Grant Lake Project Aquatic and Operations Analysis

Aspen Suites Hotel, Anchorage
July 7 – 8, 2014

McMillen
DESIGN with Vision. BUILD with Integrity.

In Association with
HEA

Review of Information Presented in March, 2014 Meeting

- Aquatic Habitat Mapping Results
- Instream Flow Results
- Connectivity Results in Reach 5
- Enhancement Opportunities:
  - Reach 2/3 Side Channel
  - Reach 1 Distributary
- Next Steps

Formed an Instream Flow Work Group

- Had 4 calls to provide data and provide discussion for outstanding issues
- Information was provided in the areas of:
  - Periodicity (resolved with exception of incubation and emergence of Sockeye salmon fry)
  - DTUs for sockeye salmon incubation and emergence
  - Synthesized record of natural hydrology for Grant Creek (1/1/57 – 12/31/13 based upon Kenai River at Cooper Landing (USGS Gage 15258000)
  - Synthesized record of “with-Project” flows for the same period

Information Provided (cont'd)

- Maps of spawning in relation to Instream Flow transects
- Maps of rearing in relation to Instream Flow transects
- CPUE for Chinook and Coho salmon and Dolly Varden char and Rainbow trout juveniles in traps
- Wetted Perimeter vs Flow
- Ramping Rates
- Number of redds by transect

Outstanding Information

- Effective Spawning Analysis (complete)
- Transect Weighting
- Habitat Time Series

HEA Proposed Instream Flow Regime

- Mimic natural flows during the spring (March – May) and fall (September – October)
- Increased flows in the winter period (November – February)
- Decreased flows in the summer period (June – August)
- Decreased, stable flows in Reach 5 (Canyon)

Proposed Reach 5 Flows

- 5 cfs
  - January 1 – July 31; Nov 1 – Dec 31
    - Rainbow trout spawning May 16 – June 30
- 10 cfs
  - August 1 – September 7
    - Chinook and Sockeye salmon spawning
    - Dolly Varden char spawning
- 7 cfs
  - September 8 – October 31
    - Sockeye and Coho salmon spawning
    - Dolly Varden char spawning

Proposed Flow Regime

- More stable flows throughout the year
- Increased flows and habitat in the Reach 2/3 side channel
- Decreased flows in summer when peak flows become less suitable for spawning and rearing
- Flows decreased in Reach 5
  - Has the lowest habitat utilization in Grant Creek
  - 5 of 388 salmon redds observed in Reach 5 (1.3%)

Proposed Enhancement Measures

- Increased flows and habitat in the Reach 2/3 side channel
- Removal of flow obstruction at the upstream end of Reach 1 Distributary to allow more water at lower flows

Reach 2/3 Side Channels

- Large amount of high quality/diverse habitat
- Currently have low to no flows during the winter and other low flow periods
- Currently subject to freezing/snow/ice and drying out during low flow periods
- Potential for freezing and desiccation of redds
- More stable flows with proposed project operation create opportunity for sustainable habitat in side channels

Side Channel Habitat, Reach 3

Reach 2/3 Side Channel (cont'd)

- Consists of two main channels that begin at the Reach 3/4 break
- Side channels constitute 21% of total length of Grant Creek, but contain:
  - 97% - OVH
  - 44% - LWD
  - 50% - Glide
  - 34% - Pool

Reach 2/3 Side Channel (cont'd)

- Proposed regime would increase flows by 104% in the side channels during the winter period
  - These increased flows would help prevent freezing and desiccation of redds, and increase overwintering rearing habitat.
- Flows would be decreased by 23% in the summer period
  - Peak flows would be removed, and spawning and rearing flows would be more stable during the summer
- Flows would remain the same in spring and fall as pre-project

Changes in WUA for rearing salmonids in the Reach 2/3 side channels (pre-project vs. proposed post-project flows)

Species	Jan	Feb	Nov	Dec	Mean
Chinook Juvenile	167.8%	178.6%	129.9%	150.2%	***156.6%***
Coho Juvenile	94.4%	96.7%	108.1%	96.8%	***99.0%***
Dolly Varden Juvenile	106.9%	116.0%	102.2%	101.5%	***106.7%***
Rainbow Juvenile	112.9%	123.0%	103.4%	105.1%	***111.1%***
Mean	***120.5%***	***128.6%***	***110.9%***	***113.4%***	***118.3%***

