

February 4, 2005

TO: Files

FROM: Stephen Hirschey

SUBJECT: Instream flows for proposed Chapter 173-505 WAC

The instream flow incremental methodology data and the exceedance hydrographs from Steward & Associates were used by a team of State and Tribal representatives to arrive at the recommended instream flows for the following rivers and streams:

Stillaguamish River mainstem,
N.F. Stillaguamish River,
S.F. Stillaguamish River,
Pilchuck Creek,
Jim Creek,
Canyon Creek, and
Squire Creek.

The principal meeting participants were Brad Caldwell and Stephen Hirschey (Ecology), Hal Beecher and Mike Chamblin (WDFW), Jody Brown (Stillaguamish Tribe of Indians), and Anne Savery (Tulalip Tribes).

A series of meetings was held during 2003 and 2004 to calibrate the modeling information and then to arrive at the proposed flows. The flows recommended are State agency flows, as the Tribal representatives were not asked to endorse the flows. The Tribe's actively participated in the discussions and to the best of our ability, their concerns were addressed.

The time period (usually a month), flow recommended, the priority species/lifestage, and the expected exceedance frequency associated with the flow for each site described in the following pages.

Proposed administrative minimum instream flow for mainstem Stillaguamish at river mile 11

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	2200	Steelhead rearing	100 % of Steelhead juvenile	80 %
February	2000	Steelhead rearing	100 % of Steelhead juvenile	80 %
March	2000	Steelhead rearing	100 % of Steelhead juvenile	80 %
April	2000	Steelhead rearing	100 % of Steelhead juvenile	90 %
May	2000	Steelhead rearing	100 % of Steelhead juvenile	90 %
June 1- 15	2200	Steelhead rearing	100 % of Steelhead juvenile	90 %
June 16-30	2000	Steelhead rearing	100 % of Steelhead juvenile temperature control	90 %
July	2000	Steelhead rearing	100 % of Steelhead juvenile temperature control	~ 75 %
August	1700	Steelhead rearing	98 % of Steelhead juvenile	~ 10 %
September	1700	Steelhead rearing 9/1 – 9/15 Chinook spawning 9/16- 9/31	98 % of Steelhead juvenile	20 %
October	1700	Steelhead rearing	98 % of Steelhead juvenile	~ < 50 %
November	2200	Steelhead rearing	100 % of Steelhead juvenile	> 50 %
December	2200	Steelhead rearing	100 % of Steelhead juvenile	80 %

Pinks have a narrow spawning window, with a peak the first two weeks of October. They are fairly uniform spawners across the transects depth/velocity. Pink Salmon are edge and riffle spawners. Steelhead are not known as mainstem spawners. Steelhead rearing and passage is important.

The proposed flow at Arlington was determined by a several step process. In general proposed instream flows at Arlington were developed using two IFIM sites, Arlington and Chappel Road and accretion flow estimates. The Chappel Road site is weighted as more important since there is more production in that reach of the river. Proposed flows were developed using the IFIM data for the species, life stage, and month at Chappel Road, and then accretion flow between the sites was added to the Chappel Road flow number to arrive at the Arlington flow recommendation.

Average monthly accretion flow from the upstream site, Chappel to the downstream site Arlington was calculated from the work northwest hydraulic consultants (nhc) produced for each exceedance value for each month. A new spreadsheet (Exceedance Plots Data.xls) with Arlington, Chappel, and Arlington minus Chappel for each day, for each exceedance was created. The daily values for Arlington minus Chappel were averaged to get a monthly average for each exceedance value. In some instances every 15 days/or half month averages were determined if the flows setting were to split the month. The accretion flow is the average difference of Chappel to Arlington for that specific time period (entire month or 15 days) and percent exceedance.

The habitat flow number for the priority species/life stage/time at Chappel was determined by group decision. The flow at Chappel's exceedance value was determined. That exceedance value was used to determine the accretion flow for that month. The accretion flow was added to the Chappel proposed instream flow to arrive at the proposed flow for Arlington for the month.

January, 1200 cfs at Chappel is 2/3 of Chum spawning flows. 1200 cfs at Chappel in January is just less than the 50 percent exceedance flow. Accretion in January at 50 percent exceedance flow is $((350 + 390) / 2) = 370$ cfs. $1200 \text{ cfs} + 370 \text{ cfs} = 1570$ cfs and it was rounded up to 1600 cfs for the proposed instream flow at Arlington.

