

APPENDIX B7: akłx^wmina? - SHINGLE CREEK

B7.1: Lower Shingle Creek

Transect Locations



Figure B7-1: Location of EFN Transects along Lower Shingle Creek near the confluence with Okanagan River

Transect Descriptions

Transect Name	SHG10SCR2016		
Install Date	August 09, 2016		
Lat./Long.	49.479871, -119.601236		
Width (install)	6.02 m	Depth (install)	0.15 m
Comment	-		



Looking upstream



Looking downstream

Transect Name SHG20GL2016

Install Date August 09, 2016

Lat./Long. 49.479330, -119.606996

Width (install) 4.63 m

Depth (install) 0.29 m



Looking upstream



Looking downstream

Transect Name SHG30SCR2016

Install Date August 09, 2016

Lat./Long. 49.479300, -119.607080

Width (install) 6.51 m

Depth (install) 0.17 m



Looking upstream



Looking downstream

Discharge Records

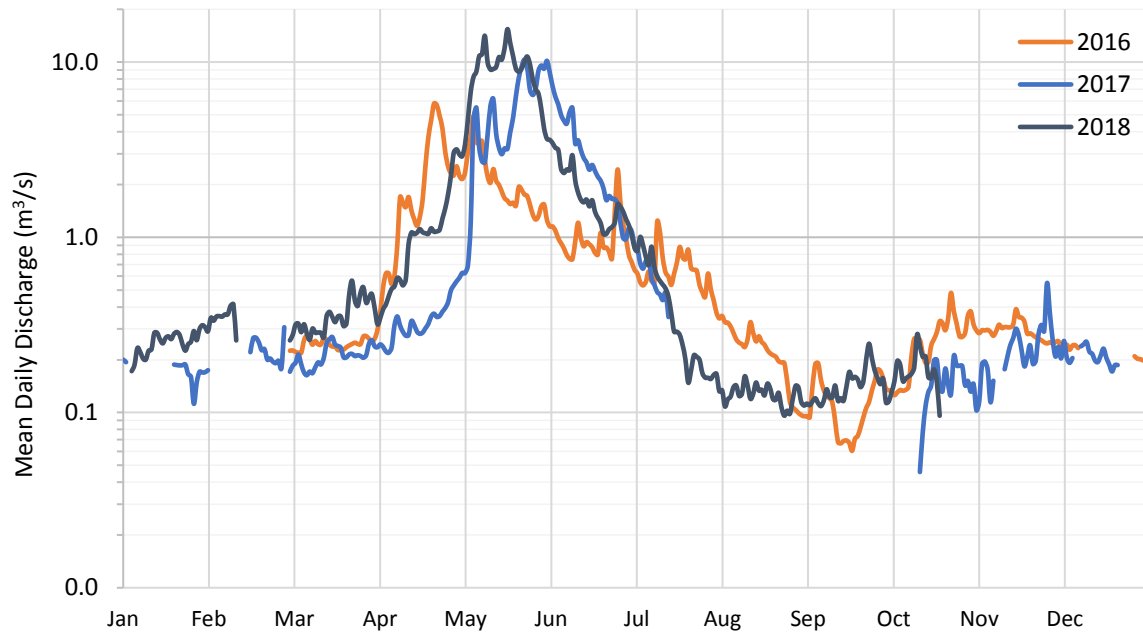


Figure B7-2: Mean daily discharge measured at the Lower Shingle Creek Hydrometric Station from 2016 to 2018

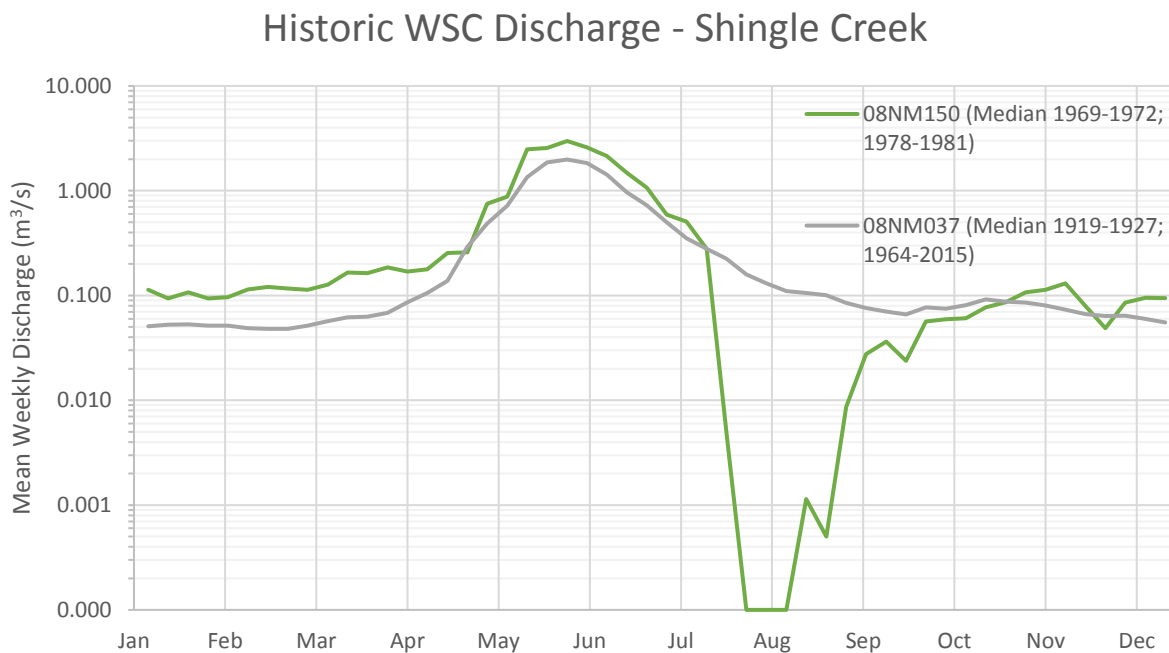


Figure B7-3: Historic discharge records from WSC stations 08NM150 (Shingle Creek at the mouth) and 08NM037 (Shatford Creek near Penticton)

