Appendix P - Powers Creek

Associated Environmental

APPENDIX P

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

Powers Creek

May 2016

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APPENDIX P

Table of Contents

1 Introduction

The purpose of this appendix is to provide information to support the application of recommended environmental flow needs (EFN)-setting methods for Powers Creek following the methods outlined in the accompanying report[1]. 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 Powers Creek is provided in Table 6-1 in the accompanying report and Table P-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.

Powers Creek is included in the Master Drainage Plan for the City of West Kelowna (RSB Engineering 2011a). The Master Drainage Plan includes an overview of the Powers Creek watershed, infrastructure within the watershed, stream characteristics, and aquatic habitat.

Environmental flows have been previously recommended for Powers Creek by Koshinsky (1972), Shepherd and Ptolemy (1999), Dobson (2010; 1990), nhc (2003; 2001), Epp (2004-2009), 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 Powers Creek. Available information sources for Powers Creek are included within Table P-1 at the end of this appendix.

2.1 OVERVIEW OF THE WATERSHED

Powers Creek has a watershed area of approximately 145 km^2. Powers Creek drains into Okanagan Lake at Westbank, between Peachland and West Kelowna. Land use within the watershed includes agriculture and urban development in the lower reaches of the watershed, and forestry in the upper portions.

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

[1] 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) hydrometric stations within the Powers Creek watershed; however, historic records are available for the following hydrometric stations within the watershed:

- **Lambly Lake Diversion to Powers Creek** (WSC 08NM136; Regulated; Period of record: 1965-1972)
- **Powers Creek Above Westbank Diversion** (WSC 08NM033; Drainage area: 128 km^2; Natural; Period of record: 1920-1974)
- **Powers Creek Westbank Diversion** (WSC 08NM034; Regulated; Period of record: 1920-1931)
- **Powers Creek Below Westbank Diversion** (WSC 08NM059; Drainage area: 139 km^2; Regulated; Period of record: 1924-1987)
- **Powers Creek at the Mouth** (WSC 08NM157; Drainage area: 144 km^2; Regulated; Period of record: 1969-1982)

In addition, the Ministry of Environment operated a seasonal hydrometric station on Powers Creek between 2004 and 2006:

- **Powers Creek at Gellatly Rd.** (Period of record: 2004-2006)

Westbank Irrigation District also operated two seasonal hydrometric stations on Powers Creek during 2007:

- **Powers Creek at Bear Main** (Period of record: 2007)
- **Powers Creek upstream from Jackpine Creek** (Period of record: 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 Powers 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 Powers Creek (Summit 2010). Figure 2-1 provides a summary of the modelled mean weekly net and naturalized streamflows for Powers 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 Powers Creek at the mouth are available for each future scenario.

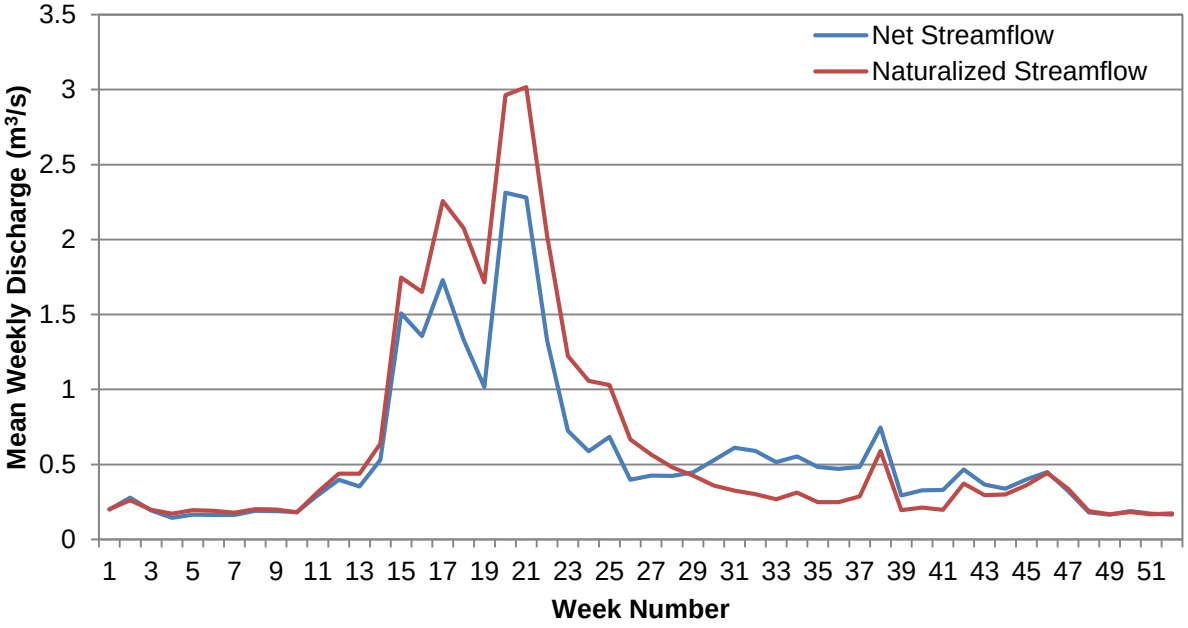

Figure 2-1
Mean weekly net and naturalized flows for Powers Creek at the mouth, 1996-2006 (Summit 2010)

2.3 FISH AND AQUATIC HABITAT

Powers Creek is considered of high importance for fisheries and aquatic habitat. Dobson has completed a number of watershed assessments within Powers Creek (Dobson 1990; 1998; 2001; 2002; 2010), which provide an overview of channel characteristics and water quality within the upper and lower portions of the watershed.

