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FISH HABITAT ASSESSMENT AND CHAR UTILIZATION FOR THE UPPER SKAGIT RIVER WATERSHED, BC

***Prepared for*:**

Ministry of Water, Land and Air Protection
Lower Mainland Region

August 2005

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INTRODUCTION

The Upper Skagit River Watershed Native Char Project commenced in 2001 and has continued through 2004 (Nelson et al. 2005). The goals of the project were to examine the potential of radio-telemetry techniques in the watershed and to collect preliminary life-history information of native resident char in the upper Skagit River, BC. Telemetry activities have been conducted in both the BC and Washington areas of the Skagit River watershed. The objectives of the multi-year biotelemetry study of native char in the upper Skagit River included:

- identify bull trout (*Salvelinus confluentus*) and Dolly Varden (*S. malma*) char presence and distribution within the upper Skagit watershed;
- distinguish between adfluvial and fluvial stocks of bull trout and Dolly Varden char and describe life history strategies;
- provide estimates of bull trout and Dolly Varden population size;
- identify, describe, and photo-document critical habitats for bull trout and Dolly Varden char, including locations used for spawning, rearing, adult holding, and feeding;
- obtain individual fish information including species, sex, life stage, fork length, weight, age, and condition factor;
- continue to monitor water temperature by location and time in relation to habitat use and migration patterns;
- provide scientifically based resource management recommendations;
- promote international technical and data exchange;
- identify information gaps and develop an action plan to complete char conservation status evaluation; and
- maintain a watershed approach to char investigations in the upper Skagit River.

This report provides the results of habitat-related assessments and activities associated with the project. The key objective of the habitat work was to quantify key habitat characteristics and conditions for char populations in the BC Skagit River, by conducting detailed habitat assessments in specific reaches and sites that have been identified (as a result of the biotelemetry study) as being important for spawning, rearing, adult holding, and feeding. This objective relates to the fulfillment of the fourth objective, as described above, for the Upper Skagit River Watershed Native Char Project. The rationale for undertaking these habitat assessments are to:

1. determine existing habitat conditions in the Skagit River;
2. ascertain the biological and physical perturbations to the existing habitat;
3. evaluate habitat condition data to identify correlations with char utilization; and
4. identify rehabilitation opportunities within the study area.

These data will be particularly useful if, in the future, the Skagit native char stock requires site-specific management for population or habitat protection/restoration.

Study Area

Although the northern headwaters of the Skagit River watershed lie in the coastal mountains of southwestern BC, the mouth of the Skagit River empties into the marine waters of northern Puget Sound, Washington (Figure 1). The Skagit River crosses the international border between

Canada and the US at the northern end of Ross Lake, a man-made reservoir in the Cascade Range of Washington. The study area for the BC component of the 2001 Skagit River Char Telemetry Project was limited to the upper Skagit River watershed (in BC), and extended from Ross Lake to the confluence with the Sumallo River (Figure 2). The BC study area is within Skagit Valley Provincial Park/Recreation Area, established in 1995.

A gravel/dirt road provides access to the study area; this road leaves the Trans-Canada Highway (Hwy 1) about 4 km west of Hope, BC, and follows Silverhope Creek and the Klesilkwa River into the study area. The road crosses the Skagit River at "26-Mile Bridge", or 26 miles from the Trans-Canada Highway (Figure 2). The Sumallo River enters the upper Skagit River near the Hope-Princeton Highway; the Sumallo River is accessible to upstream-migrating fish from its confluence with the Skagit River to the residential area near Sunshine Valley.

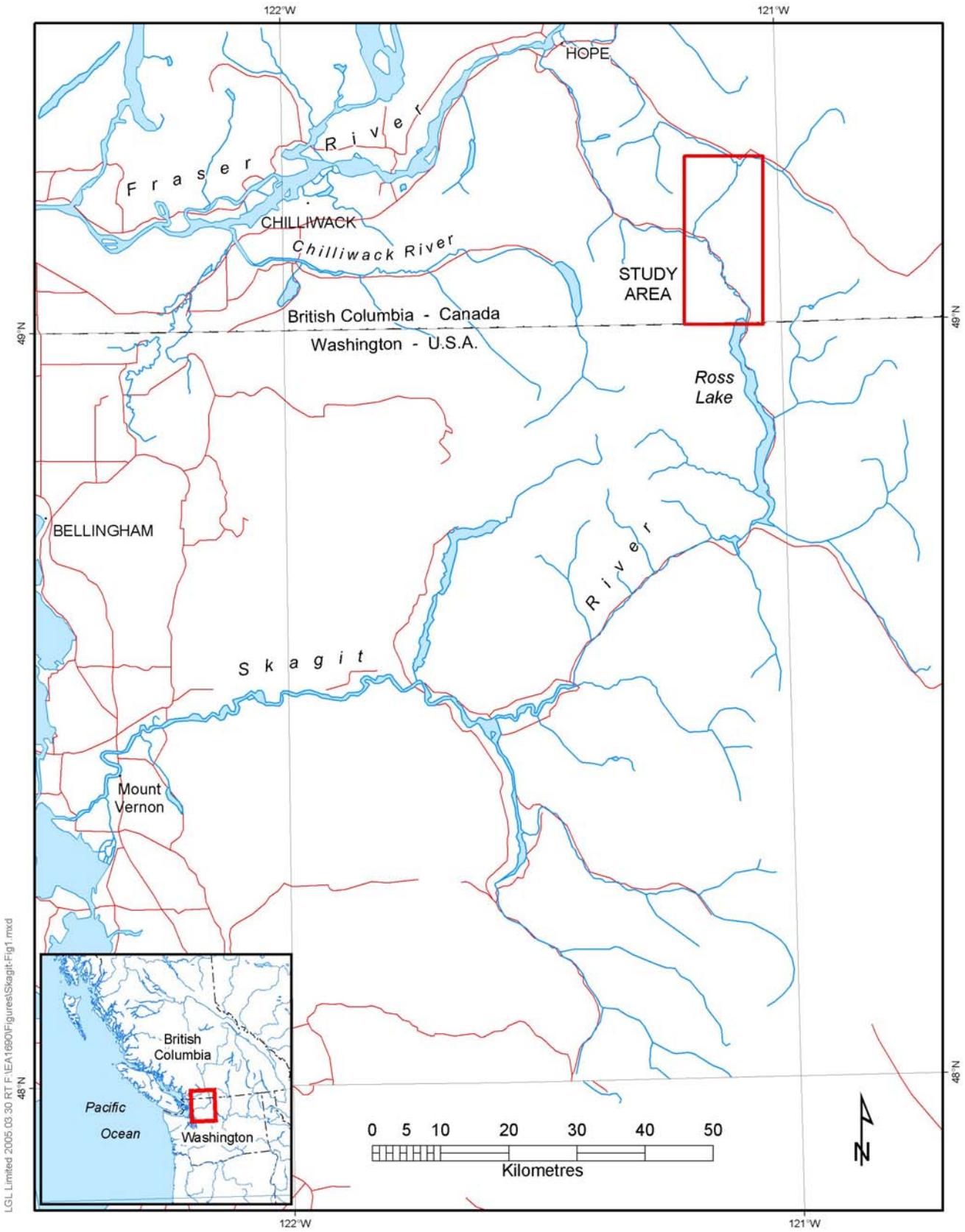

Figure 1. Index map of the Skagit River watershed.

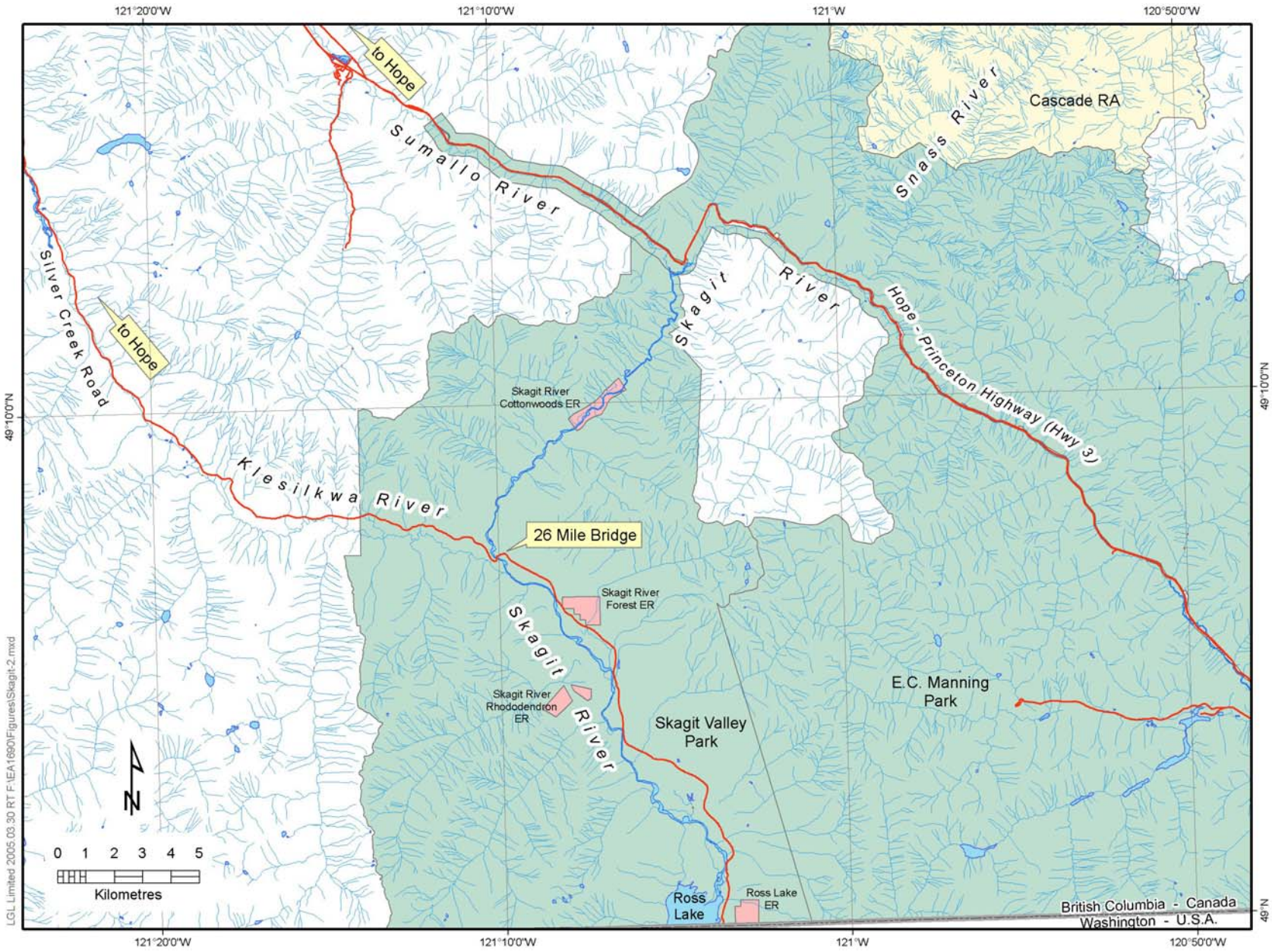

Figure 2. Access map of study area.

METHODOLOGY

At the commencement of the telemetry project in 2001, a map of the Skagit River within the BC study area was produced for river kilometer (rkm) reference points. The point where the Skagit River emptied into Ross Lake at full pool, was designated rkm 0.0; while the road crossing at 26-Mile Bridge was located at rkm 18.0 and the Sumallo-Skagit river confluence was at rkm 32.6 km. UTM coordinates for all key positions and habitat features have been referenced to these rkm positions in all telemetry data reports (Nelson et al. 2002, 2003, 2004, 2005). To be consistent with these previous reports, the point where the Skagit River lost its riverine character for the more lacustrine appearance of Ross Lake occurred at chainage 1+036 m. Therefore, detailed habitat assessments including photographic documentation were conducted in Reach 1 from chainage 1+036 m (ground zero) to 2+283 m and from chainage 4+829 to 14+292 m. Detailed habitat assessments were not conducted between chainage 2+283 and 4+829 m; however, upstream and downstream boundaries of each habitat type were geo-referenced and photo-documented (Table A1, Appendix A). Reach 2 extends from chainage 14+292 to 20+900 m. Detailed habitat assessments and photo-documentation were conducted from chainage 14+292 m to 18+000 m and from 18+900 m to 20+900 m. Reach 3 extends from chainage 20+900 m to 32+008 m. Detailed habitat assessments and photo-documentation were conducted from chainage 30+959 m 32+008 m. Reach 4 extends from chainage 32+008 to 33+048 m. Detailed habitat assessment and photo-documentation were conducted throughout this entire reach. The location of each habitat type, reach break, logjam, and char holding/spawning sites are presented in Figure 5 and Tables A1 to A7 in Appendix A.

Fish telemetry tracking and detailed fish habitat field assessments were conducted from 10-19 September 2004 by a crew of two people. The portion of the survey upstream of the 26-Mile Bridge was conducted on foot, while the portion downstream was floated with an inflatable boat. The upstream and downstream borders of each habitat type (pool, riffle, glide, cascade, other) were geo-referenced with a Garmin 12 GPS unit. Within each habitat type, physical attributes were measured and recorded according to methodologies and procedures described in Watershed Restoration Technical Circular No. 8 (Johnston and Slaney 1996).

Fish Distribution and Habitat Utilization

Fish visual observations, as well as locations involving the use of telemetry tracking equipment, were recorded by chainage and habitat type at the time of the detailed fish habitat survey. Evaluations pertaining to char holding and spawning were conducted on the combined data set generated by the Upper Skagit River Watershed Native Char Project for the years 2001 to September 2004.

Stream Habitat Condition

Diagnostic Value for Percent Pools and Pool Frequency

Ratings for percent pool habitat and pool frequency (spacing) were conducted for each reach. A poor rating was given if percent pool was less than 30%, a fair rating was given if less than or equal to 40%, and good rating was given if greater than 40%. Similarly, for pool frequency, a poor rating was given if the number of bankfull widths per pool was greater than 4, a fair rating was given if less than or equal to 4, and good rating was given if less than 2.