Water Temperature Records

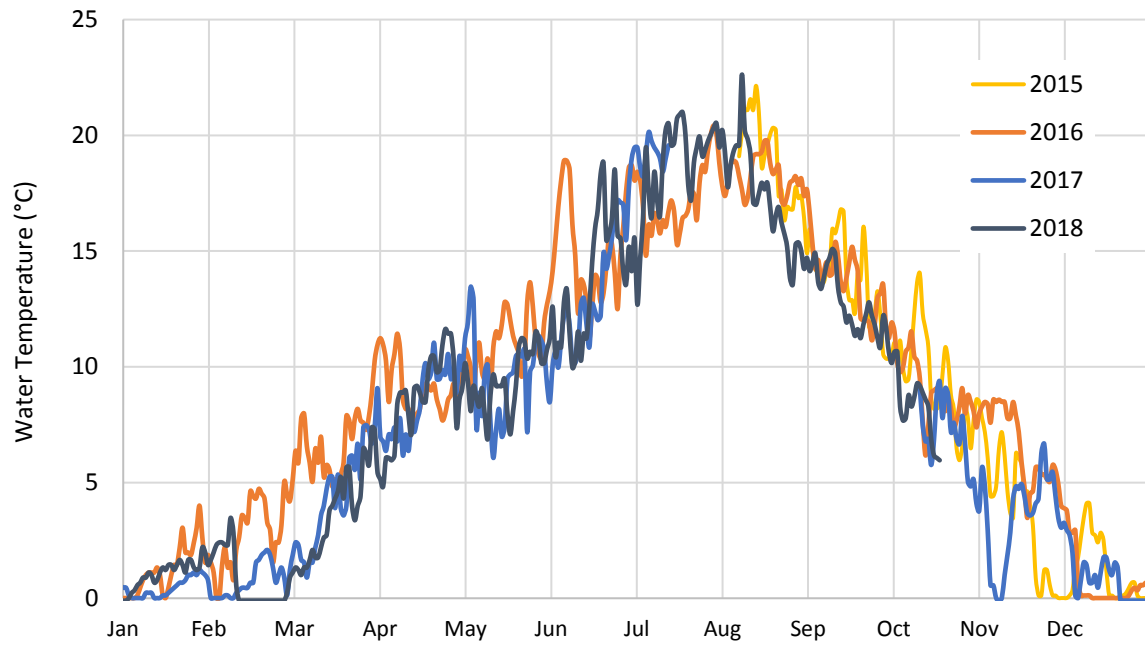


Figure B7-4: Daily maximum water temperatures recorded at the Lower Shingle Creek Hydrometric Station from 2015 to 2018

Flow standards and periodicity – Okanagan Tennant analysis for Lower Shingle Creek

Week Ending	Life Stage/ Week	Rainbow						Kokanee				Steelhead					
		Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Adult migration	Spawning	Incubation	Juvenile migration	Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering
Jan							20%			20%							20%
Feb							20%			20%							20%
Mar							20%			20%							20%
1-Apr	13				20%						50%	174%	174%	20%			
8-Apr	14				20%						50%	174%	174%	20%		50%	
15-Apr	15	174%			20%						50%	174%	174%	20%		50%	
22-Apr	16	174%			20%						50%	174%	174%	20%	20%	50%	
29-Apr	17	174%			20%						50%	174%	174%	20%	20%	50%	
6-May	18	174%			20%	50%					50%	174%	174%	20%	20%	50%	
13-May	19	174%			20%	50%					50%	174%	174%	20%	20%	50%	
20-May	20	174%	40%		20%	50%					50%	174%	174%	20%	20%	50%	
27-May	21	174%	40%	20%	20%	50%					50%	174%	174%	20%	20%	50%	
3-Jun	22	174%	40%	20%	20%	50%						174%	174%	20%	20%	50%	
10-Jun	23	174%	40%	20%	20%	50%						174%	174%	20%	20%	50%	
17-Jun	24	174%	40%	20%	20%	50%						174%	174%	20%	20%	50%	
24-Jun	25	174%	40%	20%	20%	50%						174%	174%	20%	20%		
1-Jul	26	174%	40%	20%	20%	50%								20%	20%		
8-Jul	27	174%	40%	20%	20%	50%								20%	20%		
15-Jul	28			20%	20%	50%									20%		
22-Jul	29			20%	20%										20%		
29-Jul	30			20%	20%										20%		
5-Aug	31				20%										20%		
12-Aug	32				20%										20%		
19-Aug	33				20%										20%		
26-Aug	34				20%										20%		
2-Sep	35				20%										20%		
9-Sep	36				20%										20%		
16-Sep	37				20%										20%		
23-Sep	38				20%			20%	20%	20%					20%		
30-Sep	39				20%			20%	20%	20%					20%		
7-Oct	40				20%			20%	20%	20%					20%		
14-Oct	41				20%			20%	20%	20%					20%		
21-Oct	42				20%			20%	20%	20%					20%		
28-Oct	43				20%			20%	20%	20%					20%		
Nov							20%			20%							20%
Dec							20%			20%							20%

Flow standards and periodicity – Okanagan Tennant analysis for Lower Shingle Creek - Continued

