Water Quality in the Beaver Creek Watershed 2006

Background

The Beaver Creek watershed is approximately 290 km^2 and lies partly within the M.D. of Willow Creek and partly within the M.D. of Pincher Creek. The creek is about 41 km long and meanders through mixed forest in the north and into agricultural land in the central and southern reaches before it discharges into the Oldman River. The Beaver Creek Watershed Group was formed in 2000 to address riparian health and water quality concerns. The group has been implementing land management practice changes to protect and maintain Beaver Creek. In 2003, the watershed group and the Oldman River Basin Water Quality Initiative, now the Oldman Watershed Council, developed a water quality monitoring program with the objective to document changes in water quality that may result from those land management practice changes.

Spring development using tire trough BMP

Something "fishy" going on !

As part of the monitoring effort in Beaver Creek, the Alberta Conservation Association (ACA) repeated fish inventories along Beaver Creek in 2006. In total, four sites have been sampled on the creek. Two sites were sampled 2001 and two in 2003, with three of these sites being resampled in 2006. Backpack electroshocking was used to sample the creek. All fish were identified, measured, weighed and released back into the creek. So far, five species of fish have been found in Beaver Creek. These are Cutthroat trout, Longnose Dace, Lake Chub, Long-nosed Sucker, and White Sucker. From the limited inventories that have been done, it is difficult to tell if all the beneficial management practice (BMP) work that has been done in the watershed has benefitted the fish community. We're hoping to expand on this work in 2007 to provide the watershed group with a baseline fisheries inventory, in conjunction with water quality and riparian health monitoring.

Beaver Creek, like many of the watersheds in southwestern Alberta, crosses through different ecological regions (Figure 1). It goes from the forested headwaters to a grassland confluence with the Oldman River. This means that different fish species will live in different portions of the creek. For example, Cutthroat trout are more likely to be found in the upper (cold) forested portions of the creek, while the minnows and suckers will be more prominent in the lower (cool) waters of the grassland portions of the creek and its tributaries. A few things that help fish survive and thrive are clean substrate (gravel and rocks), different types of flow habitat (pools and riffles), healthy riparian areas, and good water quality.

– Brad Taylor (ACA)

