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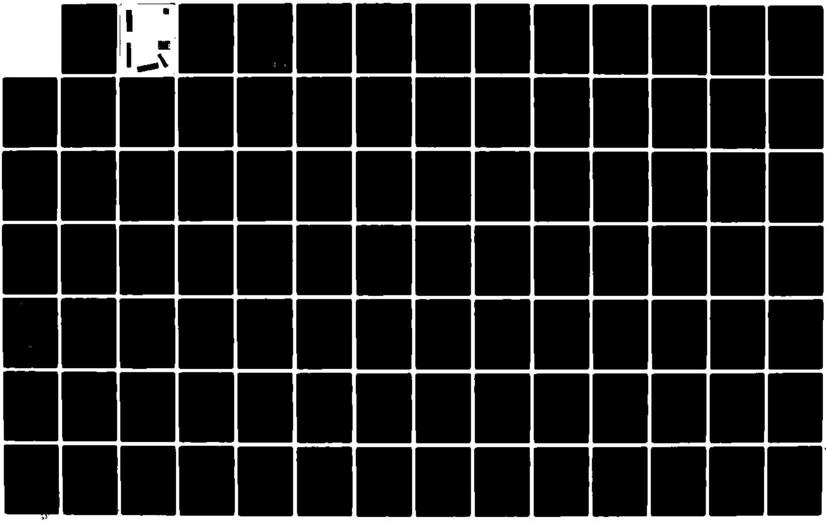

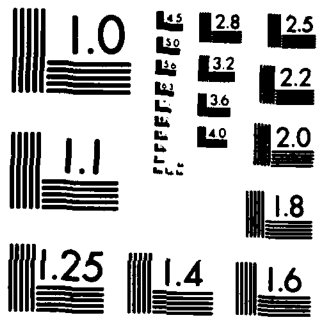
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Final Report 20 May 1983

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A thesis submitted to Cornell University, Ithaca, New York in partial fulfillment of the requirements for the degree of Master of Science.

WATERSHED MODELLING IN THE CHEMUNG
AND UPPER SUSQUEHANNA RIVER BASINS
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COMPUTER PACKAGE HEC-1

A Thesis
Presented to the Faculty of the Graduate School
of Cornell University
in Partial Fulfillment of the Requirements for the Degree of
Master of Science

by
James Clyde Styron III
May 1983

ABSTRACT

Watershed modelling of gaged streams in the Chemung and Upper Susquehanna River Basins was attempted using the U.S.Army Corps of Engineers' HEC-1, Flood Hydrograph Package. The Clark method of unit hydrograph theory and the initial and constant loss rate approach were used in this analysis. Parameters were derived from a total of 52 storm events for nine watersheds. Regression equations were derived relating the Clark unit hydrograph parameter to physical basin characteristics. Regional constant loss rates were established.

BIOGRAPHICAL SKETCH

The author, James C. Styron III, was born in Hobart, Oklahoma on September 29, 1951. He was graduated from the United States Military Academy at West Point, New York in June 1973 and was commissioned as an officer in the U.S.Army at that time. James has attended and graduated from several Army schools including a German course at the Defense Language Institute in Monterey, California, the field artillery officers advanced course at Fort Sill, Oklahoma, and Airborne and Ranger courses in Georgia.

James is an Army Captain who will be working with the U.S.Army Corps of Engineers upon leaving Cornell.

DEDICATION

To my wife and partner

ACKNOWLEDGEMENTS

I would like to thank Professor Wilfried H. Brutsaert, my Chairman and thesis advisor. I thank Professor Thomas D. O'Rourke for serving on my Special Committee. A special thanks to Steve Sather, Cornell Computer Services, for his time and effort in making the program compatable with the Cornell IBM computer.

The one person I am more indebted to than any one is my wife and to her I say "Thank you very much!"

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CHAPTER ONE
INTRODUCTION

Floods are headline grabbers. Every year floods show us how destructively nature can unleash its power. They receive extensive news coverage which describes the resulting damage and loss of life. Floods disrupt lives and productive endeavors. A great deal of effort has gone into studies of past floods and estimates of future floods in order to develop plans for flood damage reduction and prevention. Richards (1955) wrote, "The flood problem is one which affects many branches of engineering other than those dealing primary with the control of water." He also wrote that the flood estimation problem is a peculiarly difficult and complicated one. Although the natural laws governing floods are both recognizable and generally appreciated, the difficulty lies in the application.

The flood factors which are normally considered the most important are as follows: rain intensity, rainfall distribution, rainfall duration, drainage area, basin shape, basin slope, land cover, and, finally, the initial state of wetness in the soil (Richards, 1955, p. 8).

Hoyt and Langbein (1955) recognized the need for a national policy addressing the flood problem. They hypothesized that some future Congress or Congresses would recognize that "a sound approach to floods must be broader than flood protection alone,...". In their ten point proposal number three is quoted, "Flood-forecasting services should be recognized as an essential part of flood management and be appropriately supported." Indeed, around 1955, the U.S. Weather Bureau (now the National Weather Service, NOAA) received appropriations for its flood-forecasting service averaging about $900,000/year. The savings accredited to this service were roughly estimated at about $27,000,000, implying a cost-benefit ratio of 1 to 30.

Flood-forecasting is certainly not a modern notion. Diodorus Siculus visited Egypt during the 1st Century B.C. (Biswas, 1967, p.125). On the Nile River, the stage of the Nile were maintained by using nilometers (gaging stations). These structures were used to observe the river stage and compare the current height with that of previous high water marks. Little evidence of actual technical co-operation between the temples charged with running the nilometers exists but according to Diodurus, flood warnings were sounded to the population from the nilometer at Memphis (the seat of the government) in case of emergency. The ancients' warning system worked as follows; with the approach of the flood season, the stage of the Nile was carefully watched and compared with the markings of the previous year. Swift rowers were sent from the furtherest upstream gaging stations, one after another, to report the latest level at the capital. These extremely good rowers, rowing with the current, were able to outpace the approaching peak flood and give sufficient advance warning to the people along the river of the forthcoming catastrophe.

No one would seriously consider instituting a flood prediction system today based on a fleet of rowboats. However, there is a need to forecast floods in a "real-time" setting in order for warnings to be broadcasted, people and property to be evacuated, and emergency resources to be mobilized in the area of the expected threat.

But how does one go about forecasting a flood? This thesis will present only one method. That method is the unit hydrograph approach for ungaged watersheds which was suggested by the U.S. Army Corps of Engineers in its manuals and which will be presented later in Chapter Three. The selection of this method was based in part on the observation of Dooge (1959) who wrote, "The unit hydrograph approach to stream flow has developed into one of the most powerful tools of applied hydrology."

GOAL AND SCOPE OF THESIS

The goal of this thesis is to use the U.S. Army Corps of Engineer's HEC-1 computer program (discussed in Chapter Three) in developing, (a) Regression relationships between the unit hydrograph parameters (based upon the Clark Method) and some of the more important physical basin characteristics; and, (b) Regional relationships to determine the initial loss and constant loss rate parameters in the area of interest.

The scope of this thesis is to accomplish the goal by using historical storm and rainfall data from several gaged streams in the area of interest in solving the inverse problem. The inverse problem is defined as a problem in which the input (rainfall) and the output (stream runoff) are known and are used in determining the transfer functions, i.e. the Clark unit hydrograph and loss rate parameters. The area of interest is that of the Chemung and Upper Susquehanna River basins in the state of New York and a small portion of Pennsylvania. Nine gaged stream basins in this area were selected for use in calibrating the computer model HEC-1. These basins which are unregulated were chosen on the basis of their hydrological similarity. The ungaged watersheds in the area around Corning and Elmira, New York, are the main targets of this modelling effort.

OVERVIEW

This work is organized into six chapters. Chapter One is the introduction in which the consequences of floods, the need for flood prediction, and the goal and scope of this thesis were presented. Chapter Two is a literature review primarily concerned with the origins of the HEC-1 approach selected for this study. Chapter Three describes the specific method employed to obtain the results. Chapter Four presents the data and calculations performed in the application of the method in the area of interest. Chapter Five is a discussion of the results. Chapter Six presents conclusions reached by this author and other authors. Several appendices are provided to keep the basic chapters as free as possible from "data overload" and are identified in the basic work.

CHAPTER TWO

LITERATURE REVIEW

PURPOSE AND SCOPE

The purpose of this chapter is to trace the development of the unit hydrograph theory and its application in flood prediction on ungaged basins. The scope of this chapter is confined to a brief discussion of the origins of the three components of the HEC-1 model with a limited presentation of other methods.

LOSSES

The term precipitation loss is defined in this thesis as the amount of precipitation not available during a storm for overland flow. There are basically two types of precipitation losses. One is called interception. It represents the amount of rainfall which is held by the trees, grass and local depressions such as potholes and cracks. Anything that traps and does not allow the rainfall to move about freely is classified under this type of loss. The other type of precipitation loss is infiltration. It represents the amount of rainfall absorbed into the earth.

In computing rainfall excess, the precipitation losses are subtracted from the total storm rainfall. Sokolov et al. (1976, p.175) listed five methods to determine rainfall losses. They are mentioned below:

1. Constant runoff coefficient, which is the ratio of surface-runoff depth to total rainfall depth.

2. Constant infiltration rate during a storm known as the Φ-index in the U.S.

3. Initial rainfall loss followed by a constant infiltration rate. In this method all rainfall is considered to be lost until an initial rainfall-loss demand has been satisfied. Thereafter, rainfall is lost at a constant rate.

4. Regional curves of infiltration capacity, that are variable with time, and are based on soil type, land use, and an antecedent-rainfall index.

5. A variable runoff coefficient C_t method, which varies with time, even during storm periods, in response to the variation of a basin moisture index.

Any one of these methods may be included in a basin model. HEC-1 uses the methods described in 3. and 4. above and will be discussed further in Chapter Three.

UNIT HYDROGRAPH

ORIGINAL UNIT HYDROGRAPH THEORY

Sherman (1932, p. 501) first proposed the unit-graph (as it was originally called) method as a way to predict flood-peak discharges and discharge hydrographs from rainfall events. Sherman defined the unit-graph as follows:

> If a given one-day rainfall produces a 1-inch depth of rainfall over the given drainage area, the hydrograph showing the rates at which the runoff occurred can be considered a unit-graph for the watershed.

The unit hydrograph (unit-graph) theory makes two assumptions: 1) Runoff response to rainfall is time invariant. 2) Runoff response to rainfall is linear; this implies the principle of superposition. These assumptions are not rigorous and there is some flexibility.

By means of the second assumption, Sherman observed the possibility of computing the runoff history corresponding to a rainfall of any duration or degree of intensity for the same watershed from a single observed hydrograph. In applying his method, he noted, that the ordinate and time intervals of unit hydrographs for two similar watersheds of different sizes are proportional to the square root of the watershed areas, provided the difference in size is not great. He also observed that consistent results in the data were based upon the observations being confined to a single area or to closely similar areas and being segregated accoding to the seasons.

Unit hydrograph methods are usually based on the ability to separate the surface-runoff hydrograph from the hydrograph of the total rainfall. The total hydrograph is often assumed to consist of three types of flow defined below by Dooge (1959, p. 241): 1) Surface runoff, or the water reaching surface channels by the overland route; 2) Interflow, or the portion of infiltrated water that passes through the shallower horizons of the soil to reach defined stream channels within a relatively short time, without first reaching the main ground-water table; and, 3) Base flow, or the water contributed as ground water outflow from an aquifer. It should be noted that interflow is usually combined with surface runoff and collectively called surface runoff.

LATER UNIT HYDROGRAPH DEVELOPMENTS

In 1934, 1936 and 1937 Zoch (Dooge, 1959, p.241) published several papers on the unit hydrograph method based on the assumption that at any time the rate of discharge is proportional to the amount of rainfall remaining with the soil at that time. The S-hydrograph method developed by Morgan and Hullinhors (1939) employed a unit hydrograph of a certain duration to form an S-hydrograph resulting from a continuous applied rainfall to construct unit hydrographs for other than the original duration.

Snyder (1938, p.447) and Taylor and Schwartz (1952, p. 235) applied unit hydrograph theory to basins by relating features of the unit hydrograph to watershed characteristics by strictly statistical considerations. Their attempts led to the "synthetic unit hydrograph method."

In contrast to this statistical approach, several workers attempted to give a more conceptual basis to the unit hydrograph. Clark (1945, p. 1419) developed the instantaneous unit hydrograph (IUH) method by suggesting the unit hydrograph for instantaneous rainfall could be derived by routing the time-area-concentration curve through a single element of linear reservoir storage. O'Kelly (1955, p. 365) of the Irish Office of Public Works suggested replacement of the time-area-concentration curve by an isosceles triangle. Nash (1957, p. 114) noted that the instantaneous unit hydrograph could be derived by routing the instantaneous rainfall through a series of successive linear reserviors of equal delay time. Dooge (1959, p. 241) attempted to remove many of the subjective elements from unit hydrograph analysis. The number of IUH investigations goes on and on. Chow (1964, p. 14-25) compiled an extensive list of past accomplishments in his handbook. He concluded that the use of the IUH rather than other unit hydrograph methods is better suited for investigations on the rainfall and runoff relationship in drainage basins.

CLARK'S METHOD OF UNIT HYDROGRAPH ANALYSIS

Clark (1945, p. 1422) was the first to adapt the idea of the IUH in hydrograph analysis to the unit hydrograph theory. In his original work he wrote:

> "The range of possible unit-graph determinations can be reduced by correlating recognized discharge concepts with the physical limitations of valley storage and with the time elements which necessarily result from storage and discharge relations. The correlation can be utilized to develop, from time-area-concentration curves of specific drainage areas, unit hydrographs with a small range of determination variability, independent of assumptions regarding runoff distribution in the flood-producing storm and reflecting influences of drainage area shape and stream pattern."

He showed the relationship between the unit hydrograph and the methods of flood routing (means of modifying a hydrograph by the effects of valley storage). Clark stated that one advantage of using an "instantaneous hydrograph is that it can be derived from the fundamental characteristics of the basin and then used with any length of unit period to determine the unit hydrograph, ...". Other advantages stated by Clark which make his method appealing to "real-time" flood forecasting are: 1) The procedure is definable. Identical hydrographs will be obtained by different people. 2) Determination is independent of any knowledge of runoff distribution, except the time of ending. 3) The unit hydrograph quantities are instantaneous rates of discharge at the time specified.

FLOOD ESTIMATION: UNIT HYDROGRAPH

Richards (1955, p.10) presented the principal factors affecting floods. A number of flood formulas is discussed and a brief outline of the flood frequency, probability, and unit hydrograph methods used in the U.S. is included. Sokolov (1976, p.182) states that flood flow computations for unit hydrograph derivation are accomplished using three general methods: 1) Analysis of rainfall--runoff records for isolated unit storms, 2) Analysis of rainfall--runoff records for major storms, and 3) Computation of synthetic unit hydrographs from a) Direct analogy with basins of similar characteristics, or b) Indirect analogy with a large number of other basins through the application of empirical relations.

BASIN CHARACTERISTICS USED IN HYDROGRAPH ANALYSIS

POSSIBLE PARAMETERS

Relating model parameters to physical basin characteristics is the major purpose of this study. The geomorphic and geophysical structures of a basin play an important part of the watershed's response to rainfall. Many basin characteristics have been used in the past to relate a response of precipitation to physical structures in a watershed. Linsley (1982, p.311-316) defines several characteristics of interest in this study. They are: drainage area, stream density, basin shape, channel slope, and channel length.

In a very large study of the Northeastern U.S., Langbein (1947, p.125) using U.S. Geological Survey (USGS) topographic maps of 340 basins withdrainage areas of 1.64 to 7,797 square miles collected data on drainage, area, length of streams, stream density, land slope, channel slope, area-altitude distribution, and area of water bodies of the basins. Characteristics were divided into geographic such as water bodies, direction of stream flow, latitude and longitude,and topographic such as basin area, stream length, area-distance distribution, land slope, basin altitude, and tributary and principal stream slopes. A principal channel was defined as one that drains more than ten percent of the total area while a tributary channel drains less than ten percent of the total area. Their conclusions were that many characteristics have a direct relationship with other characteristics; for example, steep land slopes imply steep channel slopes and stream density tends to vary with the land slope. The study showed that no one element is unique in any one basin and that not all characteristics must be correlated to model parameters to get satisfactory regression relationships.

SOME UNIT HYDROGRAPH APPLICATIONS

Taylor and Schwarz (1952, p.235) published a study based on 65 rainfall excess periods over 20 basins in the North and Middle Atlantic States with varying drainage areas of 20 to 1600 square miles. Their results were that the drainage area, length of longest watercourse, length to center of area and the equivalent mainstream slope were the most significant basin characteristics.

Brater's (1940, p.1154) study indicated that the unit hydrograph method is one of the best practical devices for predicting flood flows. His work based on 22 small watersheds in the Southern Appalachians of varying cover with areas of 4.24 to 1,876.7 acres showed that the unit hydrograph principle "permits the engineer to estimate not merely the peak discharge, but the entire hydrograph of runoff. The peak may be determined for any desired time interval."

Analyzing data on nine streams tributary to the Chemung River in New York, Morgan and Hullinghorst (1939, p. 1) found good correlation to the area of the watershed, mean length of travel and the mean height of the watershed above the outflow.

Unit hydrographs were used in a flood-frequency work by Kinnison and Colby (1945). On about 48 basins in Massachusetts, the characteristics, found to be most influential, were: median altitude (s), drainage area (M) and the average distance which water from runoff uniformly distributed over the basin must travel to the outlet (L). Thus M is a measure of the volume of water to be discharged, s is a measure of the fall and L is a measure of the distance that the water travels to the point of discharge.

More recent works by Rodriguez and Gonzalez (1982, p. 877) and Rodriguez et al.(1982, p. 887) have applied the geomorphoclimatic theory of the IUH. Their works have helped to explain much of the noise observed in relating IUH parameters to basin characteristics without considering the coupling effects of the climate and geomorphology on a basin.

Hence, it seems that most authors use easily definable basin characteristics such as main channel length, main channel slope and drainage area to obtain their hydrograph response relationships to basin charactersitics.

BASE FLOW

The release of water from underground storage into the channel is called base flow. Dooge (1973, p. 89) has presented a thorough discussion of the subject as well as its separation from the total storm hydrograph. Although several methods exist to calculate base flow, the difference between the methods is not significant in relation to the total flow in the channel during a major storm.

CHAPTER THREE

METHOD

PURPOSE AND SCOPE

The purpose of this chapter is to describe the method used in determining HEC-1 parameters for the study region's gaged basins and in developing the relationships between unit hydrograph parameters and basin characteristics. The scope of this chapter is to present the HEC-1 options employed and the multiple regression scheme used in this thesis.

WHAT IN THE HECK IS HEC-1?

HEC-1 is the shortened name of HEC-1 Flood Hydrograph Package, Computer Program 723-x6-L2010, with its latest revision taking place in September 1981. The program was developed at the Hydrologic Engineering Center (HEC), Davis, California, which is a part of the U.S. Army Corps of Engineers' Water Resources Support Center. The original development of HEC-1 was made in 1967 by Leo Beard and others (HEC-1,'81), with the first version being published in October 1968. Major revisions have been made in 1969,1970, 1973, and 1981. The current version has the major additional capabilities of the dam-break (HEC-1DB), project optimization (HEC-1GS), and the kinematic wave (HEC-1KW) programs included in the package.

The HEC-1 model is designed to simulate the surface runoff response of a river basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components within a portion of the basin, commonly called a subbasin. A component represents a surface runoff entity, a stream channel, or a reservior. Representation of a component requires a set of parameters which specify the particular characteristics of the component and mathematical relations which describe the physical processes. The result of the modelling process is the computation of streamflow hydrographs at desired locations in the river basin.

As previously stated in the Introduction under Scope and Goals, this thesis will use HEC-1 to model gaged basins in order to determine values for parameters of a surface runoff entity component which will be used as a predicting tool for ungaged basins in the region of interest

ASSUMPTIONS AND LIMITATIONS

As pointed out in the HEC-1 Users Manual, HEC-1 makes a number of assumptions and has some limitations. The major assumptions are that hydrologic processes such as precipitation and interception/infiltration, may be represented by model parameters which reflect average conditions within a subbasin; model parameters represent temporal as well as spatial averages. Some of its limitations are that simulation is limited to a single storm event (because HEC-1 does not have the ability to account for soil moisture recovery during periods of no precipitation) and that results are given in discharge rates rather than in stage heights.

HYDROLOGIC ANALYSIS PROCEDURES OF UNGAGED WATERSHEDS USING HEC-1

Guidelines and methods for modelling ungaged basins are presented in a HEC report entitled "Hydrologic Analysis of Ungaged Watersheds Using HEC-1", Training Document No. 15, April 1982. This report formed the methodology used in this thesis. The report gave detailed techniques for estimating and calibration of HEC-1 model parameters including discussions of the runoff transformation and loss rate parameters.

Below is outlined the basic method used in the regional analysis of watershed characteristics of this thesis (which is described in greater detail in the Report):

1. Collect precipitation and runoff information for a range of major flood events (usually 5-10 for each gaged basin) in the region. Identify the watershed boundaries on a topographic map where the gaging stations are taken as the basin outlets.
2. Run a HEC-1 rainfall-runoff analysis to optimize

the unit hydrograph and loss rate parameters for the gaged drainage areas.

3. Correlate the unit hydrograph and loss rate parameters with basin characteristics and develop generalized relationships for these parameters.

4. Use the generalized relationships to compute parameters for the ungaged basins by means of measurable basin characteristics.

5. Perform a watershed simulation using HEC-1 for several historical storm events for verification of reconstituted runoff peaks and volumes at gaged locations. If unsatisfactory results are obtained, the analysis is repeated after adjusting the parameters.

RAINFALL-RUNOFF SIMULATION

The rainfall-runoff simulation involves five processes.

They are precipitation, interception/infiltration, transformation of precipitation excess to basin outflow, baseflow, and flood routing (not used in this study). Each of the first four processes will be discussed below.

PRECIPITATION

The precipitation distribution chosen for this study among the possibilities in HEC-1 was the method of weighted precipitation gages. This method determines a basin average rainfall amount for a historical storm and distributes it temporally over the entire basin. This process produces a precipitation hyetograph.

Each gaged basin in the study region was divided into Thiessen polygons (see Linsley (1982, p. 71) for the Thiessen polygon method). With one rain gage per polygon, the area of each polygon covering the basin could be determined using a planimeter. The area of a polygon divided by the total basin drainage area yielded the percent (expressed as a decimal) of the relative weight for each rain gage. Thiessen polygons were drawn for the recording (hourly measurements) and non-recording (daily measurements) rain gages. To obtain the total storm precipitation the relative weights were placed on the PT-PW input cards (input card data/format will be discussed later in Chapter Four) for the recording and non-recording gages which actually contributed rain to the basin. However, in order to develop the temporal pattern on the basin, the relative weights placed on the PR-PW input cards only used recording rain gage polygons.

The total storm precipitation for a basin was computed as the weighted average of measurements from several gages using the formula:

$$PRCPA = \frac{\sum_{J=1}^{n} PRCPN(J) * WTN(J)}{\sum_{J=1}^{n} WTN(J)}$$

where PRCPA is the basin average total precipitation, PRCPN(J) the total precipitation for gage J, WTN(J) the relative weight for gage J, and n the number of gages.

The temporal pattern for distribution of the storm-total precipitation is computed as a weighted average of temporal distributions from recording stations using the formula:

$$PRCP(I) = \frac{\sum_{J=1}^{n} PRCPR(I,J) * WTR(J)}{\sum_{J=1}^{n} WTR(J)}$$

where PRCP(I) is the basin-average precipitation for the Ith time interval, PRCPR(I,J) the recording station precipitation for the gage J.

The basin-average precipitation hyetograph is then computed using the temporal pattern, PRCP, to distribute the total rainfall amount, PRCPA, see Figure 3.1.

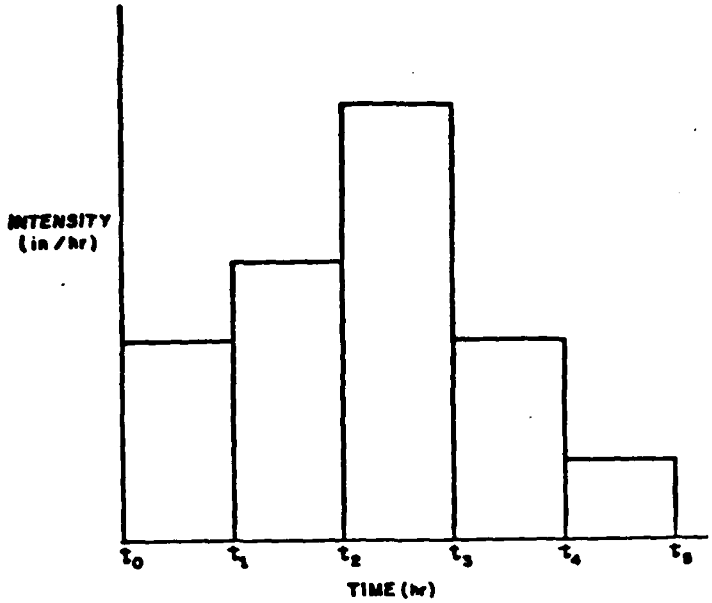


Figure 3.1. Precipitation Hyetograph (HEC-1, 1981).

INTERCEPTION/INFILTRATION

Definitions. Interception and depression storage are intended to represent the surface storage of water by trees or grass, local depressions in the ground surface, in cracks and crevices in parking lots or roofs, or in a surface area where water is not free to move as overland flow. Infiltration represents the movement of water to areas beneath the land surface. Both of these are lumped together in HEC-1 and considered as precipitation losses.

Two important factors should be noted about this process: one, precipitation which does not contribute to the runoff process is considered to be lost from the system and two, there is no provision in the model for soil moisture or surface storage recovery. The second factor has already been mentioned under the Assumptions and Limitations portion of this chapter.

As in the precipitation process, the interception/ infiltration process uniformly distributes the precipitation loss over the entire basin. This process yields a basin-average for rainfall losses. There is a feature in the model in which a percentage of the basin may be labeled as impervious and no losses are calculated for this portion; however, this feature was not used in this study.

Four different methods may be used in calculating the precipitation loss. By using any one of these methods, an average precipitation loss is determined for a computation interval and subtracted from the rainfall hyetograph. The resulting precipitation excess is used to compute an outflow hydrograph for a subbasin as is shown in Figure 3.2.

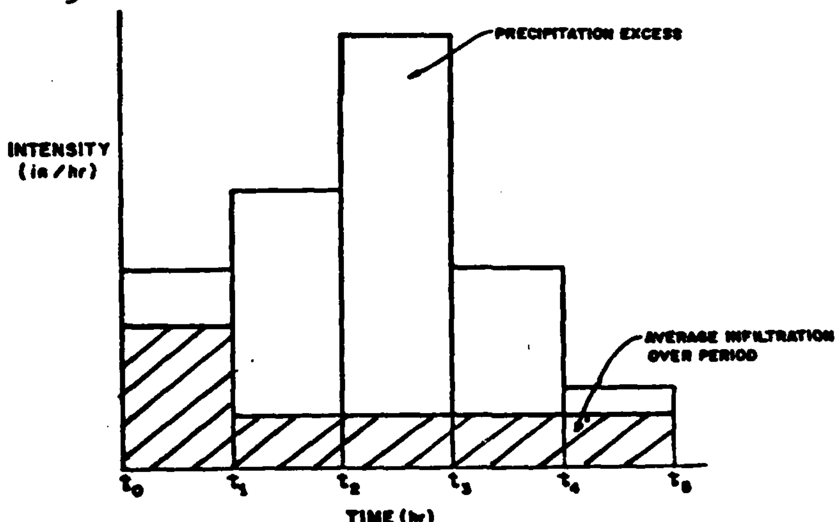


Figure 3.2. Input Hyetograph (HEC-1, 1981).

The four methods available to calculate rainfall losses are initial and uniform loss rate, exponential loss rate, Soil Conservation Service (SCS) curve number, and the Holtan loss rate. This thesis only considered the initial and uniform loss rate. It will be the only method discussed here.

The initial and uniform loss rate method has two parameters: an initial loss, STRTL (units of depth), and a constant loss rate, CNSTL (units of depth/hour). All rainfall is lost until the volume of initial loss is satisfied. After the initial loss is satisfied, rainfall is lost at the constant rate, CNSTL. These parameter values are entered as input on the LU card.

TRANSFORMATION OF PRECIPITATION EXCESS TO BASIN OUTFLOW

The transformation of rainfall excess into basin outflow for this thesis is accomplished through the unit hydrograph technique, more specifically, the technique that was proposed by Clark (1945) which has already been discussed in Chapter Two.

The basic methodology of any unit hydrograph component inHEC-1 is the same. The rainfall excess hyetograph is transformed to a subbasin outflow by utilizing the general equation:

$$Q(i) = \sum_{i=1}^{N} \sum_{j=1}^{i} U(j) * X(i-j+1)$$

where Q(i) is the subbasin outflow at the end of computational interval i, U(j) the jth ordinate of the unit hydrograph, X(i) the average rainfall excess for the computational interval i, and N the number of rainfall ordinates.

Application of the unit hydrograph technique implies two assumptions: one, the unit hydrograph is characteristic of the subbasin and is not storm dependent and two, runoff due to excess from different periods of rainfall excess may be linearly superposed.

The Clark unit hydrograph requires three parameters to calculate a unit hydrograph: the time of concentration for the subbasin, TC (units of time), a storage coefficient, R (units of time), and a time-area curve.

The time of concentration, TC, may be defined conceptually as the amount of time required for a particle of water deposited at the furtherest point upstream in the watershed to travel through the watershed until it passes the subbasin outlet. TC is estimated by the lag time between the end of the runoff producing rainfall to the inflection point on the recession limb of the surface runoff hydrograph.

The storage coefficient, R, is used to account for the effect of subbasin storage on the hydrograph. This parameter is estimated by dividing the flow at the recession inflection point of the surface runoff hydrograph by the rate of change of discharge (slope) at this same time. See Figure 3.3.

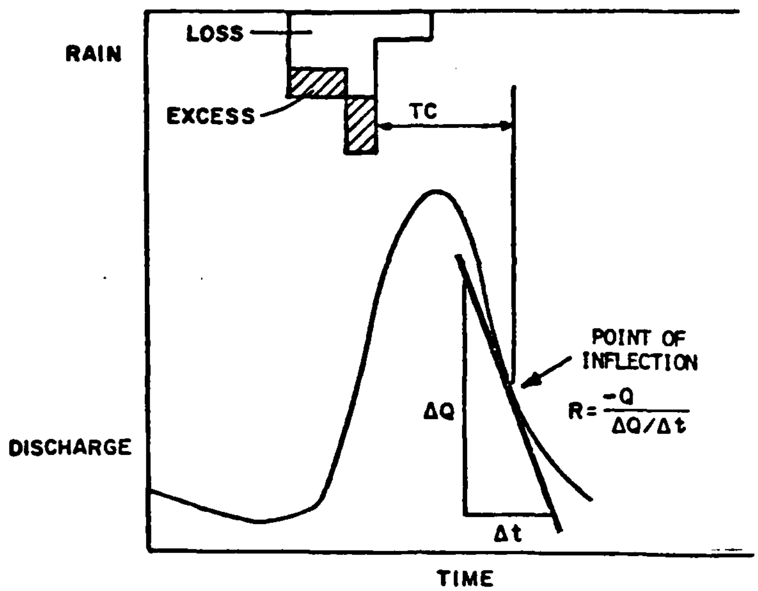


Figure 3.3. Clark UH Parameters (HEC-1, 1981).

The time-area curve defines the cumulative area of the watershed contributing runoff to the subbasin outlet as a function of time (expressed as a portion of TC).

No developed time-area curves for any of the gaged subbasins in the study region could be found, therefore, use of the HEC-1 synthetic dimensionless time-area curve was made. The equations of this curve are:

$$AI = 1.414\ T^{1.5} \qquad 0 \leq T < .5$$

$$1 - AI = 1.414\ (1-T)^{1.5} \qquad .5 \leq T \leq 1$$

where AI is the cumulative area as a fraction of the total subbasin area and T the fraction of the time of concentration. See figure 3.4.

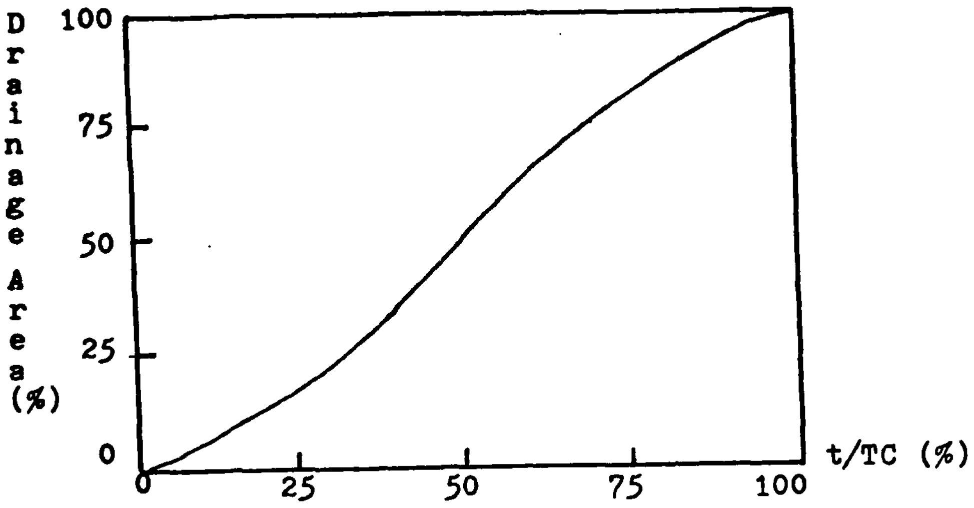


Figure 3.4. Synthetic Time-Area Curve

The ordinates of the time-area curve are converted to volume of runoff per second for unit excess and interpolated to the given time interval. This results in the development of a translation hydrograph which is then routed through a linear reservoir to simulate the storage effects of the subbasin. The routing produces a unit hydrograph for instantaneous excess which is averaged to yield the hydrograph for unit excess occurring in the given time interval (one hour in all cases of this thesis).

The linear reservoir routing is accomplished using the equation

$$Q(2) = CA * I + CB * Q(1)$$

where the routing coefficients are

$$CA = \Delta t/(R + .5\Delta t)$$

$$CB = 1 - CA$$

$$QUNGR = .5(Q(1) + Q(2))$$

and where Q(2) is the instantaneous flow at the end of the period, Q(1) the instantaneous flow at the beginning of the period, I the ordinate of the translation hydrograph, Δt the computational time interval (one hour in all cases in this study), R as previously defined, and QUNGR the unit hydrograph at the end of the computation interval.

The parameters TC and R are entered as input on the UC card.

BASEFLOW

Unlike direct surface runoff which is calculated as the total precipitation minus the losses, baseflow is defined as the release of water from subsurface storage. To include baseflow effects the HEC-1 model must be supplied with three input parameters,STRTQ, QRCSN, and RTIOR.

STRTQ is the initial discharge (starting flow) in the stream outlet at the beginning of the storm. It is the flow at the outlet at the beginning of the rainfall hyetograph. It is affected by the long term contribution of groundwater releases in the absence of precipitation and is a function of antecedent conditions.

QRCSN is the flow on the receding limb of the computed hydrograph at which an exponential recession begins.

RTIOR is a user specified exponential decay rate which is assumed to be characteristic of the subbasin. It is equal to the ratio of a recession limb flow occurring one hour later. See Figure 3.5.

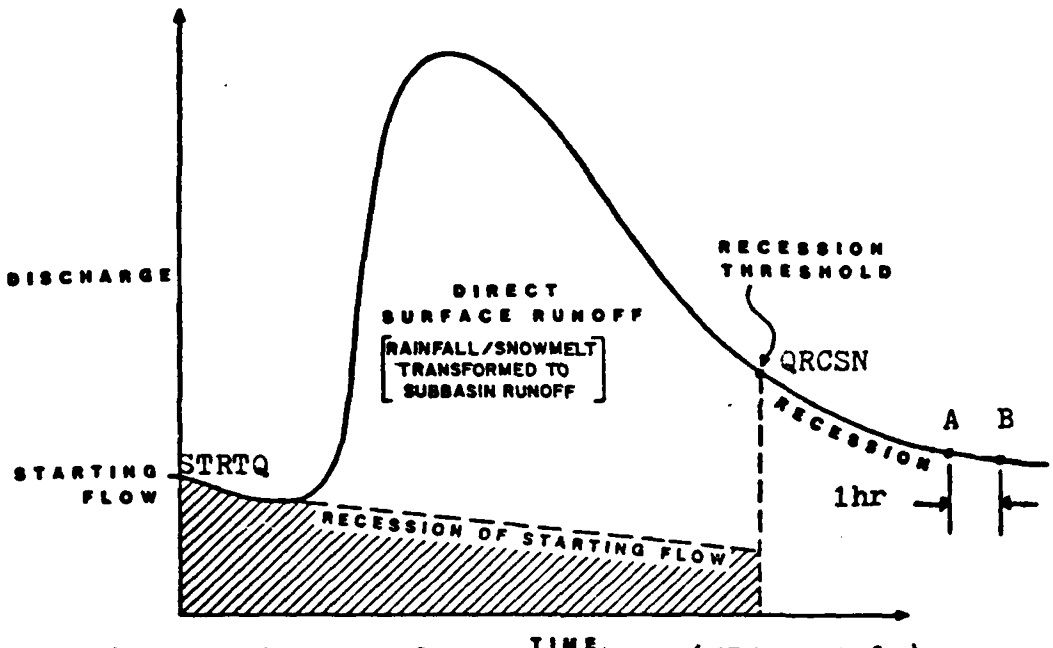


Figure 3.5. Base Flow Parameters (HEC-1, 1981).

Baseflow or recession flow is computed with the equation:

$$Q = Q_o \ (RTIOR)^n$$

where Q is STRTQ or QRCSN and n the number of time intervals since recession was initiated.

The values of QRCSN and RTIOR are obtained by plotting the observed flows (starting at the peak) versus time on semi-log paper. The point at which the flows begin to become a straight line defines QRCSN. See Figure 3.6.

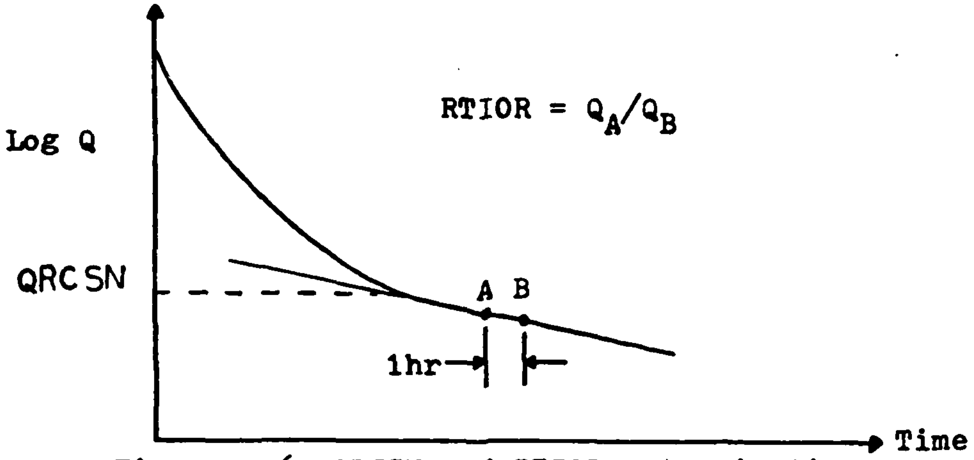


Figure 3.6. QRCSN and RTIOR Determination.

RTIOR is usually obtained by taking the average ratio of Q_a and Q_b (flows one hour apart) of several, usually about ten, along the straight line portions of Figure 3.6 In this study a subbasin average is determined by taking the average RTIOR for each storm on the basin and then averaging these values. The subbasin average was then held constant throughout all calculations for that subbasin while using HEC-1.

The computed flood hydrograph is adjusted to include the baseflow. At the beginning of a storm the baseflow is computed starting at STRTQ and decays according to the formula above until the computed flood flow on the falling limb equals the value of QRCSN. From then on, the flood flow is calculated using the base flow equation as the computed flood flow unless the computed flow rises above the recession flow. This would occur in the case of a double-peaked hydrograph such as in Figure 3.7.

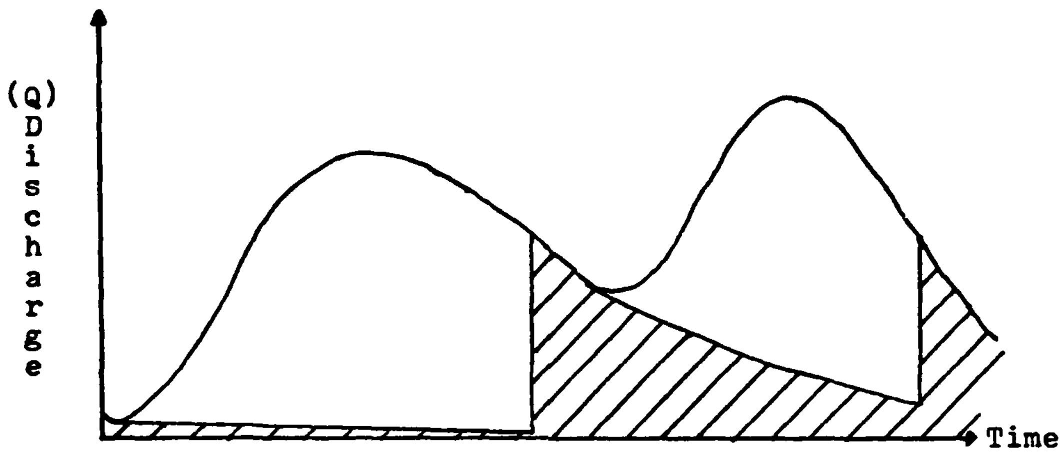


Figure 3.7. Double-Peaked Recession Flow

CALIBRATION OF MODEL PARAMETERS

As with all numerical models, the HEC-1 rainfall-runoff model for single event simulation requires data for calibration in order to be a predictive tool. The parameters of the numerical model are determined by using observed precipitation and runoff data to solve the inverse problem; in other words, given the system input (precipitation) and system output (runoff), the inverse problem consists of defining the characteristics of a system, that produces the transformation from input to output. HEC-1 has two approaches to transform rainfall values to runoff. They are the unit hydrograph and kinematic wave approaches. The unit hydrograph is the is the most commonly used and was the approach selected for this study. The unit hydrograph approach assumes that a single unit hydrograph is appropriate for all magnitudes of rainfall excess. HEC-1 has three unit hydrograph methods available in its package, those of Clark, Snyder, and the Soil Conservation Service (SCS). The U.S. Army Corps of Engineers uses the Clark unit hydrograph technique most frequently and for this reason was the technique selected for this thesis.

HEC-1 has the capability of automatically producing its "best" estimate of selected model parameters through its optimization subroutine. This subroutine selects those values of the parameters, which yield the "best" reproduction of some measured runoff event with the available measured precipitation data and the selected modelling approach. This automatic calibration approach is accomplished through an objective function, defined as;

$$STDER = \sqrt{\sum_{i=1}^{N} \left((QOBS_i - QCOMP_i)^2 * WT_i \right)}$$

where STDER is the error index, $QOBS_i$ the observed runoff hydrograph ordinate for period i, $QCOMP_i$ the computed runoff hydrograph ordinate for period i, computed by HEC-1 with current parameter estimates. N is the total number of hydrograph ordinates and WT_i a weight for the hydrograph ordinate defined as;

$$WT_i = (QOBS_i + QAVE)/(2 * QAVE)$$

where QAVE is the average computed discharge.

The STDER calculation for optimization may be viewed graphically as in Figure 3.8,

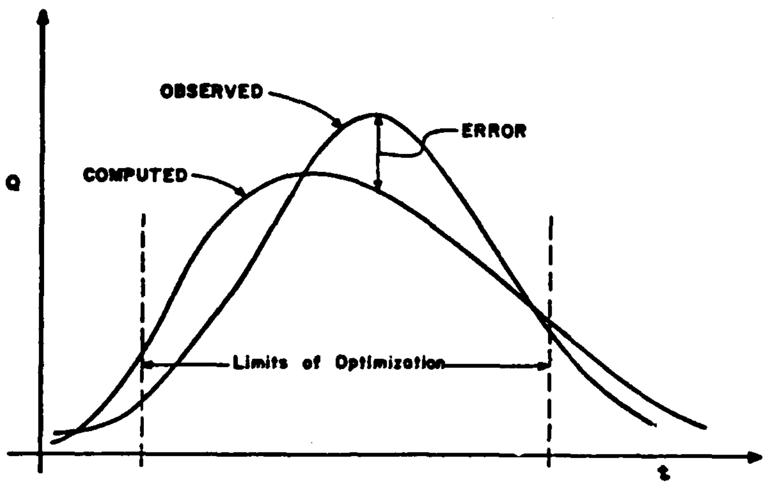


Figure 3.8. Optimization Calculation (HEC-1, 1981)

in which the limits of optimization may be user specified on the OU input card in order to get a better fit on the portion of the curve which is of interest.

The WT_i term biases the objective function by emphasizing accurate reproduction of peak flow rather than low flow. The objective of this function is to minimize the value of STDER in order to get the "best" fit. The word "best" has been placed in quotation marks to indicate that the values determined through this optimization technique do not guarantee that the values are global solutions; indeed an example of this is shown in Chapter

Five. A better solution may be found by varying the starting values of the parameters from their default values selected by HEC-1 in its first run. These default values are listed below:

Parameter Name	Initial Value
TC + R	$(\text{Drainage Area (mi}^2))^{1/2}$
R/(TC + R)	0.5
STRTL	1.00
CNSTL	0.1

The user also has the option of designating initial values for model optimization as well as designating which parameters are to be held constant during the optimization. Assignment of the initial values is discussed in the HEC-1 Programmer's Manual, October 1981. Constraints are placed on parameter values. These values are bounded by a range of feasible values because of the physical limitations on the values that the various unit hydrograph and loss-rate parameters may have. These constraints are:

$$TC + R \geq 1.03\,\Delta t/(1-R/(TC+R))$$

$$R \geq .52\Delta t$$

where t is the computation interval which is one hour in all cases in this study.

$$STRTL \geq 0$$

$$CNSTL \geq 0$$

A complete discussion of the optimization technique as well as the algorithm is presented in the HEC-1 User's Manual. The technique is a univariate search technique in which each parameter value to be optimized is varied one at a time with all other parameters held constant. The "best" value of each parameter is estimated by Newton's method. After each parameter is estimated in turn through four complete cycles, the parameter which most improved the objective function in its last change is adjusted again. This adjustment continues until no one parameter yields a reduction in the objective function of more than one percent. After one more complete search of all parameters, a final adjustment to the computed hydrograph volume to within one percent of the observed hydrograph volume is made. The final objective function value is determined from this final adjustment. An example of the optimization output is shown in Figure 3.9.

Listed first are the initial values of the parameters. The asterisked (*) values denote which variable was changed and its "optimum" value along with the objective function value with the other parameters.

After the objective function routine is printed, the optimization results are blocked out followed by a statistical summary. If the user specifies optimization limits on the OU card, two summaries are printed. The first contains statistics based on the optimization region

```
                                 INITIAL ESTIMATES FOR OPTIMIZATION VARIABLES
                 TC+R   R/(TC+R)      STRTL      CNSTL
                27.00       0.67       1.00       0.30

                                 INTERMEDIATE VALUES OF OPTIMIZATION VARIABLES
                                   (*)INDICATES CHANGE FROM PREVIOUS VALUE)
                                    (+)INDICATES VARIABLE HAS NOT CHANGED)
OBJECTIVE
 FUNCTION          TC+R   R/(TC+R)      STRTL      CNSTL
VOL. ADJ.        27.000      0.667     0.907*     0.073*

    393.9       25.919*      0.667      0.907      0.073
    169.2       25.919      0.960*      0.907      0.073
    165.6       25.919      0.960      0.874*     0.073
    165.4       25.919      0.960      0.874      0.073*

    165.4       25.919*      0.960      0.874      0.073
    165.3       25.919      0.954*     0.874      0.073
    165.0       25.919      0.954      0.870*     0.073
    164.8       25.919      0.954      0.870      0.076*

    164.7       25.813*      0.954      0.870      0.076
    164.7       25.813      0.953*     0.870      0.076
    164.6       25.813      0.953      0.866*     0.076
    164.5       25.813      0.953      0.866      0.075*

    164.5       25.729*      0.953      0.866      0.075
    164.4       25.729      0.952*     0.866      0.075
    164.4       25.729      0.952      0.863*     0.075
    164.2       25.729      0.952      0.863      0.076*

    164.2       25.660*      0.952      0.863      0.076
VOL. ADJ.       25.660      0.952      0.863      0.076
```

```
*****************************************************
*                                                   *
*              OPTIMIZATION RESULTS                 *
*                                                   *
*****************************************************
*                                                   *
*     CLARK UNITGRAPH PARAMETERS                    *
*            TC     1.24                            *
*             R    24.42                            *
*                                                   *
*     SNYDER STANDARD UNITGRAPH PARAMETERS          *
*            TP     2.16                            *
*            CP     0.09                            *
*                                                   *
*     LAG FROM CENTER OF MASS OF EXCESS             *
*     TO CENTER OF MASS OF UNITGRAPH    24.42       *
*                                                   *
*     UNITGRAPH PEAK         1697.                  *
*     TIME OF PEAK           3.00                   *
*                                                   *
*****************************************************
*                                                   *
*                                                   *
*     UNIFORM LOSS RATE PARAMETERS                  *
*         STRTL      0.86                           *
*         CNSTL      0.08                           *
*                                                   *
*****************************************************
```

```
*******************************************************************************************************
*                                                                                                     *
*                         COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS                             *
*                                                                                                     *
*******************************************************************************************************
*                                                                                                     *
*                          STATISTICS BASED ON OPTIMIZATION REGION                                    *
*                              (ORDINATES    5 THROUGH   30)                                          *
*                                                                                                     *
*******************************************************************************************************
*                                                                                                     *
*                                                           TIME TO       LAG                         *
*                           SUM OF      EQUIV        MEAN   CENTER     C.M. TO       PEAK   TIME OF   *
*                            FLOWS      DEPTH        FLOW   OF MASS       C.M.       FLOW     PEAK    *
*                                                                                                     *
*    PRECIPITATION EXCESS               0.783               13.82                                     *
*                                                                                                     *
*    COMPUTED HYDROGRAPH    19831.      0.397        763.   20.98         7.16      1345.    16.00    *
*    OBSERVED HYDROGRAPH    19670.      0.393        757.   20.48         6.67      1375.    21.00    *
*                                                                                                     *
*    DIFFERENCE               161.      0.003          6.    0.50         0.50       -30.    -5.00    *
*    PERCENT DIFFERENCE       0.82                                        7.46      -2.19             *
*                                                                                                     *
*              STANDARD ERROR       130.           AVERAGE ABSOLUTE ERROR      107.                   *
*          OBJECTIVE FUNCTION       144.   AVERAGE PERCENT ABSOLUTE ERROR     22.05                   *
*                                                                                                     *
*******************************************************************************************************
*                                                                                                     *
*                          STATISTICS BASED ON FULL HYDROGRAPH                                        *
*                              (ORDINATES    1 THROUGH   40)                                          *
*                                                                                                     *
*******************************************************************************************************
*                                                                                                     *
*                                                           TIME TO       LAG                         *
*                           SUM OF      EQUIV        MEAN   CENTER     C.M. TO       PEAK   TIME OF   *
*                            FLOWS      DEPTH        FLOW   OF MASS       C.M.       FLOW     PEAK    *
*                                                                                                     *
*    PRECIPITATION EXCESS               0.783               13.82                                     *
*                                                                                                     *
*    COMPUTED HYDROGRAPH    30592.      0.612        637.   26.93        13.11      1345.    16.00    *
*    OBSERVED HYDROGRAPH    25237.      0.505        526.   24.15        10.33      1375.    21.00    *
*                                                                                                     *
*    DIFFERENCE              5355.      0.107        112.    2.78         2.78       -30.    -5.00    *
*    PERCENT DIFFERENCE      21.22                                       26.89      -2.19             *
*                                                                                                     *
*              STANDARD ERROR       206.           AVERAGE ABSOLUTE ERROR      166.                   *
*          OBJECTIVE FUNCTION       205.   AVERAGE PERCENT ABSOLUTE ERROR     53.46                   *
*                                                                                                     *
*******************************************************************************************************
```

Figure 3.9. Optimization Output.

while the second summary is based upon the entire flood hydrograph.

The definition of the terms used in the summary are self-explanatory except for the following four terms;

Standard Error-the root mean squared sum of the difference between observed and computed hydrographs.

Objective Function--the weighted root mean squared sum of the difference between observed and computed hydrographs.

Average Absolute Error--the average of the absolute value of the differences between observed and computed hydrographs.

Average Percent Absolute Error--the average of absolute value of percent difference between observed and computed hydrograph ordinates.

APPLICATION OF THE CALIBRATION CAPABILITY

The following steps represent the strategy recommended to determine the model parameters for HEC-1 in this study;

1. For each storm, the base flow and recession parameters (STRTQ, QRCSN, and RTIOR) are determined graphically. These parameters can not be estimated automatically and must be entered as input. These parameters are placed on the BF input card for each storm.

2. For each storm and each gage, the optimal estimates of all unknown unit hydrograph and loss rate parameters (TC, R, STRTL, and CNSTL) are determined using the automatic calibration feature.

3. A value of the constant loss rate, CNSTL, is estimated. A regional value of CNSTL based on all storms at all the gages is selected.

4. With CNSTL fixed at the selected value, the automatic calibration feature is again employed for all the storms at all the gages. A regional relationship for the initial loss, STRTL, is selected. (See Figure 5.1)

5. With both loss rate parameters fixed the automatic calibration of the model is repeated.

6. Values of TC + R are selected for each basin. An average value of R/(TC + R) is selected for the region.

7. After all parameters are selected, the values are verified by simulating the response of the gaged basins to other storms not used in the calibration process.

REGRESSION ANALYSIS APPROACH TO PARAMETER ESTIMATION (HEC-1, 1982)

Multiple linear regression techniques were used to correlate the unit hydrograph parameters with several basin characteristics. Nonlinear relationships were investigated by transforming values logarithmically. Multiple regression analysis requires a computer program. Herein, the computer package MINITAB was used in the analysis.

The parameters TC and R were considered dependent variables and the basin characteristics were the independent variables. TC, R, (TC + R), and R/(TC + R) were analyzed, first, by considering several basin characteristics and, later, by reducing the number of independent variables until the "best" relationships (equations) were found.

The statistics describing the "goodness-of-fit" of the regression equation to the data are used in evaluating the analysis. These statistics are the coefficients of determination (both the adjusted and unadjusted), the partial determination coefficient, and the standard error of estimate. Their definitions are given below:

1. The adjusted and unadjusted multiple-determination coefficients (R^2) are a measure of the percent of variance in the dependent variable explained by the independent variable. The magnitude of these coefficients varies from 0 to 1. The closer to the value of 1, the greater the reliability is of the estimate.

2. The partial-determination coefficient (r^2) is a measure of the importance of an independent variable by determining the reduction in variance in the

dependent variable when the variable is included with the other independent variables.

3. The standard error of estimate (S_e) is the standard deviation of the difference between the observed dependent values and the values computed from the regression equation in the units of the dependent variable; therefore, it must be compared with the mean and the standard deviation of that variable.

For a more detailed description of multiple-regression analysis the reader is referred to a statistics book, such as Benjamin (1970, p.419). The general rule is to use the values of R^2, R^2 adjusted, and S_e computed for each regression equation as a guide and select the equation with the fewest independent variables and the best values of R^2 and S_e.

CHAPTER FOUR

DATA

PURPOSE AND SCOPE

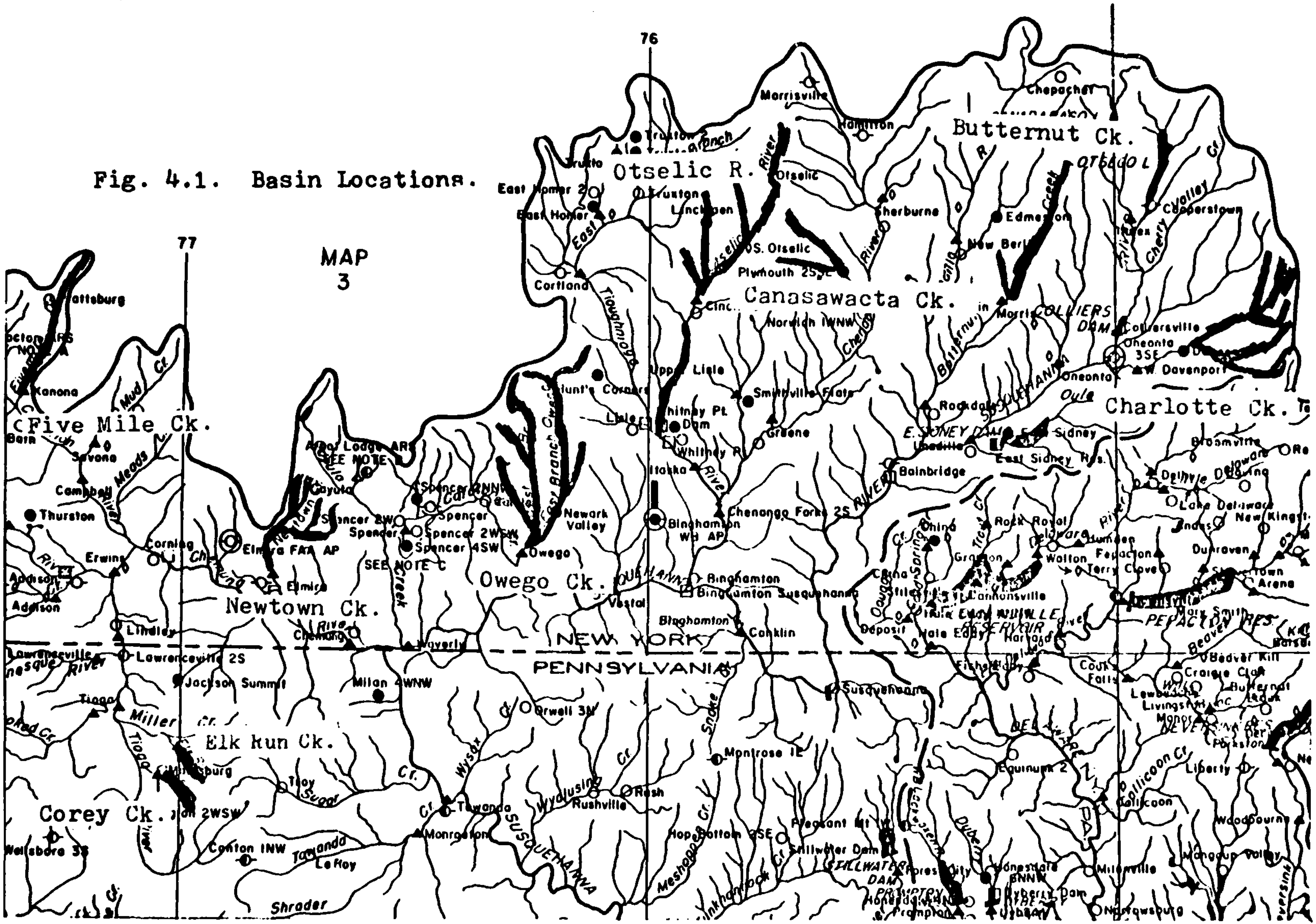
The purpose of this chapter is to present the data used in this study. The scope of this chapter is to display the basic data obtained from various sources after some refinement into a usable form for this analysis.

BASIN CHARACTERISTICS

Nine watersheds in the Susquehanna and Chemung River basins were chosen for the present investigation. The watersheds were unregulated and possessed a U.S. Geological Survey (USGS) stream gage. The locations of these gages were taken as the outlets from the watersheds. The nine basins are henceforth referred to by the main channel watercourse. Their names are: Butternut Creek, Canasawacta Creek, Charlotte Creek, Corey Creek, Elk Run Creek, Five Mile Creek, Newtown Creek, Otselic River, and Owego Creek. All basins are in New York state except Corey Creek and Elk Run Creek, which are in Pennsylvania. Figure 4.1 depicts the basins used and their location with respect to one another.

The basin characteristics were measured from USGS Topographic Quadrangle maps (1:2400). Table 4.1 contains a tabular synopsis of the basin characteristics chosen

Fig. 4.1. Basin Locations.



	DA	S	S2	SWT	DD	L	LCM	SF1	SF2	ALT
Butternut Creek	59.7	34.12	34.25	80.26	1.740	20.83	8.56	7.27	.419	780
Canasawacta Creek	57.9	46.55	50.80	68.64	1.620	12.42	8.48	2.66	.691	830
Charlotte Creek	167	34.60	36.83	67.58	1.633	24.77	15.15	3.67	.589	1110
Corey Creek	12.2	135.48	164.12	106.39	1.422	5.38	3.03	2.37	.733	1003
Elk Run Creek	10.2	105.23	115.52	123.89	1.188	6.74	4.43	4.45	.535	850
Five Mile Creek	66.8	29.75	38.10	67.06	1.790	19.51	10.42	5.70	.473	830
Newtown Creek	77.5	45.15	49.34	70.75	1.494	17.92	10.68	4.14	.554	865
Otselic River	147	23.72	25.19	51.74	1.473	29.51	14.24	5.92	.464	800
Owego Creek	185	29.22	32.34	54.38	1.809	30.57	15.95	5.05	.502	1105

Table 4.1 Basin Characteristics.

for the present analysis on the basis of the review in Chapter 2. A definition of each term follows: (after Linsley (1955, p. 313))

DRAINAGE AREA (DA)--The area in square miles of the watershed above the stream gage. Any excess rainfall falling in the watershed would at some time pass through the gaging station. Rainfall falling outside of this area would drain into another watershed. These data were obtained from USGS Water Supply Papers.

SLOPE (S)--This is the average main channel slope in vertical feet per horizontal channel mile. Slopes were obtained by plotting the elevation of the map contours (in feet) versus the distance of the map contours from the gaging stations (in miles) and taking the straight line slope fitted by the least squares method. The steeper the slope the faster the basin will drain.

SLOPE 2(S2)--This is similar to slope (S) except the main channel is divided into two segments. Two straight lines are drawn representing a closer fit to the actual main channel profile. Slope 2 is a weighted average of these two segments.

S2 =((slope of segment 1)(horizontal length of segment 1) + (slope of segment 2)(horizontal length of segment 2))/(total main channel length)

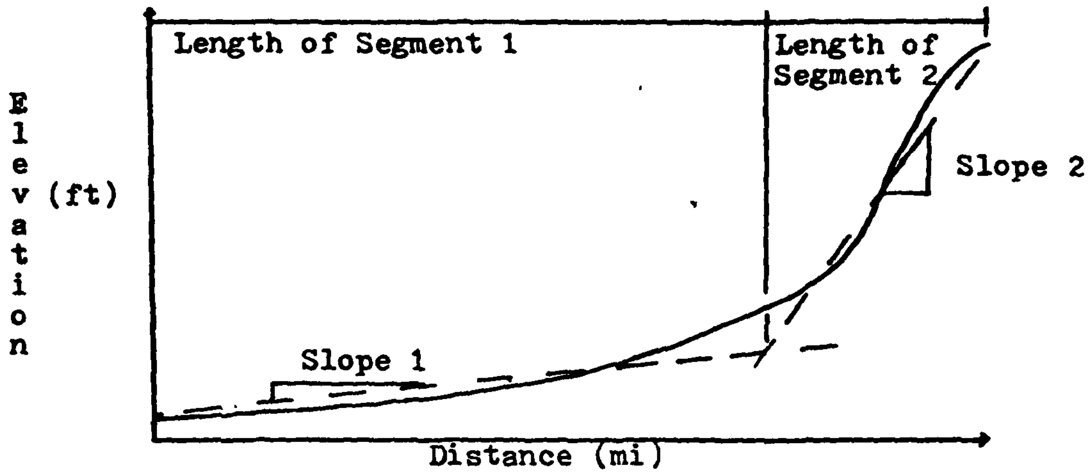


Figure 4.2. Slope2 Graphical Representation.

