

**Appendix N - Naswhito Creek**

## APPENDIX N

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

#### Naswhito Creek



**May 2016**

ISO 9001 and 14001 Certified | An Associated Engineering Company

# APPENDIX N

## Table of Contents

SECTION	PAGE NO.
<b>Table of Contents</b>	<b>i</b>
<b>1 Introduction</b>	<b>N-1</b>
<b>2 Relevant Information for Setting Environmental Flow Needs</b>	<b>N-1</b>
2.1 Overview of the Watershed	N-1
2.2 Streamflows	N-1
2.3 Fish and Aquatic Habitat	N-3
2.4 Water Use and Storage	N-4
2.5 Groundwater and Surface Water Interaction	N-4
2.6 Traditional Knowledge	N-4
<b>References</b>	

## 1 Introduction

The purpose of this appendix is to provide information to support the application of recommended environmental flow needs (EFN)-setting methods for Naswhito Creek following the methods outlined in the accompanying report<sup>1</sup>. 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 Naswhito Creek is provided in Table 6-1 in the accompanying report and Table N-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 Naswhito Creek by Robertson (1983), 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 Naswhito Creek. Available information sources for Naswhito Creek are included in Table N-1 at the end of this appendix.

### 2.1 OVERVIEW OF THE WATERSHED

Naswhito Creek has a watershed area of approximately 87 km<sup>2</sup>. The Naswhito Creek watershed is situated approximately 20 km west of Vernon and drains into Okanagan Lake. The mainstem channel descends through a deeply entrenched bedrock canyon before flowing across a large alluvial fan before draining into Okanagan Lake. Forestry is the primary land use in the upper watershed, with agricultural lands located within the lower reaches and adjacent to Okanagan Lake. Okanagan Indian Band Reserve #1 is situated on the alluvial fan at the mouth of the creek.

The Naswhito 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 Naswhito Creek watershed; however, historic records are available for the following hydrometric station:

---

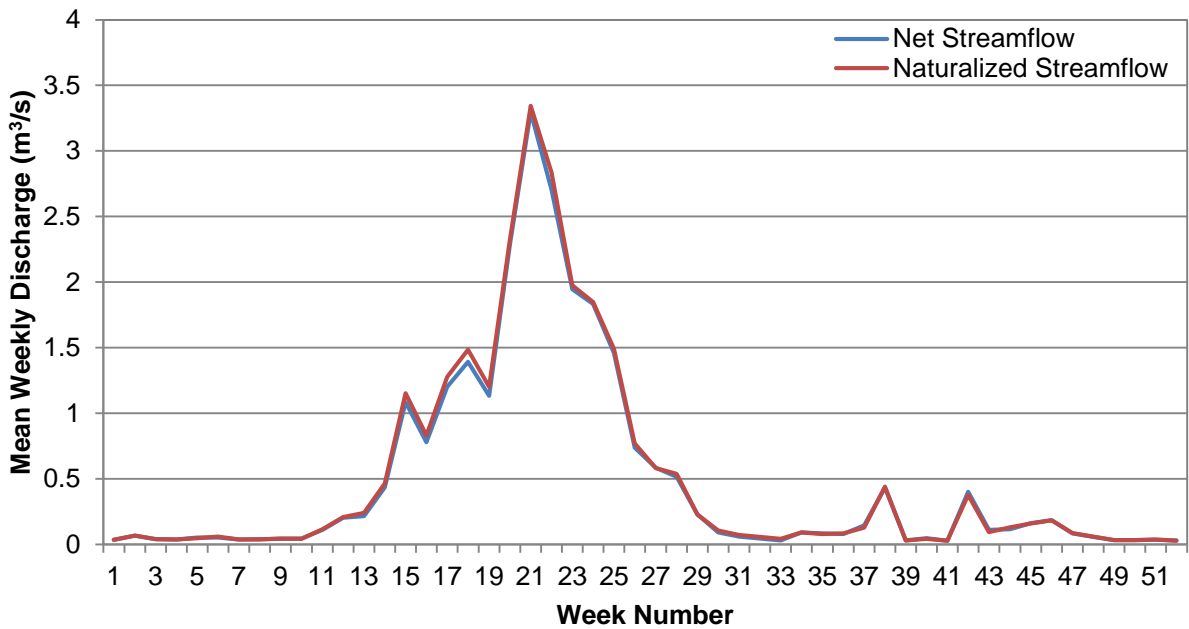
<sup>1</sup> Associated Environmental Consultants Inc. (Associated). 2016. Collaborative Development of Methods to Set Environmental Flow Needs in Okanagan Streams. Working Document, Current Version. Prepared for the Okanagan Basin Water Board, Okanagan Nation Alliance, and B.C. Ministry of Forests, Lands and Natural Resource Operations. May 2016

- **Naswhito Creek near Ewing's Landing** (WSC 08NM047; Drainage area: 81.8 km<sup>2</sup>; Natural; Period of record: 1921-1921)

### 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 Naswhito 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 Naswhito Creek (Summit 2010). Figure 2-1 provides a summary of the modelled mean weekly net and naturalized streamflows for Naswhito 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 Naswhito Creek at the mouth are available for each future scenario.