Diagnostic Value for Deep Pools (Holding Pools)

Watershed Restoration Program Technical Circular No. 8 (Johnston and Slaney 1996) uses the simple criteria of pool depth greater than 1 m to define a "good" holding pool for adult fish. However, this ignores the importance of overhead cover within the pool for creating good fish holding habitat. To account for the inter-relationship between pool depth and cover, the number of deep pools (holding pool) was identified using the following criterion:

deep pool, if (maximum depth x overhead cover >= 30),

where overhead cover includes large woody debris (LWD), boulder, cutbank, and overhanging vegetation. Maximum depth was measured during summer low flows. This diagnostic was developed to better reflect the interaction of cover and pool depth in providing suitable habitat to adult salmonids. It is based on observations by the authors, within Vancouver Island streams, of numerous pools that had greater than 1.0 m depth, no cover and no utilization by adult salmonids (or juvenile fish for that matter). Conversely, there are also numerous examples of pools with less than 1.0 m depth, abundant cover (e.g., cutbanks) and adults present.

The diagnostic value of 30 results in inclusion of roughly 30% of all pools within the project area as suitable for adult holding. On one hand, you may have a 3 m deep pool with 10% overhead cover and on the other hand, you may have a 0.5 m deep pool with 60% cover. Each would rate as a good holding pool. Note that there are very few primary pools with depths less than 0.5 m. This is because residual depth must be greater than 0.4 m in channels 2.5 m wide for a pool to be classified (Johnston and Slaney 1996).

The diagnostic value used to assess adequacy of adult holding pools within a reach was then the total number of deep pools per 1000 m of stream within each reach. A rating of poor was given if the number of deep pools as defined above was less than 1 per 1000 m of stream, a rating of fair was given if greater than or equal to 1, but less than or equal to 2, and a rating of good was given if greater than 2.

Diagnostic Value for Spawning Gravel Quantity

Spawning gravel quantity was calculated as 100% of the stream wetted area with available gravels (2-64 mm), plus 20% of the stream wetted area with available cobbles (64-256 mm) times the wetted area of the reach. Gravel quantity was rated as poor if the spawning area was less than 10% of the total wetted area, fair if greater than or equal to 10%, but less than or equal to 25%, and good if greater than 25%.

Diagnostic Value for Spawning Gravel Quality

Spawning gravel quality was coded as high, medium or low based on the degree of compaction and embeddedness (percent fines). Loose and clean substrates (fines < =15%) providing excellent spawning opportunity received a rating of high (H), while compacted and embedded substrates (fines > 25%) received a ranking of low (L). A medium ranking (M) refers to moderately embedded and uncompacted gravel (15% < fines < 25%).

Diagnostic Value for Off-channel Habitat

Off-channel habitat was rated as good if there was more than one off-channel area (of any type), fair if there was only one off-channel area, and poor if no off-channel areas were present. Note that this diagnostic as currently defined in Watershed Restoration Program Technical Circular No. 8 (Johnston and Slaney 1996) does not account for the amount of off-channel habitat (i.e., length or area). However, for an off-channel area to be included, it had to be considered, in the opinion of the field biologist, as important habitat. Minimum length or area was not considered.

RESULTS

Hydrology and Channel Characteristics

The drainage area of the Skagit River watershed is 1043 km^2 upstream of Ross Lake. Peak and mean monthly flow estimates were made using historical hydrometric data from Station 08PA001 for Skagit River near Hope, as published by Water Survey of Canada (WSC). The analysis was based on mean daily flows recorded between 1915 and 1955, the period of record for this station. Since 1955, discharges in the Skagit River have not been monitored on a continual basis by water management agencies. The estimates of the maximum daily peak discharges were computed using the Log Pearson III distribution.

Mean monthly flows in this watershed begin to rise in April in response to snowmelt, peak in June, and steadily decline through summer with the lowest discharges occurring typically in September (Figure 3). The mean annual flow at Ross Lake was estimated at 32 m^3/s (Table 1). 2-year and 50-year maximum daily flows were estimated at 179 and 312 m^3/s, respectively. The unit flood discharge with a return period of 50 years was calculated at 299 $l/s/km^2$.

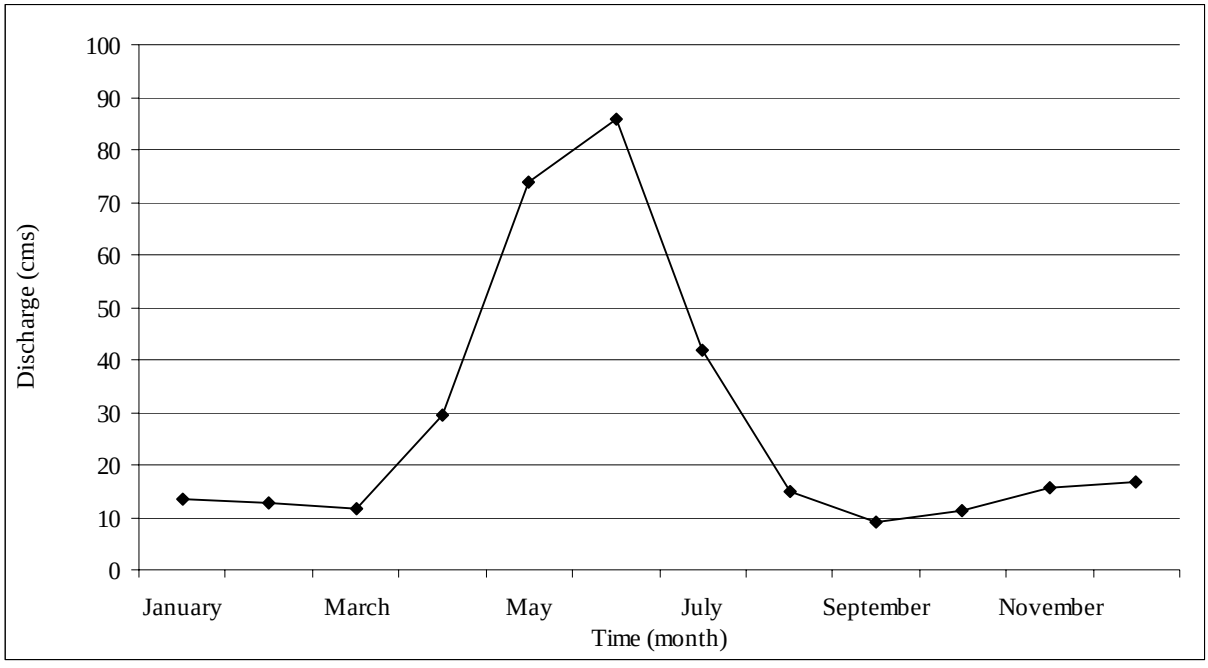

Figure 3. Annual hydrograph of mean monthly flows in Skagit River near Hope, BC. Discharges based on Water Survey of Canada Station 08PA001, 1915-1955.

Table 1. Summary of return period maximum daily and mean monthly discharges for the Skagit River. Discharges based on Water Survey of Canada Station 08PA001, 1915-1955.

	Skagit River near Hope		Skagit River Upstream of Ross Lake
Gauge	08PA001		
Years	1915-1955		
Number of Years Analyzed	30		
Drainage Area (km^2)	907		1043
Floods and Mean Monthly Flows	Discharge (m^3/s)	Unit Discharge ($l/s/km^2$)	Discharge (m^3/s)
Mean Annual	28	31	32
2 yr	156	172	179
10 yr	234	258	269
25 yr	258	284	297
50 yr	271	299	312
Maximum	289	319	332
January	14	15	16
February	13	14	15
March	12	13	13
April	29	32	34
May	74	81	85
June	86	95	99
July	42	46	48
August	15	16	17
September	9	10	11
October	11	13	13
November	16	17	18
December	17	19	19

Reach Breaks

Pre-field activities included preparing a gradient profile of the Skagit River mainstem from 1:20,000 TRIM maps. Three reach breaks were established based on this gradient profile and stream pattern (Figures 4 and 5). Reach 1 and Reach 3 have an irregular wandering pattern and are frequently confined; whereas, Reach 2 has a more sinuous pattern and is occasionally confined (Figure 5). Reach 4 is straight and frequently confined.

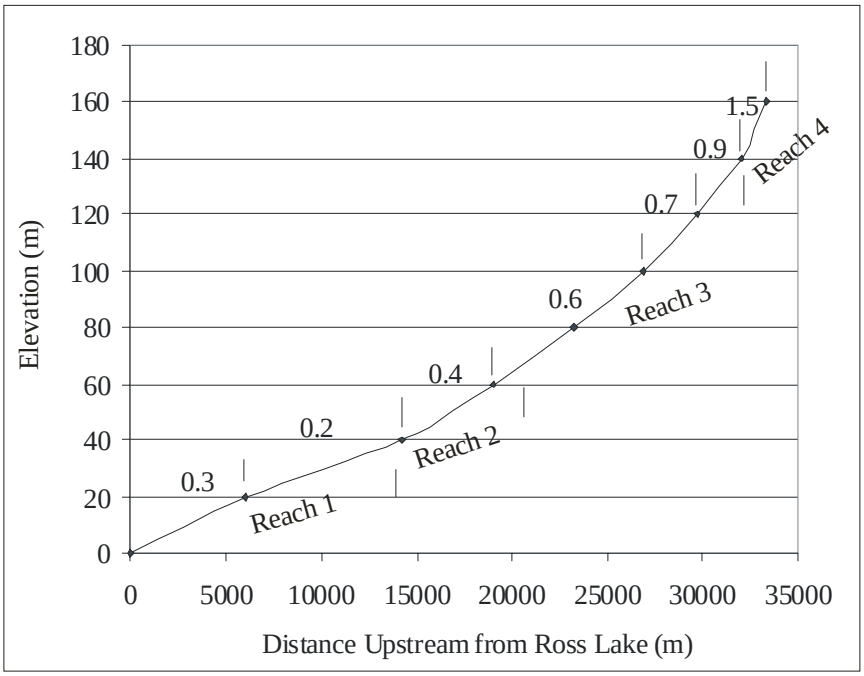

Figure 4. Long profile, gradient (%) and reach boundaries for the mainstem study area of the Skagit River.

Fish Tracking and Observations

Char distribution recorded by reach and habitat type are presented in Appendix A, and include telemetry data from previous reports (Nelson et al. 2002, 2003, 2004, 2005). Major holding and spawning areas identified are those that contained four or more char per survey and were utilized on at least three surveys during the period 2001 to 2004.

Fish Habitat Condition

This report summarizes the findings of a detailed habitat assessment of 19,276 m of Skagit mainstem and characterizes the habitats selected, as well as those not selected, by char for holding and spawning purposes. Detailed habitat condition results are presented in Appendix A. Representative photos for the habitats observed at the project streams are also presented in Photos 1 to 32. All of the reaches assessed were characterized as a riffle-pool habitat type which is typically associated with higher quality incubation, rearing and spawning habitat. In this

habitat type, LWD plays a major role for trapping gravel, forming pools and providing overhead cover (Slaney and Zaldokas 1997).

Skagit River (Reach S1)

Reach S1 extends upstream from Ross Lake to chainage 14+292 m (Figure 5; Table A1, Appendix A). Channel type is riffle-pool morphology with a predominance of cobble substrate (RPc-w, Hogan et al. 1996). Mean bankfull width and gradient is 53.5 m and 0.28%, respectively. Instream habitat type is predominantly glide (40.5%), followed by pool (37.5%) and (22%) riffle (Table A2). Most important instream cover components in all habitat types are deep pool (20.2%) and (7.1%) boulder (Table A3). Cover from overhanging vegetation is 5.3% (Table A3). The amount of functional LWD present is only 22% of the density recommended by Cederholm et al. (1997) (Table 2, Table A4). Therefore, current LWD density is considered inadequate with an uneven or clumped distribution. Substrate composition is cobble (46%), gravel (45%), boulder (7%), and (1%) fines (Table A5). Reach 1 is relatively unstable; channel disturbance indicators include: bank erosion, log jams, mid-channel bars, un-vegetated bars, multiple channels, wedges, avulsions and LWD parallel to banks (Table A1).

The diagnostic summary of salmonid habitat condition gives a good rating for off-channel habitat, gravel quantity and gravel quality for spawning; a fair rating for percent pool area, number of good holding pools with adequate overhead cover per km of stream; and a poor rating for pool frequency, percent wood cover in pools and boulder cover in riffles for rearing juveniles (Table 2). An overall inadequate rating for supply of functional LWD and a poor ranking for percent wood cover in pool habitat suggests that instream rehabilitation opportunities exist and would benefit fish and fish habitats. LWD distribution is presently clumped in at least seven logjams (Figure 5).

Table 2. Diagnostic summary of salmonid habitat condition for Skagit River mainstem.

Reach Number	% Pools[1]		Pool Frequency[2]		Holding Pools[3]		LWD Pieces[4]		% Wood in Pools[5]		% Boulder in Riffles[6]		% Overhead Pool Cover[7]		Gravel Quantity[8]		Gravel Quality[9]		Off-channel Habitat[10]	
	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating	Value	Rating
S1	37.5	Fair	6.7	Poor	1.4	Fair	0.22	Inadequate	1.9	Poor	7.0	Poor	18.1	Fair	54.8	Good	1	Good	8	Good
S2	25.4	Poor	14.4	Poor	0.5	Poor	0.28	Inadequate	2.6	Poor	14.0	Fair	10.6	Fair	43.2	Good	3	Good	4	Good
S3	25.4	Poor	13.4	Poor	1.0	Fair	0.21	Inadequate	14.1	Fair	2.4	Poor	12.1	Fair	22.3	Fair	6	Fair	3	Good
S4	12.2	Poor	10.5	Poor	0.0	Poor	0.19	Inadequate	1.4	Poor	12.7	Fair	20.3	Good	31.4	Good	3	Good	1	Fair

[1] Value is percent pools (%P = total pool area / total wetted area). Poor < 30%, Fair <= 40%, Good > 40% (for gradients 2-5%).

[2] Value is number of bankfull widths per pool (FP = mean bankfull width / total number of pools). Good < 2, Fair <= 4, Poor > 4.

[3] Value is the number of pools per 1000m for which the product of the maximum depth times the total overhead cover is >= 30. Poor < 1, Fair <= 2, Good > 2.

[4] Value is the number of functional LWD divided by the recommended number of LWD (10m x 0.5m). Inadequate < 1, Adequate >=1.

[5] Value is the mean percent wood cover in pools. Poor < 6%, Fair <= 20%, Good > 20%.

[6] Value is the percent boulder cover in riffles. Poor < 10%, Fair <= 30%, Good > 30%.

[7] Value is the percent overhead cover in pools. Poor < 15%, Fair < 30%, Good > 30%.

