Wahleach Project Water Use Plan

Boulder Creek Flow Bypass Facility Rehabilitation

Reference: WAHWORKS#1

*Boulder Creek Diversion Rehabilitation*

Condition Assessment

Report Date: July 2010

BC Hydro Engineering
Inter-office memo

TO: Dave J Hunter
DATE: 08 July 2010

FROM: Derek Sakamoto
FILE: GW1000-WAH.51.01

SUBJECT: Boulder Creek Diversion Condition Assessment

Summary
It is the understanding from Engineering that the BC Hydro is seeking to continue use of the Boulder Creek temporary diversion structure reconstructed in 2007. Continued use of the diversion is desired to extend testing of the diversion’s effectiveness in supplying supplementary flows to the Jones Creek system. This diversion had been built to reroute Boulder Creek flow, historically diverted into Jones Lake reservoir, directly back into Jones Creek.

Based on a site visit in May 2010, it is believed that the existing diversion can continue to be used to further assess its effectiveness. However, Engineering does stress that the weir has not been designed to withstand large flood events as the existing weir was designed as a “temporary test facility”. It is possible that a large flood on the Boulder Creek system could again overwhelm the weir. A permanent weir may require the implementation of additional channel stabilization measures.

Background
The Boulder Creek diversion was constructed to divert tributary flows into the Jones Lake Reservoir. The diversion consisted of a gated culvert through the diversion channel berm, with the gated culvert being protected by a concrete headwall. Problems with siltation and channel invert movement in the highly erodible Boulder Creek diversion channel led to the diversion being abandoned. Following large flows the diversion would often be found filled with sediment, and with the invert of the diversion channel slowly deepening the hard fixed diversion inlet was often too high to allow for inflow.

Through the Jones System water-use plan, methods to ensure flow into the Jones Creek system are being reviewed and a desire to investigate the potential flow augmentation available from Boulder Creek was pursued. An inexpensive temporary means of reactivating the Boulder Creek diversion was desired to investigate if a more robust permanent structure was warranted.

In the summer of 2005 a temporary weir was installed to re-establish the diversion. Loc-block type retaining wall blocks were used to construct the weir. The system was designed to encourage siltation on the bank opposite from the diversion intake; and flush sediment away from the intake by forcing higher velocities past the front of the diversion inlet in a constructed flume. This temporary weir was overwhelmed by a large inflow in late 2006, with what was believed to be the 1:25yr design flow. To continue the testing of the diversion the weir was reinstated with a more robust structure in the summer of 2007. Detail of the existing structure can be found in the Construction Report for the work¹.

The existing structure is comprised of a weir and flume constructed from large boulders. A low flow flume was created through careful placement and packing of smaller rock and gravel material. This flume was designed to ensure that even during lower summer flows, sufficient water was available to permit passage by resident kokanee.

Observations
To confirm the existing weir condition and its suitability for continued usage, the site was visited 22 April 2010 with Brent Wilson (Lower Mainland Area Environmental Coordinator), David Hunter (Natural Resource Specialist), and Derek Sakamoto (Senior Engineer). Three key issues were to be addressed in the visual inspection:

- Stability of channel invert;
- State of the existing structure; and
- Siltation / silt flushing & kokanee passage performance.

Stability of channel invert
A problem with the 2005 weir was in the degradation of the toe of the weir structure. Although the footing of the weir was well founded, the downstream channel invert continued to degrade during high flows & cut back into the weir foundation. Despite annual maintenance work to assist in the longevity of the weir, the weir foundation was eroded from the downstream side by a large flood event in 2006.

To prevent this downstream degradation from occurring in the new 2007 structure, a longer portion of the downstream channel was stabilized with careful armouring of the channel with large stones. The 2010 April inspection of these stones and comparison of the existing and as constructed photos of the downstream reach of the channel suggest the channel invert has remained fairly stable since construction completion. Although far from becoming stable, the high eroding left bank at the downstream end of the construction work does not appear to have continued to unravel significantly as it had been observed to do in the past (see figures 1 & 2). Similarly, along the right bank the rock / concrete slurry berm toe had been re-established as the channel invert along much of the length of the channel construction. This toe appears to be stable as observations suggest the channel has not cut down significantly (see figure 3).

State of the existing structure
Given the “temporary structure” design approach, the channel protection work was designed with consideration to smaller design flood events only. This led to rock sizing to be based upon a 1:25yr inflow. However, through construction of the rip-rap channel bed to interlock boulders and stones, it is possible that the channel could withstand higher less frequent storm events. Observations indicate that the larger “anchor” stones placed through the rock flume appear to remain stable. Anecdotal observations from Brent Wilson confirm that the low flow channel is functioning adequately. The weir diversion also appears intact and is functioning as designed.

Siltation / silt flushing performance
Given the high energy and continued erosion through Boulder Creek, every year sees the transfer of sediment along the channel. Before any improvements had been made to the channel in 2005, the diversion intake had been prone to infilling with sediment. As intended, any silt that is being retained by the weir structure is being held along the left bank, opposite the diversion intake. Excess sediment is flushed past the diversion through a constricted low flow channel on the right side. Commentary from Brent Wilson and Dave Hunter confirmed that the existing structure has operated since its completion in 2007 without requiring any annual maintenance, and without any siltation problems in the diversion intake. Figure 4 provides a view of the intake area clear of sediment.
Conclusions
Although the current diversion has not been subjected to the magnitude of flows expected to have toppled the weir constructed in 2005, the current configuration appears to be much more stable than the 2005 version. Annual maintenance was required for the 2005 weir to ensure the toe of the weir was not undermined, whereas the current weir has not required any maintenance. Sedimentation, which had been a problem with the diversion intake prior to the 2005 improvement, has not been an issue. It is the view of engineering that the weir should be suitable for further use to continue testing the effectiveness of the diversion. It should be noted that the diversion is meant to act as a “temporary test installation”; as its design flood is not as high as what would have been used for a permanent facility. A permanent weir structure would likely require some additional channel stabilization measures.

Derek Sakamoto, P.Eng

Attachments

c: Kelly Galway
  Brent Wilson
Exposed cut in left bank has seen little undercutting over past 3 years.
Concrete slurry toe of original right bank diversion is no longer being undercut. Constructed channel invert appears stable.

Diversion intake on right bank clear of silt with sedimentation occurring along left bank. Silt flume and diversion are functioning as designed.