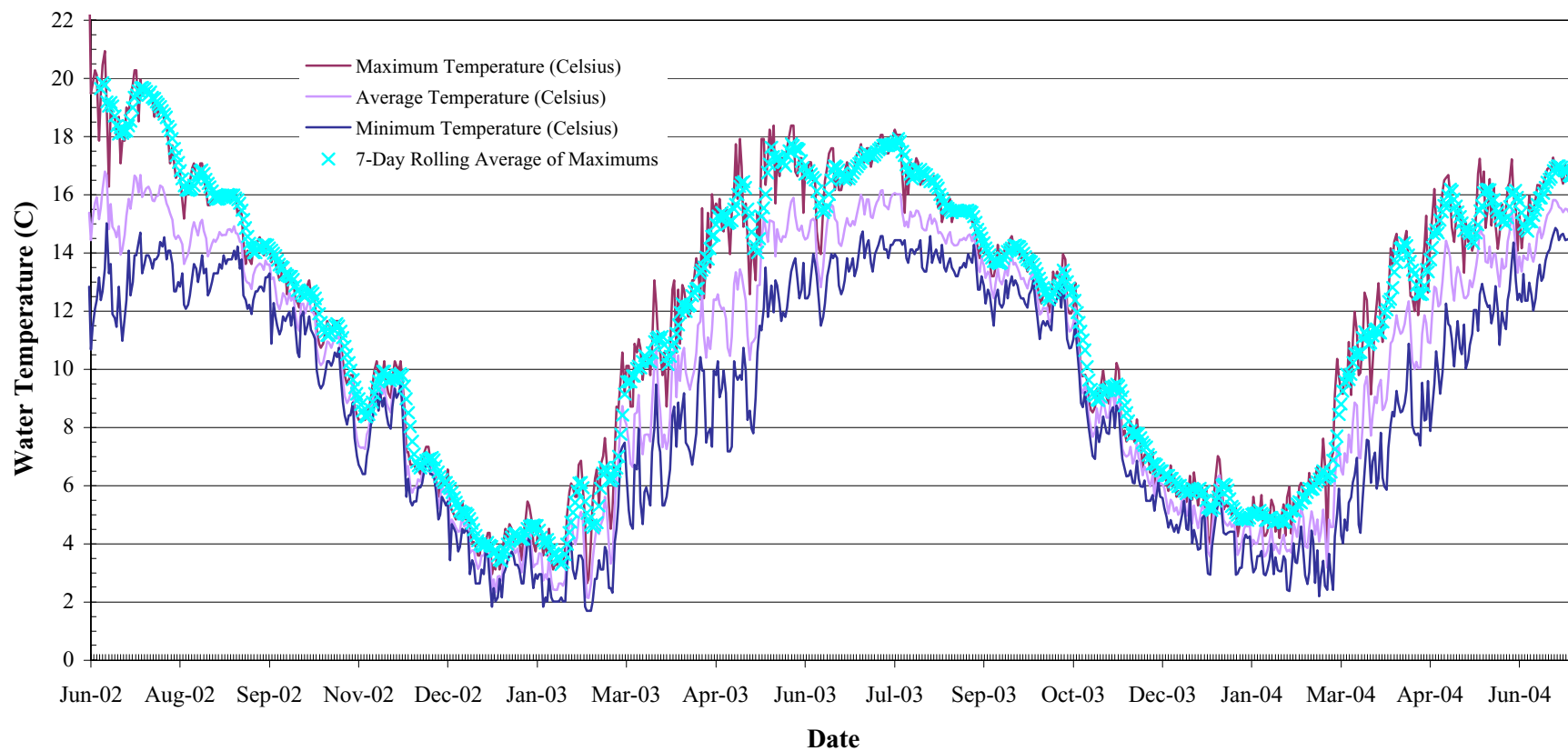
APPENDIX D

Water Temperature Profiles for Foster, Rock Island and Douglas Creeks