[8] Value is percent spawning area (%Q = spawning area / total wetted area). Poor < 10%, Fair <= 25%, Good > 25%.

[9] Value is the percent of substrate in <2 mm category (fines). Poor > 25%, Fair >15% and uncompacted, Good < =15% and uncompacted.

[10] Value is the number of off channel habitats with good access. Poor < 1, Fair <= 2, Good > 2.

Skagit River (Reach S2)

Reach S2 extends 6,608 m upstream from Reach S1 to chainage 20+900 m (Figure 5; Table A1). Mean bankfull width is 33.1 m; mean gradient is 0.48%. Channel type is classified riffle-pool morphology with a predominance of cobble substrate (RPc-w, Hogan et al. 1996). Substrate composition is cobble (55%), gravel (33%), boulder (9%) and (3%) fines. Median substrate size was measured at 9 cm for a typical riffle within this reach (Figure 6). Instream habitat type is 50% riffle, 25.4% pool and 24.5% glide (Table A2). Deep pool (9.1%) and boulder cover (9.1%) is the dominant instream cover element in all habitat types Table A3). Overhanging vegetation cover is significant at 10.1% (Table A3). Presence of functional LWD is only 28% of the density recommended by Cederholm et al. (1977) (Table 2, Table A4). Accordingly, functional LWD is considered inadequate, primarily due to an uneven or clumped distribution. Substrate composition is 55% cobble, 33% gravel, 9% boulder and 3% fines (Table A5). Reach 2 is relatively unstable; channel disturbance indicators include: bank erosion, log jams, mid-channel bars, un-vegetated bars, multiple channels, wedges, avulsions and LWD parallel to banks (Table A1).

The diagnostic summary of salmonid habitat condition assigns a good rating for amount of off-channel habitat as well as quantity and quality of spawning habitat; while a fair rating was given for percent overhead pool cover and percent boulder cover in riffles for juvenile rearing. Percent pool area, pool frequency, number of holding pools with adequate cover per km of reach and percent woody cover in pools all received a poor ranking (Table 2). An overall inadequate rating for supply of functional LWD and a poor ranking for percent wood cover in pool habitat suggests that instream rehabilitation opportunities exist and would benefit fish and fish habitats. LWD distribution is presently clumped in two major logjams (Figure 5, Photo 1 and Photo 2).

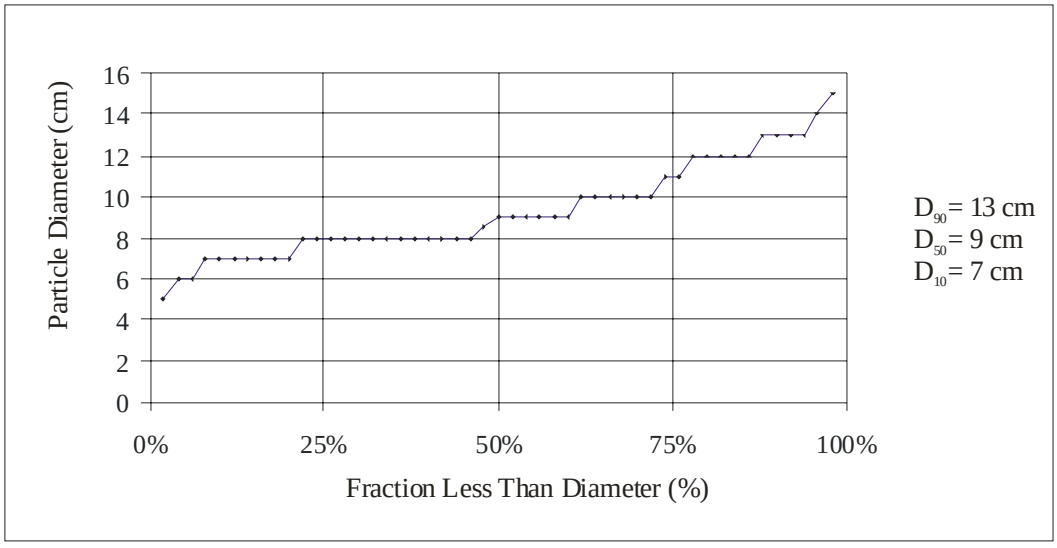

Figure 6. Substrate characteristics from pebble counts on a riffle at chainage 16+782 m in Reach 2 of Skagit River.

Skagit River (Reach S3)

Reach S3 extends 11,108 m upstream from Reach 2 to chainage 32+008 m (Figure 5; Table A1). Channel type is riffle-pool morphology with a predominance of cobble and gravel substrate (RPc-w, Hogan et al. 1996). Mean bankfull width and gradient is 29.5 m and 0.7%, respectively. Instream habitat type in the assessed section of Reach 3 is predominantly riffle (23.8%), followed by glide (13.7%), pool (12.2%) and (50.3%) logjam/wedge/dry channel (Table A2). Deep pool (3.5%), LWD (1.8%) and boulder (0.6%) are the dominant instream cover elements in all habitat types (Table A3). Overhanging vegetation accounts for 1.9% of the cover in all habitat types (Table A3). The occurrence of functional LWD is inadequate at only 21% of the density recommended by Cederholm et al. (1977) (Table 2, Table A4). Substrate composition is 46% cobble, 46% gravel, 1% boulder and 8% fines (Table A5). Reach 3 is relatively unstable; channel disturbance indicators include: bank erosion, log jams, mid-channel bars, un-vegetated bars, multiple channels, wedges, avulsions and LWD parallel to banks (Table A1).

The diagnostic summary of salmonid habitat condition provides a good rating for number of off-channel habitats with good access, and a fair rating for number of holding pools with adequate cover per km of reach, percent wood and percent overhead cover in pools, and gravel quantity and quality for spawning purposes. Pool percent and pool frequency as well as percent boulder cover in riffles for rearing juveniles received a poor ranking (Table 2). LWD distribution is clumped in four major logjams and is responsible for an overall inadequate rating for supply of functional LWD in Reach S3 (Figure 5).

Skagit River (Reach S4)

Reach S4 extends 1,040 m upstream from Reach S3 to chainage 33+048 m or 20 m upstream of the confluence with Sumallo River (Figure 5; Table A1). Mean bankfull width is 33.2 m; mean gradient is 1.5%. Channel type is classified riffle-pool morphology with a predominance of cobble substrate (RPc-w, Hogan et al. 1996). Substrate composition is cobble (52%), gravel (35%), boulder (11%) and (3%) fines (Table A5). Instream habitat type is 47.5% riffle, 11.5% pool and 41% glide (Table A2). Boulder (10.9%) and deep pool (2.4%) cover is the dominant instream cover element in all habitat types (Table A3). Over hanging vegetation cover is significant at 8.6% (Table A3). The presence of functional LWD is inadequate at only 19% of the density recommended by Cederholm et al. (1997) (Table A4). The Reach S4 channel is relatively straight with scoured and armoured bed substrate. Disturbance indicators are typically indicative of scouring flows with a predominance of LWD parallel to banks and barren bars (Table A1).

The diagnostic summary of salmonid habitat condition provides a good rating for percent overhead pool cover as well as quantity and quality of spawning habitat, and a fair rating for amount of off-channel habitat and percent boulder cover in riffles for juvenile rearing. Percent pool area, pool frequency, number of holding pools with adequate cover per km of reach and percent woody cover in pools all received a poor ranking (Table 2).

Fish Distribution and Habitat Utilization

In Reach S1, detailed habitat assessments were conducted at 18 known char holding pools (Appendix A6). Of these, 15 had sufficient cover to meet the criteria for a good holding pool. Boulder cover in excess of 30% was the dominant instream cover element at eight of the 14 sites: Waypoint (WP) 73 (Photo 3); WP 100 (Photo 8); WP 96; WP 86; WP 81; WP 58 (Photo 9); WP 48 (Photo 12); and, WP 44 (Photo 13). LWD cover in excess of 15% was the dominant instream cover

element at two sites: WP 91 and WP 31 (Photo 18). A combination of cover elements (boulder, LWD, undercut bank and overhanging vegetation) was evident at four sites: WP 56 (Photo 10); WP 53 (Photo 11); WP 35 (Photo 16); and WP 33 (Photo 17). The most consistently used holding pools with the most char have cover elements directly in the thalweg current and functioned as both overhead escape cover and as hiding places or feeding stations from which to capture food organisms. In relatively strong currents as those in the Skagit River, the best positioned and most resistant cover element providing dual purpose escape cover and feeding stations would naturally be boulders. LWD cover is often to one side of the thalweg current and tends to provide single purpose escape cover such as WP 68 (Photo 4) and WP 108 (Photo 6). Overhanging vegetation and undercut banks are good dual purpose cover providers if they are directly in the path of the thalweg current as is evident at site WP 53 (Photo 11). Reach 1 had the greatest quantity of spawning habitat of the four reaches surveyed. From a limiting factor standpoint, this spawning habitat is under-utilized. Spawning commonly occurs at pool tail-out and/or riffle crest contiguous to holding pools. Substrate composition of spawning and non-spawning riffle crests was not substantially different. Perhaps suitable escape cover in adjacent holding pools to spawning areas is limiting and if so, this could be rectified with the addition of adequate LWD/boulder structures. Spawning and holding locations are illustrated in Figure 5.

In Reach S2, char have been observed holding in four pools located at WP 11 (Photo 21), WP 1000 (Photo 22), WP 1006 (Photo 23), WP 1008 (Photo 24) and one glide at WP 1013 (Photo 25). Only the site at WP 1006 (Photo 23) met the criteria for a good holding pool. Furthermore, two other sites at WP 1016 (Photo 26) and WP 1018 (Photo 27) had sufficient overhead cover to be classified as good holding pools. No char were ever found to hold at either of these sites even though in excess of 300 rainbow trout consistently hold at WP 1018 under cover of a log jam (Photo 27).

In Reach S3, three pools with sufficient cover were classified as good holding pools. These sites are located at WP 622 (Photo 1, Photo 28), WP 1039, and WP 1043 (Photo 30). Unfortunately, all three holding pools as well as a pool at WP 1037 (Photo 29) will be cut off by an avulsion channel that scoured through a log jam at WP 1043 during the flood of 2003 (Photo 30; Figure 5).

In Reach S4, two holding pools identified during telemetry tracking and snorkel surveys are located at WP 1047 (Photo 31) and WP 1064 (Photo 32). Neither of these pools have sufficient cover to be classified as a “good holding pool”.

Riparian Condition

Results of the riparian condition, including canopy cover, bank stability and LWD impacts are presented in Table A7 of Appendix A. The riparian zone along the Skagit River mainstem is predominantly mixed, young forest (alder and cedar-hemlock-spruce) providing a low degree of canopy cover. A sporadic occurring shrub level dominated by ninebark, willow and alder, and vine maple provides excellent allochthonous insect inputs to the stream.

DISCUSSION AND RECOMMENDATIONS

Char commonly spawn in pool tail-out and riffle-crest areas contiguous to holding pools. Quality char holding pools occur infrequently throughout the study area and this paucity may be limiting char production. Enhanced overhead and thalweg cover may well produce benefits to the Skagit River char stock status and to the local economy. Feeding stations can be augmented with the placement of large boulders (mean diameter >1 m) in pool/thalweg locations. Furthermore, the

addition of large boulder anchors to existing LWD structures and placement of LWD-boulder (lateral jam) structures can improve escape cover and reduce existing bank erosion; thus improving channel stability and reduce channel migration and pool infilling with aggrading sediments from eroding banks. Improved channel stability can result in improved re-distribution and functionality of log jams that are currently over-sized and clumped in distribution.

There is a higher priority for establishing stream protection measures downstream of the 26-Mile Bridge than above it. Several stream restoration opportunities currently exist in Reach S1 and Reach S2 downstream of 26-Mile Bridge. Opportunities may exist in the un-surveyed portion of Reach S3 as well as in the surveyed portion, upstream of Waypoint 1032 (Figure 5). Lower priority opportunities are suspected in Reach S4 and Reach S2 upstream of the 26-Mile Bridge where a higher gradient and stream power would probably result in frequent maintenance of the instream structures. This, however, can be verified during Level 2 prescription surveys.

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FIGURE 5 (MAP)

PHOTO PLATES

Photo 1. Upstream view of massive logjam and sediment wedge complex (800 m in length) at WP 1030 (chainage 20+900 m), Reach S3.

Photo 2. Downstream view of logjam at WP 622 (chainage 31+054 m), Reach S3.

Photo 3. Downstream view from WP 72 at holding pool WP 73, Reach S1. Riprap contributes to boulder cover in pool.

Photo 4. Downstream view from WP 68 at holding pool WP 69, Reach S1. LWD is good overhead escape cover but because of location relative to thalweg, it is questionable cover for feeding purposes.

Photo 5. Downstream view from WP 112 at holding pool WP 113, Reach S1. Fish often holding in this pool, which has a combination of LWD and boulder cover.

Photo 6. Downstream view from WP 107 at holding pool WP 108, Reach S1. Fish holding occasionally in LWD cover. Pool is in transition, infilling with gravel from upstream sediment wedge formed prior to flood of October 2003; presently no boulder cover.

Photo 7. Downstream view from WP 105 at occasionally used holding pool WP 106, Reach S1. This logjam and sediment wedge is remnant of much larger jam formed prior to flood of October 2003.

Photo 8. Upstream view from WP 100 at holding pool WP 100, Reach S1. Pool has 35% boulder cover. On three occasions, four or more char were observed holding here.

Photo 9. View from road at holding pool WP 58, Reach S1. Char utilize large boulders (riprap from road) for holding and as feeding stations in thalweg.

Photo 10. Upstream view from WP 56, Reach S1. Excellent holding and feeding station under fallen fir with branches intact (left bank) in the thalweg at riffle tail-out.

Photo 11. Upstream view at leaning cedar off right bank at WP 53, Reach S1. Char hold under leaning cedar using combination of boulder, undercut bank and overhanging vegetation for cover. It is an excellent feeding station directly in thalweg current.

Photo 12. Upstream view from WP 48, Reach S1. Frequently holds less than five char. Boulders are smallish (D_{90}=35 cm) and flat. This site could use LWD-boulder structures for supplemental overhead cover and provide protection to eroding right bank.

Photo 13. Downstream view of pool WP 44 from WP 43, Reach S1. Good holding pool with 30% boulder cover.

Photo 14. Upstream view of LWD cover (right bank) utilized by small char at riffle tail-out at WP 43, Reach S1.