SLOPE WT (SWT)--This slope is a weighted slope intended to represent a better picture of the basin's slope characteristics by including the slope contribution of some of the tributary streams. Its feet is also listed in feet per mile.

DRAINAGE DENSITY (DD)--This is a measure of the amount of stream channel miles per basin square mile. It is obtained by measuring the cumulative length of every stream channel shown on the USGS topographic map. This cumulative length is divided by the drainage area. The higher the drainage density, the smaller distance any particle of excess rainfall must travel before entering a stream channel. This implies that the larger the DD value, the faster the basin will drain.

LENGTH OF THE MAIN CHANNEL (L)--This is a measure of the longest watercourse measured from the gaging station to the furtherest point of stream channel origination upstream.

L is measured in miles.

LENGTH TO THE BASIN CENTER OF MASS (LCM)--The center of mass is found by hanging a paper cut-out diagram of the drainage basin and marking off the vertical lines obtained from three different suspension points. The value for LCM is obtained by measuring the distance from the gaging station to the point on the main channel opposite the center of mass. LCM is measured in miles.

SHAPE FACTOR ONE (SF1)--This is a measure of the basin's shape. It is equal to the length of the main channel squared divided by the drainage area, i.e. L^2/DA.

SHAPE FACTOR TWO (SF2)--It is similar to SF1. It is the ratio between the diameter of a circle, the size of the drainage area (DA), and the length of the main channel (L), i.e. $SF2 = DIA/L$ where $DIA = (4*DA/\pi)^{1/2}$. This term was proposed by Cruff and Rantz (1965).

ALTITUDE (ALT)--This is a measure of the vertical drop between the elevation at the main channel headwaters and the gaging station in feet.

STORM/FLOOD DATA SELECTION

An effort was made to obtain 5-10 of the major flood events occurring in each basin since the record flooding which was produced by Hurricane Agnes (June 1972). There were several seasons for selecting events since the summer of 1972. First, it is desired to minimize the influences of basin changes which either naturally occur or are caused by man over time. It was felt that a time period of ten to eleven years would be a reasonable length of time to minimize basin change effects. Second, results of studies prior to,or as a result of, Hurricane Agnes may be compared with the results of this work. The storm events for each basin are presented in Table 4.2. It should be noted that not all storm dates were taken after June 1972, because not enough major storms had occurred to provide a sufficiently wide data base to conduct the analysis. In addition, only events were selected which were free from any indication of snowmelt, ice jam, or difficulties involving the stream gaging stations. These problems are beyond the scope of this work.

PRECIPITATION DATA

Precipitation data for the storm events in each basin were obtained from documents published by the National Weather Service. Basins were traced on paper from small scale maps. Locations of the rain gages in the vicinity of each basin were plotted on the tracing paper. The Thiessen Polygon method was used to divide up the basin. Planimeter measurements were made for all recording and nonrecording gages influencing the basin. The fraction of the basin contained in each polygon was recorded along with the rainfall amounts obtained from the Climatological Data

Butternut Creek (NY)
10-18-75 *
10-09-76
10-21-76
9-26-77
10-17-77

Canasawacta Creek (NY)
6-26-68
11-18-68
6-24-69
7-31-71 *
6-22/23-72
7-03-74

Charlotte Creek (NY)
6-29-73
12-21-73

Corey Creek (PA)
11-14-72
9-26-75
10-09-76 *
5-14-78
10-05-79
11-26-79
6-05-82

Elk Run Creek (NY)
10-22-70
11-14-72
9-26-75
10-09-76
10-20-76
5-14-78
8-06-78 *

Five Mile Creek
5-07-75
9-26-75
9-14-77
9-25-77 *

Newtown Creek (NY)
9-26-75
10-09-76 *
10-21-76
9-25-77
10-17-77
11-04-77
11-08-77
11-11-77
10-06-79
11-26-79
10-28-81 *

Otselic River (NY)
7-03-74
9-26-75
10-09-76 *
10-17-77
4-05-78

Owego Creek (NY)
11-08-72
9-26-75
10-09-76 *
9-25-77
10-17-77

Total Storms

52

Table 4.2

Storm Data (*)--Verification storms not used in model calibration.

and Hourly Precipitation Data (recording stations), documents of the National Weather Service. Appendix A contains the watershed rain gage locations and the Thiessen polygons.

STREAMFLOW DATA

The streamflow data for each flood event at a particular gage were obtained through the Regional Office of the U.S.G.S. located in Ithaca, New York and the State office of the U.S.G.S. located in Harrisburg, Pennsylvania for the Pennsylvania stations. Stage data were obtained as height of the stream at particular times. For this study therefore, the stage data (FT) had to be converted to flow rates (FT^3/sec) by the use of the stream's rating curve. Flow rates were tabulated and retained for use as input for the HEC-1 calibration sequence.

The recession parameters, RTIOR and QRCSN were calculated as described in Chapter Three and retained as input for the computer model.

INPUT FORMATTING AND DATA STRUCTURE FOR HEC-1

Input for the HEC-1 model is accomplished by creating a card deck organized in a certain structure and sequence for easy computer reading. Each card of eighty columns is set up in the following manner; columns 1 and 2 are used to identify the card type and purpose. Following columns 1 and 2 are ten data fields of eight columns each, except the first field which is composed of only six columns. More detailed discussion of data organization may be found in HEC-1 manuals. A brief line-by-line explanation of a typical card deck as used in this study may be found in Appendix B. as well as the input card data information for all the storms used in this study.

REGRESSION DATA FOR THE INITIAL LOSS PARAMETER (STRTL)

Because STRTL is storm dependent, a method of relating the STRTL values to the total amount of rain occurring in the 2, 3, 4, 5, 7, 8, and 10-day period prior to the storm was attempted. The statistical package MINITAB was used to perform regression analysis on the data. The data are displayed in Table 4.3. The reader may obtain further information on MINITAB by reading the MINITAB Reference Manual or by contacting MINITAB PROJECT, Statistics Department, 215 Pond Laboratory, Pennsylvania State University, University Park, PA 16802.

The values in columns two through eight were obtained by summing the products of the total rainfall recorded for each rain gage covering a portion of the basin and the fraction of the drainage area covered by that gage. The analysis of this data will be discussed in Chapter Five.

				Day Period				
Basin/Storm	STRTL	D2	D3	D4	D5	D7	D8	D10
Butternut								
* 10-18-75		.31	.31	.87	.87	1.25	1.25	1.25
10-09-76	.553	0	0	0	0	0	0	.20
10-21-76	0	0	.01	.01	.40	1.29	1.29	1.29
9-26-77	0	.73	.73	.75	1.14	3.19	3.19	5.40
10-17-77	0	.80	.8	1.01	1.01	1.73	1.73	2.02
Canawacta								
6-26-68	1.09	.09	.09	.09	.16	.38	.38	.40
11-18-68	.26	.36	.36	.61	.72	1.47	1.47	1.96
6-24-69	2.26	.44	.51	.51	.51	.81	.81	.85
* 7-31-71		.03	.88	.88	1.6	1.6	1.6	2.67
6-22/23-72	.08	0	0	0	.78	1.67	1.67	1.67
7-03-74	.98	0	*	*	FOULED*		*	*
Charlotte								
6-29-73	1.47	.01	.01	.14	.32	.41	.41	.56
12-21-73	.38	.05	.59	1.54	1.54	1.71	1.71	1.8
Corey								
11-14-72	.33	.46	.46	.66	.80	.99	.99	.99
9-26-75	.32	.37	.46	.46	.62	.77	.77	.77
10-09-76	1.33	0	0	0	0	0	0	.06
5-11-78	.56	0	0	.21	.33	.33	.42	.87
* 10-05-79		.69	1.14	1.18	1.18	2.02	2.02	2.02
11-26-79	.14	.76	.76	.76	.77	.77	.77	.77
6-05-82	.10	1.11	1.11	1.78	1.79	*	*	*
Elk Run								
10-22-70	1.01	0	0	0	.09	.55	.55	1.29
11-14-72	.39	0	0	0	1.18	2.28	2.28	2.28
9-26-75	.01	.45	.7	.7	.93	1.05	1.05	1.05
12-09-76	1.45	0	0	0	0	0	0	.12
10-20-76	.69	0	0	0	0	.29	.29	.29
5-14-78	.05	0	0	0	.78	.78	.78	1.55
* 8-06-78		2.	2.	2.	2.4	2.75	2.75	3.3

Table 4.3
Previous Rainfall Amounts

Day Period

Basin/Storm	STRTL	D2	D3	D4	D5	D7	D8	D10
Five Mile								
5-07-75	0	.1	*	Fouled	*	*	*	*
9-26-75	.92	.6	.9	.9	.9	1.1	1.1	1.1
9-14-77	1.34	.01	.01	.01	.01	.01	.18	.27
* 9-25-77		.01	.01	2.09	2.19	3.59	4.6	5.34
Newtown								
9-26-75	.01	.81	.81	.84	.94	1.43	1.43	1.43
*10-09-76		0	0	0	0	0	0	.1
10-21-76	.36	0	o	0	.05	.26	.27	.27
9-25-77	.66	.04	.09	.46	.80	1.69	2.48	3.9
11-04-77	.65	0	0	0	0	0	0	0
11-08-77	.13	.12	1.64	2.05	2.05	2.05	2.05	2.05
11-11-77	.19	.54	1.09	1.09	1.85	3.02	3.02	3.02
10-17-77	.01	.25	.25	.26	.27	.76	.76	.93
10-06-79	.96	.52	.52	.52	.52	1.44	1.44	1.44
11-26-79	.39	.3	.32	.4	.4	.4	.4	.43
*10-28-81		.14	.28	.28	.28	.4	.56	.57
Ostelic								
7-03-74	2.33	.11	.16	.47	.47	1.56	1.56	1.56
9-26-75	1.3	.24	.24	.49	.49	.91	.98	.98
*10-09-76		0	0	0	0	0	0	.13
10-17-77	.04	.63	.63	.63	.85	1.34	1.82	2.02
4-05-78	0	.01	.1	.26	.26	.28	.48	1.26
Owego								
11-08-72	.61	.01	.07	.08	.93	.99	.99	1.6
9-26-75	.29	.46	.46	.63	.78	1.15	1.2	1.2
*10-09-76		.03	.03	.03	.03	.03	.03	.13
9-25-77	0	.03	.1	1.09	1.45	2.28	4.0	5.25
10-17-77	.06	.3	.3	.44	.45	1.1	1.18	1.37

Table 4.3. (Continued)
Previous Rainfall Amounts

CHAPTER FIVE

RESULTS AND DISCUSSION

PURPOSE AND SCOPE

The purpose of this chapter is to present the results of the calibration effort for the basins and storms selected as the control group; these comprise selection of the unit hydrograph and regional loss rate parameters, determination of regression relationships, and verification of the results using uncontaminated flood events. The scope of this chapter is to display the results and to discuss the findings in relation to an earlier study.

MODEL CALIBRATION FOR EACH BASIN

The 'best' fit values of the four model parameters for each event are presented in Table 5.1. Each event was initially optimized using the model's default values. From the initial results the starting values of the parameters were manipulated until the 'best' fit choices produced the 'best' statistical summary results. These summaries as well as other 'best' fit results may be found in Appendix C.

Once the optimized parameters were determined for the control storms, the parameter for the constant loss rate, CNSTL, was averaged for each basin. For certain

Table 5.1.

"Best-Fit" Values Optimization Results.

Basin/Storm	TC	R	STRTL	CNSTL
Butternut Creek				
10-10-76	13.83	6.24	.53	.05
10-21-76	10.98	14.06	0	0
9-26-77	9.93	10.52	0	0
10-17-77	14.77	4.53	0	0
Canasawacta Creek				
6-26-68	4.25	9.69	1.23	.06
11-18-68	2.25	10.61	0	0
6-24-69	1.83	12.37	2.0	.20
6-22/23-72	3.33	7.94	.99	01
7-03-74	6.13	4.10	.9	.07
Charlotte Creek				
6-29-73	14.61	20.90	.92	.09
12-21-73	4.21	15.21	.50	.04
Corey Creek				
11-14-72	1.62	10.39	.30	.12
9-26-75	2.27	2.71	.39	.08
10-09-76	3.97	4.73	1.62	.15
5-14-78	1.03	6.94	.28	.15
11-26-79	2.60	3.73	.22	.09
6-05-82	1.05	11.96	.04	.12
Elk Run Creek				
10-22-70	1.07	5.95	1.25	.16
11-14-72	1.50	8.54	.28	.14
9-26-75	1.03	4.12	.80	.10
10-04-76	4.83	1.69	.62	.07
10-20-76	1.92	3.69	.83	.07
5-14-78	1.06	2.36	.08	.03

Table 5.1 Continued

"Best-Fit" Values Optimization Results.

Basin/Storm	TC	R	STRTL	CNSTL
Five Mile Creek				
5-07-75	14.73	25.44	.2	.02
9-26-75	4.27	26.76	.89	.02
9-14-77	9.65	20.35	1.09	.11
Newtown Creek				
9-26-75	12.48	20 58	.03	.05
10-21-76	11.01	4.84	.36	.07
9-25-77	10.42	13.59	.66	.07
10-17-77	8.31	16.02	.01	.06
11-04-77	9.18	11.90	.65	.07
11-08-77	8.41	14.53	.13	.02
11-11-77	7.86	13.48	.19	.02
10-06-79	2.64	18.50	.72	.14
11-26-79	5.79	17.17	.04	.11
Ostelic River				
7-03-74	10.37	14.26	2.0	.15
9-26-75	6.14	25.69	1.27	.06
10-17-77	15.46	29.53	.01	.05
4-05-78	6.32	26.52	.05	.01
Owego Creek				
11-08-72	8.35	18.94	.16	.06
9-26-75	7.09	15.23	.78	.03
9-25-77	6.15	17.78	.21	.03
10-17-77	10.12	17.28	.12	.03

values within the observed range of this parameter (around its average) and depending on its performance the basin value of CNSTL selected for each basin is displayed in Table 5.2.

Because of the unique structures of the Butternut and Five Mile Creeks, their values do not appear to fit into the general pattern of increasing CNSTL values as one proceeds southwestwardly from the Upper Susquehanna region. Butternut Creek has a rather large value for SWT (80.26 ft/mi) and the largest value for SF1 (7.27) implying a long,narrow, steep-sided basin. Such a basin would not allow as much water to be intercepted/infiltrated as the other basins. On the other hand, a casual observation of the Five Mile Creek basin on a topographic map shows a great deal of swamp area. This condition would retard the flood wave; however, less rainfall would be lost due to the already wet soil condition.

Holding the parameter CNSTL constant for each basin, the other three parameters were optimized. The values of the initial loss parameter, STRTL, were regressed against the amount of total precipitation falling at different time periods preceeding the storm. The best derived regression equation was STRTL = 0.861 - 0.504 * D5, where D5 is the total amount of rainfall occurring five days prior to the beginning of the storm. See Figure 5.1 for a plot of STRTL vs D5 for all of the control storms. This equation has an unadjusted multiple-determination coefficient,

Table 5.2.

Basin Averaged Constant Loss Rates (CNSTL).

	CNSTL (inches/hour)
Butternut Creek	0.00
Canasawacta Creek	0.05
Charlotte Creek	0.05
Corey Creek	0.10
Elk Run Creek	0.10
Five Mile Creek	0.03
Newtown Creek	0.07
Ostelic River	0.05
Owego Creek	0.05

R^2, equal to .192.

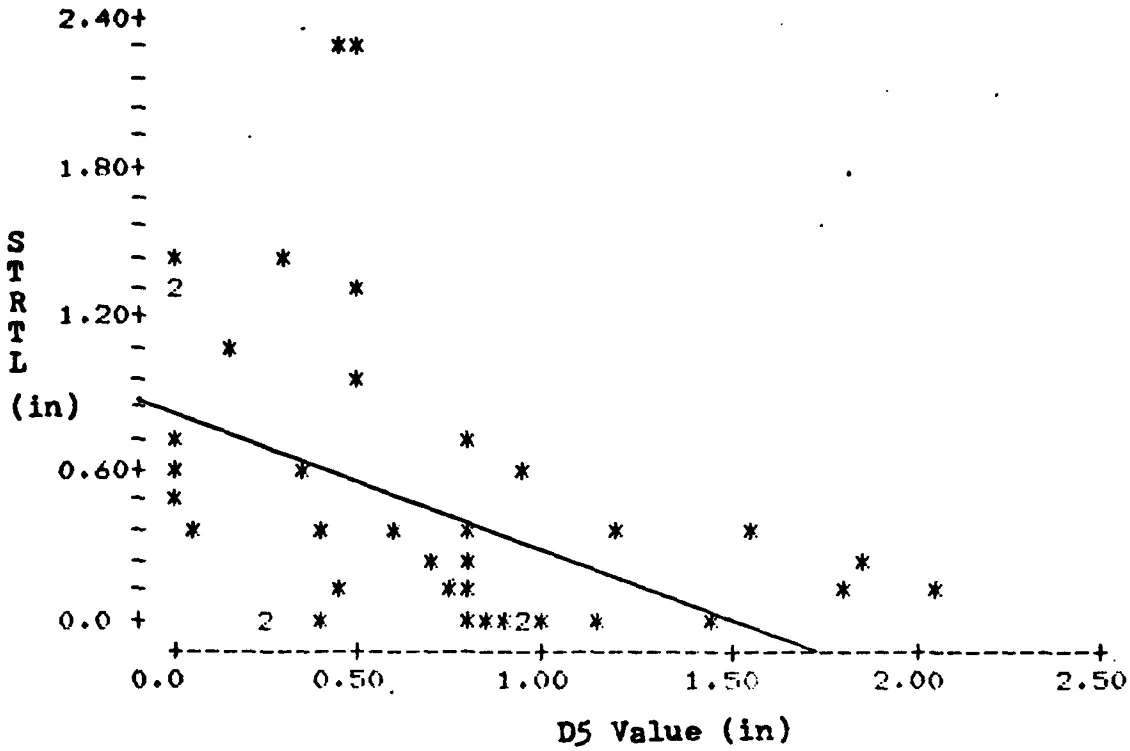


Figure 5.1. Regression Equation for STRTL Plot.

Although the coefficient is not as high as desired, the D5 term gave the best correlation. The control storms plotted below the line in Figure 5.1 will give conservative forecasts. This means higher computed peaks than the observed peaks. The STRTL term is rather sensitive (see Sensitivity Analysis section, later), however, in the absence of any other method, this approach was used.

The values for STRTL were predicted by means of this regression equation. Each storm was then optimized for the TC and R parameters. The final parameter values for the control storms are listed in Table 5.3.

These values were used in computing and comparing the verification storm group hydrographs with the observed flood hydrographs. The statistical results are presented in Appendix D for the verification storms.

COMPARISON WITH PARAMETERS DETERMINED PRIOR TO HURRICANE AGNES (1972)

In June 1970 the Susquehanna River Basin Study Coordinating Committee published an extensive work on the Susquehanna basin. Appendix D (Hydrology) of that study contained the Clark unit hydrograph parameters for several gaged basins, obtained on the basis of a similar computer program developed by the Hydrologic Engineering Center, U S. Army Engineer District, Sacramento, CA, (now HEC is located in Davis, CA).

The data base used in the study consisted of four major flood events. Basin average rainfall was determined by Thiessen polygons. Two or four-hour unit hydrographs were developed depending on the drainage area of the basin. The TC and R parameter values are presented in Table 5.4. Not all of the basins could be compared with the current results because some stream gages have been relocated since the publication of the study. Table 5.4 shows a very good comparison between most of the terms. The values of R for Charlotte and Five Mile Creeks are not in good

Table 5.3.

Derived Parameters.

Basin	TC	R (hours)
Butternut Creek	11.66	6.76
Canasawacta Creek	8.65	8.59
Charlotte Creek	11.68	27.70
Corey Creek	1.90	8.27
Elk Run Creek	2.02	8.13
Five Mile Creek	7.47	46.12
Newtown Creek	9.00	14.46
Ostelic River	9.80	36.13
Owego Creek	9.35	13.83

agreement. A possible explanation for the Charlotte Creek discrepancy is the fact that only two storms meeting the established criteria in the past fifteen years could be found for this basin. The expected value variance of any derived parameter based on only two data points is very great. Therefore, one would not expect the values of the two works to be very close.

The discrepancy of the R values for Five Mile Creek could be related to the goodness-of-fit of the storms selected for this study. Looking at the plots of the 'best' fit computed flow with the observed flow, the reader will notice that the computed hydrograph had a rather difficult time matching the observed hydrograph. Whether the rain gage in the middle of the basin failed to provide accurate data or the U.S.G.S. gaging station measurements were fouled by mechanical defects is not clear. The author is inclined to doubt the observed hydrograph measurement because of the peculiar combination of spike and round portions.

	Study(Jun 70)		Present Results	
	TC	R	TC	R
Canasawacta Ck.	2.03	11.04	8.65	8.59
Charlotte Ck.	11.83	14.79	11.68	27.70
Five Mile Creek	5.50	19.00	7.47	46.12
Newtown Creek	9.71	18.39	9.00	14.46
Owego Creek	10.10	11.82	9.35	13.83

Table 5.4.
Parameter Comparison with Previous Study

SENSITIVITY ANALYSIS OF PARAMETERS

A sensitivity analysis was performed on a selected storm whose 'best' fit results initially yielded a very good statistical summary. The storm selected from the control group was the Newtown Creek 11-04-77 storm. Holding the other three parameters constant, the parameter TC was decreased and increased 5 and 10%. The same was done for the parameter R. The loss rate parameters are not normally known to such a high degree of accuracy. Therefore, the loss rate parameters were not varied by 5 and 10% because the results were not significantly different. For the initial loss rate parameter, STRTL, the value was decreased and increased .1 and .2 inches to show a better variability. The parameter for constant loss rate, CNSTL, was varied by .02 and .04 inches/hour each way. These variations are reasonable for any basin under investigation. The results are displayed in Table 5.5.

The reader is directed to the Peak Flow column. The Peak Flow percent was not very sensitive to variations in the TC and R terms. The most change was about 6% between the computed and observed peaks. Variations in the normal range of expected values of the loss parameters are a different story. A decrease of STRTL of .2 inch caused an overestimation of the peak by 14%. While a .04 inch/hour decrease or increase in the CNSTL produced approximately a 40% change in both directions.

Adjustments	Sum of Flows Diff.	Equiv Depth Diff.	Mean Flow Diff	Time To C.M. Diff	Lag C.M. to C.M.	% Peak Flow	Time of Peak	AVG % ABS Error	OF
Control	-3.73	-.031	-23	-.96	-5.37	.60	0.	12.61	61
TC -10%	3.46	.018	34	-.17	-1.84	2.87	-1	10.77	88
-5%	2.61	.013	26	-.04	-.39	1.33	-1	10.01	68
+5%	.84	.004	8	.23	2.41	-.45	0.	9.36	63
+10%	-.06	0.	-1	.35	3.77	-1.8	0.	10.06	80
R -10%	6.81	.035	67	-.04	-.44	6.78	0.	11.74	104
-5%	4.21	.022	42	.03	.33	3.59	0.	10.46	74
+5%	-4.64	-.039	-28	-.72	-4.02	-2.29	0.	11.80	60
+10%	-2.95	-.015	-29	.21	2.22	-4.98	0.	9.62	77
STRTL -.2	27.45	.141	271	-.75	-7.09	14.23	-1.	46.17	299
-.1	14.60	.075	144	-.37	-3.72	7.34	0.	24.84	163
+.1	-11.10	-.057	-110	.7	8.12	-6.18	0.	22.21	139
+.2	-17.61	-.09	-174	1.02	12.52	-9.93	0.	31.56	208
CNSTL-.04	42.20	.217	417	.06	.62	38.5	0.	42.77	536
-.02	21.97	.113	217	.07	.78	19.55	0.	24.4	282
+.02	-18.48	-.095	-182	.13	1.37	-18.35	0.	19.05	243
+.04	-38.70	-.199	-387	.18	1.97	-37.3	0.	38.10	496

Initial Parameter Values were; TC = 9.18 STRTL = .65

R = 11.90 CNST = .07

(-) OBS > computed

(+) OBS < computed

Newtown Creek
11-04-77

Table 5.5.

Sensitivity Results

The results of the analysis show that the loss parameters are the most sensitive and must be estimated accurately to give reasonable results.

The reader may recall the discussion in Chapter Three concerning the optimized solutions of HEC-1 not being the global solution. This point is reflected in this analysis where a 5% increase in TC produced a better fit than the original controlled parameter storm.

REGRESSION ANALYSIS OF THE PARAMETERS TC AND R

Various combinations of the basin characteristics listed in Table 4. were tried. The only restriction placed on the combinations was that only one slope value and only one shape factor were permitted in any one combination. Combinations of the characteristics as well as their log values were evaluated. Table 5.6 lists the top combinations of each type along with the statistical coefficients. Table 5.7 lists some of the characteristic combinations used.

	R^2	R^2-ADJ	Standard Deviation
$TC = 7{,}942.63(DA)^{.66}/(ALT)^{1.44}$	.910	.879	0.2474
$TC = 450.34/(S2)^{1.08}$	.878	.861	0.2659
$TC = 5.93\ (DA/S)^{.412}$	.871	.853	0.2736
$TC = 1.73(L\sqrt{DA/S})$	.861	.842	0.2836
$TC = 3.60\ (L/\sqrt{S})^{.716}$	.847	.825	0.2980

Table 5.6. Highest Correlated Regression Equations.

	R^2	R^2-ADJ	Standard Deviation
$TC+R = 626.41/(S)^{.87}$	.731	.693	0.3365
$TC+R=14.15(L/\sqrt{S})^{.549}$	.686	.641	0.3638
$TC+R=20.91(DA/S)^{.312}$	.686	.641	0.3639
$TC+R=8.25(L\sqrt{DA/S})^{.35}$	.677	.630	0.3693
$TC+R=15.18(L/\sqrt{SWT})^{.653}$	.667	.619	0.3748
$TC+R=507.76/(S2)^{.794}$	.658	.610	0.3795

Table 5.6.

Highest Correlated Regression Equations
(Continued)

	DA/S	DA/SWT	L LCM/$\sqrt{S}$	L$\sqrt{DA/S}$	L/$\sqrt{S}$	L/$\sqrt{SWT}$
Butternut Ck.	1.75	.74	30.53	27.55	3.57	2.33
Canasawacta Ck.	1.24	.84	15.44	13.85	1.82	1.50
Charlotte Ck.	4.83	2.47	63.80	54.42	4.21	3.01
Corey Ck.	.09	.11	1.4	1.61	.46	.52
Elk Run Ck.	.10	.08	2.91	2.10	.66	.59
Five Mile Ck.	2.25	1.00	37.27	29.23	3.58	2.38
Newtown Ck.	1.72	1.10	28.48	23.48	2.67	2.13
Ostelic Ck.	6.2	2.84	17.72	73.46	6.06	4.10
Owego Ck.	6.33	3.40	90.20	76.92	5.66	4.15

Table 5.7.

Basin Parameter Combinations

The first equation in each group in the table has the highest correlation coefficients, lowest variance, and least number of parameters. The parameters relating best to the Clark unit hydrograph parameters TC and R were found to be the drainage area (DA), altitude difference (ALT), and the main channel slope (S). The shape factors were found to be highly related to the other terms. They were eliminated without exception in every stepwise regression operation. The term S2 faired better in the TC group than the S term. The opposite is true in the TC + R group. However, the difference between them is not great and does not warrant the additional effort of deriving S2.

AUTOMATIC CALIBRATION RESULTS

In Chapter Three under the section "Calibration of Model Parameters", it was mentioned that the optimization technique employed by HEC-1 does not guarantee that the parameters derived are global solutions. An example of this is displayed in Figures 5.2 and 5.3. Figure 5.2 is the graphical results obtained using the HEC-1 initial parameters as starting points. Figures 5.3 is the final results used in this analysis for the Butternut Creek (9-26-77) storm.

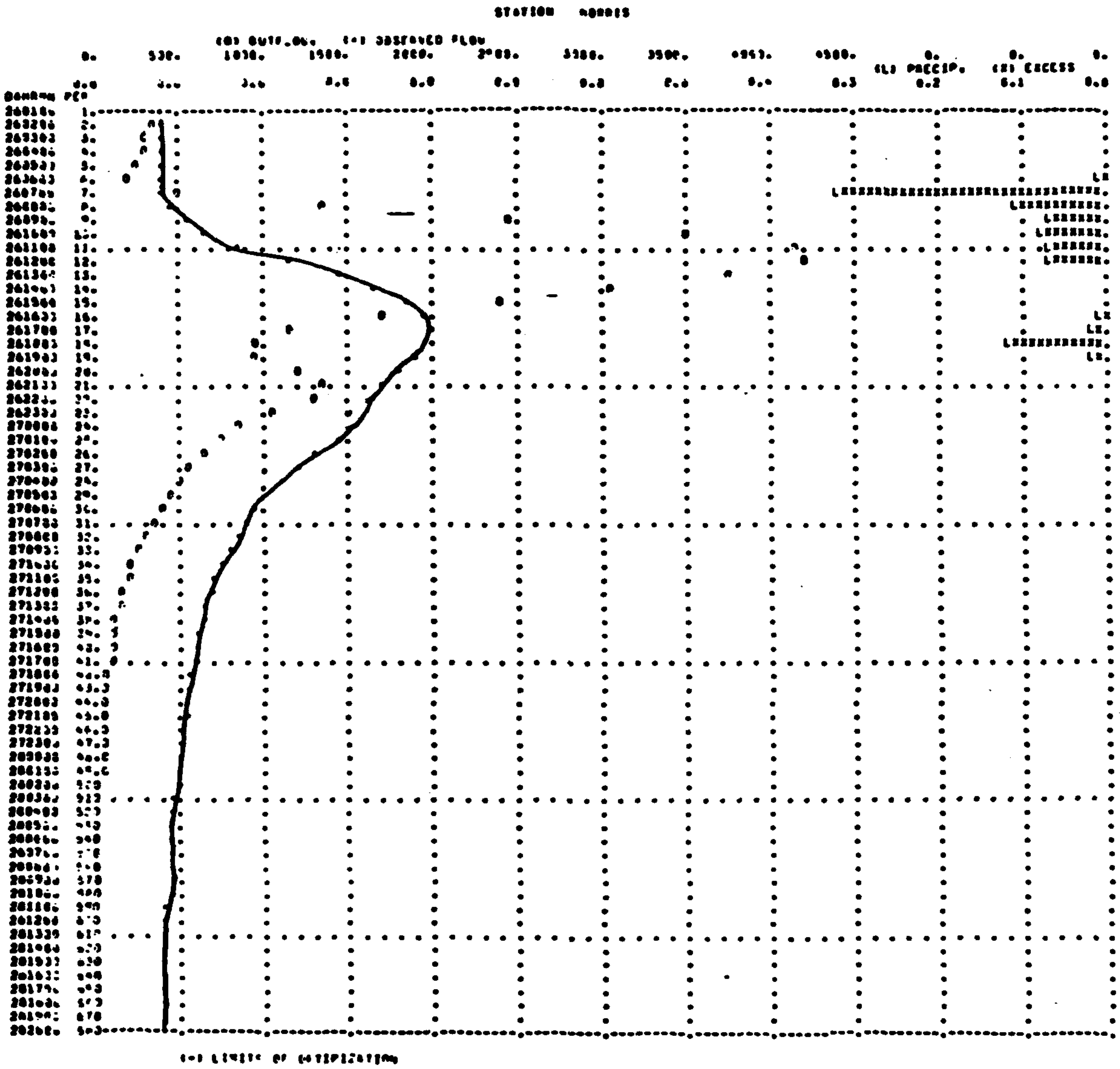


Figure 5.2. Initial Optimization Results.

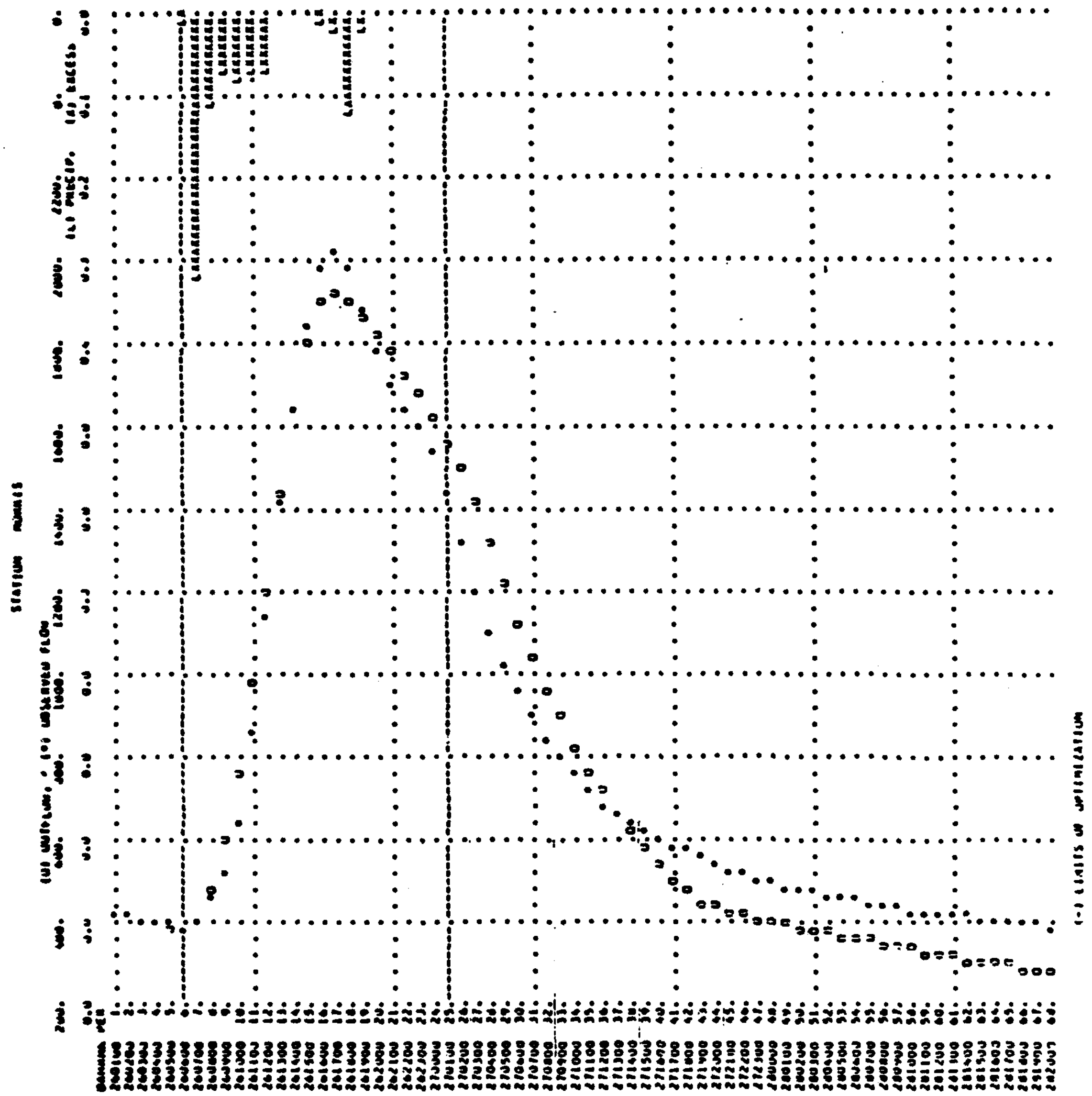


Figure 5.3. Finial Optimization Results.

CHAPTER SIX

SUMMARY AND CONCLUSIONS

McSparran (1968, p.937) found in his study of 32 watersheds varying in drainage area from 2 to 210 square miles in Pennsylvania that relating hydrograph parameters to watershed characteristics is not an easy task. He found nonlinearity factors present in every storm, adjusting and altering the parameters. As a result he felt that the unit hydrograph method was not as accurate as it should be. He stated that major floods would be underpredicted and on the average the observed peaks would be underpredicted by 22% using the Snyder unit hydrograph method. Yet by using the Soil Conservation Service (SCS) method the average peaks were predicted 51% too high.

On the other hand, Heerdegen (1974, p.1143) concluded with a resounding "affirmative" to his article's question-title, "Unit Hydrograph: A Satisfactory Model of Watershed Response?" Sixty measured parameters for each of the sixteen watersheds in Pennsylvania were used in analyzing ninety-six flood events. Five parameters were eventually selected as the most influential for his area. However, they were not constant from area to area. In his study he concluded that the storm variable of precipitation duration and volume of precipitation excess are major factors in flood hydrograph responses.

SOURCES OF ERROR

Whenever one attempts to measure a physical property in nature, there is some error. Rain gages and streamflow gages leave a lot to be desired when it comes to accurate measurements. Rain gages are point measuring instruments and they hardly ever represent the amount of rainfall deposited on a basin accurately. In some cases rain gages at a great distance from the basins had to be used, because the local data were fouled or not reported.

The choice of model is a source of error. Every model makes some simplifying assumptions for ease of computation, cost, or speed. HEC-1 is a lumped or bulk parameter model. It groups all of the irregularities and unique features of a basin into one big box. Richards (1955, p.110) presented nine factors affecting runoff. Some of these factors, such as moving storms and intensity variations, are ignored by HEC-1.

In the absence of specific information, a synthetic time area curve (supplied by HEC-1) was made to create a translation hydrograph for each basin. The basins varied in many sizes and shapes and forcing the time-area curve to fit all the basins seems unrealistic.

The type of optimization routine, i.e. univariant search technique, does not guarantee the results to be a global solution and indeed the user of the model must be aware of its hazards. Picking new starting points and adjusting the parameters to get a better fit is sometimes more luck than skill.

The loss rate selection is a major source of error. The inability to obtain a consistent and reliable STRTL predicting device greatly influenced the final results and future applications of this study. Bulk loss rates are perhaps better suited for large areas.

Selection of the Clark method to derive flood hydrographs affected the results. The application of a linear numerical model, although frequently used in government and private studies, to a nonlinear problem induces error.

Are the areas of interest, i.e. the Upper Susquehanna and Chemung River Basins, compatable? The nine stream basins are supposed to be hydrologically similar. Are they? What does hydrologically similar mean? This author concluded that the basins are fairly hydrologically similar because the slopes and valley structures appear to be consistent among the nine basins and most major storms track across both river basins. What basin or climatic factors were not included which would have improved the correlation between the model parameters and the basin characteristics? Chow (1964, p.27-104) states that some areas are just not adequate for unit hydrographs.

The unit hydrograph assumptions of time invariance and linear runoff responses are not strictly valid in real life. Basin characteristics do change with time, e.g. land cover and seasonal changes influence loss rates.

The selection of storms will affect the results. Although the storms are the largest occurring in the last ten to fifteen years (unaffected by snow), most are not to be considered major storms. Sokolov (1976, p.199) quoted U.S. Army Corps of Engineers' studies when they said that in the majority of the basins studied the peak ordinates of the unit hydrographs derived from a major flood are generally significantly greater than those derived from data from a minor flood. Those studies stated that unit hydrograph peak ordinates from major floods were twenty-five to fifty percent greater than those derived from minor floods. Therefore, one would expect the results obtained in the application of the regression relationships to be somewhat underpredictive, i.e. on the conservative side.

The storms selected cover several seasons from early April until December. Although Heerdegen (1968, p.1143) found no significant seasonal differentiation in the unit hydrograph at the five percent level, Sherman (1932, p.504) felt that unit hydrographs should be seasonally segregated.

LIMITS OF APPLICATION

The data were obtained from streams and rain gages in south central New York and north central Pennsylvania and they should be applied in that area. With the exception of Five Mile Creek, the streams appear to be free from a great deal of valley storage and swampy areas. The results were obtained without snowmelt or ice jams affecting the outlet flow rate. Therefore, the results should apply primarily to summer and fall seasons.

AREAS IN NEED OF FUTURE INVESTIGATION

The lack of adequate soil moisture data hindered the proper calibration of the parameter STRTL. Without adequate or reasonable loss rate parameter values, the model will not serve as a reliable predictive tool.

SUMMARY

By using the Flood Hydrograph, HEC-1, computer package, the Clark unit hydrograph, and the initial/uniform loss rate, parameters were determined for nine watersheds in the Chemung and Upper Susquehanna River basins. Fifty-two storms were used in the analysis on the watersheds which range in drainage areas from 10.2 to 185 square miles. Regression equations predicting the time of concentration, TC, and the term TC + R were derived.

CONCLUSIONS

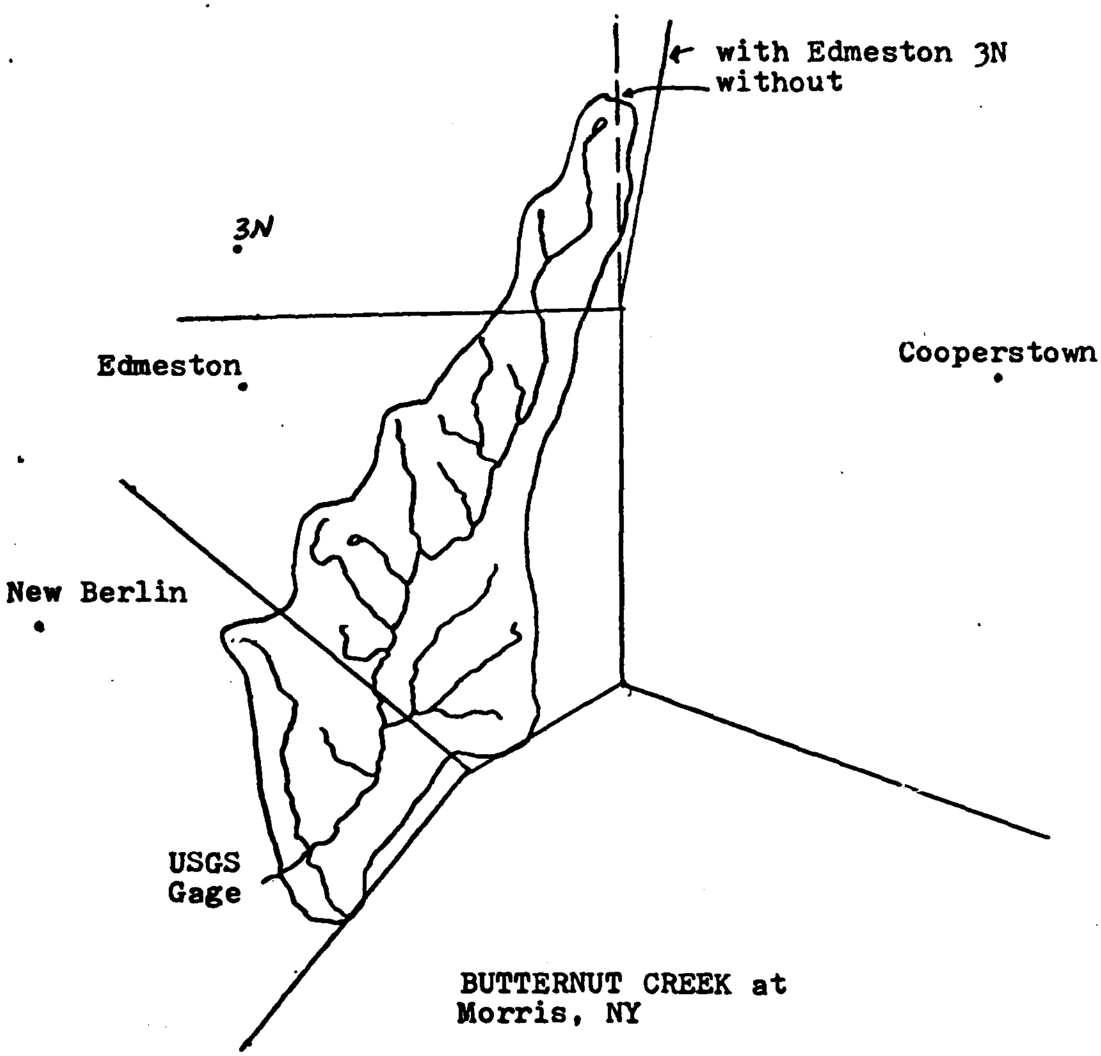
Specifically, the conclusions of this thesis are:

1. HEC-1 may be applied successfully in the study area.
2. Sensitivity of the parameters TC, R, STRTL, and CNSTL in HEC-1 are established.
3. The HEC-1 optimization search technique should be improved to give a global solution.
4. The relationship to determine the term STRTL needs to be improved.
5. Regional values of the term CNSTL are now established.
6. The initial and constant loss rate method is not the best method but it works fairly well.
7. The results should be applied seasonally.
8. Good correlation between the parameters TC and R with basin characteristics were obtained. The recommended equations are the first in each group in Figure 5.
9. A very good comparison with a 1970 study was obtained for the terms TC and R.

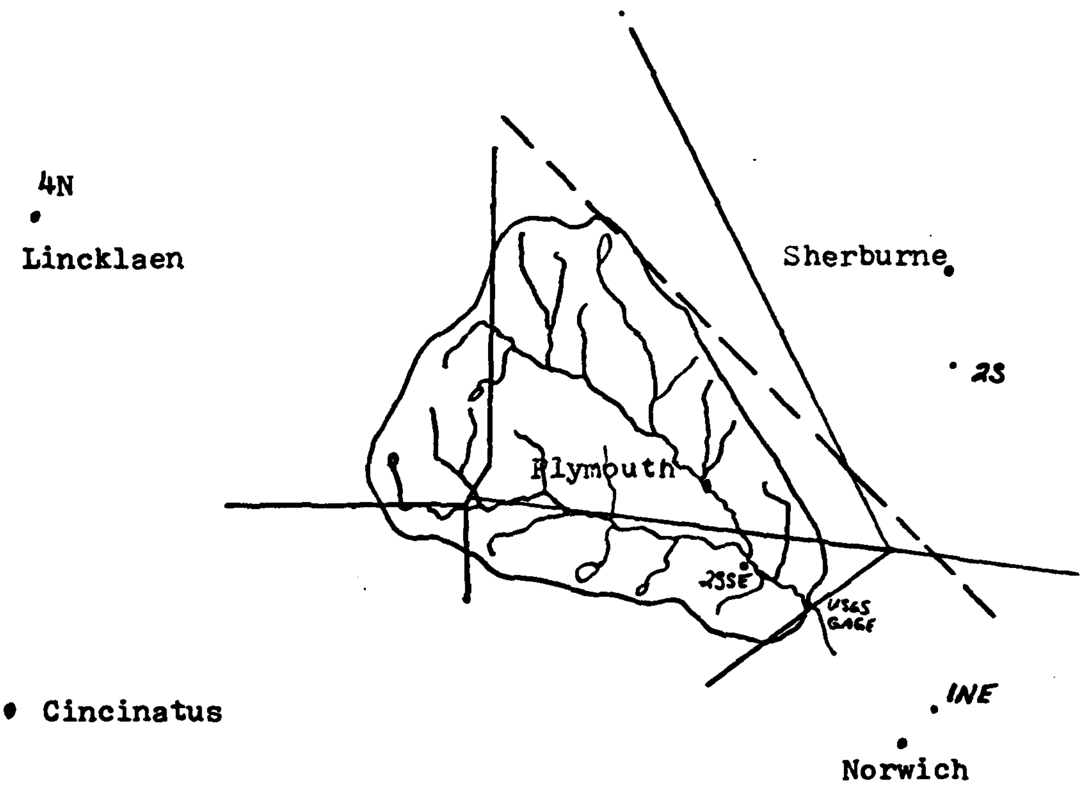
Appendix A Watershed Rain Gage Locations and Thiessen Polygons.

Recording Stations: Edmeston
Edmeston 3N

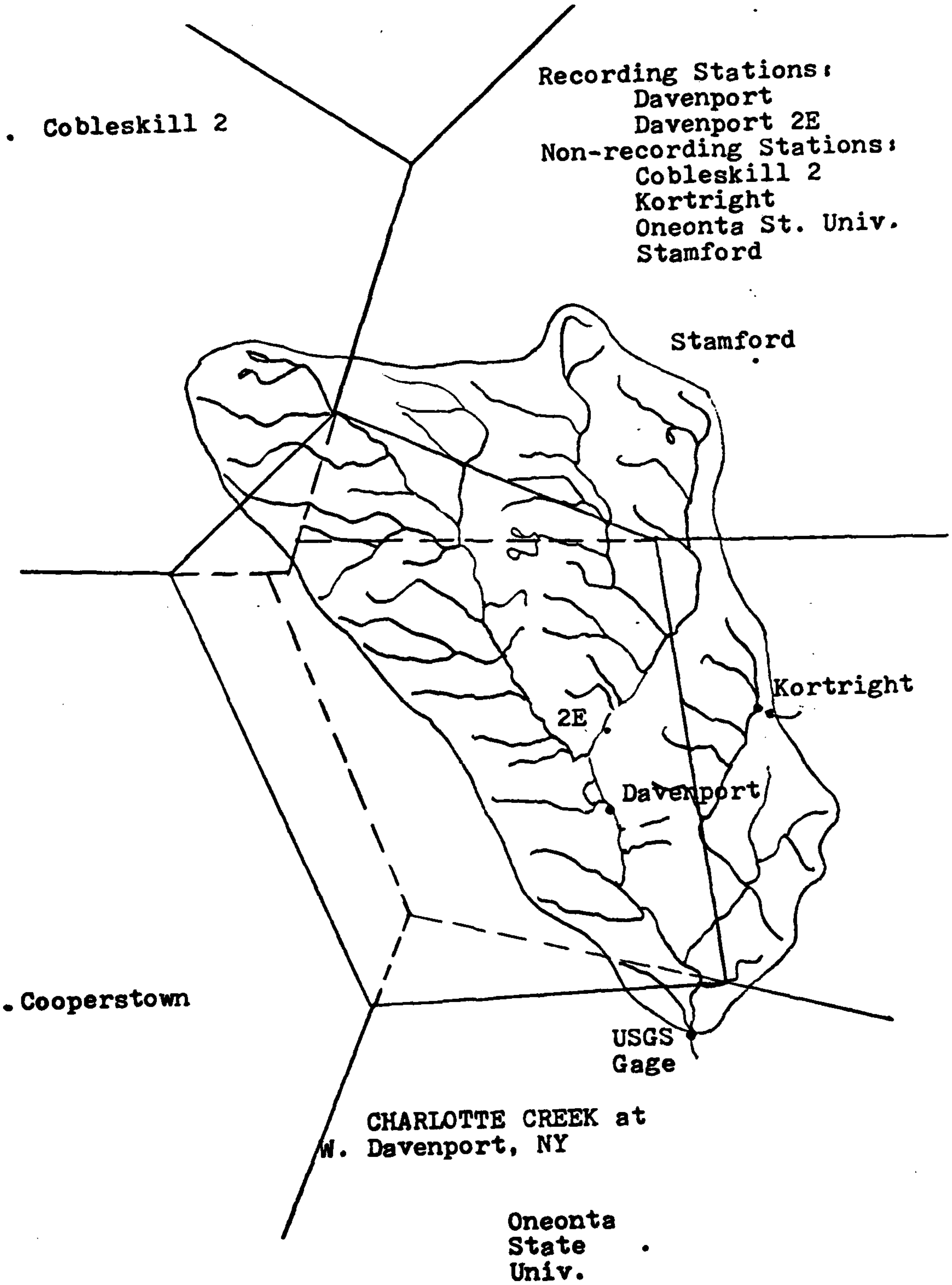
Non-recording Stations: Cooperstown
New Berlin



Recording Stations: Plymouth
Plymouth 2SSE
Non-recording Stations: Cincinatus
Lincklaen
Norwich
Norwich 1NE
Sherburne

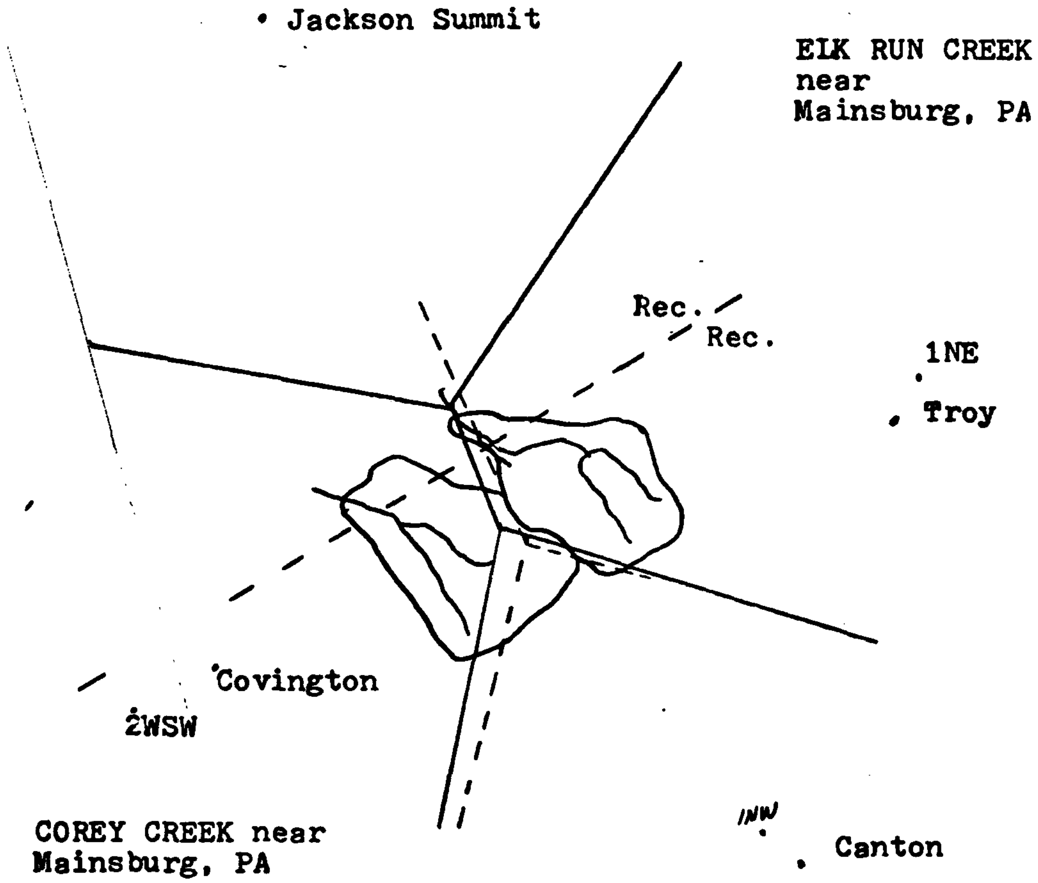


CANASAWACTA CREEK near
Plymouth, NY


Recording Stations:
Davenport
Davenport 2E
Non-recording Stations:
Cobleskill 2
Kortright
Oneonta St. Univ.
Stamford
Cobleskill 2
Stamford
Kortright
2E
Davenport
Cooperstown
USGS
Gage
CHARLOTTE CREEK at
W. Davenport, NY
Oneonta
State
Univ.

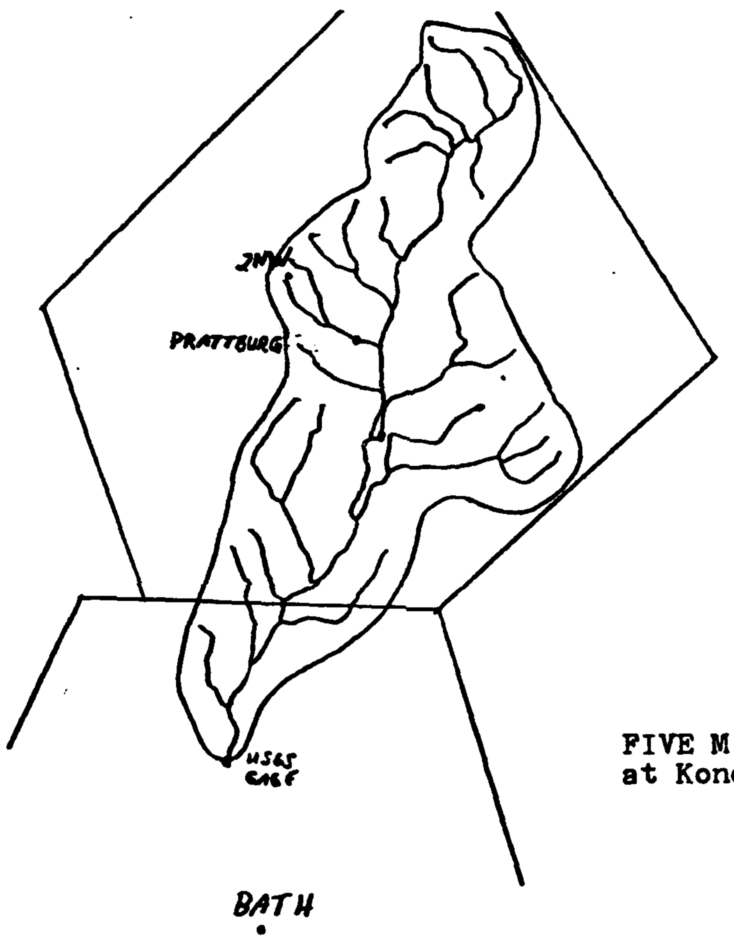
Recording Stations: Canton
Jackson Summit

Non-recording Stations: Canton
Covington
Troy



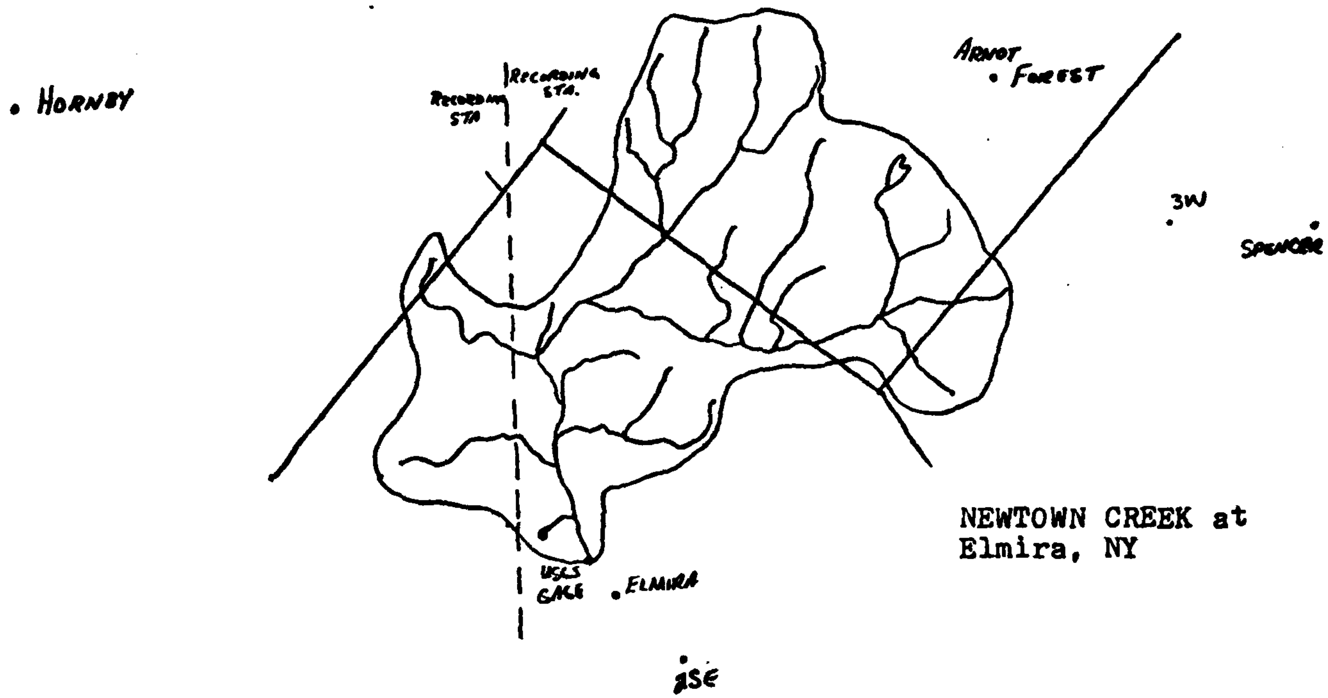
Recording Stations: None

Non-recording Stations: Bath
Prattburg



FIVE MILE CREEK
at Konona, NY

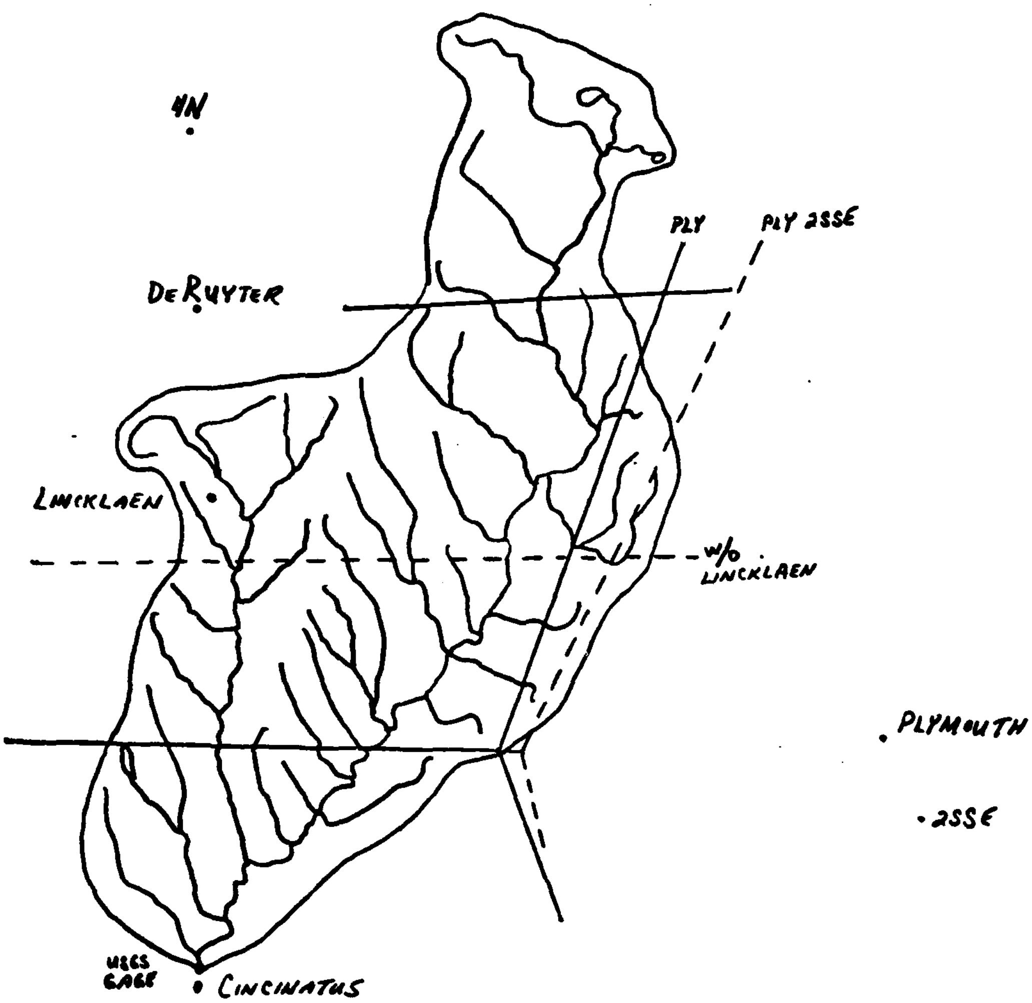
Recording Stations: Arnot Forest
Hornby
Non-recording Stations: Elmira
Spencer



NEWTOWN CREEK at
Elmira, NY

Recording Stations: Plymouth
Plymouth 2SSE

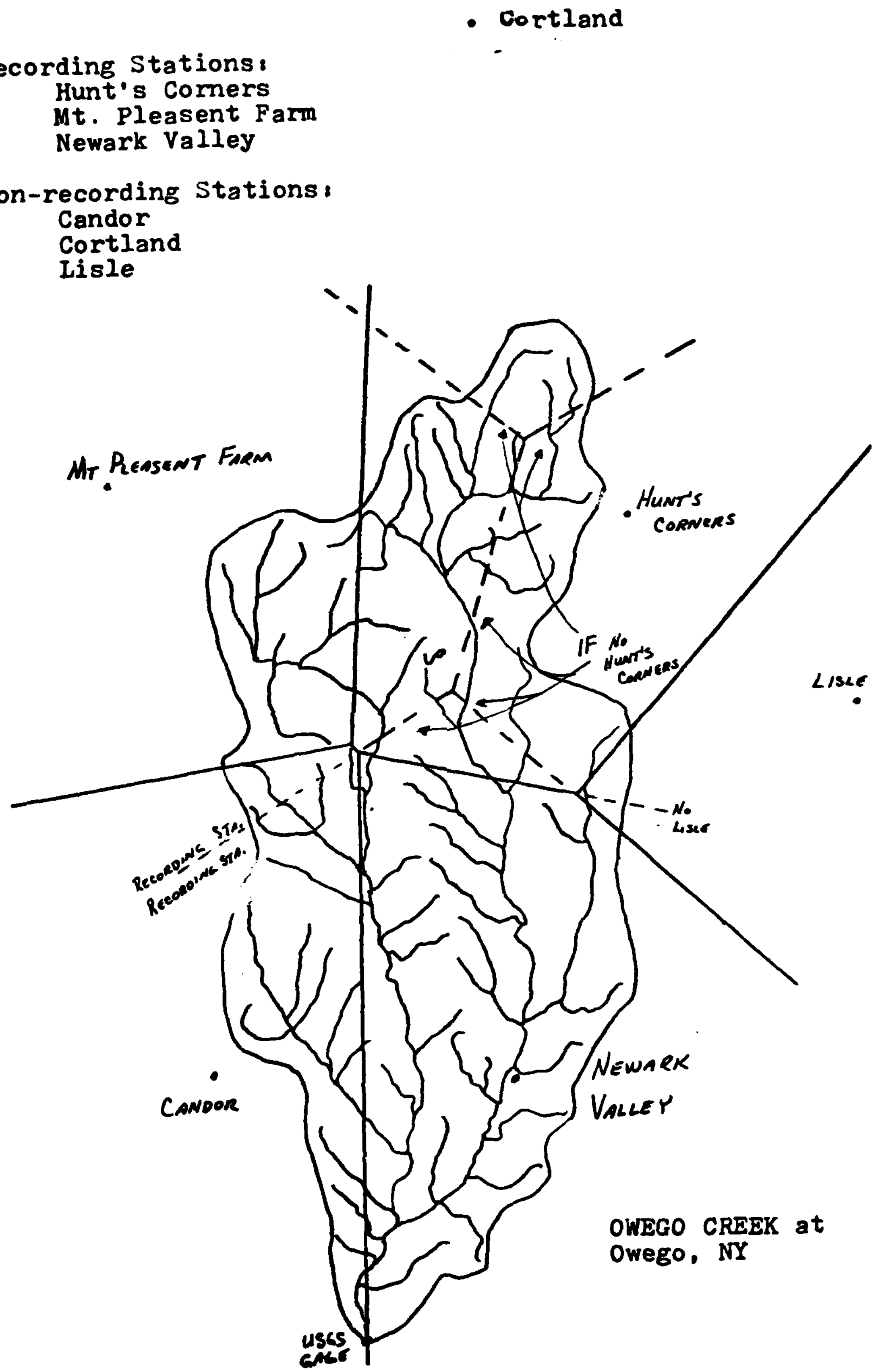
Non-recording Sta.s: Cincinatus
DeRuyter
Lincklaen



OTSELIC RIVER at
Cincinatus, NY

Recording Stations:
Hunt's Corners
Mt. Pleasent Farm
Newark Valley

Non-recording Stations:
Candor
Cortland
Lisle



OWEGO CREEK at
Owego, NY

Appendix B

Input Card Deck Description

A brief line-by-line explanation of a typical card deck used in this study follows:

ID -- (Identification card) Serves to identify job by providing an opportunity to make comments or to describe an operation to be performed.