Reach 2/3 Side Channel (cont'd)

- Winter rearing WUA ranging from 94% - 179% of the pre-project WUA
- Mean 18% increase in WUA for the 4-month period
- During June – August, 3%, 9% and 16% decrease in fry, juvenile, and adult rearing WUA, respectively in the side channels
- No change in WUA in spring and fall

Potential Enhancement Opportunity - Reach 1 Distributary – Flow Additions

- Modify existing upstream entrance to the Distributary to allow flows there at a lower discharge
- Currently distributary does not get wetted until Grant Creek flows reach ~ 180 - 190 cfs
  - Dry during winter, early spring and late fall
- Analysis indicates T100 and T110 currently receive only about 1% of the water in Grant Creek once the distributary is activated
- Modeling of higher flows indicates that significant increases in WUA are possible with additional flow

Reach 1 Distributary, cont'd

- Reach 1 distributary constitutes only 5.6% of the stream length of Grant Creek, but has:
  - 17.6% of the pool habitat
  - 20% of the LWD
  - 12% of the undercut banks

Reach 1 Distributary

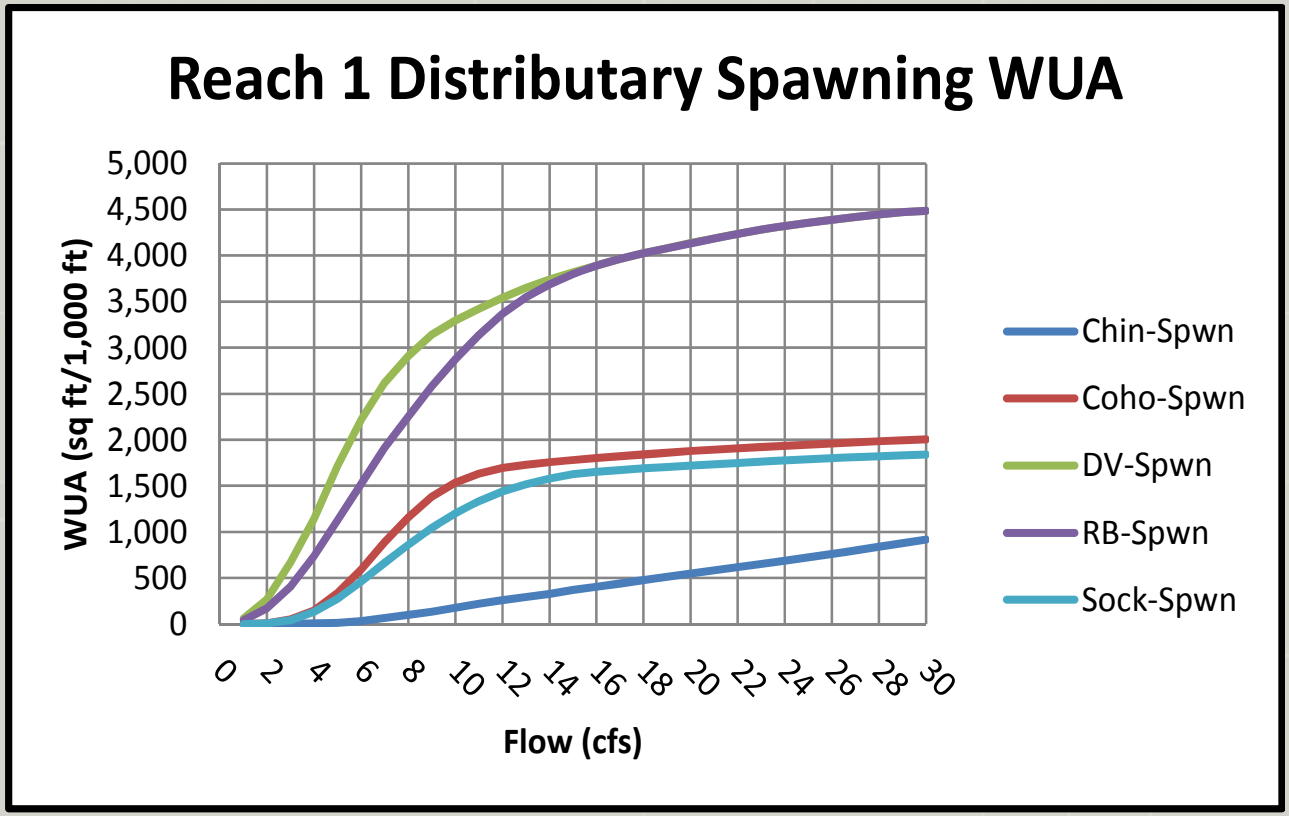
Distributary mouth @ Grant Creek
flow of 131 cfs

