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Memorandum

Ministry of Environment

Water Management Branch

Date: September 22, 2010

To: Doug Konkin
Deputy Minister
Ministry of Environment

Re: Review of the Provincial Dam Safety Program

As requested, staff from the Ministry of Environment have conducted an internal review of the Dam Safety Program. I am writing to convey this report as well as provide you with my observations and recommendations for improving the program.

Background

BC is one of four provinces with a formalized dam safety program which provides oversight to nearly 2000 dams in the Province including some of the largest structures Canada. In a province with very diverse geologic, hydrologic and seismic conditions along with a variety of dam owners and operators, regulation of these structures can poses significant challenges.

In the late 1990's, in response to a significant dam failure a program review by Semmens and Adams and restructuring of the Dam Safety Program was undertaken. A copy of the Semmens and Adams report along with some of the details of the new program is contained in the attached material. The reader is encouraged to review the findings of this report, particularly the executive summary which provides a good overview of the issues. This current review will not attempt to reproduce this information, but will build on the previous recommendations and identify areas where the program can be further improved.

By the early 2000's the recommendations of this review were fully implemented and this is essentially the program that we are delivering today. The new dam safety program is "results-based" with considerable reliance on professionals and dam owners to maintain the safety of these structures. Fundamental to this new program was the shift in Ministry staff role from inspection functions to audit and education functions. The primary responsibility for the safety and operation of these structures rests with the dam owners.

Under this new approach it is anticipated that there will be a certain number of negative results, which in the field of dam safety are represented by dam failures or incidents. On average we have been experiencing several incidents and at least one dam failure in British Columbia annually. While it is possible to further reduce the number of these incidents and failures

through some of the recommendations outlined below, it is not possible to completely eliminate them. In fact if we wish to reduce these incidents and failures to near zero, we may need to move towards a more prescriptive model, and even then they will not entirely be eliminated. The Semmens and Adams report states that "Dams can and do fail", as a compelling and factual reality.

In general I believe that we have a good, effective, modern dam safety program, however it could be improved through a modest increase in resources along with a refocusing of efforts as described below.

Observations and Recommendations

1. Priority

Many of the provincial Dam Safety Officers do not work full time on dam safety issues and other competing priorities such as water licensing, IPPs and flood safety issues take time away from dam safety activities. Ensuring dam safety activities are a priority for these individuals is essential for an effective dam safety program.

The Province and specifically the Ministry of Environment currently owns and operate a number of dams. Some of these structures are not fully compliant with the Dam Safety Regulations with respect to inspection, operation and review. Compliance with the Regulations must be a priority for all provincial staff.

Many of these provincial dams have been constructed or acquired over the years for flood control, water supply or habitat enhancement purposes; however inspection and maintenance resources to manage these structures are not always in available. Some dams have been transferred or defaulted to the Province and continue to be maintained on an ad hoc basis. The suite of dams owned by the Province should be reviewed; a business case for their operation or removal should be developed, along with a plan for removal of those structures that are no longer required.

2. Resources

The Dam Safety Program was transformed to a results-based model in part due to the excessive resources required to maintain the existing approach. After the transformation the Ministry assigned approximately 8.5 full-time equivalents (FTEs) to this program, however this number has fallen to 5.5 in recent years. This has resulted in staff being slightly behind on scheduled audits and left little time for follow-up of outstanding issues identified during these audits. Additional staff resources would allow for more frequent audits, follow-up on problem dams and an application of the Dam Safety Program as originally designed.

3. Program Design

While the Provincial Dam Safety Program is a good model there are a number of minor improvements that could be made. These include a change to the Dam Safety Regulation which would bring the classification system in line with the 2007 Canadian Dam Association

Guidelines, along with the minor updates of the provincial dam database. In addition, an internal review of consequence classifications for all dams in BC may be warranted, however this is a highly technical, labour intensive process. Although the program currently has an 87% return of annual compliance reports a review of the regulatory framework in regard to improving that number and general efficiency and effectiveness should be undertaken.

4. Other Related Risks

While the recent failure of the dam near Oliver has brought attention to the dam safety program there are several other water related risks that could attract future attention from a similar failure.

Mine tailing dams are not regulated by the provincial Dam Safety Program, even though they are similar in nature. An MOU exists between the Ministry of Environment (MOE) and the Ministry of Energy Mines and Petroleum Resources (MEMPR) which assigns MEMPR as the lead with respect to these structures. The public is not likely to make the distinction between one of these structures and a regulated dam, so a consistent approach to risk ranking and mitigation could be advantageous. MOE staff will explore these issues with MEMPR staff.

