Appendix K - Mill Creek

Associated Environmental

APPENDIX K

Okanagan Basin Water Board
Okanagan Nation Alliance
B.C. Ministry of Forests, Lands and Natural Resource Operations

Mill Creek

May 2016

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APPENDIX K

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APPENDIX K

1 Introduction

The purpose of this appendix is to provide information to support the application of recommended environmental flow needs (EFN)-setting methods for Mill Creek[1] following the methods outlined in the accompanying report[2]. This document contains information obtained and collated by Associated Environmental Consultants Inc. (Associated) and will be revised following additional input from Okanagan Nation Alliance. A summary of current available information for Mill Creek is provided in Table 6-1 in the accompanying report and Table K-1 at the end of this appendix.

Section 5 in the accompanying report provides an overview of two recommended EFN-setting methods for tributaries within the Okanagan Basin, while Section 6 lists the key steps to implement each of the two methods, in both flowchart and text form.

Environmental flows have been previously recommended for Mill (Kelowna) Creek by Koshinsky (1972), Shepherd and Ptolemy (1999), nhc (2001), and ESSA and Solander (2009) (Table 6-1 in the accompanying report).

2 Relevant Information for Setting Environmental Flow Needs

This section summarizes the information available to support EFN-setting in Mill Creek. Available information sources for Mill Creek are included within Table K-1 at the end of this appendix.

2.1 OVERVIEW OF THE WATERSHED

The Mill Creek watershed drainage area is approximately 224 km^2. The headwaters of the watershed include the forested plateau are to the north-east of the City of Kelowna. From the headwaters, Mill Creek generally flows west before discharging into Okanagan Lake. The main tributaries to Mill Creek include Scotty Creek, and Whelan Creek. Land use activities in the watershed include agriculture and urban development in the lower watershed, and forestry in the middle and upper portions of the watershed.

The Mill Creek watershed is shown in Figure 1-1 in the accompanying report.

[1] Mill Creek is also known as Kelowna Creek.
[2] Associated Environmental Consultants Inc. (Associated). 2016. Collaborative Development of Methods to Set Environmental Flow Needs in Okanagan Streams. Working document, Current Version. Prepared for the Okanagan Basin Water Board, Okanagan Nation Alliance, and B.C. Ministry of Forests, Lands and Natural Resource Operations. May 2016

2.2 STREAMFLOWS

2.2.1 Hydrometric Data

There are currently no active Water Survey of Canada (WSC) stations within the Mill Creek watershed; however, historic records are available from the following hydrometric stations:

- **Kelowna Creek at Rutland Station** (WSC 08NM117; Drainage area: 162 km^2; Regulated; Period of record: 1950-1975)
- **Kelowna Creek near Kelowna (Lower Station)** (WSC 08NM053; Drainage area: 221 km^2; Regulated; Period of record: 1922-1998)
- **Kelowna Creek near Rutland** (WSC 08NM061; Drainage area: 77.7 km^2; Regulated; Period of record: 1924-1931)
- **Kelowna Creek near Rutland (Upper Station)** (WSC 08NM026; Drainage area: 67.3 km^2; Regulated; Period of record: 1911-1922)
- **Scotty Creek near Rutland** (WSC 08NM036; Drainage area: 35 km^2; Natural; Period of record: 1911-1964)
- **Bulman Creek at the Mouth** (WSC 08NM145; Drainage area: 12.7 km^2; Regulated; Period of record: 1968-2004)
- **Moore Lake Reservoir at the dam** (WSC 08NM234; Regulated; Period of record: 1973-1986)

In addition, Glenmore Ellison Irrigation District (GEID) operated two seasonal hydrometric stations on Mill Creek between 2005 and 2007 (Summit 2009):

- **Mill Creek downstream of GEID Intake** (Regulated; Period of record: 2005-2007)
- **Mill Creek / Postill Reservoir Sluiceway** (Regulated; Period of record: 2005-2007)

2.2.2 Naturalized Streamflows

Figure 6-1 in the accompanying report highlights the necessity of producing hydrographs under natural conditions and under actual, licensed, and future proposed water use conditions. nhc (2001) and Summit (2009) provided naturalized streamflow estimates for Mill Creek at the mouth. In addition, as part of the Okanagan Water Supply and Demand Project, net and naturalized flows were modelled for the majority of Okanagan tributaries, including Mill Creek (Summit 2010). Figure 2-1 provides a summary of the modelled mean weekly net and naturalized streamflows for Mill Creek at the mouth for 1996-2006 (i.e., the model calibration period).