Distributary mouth @ Grant Creek
flow of 700 cfs

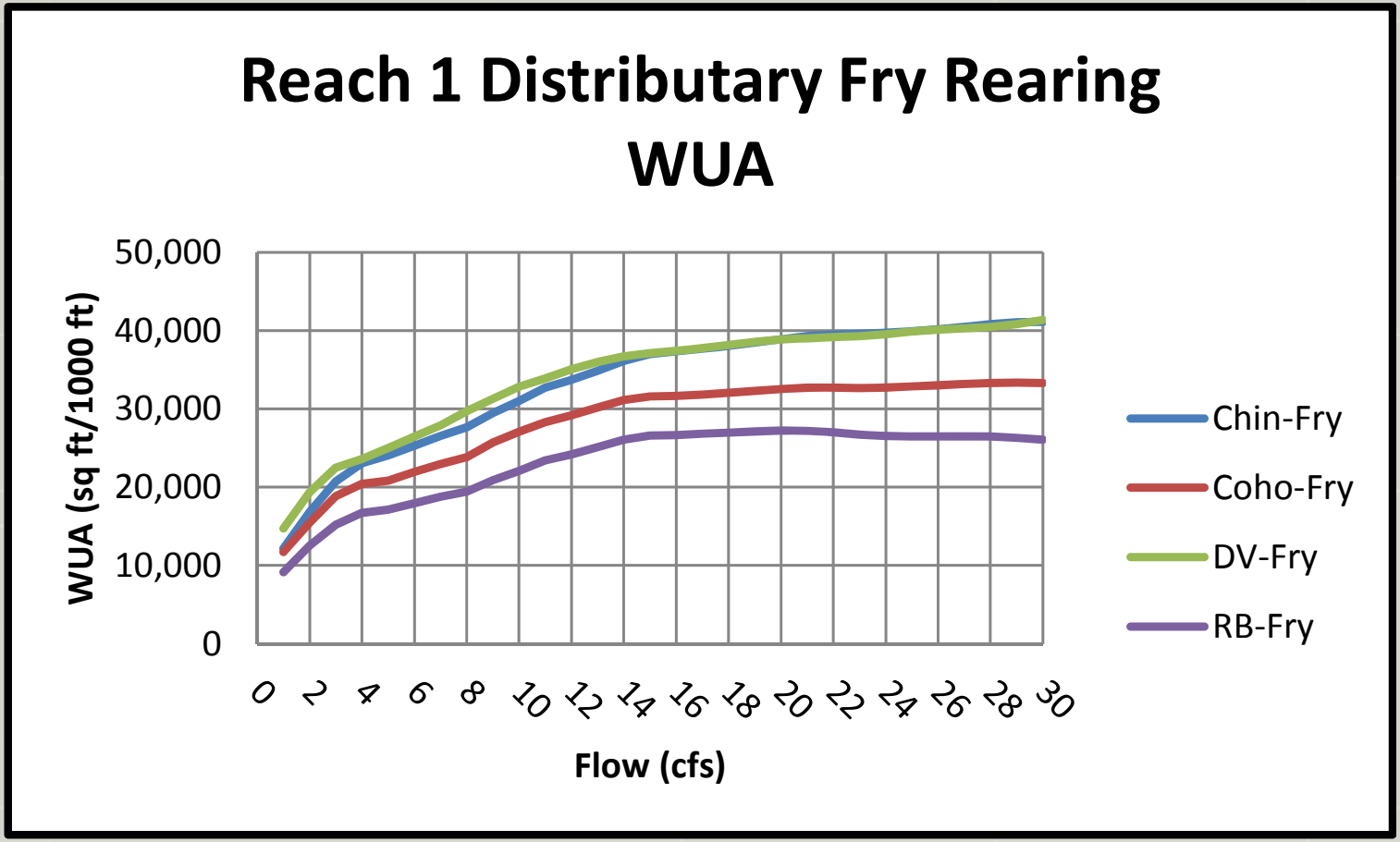
Distributary – Reach 1