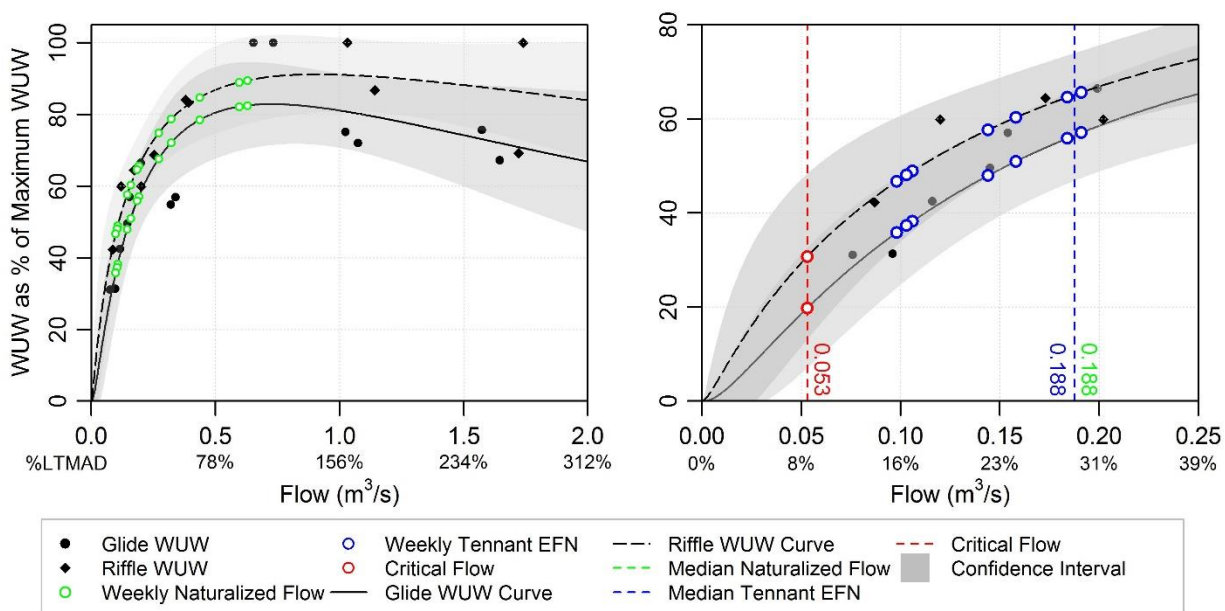
		Chinook (summer) rearing	Chinook (spring)					Sockeye				Ecological Flows		
Week Ending	Life Stage/ Week		Adult migration	Spawning	Incubation	Rearing	Juvenile migration	Over-wintering	Adult migration	Spawning	Incubation	Juvenile migration	Wetland, side channel linkage, flushing and channel maintenance flow	Cottonwood ecosystems
Jan					20%			20%			20%			
Feb					20%			20%			20%			
Mar		20%			20%			20%			20%			
1-Apr	13	20%				20%	50%					50%	☑	
8-Apr	14	20%				20%	50%					50%	☑	
15-Apr	15	20%				20%	50%					50%	☑	
22-Apr	16	20%				20%	50%					50%	☑	
29-Apr	17	20%				20%	50%					50%	☑	
6-May	18					20%	50%					50%	☑	
13-May	19					20%	50%					50%	☑	
20-May	20					20%	50%					50%	☑	
27-May	21					20%	50%						1510%	
3-Jun	22					20%	50%						1510%	
10-Jun	23					20%	50%						☑	100%
17-Jun	24					20%	50%						☑	100%
24-Jun	25					20%	50%							100%
1-Jul	26		174%			20%			25%					100%
8-Jul	27		174%			20%			25%					100%
15-Jul	28		174%			20%			25%					100%
22-Jul	29		174%			20%			25%					100%
29-Jul	30		174%			20%			25%					100%
5-Aug	31		174%			20%			25%					
12-Aug	32		174%			20%			25%					
19-Aug	33		174%			20%			25%					
26-Aug	34		174%	174%	20%	20%			25%					
2-Sep	35		174%	174%	20%	20%			25%					
9-Sep	36		174%	174%	20%	20%			25%					
16-Sep	37			174%	20%	20%				40%	20%			
23-Sep	38			174%	20%	20%				40%	20%			
30-Sep	39			174%	20%	20%				40%	20%			
7-Oct	40				20%	20%				40%	20%			
14-Oct	41				20%	20%				40%	20%			
21-Oct	42				20%	20%				40%	20%			
28-Oct	43				20%	20%				40%	20%			
Nov					20%			20%			20%			
Dec					20%			20%			20%			

EFNs and Critical Flows for Lower Shingle Creek

Week Ending	Okanagan Tennant EFN					WUW EFN (m³/s)						FINAL EFN (m³/s)		CRITICAL FLOWS (m³/s)				
	Flow standard (%LTMAD)	Flow standard EFN (m³/s)	Nat. median flow (m³/s)	Okanagan Tennant EFN	%LTMAD	Rainbow & Chinook rearing, insect production	Chinook spawning	Kokanee and Sockeye spawning	Steelhead Spawning	Rainbow spawning	FINAL	Value (m³/s)	Dominant Species / Life Stage	Rainbow and Chinook rearing & overwintering	Kokanee and Sockeye spawning	Rainbow and Steelhead spawning	Chinook Migration and spawning	FINAL
Jan	20%	0.128	0.068	0.068	11%							0.068	overwintering egg Incubation	0.053				0.053
Feb	20%	0.128	0.064	0.064	10%							0.064	overwintering egg Incubation	0.053				0.053
Mar	20%	0.128	0.073	0.073	11%							0.073	overwintering egg Incubation	0.053				0.053
1-Apr	174%	1.115	0.094	0.094	15%	0.128			1.115		1.115	0.094	ST spawning	0.053		0.094		0.094
8-Apr	174%	1.115	0.122	0.122	19%	0.128			1.115		1.115	0.122	ST spawning	0.053		0.122		0.122
15-Apr	174%	1.115	0.140	0.140	22%	0.128			1.115		1.115	0.140	ST spawning	0.053		0.140		0.140
22-Apr	174%	1.115	0.207	0.207	32%	0.128			1.115		1.115	0.207	ST spawning	0.053		0.207		0.207
29-Apr	174%	1.115	0.437	0.437	68%	0.128			1.115		1.115	0.437	ST spawning	0.053		0.437		0.437
6-May	174%	1.115	0.608	0.608	95%	0.128			1.115		1.115	0.608	ST spawning	0.053		0.493		0.493
13-May	174%	1.115	0.702	0.702	110%	0.128			1.115	1.115	1.115	0.702	ST spawning	0.053		0.493		0.493
20-May	174%	1.115	2.232	1.115	174%	0.128			1.115	1.115	1.115	1.115	ST spawning	0.053		0.493		0.493
27-May	1510%	9.678	3.870	3.870	604%	0.128			1.115	1.115	1.115	3.870	ecosystem	0.053		0.493		0.493
3-Jun	1510%	9.678	3.501	3.501	546%	0.128			1.115	1.115	1.115	3.501	ecosystem	0.053		0.493		0.493
10-Jun	174%	1.115	2.771	1.115	174%	0.128			1.115	1.115	1.115	1.115	RB Spawning	0.053		0.493		0.493
17-Jun	174%	1.115	3.277	1.115	174%	0.128			1.115	1.115	1.115	1.115	RB Spawning	0.053		0.493		0.493
24-Jun	174%	1.115	1.703	1.115	174%	0.128			1.115	1.115	1.115	1.115	RB Spawning	0.053		0.493		0.493
1-Jul	174%	1.115	1.492	1.115	174%	0.128				1.115	1.115	1.115	RB Spawning	0.053		0.493	0.849	0.849
8-Jul	174%	1.115	0.893	0.893	139%	0.128				1.115	1.115	0.893	RB Spawning	0.053		0.493	0.849	0.849
15-Jul	174%	1.115	0.629	0.629	98%	0.128					0.128	0.629	RB incubation	0.053			0.629	0.629
22-Jul	174%	1.115	0.595	0.595	93%	0.128					0.128	0.595	RB incubation	0.053			0.595	0.595
29-Jul	174%	1.115	0.436	0.436	68%	0.128					0.128	0.436	RB incubation	0.053			0.436	0.436
5-Aug	174%	1.115	0.321	0.321	50%	0.128					0.128	0.321	CH migration	0.053			0.321	0.321
12-Aug	174%	1.115	0.271	0.271	42%	0.128					0.128	0.271	CH migration	0.053			0.271	0.271
19-Aug	174%	1.115	0.191	0.191	30%	0.128					0.128	0.191	CH migration	0.053			0.191	0.191
26-Aug	174%	1.115	0.184	0.184	29%	0.128	0.184				0.184	0.184	CH spawning	0.053			0.184	0.184
2-Sep	174%	1.115	0.158	0.158	25%	0.128	0.158				0.158	0.158	CH spawning	0.053			0.158	0.158
9-Sep	174%	1.115	0.144	0.144	22%	0.128	0.144				0.144	0.144	CH spawning	0.053			0.144	0.144
16-Sep	174%	1.115	0.106	0.106	17%	0.128	0.106	0.128			0.128	0.106	CH spawning	0.053	0.064		0.106	0.106
23-Sep	174%	1.115	0.103	0.103	16%	0.128	0.103	0.128			0.128	0.103	CH spawning	0.053	0.064		0.103	0.103
30-Sep	174%	1.115	0.098	0.098	15%	0.128	0.098	0.128			0.128	0.098	CH spawning	0.053	0.064		0.098	0.098
7-Oct	40%	0.256	0.133	0.133	21%	0.128		0.128			0.128	0.128	KO/SK Spawning	0.053	0.064			0.064
14-Oct	40%	0.256	0.130	0.130	20%	0.128		0.128			0.128	0.128	KO/SK Spawning	0.053	0.064			0.064
21-Oct	40%	0.256	0.128	0.128	20%	0.128		0.128			0.128	0.128	KO/SK Spawning	0.053	0.064			0.064
28-Oct	40%	0.256	0.126	0.126	20%	0.128		0.128			0.128	0.126	KO/SK Spawning	0.053	0.064			0.064
Nov	20%	0.128	0.115	0.115	18%							0.115	overwintering egg Incubation	0.053				0.053
Dec	20%	0.128	0.086	0.086	13%							0.086	overwintering egg Incubation	0.053				0.053