February, 1200 cfs at Chappel is 2/3 of Chum spawning flows. 1200 cfs at Chappel in February is just less than 50 percent exceedance flow. Accretion in February at 50 percent exceedance flow is $((405 + 389) / 2) = 397$ cfs. $1200 \text{ cfs} + 397 \text{ cfs} = 1597$ cfs and it was rounded up to 1600 cfs for the proposed instream flow at Arlington.

March, 1600 cfs at Chappel is peak, steelhead, spawning flow. 1600 cfs at Chappel in March is just less than the 20 percent exceedance flow. Accretion in March at 20 percent exceedance flow is $((660 + 603) / 2) = 631.5$ cfs. $1600 \text{ cfs} + 631.5 \text{ cfs} = 2231.5$ cfs and it was rounded up to 2250 cfs for the proposed instream flow at Arlington.

April, 1600 cfs at Chappel is peak, steelhead, spawning flow. 1600 cfs at Chappel in April is just less than the 20 percent exceedance flow. Accretion in April at 20 percent exceedance flow is $((514 + 380) / 2) = 447$ cfs. $1600 \text{ cfs} + 447 \text{ cfs} = 2047$ cfs and it was rounded down to 2000 cfs for the proposed instream flow at Arlington.

May, 1600 cfs at Chappel is peak, steelhead, spawning flow. 1600 cfs at Chappel in May is very near the 20 percent exceedance flow. Accretion in May at 20 percent exceedance flow is $((344 + 326) / 2) = 335$ cfs. $1600 \text{ cfs} + 335 \text{ cfs} = 1935$ cfs and it was rounded up to 2000 cfs for the proposed instream flow at Arlington.

June, 1060 at Chappel is 2/3 of the steelhead spawning flow and is the steelhead egg incubation flow. 1060 cfs at Chappel in June is just greater than the 50 percent exceedance flow. Accretion in June at 50 percent exceedance flow is $((174 + 104) / 2) = 139$ cfs. $1060 \text{ cfs} + 139 \text{ cfs} = 1199$ cfs and it was rounded up to 1200 cfs for the proposed instream flow at Arlington.

July, 1- 15, 1060 at Chappel is 2/3 of the steelhead spawning flow and is the steelhead egg incubation flow. 1060 cfs at Chappel in July is just greater than the 20 percent exceedance flow. Accretion in July at 20 percent exceedance flow is 75 cfs. $1060 \text{ cfs} + 75 \text{ cfs} = 1135 \text{ cfs}$ and it was rounded up to 1150 cfs for the proposed instream flow at Arlington.

July, 15 -31, 700 cfs at Chappel is steelhead juvenile rearing peak. 700 cfs at Chappel in July is the 50 percent exceedance flow. Accretion in July at 50 percent exceedance flow is 21 cfs. $700 \text{ cfs} + 21 \text{ cfs} = 721 \text{ cfs}$ and it was rounded up to 750 cfs for the proposed instream flow at Arlington.

August, 700 cfs at Chappel is steelhead juvenile rearing peak. 700 cfs at Chappel in August is the 10 percent exceedance flow. Accretion in August at 10 percent exceedance flow is $((40 \text{ cfs} + 48 \text{ cfs}) / 2) = 44 \text{ cfs}$. $700 \text{ cfs} + 44 \text{ cfs} = 744 \text{ cfs}$ and it was rounded up to 750 cfs for the proposed instream flow at Arlington.

September, 700 cfs at Chappel is steelhead juvenile rearing peak. 700 cfs at Chappel in September is the 10 percent exceedance flow. Accretion in September at 10 percent exceedance flow is $((78 \text{ cfs} + 73 \text{ cfs}) / 2) = 75.5 \text{ cfs}$. $700 \text{ cfs} + 75.5 \text{ cfs} = 775.5 \text{ cfs}$ and it was rounded down to 775 cfs for the proposed instream flow at Arlington.

