3.16 Trout Creek

Trout Creek is the second largest tributary to Okanagan Lake, flowing from the west side of the Okanagan Basin to its mouth at Summerland, B.C. The Trout Creek watershed is approximately 762 km^2 (NHC 2003) and has a number of main tributaries including North Trout, Camp, Bull, Isintok, and Darke creeks (Associated 2016). From the forested headwaters, Trout Creek flows through deeply incised canyon sections before flowing onto a large alluvial fan at Okanagan Lake (Associated 2017). The lowest reaches flow through orchards and residential areas near the town of Summerland. A summary of creek characteristics is found in Table 3-48 and additional stream-specific data is provided in Appendix B16.

Trout Creek supports populations of Kokanee (spawning) and Rainbow (Associated 2016). The lowest section of the creek below the canyon was entirely channelized for flood control purposes in the 1970s. With additional impacts including removal of streamside vegetation and high water demand, the once relatively large Kokanee and Rainbow populations in the creek have been have almost entirely eliminated (Hinton 1972). The channelized section has large substrate because of resulting high water velocities that provides only marginal spawning habitat. Access to upstream sections is blocked by seven fish migration barriers that occur within the lower 8.8 km of Trout Creek. Upstream of the lowest 2 km is an unstable canyon that contributes significant amounts of suspended sediment into the lower reaches (NHC 2003). The lower 11 km of Trout Creek and particularly the lowest 2 km experience acute low flows due to irrigation diversions (Wightman & Taylor 1978) and typically experienced dry streambed conditions in the summer months (Koshinsky & MacDonald 1971). Historical hydrometric records show low flows in particular years with unnatural down-ramping rates due to flow regulation.

At present, there are 127 points of diversion and three pending water licence applications within the Trout Creek watershed (Associated 2019); however, the actual volume extracted is unknown. The stream is currently fully recorded except for domestic licences (FLNRORD 2016). The District of Summerland is the main water supplier, and has developed water storage at Thirsk Reservoir (Associated 2016). There are eight more additional reservoirs in the watershed including Crescent, Whitehead, Tsuh, Isintok, and four headwater reservoirs. Serious impairment of fish populations resulting from low flows in the lower reaches of Trout Creek have been documented in numerous reports over the years. A summary of the Trout Creek streamflow and Kokanee spawning data was undertaken by Keystone Environmental and Columbia Environmental Consulting Ltd. (Martins 2003). Concerns were brought up regarding the lack of flow data available. Flow monitoring and WUW investigations in the mid-2000s contributed to development of a Water Use Plan for Trout Creek. In the plan, EFNs were set to the lesser of WUW-derived conservation flows and a multiplier of an unregulated tributary to Trout Creek (WSC station 08NM134 Camp Creek) that represents largely natural streamflow conditions (NHC 2005). Naturalized flow data provided by Associated (2019) indicates that the lower reaches of Trout Creek are naturally 'flow sensitive' during the winter as naturalized flows are below 20% LTMAD (Table 3-49). Water losses or gains across the alluvial fan near the mouth are unknown since no field measurements were collected; however, the stream was assumed to lose flow to groundwater on the fan based on information from the Water Use Plan (Associated 2019).

Naturalized flow data were provided by Associated (2019) with an estimated data quality rating of B (data error between 10% and 25%); residual and maximum licensed flows were not available at the time of reporting. Okanagan Tennant EFNs for Trout 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. Weekly Okanagan Tennant EFNs were set to the lower of the residual flow or flow standard. However, Kokanee spawning flows were set to naturalized flows to conform to the current

Water Use Plan. A summary of EFNs for Trout Creek is provided in Table 3-50 including the median EFN and the range of weekly EFNs, with weekly details in Figure 3-34, Figure 3-35 and Appendix B16, and flow sensitivities in Table 3-49. Further information on EFN setting in Trout Creek is provided at the end of this section.