Phases 2 and 3 of the Okanagan Water Supply and Demand Project included modeling of multiple future scenarios for the Okanagan Basin, which considered projected climate change, population growth, changes to irrigation efficiencies, and other factors. Net and naturalized streamflow outputs for Mill Creek at the mouth are available for each future scenario.

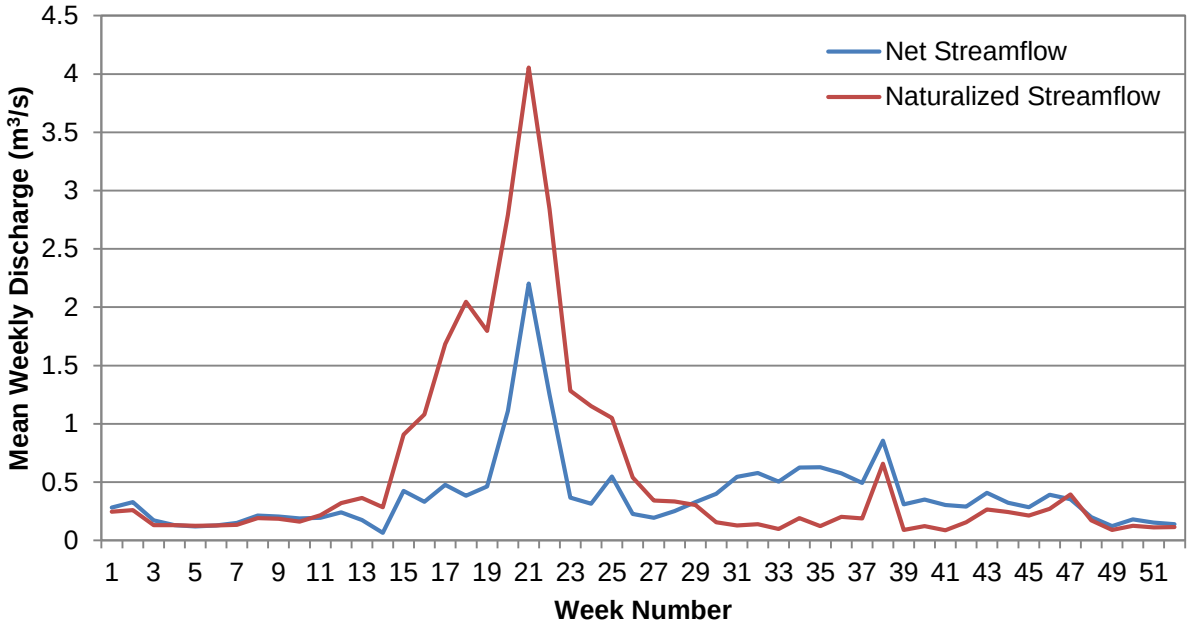

Figure 2-1
Mean weekly net and naturalized flows for Mill Creek at the mouth, 1996-2006 (Summit 2010)

2.3 FISH AND AQUATIC HABITAT

Mill Creek has been rated as high importance for both fisheries and aquatic habitat (Rae 2005). An overview assessment of channel conditions, water quality, and fisheries management for Mill Creek was completed by Wildstone Resources Ltd. (1992), while Dobson (2010) completed a Source Assessment Report (i.e., Drinking Water Source Protection Plan) for the watershed. Dobson (2010) summarized information on water quality, water quantity, and general watershed health.

Ecoscape (2006) completed sensitive habitat inventory and mapping (SHIM) for Mill Creek. Fish habitat features were mapped throughout Mill Creek, as well as obstructions and barriers to fish migration (Section 4.2 of Ecoscape [2006]).

Since current (and potentially historic) aquatic habitat information is important for developing an EFN flow regime, it is recommended that up-to-date aquatic habitat information be obtained from publically available databases at the time of investigation.[3]

[3] Aquatic habitat information, including fish barriers can be obtained from the Government of B.C. Habitat Wizard: http://www.env.gov.bc.ca/habwiz/.

