

Chapter 1

Introduction

1.1 Program Development

The HEC-1, Flood Hydrograph Package, computer program was originally developed in 1967 by Leo R. Beard and other members of the Hydrologic Engineering Center (HEC) staff. The first version of the HEC-1 program package was published in October 1968. It was expanded and revised and published again in 1969 and 1970. The first package version represented a combination of several smaller programs which had previously been operated independently.

Input and output formats were almost completely restructured in order to simplify input requirements and to make the program output more meaningful and readable when the 1970 version underwent a major revision in 1973. In 1981 the computational capabilities of the dam-break (HEC-1DB), project optimization (HEC-1GS) and kinematic wave (HEC-1KW) special versions were combined. These were put into a single easy to use package. In late 1984 a microcomputer version (PC version) was developed.

The latest version, Version 4.0 (September 1990), represents improvements and expansions to the hydrologic simulation capabilities together with interfaces to the HEC Data Storage System (DSS). The DSS capability allows storage and retrieval of data from/for other computer programs as well as the creation of report-quality graphics and tables. New hydrologic capabilities include Green and Ampt infiltration, Muskingum-Cunge flood routing, reservoir releases input over time, and improved numerical solution of kinematic wave equations. The Muskingum-Cunge routing may also be used for the collector and main channels in a kinematic wave land surface runoff calculation.

1.2 Overview of the HEC-1 Package

The basic steps in rainfall-runoff simulation include:

Gathering data (topographic maps, precipitation and streamflow data, aerial photos, soils and land use information, etc....).

Estimate model parameters (unit hydrograph, loss rate, and routing parameters, etc...).

Develop HEC-1 input data file representing the watershed and rainfall-runoff.

Simulate the flood event by executing HEC-1.

Review and evaluate model results as compared to observed information. (HEC-1 output and/or graphical displays with DSS.)

Calibrate model parameters to obtain best fit of several observed events.

Use calibrated model for design or analysis purposes.

The programs distributed with the HEC-1 package provide the necessary tools to accomplish all the basic steps for a rainfall-runoff simulation on the personal computer (PC). The computational process for doing a flood runoff analysis is illustrated in Figure 1. A menu program, MENU1, has been developed to provide program users convenient access to the HEC-1 package of programs and related files, when operating a PC with a hard disk. The MENU1 program, described in chapter 3, eliminates repeated typing of program and filenames while using the HEC-1 package of programs.

Text editors can be used to create or modify an input data file for the HEC-1 program. The Corps editor COED, has been developed with some features specifically designed around the HEC format for computer program input. COED will place the input data in the format expected by HEC-1 as the data file is created. It also has help information for HEC-1 input data. Chapter 4 provides information on creating and editing input files with COED.

An interactive data input program (HEC1IN) has been developed for new to intermediate users of the HEC-1 program. This program leads the user through a sequence of formatted screens and tables that describe the watershed and the type of hydrologic processes to be used in the computations. After all the screens and tables are filled out, the program creates a skeleton HEC-1 input file. This file will contain all of the data records required to simulate the rainfall-runoff process, but not all of the data. It is the users responsibility to edit the file (using COED or any other text editor) and fill in the necessary data associated with each record. Appendix A of this document contains more information about the HEC1IN program.

After the HEC-1 input file is developed, the model can be executed. Chapter 5 provides information on running HEC-1 on the PC. Once the HEC-1 program has finished executing, the user can begin to review the results. Reviewing model results is described in Chapter 6.

1.3 Acknowledgments

This document was developed by Gary W. Brunner. Arlen Feldman, Chief of the Research Division, provided valuable input and editorial comments. Word processing and graphics were accomplished by Diane Harris and Penni Baker.

1.4 Program Documentation

The primary documentation for the HEC-1 program is the User's Manual. The manual provides a complete description of the HEC-1 program capabilities, theoretical basis for computations, and example problems with input and output. A careful review of the User's Manual should be made before using the computer program.

