CHAPTER 7
BENEFIT-COST PROGRAM: FLOOD HAZARD RISK

Introduction

This section contains data entries for flood frequencies, discharges and elevations which are necessary to specify quantitatively the extent of flood hazard at the site under evaluation. From the entered flood data, the program calculates the expected annual number of floods in one-foot elevation increments. "Expected" annual number means the long term statistical average number per year, not that this number of floods occurs every year.

The degree of flood risk at a particular site profoundly affects the expected flood damages at a site and thus profoundly affects the benefits of avoiding flood damages at the site. Therefore, the flood hazard data entered in this section are among the most critical data inputs for benefit-cost analysis of flood hazard mitigation projects.

Entering incorrect flood frequency, discharge, and elevation data will result in incorrect flood probabilities and thus yield INVALID BENEFIT-COST RESULTS.

LEVEL ONE Analysis

A **LEVEL ONE** Flood Hazard Risk Analysis is performed using information from a FIS and a FIRM, or equivalent information, for the location under evaluation. Data on flood frequencies, discharges, and elevations are entered into the Flood Data table shown on page 7-2.

A LEVEL ONE Analysis of Flood Hazard Risk requires a FIS and a FIRM, or equivalent information, for the location under evaluation.

LEVEL TWO Analysis

If a FIS and a FIRM are not available, or if the user desires to use other estimates of flood hazard risk, then a **LEVEL TWO** Analysis must be performed.

FLOOD HAZARD RISK

Carry Over Information

PURPLE Blocks (Carry Over). Information from the **LEVEL ONE DATA** page is displayed to identify the building under consideration and to provide reference information and guidance for **LEVEL TWO (Detailed)** evaluations.

FLOOD HAZARD DATA

Flood Data

Data from Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM)

Flood Frequency (years)	Discharge (cfs)	Elevation (ft)
10	279,000	5.8
50	351,000	7.4
100	377,000	8
500	444,000	9.5

Flood frequency, discharge and elevation data **MUST** be entered in the flood hazard table in order to calculate the degree of flood risk at the site under evaluation. Flood data for 10-, 50-, 100-, and 500-year floods are generally available from the Flood Insurance Study (FIS) for the area under evaluation. However, if flood data for other frequencies are available, the frequencies and corresponding discharge and elevation data may be entered in this table.

The table showing the expected annual number of floods is automatically recalculated whenever the flood data are revised.

Flood Discharge Data

The FIS contains a table of flood frequencies and discharges similar to the two left hand columns of the table above. If more than one set of discharge data are shown for the stream, use the discharges for the closest location **downstream** from the building location.

Flood Elevation Data

The FIS also contains **Flood Profile** graphs which show the elevations of 10-, 50-, 100-, and 500-year floods along the stream. The elevation of a 100-year flood, for example, varies with location along the stream because water runs downhill. To characterize flood risk at a given location, it is necessary to know the elevation of the 10-, 50-, 100-, and 500-year floods **at this location**. These data may be obtained from the **Flood Profile** graphs in the FIS.

Flood Profile graphs show the variation of flood elevations with distance upstream from a waterway confluence, bridge, or street crossing. To determine the elevations for the building under evaluation, the distance upstream from a landmark on the Flood Profile graph must be measured on a map. The Flood Insurance Rate Map (FIRM) may be used for this purpose. Once the location has been properly identified, then flood elevations for 10-, 50-, 100-, and 500-year floods are read from the Flood Profile graph.

An example of a Flood Profile graph from an FIS is shown on the following page. In this example, stream distance is shown in thousands of feet above the confluence with Overpeck Creek. The house under evaluation is located about 7850 feet above the confluence, or 45 feet upstream from the Vanostrand Avenue overcrossing. Flood elevations for the 10-, 50-, 100-, and 500-year floods are read from this section of the Flood Profile graph.

In this example, the 500-year elevation is 128.1 feet; the 100-year elevation is 127.1 feet; the 50-year elevation is 125.9 feet; the 10-year elevation is 124.5 feet; and the channel bottom is 119.5 feet. See the Flood Profile graph on the next page.

Flood elevations may vary **markedly** along the stream course depending on the gradient of the individual stream. Therefore, it is **very important** to read properly the flood elevation data on the Flood Profile graph for the **specific site** under evaluation.

Entering incorrect flood discharge and flood elevation data will result in incorrect flood probabilities and thus INVALID BENEFIT-COST RESULTS.

For additional guidance on obtaining flood information from Flood Insurance Studies and Flood Insurance Rate Maps, users are referred to the following publications:

1. **Guide to Flood Insurance Rate Maps** (FIA-14), FEMA, May, 1988.

2. **Flood Proofing, How to Evaluate Your Options**, U.S. Army Corps of Engineers, 1993.

3. **Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings**, FEMA, 1994.

Figure 7-1
Example Flood Profile Graph