Weighted Usable Width

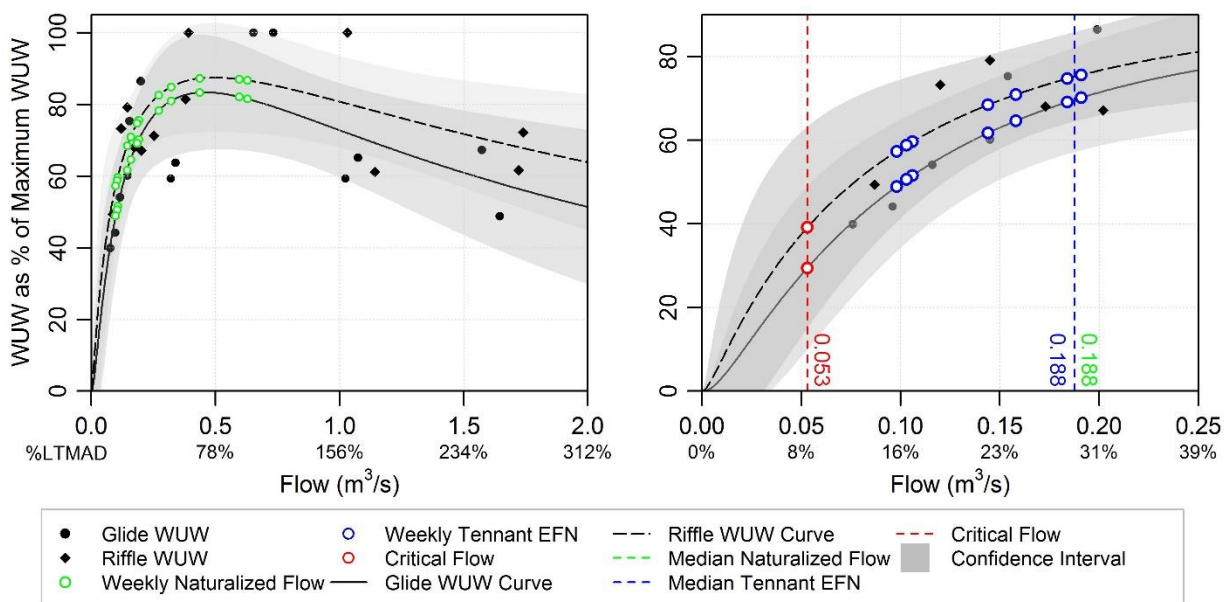
Lower Shingle Creek O. Mykiss Parr Rearing WUW



Median values from mid-July to end of September (week 28-39)

Figure B7-5: WUW curves for *O. Mykiss* rearing in Lower Shingle Creek for all flows (left) and low flows (right)

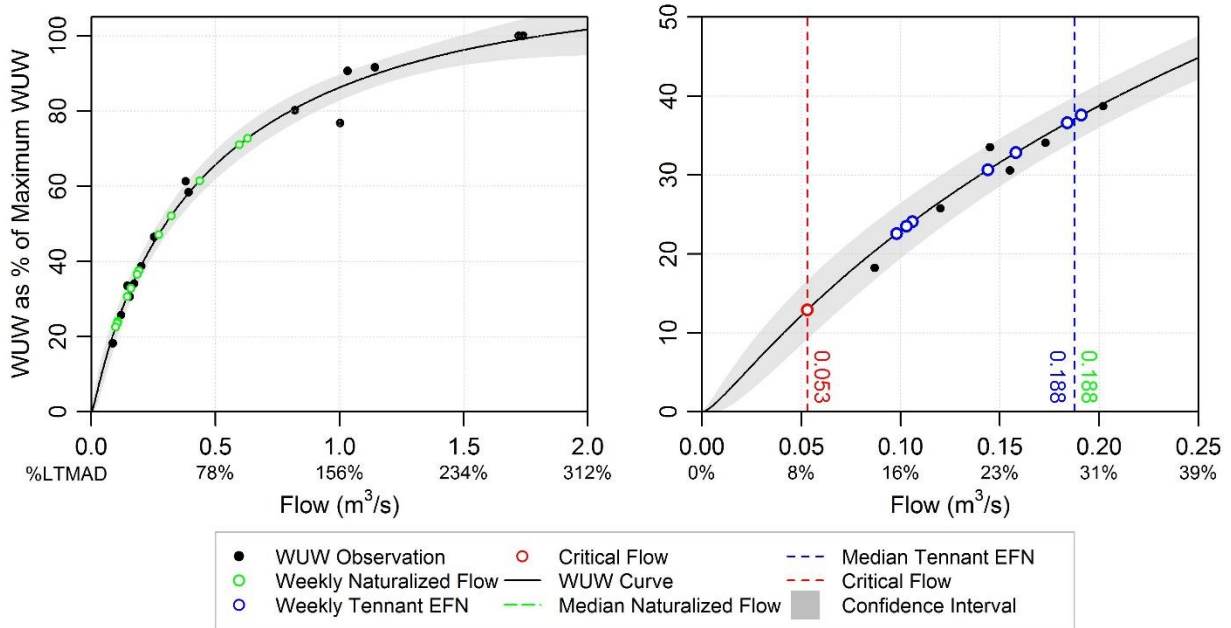
Lower Shingle Creek Chinook Fry Rearing WUW