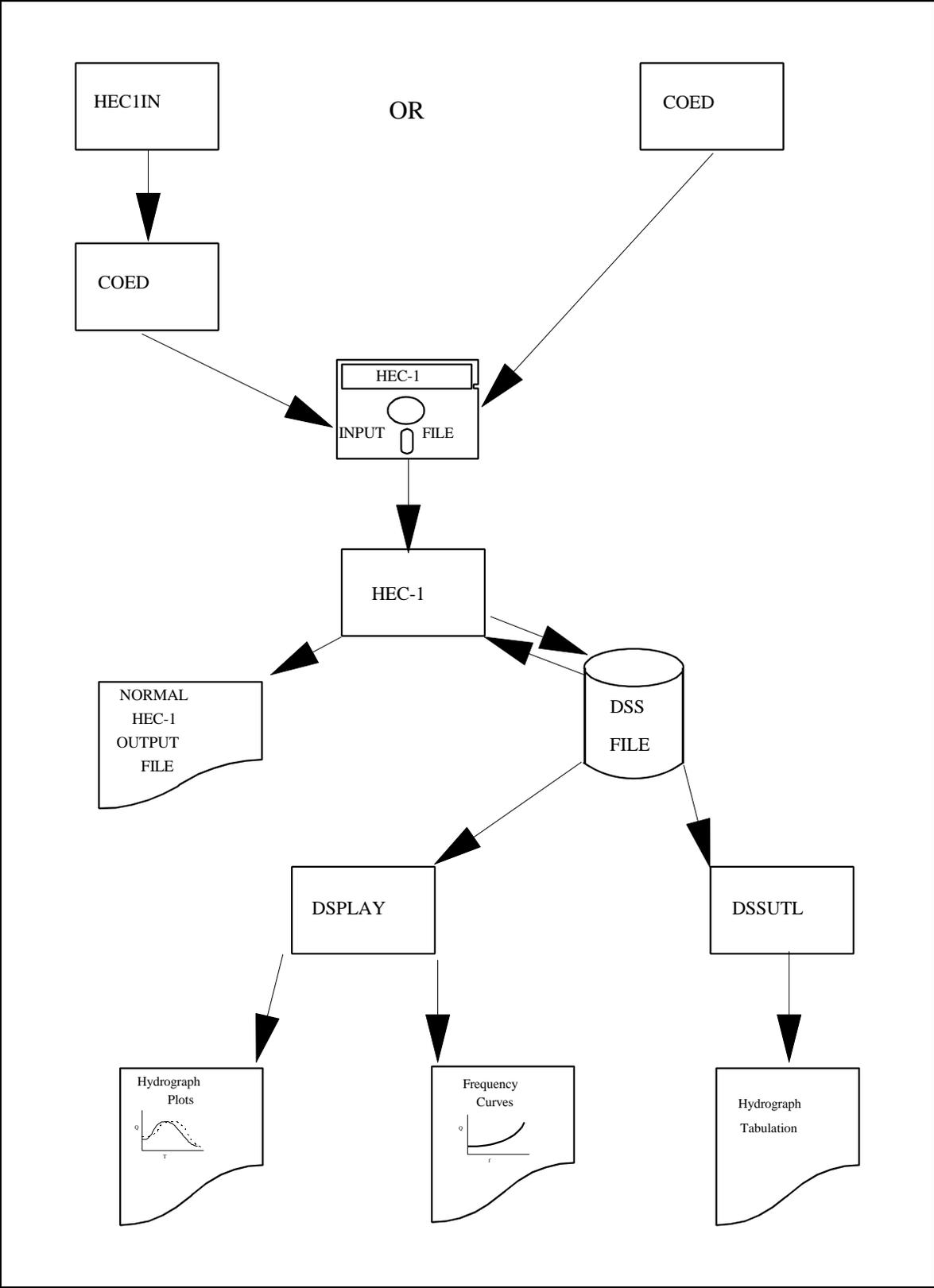


Figure 1. HEC-1 Computation Process

Supplemental technical information is available through the following HEC publications:

Probable Maximum Storm (Eastern United States) (HMR52) User's Manual

Training Document No. 10, Introduction and Application of Kinematic Wave Routing Techniques Using HEC-1.

Training Document No. 15, Hydrologic Analysis of Ungaged Watersheds with HEC-1

Training Document No. 19, Application of Spatial Data Management Techniques to HEC-1 Rainfall - Runoff Studies

Technical Paper No. 54, Adjustment of Peak Discharge Rates for Urbanization

Technical Paper No. 59, Testing of Several Runoff Models on an Urban Watershed

Technical Paper No. 62, Flood Hydrograph and Peak Flow Frequency Analysis

Technical Paper No. 70, Corps of Engineers Experience with Automatic Calibration of a Precipitation - Runoff Model

Technical Paper No. 100, Probable Maximum Flood Estimation - Eastern United States

Technical Paper No. 116, The HEC's Activities in Watershed modeling

Technical Paper No. 118, Real-Time Snow Simulation Model for the Monongahela River Basin

Technical Paper No. 121, Development, Calibration and Application of Runoff Forecasting Models for the Allegheny River Basin

Technical Paper No. 122, The Estimation of Rainfall for Flood Forecasting Using Radar and Rain Gage Data

Computer Program Documentation No. 45, HEC/DSS, User's Guide and Utility Program Manuals

Computer Program Documentation No. 56, Corps of Engineers Editor Users's Manual (COED)

Supplemental information on the computer hardware/software installation for HEC-1 is available through the following HEC publications:

Installation Instructions for Microcomputer Version of HEC-1

HEC-1 Flood Hydrograph Package, Large-Array Version Implementation

Installation Instructions for Device Drivers

The supplemental material, as well as other HEC publications, are listed in the Publication Catalog; along with prices and ordering information. This free catalog is available from:

**Hydrologic Engineering Center
609 Second Street
Davis, CA 95616-4687**

HEC provides training in HEC-1 primarily for Corps and other Federal offices; Basic and Advanced HEC-1 courses and a Floodplain Hydrology Course are offered. HEC also provides user assistance for Corps offices and other federal agencies. There are several university extension short courses on the use of the HEC-1 program. A one-week course provides a good overview of the basic program capabilities.

For those unable to attend a course, there are video tapes of most lectures given in HEC training courses on HEC-1. The tapes are distributed only in the USA by a contractor. A Video Tape Catalog with ordering information is available from the HEC at no charge.

1.5 Program Distribution

Corps of Engineers offices and other Federal agencies may receive copies of the HEC-1 package from HEC at no charge. Other offices may obtain the program from National Technical Information Service (NTIS) or a number of private distributors. A list of these private distributors is available from HEC.

A free Computer Program Catalog is available from HEC. The catalog provides a description of all available computer programs and program support information. The catalog can be ordered at the address shown on the previous page.