IT -- (Identify Time periods card) Serves to establish hydrograph time axis (60 minutes), start date of storm hydrograph (24 September 1977), start time of storm hydrograph (1300 hours), and number of hydrograph ordinates which must match the total number of flowrate entries on the QO cards.

IO -- (Identify Output formats) Serves to request supression or printing of selected output, calculations, or plots.

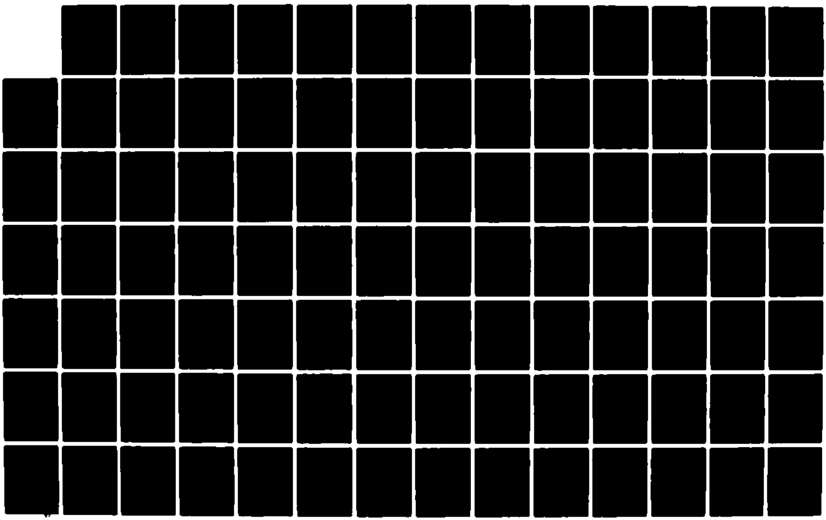
OU -- (Optimization limits for Unit hydrographs) The first number tells the program at which flood hydrograph ordinates optimization must be started. The second establishes the optimization ending ordinate.

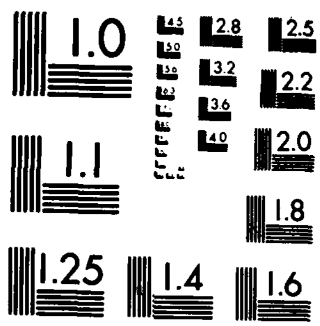
PG -- (Precipitation Gage) Serves to identify rainfall gages. If a number follows the gage name, the gage is non-recording and the number is the total storm rainfall in inches. If no amount of rainfall is given, then the gage is a recording gage and must be followed by a PI card.

AD-A129 964 WATERSHED MODELLING IN THE CHEMUNG AND UPPER SUSQUEHANNA RIVER BASINS USI..(U) ARMY MILITARY PERSONNEL CENTER ALEXANDRIA VA J C STYRON 20 MAY 83

2/4

UNCLASSIFIED F/G 8/8 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PI -- (Precipitation, Incremental) Serves to follow a recording rain gage PG card to describe the temporal rainfall distribution of the recording gage. The values are spaced at the time interval established on the IT card. The first value must represent the amount of rain falling in the first time period indicated on the IT card. The start of the rain must coincide with the start of the flood hydrograph flowrate on the QO cards.

KK -- (Kontrol Kard) Serves to identify the name of the stream gaging station at the basin outlet and to separate the precipitation data cards from the outflow data.

QO -- (Discharge (Q) Ordinate) Serves to input the observed hydrograph ordinates. The first flow value must match the first PI card entry as well as the IT card, i.e. all occur at the same instant.

PT -- (Precipitation Gage Total) Serves to identify those precipitation gages (either recording or nonrecording) which cover some fraction of the basin and contribute to the basin runoff.

PW -- (Precipitation Gage Weightings) Serves to provide the fraction of the basin covered by the gage above it.

PR -- (Precipitation Recording) Serves to identify the recording stations which are used in deriving the temporal rainfall distribution pattern.

PW -- Same as the PW card above except it represents the fraction of the basin covered only by recording stations.

BA -- (Basin Area) The first value is the drainage area while the second is the mean annual rainfall for the basin, if known.

BF -- (Base Flow) The values of STRTQ, QRCSN, and RTIOR respectively.

UC -- (Unit Hydrograph, Clark Method) The two parameters are the time of concentration (TC) and storage (R), respectively. If the numbers are positive, they remain constant throughout the calculations. If negative, the optimization routine begins with these values and then adjusts their values after removing the negative sign. If one or both are -1, then the optimization routine supplies an initial default value and then optimizes. In this model both parameters must be either positive or negative because of their interrelationship.

LU -- (Loss Rate, Initial and Uniform) The two parameters are the initial loss (STRTL) and the constant loss rate (CNSTL), respectively. The same definitions for positive and negative values apply as above, except that both do not have to be positive or negative at the same time.

ZZ -- (End of Data) HEC-1 begins calculations after all data is read into its scratch files.

Appendix C -- "Best" Fit Results

HEC-1 INPUT

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID	BUTTERNUT CREEK 10-18-75									
2	ID	UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)									
3	IT	60	17OCT75	1300	114						
4	IO	1	2								
5	OU	10	65								
6	PG	EDMES									
7	PI	.00	.00	.00	.00	.00	.01	.10	.10	.05	.10
8	PI	.20	.10	.19	.11	.16	.12	.07	.05	.03	.01
9	PI	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10	PI	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03
11	PI	.07	.05	.20	.17	.10	.02	.01	.04	.09	.02
12	PI	.05	.07	.00	.00	.00	.00	.00	.00	.00	.00
13	KK	MORRIS									
14	QO	93	93	92	92	91	91	91	92	93	97
15	QO	101	113	136	172	247	345	608	1201	1700	2050
16	QO	2489	2698	2914	3022	2974	2786	2588	2368	2130	1920
17	QO	1727	1520	1307	1053	883	775	712	667	632	600
18	QO	576	564	564	596	685	865	1113	1376	1601	1862
19	QO	1740	2090	2070	2020	1960	1940	1930	1920	1910	1890
20	QO	1817	1628	1469	1341	1225	1129	1016	928	835	780
21	QO	740	708	680	658	636	616	596	580	568	552
22	QO	540	528	513	503	489	481	467	457	447	438
23	QO	429	420	414	408	396	390	383	378	373	368
24	QO	360	355	350	345	340	336	332	328	324	322
25	QO	318	314	312	310	0	0	0	0	0	0
26	PT	EDMES									
27	PW	1.00	0.	0.	0.	0.					
28	PR	EDMES									
29	PW	1.00	0.	0.	0.	0.					
30	BA	59.7	0.								
31	BF	93.	590.	1.0191							
32	UC	-12.15	-8.								
33	LU	-0.	-0.								
34	ZZ										

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 10 THROUGH 65)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.320		26.54			
COMPUTED HYDROGRAPH	82015.	2.129	1465.	37.31	10.77	2820.	23.00
OBSERVED HYDROGRAPH	79287.	2.058	1416.	39.40	12.86	3022.	23.00
DIFFERENCE	2728.	0.071	49.	-2.09	-2.09	-202.	0.00
PERCENT DIFFERENCE	3.44				-16.23	-6.67	

STANDARD ERROR	291.	AVERAGE ABSOLUTE ERROR	222.
OBJECTIVE FUNCTION	268.	AVERAGE PERCENT ABSOLUTE ERROR	40.58

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 114)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.320		26.54			
COMPUTED HYDROGRAPH	104896.	2.723	920.	47.17	20.63	2820.	23.00
OBSERVED HYDROGRAPH	104605.	2.715	918.	49.84	23.30	3022.	23.00
DIFFERENCE	291.	0.008	3.	-2.67	-2.67	-202.	0.00
PERCENT DIFFERENCE	0.28				-11.47	-6.67	

STANDARD ERROR	208.	AVERAGE ABSOLUTE ERROR	130.
OBJECTIVE FUNCTION	236.	AVERAGE PERCENT ABSOLUTE ERROR	26.04

UNIT HYDROGRAPH
58 END-OF-PERIOD ORDINATES

64.	240.	487.	772.	1082.	1406.	1721.	1984.	2179.	2295.
2341.	2295.	2135.	1925.	1735.	1564.	1413.	1271.	1146.	1033.
931.	839.	756.	682.	615.	554.	499.	450.	406.	366.
330.	297.	268.	242.	218.	196.	177.	159.	144.	130.
117.	105.	95.	86.	77.	70.	63.	57.	51.	46.
41.	37.	34.	30.	27.	25.	22.	20.		

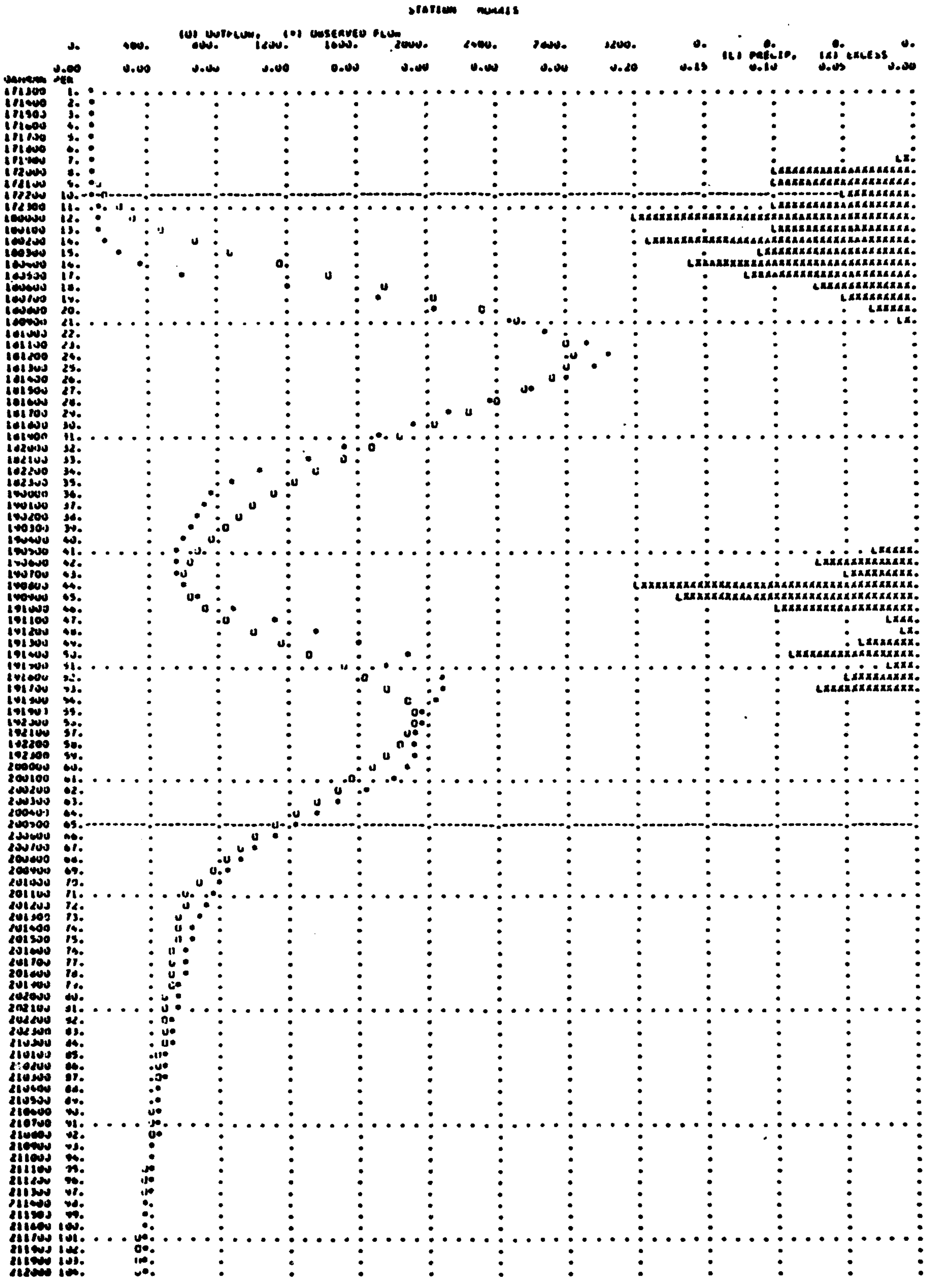
HYDROGRAPH AT STATION MORRIS

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
17 OCT 1300	1	0.00	0.00	0.00	93.	93.
17 OCT 1400	2	0.00	0.00	0.00	91.	93.
17 OCT 1500	3	0.00	0.00	0.00	90.	92.
17 OCT 1600	4	0.00	0.00	0.00	88.	92.
17 OCT 1700	5	0.00	0.00	0.00	86.	91.
17 OCT 1800	6	0.00	0.00	0.00	85.	91.
17 OCT 1900	7	0.01	0.00	0.01	84.	91.
17 OCT 2000	8	0.10	0.00	0.10	90.	92.
17 OCT 2100	9	0.10	0.00	0.10	115.	93.
17 OCT 2200	10	0.05	0.00	0.05	162.	97.
17 OCT 2300	11	0.10	0.00	0.10	232.	101.
18 OCT 0000	12	0.20	0.00	0.20	336.	113.
18 OCT 0100	13	0.10	0.00	0.10	482.	136.
18 OCT 0200	14	0.19	0.00	0.19	670.	172.
18 OCT 0300	15	0.11	0.00	0.11	898.	247.
18 OCT 0400	16	0.16	0.00	0.16	1156.	345.
18 OCT 0500	17	0.12	0.00	0.12	1446.	608.
18 OCT 0600	18	0.07	0.00	0.07	1748.	1201.
18 OCT 0700	19	0.05	0.00	0.05	2040.	1700.
18 OCT 0800	20	0.03	0.00	0.03	2303.	2050.
18 OCT 0900	21	0.01	0.00	0.01	2523.	2489.
18 OCT 1000	22	0.00	0.00	0.00	2685.	2698.
18 OCT 1100	23	0.00	0.00	0.00	2788.	2914.
18 OCT 1200	24	0.00	0.00	0.00	2820.	3022.
18 OCT 1300	25	0.00	0.00	0.00	2789.	2974.
18 OCT 1400	26	0.00	0.00	0.00	2702.	2786.
18 OCT 1500	27	0.00	0.00	0.00	2570.	2584.
18 OCT 1600	28	0.00	0.00	0.00	2406.	2368.
18 OCT 1700	29	0.00	0.00	0.00	2221.	2130.
18 OCT 1800	30	0.00	0.00	0.00	2032.	1920.
18 OCT 1900	31	0.00	0.00	0.00	1848.	1727.
18 OCT 2000	32	0.00	0.00	0.00	1674.	1520.
18 OCT 2100	33	0.00	0.00	0.00	1514.	1307.
18 OCT 2200	34	0.00	0.00	0.00	1368.	1053.
18 OCT 2300	35	0.00	0.00	0.00	1237.	883.
19 OCT 0000	36	0.00	0.00	0.00	1119.	775.
19 OCT 0100	37	0.00	0.00	0.00	1013.	712.
19 OCT 0200	38	0.00	0.00	0.00	917.	667.
19 OCT 0300	39	0.00	0.00	0.00	830.	632.
19 OCT 0400	40	0.00	0.00	0.00	752.	600.
19 OCT 0500	41	0.03	0.00	0.03	683.	576.
19 OCT 0600	42	0.07	0.00	0.07	629.	564.
19 OCT 0700	43	0.05	0.00	0.05	595.	564.
19 OCT 0800	44	0.20	0.00	0.20	590.	596.
19 OCT 0900	45	0.17	0.00	0.17	631.	685.
19 OCT 1000	46	0.10	0.00	0.10	720.	865.
19 OCT 1100	47	0.02	0.00	0.02	848.	1113.
19 OCT 1200	48	0.01	0.00	0.01	999.	1376.
19 OCT 1300	49	0.04	0.00	0.04	1163.	1601.
19 OCT 1400	50	0.09	0.00	0.09	1335.	1662.
19 OCT 1500	51	0.02	0.00	0.02	1503.	1740.
19 OCT 1600	52	0.05	0.00	0.05	1653.	2090.
19 OCT 1700	53	0.07	0.00	0.07	1775.	2070.
19 OCT 1800	54	0.00	0.00	0.00	1864.	2020.
19 OCT 1900	55	0.00	0.00	0.00	1916.	1960.
19 OCT 2000	56	0.00	0.00	0.00	1921.	1940.
19 OCT 2100	57	0.00	0.00	0.00	1885.	1930.
19 OCT 2200	58	0.00	0.00	0.00	1825.	1920.
19 OCT 2300	59	0.00	0.00	0.00	1753.	1910.
20 OCT 0000	60	0.00	0.00	0.00	1671.	1890.
20 OCT 0100	61	0.00	0.00	0.00	1577.	1817.
20 OCT 0200	62	0.00	0.00	0.00	1471.	1628.
20 OCT 0300	63	0.00	0.00	0.00	1358.	1469.
20 OCT 0400	64	0.00	0.00	0.00	1243.	1341.
20 OCT 0500	65	0.00	0.00	0.00	1127.	1225.
20 OCT 0600	66	0.00	0.00	0.00	1016.	1129.
20 OCT 0700	67	0.00	0.00	0.00	916.	1016.
20 OCT 0800	68	0.00	0.00	0.00	827.	928.
20 OCT 0900	69	0.00	0.00	0.00	746.	835.
20 OCT 1000	70	0.00	0.00	0.00	671.	780.
20 OCT 1100	71	0.00	0.00	0.00	605.	740.
20 OCT 1200	72	0.00	0.00	0.00	582.	708.
20 OCT 1300	73	0.00	0.00	0.00	571.	680.
20 OCT 1400	74	0.00	0.00	0.00	560.	658.
20 OCT 1500	75	0.00	0.00	0.00	550.	636.
20 OCT 1600	76	0.00	0.00	0.00	539.	616.
20 OCT 1700	77	0.00	0.00	0.00	529.	596.
20 OCT 1800	78	0.00	0.00	0.00	519.	580.
20 OCT 1900	79	0.00	0.00	0.00	510.	568.
20 OCT 2000	80	0.00	0.00	0.00	500.	552.
20 OCT 2100	81	0.00	0.00	0.00	491.	540.
20 OCT 2200	82	0.00	0.00	0.00	481.	528.
20 OCT 2300	83	0.00	0.00	0.00	472.	513.
21 OCT 0000	84	0.00	0.00	0.00	464.	503.
21 OCT 0100	85	0.00	0.00	0.00	455.	489.
21 OCT 0200	86	0.00	0.00	0.00	446.	481.
21 OCT 0300	87	0.00	0.00	0.00	438.	467.
21 OCT 0400	88	0.00	0.00	0.00	430.	457.
21 OCT 0500	89	0.00	0.00	0.00	422.	447.
21 OCT 0600	90	0.00	0.00	0.00	414.	438.
21 OCT 0700	91	0.00	0.00	0.00	406.	429.
21 OCT 0800	92	0.00	0.00	0.00	398.	420.
21 OCT 0900	93	0.00	0.00	0.00	391.	414.
21 OCT 1000	94	0.00	0.00	0.00	384.	408.
21 OCT 1100	95	0.00	0.00	0.00	376.	396.
21 OCT 1200	96	0.00	0.00	0.00	369.	390.
21 OCT 1300	97	0.00	0.00	0.00	362.	383.
21 OCT 1400	98	0.00	0.00	0.00	356.	378.
21 OCT 1500	99	0.00	0.00	0.00	349.	373.
21 OCT 1600	100	0.00	0.00	0.00	342.	368.
21 OCT 1700	101	0.00	0.00	0.00	336.	360.
21 OCT 1800	102	0.00	0.00	0.00	330.	355.
21 OCT 1900	103	0.00	0.00	0.00	324.	350.
21 OCT 2000	104	0.00	0.00	0.00	317.	345.
21 OCT 2100	105	0.00	0.00	0.00	312.	340.
21 OCT 2200	106	0.00	0.00	0.00	306.	336.
21 OCT 2300	107	0.00	0.00	0.00	300.	332.
22 OCT 0000	108	0.00	0.00	0.00	294.	328.
22 OCT 0100	109	0.00	0.00	0.00	289.	324.
22 OCT 0200	110	0.00	0.00	0.00	283.	322.
22 OCT 0300	111	0.00	0.00	0.00	278.	318.
22 OCT 0400	112	0.00	0.00	0.00	273.	314.
22 OCT 0500	113	0.00	0.00	0.00	268.	312.
22 OCT 0600	114	0.00	0.00	0.00	263.	310.

TOTAL RAINFALL = 2.32, TOTAL LOSS = 0.00, TOTAL EXCESS = 2.32

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	113.00-HR
2820.	23.00	(CFS)	2721.	1908.	1289.	927.
		(INCHES)	0.424	1.188	2.409	2.718
		(AC-FT)	1349.	3784.	7671.	8654.