Median values from mid-July to end of September (week 28-39)

Figure B7-6: WUW curves for Chinook fry rearing in Lower Shingle Creek for all flows (left) and low flows (right)

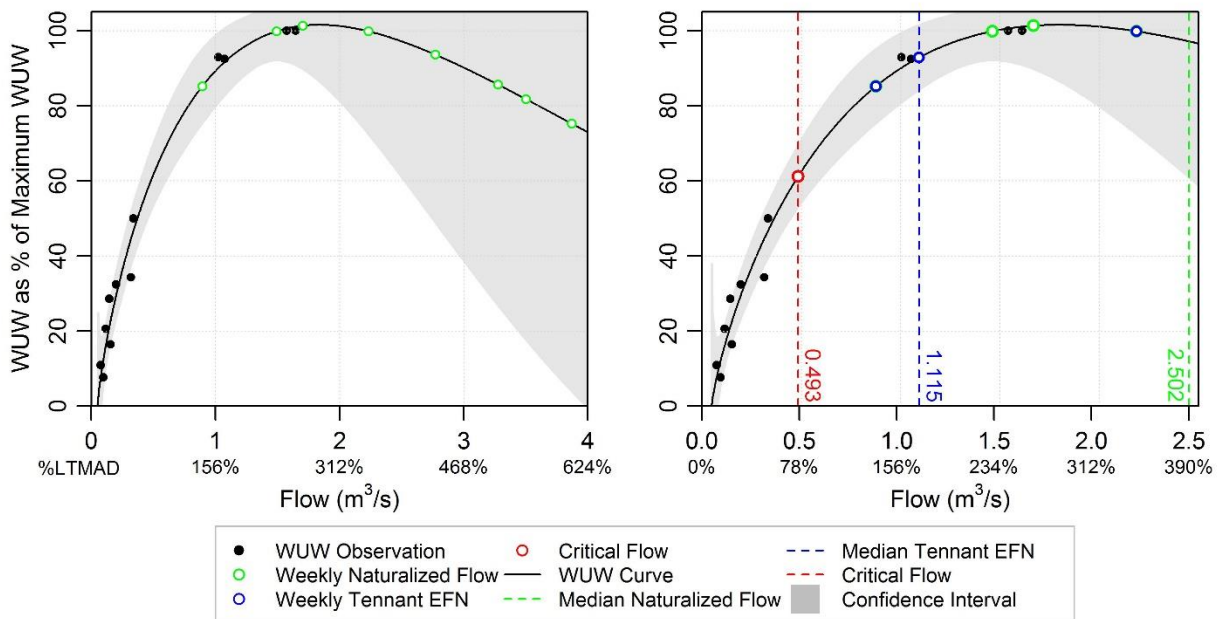
Lower Shingle Creek Insect Production WUW



Median values from mid-July to end of September (week 28-39)

Figure B7-7: WUW curves for insect production in Lower Shingle Creek for all flows (left) and low flows (right)

Lower Shingle Creek Rainbow Spawning WUW



Median values from May 20 to July 10 (week 20-27)

Figure B7-8: WUW curves Rainbow spawning in Lower Shingle Creek for all flows (left) and low flows (right)

Lower Shingle Creek Steelhead Spawning WUW

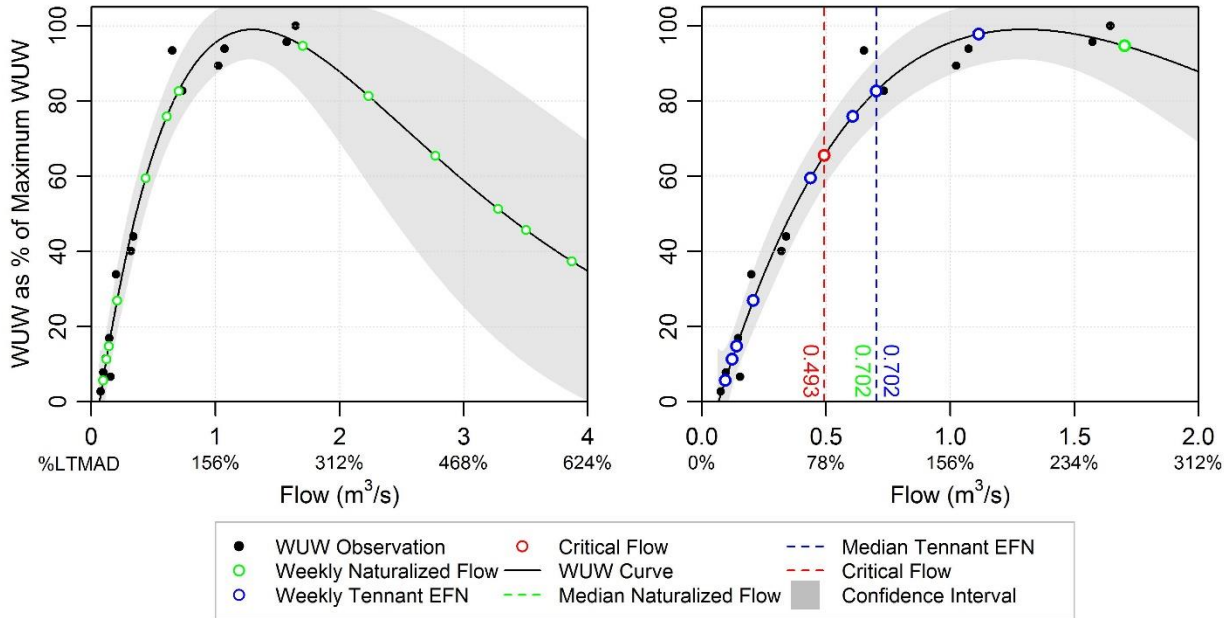


Figure B7-9: WUW curves for Steelhead spawning in Lower Shingle Creek for all flows (left) and low flows (right)