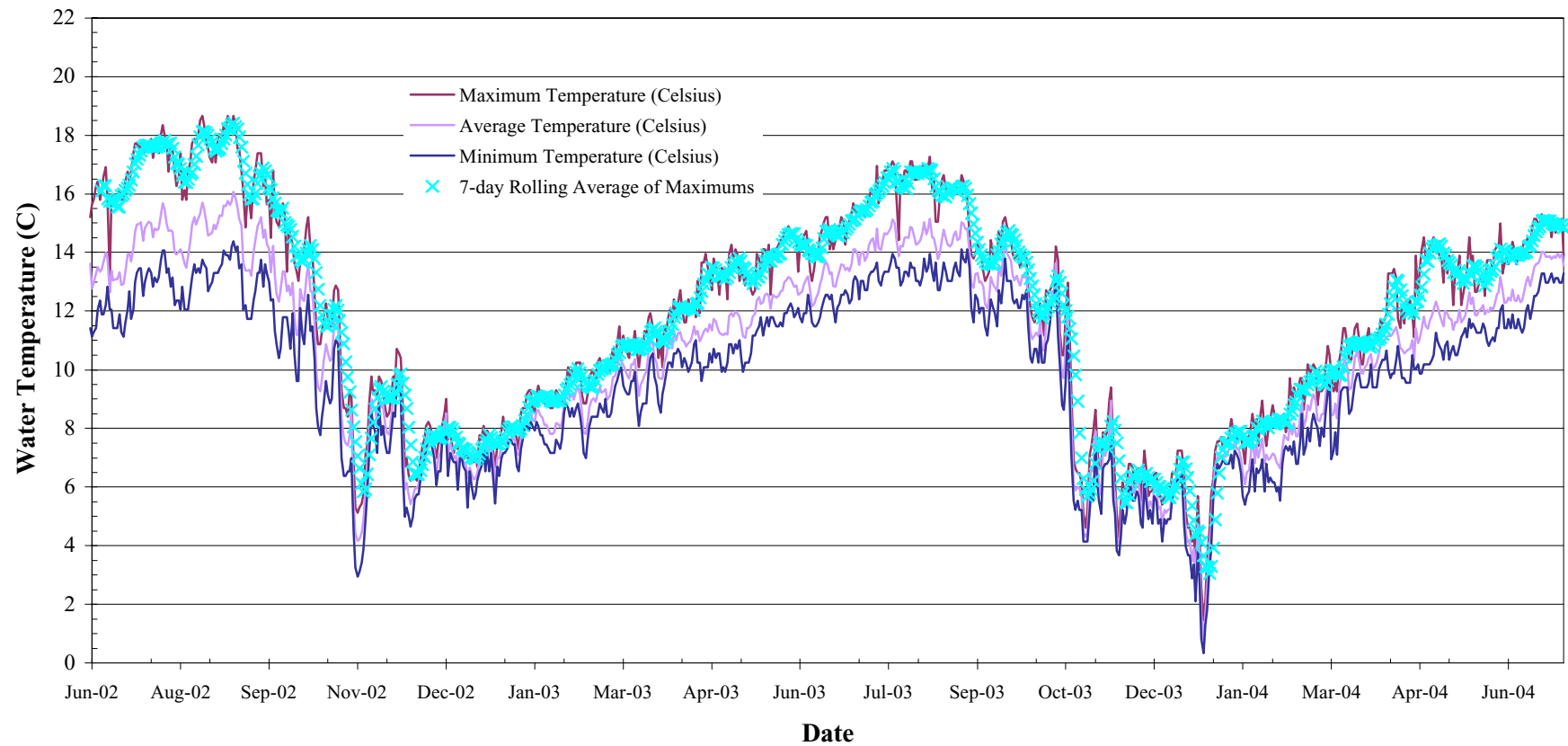
Mean Daily Temperature for Douglas, Foster and Rock Island Creeks