October 1- 15, 1200 cfs at Chappel is pink spawning peak. 1200 cfs at Chappel in October is just less than the 20 percent exceedance flow. Accretion in October at 20 percent exceedance flow is 46 cfs. $1200 \text{ cfs} + 46 \text{ cfs} = 1246 \text{ cfs}$ and it was rounded up to 1250 cfs for the proposed instream flow at Arlington.

October 15 - 31, 1700 cfs at Chappel is Chinook spawning peak. 1700 cfs at Chappel in late October is just greater than the 20 percent exceedance flow. Accretion in late October at 20 percent exceedance flow is 188 cfs. $1700 \text{ cfs} + 188 \text{ cfs} = 1888 \text{ cfs}$ and it was rounded up to 1900 cfs for the proposed instream flow at Arlington.

November, 1800 cfs at Chappel is chum spawning peak. 1800 cfs at Chappel in November is 20 percent exceedance flow. Accretion in November at 20 percent exceedance is $((415 + 576) / 2) = 495.5$. $1800 \text{ cfs} + 496 \text{ cfs} = 2296 \text{ cfs}$ and it was rounded up to 2300 cfs for the proposed instream flow at Arlington.

December, 1800 cfs at Chappel is chum spawning peak. 1800 cfs at Chappel in December is just greater than the 20 percent exceedance flow. Accretion in December at 20 percent exceedance is $((691 + 746) / 2) = 718.5 \text{ cfs}$. $1800 \text{ cfs} + 718.5 \text{ cfs} = 2518.5 \text{ cfs}$ and it was rounded down to 2500 cfs for the proposed instream flow at Arlington.

Proposed administrative minimum instream flow for SF Stillaguamish at Arlington (RM 21.1) and Chappel (RM 34.9)

Months	Administrative minimum instream flow in cfs	Priority fish species and life stages	Biological rationale	Percent flow exceedance ⁱ
January	1800 - Arlington ⁱⁱ 1200- Chappel	Chinook and Chum egg incubation Steelhead rearing Coho rearing	Incubation Q at Chappel is 2/3 of chum spawning Q. Q at Arlington is Chappel + accretion inflow	> 50 %
February	1600- Arlington 1200- Chappel	Chinook egg incubation Pink incubation Chum incubation Steelhead rearing Coho rearing	Steelhead rearing 98 % at Chappel Steelhead rearing 97 % at Arlington	50 %
March	2250 at Arlington 1600 at Chappel	Steelhead spawning Steelhead incubation Chinook rearing Steelhead rearing	Blend of Chappel and Arlington with focus at Chappel because of Steelhead spawning at that site. Flows cover SH juv. rearing and incubation. Equal weighting for all three life stages.	< 50 %
April	2000 at Arlington 1600 at Chappel	Steelhead spawning Steelhead incubation Pink incubation Chum incubation Chinook rearing Steelhead rearing Coho rearing	Blend of Chappel and Arlington with focus at Chappel because of Steelhead spawning at that site. Flows cover steelhead juv. rearing.	< 50 %
May	2000 at Arlington 1600 at Chappel	Steelhead spawning Steelhead incubation Chinook rearing Steelhead rearing Coho rearing	Blend of Chappel and Arlington with focus at Chappel because of Steelhead spawning at that site. Flows cover steelhead juv. rearing.	< 50 %
June	1200 at Arlington 1060 at Chappel	Steelhead incubation Steelhead rearing Coho rearing	Steelhead incubation Steelhead rearing 98 % at Chappel Rd Incubation flow is 2/3 of spawning flow (1600 x 2/3 = 1060) is for egg incubation (1800 at Arlington	80 %
July 1-15	1150 at Arlington 1060 at Chappel	Steelhead incubation Chinook rearing Steelhead, Coho rearing	Steelhead incubation Steelhead rearing is 98 % at Chappel Rd	50 %
July 16-31	750 at Arlington 700 at Chappel	Steelhead rearing Coho rearing	Steelhead rearing 100 % at Chappel	< 20 %
August	750 at Arlington 700 at Chappel	Steelhead rearing Coho rearing	Blend of Chappel and Arlington with focus at Chappel because of Steelhead spawning at that site. Steelhead rearing 100 % at	20 %

