

### **3.18 McLean Creek**

McLean Creek flows from the east side of the Okanagan Basin into Skaha Lake just north of the town of Okanagan Falls, B.C. It is the only significant tributary to Skaha Lake other than the Okanagan River (Matthews & Bull 2003). From the headwaters McLean Creek flows through an agricultural plateau for approximately 2 km before discharging into Skaha Lake (Associated 2016). The McLean Creek watershed has an area of approximately 63 km<sup>2</sup> (Associated 2016). A summary of creek characteristics is found in Table 3-54 and additional stream-specific data is provided in Appendix B18.

The stream is known to support populations of fluvial and adfluvial Rainbow (Associated 2016) and dense areas of juvenile Rainbow rearing upstream of Eastside Road were observed during snorkel surveys (OBMEP 2017). The stream is also available to salmon species that include Kokanee, anadromous Steelhead, Sockeye, Chinook and Coho. The lowest permanent barrier to fish migration is a waterfall approximately 2.2 km from the mouth (OBMEP 2019). This represents the extent of anadromous salmon habitat.

The lowest reach of McLean Creek experiences a varying degree of riparian habitat impairment and hydro-modification. From the confluence with Skaha Lake upstream to Eastside Road, the creek has undergone significant riparian habitat impairment and hydro-modification. In this lowest section, banks have been armoured and yards are maintained right up to the creek. However, upstream of Eastside Road to the upstream fish migration barrier (2.2 km from the mouth) the riparian habitat is very good with minimal hydro-modification. In this upper section, the stream meanders well and there is a complex of riparian vegetation and large woody debris. A number of endangered wildlife species have been observed in this section.

McLean Creek contains some of the coolest summer water temperatures in the southern portion of the Canadian Okanagan basin. Water temperatures are generally within preferred ranges for salmonid life histories in summer months and generally remain lower than 20°C.

At present, there are 65 points of diversion and one pending water licence application within the watershed (Associated 2019); however, the actual volume extracted annually is unknown. FLNRORD (2016) registered a possible water shortage for McLean Creek in 1967. There is no main water user in the watershed and there is no developed water storage (Associated 2016). Upper reaches go dry immediately following freshet and there are a high number of withdrawals above the waterfall. McLean Creek has considerable groundwater inputs from wetland areas in the mid-elevation reaches that augment winter flows. Many of the water licences are above the wetland reach and the lower reaches have flow year-round. No field measurements were collected for this project and groundwater gains and losses across the alluvial fan are unknown. McLean Creek is naturally 'flow sensitive' during summer and winter as flows are below 20% LTMAD (Table 3-55).

Naturalized flows were provided by Associated (2019) with an estimated data quality rating of C (data error between 25% and 50%); residual and maximum licensed flows were not available at the time of reporting. Okanagan Tennant EFNs for McLean Creek were developed in accordance with the methods outlined in Section 2.2. No WUW data was collected. Fish periodicity and flow standards described in Table 2-2 to Table 2-6 were used. A summary of EFNs for McLean Creek is provided in Table 3-56 including the median EFN and the range of weekly EFNs, with weekly details in Figure 3-38, Figure 3-39 and Appendix B18, and flow sensitivities in Table 3-55. Further information on EFN setting in McLean Creek is provided at the end of this section.

**Table 3-54: McLean Creek description**

Drainage Area	63.2 km <sup>2</sup>
Median Elevation	1243 m
WSC station	08NM005 (historic) Mclean Creek near OK Falls (1921-1926)
LTMAD	0.167 m <sup>3</sup> /s (Associated 2019)
Fish species expected	Rainbow (Matthews & Bull 2003)
Land use	Agriculture

**Table 3-55: Flow sensitivities in McLean Creek**

Species & life stage	1-in-2 yr 30-day summer low flow		1-in-2 yr 30-day winter low flow	
	Flow (m <sup>3</sup> /s)	% LTMAD	Flow (m <sup>3</sup> /s)	% LTMAD
<i>O. mykiss</i> rearing	0.023	14%		
Insect production				
Kokanee spawning				
<i>O. mykiss</i> & Chinook overwintering			0.017	10%
Kokanee & Chinook egg incubation				

Source: Associated (2019)

**Table 3-56: EFN summary table for McLean Creek**

Species & life stage	Time period	Okanagan Tennant Recommended EFN				Critical flow	
		Median (m <sup>3</sup> /s)	% LTMAD	Min (m <sup>3</sup> /s)	Max (m <sup>3</sup> /s)	Flow (m <sup>3</sup> /s)	% LTMAD
<i>O. Mykiss</i> parr rearing & insect production <sup>a</sup>	April 1 – Oct 31	0.032	19%	0.021	0.125	0.008	5%
Steelhead spawning	April 1 – Jun 25	0.428	256%	0.035	0.980	0.084	50%
Rainbow spawning	May 20 – Jul 10	0.471	282%	0.180	0.980	0.084	50%
Kokanee spawning	Sep 1 – Oct 20	0.026	15%	0.021	0.033	0.017	10%
Salmonid overwintering	Nov 1 – Mar 31	0.021	13%	0.019	0.033	0.008	5%

