Duteau Creek Watershed Assessment Final Report

December 2008

Executive Summary

The Duteau Creek Watershed Assessment and Protection Plan have been prepared for Greater Vernon Water (GVW) in response to a requirement on its Operating Permit by the Interior Health Authority under the *Drinking Water Protection Act*. The key elements considered in this project are: Modules 1, 2, 7 and 8 of the *Comprehensive Drinking Water Source to Tap Assessment Guideline,* and an update of the *Interior Watershed Assessment Procedure*.

Duteau Creek is a major source of water supply for GVW. GVW is a partnership established by the Regional District of North Okanagan (RDNO), City of Vernon and District of Coldstream. At the time of preparation of this report, GVW was in the process of building Phase 1 of the Duteau Creek Water Treatment Plant.

The Source Area

Duteau Creek is a tributary to Bessette Creek, which is tributary to the Shuswap River. The watershed is located approximately 20 km southeast of the City of Vernon. The watershed is located within the Thompson Plateau of the Interior Plateau Physiographic Region with elevation ranging from 660 m at the Headgates intake to 1,800 m in the Grizzly Hills. Biogeoclimatic zones include Interior Douglas Fir and Interior Cedar Hemlock at the lower elevations, with Montane Spruce and Engelmann Spruce Sub-Alpine Fir at mid to upper elevations. The plateau area consists of a gentle, undulating terrain separated by large, commonly steep-sided valleys.

The source area upstream of the Headgates intake is a Community Watershed with a drainage area of 182 km^2, including a portion of the Harris Creek watershed that is diverted into the Duteau watershed. The Community Watershed area is mostly Crown Land. the water supply system includes three reservoirs in the upper watershed approximately 14 km upstream of the Headgates intake. The watershed upstream of Headgates consists of two parts: a canyon section and an upland section. In the upland section, surficial materials consist of moderate to well drained moraine. The canyon section has steep slopes consisting of rock outcrops, escarpments and steep gravelly colluvium with slopes in excess of 80%. The intake is situated directly 'on-stream' hence the intake water quality is not buffered from the raw water in Duteau Creek. The community water supply hence receives direct creek water, at the turbidity levels directly present in the creek.

Contaminants originating from within the unbuffered watershed area between the Haddo Reservoir and the intake pose the greatest risk to source water quality. The buffered area upstream of the reservoirs provides some protection from contamination. However, once the reservoirs are full and spilling, this buffering benefit is substantially reduced.

Duteau Creek is a snow-dominated system with peak flows occurring from late-April to mid-June. The mean daily discharge measured at Headgates is 0.67 m^3/s and the maximum daily

discharge was 16.2 m^3/s recorded in the spring of 1990. Maximum withdrawals are in the order of 2 to 3 m^3/s during peak water demand periods.

Water Quality

There are draft raw water quality objectives proposed by the Ministry of Environment, as well as the 4-3-2-1-0 guideline for treated drinking water quality established by the Interior Health Authority. The range of source water quality risks is limited in the Duteau watershed as it is mostly Crown Land with minimal private or commercial activity. The activities within the watershed are forest development, range use (cattle), limited industrial traffic associated with a quarry that is accessed via the forest roads, and recreation. The raw water quality variables of greatest concern are turbidity, organic carbon and pathogenic organisms such as *E.coli* O157:H7, *Giardia lamblia* and *Cryptosporidium parvum*.

Turbidity is a persistent drinking water quality problem on the Duteau Creek source. During the freshet, high turbidity results from increased overland flow transporting sediment from the creek banks and surrounding areas and from remobilization of sediment within the stream channels. For the duration of the spring freshet, turbidity is greater than the IHA objective of 1 NTU and often above 5 NTU. High levels of total organic material result in the formation of trihalomethanes in the distribution drinking water when the water is chlorinated. The Guidelines for Canadian Drinking Water Quality have set the interim maximum acceptable concentration for trihalomethanes at 100ug/L (0.100 mg/L). Trihalomethanes measured within the distribution system exceed this objective, and show an increasing trend in the past years. This may be due to increase in chlorination dosage, increase in organic matter in the source water, or a combination of both.

Bacterial loading is a concern for drinking water quality. Fecal coliform and more specifically *E.coli* are of particular concern due to known adverse health effects. The peak fecal and *E.coli* presence is commonly in June. Bacteria levels periodically exceed the MoE draft objective, especially in the spring.

Water Quantity

Water quantity is of increasing concern as a result of the increased demand for water and effects of mountain pine beetle activity and climate change. There are three key issues regarding quantity: the amount of spring runoff in the upper watershed upstream of the storage reservoirs; the amount of developed storage; and the opportunity to increase the diversion of runoff from adjacent watersheds. GVW has ~19,000 ML of developed storage in the three upland reservoirs. It is in the process of evaluating the potential to divert runoff from the Upper Flyfish Lakes system, a tributary within the Duteau Creek watershed, into upper Duteau Creek, and also evaluating the feasibility of raising Aberdeen Dam for increased supply storage.

Vulnerability of Intake Works

In its present configuration, the intake is directly vulnerable to contamination from the raw water as the intake is located directly on-stream. The intake is vulnerable to impacts or contamination

affecting the stream immediately upstream of the intake, such as landslides and increased channel instability resulting in increased sediment and debris loads. The spillway at Headgates does not meet the current design flood capacity criteria established by the Ministry of Environment. Increases in peak flow, expected as a result of the mountain pine beetle, may exacerbate this vulnerability.

