TROUT CREEK FLOW MONITORING

YEAR 1 PROGRESS REPORT

by

Ward and Associates Ltd.[1]

INTRODUCTION

Trout Creek was once a major spawning and rearing tributary for Okanagan Lake rainbow trout and kokanee. Historically kokanee spawned in smaller gravels in the lower reaches of the stream or in several of the now defunct side channels. It is believed that rainbow trout at one time spawned in the lower-to-mid reach areas. A good summary of the history of development in the Trout Creek watershed is provided by J. den Dulk (*in* Ashley et al. 1998). In short, the watershed hydrology has been severely altered due to forest harvesting and domestic water storage while the lower reaches have been radically altered due to channelization. One of the objectives of the OLAP is to investigate restoration opportunities within the Trout Creek watershed. J. den Dulk (*in* Ashley et al. 1998) provided an overview of some restoration options while Zimmerman and Epp (*in* Ashley et al. 1999) described some initial stream bank stabilization work. Both studies emphasized the need to recover water if fish are to once again utilize Trout Creek for spawning and rearing.

This report is directed at reviewing the extent of water use and flows associated with Trout Creek.

SITE DESCRIPTION

Trout Creek drains an area of 764 km^2 to the west of Okanagan Lake. The basin ranges in elevation from 1923 m to the lowest point (342 m) at Okanagan Lake. Precipitation and annual runoff vary widely over this altitude range. Records of flows are available from Water Survey of Canada data. The watershed area is designated as a community watershed and is used as a domestic and irrigation water supply by the District of Summerland. Several water storage reservoirs are found throughout the watershed. A dominant feature of Trout Creek is a major diversion canal that exists on the lower reaches of Trout Creek with the intake located at 625 m elevation (Fig. 1).

Stream Flow Data

A Water Survey of Canada gauging station (Station No. 08NM158) at the mouth of Trout Creek was operated from 1969 to 1982. This station is downstream of the Summerland diversion canal, and diversion of flows through the canal account for the very low flow values that are occasionally measured at the mouth of Trout Creek. Records of annual low flows during this 14

[1] 503 – 1311 Howe Street, Vancouver, BC V6Z 2P3

year period show two years when the minimum daily flow was zero, and minimum daily flows of less than 30 L·s for 8 out of 14 years. Very low flows for a month or more are evident in the records. These usually occur during summer, e.g. 23 L·s for August 1973; 37 L·s for August 1970; and occasionally during the winter, 65 L·s for January 1980.

Flows measured at a location upstream of the diversion (WSC No. 08NM054) on Trout Creek near Faulder where the basin area is slightly smaller (704 km^2) are much higher than Trout Creek at the mouth during the summer months. There are 25 years of records for the Faulder station measured during the period 1922 to 1954. The mean value of flow for September (low flow month) is 900 L·s, with minimum values of 131 L·s (September 1924) and 143 L·s (September 1926).

In 1999 two site visits were undertaken as part of this study. The first was on June 18, 1999, when various reaches of Trout Creek were examined. A meeting was then held with Ministry of Environment, Lands and Parks staff to define the 1999 field work program. A second visit to review progress on low flow monitoring was made on October 28, 1999.

Water Licenses

A map of the District of Summerland system, including Trout Creek and Eneas Creek basins is shown in Appendix 1. There are 80 to 85 water licenses issued on Trout Creek for the purpose of irrigation, domestic supply and storage. The licenses allow a maximum annual withdrawal of approximately 18.6 Mm^3 (15,100 acre-ft) of water that can be diverted from the creek. Approximately 13 Mm^3 (10,600 acre-ft) of water is licensed for annual storage.

Of the 80 to 85 licenses issued on Trout Creek, the Summerland Water District holds 15 licenses. These include five storage licenses and about 97% (in terms of total diverted flow) of the diversion licenses. In addition, there are another 65 to 70 diversion licenses for Trout Creek held by small users, but these account for less than 3% of the total licensed water volume.

The largest storage license (number C016414) for 5,500 acre feet (6.78 Mm^3) comprises annual storage in five separate reservoirs:

Headwaters/Crescent Diversion	3.70 Mm^3
Crescent Lake	0.62 Mm^3
Whitehead Lake	0.43 Mm^3
Isintok Lake	1.66 Mm^3
Tsuh Lake	0.37 Mm^3

The second largest storage license, number C014568, for 2630 acre feet (2.13 Mm^3) is for storage in Thirsk Lake.

The largest water diversion license held by District of Summerland (Number C016413), allows for a maximum annual diversion of 7.4 Mm^3 (6000 acre-ft) for irrigation purposes. Details of licenses on the Trout Creek system owned by the Summerland Water District are shown in Table 1.

