

3.4 Whiteman Creek

Whiteman Creek is a tributary to the northwest arm of Okanagan Lake. It drains a gently sloping plateau with several small lakes, then flows eastward through steep hillslopes and finally over a large alluvial fan before entering Okanagan Lake. Its main tributary is Bouleau Creek, which drains Bouleau Lake. Whiteman Creek has no developed storage and flows are not regulated. The stream is approximately 25 km long (Eyjolfson & Dunn 2016) with a watershed area of 203 km² (Associated 2016). A summary of creek characteristics is found in Table 3-10 and additional stream-specific data is provided in Appendix B4.

Whiteman Creek supports a population of large adfluvial Rainbow from Okanagan Lake that migrate over 10 km upstream to spawn, as well as a resident smaller bodied population (Agrodev 1996). The lower sections also provide important habitat for a population of approximately 500 Kokanee spawners from Okanagan Lake (Northcote et al. 1972; Louis 2012). The lower reaches of Whiteman Creek below Westside Road flow through a residential area and agricultural fields. The channel in this section was straightened in the past for flood control purposes (Anonymous 1969). Impacts of past channelization were observed during habitat surveys for this project and the lower section remains characterized by a relatively straight channel and a lack of habitat complexity. However, there is good riparian cover and suitable spawning gravels throughout this section. Upstream of Westside Road, habitat becomes more complex and the relatively coarse, cobbly substrate provides for ideal rearing habitat for juvenile Rainbow with high numbers of parr observed during the habitat surveys for this project. Water temperatures in Whiteman Creek remain relatively cold even during the summer low flow period (<20°C, Figure B4-5 Appendix B4), contributing to excellent Rainbow rearing conditions in the creek.

Wightman & Taylor (1978) identified a natural debris jam barrier approximately 4.8 km from the mouth. Habitat surveys for this project were limited to sections closer to the mouth and thus the barrier was not confirmed. However, it is possible and likely that the obstruction has since been washed out by high freshet flows. A previously documented irrigation dam 1.6 km from the mouth (Wightman & Taylor 1978) has since been removed and no other barriers were identified.

A total of two glide and two riffle transects were established in Whiteman Creek in August 2016 (Figure B4-2, Appendix B4). All transects were located in the lowest 1.2 km between Westside Road and Okanagan Lake where the best Kokanee spawning habitat is located and where all spawning activity is typically observed (Louis 2012).

The Okanagan Indian Band is the primary water supplier within the Whiteman Creek watershed (Dobson 2008) and there are 12 points of diversion within the watershed (Associated 2019). Past reports mention serious impairment to fish production from low flows and high water use in Whiteman Creek (Wightman & Taylor 1978); recent streamflow data from the mouth is very limited (2017) and did reveal relatively low late summer flows (9% LTMAD), but it is unknown if flow impairment resulted from water use. Streamflow measurements indicated streamflow losses to groundwater on the alluvial fan but due to the limited spatial extent of surveys and unclear seasonal variation, water losses and gains across the fan are considered unknown. Recent field surveys completed by ONA revealed one diversion ditch upstream of Westside Road (ONA unpublished data 2019) but the diversion was not in use during the late fall survey and its impacts on streamflows during summer is unknown. The stream is currently fully recorded for irrigation unless supported by storage (FLNRORD 2016). Whiteman Creek is 'flow sensitive' during summer and winter as naturalized flows are below 20% LTMAD (Table 3-11). One hydrometric station was installed near the mouth in 2016 and continues to operate (Figure B4-2, Appendix B4).

Table 3-10: Whiteman Creek description

Drainage Area	203 km ²
Median Elevation	1340 m
WSC station	08NM174 – Whiteman Creek above Bouleau Creek
ONA station	08NM587 (2016 – present) Whiteman Creek at Raven Road Bridge
LTMAD	1.092 m ³ /s (Associated 2019)
Fish species expected	Kokanee (Northcote et al. 1972; Louis 2012), Rainbow (FIDQ 1996)
Land use	Urban, transportation, agriculture, forestry (Associated 2016). Flows through Okanagan Indian Band No.1 on the alluvial fan

Naturalized, residual and maximum licensed flow data were provided by Associated (2019) with an estimated data quality rating of B (data error between 10% and 25%). Estimated residual flows indicate near zero water withdrawals but this should be verified in the future as at least one large diversion ditch was documented recently. Estimated maximum licensed flows indicate that flows would be below the EFN throughout the summer and below critical flows during the Kokanee spawning period if licensed withdrawals were maximized.