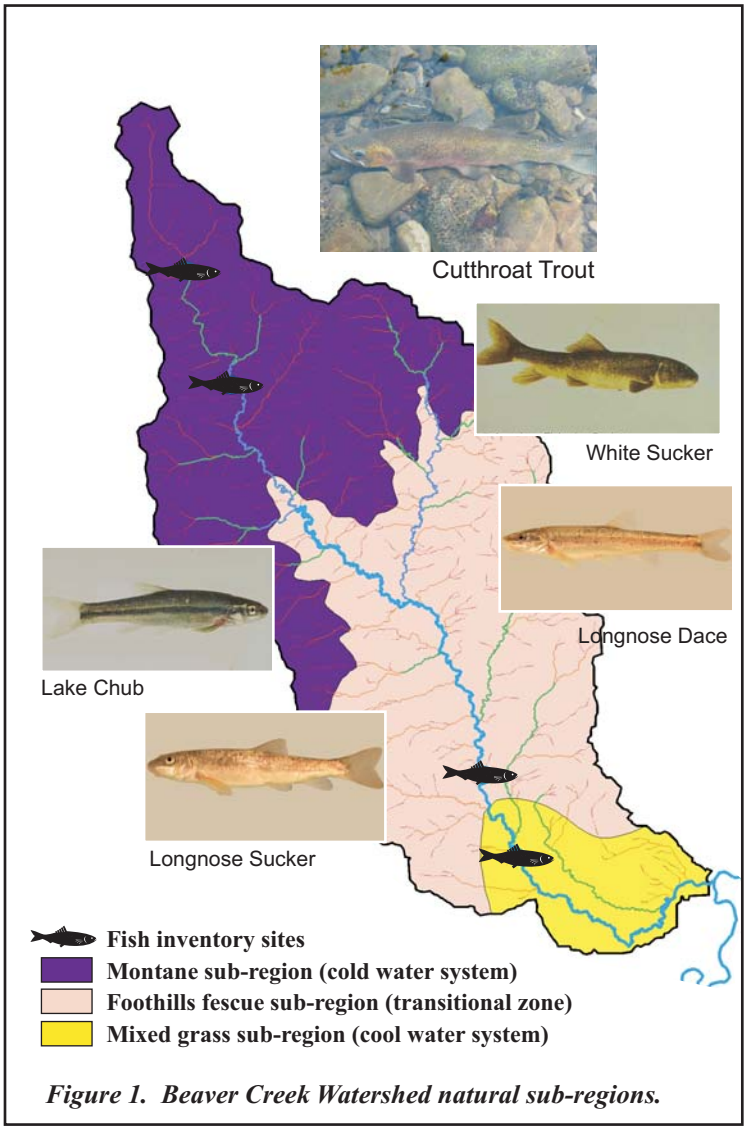

Figure 1. Beaver Creek Watershed natural sub-regions.

Methods

Water sampling and flow monitoring continued in 2006 at the six water quality monitoring sites established in 2003 in the watershed (Figure 2). In addition, four new sites were established in 2006. One main stem site was added between Five Mile Creek and Nine Mile Creek (BVR-7), and three sites were added upstream on these tributaries (BVR4-1, BVR4-2, and BVR5-1). Water samples were collected every two weeks from April to October and monthly during the winter. These samples were analyzed for water quality parameters with the primary focus being on total phosphorus, total nitrogen, total suspended solids and fecal coliforms. Most analyses were done by Alberta Agriculture, Food and Rural Development's (AAFRD's) Soil and Water Assessment Unit in Lethbridge, with the bacteria samples being sent to the Provincial Lab of Public Health in Calgary. Continuous flow data was collected by dataloggers and float potentiometers in stilling wells at BVR-2 and BVR-3 and by Alberta Environment's pre-existing flow measurement station at BVR-6. Other sites have staff gauges for calculating flow at the time of water sampling.

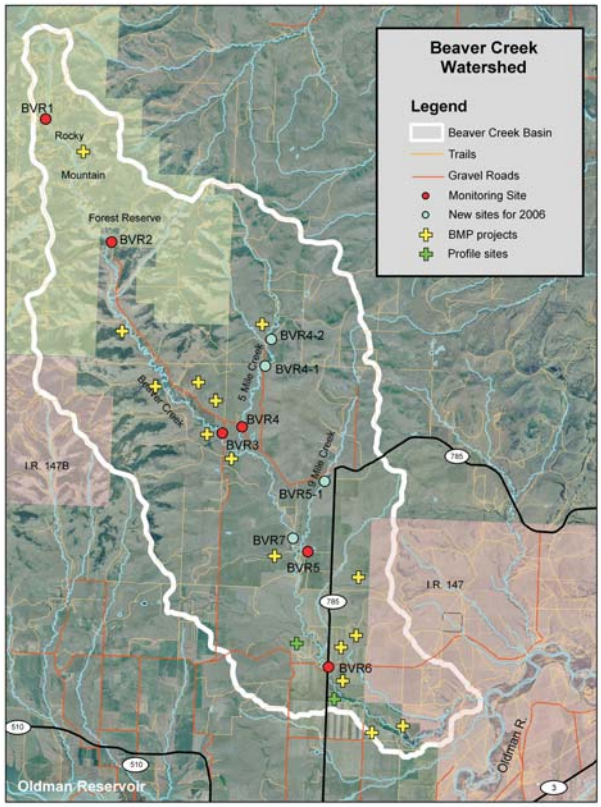

Figure 2. The Beaver Creek Watershed and water quality monitoring sites.