2.3.1 Current and Historical Fish Species Presence

ESSA and Solander (2009) reported that the following fish species are present within the Mill Creek watershed:

- rainbow trout
- kokanee salmon
- eastern brook trout
- burbot
- northern pikeminnow
- longnose sucker
- largescale sucker
- leopard dace
- longnose dace
- prickly sculpin
- redside shiner
- carp
- peamouth chub

Since current (and potentially historic) fish presence information is important for developing an EFN flow regime, it is recommended that up-to-date fish presence information be obtained from publically available databases at the time of investigation.[4]

2.3.2 Fish Periodicity and Habitat Suitability

No stream-specific fish periodicity or habitat suitability indices have been developed for Mill Creek (Table 6-1 in the accompanying main report). However, Appendix E of the accompanying report provides information on species-specific life stage periodicities for the Okanagan Basin, as well as habitat suitability index (HSI) curves for select species. The information within Appendix E should be used at a minimum to support EFN-setting for Mill Creek.

2.4 WATER USE AND STORAGE

There are three major water suppliers within the Mill Creek watershed (Dobson 2008 [included in Summit 2010]):

- Black Mountain Irrigation District (BMID)
- Glenmore-Ellison Improvement District (GEID)
- Rutland Water Works (groundwater source only)

The Regional District of Central Okanagan (Sunset Ranch Water Utility) and City of Kelowna (lands along lower Mill Creek) also use the Mill Creek watershed for water supply purposes (Dobson 2008). A summary

[4] Fish presence information can be obtained from the Government of B.C. Fish Inventory Summary System Database Query: http://www.env.gov.bc.ca/fish/fiss/.

of water use from each purveyor is provided in Section 4.2.18 of the Water Management and Use Study (Dobson 2008).

Summit (2010) provides an estimate of actual surface water use within the Mill Creek watershed for 1996-2006 in Appendix C of the Okanagan Water Supply and Demand Project – Phase 2. The actual mean annual surface water use over 1996-2006 was estimated to be 6,026 ML. These water use estimates were subsequently included within the Okanagan Hydrologic Connectivity Model that was used to investigate 'first-in-time, first-in-right' water license legislation within the Okanagan Basin (Summit 2013).

The B.C. Ministry of Environment hold a water licence on Mill Creek for instream (conservation) use (annual licensed volume of 9,668 ML), which stipulates that 0.300 m^3/s is to be maintained within Mill Creek (Dobson 2008).

2.4.1 Storage Reservoirs

BMID hold water licences to store approximately 1,825 ML of water in James Reservoir, while GEID hold water licences to store approximately 7,869 ML of water in three reservoirs (Posthill, Bulman, and South) (DHI 2010). The GEID reservoirs are managed to collect water during freshet and to release water in the summer and fall to supplement natural creek flows. Water from James Reservoir is released into Scotty Creek in the summer and BMID diverts released water into a closed pipe distribution system at an intake near the Sunset Ranch Golf Course (Dobson 2008).

2.4.2 Water Licences and Major Points of Diversion

The GEID water system intake is located approximately 2 km north-east of the Kelowna airport and 15 km upstream from Okanagan Lake (Dobson 2010).

At present, there are 84 current water extraction licences and one active application within the Mill Creek watershed. Since knowledge of current water licences is critical in developing EFN flow regimes, it is recommended that up-to-date water licence information be obtained at the time of investigation.[5]

2.4.3 Interbasin Transfers

Under flood conditions (i.e., flows greater than 3.2 m^3/s within Mill Creek), water from Mill Creek is transferred to Mission Creek by a diversion channel maintained by the City of Kelowna (Wildstone Resources 1992, Dobson 2008). The purpose of the diversion channel is to reduce flood volumes throughout the City of Kelowna.

Water is also transported from Mill Creek to McKinley Reservoir (a balancing reservoir located within Residual Area E-2 [Summit 2010]) by GEID[6]. Dobson (2008) provides additional information on water use and water transfers to and from the Mill Creek watershed.

[5] Water Licence Information can be obtained from the Government of B.C. Water Licences Query: http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input.

2.5 GROUNDWATER AND SURFACE WATER INTERACTION

nhc (2001) reported that Mill Creek is likely to gain water from groundwater. In addition, Summit (2009) reported that there is likely no net loss / gain of streamflow to or from groundwater across the entire Mill Creek alluvial fan because losses at the top of fan are likely offset by gains along the lower reaches (Section 3.6 of Summit 2009).

2.6 TRADITIONAL KNOWLEDGE

The current version of this document does not include presentation of any Okanagan Nation Traditional Knowledge. However it is anticipated that a future revision will include such information, as well as potentially other technical information held by the Okanagan Nation Alliance Fisheries Department.