CUMULATIVE AREA = 59.70 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 400. 800. 1200. 1600. 2000. 2400. 2800. 3200.
(L) PRECIP, (X) EXCESS

```
LINE    10.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1     ID        BUTTERNUT CREEK 10-09-76
  2     ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)

  3     IT      60 07OCT76    1700     105
  4     IO       1       2
  5     OU      35      60
  6     PG      NB    2.11
  7     PG      ED
  8     PI     .00     .00     .00     .00     .02     .03     .09     .06     .06     .15
  9     PI     .01     .03     .01     .01     .01     .00     .00     .00     .01     .01
 10     PI     .02     .01     .01     .00     .00     .00     .00     .05     .00     .06
 11     PI     .01     .02     .01     .04     .14     .13     .11     .14     .09     .17
 12     PI     .21     .17     .33     .32     .10     .05     .00     .00     .01     .02
 13     PG    ED3N
 14     PI     .00     .00     .00     .00     .00     .00      .2      .1      .1      .1
 15     PI      .1      .0      .1      .0      .0      .0      .0      .0      .0      .0
 16     PI      .0      .0      .1      .0      .0      .0      .0      .0      .0      .1
 17     PI      .0      .0      .0      .0      .1      .2      .1      .1      .2      .1
 18     PI      .2      .2      .4      .3      .1      .0      .1      .0      .0      .0

 19     KK  MORRIS
 20     QO      34      34      34      34      34      33      33      33      34      34
 21     QO      35      35      36      37      38      39      41      43      47      51
 22     QO      53      55      56      58      59      59      59      59      60      60
 23     QO      60      59      60      61      63      67      74      85     104     132
 24     QO     183     266     378     564     921    1538    1862    2324    2632    2866
 25     QO    3106    3242    3268    3154    2914    2632    2368    2140    1940    1727
 26     QO    1478    1177     915     725     654     600     564     528     494     471
 27     QO     447     429     414     399     385     373     362     353     343     334
 28     QO     328     322     314     308     302     294     290     286     280     276
 29     QO     272     266     262     258     255     251     247     246     242     238
 30     QO     235     231     229     226     224       0       0       0       0       0
 31     PT      NB      ED    ED3N
 32     PW     .30     .58     .12      .0      .0
 33     PR      ED    ED3N       0       0       0
 34     PW     .88     .12      .0      .0      .0
 35     UA    59.7      0.
 36     BF     34.    400.  1.0191
 37     UC  -12.53   -8.07
 38     LU    -.35    -.03
 39     ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 35 THROUGH 60)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.276		41.94			
COMPUTED HYDROGRAPH	40550.	1.053	1560.	51.84	9.91	3008.	52.00
OBSERVED HYDROGRAPH	40550.	1.053	1560.	52.25	10.31	3268.	52.00
DIFFERENCE	0.	0.000	0.	-0.40	-0.40	-260.	0.00
PERCENT DIFFERENCE	0.00				-3.88	-7.96	

STANDARD ERROR	176.	AVERAGE ABSOLUTE ERROR	137.
OBJECTIVE FUNCTION	174.	AVERAGE PERCENT ABSOLUTE ERROR	29.87

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 105)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.276		41.94			
COMPUTED HYDROGRAPH	58674.	1.523	559.	58.64	16.70	3008.	52.00
OBSERVED HYDROGRAPH	60239.	1.564	574.	58.84	16.90	3268.	52.00
DIFFERENCE	-1565.	-0.041	-15.	-0.20	-0.20	-260.	0.00
PERCENT DIFFERENCE	-2.60				-1.19	-7.96	

STANDARD ERROR	92.	AVERAGE ABSOLUTE ERROR	47.
OBJECTIVE FUNCTION	146.	AVERAGE PERCENT ABSOLUTE ERROR	15.28

UNIT HYDROGRAPH
41 END-OF-PERIOD ORDINATES

79.	289.	576.	897.	1234.	1577.	1919.	2231.	2469.	2620.
2691.	2686.	2603.	2411.	2113.	1800.	1533.	1305.	1112.	947.
806.	687.	585.	498.	424.	361.	308.	262.	223.	190.
162.	138.	117.	100.	85.	73.	62.	53.	45.	38.
32.									

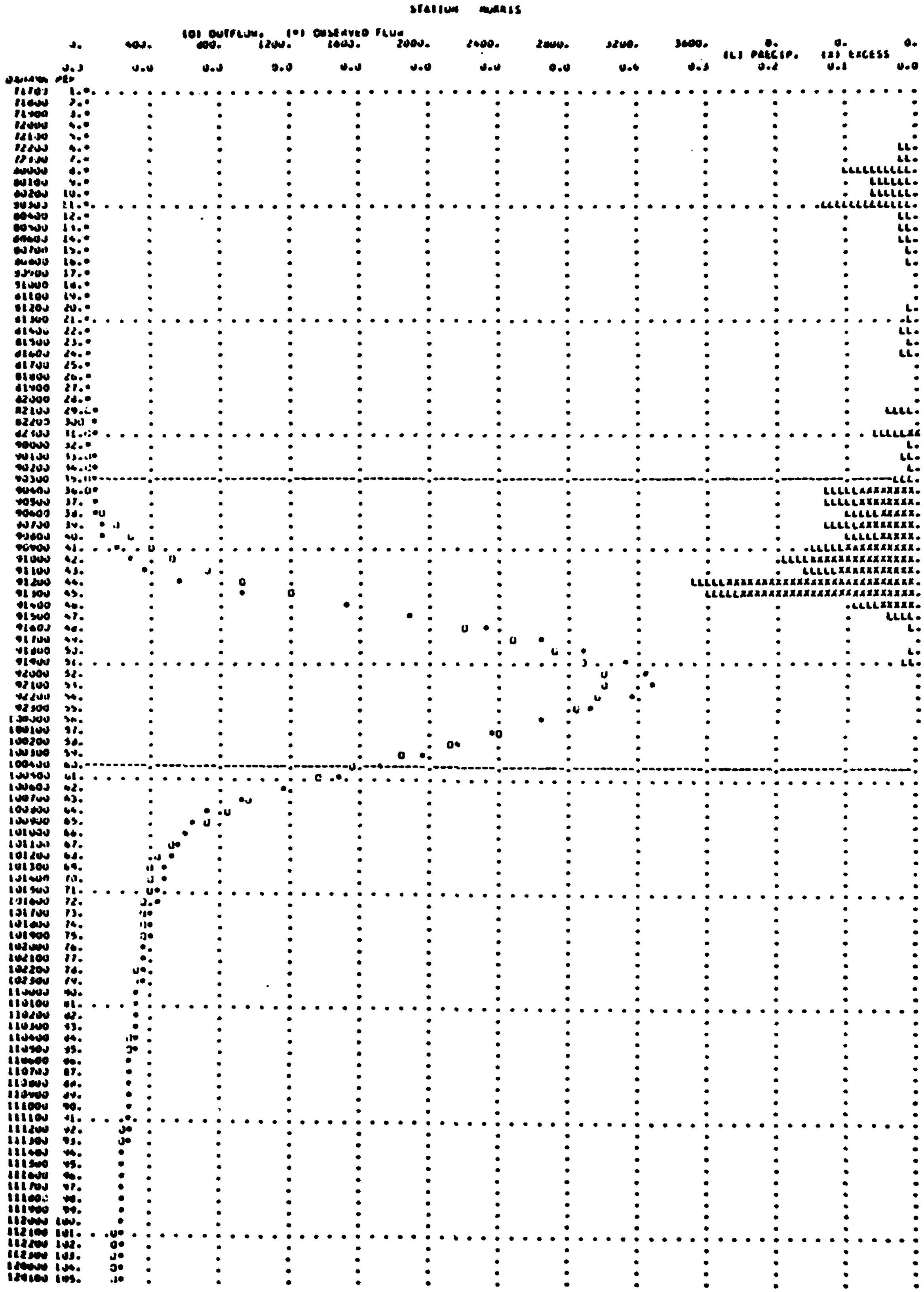
HYDROGRAPH AT STATION RUKKIS

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7 OCT 1700	1	0.00	0.00	0.00	34.	34.
7 OCT 1800	2	0.00	0.00	0.00	33.	34.
7 OCT 1900	3	0.00	0.00	0.00	33.	34.
7 OCT 2000	4	0.00	0.00	0.00	32.	34.
7 OCT 2100	5	0.00	0.00	0.00	32.	34.
7 OCT 2200	6	0.02	0.02	0.00	31.	33.
7 OCT 2300	7	0.02	0.02	0.00	30.	33.
8 OCT 0000	8	0.10	0.10	0.00	30.	33.
8 OCT 0100	9	0.06	0.06	0.00	29.	34.
8 OCT 0200	10	0.06	0.06	0.00	29.	34.
8 OCT 0300	11	0.13	0.13	0.00	28.	35.
8 OCT 0400	12	0.02	0.02	0.00	28.	35.
8 OCT 0500	13	0.02	0.02	0.00	27.	36.
8 OCT 0600	14	0.02	0.02	0.00	27.	37.
8 OCT 0700	15	0.01	0.01	0.00	26.	38.
8 OCT 0800	16	0.01	0.01	0.00	26.	39.
8 OCT 0900	17	0.00	0.00	0.00	25.	41.
8 OCT 1000	18	0.00	0.00	0.00	25.	43.
8 OCT 1100	19	0.00	0.00	0.00	24.	47.
8 OCT 1200	20	0.01	0.01	0.00	24.	51.
8 OCT 1300	21	0.01	0.01	0.00	23.	53.
8 OCT 1400	22	0.02	0.02	0.00	23.	55.
8 OCT 1500	23	0.01	0.01	0.00	22.	56.
8 OCT 1600	24	0.02	0.02	0.00	22.	58.
8 OCT 1700	25	0.00	0.00	0.00	22.	59.
8 OCT 1800	26	0.00	0.00	0.00	21.	59.
8 OCT 1900	27	0.00	0.00	0.00	21.	59.
8 OCT 2000	28	0.00	0.00	0.00	20.	59.
8 OCT 2100	29	0.04	0.04	0.00	20.	60.
8 OCT 2200	30	0.00	0.00	0.00	20.	60.
8 OCT 2300	31	0.06	0.05	0.01	20.	60.
9 OCT 0000	32	0.01	0.01	0.00	22.	59.
9 OCT 0100	33	0.02	0.02	0.00	26.	60.
9 OCT 0200	34	0.01	0.01	0.00	29.	61.
9 OCT 0300	35	0.03	0.03	0.00	33.	63.
9 OCT 0400	36	0.13	0.05	0.08	43.	67.
9 OCT 0500	37	0.13	0.05	0.08	70.	74.
9 OCT 0600	38	0.10	0.05	0.05	117.	85.
9 OCT 0700	39	0.13	0.05	0.08	185.	104.
9 OCT 0800	40	0.10	0.05	0.05	275.	132.
9 OCT 0900	41	0.15	0.05	0.10	387.	183.
9 OCT 1000	42	0.19	0.05	0.15	532.	266.
9 OCT 1100	43	0.16	0.05	0.11	712.	378.
9 OCT 1200	44	0.32	0.05	0.27	935.	564.
9 OCT 1300	45	0.30	0.05	0.25	1212.	921.
9 OCT 1400	46	0.09	0.05	0.05	1533.	1538.
9 OCT 1500	47	0.04	0.04	0.00	1867.	1862.
9 OCT 1600	48	0.01	0.01	0.00	2189.	2324.
9 OCT 1700	49	0.00	0.00	0.00	2476.	2632.
9 OCT 1800	50	0.01	0.01	0.00	2712.	2866.
9 OCT 1900	51	0.02	0.02	0.00	2885.	3106.
9 OCT 2000	52	0.00	0.00	0.00	2986.	3242.
9 OCT 2100	53	0.00	0.00	0.00	3008.	3268.
9 OCT 2200	54	0.00	0.00	0.00	2955.	3154.
9 OCT 2300	55	0.00	0.00	0.00	2832.	2914.
10 OCT 0000	56	0.00	0.00	0.00	2647.	2632.
10 OCT 0100	57	0.00	0.00	0.00	2411.	2368.
10 OCT 0200	58	0.00	0.00	0.00	2134.	2140.
10 OCT 0300	59	0.00	0.00	0.00	1842.	1940.
10 OCT 0400	60	0.00	0.00	0.00	1573.	1727.
10 OCT 0500	61	0.00	0.00	0.00	1341.	1474.
10 OCT 0600	62	0.00	0.00	0.00	1144.	1177.
10 OCT 0700	63	0.00	0.00	0.00	975.	915.
10 OCT 0800	64	0.00	0.00	0.00	832.	725.
10 OCT 0900	65	0.00	0.00	0.00	710.	654.
10 OCT 1000	66	0.00	0.00	0.00	606.	600.
10 OCT 1100	67	0.00	0.00	0.00	517.	564.
10 OCT 1200	68	0.00	0.00	0.00	442.	528.
10 OCT 1300	69	0.00	0.00	0.00	397.	499.
10 OCT 1400	70	0.00	0.00	0.00	390.	471.
10 OCT 1500	71	0.00	0.00	0.00	383.	447.
10 OCT 1600	72	0.00	0.00	0.00	375.	429.
10 OCT 1700	73	0.00	0.00	0.00	368.	414.
10 OCT 1800	74	0.00	0.00	0.00	362.	399.
10 OCT 1900	75	0.00	0.00	0.00	355.	385.
10 OCT 2000	76	0.00	0.00	0.00	348.	373.
10 OCT 2100	77	0.00	0.00	0.00	342.	362.
10 OCT 2200	78	0.00	0.00	0.00	335.	353.
10 OCT 2300	79	0.00	0.00	0.00	329.	343.
11 OCT 0000	80	0.00	0.00	0.00	323.	334.
11 OCT 0100	81	0.00	0.00	0.00	317.	328.
11 OCT 0200	82	0.00	0.00	0.00	311.	322.
11 OCT 0300	83	0.00	0.00	0.00	305.	314.
11 OCT 0400	84	0.00	0.00	0.00	299.	308.
11 OCT 0500	85	0.00	0.00	0.00	294.	302.
11 OCT 0600	86	0.00	0.00	0.00	288.	294.
11 OCT 0700	87	0.00	0.00	0.00	283.	290.
11 OCT 0800	88	0.00	0.00	0.00	277.	284.
11 OCT 0900	89	0.00	0.00	0.00	272.	280.
11 OCT 1000	90	0.00	0.00	0.00	267.	276.
11 OCT 1100	91	0.00	0.00	0.00	262.	272.
11 OCT 1200	92	0.00	0.00	0.00	257.	266.
11 OCT 1300	93	0.00	0.00	0.00	252.	262.
11 OCT 1400	94	0.00	0.00	0.00	248.	258.
11 OCT 1500	95	0.00	0.00	0.00	243.	255.
11 OCT 1600	96	0.00	0.00	0.00	238.	251.
11 OCT 1700	97	0.00	0.00	0.00	234.	247.
11 OCT 1800	98	0.00	0.00	0.00	230.	244.
11 OCT 1900	99	0.00	0.00	0.00	225.	242.
11 OCT 2000	100	0.00	0.00	0.00	221.	238.
11 OCT 2100	101	0.00	0.00	0.00	217.	235.
11 OCT 2200	102	0.00	0.00	0.00	213.	231.
11 OCT 2300	103	0.00	0.00	0.00	209.	229.
12 OCT 0000	104	0.00	0.00	0.00	205.	226.
12 OCT 0100	105	0.00	0.00	0.00	201.	224.

TOTAL RAINFALL = 2.57, TOTAL LOSS = 1.29, TOTAL EXCESS = 1.28

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	104.00-HR
3268.	52.00	(CFS)	2891.	1853.	802.	563.
		(INCHES)	0.450	1.154	1.499	1.520
		(AC-FT)	1433.	3676.	4771.	4839.

CUMULATIVE AREA = 59.70 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 400. 800. 1200. 1600. 2000. 2400. 2800. 3200. 3600.
(L) PRECIP. (X) EXCESS

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                              HEC-1 INPUT                                        PAGE  1

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1       ID        BUTTERNUT CREEK 10-21-76
  2       ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)

  3       IT      60 20OCT76    0100     101
  4       IO       1       2
  5       QU      15      45
  6       PG      NB    2.69
  7       PG      ED
  8       PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .01
  9       PI     .08     .02     .04     .03     .05     .07     .11     .18     .18     .08
 10       PI     .07     .09     .03     .29     .40     .21     .11     .10     .04     .00
 11       PG    ED3N
 12       PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 13       PI     .10     .10     .00     .00     .10     .10     .10     .10     .20     .10
 14       PI     .10     .10     .10     .20     .00     .00     .00     .00     .00     .00

 15       KK  MORRIS
 16       QO     148     148     148     146     146     145     145     145     143     145
 17       QO     146     148     153     158     166     177     190     208     237     284
 18       QO     355     475     636     808    1038    1367    1754    2080    2522    2950
 19       QO    3268    3502    3622    3692    3650    3515    3294    3106    2890    2698
 20       QO    2522    2313    2050    1745    1461    1233    1068     957     877     819
 21       QO     770     735     703     676     649     628     608     588     568     548
 22       QO     532     513     503     489     475     461     450     438     432     420
 23       QO     411     402     393     387     380     375     368     362     358     350
 24       QO     345     340     336     332     328     324     320     316     312     310
 25       QO     306     302     298     294     290     288     284     282     278     276
 26       QO     274       0       0       0       0       0       0       0       0       0
 27       PT      NB      ED    ED3N
 28       PW     .30     .58     .12      .0      .0
 29       PR      ED    ED3N       0       0       0
 30       PW     .88     .12      .0      .0      .0
 31       BA    59.7      0.
 32       BF    148.    340.  1.0191
 33       UC    -11.    -13.
 34       LU     -0.     -0.
 35       ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 15 THROUGH 45)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.245		22.51			
COMPUTED HYDROGRAPH	63347.	1.644	2043.	33.72	11.21	3511.	34.00
OBSERVED HYDROGRAPH	58575.	1.520	1890.	34.27	11.77	3692.	33.00
DIFFERENCE	4772.	0.124	154.	-0.56	-0.56	-181.	1.00
PERCENT DIFFERENCE	8.15				-4.72	-4.91	

STANDARD ERROR	281.	AVERAGE ABSOLUTE ERROR	229.
OBJECTIVE FUNCTION	254.	AVERAGE PERCENT ABSOLUTE ERROR	32.81

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 101)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.245		22.51			
COMPUTED HYDROGRAPH	95982.	2.491	950.	42.39	19.88	3511.	34.00
OBSERVED HYDROGRAPH	87000.	2.258	861.	43.60	21.09	3692.	33.00
DIFFERENCE	8982.	0.233	89.	-1.21	-1.21	-181.	1.00
PERCENT DIFFERENCE	10.32				-5.74	-4.91	

STANDARD ERROR	238.	AVERAGE ABSOLUTE ERROR	160.
OBJECTIVE FUNCTION	275.	AVERAGE PERCENT ABSOLUTE ERROR	29.92

UNIT HYDROGRAPH
81 END-OF-PERIOD ORDINATES

51.	193.	396.	634.	898.	1177.	1436.	1644.	1796.	1888.
1901.	1821.	1696.	1579.	1471.	1370.	1276.	1188.	1107.	1031.
963.	899.	832.	775.	722.	672.	626.	583.	543.	506.
471.	439.	409.	381.	354.	330.	307.	286.	267.	248.
231.	215.	201.	187.	174.	162.	151.	141.	131.	122.
114.	106.	98.	92.	85.	80.	74.	69.	64.	60.
56.	52.	48.	45.	42.	39.	36.	34.	32.	29.
27.	25.	24.	22.	21.	19.	18.	17.	15.	14.
13.									

HYDROGRAPH AT STATION MORRIS

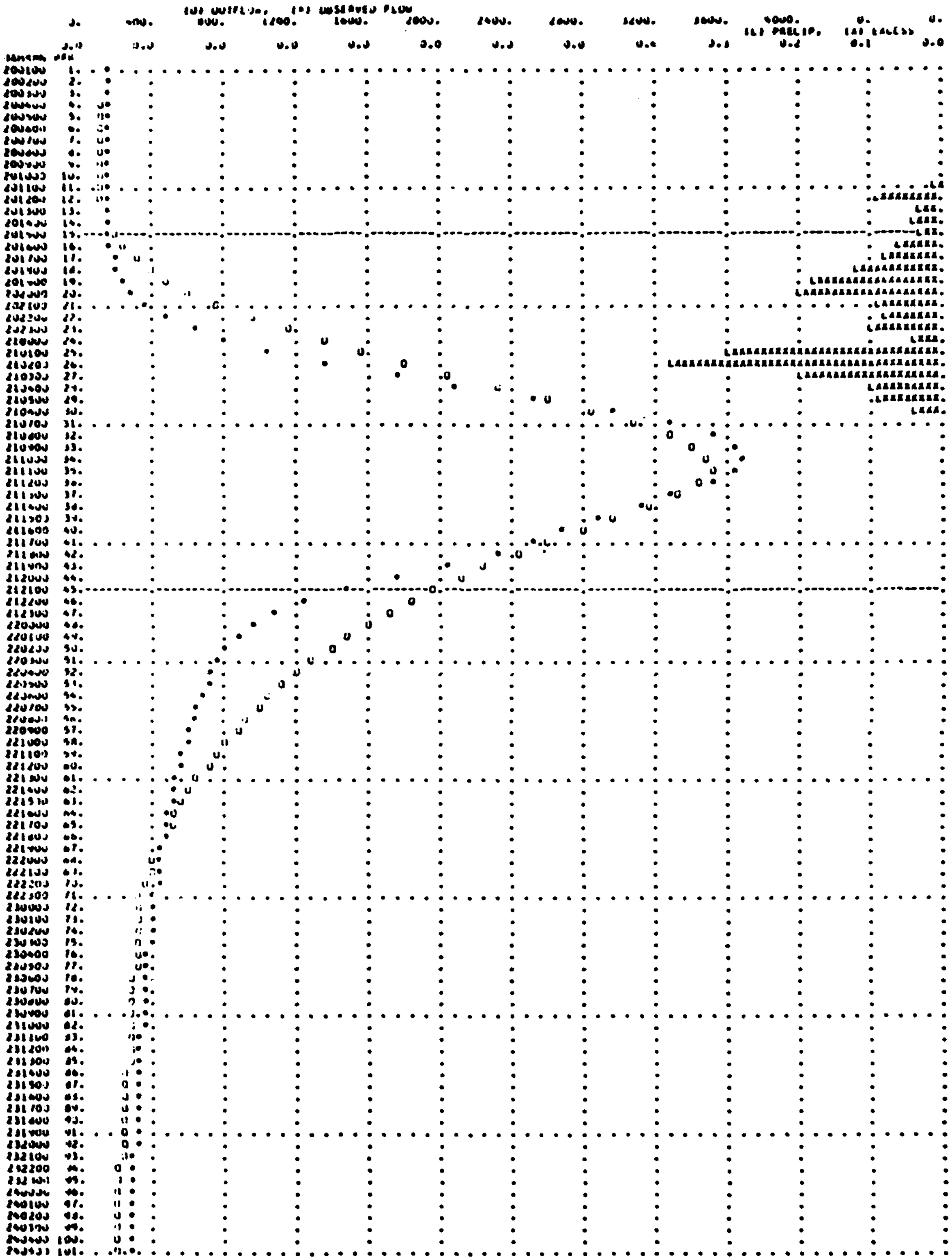
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
20 OCT 0100	1	0.00	0.00	0.00	148.	148.
20 OCT 0200	2	0.00	0.00	0.00	145.	148.
20 OCT 0300	3	0.00	0.00	0.00	143.	146.
20 OCT 0400	4	0.00	0.00	0.00	140.	146.
20 OCT 0500	5	0.00	0.00	0.00	137.	146.
20 OCT 0600	6	0.00	0.00	0.00	135.	145.
20 OCT 0700	7	0.00	0.00	0.00	132.	145.
20 OCT 0800	8	0.00	0.00	0.00	130.	145.
20 OCT 0900	9	0.00	0.00	0.00	127.	143.
20 OCT 1000	10	0.00	0.00	0.00	125.	145.
20 OCT 1100	11	0.01	0.00	0.01	123.	146.
20 OCT 1200	12	0.09	0.00	0.09	127.	148.
20 OCT 1300	13	0.03	0.00	0.03	140.	153.
20 OCT 1400	14	0.04	0.00	0.04	165.	158.
20 OCT 1500	15	0.03	0.00	0.03	199.	166.
20 OCT 1600	16	0.06	0.00	0.06	245.	177.
20 OCT 1700	17	0.08	0.00	0.08	306.	190.
20 OCT 1800	18	0.12	0.00	0.12	384.	208.
20 OCT 1900	19	0.18	0.00	0.18	484.	237.
20 OCT 2000	20	0.20	0.00	0.20	615.	284.
20 OCT 2100	21	0.09	0.00	0.09	776.	355.
20 OCT 2200	22	0.08	0.00	0.08	957.	475.
20 OCT 2300	23	0.10	0.00	0.10	1149.	636.
21 OCT 0000	24	0.04	0.00	0.04	1347.	808.
21 OCT 0100	25	0.30	0.00	0.30	1554.	1038.
21 OCT 0200	26	0.38	0.00	0.38	1744.	1367.
21 OCT 0300	27	0.20	0.00	0.20	2041.	1754.
21 OCT 0400	28	0.10	0.00	0.10	2312.	2083.
21 OCT 0500	29	0.09	0.00	0.09	2582.	2522.
21 OCT 0600	30	0.04	0.00	0.04	2838.	2950.
21 OCT 0700	31	0.00	0.00	0.00	3070.	3268.
21 OCT 0800	32	0.00	0.00	0.00	3263.	3502.
21 OCT 0900	33	0.00	0.00	0.00	3406.	3622.
21 OCT 1000	34	0.00	0.00	0.00	3491.	3692.
21 OCT 1100	35	0.00	0.00	0.00	3511.	3650.
21 OCT 1200	36	0.00	0.00	0.00	3454.	3515.
21 OCT 1300	37	0.00	0.00	0.00	3327.	3294.
21 OCT 1400	38	0.00	0.00	0.00	3157.	3106.
21 OCT 1500	39	0.00	0.00	0.00	2971.	2893.
21 OCT 1600	40	0.00	0.00	0.00	2781.	2698.
21 OCT 1700	41	0.00	0.00	0.00	2595.	2522.
21 OCT 1800	42	0.00	0.00	0.00	2420.	2313.
21 OCT 1900	43	0.00	0.00	0.00	2257.	2050.
21 OCT 2000	44	0.00	0.00	0.00	2106.	1745.
21 OCT 2100	45	0.00	0.00	0.00	1964.	1461.
21 OCT 2200	46	0.00	0.00	0.00	1833.	1233.
21 OCT 2300	47	0.00	0.00	0.00	1710.	1068.
22 OCT 0000	48	0.00	0.00	0.00	1596.	957.
22 OCT 0100	49	0.00	0.00	0.00	1489.	877.
22 OCT 0200	50	0.00	0.00	0.00	1390.	819.
22 OCT 0300	51	0.00	0.00	0.00	1297.	770.
22 OCT 0400	52	0.00	0.00	0.00	1211.	735.
22 OCT 0500	53	0.00	0.00	0.00	1131.	703.
22 OCT 0600	54	0.00	0.00	0.00	1056.	676.
22 OCT 0700	55	0.00	0.00	0.00	986.	649.
22 OCT 0800	56	0.00	0.00	0.00	921.	628.
22 OCT 0900	57	0.00	0.00	0.00	860.	608.
22 OCT 1000	58	0.00	0.00	0.00	804.	588.
22 OCT 1100	59	0.00	0.00	0.00	751.	568.
22 OCT 1200	60	0.00	0.00	0.00	702.	548.
22 OCT 1300	61	0.00	0.00	0.00	656.	532.
22 OCT 1400	62	0.00	0.00	0.00	613.	513.
22 OCT 1500	63	0.00	0.00	0.00	574.	503.
22 OCT 1600	64	0.00	0.00	0.00	537.	489.
22 OCT 1700	65	0.00	0.00	0.00	502.	475.
22 OCT 1800	66	0.00	0.00	0.00	470.	461.
22 OCT 1900	67	0.00	0.00	0.00	440.	450.
22 OCT 2000	68	0.00	0.00	0.00	411.	438.
22 OCT 2100	69	0.00	0.00	0.00	385.	432.
22 OCT 2200	70	0.00	0.00	0.00	361.	420.
22 OCT 2300	71	0.00	0.00	0.00	339.	411.
23 OCT 0000	72	0.00	0.00	0.00	333.	402.
23 OCT 0100	73	0.00	0.00	0.00	327.	393.
23 OCT 0200	74	0.00	0.00	0.00	321.	387.
23 OCT 0300	75	0.00	0.00	0.00	315.	380.
23 OCT 0400	76	0.00	0.00	0.00	309.	375.
23 OCT 0500	77	0.00	0.00	0.00	303.	368.
23 OCT 0600	78	0.00	0.00	0.00	297.	362.
23 OCT 0700	79	0.00	0.00	0.00	292.	358.
23 OCT 0800	80	0.00	0.00	0.00	286.	350.
23 OCT 0900	81	0.00	0.00	0.00	281.	345.
23 OCT 1000	82	0.00	0.00	0.00	276.	340.
23 OCT 1100	83	0.00	0.00	0.00	271.	336.
23 OCT 1200	84	0.00	0.00	0.00	265.	332.
23 OCT 1300	85	0.00	0.00	0.00	260.	328.
23 OCT 1400	86	0.00	0.00	0.00	256.	324.
23 OCT 1500	87	0.00	0.00	0.00	251.	320.
23 OCT 1600	88	0.00	0.00	0.00	246.	316.
23 OCT 1700	89	0.00	0.00	0.00	241.	312.
23 OCT 1800	90	0.00	0.00	0.00	237.	310.
23 OCT 1900	91	0.00	0.00	0.00	233.	306.
23 OCT 2000	92	0.00	0.00	0.00	228.	302.
23 OCT 2100	93	0.00	0.00	0.00	224.	298.
23 OCT 2200	94	0.00	0.00	0.00	220.	294.
23 OCT 2300	95	0.00	0.00	0.00	216.	290.
24 OCT 0000	96	0.00	0.00	0.00	212.	288.
24 OCT 0100	97	0.00	0.00	0.00	208.	284.
24 OCT 0200	98	0.00	0.00	0.00	204.	282.
24 OCT 0300	99	0.00	0.00	0.00	200.	278.
24 OCT 0400	100	0.00	0.00	0.00	196.	276.
24 OCT 0500	101	0.00	0.00	0.00	192.	274.

TOTAL RAINFALL = 2.25, TOTAL LOSS = 0.00, TOTAL EXCESS = 2.25

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	100.00-HR
3511.	14.00	(CFS)	3400.	2583.	1261.	958.
		(INCHES)	0.530	1.609	2.357	2.487
		(AC-FT)	1686.	5123.	7505.	7918.

CUMULATIVE AREA = 59.70 SQ MI

STATION [illegible]



(-) LIMITS OF OPTIMIZATION

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                                   HEC-1 INPUT                                                 PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        BUTTERNUT CREEK 9-26-77
   2          ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)

   3          IT      60 26SEP77    0100      68
   4          IO       1       2
   5          OU       6      25
   6          PG      NB     .86
   7          PG      ED
   8          PI     .00     .00     .00     .00     .01     .37     .10     .07     .08     .07
   9          PI     .05     .00     .00     .00     .00     .00     .14     .01     .00     .00
  10          PG    ED3N
  11          PI     .00     .00     .00     .00     .00     .00     .20     .10     .10     .10
  12          PI     .20     .00     .00     .00     .10     .20     .00     .10     .00     .00

  13          KK  MORRIS
  14          QO     420     411     402     396     390     387     405     450     528     645
  15          QO     853    1145    1426    1646    1844    1970    2020    1980    1880    1781
  16          QO    1700    1646    1592    1538    1444    1316    1201    1105    1023     960
  17          QO     902     841     797     750     717     685     663     636     620     604
  18          QO     588     572     556     540     528     513     506     496     489     481
  19          QO     471     464     457     450     444     438     432     426     423     417
  20          QO     414     411     405     402     396     393     390     387       0       0
  21          PT      NB      ED    ED3N
  22          PW     .30     .58     .12
  23          PR      ED    ED3N       0       0       0
  24          PW     .88     .12      .0      .0      .0
  25          BA    59.7      0.
  26          BF    420.    440.  1.0191
  27          UC    -10.     -8.
  28          LU     -0.     -0.
  29          ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 6 THROUGH 25)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.912		10.34			
COMPUTED HYDROGRAPH	27459.	0.713	1373.	17.36	7.02	1928.	16.00
OBSERVED HYDROGRAPH	26880.	0.698	1344.	17.36	7.02	2020.	16.00
DIFFERENCE	579.	0.015	29.	-0.00	-0.00	-92.	0.00
PERCENT DIFFERENCE	2.15				-0.01	-4.53	

STANDARD ERROR	70.	AVERAGE ABSOLUTE ERROR	59.
OBJECTIVE FUNCTION	70.	AVERAGE PERCENT ABSOLUTE ERROR	5.22

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 68)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.912		10.34			
COMPUTED HYDROGRAPH	53767.	1.396	791.	27.33	16.99	1928.	16.00
OBSERVED HYDROGRAPH	54608.	1.417	803.	28.79	18.45	2020.	16.00
DIFFERENCE	-841.	-0.022	-12.	-1.46	-1.46	-92.	0.00
PERCENT DIFFERENCE	-1.54				-7.89	-4.53	

STANDARD ERROR	95.	AVERAGE ABSOLUTE ERROR	81.
OBJECTIVE FUNCTION	98.	AVERAGE PERCENT ABSOLUTE ERROR	13.98

UNIT HYDROGRAPH
61 END-OF-PERIOD ORDINATES

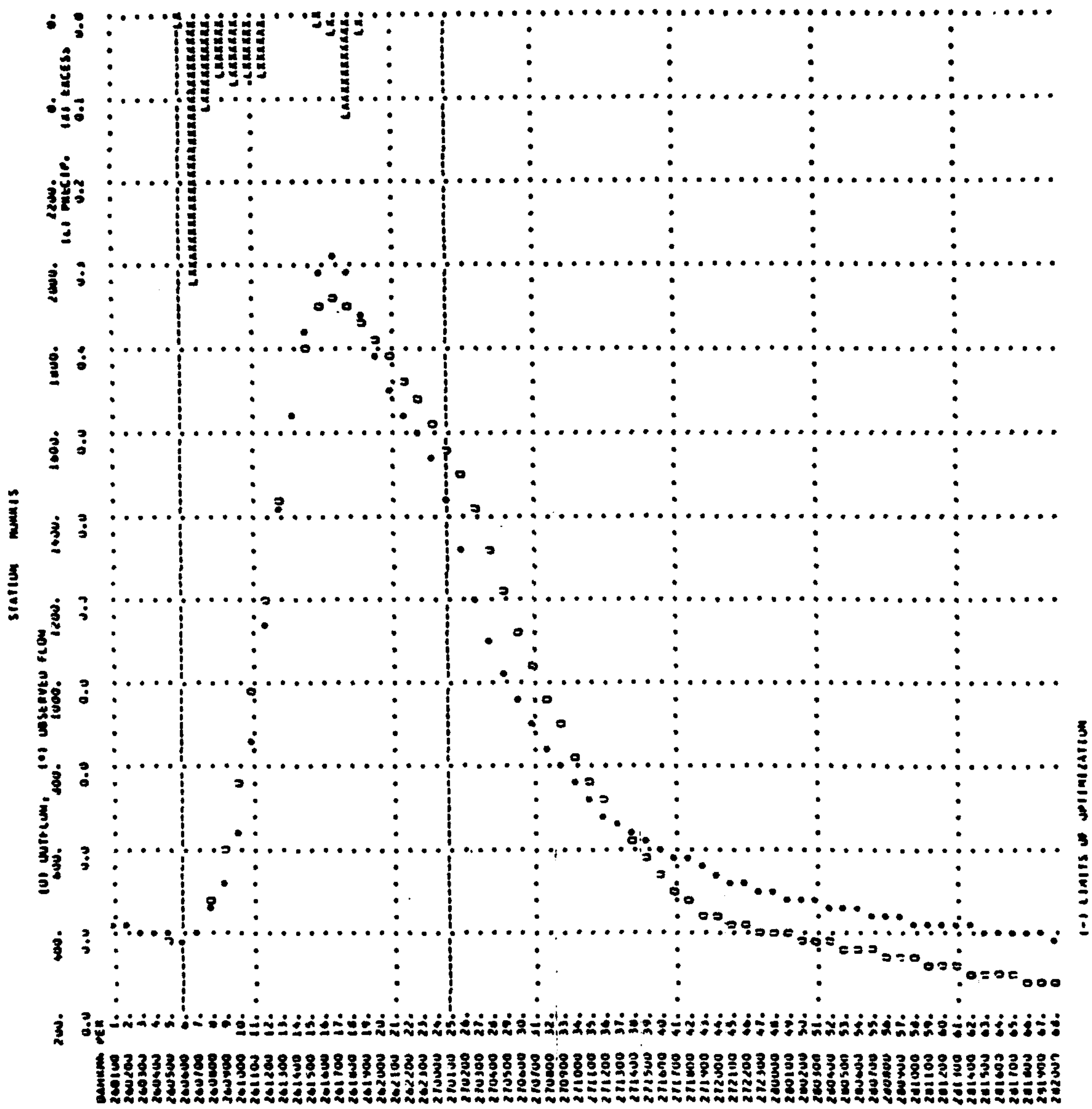
79.	295.	600.	954.	1340.	1719.	2031.	2251.	2372.	2369.
2225.	2023.	1839.	1673.	1521.	1383.	1257.	1143.	1039.	945.
859.	781.	710.	646.	587.	534.	486.	441.	401.	365.
332.	302.	274.	249.	227.	206.	188.	170.	155.	141.
128.	117.	106.	96.	88.	80.	72.	66.	60.	54.
49.	45.	41.	37.	34.	31.	28.	25.	23.	21.
19.									

HYDROGRAPH AT STATION MORRIS

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
26 SEP 0100	1	0.00	0.00	0.00	420.	420.	27 SEP 1100	35	0.00	0.00	0.00	767.	717.
26 SEP 0200	2	0.00	0.00	0.00	412.	411.	27 SEP 1200	36	0.00	0.00	0.00	713.	685.
26 SEP 0300	3	0.00	0.00	0.00	404.	402.	27 SEP 1300	37	0.00	0.00	0.00	664.	663.
26 SEP 0400	4	0.00	0.00	0.00	397.	396.	27 SEP 1400	38	0.00	0.00	0.00	619.	636.
26 SEP 0500	5	0.00	0.00	0.00	389.	390.	27 SEP 1500	39	0.00	0.00	0.00	578.	620.
26 SEP 0600	6	0.01	0.00	0.01	383.	387.	27 SEP 1600	40	0.00	0.00	0.00	540.	604.
26 SEP 0700	7	0.32	0.00	0.32	403.	405.	27 SEP 1700	41	0.00	0.00	0.00	506.	588.
26 SEP 0800	8	0.11	0.00	0.11	477.	450.	27 SEP 1800	42	0.00	0.00	0.00	474.	572.
26 SEP 0900	9	0.07	0.00	0.07	600.	528.	27 SEP 1900	43	0.00	0.00	0.00	445.	556.
26 SEP 1000	10	0.08	0.00	0.08	767.	645.	27 SEP 2000	44	0.00	0.00	0.00	433.	540.
26 SEP 1100	11	0.07	0.00	0.07	972.	853.	27 SEP 2100	45	0.00	0.00	0.00	425.	528.
26 SEP 1200	12	0.07	0.00	0.07	1204.	1145.	27 SEP 2200	46	0.00	0.00	0.00	417.	513.
26 SEP 1300	13	0.00	0.00	0.00	1435.	1426.	27 SEP 2300	47	0.00	0.00	0.00	409.	506.
26 SEP 1400	14	0.00	0.00	0.00	1640.	1646.	28 SEP 0000	48	0.00	0.00	0.00	402.	496.
26 SEP 1500	15	0.00	0.00	0.00	1803.	1844.	28 SEP 0100	49	0.00	0.00	0.00	394.	489.
26 SEP 1600	16	0.01	0.00	0.01	1904.	1970.	28 SEP 0200	50	0.00	0.00	0.00	387.	481.
26 SEP 1700	17	0.02	0.00	0.02	1928.	2020.	28 SEP 0300	51	0.00	0.00	0.00	380.	471.
26 SEP 1800	18	0.12	0.00	0.12	1905.	1980.	28 SEP 0400	52	0.00	0.00	0.00	372.	464.
26 SEP 1900	19	0.02	0.00	0.02	1869.	1880.	28 SEP 0500	53	0.00	0.00	0.00	365.	457.
26 SEP 2000	20	0.00	0.00	0.00	1824.	1781.	28 SEP 0600	54	0.00	0.00	0.00	359.	450.
26 SEP 2100	21	0.00	0.00	0.00	1772.	1700.	28 SEP 0700	55	0.00	0.00	0.00	352.	444.
26 SEP 2200	22	0.00	0.00	0.00	1720.	1646.	28 SEP 0800	56	0.00	0.00	0.00	345.	438.
26 SEP 2300	23	0.00	0.00	0.00	1671.	1592.	28 SEP 0900	57	0.00	0.00	0.00	339.	432.
27 SEP 0000	24	0.00	0.00	0.00	1620.	1538.	28 SEP 1000	58	0.00	0.00	0.00	332.	426.
27 SEP 0100	25	0.00	0.00	0.00	1561.	1444.	28 SEP 1100	59	0.00	0.00	0.00	326.	423.
27 SEP 0200	26	0.00	0.00	0.00	1493.	1316.	28 SEP 1200	60	0.00	0.00	0.00	320.	417.
27 SEP 0300	27	0.00	0.00	0.00	1410.	1201.	28 SEP 1300	61	0.00	0.00	0.00	314.	414.
27 SEP 0400	28	0.00	0.00	0.00	1314.	1105.	28 SEP 1400	62	0.00	0.00	0.00	308.	411.
27 SEP 0500	29	0.00	0.00	0.00	1214.	1023.	28 SEP 1500	63	0.00	0.00	0.00	302.	405.
27 SEP 0600	30	0.00	0.00	0.00	1122.	960.	28 SEP 1600	64	0.00	0.00	0.00	297.	402.
27 SEP 0700	31	0.00	0.00	0.00	1037.	902.	28 SEP 1700	65	0.00	0.00	0.00	291.	396.
27 SEP 0800	32	0.00	0.00	0.00	960.	841.	28 SEP 1800	66	0.00	0.00	0.00	286.	393.
27 SEP 0900	33	0.00	0.00	0.00	890.	797.	28 SEP 1900	67	0.00	0.00	0.00	280.	390.
27 SEP 1000	34	0.00	0.00	0.00	826.	750.	28 SEP 2000	68	0.00	0.00	0.00	275.	387.

TOTAL RAINFALL = 0.91, TOTAL LOSS = 0.00, TOTAL EXCESS = 0.91

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	67.00-HR
1928.	16.00	(CFS)	1870.	1461.	797.	797.
		(INCHES)	0.291	0.910	1.387	1.387
		(AC-FT)	927.	2898.	4415.	4415.


STATION
(O) OUTFLOW,
(*) OBSERVED FLOW
(L) PRECIP.
(X) EXCESS
(-) LIMITS OF OPTIMIZATION

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LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1     ID      BUTTERNUT CREEK 10-17-77
  2     ID      UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)

  3     IT     60 16OCT77    0100      86
  4     IO      1       2
  5     OU     20      50
  6     PG     NB    2.76
  7     PG     ED
  8     PI    .00     .00     .00     .00     .00     .00     .00     .00     .00     .02
  9     PI    .01     .01     .01     .00     .00     .00     .00     .01     .00     .00
 10     PI    .11     .33     .34     .09     .24     .19     .25     .23     .09     .05
 11     PI    .21     .17     .13     .13     .08     .05     .08     .04     .02     .00
 12     PI    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 13     PG   ED3N
 14     PI    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 15     PI    .00     .10     .00     .00     .00     .00     .00     .00     .00     .00
 16     PI    .00     .10     .30     .30     .20     .20     .10     .30     .20     .10
 17     PI    .10     .00     .10     .00     .10     .00     .10     .10     .00     .10
 18     PI    .00     .00     .10     .00     .00     .00     .00     .00     .00     .00

 19     KK MORRIS
 20     QO    306     298     290     282     276     270     266     262     258     257
 21     QO    253     252     252     250     248     246     246     245     245     243
 22     QO    243     243     250     282     368     588    1097    1781    2467    3166
 23     QO   3822    4465    5100    5620    5920    5940    5980    5860    5760    5600
 24     QO   5400    5220    4980    4750    4510    4315    4105    3902    3719    3531
 25     QO   3348    3172    2989    2813    2643    2483    2319    2179    2034    1906
 26     QO   1792    1691    1583    1501    1440    1377    1325    1277    1237    1198
 27     QO   1160    1130    1094    1058    1023     995     968     942     916     890
 28     QO    865     847     823     805     793     781       0       0       0       0
 29     PT     NB      ED    ED3N
 30     PW    .30     .58     .12
 31     PR     ED    ED3N
 32     PW    .88     .12
 33     BA   59.7      0.
 34     BF   306.    850.  1.0191
 35     UC   -12.     -6.
 36     LU    -0.     -0.
 37     ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 20 THROUGH 50)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.816		28.44			
COMPUTED HYDROGRAPH	103309.	2.682	3333.	38.22	9.77	5917.	37.00
OBSERVED HYDROGRAPH	109227.	2.835	3523.	38.79	10.35	5980.	36.00
DIFFERENCE	-5918.	-0.154	-191.	-0.57	-0.57	-63.	1.00
PERCENT DIFFERENCE	-5.42				-5.55	-1.05	

STANDARD ERROR	472.	AVERAGE ABSOLUTE ERROR	354.
OBJECTIVE FUNCTION	480.	AVERAGE PERCENT ABSOLUTE ERROR	24.76

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 86)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.816		28.44			
COMPUTED HYDROGRAPH	135586.	3.519	1577.	42.42	13.98	5917.	37.00
OBSERVED HYDROGRAPH	169626.	4.403	1972.	46.12	17.68	5980.	36.00
DIFFERENCE	-34041.	-0.884	-396.	-3.70	-3.70	-63.	1.00
PERCENT DIFFERENCE	-20.07				-20.93	-1.05	

STANDARD ERROR	662.	AVERAGE ABSOLUTE ERROR	460.
OBJECTIVE FUNCTION	733.	AVERAGE PERCENT ABSOLUTE ERROR	37.60

UNIT HYDROGRAPH
33 END-OF-PERIOD ORDINATES

95.	366.	670.	1036.	1401.	1762.	2112.	2438.	2694.	2845.
2903.	2880.	2761.	2604.	2311.	1917.	1535.	1230.	946.	790.
633.	507.	406.	325.	261.	209.	167.	134.	107.	86.
69.	55.	44.							

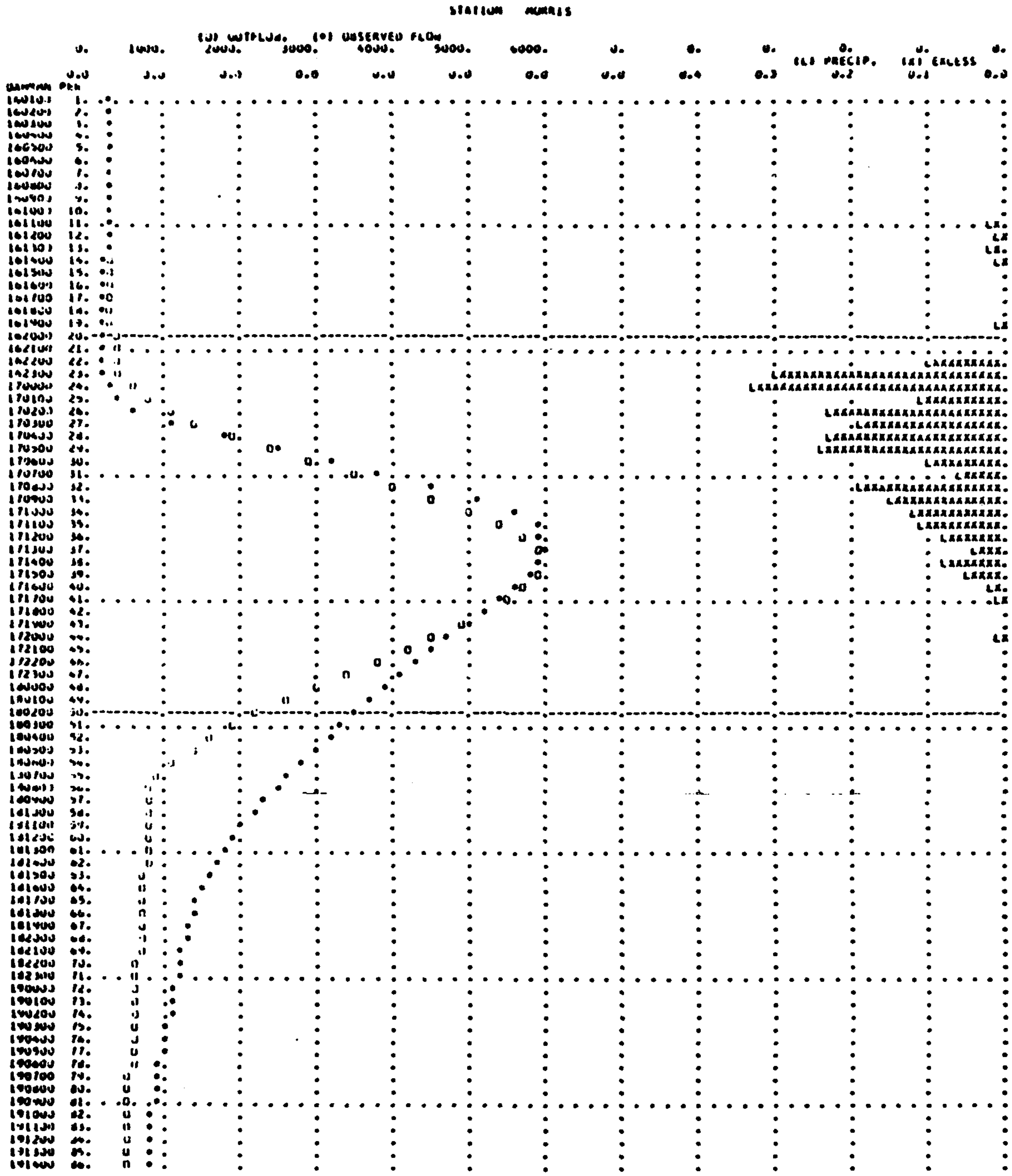
HYDROGRAPH AT STATION MORRIS

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
16 OCT 0100	1	0.00	0.00	0.00	306.	306.	17 OCT 2000	44	0.01	0.00	0.01	4534.	4750.
16 OCT 0200	2	0.00	0.00	0.00	300.	298.	17 OCT 2100	45	0.00	0.00	0.00	4160.	4510.
16 OCT 0300	3	0.00	0.00	0.00	295.	290.	17 OCT 2200	46	0.00	0.00	0.00	3781.	4315.
16 OCT 0400	4	0.00	0.00	0.00	289.	282.	17 OCT 2300	47	0.00	0.00	0.00	3388.	4105.
16 OCT 0500	5	0.00	0.00	0.00	284.	276.	18 OCT 0000	48	0.00	0.00	0.00	2991.	3902.
16 OCT 0600	6	0.00	0.00	0.00	278.	270.	18 OCT 0100	49	0.00	0.00	0.00	2606.	3719.
16 OCT 0700	7	0.00	0.00	0.00	273.	266.	18 OCT 0200	50	0.00	0.00	0.00	2243.	3531.
16 OCT 0800	8	0.00	0.00	0.00	268.	262.	18 OCT 0300	51	0.00	0.00	0.00	1913.	3348.
16 OCT 0900	9	0.00	0.00	0.00	263.	258.	18 OCT 0400	52	0.00	0.00	0.00	1615.	3172.
16 OCT 1000	10	0.00	0.00	0.00	258.	257.	18 OCT 0500	53	0.00	0.00	0.00	1351.	2989.
16 OCT 1100	11	0.02	0.00	0.02	255.	253.	18 OCT 0600	54	0.00	0.00	0.00	1122.	2813.
16 OCT 1200	12	0.01	0.00	0.01	255.	252.	18 OCT 0700	55	0.00	0.00	0.00	926.	2643.
16 OCT 1300	13	0.02	0.00	0.02	261.	252.	18 OCT 0800	56	0.00	0.00	0.00	841.	2483.
16 OCT 1400	14	0.01	0.00	0.01	271.	250.	18 OCT 0900	57	0.00	0.00	0.00	825.	2319.
16 OCT 1500	15	0.00	0.00	0.00	285.	248.	18 OCT 1000	58	0.00	0.00	0.00	810.	2179.
16 OCT 1600	16	0.00	0.00	0.00	300.	246.	18 OCT 1100	59	0.00	0.00	0.00	795.	2034.
16 OCT 1700	17	0.00	0.00	0.00	316.	246.	18 OCT 1200	60	0.00	0.00	0.00	780.	1906.
16 OCT 1800	18	0.00	0.00	0.00	331.	245.	18 OCT 1300	61	0.00	0.00	0.00	765.	1792.
16 OCT 1900	19	0.01	0.00	0.01	345.	245.	18 OCT 1400	62	0.00	0.00	0.00	751.	1691.
16 OCT 2000	20	0.00	0.00	0.00	358.	243.	18 OCT 1500	63	0.00	0.00	0.00	737.	1583.
16 OCT 2100	21	0.00	0.00	0.00	367.	243.	18 OCT 1600	64	0.00	0.00	0.00	723.	1501.
16 OCT 2200	22	0.10	0.00	0.10	381.	243.	18 OCT 1700	65	0.00	0.00	0.00	710.	1440.
16 OCT 2300	23	0.30	0.00	0.30	433.	250.	18 OCT 1800	66	0.00	0.00	0.00	696.	1377.
17 OCT 0000	24	0.33	0.00	0.33	567.	282.	18 OCT 1900	67	0.00	0.00	0.00	683.	1325.
17 OCT 0100	25	0.11	0.00	0.11	784.	368.	18 OCT 2000	68	0.00	0.00	0.00	670.	1277.
17 OCT 0200	26	0.23	0.00	0.23	1071.	588.	18 OCT 2100	69	0.00	0.00	0.00	658.	1237.
17 OCT 0300	27	0.19	0.00	0.19	1424.	1097.	18 OCT 2200	70	0.00	0.00	0.00	645.	1198.
17 OCT 0400	28	0.23	0.00	0.23	1855.	1781.	18 OCT 2300	71	0.00	0.00	0.00	633.	1160.
17 OCT 0500	29	0.24	0.00	0.24	2355.	2467.	19 OCT 0000	72	0.00	0.00	0.00	622.	1130.
17 OCT 0600	30	0.10	0.00	0.10	2912.	3166.	19 OCT 0100	73	0.00	0.00	0.00	610.	1094.
17 OCT 0700	31	0.06	0.00	0.06	3477.	3822.	19 OCT 0200	74	0.00	0.00	0.00	598.	1058.
17 OCT 0800	32	0.19	0.00	0.19	4018.	4465.	19 OCT 0300	75	0.00	0.00	0.00	587.	1023.
17 OCT 0900	33	0.15	0.00	0.15	4527.	5100.	19 OCT 0400	76	0.00	0.00	0.00	576.	995.
17 OCT 1000	34	0.12	0.00	0.12	4990.	5620.	19 OCT 0500	77	0.00	0.00	0.00	565.	968.
17 OCT 1100	35	0.11	0.00	0.11	5389.	5920.	19 OCT 0600	78	0.00	0.00	0.00	555.	942.
17 OCT 1200	36	0.08	0.00	0.08	5697.	5940.	19 OCT 0700	79	0.00	0.00	0.00	544.	916.
17 OCT 1300	37	0.04	0.00	0.04	5877.	5980.	19 OCT 0800	80	0.00	0.00	0.00	534.	890.
17 OCT 1400	38	0.08	0.00	0.08	5917.	5860.	19 OCT 0900	81	0.00	0.00	0.00	524.	865.
17 OCT 1500	39	0.05	0.00	0.05	5852.	5760.	19 OCT 1000	82	0.00	0.00	0.00	514.	847.
17 OCT 1600	40	0.02	0.00	0.02	5714.	5600.	19 OCT 1100	83	0.00	0.00	0.00	505.	823.
17 OCT 1700	41	0.01	0.00	0.01	5506.	5400.	19 OCT 1200	84	0.00	0.00	0.00	495.	805.
17 OCT 1800	42	0.00	0.00	0.00	5231.	5220.	19 OCT 1300	85	0.00	0.00	0.00	486.	793.
17 OCT 1900	43	0.00	0.00	0.00	4900.	4980.	19 OCT 1400	86	0.00	0.00	0.00	477.	781.

TOTAL RAINFALL = 2.82, TOTAL LOSS = 0.00, TOTAL EXCESS = 2.82

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	85.00-HR
5917.	37.00	(CFS)	5751.	4155.	1828.	1591.
		(INCHES)	0.896	2.588	3.417	3.509
		(AC-FT)	2852.	8241.	10873.	11173.

CUMULATIVE AREA = 59.73 SQ MI



(-) LIMITS OF OPTIMIZATION

HEC-1 INPUT PAGE 1

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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1        ID      CANASAWACTA CREEK    6-26-68
   2        ID      UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3        IT     60 25JUN68    1400      93
   4        IO       1       2
   5        OU      14      30
   6        PG    PLYM
   7        PI     .02     .02     .04     .02     .02     .01     .21     .02     .01     .01
   8        PI     .03     .02     .18     .39     .12     .00     .03     .26     .42     .08
   9        PI     .02     .02     .02     .04     .01     .02     .01     .01     .01     .03
  10        PI     .01     .01     .00     .01     .00     .00     .00     .00     .00     .00
  11        PI     .00     .00     .10     .07     .03     .00     .00     .00     .03     .01
  12        PI     .00     .00     .00     .00     .00     .04     .24     .00     .04     .05
  13        PI     .24     .04     .02     .00     .00     .00     .00     .00     .00     .00

  14        KK   SPLYM
  15        QO      25      25      29      29      30      30      31      33      34      35
  16        QO      38      38      40      46      53     100     162     202     255     377
  17        QO     526     980    1632    1506    1394    1216    1060     920     791     719
  18        QO     647     604     564     540     512     491     464     470     452     440
  19        QO     422     410     399     394     394     410     428     452     470     470
  20        QO     464     456     446     434     416     404     394     428     456     519
  21        QO     588     737     890    1000    1120    1132    1072     980     900     830
  22        QO     764     710     656     620     560     556     526     512     491     477
  23        QO     458     446     434     428     416     410     399     393     383     377
  24        QO     372     366     361       0       0       0       0       0       0       0
  25        PT    PLYM
  26        PW    1.00
  27        PR    PLYM
  28        PW    1.00
  29        BA    57.9      0.
  30        BF     25.    +30.   1.024
  31        UC     -4.    -10.
  32        LU     -1.    -.05
  33        ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 14 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.932		36.78			
COMPUTED HYDROGRAPH	11992.	0.321	705.	25.09	-11.69	1532.	23.00
OBSERVED HYDROGRAPH	11939.	0.320	702.	24.58	-12.20	1632.	22.00
DIFFERENCE	53.	0.001	3.	0.51	0.51	-100.	1.00
PERCENT DIFFERENCE	0.44				-4.18	-6.12	

STANDARD ERROR 126. AVERAGE ABSOLUTE ERROR 109.
OBJECTIVE FUNCTION 122. AVERAGE PERCENT ABSOLUTE ERROR 36.58

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 93)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.932		36.78			
COMPUTED HYDROGRAPH	40369.	1.080	434.	49.82	13.05	1532.	23.00
OBSERVED HYDROGRAPH	46614.	1.248	501.	52.00	15.22	1632.	22.00
DIFFERENCE	-6245.	-0.167	-67.	-2.17	-2.17	-100.	1.00
PERCENT DIFFERENCE	-13.40				-14.27	-6.12	

STANDARD ERROR 112. AVERAGE ABSOLUTE ERROR 92.
OBJECTIVE FUNCTION 121. AVERAGE PERCENT ABSOLUTE ERROR 23.74

UNIT HYDROGRAPH
54 END-OF-PERIOD ORDINATES

299.	1114.	2135.	2683.	3305.	2742.	2673.	2230.	2011.	1819.
1636.	1475.	1310.	1250.	1062.	976.	880.	794.	716.	645.
582.	525.	473.	427.	385.	347.	313.	282.	255.	230.
207.	187.	168.	152.	137.	124.	111.	100.	91.	82.
74.	66.	60.	54.	49.	44.	40.	36.	32.	29.
26.	24.	21.	19.						

HYDROGRAPH AT STATION SPLYM

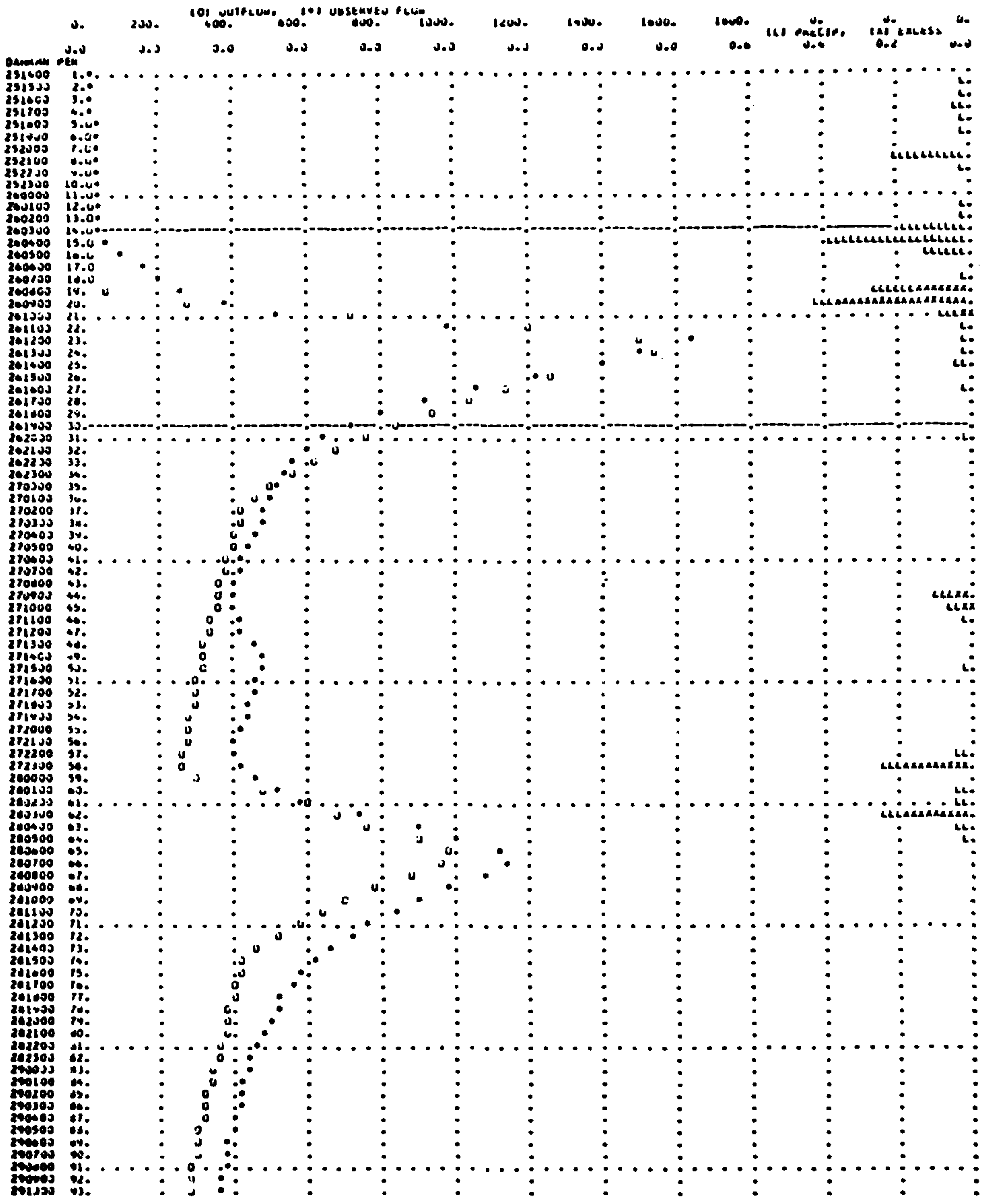
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
25 JUN 1400	1	0.00	0.00	0.00	25.	25.
25 JUN 1500	2	0.02	0.02	0.00	24.	25.
25 JUN 1600	3	0.02	0.02	0.00	24.	29.
25 JUN 1700	4	0.04	0.04	0.00	23.	29.
25 JUN 1800	5	0.02	0.02	0.00	23.	30.
25 JUN 1900	6	0.02	0.02	0.00	22.	30.
25 JUN 2000	7	0.01	0.01	0.00	22.	31.
25 JUN 2100	8	0.21	0.21	0.00	21.	33.
25 JUN 2200	9	0.02	0.02	0.00	21.	34.
25 JUN 2300	10	0.01	0.01	0.00	20.	35.
26 JUN 0000	11	0.01	0.01	0.00	20.	38.
26 JUN 0100	12	0.03	0.03	0.00	19.	38.
26 JUN 0200	13	0.02	0.02	0.00	19.	43.
26 JUN 0300	14	0.18	0.18	0.00	18.	46.
26 JUN 0400	15	0.39	0.39	0.00	18.	53.
26 JUN 0500	16	0.12	0.12	0.00	18.	100.
26 JUN 0600	17	0.00	0.03	0.00	17.	162.
26 JUN 0700	18	0.03	0.03	0.00	17.	202.
26 JUN 0800	19	0.26	0.12	0.14	57.	255.
26 JUN 0900	20	0.42	0.06	0.36	275.	377.
26 JUN 1000	21	0.38	0.06	0.32	713.	526.
26 JUN 1100	22	0.02	0.02	0.00	1200.	980.
26 JUN 1200	23	0.02	0.02	0.00	1508.	1632.
26 JUN 1300	24	0.02	0.02	0.00	1532.	1506.
26 JUN 1400	25	0.04	0.04	0.00	1403.	1394.
26 JUN 1500	26	0.01	0.01	0.00	1267.	1216.
26 JUN 1600	27	0.02	0.02	0.00	1144.	1080.
26 JUN 1700	28	0.01	0.01	0.00	1032.	920.
26 JUN 1800	29	0.01	0.01	0.00	932.	791.
26 JUN 1900	30	0.01	0.01	0.00	841.	719.
26 JUN 2000	31	0.03	0.03	0.00	760.	647.
26 JUN 2100	32	0.01	0.01	0.00	686.	604.
26 JUN 2200	33	0.01	0.01	0.00	620.	564.
26 JUN 2300	34	0.00	0.00	0.00	560.	540.
27 JUN 0000	35	0.01	0.01	0.00	506.	512.
27 JUN 0100	36	0.00	0.00	0.00	457.	491.
27 JUN 0200	37	0.00	0.00	0.00	420.	484.
27 JUN 0300	38	0.00	0.00	0.00	416.	470.
27 JUN 0400	39	0.00	0.00	0.00	406.	452.
27 JUN 0500	40	0.00	0.00	0.00	397.	440.
27 JUN 0600	41	0.00	0.00	0.00	387.	422.
27 JUN 0700	42	0.00	0.00	0.00	378.	410.
27 JUN 0800	43	0.00	0.00	0.00	370.	399.
27 JUN 0900	44	0.13	0.08	0.04	361.	399.
27 JUN 1000	45	0.07	0.06	0.01	352.	394.
27 JUN 1100	46	0.03	0.03	0.00	344.	410.
27 JUN 1200	47	0.00	0.00	0.00	336.	428.
27 JUN 1300	48	0.00	0.00	0.00	328.	452.
27 JUN 1400	49	0.00	0.00	0.00	321.	470.
27 JUN 1500	50	0.03	0.03	0.00	313.	470.