Ecoscape (2010) and RSB Engineering (2011b) completed sensitive habitat inventory and mapping (SHIM) for Powers Creek. Fish habitat features were mapped throughout the portion of Powers Creek watershed that falls within the District of West Kelowna, as well as obstructions and barriers to fish migration.

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.[2]

[2] 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

Fish species found in Powers Creek include rainbow trout, kokanee salmon, eastern brook trout, and sculpin (general) (ESSA and Solander 2009). Chinook and coho salmon are not currently present in Powers Creek, but could be supported if species recovery to Okanagan Lake occurs in the future (ESSA and Solander 2009).

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.[3]

2.3.2 Fish Periodicity and Habitat Suitability

Epp (2004-2009) provided Weighted Useable Width results for Powers Creek, and provided essential building blocks for developing Habitat Suitability Index (HSI) curves for Powers Creek. In addition, nhc (2003) provided a fish periodicity chart for Powers Creek, which defined critical timing periods for adult migration, spawning, incubation, fry rearing, and par rearing, for rainbow trout and kokanee salmon (Table 6-1 in the accompanying main report).

In addition, Appendix E of the accompanying report provides information on salmonid species-specific life stage periodicities for the Okanagan Basin, as well as habitat suitability index (HSI) curves for select species. The information within Epp (2004-2009), nhc (2003), and Appendix E should be used at a minimum to support EFN-setting for Powers Creek.

2.4 WATER USE AND STORAGE

The City of West Kelowna[4] (for the Westbank Service Area) is the main water supplier within the Powers Creek watershed.

Summit (2010) provides an estimate of actual surface water use within the Powers 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 3,035 ML. These water use estimates were subsequently included in the Okanagan Hydrologic Connectivity Model that was used to investigate ‘first-in-time, first-in-right’ water licence legislation within the Okanagan Basin (Summit 2013).

[3] 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/.

[4] The Westbank Service Areas was serviced by the Westbank Irrigation District prior to 2011 when the City of West Kelowna took over responsibility for the service area.

2.4.1 Storage Reservoirs

The City of West Kelowna operate five storage reservoirs in the Powers Creek watershed to support water use within the Westbank Service Area. The storage reservoirs within Powers Creek watershed are as follows:

- Horseshoe Lake
- Dobbin Lake
- Paynter Lake
- Jackpine Lake
- Lambly Lake
- Tadpole Lake

Water is collected in storage reservoirs during freshet and released to augment summer, fall, and winter flows within the creek (Dobson 2008 [included in Summit 2010]).

2.4.2 Water Licences and Major Points of Diversion

The City of West Kelowna operates a water intake and water treatment plant on the lower reaches of watershed (Dobson 2008).

The Ministry of Environment holds a water licence on Powers Creek for instream (conservation) use for the maintenance of 0.085 m^3/s within the creek throughout the year (Dobson 2008). In addition, the Ministry of Environment placed a *Water Act Reserve* on Powers Creek (and all its tributaries) on June 15, 1989. The *Water Act Reserve* requires that 0.13 m^3/s be maintained within the creek to meet current and projected angling demands for recreational fisheries (Dobson 2008).

At present, there are 63 current water extraction licences within the Powers 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

The City of West Kelowna operates a water diversion from Lambly Creek and the Nicola River watershed (outside of the Okanagan Basin) into Powers Creek (Summit 2010). Water is diverted into Powers Creek watershed (into Dobbin Lake) via the Alocin Creek diversion, which gains water from the Nicola River watershed (Nicola ditch) and the Lambly Creek watershed (Tadpole Lake diversion). Summit (2010) estimated that the average annual diversion volume into Powers Creek watershed by the Alocin Creek diversion for 1996-2006 was 220 ML.

[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

Summit (2009) reports that there is likely no net loss / gain of streamflow to or from groundwater across the entire Powers 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.

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Table P-1 Summary of relevant information for setting environmental flow needs within Powers 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. 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/)																					✓										
DataBC (http://www.data.gov.bc.ca/)												✓	✓				✓	✓		✓	✓	✓					✓				
District of West Kelowna (http://www.districtofwestkelowna.ca/). Contact: Utilities Supervisor																✓							✓				✓	✓	✓	✓	
Fisheries Inventory Summary System (http://www.env.gov.bc.ca/fish/fiss/)	✓			✓																											
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 Report. Prepared for the Okanagan Basin Water Board, May 2013.									✓					✓	✓								✓				✓				
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describing monthly water extraction, water use, and net and natural streamflow for all major tributaries in the Okanagan Basin.																															
Epp, P. 2012. HSI tables in Microsoft Excel Files: Glide Habitat Template and Riffle Habitat Template								✓																							
RSB Engineering. 2011. District of West Kelowna Master Drainage Plan Volume 1.											✓		✓		✓	✓						✓									✓
RSB Engineering. 2011. District of West Kelowna Master Drainage Plan Volume 2. Impact and Habitat Rating Mapsheets - Sensitive Habitat Inventory and Mapping..				✓				✓	✓		✓																				
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Summit Environmental Consultants Ltd. 1998. North Powers Creek and Bear Lake Fisheries Assessment – Final Report. Prepared for Westbank Irrigation District.	✓			✓	✓									✓																	
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Wildstone Resources. 1992. Okanagan Lake Tributaries Plan: Volume 4 – Powers Creek Management Plan. Prepared for B.C. Environment.		✓							✓				✓										✓								
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