Photo 15. Upstream view from WP 41, Reach S1. Pool now infilling. Prior to October 2003 flood, single char were often holding under LWD.

Photo 16. Downstream view from WP 34, Reach S1. Holding pool WP 35 not heavily utilized; few feeding stations, only 15% boulder cover, boulders predominantly small (25 cm).

Photo 17. Upstream view from WP 33. This pool was well-utilized by char until a massive log jam across the entire channel width at WP30 washed out in the October 2003 flood (Figure 5).

Photo 18. Upstream view from WP 31 at new holding pool with LWD overhead cover. This pool is being used by char since previous logjam and sediment wedge scoured out in 2003 flood.

Photo 19. Upstream view from WP 25, Reach S1. Char hold under limited LWD cover off left bank.

Photo 20. Upstream view from WP 18, Reach S1 of well used holding pool.

Photo 21. Looking upstream at char holding pool at WP 11, Reach S2.

Photo 22. Looking downstream at frequently used char holding pool at WP 1000, Reach S2.

Photo 23. Looking downstream at frequently used char holding pool at WP 1006, Reach S2.

Photo 24. View of char holding pool located at WP 1008, Reach S2.

Photo 25. Upstream view in glide frequently used by holding char at WP 1013, Reach S2.

Photo 26. Upstream view of pool (photo background) at WP 1016 that char have never used for holding.

Photo 27. Upstream view of rainbow trout holding pool and logjam at WP 1018, Reach S2.

Photo 28. View of log jam at WP 622, Reach S3. No char have been recorded holding at this site.

Photo 29. Upstream view of holding pool at WP 1037, Reach S3.

Photo 30. Looking downstream at new avulsion channel that has eroded through massive log jam at WP 1043, Reach S3. This avulsion will eventually cut off holding pools at WP 622 and WP 1037 and WP 1042 located just left (photo left) of avulsion channel.

Photo 31. View of holding pool at WP 1047, Reach S3. On two previous floats, this pool held at least four char.

Photo 32. Upstream view of pool at WP 1064, Reach S4. Char occasionally hold here; rainbow trout always hold in this pool.

APPENDICES

Table A1. Detailed habitat descriptions for selected reaches in Skagit watershed.

								Bank height (m)		Mean Width (m)			Percent bed material (range in mm)						Spawning Gravel			Pools Only					Functional LWD Tally					Cover							Off-channel habitat				
Sub Basin	Reach	Reach location (m) [1] SampleDW Fraction [2]	Habitat Type [2]	Waypoint (WP) [3]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bankfull height (m)	Bankfull depth (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m2) [4]	<2 mm	2-64 mm	64-256 mm	>256 mm	Bed rock	Compaction	D90 (cm)	Type [5]	Quality [6]	Amount (m^2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [7]	Good holding pool [8]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [9]	Access [10]	Length (m)	Channel Disturbances [11]	Barriers [12]
Skagit River	S1	1036	G	77	36	0.2	0.75	0.6	1.35	56.0	26.0	936	2	58	40	0	0	L	10	AR	M	618	1.50	0.4	1.10	O		8	0	3	1	0.3	0	0	5	0	5.3	2				JM, DW, PD	N
Skagit River	S1	1072	P	76	55	0.0	0.90	0.65	1.55	69.0	34.0	1870	2	58	40	0	0	M	10	AR	M	1234	1.75	0.40	1.35	W		14				30.0	0	0	50	0	80.0	0				WG, MB, JM, MC	N
Skagit River	S1	1127	R	75	64	0.7	0.40	0.70	1.10	65.0	49.0	3136	0	40	60	0	0	M	13	AR	M	1631	0.50		0.50	R		0				0.0	0	0	0	0	0.0	2				MB, MC	N
Skagit River	S1	1191	G	74	42	0.7	0.75	0.70	1.45	58.0	48.0	2016	0	40	60	0	0	M	13	AR	M	1048						4	0	2	0	0.1	0	0	0	0	0.1	0				PD	N
Skagit River	S1	1233	P	73	133	0.0	1.50	0.60	2.10	40.0	35.0	4655	10	30	30	30	0	M	100	AR	M	1676	3.00	0.30	2.70	R	Y	7	0	4	0	0.1	30	0	50	0	80.1	2				PD	N
Skagit River	S1	1366	R	72	54	0.5	0.30	0.60	0.90	60.0	35.0	1890	2	78	20	0	0	L	8	AR	H	1550						0	0	0	0	0.0	0	0	0	0	0.0	0				DW	N
Skagit River	S1	1420	P	71	68	0.0	0.80	0.50	1.30	60.0	21.0	1428	2	30	68	0	0	M	11	AR	M	623	2.40	0.65	1.75	R		1	0	0	0	0.0	0	0	40	0	40.0	2				DW	N
Skagit River	S1	1488	R	70	74	1.1	0.65	0.70	1.35	66.0	41.0	3034	0	15	85	0	0	H	11	AR	L	971						14	9	5		1.1	0	0	0	0	1.1	4				WG, MB, DW, PD	N
Skagit River	S1	1562	P	69	71	0.0	2.00	0.60	2.60	65.0	30.0	2130	8	77	15	0	0	M	8	AR	M	1704	2.75	0.70	2.05	W		20	11	8	1	8.0	0	0	65	0	73.0	0				DW, PD, JM	N
Skagit River	S1	1633	G	68	125	0.1	0.70	0.70	1.40	65.0	31.0	3875	0	30	70	0	0	H	13	AR	L	1705						5	0	4	1	0.9	0	0	2	0	2.9	0				DW, PD	N
Skagit River	S1	1758	P	67	54	0.0	1.10	0.30	1.40	69.0	27.0	1458	0	60	40	0	0	M	10	AR	M	991	1.80	0.50	1.30	W		6	1	4	1	2.3	0	0	35	0	37.3	0				DW, PD	N
Skagit River	S1	1812	R	66	43	1.0	0.50	0.40	0.90	84.0	30.0	1290	0	25	73	2	0	M	13	AR	L	511						6	0	6	0	2.6	2	0	0	0	4.6	2				DW, PD	N
Skagit River	S1	1855	P	65	55	0.0	0.95	0.40	1.35	70.0	30.0	1650	15	65	20	0	0	M	8	AR	M	1139	2.25	0.62	1.63	R		21	11	10	0	2.0	0	0	40	0	42.0	0				DW	N
Skagit River	S1	1910	R	64	85	1.1	0.62	0.50	1.12	100.0	35.0	2975	0	55	45	0	0	M	10	AR	M	1904						2	0	1	0	1.1	0	0	0	0	1.1	0				MB, PD	N
Skagit River	S1	1995	P	63	31	0	0.95	0.5	1.45	100.0	35	1085	2	68	30	0	0	L	10	AR	H	803	1.9	0.7	1.20	W		7	0	4	1	3.1	0	0	50	0	53.1	0				DW, PD	N
Skagit River	S1	2026	G	62	159	0.1	0.70	0.50	1.20	111.0	27.0	4293	0	60	40	0	0	M	10	AR	M	2919						5	0	4	0	0.8	0	0	0	0	0.8	0				DW, PD	N
Skagit River	S1	2185	R	61	33	0.9	0.53	0.60	1.13	50.0	40.0	1320	0	15	83	2	0	M	13	AR	L	417						1	0	0	0	2.6	2	0	0	0	4.6	0				DW, PD	N
Skagit River	S1	2218	G	60	65	0.2	0.80	0.60	1.40	57.0	22.0	1430	2	30	69	1	0	M	13	AR	M	626						1	0	0	0	2.4	1	0	10	0	13.4	0	BC	G	50	WG, DW, PD	N
Skagit River		2283	R	59	66																																					N
Skagit River		2349	P	119	258																																					N
Skagit River		2607	R	118	251																																					N
Skagit River		2858	G	116	170																																					
Skagit River		3028	P	115	193																																					N
Skagit River		3221	G	114	190																																					N
Skagit River		3411	P	113	166																																					N
Skagit River		3577	R	112	126																																					N
Skagit River		3703	G	111	48																																					N
Skagit River		3751	P	110	123																																					N
Skagit River		3874	R	109	68																																					N
Skagit River		3942	P	108	48																																				MB, WG, JM	N
Skagit River		3990	R	107	91																																					N
Skagit River		4081	P	106	54																																				JM	N
Skagit River		4135	R	105	119																																					N
Skagit River		4254	G	104	211																																					N
Skagit River		4465	P	102	206																																					N
Skagit River		4671	R	101	158																																					N
Skagit River	S1	4829	P	100	89	0.0	1.67	0.80	2.47	35.0	26.0	2314	3	30	30	35	2	M	100	AR	M	833	2.50	0.60	1.90	R	Y	0	0	0	0	0.0	35	0	90	0	125	4					N
Skagit River	S1	4918	P	99	303	0.0	1.15	0.60	1.75	55.0	3.0	909	2	50	50	0	0	M	18	AR	M	545	1.80	0.60	1.20	R		13	0	9	2	0.5	0	0	60	0	60.5	7				PD	N
Skagit River	S1	5221	R	98	91	0.9	0.60	0.60	1.20	52.0	30.0	2730	0	30	69	1	0	M	15	AR	M	1196						2	0	2	0	0.1	1	0	0	0	1.1	2					N
Skagit River	S1	5312	G	97	79	0.2	0.90	0.60	1.50	47.0	29.0	2291	0	50	50	0	0	L	10	AR	H	1375						6	0	4	1	1.3	0	0	2	0	3.3	17				PD	N
Skagit River	S1	5391	P	96	121	0.0	1.25	0.60	1.85	50.0	42.0	5082	5	30	30	35	0	M	70	AR	M	1830	1.75	0.30	1.45	R	Y	1	0	0	0	0.0	35	0	50	0	85.0	0				PD	N
Skagit River	S1	5512	R	95	30	0.5	0.28	0.60	0.88	72.0	40.0	1200	0	95	5	0	0	L	6	AR	H	1152						12	4	8	0	2.0	0	0	0	0	2.0	1				WG, MB, DW, PD	N
Skagit River	S1	5542	G	94	39	0.2	0.85	0.60	1.45	72.0	40.0	1560	0	30	20	50	0	M	70	AR	M	530			0.00			0	0	0	0	0.0	50	0	5	0	55.0	0				DW	N
Skagit River	S1	5581	P	93	167	0.0	1.10	0.50	1.60	70.0	35.0	5845	2	68	30	0	0	L	9	AR	H	4325	1.75	0.50	1.25	W		40	0	40	0	2.9	0	0	60	0	62.9	6				WG, MB, PD	N
Skagit River	S1	5748	R	92	173	0.9	0.50	0.60	####	78.0	27.0	4671	0	40	60	0	0	L	12	AR	H	2429						53	0	2	1	0.1	0	0	0	0	0.1	4	SL	P	50	EB, PD	N
Skagit River	S1	5921	P	91	168	0.0	1.30	0.70	1.20	54.0	27.0	4536	2	58	40	0	0	L	8	AR	H	2994	1.90	0.50	1.40	W	Y	132	0	##	0	15.0	0	0	45	0	60.0	7				DW, PD, JM	N

Table A1. Detailed habitat descriptions for selected reaches in Skagit watershed.

