4.8 Design Discharge Criteria

Determine the design discharge for streams for a particular recurrence interval. Establishing a return period provides a benchmark of the relative risk to be attached to any particular design. The current regulation requires peak flows to be determined in accordance with the anticipated life span of the structure at a site [see FPPR section 74 (1)].

4.8.1 Factors Affecting Runoff

The runoff effect of a stream depends on many factors, most of which are not readily available or easy to calculate, such as:

- rainfall (e.g., occurrence of cloudbursts; hourly and daily maxima);
- snowpack depth and distribution, and snowmelt;
- contributory watershed area, shape, and slope;
- topography and aspect;
- forest and ground cover;
- soil and subsoil composition;
- weather conditions;
- harvesting and road or other upslope development or disturbance;
- drainage pattern (stream order, branchiness; lakes and swamps); and
- stream channel shape, length, cross-section, slope, and “roughness.”

Because topography, soil, and climate combine in infinite variety, design the drainage for specific sites individually from available data for each site. In addition, consult those who have long experience in maintaining drainage structures in the area, as well as observing evidence of local activity/events.

4.8.2 Methodologies to Estimate Design Flood Discharge

There are too many analytical and empirical methods for estimating stream discharge to be discussed at any length in this manual. Professional engineers, who in the course of carrying out their professional functions as designers of a bridge or a major culvert, are ultimately responsible for establishing the design discharge for a structure. Methodologies for determining design flood discharge include:

- working from available evidence of flood flows in the stream in question;
- gathering evidence of flood flows in other streams, relating these to their drainage basin characteristics, and then, from the characteristics of the basin under consideration, estimating a flood flow; and
- relating meteorological data to stream basin characteristics and estimating flood flow through empirical

methods.

Obtain the necessary data for these methodologies from various sources:

Expand All | Collapse All

Site information

Use site-specific data at, and adjacent to, the proposed crossing to estimate the maximum flow. Records of culverts and bridges within the vicinity that have successfully withstood known flood events can provide useful information in the estimation of flood flows.

Stream basin characteristics

Use stream basin characteristics such as length, slope, order, roughness, vegetative characteristics, and elevation band, combined with meteorological data, in empirical approaches to determine design flood flows.

Data from other streams

Use studies done on other streams in the vicinity, with similar characteristics, to provide information on relationships and comparative values.

Hydrometric records

The Water Survey of Canada publishes Surface Water Data (annual reports of readings on hydrometric stations throughout the province), as well as Historical Stream Flow Summaries in which mean values and annual peaks are tabulated. Use these stream flow records to project design flood flows from theoretical analysis.

4.8.3 Comparing Discharges Using Hydrological Information

Determining design flood discharge usually involves applying several different methods and then using judgment to select an appropriate design value. In all stream flood discharge determinations, compare the proposed opening size with historically problem-free existing stream crossings serving similar drainages in the same area.

Compare the flood discharge estimates derived from the site information with other data and theoretical derivations. Base the final selection of design discharge and resulting bridge opening or major culvert size, taking into account these comparisons together with consideration of debris potential, ice jams, and any other local factors that might influence the structure opening.