LWD @ Grant Creek flow of 64 cfs

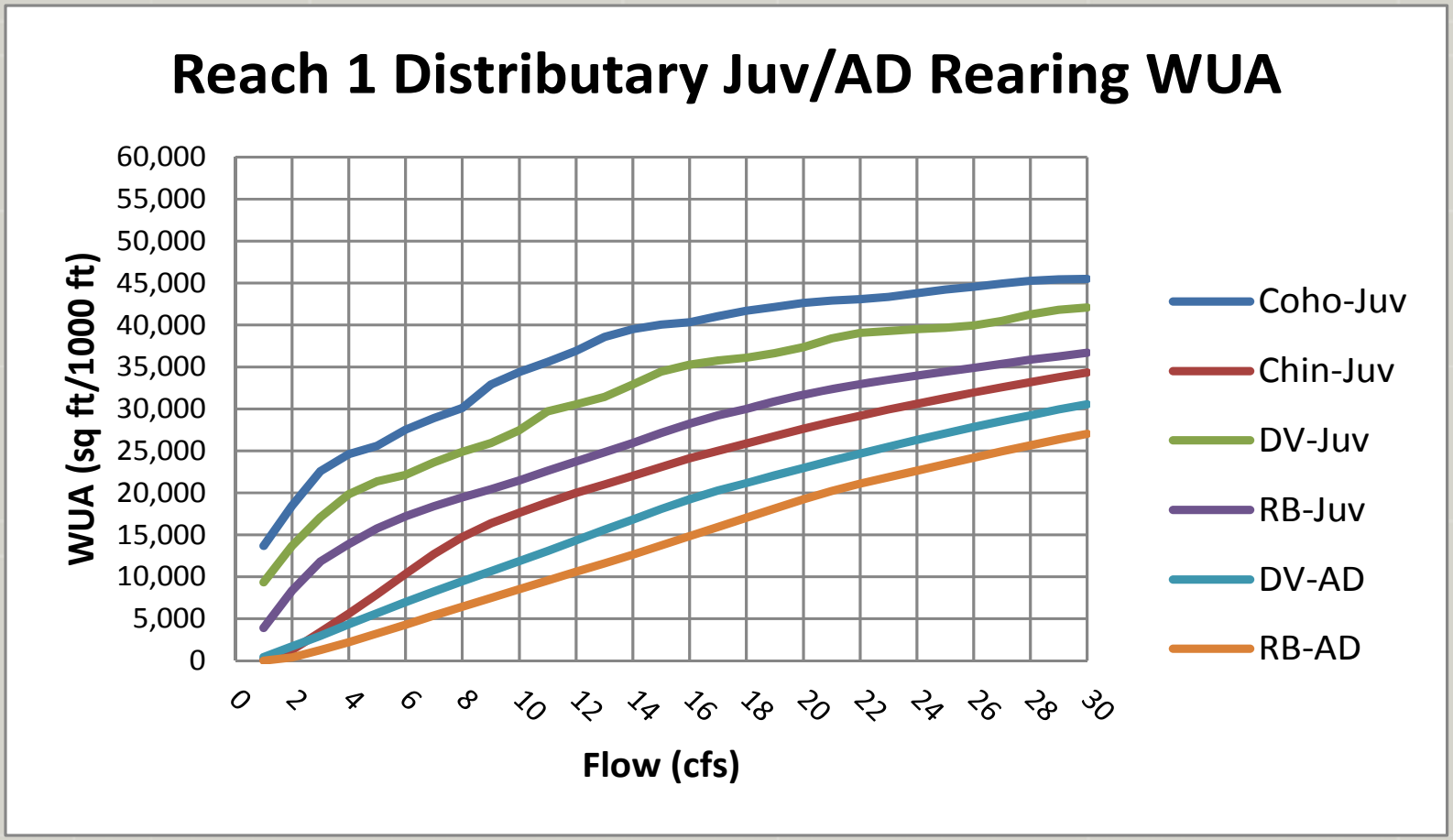
Distributary @ Grant Creek flow of 700 cfs (7 cfs in distributary)