Okanagan Tennant EFNs for Whiteman Creek were developed in accordance with the methods outlined in Section 2.2. Fish periodicity and flow standards described in Table 2-2 to Table 2-6 were used. Weekly Okanagan Tennant EFNs were set to the lower of the naturalized flow or flow standard. WUW information from the study transects was then reviewed to determine whether final EFN recommendations needed adjustment from the Okanagan Tennant EFN. A summary of the recommended EFNs is provided in Table 3-12, including the median EFN and the range of weekly EFNs, with weekly details in Figure 3-7, Figure 3-8 and Appendix B4 and flow sensitivities in Table 3-11. Critical flows were calculated as described in Section 2.4. Further information regarding EFN and critical flow setting in Whiteman Creek is provided at the end of this section.

Table 3-11: Flow sensitivities in Whiteman Creek

Species & life stage	1-in-2 yr 30-day summer low flow		1-in-2 yr 30-day winter low flow	
	Flow (m ³ /s)	% LTMAD	Flow (m ³ /s)	% LTMAD
Rainbow rearing	0.108	10%		
Insect production				
Kokanee spawning				
Rainbow overwintering			0.098	9%
Kokanee egg incubation				

Source: Associated (2019)

Table 3-12: EFN summary table for Whiteman Creek

Species & life stage	Time period	Okanagan Tennant EFN		WUW EFN (m ³ /s)	Recommended EFN (m ³ /s)				Critical flow	
		Median (m ³ /s)	% LTMAD		Median	% LTMAD	Min	Max	Flow (m ³ /s)	% LTMAD
Rainbow rearing & insect production ^a	April 1 – Oct 31	0.158	14%	0.158	0.158	14%	0.112	0.659	0.052	5%
Rainbow spawning	May 20 – Jul 10	1.56	143%	1.10	1.10	101%	0.961	5.70	0.361	33%
Kokanee spawning	Sep 8 – Oct 5	0.141	13%	0.141	0.141	13%	0.112	0.146	0.109	10%
Rainbow overwintering	Nov 1 – March 31	0.138	13%	n/a	0.138	13%	0.122	0.179	0.052	5%

^a while EFNs apply to the entire period, median values are presented for the summer low flow period from Jul 15-Sept 30.