27 JUN 1600	51	0.01	0.01	0.00	306.	464.
27 JUN 1700	52	0.00	0.00	0.00	299.	458.
27 JUN 1800	53	0.00	0.00	0.00	292.	446.
27 JUN 1900	54	0.00	0.00	0.00	285.	434.
27 JUN 2000	55	0.00	0.00	0.00	278.	416.
27 JUN 2100	56	0.00	0.00	0.00	271.	404.
27 JUN 2200	57	0.04	0.04	0.00	265.	394.
27 JUN 2300	58	0.24	0.08	0.16	259.	428.
28 JUN 0000	59	0.00	0.00	0.00	302.	456.
28 JUN 0100	60	0.04	0.04	0.00	477.	519.
28 JUN 0200	61	0.05	0.05	0.00	604.	588.
28 JUN 0300	62	0.24	0.06	0.18	673.	737.
28 JUN 0400	63	0.04	0.04	0.00	766.	890.
28 JUN 0500	64	0.02	0.02	0.00	896.	1000.
28 JUN 0600	65	0.00	0.00	0.00	982.	1120.
28 JUN 0700	66	0.00	0.00	0.00	959.	1132.
28 JUN 0800	67	0.00	0.00	0.00	871.	1072.
28 JUN 0900	68	0.00	0.00	0.00	786.	980.
28 JUN 1000	69	0.00	0.00	0.00	709.	930.
28 JUN 1100	70	0.00	0.00	0.00	640.	830.
28 JUN 1200	71	0.00	0.00	0.00	578.	764.
28 JUN 1300	72	0.00	0.00	0.00	521.	710.
28 JUN 1400	73	0.00	0.00	0.00	468.	656.
28 JUN 1500	74	0.00	0.00	0.00	427.	620.
28 JUN 1600	75	0.00	0.00	0.00	417.	580.
28 JUN 1700	76	0.00	0.00	0.00	408.	550.
28 JUN 1800	77	0.00	0.00	0.00	398.	528.
28 JUN 1900	78	0.00	0.00	0.00	389.	512.
28 JUN 2000	79	0.00	0.00	0.00	380.	491.
28 JUN 2100	80	0.00	0.00	0.00	371.	477.
28 JUN 2200	81	0.00	0.00	0.00	362.	458.
28 JUN 2300	82	0.00	0.00	0.00	353.	446.
29 JUN 0000	83	0.00	0.00	0.00	345.	434.
29 JUN 0100	84	0.00	0.00	0.00	337.	428.
29 JUN 0200	85	0.00	0.00	0.00	329.	416.
29 JUN 0300	86	0.00	0.00	0.00	321.	410.
29 JUN 0400	87	0.00	0.00	0.00	314.	399.
29 JUN 0500	88	0.00	0.00	0.00	307.	393.
29 JUN 0600	89	0.00	0.00	0.00	299.	381.
29 JUN 0700	90	0.00	0.00	0.00	292.	377.
29 JUN 0800	91	0.00	0.00	0.00	286.	372.
29 JUN 0900	92	0.00	0.00	0.00	279.	366.
29 JUN 1000	93	0.00	0.00	0.00	272.	361.

TOTAL RAINFALL = 3.04, TOTAL LOSS = 2.11, TOTAL EXCESS = 0.93

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	92.00-HR
1532.	25.00	(CFS)	1328.	781.	547.	437.
		(INCHES)	0.213	0.499	1.054	1.076
		(AC-FT)	659.	1539.	3256.	3324.

CUMULATIVE AREA = 57.90 SQ MI

STATION SPLYA



(-) LIMITS OF OPTIMIZATION

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                                        HEC-1 INPUT                                        PAGE  1

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1           ID       CANASAWACTA CREEK    11-18-68
   2           ID       UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3           IT     60 18NOV68    0100      66
   4           IO      1       2
   5           OO      1      31
   6           PG    PLYM
   7           PI     .01     .07     .13     .05     .02     .01     .04     .02     .02     .00
   8           PI     .02     .00     .00     .12     .09     .08     .04     .14     .09     .07
   9           PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  10           PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .02
  11           PI     .04     .03     .02     .00     .00     .00     .00     .00     .00     .00

  12           KK   SPLYM
  13           QO     255     260     285     315     399     505     556     701     755     810
  14           QO     810     820     830     850    1000    1192    1408    1664    1792    1948
  15           QO    2002    2056    1966    1876    1680    1506    1338    1180    1096    1012
  16           QO     960     900     850     800     764     719     692     665     656     638
  17           QO     612     580     564     548     540     533     526     512     498     477
  18           QO     470     466     454     442     436     422     416     404     399     388
  19           QO     377     366     372     372     366     360       0       0       0       0
  20           PT    PLYM
  21           PW    1.00
  22           PK    PLYM
  23           PW    1.00
  24           BA    57.9      0.
  25           BF    255.    580.   1.024
  26           UC     -4.     -8.
  27           LO     -0.     -0.
  28           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 1 THROUGH 31)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.130		15.97			
COMPUTED HYDROGRAPH	35348.	0.946	1140.	18.49	2.52	2010.	21.00
OBSERVED HYDROGRAPH	33827.	0.905	1091.	19.35	3.37	2056.	21.00
DIFFERENCE	1521.	0.041	49.	-0.85	-0.85	-46.	0.00
PERCENT DIFFERENCE	4.50				-25.33	-2.23	

STANDARD ERROR	183.	AVERAGE ABSOLUTE ERROR	132.
OBJECTIVE FUNCTION	168.	AVERAGE PERCENT ABSOLUTE ERROR	18.97

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 66)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.130		15.97			
COMPUTED HYDROGRAPH	53863.	1.442	816.	28.29	12.31	2010.	21.00
OBSERVED HYDROGRAPH	52411.	1.403	794.	28.92	12.94	2056.	21.00
DIFFERENCE	1452.	0.039	22.	-0.63	-0.63	-46.	0.00
PERCENT DIFFERENCE	2.77				-4.85	-2.23	

STANDARD ERROR	131.	AVERAGE ABSOLUTE ERROR	87.
OBJECTIVE FUNCTION	140.	AVERAGE PERCENT ABSOLUTE ERROR	13.50

UNIT HYDROGRAPH
58 END-OF-PERIOD ORDINATES

704.	2233.	3009.	2827.	2573.	2341.	2130.	1939.	1764.	1606.
1461.	1330.	1210.	1101.	1002.	912.	830.	755.	687.	625.
569.	518.	471.	429.	390.	355.	323.	294.	268.	244.
222.	202.	184.	167.	152.	138.	126.	115.	104.	95.
86.	79.	72.	65.	59.	54.	49.	45.	41.	37.
34.	31.	28.	25.	23.	21.	19.	17.		

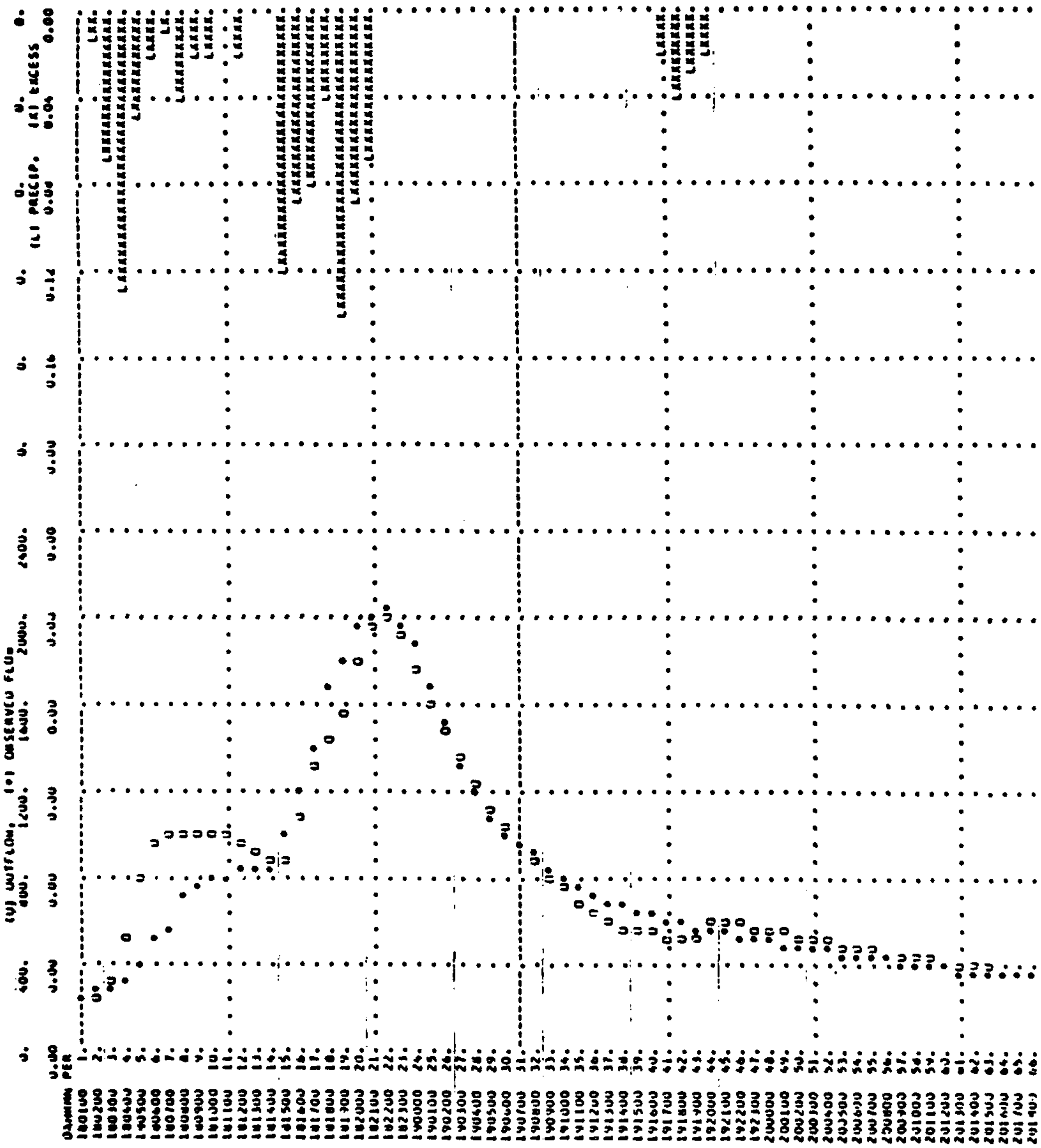
HYDROGRAPH AT STATION SPLYN

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
18	NOV	0100	1	0.00	0.00	0.00	255.	255.
18	NOV	0200	2	0.01	0.00	0.01	256.	260.
18	NOV	0300	3	0.07	0.00	0.07	315.	285.
18	NOV	0400	4	0.13	0.00	0.13	515.	315.
18	NOV	0500	5	0.05	0.00	0.05	796.	399.
18	NOV	0600	6	0.02	0.00	0.02	967.	505.
18	NOV	0700	7	0.01	0.00	0.01	994.	556.
18	NOV	0800	8	0.04	0.00	0.04	988.	701.
18	NOV	0900	9	0.02	0.00	0.02	1002.	755.
18	NOV	1000	10	0.02	0.00	0.02	1012.	810.
18	NOV	1100	11	0.00	0.00	0.00	990.	810.
18	NOV	1200	12	0.02	0.00	0.02	949.	820.
18	NOV	1300	13	0.00	0.00	0.00	911.	830.
18	NOV	1400	14	0.00	0.00	0.00	861.	850.
18	NOV	1500	15	0.12	0.00	0.12	882.	1000.
18	NOV	1600	16	0.09	0.00	0.09	1069.	1192.
18	NOV	1700	17	0.08	0.00	0.08	1302.	1408.
18	NOV	1800	18	0.04	0.00	0.04	1451.	1664.
18	NOV	1900	19	0.14	0.00	0.14	1580.	1792.
18	NOV	2000	20	0.09	0.00	0.09	1781.	1948.
18	NOV	2100	21	0.07	0.00	0.07	1965.	2002.
18	NOV	2200	22	0.00	0.00	0.00	2010.	2056.
18	NOV	2300	23	0.00	0.00	0.00	1916.	1966.
19	NOV	0000	24	0.00	0.00	0.00	1760.	1876.
19	NOV	0100	25	0.00	0.00	0.00	1611.	1680.
19	NOV	0200	26	0.00	0.00	0.00	1476.	1506.
19	NOV	0300	27	0.00	0.00	0.00	1353.	1338.
19	NOV	0400	28	0.00	0.00	0.00	1240.	1180.
19	NOV	0500	29	0.00	0.00	0.00	1137.	1096.
19	NOV	0600	30	0.00	0.00	0.00	1044.	1012.
19	NOV	0700	31	0.00	0.00	0.00	958.	960.
19	NOV	0800	32	0.00	0.00	0.00	881.	900.
19	NOV	0900	33	0.00	0.00	0.00	809.	850.
19	NOV	1000	34	0.00	0.00	0.00	745.	800.
19	NOV	1100	35	0.00	0.00	0.00	685.	764.
19	NOV	1200	36	0.00	0.00	0.00	631.	719.
19	NOV	1300	37	0.00	0.00	0.00	582.	692.
19	NOV	1400	38	0.00	0.00	0.00	567.	665.
19	NOV	1500	39	0.00	0.00	0.00	554.	656.
19	NOV	1600	40	0.00	0.00	0.00	541.	638.
19	NOV	1700	41	0.02	0.00	0.02	528.	612.
19	NOV	1800	42	0.04	0.00	0.04	516.	580.
19	NOV	1900	43	0.03	0.00	0.03	534.	564.
19	NOV	2000	44	0.02	0.00	0.02	545.	548.
19	NOV	2100	45	0.00	0.00	0.00	612.	540.
19	NOV	2200	46	0.00	0.00	0.00	585.	533.
19	NOV	2300	47	0.00	0.00	0.00	568.	526.
20	NOV	0000	48	0.00	0.00	0.00	555.	512.
20	NOV	0100	49	0.00	0.00	0.00	542.	498.
20	NOV	0200	50	0.00	0.00	0.00	529.	477.
20	NOV	0300	51	0.00	0.00	0.00	517.	470.
20	NOV	0400	52	0.00	0.00	0.00	504.	466.
20	NOV	0500	53	0.00	0.00	0.00	493.	454.
20	NOV	0600	54	0.00	0.00	0.00	481.	442.
20	NOV	0700	55	0.00	0.00	0.00	470.	436.
20	NOV	0800	56	0.00	0.00	0.00	459.	422.
20	NOV	0900	57	0.00	0.00	0.00	448.	416.
20	NOV	1000	58	0.00	0.00	0.00	438.	404.
20	NOV	1100	59	0.00	0.00	0.00	427.	399.
20	NOV	1200	60	0.00	0.00	0.00	417.	388.
20	NOV	1300	61	0.00	0.00	0.00	407.	377.
20	NOV	1400	62	0.00	0.00	0.00	398.	366.
20	NOV	1500	63	0.00	0.00	0.00	389.	372.
20	NOV	1600	64	0.00	0.00	0.00	379.	372.
20	NOV	1700	65	0.00	0.00	0.00	371.	366.
20	NOV	1800	66	0.00	0.00	0.00	362.	360.

TOTAL RAINFALL = 1.13, TOTAL LOSS = 0.00, TOTAL EXCESS = 1.13

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	65.00-HR
2010.	21.00	(CFS)	1838.	1303.	824.	824.
		(INCHES)	0.295	0.837	1.433	1.433
		(AC-FT)	911.	2584.	4426.	4426.

CUMULATIVE AREA = 57.90 SQ MI


STATION SPLVN
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP, (X) EXCESS

HEC-1 INPUT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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID       CANASAWACTA CREEK    6-24-69
  2         ID       UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3         IT      60 22JUN69    2200      70
  4         IO       1       2
  5         OU      25      36
  6         PG    PLYM
  7         PI     .01     .01     .00     .10     .00     .00     .00     .01     .13     .06
  8         PI     .02     .07     .11     .09     .20     .01     .00     .00     .00     .00
  9         PI     .00     .00     .06     .06     .17     .17     .67     .50     .60     .12
 10         PI     .08     .01     .00     .00     .01     .00     .00     .01     .01     .01

 11         KK   SPLYM
 12         QO      10      10      10       9       9       9       9       9      10      11
 13         QO      11      11      12      13      15      18      21      26      43      67
 14         QO      79      92      88      83      79      74      97     126     193    1060
 15         QO    1380    1760    1648    1536    1324    1144     950     782     674     572
 16         QO     505     446     404     382     345     320     300     280     265     251
 17         QO     238     230     221     213     206     199     191     188     184     181
 18         QO     174     171     167     164     161     158     155     152     146     143
 19         PT    PLYM
 20         PW    1.00
 21         PR    PLYM
 22         PW    1.00
 23         BA    57.9      0.
 24         BF     10.    200.   1.024
 25         UC     -4.    -10.
 26         LU     -1.     -1.
 27         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 25 THROUGH 36)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.679		29.59			
COMPUTED HYDROGRAPH	10366.	0.277	864.	32.92	3.32	1759.	31.00
OBSERVED HYDROGRAPH	10421.	0.279	868.	32.69	3.10	1760.	31.00
DIFFERENCE	-55.	-0.001	-5.	0.23	0.23	-1.	0.00
PERCENT DIFFERENCE	-0.52				7.30	-0.07	

STANDARD ERROR 105. AVERAGE ABSOLUTE ERROR 84.
OBJECTIVE FUNCTION 109. AVERAGE PERCENT ABSOLUTE ERROR 37.06

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 70)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.679		29.59			
COMPUTED HYDROGRAPH	25268.	0.676	361.	41.11	11.52	1759.	31.00
OBSERVED HYDROGRAPH	21214.	0.568	303.	39.65	10.06	1760.	31.00
DIFFERENCE	4054.	0.108	58.	1.46	1.46	-1.	0.00
PERCENT DIFFERENCE	19.11				14.54	-0.07	

STANDARD ERROR 135. AVERAGE ABSOLUTE ERROR 80.
OBJECTIVE FUNCTION 164. AVERAGE PERCENT ABSOLUTE ERROR 38.03

UNIT HYDROGRAPH
67 END-OF-PERIOD ORDINATES

825.	2212.	2666.	2459.	2268.	2092.	1930.	1780.	1641.	1514.
1396.	1288.	1188.	1096.	1011.	932.	860.	793.	731.	674.
622.	574.	529.	488.	450.	415.	383.	353.	326.	300.
277.	256.	236.	217.	201.	185.	171.	157.	145.	134.
123.	114.	105.	97.	89.	82.	76.	70.	65.	60.
55.	51.	47.	43.	40.	37.	34.	31.	29.	27.
25.	23.	21.	19.	18.	16.	15.			

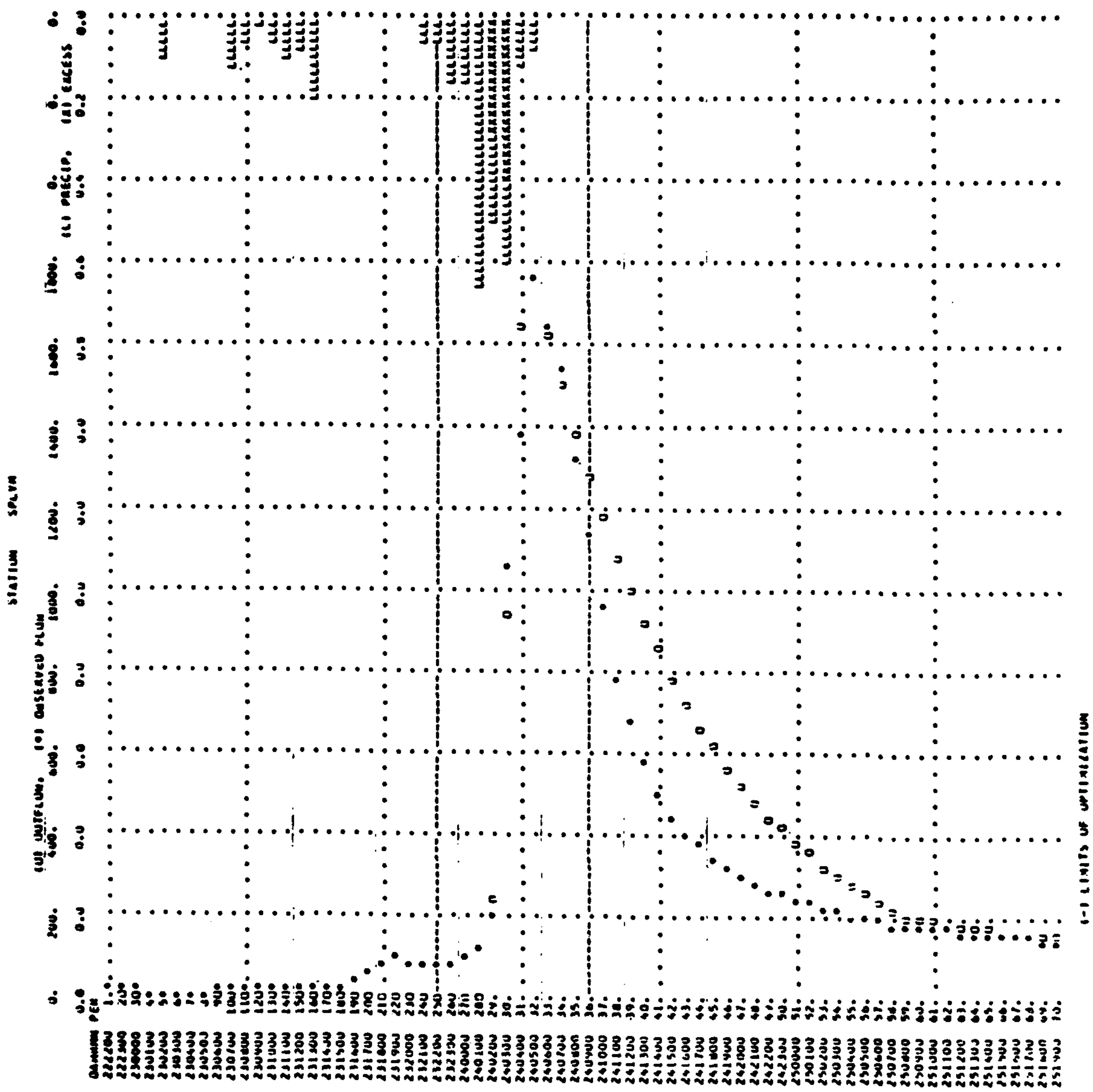
HYDROGRAPH AT STATION SPLYM

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
22 JUN 2200	1	0.00	0.00	0.00	10.	10.	24 JUN 0900	36	0.01	0.01	0.00	1274.	1144.
22 JUN 2300	2	0.01	0.01	0.00	10.	10.	24 JUN 1000	37	0.00	0.00	0.00	1175.	950.
23 JUN 0000	3	0.01	0.01	0.00	10.	10.	24 JUN 1100	38	0.00	0.00	0.00	1084.	782.
23 JUN 0100	4	0.00	0.00	0.00	9.	9.	24 JUN 1200	39	0.01	0.01	0.00	1000.	674.
23 JUN 0200	5	0.10	0.10	0.00	9.	9.	24 JUN 1300	40	0.01	0.01	0.00	923.	572.
23 JUN 0300	6	0.00	0.00	0.00	9.	9.	24 JUN 1400	41	0.01	0.01	0.00	851.	505.
23 JUN 0400	7	0.00	0.00	0.00	9.	9.	24 JUN 1500	42	0.00	0.00	0.00	785.	446.
23 JUN 0500	8	0.00	0.00	0.00	8.	9.	24 JUN 1600	43	0.00	0.00	0.00	724.	404.
23 JUN 0600	9	0.01	0.01	0.00	8.	10.	24 JUN 1700	44	0.00	0.00	0.00	668.	382.
23 JUN 0700	10	0.13	0.13	0.00	8.	11.	24 JUN 1800	45	0.00	0.00	0.00	617.	345.
23 JUN 0800	11	0.06	0.06	0.00	8.	11.	24 JUN 1900	46	0.00	0.00	0.00	569.	320.
23 JUN 0900	12	0.02	0.02	0.00	8.	11.	24 JUN 2000	47	0.00	0.00	0.00	525.	300.
23 JUN 1000	13	0.07	0.07	0.00	8.	12.	24 JUN 2100	48	0.00	0.00	0.00	484.	280.
23 JUN 1100	14	0.11	0.11	0.00	7.	13.	24 JUN 2200	49	0.00	0.00	0.00	447.	265.
23 JUN 1200	15	0.09	0.09	0.00	7.	15.	24 JUN 2300	50	0.00	0.00	0.00	412.	251.
23 JUN 1300	16	0.20	0.20	0.00	7.	18.	25 JUN 0000	51	0.00	0.00	0.00	381.	238.
23 JUN 1400	17	0.01	0.01	0.00	7.	21.	25 JUN 0100	52	0.00	0.00	0.00	351.	230.
23 JUN 1500	18	0.00	0.00	0.00	7.	26.	25 JUN 0200	53	0.00	0.00	0.00	324.	221.
23 JUN 1600	19	0.00	0.00	0.00	7.	43.	25 JUN 0300	54	0.00	0.00	0.00	299.	213.
23 JUN 1700	20	0.00	0.00	0.00	6.	67.	25 JUN 0400	55	0.00	0.00	0.00	276.	206.
23 JUN 1800	21	0.00	0.00	0.00	6.	79.	25 JUN 0500	56	0.00	0.00	0.00	255.	199.
23 JUN 1900	22	0.00	0.00	0.00	6.	92.	25 JUN 0600	57	0.00	0.00	0.00	235.	191.
23 JUN 2000	23	0.00	0.00	0.00	6.	88.	25 JUN 0700	58	0.00	0.00	0.00	217.	188.
23 JUN 2100	24	0.06	0.06	0.00	6.	83.	25 JUN 0800	59	0.00	0.00	0.00	200.	184.
23 JUN 2200	25	0.06	0.06	0.00	6.	79.	25 JUN 0900	60	0.00	0.00	0.00	195.	181.
23 JUN 2300	26	0.17	0.17	0.00	6.	74.	25 JUN 1000	61	0.00	0.00	0.00	191.	174.
24 JUN 0000	27	0.17	0.17	0.00	5.	97.	25 JUN 1100	62	0.00	0.00	0.00	186.	171.
24 JUN 0100	28	0.67	0.67	0.00	5.	126.	25 JUN 1200	63	0.00	0.00	0.00	182.	167.
24 JUN 0200	29	0.50	0.22	0.28	232.	193.	25 JUN 1300	64	0.00	0.00	0.00	178.	164.
24 JUN 0300	30	0.60	0.20	0.40	947.	1060.	25 JUN 1400	65	0.00	0.00	0.00	174.	161.
24 JUN 0400	31	0.12	0.12	0.00	1632.	1380.	25 JUN 1500	66	0.00	0.00	0.00	169.	158.
24 JUN 0500	32	0.08	0.08	0.00	1759.	1760.	25 JUN 1600	67	0.00	0.00	0.00	165.	155.
24 JUN 0600	33	0.01	0.01	0.00	1622.	1648.	25 JUN 1700	68	0.00	0.00	0.00	162.	152.
24 JUN 0700	34	0.00	0.00	0.00	1497.	1536.	25 JUN 1800	69	0.00	0.00	0.00	158.	146.
24 JUN 0800	35	0.00	0.00	0.00	1381.	1324.	25 JUN 1900	70	0.00	0.00	0.00	154.	143.

TOTAL RAINFALL = 3.30, TOTAL LOSS = 2.62, TOTAL EXCESS = 0.68

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	69.00-HR
1759.	31.00	(CFS)	1500.	891.	365.	365.
		(INCHES)	0.241	0.572	0.674	0.674
		(AC-FT)	744.	1768.	2081.	2081.

CUMULATIVE AREA = 57.00 SQ MI


STATION
(O) OBSERVED FLOW
(L) PRECIP.
(X) EXCESS
(-) LIMITS OF OPTIMIZATION

HEC-1 INPUT PAGE 1

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID       CANASAWACTA CREEK    7-31-71
   2          ID       UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3          IT      60 29JUL71    0900      80
   4          IO       1       2
   5          OU      40      54
   6          PG    PLYM
   7          PI     .01     .52     .05     .05     .12     .06     .01     .01     .01     .01
   8          PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
   9          PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  10          PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .08
  11          PI     .13     .59     .48     .12     .01     .00     .00     .02     .00     .00

  12          KK   SPLYM
  13          QO       9       9      10      12      21      33     186     516     418     335
  14          QO     266     198     173     149     137     122     112     102      94      85
  15          QO      81      74      70      66      62      60      56      54      51      49
  16          QO      48      46      42      41      39      38      36      35      35      33
  17          QO      33      35      60      92     376    1000    1162    1345    1075     850
  18          QO     723     612     516     430     370     320     284     262     239     218
  19          QO     202     190     180     169     162     155     149     143     137     134
  20          QO     131     128     122     120     117     115     109     107     104     102
  21          PT    PLYM
  22          PW    1.00
  23          PR    PLYM
  24          PW    1.00
  25          BA    57.9      0.
  26          BF      9.    145.   1.024
  27          UC     -4.    -10.
  28          LU     -1.     -1.
  29          ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 40 THROUGH 54)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.313		44.00			
COMPUTED HYDROGRAPH	8331.	0.223	555.	49.04	5.04	1179.	46.00
OBSERVED HYDROGRAPH	8342.	0.223	556.	48.83	4.83	1345.	47.00
DIFFERENCE	-11.	-0.000	-1.	0.21	0.21	-166.	-1.00
PERCENT DIFFERENCE	-0.14				4.35	-12.37	

STANDARD ERROR	74.	AVERAGE ABSOLUTE ERROR	62.
OBJECTIVE FUNCTION	83.	AVERAGE PERCENT ABSOLUTE ERROR	34.78

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 80)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.313		44.00			
COMPUTED HYDROGRAPH	13018.	0.348	163.	53.63	9.63	1179.	46.00
OBSERVED HYDROGRAPH	16781.	0.449	210.	45.20	1.20	1345.	47.00
DIFFERENCE	-3763.	-0.101	-47.	8.43	8.43	-166.	-1.00
PERCENT DIFFERENCE	-22.42				700.18	-12.37	

STANDARD ERROR	35.	AVERAGE ABSOLUTE ERROR	18.
OBJECTIVE FUNCTION	61.	AVERAGE PERCENT ABSOLUTE ERROR	18.90

UNIT HYDROGRAPH
41 END-OF-PERIOD ORDINATES

421.	1563.	2915.	3759.	3715.	3236.	2817.	2452.	2135.	1858.
1616.	1408.	1226.	1067.	929.	809.	704.	613.	533.	464.
404.	352.	306.	267.	232.	202.	176.	153.	133.	116.
101.	88.	77.	67.	58.	50.	44.	38.	33.	29.
25.									

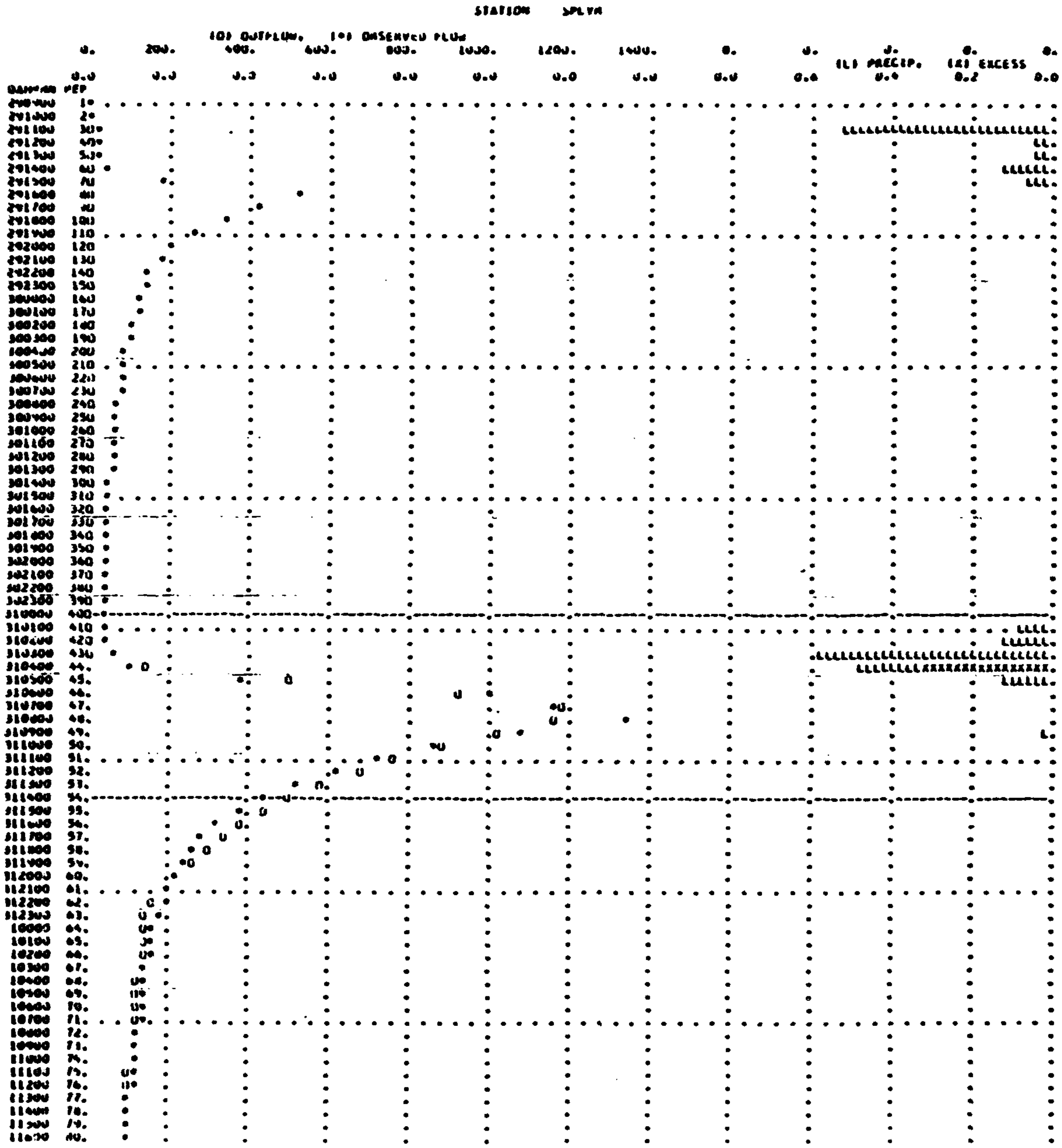
HYDROGRAPH AT STATION SPLYH

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
29 JUL 0900	1	0.00	0.00	0.00	9.	9.	31 JUL 0100	41	0.08	0.08	0.00	3.	33.
29 JUL 1000	2	0.01	0.01	0.00	9.	9.	31 JUL 0200	42	0.13	0.13	0.00	3.	35.
29 JUL 1100	3	0.52	0.52	0.00	9.	10.	31 JUL 0300	43	0.59	0.59	0.00	3.	60.
29 JUL 1200	4	0.05	0.05	0.00	8.	12.	31 JUL 0400	44	0.48	0.17	0.31	135.	92.
29 JUL 1300	5	0.05	0.05	0.00	8.	21.	31 JUL 0500	45	0.12	0.12	0.00	492.	376.
29 JUL 1400	6	0.12	0.12	0.00	8.	33.	31 JUL 0600	46	0.01	0.01	0.00	915.	1000.
29 JUL 1500	7	0.06	0.06	0.00	8.	186.	31 JUL 0700	47	0.00	0.00	0.00	1179.	1162.
29 JUL 1600	8	0.01	0.01	0.00	8.	516.	31 JUL 0800	48	0.00	0.00	0.00	1165.	1345.
29 JUL 1700	9	0.01	0.01	0.00	7.	418.	31 JUL 0900	49	0.02	0.02	0.00	1015.	1075.
29 JUL 1800	10	0.01	0.01	0.00	7.	335.	31 JUL 1000	50	0.00	0.00	0.00	884.	850.
29 JUL 1900	11	0.01	0.01	0.00	7.	266.	31 JUL 1100	51	0.00	0.00	0.00	770.	723.
29 JUL 2000	12	0.00	0.00	0.00	7.	198.	31 JUL 1200	52	0.00	0.00	0.00	673.	612.
29 JUL 2100	13	0.00	0.00	0.00	7.	173.	31 JUL 1300	53	0.00	0.00	0.00	584.	516.
29 JUL 2200	14	0.00	0.00	0.00	7.	149.	31 JUL 1400	54	0.00	0.00	0.00	509.	430.
29 JUL 2300	15	0.00	0.00	0.00	6.	137.	31 JUL 1500	55	0.00	0.00	0.00	443.	370.
30 JUL 0000	16	0.00	0.00	0.00	6.	122.	31 JUL 1600	56	0.00	0.00	0.00	386.	320.
30 JUL 0100	17	0.00	0.00	0.00	6.	112.	31 JUL 1700	57	0.00	0.00	0.00	336.	284.
30 JUL 0200	18	0.00	0.00	0.00	6.	102.	31 JUL 1800	58	0.00	0.00	0.00	293.	262.
30 JUL 0300	19	0.00	0.00	0.00	6.	94.	31 JUL 1900	59	0.00	0.00	0.00	255.	239.
30 JUL 0400	20	0.00	0.00	0.00	6.	85.	31 JUL 2000	60	0.00	0.00	0.00	222.	218.
30 JUL 0500	21	0.00	0.00	0.00	6.	81.	31 JUL 2100	61	0.00	0.00	0.00	194.	202.
30 JUL 0600	22	0.00	0.00	0.00	5.	76.	31 JUL 2200	62	0.00	0.00	0.00	169.	190.
30 JUL 0700	23	0.00	0.00	0.00	5.	70.	31 JUL 2300	63	0.00	0.00	0.00	147.	180.
30 JUL 0800	24	0.00	0.00	0.00	5.	66.	1 AUG 0000	64	0.00	0.00	0.00	142.	169.
30 JUL 0900	25	0.00	0.00	0.00	5.	62.	1 AUG 0100	65	0.00	0.00	0.00	139.	162.
30 JUL 1000	26	0.00	0.00	0.00	5.	60.	1 AUG 0200	66	0.00	0.00	0.00	135.	155.
30 JUL 1100	27	0.00	0.00	0.00	5.	56.	1 AUG 0300	67	0.00	0.00	0.00	132.	149.
30 JUL 1200	28	0.00	0.00	0.00	5.	54.	1 AUG 0400	68	0.00	0.00	0.00	129.	143.
30 JUL 1300	29	0.00	0.00	0.00	5.	51.	1 AUG 0500	69	0.00	0.00	0.00	126.	137.
30 JUL 1400	30	0.00	0.00	0.00	5.	49.	1 AUG 0600	70	0.00	0.00	0.00	123.	134.
30 JUL 1500	31	0.00	0.00	0.00	4.	48.	1 AUG 0700	71	0.00	0.00	0.00	120.	131.
30 JUL 1600	32	0.00	0.00	0.00	4.	46.	1 AUG 0800	72	0.00	0.00	0.00	117.	128.
30 JUL 1700	33	0.00	0.00	0.00	4.	42.	1 AUG 0900	73	0.00	0.00	0.00	115.	122.
30 JUL 1800	34	0.00	0.00	0.00	4.	41.	1 AUG 1000	74	0.00	0.00	0.00	112.	120.
30 JUL 1900	35	0.00	0.00	0.00	4.	39.	1 AUG 1100	75	0.00	0.00	0.00	109.	117.
30 JUL 2000	36	0.00	0.00	0.00	4.	38.	1 AUG 1200	76	0.00	0.00	0.00	107.	115.
30 JUL 2100	37	0.00	0.00	0.00	4.	36.	1 AUG 1300	77	0.00	0.00	0.00	104.	109.
30 JUL 2200	38	0.00	0.00	0.00	4.	35.	1 AUG 1400	78	0.00	0.00	0.00	102.	107.
30 JUL 2300	39	0.00	0.00	0.00	4.	35.	1 AUG 1500	79	0.00	0.00	0.00	100.	104.
31 JUL 0000	40	0.00	0.00	0.00	4.	33.	1 AUG 1600	80	0.00	0.00	0.00	97.	102.

TOTAL RAINFALL = 2.28, TOTAL LOSS = 1.97, TOTAL EXCESS = 0.31

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	79.00-HR
1179.	46.00	(CFS)	967.	471.	179.	164.
		(INCHES)	0.155	0.303	0.345	0.347
		(AC-FT)	480.	935.	1067.	1072.

CUMULATIVE AREA = 57.90 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 200. 400. 600. 800. 1000. 1200. 1400.
(L) PRECIP, (X) EXCESS

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                                        HEC-1 INPUT                                    PAGE  1

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID      CANASAWACTA CREEK     6-22/23-72
  2         ID      UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3         IT      60 21JUN72    1200      85
  4         IO       1       2
  5         OU       7      45
  6         PG    PLYM
  7         PI     .05  [illegible]  .01     .00     .00     .00     .01     .60     .68     .44
  8         PI     .31     .07     .18     .10     .08     .31     .24     .01     .01     .00
  9         PI     .00     .00     .00     .00     .00     .02     .01     .03     .07     .01
 10         PI     .15     .17     .23     .23     .03     .02     .01     .00     .00     .00
 11         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 12         PI     .04     .15     .06     .02     .03     .02     .00     .00     .00     .00

 13         KK   SPLYM
 14         QO      68      70      72      74      78      83      87     102     117     370
 15         QO     880    1940    3800    5000    4760    4610    4430    4550    4670    4340
 16         QO    4010    3560    3080    2675    2320    2080    1820    1620    1465    1390
 17         QO    1315    1360    1405    1780    2200    2800    3530    3680    3590    3320
 18         QO    3020    2700    2400    2180    1960    1760    1495    1375    1263    1188
 19         QO    1113    1063    1010    1030    1063    1125    1188    1175    1162    1113
 20         QO    1050    1030     970     920     880     840     810     780     750     723
 21         QO     705     678     660     636     620     604     588     564     548     524
 22         QO     508     493     486     472     465       0       0       0       0       0
 23         PT    PLYM
 24         PW    1.00
 25         PR    PLYM
 26         PW    1.00
 27         BA    57.9      0.
 28         HF     68.    810.   1.024
 29         UC     -3.     -8.
 30         LU     -.4    -.01
 31         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 7 THROUGH 45)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.192		22.05			
COMPUTED HYDROGRAPH	100915.	2.701	2588.	25.75	3.70	4971.	19.00
OBSERVED HYDROGRAPH	100916.	2.701	2588.	26.37	4.32	5000.	13.00
DIFFERENCE	-1.	-0.000	-0.	-0.62	-0.62	-29.	6.00
PERCENT DIFFERENCE	-0.00				-14.37	-0.58	

STANDARD ERROR	448.	AVERAGE ABSOLUTE ERROR	389.
OBJECTIVE FUNCTION	471.	AVERAGE PERCENT ABSOLUTE ERROR	18.99

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 85)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.192		22.05			
COMPUTED HYDROGRAPH	130672.	3.497	1537.	34.00	11.95	4971.	19.00
OBSERVED HYDROGRAPH	136788.	3.661	1609.	35.44	13.39	5000.	13.00
DIFFERENCE	-6116.	-0.164	-72.	-1.44	-1.44	-29.	6.00
PERCENT DIFFERENCE	-4.47				-10.74	-0.58	

STANDARD ERROR	336.	AVERAGE ABSOLUTE ERROR	250.
OBJECTIVE FUNCTION	427.	AVERAGE PERCENT ABSOLUTE ERROR	16.70

UNIT HYDROGRAPH
44 END-OF-PERIOD ORDINATES

515.	1876.	3253.	3659.	3324.	2930.	2561.	2277.	2007.	1770.
1560.	1375.	1212.	1069.	942.	831.	732.	645.	569.	502.
442.	390.	344.	303.	267.	235.	208.	183.	161.	142.
125.	110.	97.	86.	76.	67.	59.	52.	46.	40.
36.	31.	28.	24.						

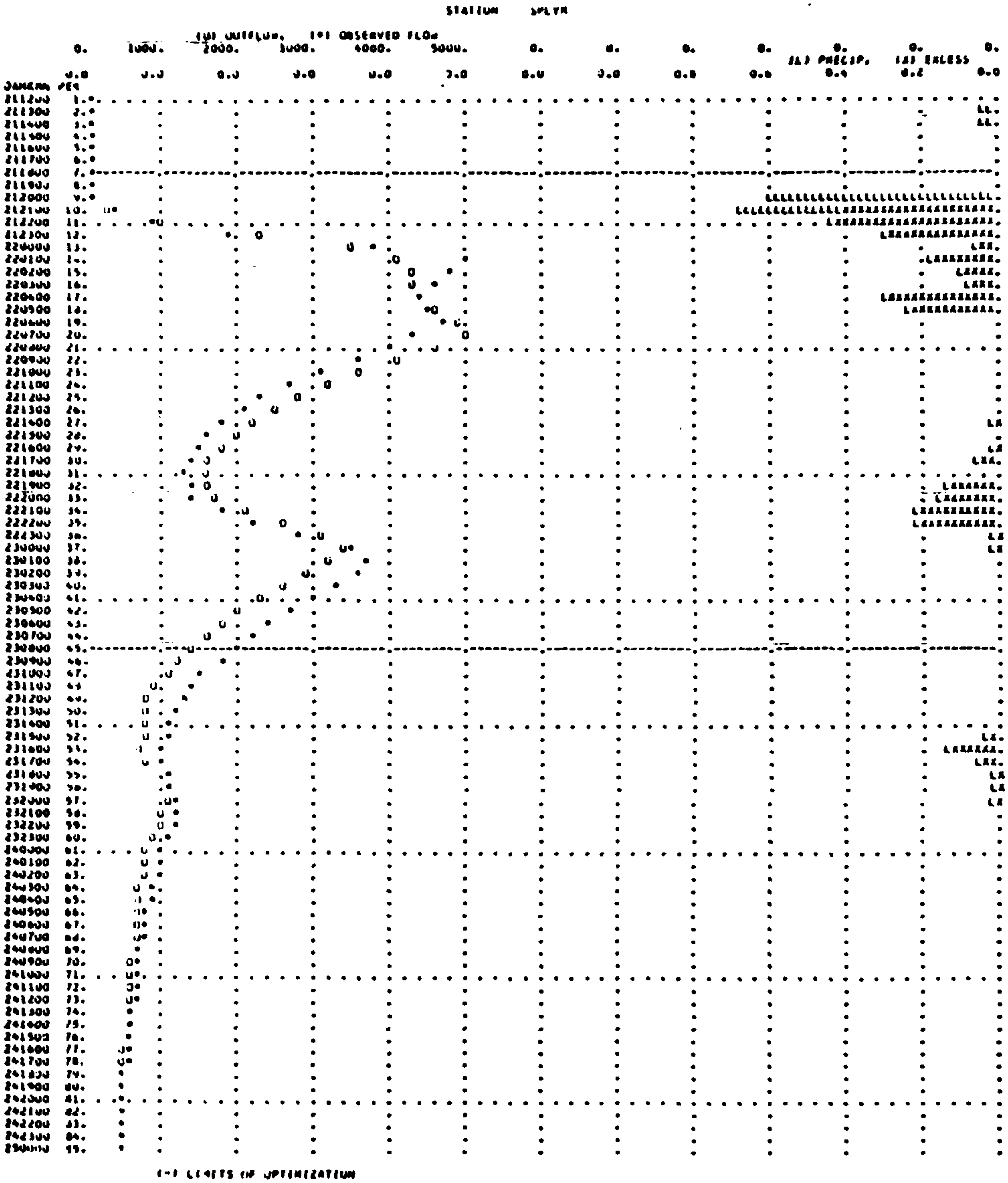
HYDROGRAPH AT STATION SPLYM

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
21 JUN 1200	1	0.00	0.00	0.00	68.	68.
21 JUN 1300	2	0.05	0.05	0.00	66.	70.
21 JUN 1400	3	0.05	0.05	0.00	65.	72.
21 JUN 1500	4	0.01	0.01	0.00	63.	74.
21 JUN 1600	5	0.00	0.00	0.00	62.	78.
21 JUN 1700	6	0.00	0.00	0.00	60.	83.
21 JUN 1800	7	0.00	0.00	0.00	59.	87.
21 JUN 1900	8	0.01	0.01	0.00	58.	102.
21 JUN 2000	9	0.60	0.60	0.00	56.	117.
21 JUN 2100	10	0.68	0.28	0.40	263.	370.
21 JUN 2200	11	0.44	0.01	0.43	1033.	880.
21 JUN 2300	12	0.31	0.01	0.30	2330.	1940.
22 JUN 0000	13	0.37	0.01	0.36	3527.	3800.
22 JUN 0100	14	0.18	0.01	0.17	4149.	5000.
22 JUN 0200	15	0.10	0.01	0.09	4329.	4760.
22 JUN 0300	16	0.08	0.01	0.07	4337.	4610.
22 JUN 0400	17	0.31	0.01	0.30	4369.	4430.
22 JUN 0500	18	0.24	0.01	0.23	4603.	4550.
22 JUN 0600	19	0.01	0.01	0.00	4937.	4670.
22 JUN 0700	20	0.01	0.01	0.00	4971.	4340.
22 JUN 0800	21	0.00	0.00	0.00	4600.	4010.
22 JUN 0900	22	0.00	0.00	0.00	4084.	3560.
22 JUN 1000	23	0.00	0.00	0.00	3634.	3080.
22 JUN 1100	24	0.00	0.00	0.00	3181.	2675.
22 JUN 1200	25	0.00	0.00	0.00	2808.	2320.
22 JUN 1300	26	0.00	0.00	0.00	2479.	2040.
22 JUN 1400	27	0.02	0.01	0.01	2195.	1820.
22 JUN 1500	28	0.01	0.01	0.00	1954.	1620.
22 JUN 1600	29	0.03	0.01	0.02	1754.	1465.
22 JUN 1700	30	0.37	0.01	0.36	1620.	1390.
22 JUN 1800	31	0.01	0.01	0.00	1552.	1315.
22 JUN 1900	32	0.15	0.01	0.14	1558.	1360.
22 JUN 2000	33	0.17	0.01	0.16	1711.	1405.
22 JUN 2100	34	0.23	0.01	0.22	2084.	1780.
22 JUN 2200	35	0.23	0.01	0.22	2636.	2200.
22 JUN 2300	36	0.03	0.01	0.02	3145.	2800.
23 JUN 0000	37	0.02	0.01	0.01	3354.	3530.
23 JUN 0100	38	0.01	0.01	0.00	3204.	3680.
23 JUN 0200	39	0.00	0.00	0.00	2883.	3590.
23 JUN 0300	40	0.00	0.00	0.00	2556.	3320.
23 JUN 0400	41	0.00	0.00	0.00	2257.	3020.
23 JUN 0500	42	0.00	0.00	0.00	1992.	2700.
23 JUN 0600	43	0.00	0.00	0.00	1759.	2400.
23 JUN 0700	44	0.00	0.00	0.00	1553.	2180.
23 JUN 0800	45	0.00	0.00	0.00	1371.	1960.
23 JUN 0900	46	0.00	0.00	0.00	1211.	1760.
23 JUN 1000	47	0.00	0.00	0.00	1070.	1495.
23 JUN 1100	48	0.00	0.00	0.00	945.	1375.
23 JUN 1200	49	0.00	0.00	0.00	835.	1263.
23 JUN 1300	50	0.00	0.00	0.00	746.	1188.
23 JUN 1400	51	0.00	0.00	0.00	777.	1113.
23 JUN 1500	52	0.04	0.01	0.03	759.	1063.
23 JUN 1600	53	0.15	0.01	0.14	741.	1010.
23 JUN 1700	54	0.06	0.01	0.05	833.	1030.
23 JUN 1800	55	0.02	0.01	0.01	1054.	1063.
23 JUN 1900	56	0.03	0.01	0.02	1146.	1125.
23 JUN 2000	57	0.02	0.01	0.01	1116.	1188.
23 JUN 2100	58	0.00	0.00	0.00	1044.	1175.
23 JUN 2200	59	0.00	0.00	0.00	954.	1162.
23 JUN 2300	60	0.00	0.00	0.00	852.	1113.
24 JUN 0000	61	0.00	0.00	0.00	749.	1050.
24 JUN 0100	62	0.00	0.00	0.00	760.	1030.
24 JUN 0200	63	0.00	0.00	0.00	762.	970.
24 JUN 0300	64	0.00	0.00	0.00	744.	920.
24 JUN 0400	65	0.00	0.00	0.00	726.	880.
24 JUN 0500	66	0.00	0.00	0.00	709.	840.
24 JUN 0600	67	0.00	0.00	0.00	693.	810.
24 JUN 0700	68	0.00	0.00	0.00	676.	780.
24 JUN 0800	69	0.00	0.00	0.00	661.	750.
24 JUN 0900	70	0.00	0.00	0.00	645.	723.
24 JUN 1000	71	0.00	0.00	0.00	630.	705.
24 JUN 1100	72	0.00	0.00	0.00	615.	678.
24 JUN 1200	73	0.00	0.00	0.00	601.	660.
24 JUN 1300	74	0.00	0.00	0.00	587.	636.
24 JUN 1400	75	0.00	0.00	0.00	573.	620.
24 JUN 1500	76	0.00	0.00	0.00	560.	604.
24 JUN 1600	77	0.00	0.00	0.00	546.	588.
24 JUN 1700	78	0.00	0.00	0.00	534.	564.
24 JUN 1800	79	0.00	0.00	0.00	521.	548.
24 JUN 1900	80	0.00	0.00	0.00	509.	524.
24 JUN 2000	81	0.00	0.00	0.00	497.	508.
24 JUN 2100	82	0.00	0.00	0.00	485.	493.
24 JUN 2200	83	0.00	0.00	0.00	474.	486.
24 JUN 2300	84	0.00	0.00	0.00	463.	472.
25 JUN 0000	85	0.00	0.00	0.00	452.	465.

TOTAL RAINFALL = 4.45, TOTAL LOSS = 1.26, TOTAL EXCESS = 3.19

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	84.00-HR
4971.	14.00	(CFS)	4615.	3171.	1763.	1553.
		(INCHES)	0.741	2.037	3.435	3.490
		(AC-FT)	2288.	6259.	10608.	10778.

CUMULATIVE AREA = 57.90 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 1000. 2000. 3000. 4000. 5000.
(L) PRECIP, (X) EXCESS
(-) LIMITS OF OPTIMIZATION

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                                          HEC-1 INPUT                                          PAGE  1

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID        CANASAWACTA CREEK    7-03-74
  2         ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3         IT      60 03JUL74    0400      55
  4         IO       1       2
  5         OO       1      15
  6         PG    PLYM
  7         PI     .05     .44     .91     .40     .05     .10     .00     .00     .00     .00
  8         PI     .00     .01     .00     .01     .01     .01     .01     .00     .00     .00

  9         KK   SPLYM
 10         QO      30      30      33      72     223    1016    2678    3951    4095    3782
 11         QO    2989    2484    1961    1665    1369    1141     962     850     772     707
 12         QO     654     620     587     555     533     512     489     475     455     442
 13         QO     429     416     403     385     373     355     340     330     315     301
 14         QO     292     283     278     270     265     261     257     257     252     248
 15         QO     244     239     239     235     231       0       0       0       0       0
 16         PT    PLYM
 17         PW    1.00
 18         PR    PLYM
 19         PW    1.00
 20         BA    57.9      0.
 21         BF     30.    285.   1.024
 22         UC     -5.     -5.
 23         LU     -.5    -.04
 24         ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 1 THROUGH 15)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.807		4.51			
COMPUTED HYDROGRAPH	26373.	0.706	1758.	9.79	5.28	3816.	8.00
OBSERVED HYDROGRAPH	26378.	0.706	1759.	10.04	5.53	4095.	8.00
DIFFERENCE	-5.	-0.000	-0.	-0.25	-0.25	-279.	0.00
PERCENT DIFFERENCE	-0.02				-4.50	-6.81	

STANDARD ERROR	279.	AVERAGE ABSOLUTE ERROR	186.
OBJECTIVE FUNCTION	277.	AVERAGE PERCENT ABSOLUTE ERROR	37.03

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 55)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.807		4.51			
COMPUTED HYDROGRAPH	36280.	0.971	660.	15.32	10.81	3816.	8.00
OBSERVED HYDROGRAPH	43630.	1.168	793.	18.09	13.58	4095.	8.00
DIFFERENCE	-7350.	-0.197	-134.	-2.77	-2.77	-279.	0.00
PERCENT DIFFERENCE	-16.85				-20.39	-6.81	

STANDARD ERROR	225.	AVERAGE ABSOLUTE ERROR	184.
OBJECTIVE FUNCTION	267.	AVERAGE PERCENT ABSOLUTE ERROR	41.75

UNIT HYDROGRAPH
25 END-OF-PERIOD ORDINATES

378.	1365.	2655.	3892.	4686.	4828.	4235.	3332.	2608.	2041.
1597.	1250.	978.	765.	599.	469.	367.	287.	225.	176.
138.	108.	84.	66.	52.					

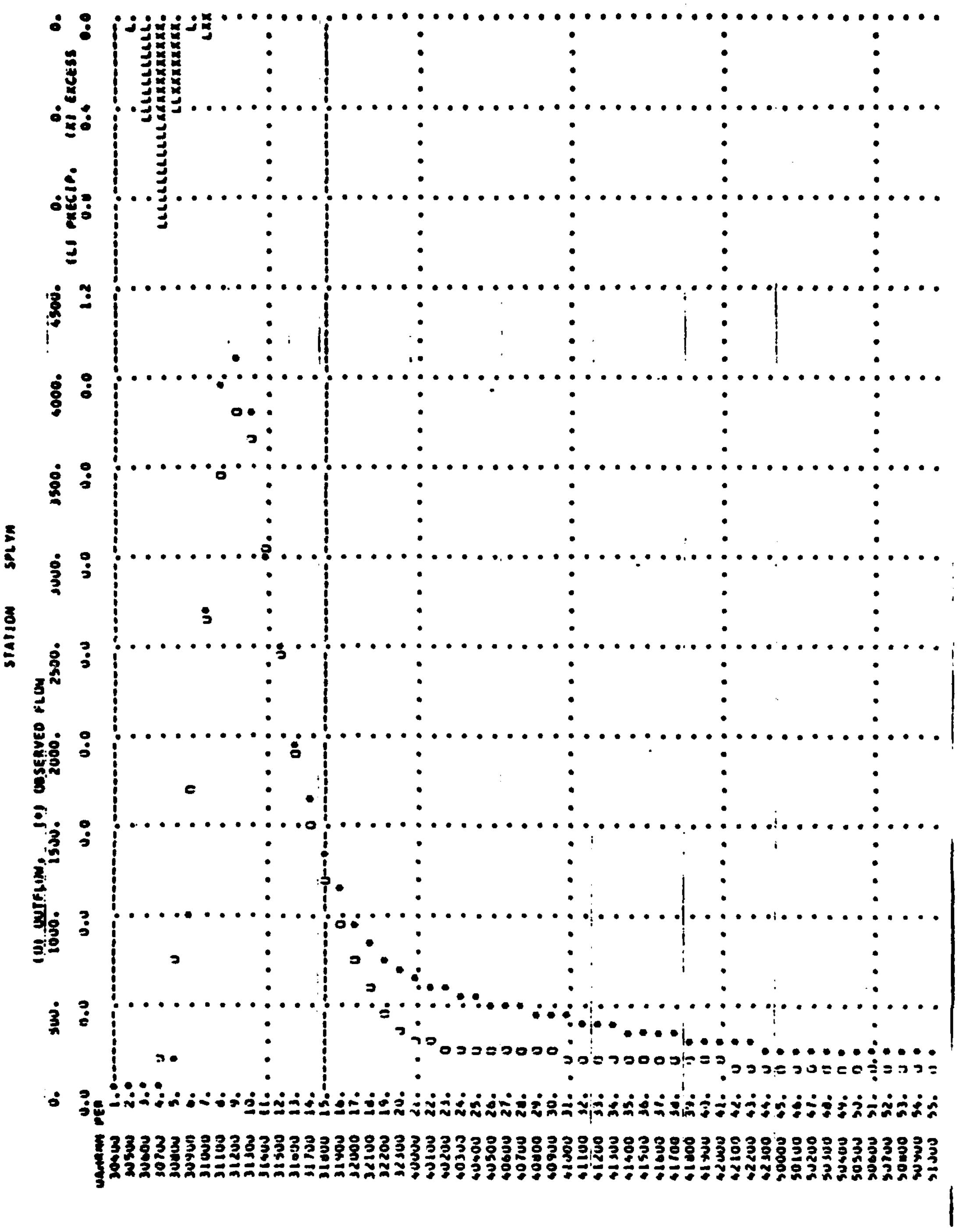
HYDROGRAPH AT STATION SPLYM

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
3 JUL 0400	1	0.00	0.00	0.00	30.	30.	4 JUL 0800	29	0.00	0.00	0.00	236.	455.
3 JUL 0500	2	0.05	0.05	0.00	29.	30.	4 JUL 0900	30	0.00	0.00	0.00	230.	442.
3 JUL 0600	3	0.44	0.44	0.00	29.	33.	4 JUL 1000	31	0.00	0.00	0.00	225.	429.
3 JUL 0700	4	0.91	0.46	0.45	199.	72.	4 JUL 1100	32	0.00	0.00	0.00	220.	416.
3 JUL 0800	5	0.40	0.07	0.33	769.	223.	4 JUL 1200	33	0.00	0.00	0.00	214.	403.
3 JUL 0900	6	0.05	0.05	0.00	1675.	1010.	4 JUL 1300	34	0.00	0.00	0.00	209.	385.
3 JUL 1000	7	0.10	0.07	0.03	2667.	2678.	4 JUL 1400	35	0.00	0.00	0.00	204.	373.
3 JUL 1100	8	0.00	0.00	0.00	3457.	3951.	4 JUL 1500	36	0.00	0.00	0.00	200.	355.
3 JUL 1200	9	0.00	0.00	0.00	3816.	4095.	4 JUL 1600	37	0.00	0.00	0.00	195.	340.
3 JUL 1300	10	0.00	0.00	0.00	3628.	3782.	4 JUL 1700	38	0.00	0.00	0.00	190.	330.
3 JUL 1400	11	0.00	0.00	0.00	3046.	2989.	4 JUL 1800	39	0.00	0.00	0.00	186.	315.
3 JUL 1500	12	0.00	0.00	0.00	2427.	2484.	4 JUL 1900	40	0.00	0.00	0.00	182.	301.
3 JUL 1600	13	0.01	0.01	0.00	1916.	1961.	4 JUL 2000	41	0.00	0.00	0.00	177.	292.
3 JUL 1700	14	0.00	0.00	0.00	1504.	1665.	4 JUL 2100	42	0.00	0.00	0.00	173.	283.
3 JUL 1800	15	0.01	0.01	0.00	1181.	1369.	4 JUL 2200	43	0.00	0.00	0.00	169.	278.
3 JUL 1900	16	0.01	0.01	0.00	929.	1141.	4 JUL 2300	44	0.00	0.00	0.00	165.	270.
3 JUL 2000	17	0.01	0.01	0.00	731.	962.	5 JUL 0000	45	0.00	0.00	0.00	161.	265.
3 JUL 2100	18	0.01	0.01	0.00	576.	850.	5 JUL 0100	46	0.00	0.00	0.00	158.	261.
3 JUL 2200	19	0.00	0.00	0.00	455.	772.	5 JUL 0200	47	0.00	0.00	0.00	154.	257.
3 JUL 2300	20	0.00	0.00	0.00	360.	707.	5 JUL 0300	48	0.00	0.00	0.00	150.	257.
4 JUL 0000	21	0.00	0.00	0.00	285.	654.	5 JUL 0400	49	0.00	0.00	0.00	147.	252.
4 JUL 0100	22	0.00	0.00	0.00	278.	620.	5 JUL 0500	50	0.00	0.00	0.00	143.	248.
4 JUL 0200	23	0.00	0.00	0.00	272.	587.	5 JUL 0600	51	0.00	0.00	0.00	140.	244.
4 JUL 0300	24	0.00	0.00	0.00	265.	555.	5 JUL 0700	52	0.00	0.00	0.00	137.	239.
4 JUL 0400	25	0.00	0.00	0.00	259.	533.	5 JUL 0800	53	0.00	0.00	0.00	133.	239.
4 JUL 0500	26	0.00	0.00	0.00	253.	512.	5 JUL 0900	54	0.00	0.00	0.00	130.	235.
4 JUL 0600	27	0.00	0.00	0.00	247.	489.	5 JUL 1000	55	0.00	0.00	0.00	127.	231.
4 JUL 0700	28	0.00	0.00	0.00	241.	475.							

TOTAL RAINFALL = 2.00, TOTAL LOSS = 1.19, TOTAL EXCESS = 0.81

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	54.00-HR
3816.	8.00	(CFS)	3111.	1301.	670.	670.
		(INCHES)	0.530	0.835	0.969	0.969
		(AC-FT)	1543.	2580.	2992.	2992.

CUMULATIVE AREA = 57.90 SQ MI


STATION SPLVN
(U) UNITFLOW, (*) OBSERVED FLOW
(L) PRECIP.
(X) EXCESS
0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 4500.

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                                        HEC-1 INPUT                                              PAGE  1

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1          ID        CHARLOTTE CREEK 6-29-73
  2          ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3          IT      60 28JUN73    2000     110
  4          IO       1       2
  5          OU       7      35
  6          PG     KOR    3.21
  7          PG     OSU    4.46
  8          PG     COB    2.04
  9          PG     STM    2.73
 10          PG    ESID
 11          PI     .00     .00     .00     .00     .20     .90     .30     .20     .50     .10
 12          PI     .20     .10     .10     .00     .00     .10     .20     .30     .00     .00

 13          KK    WDAV
 14          QO     107     107     107     107     110     111     112     131     149     322
 15          QO     495    1034    1573    1811    2049    2107    2164    2201    2238    2640
 16          QO    3042    3224    3405    3515    3625    3691    3647    3565    3482    3378
 17          QO    3273    3097    2921    2726    2530    2339    2148    2042    1936    1912
 18          QO    1883    1862    1836    1757    1678    1598    1517    1435    1352    1295
 19          QO    1238    1202    1166    1136    1106    1082    1058    1034    1010     994
 20          QO     977     963     949     933     917     901     884     865     845     826
 21          QO     806     783     760     745     730     718     705     693     680     673
 22          QO     665     660     655     652     650     645     640     633     625     617
 23          QO     610     602     595     582     568     556     545     535     523     516
 24          QO     509     505     500     495     491     488     486     484     482     480
 25          PT     KOR     OSU     COB     STM
 26          PW     .60     .02     .09     .29
 27          PR    ESID
 28          PW    1.00
 29          BA    167.      0.
 30          BF    107.    500.  1.0165
 31          UC    -13.    -22.
 32          LU     -1.     -1.
 33          ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 7 THROUGH 35)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.128		11.66			
COMPUTED HYDROGRAPH	68046.	0.631	2346.	24.76	13.10	3539.	24.00
OBSERVED HYDROGRAPH	68147.	0.632	2350.	24.49	12.84	3691.	25.00
DIFFERENCE	-101.	-0.001	-3.	0.27	0.27	-152.	-1.00
PERCENT DIFFERENCE	-0.15				2.07	-4.13	

STANDARD ERROR	249.	AVERAGE ABSOLUTE ERROR	180.
OBJECTIVE FUNCTION	242.	AVERAGE PERCENT ABSOLUTE ERROR	9.78

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 110)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.128		11.66			