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

## 2.3 FISH AND AQUATIC HABITAT

Wildstone Resources Ltd. (1997) completed an overview fish habitat assessment of Naswhito Creek, which provides a comprehensive review of aquatic habitat throughout the creek. Wildstone Resources Ltd. (1997) reported that the steep gradient of the upper reaches of Naswhito Creek limit upstream fish migration; however, the exact upper limit of fish utilization was not known.

There are a number of irrigation dams that obstruct fish passage up Naswhito Creek (Wightman and Taylor 1978). Wightman and Taylor (1978) reported that the habitat quality below the most downstream dam remains compatible with rainbow trout production; although evidence of fairly severe spring flows (e.g. bank erosion presence) combined with flood control measures have probably reduced the productive stream area.

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

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.<sup>2</sup>

### 2.3.1 Current and Historical Fish Species Presence

Fish species found in Naswhito Creek include rainbow trout, kokanee salmon, and prickly sculpin (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.<sup>3</sup>

### 2.3.2 Fish Periodicity and Habitat Suitability

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

<sup>2</sup> Aquatic habitat information, including fish barriers can be obtained from the Government of B.C. Habitat Wizard: <http://www.env.gov.bc.ca/habwiz/>.

<sup>3</sup> 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/>.



## 2.4 WATER USE AND STORAGE

The Okanagan Indian Band is the main water user within the Naswhito Creek watershed and withdraws water from Naswhito Creek for use within the watershed, as well as within neighbouring watersheds (Residual Areas W-3 and W-4) (Dobson 2008 [included in Summit 2010]).<sup>4</sup> Dobson (2008) reported that all water use within the Naswhito Creek watershed is used for irrigation purposes.

Summit (2010) provides an estimate of actual surface water use within the Naswhito 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 132 ML.

### 2.4.1 Storage Reservoirs

There are multiple irrigation dams which divert water for irrigation purposes on Naswhito Creek (Wightman and Taylor 1978); however, streamflows within Naswhito Creek are reported to be unsupported by storage (Dobson 2008). No major waterworks or reservoir construction has taken place in the watershed to increase water yield or augment seasonal low flows (Dobson 1999).

### 2.4.2 Water Licences and Major Points of Diversion

At present, there are 10 water extraction licences within the Naswhito Creek watershed. Since current knowledge of 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.<sup>5</sup>

### 2.4.3 Interbasin Transfers

A licensed water diversion was constructed on the south fork of Naswhito Creek to divert water into Browns Creek, but this diversion is no longer active (Dobson 1999).

## 2.5 GROUNDWATER AND SURFACE WATER INTERACTION

Summit (2009) identified that Naswhito Creek likely loses water to groundwater and estimated that streamflow is lost to groundwater at a rate of 0.014 m<sup>3</sup>/s per km of channel across 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.

---

<sup>4</sup> The geographic location of the residual areas and water use areas can be found on Figure 1.1 in Dobson (2008), and Maps 1 and 3 in Summit (2010).

<sup>5</sup> 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](http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input).

## References

- Dobson Engineering Ltd. (Dobson) 2008. Water Management and Use Study. Prepared for Okanagan Basin Water Board as part of the Phase 2 Okanagan Water Supply and Demand Project.
- Dobson Engineering Ltd. (Dobson). 1999. Interior Watershed Assessment for the Naswhito Creek Watershed (Vernon Forest District) Final Report. Prepared for Riverside Forest Products Limited, Armstrong Division.
- ESSA Technologies Ltd. and Solander Ecological Research (ESSA and Solander). 2009. Instream Flow Analysis for the Okanagan Water Supply & Demand Project. Prepared for the Okanagan Basin Water Board.
- Northwest Hydraulic Consultants Ltd. (nhc). 2001. Hydrology, Water Use and Conservation Flows for Kokanee Salmon and Rainbow Trout in the Okanagan Lake Basin, BC. Prepared for BC Fisheries, Fisheries Management Branch.
- Robertson, I. L. M. 1983. Nashwito Creek Applications – File Nos. 80296, 80297. Regional Manager, Fish and Wildlife, Okanagan Region.
- Summit Environmental Consultants Ltd. (Summit). 2009. Surface Water Hydrology and Hydrologic Modelling Study “State of the Basin” Report. Prepared for the Okanagan Basin Water Board as part of the Phase 2 Okanagan Water Supply and Demand Project.
- 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.
- Wildstone Resources Ltd. 1997. Overview Fish Habitat Assessment Procedure Equesis, Nashwito, Whiteman and Shorts Creek. Prepared for Okanagan Indian Band, April 1997.
- Wightman, J.C., and G. D. Taylor. 1978. Overview and rating of production capabilities and enhancement opportunities for rainbow trout and kokanee in tributaries to upper Okanagan basin lakes. Fish Habitat improvement Section, Fish and Wildlife Branch, Ministry of Recreation and Conservation, Victoria, B.C.