Risks to Source Water Quality

The primary contaminants of concern identified in the watershed are:

- Sedimentation to streams from forest development activities and recreation use;
- Sedimentation to streams from cattle disturbance at road crossings and along stream banks;
- Bacteriological and pathogen contamination from cattle and wildlife activity around streams and reservoirs;
- By-products from algal blooms in reservoirs resulting from increased nutrient loading;
- Bacteriological and pathogen contamination from human activity around streams and reservoirs; and
- Petroleum spills.

The risk of the contaminants entering the drinking water increases with increased activity in the watershed. The most likely locations of contaminant introduction are those sites with direct access to the stream network, i.e., at stream crossings and around reservoirs.

Contamination sources of concern in the watershed originate from forest development, soil disturbance associated with harvesting activities and roads, cattle grazing, soil disturbance around streams, and fecal coliforms from manure deposits near streams, recreation, soil disturbance near streams from off-road vehicles, and pathogenic organisms from human waste.

The loss of forest cover due to mountain pine beetle attack will likely change the hydrology in the watershed, resulting in increased runoff and higher more frequent extreme peak flows. This in turn may put road-crossing structures at risk if they have inadequate capacity. Increased peak flows may also increase the risk of failure of the spillway at the Headgates intake. Channels on the mainstem creek could be subject to increased rates of erosion due to higher flows, which would increase sediment loads and degradation of water quality. These changes will occur gradually as the pine stands die and as affected stands are salvaged, but the condition could persist for decades.

Risks to source water are categorized as physical, biological and chemical. The particular hazards and risks resulting from this assessment are summarized in the following table.

Summary of Risks to Source Water

Hazard Type	Drinking Water Hazard	Risk	Comment/Assumption
Physical	**Sediment** - Natural sediment load from channel erosion and mass wasting	Moderate	The mass wasting risk should be low provided development is restricted on class IV and V terrain. Natural sediment loads will increase with increasing peak flows but the reservoirs and wetlands provide substantial buffering.
	Sediment - Sedimentation from industrial activity and recreation use	High	It is assumed that there will always be some sediment transport at road crossings.
	Sediment - Sedimentation from cattle activity in and around streams and road crossings	Very High	It is assumed that cattle will continue to graze in the watershed.
	Turbidity – Increased turbidity from natural and human activities	Very High	It has been assumed that the mature pine will die and that flows will increase. It is also assumed that recreational use in the watershed will continue to increase.
	Organic material - (Total Organic Carbon)	Very High	Organic material in streams will increase as the mature pine stands die.
	Water Quantity – Increased peak flows as pine dies; decreased runoff from lower snow packs	High	Over the next 30 years there could be increased peak flows related to the loss of forest cover to the pine beetle. Over the long-term, 50 years and beyond, if there is a long-term decline in snow packs, there may be a supply capacity problem.
	Wildfire	Very High	Wildfire risk will increase when the pine is in the red attack stage. An intense wildfire could result in the loss of the watershed for water supply for an extended period of time.
Biological	**Bacteria** - Bacteriological contamination from wildlife/cattle/human presence in and along streams	Very High	The likelihood for increased contamination will be very high as recreational use increases and the forest mosaic changes as a result of the pine beetle infestation.
	Protozoa – presence of *Giardia*, *Cryptosporidium*	Very High	
	Viruses - presence	Very High	
	Algae – algal blooms in reservoirs	Very High	
Chemical	**Hydrocarbons** -Petroleum contamination from an industrial fuel spill or vehicle accident and gas powered boats on reservoirs	Low	Even with increased activity in the watershed the likelihood of a spill affecting the water at the intake is low.
	Herbicides	Low	Since herbicides should only be used under permit and by licensed applicators, the likelihood of a spill is low.

Recommendations

The intent of the Source Protection Plan is to recommend opportunities to mitigate risks to public health inherent in the drinking water supply, as well as any issues affecting the sustainability of the water supply. Based on the risks to drinking water quality identified in this assessment, there is an urgent need for diligent protection of the source water quality in the watershed through the implementation of additional barriers.

The final section of the report contains a SWOT analysis (strengths, weaknesses, opportunities and threats*)* and provides an effective summary of the situation in the watershed with regards to risks to source water protection. Recommendations are provided to address the priority risks from sediment and turbidity from anthropogenic activities in the watershed, and from sources of pathogenic organisms. Additional recommendations are provided to address other risks from increased peak flows at Headgates, recreation use, and the use of herbicides and pesticides. Recommendations are also provided for monitoring compliance reporting, education and wildfire planning.

The key components of the Source Protection Plan include:

- enhanced efforts with agencies responsible for watershed use activities (such as cattle, forestry, recreation) to implement actions to reduce the generation of sediment and presence of pathogens, and to monitor the results of these efforts;

- review of existing stream-road crossings (bridges and culverts) to confirm capacity to convey peak flows;

- restriction on access to sensitive areas along watercourses, lakes and wetlands;

- inclusion of this watershed protection plan in Tolko's forest stewardship plan;

- enhanced education for watershed users (public and agencies) on protection of drinking water quality;

- specific focus on reducing the impacts of cattle activity in and about all watercourses and lakes;

- review of the Headgates intake area, with the objectives of creating a Duteau Creek bypass arrangement and/or addressing the susceptibility of the existing spillway to excess flows;

- providing alternative recreation sites, i.e., away from the mainstem reservoirs and creeks;

- an enhanced raw water quality monitoring program;

- development of a wildfire preparedness plan;

- consideration for acquisition of additional GVW-owned land around the reservoirs and mainstem creeks;

- a land management plan for GVS-owned lands around the reservoirs and Duteau Creek;

- provision for streamflow and reservoir storage monitoring and long-term data trending; and

- annual compliance reporting to the Drinking Water Officer.

Finally, it is recommended that GVS and the related agencies establish a technical advisory committee to implement, coordinate and monitor the recommendations herein, and to update the Source Protection Plan on a regular basis.