Significant increases in spawning habitat at 20 cfs as compared to 2 cfs (flow in distributary when approximately 200 cfs in Grant Creek main channel)

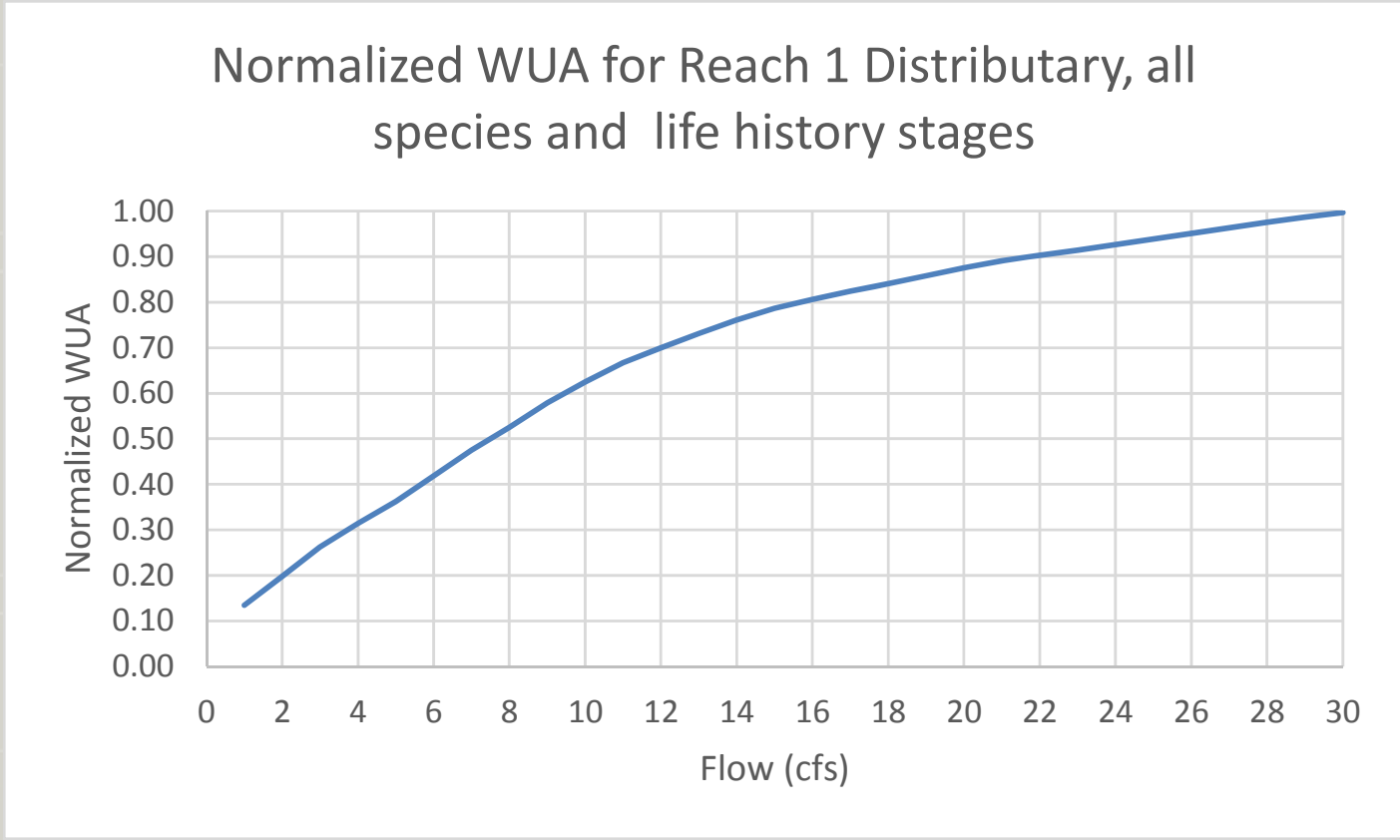


2.0 – 2.3 ***TIMES*** more fry rearing habitat at 20 cfs than 2 cfs (flow in distributary when approximately 200 cfs in Grant Creek main channel)