Results

Flow

The mean daily flow in Beaver Creek for 2006 ranged from 0.2 to 1.27 cubic metres/second (cms), as recorded at BVR-6 (Figure 3). Peak flows occurred in April and June, following rainfall events. Throughout the year, any significant rainfall usually resulted in an increase in flow in the creek. Underground springs discharging to the surface feed Beaver Creek throughout its reach, resulting in increased flows as water moves down through the basin. Five Mile Creek (BVR-4) is a major tributary to Beaver Creek that flowed all year long. The tributary Nine Mile Creek (BVR-5) flowed through the winter, spring and early summer but then went dry for a period of time before it started flowing again in late October.

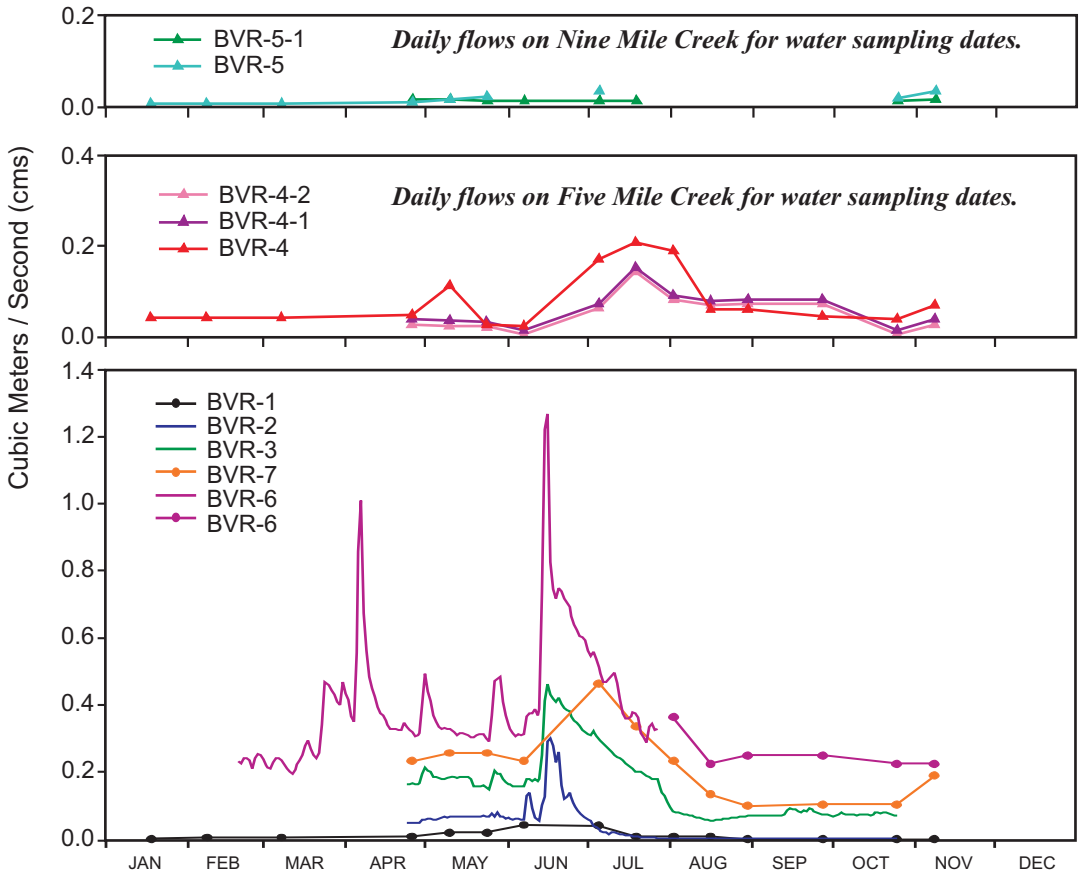

Figure 3. Mean daily flows from main stem water quality monitoring sites in 2006. (Solid lines represent continuous flow data, dotted lines represent flows calculated from staff gauge readings.)