Lower Shingle Creek Chinook Spawning WUW

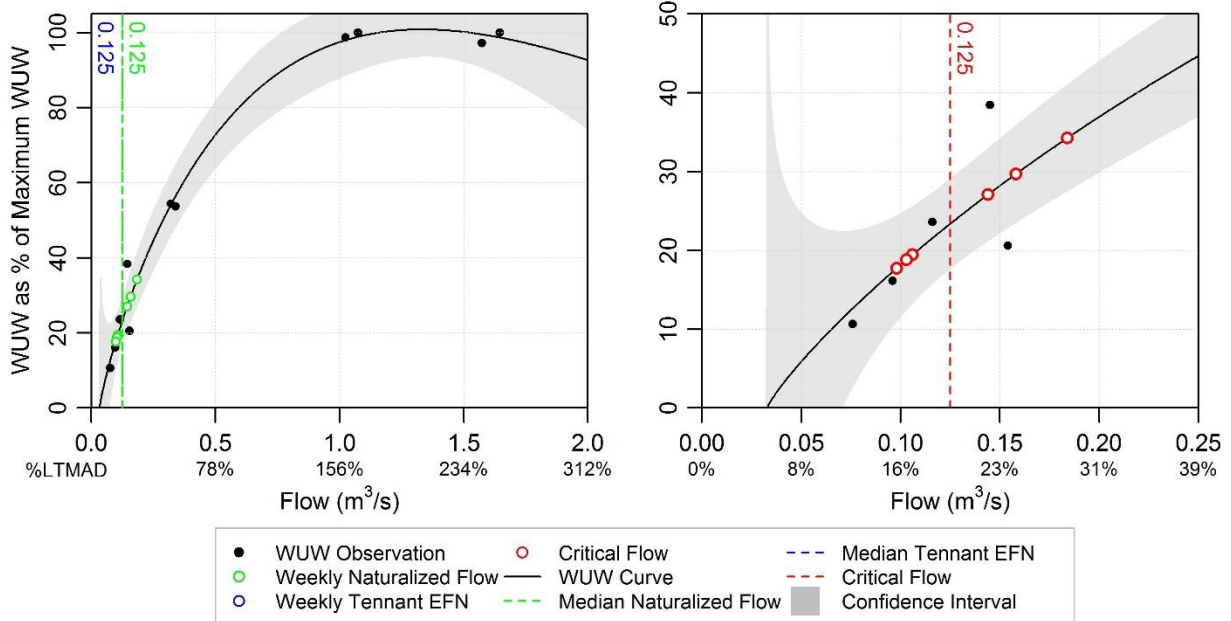
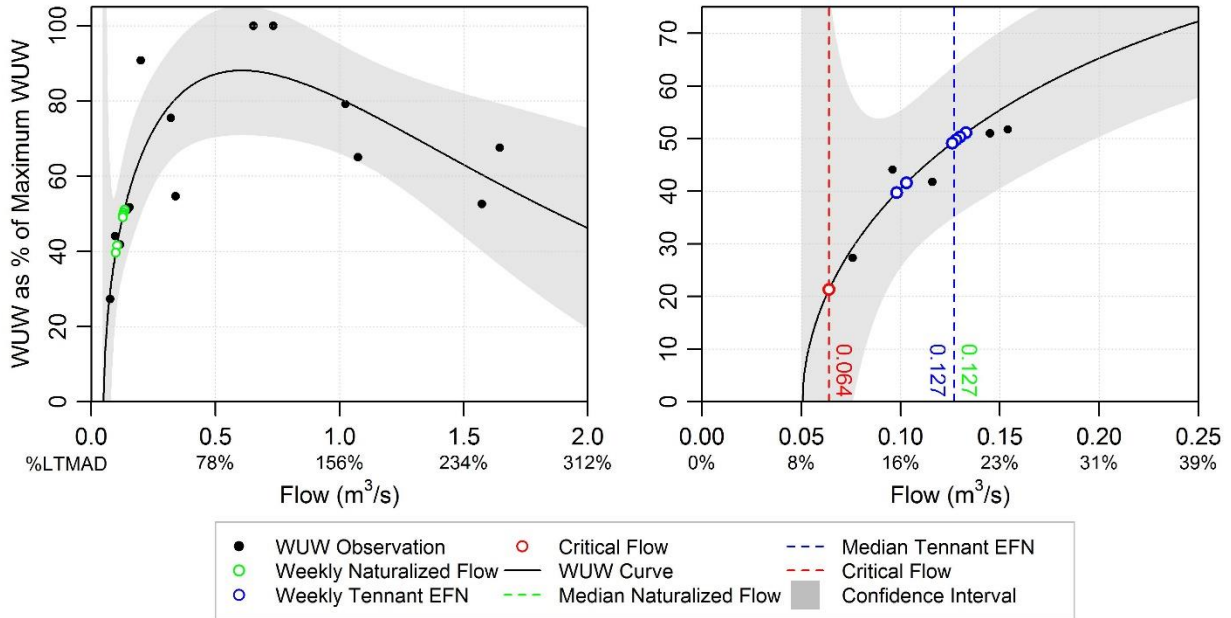


Figure B7-10: WUW curves Chinook spawning in Lower Shingle Creek for all flows (left) and low flows (right)

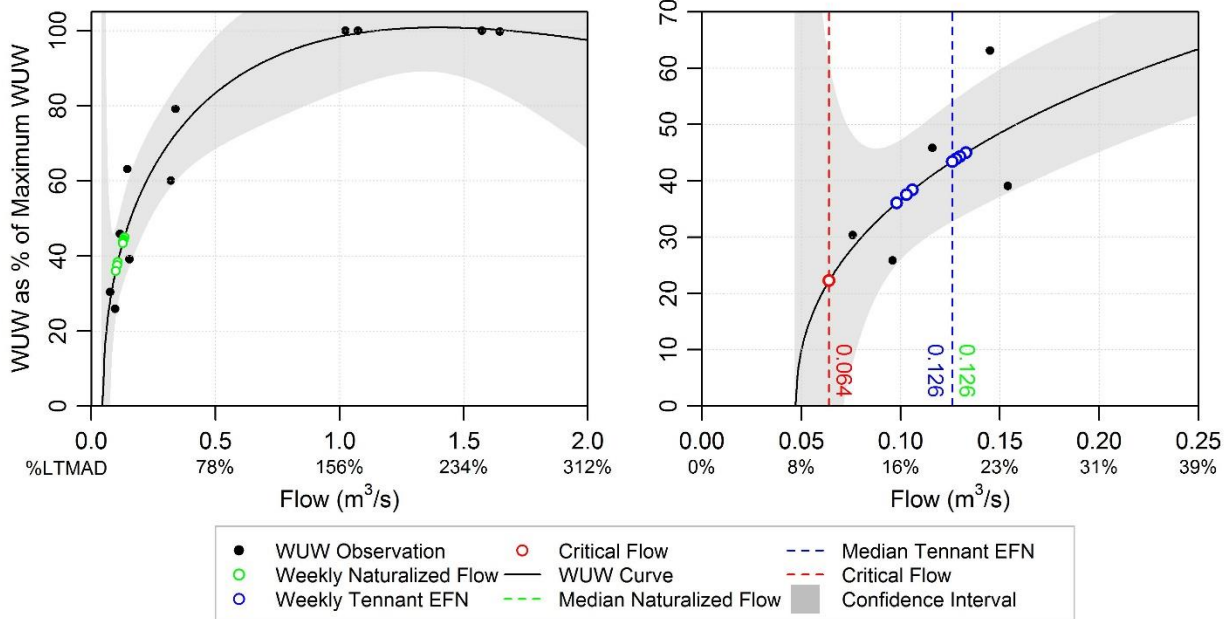
Lower Shingle Creek Kokanee Spawning WUW