								Bank height (m)		Mean Width (m)			Percent bed material (range in mm)							Spawning Gravel			Pools Only					Functional LWD Tally					Cover							Off-channel habitat					
Sub Basin	Reach	Reach location (m) [1] SampleID/W Fraction 2	Habitat Type [2]	Waypoint (WP) [3]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bankfull height (m)	Bankfull depth (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m2) 4	<2 mm	2-64 mm	64-256 mm	>256 mm	Bed rock	Compaction	D90 (cm)	Type [5]	Quality [6]	Amount (m^2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [7]	Good holding pool [8]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [9]	Access [10]	Length (m)	Channel Disturbances [11]	Barriers [12]
Skagit River	S1	6089	R	90	34	1.1	0.5	0.60	1.90	80.0	45.0	1530	0	50	50	0	0	L	8	AR	H	918						2	0	2	0	1.1	0	0	0	0	1.1	0				DW	N
Skagit River	S1	6123	G	89	406	0.2	0.85	0.60	1.45	53.0	49.0	19894	0	55	45	0	0	M	8	AR	M	12732						11	0	6	2	0.1	0	2	25		27.1	5				DW, PD	N
Skagit River	S1	6529	P	88	190	0.0	1.20	0.65	1.85	55.0	35.0	6650	2	58	40	0	0	M	8	AR	M	4389	1.50	0.45	1.05	W		10	2	4	2	0.2	0	0	80	0	80.2	6				MC, MB, PD, DW	N
Skagit River	S1	6719	R	87	58	0.9	0.45	0.60	1.05	68.0	52.0	3016	0	60	40	0	0	M	7	AR	M	2051						4	0	0	2	0.1	0	0	0	0	0.1	3				PD	N
Skagit River	S1	6777	P	86	277	0.0	1.30	0.6	1.90	45.0	36.0	9972	10	30	30	30	0	M	10	AR	M	3590	2.20	0.5	1.70		Y	10	0	5	1	0.2	30	0	90	0	####	1				PD	N
Skagit River	S1	7054	G	85	307	0.2	0.50	0.6	1.10	40.0	35.0	10745	2	63	35	0	0	L	10	AR	H	7522						9	0	6	1	0.2	0	0	0	0	0.2	9				PD	N
Skagit River	S1	7361	P	84	317	0.0	1.25	0.6	1.85	42.0	26.0	8242	2	43	55	0	0	L	13	AR	H	4451	1.75	0.5	1.25	W		8	0	8	0	0.1	0	0	55	0	55.1	12					N
Skagit River	S1	7678	R	83	31	0.9	0.50	0.65	1.15	45.0	43.0	1333	0	40	60	0	0	L	10	AR	H	693						3	3	0	0	0.1	0	0	0	0	0.1	2					N
Skagit River	S1	7709	G	82	255	0.2	0.85	0.6	1.45	41.5	41.0	10455	2	30	66	2	0	M	13	AR	M	5562						4	0	4	0	0.0	2	0	0	0	2.0	10					N
Skagit River	S1	7964	P	81	119	0.0	1.05	0.65	1.70	33.0	26.0	3094	2	25	38	35	0	M	70	AR	M	1009	2.30	0.6	1.70	R	Y	5	0	3	0	0.1	35	2	30	0	67.1	15					N
Skagit River	S1	8083	G	80	662	0.3	0.60	0.6	1.20	37.0	36.0	23832	0	40	58	2	0	H	13	AR	L	12297	0.80					23	10	11	2	2.0	2	2	0	0	6.0	11				PD	N
Skagit River	S1	8745	R	79	111	0.9	0.50	0.5	1.00	39.0	33.0	3663	0	40	60	0	0	M	13	AR	M	1905						9	9	0	0	0.1	0	2	0	0	2.1	9					N
Skagit River	S1	8856	P	58	96	0.0	0.90	0.35	1.25	39.0	38.0	3648	2	18	35	45	0	M	100	AR	M	912	1.50	0.6	0.90	R	Y	3	0	3	0	0.1	45	0	60	0	####	0					N
Skagit River	S1	8952	R	57	51	0.8	0.47	0.4	0.87	34.0	36.0	1836	0	20	80	0	0	M	13	AR	M	661						0	0	0	0	0.0	0	0	0	0	0.0	0					N
Skagit River	S1	9003	P	56	119	0.0	1.20	0.4	1.60	59.0	51.0	6069	0	15	77	8	0	M	28	AR	M	1845	2.50	0.6	1.90	R	Y	4	0	4	0	1.6	8	0	20	0	29.6	3				WG, MB, MC, PD	N
Skagit River	S1	9122	R	55	129	1.0	0.60	0.4	1.00	46.0	30.0	3870	0	15	65	20	0	H	28	AR	L	1084						0	0	0	0	0.0	20	0	0	0	20.0	0					N
Skagit River	S1	9251	G	54	75	0.2	0.63	0.4	1.03	45.0	35.0	2625	2	28	55	15	0	M	28	AR	M	1024						0	0	0	0	0.0	15	0	0	0	15.0	0					N
Skagit River	S1	9326	P	5475	77	0.0	1.20	0.5	1.70	29.0	22.0	1694	2	55	35	8	0	M	22	AR	M	1050	2.40	0.6	1.80	R	Y	5	0	4	0	0.7	8	5	30	0	43.7	5	BC	P		PD	N
Skagit River	S1	9403	R	53	107	0.4	0.30	0.6	0.90	39.0	37.0	3959	0	30	68	2	0	L	13	AR	H	1726						0	0	0	0	0.0	2	0	0	0	2.0	8					N
Skagit River	S1	9510	G	52	158	0.2	0.95	0.5	1.45	47.0	46.0	7268	0	60	35	5	0	M	18	AR	M	4870	1.10			R		3	0	3	0	0.1	5	0	15	0	20.1	2				DW	N
Skagit River	S1	9668	R	51	100	0.4	0.50	0.6	1.10	31.0	21.0	2100	0	10	50	40	0	H	35	AR	L	420						0	0	0	0	0.0	40	0	0	0	40.0	0				MB, MC, DW	N
Skagit River	S1	9768	G	50	94	0.3	0.90	0.6	1.50	55.0	37.0	3478	5	30	35	30	0	M	35	AR	M	1287	1.05			R	Y	2	0	0	0	0.0	30	0	0	0	30.0	2	SC	G		MB, MC, PD	N
Skagit River	S1	9862	R	49	78	0.5	0.50	0.6	1.10	49.0	32.0	2496	0	10	40	50	0	H	35	AR	L	449						2	0	0	0	0.0	50	0	0	0	50.0	5				PD	N
Skagit River	S1	9940	P	48	147	0.0	0.90	0.8	1.70	41.0	27.0	3969	0	10	50	40	0	H	35	AR	L	794	2.10	0.44	1.66	R	Y	7	0	5	0	0.4	40	0	60	0	####	0				PD, EB	N
Skagit River	S1	10087	R	47	161	0.8	0.44	0.8	1.24	35.0	32.0	5152	2	58	40	0	0	L	10	AR	H	3400						6	0	3	0	0.2	0	0	0	0	0.2	6	SC	G	50	WG, MB, PD, EB	N
Skagit River	S1	10248	G	46	530	0.3	0.60	0.8	1.40	32.0	32.0	16960	2	53	40	5	0	M	40	AR	M	10346	0.90					13	2	9	0	0.1	5	2	2	0	9.1	13				PD	N
Skagit River	S1	10778	R	45	93	0.0	0.60	0.8	1.40	30.0	26.0	2418	0	5	25	70	0	H	40	AR	L	242						8	0	7	0	0.3	70	1	0	2	73.3	2				PD	N
Skagit River	S1	10871	P	44	47	0.9	0.80	0.35	1.15	40.0	40.0	1880	5	20	55	30	0	H	30	AR	L	583	0.90	0.6	0.30	R	Y	0	0	0	0	0.0	30	2	0	0	32.0	2	BC	G	50		N
Skagit River	S1	10918	R	43	107	1.1	0.85	0.5	1.35	40.0	30.0	3210	0	20	60	20	0	H	30	AR	H	1027						4	0	2	0	3.1	20	0	0	0	23.1	0	SC	G	50	WG, MB, MC, PD	N
Skagit River	S1	11025	G	42	154	0.2	0.70	0.5	1.20	44.0	30.0	4620	2	53	45	0	0	M	10	M	M	2864	1.50					5	0	4	1	0.1	0	0	3	0	3.6	0					N
Skagit River	S1	11179	P	41	108	0.0	1.08	0.4	1.48	43.0	30.0	3240	2	63	35	0	0	L	10	AR	H	2268	1.75	0.6	1.15	W		12	0	9	0	1.8	0	0	30	0	31.8	3				DW, PD	N
Skagit River	S1	11287	G	40	181	0.2	0.80	0.5	1.30	41.0	25.0	4525	2	28	68	2	0	H	18	AR	L	1882	0.80					9	3	3	0	0.6	2	0	0	0	2.6	6				WG, MB,MC,PD,DW	N
Skagit River	S1	11468	R	38	59	0.9	0.20	0.5	0.70	76.0	61.0	3599	0	58	40	2	0	M	20	AR	M	2375						14	0	2	0	0.4	2	2	0	0	4.4	3				WG,MB,JM, DW	N
Skagit River	S1	11527	P	35	250	0.0	0.80	0.5	1.30	61.0	56.0	14000	0	60	25	15	0	M	25	AR	M	9100	1.75	0.6	1.15	R	Y	14	0	2	2	0.5	15	2	45	0	62.5	12				MB, PD	N
Skagit River	S1	11777	R	34	307	1.0	0.60	0.5	1.10	54.0	24.0	7368	0	70	30	0	0	L	10	AR	H	5600						31	0	3	1	0.2	0	0	0	0	0.2	2				WG, DW, PD	N
Skagit River	S1	12084	P	33	93	0.0	1.05	0.5	1.55	51.0	26.0	2418	0	60	40	0	0	M	10	AR	M	1644	2.50	0.5	0.20	W	Y	49	0	9	0	8.4	0	2	65	0	75.4	2				WG, EB, PD	N
Skagit River	S1	12177	R	32	32	0.5	0.50	0.5	1.00	53.0	34.0	1088	0	55	45	0	0	M	10	AR	M	696						0	0	0	0	0.0	0	0	0	0	0.0	0				WG, EB, PD	N
Skagit River	S1	12209	P	31	48	0.0	0.85	0.5	1.35	59.0	21.0	1008	0	55	45	0	0	M	10	AR	M	645	1.20	0.7	0.50	W	Y	90				31.0	0	0	90	0	####	0				WG, JM, EB, PD	N
Skagit River	S1	12257	G	30	59	0.5	0.70	0.5	1.20	50.0	24.0	1416	0	30	70	0	0	M	10	AR	M	623						19	0	0	0	0.0	0	0	0	0	0.0	0				WG, JM, EB, PD	N
Skagit River	S1	12316	R	29	68	1	0.40	0.4	0.80	50.0	24.0	1632	0	30	68	2	0	M	10	AR	M	712						24	0	4	4	0.6	2	0	0	0	2.6	0				WG, JM, EB, PD	N
Skagit River	S1	12384	G	28	188	0.2	0.50	0.3	0.80	47.0	34.0	6392	0	30	68	2	0	M	10	AR	M	2787						18	12	6	0	0.2	2	0	0	0	2.2	6	SL	G		DW	N
Skagit River	S1	12572	P	27	129	0.0	0.90	0.4	1.30	42.0	35.0	4515	0	73	25	2	0	L	10	AR	H	3522	1.76	0.45	1.31	R		8	0	1	2	0.1	2	0	50	0	52.1	0				DW, PD	N
Skagit River	S1	12701	R	26	142	0.3	0.45	0.5	0.95	44.0	32.0	4544	0	79	20	1	0	L	10	AR	H	3772						11	0	1	1	0.4	1	0	0	0	1.4	0				WG, JM, DW, PD	N
Skagit River	S1	12843	P	25	250	0.0	1.25	0.6	1.15	51.0	49.0	12250	0	60	38	2	0	L	11	AR	H	8281	1.50	0.45	1.05	R		7	0	2	5	0.4	2	0	25	0	27.4	4				76.47058824	N
Skagit River	S1	13093	G	24	303	0.1	0.45	0.6	2.57	44.0	31.0	9393	0	60	38	2	0	L	12	AR	H	6350						6	0	0	2	0.1	2	0	0	0	2.1	13				PD	N
Skagit River	S1	13396	P	23	49	0.0	0.87	0.6	1.47	65.0	27.0	1323	2	43	53	2	0	M	12	AR	M	709	1.50	0.8	0.70	R		0	0	0	0	2.0	2	0	0	0	4.0	2				DW	N

Table A1. Detailed habitat descriptions for selected reaches in Skagit watershed.