Water Quality

Phosphorus. In 2006, total phosphorus concentrations in upper Beaver Creek (BVR-1, BVR-2) were always below the water quality guideline of 0.05 mg L^{-1} (Figure 4a). Concentrations at downstream sites (BVR-3, BVR-7, BVR-6) greatly exceeded the guideline for the March sampling (this may be related to spring runoff) and then occasionally exceeded the guideline during the rest of the year. Phosphorus concentrations near the mouth of Five Mile Creek (BVR-4) exceeded the guideline for the March sampling and for most of the summer. Phosphorus concentrations further upstream on Five Mile Creek (BVR4-1, BVR4-2) followed the same trend as BVR4 (data not shown). When Nine Mile Creek flowed, all samples collected from near the mouth (BVR-5) exceeded the guideline, however this tributary was dry for most of the summer. Concentrations further upstream on Nine Mile Creek (BVR5-1) also consistently exceeded the guideline (Data not shown).

Nitrogen. Total nitrogen concentrations were mainly below the water quality guideline of 1 mg L^{-1} for all main stem sites (Figure 4b). Sites in upper Beaver Creek (BVR-1, BVR-2) never exceeded the guideline in 2006 and mid and lower sites (BVR-3, BVR-7, BVR-6) only exceeded during the March sampling. Concentrations in Five Mile Creek at BVR-4 only exceeded the guideline in March, while concentrations further upstream (BVR4-1, BVR4-2) occasionally exceeded the guideline. All concentrations in Nine Mile Creek at BVR-5 exceeded the guideline, and all concentrations upstream at BVR5-1 were below the guideline.

Total suspended solids. While no in-stream guideline exists for total suspended solids, the risk of negative impacts to aquatic life and habitat increases with greater amounts of solids. Total suspended solids (TSS) concentrations remained relatively low for most of the year with increases at the mid and lower sites (BVR-3, BVR-7, BVR-6) during the summer months and again in November (Figure 4c). Concentrations generally increase as water flows through the basin. TSS concentrations for Five Mile Creek and Nine Mile Creek followed the same trend as Beaver Creek and both tributaries had higher concentrations upstream (BVR4-1, BVR4-2, BVR5-1) than downstream (BVR-4, BVR-5).

Fecal coliforms. Fecal coliform concentrations at all sites except BVR-1often exceeded the water quality guideline for irrigation (100 counts per 100 ml) and occasionally exceeded the guideline for contact recreation (400 counts per 100 ml) (Figure 4d) in 2006. Concentrations of fecal coliforms generally increase downstream through the basin. It is difficult to summarize the data as different sites experience high concentrations at different times. For example, BVR-3 is the only site to have high concentrations during March and BVR-2 is the only site to have very high concentrations in mid-May. Because fecal coliforms are living organisms, factors such as water temperature and environment can have a large influence on their survival and multiplication rates. The presence of livestock, wildlife and humans in the area can increase fecal coliform numbers.