			Chappel	
September	775 at Arlington 700 at Chappel	Steelhead rearing	Blend of Chappel and Arlington with focus at Chappel because of Steelhead spawning at that site. Steelhead rearing is 100 % at Chappel	> 10 %
October 1-15	1250 at Arlington 1200 at Chappel	Chinook spawning – mainstem Pink spawning Chum spawning - tributaries	Blended flow for Chinook and Pink spawning with weighting to Pink spawning	> 20 %
October 16 - 31	1900 at Arlington 1700 at Chappel	Chinook spawning Pink spawning Steelhead rearing Coho rearing	Blended flow for Chinook and Pink spawning with weighting to Chinook spawning at Chappel site.	< 20 %
November	2300 at Arlington 1800 at Chappel	Chum spawning Steelhead rearing Coho rearing	Chum spawning with recognition of some Chinook spawning Steelhead rearing 89 %	< 50 %
December	2500 at Arlington 1800 at Chappel	Chum spawning Steelhead rearing Coho rearing	Chum spawning 100 % at Chappel	< 50 %

Proposed administrative minimum instream flow for NF Stillaguamish at river mile 6.5

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	1200	Chum spawning Chinook egg incubation Steelhead juvenile	Wiersma: 39% chum spawning, 97% steelhead juvenile. Oso (600 cfs) 95% chum spawning, 92% sthd. juvenile	70%
February	1200	Chinook egg incubation/out migration Steelhead juvenile & spawning	Wiersma: 97% steelhead juvenile, 73% steelhead spawning Oso: (600cfs) 92% steelhead juvenile, 93% steelhead spawning	70%
March 1-15	1300	Steelhead spawning, egg incubation, and juvenile Chinook egg incubation/out migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (750 cfs) 100% steelhead spawn and 98% steelhead juvenile	70%
March 16-31	1300	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (750 cfs) 100% steelhead spawn and 98% steelhead juvenile	70%
April 1-15	1300	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (700 cfs) 100% steelhead spawn and 97% steelhead juvenile	80%
April 16-30	1300	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (700 cfs) 100% steelhead spawn and 97% steelhead juvenile	80%
May 1-15	1300	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (650 cfs) 95% steelhead spawn and 94% steelhead juvenile	80%
May 16-31	1300	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (650 cfs) 95% steelhead spawn and 94% steelhead juvenile	80%
June 1-15	1300	Steelhead spawning, egg incubation, and juvenile Chinook out migration and upstream migration	Wiersma: 68% steelhead spawn, 97% steelhead juvenile Oso: (700 cfs) 100% steelhead spawn and 97% steelhead juvenile	60%

June 16-30	1400	Steelhead egg incubation and juvenile Chinook upstream migration	Wiersma: 96% steelhead juvenile Oso: (800 cfs) 100% steelhead juvenile	50%
July 1-15	1100	Steelhead juveniles Chinook upstream migration	Wiersma: 99% steelhead juvenile Oso: (800 cfs) 100% steelhead juvenile	30%
July 16-31	800	Steelhead juvenile Chinook upstream migration	Wiersma: 94% steelhead juvenile Oso: (550-600 cfs) 92% steelhead juvenile	30%
August 1-15	800	Chinook upstream migration Steelhead juvenile	Wiersma: 94% steelhead juvenile Oso: (600 cfs) 83% steelhead juvenile	10%
August 16-31	800	Chinook Spawning Steelhead Juvenile	Wiersma: 93% chin spawning 94% st. juvenile Oso: (600 cfs) 93% & 92% respectively	7%
September	800	Chinook Spawning Steelhead Juvenile Chinook egg incubation	Wiersma: 93% chin spawning & 94% St.hd. juvenile Oso: (700) 99% chin spawning & 97% st.hd juvenile	10%
October	800	Chinook & Chum Spawning, Steelhead Juvenile, egg incubation	Wiersma: 93% chin. Spawning, 68% chum spawning, 94% st.hd. juvenile Oso: (650 cfs) 95% chin spawning, 93% chum spawning, 94% sthd juvenile	40%
November	950	Chum spawning Chinook egg incubation Steelhead juvenile	Wiersma: 60% chum spawning, 98% steelhead juvenile. Oso (450 cfs): 100% chum spawning, 82% steelhead juvenile	60%
December	1300	Chum spawning Chinook egg incubation Steelhead juvenile	Wiersma: 34% chum spawning, 97% steelhead juvenile. Oso (600 cfs) 95% chum spawning, 92% sthd. juvenile	70%

RHABSIM data from two sites was simultaneously evaluated to arrive at the recommended flows. Preference was given to the Oso site over Wiersma based on Chinook spawner surveys.