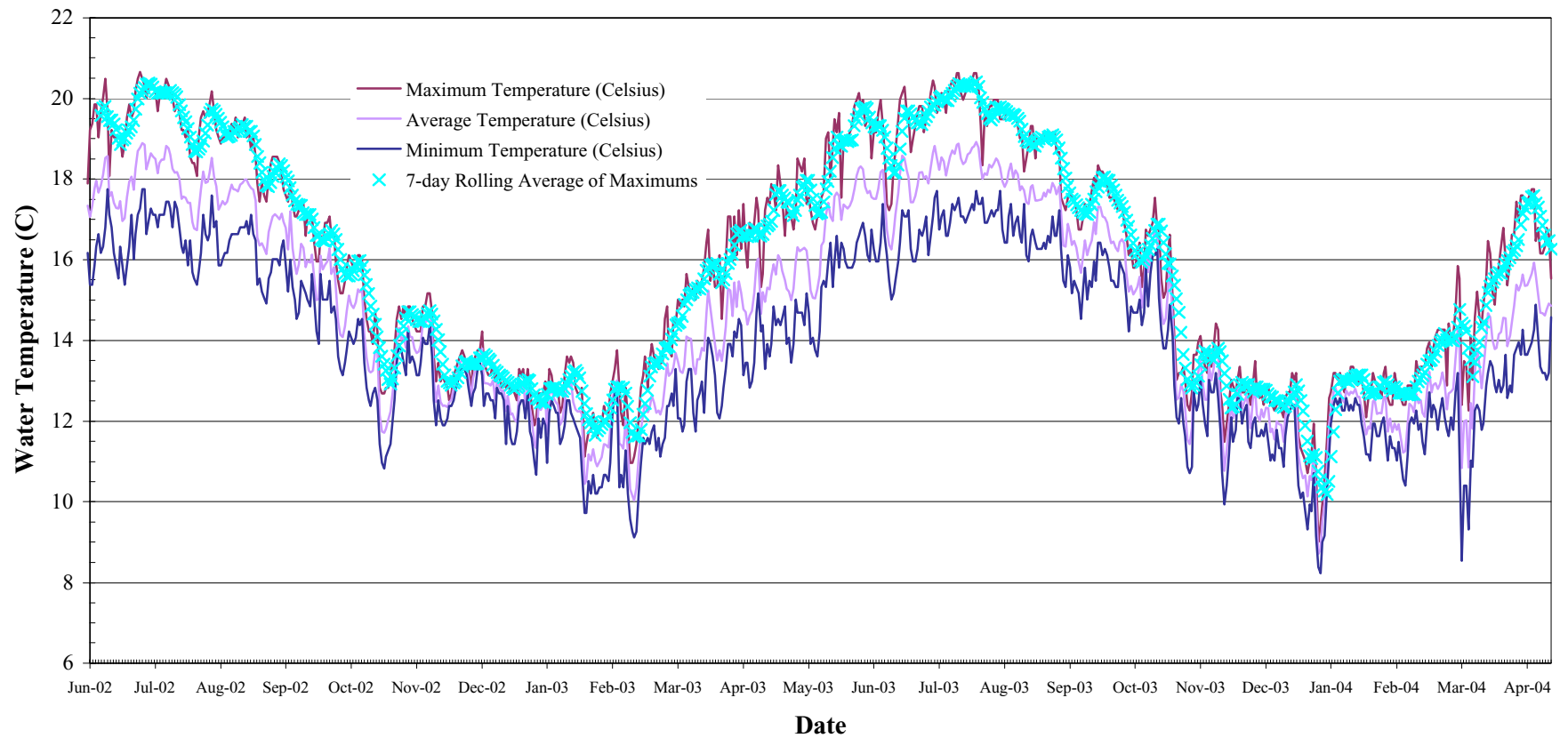
Mean Daily Temperature in Foster Creek



Mean Daily Temperature in Rock Island Creek



Mean Daily Temperature in Douglas Creek



APPENDIX E

State Caucus Comments on October 2003 Draft Snorkel Report and Authors' Response

Authors' Response to State Comments

October 29, 2003

Note to: Mark Cookson (WDFW) and John Storman (Ecology)

From: Ron Campbell (R2 Resource Consultants)

cc: Bob Vadas, Tim Behne, Kathleen Bartu, Mike Gagner, Chuck Jones

Subject: Bob's comments on R2's October 2003 draft snorkel report on WRIA 44 & 50 Priority Streams.

Generic comment: Unfortunately, Bob was reading the snorkel assessment without the benefit of the balance of the watershed planning documentation. The snorkel report is one small piece of the picture and we did not prepare it as a stand-alone report. Thus, information submitted in earlier reports was not repeated therein. I fear Bob missed much of the important context as a result.

Specific comments:

- 1) *[Given the spawning timing of Chinook and coho] the streams may not have been adequately sampled.* Reference to Chinook spawning and coho spawning until late November and into January, respectively, is accurate and the appropriate timing was stated as such in the snorkel report. Based on my experience in performing spawning surveys in the mid-Columbia region fall Chinook spawning is usually complete by Thanksgiving. We also noted in the report that spawning surveys will continue under the ISF contract through the month of November. Under agreement with FCCD, their staff will continue spawning surveys for coho salmon in Rock Island Creek through January. The results of the spawner surveys will be the subject of an additional report, so Bob's comment about 'not adequately sampling' based on a point in time of the draft snorkel assessment is somewhat out of context.
- 2) *[Given the size of the] predominately newly emerged (25 – 50 mm) fry in Foster and Rock Island creeks, it is likely that on-site spawning was occurring.* Bob believes it is likely that spawning is occurring on-site based on the size of the observed fry. It would be my first impression also if I did not know anything about the streams. And I must admit when we saw the newly emerged fry that was the primary assumption as well. However, streamflow in the creeks during the late summer and fall spawning periods is extremely low to non-existent, especially in Rock Island Creek. The streams simply will not support large bodied