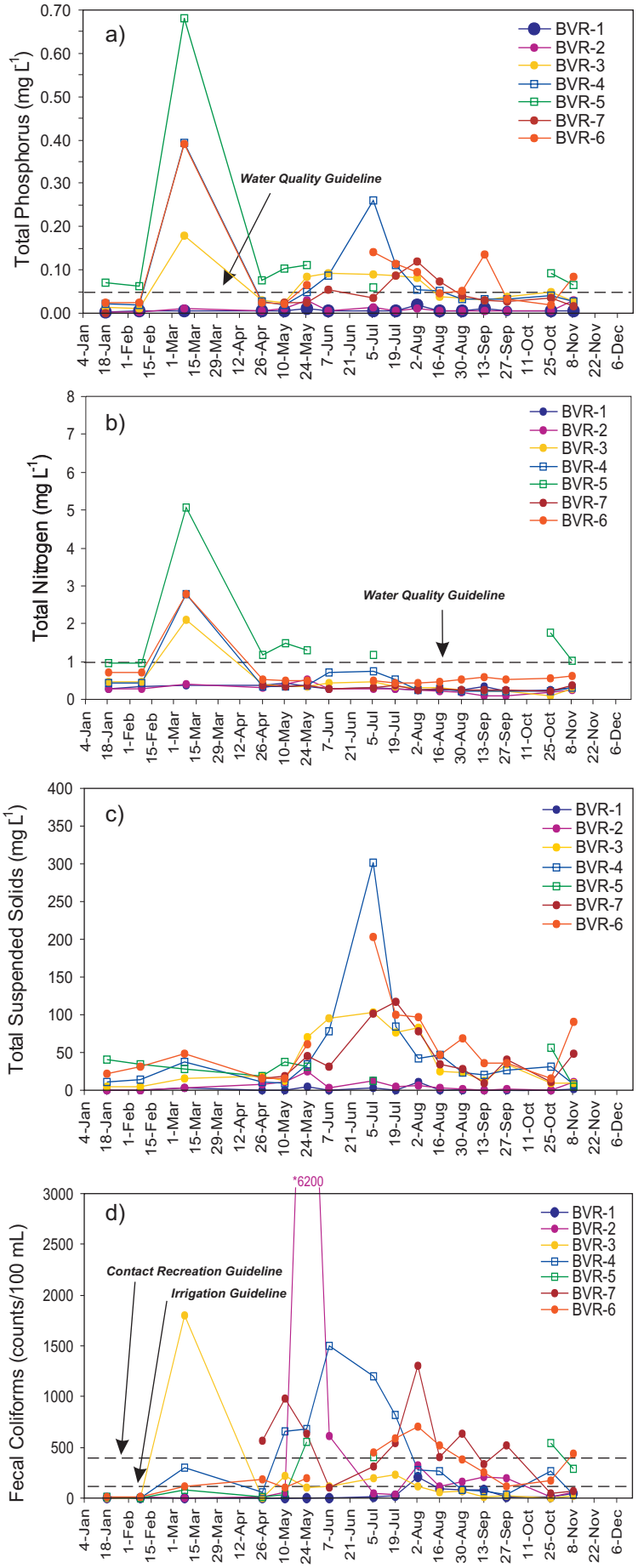

Figure 4. Concentrations of a) Total phosphorus, b) Total nitrogen, c) Total suspended solids, and d) Fecal coliforms at the Beaver Creek sites in 2006.

Beaver Creek Watershed Health Evaluation Project

The Beaver Creek Watershed Group has been successful at securing funding from the Agricultural Research and Extension Council of Alberta (ARECA) for a Watershed Health Evaluation Project for 2007/2008. This project will include another year of water quality monitoring, the completion of a more comprehensive fisheries inventory and the re-evaluation of riparian health in the basin. Subject to landowner approval, the riparian health inventories completed by Cows and Fish in 2001 and 2002 will be repeated to document any changes to riparian health in the past 6 years. These datasets (water quality, fish inventories and riparian health) will be interpreted in relation to each other, as they are inter-connected. This will provide a more complete picture of watershed health, which will assist in evaluating BMPs completed by the watershed group since it's inception. Participating partners on this project are Alberta Agriculture, Food and Rural Development (water quality monitoring), Alberta Conservation Association (fisheries inventory), Cows and Fish (riparian health inventories) and the Oldman Watershed Council (administration). The support for this project comes from ARECA's Environmentally Sustainable Agriculture Initiatives Program (ESAIP) which provides funding for initiatives that are complementary to the objectives of environmentally sustainable agriculture. This includes, but is not limited to, such things as: nutrient management, soil and water management and monitoring, integrated crop management, riparian and grazing management, climate change, greenhouse gases and biodiversity.

Water sampling

Riparian health inventory

Fisheries inventory

The Beaver Creek Watershed Group gratefully acknowledges the Alberta Stewardship Network, the Alberta Environment Water for Life Strategy, and the Department of Fisheries and Oceans Stewardship in Action Program for their support of the water quality monitoring program and field day in 2006.

Alberta Stewardship Network

water for life

Beaver Creek Watershed

OWC OLDMAN WATERSHED COUNCIL
water management – water health

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