

Simplified Method For Assessing Flood Conveyance Capacity and Seismic Stability for Dams under 9 Meters in Height

Note: It is the intent of the Dam Safety Section to prepare a more comprehensive guide on how to assess the flood capacity and seismic stability of small dams. Until that time, the following information is provided to assist the dam safety review engineer to determine if further study is required to assess the flood capacity and seismic stability of small dams. Please also refer to the Canadian Dam Association, Dam Safety Guidelines and Technical Bulletins.

Rough Estimate of Flood Capacity

Dam Review Engineers may elect to review the spillway capacity and determine if it approximates or exceeds the required Inflow Design Flood (IDF) by following the steps below. These steps should be used to provide a cursory assessment only; this is not appropriate for use in a spillway design.

1. Hydraulic Capacity - Determine the existing spillway discharge capacity assuming adequate freeboard. Methods of determining the capacity of spillways and other discharge structures are outlined in the “Design of Small Dams” and other engineering texts and publications. For determination of freeboard requirements see the “Plan Submission Requirements for the Construction and Rehabilitation of Dams” and CDA Dam Safety Technical Bulletin #6: Hydrotechnical Considerations for Dam Safety.
2. Hydrology Assessment -
 - a) Determine the 1:10 and 1:100 year instantaneous peak flow based on the 1998 report, “[British Columbia Streamflow Inventory](#)”. Some more recent regional streamflow studies, including peak flow data for specific regions of BC by Obedkoff, are available on the [BC Ecological Reports Catalogue \(EcoCat\)](#) website. The review engineer can then make a rough estimate of the lower bounds of the IDF, but in extrapolating beyond the 1/100 year flood, the statistics give only an “order of magnitude” estimate. Extrapolation beyond the 1/1000 year flow is discouraged, although may be justified up to the 1/2500 year flow. The review engineer should also take into account that the runoff to watershed ratio is higher for smaller watersheds particularly in the Interior.
 - b) [Probable Maximum Flood Estimator for British Columbia](#) - Determine a rough estimate of the Probable Maximum Flood (PMF) using this estimator derived from 46 PMF studies across BC and 7 from the states of Washington, Idaho and Montana.
3. Flood Routing – The accumulation of storage in the reservoir may result in a considerable reduction of the spillway outflow compared to the reservoir inflow. A flood routing calculation is needed to determine the peak flow in the spillway during the IDF. Method of calculating flood routing are outlined in the “Design of Small Dams” and other engineering texts and publications.

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Assessing Seismic Stability

The Natural Resources Canada web site below has a link that automatically calculates seismic hazard values for five parameters including peak acceleration. Follow the link “determine seismic hazard at your site” and insert the coordinates for the dam location to view the seismic hazard values.

<http://earthquakescanada.nrcan.gc.ca/hazard-alea/index-eng.php>

The following describes the Geological Survey of Canada’s seismic hazard calculations. For further information see the above link.

“Canada’s 4th generation seismic hazard model is the basis for the seismic design provisions in the 2005 National Building Code of Canada. The 2005 code uses median ground motion on firm soil sites for a probability of exceedence of 2% in 50 years, with the ground motion being described by seismic hazard values for five parameters: spectral acceleration at 0.2, 0.5, 1.0 and 2.0 second periods and peak acceleration. We tabulate values of the five parameters for more than 200,000 grid points over Canadian territory and surrounding areas. The four spectral parameters will allow the construction of approximate uniform hazard spectra for every place in Canada, and hence improve earthquake-resistant design.”

Seismic Stability Analysis: Information on seismic stability analysis is described in the CDA Dam Safety Technical Bulletin #8 for earth fill dams and Bulletin #9 for concrete dams. The simplified methods are identified in these bulletins. Another source of information on seismic stability analysis for dams is in the Washington State, Department of Ecology, Dam Safety Guidelines, Part IV: [Dam Design and Construction](#).