It should be noted that water licenses are also held by Summerland Water District on the Eneas Creek system, and on Okanagan Lake. Two significantly large water diversion licenses are held on these sources. These are:

• Eneas Creek and Latimer Brook (irrigation)	#C016413 (July 11, 1903)	3.70 Mm^3·year
• Okanagan Lake (domestic)	#C032615 (June 06, 1967)	2.65 Mm^3·year

Since 1978, an average 8.6% of the total water use within the District of Summerland (about 1.43 Mm^3 per year) has been supplied by the Eneas Creek system to users in the Garnet Valley (Associated Engineering Ltd.1997).

Water Use for Irrigation and Domestic Supply

A recent report by Associated Engineering Ltd. (1997) summarizes some of the history of the Corporation of the District of Summerland (CDS) water system. Suggestions for improvements and expansion of the water system for the period up to 2015 are made. This report notes that previous predictions of irrigation water use by the Water Investigations Branch (1973) were for up to 12.4 Mm^3 per year for irrigation supplies from the Trout Creek system. In recent years, the highest demand for both irrigation and domestic water was in 1987 (15.6 Mm^3). Data presented in the next section of this report shows that for the last decade, total withdrawals from Trout Creek have averaged only about 70% of the 1987 demand.

Associated Engineering Ltd. (1997) presents data for present (1995) and future demands for water. Three main demands for water were foreseen:

1. Domestic supplies 4,700 residential connections (10,400 users) in 1995 (computed water volume of 3.04 Mm^3).
2. Commercial and industrial demands were listed as 0.41 Mm^3 per year.
3. Irrigation water (see Table 2-3 of Associated Engineering report) was listed as: (a) land area 1,416 ha of agricultural land, and (b) computed required volume for irrigation 13.2 Mm^3.

The total "current" water demand for Summerland Water District requires in 1995 was therefore estimated to be 16.7 Mm^3. Note that this water demand could be potentially drawn from both Trout and Eneas creeks.

This estimate appears to be excessively high. The actual water supplied from Trout Creek for domestic, industrial and irrigation water from 1986 to 1995 was about 11.5 Mm^3. Taking into account the additional flow of 11% from Eneas Creek system, the total flow supplied (irrigation and domestic) averaged about 12.8 Mm^3 during the decade. We believe that the discrepancy between the demand listed by Associated Engineering Ltd. (1997) and the actual water supplied may be due to either less land actively under irrigation, or the per hectare rates of irrigation water demand are over-estimated.

It should be noted that the number of domestic water users increased significantly over the period 1992 to 1997, at a rate of 5% per year. The Official Community Plan for District of

Summerland anticipates an average population growth rate of 3% per year to year 2015. Associated Engineering Ltd. (1997) anticipated a proportional (3% per year) increase in residential water use, with a value of 5.49 Mm^3 forecast for year 2015. The report outlines methods of providing additional water to Summerland from the Trout Creek system to accommodate growth in the community over the next 20 years. Increased storage at specific locations is suggested, with preliminary estimates of construction costs. Suggestions for water demand management were also included.

Summary of Water Withdrawal by Summerland Water District

The Summerland Water District diverts water from Trout Creek for the purpose of both domestic consumption and agricultural irrigation. The flow is diverted at about the 625 m elevation by a canal (~1,400 m) to a balancing reservoir of about 9 ha in size at about 596 m elevation (Figs. 2, 3, and 4). The screening and chlorination station is located on the north side of this reservoir. Water is passed into the Summerland system by two pipelines, both of which are metered (Fig. 5). During the irrigation season the larger 1.4 m (54 inch) pipeline is used while during the rest of the year, the smaller 0.36 m (14 inch) pipeline is used.

The Summerland Water District Corporation has kept records of daily diversions for over 20 years. Daily diversion data for the period of January 01, 1977 to June 30, 1999 was obtained from the Water District and analyzed. The daily values were summarized to monthly and annual diversion volumes (Table 2) in order to compare with licensed maximum annual diversion volumes. Annual diversion volumes are summarized and compared with the licensed maximum diversion volume for the period 1977 to 1998 (Fig. 6). Note that during this period, the annual diversion volumes were well within the licensed diversion volume of 18.6 Mm^3. The highest annual diversion volume occurred in 1987 (15.6 Mm^3). However, for the 10 year period 1989 to 1998 annual diversion volumes did not exceed 13.1 Mm^3.

From 1922 to 1931 a gauging station in the diversion channel was operated by Water Survey Canada (*Trout Creek Summerland Diversion*, Station Number 08NM055) for the summer months. Monthly average flow volumes were computed for the months with flow records, April to September, for the period of record (10 years). These historic monthly flow volumes were then compared with recent diversion volumes documented by the Summerland Water District for the period 1978 to 1999. A comparison of the water withdrawal data for the two time periods, 1922 to 1931 and 1978 to 1999 (Fig. 7) suggests:

- annual withdrawals are within 1-2% of one another;
- withdrawal in May has significantly decreased; and
- withdrawal in September has significantly increased.