								Bank height (m)		Mean Width (m)			Percent bed material (range in mm)							Spawning Gravel			Pools Only					Functional LWD Tally					Cover							Off-channel habitat					
Sub Basin	Reach	Reach location (m) [1] SampleDW Fraction [2]	Habitat Type [2]	Waypoint (WP) [3]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bankfull height (m)	Bankfull depth (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m2) [4]	<2 mm	2-64 mm	64-256 mm	>256 mm	Bed rock	Compaction	D90 (cm)	Type [5]	Quality [6]	Amount (m2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [7]	Good holding pool [8]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [9]	Access [10]	Length (m)	Channel Disturbances [11]	Barriers [12]
Skagit River	S1	13445	G	22	113	0.1	0.80	0.6	1.40	50.0	31.0	3503	0	25	70	5	0	L	13	AR	H	1366						0	0	0	0	2.0	5	0	0	0	7.0	2				EB	N
Skagit River	S1	13558	R	21	77	0.3	0.55	0.5	1.05	70.0	20.0	1540	2	38	58	2	0	L	11	AR	H	764						0	0	0	0	0.0	2	0	0	0	2.0	3				EB, DW	N
Skagit River	S1	13635	P	20	114	0.0	1.97	0.5	2.47	70.0	25.0	2850	2	38	58	2	0	L	11	AR	H	1414	2.50	0.25	1.25	R		10	0	3	0	0.3	2	0	30	0	32.3	2				PD, DW	N
Skagit River	S1	13749	R	19	59	0.4	0.25	0.5	0.75	42.0	35.0	2065	0	45	55	0	0	L	11	AR	H	1156						2	0	2	0	0.1	0	0	0	0	0.1	11				DW	N
Skagit River	S1	13808	P	18	352	0.0	1.35	0.5	1.85	42.0	41.0	14432	2	43	53	2	0	L	11	AR	H	7736	1.50	0.65	0.85	R		12	0	3	0	0.0	2	0	40	0	42.0	2				PD	N
Skagit River	S1	14160	G	17	132	0.3	0.80	0.65	1.45	28.0	27.0	3564	0	40	60	0	0	M	13	AR	M	1853						9	0	3	0	0.1	0	0	0	0	0.1	15					N
Skagit River	S2	14292	R	16	106	0.5	0.50	0.6	1.10	43.0	21.0	2226	0	40	60	0	0	M	13	AR	M	1158						3	0	2	1	0.3	0	0	0	0	0.3	4.8				DW	N
Skagit River	S2	14398	P	15	215	0.0	1.20	0.6	1.80	34.0	33.0	7095	0	60	38	2	0	L	8	AR	H	4796	1.50	0.47	1.03	R		13	0	6	0	0.1	2	2	10	0	14.1	9.1				PD, DW	N
Skagit River	S2	14613	R	14	325	0.7	0.47	0.6	1.07	49.0	24.0	7800	0	55	45	0	0	M	10	AR	M	4992						1	0	0	1	0.6	0	0	0	0	0.6	0				WG, DW, EB	N
Skagit River	S2	14938	P	13	52	0.0	1.36	0.6	1.96	33.0	20.0	1040	2	63	30	5	0	L	18	AR	H	718	1.60	0.53	1.07	R		0	0	0	0	2.0	5	5	35	0	47.0	6.1	SC	G	90	EB	N
Skagit River	S2	14990	R	12	224	0.8	0.53	0.6	1.13	33.0	31.0	6944	0	55	43	2	0	L	15	AR	H	4416						7	0	4	3	0.6	2	2	0	0	4.6	2				EB	N
Skagit River	S2	15214	P	11	210	0.0	1.25	0.6	1.85	37.0	33.0	6930	10	53	35	2	0	M	12	AR	M	4158	1.60	0.6	1.00	R		2	0	0	0	0.0	2	2	45	0	49.0	9.1				DW, PD	N
Skagit River	S2	15424	G	10	83	0.2	0.67	0.6	1.27	38.0	29.0	2407	2	63	33	2	0	M	12	AR	M	1675						2	0	0	2	0.7	2	0	0	0	2.7	5.3				DW	N
Skagit River	S2	15507	R	9	136	0.3	0.50	0.6	1.10	38.0	29.0	3944	0	70	30	0	0	L	8	AR	H	2997						11	4	0	0	2.2	0	2	0	0	4.2	6.7				PD	N
Skagit River	S2	15643	P	1000	154	0.0	1.02	0.6	1.62	38.0	26.0	4004	0	65	35	0	0	L	15	AR	H	2883	1.30	0.48	0.82	R		7	0	4	0	2.1	0	0	50	0	52.1	6.6				PD, DW	N
Skagit River	S2	15797	R	1001	233	0.2	0.48	0.6	1.08	35.0	31.0	7223	2	40	58	0	0	L	13	AR	H	3727						29	0	20	0	0.5	0	0	0	0	2.1	14				PD, DW	N
Skagit River	S2	16030	G	1002	196	0.1	0.54	0.6	1.14	37.0	32.0	6272	0	65	35	0	0	L	10	AR	H	4516						17	0	3	0	0.3	0	0	0	0	0.3	14				PD	N
Skagit River	S2	16226	P	1003	119	0.0	1.36	0.6	1.96	45.0	33.0	3927	2	20	74	2	2	L	13	AR	H	1367	1.55	0.39	1.16	R		2	0	1	0	0.1	2	0	70	0	72.1					PD	N
Skagit River	S2	16345	R	1004	39	0.8	0.39	0.5	0.89	41.0	18.0	702	2	15	82	1	0	M	13	AR	M	220						4	0	2	0	0.3	1	0	0	0	1.3	4.9				PD, DW	N
Skagit River	S2	16384	G	1005	154	0.2	0.62	0.6	1.22	38.0	33.0	5082	2	15	82	1	0	M	13	AR	M	1596						15	0	6	0	0.2	1	0	0	0	1.2	5.3				PD	N
Skagit River	S2	16538	P	1006	109	0.0	1.22	0.6	1.82	29.0	24.0	2616	2	15	58	25	0	H	33	AR	L	696	1.50	0.43	1.07	R	Y	0	0	0	0	0.0	25	0	40	0	65.0	2					N
Skagit River	S2	16647	R	1007	53	0.5	0.43	0.55	0.98	39.0	33.0	1749	0	15	82	3	0	M	13	AR	M	549						1	0	0	0	0.0	3	0	0	0	3.0	2				PD, DW	N
Skagit River	S2	16700	P	1008	105	0.0	0.83	0.5	1.33	39.0	23.0	2415	2	30	68	0	0	M	13	AR	M	1053	0.90	0.54	0.44	R		3	0	0	0	0.5	0	2	0	0	2.5	5				DW	N
Skagit River	S2	16805	R	1009	20	0.9	0.54	0.6	1.14	36.0	31.0	620	2	33	63	2	0	M	13	AR	M	283						5	0	3	0	0.7	2	2	0	0	4.7	2				PD, DW	N
Skagit River	S2	16825	G	1010	293	0.3	0.70	0.55	1.25	36.0	33.0	9669	2	33	63	2	0	H	13	AR	L	4409						11	0	0	0	0.0	2	2	0	0	4.0	2				PD	N
Skagit River	S2	17118	P	1011	124	0.0	1.22	0.5	1.72	32.0	26.0	3224	5	15	70	10	0	H	25	AR	L	935	1.50	0.56	0.94	R		1	0	0	0	0.0	10	0	60	0	70.0	2				PD	N
Skagit River	S2	17242	R	1012	62	0.9	0.56	0.6	1.16	31.0	26.0	3224	2	15	78	5	0	H	25	AR	L	987						2	0	0	0	0.0	5	0	0	0	5.0	2				PD, DW	N
Skagit River	S2	17304	G	1013	100	0.5	0.91	0.5	1.41	32.0	28.0	1736	2	20	66	12	0	H	30	AR	L	576	1.02					4	0	2	0	0.1	12	2	2	0	16.1	2				PD	N
Skagit River	S2	17404	R	1014	96	0.7	0.31	0.5	0.81	27.0	22.0	2112	2	20	68	10	0	M	30	AR	M	710						5	0	1	3	3.0	10	0	0	2	15.0	2				EB, PD	N
Skagit River	S2	17500	G	1015	125	0.8	0.49	0.35	0.84	32.0	23.0	2875	5	25	58	12	0	M	30	AR	M	1052						5	0	4	1	0.4	12	5	0	0	17.4	2				EB	N
Skagit River	S2	17625	P	1016	68	0.0	1.18	0.5	1.68	21.0	16.0	1088	0	8	80	12	0	M	30	AR	M	261	1.30	0.28	1.02	R	Y	58	28	34	6	40.0	12	0	50	0	####	0	SC	G		JM	N
Skagit River	S2	17693	R	1017	83	0.9	0.28	0.65	0.93	40.0	21.0	1743	0	8	80	12	0	M	30	AR	M	418						3	0	0	0	0.0	12	2	0	0	14.0	2	SC	G		MB, DW, PD	N
Skagit River	S2	17776	P	1018	61	0.0	1.67	0.4	2.07	27.0	19.0	1159	5	63	30	2	0	L	12	AR	H	204	2.01	0.27	1.74	R	Y	188	67	56	29	36.2	2	2	65	0	####	0				JM, EB, PD, DW	N
Skagit River	S2	17837	R	1019	91	0.8	0.27	0.7	0.97	38.0	32.0	2912	2	5	78	15	0	M	27	AR	M	600						11	0	6	3	1.3	15	0	0	0	16.3	0				PD, DW	N
Skagit River	S2	17928	P	1020	72	0.0	0.68	0.7	1.38	35.5	31.0	2232	5	67	20	8	0	L	22	AR	H	1585	1.10	0.4	0.70	R		3	0	1	2	0.5	8	0	0	0	8.5	4				DW	N
Skagit River	S2	18900	R	1022	330	1.2	0.65	-0.1	0.53	29.6	30.0	9900	2	10	73	15	0	H	50	AR	L	2435						0	0	0	0	0.0	15	0	0	0	15.0	12					328 N
Skagit River	S2	19230	R		857	2.0	0.80	-0.1	0.72	19.4	20.0	17140	2	10	48	40	0	H	80	AR	L	3359						21	5	11	2	0.3	40	0	0	0	40.3	21				PD	N
Skagit River	S2	20087	P	1023	109	0.0	0.53	-0.2	0.38	25.5	29.0	3161	5	35	58	2	0	H	13	AR	L	1473	1.60	0.85	0.75	R		1	0	1	0	0.1	2	0	20	0	22.1	2				EB, DW	N
Skagit River	S2	20196	R	1024	174	0.9	0.60	-0.1	0.52	22.5	23.0	4002	2	20	76	2	0	H	15	AR	L	1409						7	0	0	0	0.0	2	0	0	0	2.0	13				PD	N
Skagit River	S2	20370	G	1025	160	0.3	0.65	-0.1	0.57	26.8	27.0	4320	15	20	63	2	0	H	13	AR	L	1408						2	0	0	0	0.0	2	0	0	0	2.0	26				PD	N
Skagit River	S2	20530	R	1026	84	2.0	0.70	-0.1	0.62	25.2	26.0	2184	0	5	65	30	0	H	90	AR	L	393						4	0	0	0	0.0	30	0	0	0	30.0	36				PD	N
Skagit River	S2	20614	G	1027	68	0.2	0.85	-0.1	0.77	24.5	25.0	1700	5	8	67	20	0	H	70	AR	L	364						2	0	0	0	0.0	20	0	0	0	20.0	44				PD	N
Skagit River	S2	20682	R	1028	81	1.1	0.80	-0.1	0.75	25.0	26.0	2106	5	8	67	20	0	H	70	AR	L	451						5	0	0	0	0.0	20	0	0	0	20.0	40	AV	G	400	PD	N
Skagit River	S2	20763	G	1029	137	0.3	0.75	-0.1	0.70	24.0	25.0	3425	10	58	30	2	0	H	12	AR	L	2192						4	0	0	0	0.0	2	0	0	0	2.0	40				PD	N
Skagit River	S3	20900	O	1030	796						25.0	19900	10	50	40	0	0	H	9	AR	L	11542																				WG,MB,**JM**,MC,PD	N
Skagit River	S3	30959	O	1032	95				0.00			0	10	50	40	0	0	H	9	AR	L	0																				WG	U

Table A1. Detailed habitat descriptions for selected reaches in Skagit watershed.

								Bank height (m)		Mean Width (m)			Percent bed material (range in mm)						Spawning Gravel			Pools Only					Functional LWD Tally					Cover						Off-channel habitat				
Sub Basin	Reach	Reach location (m) [1] SampliDW Fraction 2	Habitat Type [2]	Waypoint (WP) [3]	Habitat length (m)	Gradient (%)	Mean depth (m)	Bankfull height (m)	Bankfull depth (m)	Bankfull width (m)	Wetted width (m)	Rearing Habitat Area (m2) [4]	<2 mm	2-64 mm	64-256 mm	>256 mm	Bed rock	Compaction	D90 (cm)	Type [5]	Quality [6]	Amount (m2)	Maximum depth (m)	Crest depth (m)	Residual depth (m)	Control element [7]	Good holding pool [8]	Total LWD tally	10 to 20 cm	20 to 50 cm	>50 cm	Woody debris	Boulder	Cutbank	Deep pool	Instream veg.	Total instream cover	Overhanging veg.	Type [9]	Access [10]	Length (m)	Channel Disturbances [11]	Barriers [12]
Skagit River	S3	31054	P	622	37	0.0	0.60	0.3	0.90		17.0	629	10	50	40	0	0	H	9	AR	L	365	0.80	0.4	0.40	W	Y					50.0	0	0		0	50.0	0	AV	P	160	JM	U
Skagit River	S3	31091	R	1034	23	0.4	0.30	0.3	0.60	30.0	9.0	207	10	50	40	0	0	H	9	AR	L	120						0	0	0	0	0.0	0	0	0	0	0.0						N
Skagit River	S3	31114	G	1035	107	0.3	0.75	0.3	1.05	30.0	9.0	963	10	50	40	0	0	H	9	AR	L	559						5	0	0	1	0.5	0	0	0	0	0.5	2				PD	N
Skagit River	S3	31221	R	1036	48	0.4	0.60	0.3	0.90	29.0	9.0	432	0	60	40	0	0	M	9	AR	M	294						0	0	0	0	0.0	0	0	0	0	0.0	7				DW	N
Skagit River	S3	31269	P	1037	65	0.0	0.80	0.3	1.10	24.0	12.0	780	0	50	46	2	2	M	9	AR	M	462	1.40	0.32	1.08	R		2	0	0	1	0.4	2	0	15	0	17.4	0				DW, PD	N
Skagit River	S3	31334	R	1038	50	0.8	0.30	0.4	0.70	29.0	20.0	1000	0	40	59	1	0	M	12	AR	M	518						0	0	0	0	0.0	1	0	0	0	1.0	0				MB, MC	N
Skagit River	S3	31384	P	1039	15	0.0	0.70	0.4	1.10	27.0	21.0	315	20	50	30	0	0	M	10	AR	M	176	1.50	0.4	1.10	W	Y	27	9	10	4	36.6	0	0	30	0	66.6	8				JM, PD	N
Skagit River	S3	31399	G	1040	21	0.4	0.40	0.4	0.80	25.0	18.0	378	0	40	60	0	0	M	12	AR	M	197						10	6	4	0	5.1	0	0	0	0	5.1	16				JM	N
Skagit River	S3	31420	P	1041	18	0.0	0.75	0.35	1.10	17.0	12.0	216	0	55	45	0	0	L	10	AR	H	138	1.00	0.4	0.60	R		3	0	1	0	3.6	0	0	40	0	43.6	5				PD	N
Skagit River	S3	31438	R	1042	63	0.8	0.40	0.35	0.75	37.0	15.0	945	0	55	45	0	0	M	11	AR	M	605						19	0	2	1	0.7	0	0	0	0	0.7	0	AV	G		WG,MB,MC,PD	N
Skagit River	S3	31501	P	1043	47	0.0	0.85	0.3	1.15	50.0	26.0	1222	0	40	60	0	0	L	10	AR	H	635	1.80	0.35	1.45	W	Y	40	13	22	5	17.9	0	0	30	0	47.9	0	AV	G		JM	N
Skagit River	S3	31548	R	1044	38	1.3	0.35	0.3	0.65	43.0	35.0	1330	15	15	70	0	0	H	13	AR	L	386						0	0	0	0	0.0	0	0	0	0	0.0	5				WG	N
Skagit River	S3	31586	G	1045	78	0.4	0.70	0.4	1.10	36.0	35.0	2730	15	45	40	0	0	H	10	AR	L	1447						0	0	0	0	0.0	0	0	0	0	0.0	8.3					N
Skagit River	S3	31664	R	1046	56	0.5	0.40	0.35	0.75	31.0	31.0	1736	15	45	40	0	0	H	10	AR	L	920						0	0	0	0	0.0	0	2	0	0	2.0	6.5					N
Skagit River	S3	31720	P	1047	55	0.0	0.95	0.4	1.35	27.0	17.0	935	10	66	20	2	2	H	10	AR	L	655	1.90	0.55	1.35	R		0	0	0	0	0.0	2	0	40	0	42.0	16					N
Skagit River	S3	31775	R	1048	74	1.1	0.55	0.5	1.05	42.0	26.0	1924	0	20	70	10	0	H	25	AR	L	654						0	0	0	0	0.0	10	0	0	0	10.0	0				EB	N
Skagit River	S3	31849	P	1049	28	0.0	0.90	0.4	1.30	35.0	26.0	728	0	40	60	0	0	H	13	AR	L	379	1.70	0.45	1.25	R		9	0	5	2	2.7	0	0	50	0	52.7	0				PD	N
Skagit River	S3	31877	R	1050	32	0.5	0.45	0.4	0.85	50.0	26.0	832	0	40	60	0	0	H	13	AR	L	433						0	0	0	0	0.0	0	0	0	0	0.0	0					N
Skagit River	S3	31909	G	1051	51	0.4	0.65	0.4	1.05	50.0	26.0	1326	2	45	53	0	0	H	10	AR	L	737						0	0	0	0	0.0	0	0	0	0	0.0	0					N
Skagit River	S3	31960	R	1052	48	0.6	0.60	0.4	1.00	36.0	21.0	1008	0	25	73	2	0	H	13	AR	L	399						0	0	0	0	0.0	2	0	0	0	2.0	3					N
Skagit River	S4	32008	P	1053	46	0.0	0.85	0.4	1.25	37.0	19.0	874	2	68	30	0	0	H	10	AR	L	647	1.70	0.5	1.20	R		3	0	0	18	4.6	0	0	20	0	24.6	5				DW	N
Skagit River	S4	32054	R	1054	42	0.8	0.50	0.4	0.90	46.0	19.0	798	0	40	60	0	0	H	12	AR	L	415						2	0	2	0	0.3	0	0	0	0	0.3	2				DW	N
Skagit River	S4	32096	G	1055	67	0.2	0.40	0.5	0.90	37.0	23.0	1541	2	63	35	0	0	M	12	AR	M	1079						11	0	5	0	1.1	0	0	0	0	1.1	0				PD	N
Skagit River	S4	32163	P	1056	45	0.0	0.85	0.4	1.25	35.0	21.0	945	2	65	35	0	0	M	12	AR	M	680	1.30	0.5	0.80	R		4	0	1	0	0.4	0	0	30	0	30.4	3				PD	N
Skagit River	S4	32208	R	1057	122	0.6	0.50	0.35	0.85	30.0	30.0	3660	2	20	63	15	0	H	30	AR	L	1193						3	0	0	0	0.0	15	0	0	0	15.0	6				PD	N
Skagit River	S4	32330	G	1058	85	0.2	0.75	0.2	0.95	25.0	21.0	1785	2	25	65	8	0	H	22	AR	L	678						1	0	1	0	0.2	8	0	0	0	8.2	12					N
Skagit River	S4	32415	R	1059	51	0.5	0.53	0.35	0.88	25.0	25.0	1275	0	15	60	15	0	H	45	AR	L	344						0	0	0	0	0.0	15	0	0	0	15.0	8					N
Skagit River	S4	32466	G	1060	234	0.4	0.60	0.35	0.95	25.0	25.0	5850	2	30	50	20	0	H	40	AR	L	2340						9	0	6	0	0.3	20	2	0	1	23.3	16				PD	N
Skagit River	S4	32700	R	1061	98	1.1	0.55	0.35	0.90	32.0	28.0	2744	10	30	30	30	0	H	60	AR	L	988						11	0	4	1	0.3	30	0	0	0	30.3	12				PD	N
Skagit River	S4	32798	G	1062	85	0.3	0.70	0.55	1.25	29.0	25.0	2125	2	20	79	1	0	M	13	AR	M	761						0	0	0	0	0.0	1	0	0	0	1.0	6					N
Skagit River	S4	32883	R	1063	81	1.0	0.15	0.45	0.60	54.0	52.0	4212	2	43	53	2	0	M	18	AR	M	2258						4	0	1	0	0.2	2	0	0	0	2.2	6				WG,MB,MC,PD	N
Skagit River	S4	32964	P	1064	64	0.0	0.85	0.3	1.15	29.0	21.0	1344	10	50	40	0	0	M	11	AR	M	780	1.30	0.7	0.60	R		2	0	1	0	0.1	0	0	15	0	15.1	6	WL	P	25		N
Skagit River	S4	33028	R	1065	20	1.5	0.70	0.5	1.20	27.0	21.0	420	0	55	40	5	0	M	15	AR	M	265						0	0	0	0	0.0	5	0	0	0	5.0	6					N