Table 3-48: Trout Creek description

Drainage Area	747 km^2
Median Elevation	1330 m
WSC station	08NM134 (active) Camp Creek at Mouth near Thirsk (1965-present) 08NM238 (historic) Thirsk Lake near the Outlet (1979-1987) 08NM238 (historic) Trout Creek Below Thirsk (1979-1986) 08NM133 (historic) Bull Creek near Crump (1965-1986) 08NM023 (historic) Darke Creek Northwest Fork (1921-1922) 08NM025 (historic) Darke Creek at Meadow Valley (1921-1922) 08NM055 (historic) Trout Creek Summerland Diversion (1922-1931) 08NM054 (historic) Trout Creek near Faulder (1922-1954) 08NM042 (historic) Trout Creek near Summerland (1920-1922) 08NM158 (historic) Trout Creek at the Mouth (1969-1982)
MOE station	08NM042-HDS (2004-2009)
LTMAD	2.17 m^3/s (Associated 2019)
Fish species expected	Rainbow, Kokanee, Eastern Brook Trout, Mountain Whitefish, Largescale Sucker, Longnose Dace, Prickly Sculpin, Sculpin (general), Redside Shiner, Peamouth Chub (ESSA & Solander 2009)
Land use	Forestry and livestock grazing in upper watershed, and agriculture and urban development in lower watershed (Associated 2016). The lowest reach was once within the Penticton Indian Band reserve

Table 3-49: Flow sensitivities in Trout 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	0.512	24%		
Insect production				
Kokanee spawning				
Rainbow overwintering			0.401	18%
Kokanee egg incubation				

Source: Associated (2019)

Table 3-50: EFN summary table for Trout Creek

Species & life stage	**Time period**	**Okanagan Tennant Recommended EFN**				**Critical flow**	
		Median (m^3/s)	% LTMAD	Min (m^3/s)	Max (m^3/s)	Flow (m^3/s)	% LTMAD
Rainbow rearing & insect production [a]	April 1 – Oct 31	0.435	20%	0.435	1.57	0.109	5%
Rainbow spawning	May 20 – Jul 10	2.44	112%	1.88	9.74	1.09	50%
Kokanee spawning	Sep 1 – Oct 20	0.520	24%	0.520	0.520	0.217	10%
Rainbow overwintering	Nov 1 – Mar 31	0.441	20%	0.420	0.547	0.109	5%

