10.0 INSTREAM FLOW NEEDS FOR THE OKANAGAN

The Working Group completed a study to determine the most appropriate office-based method(s) to apply in the Okanagan to identify instream flow regimes needed to both minimally sustain, and optimize conditions for, aquatic biota and their ecosystems. That study is presented in Appendix H.

The study describes the distribution of six (6) species of salmonid fishes that utilize the lakes and tributaries in the Okanagan (Table 2.2 of Appendix H). Extensive datasets on salmonids were assembled from studies relevant to the Okanagan region, and ranges of optimal spawning and rearing flows for these fish species in each of 36 Okanagan tributaries were identified (Figures B.1 to B.36 of Appendix H). The authors found that naturalized flows (i.e. flows that would exist without human use or management) are sufficient in most years to achieve optimal spawning flows for spring-spawning salmonids (i.e. rainbow trout and steelhead); however, naturalized flows usually fail to provide recommended flows for fall-spawning species (i.e. kokanee and sockeye). Optimal rearing conditions are mostly rare in the late summer to mid-winter for resident salmonids (Section 3.2 of Appendix H). Thus, estimates of naturalized flows suggest that most Okanagan streams historically provided suboptimal habitat for salmonid fishes and associated biota in late summer through mid-winter.

The study team recommended use of the BC Instream Flow Methodology (BCIFN) to identify instream flow regimes that protect aquatic life and sustain aquatic populations in individual tributaries. The minimum flow regime identified using this method is "conservative", meaning that even when flows are lower than the BCIFN flows, there is a relatively low risk of acute damage or extirpation for salmonid populations. The authors also identified the lowest 25th percentile of flows as a low-flow reference level. Salmonid fishes are generally regarded as sensitive "sentinels" of aquatic ecosystem integrity, under the assumption that if they are adequately protected, then most other aquatic species and their habitats will be protected.

The final flow parameter considered in this study was a "watershed conservation flow" - a high flow which should occur in spring every few years to sustain physical and biological processes along streams and riparian zones. The results (from the minimum instream flow regime estimation methods and the watershed conservation flow) are illustrated for each of the 36 Okanagan tributaries on Figures B.1 to B.36 in Appendix H.

Eight additional sensitive species and ecological functions that could be affected by instream flows are briefly considered in Section 3.4 of Appendix H. These species include the chiselmouth chub (fish), Mexican mosquito fern, tiger salamander, Great Basin spadefoot toad, vivid dancer damselfly, western painted turtle and Rocky Mountain ridged mussel. It is not yet possible to model their habitat requirements directly in an instream flow analysis.

An analysis comparing regulated flows to naturalized flows found that at some locations the recommended BCIFN minimum risk flows were achieved more frequently in the late summer dry period with regulated flows than with naturalized flows. This is likely due to water storage in these watersheds during the spring freshet, with subsequent release of this stored water later in the summer. However, regulated flows generally met BCIFN minimum risk flow thresholds less often than naturalized flows during other critical time periods (e.g. mid-winter - Table 3.3). These findings indicate the importance of upland reservoirs as a potential source of instream flow in support of aquatic habitat.

The BCIFN guidelines provide standardized methods for setting operational ecosystem objectives, indicators and reference points to facilitate water management decisions that are responsive to the requirements of federal and provincial laws, regulations and policies to promote the maintenance of ecosystem integrity and healthy populations of specified aquatic biota. However, the current study has demonstrated some weaknesses for effective application of outputs from these guidelines. These include: (a) the observation that minimum flow recommendations in drought prone areas such as the Okanagan under BCIFN guidelines may be higher than estimates of historic, naturalized low flows for a given stream, (b) the omission of any consideration of maintenance of water quality characteristics such as suitable temperatures for aquatic biota that may be controlled by the influence of interactions among surface and groundwater flows on habitat or ecosystem integrity, and (c) the failure of BCIFN guidelines to explicitly consider that maintenance of healthy populations of aquatic biota and ecosystem integrity frequently depend on interdependent processes (e.g. mating, spawning, rearing, and overwintering), operating at spatial scales involving migration or dispersal of aquatic biota among multiple streams exhibiting a wider range of seasonal flow variations than recommended from application of BCIFN methods.

Recommendations:

The following recommendations are made for future studies to refine the approach to specifying instream flow needs to maintain aquatic biota and their ecosystems in the Basin:

- Conduct additional studies to assess the consequences of failure to meet particular low flow thresholds – e.g. increased risk of production losses or extirpation of specified aquatic biota (e.g. fish and SARA-listed species).
- Initiate tests of the key assumption that habitat requirements of a broad range of sensitive aquatic biota will be met if the requirements of sentinel species such as salmonid fishes are satisfied.

- Assess the importance of combinations of surface and groundwater flows and withdrawals in various streams of the Okanagan to the maintenance of suitable, seasonal, thermal conditions required to sustain healthy populations of salmonids and other sensitive species of aquatic biota.
- Initiate work to identify how to expand effective application of the BCIFN methodology to sets of streams by determining the consequences of annual to seasonal temperature and flow variations on migration, dispersal, recolonization and production of sentinel species of aquatic biota among streams that taken together comprise the ecosystem(s) of such species.

In the meantime, when an appropriate minimum instream flow regime must be identified on a particular stream, it is recommended that:

- Agreement on an acceptable minimum instream flow regime for a set of streams will likely require that the agencies with a responsibility for aquatic species agree in advance on an acceptable level of risk to these species.
- A preliminary evaluation of the instream flows required to sustain aquatic biota should be made using the BC Instream Flow Methodology, with consideration of the 25th flow percentile documented herein.
- These office-based studies should be supplemented by site-specific field evidence for the stream (or representative member of a characteristic set of streams).

11.0 OKANAGAN WATER DATABASE

Phase 2 of the Okanagan Water Supply and Demand Project involved many modelling and analysis exercises to produce time series datasets for various water balance variables. The purpose of the Okanagan Water Database (OkWater Database) is to standardize these datasets and provide a website for automating remote delivery into a central long-term storage system. The system uses a flexible design that allows for additions and potential modifications in the future.

The central database is web-enabled via a web browser that allows users to upload MS Access templates through a simple import interface. This interface also enforces an audit trail and requires standard metadata information so that the datasets can be appropriately referenced and combined to form complete water balance scenarios.