Median values from September 25 to November 1 (week 38-43)

Figure B7-11: WUW curves for Kokanee spawning in Lower Shingle Creek for all flows (left) and low flows (right)

Lower Shingle Creek Sockeye Spawning WUW



Median values from September 16 to October 31 (week 37-43)

Figure B7-12: WUW curves for Sockeye spawning in Lower Shingle Creek for all flows (left) and low flows (right)

Critical Flows

Table B7-1: Critical flow analysis for Lower Shingle Creek

Species / Life stage	Critical Flow Criteria	SHG10SCR2016		SHGSCR302016		Average	
		(m ³ /s)	% LTMAD	(m ³ /s)	% LTMAD	(m ³ /s)	% LTMAD
	Naturalized LTMAD	0.641	100%	0.641	100%		
	Wetted width at 100% LTMAD (m)	5.980		4.700			
Insect production, Rainbow rearing & overwintering	60% of width at 100% LTMAD	0.053	8%	0.125	20%	0.089	14%
Chinook spawning & migration	25% of width at 100% LTMAD is ≥0.24m deep	0.829	129%	0.868	135%	0.849	132%
Rainbow, Steelhead & Sockeye spawning	25% of width at 100% LTMAD is ≥0.18m deep	0.389	61%	0.597	93%	0.493	77%
Kokanee spawning	25% of width at 100% LTMAD is ≥0.12m deep	0.127	20%	0.218	34%	0.173	27%

Table B7-2: Final critical flows for Lower Shingle Creek

Species/Life stage	Final Critical Flow (m ³ /s)	% LTMAD	Criteria Used
Rainbow Steelhead, Chinook rearing; insect production	0.053	8%	60% of max wetted width at riffle 1
Rainbow & Steelhead spawning	0.493	77%	0.18m depth criterion
Chinook migration	0.321	50%	Median weekly naturalized flow
Chinook spawning	0.125	19%	Median weekly naturalized flow
Kokanee & Sockeye spawning	0.064	10%	10% LTMAD
Overwintering salmonids	0.053	8%	60% of max wetted width

Table B7-3: 30 day naturalized low flows for Summer and Winter provided by Associated (2019)

	(m ³ /s)	% LTMAD
Summer (July 1 to September 30) Minimum		
Summer 1:2-year return period 30 Day Naturalized Low	0.110	17%
Summer 1:5-year return period 30 Day Naturalized Low	0.067	10%
Summer 1:10-year return period 30 Day Naturalized Low	0.052	8%
Summer 1:20-year return period 30 Day Naturalized Low	0.043	7%
Winter (November 1 to March 31) Minimum		
Winter 1:2-year return period 30 Day Naturalized Low	0.063	10%
Winter 1:5-year return period 30 Day Naturalized Low	0.047	7%
Winter 1:10-year return period 30 Day Naturalized Low	0.042	7%
Winter 1:20-year return period 30 Day Naturalized Low	0.040	6%

Percentile Flows for Lower Shingle Creek

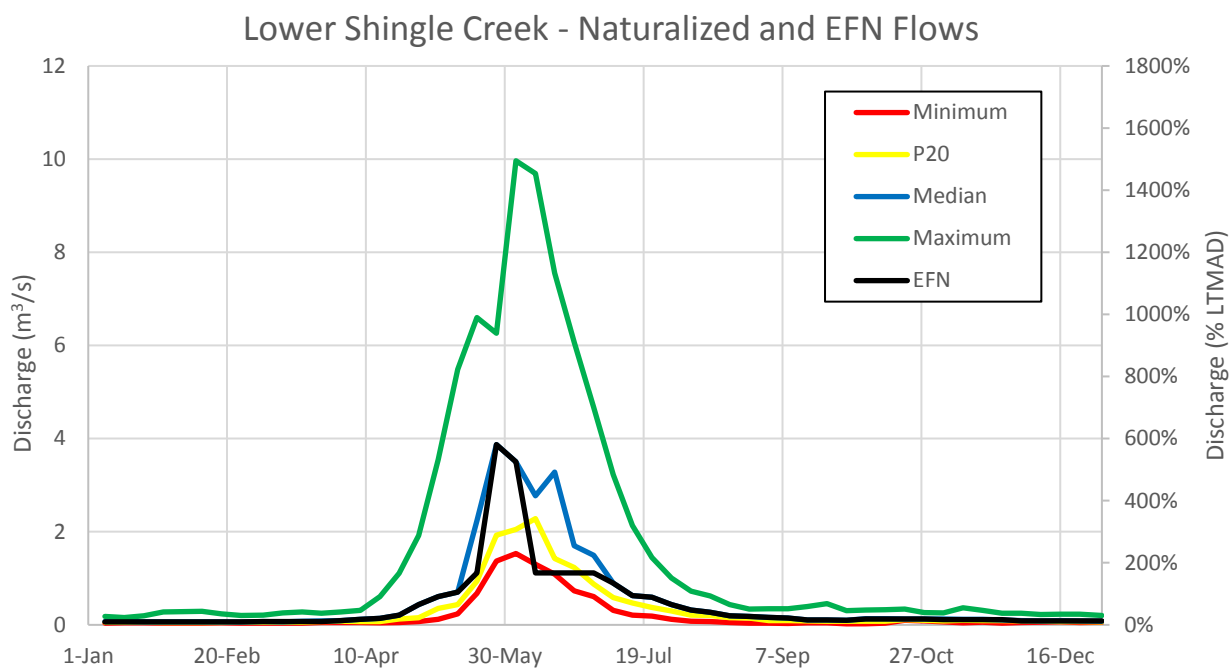


Figure B7-13: EFN flows compared with naturalized flow percentiles in Lower Shingle Creek (Discharge & %LTAD)