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

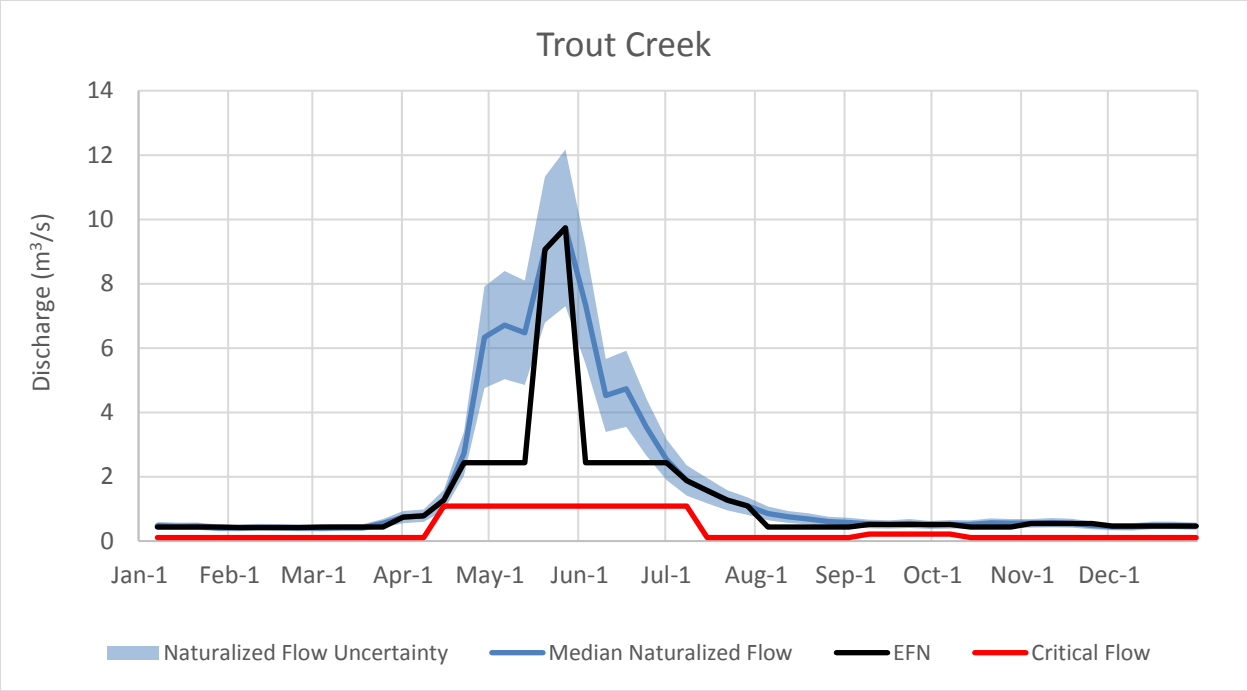

Figure 3-34: Weekly EFNs, critical flow and streamflows in Trout Creek

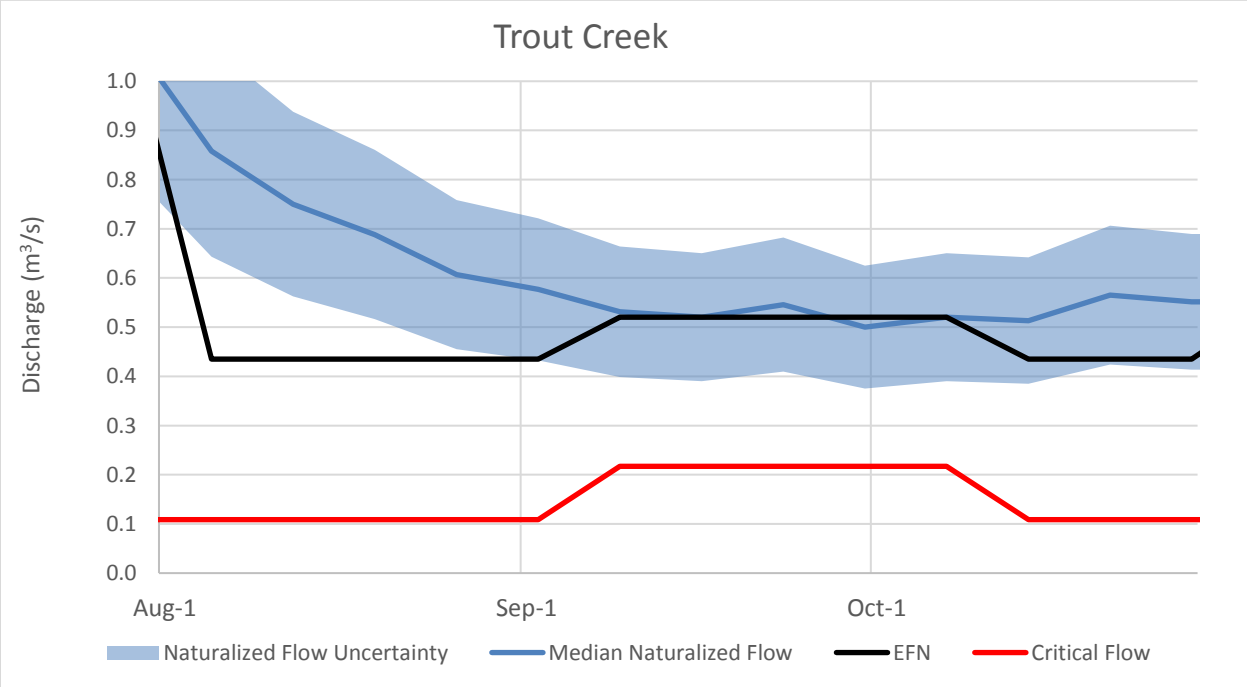

Figure 3-35: Weekly EFNs, critical flow and streamflows during the summer and fall period in Trout Creek

Rainbow parr rearing

The recommended Okanagan Tennant EFN for Rainbow parr rearing is 0.435 m^3/s (20% LTMAD); however, the median Okanagan Tennant EFN for the mid-July to late September period in Trout Creek is 0.520 m^3/s (24% LTMAD) due to higher flow requirements for Kokanee spawning in the fall (Table 3-50). Estimated weekly naturalized flows (Associated 2019) range from 0.500 – 1.568 m^3/s (median 0.647 m^3/s) during the mid-July to late September period. The EFN is lower than naturalized flow estimates throughout the summer (Figure 3-35). Previous WUW investigations indicate approximately 60% of maximum parr rearing WUW remaining at the recommended EFN (NHC 2005). The recommended critical flow for Rainbow rearing is 0.109 m^3/s (5% LTMAD) based on the LTMAD criterion (Table 2-7).