COMPUTED HYDROGRAPH	130634.	1.212	1188.	40.48	28.83	3539.	24.00
OBSERVED HYDROGRAPH	139764.	1.297	1271.	44.03	32.38	3691.	25.00
DIFFERENCE	-9130.	-0.085	-83.	-3.55	-3.55	-152.	-1.00
PERCENT DIFFERENCE	-6.53				-10.96	-4.13	

STANDARD ERROR	219.	AVERAGE ABSOLUTE ERROR	183.
OBJECTIVE FUNCTION	238.	AVERAGE PERCENT ABSOLUTE ERROR	21.90

UNIT HYDROGRAPH
110 END-OF-PERIOD ORDINATES

86.	241.	447.	804.	1148.	1521.	1918.	2325.	2706.	3032.
3300.	3539.	3652.	3720.	3677.	3535.	3370.	3213.	3063.	2919.
2783.	2653.	2529.	2411.	2298.	2191.	2088.	1991.	1898.	1809.
1725.	1644.	1567.	1494.	1424.	1358.	1294.	1234.	1176.	1121.
1069.	1019.	971.	926.	883.	841.	802.	764.	729.	695.
662.	631.	602.	574.	547.	521.	497.	474.	452.	431.
410.	391.	373.	356.	339.	323.	308.	294.	280.	267.
254.	242.	231.	220.	210.	200.	191.	182.	173.	165.
159.	150.	143.	137.	130.	124.	118.	113.	107.	102.
98.	93.	89.	85.	81.	77.	73.	70.	67.	63.
61.	58.	55.	52.	50.	48.	45.	43.	41.	39.
34.	36.	34.	32.	31.	33.	28.	27.	26.	

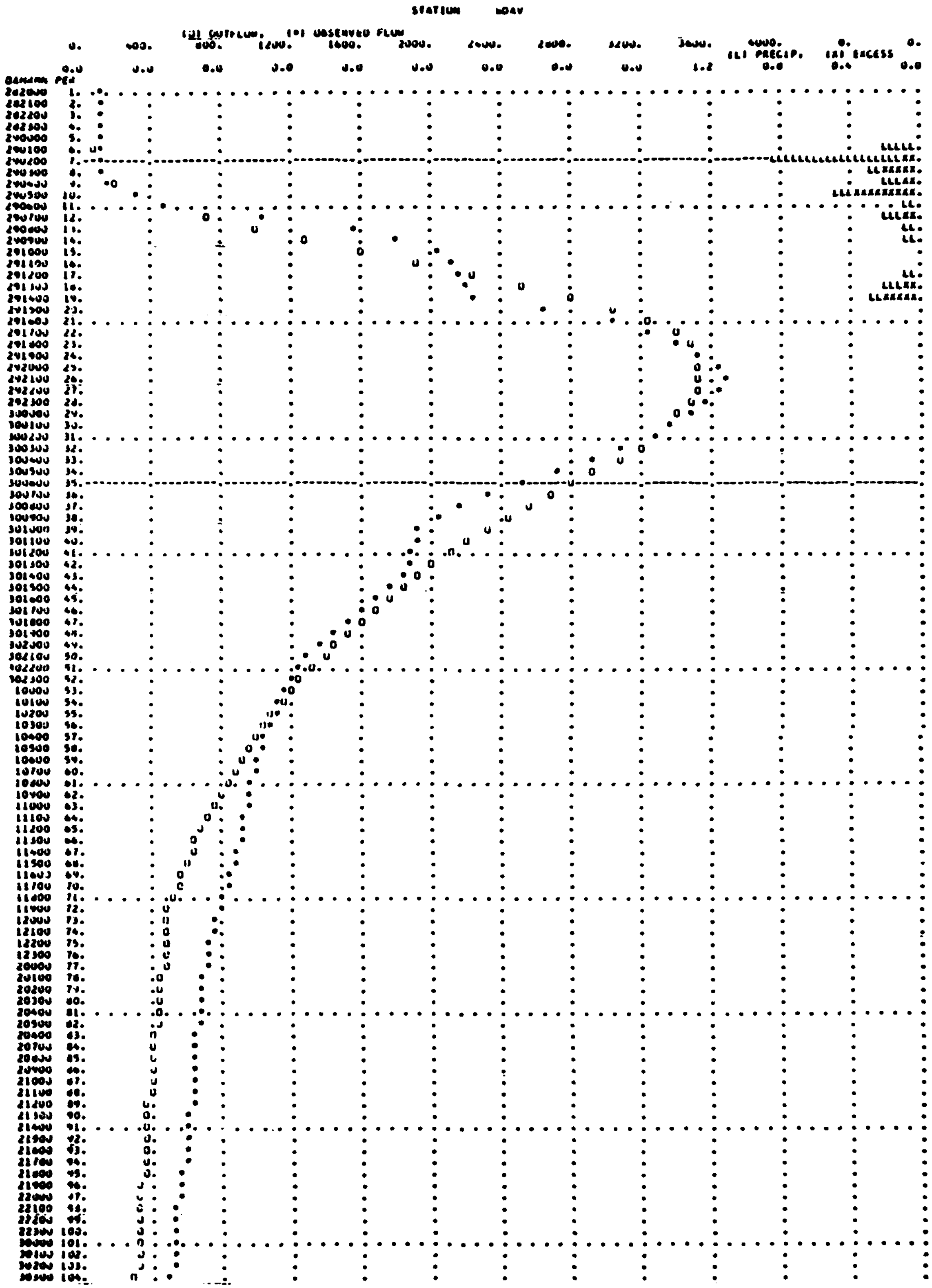
HYDROGRAPH AT STATION ODAV

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
28	JUN	2000	1	0.00	0.00	0.00	107.	107.
28	JUN	2100	2	0.00	0.00	0.00	105.	107.
28	JUN	2200	3	0.00	0.00	0.00	104.	107.
28	JUN	2300	4	0.00	0.00	0.00	102.	107.
29	JUN	0000	5	0.00	0.00	0.00	100.	110.
29	JUN	0100	6	0.19	0.19	0.00	99.	111.
29	JUN	0200	7	0.84	0.74	0.10	103.	112.
29	JUN	0300	8	0.28	0.09	0.19	131.	131.
29	JUN	0400	9	0.19	0.09	0.09	193.	149.
29	JUN	0500	10	0.47	0.09	0.37	310.	322.
29	JUN	0600	11	0.09	0.09	0.00	489.	495.
29	JUN	0700	12	0.19	0.09	0.09	719.	1034.
29	JUN	0800	13	0.09	0.09	0.00	989.	1573.
29	JUN	0900	14	0.09	0.09	0.00	1293.	1811.
29	JUN	1000	15	0.00	0.00	0.00	1607.	2049.
29	JUN	1100	16	0.00	0.00	0.00	1928.	2107.
29	JUN	1200	17	0.09	0.09	0.00	2237.	2164.
29	JUN	1300	18	0.19	0.09	0.09	2523.	2201.
29	JUN	1400	19	0.28	0.09	0.19	2789.	2238.
29	JUN	1500	20	0.00	0.00	0.00	3034.	2840.
29	JUN	1600	21	0.00	0.00	0.00	3240.	3042.
29	JUN	1700	22	0.00	0.00	0.00	3392.	3224.
29	JUN	1800	23	0.00	0.00	0.00	3489.	3405.
29	JUN	1900	24	0.00	0.00	0.00	3533.	3515.
29	JUN	2000	25	0.00	0.00	0.00	3539.	3625.
29	JUN	2100	26	0.00	0.00	0.00	3527.	3691.
29	JUN	2200	27	0.00	0.00	0.00	3501.	3647.
29	JUN	2300	28	0.00	0.00	0.00	3463.	3565.
30	JUN	0000	29	0.00	0.00	0.00	3414.	3482.
30	JUN	0100	30	0.00	0.00	0.00	3354.	3378.
30	JUN	0200	31	0.00	0.00	0.00	3279.	3273.
30	JUN	0300	32	0.00	0.00	0.00	3184.	3097.
30	JUN	0400	33	0.00	0.00	0.00	3065.	2921.
30	JUN	0500	34	0.00	0.00	0.00	2929.	2726.
30	JUN	0600	35	0.00	0.00	0.00	2794.	2530.
30	JUN	0700	36	0.00	0.00	0.00	2666.	2339.
30	JUN	0800	37	0.00	0.00	0.00	2543.	2148.
30	JUN	0900	38	0.00	0.00	0.00	2426.	2042.
30	JUN	1000	39	0.00	0.00	0.00	2314.	1936.
30	JUN	1100	40	0.00	0.00	0.00	2208.	1912.
30	JUN	1200	41	0.00	0.00	0.00	2107.	1898.
30	JUN	1300	42	0.00	0.00	0.00	2010.	1862.
30	JUN	1400	43	0.00	0.00	0.00	1918.	1836.
30	JUN	1500	44	0.00	0.00	0.00	1830.	1757.
30	JUN	1600	45	0.00	0.00	0.00	1746.	1678.
30	JUN	1700	46	0.00	0.00	0.00	1666.	1598.
30	JUN	1800	47	0.00	0.00	0.00	1589.	1517.
30	JUN	1900	48	0.00	0.00	0.00	1517.	1435.
30	JUN	2000	49	0.00	0.00	0.00	1447.	1352.
30	JUN	2100	50	0.00	0.00	0.00	1381.	1295.
30	JUN	2200	51	0.00	0.00	0.00	1318.	1234.
30	JUN	2300	52	0.00	0.00	0.00	1258.	1202.
1	JUL	0000	53	0.00	0.00	0.00	1201.	1166.
1	JUL	0100	54	0.00	0.00	0.00	1146.	1136.
1	JUL	0200	55	0.00	0.00	0.00	1094.	1106.
1	JUL	0300	56	0.00	0.00	0.00	1044.	1082.
1	JUL	0400	57	0.00	0.00	0.00	997.	1058.
1	JUL	0500	58	0.00	0.00	0.00	951.	1034.
1	JUL	0600	59	0.00	0.00	0.00	908.	1010.
1	JUL	0700	60	0.00	0.00	0.00	867.	994.
1	JUL	0800	61	0.00	0.00	0.00	828.	977.
1	JUL	0900	62	0.00	0.00	0.00	790.	963.
1	JUL	1000	63	0.00	0.00	0.00	754.	949.
1	JUL	1100	64	0.00	0.00	0.00	720.	933.
1	JUL	1200	65	0.00	0.00	0.00	688.	917.
1	JUL	1300	66	0.00	0.00	0.00	657.	901.
1	JUL	1400	67	0.00	0.00	0.00	627.	884.
1	JUL	1500	68	0.00	0.00	0.00	599.	865.
1	JUL	1600	69	0.00	0.00	0.00	572.	845.
1	JUL	1700	70	0.00	0.00	0.00	547.	826.
1	JUL	1800	71	0.00	0.00	0.00	522.	806.
1	JUL	1900	72	0.00	0.00	0.00	500.	785.
1	JUL	2000	73	0.00	0.00	0.00	491.	760.
1	JUL	2100	74	0.00	0.00	0.00	483.	745.
1	JUL	2200	75	0.00	0.00	0.00	474.	730.
1	JUL	2300	76	0.00	0.00	0.00	468.	718.
2	JUL	0000	77	0.00	0.00	0.00	460.	705.
2	JUL	0100	78	0.00	0.00	0.00	453.	693.
2	JUL	0200	79	0.00	0.00	0.00	445.	680.
2	JUL	0300	80	0.00	0.00	0.00	438.	673.
2	JUL	0400	81	0.00	0.00	0.00	431.	665.
2	JUL	0500	82	0.00	0.00	0.00	424.	660.
2	JUL	0600	83	0.00	0.00	0.00	417.	655.
2	JUL	0700	84	0.00	0.00	0.00	410.	652.
2	JUL	0800	85	0.00	0.00	0.00	404.	650.
2	JUL	0900	86	0.00	0.00	0.00	397.	645.
2	JUL	1000	87	0.00	0.00	0.00	391.	640.
2	JUL	1100	88	0.00	0.00	0.00	384.	633.
2	JUL	1200	89	0.00	0.00	0.00	378.	625.
2	JUL	1300	90	0.00	0.00	0.00	372.	617.
2	JUL	1400	91	0.00	0.00	0.00	366.	610.
2	JUL	1500	92	0.00	0.00	0.00	360.	602.
2	JUL	1600	93	0.00	0.00	0.00	354.	595.
2	JUL	1700	94	0.00	0.00	0.00	349.	582.
2	JUL	1800	95	0.00	0.00	0.00	343.	568.
2	JUL	1900	96	0.00	0.00	0.00	337.	556.
2	JUL	2000	97	0.00	0.00	0.00	332.	545.
2	JUL	2100	98	0.00	0.00	0.00	326.	535.
2	JUL	2200	99	0.00	0.00	0.00	321.	523.
2	JUL	2300	100	0.00	0.00	0.00	316.	516.
3	JUL	0000	101	0.00	0.00	0.00	311.	509.
3	JUL	0100	102	0.00	0.00	0.00	306.	505.
3	JUL	0200	103	0.00	0.00	0.00	301.	500.
3	JUL	0300	104	0.00	0.00	0.00	296.	495.
3	JUL	0400	105	0.00	0.00	0.00	291.	491.
3	JUL	0500	106	0.00	0.00	0.00	286.	488.
3	JUL	0600	107	0.00	0.00	0.00	282.	486.
3	JUL	0700	108	0.00	0.00	0.00	277.	484.
3	JUL	0800	109	0.00	0.00	0.00	273.	482.
3	JUL	0900	110	0.00	0.00	0.00	268.	480.

TOTAL RAINFALL = 2.99, TOTAL LOSS = 1.86, TOTAL EXCESS = 1.13

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	109.00-HR
3539.	24.00	(CFS)	3503.	3016.	1664.	1197.
		(INCHES)	0.195	0.672	1.112	1.210
		(AC-FT)	1737.	5982.	9901.	10761.

CUMULATIVE AREA = 167.00 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 400. 800. 1200. 1600. 2000. 2400. 2800. 3200. 3600. 4000. 0. 0.
(L) PRECIP, (X) EXCESS
DAHRMN PER

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        CHARLOTTE CREEK 12-21-73
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT      60 20DEC73    1800      67
  4           IO       1       2
  5           OU       1      35
  6           PG     KOR    2.23
  7           PG     OSU    2.37
  8           PG     COB    2.10
  9           PG     STM    3.06
 10           PG     DAV
 11           PI     .08     .02     .10     .11     .14     .13     .07     .10     .05     .10
 12           PI     .05     .08     .15     .12     .07     .13     .10     .06     .07     .03
 13           PI     .00     .06     .08     .04     .09     .07     .03     .02     .01     .02
 14           PI     .03     .00     .00     .00     .00     .00     .00     .00     .00     .00

 15           KK    WDAV
 16           QO     302     312     322     358     394     497     600     786     972    1156
 17           QO    1340    1460    1580    1928    2276    2692    3108    3405    3702    3790
 18           QO    3879    3961    4044    4165    4286    4299    4140    3894    3647    3317
 19           QO    2987    2709    2430    2267    2103    1992    1880    1800    1720    1671
 20           QO    1622    1584    1545    1524    1503    1475    1447    1423    1398    1363
 21           QO    1328    1301    1274    1259    1244    1229    1214    1202    1190    1175
 22           QO    1160    1145    1130    1124    1118    1106    1094       0       0       0
 23           PT     KOR     OSU     COB     STM     DAV
 24           PW     .17     .02     .07     .19     .55
 25           PR     DAV
 26           PW    1.00
 27           BA    167.      0.
 28           BF    302.   1250.  1.0165
 29           UC    -10.    -12.
 30           LU     -.4    -.03
 31           ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 1 THROUGH 35)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.028		15.56			
COMPUTED HYDROGRAPH	83096.	0.771	2374.	22.91	7.36	4078.	20.00
OBSERVED HYDROGRAPH	83107.	0.771	2374.	22.54	6.98	4299.	25.00
DIFFERENCE	-11.	-0.000	-0.	0.37	0.37	-221.	-5.00
PERCENT DIFFERENCE	-0.01				5.35	-5.14	

STANDARD ERROR 291. AVERAGE ABSOLUTE ERROR 224.
OBJECTIVE FUNCTION 313. AVERAGE PERCENT ABSOLUTE ERROR 12.68

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 67)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.028		15.56			
COMPUTED HYDROGRAPH	125636.	1.166	1875.	31.68	16.13	4078.	20.00
OBSERVED HYDROGRAPH	127347.	1.182	1901.	32.06	16.51	4299.	25.00
DIFFERENCE	-1711.	-0.016	-26.	-0.38	-0.38	-221.	-5.00
PERCENT DIFFERENCE	-1.34				-2.31	-5.14	

STANDARD ERROR 254. AVERAGE ABSOLUTE ERROR 206.
OBJECTIVE FUNCTION 287. AVERAGE PERCENT ABSOLUTE ERROR 12.97

UNIT HYDROGRAPH
83 END-OF-PERIOD ORDINATES

562.	2114.	4101.	5627.	6016.	5687.	5325.	4986.	4668.	4371.
4093.	3833.	3589.	3360.	3146.	2946.	2759.	2583.	2419.	2265.
2121.	1986.	1859.	1741.	1630.	1526.	1429.	1338.	1253.	1173.
1099.	1029.	963.	902.	845.	791.	741.	693.	649.	608.
569.	533.	499.	467.	438.	410.	384.	359.	336.	315.
295.	276.	259.	242.	227.	212.	199.	186.	174.	163.
153.	143.	134.	125.	117.	110.	103.	96.	90.	85.
79.	74.	69.	65.	61.	57.	53.	50.	47.	44.
41.	38.	36.							

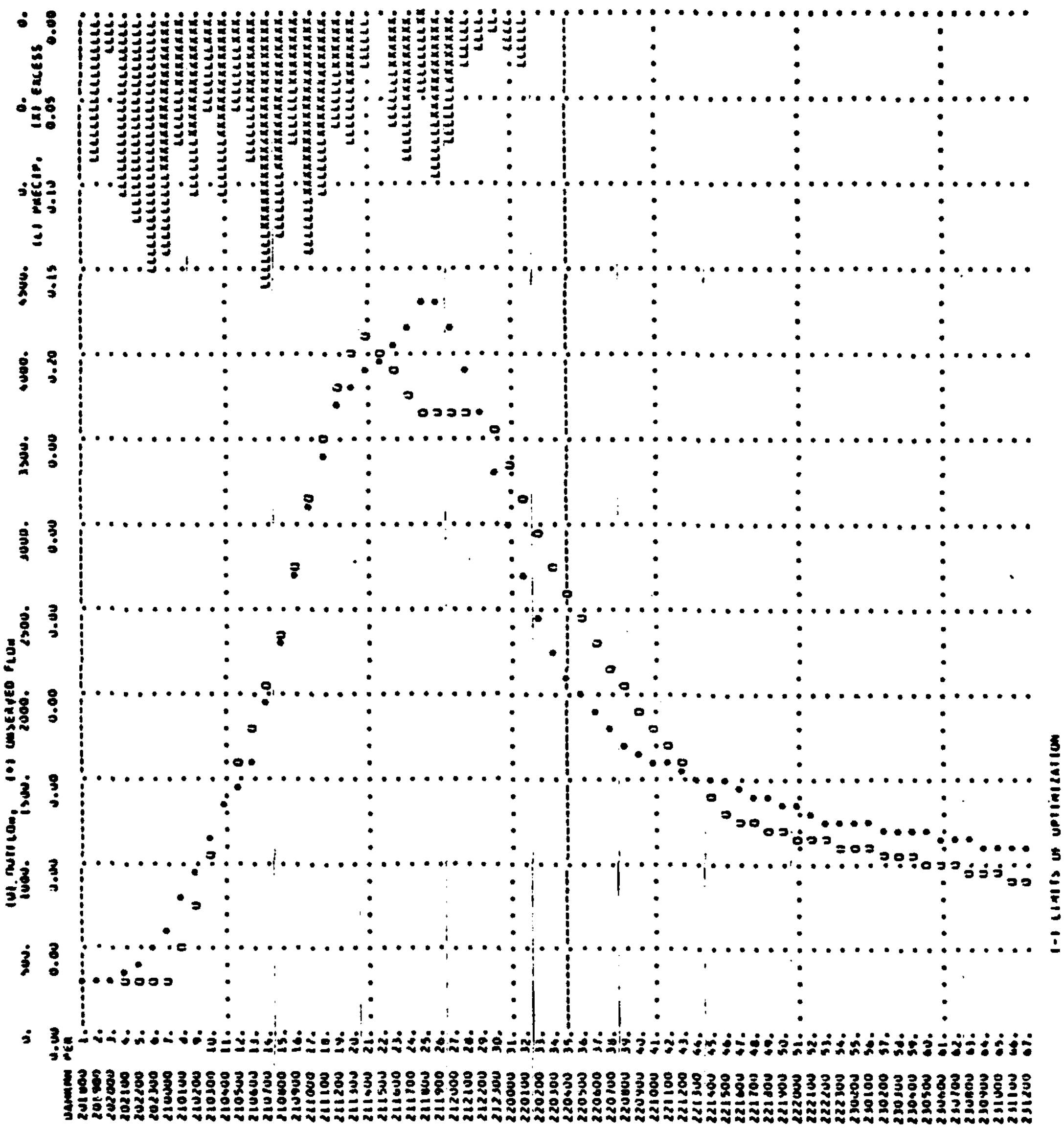
HYDROGRAPH AT STATION 8DAV

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
20 DEC 1800	1	0.00	0.00	0.00	302.	302.
20 DEC 1900	2	0.09	0.09	0.00	297.	312.
20 DEC 2000	3	0.02	0.02	0.00	292.	322.
20 DEC 2100	4	0.11	0.11	0.00	288.	358.
20 DEC 2200	5	0.12	0.12	0.00	283.	394.
20 DEC 2300	6	0.15	0.15	0.00	278.	497.
21 DEC 0000	7	0.14	0.05	0.09	323.	600.
21 DEC 0100	8	0.08	0.04	0.04	477.	786.
21 DEC 0200	9	0.11	0.04	0.07	747.	972.
21 DEC 0300	10	0.05	0.04	0.02	1072.	1156.
21 DEC 0400	11	0.11	0.04	0.07	1368.	1340.
21 DEC 0500	12	0.05	0.04	0.02	1611.	1460.
21 DEC 0600	13	0.09	0.04	0.05	1810.	1580.
21 DEC 0700	14	0.16	0.04	0.12	2034.	1928.
21 DEC 0800	15	0.13	0.04	0.09	2354.	2276.
21 DEC 0900	16	0.08	0.04	0.04	2752.	2692.
21 DEC 1000	17	0.14	0.04	0.10	3162.	3108.
21 DEC 1100	18	0.11	0.04	0.07	3517.	3405.
21 DEC 1200	19	0.06	0.04	0.03	3794.	3702.
21 DEC 1300	20	0.08	0.04	0.04	3997.	3790.
21 DEC 1400	21	0.03	0.03	0.00	4078.	3878.
21 DEC 1500	22	0.00	0.00	0.00	4019.	3961.
21 DEC 1600	23	0.06	0.04	0.03	3882.	4044.
21 DEC 1700	24	0.09	0.04	0.05	3747.	4165.
21 DEC 1800	25	0.04	0.04	0.01	3661.	4286.
21 DEC 1900	26	0.10	0.04	0.06	3636.	4299.
21 DEC 2000	27	0.08	0.04	0.04	3653.	4140.
21 DEC 2100	28	0.03	0.03	0.00	3668.	3894.
21 DEC 2200	29	0.02	0.02	0.00	3640.	3647.
21 DEC 2300	30	0.01	0.01	0.00	3531.	3317.
22 DEC 0000	31	0.02	0.02	0.00	3347.	2987.
22 DEC 0100	32	0.03	0.03	0.00	3145.	2709.
22 DEC 0200	33	0.00	0.00	0.00	2954.	2430.
22 DEC 0300	34	0.00	0.00	0.00	2774.	2267.

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
22 DEC 0400	35	0.00	0.00	0.00	2606.	2103.
22 DEC 0500	36	0.00	0.03	0.00	2448.	1992.
22 DEC 0600	37	0.00	0.00	0.00	2300.	1880.
22 DEC 0700	38	0.00	0.00	0.00	2162.	1800.
22 DEC 0800	39	0.00	0.00	0.00	2032.	1720.
22 DEC 0900	40	0.00	0.00	0.00	1911.	1671.
22 DEC 1000	41	0.00	0.00	0.00	1797.	1622.
22 DEC 1100	42	0.00	0.03	0.00	1690.	1584.
22 DEC 1200	43	0.00	0.00	0.00	1589.	1545.
22 DEC 1300	44	0.00	0.00	0.00	1495.	1524.
22 DEC 1400	45	0.00	0.00	0.00	1407.	1503.
22 DEC 1500	46	0.00	0.00	0.00	1325.	1475.
22 DEC 1600	47	0.00	0.00	0.00	1249.	1447.
22 DEC 1700	48	0.00	0.00	0.00	1229.	1423.
22 DEC 1800	49	0.00	0.00	0.00	1209.	1398.
22 DEC 1900	50	0.00	0.00	0.00	1189.	1363.
22 DEC 2000	51	0.00	0.00	0.00	1170.	1328.
22 DEC 2100	52	0.00	0.00	0.00	1151.	1301.
22 DEC 2200	53	0.00	0.00	0.00	1132.	1274.
22 DEC 2300	54	0.00	0.00	0.00	1114.	1259.
23 DEC 0000	55	0.00	0.00	0.00	1096.	1244.
23 DEC 0100	56	0.00	0.00	0.00	1078.	1229.
23 DEC 0200	57	0.00	0.00	0.00	1061.	1214.
23 DEC 0300	58	0.00	0.00	0.00	1043.	1202.
23 DEC 0400	59	0.00	0.00	0.00	1027.	1190.
23 DEC 0500	60	0.00	0.00	0.00	1010.	1175.
23 DEC 0600	61	0.00	0.00	0.00	993.	1160.
23 DEC 0700	62	0.00	0.00	0.00	977.	1145.
23 DEC 0800	63	0.00	0.00	0.00	961.	1130.
23 DEC 0900	64	0.00	0.00	0.00	946.	1124.
23 DEC 1000	65	0.00	0.00	0.00	931.	1118.
23 DEC 1100	66	0.00	0.00	0.00	915.	1106.
23 DEC 1200	67	0.00	0.00	0.00	901.	1094.

TOTAL RAINFALL = 2.37, TOTAL LOSS = 1.34, TOTAL EXCESS = 1.03

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	66.00-HR
4078.	20.30	(CFS)	1908.	3282.	1894.	1894.
		(INCHES)	0.218	0.731	1.160	1.160
		(AC-FT)	1938.	6509.	13333.	10333.


STATION WDAY
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP. (X) EXCESS
(-) LIMITS OF OPTIMIZATION

HEC-1 INPUT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LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1       ID        COREY CREEK     11-14-72
  2       IJ        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3       IT      60 13NOV72    1800      45
  4       IO       1       2
  5       IN       8      18
  6       PG  CANTON    1.83
  7       PG  COVING    2.06
  8       PG    TROY    2.06
  9       PG  JACSUM
 10       PI     .00     .02     .05     .03     .00     .01     .04     .05     .15     .15
 11       PI     .02     .13     .15     .20     .10     .10     .05     .05     .00     .00
 12       PI     .00     .00     .01     .00     .00     .00     .01     .01     .02     .02
 13       PI     .02     .01     .00     .00     .01     .00     .00     .00     .00     .00

 14       KK   COREY
 15       QO       7       7       8       8       8       9       9      13      18      36
 16       QO      64      93     127     180     240     259     276     302     326     269
 17       QO     218     174     133     118     102     100      98      96      93      89
 18       QO      85      80      75      71      67      64      60      57      54      52
 19       QO      49      47      45      44      43       0       0       0       0       0
 20       PT  CANTON  COVING    TROY
 21       PW     .28     .68     .04
 22       PR  JACSUM
 23       PW     1.0
 24       BA    12.2      0.
 25       BF      7.     46.  1.0335
 26       UC     -3.     -7.
 27       LU     -.8    -.11
 28       ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 8 THROUGH 18)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.544		13.24			
COMPUTED HYDROGRAPH	1610.	0.204	146.	15.26	2.02	293.	16.00
OBSERVED HYDROGRAPH	1608.	0.204	146.	15.23	1.99	302.	17.00
DIFFERENCE	2.	0.000	0.	0.03	0.03	-9.	-1.00
PERCENT DIFFERENCE	0.10				1.69	-3.06	

STANDARD ERROR 16. AVERAGE ABSOLUTE ERROR 15.
OBJECTIVE FUNCTION 18. AVERAGE PERCENT ABSOLUTE ERROR 21.74

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 45)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.544		13.24			
COMPUTED HYDROGRAPH	4318.	0.549	96.	22.52	9.28	293.	16.00
OBSERVED HYDROGRAPH	4373.	0.555	97.	22.76	9.52	326.	18.00
DIFFERENCE	-55.	-0.007	-1.	-0.24	-0.24	-33.	-2.00
PERCENT DIFFERENCE	-1.25				-2.51	-10.20	

STANDARD ERROR 20. AVERAGE ABSOLUTE ERROR 14.
OBJECTIVE FUNCTION 25. AVERAGE PERCENT ABSOLUTE ERROR 18.57

UNIT HYDROGRAPH
56 END-OF-PERIOD ORDINATES

249.	579.	644.	588.	534.	485.	441.	400.	363.	330.
300.	272.	247.	225.	204.	185.	168.	153.	139.	126.
114.	104.	94.	86.	78.	71.	64.	58.	53.	48.
44.	40.	36.	33.	30.	27.	24.	22.	20.	18.
17.	15.	14.	12.	11.	10.	9.	8.	8.	7.
6.	6.	5.	5.	4.	4.				

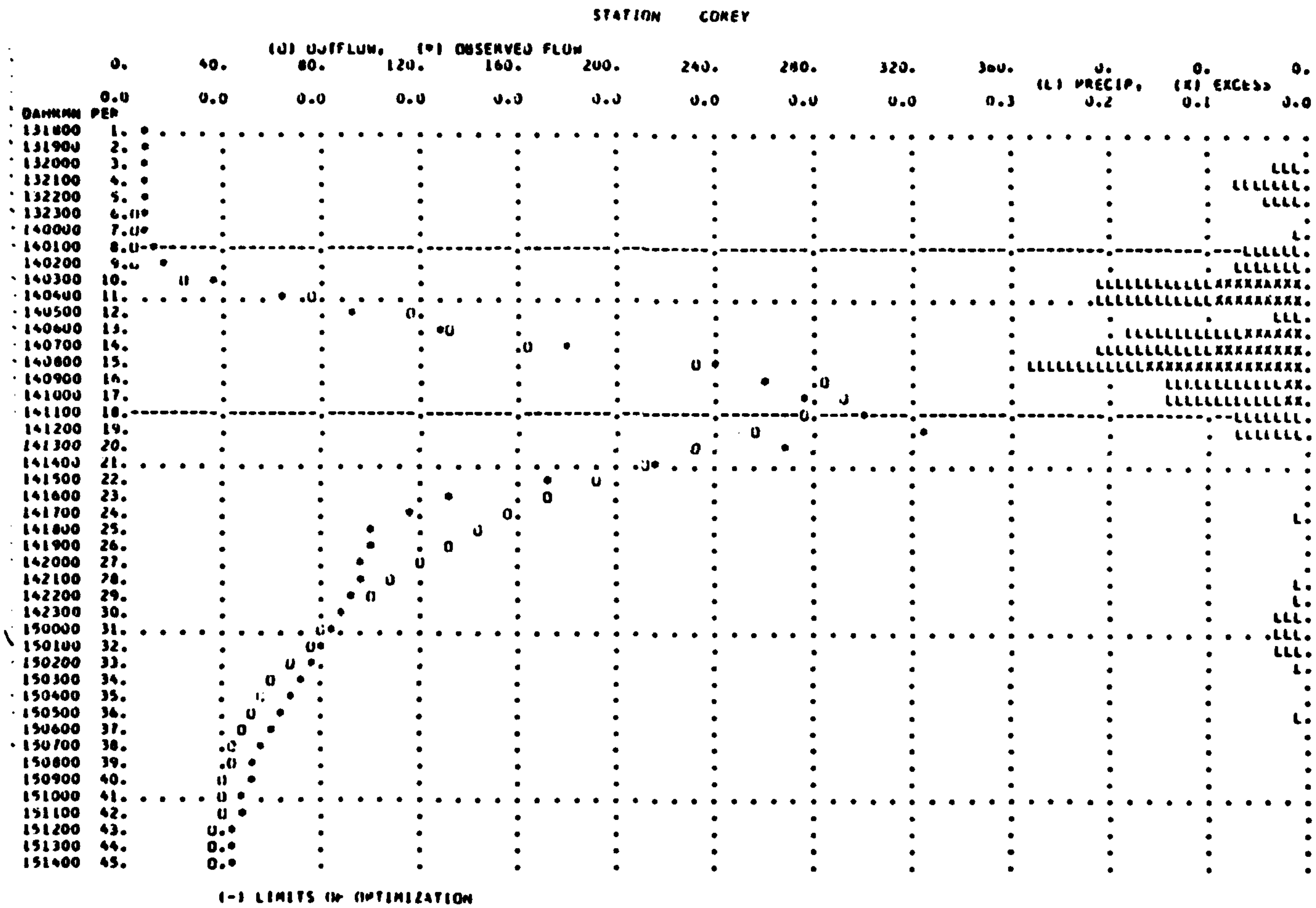
HYDROGRAPH AT STATION CUREY

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
13 NOV 1800	1	0.00	0.00	0.00	7.	7.
13 NOV 1900	2	0.00	0.00	0.00	7.	7.
13 NOV 2000	3	0.03	0.03	0.00	7.	8.
13 NOV 2100	4	0.07	0.07	0.00	6.	8.
13 NOV 2200	5	0.04	0.04	0.00	6.	8.
13 NOV 2300	6	0.00	0.00	0.00	6.	9.
14 NOV 0000	7	0.01	0.01	0.00	6.	9.
14 NOV 0100	8	0.06	0.06	0.00	6.	13.
14 NOV 0200	9	0.07	0.07	0.00	5.	18.
14 NOV 0300	10	0.21	0.13	0.08	26.	36.
14 NOV 0400	11	0.21	0.12	0.09	77.	64.
14 NOV 0500	12	0.03	0.03	0.00	114.	93.
14 NOV 0600	13	0.18	0.12	0.06	131.	127.
14 NOV 0700	14	0.21	0.12	0.09	165.	180.
14 NOV 0800	15	0.28	0.12	0.16	231.	240.
14 NOV 0900	16	0.14	0.12	0.02	285.	259.
14 NOV 1000	17	0.14	0.12	0.02	293.	276.
14 NOV 1100	18	0.07	0.07	0.00	277.	302.
14 NOV 1200	19	0.07	0.07	0.00	254.	325.
14 NOV 1300	20	0.00	0.00	0.00	231.	269.
14 NOV 1400	21	0.00	0.00	0.00	213.	218.
14 NOV 1500	22	0.00	0.00	0.00	191.	174.
14 NOV 1600	23	0.00	0.00	0.00	174.	133.
14 NOV 1700	24	0.01	0.01	0.00	158.	116.
14 NOV 1800	25	0.00	0.00	0.00	144.	102.
14 NOV 1900	26	0.00	0.00	0.00	131.	100.
14 NOV 2000	27	0.00	0.00	0.00	119.	98.
14 NOV 2100	28	0.01	0.01	0.00	108.	90.
14 NOV 2200	29	0.01	0.01	0.00	93.	73.
14 NOV 2300	30	0.03	0.03	0.00	89.	89.
15 NOV 0000	31	0.03	0.03	0.00	81.	85.
15 NOV 0100	32	0.03	0.03	0.00	74.	80.
15 NOV 0200	33	0.01	0.01	0.00	67.	75.
15 NOV 0300	34	0.00	0.00	0.00	61.	71.
15 NOV 0400	35	0.00	0.00	0.00	56.	67.
15 NOV 0500	36	0.01	0.01	0.00	51.	64.
15 NOV 0600	37	0.00	0.00	0.00	46.	60.
15 NOV 0700	38	0.00	0.00	0.00	45.	57.
15 NOV 0800	39	0.00	0.00	0.00	43.	54.
15 NOV 0900	40	0.00	0.00	0.00	42.	52.
15 NOV 1000	41	0.00	0.00	0.00	40.	49.
15 NOV 1100	42	0.00	0.00	0.00	39.	47.
15 NOV 1200	43	0.00	0.00	0.00	38.	45.
15 NOV 1300	44	0.00	0.00	0.00	37.	44.
15 NOV 1400	45	0.00	0.00	0.00	35.	43.

TOTAL RAINFALL = 2.00, TOTAL LOSS = 1.45, TOTAL EXCESS = 0.54

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	44.00-HR
293.	16.00	(CFS)	260.	156.	98.	98.
		(INCHES)	0.198	0.477	0.546	0.546
		(AC-FT)	129.	310.	355.	355.

CUMULATIVE AREA = 12.20 SQ MI


STATION COREY
(O) OUTFLOW, (*) OBSERVED FLOW
0. 40. 80. 120. 160. 200. 240. 280. 320. 360.
(L) PRECIP, (X) EXCESS
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.3 0.2 0.1 0.0
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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                                         HEC-1 INPUT                                              PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        COREY CREEK      9-26-75
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3           IT      60 24SEP75    0300      70
  4           IO       1       2
  5           QO      45      57
  6           PG  CANTON    6.92
  7           PG  COVING    5.69
  8           PG    TROY    6.96
  9           PG  JACSUM
 10           PI     .10     .10     .20     .10     .20     .10     .00     .00     .00     .00
 11           PI     .00     .00     .00     .10     .00     .00     .00     .00     .00     .10
 12           PI     .00     .10     .00     .00     .10     .10     .20     .20     .10     .30
 13           PI     .00     .10     .10     .00     .00     .10     .00     .10     .20     .10
 14           PI     .10     .00     .00     .00     .40     .30     .50     .30     .50     .40
 15           PI     .10     .20     .10     .10     .10     .00     .00     .00     .00     .00

 16           KK   COREY
 17           QO       2       3       4       6      10      33      82     101      92      71
 18           QO      55      40      35      28      25      23      21      19      18      17
 19           QO      17      24      40      62      69      65      70     102     197     388
 20           QO     433     402     349     314     283     238     202     180     180     337
 21           QO     378     393     334     288     244     290     509    1190    1707    2126
 22           QO    2094    2062    2038    1370    1069     895     797     547     409     309
 23           QO     277     246     221     206     183     168     160     148     144     136
 24           PT  CANTON  COVING    TROY
 25           PW     .28     .68     .04
 26           PR  JACSUM
 27           PW     1.0
 28           BA    12.2      0.
 29           BF      2.    150.  1.0335
 30           UC    -2.2     -3.
 31           LU     -.4    -.08
 32           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 45 THROUGH 57)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.266		41.90			
COMPUTED HYDROGRAPH	16359.	2.078	1258.	51.58	9.68	2237.	51.00
OBSERVED HYDROGRAPH	16391.	2.082	1261.	51.59	9.69	2126.	49.00
DIFFERENCE	-32.	-0.004	-2.	-0.01	-0.01	111.	2.00
PERCENT DIFFERENCE	-0.20				-0.08	5.23	

STANDARD ERROR	123.	AVERAGE ABSOLUTE ERROR	108.
OBJECTIVE FUNCTION	128.	AVERAGE PERCENT ABSOLUTE ERROR	12.05

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 70)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.266		41.90			
COMPUTED HYDROGRAPH	27608.	3.507	394.	44.79	2.89	2237.	51.00
OBSERVED HYDROGRAPH	25580.	3.249	365.	48.46	6.56	2126.	49.00
DIFFERENCE	2028.	0.258	29.	-3.67	-3.67	111.	2.00
PERCENT DIFFERENCE	7.93				-55.96	5.23	

STANDARD ERROR	62.	AVERAGE ABSOLUTE ERROR	32.
OBJECTIVE FUNCTION	107.	AVERAGE PERCENT ABSOLUTE ERROR	19.87

UNIT HYDROGRAPH
16 END-OF-PERIOD ORDINATES

508.	1507.	1755.	1278.	880.	606.	417.	287.	198.	136.
94.	64.	44.	31.	21.	14.				

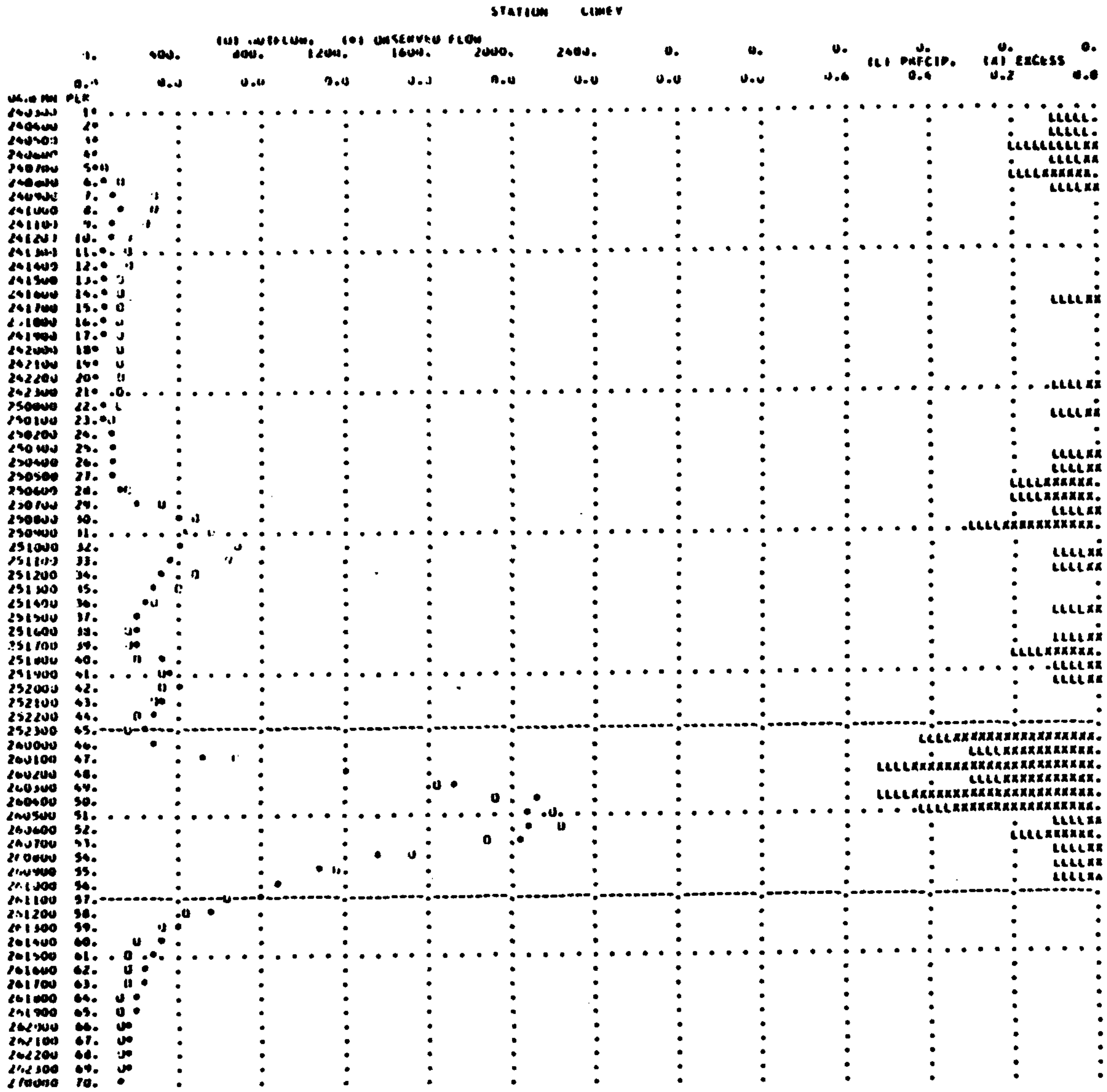
HYDROGRAPH AT STATION COMEY

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24 SEP 0300	1	0.00	0.00	0.00	2.	2.	25 SEP 1400	36	0.00	0.00	0.00	283.	238.
24 SEP 0400	2	0.10	0.10	0.00	2.	1.	25 SEP 1500	37	0.10	0.08	0.02	208.	202.
24 SEP 0500	3	0.10	0.10	0.00	2.	4.	25 SEP 1600	38	0.00	0.00	0.00	169.	180.
24 SEP 0600	4	0.21	0.19	0.02	10.	6.	25 SEP 1700	39	0.10	0.08	0.02	149.	180.
24 SEP 0700	5	0.10	0.08	0.02	37.	13.	25 SEP 1800	40	0.21	0.08	0.13	190.	337.
24 SEP 0800	6	0.21	0.08	0.13	124.	33.	25 SEP 1900	41	0.10	0.08	0.02	304.	378.
24 SEP 0900	7	0.10	0.08	0.02	262.	82.	25 SEP 2000	42	0.10	0.08	0.02	338.	393.
24 SEP 1000	8	0.00	0.00	0.00	298.	101.	25 SEP 2100	43	0.00	0.00	0.00	283.	334.
24 SEP 1100	9	0.00	0.00	0.00	231.	92.	25 SEP 2200	44	0.00	0.00	0.00	217.	288.
24 SEP 1200	10	0.00	0.00	0.00	161.	71.	25 SEP 2300	45	0.00	0.00	0.00	150.	244.
24 SEP 1300	11	0.00	0.00	0.00	146.	55.	26 SEP 0000	46	0.41	0.08	0.33	264.	290.
24 SEP 1400	12	0.00	0.00	0.00	141.	40.	26 SEP 0100	47	0.31	0.08	0.23	683.	509.
24 SEP 1500	13	0.00	0.00	0.00	137.	35.	26 SEP 0200	48	0.52	0.08	0.43	1194.	1190.
24 SEP 1600	14	0.00	0.00	0.00	132.	28.	26 SEP 0300	49	0.31	0.08	0.23	1629.	1707.
24 SEP 1700	15	0.10	0.08	0.02	128.	25.	26 SEP 0400	50	0.52	0.08	0.43	1935.	2126.
24 SEP 1800	16	0.00	0.00	0.00	124.	23.	26 SEP 0500	51	0.41	0.08	0.33	2199.	2094.
24 SEP 1900	17	0.00	0.00	0.00	120.	21.	26 SEP 0600	52	0.10	0.08	0.02	2237.	2062.
24 SEP 2000	18	0.00	0.00	0.00	116.	19.	26 SEP 0700	53	0.21	0.08	0.13	1898.	2038.
24 SEP 2100	19	0.00	0.00	0.00	112.	18.	26 SEP 0800	54	0.10	0.08	0.02	1503.	1370.
24 SEP 2200	20	0.00	0.00	0.00	109.	17.	26 SEP 0900	55	0.10	0.08	0.02	1163.	1069.
24 SEP 2300	21	0.10	0.08	0.02	105.	17.	26 SEP 1000	56	0.10	0.08	0.02	862.	895.
25 SEP 0000	22	0.00	0.00	0.00	102.	24.	26 SEP 1100	57	0.00	0.00	0.00	637.	797.
25 SEP 0100	23	0.10	0.08	0.02	98.	40.	26 SEP 1200	58	0.00	0.00	0.00	456.	547.
25 SEP 0200	24	0.00	0.00	0.00	95.	62.	26 SEP 1300	59	0.00	0.00	0.00	315.	409.
25 SEP 0300	25	0.00	0.00	0.00	92.	69.	26 SEP 1400	60	0.00	0.00	0.00	217.	309.
25 SEP 0400	26	0.10	0.08	0.02	89.	65.	26 SEP 1500	61	0.00	0.00	0.00	150.	277.
25 SEP 0500	27	0.10	0.08	0.02	86.	70.	26 SEP 1600	62	0.00	0.00	0.00	145.	246.
25 SEP 0600	28	0.21	0.08	0.13	158.	102.	26 SEP 1700	63	0.00	0.00	0.00	140.	221.
25 SEP 0700	29	0.21	0.08	0.13	336.	197.	26 SEP 1800	64	0.00	0.00	0.00	136.	206.
25 SEP 0800	30	0.10	0.08	0.02	480.	388.	26 SEP 1900	65	0.00	0.00	0.00	131.	183.
25 SEP 0900	31	0.31	0.08	0.23	571.	438.	26 SEP 2000	66	0.00	0.00	0.00	127.	168.
25 SEP 1000	32	0.00	0.00	0.00	683.	402.	26 SEP 2100	67	0.00	0.00	0.00	123.	160.
25 SEP 1100	33	0.10	0.08	0.02	647.	349.	26 SEP 2200	68	0.00	0.00	0.00	119.	148.
25 SEP 1200	34	0.10	0.08	0.02	499.	314.	26 SEP 2300	69	0.00	0.00	0.00	115.	144.
25 SEP 1300	35	0.00	0.00	0.00	386.	283.	27 SEP 0000	70	0.00	0.00	0.00	111.	136.

TOTAL RAINFALL = 6.09, TOTAL LOSS = 2.82, TOTAL EXCESS = 3.27

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	69.00-HR
2237.	51.00	(CFS)	1874.	804.	399.	399.
		(INCHES)	1.428	2.467	3.499	3.499
		(AC-FT)	929.	1602.	2277.	2277.

CUMULATIVE AREA = 12.20 SQ MI


STATION LIMEY
(O) OUTFLOW, (O) OBSERVED FLOW
(L) PRECIP, (X) EXCESS

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                                   HEC-1 INPUT                                                   PAGE  1

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID        COREY CREEK      10-09-76
  2         ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3         IT      60  7OCT76    1000      80
  4         IO       1       2
  5         OU      45      60
  6         PG  CANTON    3.46
  7         PG  COVING    3.15
  8         PG    TROY    3.26
  9         PG  JACSUM
 10         PI     .20     .00     .00     .00     .00     .00     .00     .10     .10     .00
 11         PI     .00     .10     .20     .40     .10     .00     .10     .00     .00     .00
 12         PI     .00     .00     .00     .10     .00     .00     .00     .00     .00     .00
 13         PI     .00     .00     .00     .00     .00     .10     .00     .00     .10     .00
 14         PI     .10     .10     .10     .10     .10     .10     .30     .30     .30     .10
 15         PI     .10     .00     .20     .10     .00     .00     .10     .00     .00     .00

 16         KK   COREY
 17         QO       1       1       1       1       1       1       1       1       1       1
 18         QO       1       1       2       2       2       3       3       3       3       3
 19         QO       4       4       4       4       4       4       3       3       3       3
 20         QO       3       3       3       3       3       3       3       4       3       4
 21         QO       4       6       8      10      16      22      26      38      75     164
 22         QO     259     312     314     277     214     180     155     131     114     102
 23         QO      90      81      72      66      60      55      50      47      44      41
 24         QO      39      36      34      32      31      30      29      27      26      25
 25         PT  CANTON  COVING    TROY
 26         PW     .14     .85     .01
 27         PR  JACSUM
 28         PW     1.0
 29         BA    12.2      0.
 30         BF      1.     35.  1.0335
 31         UC     -4.     -5.
 32         LU    -1.7    -.15
 33         ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 45 THROUGH 60)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.354		49.33			
COMPUTED HYDROGRAPH	2399.	0.305	150.	53.97	4.64	328.	51.00
OBSERVED HYDROGRAPH	2399.	0.305	150.	53.70	4.36	314.	52.00
DIFFERENCE	0.	0.000	0.	0.28	0.28	14.	-1.00
PERCENT DIFFERENCE	0.00				6.37	4.60	

STANDARD ERROR 15. AVERAGE ABSOLUTE ERROR 13.
OBJECTIVE FUNCTION 14. AVERAGE PERCENT ABSOLUTE ERROR 26.63

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 80)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.354		49.33			
COMPUTED HYDROGRAPH	3083.	0.392	39.	56.82	7.48	328.	51.00
OBSERVED HYDROGRAPH	3443.	0.437	43.	56.62	7.29	314.	52.00
DIFFERENCE	-360.	-0.046	-5.	0.19	0.19	14.	-1.00
PERCENT DIFFERENCE	-10.46				2.63	4.60	

STANDARD ERROR 10. AVERAGE ABSOLUTE ERROR 6.
OBJECTIVE FUNCTION 14. AVERAGE PERCENT ABSOLUTE ERROR 26.44

UNIT HYDROGRAPH
28 END-OF-PERIOD ORDINATES

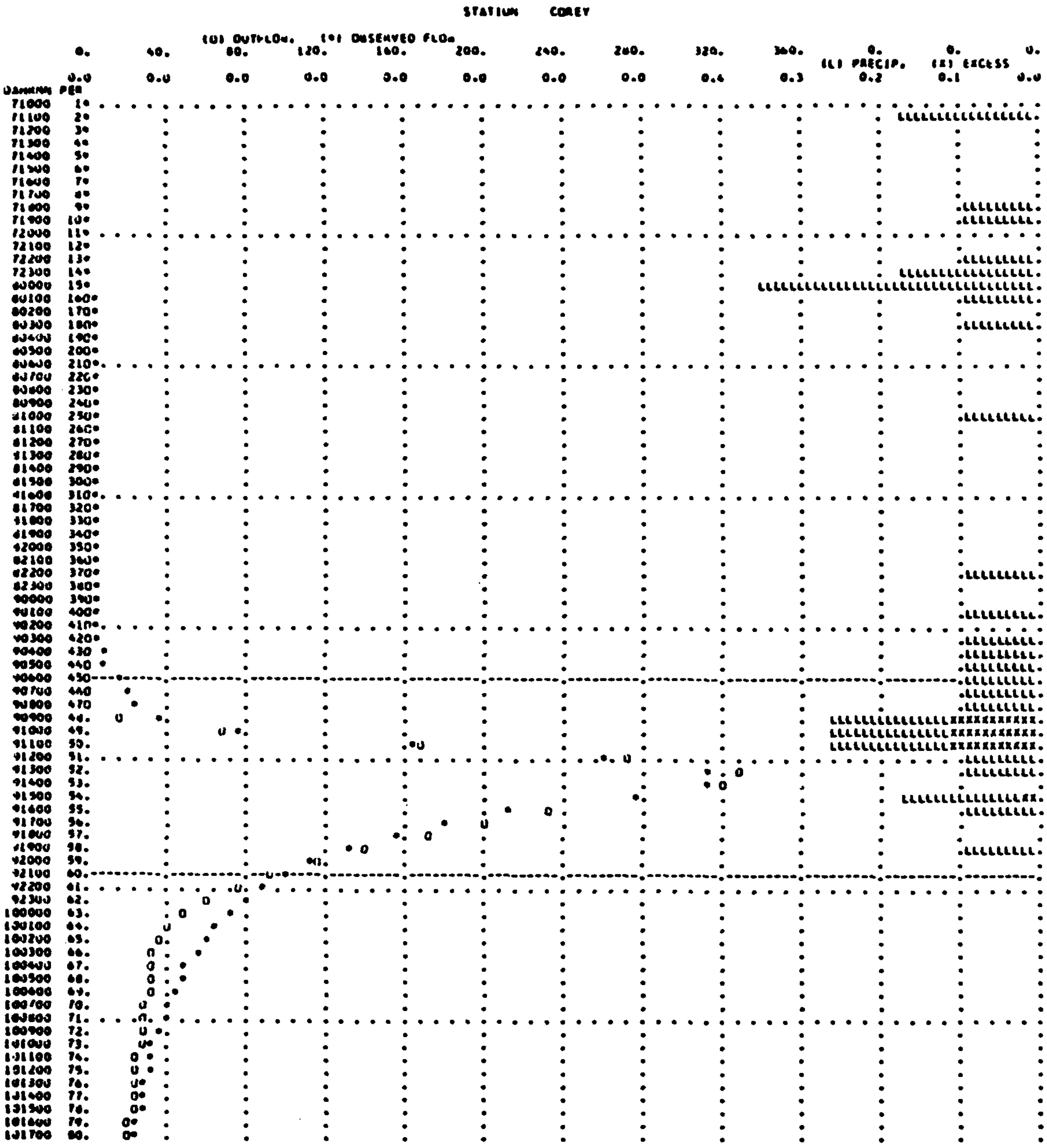
135.	490.	886.	1089.	1009.	816.	660.	534.	432.	349.
282.	228.	185.	149.	121.	98.	79.	64.	52.	42.
34.	27.	22.	18.	14.	12.	9.	8.		

HYDROGRAPH AT STATION COREY

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7 OCT 1000	1	0.00	0.00	0.00	1.	1.	9 OCT 0200	41	0.00	0.00	0.00	0.	4.
7 OCT 1100	2	0.17	0.17	0.00	1.	1.	9 OCT 0300	42	0.09	0.09	0.00	0.	6.
7 OCT 1200	3	0.00	0.00	0.00	1.	1.	9 OCT 0400	43	0.09	0.09	0.00	0.	8.
7 OCT 1300	4	0.00	0.00	0.00	1.	1.	9 OCT 0500	44	0.09	0.09	0.00	0.	10.
7 OCT 1400	5	0.00	0.00	0.00	1.	1.	9 OCT 0600	45	0.09	0.09	0.00	0.	16.
7 OCT 1500	6	0.00	0.00	0.00	1.	1.	9 OCT 0700	46	0.09	0.09	0.00	0.	22.
7 OCT 1600	7	0.00	0.00	0.00	1.	1.	9 OCT 0800	47	0.09	0.09	0.00	0.	26.
7 OCT 1700	8	0.00	0.00	0.00	1.	1.	9 OCT 0900	48	0.26	0.15	0.11	15.	38.
7 OCT 1800	9	0.09	0.09	0.00	1.	1.	9 OCT 1000	49	0.26	0.15	0.11	69.	75.
7 OCT 1900	10	0.09	0.09	0.00	1.	1.	9 OCT 1100	50	0.26	0.15	0.11	166.	164.
7 OCT 2000	11	0.00	0.00	0.00	1.	1.	9 OCT 1200	51	0.09	0.09	0.00	271.	259.
7 OCT 2100	12	0.00	0.00	0.00	1.	1.	9 OCT 1300	52	0.09	0.09	0.00	324.	312.
7 OCT 2200	13	0.09	0.09	0.00	1.	2.	9 OCT 1400	53	0.00	0.00	0.00	321.	314.
7 OCT 2300	14	0.17	0.17	0.00	1.	2.	9 OCT 1500	54	0.17	0.15	0.02	277.	277.
8 OCT 0000	15	0.35	0.35	0.00	1.	2.	9 OCT 1600	55	0.09	0.09	0.00	233.	214.
8 OCT 0100	16	0.09	0.09	0.00	1.	3.	9 OCT 1700	56	0.00	0.00	0.00	200.	180.
8 OCT 0200	17	0.00	0.00	0.00	1.	3.	9 OCT 1800	57	0.00	0.00	0.00	171.	155.
8 OCT 0300	18	0.09	0.09	0.00	1.	3.	9 OCT 1900	58	0.09	0.09	0.00	141.	131.
8 OCT 0400	19	0.00	0.00	0.00	1.	3.	9 OCT 2000	59	0.00	0.00	0.00	114.	114.
8 OCT 0500	20	0.00	0.00	0.00	1.	3.	9 OCT 2100	60	0.00	0.00	0.00	92.	102.
8 OCT 0600	21	0.00	0.00	0.00	1.	4.	9 OCT 2200	61	0.00	0.00	0.00	75.	90.
8 OCT 0700	22	0.00	0.00	0.00	1.	4.	9 OCT 2300	62	0.00	0.00	0.00	60.	81.
8 OCT 0800	23	0.00	0.00	0.00	0.	4.	10 OCT 0000	63	0.00	0.00	0.00	49.	72.
8 OCT 0900	24	0.00	0.00	0.00	0.	4.	10 OCT 0100	64	0.00	0.00	0.00	40.	66.
8 OCT 1000	25	0.09	0.09	0.00	0.	4.	10 OCT 0200	65	0.00	0.00	0.00	35.	60.
8 OCT 1100	26	0.00	0.00	0.00	0.	4.	10 OCT 0300	66	0.00	0.00	0.00	33.	55.
8 OCT 1200	27	0.00	0.00	0.00	0.	3.	10 OCT 0400	67	0.00	0.00	0.00	32.	50.
8 OCT 1300	28	0.00	0.00	0.00	0.	3.	10 OCT 0500	68	0.00	0.00	0.00	31.	47.
8 OCT 1400	29	0.00	0.00	0.00	0.	3.	10 OCT 0600	69	0.00	0.00	0.00	30.	44.
8 OCT 1500	30	0.00	0.00	0.00	0.	3.	10 OCT 0700	70	0.00	0.00	0.00	29.	41.
8 OCT 1600	31	0.00	0.00	0.00	0.	3.	10 OCT 0800	71	0.00	0.00	0.00	28.	39.
8 OCT 1700	32	0.00	0.00	0.00	0.	3.	10 OCT 0900	72	0.00	0.00	0.00	27.	36.
8 OCT 1800	33	0.00	0.00	0.00	0.	3.	10 OCT 1000	73	0.00	0.00	0.00	27.	34.
8 OCT 1900	34	0.00	0.00	0.00	0.	3.	10 OCT 1100	74	0.00	0.00	0.00	26.	32.
8 OCT 2000	35	0.00	0.00	0.00	0.	3.	10 OCT 1200	75	0.00	0.00	0.00	25.	31.
8 OCT 2100	36	0.00	0.00	0.00	0.	3.	10 OCT 1300	76	0.00	0.00	0.00	24.	30.
8 OCT 2200	37	0.09	0.09	0.00	0.	3.	10 OCT 1400	77	0.00	0.00	0.00	23.	29.
8 OCT 2300	38	0.00	0.00	0.00	0.	4.	10 OCT 1500	78	0.00	0.00	0.00	23.	27.
9 OCT 0000	39	0.00	0.00	0.00	0.	3.	10 OCT 1600	79	0.00	0.00	0.00	22.	26.
9 OCT 0100	40	0.09	0.09	0.00	0.	4.	10 OCT 1700	80	0.00	0.00	0.00	21.	25.

TOTAL RAINFALL = 3.19, TOTAL LOSS = 2.84, TOTAL EXCESS = 0.35

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	79.00-HR
326.	51.00	(CFS)	269.	119.	45.	39.
		(INCHES)	0.205	0.362	0.385	0.390
		(AC-FT)	133.	235.	251.	254.



(-) LIMITS OF OPTIMIZATION

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        COREY CREEK      5-14-78
   2          ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3          IT      60 14MAY78    0500      30
   4          IO       1       2
   5          IN       5      16
   6          PG  CANTON    3.37
   7          PG  COVING    1.96
   8          PG    TROY    1.26
   9          PG  JACSUM
  10          PI     .10     .10     .00     .10     .20     .10     .00     .00     .50     .20
  11          PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  12          PI     .00     .00     .00     .00     .00     .00     .10     .00     .00     .00

  13          KK   COREY
  14          QO      13      17      23      45      86     143     183     245     451     736
  15          QO     338     672     524     398     306     254     221     200     183     171
  16          QO     169     162     151     142     136     132     136     141     135     128
  17          PT  CANTON  COVING    TROY
  18          PW     .14     .85     .01
  19          PR  JACSUM
  20          PW     1.0
  21          BA    12.2      0.
  22          BF     13.     85.  1.0335
  23          UC    1.03    6.94
  24          LU     .28     .14
  25          ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 16)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.006		9.62			
COMPUTED HYDROGRAPH	5041.	0.640	420.	12.11	2.49	824.	10.00
OBSERVED HYDROGRAPH	4836.	0.614	403.	11.22	1.60	838.	10.00
DIFFERENCE	205.	0.026	17.	0.89	0.89	-14.	0.00
PERCENT DIFFERENCE	4.25				55.58	-1.68	

STANDARD ERROR	171.	AVERAGE ABSOLUTE ERROR	141.
OBJECTIVE FUNCTION	178.	AVERAGE PERCENT ABSOLUTE ERROR	40.86

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.006		9.62			
COMPUTED HYDROGRAPH	7719.	0.980	257.	15.23	5.61	824.	10.00
OBSERVED HYDROGRAPH	7141.	0.907	238.	14.71	5.09	838.	10.00
DIFFERENCE	578.	0.073	19.	0.52	0.52	-14.	0.00
PERCENT DIFFERENCE	8.10				10.29	-1.68	

STANDARD ERROR	120.	AVERAGE ABSOLUTE ERROR	84.
OBJECTIVE FUNCTION	155.	AVERAGE PERCENT ABSOLUTE ERROR	37.61

UNIT HYDROGRAPH
38 END-OF-PERIOD ORDINATES

525.	984.	855.	740.	641.	555.	480.	416.	360.	311.
270.	231.	202.	175.	151.	131.	113.	98.	85.	74.
64.	55.	48.	41.	36.	31.	27.	23.	20.	17.
15.	13.	11.	10.	8.	7.	6.	5.		

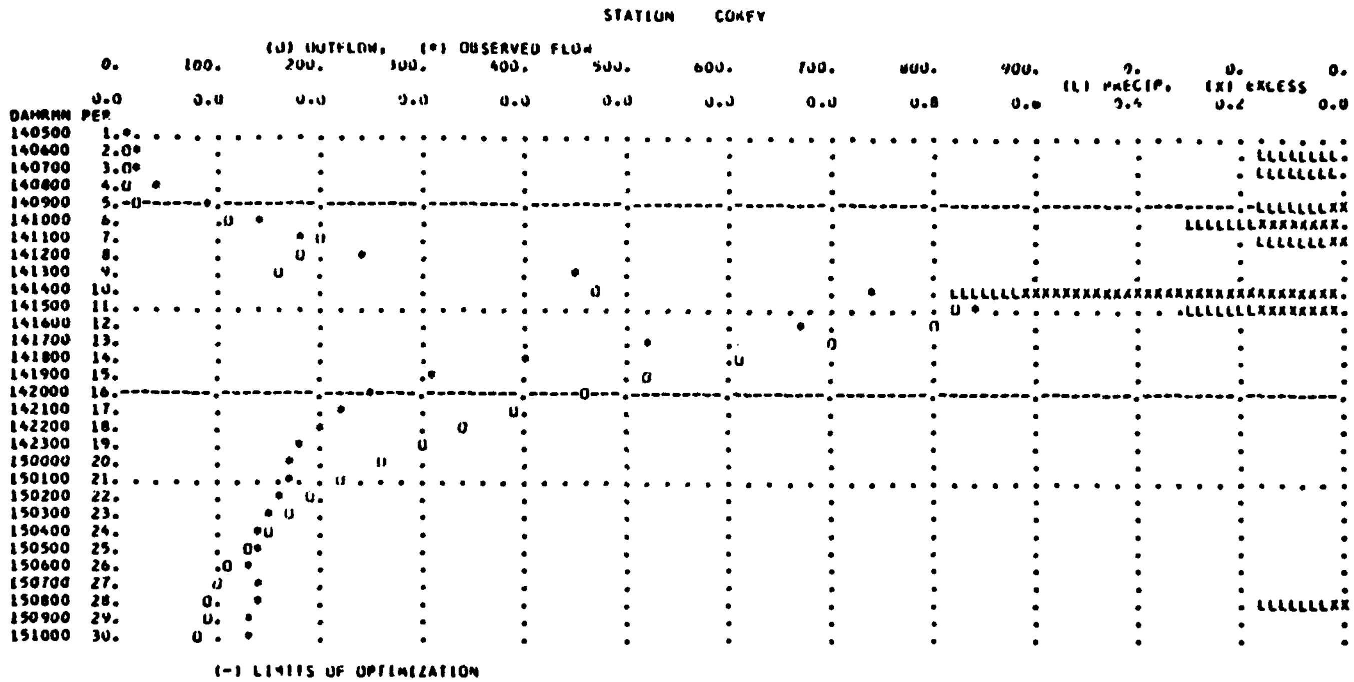
HYDROGRAPH AT STATION COREY

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
14 MAY 0500	1	0.00	0.00	0.00	13.	13.	14 MAY 2000	16	0.00	0.00	0.00	455.	294.
14 MAY 0600	2	0.15	0.15	0.00	13.	17.	14 MAY 2100	17	0.00	0.00	0.00	395.	221.
14 MAY 0700	3	0.15	0.15	0.00	13.	23.	14 MAY 2200	18	0.00	0.00	0.00	342.	200.
14 MAY 0800	4	0.00	0.00	0.00	14.	45.	14 MAY 2300	19	0.00	0.00	0.00	297.	183.
14 MAY 0900	5	0.15	0.14	0.01	21.	80.	15 MAY 0000	20	0.00	0.00	0.00	258.	171.
14 MAY 1000	6	0.31	0.14	0.17	115.	143.	15 MAY 0100	21	0.00	0.00	0.00	224.	169.
14 MAY 1100	7	0.15	0.14	0.01	195.	183.	15 MAY 0200	22	0.00	0.00	0.00	195.	162.
14 MAY 1200	8	0.00	0.00	0.00	178.	245.	15 MAY 0300	23	0.00	0.00	0.00	169.	151.
14 MAY 1300	9	0.00	0.00	0.00	155.	451.	15 MAY 0400	24	0.00	0.00	0.00	147.	142.
14 MAY 1400	10	0.77	0.14	0.63	465.	736.	15 MAY 0500	25	0.00	0.00	0.00	128.	136.
14 MAY 1500	11	0.31	0.14	0.17	824.	838.	15 MAY 0600	26	0.00	0.00	0.00	111.	132.
14 MAY 1600	12	0.00	0.00	0.00	905.	672.	15 MAY 0700	27	0.00	0.00	0.00	97.	136.
14 MAY 1700	13	0.00	0.00	0.00	698.	524.	15 MAY 0800	28	0.15	0.14	0.01	92.	141.
14 MAY 1800	14	0.00	0.00	0.00	605.	398.	15 MAY 0900	29	0.00	0.07	0.00	87.	135.
14 MAY 1900	15	0.00	0.00	0.00	525.	306.	15 MAY 1000	30	0.00	0.00	0.00	33.	128.

TOTAL RAINFALL = 2.15, TOTAL LOSS = 1.14, TOTAL EXCESS = 1.01

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	29.00-HR
824.	10.00	(CFS)	653.	314.	265.	265.
		(INCHES)	0.498	0.959	0.974	0.974
		(AC-FT)	324.	624.	634.	634.

CUMULATIVE AREA = 12.20 SQ MI


STATION COKEY
(O) OUTFLOW, (*) OBSERVED FLOW
0. 100. 200. 300. 400. 500. 600. 700. 800. 900.
(L) PRECIP, (X) EXCESS
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1        ID        COREY CREEK     10-05-79
  2        ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3        IT      60 05OCT79    0800      40
  4        IO       1       2
  5        OU       5      23
  6        PG  CANTON    1.73
  7        PG  COVING    2.50
  8        PG  JACSUM
  9        PI     .10     .00     .10     .30     .20     .40     .20     .30     .30     .10
 10        PI     .10     .00     .20     .20     .00     .10     .00     .00     .00     .00

 11        KK   COREY
 12        QO       9       9       9      10      11      17      43     168     255     286
 13        QO     363     396     393     322     368     390     385     385     340     274
 14        QO     212     176     152     136     124     114     107      99      94      88
 15        QO      84      80      76      73      71      68      66      64      61      60
 16        PT  CANTON  COVING
 17        PW     .13     .87
 18        PR  JACSUM
 19        PW     1.0
 20        BA    12.2      0.
 21        OF      7.     60.  1.0335
 22        UC     -3.     -8.
 23        LU    -.90    -.19
 24        ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 5 THROUGH 23)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.826		10.08			
COMPUTED HYDROGRAPH	4918.	0.625	259.	15.28	5.19	404.	11.00
OBSERVED HYDROGRAPH	4936.	0.627	260.	15.06	4.97	396.	11.00
DIFFERENCE	-18.	-0.002	-1.	0.22	0.22	8.	0.00
PERCENT DIFFERENCE	-0.36				4.43	2.00	

STANDARD ERROR 31. AVERAGE ABSOLUTE ERROR 25.
OBJECTIVE FUNCTION 31. AVERAGE PERCENT ABSOLUTE ERROR 15.21

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 40)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.826		10.08			