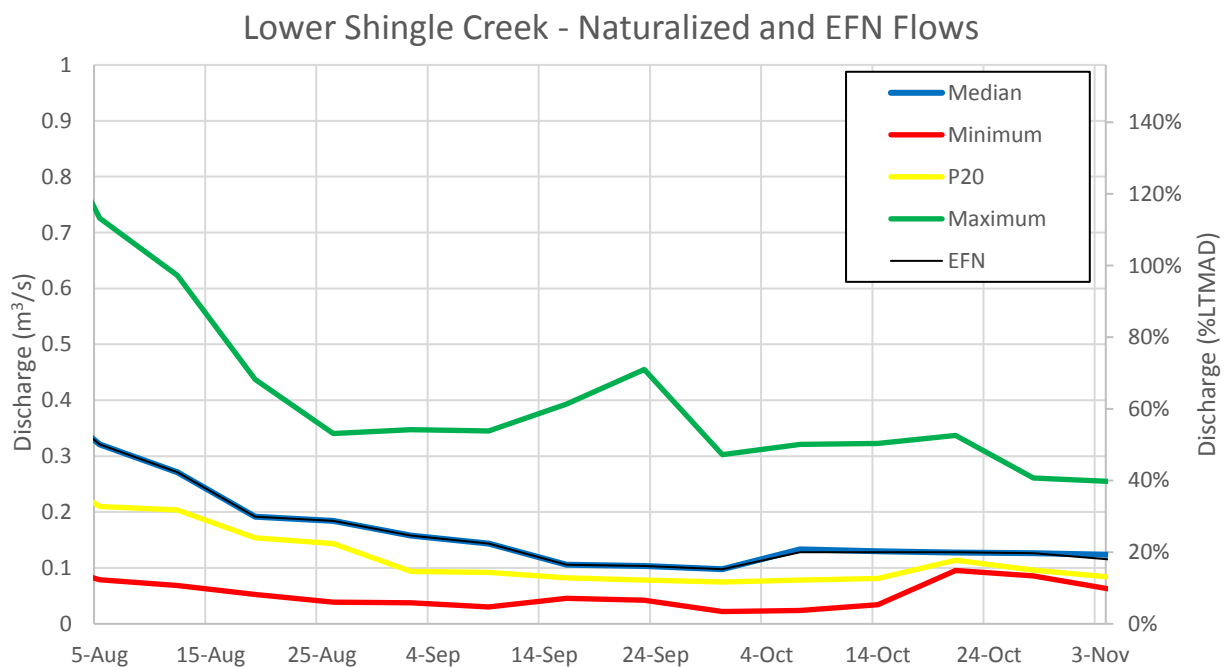


Figure B7-14: EFN flows compared with naturalized flow percentiles in Lower Shingle Creek Aug-Nov (Discharge & %LTAD)

Naturalized Percentile Flows for Lower Shingle Creek

NATURALIZED FLOW		as m ³ /s				as %LTMD			
Week	Ending	Min	P20	Median	Max	Min	P20	Median	Max
01	7-Jan	0.034	0.060	0.073	0.183	5%	9%	11%	28%
02	14-Jan	0.043	0.059	0.072	0.157	7%	9%	11%	24%
03	21-Jan	0.043	0.056	0.067	0.194	7%	9%	10%	30%
04	28-Jan	0.037	0.053	0.065	0.279	6%	8%	10%	44%
05	4-Feb	0.035	0.053	0.066	0.286	6%	8%	10%	45%
06	11-Feb	0.036	0.053	0.063	0.291	6%	8%	10%	45%
07	18-Feb	0.042	0.053	0.067	0.236	7%	8%	11%	37%
08	25-Feb	0.040	0.056	0.062	0.202	6%	9%	10%	32%
09	4-Mar	0.040	0.056	0.068	0.206	6%	9%	11%	32%
10	11-Mar	0.037	0.060	0.064	0.260	6%	9%	10%	41%
11	18-Mar	0.038	0.060	0.080	0.275	6%	9%	12%	43%
12	25-Mar	0.052	0.068	0.085	0.253	8%	11%	13%	39%
13	1-Apr	0.053	0.077	0.094	0.276	8%	12%	15%	43%
14	8-Apr	0.053	0.071	0.122	0.311	8%	11%	19%	49%
15	15-Apr	0.046	0.070	0.140	0.610	7%	11%	22%	95%
16	22-Apr	0.051	0.124	0.207	1.108	8%	19%	32%	173%
17	29-Apr	0.073	0.156	0.437	1.916	11%	24%	68%	299%
18	6-May	0.120	0.353	0.608	3.545	19%	55%	95%	553%
19	13-May	0.238	0.435	0.702	5.486	37%	68%	110%	856%
20	20-May	0.674	0.940	2.232	6.599	105%	147%	348%	1030%
21	27-May	1.373	1.923	3.870	6.262	214%	300%	604%	977%
22	3-Jun	1.532	2.053	3.501	9.964	239%	320%	546%	1555%
23	10-Jun	1.303	2.281	2.771	9.689	203%	356%	432%	1512%
24	17-Jun	1.088	1.425	3.277	7.553	170%	222%	511%	1178%
25	24-Jun	0.731	1.229	1.703	6.068	114%	192%	266%	947%
26	1-Jul	0.607	0.876	1.492	4.671	95%	137%	233%	729%
27	8-Jul	0.314	0.588	0.893	3.224	49%	92%	139%	503%
28	15-Jul	0.211	0.469	0.629	2.132	33%	73%	98%	333%
29	22-Jul	0.187	0.377	0.595	1.445	29%	59%	93%	225%
30	29-Jul	0.121	0.296	0.436	1.004	19%	46%	68%	157%
31	5-Aug	0.079	0.210	0.321	0.726	12%	33%	50%	113%
32	12-Aug	0.068	0.204	0.271	0.623	11%	32%	42%	97%
33	19-Aug	0.052	0.154	0.191	0.438	8%	24%	30%	68%
34	26-Aug	0.039	0.143	0.184	0.341	6%	22%	29%	53%
35	2-Sep	0.038	0.094	0.158	0.347	6%	15%	25%	54%
36	9-Sep	0.030	0.092	0.144	0.345	5%	14%	22%	54%
37	16-Sep	0.045	0.083	0.106	0.393	7%	13%	17%	61%
38	23-Sep	0.042	0.078	0.103	0.455	7%	12%	16%	71%
39	30-Sep	0.022	0.075	0.098	0.302	3%	12%	15%	47%
40	7-Oct	0.024	0.079	0.133	0.321	4%	12%	21%	50%
41	14-Oct	0.034	0.081	0.130	0.323	5%	13%	20%	50%
42	21-Oct	0.095	0.114	0.128	0.337	15%	18%	20%	53%
43	28-Oct	0.085	0.096	0.126	0.261	13%	15%	20%	41%
44	4-Nov	0.062	0.083	0.124	0.254	10%	13%	19%	40%
45	11-Nov	0.045	0.098	0.120	0.369	7%	15%	19%	58%
46	18-Nov	0.059	0.093	0.121	0.312	9%	15%	19%	49%
47	25-Nov	0.038	0.093	0.108	0.251	6%	15%	17%	39%
48	2-Dec	0.050	0.083	0.094	0.251	8%	13%	15%	39%
49	9-Dec	0.056	0.079	0.085	0.220	9%	12%	13%	34%
50	16-Dec	0.066	0.074	0.090	0.232	10%	12%	14%	36%
51	23-Dec	0.052	0.073	0.085	0.232	8%	11%	13%	36%
52	31-Dec	0.056	0.066	0.077	0.201	9%	10%	12%	31%

Residual and Max licensed residual flows are not available at this time.