[1] Reach location denotes the 3 N
[2] Habitat types are: pool (P), . N
[3] Waypoint or GPS location N
[4] Habitat area is calculated for reariDW salmonids as leDWth x wetted width. N
[5] SpawniDW gravel type codes are: suitable for anadromous salmon (A), suitable for resident trout and char (R), suitable for both salmon and trout (AR), not suitable (N). N
6 SpawniDW gravel quality codes are: low (L), moderate (M), high (H), none (N). N
[7] Control element codes are: boulder (B), bedrock (R), wood (W), beaver dam (D), other (O). N
[9] A pool is classified as a good adult holdiDW pool (Y) if the product of the maximum depth times the total overhead cover is >= 30. Overhead cover is the sum of LWD, boulder, cutbank and overhaDWiDW vegetation. N
[10] Off-channel habitat codes are: alcove (ALC), side channel (SC), slough (SL), pond (PD), wetland (WL), other (O). N
[11] Off-channel access codes are: no access (N), high flow only (P), most flows (G). N
[12] Disturbance indicator codes are: scour (SC), unvegetated bar (DW), sediment wedge (WG), middle-channel bars (MB), extensive riffle zone (LR), low pool frequency (FP), multiple channels (MC), erodible banks (EB), log jams (JM). N
backchannels (BC), LWD parallel to bank (PD), LWD jams (JM), avulsion (AV), >50% silt content (E), other (O). N
[13] Potential barrier codes are: none (N), log jam (X), falls > 2 m (F), culvert (CV), bridge (BR), beaver dam (BD), land slide or bank failure (LS), cascade or chute (C), unknown (U), other (O). N

Table A2. Area surveyed and percentage of each primary habitat type in Skagit watershed.

Reach Number	Surveyed Area (m^2)	Percent Habitat Type				
		Pool	Riffle	Glide	Cascade	Other
S1	357952	37.5	22.0	40.5	0.0	0.0
S2	152848	25.4	50.0	24.5	0.0	0.0
S3	39536	12.2	23.8	13.7	0.0	50.3
S4	27573	11.5	47.5	41.0	0.0	0.0

Table A3. Summary of cover attributes for Skagit River watershed.

Reach Number	Habitat Unit	Percent Instream Cover Types						
		LWD	Boulder	Undercut Banks	Deep Pool	Instream Vegetation	Total Percent Instream Cover	Overhanging Vegetation
S1	P	1.9	11.4	0.4	48.7	0.0	62.4	4.4
S1	R	0.5	7.0	0.2	0.0	0.0	7.8	2.9
S1	G	0.5	3.2	0.8	4.8	0.0	9.4	7.4
S1	C	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S1	All	1.0	7.1	0.5	20.2	0.0	28.9	5.3
S2	P	2.6	4.6	1.0	35.6	0.0	43.8	5.1
S2	R	0.5	14.0	0.3	0.0	0.1	15.1	11.3
S2	G	0.2	3.6	1.0	0.1	0.0	4.8	12.7
S2	C	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S2	All	0.9	9.1	0.7	9.1	0.0	19.9	10.1
S3	P	14.1	0.7	0.0	29.1	0.0	43.9	3.8
S3	R	0.1	2.4	0.4	0.0	0.0	2.8	2.5
S3	G	0.4	0.0	0.0	0.0	0.4	0.4	5.7
S3	C	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S3	All	1.8	0.6	0.1	3.5	0.1	6.1	1.9
S4	P	1.4	0.0	0.0	20.9	0.0	22.3	4.8
S4	R	0.1	12.7	0.0	0.0	0.0	12.9	7.2
S4	G	0.4	11.8	1.0	0.0	0.5	13.7	11.3
S4	C	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S4	All	0.4	10.9	0.4	2.4	0.2	14.3	8.6

Table A4. Summary of LWD attributes for study area reaches.

Reach Number	Habitat Unit	Surveyed Length (m)	Mean Bankfull Width (m)	Number of Functional LWD [1]				Total All LWD	Recommended Number of LWD Pieces [2]		
				<20 cm	20-50 cm	>50 cm	Total		10m x 0.35m pieces	10m x 0.5m pieces	10m x 0.75m pieces
S1	All	10710	53.5	77	376	37	490	872	4463	2186	969
S2	All	5708	33.1	104	167	53	324	459	2378	1165	517
S3	All	1845	29.5	28	65	33	126	165	769	377	167
S4	All	1040	33.2	0	21	19	40	50	433	212	94

[1] To be termed functional, a piece of LWD most be either providing cover, a control element for a pool or modifies channel morphology.

[2] Modified from Cederholm et al. (1997) such that recommended volume of LWD per 100 m of stream is 80 m^3 for streams with less than or equal to 10 m bankfull width and 40 m^3 for streams with greater than 10 m bankfull width.

Table A5. Summary of bed material and spawning attributes for study area reaches.

Reach Number	Bed Material Composition (%)						
	<2 mm	2-64 mm	64-256 mm	>256 mm	Bedrock	Spawning Quantity (m^2) [1]	Spawning Quality [2]
S1	1	45	46	7	0	196234	Good
S2	3	33	55	9	0	67021	Good
S3	8	46	46	1	0	21619	Good
S4	3	35	52	11	0	12427	Good

[1] Value = (%gravels (2-64 mm) + 20 % cobbles (64-256 mm))*length*wetted width (surveyed area only).

[2] Poor is fines (<2 mm) >25%, Fair if fines >15% and uncompacted, Good if fines < =15% and uncompacted.

Table A6. Summary of known holding and spawning locations in Skagit watershed, by reach, location and species.

Reach Name	Holding (H) Spawning (S) Redds (R)	Reach Location [1] (m)	Waypoint Number	Habitat Type [2]	Survey Method [3]	Char No.	Char Frequency of Occurrence	ST/Rainbow No.	ST/Rainbow Frequency of Occurrence	Comment
S1	NO RECORD	1072	76	P						new pool since Oct 2003 flood
S1	H	1233	73	P	SN, T	3	FREQUENT	12+	FREQUENT	
S1	NO RECORD	1420	71	P						new pool since Oct 2003 flood
S1	H	1562	69	P	SN, T	4+	FREQUENT	300	FREQUENT	
S1	R	1812	66	R	T					
S1	NO RECORD	1855	65	P						new pool since Oct 2003 flood
S1	NO RECORD	1995	63	P						new pool since Oct 2003 flood
S1	H	3411	113	P	SN, T	1+	FREQUENT			
S1	H	4081	106	P	SN, T		FREQUENT			use logjam and boulders for overhead cove
S1	H	4829	100	P	SN, T	4+	3 OCCASIONS			
S1	H, S	4918	99	P	HELICOPTER					
S1	H	5391	96	P	SN, T		FREQUENT			holding in boulders and depth to1.25m
S1	H	5921	91	P	SN, T		FREQUENT			holding for smaller char
S1	H	6777	86	P	SN, T	20	FREQUENT	400	FREQUENT	depth, boulder and LWD cover
S1	H	7964	81	P	SN, T		FREQUENT			depth and boulder cover
S1	H	8083	80	G	SN, T		OCCASIONAL			holding today and once previously
S1	H	8856	58	P	SN, T		FREQUENT			hold in deep pool and rip rap from road
S1	H	9003	56	P	SN, T					cover of fallen balsam fir with branches
S1	H, S	9122	55	R	SN, T					riffle tail out
S1	H, S	9326	1067	P	SN, T	4+	ALL YEARS			deep pool under shade of cedar riparian
S1	R	10087	46	R	HELICOPTER					
S1	H	10871	43	P	SN, T		FREQUENT TO 2003			now infilled good holding previous to flood
S1	R	10918	42	R						
S1	R	11025	41	G						
S1	H	11179	40	P	SN, T	1	FREQUENT TO 2003			holding close to LWD prior to 2004
S1	H	11527	35	P	SN, T	1				
S1	R	11777	34	R	HELICOPTER					
S1	H	12084	33	P	SN, T		FREQUENT TO 2003			now infilling, holding previous to flood 200
S1	H	12209	31	P	SN, T	1	first holding now			logjam across channel here; blow out 2003
S1	H, R	12843	25	P	SN, T	1	holding now			two redds in 2002
S1	H	13808	18	P	SN, T		major holding pool			
S2	R	14398	15	P						
S2	R	16647	1007	R						wolman site
S2	H	17776	1018	P	SN, T	0		300		large logjam
S2	R	18377			T	1	1			
S3	S	23000			T		occasional			
S3	R	25400		R	T		occasional			
S3	S	28500		P	T	2	occasional			
S3	S	31221	1036	P	T	2	occasional			
S3	S	31269	1037	P	HELICOPTER					

Table A6. Summary of known holding and spawning locations in Skagit watershed, by reach, location and species.

Reach Name	Holding (H) Spawning (S) Redds (R)	Reach Location [1] (m)	Waypoint Number	Habitat Type [2]	Survey Method [3]	Char No.	Char Frequency of Occurrence	ST/Rainbow No.	ST/Rainbow Frequency of Occurrence	Comment
S3	R	31664	1045	R	T					
S3	H	31720	1046	P	SN	4+	on 4 surveys			
S4	H	32964	1063	P	SN	<4	on one survey	4+	always present	

Table A7. Riparian condition assessment results for Skagit watershed

Sub Basin	Reach	Reach Loc.[1]	Habitat Type[2]	Habitat Length[3]	Canopy Code[4]	Riparian LB		Riparian RB		Species		Impact Class LB		Impact Class RB	
						Type	Stage	Type	Stage	Dominant	Subdominant	Bank Stab.[5]	LWD[6]	Bank Stab.[5]	LWD[6]
Skagit River	S1	1036	G	36	1	N	IN	M	YF	alder/cedar	dw/ald/nb	H	H	M	M
Skagit River	S1	1072	P	55	1	S	SH	M	YF	alder/cedar	dw/ald/nb	M	M	M	M
Skagit River	S1	1127	R	64	1	S	SH	M	YF	alder/cedar	dw/ald/nb	M	M	M	M
Skagit River	S1	1191	G	42	1	S	SH	D	MF	CW/ald/WS	dw/ald/nb	M	M	M	M
Skagit River	S1	1233	P	133	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	1366	R	54	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	1420	P	68	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	1488	R	74	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	1562	P	71	1	N	IN	M	YF	alder/cedar	dw/ald/nb	H	H	M	M
Skagit River	S1	1633	G	125	0	N	IN	M	YF	alder/cedar	dw/ald/nb	H	H	M	M
Skagit River	S1	1758	P	54	1	N	IN	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	1812	R	43	1	N	IN	S	SH	alder/cedar	dw/ald/nb	H	H	H	H
Skagit River	S1	1855	P	55	1	N	IN	S	SH	alder/cedar	dw/ald/nb	H	H	H	H
Skagit River	S1	1910	R	85	1	M	YF	S	SH	alder/cedar	dw/ald/nb	L	L	H	H
Skagit River	S1	1995	P	31	1	C	MF	S	SH	alder/cedar	dw/ald/nb	L	L	H	H
Skagit River	S1	2026	G	159	1	C	MF	S	SH	alder/cedar	dw/ald/nb	L	L	H	H
Skagit River	S1	2185	R	33	1	C	MF	S	SH	alder/cedar	dw/ald/nb	L	L	H	H
Skagit River	S1	2218	G	65	1	M	YF	S	SH	alder/cedar	dw/ald/nb	L	L	H	H
Skagit River		2283	R	66											
Skagit River		2349	P	59											
Skagit River		2607	R	119											
Skagit River		2858	G	118											
Skagit River		3028	P	116											
Skagit River		3221	G	115											
Skagit River		3411	P	114											
Skagit River		3577	R	113											
Skagit River		3703	G	112											
Skagit River		3751	P	111											
Skagit River		3874	R	110											
Skagit River		3942	P	109											
Skagit River		3990	R	108											
Skagit River		4081	P	107											
Skagit River		4135	R	106											
Skagit River		4254	G	105											
Skagit River		4465	P	104											
Skagit River		4671	R	102											
Skagit River	S1	4829	P	89	2	M	YF	M	YF	alder/cedar	dw/ald/nb	L	L	L	L
Skagit River	S1	4918	P	303	0	M	YF	M	YF	alder/cedar	dw/ald/nb	M	M	M	M
Skagit River	S1	5221	R	91	1	M	MF	S	SH	alder/cedar	dw/ald/nb	L	L	H	H