COMPUTED HYDROGRAPH	6499.	0.825	162.	18.70	8.62	404.	11.00
OBSERVED HYDROGRAPH	6438.	0.818	161.	18.56	8.48	396.	11.00
DIFFERENCE	61.	0.008	2.	0.14	0.14	8.	0.00
PERCENT DIFFERENCE	0.95				1.63	2.00	

STANDARD ERROR 25. AVERAGE ABSOLUTE ERROR 18.
OBJECTIVE FUNCTION 30. AVERAGE PERCENT ABSOLUTE ERROR 15.64

UNIT HYDROGRAPH
51 END-OF-PERIOD ORDINATES

192.	517.	774.	651.	586.	526.	472.	424.	381.	342.
307.	275.	247.	222.	199.	179.	161.	144.	129.	116.
104.	94.	84.	76.	68.	61.	55.	49.	44.	40.
35.	32.	29.	26.	23.	21.	19.	17.	15.	13.
12.	11.	10.	9.	8.	7.	6.	6.	5.	5.
4.									

HYDROGRAPH AT STATION COREY

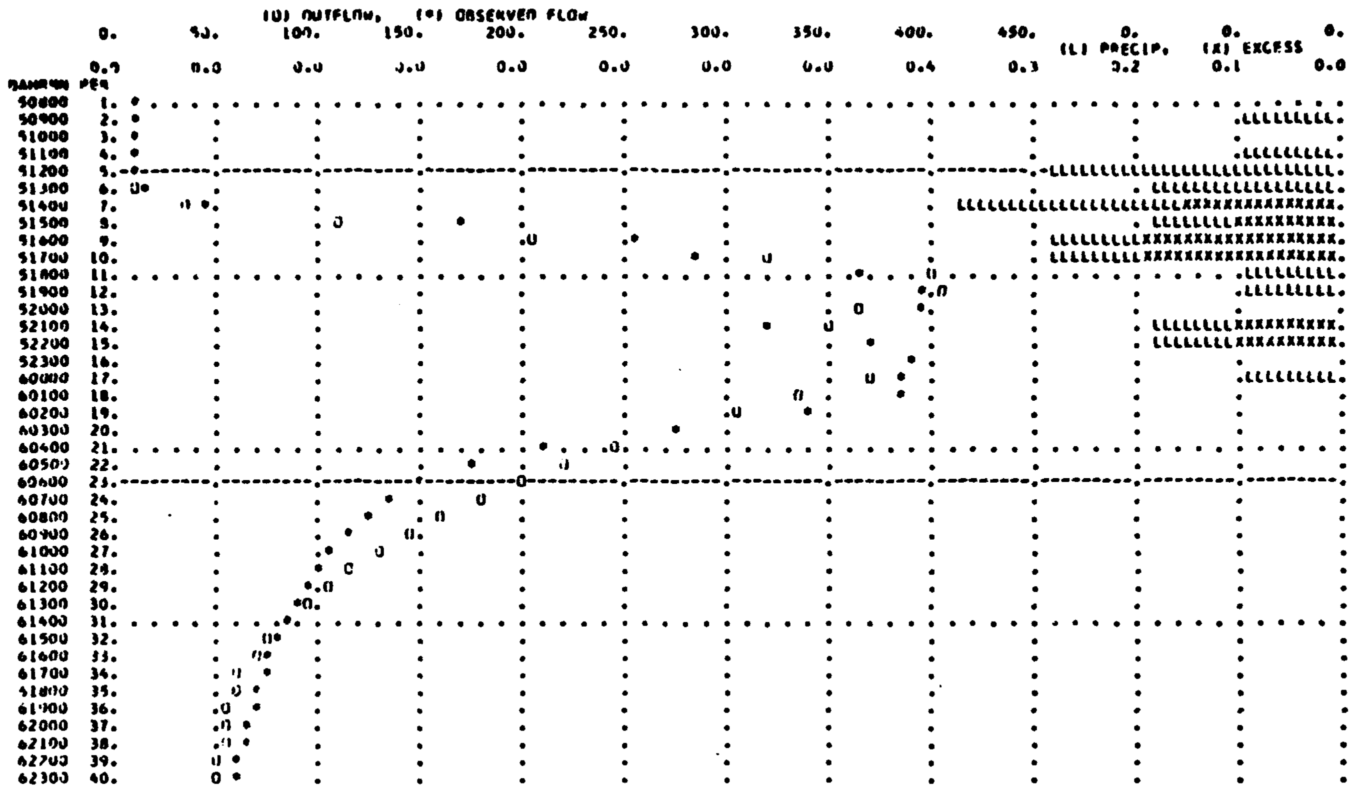
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
5 OCT 0800	1	0.33	0.00	0.33	9.	9.	6 OCT 0400	21	0.00	0.00	0.00	245.	212.
5 OCT 0900	2	0.09	0.09	0.00	9.	9.	6 OCT 0500	22	0.00	0.00	0.00	220.	176.
5 OCT 1000	3	0.00	0.00	0.00	8.	9.	6 OCT 0600	23	0.00	0.00	0.00	198.	152.
5 OCT 1100	4	0.09	0.09	0.00	8.	10.	6 OCT 0700	24	0.00	0.00	0.00	178.	136.
5 OCT 1200	5	0.28	0.28	0.00	8.	11.	6 OCT 0800	25	0.00	0.00	0.00	160.	124.
5 OCT 1300	6	0.14	0.13	0.01	9.	17.	6 OCT 0900	26	0.00	0.00	0.00	144.	114.
5 OCT 1400	7	0.37	0.22	0.15	36.	43.	6 OCT 1000	27	0.00	0.00	0.00	130.	107.
5 OCT 1500	8	0.16	0.04	0.12	112.	168.	6 OCT 1100	28	0.00	0.00	0.00	117.	99.
5 OCT 1600	9	0.28	0.09	0.19	207.	255.	6 OCT 1200	29	0.00	0.00	0.00	105.	94.
5 OCT 1700	10	0.29	0.09	0.20	319.	286.	6 OCT 1300	30	0.00	0.00	0.00	95.	88.
5 OCT 1800	11	0.09	0.09	0.00	402.	363.	6 OCT 1400	31	0.00	0.00	0.00	85.	84.
5 OCT 1900	12	0.09	0.09	0.00	404.	396.	6 OCT 1500	32	0.00	0.00	0.00	77.	80.
5 OCT 2000	13	0.10	0.00	0.00	366.	393.	6 OCT 1600	33	0.00	0.00	0.00	69.	76.
5 OCT 2100	14	0.18	0.09	0.10	348.	372.	6 OCT 1700	34	0.00	0.00	0.00	62.	73.
5 OCT 2200	15	0.18	0.09	0.10	370.	368.	6 OCT 1800	35	0.00	0.00	0.00	59.	71.
5 OCT 2300	16	0.00	0.00	0.00	391.	390.	6 OCT 1900	36	0.00	0.00	0.00	57.	68.
6 OCT 0000	17	0.09	0.09	0.00	372.	385.	6 OCT 2000	37	0.00	0.00	0.00	55.	66.
6 OCT 0100	18	0.09	0.00	0.00	346.	385.	6 OCT 2100	38	0.00	0.00	0.00	53.	64.
6 OCT 0200	19	0.00	0.00	0.00	303.	340.	6 OCT 2200	39	0.00	0.00	0.00	51.	61.
6 OCT 0300	20	0.00	0.00	0.00	273.	274.	6 OCT 2300	40	0.00	0.00	0.00	50.	60.

TOTAL RAINFALL = 2.40, TOTAL LOSS = 1.57, TOTAL EXCESS = 0.83

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	39.00-HR
434.	11.00	(CFS)	474.	244.	166.	166.
		(INCHES)	0.238	0.745	0.822	0.822
		(AC-FT)	187.	484.	535.	535.

CUMULATIVE AREA = 12.20 SQ MI

STATION COREY



(-) LIMITS OF OPTIMIZATION

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                                              HEC-1 INPUT                                        PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        COREY CREEK      11-26-79
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3           IT      60 26NOV79    0900      30
  4           IO       1       2
  5           OU       3      12
  6           PG  CANTCN    1.48
  7           PG  COVING    1.45
  8           PG  JACSUM
  9           PI      .2      .4      .0      .6      .2      .1      .1      .0      .0      .1

 10           KK   COREY
 11           QO       9      13     107     375     484     584     867     833     580     403
 12           QO     321     288     261     229     203     183     160     149     139     131
 13           QO     123     116     110     105     100      96      92      88      84      81
 14           PT  CANTCN  COVING
 15           PW     .13     .87
 16           PR  JACSUM
 17           PW     1.0
 18           BA    12.2      0.
 19           BF      9.    140.  1.0335
 20           UC     -3.     -4.
 21           LU     -.3    -.08
 22           ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 3 THROUGH 12)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.715		4.52			
COMPUTED HYDROGRAPH	4836.	0.614	484.	7.76	3.24	878.	6.00
OBSERVED HYDROGRAPH	4842.	0.615	484.	7.58	3.06	867.	6.00
DIFFERENCE	-6.	-0.001	-1.	0.17	0.17	11.	0.00
PERCENT DIFFERENCE	-0.13				5.65	1.24	

STANDARD ERROR	74.	AVERAGE ABSOLUTE ERROR	58.
OBJECTIVE FUNCTION	73.	AVERAGE PERCENT ABSOLUTE ERROR	14.86

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.715		4.52			
COMPUTED HYDROGRAPH	6975.	0.886	233.	11.56	7.04	878.	6.00
OBSERVED HYDROGRAPH	7314.	0.929	244.	11.62	7.10	867.	6.00
DIFFERENCE	-339.	-0.043	-11.	-0.06	-0.06	11.	0.00
PERCENT DIFFERENCE	-4.63				-0.77	1.24	

STANDARD ERROR	48.	AVERAGE ABSOLUTE ERROR	31.
OBJECTIVE FUNCTION	64.	AVERAGE PERCENT ABSOLUTE ERROR	12.31

UNIT HYDROGRAPH
22 END-OF-PERIOD ORDINATES

313.	1021.	1399.	1215.	928.	708.	541.	413.	315.	241.
184.	141.	107.	82.	62.	48.	36.	28.	21.	16.
12.	9.								

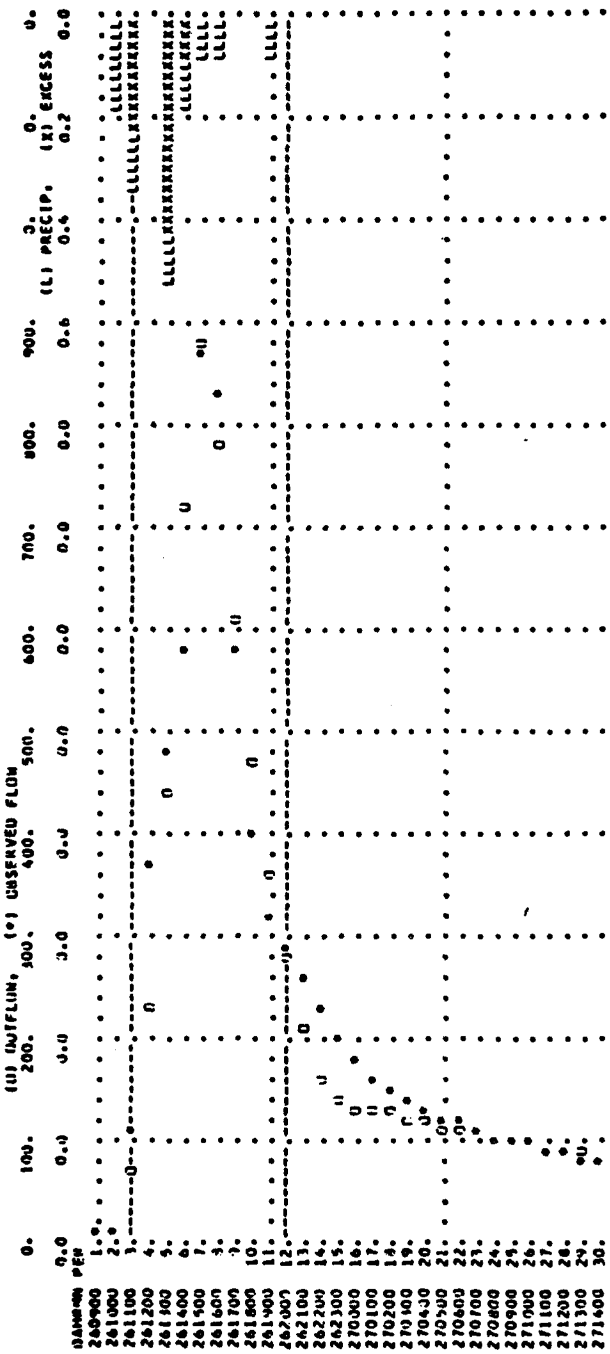
HYDROGRAPH AT STATION COKEY

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
26 NOV 0900	1	0.00	0.00	0.00	9.	9.	27 NOV 0000	16	0.00	0.00	0.00	134.	183.
26 NOV 1000	2	0.17	0.17	0.00	9.	13.	27 NOV 0100	17	0.00	0.00	0.00	129.	160.
26 NOV 1100	3	0.38	0.17	0.21	75.	107.	27 NOV 0200	18	0.00	0.00	0.00	125.	149.
26 NOV 1200	4	0.09	0.00	0.09	225.	175.	27 NOV 0300	19	0.00	0.00	0.00	121.	139.
26 NOV 1300	5	0.51	0.09	0.42	437.	484.	27 NOV 0400	20	0.00	0.00	0.00	117.	131.
26 NOV 1400	6	0.17	0.09	0.08	723.	584.	27 NOV 0500	21	0.00	0.00	0.00	113.	123.
26 NOV 1500	7	0.09	0.09	0.00	878.	867.	27 NOV 0600	22	0.00	0.00	0.00	110.	116.
26 NOV 1600	8	0.09	0.09	0.00	784.	833.	27 NOV 0700	23	0.00	0.00	0.00	106.	110.
26 NOV 1700	9	0.00	0.00	0.00	612.	580.	27 NOV 0800	24	0.00	0.00	0.00	103.	105.
26 NOV 1800	10	0.00	0.00	0.00	464.	403.	27 NOV 0900	25	0.00	0.00	0.00	99.	100.
26 NOV 1900	11	0.00	0.00	0.00	359.	321.	27 NOV 1000	26	0.00	0.00	0.00	96.	96.
26 NOV 2000	12	0.00	0.00	0.00	275.	248.	27 NOV 1100	27	0.00	0.00	0.00	93.	92.
26 NOV 2100	13	0.00	0.00	0.00	212.	261.	27 NOV 1200	28	0.00	0.00	0.00	90.	88.
26 NOV 2200	14	0.00	0.00	0.00	163.	229.	27 NOV 1300	29	0.00	0.00	0.00	87.	84.
26 NOV 2300	15	0.00	0.00	0.00	138.	203.	27 NOV 1400	30	0.00	0.00	0.00	84.	81.

TOTAL RAINFALL = 1.45, TOTAL LOSS = 0.74, TOTAL EXCESS = 0.72

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	29.00-HR
878.	6.00	(CFS)	644.	275.	239.	239.
		(INCHES)	0.491	0.840	0.880	0.880
		(AC-FT)	319.	546.	573.	573.

CUMULATIVE AREA = 12.20 SQ MI


STATION COREY
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP, (X) EXCESS

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                                              HEC-1 INPUT                                              PAGE  1

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1            ID        COREY CREEK      6-05-82
   2            ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3            IT      60  5JUN82    0700      40
   4            IO       1       2
   5            IN       1      21
   6            PG  CANTON    2.34
   7            PG  COVING    3.28
   8            PG    TROY    1.77
   9            PG  JACSUM
  10            PI     .10     .10     .20     .10     .10     .10     .10     .10     .00     .10
  11            PI     .20     .20     .00     .10     .10     .10     .00     .00     .00     .00
  12            PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  13            PI     .00     .00     .10     .00     .00     .00     .00     .00     .00     .00

  14            KK   COREY
  15            QO      36      37      43      87     247     327     327     331     341     331
  16            QO     331     400     464     467     464     475     464     418     377     350
  17            QO     326     303     283     261     244     230     218     212     210     210
  18            QO     212     210     203     191     179     170     159     151     144     139
  19            PT  CANTON  COVING    TROY
  20            PW     .14     .85     .01
  21            PR  JACSUM
  22            PW     1.0
  23            BA    12.2      0.
  24            BF     36.    140.  1.0335
  25            UC     -3.     -8.
  26            LU    -.80    -.10
  27            ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 1 THROUGH 21)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.337		10.45			
COMPUTED HYDROGRAPH	6704.	0.851	319.	13.36	2.91	510.	13.00
OBSERVED HYDROGRAPH	6643.	0.844	316.	13.11	2.66	475.	15.00
DIFFERENCE	61.	0.008	3.	0.25	0.25	35.	-2.00
PERCENT DIFFERENCE	0.91				9.47	7.46	

STANDARD ERROR	40.	AVERAGE ABSOLUTE ERROR	35.
OBJECTIVE FUNCTION	40.	AVERAGE PERCENT ABSOLUTE ERROR	17.13

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 40)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.337		10.45			
COMPUTED HYDROGRAPH	10336.	1.313	258.	18.95	8.50	510.	13.00
OBSERVED HYDROGRAPH	10572.	1.343	264.	19.34	8.89	475.	15.00
DIFFERENCE	-236.	-0.030	-6.	-0.39	-0.39	35.	-2.00
PERCENT DIFFERENCE	-2.24				-4.40	7.46	

STANDARD ERROR	36.	AVERAGE ABSOLUTE ERROR	32.
OBJECTIVE FUNCTION	38.	AVERAGE PERCENT ABSOLUTE ERROR	15.58

UNIT HYDROGRAPH
64 END-OF-PERIOD ORDINATES

312.	603.	559.	514.	472.	435.	400.	368.	338.	311.
286.	263.	242.	222.	205.	188.	173.	159.	146.	135.
124.	114.	105.	96.	89.	82.	75.	69.	63.	58.
54.	49.	45.	42.	38.	35.	32.	30.	27.	25.
23.	21.	20.	18.	17.	15.	14.	13.	12.	11.
10.	9.	9.	8.	7.	7.	6.	6.	5.	5.
4.	4.	4.	3.						

HYDROGRAPH AT STATION   COREY

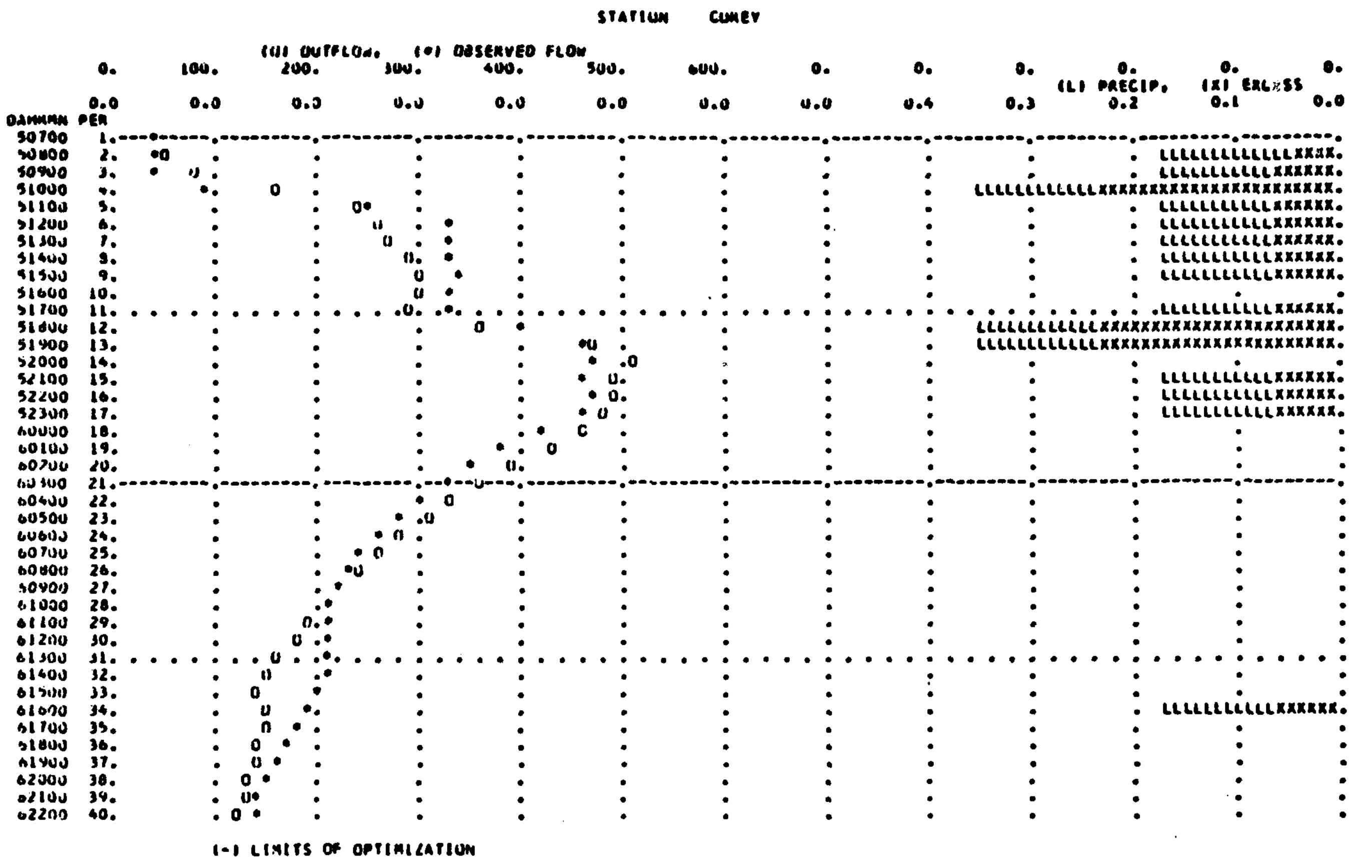
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
5 JUN 0700	1	0.00	0.00	0.00	36.	36.
5 JUN 0800	2	0.17	0.13	0.04	48.	37.
5 JUN 0900	3	0.17	0.12	0.06	76.	43.
5 JUN 1000	4	0.35	0.12	0.23	160.	87.
5 JUN 1100	5	0.17	0.12	0.06	239.	247.
5 JUN 1200	6	0.17	0.12	0.06	257.	327.
5 JUN 1300	7	0.17	0.12	0.06	273.	327.
5 JUN 1400	8	0.17	0.12	0.06	287.	331.
5 JUN 1500	9	0.17	0.12	0.06	300.	341.
5 JUN 1600	10	0.00	0.00	0.00	295.	331.
5 JUN 1700	11	0.17	0.12	0.06	290.	331.
5 JUN 1800	12	0.35	0.12	0.23	357.	400.
5 JUN 1900	13	0.35	0.12	0.23	474.	464.
5 JUN 2000	14	0.00	0.00	0.00	510.	467.
5 JUN 2100	15	0.17	0.12	0.06	489.	464.
5 JUN 2200	16	0.17	0.12	0.06	485.	475.
5 JUN 2300	17	0.17	0.12	0.06	482.	464.
6 JUN 0000	18	0.00	0.00	0.00	462.	418.
6 JUN 0100	19	0.00	0.00	0.00	426.	377.
6 JUN 0200	20	0.00	0.00	0.00	393.	350.

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
6 JUN 0300	21	0.00	0.00	0.00	362.	326.
6 JUN 0400	22	0.00	0.00	0.00	334.	303.
6 JUN 0500	23	0.00	0.00	0.00	308.	283.
6 JUN 0600	24	0.00	0.00	0.00	284.	261.
6 JUN 0700	25	0.00	0.00	0.00	262.	244.
6 JUN 0800	26	0.00	0.00	0.00	242.	230.
6 JUN 0900	27	0.00	0.00	0.00	223.	218.
6 JUN 1000	28	0.00	0.00	0.00	206.	212.
6 JUN 1100	29	0.00	0.00	0.00	190.	210.
6 JUN 1200	30	0.00	0.00	0.00	176.	210.
6 JUN 1300	31	0.00	0.00	0.00	162.	212.
6 JUN 1400	32	0.00	0.00	0.00	150.	210.
6 JUN 1500	33	0.00	0.00	0.00	139.	203.
6 JUN 1600	34	0.17	0.12	0.06	145.	191.
6 JUN 1700	35	0.00	0.00	0.00	152.	179.
6 JUN 1800	36	0.00	0.00	0.00	140.	170.
6 JUN 1900	37	0.00	0.00	0.00	136.	159.
6 JUN 2000	38	0.00	0.00	0.00	131.	151.
6 JUN 2100	39	0.00	0.00	0.00	127.	144.
6 JUN 2200	40	0.00	0.00	0.00	123.	139.

TOTAL RAINFALL = 3.13, TOTAL LOSS = 1.80, TOTAL EXCESS = 1.34

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	39.00-HR
510.	13.00	(CFS)	480.	343.	263.	263.
		(INCHES)	0.366	1.044	1.303	1.303
		(AC-FT)	238.	679.	848.	848.

CUMULATIVE AREA = 12.20 SQ MI


STATION CUMEY
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP, (X) EXCESS
DAHMMN PER
(-) LIMITS OF OPTIMIZATION

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                                          HEC-1 INPUT                                                   PAGE  1

 LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    1      ID        ELK RUN CREEK    10-22-70
    2      ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
    3      IT      60 21OCT70    1300      50
    4      IO       1       2
    5      OU      10      30
    6      PG    TROY    2.91
    7      PG  JACSUM
    8      PI     .05     .00     .10     .10     .10     .00     .10     .05     .05     .10
    9      PI     .00     .05     .05     .00     .20     .10     .10     .10     .20     .05
   10      PI     .05     .05     .00     .00     .00     .00     .00     .00     .00     .00

   11      KK  ELKRUN
   12      QO       3       3       3       3       3       4       4       5       6       9
   13      QO      25      48      68      81      85      95     121     200     289     320
   14      QO     278     210     180     177     158     131     108      95      89      87
   15      QO      85      76      71      65      59      56      54      51      48      46
   16      QO      44      43      41      40      39      38      37      36      35      34
   17      PT    TROY
   18      PW      1.
   19      PR  JACSUM
   20      PW     1.0
   21      BA    10.2      0.
   22      BF      3.     45.  1.0327
   23      UC     -1.     -1.
   24      LU     -1.     -1.
   25      ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 10 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.491		18.00			
COMPUTED HYDROGRAPH	2853.	0.433	136.	22.09	4.09	347.	20.00
OBSERVED HYDROGRAPH	2854.	0.434	136.	21.12	3.12	320.	19.00
DIFFERENCE	-1.	-0.000	-0.	0.97	0.97	27.	1.00
PERCENT DIFFERENCE	-0.05				31.13	8.38	

STANDARD ERROR	52.		AVERAGE ABSOLUTE ERROR	42.
OBJECTIVE FUNCTION	55.		AVERAGE PERCENT ABSOLUTE ERROR	41.91

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 50)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.491		18.00			
COMPUTED HYDROGRAPH	3631.	0.552	73.	25.52	7.52	347.	20.00
OBSERVED HYDROGRAPH	3886.	0.590	78.	25.56	7.56	320.	19.00
DIFFERENCE	-255.	-0.039	-5.	-0.04	-0.04	27.	1.00
PERCENT DIFFERENCE	-6.57				-0.57	8.38	

STANDARD ERROR	35.		AVERAGE ABSOLUTE ERROR	22.
OBJECTIVE FUNCTION	48.		AVERAGE PERCENT ABSOLUTE ERROR	33.04

UNIT HYDROGRAPH
32 END-OF-PERIOD ORDINATES

498.	931.	799.	675.	571.	482.	407.	344.	291.	246.
208.	175.	148.	125.	106.	89.	75.	64.	54.	46.
38.	33.	27.	23.	20.	17.	14.	12.	10.	8.
7.	6.								

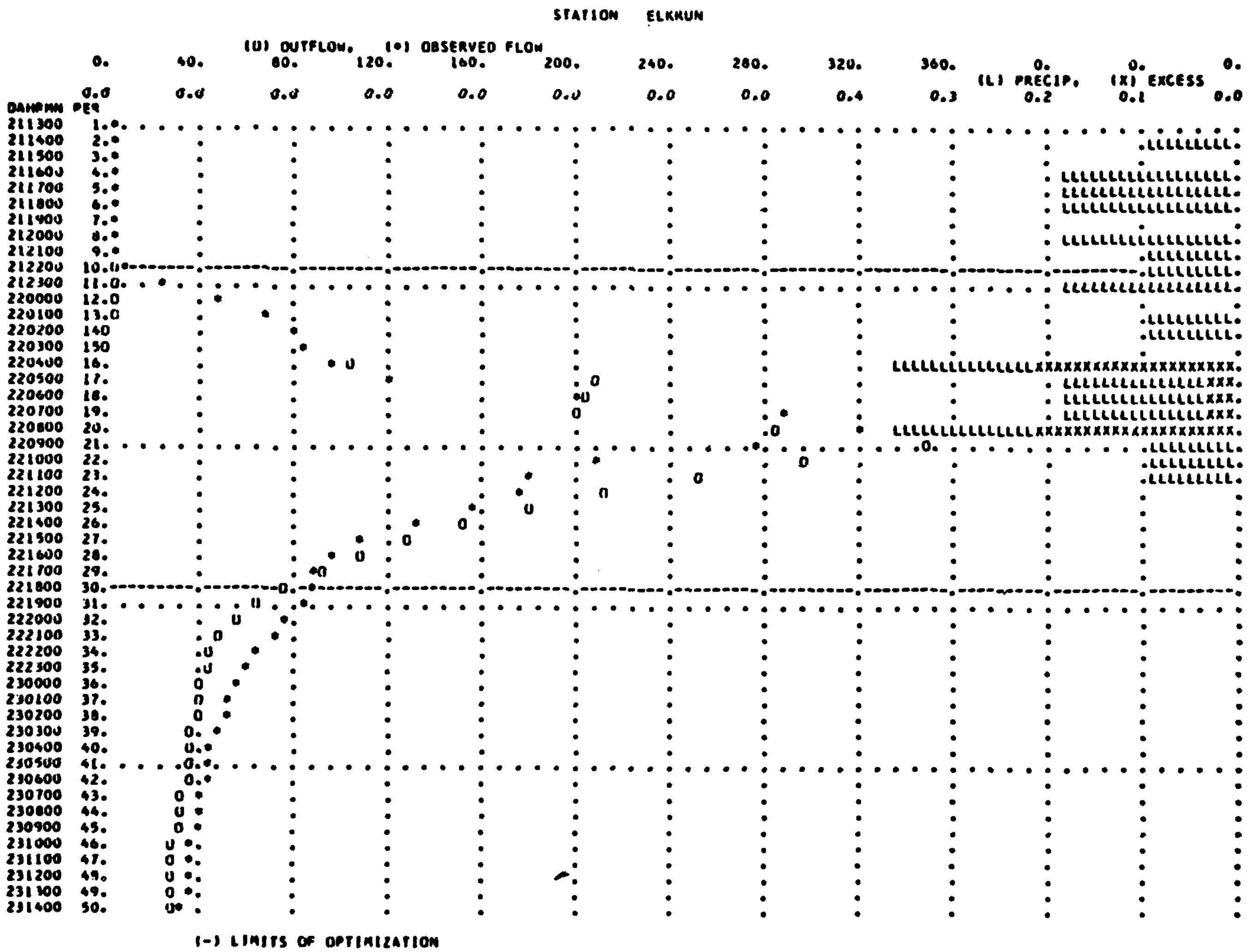
HYDROGRAPH AT STATION ELKRUN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
21 OCT 1300	1	0.00	0.00	0.00	3.	3.	22 OCT 1400	26	0.00	0.00	0.00	151.	131.
21 OCT 1400	2	0.09	0.09	0.00	3.	3.	22 OCT 1500	27	0.00	0.00	0.00	128.	108.
21 OCT 1500	3	0.00	0.00	0.00	3.	3.	22 OCT 1600	28	0.00	0.00	0.00	108.	95.
21 OCT 1600	4	0.18	0.18	0.00	3.	3.	22 OCT 1700	29	0.00	0.00	0.00	92.	89.
21 OCT 1700	5	0.18	0.18	0.00	3.	3.	22 OCT 1800	30	0.00	0.00	0.00	78.	87.
21 OCT 1800	6	0.18	0.18	0.00	3.	4.	22 OCT 1900	31	0.00	0.00	0.00	66.	85.
21 OCT 1900	7	0.00	0.00	0.00	2.	4.	22 OCT 2000	32	0.00	0.00	0.00	56.	76.
21 OCT 2000	8	0.18	0.18	0.00	2.	5.	22 OCT 2100	33	0.00	0.00	0.00	47.	71.
21 OCT 2100	9	0.09	0.09	0.00	2.	6.	22 OCT 2200	34	0.00	0.00	0.00	44.	65.
21 OCT 2200	10	0.09	0.09	0.00	2.	9.	22 OCT 2300	35	0.00	0.00	0.00	43.	59.
21 OCT 2300	11	0.18	0.18	0.00	2.	25.	23 OCT 0000	36	0.00	0.00	0.00	41.	56.
22 OCT 0000	12	0.00	0.00	0.00	2.	48.	23 OCT 0100	37	0.00	0.00	0.00	40.	54.
22 OCT 0100	13	0.09	0.09	0.00	2.	68.	23 OCT 0200	38	0.00	0.00	0.00	39.	51.
22 OCT 0200	14	0.09	0.09	0.00	2.	81.	23 OCT 0300	39	0.00	0.00	0.00	37.	48.
22 OCT 0300	15	0.00	0.00	0.00	2.	85.	23 OCT 0400	40	0.00	0.00	0.00	36.	46.
22 OCT 0400	16	0.36	0.16	0.21	105.	95.	23 OCT 0500	41	0.00	0.00	0.00	35.	44.
22 OCT 0500	17	0.18	0.16	0.03	208.	121.	23 OCT 0600	42	0.00	0.00	0.00	34.	43.
22 OCT 0600	18	0.18	0.16	0.03	204.	200.	23 OCT 0700	43	0.00	0.00	0.00	33.	41.
22 OCT 0700	19	0.18	0.16	0.03	199.	289.	23 OCT 0800	44	0.00	0.00	0.00	32.	40.
22 OCT 0800	20	0.36	0.16	0.21	285.	320.	23 OCT 0900	45	0.00	0.00	0.00	31.	39.
22 OCT 0900	21	0.09	0.09	0.00	347.	278.	23 OCT 1000	46	0.00	0.00	0.00	30.	38.
22 OCT 1000	22	0.09	0.09	0.00	296.	210.	23 OCT 1100	47	0.00	0.00	0.00	29.	37.
22 OCT 1100	23	0.09	0.09	0.00	250.	180.	23 OCT 1200	48	0.00	0.00	0.00	28.	36.
22 OCT 1200	24	0.00	0.00	0.00	212.	177.	23 OCT 1300	49	0.00	0.00	0.00	27.	35.
22 OCT 1300	25	0.00	0.00	0.00	179.	158.	23 OCT 1400	50	0.00	0.00	0.00	26.	34.

TOTAL RAINFALL = 2.91, TOTAL LOSS = 2.42, TOTAL EXCESS = 0.49

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	49.00-HR
347.	20.00	(CFS)	264.	135.	74.	74.
		(INCHES)	0.241	0.491	0.549	0.549
		(AC-FT)	131.	267.	299.	299.

CUMULATIVE AREA = 10.20 SQ MI


STATION ELKRUN
(U) OUTFLOW, (*) OBSERVED FLOW
0. 40. 80. 120. 160. 200. 240. 280. 320. 360.
(L) PRECIP, (X) EXCESS
0. 0. 0.
0.3 0.2 0.1 0.0
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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                                        HEC-1 INPUT                                             PAGE  1

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1         ID        ELK RUN CREEK   11-14-72
   2         ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3         IT      60 13NOV72    1900      45
   4         IO       1       2
   5         QU       8      25
   6         PG    TROY    2.06
   7         PG  JACSUM
   8         PI     .00     .02     .05     .03     .00     .01     .04     .05     .15     .15
   9         PI     .02     .13     .15     .20     .10     .10     .05     .05     .00     .00
  10         PI     .00     .00     .01     .00     .00     .00     .01     .01     .02     .02
  11         PI     .02     .01     .00     .00     .01     .00     .00     .00     .00     .00

  12         KK  ELKRUN
  13         QO       6       6       6       7       7       7       8      13      19      34
  14         QO      67     100     126     177     204     216     207     233     216     179
  15         QO     154     124     107      98      92      89      87      85      83      81
  16         QO      79      75      71      67      63      61      60      57      55      53
  17         QO      51      50      48      47      46       0       0       0       0       0
  18         PT    TROY
  19         PW      1.
  20         PR  JACSUM
  21         PW     1.0
  22         BA    10.2      0.
  23         BF      6.     50.  1.0327
  24         UC     -3.     -6.
  25         LU     -.4    -.12
  26         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 8 THROUGH 25)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.465		13.09			
COMPUTED HYDROGRAPH	2366.	0.359	131.	17.82	4.73	247.	15.00
OBSERVED HYDROGRAPH	2366.	0.359	131.	17.61	4.52	233.	17.00
DIFFERENCE	0.	0.000	0.	0.21	0.21	14.	-2.00
PERCENT DIFFERENCE	0.00				4.69	5.92	

STANDARD ERROR	17.	AVERAGE ABSOLUTE ERROR	13.
OBJECTIVE FUNCTION	18.	AVERAGE PERCENT ABSOLUTE ERROR	16.62

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 45)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.465		13.09			
COMPUTED HYDROGRAPH	3355.	0.510	75.	22.21	9.12	247.	15.00
OBSERVED HYDROGRAPH	3721.	0.565	83.	23.29	10.20	233.	17.00
DIFFERENCE	-366.	-0.056	-8.	-1.08	-1.08	14.	-2.00
PERCENT DIFFERENCE	-9.83				-10.58	5.92	

STANDARD ERROR	16.	AVERAGE ABSOLUTE ERROR	13.
OBJECTIVE FUNCTION	19.	AVERAGE PERCENT ABSOLUTE ERROR	22.71

UNIT HYDROGRAPH
45 END-OF-PERIOD ORDINATES

265.	601.	633.	543.	500.	445.	396.	352.	313.	278.
249.	220.	196.	174.	155.	138.	122.	109.	97.	86.
77.	68.	61.	54.	48.	43.	38.	34.	30.	27.
24.	21.	19.	17.	15.	13.	12.	10.	9.	8.
7.	7.	6.	5.	5.	4.				

HYDROGRAPH AT STATION ELKRUN

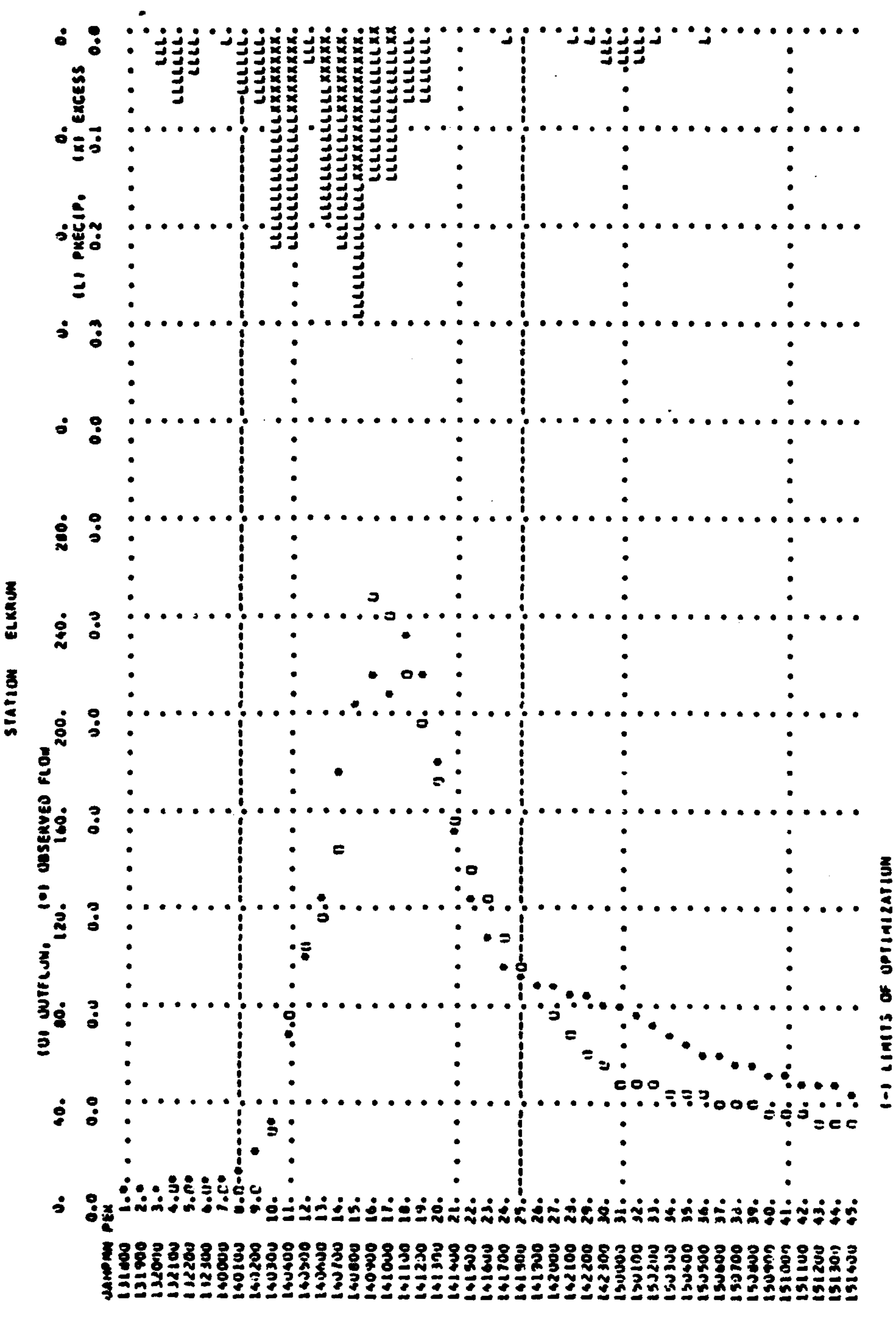
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
13 NOV 1800	1	0.00	0.00	0.00	6.	6.
13 NOV 1900	2	0.00	0.00	0.00	6.	6.
13 NOV 2000	3	0.03	0.03	0.00	6.	6.
13 NOV 2100	4	0.07	0.07	0.00	5.	7.
13 NOV 2200	5	0.04	0.04	0.00	5.	7.
13 NOV 2300	6	0.00	0.00	0.00	5.	7.
14 NOV 0000	7	0.01	0.01	0.00	5.	8.
14 NOV 0100	8	0.06	0.06	0.00	5.	13.
14 NOV 0200	9	0.07	0.07	0.00	5.	19.
14 NOV 0300	10	0.22	0.14	0.08	26.	34.
14 NOV 0400	11	0.22	0.14	0.08	75.	67.
14 NOV 0500	12	0.03	0.03	0.00	104.	100.
14 NOV 0600	13	0.19	0.14	0.05	115.	126.
14 NOV 0700	14	0.22	0.14	0.09	143.	177.
14 NOV 0800	15	0.29	0.14	0.15	203.	204.
14 NOV 0900	16	0.15	0.14	0.01	247.	216.
14 NOV 1000	17	0.15	0.14	0.01	240.	207.
14 NOV 1100	18	0.07	0.07	0.00	217.	233.
14 NOV 1200	19	0.07	0.07	0.00	194.	216.
14 NOV 1300	20	0.00	0.00	0.00	173.	174.
14 NOV 1400	21	0.00	0.00	0.00	154.	154.
14 NOV 1500	22	0.00	0.00	0.00	137.	124.
14 NOV 1600	23	0.00	0.00	0.00	122.	107.

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
14 NOV 1700	24	0.01	0.01	0.00	109.	98.
14 NOV 1800	25	0.00	0.00	0.00	97.	92.
14 NOV 1900	26	0.00	0.00	0.00	87.	89.
14 NOV 2000	27	0.00	0.00	0.00	77.	87.
14 NOV 2100	28	0.01	0.01	0.00	69.	85.
14 NOV 2200	29	0.01	0.01	0.00	62.	83.
14 NOV 2300	30	0.03	0.03	0.00	55.	81.
15 NOV 0000	31	0.03	0.03	0.00	50.	79.
15 NOV 0100	32	0.03	0.03	0.00	48.	75.
15 NOV 0200	33	0.01	0.01	0.00	47.	71.
15 NOV 0300	34	0.00	0.00	0.00	45.	67.
15 NOV 0400	35	0.00	0.00	0.00	44.	63.
15 NOV 0500	36	0.01	0.01	0.00	42.	61.
15 NOV 0600	37	0.00	0.00	0.00	41.	60.
15 NOV 0700	38	0.00	0.00	0.00	40.	57.
15 NOV 0800	39	0.00	0.00	0.00	38.	55.
15 NOV 0900	40	0.00	0.00	0.00	37.	53.
15 NOV 1000	41	0.00	0.00	0.00	36.	51.
15 NOV 1100	42	0.00	0.00	0.00	35.	50.
15 NOV 1200	43	0.00	0.00	0.00	34.	48.
15 NOV 1300	44	0.00	0.00	0.00	33.	47.
15 NOV 1400	45	0.00	0.00	0.00	32.	46.

TOTAL RAINFALL = 2.06, TOTAL LOSS = 1.60, TOTAL EXCESS = 0.46

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	44.00-HR
247.	15.00	(CFS)	210.	119.	76.	76.
		(INCHES)	0.191	0.435	0.507	0.507
		(AC-FT)	104.	236.	276.	276.

CUMULATIVE AREA = 10.20 SQ MI


STATION ELKRUN
(U) OUTFLOW, (O) OBSERVED FLOW
(L) PRECIP, (X) EXCESS
(-) LIMITS OF OPTIMIZATION

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        ELK RUN CREEK    9-26-75
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3           IT      60 24SEP75    0300      90
  4           IO       1       2
  5           QU       6      56
  6           PG    TROY    6.96
  7           PG  JACSUM
  8           PI     .10     .10     .20     .10     .20     .10     .00     .00     .00     .00
  9           PI     .00     .00     .00     .10     .00     .00     .00     .00     .00     .10
 10           PI     .00     .10     .00     .00     .10     .10     .20     .20     .10     .30
 11           PI     .00     .10     .10     .00     .00     .10     .00     .10     .20     .10
 12           PI     .10     .00     .00     .00     .40     .30     .50     .30     .50     .40
 13           PI     .10     .20     .10     .10     .10     .00     .00     .00     .00     .00

 14           KK  ELKRUN
 15           QO       2       3       3       4       6      18      45      56      53      45
 16           QO      38      33      29      26      23      22      18      17      17      17
 17           QO      17      18      27      35      42      44      45      58     223     401
 18           QO     446     380     342     322     254     194     160     141     200     310
 19           QO     371     334     276     223     204     307     648    1502    1740    1655
 20           QO    1610    1700    1457    1214    1040     900     744     550     442     367
 21           QO     322     280     247     219     200     188     171     163     152     141
 22           QO     134     126     119     114     107     103      98      94      89      85
 23           QO      81      79      77      73      71      69      67      65      63      62
 24           PT    TROY
 25           PW      1.
 26           PR  JACSUM
 27           PW     1.0
 28           BA    10.2      0.
 29           BF      2.     85.  1.0327
 30           UC     -1.     -1.
 31           LU     -1.     -1.
 32           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 6 THROUGH 56)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.358		44.03			
COMPUTED HYDROGRAPH	19221.	2.920	377.	45.85	1.82	1886.	50.00
OBSERVED HYDROGRAPH	19297.	2.932	378.	46.24	2.21	1740.	48.00
DIFFERENCE	-76.	-0.012	-1.	-0.39	-0.39	146.	2.00
PERCENT DIFFERENCE	-0.39				-17.73	8.37	

STANDARD ERROR	98.	AVERAGE ABSOLUTE ERROR	57.
OBJECTIVE FUNCTION	145.	AVERAGE PERCENT ABSOLUTE ERROR	28.15

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 90)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.358		44.03			
COMPUTED HYDROGRAPH	23405.	3.556	260.	49.31	5.28	1886.	50.00
OBSERVED HYDROGRAPH	25277.	3.840	281.	51.04	7.01	1740.	48.00
DIFFERENCE	-1872.	-0.284	-21.	-1.73	-1.73	146.	2.00
PERCENT DIFFERENCE	-7.41				-24.67	8.37	

STANDARD ERROR	82.	AVERAGE ABSOLUTE ERROR	52.
OBJECTIVE FUNCTION	131.	AVERAGE PERCENT ABSOLUTE ERROR	31.85

UNIT HYDROGRAPH
23 END-OF-PERIOD ORDINATES

708.	1268.	994.	782.	612.	480.	376.	294.	231.	181.
142.	111.	87.	68.	53.	42.	33.	26.	20.	16.
12.	10.	8.							

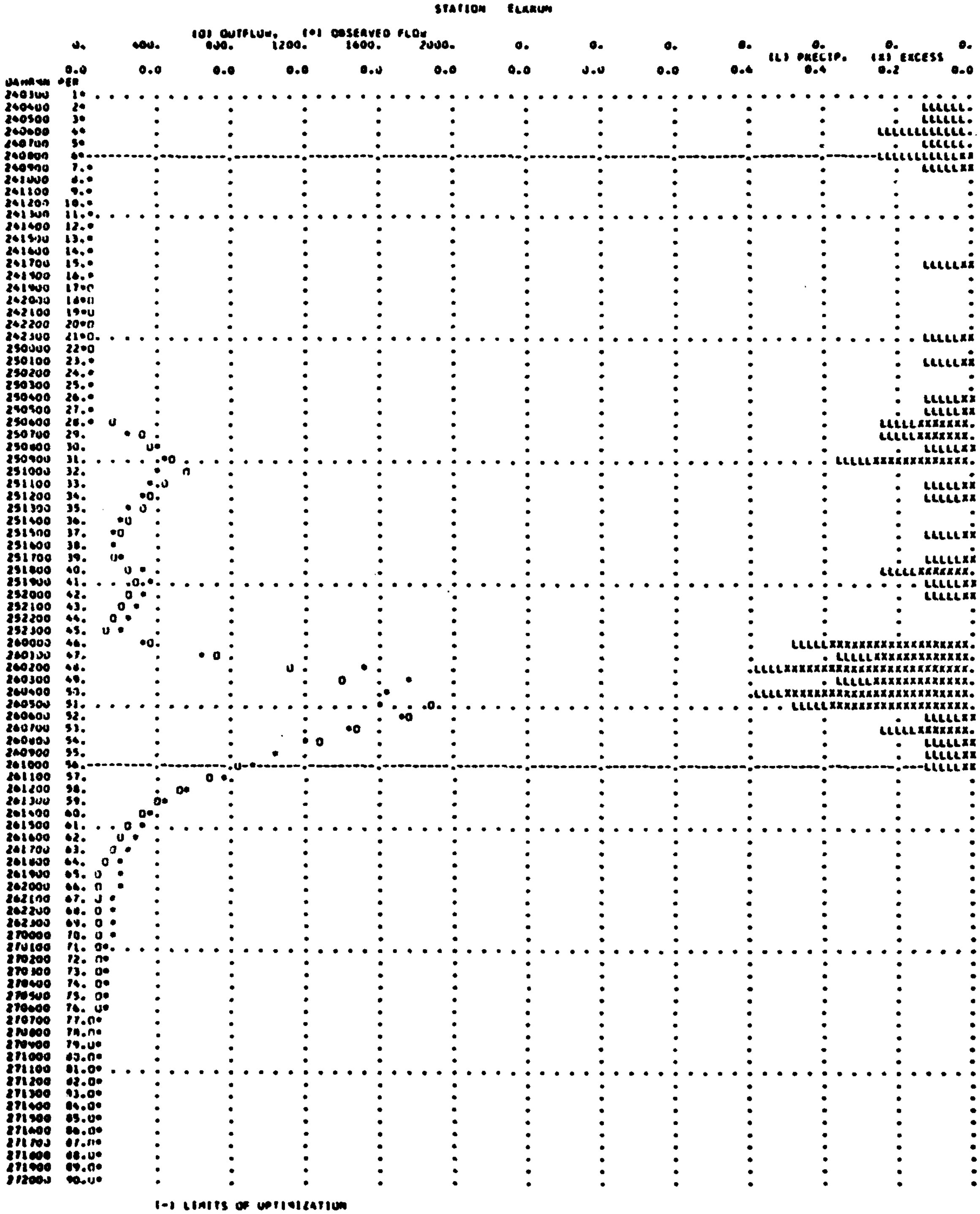
HYDROGRAPH AT STATION CLARUN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24 SEP 0300	1	0.00	0.00	0.00	2.	2.
24 SEP 0400	2	0.12	0.12	0.00	2.	3.
24 SEP 0500	3	0.12	0.12	0.00	2.	4.
24 SEP 0600	4	0.24	0.24	0.00	2.	4.
24 SEP 0700	5	0.12	0.12	0.00	2.	6.
24 SEP 0800	6	0.24	0.22	0.01	10.	18.
24 SEP 0900	7	0.12	0.10	0.02	30.	45.
24 SEP 1000	8	0.00	0.00	0.00	37.	56.
24 SEP 1100	9	0.00	0.00	0.00	36.	53.
24 SEP 1200	10	0.00	0.00	0.00	35.	45.
24 SEP 1300	11	0.00	0.00	0.00	34.	38.
24 SEP 1400	12	0.00	0.00	0.00	33.	33.
24 SEP 1500	13	0.00	0.00	0.00	32.	29.
24 SEP 1600	14	0.00	0.00	0.00	31.	26.
24 SEP 1700	15	0.12	0.10	0.02	30.	23.
24 SEP 1800	16	0.00	0.00	0.00	30.	22.
24 SEP 1900	17	0.00	0.00	0.00	29.	18.
24 SEP 2000	18	0.00	0.00	0.00	28.	17.
24 SEP 2100	19	0.00	0.00	0.00	27.	17.
24 SEP 2200	20	0.00	0.00	0.00	26.	17.
24 SEP 2300	21	0.12	0.10	0.02	25.	17.
25 SEP 0000	22	0.00	0.00	0.00	31.	18.
25 SEP 0100	23	0.12	0.10	0.02	37.	27.
25 SEP 0200	24	0.00	0.00	0.00	43.	35.
25 SEP 0300	25	0.00	0.00	0.00	41.	42.
25 SEP 0400	26	0.12	0.10	0.02	40.	44.
25 SEP 0500	27	0.12	0.10	0.02	57.	45.
25 SEP 0600	28	0.24	0.10	0.14	155.	56.
25 SEP 0700	29	0.24	0.10	0.14	315.	223.
25 SEP 0800	30	0.12	0.10	0.02	358.	401.
25 SEP 0900	31	0.35	0.10	0.25	474.	446.
25 SEP 1000	32	0.00	0.00	0.00	553.	393.
25 SEP 1100	33	0.12	0.10	0.02	448.	342.
25 SEP 1200	34	0.12	0.10	0.02	377.	322.
25 SEP 1300	35	0.00	0.00	0.00	309.	254.
25 SEP 1400	36	0.00	0.00	0.00	242.	194.
25 SEP 1500	37	0.12	0.10	0.02	203.	160.
25 SEP 1600	38	0.00	0.00	0.00	172.	141.
25 SEP 1700	39	0.12	0.10	0.02	143.	200.
25 SEP 1800	40	0.24	0.10	0.14	226.	310.
25 SEP 1900	41	0.12	0.10	0.02	287.	371.
25 SEP 2000	42	0.12	0.10	0.02	252.	334.
25 SEP 2100	43	0.00	0.00	0.00	211.	276.
25 SEP 2200	44	0.00	0.00	0.00	165.	223.
25 SEP 2300	45	0.00	0.00	0.00	129.	204.
26 SEP 0000	46	0.47	0.10	0.37	365.	307.
26 SEP 0100	47	0.35	0.10	0.25	731.	648.
26 SEP 0200	48	0.59	0.10	0.49	1103.	1502.
26 SEP 0300	49	0.35	0.10	0.25	1395.	1740.
26 SEP 0400	50	0.59	0.10	0.49	1624.	1655.
26 SEP 0500	51	0.47	0.10	0.37	1886.	1610.
26 SEP 0600	52	0.12	0.10	0.02	1757.	1700.
26 SEP 0700	53	0.24	0.10	0.14	1488.	1457.
26 SEP 0800	54	0.12	0.10	0.02	1275.	1214.
26 SEP 0900	55	0.12	0.10	0.02	1025.	1040.
26 SEP 1000	56	0.12	0.10	0.02	829.	900.
26 SEP 1100	57	0.00	0.00	0.00	663.	744.
26 SEP 1200	58	0.00	0.00	0.00	519.	550.
26 SEP 1300	59	0.00	0.00	0.00	407.	442.
26 SEP 1400	60	0.00	0.00	0.00	319.	367.
26 SEP 1500	61	0.00	0.00	0.00	250.	322.
26 SEP 1600	62	0.00	0.00	0.00	196.	280.
26 SEP 1700	63	0.00	0.00	0.00	152.	247.
26 SEP 1800	64	0.00	0.00	0.00	119.	219.
26 SEP 1900	65	0.00	0.00	0.00	93.	200.
26 SEP 2000	66	0.00	0.00	0.00	83.	188.
26 SEP 2100	67	0.00	0.00	0.00	81.	171.
26 SEP 2200	68	0.00	0.00	0.00	78.	163.
26 SEP 2300	69	0.00	0.00	0.00	76.	152.
27 SEP 0000	70	0.00	0.00	0.00	73.	141.
27 SEP 0100	71	0.00	0.00	0.00	71.	134.
27 SEP 0200	72	0.00	0.00	0.00	69.	126.
27 SEP 0300	73	0.00	0.00	0.00	67.	119.
27 SEP 0400	74	0.00	0.00	0.00	64.	114.
27 SEP 0500	75	0.00	0.00	0.00	62.	107.
27 SEP 0600	76	0.00	0.00	0.00	60.	103.
27 SEP 0700	77	0.00	0.00	0.00	59.	98.
27 SEP 0800	78	0.00	0.00	0.00	57.	94.
27 SEP 0900	79	0.00	0.00	0.00	55.	89.
27 SEP 1000	80	0.00	0.00	0.00	53.	85.
27 SEP 1100	81	0.00	0.00	0.00	51.	81.
27 SEP 1200	82	0.00	0.00	0.00	50.	79.
27 SEP 1300	83	0.00	0.00	0.00	48.	77.
27 SEP 1400	84	0.00	0.00	0.00	47.	73.
27 SEP 1500	85	0.00	0.00	0.00	45.	71.
27 SEP 1600	86	0.00	0.00	0.00	44.	69.
27 SEP 1700	87	0.00	0.00	0.00	42.	67.
27 SEP 1800	88	0.00	0.00	0.00	41.	65.
27 SEP 1900	89	0.00	0.00	0.00	40.	63.
27 SEP 2000	90	0.00	0.00	0.00	39.	62.

TOTAL RAINFALL = 6.96, TOTAL LOSS = 3.60, TOTAL EXCESS = 3.36

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	89.00-HR
1886.	50.00	(CFS)	1556.	719.	319.	263.
		(INCHES)	1.419	2.621	3.494	3.553
		(AC-FT)	772.	1426.	1901.	1933.

CUMULATIVE AREA = 10.20 SQ MI


STATION ELKHUN
(O) OUTFLOW, (*) OBSERVED FLOW
0. 400. 800. 1200. 1600. 2000.
(L) PRECIP, (X) EXCESS
(-) LIMITS OF OPTIMIZATION

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                              HEC-1 INPUT                                                    PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        ELK RUN CREEK    10-09-76
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3           IT       60 08OCT76    0600       50
  4           IO        1       2
  5           OU       24      38
  6           PG     TROY    1.59
  7           PG   JACSUM
  8           PI      .00     .00     .00     .10     .00     .00     .00     .00     .00     .00
  9           PI      .00     .00     .00     .00     .00     .10     .00     .00     .10     .00
 10           PI      .10     .10     .10     .10     .10     .10     .30     .30     .30     .10
 11           PI      .10     .00     .20     .10     .00     .00     .10     .00     .00     .00

 12           KK   ELKRUN
 13           QO        3       4       4       4       3       3       3       3       3       3
 14           QO        3       3       3       3       3       3       3       3       3       4
 15           QO        4       4       5       7       9      21      28      40      85     216
 16           QO      367     473     419     319     216     171     136     114      98      85
 17           QO       75      67      60      55      51      47      44      42      40      38
 18           PT     TROY
 19           PW       1.
 20           PR   JACSUM
 21           PW      1.0
 22           BA     10.2      0.
 23           BF       3.     47.  1.0327
 24           UC      -3.     -5.
 25           LU      -.9     -.1
 26           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 24 THROUGH 38)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.420		29.74			
COMPUTED HYDROGRAPH	2638.	0.401	176.	32.95	3.22	467.	31.00
OBSERVED HYDROGRAPH	2620.	0.398	175.	32.82	3.09	473.	31.00
DIFFERENCE	18.	0.003	1.	0.13	0.13	-6.	0.00
PERCENT DIFFERENCE	0.69				4.17	-1.35	

STANDARD ERROR	15.	AVERAGE ABSOLUTE ERROR	13.
OBJECTIVE FUNCTION	15.	AVERAGE PERCENT ABSOLUTE ERROR	30.33

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 50)

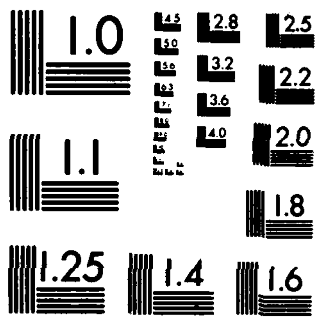
	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.420		29.74			
COMPUTED HYDROGRAPH	3192.	0.485	64.	34.34	4.60	467.	31.00
OBSERVED HYDROGRAPH	3399.	0.516	68.	34.56	4.82	473.	31.00
DIFFEPENCE	-207.	-0.031	-4.	-0.22	-0.22	-6.	0.00
PERCENT DIFFERENCE	-6.09				-4.50	-1.35	

STANDARD ERROR	13.	AVERAGE ABSOLUTE ERROR	8.
OBJECTIVE FUNCTION	16.	AVERAGE PERCENT ABSOLUTE ERROR	28.06

AD-A129 964 WATERSHED MODELLING IN THE CHEMUNG AND UPPER SUSQUEHANNA RIVER BASINS USI..(U) ARMY MILITARY PERSONNEL CENTER ALEXANDRIA VA J C STYRON 20 MAY 83

3/4

UNCLASSIFIED F/G 8/8 NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

UNIT HYDROGRAPH
12 END-OF-PERIOD ORDINATES

203.	676.	1173.	1422.	1269.	842.	458.	249.	135.	73.
40.	22.								

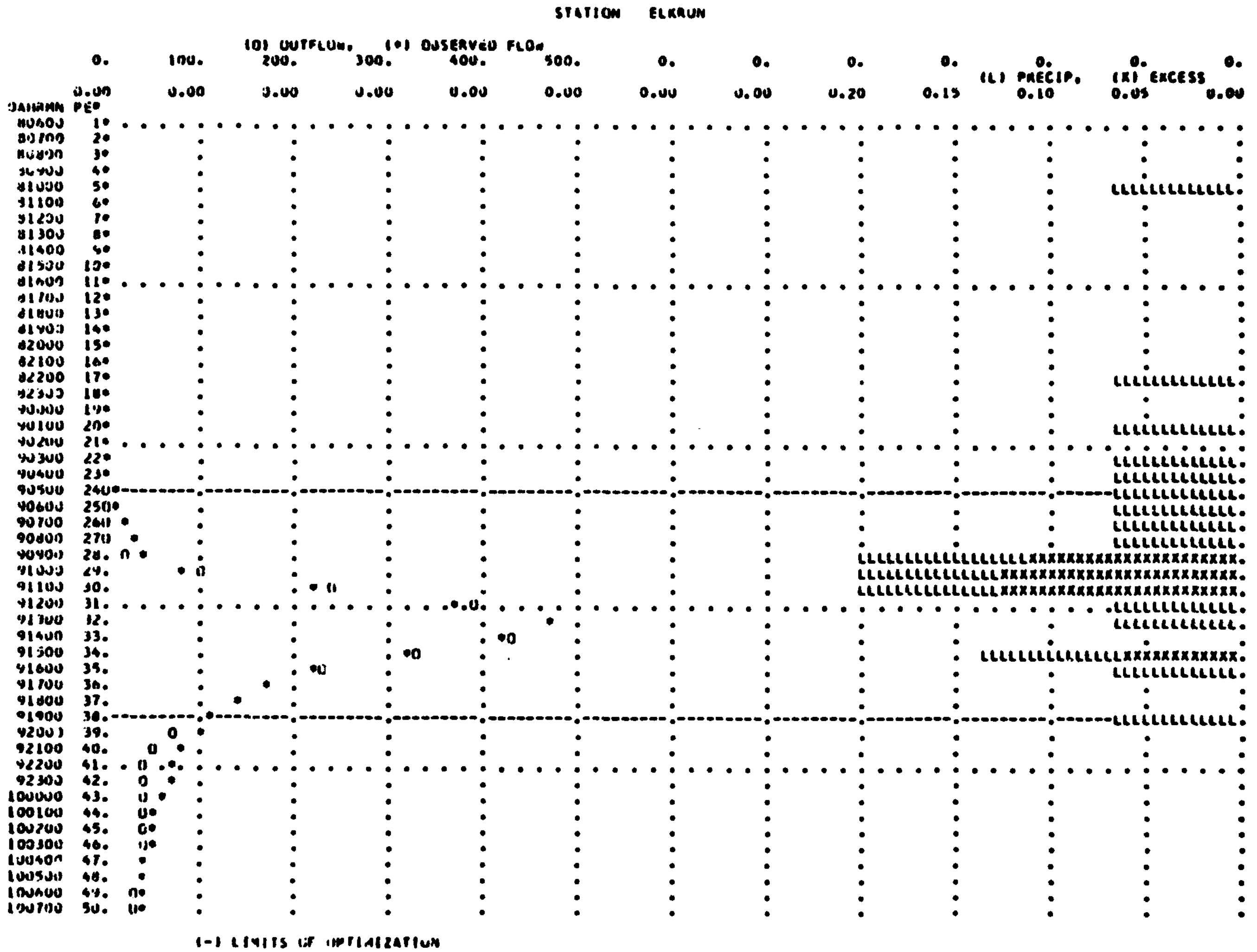
HYDROGRAPH AT STATION ELKRUN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
8 OCT 0600	1	0.00	0.00	0.00	1.	3.	9 OCT 0700	26	0.07	0.07	0.00	1.	21.
8 OCT 0700	2	0.00	0.00	0.00	3.	4.	9 OCT 0800	27	0.07	0.07	0.00	1.	28.
8 OCT 0800	3	0.00	0.00	0.00	3.	4.	9 OCT 0900	28	0.20	0.09	0.11	23.	40.
8 OCT 0900	4	0.00	0.00	0.00	3.	4.	9 OCT 1000	29	0.20	0.07	0.13	101.	85.
8 OCT 1000	5	0.07	0.07	0.00	3.	3.	9 OCT 1100	30	0.20	0.07	0.13	240.	216.
8 OCT 1100	6	0.00	0.00	0.00	3.	3.	9 OCT 1200	31	0.07	0.07	0.00	390.	367.
8 OCT 1200	7	0.00	0.00	0.00	2.	3.	9 OCT 1300	32	0.07	0.07	0.00	467.	473.
8 OCT 1300	8	0.00	0.00	0.00	2.	3.	9 OCT 1400	33	0.00	0.00	0.00	431.	419.
8 OCT 1400	9	0.00	0.00	0.00	2.	3.	9 OCT 1500	34	0.13	0.07	0.06	328.	319.
8 OCT 1500	10	0.00	0.00	0.00	2.	3.	9 OCT 1600	35	0.07	0.07	0.00	231.	216.
8 OCT 1600	11	0.00	0.00	0.00	2.	3.	9 OCT 1700	36	0.00	0.00	0.00	174.	171.
8 OCT 1700	12	0.00	0.00	0.00	2.	3.	9 OCT 1800	37	0.00	0.00	0.00	141.	136.
8 OCT 1800	13	0.00	0.00	0.00	2.	3.	9 OCT 1900	38	0.07	0.07	0.00	106.	114.
8 OCT 1900	14	0.00	0.00	0.00	2.	3.	9 OCT 2000	39	0.00	0.00	0.00	67.	96.
8 OCT 2000	15	0.00	0.00	0.00	2.	3.	9 OCT 2100	40	0.00	0.00	0.00	46.	85.
8 OCT 2100	16	0.00	0.00	0.00	2.	3.	9 OCT 2200	41	0.00	0.00	0.00	45.	75.
8 OCT 2200	17	0.07	0.07	0.00	2.	3.	9 OCT 2300	42	0.00	0.00	0.00	44.	67.
8 OCT 2300	18	0.00	0.00	0.00	2.	3.	10 OCT 0000	43	0.00	0.00	0.00	42.	60.
9 OCT 0000	19	0.00	0.00	0.00	2.	3.	10 OCT 0100	44	0.00	0.00	0.00	41.	55.
9 OCT 0100	20	0.07	0.07	0.00	2.	4.	10 OCT 0200	45	0.00	0.00	0.00	40.	51.
9 OCT 0200	21	0.00	0.00	0.00	2.	4.	10 OCT 0300	46	0.00	0.00	0.00	38.	47.
9 OCT 0300	22	0.07	0.07	0.00	2.	4.	10 OCT 0400	47	0.00	0.00	0.00	37.	44.
9 OCT 0400	23	0.07	0.07	0.00	1.	5.	10 OCT 0500	48	0.00	0.00	0.00	36.	42.
9 OCT 0500	24	0.07	0.07	0.00	1.	7.	10 OCT 0600	49	0.00	0.00	0.00	35.	40.
9 OCT 0600	25	0.07	0.07	0.00	1.	8.	10 OCT 0700	50	0.00	0.00	0.00	34.	38.

TOTAL RAINFALL = 1.59, TOTAL LOSS = 1.17, TOTAL EXCESS = 0.42

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	49.00-HR
467.	31.00	(CFS)	342.	130.	65.	65.
		(INCHES)	0.312	0.474	0.482	0.482
		(AC-FT)	170.	258.	262.	262.

CUMULATIVE AREA = 10.20 SQ MI


STATION ELKRUN
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP, (X) EXCESS
(-) LIMITS OF OPTIMIZATION

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                                          HEC-1 INPUT                                                 PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        ELK RUN CREEK    10-20-76
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
  3           IT      60 20OCT76    1300      30
  4           IU       1       2
  5           UI       7      20
  6           PG    TROY    1.44
  7           PG  JACSUM
  8           PI     .10     .10     .10     .10     .10     .20     .10     .30     .10     .20
  9           PI     .10     .00     .20     .00     .00     .00     .00     .00     .00     .00

 10           KK  ELKRUN
 11           QO       3       4       4       4       5       6      13      29      45      75
 12           QO     136     177     194     210     204     185     149     119      98      79
 13           QO      67      58      53      50      47      44      42      40      38      37
 14           PT    TROY
 15           PW      1.
 16           PR  JACSUM
 17           PW     1.0
 18           BA    10.2      0.
 19           BF      3.     45.  1.0327
 20           UC     -1.     -1.
 21           LU     -1.     -1.
 22           ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 7 THROUGH 20)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.289		11.49			
COMPUTED HYDROGRAPH	1711.	0.260	122.	14.52	3.03	222.	14.00
OBSERVED HYDROGRAPH	1713.	0.260	122.	14.42	2.92	210.	13.00
DIFFERENCE	-2.	-0.000	-0.	0.10	0.10	12.	1.00
PERCENT DIFFERENCE	-0.09				3.58	5.68	

STANDARD ERROR 14. AVERAGE ABSOLUTE ERROR 12.
OBJECTIVE FUNCTION 14. AVERAGE PERCENT ABSOLUTE ERROR 20.32

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.289		11.49			
COMPUTED HYDROGRAPH	2135.	0.324	71.	16.46	4.97	222.	14.00
OBSERVED HYDROGRAPH	2215.	0.337	74.	16.56	5.07	210.	13.00
DIFFERENCE	-80.	-0.012	-3.	-0.10	-0.10	12.	1.00
PERCENT DIFFERENCE	-3.59				-1.93	5.68	

STANDARD ERROR 11. AVERAGE ABSOLUTE ERROR 8.
OBJECTIVE FUNCTION 13. AVERAGE PERCENT ABSOLUTE ERROR 17.45

UNIT HYDROGRAPH
21 END-OF-PERIOD ORDINATES

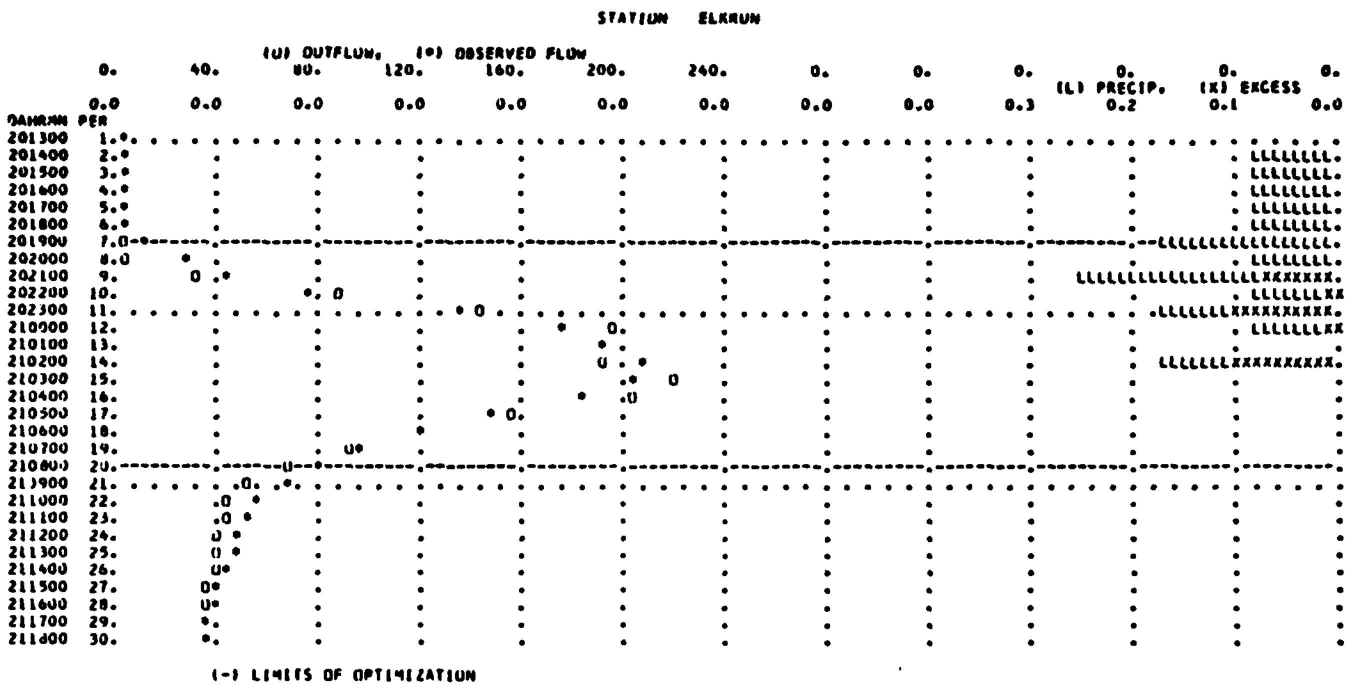
418.	1103.	1207.	919.	700.	533.	406.	309.	235.	179.
137.	104.	79.	60.	46.	35.	27.	20.	15.	12.
7.									

HYDROGRAPH AT STATION ELKRUN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
20 OCT 1300	1	0.00	0.00	0.00	3.	3.	21 OCT 0400	16	0.00	0.00	0.00	205.	185.
20 OCT 1400	2	0.08	0.08	0.00	3.	4.	21 OCT 0500	17	0.00	0.00	0.00	156.	149.