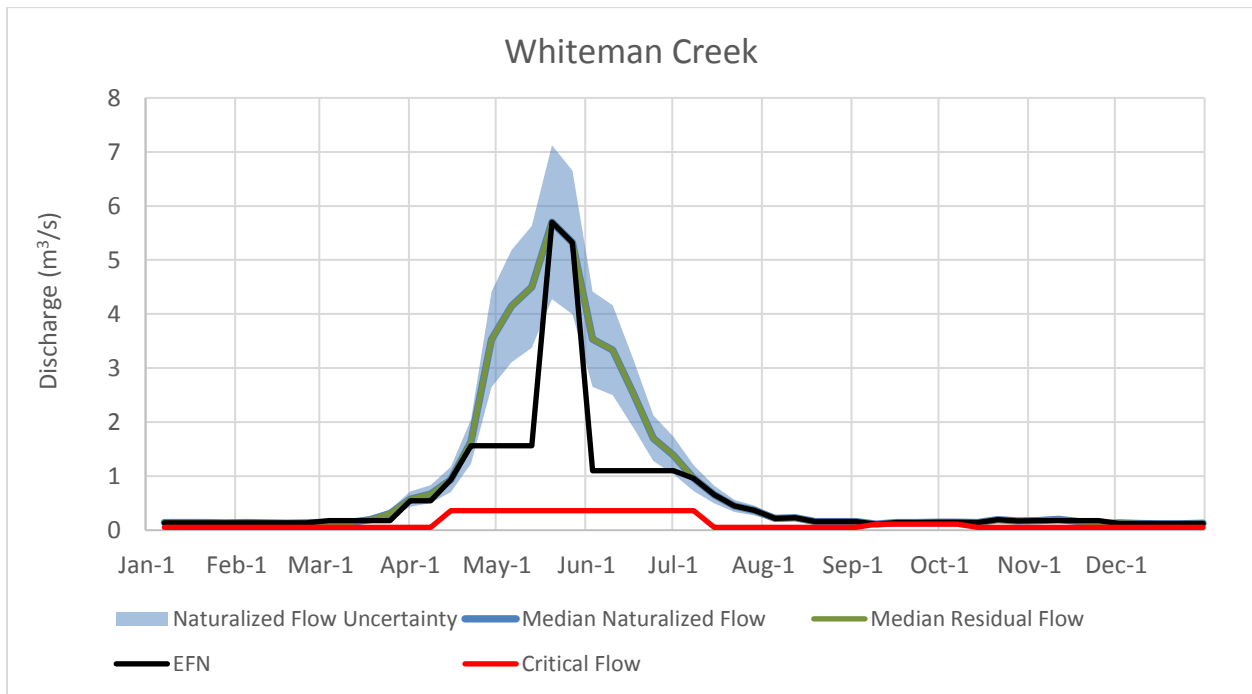


Figure 3-7: Weekly EFNs, critical flow and streamflows in Whiteman Creek

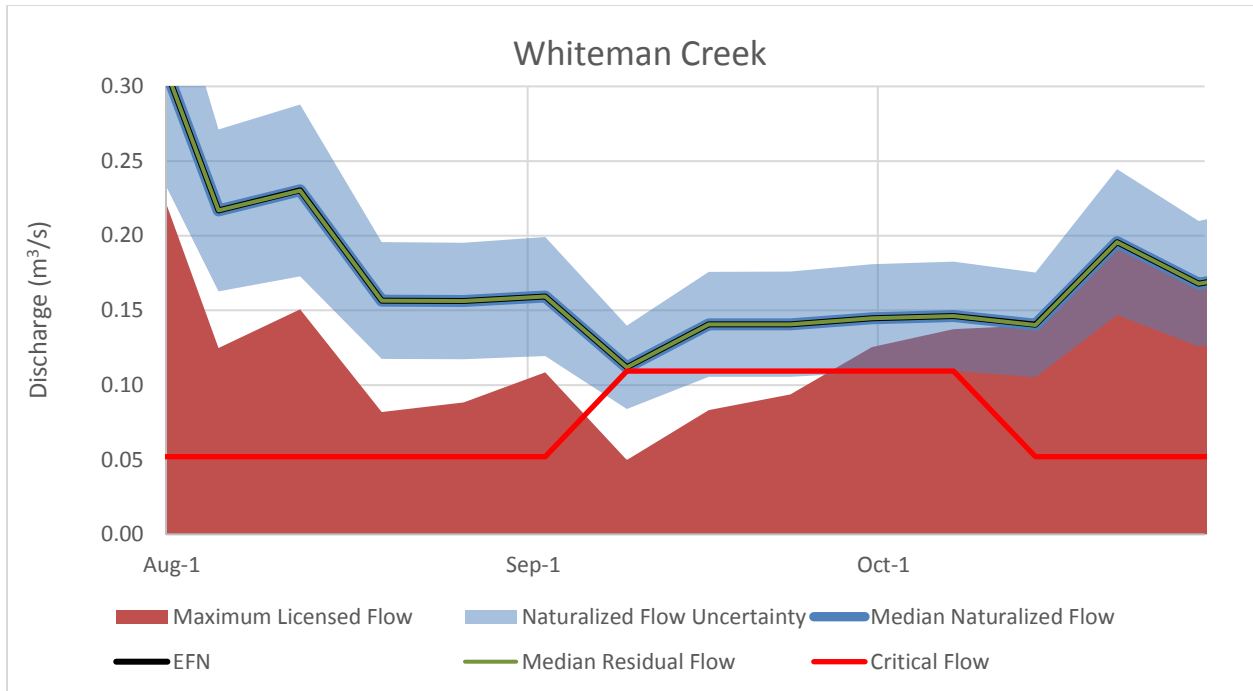


Figure 3-8: Weekly EFNs, critical flow and streamflows during the summer and fall in Whiteman Creek

Rainbow parr rearing

The recommended EFN for Rainbow parr rearing is 0.158 m³/s (14% LTMAD), which is equivalent to the median Okanagan Tennant EFN and median naturalized flows for the summer and fall low flow period (mid-July from end of Rainbow spawning to end of September). This EFN maintains approximately 45% of maximum WUW in glides and 25% in riffles (Figure B4-6, Appendix B4), and 20% of maximum insect production WUW (Figure B4-7, Appendix B4). Estimated naturalized summer and fall flows in Whiteman Creek are relatively low (the lowest weekly naturalized flow is 0.113 m³/s = 10% LTMAD in early September) (Associated 2019). WUW curves indicate that rearing conditions at those flows are marginal with <20% parr rearing WUW and ~10% insect production WUW. Thus, the weekly recommended EFNs were set equal to the naturalized flows throughout the summer and fall period to maximize the naturally limited rearing habitat available (Figure 3-8). Parr rearing WUW rapidly increases to 0.4 m³/s and juvenile Rainbow in Whiteman Creek would benefit from flows greater than the EFN whenever available. Photos of habitat conditions in Whiteman Creek at the recommended EFN flows are provided in Plate 3-7. The recommended EFN is greater than the minimum flow for Rainbow rearing recommended by the B.C. Fish and Wildlife Branch of 0.085 m³/s (Robertson 1983) as well as those by Shepherd & Ptolemy (1999) and Koshinsky (1972) of 0.09 m³/s. The recommended critical flow for Rainbow parr is 0.052 m³/s (5% LTMAD, Table B4-2, Appendix B4) based on the riffle width criterion (Table 2-7).