Table A7. Riparian condition assessment results for Skagit watershed

Sub Basin	Reach	Reach Loc.[1]	Habitat Type[2]	Habitat Length[3]	Canopy Code[4]	Riparian LB		Riparian RB		Species		Impact Class LB		Impact Class RB	
						Type	Stage	Type	Stage	Dominant	Subdominant	Bank Stab.[5]	LWD[6]	Bank Stab.[5]	LWD[6]
Skagit River	S1	5312	G	79	1	M	YF	M	YF	alder/cedar	dw/ald/nb	M	M	L	L
Skagit River	S1	5391	P	121	1	M	YF	M	YF	alder/cedar	dw/ald/nb	L	L	L	L
Skagit River	S1	5512	R	30	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	5542	G	39	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	5581	P	167	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	L	L
Skagit River	S1	5748	R	173	1	S	SH	M	YF	alder/cedar	dw/ald/nb	H	H	M	M
Skagit River	S1	5921	P	168	1	M	MF	N	IN	alder/cedar	dw/ald/nb	M	M	H	H
Skagit River	S1	6089	R	34	0	M	YF	S	SH	alder/cedar	dw/ald/nb	M	M	H	H
Skagit River	S1	6123	G	406	0	M	YF	M	YF	alder/cedar	dw/ald/nb	M	M	M	M
Skagit River	S1	6529	P	190	1	M	YF	M	YF	alder/cedar	dw/ald/nb	L	L	L	L
Skagit River	S1	6719	R	58	1	M	YF	M	YF	alder/cedar	dw/ald/nb	L	L	L	L
Skagit River	S1	6777	P	277	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	7054	G	307	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	7361	P	317	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	7678	R	31	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	7709	G	255	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	7964	P	119	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	8083	G	662	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	8745	R	111	1	C	MF	C	MF	cedar/fir		L	L	L	L
Skagit River	S1	8856	P	96	1	S	SH	M	YF	alder/cedar	dw/ald/nb/cd	M	M	L	L
Skagit River	S1	8952	R	51	1	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	M	M	L	L
Skagit River	S1	9003	P	119	0	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	M	M	L	L
Skagit River	S1	9122	R	129	0	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	9251	G	75	1	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	9326	P	77	1	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	9403	R	107	0	M	YF	M	YF	alder/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	9510	G	158	1	M	YF	M	YF	alder/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	9668	R	100	0	M	YF	M	YF	alder/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	9768	G	94	1	M	MF	M	MF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	9862	R	78	1	M	MF	M	MF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	9940	P	147	1	M	YF	M	YF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	10087	R	161	1	M	YF	M	YF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	10248	G	530	1	M	YF	M	YF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	10778	R	93	1	M	YF	M	YF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	10871	P	47	1	M	YF	M	YF	cw/cedar	dw/ald/nb/cd	L	L	L	L
Skagit River	S1	10918	R	107	0	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	11025	G	154	0	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	11179	P	108	1	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	11287	G	181	1	S/N	SH/IN	M	YF	alder/cedar	dw/ald/nb/cd	H	H	L	L
Skagit River	S1	11527	P	250	1	M	YF	M	YF	alder/cedar	dw/ald/nb/cd	M	M	M	M

Table A7. Riparian condition assessment results for Skagit watershed

Sub Basin	Reach	Reach Loc.[1]	Habitat Type[2]	Habitat Length[3]	Canopy Code[4]	Riparian LB		Riparian RB		Species		Impact Class LB		Impact Class RB	
						Type	Stage	Type	Stage	Dominant	Subdominant	Bank Stab.[5]	LWD[6]	Bank Stab.[5]	LWD[6]
Skagit River	S1	11777	R	307	1	M	YF	M	YF	alder/cedar	dw/ald/nb/cd	M	M	M	M
Skagit River	S1	12084	P	93	1	M	YF	M	YF	alder/cedar	dw/ald/nb/cd	M	M	M	M
Skagit River	S1	12177	R	32	0	S/N	SH/IN	M	YF	cw/cedar/bpop	willow/ald	H	H	M	M
Skagit River	S1	12209	P	48	0	S/N	SH/IN	M	YF	cw/cedar	dw/ald/nb/cd	H	H	M	M
Skagit River	S1	12257	G	59	0	S/N	SH/IN	M	YF	cw/cedar	dw/ald/nb/cd	H	H	M	M
Skagit River	S1	12316	R	68	0	S/N	SH/IN	M	YF	cw/cedar	dw/ald/nb/cd	H	H	M	M
Skagit River	S1	12384	G	188	0	S/N	SH/IN	M	YF	cw/cedar	dw/ald/nb/cd	H	H	M	M
Skagit River	S1	12572	P	129	0	S/N	SH/IN	M	YF	cw/cedar	dw/ald/nb/cd	H	H	M	M
Skagit River	S1	12701	R	142	0	S/N	SH/IN	M	YF	cw/cedar	dw/ald/nb/cd	M	M	L	L
Skagit River	S1	12843	P	250	0	M	YF	M	YF	cw/cedar/bpop	willow/dw/ald/	M	M	M	M
Skagit River	S1	13093	G	303	0	M	YF	M	YF	cw/cedar/bpop	willow/dw/ald/	M	M	M	M
Skagit River	S1	13396	P	49	1	S/N	SH/IN	M	YF	cw/cedar	willow/dw/ald/	H	H	M	M
Skagit River	S1	13445	G	113	0	S/N	SH/IN	M	YF	cw/cedar	willow/dw/ald/	H	H	M	M
Skagit River	S1	13558	R	77	0	S/N	SH/IN	M	YF	cw/cedar	willow/dw/ald/	H	H	M	M
Skagit River	S1	13635	P	114	0	S/N	SH/IN	M	YF	cw/cedar	willow/dw/ald/	H	H	M	M
Skagit River	S1	13749	R	59	1	S/N	SH/IN	C	MF	cedar/fir	willow/dw/ald/	M	M	L	L
Skagit River	S1	13808	P	352	2	S/N	SH/IN	C	MF	cedar/fir	willow/dw/ald/	M	M	L	L
Skagit River	S1	14160	G	132	1	M	YF	C	MF	cedar/fir	dw/ald/cd	L	L	L	L
Skagit River	S2	14292	R	106	0	S/N	SH/IN	C	MF	cedar/fir	willow/dw/ald/	H	H	L	L
Skagit River	S2	14398	P	215	1	M	YF	C	MF	cedar/fir	dw/ald/cd	L	L	L	L
Skagit River	S2	14613	R	325	0	M	YF	C	MF	cedar/fir	dw/ald/cd	L	L	L	L
Skagit River	S2	14938	P	52	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	14990	R	224	0	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	15214	P	210	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	15424	G	83	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	15507	R	136	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	15643	P	154	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	15797	R	233	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16030	G	196	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16226	P	119	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16345	R	39	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16384	G	154	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16538	P	109	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16647	R	53	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16700	P	105	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16805	R	20	1	M	YF	M	YF	cedar/ald	willow	L	L	L	L
Skagit River	S2	16825	G	293	1	C	MF	C	MF	cedar/dfir	willow	L	L	L	L
Skagit River	S2	17118	P	124	2	C	MF	C	MF	cedar/dfir		L	L	L	L
Skagit River	S2	17242	R	62	1	C	MF	C	MF	cedar/dfir		L	L	L	L
Skagit River	S2	17304	G	100	2	C	MF	C	MF	cedar/dfir		L	L	L	L

Table A7. Riparian condition assessment results for Skagit watershed

Sub Basin	Reach	Reach Loc.[1]	Habitat Type[2]	Habitat Length[3]	Canopy Code[4]	Riparian LB		Riparian RB		Species		Impact Class LB		Impact Class RB	
						Type	Stage	Type	Stage	Dominant	Subdominant	Bank Stab.[5]	LWD[6]	Bank Stab.[5]	LWD[6]
Skagit River	S2	17404	R	96	2	M	YF	M	YF	cedar/ald	ald/willow/cd	L	L	L	L
Skagit River	S2	17500	G	125	2	M	YF	M	YF	cedar/ald	ald/willow/cd	L	L	L	L
Skagit River	S2	17625	P	68	0	M	YF	M	YF	cedar/ald	ald/willow/cd	M	M	M	M
Skagit River	S2	17693	R	83	1	M	YF	M	YF	cedar/ald	ald/willow/cd	M	M	M	M
Skagit River	S2	17776	P	61	0	M	YF	M	YF	cedar/ald	ald/willow/cd	M	M	M	M
Skagit River	S2	17837	R	91	0	M	YF	M	YF	cedar/ald	ald/willow/cd	M	L	M	L
Skagit River	S2	17928	P	72	1	M	YF	M	YF	cedar/ald	ald/willow/cd	M	L	M	L
Skagit River	S2	18900	R	330	1	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	19230	R	857	2	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20087	P	109	2	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20196	R	174	3	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20370	G	160	3	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20530	R	84	3	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20614	G	68	3	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20682	R	81	3	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S2	20763	G	137	3	C	MF	C	MF	cedar/hem/fir		L	L	L	L
Skagit River	S3	20900	O	796	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/map	M	M	M	M
Skagit River	S3	30959	O	95	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/map	M	M	M	M
Skagit River	S3	31054	P	37	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/maple	M	M	M	M
Skagit River	S3	31091	R	23	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/maple	M	M	M	M
Skagit River	S3	31114	G	107	1	S	SH	C	MF	cd/hem/sp/cw/ald	ald/dw/cd/maple	H	H	L	L
Skagit River	S3	31221	R	48	1	C	MF	S	SH	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	H	H
Skagit River	S3	31269	P	65	1	C	MF	S	SH	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	H	H
Skagit River	S3	31334	R	50	0	C	MF	S	SH	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	H	H
Skagit River	S3	31384	P	15	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	H	H
Skagit River	S3	31399	G	21	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	H	H
Skagit River	S3	31420	P	18	1	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	H	H
Skagit River	S3	31438	R	63	0	M	YF	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/maple	L	L	M	H
Skagit River	S3	31501	P	47	1	S	SH	C	MF	cd/hem/sp/cw/ald	ald/dw/cd/maple	M	H	L	L
Skagit River	S3	31548	R	38	1	S	SH	C	MF	cd/hem/sp/cw/ald	ald/dw/cd/hem	M	M	L	L
Skagit River	S3	31586	G	78	1	S	SH	M	YF	cd/hem/sp/cw/ald	ald/dw/cd/hem	M	M	L	L
Skagit River	S3	31664	R	56	1	M	YF	C	MF	cd/hem/sp/cw/ald	ald/dw/cd/hem	L	L	L	L
Skagit River	S3	31720	P	55	4	M	YF	M	YF	cd/hem/fir/cw/ald	ald/dw/cd/hem	L	L	L	L
Skagit River	S3	31775	R	74	0	M	YF	M	YF	cd/hem/fir/cw/ald	ald/dw/cd/hem	L	L	H	H
Skagit River	S3	31849	P	28	2	M	YF	M	YF	cd/hem/fir/cw/ald	ald/dw/cd/hem	L	L	H	H
Skagit River	S3	31877	R	32	2	M	YF	M	YF	cedar/alder	ald/dw/cd/hem	L	L	M	M
Skagit River	S3	31909	G	51	1	M	YF	M	YF	cedar/alder	ald/dw/cd/hem	L	L	L	L
Skagit River	S3	31960	R	48	1	M	YF	M	YF	cedar/alder	ald/dw/cd/hem	L	L	L	L
Skagit River	S4	32008	P	46	0	M	YF	S	SH	cedar/alder	ald/dw/cd/hem	M	M	H	H
Skagit River	S4	32054	R	42	1	C	MF	C	MF	cedar/d fir	maple/alder	L	L	L	L

Table A7. Riparian condition assessment results for Skagit watershed

Sub Basin	Reach	Reach Loc.[1]	Habitat Type[2]	Habitat Length[3]	Canopy Code[4]	Riparian LB		Riparian RB		Species		Impact Class LB		Impact Class RB	
						Type	Stage	Type	Stage	Dominant	Subdominant	Bank Stab.[5]	LWD[6]	Bank Stab.[5]	LWD[6]
Skagit River	S4	32096	G	67	1	C	MF	C	MF	cedar/d fir	maple/alder	L	L	L	L
Skagit River	S4	32163	P	45	1	C	MF	C	MF	cedar/d fir	maple/alder	L	L	L	L
Skagit River	S4	32208	R	122	1	C	MF	C	MF	cedar/d fir	maple/alder	L	L	L	L
Skagit River	S4	32330	G	85	3	C	MF	C	MF	cedar/hem	maple/alder	L	L	L	L
Skagit River	S4	32415	R	51	3	C	MF	C	MF	cedar/hem	maple/alder	L	L	L	L
Skagit River	S4	32466	G	234	3	C	MF	C	MF	cedar/hem	maple/alder	L	L	L	L
Skagit River	S4	32700	R	98	1	C	MF	C	MF	cedar/hem	maple/alder	L	L	L	L
Skagit River	S4	32798	G	85	1	S	SH	C	MF	cedar/hem	ald/dw/cd	M	M	L	L
Skagit River	S4	32883	R	81	1	S	SH	C	MF	cedar/hem	ald/dw/cd	M	M	L	L
Skagit River	S4	32964	P	64	1	S	SH	C	MF	cedar/hem	ald/dw/cd	M	M	L	L
Skagit River	S4	33028	R	20	1	S	SH	C	MF	cedar/hem	ald/dw/cd	M	M	L	L

[1] Reach location (in meters); denotes the distance upstream from the lower reach break.

[2] Habitat types are: pool (P), riffle (R), glide (G), cascade (C) and other (O).

[3] Habitat length is the length (m) of the habitat unit being assessed.

[4] Canopy code is: 0 = O%; 1 = 1-20%; 2 = 21-40%; 3 = 41-70%; 4 = 71-90%; 5 = > 90%.

[5] Bank stability impact is: High = no bank-rooted conifers; Mod = bank-rooted conifers and deciduous (mixed); Low = bank-rooted conifers dominant.

[6] LWD impact is: High = < 50 stems/ha; Mod = 50-100 stems/ha; Low = > 100 stems/ha.