[6] The geographic location of residual areas and water use areas can be found on Figure 1.1 in Dobson (2008), and Maps 1 and 3 in Summit (2010).

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Table K-1 Summary of relevant information for setting environmental flow needs within Mill Creek watershed

Information Source	Fish and Aquatic Habitat											Streamflow				Water Management																
	Current Fish Species Presence	Historic Fish Species Presence	Fish Periodicity Tables	Aquatic Habitat	Channel Characteristics	Channel Cross-Sections	Channel Velocity/Depth Measurements	Habitat Suitability Index	Fish Barriers (Natural/Man-made)	EFN Investigations / Recommended Fish Flows	Other Relevant Information	Streamflow Measurements	Water Quality / Temperature	Streamflow Estimates	Other Relevant Information	History of Water Management	Water License Points-of-Diversion Mapping	Water License Information	Water License – Conservation Storage/Flows	Water Purveyor Intakes	Groundwater Wells Mapping	Groundwater Information	Water Use Information (Actual/Estimated)	Return Flow Information	Land Use and Associated Water Supply Source	Interbasin/Intrabasin Transfers	Flow Regulation	Reservoir Flow Release Patterns	Reservoir Minimum Flow Releases	Other Relevant Information
Online Resources																																
B.C. Habitat Wizard (http://www.env.gov.bc.ca/habwiz/)	✓								✓																							
B.C. Ministry of Forests, Lands, and Natural Resource Operations – Dam Safety Program (http://www.env.gov.bc.ca/wsd/public_safety/dam_safety/). Contact: Mike Noseworthy, Dam Safety Officer (Penticton).																											✓				
B.C. Orchard Museum (https://kelownamuseums.ca/museums/the-bc-orchard-industry-museum/)																✓																
B.C. Water Licences Query (http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input)																		✓														
B.C. Water Resources Atlas (http://www.env.gov.bc.ca/wsd/data_searches/wrbc/)												✓	✓				✓			✓	✓	✓					✓					
B.C. Water Use Reporting Center (http://www.obwb.ca/tools/bc-water-use-reporting-centre/)												✓											✓									
B.C. Water Well Application (https://a100.gov.bc.ca/pub/wells/public/)																					✓											
Black Mountain Irrigation District (http://www.bmid.ca/). Contact: Operations Superintendent																✓				✓			✓				✓	✓	✓	✓		
DataBC (http://www.data.gov.bc.ca/)												✓	✓				✓	✓		✓	✓	✓					✓					
Fisheries Inventory Summary System (http://www.env.gov.bc.ca/fish/fiss/)	✓			✓																												
Glenmore-Ellison Improvement District (http://glenmoreellison.com/). Contact: Operations Coordinator																✓				✓			✓				✓	✓	✓	✓		
Okanagan Historical Society Reports (https://open.library.ubc.ca/#/collections/ohs)																✓																
Water Survey of Canada (https://www.ec.gc.ca/rhc-wsc/)												✓																				
Literature Resources																																
Western Water Associates Ltd., Polar Geoscience Ltd., and ESSA Technologies Ltd. 2014. Okanagan Water Allocation Tool Plan. Prepared for the Okanagan Basin Water Board, May 2014.										✓																						
Summit Environmental Consultants Inc. 2013. Okanagan Hydrologic Connectivity Model: Summary										✓				✓				✓		✓							✓					

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Report. Prepared for the Okanagan Basin Water Board, May 2013.																															
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	Current Fish Species Presence	Historic Fish Species Presence	Fish Periodicity Tables	Aquatic Habitat	Channel Characteristics	Channel Cross-Sections	Channel Velocity/Depth Measurements	Habitat Suitability Index	Fish Barriers (Natural/Man-made)	EFN Investigations / Recommended Fish Flows	Other Relevant Information	Streamflow Measurements	Water Quality / Temperature	Streamflow Estimates	Other Relevant Information	History of Water Management	Water License Points-of-Diversion Mapping	Water License Information	Water License – Conservation Storage/Flows	Water Purveyor Intakes	Groundwater Wells Mapping	Groundwater Information	Water Use Information (Actual/Estimated)	Return Flow Information	Land Use and Associated Water Supply Source	Interbasin/Intrabasin Transfers	Flow Regulation	Reservoir Flow Release Patterns	Reservoir Minimum Flow Releases	Other Relevant Information
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