Proposed administrative minimum instream flow for Pilchuck Creek

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	170	Chinook egg incubation, steelhead juvenile	100% steelhead juvenile	> 90%
February	170	Chinook egg incubation, steelhead juvenile	100% steelhead juvenile	< 90%
March	170	Steelhead spawning, steelhead juvenile, Chinook egg incubation/out migration	99 % steelhead spawning, 100% steelhead juvenile	90%
April	170	Steelhead spawning, steelhead juvenile, Chinook out migration	99 % steelhead spawning, 100% steelhead juvenile	90%
May	170	Steelhead spawning, steelhead juvenile, Chinook out migration	99 % steelhead spawning, 100% steelhead juvenile	80 %
June 1-15	170	Steelhead spawning, steelhead juvenile	99 % steelhead spawning, 100% steelhead juvenile	>50%
June 16-30	170	Steelhead juvenile	100% steelhead juvenile	>20%
July	170	Steelhead juvenile	100% steelhead juvenile	1-15 20 % 16-31 10 %
August	140	Steelhead juvenile, Chinook upstream migration/holding	98 % steelhead juvenile	>5%
September	170	Chinook spawning, steelhead juvenile, Chinook egg incubation	100 % Chinook spawning, 100 % steelhead juvenile	1-15 10% 16-30 20%
October	170	Chinook spawning, steelhead juvenile, chum spawning, Chinook egg incubation	100 % Chinook spawning, 100 % steelhead juvenile, 84 % chum spawning	> 50%
November 1-15	170	Chinook spawning, chum spawning, steelhead juvenile, Chinook egg incubation	100% Chinook spawning, 100 % steelhead juvenile, 84 % chum spawning	< 80%
November 16-31	170	Chinook egg incubation, steelhead juvenile	100 % steelhead juvenile	90%
December	170	Chinook egg incubation, steelhead juvenile	100 % steelhead juvenile	> 90%

Fall Chinook – later spawning than N.F. run

Proposed administrative minimum instream flow for Jim Creek

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	250	Chinook egg incubation, steelhead juvenile	100% steelhead juvenile	<50%
February	250	Chinook egg incubation, steelhead juvenile	100% steelhead juvenile	<50%
March	250	Steelhead spawning, steelhead juvenile, Chinook egg incubation/out migration	100% steelhead spawning, 100% steelhead juvenile	>20%
April	250	Steelhead spawning, steelhead juvenile, Chinook out migration	100% steelhead spawning, 100% steelhead juvenile	>20%
May	250	Steelhead spawning, steelhead juvenile, Chinook out migration	100% steelhead spawning, 100% steelhead juvenile	20%
June 1-15	250	Steelhead spawning, steelhead juvenile	100 % steelhead spawning, 100 % steelhead juvenile	5 %
June 16-30	250	Steelhead juvenile	100 % steelhead juvenile	5 %
July	250	Steelhead juvenile	100 % steelhead juvenile	<5 %
August	250	Steelhead juvenile, Chinook upstream migration	100 % steelhead juvenile	<<5 %
September 1-15	250	Steelhead juvenile, Chinook upstream migration	100 % steelhead juvenile	<5%
September 16-31	250	Chinook spawning, steelhead juvenile, Chinook egg incubation	100% steelhead spawning, 100% steelhead juvenile	10 %
October	250	Chinook spawning, steelhead juvenile, chum spawning, Chinook egg incubation	100% steelhead spawning, 100% steelhead juvenile, 97 % chum spawning	15%
November 1-15	250	Chinook spawning, chum spawning, steelhead juvenile, Chinook egg incubation	100% Chinook spawning, 100 % steelhead juvenile, 97 % chum spawning	>20%,
November 16-31	250	Chum spawning, steelhead juvenile, Chinook egg incubation	100% chum spawning, 100% steelhead juvenile	50%
December	250	Chum spawning, steelhead juvenile, Chinook egg incubation	97 % chum spawning, 100 steelhead juvenile	50%