Residual flows recorded at the hydrometric station near the mouth in 2017 (a drought year) were below the recommended EFN from mid-August to late September (Figure B4-3, Appendix B4). Water temperatures recorded at the station were generally favorable to Rainbow rearing at the observed flows (maximum 18°C in mid-July) (Figure B4-5, Appendix B4). There is one known water diversion upstream of the station (Eyjolfson & Dunn 2016) but surveys were limited and it is unknown to what extent the recorded flows were affected by water withdrawals. Median daily flows at the historic WSC hydrometric station 08NM046 (1920-21 and 1949-70) were generally greater than the recommended EFN during the summer and fall period (Figure B4-4, Appendix B4), therefore the EFN is considered attainable during

most years. Records from this station were likely heavily affected by irrigation withdrawals documented in Wightman & Taylor (1978) and Galbraith & Taylor (1969).

Rainbow spawning

The recommended EFN for Rainbow spawning is 1.10 m³/s (100% LTMAD), which is lower than the Okanagan Tennant EFN (143% LTMAD) and well below the median weekly naturalized flows during the Rainbow spawning period (Figure B4-8, Appendix B4). The recommended EFN maintains high Rainbow spawning WUW (> 90% of maximum) while also maximizing Rainbow parr rearing WUW in riffles and glides. Recent and historic residual streamflows indicate that the EFN is typically met for the duration of the spawning period (Figures B4-3 and B4-4, Appendix B4). Photos of habitat conditions in Whiteman Creek at the recommended EFN flows are provided in Plate 3-8. The recommended critical flow for Rainbow spawning is 0.361 m³/s (33% LTMAD, Table B4-2, Appendix B4) based on the passage depth criterion (Table 2-7).

Kokanee spawning

The recommended EFN for Kokanee spawning is 0.141 m³/s (13% LTMAD) which maintains 45% of maximum WUW (Figure B4-9, Appendix B4). The EFN corresponds to the median Okanagan Tennant EFN and median naturalized flows during the Kokanee spawning period. The rapidly increasing WUW curve up to 0.5 m³/s suggests that Kokanee in Whiteman Creek would greatly benefit from flows higher than the recommended EFN when available. Minimum passage depth for Kokanee was achieved at the lowermost riffle transect at approximately 0.13 m³/s (12% LTMAD), and any reduction in flows from the recommended EFN may result in passage issues. The recommended EFN is equal to that recommended for Kokanee spawning in Whiteman Creek by Koshinsky (1972b). Photos of habitat conditions in Whiteman Creek at the recommended EFN flows are provided in Plate 3-7.

The recommended critical flow for Kokanee spawning is 0.109 m³/s (10% LTMAD, Table B4-2, Appendix B4) based on the %LTMAD criterion (Table 2-7). Riffle analysis indicated average critical passage flows of 0.180 m³/s (16% LTMAD), which is slightly greater than naturalized flows during the spawning and migration period.

The recommended EFN is slightly higher than the residual flows recorded at the ONA hydrometric station during 2017, which was a drought year, indicating that EFNs may not be met during some years (Figure B4-3, Appendix B4). Historically, median daily flows at the historic WSC hydrometric station 08NM046 (1920-21 and 1949-70) were generally greater than the recommended EFN during the Kokanee spawning period (Figure B4-4, Appendix B4).

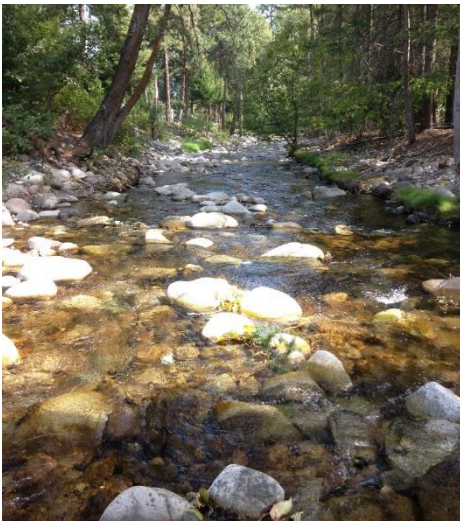
Plate 3-7: Whiteman Creek habitat conditions at flows near the recommended Rainbow parr rearing EFN (0.158 m³/s) and Kokanee spawning EFN (0.141 m³/s)



Glide 1 at 0.113 m³/s (10% LTMAD)



Glide 1 at 0.182 m³/s (17% LTMAD)



Riffle 2 at 0.125 m³/s (11% LTMAD)



Riffle 2 at 0.189 m³/s (17% LTMAD)

Plate 3-8: Whiteman Creek habitat conditions at flows near the recommended Rainbow spawning EFN (1.10 m³/s)



Glide 2 at 0.904 m³/s (82% LTMAD)



Glide 1 at 1.20 m³/s (110% LTMAD)