Historical EFN recommendations for Rainbow parr rearing ranged from 0.075 m^3/s (Associated 1997) to 1 m^3/s (ESSA & Solander 2009). Maximum incremental benefits are achieved between 0.4 and 0.5 m^3/s (NHC 2004) and optimum flows are at 1.2 m^3/s (NHC 2005). The lowest monthly conservation flow from the Water Use Plan is 0.54 m^3/s and occurs in October, though the operational flow release during a drought year would be much lower as it would default to 4x Camp Creek real-time flows. Due to the rapid increase in WUW between the recommended EFN and approximately 1.2 m^3/s (NHC 2005), there is significant benefit in sustaining flows greater than the recommended EFN during wetter years.

Median residual flows recorded at the WSC hydrometric station 08NM158 (Trout Creek at the mouth, 1969-1982; Figure B16-1, Appendix B16) were well below the recommended EFN from mid-July to September, and below the EFN for the remainder of the fall. More recent data from the MOE station 08NM042-HDS (2004-2009) shows median weekly summer flows at the recommended EFN though flows during individual weeks dropped below the EFN at times (Figure B16-1, Appendix B16). Meeting EFNs for Rainbow rearing near the mouth is thus considered possible but requires careful management of releases and withdrawals.

Rainbow spawning

The median recommended Okanagan Tennant EFN for Rainbow spawning is 2.44 m^3/s (Table 3-50), which is equal to the flow standard of 112% LTMAD. Estimated naturalized flows (Figure 3-34) are greater than the EFN from mid-April to late June. A previous EFN recommendation by ESSA & Solander (2009) was approximately 4 m^3/s. The recommended critical flow for Rainbow spawning is 1.09 m^3/s (50% LTMAD) based on the LTMAD criterion (Table 2-7).

Median residual flows recorded at the WSC hydrometric station 08NM158 (Trout Creek at the mouth, 1969-1982; Figure B16-1, Appendix B16) were above the recommended EFN during the spawning period from mid-May to late July. More recent data from the MOE station 08NM042-HDS (2004-2009) shows median weekly flows below the recommended EFN from late May onwards (Figure B16-1, Appendix B16). Meeting EFNs for Rainbow spawning in Trout Creek is possible but requires careful management of water storage activities to avoid disrupting spawning EFNs.

Kokanee spawning

The recommended Okanagan Tennant EFN for Kokanee spawning is 0.520 m^3/s (24% LTMAD, Table 3-44), which is equal to the median weekly naturalized flows during the Kokanee spawning period (Figure 3-35) and slightly greater than the flow standard of 20% LTMAD. Previous WUW investigations indicate approximately 85% of maximum Kokanee spawning WUW remaining at the recommended EFN in the lower accessible reaches of Trout Creek (NHC 2005). Historical EFN recommendations for Kokanee spawning range from 0.28-2 m^3/s (Associated 1997; CBCOBA 1974; NHC 2004; ESSA & Solander 2009).

The recommendation from the Water Use Plan of approximately 0.54-0.68 m^3/s during an average year is in close agreement with the recommended EFN. Operational flow releases during a drought year would be much lower as they would default to 4x Camp Creek real-time flows.

The recommended critical flow for Kokanee spawning is 0.217 m^3/s (10% LTMAD) based on the LTMAD criterion (Table 2-7). Historical recommended minimum discharges range from 0.28 m^3/s (Koshinsky & MacDonald 1971) to 0.618 m^3/s (MOE 2000) with a note that flows of 0.14 m^3/s were "probably disastrous" for salmon (Koshinsky & MacDonald 1971). Optimum flows of 0.8 m^3/s were recommended by NHC (2005).

Median residual flows recorded at the WSC hydrometric station 08NM158 (Trout Creek at the mouth, 1969-1982; Figure B16-1, Appendix B16) were below the recommended EFN during the Kokanee spawning period. More recent data from the MOE station 08NM042-HDS (2004-2009) shows median weekly flows at or just below the recommended EFN though flows during individual weeks dropped below the EFN at times and near critical flows on occasion (Figure B16-1, Appendix B16). Meeting EFNs for Kokanee spawning is thus considered possible but requires careful management of releases and withdrawals.