2.3 – 48 ***TIMES*** more juvenile and adult rearing habitat at 20 cfs than 2 cfs (flow in distributary when approximately 200 cfs in Grant Creek main channel)

What's a good flow? 12 – 20 cfs



HEA Proposed Flows

Instream Flow Release (Reach 5)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Main Channel Flow (Reach 1-4) Natural	55	51	51	52	47	45	41	39	36	34	32	31	30	31	35	45
Main Channel Flow (Reach 1-4) w/Project	133	128	128	128	124	119	115	106	36	34	33	30	30	30	35	46
Approx. Reach 2/3 Natural Side Channel Flow	9.2	8.5	8.6	8.6	7.8	7.4	6.8	6.4	6	5.6	5.3	5.1	5	5.2	5.8	7.6
Approx. Reach 2/3 Side Channel Flow w/Project	22	21	21	21	21	20	19	18	6	5.6	5.4	5.1	5	5	5.8	7.7

HEA Proposed Flows, cont'd

	May				June				July				August			
Instream Flow Release (Reach 5)	5	5	5	5	5	5	5	5	5	5	5	5	10	10	10	10
Main Channel Flow (Reach 1-4) Natural	69	101	152	227	318	382	431	483	494	517	507	496	484	469	440	402
Main Channel Flow (Reach 1-4) w/Project	68	97	155	224	199	260	310	360	370	390	388	375	365	347	395	399
Approx. Reach 2/3 Natural Side Channel Flow	12	17	25	38	53	64	72	81	82	86	84	83	81	78	73	67
Approx. Reach 2/3 Side Channel Flow w/Project	11	16	26	37	33	43	52	60	62	65	65	63	61	58	66	67

HEA Proposed Flows, cont'd

	September				October				November				December			
Instream Flow Release (Reach 5)	10	7	7	7	7	7	7	7	5	5	5	5	5	5	5	5
Main Channel Flow (Reach 1-4) Natural	379	347	379	364	280	272	216	184	159	133	109	99	92	74	67	63
Main Channel Flow (Reach 1-4) w/Project	395	374	372	365	282	273	212	187	234	207	185	180	172	150	141	147
Approx. Reach 2/3 Natural Side Channel Flow	63	58	63	61	47	45	36	31	26	22	18	16	15	12	11	10
Approx. Reach 2/3 Side Channel Flow w/Project	66	62	62	61	47	46	35	31	39	35	31	30	29	25	24	24

Comparison of Impacts and Enhancements

Impacts

- Reach 5:
  - Reduced flows in Reach 5
  - Limited use by adult salmonids (1.3% of redds in 2013)
  - Limited Habitat

Habitat Type	Sq Ft	Percentage
Cascades	33,593	57.5%
Pool	7,977	13.7%
Step Pool	16,858	28.9%
Total	**58,428**	

  - Reduction in Wetted Perimeter (from inflexion point):
    - 5 cfs: 43%
    - 7 cfs: 36%
    - 10 cfs: 24%

Comparison of Impacts and Enhancements, cont'd

- Reach 2/3 Side Channels
  - Overall 18% increase in winter juvenile rearing habitat
  - More stable, higher flows during this period, with likely less freezing and desiccation of redds and increased winter rearing habitat
  - More stable flows during the balance of the year as well

Comparison of Impacts and Enhancements, cont'd

Reach 1 Distributary

- Currently dry during late fall, winter and early spring
- Proposed 12 – 20 cfs in Distributary Reach 1:
  - Change in winter rearing WUA from 0 to 111k – 140k ft^2/1000 ft of stream
- 5 cfs in winter nets an increase from 0 – 70k ft^2 WUA

	Juvenile Rearing WUA			
Species	**Currently**	**5 cfs**	**12 cfs**	**20 cfs**
Coho	0	25,608	36,959	42,629
Chinook	0	7,908	19,988	27,674
Dolly Varden	0	21,370	30,544	37,364
Rainbow	0	15,784	23,774	31,690
Total	**0**	**70,670**	**111,265**	**139,356**