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

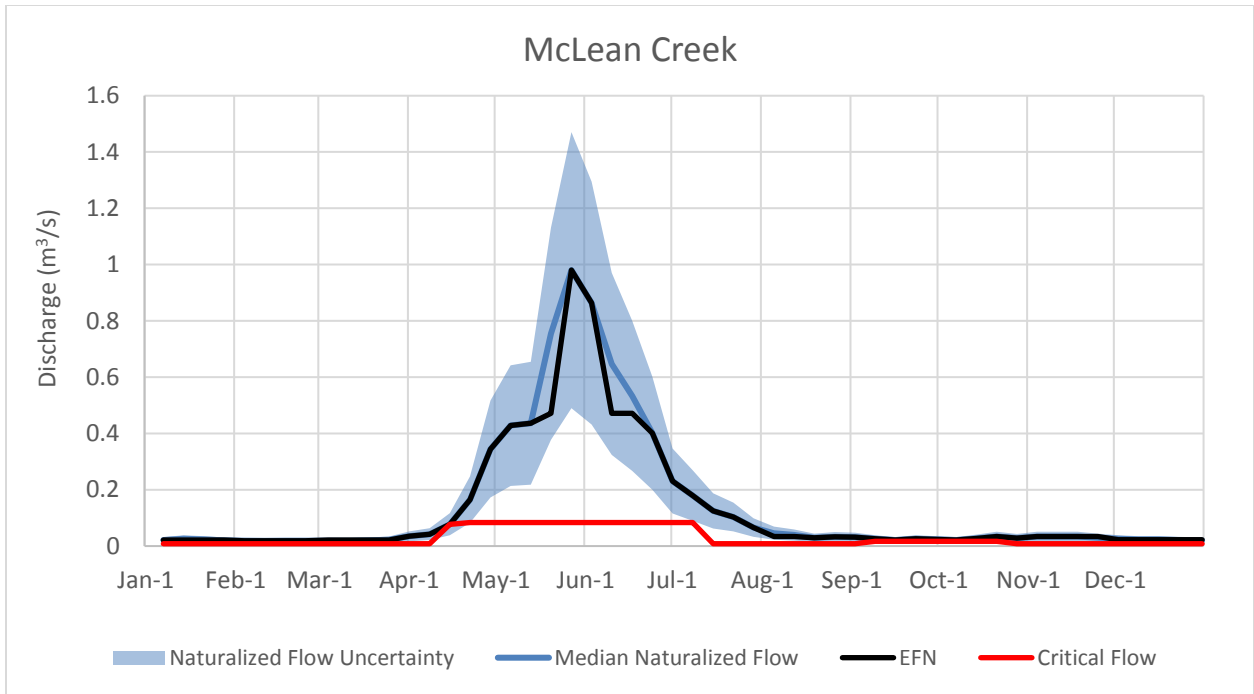


Figure 3-38: Weekly EFNs, critical flow and streamflows in McLean Creek

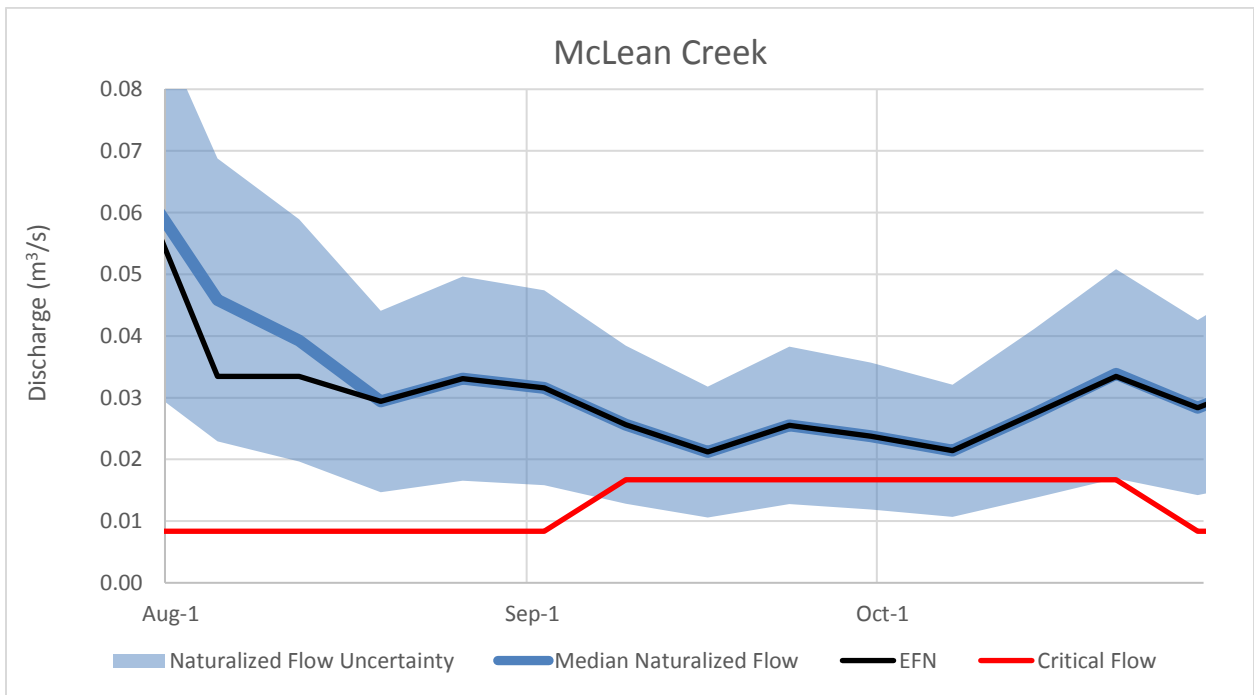


Figure 3-39: Weekly EFNs, critical flow and streamflows during the summer and fall period in McLean Creek

### O. mykiss parr rearing

The recommended Okanagan Tennant EFN for Steelhead and Rainbow (*O. mykiss*) parr rearing is 0.032 m<sup>3</sup>/s (19% LTMAD), which is equal to the median weekly naturalized flows during the mid-July to late September period (Table 3-56, Figure 3-39). The recommended critical flow for *O. mykiss* parr rearing is 0.008 m<sup>3</sup>/s (5% LTMAD) based on the LTMAD criterion (Table 2-7). Historical recorded flows at the WSC hydrometric station 08NM005, which operated seasonally from 1921-1926, document flows much below the recommended EFN from early July onwards (Figure B18-1, Appendix B18). However, mapping by Associated (2017) indicates that the hydrometric station was located high in the watershed in the reaches above the wetland discharge and thus flows were likely lower than in the reaches at the mouth. No historical EFN recommendations have been made for McLean Creek

### Steelhead spawning

The recommended Okanagan Tennant EFN for Steelhead spawning is 0.428 m<sup>3</sup>/s (256% LTMAD), which is slightly lower than the flow standard of 282% LTMAD (Table 3-56) due lower naturalized flows in the beginning of the spawning period. The recommended critical flow for Steelhead spawning is 0.084 m<sup>3</sup>/s (50% LTMAD) based on the LTMAD criterion (Table 2-7). Estimated naturalized flows are typically greater than the EFN during the later part of the spawning period from early May to late June (Figure 3-38). Median historical recorded flows at the WSC hydrometric station 08NM005 were above the recommended EFN during only a small portion of freshet (Figure B18-1, Appendix B18); however, mapping by Associated (2017) indicates that the station was located high in the watershed above several tributaries and thus likely experienced lower peak flows than reaches near the mouth.

