WORKING DOCUMENT VERSION 1

Appendix S - Shuttleworth Creek





APPENDIX S

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

Shuttleworth Creek









May 2016



APPENDIX S

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1 Introduction

The purpose of this appendix is to provide information to support the application of recommended environmental flow needs (EFN)-setting methods for Shuttleworth Creek following the methods outlined in the accompanying report¹. 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 Shuttleworth Creek is provided in Table 6-1 in the accompanying report and Table S-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 Shuttleworth Creek by 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 Shuttleworth Creek. Available information sources for Shuttleworth Creek are included within Table S-1 at the end of this appendix.

2.1 OVERVIEW OF THE WATERSHED

Shuttleworth Creek has a watershed area of approximately 90 km². The forested plateau headwaters of Shuttleworth Creek lie to the southeast of Skaha Lake. Shuttleworth Creek flows through an incised canyon before discharging into the Okanagan River just south of Okanagan Falls. The main land use within the watershed is agriculture and urban development along the lower reaches of the creek, around the community of Okanagan Falls.

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

2.2 STREAMFLOWS

2.2.1 Hydrometric Data

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

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



- Shuttleworth Creek near Okanagan Falls (WSC 08NM006; Drainage area: 85.2 km²; Regulated; Period of record: 1921-1964)
- Shuttleworth Creek near the Mouth (WSC 08NM149; Drainage area: 89.9 km²; Regulated; Period of record: 1969-2010)

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. Summit (2009) provided naturalized streamflow estimates for Shuttleworth 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 Shuttleworth Creek (Summit 2010). Figure 2-1 provides a summary of the modelled mean weekly net and naturalized streamflows for Shuttleworth 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, change to irrigation efficiencies, and other factors. Net and naturalized streamflow outputs for Shuttleworth Creek at the mouth are available for each future scenario.

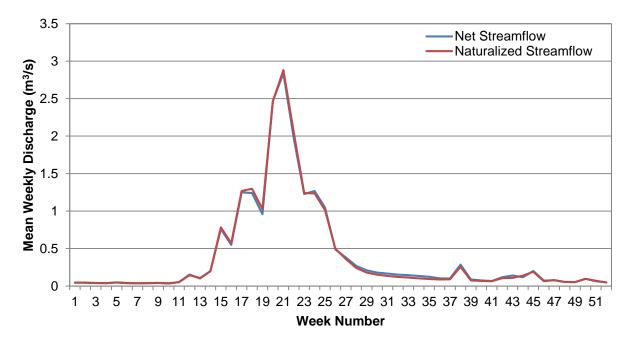


Figure 2-1

Mean weekly net and naturalized flows for Shuttleworth Creek at the mouth, 1996-2006 (Summit 2010)

2.3 **FISH AND AQUATIC HABITAT**

Grainger (2011) completed a fish passage culvert assessment within Shuttleworth Creek, documenting one rock weir which presented a barrier to fish migration. In addition, ONA (2006) documented one rock weir located approximately 30 m upstream from the mouth of Shuttleworth Creek which presented a partial barrier to fish migration.

No sensitive habitat inventory and mapping (SHIM) has been completed for Shuttleworth Creek (Table 6-1 in the accompanying main report).

Since current (and potentially historic) aguatic 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

2.3.1 **Current and Historical Fish Species Presence**

Fish species found in Shuttleworth Creek include rainbow trout and longnose dace (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

No stream-specific fish periodicity or habitat suitability indices have been developed for Shuttleworth 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 Shuttleworth Creek.

2.4 WATER USE AND STORAGE

Okanagan Falls Irrigation District (OKID) is the main water purveyor within the Shuttleworth Creek watershed. However, due to the lack of storage within the watershed, the majority of water use is sourced from surrounding areas, outside of the watershed (Section 2.4.3).

Summit (2010) provides an estimate of actual surface water use within the Shuttleworth 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 152 ML.

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/.



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/.

2.4.1 Storage Reservoirs

There is no developed storage within the Shuttleworth Creek watershed (Dobson 2008 [included in Summit 2010]).

2.4.2 Water Licences and Major Points of Diversion

At present, there are 13 water extraction licences within the Shuttleworth 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.⁴

2.4.3 Interbasin Transfers

OKID supplies water to users within the Shuttleworth Creek watershed from groundwater wells located within the surrounding areas (Dobson 2008).

2.5 GROUNDWATER AND SURFACE WATER INTERACTION

Summit (2009) identified that Shuttleworth Creek likely loses water to groundwater and estimated that streamflow is lost to groundwater at a rate of 0.014 m³/s per km of channel on the alluvial fan (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.

⁴ 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.

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- Summit Environmental Consultants Inc. (Summit). 2010. Okanagan Water Supply and Demand Project: Phase 2 Summary Report. Prepared for the Okanagan Basin Water Board, July 2010.



Table S-1 Summary of relevant information for setting environmental flow needs within Shuttleworth Creek watershed

	Fish and Aquatic Habitat Str													Streamflow Water Management																
Information Source	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/)												✓	✓				✓	✓		✓	✓	✓					✓			
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.															✓															✓
Epp, P. 2012. HSI tables in Microsoft Excel Files: Glide Habitat Template and Riffle Habitat Template.								✓																						
Polar Geoscience Ltd. 2012. Projected Water Supply and Use in the Okanagan Basin (2011-2040) – Okanagan Basin Water Accounting Model Results. Prepared for the Okanagan Basin Water Board. March 2012. Note: Several Excel spreadsheets (not attached to the report) are available from the author														✓	✓															

	Fish and Aquatic Habitat										Strea	mflow	flow Water Management																		
Information Source	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
describing monthly water extraction, water use, and net and natural streamflow for all major tributaries in the Okanagan Basin.																															
Grainger, L. 2011. 2010 Fish Passage Culvert Assessments within Weyerhaeuser Operating Areas in the Okanagan Shuswap and Arrow Boundary Forest Districts: TSA 22, TSA 02, and TFL 59. Prepared for Weyerhaeuser Company Ltd., January 2011.				✓	✓					✓																					
DHI Water and Environment. 2010. Okanagan Basin Water Accounting Model. Prepared for the Okanagan Basin Water Board, November 2010.															✓												✓				
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Dobson Engineering Ltd. 2008. Water Management and Use Study. Prepared for Okanagan Basin Water Board, December 2008.																	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓
Neilsen-Welch, L., and D. Allen. 2007. Groundwater and Hydrogeological Conditions in the Okanagan Basin, B.C. A State of the Basin Report. Prepared for the Okanagan Basin Water Board, December 2007.																							✓								
Long, K. 2006. Steelhead Spawner Enumeration in the Okanagan River Mainstem and Tributaries: Inkaneep, Vaseux and Shuttlework Creeks - 2006. Okanagan Nation Alliance, July 2006.	✓																														
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Cohen, S., and T. Neale. 2006. Participatory Integrated Assessment of Water Management and Climate Change in the Okanagan Basin, British Columbia. Environment Canada and University of British Columbia, Vancouver.														√	✓								✓							✓				
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