Proposed administrative minimum instream flow for Canyon Creek

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	525	Chinook egg incubation Steelhead juvenile Chum spawning	98 % Steelhead juvenile higher flows will keep chum spawning to the edge, better for scour	50%
February	450	Chinook egg incubation Steelhead juvenile	98 % Steelhead juvenile	50%
March	450	Steelhead spawning, Chinook egg incubation/out migration, Steelhead juvenile	100 % Steelhead spawn 98 % Steelhead juvenile	~ <50%
April	450	Steelhead spawning, Chinook out migration, Steelhead juvenile	100 % Steelhead spawn 98 % Steelhead juvenile	>50%
May	450	Steelhead spawning, Steelhead juvenile, Chinook out migration	100 % Steelhead spawn 98 % Steelhead juvenile	>50%
June 1-15	450	Steelhead spawning, Steelhead juvenile, Chinook out migration	100 % Steelhead spawning, 98% Steelhead juvenile	>50%
June 16-30	350	Steelhead juvenile	97 % Steelhead juvenile	~ <50%
July	350	Steelhead juvenile	97 % Steelhead juvenile	~ <50%
August	350	Steelhead juvenile, Chinook upstream migration	97 % Steelhead juvenile 92 % Chinook spawning (use Chinook riv curves)	~ < 10%
September	400	Chinook Spawning Steelhead juvenile	96 % Chinook spawning, 97 % Steelhead juvenile	10%
October	525	Chinook Spawning Steelhead juvenile	100% Chinook spawning, 98 % Steelhead juvenile	>20%
November	525	Chinook spawning, Steelhead juvenile, Chum spawning,	100 % Chinook spawning, 98 % Steelhead juvenile	< 50%
December	525	Chinook egg incubation, Steelhead juvenile	100 % Steelhead juvenile 92 % chum spawning	50%

Proposed administrative minimum instream flow for NF Stillaguamish at RM 17

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	915	Chum spawning, Chinook egg incubation, and steelhead juvenile	Hazel: 90% chum spawning, 93% steelhead juvenile Blue Slough: (745 cfs) 89% chum spawning, 71% steelhead juvenile	<50%
February	800	Chinook egg incubation/out migration, steelhead juvenile/spawning	Hazel: 86% steelhead spawning, 97% steelhead juvenile Blue Slough: (640 cfs) 91% steelhead spawning 75 % steelhead juvenile	50%
March 1-15	850	Steelhead spawning, egg incubation, and juvenile Chinook egg incubation/out migration	Hazel: 96% steelhead spawning, 95% steelhead juvenile Blue Slough: (700 cfs) 94% steelhead spawning, 72% steelhead juvenile	<50%
March 16-31	915	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Hazel: 99% steelhead spawning, 93% steelhead juvenile Blue Slough: (750cfs) 97% steelhead spawning, 71% steelhead juvenile	50%
April 1-15	915	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Hazel: 96% steelhead spawning, 95% steelhead juvenile Blue Slough: (720cfs) 96% steelhead spawning, 72% steelhead juvenile	>50%
April 16-30	915	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Hazel: 96% steelhead spawning, 95% steelhead juvenile Blue Slough: (700cfs) 94% steelhead spawning, 72% steelhead juvenile	>50%
May 1-15	915	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Hazel: 96% steelhead spawning, 95% steelhead juvenile Blue Slough: (700cfs) 94% steelhead spawning, 72% steelhead juvenile	>50%
May 16-31	915	Steelhead spawning, egg incubation, and juvenile Chinook out migration	Hazel: 96% steelhead spawning, 95% steelhead juvenile Blue Slough: (700cfs) 94% steelhead spawning, 72% steelhead juvenile	>50%
June 1-15	915	Steelhead spawning, egg incubation, and juvenile Chinook out migration and upstream migration	Hazel: 96% steelhead spawning, 95% steelhead juvenile Blue Slough: (735cfs) 97% steelhead spawning, 71% steelhead juvenile	50%