### Rainbow spawning

The recommended Okanagan Tennant EFN for Rainbow spawning is 0.471 m<sup>3</sup>/s, which is equal to the flow standard of 282% LTMAD (Table 3-56). The recommended critical flow for Rainbow spawning is 0.084 m<sup>3</sup>/s (50% LTMAD) based on the LTMAD criterion (Table 2-7). Estimated naturalized flows are typically greater during the spawning period from mid-May to late June (Figure 3-38). Median historical recorded flows at the WSC hydrometric station 08NM005 were at the recommended EFN during only a small portion of freshet (Figure B18-1, Appendix B18); however, mapping by Associated (2017) indicates that the station was located high in the watershed above several tributaries and thus likely experienced lower peak flows than reaches near the mouth.

### Kokanee spawning

The recommended Okanagan Tennant EFN for Kokanee spawning is 0.026 m<sup>3</sup>/s (15% LTMAD), which is equal to the median naturalized flows during the Kokanee spawning period (Table 3-56). The recommended critical flow for Kokanee spawning is 0.017 m<sup>3</sup>/s (10% LTMAD) based on the LTMAD criterion (Table 2-7). It is likely that fall rain events play an important role for Kokanee access in McLean Creek. Median historical recorded flows at the WSC hydrometric station 08NM005 during early September were below the recommended EFN (~0.01 m<sup>3</sup>/s) (Figure B18-1, Appendix B18); however, mapping by Associated (2017) indicates that the station was located high in the watershed in the reaches above the wetland discharge and thus flows were likely lower than in the reaches at the mouth.