The majority of the **dikes** in the province, both those with an identified owner and orphan structures (provincial) do not meet current provincial standards. In many cases regular inspection and maintenance of these structures is not being undertaken by the owners. It is therefore very possible that failures of these structures could occur during flood events, below design levels. The current provincial Flood Protection Program is addressing some of the infrastructure upgrades associated with these structures; however a considerable backlog in inspection, maintenance and capital investment exists.

Associated with the 44,000 water licenses in the province are **authorized works**, most of which are not covered by the Dam Safety Regulations. A very small portion of these works do include structures which could pose a risk to public safety. These include high pressure water conveyance structures such as pipelines and penstocks along with other works associated with the hydroelectric industry. IPPs, most of which are run of river include many works not associated with a dam. As such they are not subject to the normal audit programs. Due to the limited number of these types of works and a high standard of design the overall risk is generally low, however it may be prudent to identify any higher consequence structures for additional oversight similar to the Dam Safety Program.

Conclusions

The model and tools employed by the Provincial Dam Safety Program are appropriate; however the effectiveness could be significantly improved with some relatively minor resource and program enhancements as outlined above. There are some related hazards associated with other water control structures which could also be reduced by a similar review.

Glen Davidson, P.Eng.
Comptroller of Water Rights
Ministry of Environment

Report on the BC Dam Safety Program 1967 to 2010

Introduction:

This report will describe the development of the BC Dam Safety Program from 1967 until the present day. The report was commissioned as a result of the events that occurred near Oliver BC on June 13, 2010 when the failure of a small dam apparently triggered a destructive debris torrent in the Testalinden Creek adjacent to the Okanagan River.

History of Dam Failures in British Columbia:

Despite the large number of dams in BC, there have been only two known fatalities as a result of dam failures. The first occurred in 1912 in the Vancouver Island port community of Union Bay. The Langley Lake Dam, which was poorly designed, collapsed during a winter rainstorm causing extensive damage to part of the town and the coal loading facility. Due to some advanced warning, the densely populated lower creek area was quickly evacuated, but one person died in the flood. During the 1948 spring flooding, a placer miner went missing following the failure of the Devick Lake Dam 30 kilometres north east of Kamloops. The body was never recovered and he was presumed drowned by the dam failure inundation. The main CN rail line was washed out on the North Thompson River, and considerable damage was done in the Heffley Creek area.

In the last 30 years, on average, there has been one recorded dam failure per year. Most of these failed dams have been small dams which caused minor damage which was sometimes reported in local media. The Cannon Creek Dam breach, in May 1995, was the most damaging failure in that time period (until the events near Oliver, June 13, 2010) and the impact on the Dam Safety Program was far reaching. This report will describe the development of the BC Dam Safety Program before the Cannon Creek Dam failure and after, and will explain how this near disaster was the catalyst for change. The report will outline the findings of the formal review of the provincial Dam Safety Program, conducted in 1996, and then focus on how the program evolved after that.

Dam Safety Program History

Prior to the establishment of the current provincial dam safety program in 1967, the safety of dams was regulated by Regional Engineers on an ad hoc basis. A number of dams failed during the flood season of 1948 causing wide spread damage and one fatality. An index of dams for the Interior of BC was created following the 1948 floods and dam inspections by Regional Engineers and technical staff were carried out. The dam building boom of the 1960's created the need for a formal Dam Safety Program to review and authorize the construction of major projects such as the WAC Bennett and the Mica Dams and to inspect all major dams. The Provincial Dam Safety Program was established in Victoria in 1967 by the Comptroller of Water Rights to ensure that Major Dams in the province were designed, constructed, operated and maintained to acceptable standards for public safety. Major Dams were initially defined as meeting the size criteria for ICOLD[4] dams, but soon the dam height definition was dropped from 15m (50 feet) to 9m (30 feet). Smaller dams continued to be inspected by Water Rights staff in some regions under the Regional Engineers. The regional offices began to turn to the Dam Safety Program in Victoria for assistance with plans review and approval. Additional staff were added in Victoria in 1971 and 1975 to undertake dam inspections as well as specialized work such as underwater inspections and dam

[4] International Commission on Large Dams