The significance of these diversions compared with low flows in Trout Creek downstream of the diversion are discussed in the next section.

Low Flows in Trout Creek

Water Survey Canada maintained a stream gauging station at the mouth of Trout Creek (Station Number 08NM158) for the period 1969 to 1982. Figure 8 shows the location of this station, near the highway bridge. The lower reach of Trout Creek downstream of the canyon section during a high runoff year (June 18, 1999) is shown in Figure 9. Trout Creek flow volumes at the mouth were compared with Summerland Water District Corporation diversion volumes for the period 1978 to 1982. Plots of annual and monthly water volume comparisons are illustrated in Figures 10 and 11.

A comparison of five years (1978 to 1982) of monthly low flows recorded at the mouth of Trout Creek with those recorded at the Summerland Water District diversion was made (Table 3; Fig.12). Examination of Figure 12 makes it clear that during August and September (and sometimes July) nearly all the flow from Trout Creek is diverted out of the lower reaches of the creek.

1999 Flow Data

As part of a long-term flow monitoring program, various gauging stations were selected on Trout Creek in the early summer of 1999 (see Kirk in this OLAP report). Permanent staff gauges were installed in the creek and readings were taken on a regular basis. Three measuring stations were established along the lower reaches of Trout Creek in July 1999. These were located:

- immediately upstream of the main diversion channel intake;
- at the canyon exit on the upper end of the fan; and
- at the mouth of the creek about 30 m from the lake.

Flows were measured approximately weekly at the three gauging stations for the period July to September of 1999. Results of the 1999 flow measurements (Table 4) are illustrated in Figure 13. It should be noted that this figure is based on preliminary analysis of data supplied by Ministry of Environment, Lands and Parks, Southern Interior Region Office.

Kirk (in this OLAP report) observed relatively high flows in several Okanagan Lake tributary streams in 1999. With such high flows we expected that flows at the downstream two stations (Trout Creek at the Canyon Exit, and Trout Creek at the lake) would be virtually the same. The fact that the recordings were in significantly different on two occasions and somewhat different on other occasions suggests that a more thorough analysis of the calculations is required.

SUMMARY and RECOMMENDATIONS

Analysis of water licenses on Trout Creek issued to the Summerland Water District Corporation and the data for annual water volumes diverted from Trout Creek by the Summerland Water District showed that there was no diversion of water above the maximum volume specified in the license. We assume that the data provided, based on flow metering in the two pipelines that supply Summerland with water, were reliable.

One of the purposes of the 1999 flow measurement program (Kirk in this OLAP report) was to independently check on the accuracy of diversion flow data supplied by the Summerland District Corporation. Only in late 1999 was it realized that no gauging station had been established in the diversion channel. It is recommended that a gauging station be established there, to measure flows in the diversion channel.

A diversion pipe was observed next to the main diversion channel during a site visit. It was not obvious how much and when water is diverted through this pipe. This diversion needs to be investigated and an estimate made of the diversion volume. In 2000, the upper part of Trout Creek above the Summerland diversion point needs to be investigated. It is important to check on major irrigation flows in the summer months in the mid basin area to determine if any significant unlicensed withdrawals occur.

REFERENCES

Ashley, K., Bruce Shepherd, Dale Sebastian, Lisa Thompson, Lidija Vidmanic, Dr. Peter Ward, Hansen A. Yassien, Laurie McEachern, Rick Nordin, Dr. Dave Lasenby, Janice Quirt, J.D. Whall, Dr. Peter Dill, Dr. Eric Taylor, Susan Pollard, Cecilia Wong, Jan den Dulk, George Scholten. 1998. Okanagan Lake Action Plan Year 1 (1996-97) and Year 2 (1997-98) Report. Fisheries Project Report No. RD 73 Province of British Columbia, Ministry of Fisheries, Fisheries Management Branch

Ashley, K., I. McGregor, B. Shepherd, D. Sebastian, S. Matthews, L. Vidmanic, P. Ward, H. Yassien, L. McEachern, H. Andrusak, D. Lasenby, J. Quirt, J. Whall, E. Taylor, A. Kuiper, P.M. Troffe, C. Wong, G. Scholten, M. Zimmerman, P. Epp, V. Jensen, R. Finnegan. 1999. Okanagan Lake Action Plan Year 3 (1998-99) Report. Fisheries Project Report No. RD 78. Province of British Columbia, Ministry of Fisheries, Fisheries Management Branch, Victoria BC.

Associated Engineering Ltd. 1997. District of Summerland Water System Master Plan. Contract report prepared for Public Works Superintendent, District of Summerland, BC.

Province of British Columbia, Water Investigations Branch. 1973. Engineering Study Rehabilitation of Irrigation and Water Supply Systems. Province of British Columbia, Ministry of Environment, Lands and Parks, Water Investigations Branch.

Water Survey of Canada records.