June 16-30	650	Steelhead egg incubation and juvenile rearing, Chinook upstream migration	Hazel: 100% steelhead juvenile Blue Slough: (510cfs) 87% steelhead juvenile	50%
July 1-15	600	Steelhead juveniles and Chinook upstream migration and holding	Hazel: 100% steelhead juvenile Blue Slough: (475cfs) 92% steelhead juvenile	<50%, >20%
July 16-31	500	Steelhead juveniles and Chinook upstream migration and holding	Hazel: 94% steelhead juvenile Blue Slough: (400cfs) 96% steelhead juvenile	20%
August 1-15	425	Chinook upstream migration and holding, Steelhead juvenile	Hazel: 86% steelhead juvenile Blue Slough: (340cfs) 100% steelhead juvenile	5%
August 16-31	500	Steelhead juvenile Chinook spawning	Hazel: 94% steelhead juvenile, 33% Chinook spawning Blue Slough: (400cfs) 96% steelhead juvenile, 85% Chinook spawning	5%
September 1-15	700	Chinook spawning Steelhead juvenile Chinook egg incubation	Hazel: 86% Chinook spawning, 99% steelhead juvenile Blue Slough: (550 cfs) 100% Chinook spawning, 82% steelhead juvenile	<5%
September 16-30	850	Chinook spawning Chinook egg incubation Steelhead juvenile	Hazel: 99% Chinook spawning, 95% Steelhead juvenile Blue Slough: (650 cfs) 98% Chinook spawning, 75% steelhead juvenile	5%
October	870	Chinook and Chum Spawning, Chinook, chum, and pink egg incubation Steelhead juvenile.	Hazel: 100% Chinook spawning, 94% chum spawning, 95% steelhead juveniles Blue Slough: (700 cfs) 97% Chinook spawning, 89% chum spawning, 72% steelhead juvenile	20%
November	915	Chum spawning, Chinook, chum, and pink egg incubation steelhead juvenile	Hazel: 90% chum spawning, 93% steelhead juvenile Blue Slough: (700 cfs) 89% chum spawning, 72% steelhead juvenile	50%
December	915	Chum spawning, Chinook, chum, and pink egg incubation, steelhead juvenile	Hazel: 90% chum spawning, 93% steelhead juvenile Blue Slough: (715 cfs) 89% chum spawning, 72% steelhead juvenile	50%

Proposed administrative minimum instream flow for Squire Creek

Months	Administrative minimum instream flow in cfs	Priority fish species and lifestages	Biological rationale	Percent flow exceedance
January	200	Chum spawning, Coho spawning, egg incubation, steelhead juvenile	94% chum spawning, 89% Coho spawning, 93% steelhead juvenile	>50%
February	200	Egg incubation Steelhead juvenile	93% steelhead juvenile	50%
March	280	Steelhead spawning/juvenile Egg incubation Chinook out migration	100 % steelhead spawning, 100 % steelhead juvenile	<50%
April	280	Steelhead spawning/juvenile Egg incubation Chinook out migration	100 % steelhead spawning, 100 % steelhead juvenile	20%
May	280	Steelhead spawning/juvenile Egg incubation Chinook out migration	100 % steelhead spawning, 100 % steelhead juvenile	50%
June	280	Steelhead spawning/juvenile Egg incubation Chinook out migration	100 % steelhead spawning, 100 % steelhead juvenile	> 50%
July	200	Steelhead juvenile Chinook upstream migration/holding	93% steelhead juvenile	> 50% ~ 10 %
August	200	Steelhead juvenile Chinook upstream migration/holding	93% steelhead juvenile	< 5 %
September	200	Chinook spawning/egg incubation Steelhead juvenile	100% Chinook spawning, 93% steelhead juvenile	5 %
October	200	Chinook spawning/egg incubation Steelhead juvenile Chum spawning	100% Chinook spawning, 93% steelhead juvenile, 94% chum spawning	< 50 %
November	200	Chinook egg incubation Chum spawning Steelhead juvenile	94% chum spawning, 93% steelhead juvenile	> 50%
December	200	Chinook egg incubation Chum spawning Steelhead juvenile	94% chum spawning, 93% steelhead juvenile	>50%

July Q of 200 cfs is fairly protective yet recognition of the dropping flow. 2/3 rule on Chinook egg incubation = Q of 133 cfs

ⁱ Percent exceedance is given for S.F. Stillaguamish at Arlington