fishes. Rock Island during the spawning season runs between 0.0 to 0.2 cfs and water depths are typically below 0.2 ft. We have no spawning suitability criteria for either coho or Chinook that run below 0.5 ft of water depth. Minimum steelhead spawning depths are more like 0.65 ft. We do not know a lot about the opportunistic nature of juvenile fish to migrate upstream to use tributary rearing habitats, but if I have learned anything over the years, it is clear that fish do not read the books about what we think they should do.

On-site spawning surveys have now been conducted through the month of October without any observations of adult salmon. At this point in time, given the history of stream flows from 2001 through 2003, the results of on-site spawners surveys conducted to date and the input of local residents, we can only conclude the streams do not offer fall spawning habitat. Should we observe adult spawners when stream flows come up during the late fall and early winter season, we will alter the utilization assessment for the final instream flow report.

- 3) *[R2] needs to specify whether length measurements were for total, fork or std. length.* Since we observed these fish underwater, without collection or physical measurement, the exactness of the measurements with respect to total, fork or standard lengths is meaningless. Lengths were estimated in large size increments of ± 25 mm. Scales taped to divers gloves and measured objects helped to “calibrate” the observer’s eyes to underwater magnification. Size approximations should be regarded as total lengths.
- 4) *Certainly, Chinook and steelhead have historically spawned in WRIA 44 and 50 streams (PGG et al. 2002).* Well, juveniles have been noted on occasion in a number streams but their presence needs to be described as opportunistic since stream flows that appear consistent one year are non-existent in other years. Spawning may have been suspected in some streams historically, but actual historic documentation is lacking. The term “certainly” is not too certain, especially if it implies consistently.
- 5) *It was odd that Douglas Cr. was considered to have only resident rainbow trout because it was “warmer” than the other 2 target streams, yet it has high groundwater input...* Douglas Creek supports only resident trout, not due to warmer temperatures but since it is an isolated, “land-locked” stream. More than 18 miles of dry streambed exist downstream of its confluence with the Moses Coulee channel. Moses Coulee has been dry, year-round for well over 5 years or more. There exists no connectivity with the Columbia River for anadromous fish passage. Hence, the noted contrast of the surveys in comparison with the other two streams and the less intensive effort for the area of stream coverage. Also note the groundwater influence is indeed a warm thermal spring. The fish have steady stream flows and temperatures remain between 10C and 20C year-round. The combination is great for

fish growth and metabolic activity, but the fish present are indeed resident fish only. Also note we have continuous thermal and discharge recordings for at least the last two years and perhaps for a longer period of record.

- 6) *[R2] did not observe steelhead spawners in Rock Island Creek, but spawner access is likely given the higher flows in spring than during fall....* Yes, there was sufficient flow for steelhead during spring when stream flows ranged between 1 and 2 cfs. Given the findings in Foster Creek, we expected to find adult steelhead in Rock Island Creek. At no time during either the formal foot or snorkel surveys of the anadromous reach in either 2003 (or 2004 [editors note]) or during informal spring spot surveys conducted with other activities 2001 and 2002 have we observed adult steelhead trout. Due to the very small size of the stream, we are convinced, if steelhead were present, they would have been encountered as they have been every year in Foster Creek since our work began in 2001.
- 7) *[Species] periodicity is also confusing via lack of explanation.* Periodicity is based on a number of factors including (1) the specific thermal regime of each creek that will dictate fish behavior, growth, and swimming speed, (2) the observed presence and size of the fish during both snorkel and spawner surveys, and (3) a back calculation with temperature units specific to each species to approximate the period of spawning. Some streams, like Douglas do not support temperature regimes that approximate winter rearing conditions. Similarly, Rock Island will only approach winter conditions for a brief period, whereas Foster Island is more typical of the streams with a wide range of thermal conditions. I will add further explanation for the periodicity decisions for each stream in the final report.

I hope the explanations are helpful in providing the proper context. I will modify the final report where possible in consideration of some of Bob's comments.