20 OCT 1500	3	0.08	0.08	0.00	3.	4.	21 OCT 0600	18	0.00	0.00	0.00	119.	119.
20 OCT 1600	4	0.08	0.08	0.00	3.	4.	21 OCT 0700	19	0.00	0.00	0.00	91.	98.
20 OCT 1700	5	0.08	0.08	0.00	3.	5.	21 OCT 0800	20	0.00	0.00	0.00	70.	79.
20 OCT 1800	6	0.08	0.08	0.00	3.	6.	21 OCT 0900	21	0.00	0.00	0.00	54.	67.
20 OCT 1900	7	0.17	0.17	0.00	2.	13.	21 OCT 1000	22	0.00	0.00	0.00	45.	58.
20 OCT 2000	8	0.08	0.08	0.00	2.	29.	21 OCT 1100	23	0.00	0.00	0.00	43.	53.
20 OCT 2100	9	0.25	0.18	0.07	33.	45.	21 OCT 1200	24	0.00	0.00	0.00	42.	50.
20 OCT 2200	10	0.08	0.07	0.01	88.	75.	21 OCT 1300	25	0.00	0.00	0.00	40.	47.
20 OCT 2300	11	0.17	0.07	0.10	144.	136.	21 OCT 1400	26	0.00	0.00	0.00	39.	44.
21 OCT 0000	12	0.08	0.07	0.01	194.	177.	21 OCT 1500	27	0.00	0.00	0.00	38.	42.
21 OCT 0100	13	0.00	0.00	0.00	193.	194.	21 OCT 1600	28	0.00	0.00	0.00	37.	40.
21 OCT 0200	14	0.17	0.07	0.10	192.	210.	21 OCT 1700	29	0.00	0.00	0.00	36.	38.
21 OCT 0300	15	0.00	0.00	0.00	222.	204.	21 OCT 1800	30	0.00	0.00	0.00	34.	37.

TOTAL RAINFALL = 1.44, TOTAL LOSS = 1.15, TOTAL EXCESS = 0.29

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	29.00-HR
222.	14.00	(CFS)	193.	88.	73.	73.
		(INCHES)	0.176	0.319	0.322	0.322
		(AC-FT)	95.	174.	175.	175.


STATION ELKRUN
(O) OUTFLOW, (*) OBSERVED FLOW
0. 40. 80. 120. 160. 200. 240. 0. 0. 0. 0. 0. 0.
(L) PRECIP. (X) EXCESS
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.3 0.2 0.1 0.0
DAHRMN PER
201300 1.
201400 2.
201500 3.
201600 4.
201700 5.
201800 6.
201900 7.
202000 8.
202100 9.
202200 10.
202300 11.
210000 12.
210100 13.
210200 14.
210300 15.
210400 16.
210500 17.
210600 18.
210700 19.
210800 20.
210900 21.
211000 22.
211100 23.
211200 24.
211300 25.
211400 26.
211500 27.
211600 28.
211700 29.
211800 30.
(-) LIMITS OF OPTIMIZATION

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LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1       ID        ELK RUN CREEK   5-14-78
   2       ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3       IT      60 14MAY78    0300      40
   4       IO       1       2
   5       OU       5      15
   6       PG    TROY    1.22
   7       PG  JACSUM
   8       PI     .00     .00     .10     .10     .00     .10     .20     .10     .00     .00
   9       PI     .50     .20     .00     .00     .00     .00     .00     .00     .00     .00
  10       PI     .00     .00     .00     .00     .00     .00     .00     .00     .10     .00

  11       KK  ELKRUN
  12       QO      15      15      18      24      42      91     154     213     257     398
  13       QO     735    1061     798     545     412     304     254     223     201     187
  14       QO     176     165     157     146     137     132     132     139     154     149
  15       QO     141     129     124     115     108     102      95      91      87      83
  16       PT    TROY
  17       PW      1.
  18       PR  JACSUM
  19       PW     1.0
  20       BA    10.2      0.
  21       SF     15.     85.  1.0327
  22       UC     -1.     -1.
  23       LU     -1.     -1.
  24       ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 5 THROUGH 15)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.911		11.68			
COMPUTED HYDROGRAPH	4738.	0.720	431.	11.75	0.06	1026.	12.00
OBSERVED HYDROGRAPH	4706.	0.715	428.	11.65	-0.03	1061.	11.00
DIFFERENCE	32.	0.005	3.	0.10	0.10	-35.	1.00
PERCENT DIFFERENCE	0.68				******	-3.29	

STANDARD ERROR 245. AVERAGE ABSOLUTE ERROR 184.
OBJECTIVE FUNCTION 290. AVERAGE PERCENT ABSOLUTE ERROR 44.74

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 40)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.911		11.68			
COMPUTED HYDROGRAPH	7241.	1.100	181.	16.24	4.55	1026.	12.00
OBSERVED HYDROGRAPH	8509.	1.293	213.	17.76	6.07	1061.	11.00
DIFFERENCE	-1268.	-0.193	-32.	-1.52	-1.52	-35.	1.00
PERCENT DIFFERENCE	-14.90				-25.05	-3.29	

STANDARD ERROR 138. AVERAGE ABSOLUTE ERROR 86.
OBJECTIVE FUNCTION 220. AVERAGE PERCENT ABSOLUTE ERROR 40.01

UNIT HYDROGRAPH
13 END-OF-PERIOD ORDINATES

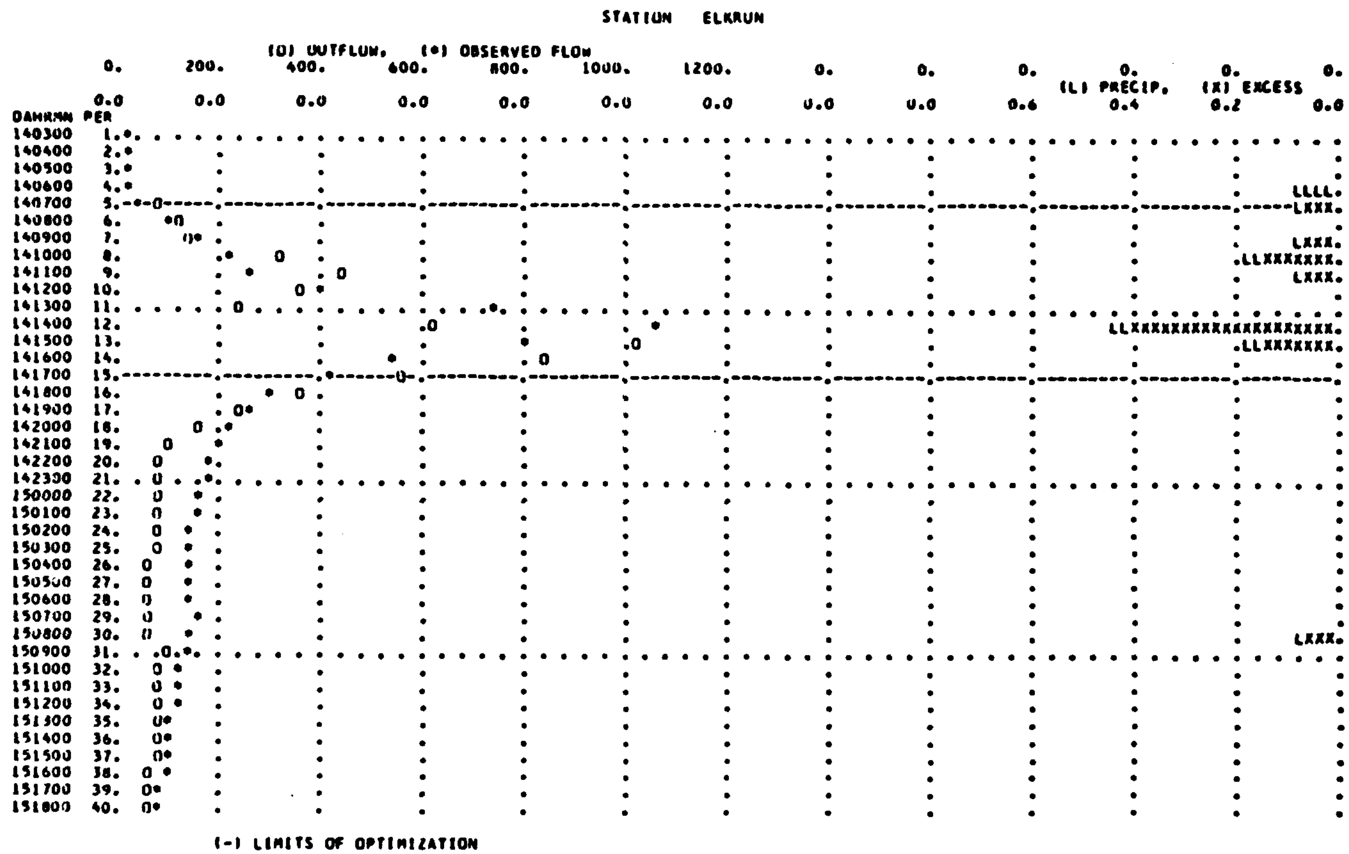
1124.	1884.	1247.	812.	528.	344.	224.	145.	95.	62.
40.	26.	17.							

HYDROGRAPH AT STATION ELKRUN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
14 MAY 0300	1	0.00	0.00	0.00	15.	15.	14 MAY 2300	21	0.00	0.00	0.00	81.	176.
14 MAY 0400	2	0.00	0.00	0.00	15.	15.	15 MAY 0000	22	0.00	0.00	0.00	79.	165.
14 MAY 0500	3	0.00	0.00	0.00	14.	18.	15 MAY 0100	23	0.00	0.00	0.00	76.	157.
14 MAY 0600	4	0.09	0.08	0.00	17.	24.	15 MAY 0200	24	0.00	0.00	0.00	74.	146.
14 MAY 0700	5	0.09	0.03	0.05	81.	42.	15 MAY 0300	25	0.00	0.00	0.00	71.	137.
14 MAY 0800	6	0.00	0.00	0.00	120.	91.	15 MAY 0400	26	0.00	0.00	0.00	69.	132.
14 MAY 0900	7	0.09	0.03	0.05	146.	154.	15 MAY 0500	27	0.00	0.00	0.00	67.	132.
14 MAY 1000	8	0.17	0.03	0.14	322.	213.	15 MAY 0600	28	0.00	0.00	0.00	65.	139.
14 MAY 1100	9	0.09	0.03	0.05	440.	257.	15 MAY 0700	29	0.00	0.00	0.00	63.	154.
14 MAY 1200	10	0.00	0.00	0.00	356.	398.	15 MAY 0800	30	0.09	0.03	0.05	68.	149.
14 MAY 1300	11	0.00	0.00	0.00	236.	735.	15 MAY 0900	31	0.00	0.00	0.00	109.	141.
14 MAY 1400	12	0.44	0.03	0.40	613.	1061.	15 MAY 1000	32	0.00	0.00	0.00	84.	129.
14 MAY 1500	13	0.17	0.03	0.14	1026.	798.	15 MAY 1100	33	0.00	0.00	0.00	81.	124.
14 MAY 1600	14	0.00	0.00	0.00	843.	545.	15 MAY 1200	34	0.00	0.00	0.00	79.	115.
14 MAY 1700	15	0.00	0.00	0.00	555.	412.	15 MAY 1300	35	0.00	0.00	0.00	76.	108.
14 MAY 1800	16	0.00	0.00	0.00	364.	304.	15 MAY 1400	36	0.00	0.00	0.00	74.	102.
14 MAY 1900	17	0.00	0.00	0.00	240.	254.	15 MAY 1500	37	0.00	0.00	0.00	72.	95.
14 MAY 2000	18	0.00	0.00	0.00	158.	223.	15 MAY 1600	38	0.00	0.00	0.00	69.	91.
14 MAY 2100	19	0.00	0.00	0.00	106.	201.	15 MAY 1700	39	0.00	0.00	0.00	67.	87.
14 MAY 2200	20	0.00	0.00	0.00	84.	187.	15 MAY 1800	40	0.00	0.00	0.00	65.	83.

TOTAL RAINFALL = 1.22, TOTAL LOSS = 0.31, TOTAL EXCESS = 0.91

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	39.00-HR
1026.	12.00	(CFS)	606.	261.	185.	185.
		(INCHES)	0.553	0.951	1.094	1.094
		(AC-FT)	301.	518.	595.	595.


STATION ELKRUN
(O) OUTFLOW, (*) OBSERVED FLOW
0. 200. 400. 600. 800. 1000. 1200. 0. 0. 0. 0. 0. 0.
(L) PRECIP. (X) EXCESS
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.6 0.4 0.2 0.0
DAHRMN PER
140300 1.
140400 2.
140500 3.
140600 4.
140700 5.
140800 6.
140900 7.
141000 8.
141100 9.
141200 10.
141300 11.
141400 12.
141500 13.
141600 14.
141700 15.
141800 16.
141900 17.
142000 18.
142100 19.
142200 20.
142300 21.
150000 22.
150100 23.
150200 24.
150300 25.
150400 26.
150500 27.
150600 28.
150700 29.
150800 30.
150900 31.
151000 32.
151100 33.
151200 34.
151300 35.
151400 36.
151500 37.
151600 38.
151700 39.
151800 40.
(-) LIMITS OF OPTIMIZATION

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                                              HEC-1 INPUT                                                    PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        ELK RUN CREEK      8-06-78
   2          ID        UNIT GRAPH (CLARK) AND LOSS RATE (UNIFORM) OPTIMIZATION
   3          IT      60  5AUG78    2100      37
   4          IO       1       2
   5          OU       8      20
   6          PG    TROY    1.54
   7          PG  JACSUM
   8          PI      .1      .0      .0      .0      .0      .0      .1      .2      .0      .0
   9          PI      .2      .6      .5      .3      .0      .0      .0      .1      .0      .0

  10          KK  ELKRUN
  11          QO       3       3       3       3       3       3       3       4       5      41
  12          QO      95      87      74     139     176     236     236     151     108      79
  13          QO      70      66      59      52      45      41      36      33      32      29
  14          QO      28      27      25      24      22      21      20       0       0       0
  15          PT    TROY
  16          PW     1.0
  17          PR  JACSUM
  18          PW     1.0
  19          BA    10.2      0.
  20          BF      3.     34.  1.0327
  21          UC     -3.     -7.
  22          LU    -1.1     -1.
  23          ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 8 THROUGH 20)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.457		14.22			
COMPUTED HYDROGRAPH	1429.	0.217	110.	16.94	2.72	256.	15.00
OBSERVED HYDROGRAPH	1431.	0.217	110.	15.56	1.34	236.	15.00
DIFFERENCE	-2.	-0.000	-0.	1.38	1.38	20.	0.00
PERCENT DIFFERENCE	-0.16				103.24	8.30	

STANDARD ERROR 58. AVERAGE ABSOLUTE ERROR 48.
OBJECTIVE FUNCTION 57. AVERAGE PERCENT ABSOLUTE ERROR 58.40

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 37)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0 457		14.22			
COMPUTED HYDROGRAPH	2785.	0.423	75.	21.55	7.33	256.	15.00
OBSERVED HYDROGRAPH	2082.	0.316	56.	18.92	4.70	236.	15.00
DIFFERENCE	703.	0.107	19.	2.63	2.63	20.	0.00
PERCENT DIFFERENCE	33.75				55.86	8.30	

STANDARD ERROR 47. AVERAGE ABSOLUTE ERROR 36.
OBJECTIVE FUNCTION 57. AVERAGE PERCENT ABSOLUTE ERROR 85.60

UNIT HYDROGRAPH
56 END-OF-PERIOD ORDINATES

313.	598.	553.	491.	444.	402.	363.	328.	297.	268.
243.	219.	198.	179.	162.	147.	133.	120.	109.	98.
89.	80.	73.	66.	59.	54.	49.	44.	40.	36.
32.	29.	27.	24.	22.	20.	18.	16.	14.	13.
12.	11.	10.	9.	8.	7.	6.	6.	5.	5.
4.	4.	4.	3.						

HYDROGRAPH AT STATION ELKRUN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
5 AUG 2100	1	0.00	0.00	0.00	3.	3.
5 AUG 2200	2	0.07	0.07	0.00	3.	3.
5 AUG 2300	3	0.00	0.00	0.00	3.	3.
6 AUG 0000	4	0.00	0.00	0.00	3.	3.
6 AUG 0100	5	0.00	0.00	0.00	3.	3.
6 AUG 0200	6	0.00	0.00	0.00	3.	3.
6 AUG 0300	7	0.00	0.00	0.00	2.	3.
6 AUG 0400	8	0.07	0.07	0.00	2.	4.
6 AUG 0500	9	0.15	0.15	0.00	2.	5.
6 AUG 0600	10	0.00	0.00	0.00	2.	41.
6 AUG 0700	11	0.00	0.00	0.00	2.	95.
6 AUG 0800	12	0.15	0.15	0.00	2.	87.
6 AUG 0900	13	0.44	0.40	0.04	13.	74.
6 AUG 1000	14	0.37	0.09	0.28	112.	139.
6 AUG 1100	15	0.22	0.08	0.14	234.	176.
6 AUG 1200	16	0.00	0.00	0.00	256.	236.
6 AUG 1300	17	0.00	0.00	0.00	232.	236.
6 AUG 1400	18	0.00	0.00	0.00	209.	151.
6 AUG 1500	19	0.07	0.07	0.00	190.	108.

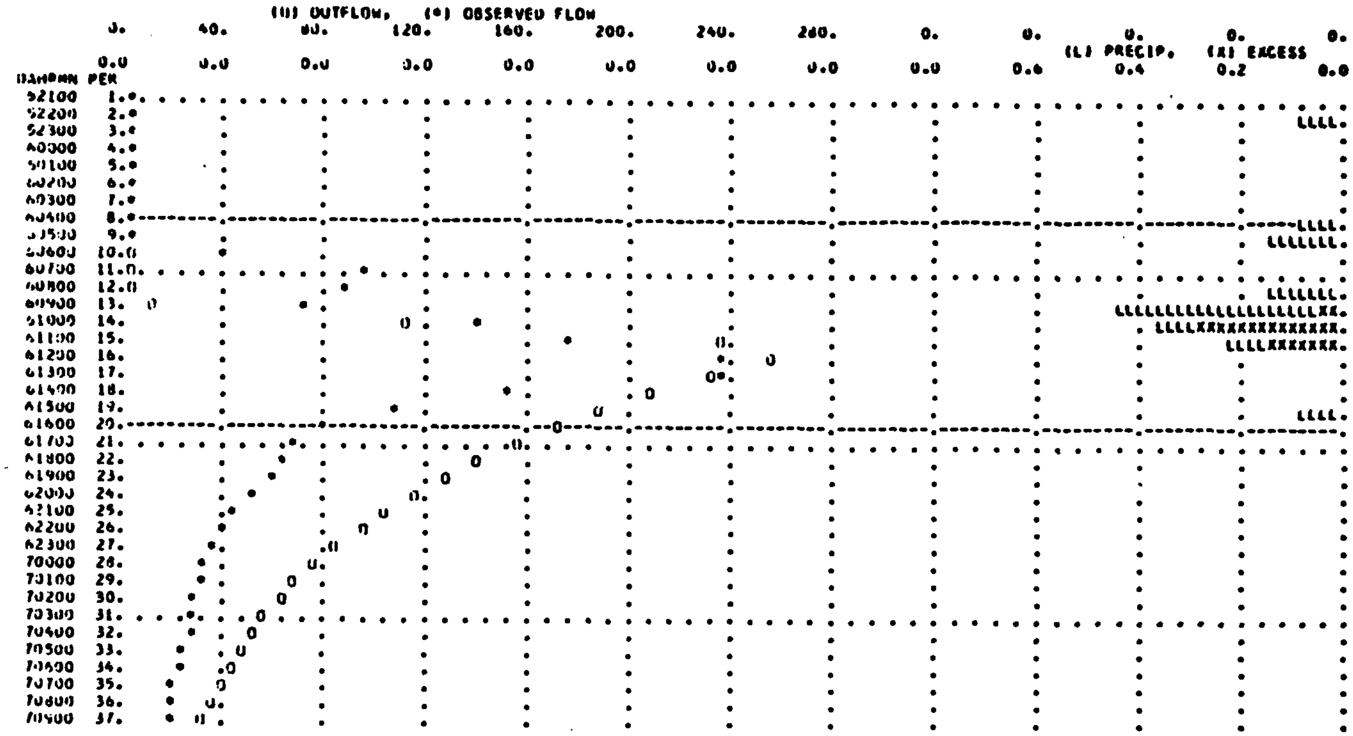
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
6 AUG 1600	20	0.00	0.00	0.00	171.	79.
6 AUG 1700	21	0.00	0.00	0.00	155.	70.
6 AUG 1800	22	0.00	0.00	0.00	140.	66.
6 AUG 1900	23	0.00	0.00	0.00	127.	59.
6 AUG 2000	24	0.00	0.00	0.00	115.	52.
6 AUG 2100	25	0.00	0.00	0.00	104.	45.
6 AUG 2200	26	0.00	0.00	0.00	94.	41.
6 AUG 2300	27	0.00	0.00	0.00	85.	36.
7 AUG 0000	28	0.00	0.00	0.00	77.	33.
7 AUG 0100	29	0.00	0.00	0.00	70.	32.
7 AUG 0200	30	0.00	0.00	0.00	63.	29.
7 AUG 0300	31	0.00	0.00	0.00	57.	28.
7 AUG 0400	32	0.00	0.00	0.00	52.	27.
7 AUG 0500	33	0.00	0.00	0.00	47.	25.
7 AUG 0600	34	0.00	0.00	0.00	43.	24.
7 AUG 0700	35	0.00	0.00	0.00	39.	22.
7 AUG 0800	36	0.00	0.00	0.00	35.	21.
7 AUG 0900	37	0.00	0.00	0.00	33.	20.

TOTAL RAINFALL = 1.54, TOTAL LOSS = 1.08, TOTAL EXCESS = 0.46

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	36.00-HR
256.	15.00	(CFS)	210.	114.	77.	77.
		(INCHES)	0.192	0.415	0.420	0.420
		(AC-FT)	104.	226.	229.	229.

CUMULATIVE AREA = 13.20 SQ MI

STATION ELKRUN



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LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1        ID        FIVE MILE CREEK    5-07-75
  2        ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3        IT      60 06MAY75    0800      70
  4        IO       1       2
  5        OU       1      35
  6        PC    PRAT    1.18
  7        PG     H-A
  8        PI     .10     .10     .20     .30     .30     .10     .10     .10     .00     .00

  9        KK  KANUNA
 10        QO     330     318     305     299     296     312     371     511     716     860
 11        QO     950    1006    1013     992     971     964     957     978     985     992
 12        QO    1006    1006    1027    1037    1020    1020    1027     999     999     985
 13        QO     964     964     957     920     896     884     860     836     806     782
 14        QO     752     728     690     665     640     610     580     547     525     498
 15        QO     471     447     427     395     374     357     334     312     296     262
 16        QO     265     255     242     234     224     216     206     199     195     166
 17        PT    PRAT
 18        PW    1.00
 19        PK     H-A
 20        PW    1.00
 21        BA    66.8      0.
 22        BF    330.    168.  1.0318
 23        UC     -9.    -18.
 24        LU     -1.    -.05
 25        ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 1 THROUGH 35)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.864		5.86			
COMPUTED HYDROGRAPH	28968.	0.672	828.	20.35	14.48	1268.	18.00
OBSERVED HYDROGRAPH	28953.	0.672	827.	20.49	14.62	1037.	23.00
DIFFERENCE	15.	0.000	0.	-0.14	-0.14	231.	-5.00
PERCENT DIFFERENCE	0.05				-0.96	22.27	

STANDARD ERROR	154.	AVERAGE ABSOLUTE ERROR	121.
OBJECTIVE FUNCTION	159.	AVERAGE PERCENT ABSOLUTE ERROR	13.25

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 70)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.864		5.86			
COMPUTED HYDROGRAPH	42848.	0.994	612.	29.71	23.84	1268.	18.00
OBSERVED HYDROGRAPH	45275.	1.050	647.	30.50	24.63	1037.	23.00
DIFFERENCE	-2427.	-0.056	-35.	-0.79	-0.79	231.	-5.00
PERCENT DIFFERENCE	-5.36				-3.22	22.27	

STANDARD ERROR	130.	AVERAGE ABSOLUTE ERROR	98.
OBJECTIVE FUNCTION	147.	AVERAGE PERCENT ABSOLUTE ERROR	12.81

UNIT HYDROGRAPH
143 END-OF-PERIOD ORDINATES

21.	79.	163.	264.	378.	503.	636.	774.	905.	1019.
1115.	1193.	1249.	1282.	1279.	1263.	1195.	1149.	1103.	1062.
1021.	982.	944.	906.	871.	839.	807.	776.	746.	717.
689.	663.	637.	613.	589.	566.	544.	523.	503.	484.
465.	447.	430.	413.	398.	382.	367.	353.	340.	327.
314.	302.	290.	279.	268.	258.	248.	238.	229.	220.
212.	204.	196.	188.	181.	174.	167.	161.	155.	149.
143.	138.	132.	127.	122.	118.	113.	109.	104.	100.
97.	93.	89.	86.	83.	79.	76.	73.	71.	68.
65.	63.	60.	58.	56.	54.	51.	50.	48.	46.
44.	42.	41.	39.	38.	36.	35.	33.	32.	31.
30.	29.	27.	26.	25.	24.	23.	22.	22.	21.
20.	19.	19.	18.	17.	16.	16.	15.	15.	14.
14.	13.	13.	12.	12.	11.	11.	10.	10.	9.
9.	9.	8.							

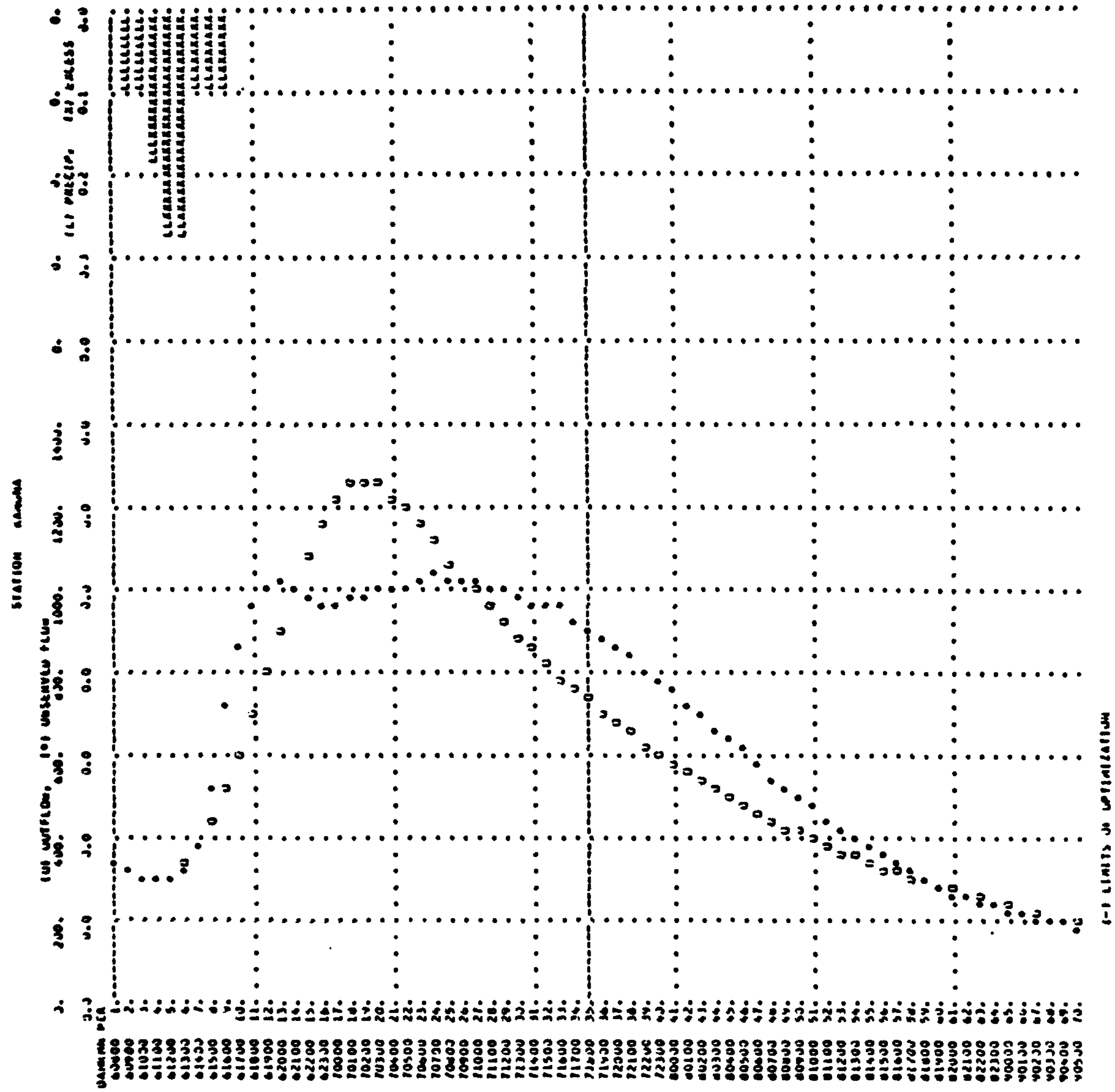
HYDROGRAPH AT STATION KANDRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
6 MAY 0800	1	0.00	0.00	0.00	330.	330.
6 MAY 0900	2	0.09	0.09	0.00	320.	316.
6 MAY 1000	3	0.09	0.09	0.00	313.	305.
6 MAY 1100	4	0.18	0.04	0.15	303.	299.
6 MAY 1200	5	0.27	0.02	0.25	338.	296.
6 MAY 1300	6	0.27	0.02	0.25	331.	312.
6 MAY 1400	7	0.09	0.02	0.07	374.	371.
6 MAY 1500	8	0.09	0.02	0.07	435.	511.
6 MAY 1600	9	0.09	0.02	0.07	511.	716.
6 MAY 1700	10	0.00	0.00	0.00	630.	860.
6 MAY 1800	11	0.00	0.00	0.00	749.	950.
6 MAY 1900	12	0.00	0.00	0.00	833.	1006.
6 MAY 2000	13	0.00	0.00	0.00	907.	1013.
6 MAY 2100	14	0.00	0.00	0.00	1004.	992.
6 MAY 2200	15	0.00	0.00	0.00	1090.	971.
6 MAY 2300	16	0.00	0.00	0.00	1162.	964.
7 MAY 0000	17	0.00	0.00	0.00	1219.	957.
7 MAY 0100	18	0.00	0.00	0.00	1255.	978.
7 MAY 0200	19	0.00	0.00	0.00	1268.	985.
7 MAY 0300	20	0.00	0.00	0.00	1257.	992.
7 MAY 0400	21	0.00	0.00	0.00	1233.	1006.
7 MAY 0500	22	0.00	0.00	0.00	1194.	1038.
7 MAY 0600	23	0.00	0.00	0.00	1153.	1027.
7 MAY 0700	24	0.00	0.00	0.00	1111.	1037.
7 MAY 0800	25	0.00	0.00	0.00	1069.	1020.
7 MAY 0900	26	0.00	0.00	0.00	1029.	1020.
7 MAY 1000	27	0.00	0.00	0.00	991.	1027.
7 MAY 1100	28	0.00	0.00	0.00	954.	995.
7 MAY 1200	29	0.00	0.00	0.00	918.	999.
7 MAY 1300	30	0.00	0.00	0.00	884.	985.
7 MAY 1400	31	0.00	0.00	0.00	851.	964.
7 MAY 1500	32	0.00	0.00	0.00	819.	964.
7 MAY 1600	33	0.00	0.00	0.00	788.	957.
7 MAY 1700	34	0.00	0.00	0.00	759.	920.
7 MAY 1800	35	0.00	0.00	0.00	731.	898.
7 MAY 1900	36	0.00	0.00	0.00	703.	884.
7 MAY 2000	37	0.00	0.00	0.00	677.	860.
7 MAY 2100	38	0.00	0.00	0.00	652.	836.
7 MAY 2200	39	0.00	0.00	0.00	627.	808.
7 MAY 2300	40	0.00	0.00	0.00	604.	782.
8 MAY 0000	41	0.00	0.00	0.00	582.	752.
8 MAY 0100	42	0.00	0.00	0.00	560.	720.
8 MAY 0200	43	0.00	0.00	0.00	539.	690.
8 MAY 0300	44	0.00	0.00	0.00	519.	665.
8 MAY 0400	45	0.00	0.00	0.00	500.	640.
8 MAY 0500	46	0.00	0.00	0.00	481.	610.
8 MAY 0600	47	0.00	0.00	0.00	463.	580.
8 MAY 0700	48	0.00	0.00	0.00	446.	547.
8 MAY 0800	49	0.00	0.00	0.00	429.	525.
8 MAY 0900	50	0.00	0.00	0.00	413.	496.
8 MAY 1000	51	0.00	0.00	0.00	398.	471.
8 MAY 1100	52	0.00	0.00	0.00	383.	447.
8 MAY 1200	53	0.00	0.00	0.00	369.	427.
8 MAY 1300	54	0.00	0.00	0.00	355.	395.
8 MAY 1400	55	0.00	0.00	0.00	342.	374.
8 MAY 1500	56	0.00	0.00	0.00	329.	357.
8 MAY 1600	57	0.00	0.00	0.00	317.	334.
8 MAY 1700	58	0.00	0.00	0.00	305.	312.
8 MAY 1800	59	0.00	0.00	0.00	294.	296.
8 MAY 1900	60	0.00	0.00	0.00	283.	282.
8 MAY 2000	61	0.00	0.00	0.00	272.	265.
8 MAY 2100	62	0.00	0.00	0.00	262.	255.
8 MAY 2200	63	0.00	0.00	0.00	253.	242.
8 MAY 2300	64	0.00	0.00	0.00	243.	236.
9 MAY 0000	65	0.00	0.00	0.00	234.	224.
9 MAY 0100	66	0.00	0.00	0.00	225.	216.
9 MAY 0200	67	0.00	0.00	0.00	217.	206.
9 MAY 0300	68	0.00	0.00	0.00	209.	199.
9 MAY 0400	69	0.00	0.00	0.00	201.	195.
9 MAY 0500	70	0.00	0.00	0.00	194.	188.

TOTAL RAINFALL = 1.18, TOTAL LOSS = 0.32, TOTAL EXCESS = 0.86

PEAK FLOW (CFS)	TIME (HR)		6-HR	24-HR	72-HR	69.00-HR
			MAXIMUM AVERAGE FLOW			
1268.	19.00	(CFS)	1234.	1016.	617.	617.
		(INCHES)	0.172	0.567	0.988	0.988
		(AC-FT)	612.	2019.	3520.	3520.

CUMULATIVE AREA = 66.83 SQ MI


STATION
(L) PRECIP.
(X) EXCESS
(-) LIMITS OF OPTIMIZATION

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                                         HEC-1 INPUT                                                   PAGE  1

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10

  1         ID        FIVE MILE CREEK     9-26-75
  2         ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3         IT      60 24SEP75    2400     110
  4         IO       1       2
  5         OU       5      50
  6         PG    PRAT    4.59
  7         PG      TH
  8         PI     .05     .04     .05     .05     .06     .17     .18     .15     .15     .05
  9         PI     .25     .16     .03     .01     .05     .10     .12     .06     .07     .20
 10         PI     .20     .15     .10     .31     .22     .17     .10     .11     .06     .04
 11         PI     .09     .07     .02     .01     .00     .00     .00     .00     .00     .00

 12         KK  KANUNA
 13         QO      31      32      32      34      36      38      41      47      60      97
 14         QO     177     337     443     547     675     770     842     878     902     950
 15         QO    1034    1125    1304    1620    2037    2222    2800    3350    4386    3966
 16         QO    3548    3024    2885    2766    2698    2630    2647    2630    2664    2681
 17         QO    2664    2664    2681    2698    2681    2664    2664    2614    2598    2550
 18         QO    2502    2425    2395    2350    2282    2222    2180    2121    2090    2038
 19         QO    1966    1918    1834    1788    1711    1680    1610    1570    1540    1473
 20         QO    1428    1401    1356    1312    1280    1232    1200    1153    1111    1076
 21         QO    1055     999     957     926     890     860     818     788     746     705
 22         QO     675     645     625     583     565     538     507     484     455     431
 23         QO     403     381     367     347     330     318     308     299     296     285
 24         PT    PRAT
 25         PW    1.00
 26         PR      TH
 27         PW    1.00
 28         BA    66.8      0.
 29         BF     31.    300.  1.0318
 30         UC     -8.    -18.
 31         LU     -1.    -.05
 32         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 50)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.125		21.26			
COMPUTED HYDROGRAPH	85934.	1.993	1868.	33.55	12.30	3352.	30.00
OBSERVED HYDROGRAPH	85335.	1.980	1855.	34.55	13.29	4386.	28.00
DIFFERENCE	599.	0.014	13.	-0.99	-0.99	-1034.	2.00
PERCENT DIFFERENCE	0.70				-7.48	-23.57	

STANDARD ERROR	382.	AVERAGE ABSOLUTE ERROR	302.
OBJECTIVE FUNCTION	430.	AVERAGE PERCENT ABSOLUTE ERROR	21.23

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 110)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.125		21.26			
COMPUTED HYDROGRAPH	130519.	3.028	1187.	46.01	24.76	3352.	30.00
OBSERVED HYDROGRAPH	155294.	3.602	1412.	50.72	29.46	4386.	28.00
DIFFERENCE	-24775.	-0.575	-225.	-4.71	-4.71	-1034.	2.00
PERCENT DIFFERENCE	-15.95				-15.98	-23.57	

STANDARD ERROR	433.	AVERAGE ABSOLUTE ERROR	357.
OBJECTIVE FUNCTION	491.	AVERAGE PERCENT ABSOLUTE ERROR	29.52

UNIT HYDROGRAPH
144 END-OF-PERIOD ORDINATES

127.	481.	898.	1326.	1458.	1422.	1370.	1323.	1271.	1225.
1180.	1137.	1095.	1055.	1016.	979.	943.	908.	875.	843.
812.	782.	753.	726.	699.	674.	649.	625.	602.	580.
559.	538.	518.	499.	481.	463.	446.	430.	414.	399.
384.	370.	357.	344.	331.	319.	307.	296.	285.	275.
265.	255.	246.	237.	228.	219.	211.	204.	196.	189.
182.	175.	169.	163.	157.	151.	146.	140.	135.	130.
125.	121.	116.	112.	108.	104.	100.	96.	93.	90.
86.	83.	80.	77.	74.	72.	69.	66.	64.	62.
59.	57.	55.	53.	51.	49.	47.	46.	44.	42.
41.	39.	38.	37.	35.	34.	33.	31.	30.	29.
28.	27.	26.	25.	24.	23.	22.	22.	21.	20.
19.	19.	18.	17.	17.	16.	15.	15.	14.	14.
13.	13.	12.	12.	11.	11.	11.	10.	10.	10.
9.	9.	8.	8.						

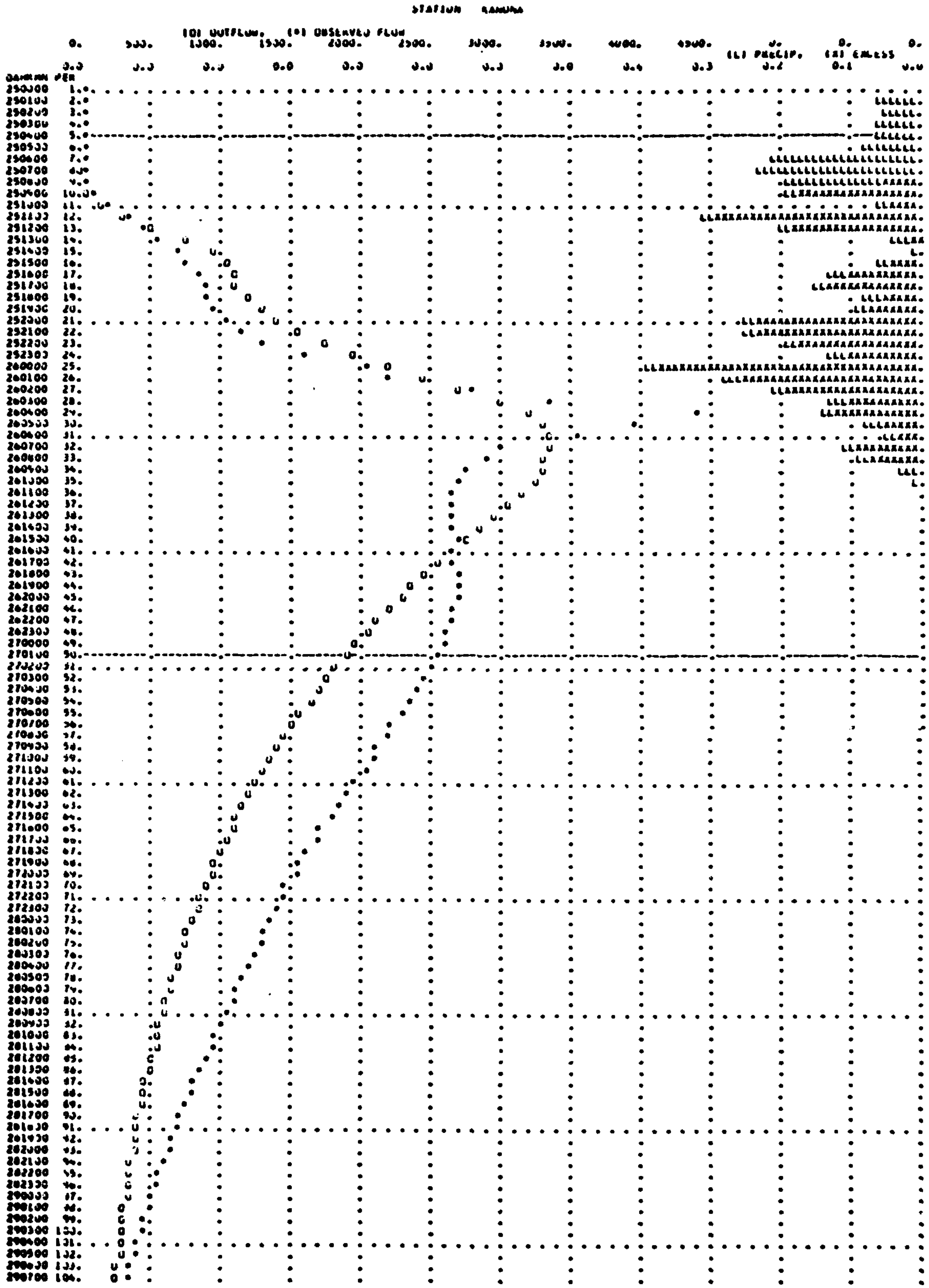
HYDROGRAPH AT STATION KANONA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
25 SEP 0000	1	0.00	0.00	0.00	31.	31.
25 SEP 0100	2	0.06	0.06	0.00	30.	32.
25 SEP 0200	3	0.05	0.05	0.00	29.	32.
25 SEP 0300	4	0.06	0.06	0.00	28.	34.
25 SEP 0400	5	0.06	0.06	0.00	27.	36.
25 SEP 0500	6	0.08	0.08	0.00	27.	38.
25 SEP 0600	7	0.21	0.21	0.00	26.	41.
25 SEP 0700	8	0.23	0.23	0.00	25.	47.
25 SEP 0800	9	0.19	0.14	0.05	30.	60.
25 SEP 0900	10	0.19	0.02	0.17	88.	97.
25 SEP 1000	11	0.36	0.02	0.34	155.	177.
25 SEP 1100	12	0.31	0.02	0.29	301.	337.
25 SEP 1200	13	0.20	0.02	0.18	515.	443.
25 SEP 1300	14	0.34	0.02	0.31	750.	547.
25 SEP 1400	15	0.31	0.01	0.30	965.	675.
25 SEP 1500	16	0.06	0.02	0.04	1050.	770.
25 SEP 1600	17	0.11	0.02	0.10	1083.	842.
25 SEP 1700	18	0.15	0.02	0.13	1122.	878.
25 SEP 1800	19	0.08	0.02	0.05	1200.	902.
25 SEP 1900	20	0.09	0.02	0.07	1295.	950.
25 SEP 2000	21	0.25	0.02	0.23	1398.	1034.
25 SEP 2100	22	0.25	0.02	0.23	1538.	1125.
25 SEP 2200	23	0.19	0.02	0.17	1732.	1304.
25 SEP 2300	24	0.13	0.02	0.10	1959.	1620.
26 SEP 0000	25	0.39	0.02	0.37	2188.	2037.
26 SEP 0100	26	0.28	0.02	0.25	2436.	2222.
26 SEP 0200	27	0.21	0.02	0.19	2716.	2803.
26 SEP 0300	28	0.13	0.02	0.10	2994.	3350.
26 SEP 0400	29	0.14	0.02	0.12	3202.	4388.
26 SEP 0500	30	0.08	0.02	0.05	3314.	3988.
26 SEP 0600	31	0.05	0.02	0.03	3352.	3548.
26 SEP 0700	32	0.11	0.02	0.09	3346.	3024.
26 SEP 0800	33	0.09	0.02	0.07	3322.	2883.
26 SEP 0900	34	0.03	0.02	0.00	3290.	2768.
26 SEP 1000	35	0.01	0.01	0.00	3245.	2698.
26 SEP 1100	36	0.00	0.00	0.00	3172.	2633.
26 SEP 1200	37	0.00	0.00	0.00	3070.	2647.
26 SEP 1300	38	0.00	0.00	0.00	2959.	2630.
26 SEP 1400	39	0.00	0.00	0.00	2850.	2664.
26 SEP 1500	40	0.00	0.00	0.00	2748.	2681.
26 SEP 1600	41	0.00	0.00	0.00	2645.	2664.
26 SEP 1700	42	0.00	0.00	0.00	2548.	2664.
26 SEP 1800	43	0.00	0.00	0.00	2455.	2681.
26 SEP 1900	44	0.00	0.00	0.00	2365.	2698.
26 SEP 2000	45	0.00	0.00	0.00	2278.	2681.
26 SEP 2100	46	0.00	0.00	0.00	2194.	2664.
26 SEP 2200	47	0.00	0.00	0.00	2114.	2664.
26 SEP 2300	48	0.00	0.00	0.00	2036.	2614.
27 SEP 0000	49	0.00	0.00	0.00	1962.	2593.
27 SEP 0100	50	0.00	0.00	0.00	1890.	2550.
27 SEP 0200	51	0.00	0.00	0.00	1821.	2502.
27 SEP 0300	52	0.00	0.00	0.00	1754.	2425.
27 SEP 0400	53	0.00	0.00	0.00	1690.	2395.
27 SEP 0500	54	0.00	0.00	0.00	1628.	2350.
27 SEP 0600	55	0.00	0.00	0.00	1568.	2282.
27 SEP 0700	56	0.00	0.00	0.00	1510.	2222.
27 SEP 0800	57	0.00	0.00	0.00	1455.	2180.
27 SEP 0900	58	0.00	0.00	0.00	1402.	2121.
27 SEP 1000	59	0.00	0.00	0.00	1350.	2090.
27 SEP 1100	60	0.00	0.00	0.00	1301.	2038.
27 SEP 1200	61	0.00	0.00	0.00	1253.	1988.
27 SEP 1300	62	0.00	0.00	0.00	1207.	1918.
27 SEP 1400	63	0.00	0.00	0.00	1163.	1834.
27 SEP 1500	64	0.00	0.00	0.00	1120.	1788.
27 SEP 1600	65	0.00	0.00	0.00	1079.	1711.
27 SEP 1700	66	0.00	0.00	0.00	1040.	1680.
27 SEP 1800	67	0.00	0.00	0.00	1002.	1610.
27 SEP 1900	68	0.00	0.00	0.00	965.	1570.
27 SEP 2000	69	0.00	0.00	0.00	929.	1540.
27 SEP 2100	70	0.00	0.00	0.00	895.	1473.
27 SEP 2200	71	0.00	0.00	0.00	863.	1426.
27 SEP 2300	72	0.00	0.00	0.00	831.	1401.
28 SEP 0000	73	0.00	0.00	0.00	800.	1356.
28 SEP 0100	74	0.00	0.00	0.00	771.	1312.
28 SEP 0200	75	0.00	0.00	0.00	743.	1280.
28 SEP 0300	76	0.00	0.00	0.00	716.	1232.
28 SEP 0400	77	0.00	0.00	0.00	689.	1200.
28 SEP 0500	78	0.00	0.00	0.00	664.	1153.
28 SEP 0600	79	0.00	0.00	0.00	640.	1111.
28 SEP 0700	80	0.00	0.00	0.00	616.	1076.
28 SEP 0800	81	0.00	0.00	0.00	594.	1055.
28 SEP 0900	82	0.00	0.00	0.00	572.	999.
28 SEP 1000	83	0.00	0.00	0.00	551.	957.
28 SEP 1100	84	0.00	0.00	0.00	531.	926.
28 SEP 1200	85	0.00	0.00	0.00	511.	890.
28 SEP 1300	86	0.00	0.00	0.00	493.	868.
28 SEP 1400	87	0.00	0.00	0.00	475.	818.
28 SEP 1500	88	0.00	0.00	0.00	457.	788.
28 SEP 1600	89	0.00	0.00	0.00	440.	748.
28 SEP 1700	90	0.00	0.00	0.00	424.	705.
28 SEP 1800	91	0.00	0.00	0.00	409.	675.
28 SEP 1900	92	0.00	0.00	0.00	394.	645.
28 SEP 2000	93	0.00	0.00	0.00	379.	625.
28 SEP 2100	94	0.00	0.00	0.00	365.	583.
28 SEP 2200	95	0.00	0.00	0.00	352.	565.
28 SEP 2300	96	0.00	0.00	0.00	339.	538.
29 SEP 0000	97	0.00	0.00	0.00	327.	507.
29 SEP 0100	98	0.00	0.00	0.00	315.	484.
29 SEP 0200	99	0.00	0.00	0.00	303.	455.
29 SEP 0300	100	0.00	0.00	0.00	293.	431.
29 SEP 0400	101	0.00	0.00	0.00	284.	403.
29 SEP 0500	102	0.00	0.00	0.00	276.	381.
29 SEP 0600	103	0.00	0.00	0.00	267.	367.
29 SEP 0700	104	0.00	0.00	0.00	259.	347.
29 SEP 0800	105	0.00	0.00	0.00	251.	330.
29 SEP 0900	106	0.00	0.00	0.00	243.	316.
29 SEP 1000	107	0.00	0.00	0.00	236.	308.
29 SEP 1100	108	0.00	0.00	0.00	228.	299.
29 SEP 1200	109	0.00	0.00	0.00	221.	290.
29 SEP 1300	110	0.00	0.00	0.00	215.	285.

TOTAL RAINFALL = 4.59, TOTAL LOSS = 1.47, TOTAL EXCESS = 3.12

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	109.00-HR
3352.	31.00	(CFS)	3308.	2783.	1683.	1198.
		(INCHES)	0.463	1.559	2.837	3.025
		(AC-FT)	1640.	5520.	9999.	10777.

CUMULATIVE AREA = 66.40 SQ MI


(O) OUTFLOW, (*) OBSERVED FLOW
0. 500. 1000. 1500. 2000. 2500. 3000. 3500. 4000. 4500.
(L) PRECIP, (X) EXCESS
DAHRMN PER

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                                         HEC-1 INPUT                                                         PAGE  1

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1            ID        FIVE MILE CREEK     9-14-77
  2            ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3            IT      60 13SEP77    1500      50
  4            IO       1       2
  5            OO       6      32
  6            PG    BATH    2.39
  7            PG    PRAT    1.85
  8            PG      TH
  9            PI     .03     .01     .04     .07     .05     .03     .22     .35     .54     .16
 10            PI     .14     .05     .09     .05     .00     .00     .00     .00     .00     .00

 11            KK  KANUNA
 12            QO      11      11      11      11      11      11      11      12      23      35
 13            QO      94     166     357     388     371     371     427     480     515     534
 14            QO     520     497     484     471     463     443     423     403     381     353
 15            QO     327     299     271     245     216     192     172     156     143     132
 16            QO     123     117     109     103      99      94      91      87      86      86
 17            PT    PRAT    BATH
 18            PW     .87     .13
 19            PR      TH
 20            PW    1.00
 21            BA    66.8      0.
 22            BF     11.    110.  1.0318
 23            UC    -10.    -18.
 24            LU     -1.     -1.
 25            ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 6 THROUGH 32)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.347		10.37			
COMPUTED HYDROGRAPH	8853.	0.205	328.	22.06	11.69	579.	18.00
OBSERVED HYDROGRAPH	8859.	0.206	328.	21.81	11.44	534.	19.00
DIFFERENCE	-6.	-0.000	-0.	0.25	0.25	45.	-1.00
PERCENT DIFFERENCE	-0.07				2.19	8.46	

STANDARD ERROR	52.	AVERAGE ABSOLUTE ERROR	34.
OBJECTIVE FUNCTION	54.	AVERAGE PERCENT ABSOLUTE ERROR	15.60

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 50)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.347		10.37			
COMPUTED HYDROGRAPH	12649.	0.293	253.	27.35	16.98	579.	18.00
OBSERVED HYDROGRAPH	11436.	0.265	229.	25.64	15.27	534.	19.00
DIFFERENCE	1213.	0.028	24.	1.72	1.71	45.	-1.00
PERCENT DIFFERENCE	10.61				11.23	8.46	

STANDARD ERROR	56.	AVERAGE ABSOLUTE ERROR	43.
OBJECTIVE FUNCTION	60.	AVERAGE PERCENT ABSOLUTE ERROR	31.56

UNIT HYDROGRAPH
113 END-OF-PERIOD ORDINATES

49.	186.	380.	614.	876.	1137.	1361.	1533.	1644.	1669.
1614.	1537.	1463.	1393.	1326.	1263.	1202.	1144.	1090.	1037.
988.	940.	895.	852.	811.	772.	735.	700.	667.	635.
604.	575.	548.	521.	496.	472.	450.	428.	408.	388.
370.	352.	335.	319.	304.	289.	275.	262.	249.	237.
226.	215.	205.	195.	186.	177.	168.	160.	153.	145.
138.	132.	125.	119.	114.	108.	103.	98.	93.	89.
85.	81.	77.	73.	69.	66.	63.	60.	57.	54.
52.	49.	47.	45.	43.	40.	39.	37.	35.	33.
32.	30.	29.	27.	26.	25.	24.	22.	21.	20.
19.	18.	17.	17.	16.	15.	14.	14.	13.	12.
12.	11.	11.							

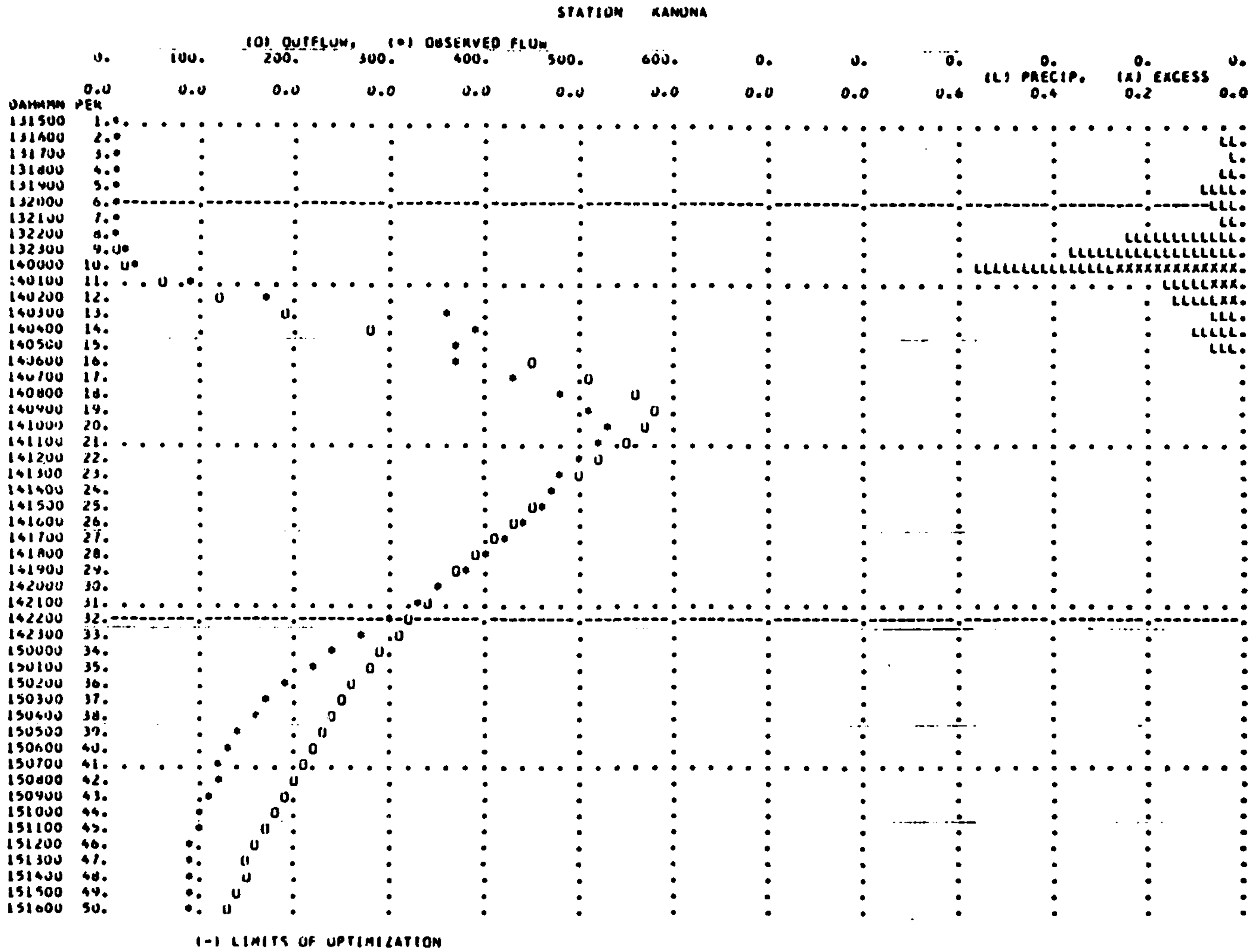
HYDROGRAPH AT STATION KANUNA

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
13	SEP	1500	1	0.00	0.00	0.00	11.	11.	14	SEP	1600	26	0.00	0.00	0.00	430.	443.
13	SEP	1600	2	0.03	0.03	0.00	11.	11.	14	SEP	1700	27	0.00	0.00	0.00	409.	423.
13	SEP	1700	3	0.01	0.01	0.00	10.	11.	14	SEP	1800	28	0.00	0.00	0.00	390.	403.
13	SEP	1800	4	0.04	0.04	0.00	10.	11.	14	SEP	1900	29	0.00	0.00	0.00	371.	381.
13	SEP	1900	5	0.07	0.07	0.00	10.	11.	14	SEP	2000	30	0.00	0.00	0.00	354.	353.
13	SEP	2000	6	0.05	0.05	0.00	9.	11.	14	SEP	2100	31	0.00	0.00	0.00	337.	327.
13	SEP	2100	7	0.03	0.03	0.00	9.	11.	14	SEP	2200	32	0.00	0.00	0.00	321.	299.
13	SEP	2200	8	0.23	0.23	0.00	9.	12.	14	SEP	2300	33	0.00	0.00	0.00	305.	271.
13	SEP	2300	9	0.37	0.37	0.00	9.	23.	15	SEP	0000	34	0.00	0.00	0.00	291.	245.
14	SEP	0000	10	0.57	0.31	0.26	21.	35.	15	SEP	0100	35	0.00	0.00	0.00	277.	216.
14	SEP	0100	11	0.17	0.11	0.06	58.	94.	15	SEP	0200	36	0.00	0.00	0.00	264.	192.
14	SEP	0200	12	0.15	0.11	0.04	117.	166.	15	SEP	0300	37	0.00	0.00	0.00	251.	172.
14	SEP	0300	13	0.05	0.05	0.00	192.	357.	15	SEP	0400	38	0.00	0.00	0.00	239.	156.
14	SEP	0400	14	0.09	0.09	0.00	279.	388.	15	SEP	0500	39	0.00	0.00	0.00	228.	143.
14	SEP	0500	15	0.05	0.05	0.00	368.	371.	15	SEP	0600	40	0.00	0.00	0.00	217.	132.
14	SEP	0600	16	0.00	0.00	0.00	449.	371.	15	SEP	0700	41	0.00	0.00	0.00	206.	123.
14	SEP	0700	17	0.00	0.00	0.00	515.	427.	15	SEP	0800	42	0.00	0.00	0.00	197.	117.
14	SEP	0800	18	0.00	0.00	0.00	561.	480.	15	SEP	0900	43	0.00	0.00	0.00	187.	109.
14	SEP	0900	19	0.00	0.00	0.00	579.	515.	15	SEP	1000	44	0.00	0.00	0.00	178.	103.
14	SEP	1000	20	0.00	0.00	0.00	570.	534.	15	SEP	1100	45	0.00	0.00	0.00	170.	99.
14	SEP	1100	21	0.00	0.00	0.00	548.	520.	15	SEP	1200	46	0.00	0.00	0.00	162.	94.
14	SEP	1200	22	0.00	0.00	0.00	523.	497.	15	SEP	1300	47	0.00	0.00	0.00	154.	91.
14	SEP	1300	23	0.00	0.00	0.00	498.	484.	15	SEP	1400	48	0.00	0.00	0.00	147.	87.
14	SEP	1400	24	0.00	0.00	0.00	474.	471.	15	SEP	1500	49	0.00	0.00	0.00	140.	86.
14	SEP	1500	25	0.00	0.00	0.00	452.	463.	15	SEP	1600	50	0.00	0.00	0.00	133.	86.

TOTAL RAINFALL = 1.92, TOTAL LOSS = 1.57, TOTAL EXCESS = 0.35

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	49.00-HR
579.	18.00	(CFS)	548.	408.	257.	257.
		(INCHES)	0.076	0.227	0.292	0.292
		(AC-FT)	272.	810.	1039.	1039.

CUMULATIVE AREA = 66.80 SQ MI


STATION KANONA
(O) OUTFLOW, (*) OBSERVED FLOW
0. 100. 200. 300. 400. 500. 600.
(L) PRECIP., (X) EXCESS
0.6 0.4 0.2 0.0
DAHMMN PER
(-) LIMITS OF OPTIMIZATION

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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID        FIVE MILE CREEK     9-25-77
  2         ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3         IT      60 24SEP77    1000      80
  4         IO       1       2
  5         OU       5      40
  6         PG    BATH    1.97
  7         PG    PRAT    2.14
  8         PG     HOR
  9         PI     .00     .00     .00     .00     .10     .20     .10     .30     .20     .00
 10         PI     .20     .10     .10     .10     .10     .20     .00     .00     .00     .00
 11         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 12         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 13         PI     .00     .10     .00     .00     .00     .00     .20     .10     .00     .00
 14         PI     .00     .00     .10     .00     .00     .00     .00     .00     .00     .00

 15         KK  KANONA
 16         QO     106     106     105     103     103     103     111     125     174     258
 17         QO     407     563     740     854     971    1176    1329    1491    1680    1777
 18         QO    1777    1690    1580    1530    1482    1473    1491    1491    1491    1491
 19         QO    1491    1482    1473    1464    1455    1437    1419    1392    1383    1347
 20         QO    1320    1296    1264    1240    1200    1184    1146    1111    1090    1055
 21         QO    1027     992     957     920     890     854     816     782     752     734
 22         QO     700     675     645     620     592     565     547     520     498     471
 23         QO     451     431     411     391     374     367     353     344     337     327
 24         PT    PRAT    BATH
 25         PW     .87     .13
 26         PR     HOR
 27         PW    1.00
 28         BA    66.8      0.
 29         BF    108.    200.  1.0318
 30         UC     -9.    -18.
 31         LU     -1.    -.05
 32         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 5 THROUGH 40)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.002		19.69			
COMPUTED HYDROGRAPH	41484.	0.962	1152.	25.83	6.15	1827.	23.00
OBSERVED HYDROGRAPH	41721.	0.968	1159.	26.15	6.47	1777.	19.00
DIFFERENCE	-237.	-0.005	-7.	-0.32	-0.32	50.	4.00
PERCENT DIFFERENCE	-0.57				-4.98	2.82	

STANDARD ERROR	154.	AVERAGE ABSOLUTE ERROR	114.
OBJECTIVE FUNCTION	163.	AVERAGE PERCENT ABSOLUTE ERROR	9.09

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 80)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.002		19.69			
COMPUTED HYDROGRAPH	76175.	1.767	952.	40.56	20.87	1827.	23.00
OBSERVED HYDROGRAPH	72394.	1.679	905.	38.37	18.68	1777.	19.00
DIFFERENCE	3781.	0.088	47.	2.19	2.19	50.	4.00
PERCENT DIFFERENCE	5.22				11.71	2.82	

STANDARD ERROR	207.	AVERAGE ABSOLUTE ERROR	172.
OBJECTIVE FUNCTION	212.	AVERAGE PERCENT ABSOLUTE ERROR	24.98

UNIT HYDROGRAPH
148 END-OF-PERIOD ORDINATES

31.	117.	243.	394.	564.	748.	924.	1073.	1192.	1275.
1311.	1291.	1244.	1198.	1154.	1112.	1071.	1032.	994.	958.
923.	889.	856.	825.	795.	766.	737.	710.	684.	659.
635.	612.	590.	568.	547.	527.	508.	489.	471.	454.
437.	421.	406.	391.	377.	363.	350.	337.	324.	313.
301.	290.	279.	269.	259.	250.	241.	232.	223.	215.
207.	200.	192.	185.	179.	172.	166.	160.	154.	148.
143.	137.	132.	128.	123.	118.	114.	110.	106.	102.
98.	95.	91.	88.	85.	82.	79.	76.	73.	70.
68.	65.	63.	60.	58.	56.	54.	52.	50.	48.
47.	45.	43.	42.	40.	39.	37.	36.	35.	33.
32.	31.	30.	29.	28.	27.	26.	25.	24.	23.
22.	21.	20.	20.	19.	18.	18.	17.	16.	16.
15.	15.	14.	14.	13.	13.	12.	12.	11.	11.
10.	10.	10.	9.	9.	9.	8.	8.		

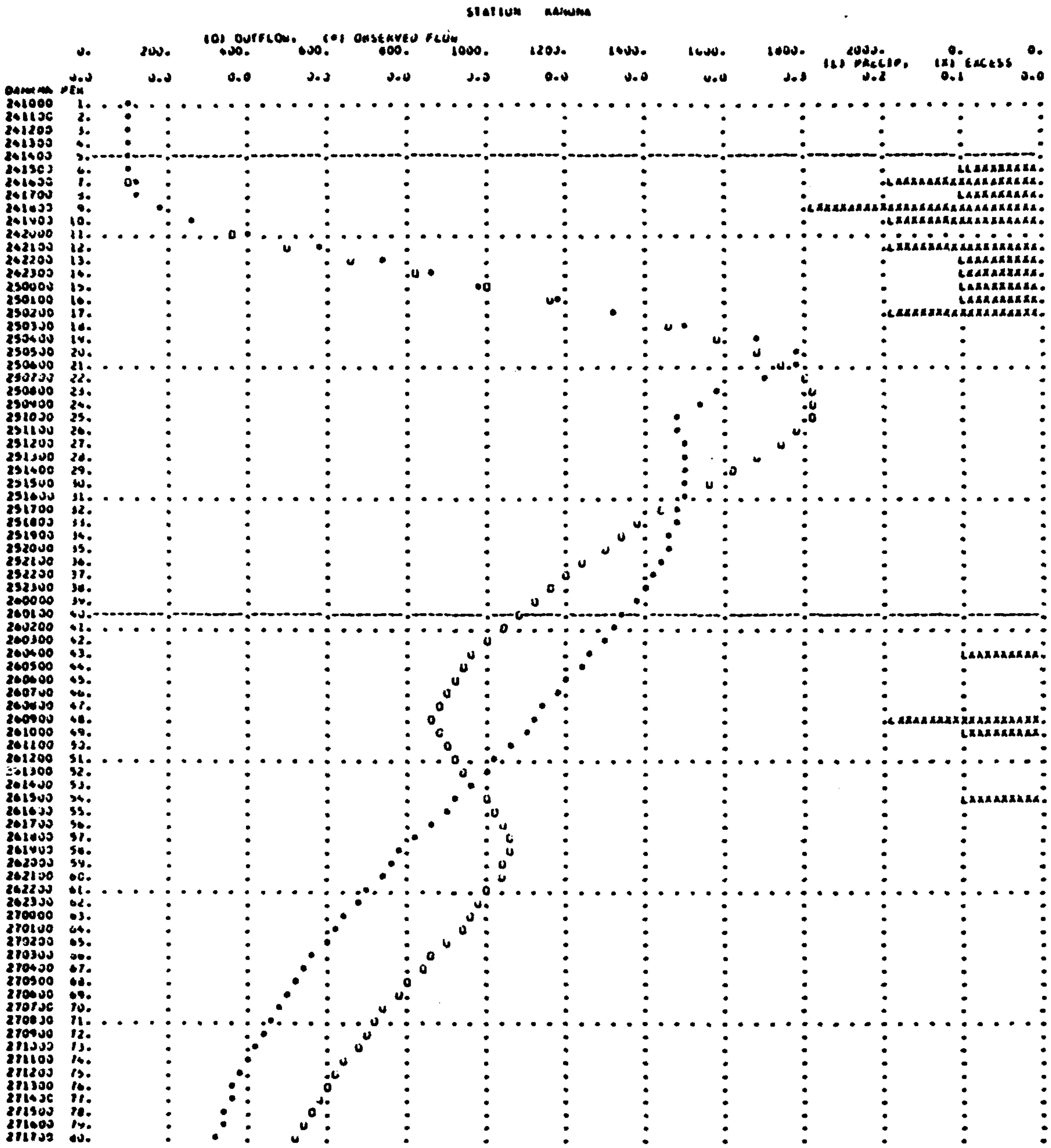
HYDROGRAPH AT STATION KANDRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24 SEP 1000	1	0.00	0.00	0.00	108.	106.
24 SEP 1100	2	0.00	0.00	0.00	105.	106.
24 SEP 1200	3	0.00	0.00	0.00	101.	105.
24 SEP 1300	4	0.00	0.00	0.00	98.	103.
24 SEP 1400	5	0.00	0.00	0.00	95.	103.
24 SEP 1500	6	0.10	0.02	0.08	95.	103.
24 SEP 1600	7	0.19	0.01	0.19	104.	111.
24 SEP 1700	8	0.10	0.01	0.09	130.	125.
24 SEP 1800	9	0.29	0.01	0.28	178.	179.
24 SEP 1900	10	0.19	0.01	0.19	258.	258.
24 SEP 2000	11	0.00	0.00	0.00	366.	407.
24 SEP 2100	12	0.19	0.01	0.19	498.	583.
24 SEP 2200	13	0.10	0.01	0.09	651.	743.
24 SEP 2300	14	0.10	0.01	0.09	818.	854.
25 SEP 0000	15	0.10	0.01	0.09	991.	971.
25 SEP 0100	16	0.10	0.01	0.09	1160.	1176.
25 SEP 0200	17	0.19	0.01	0.19	1319.	1329.
25 SEP 0300	18	0.00	0.00	0.00	1464.	1491.
25 SEP 0400	19	0.00	0.00	0.00	1585.	1680.
25 SEP 0500	20	0.00	0.00	0.00	1679.	1777.
25 SEP 0600	21	0.00	0.00	0.00	1748.	1777.
25 SEP 0700	22	0.00	0.00	0.00	1798.	1690.
25 SEP 0800	23	0.00	0.00	0.00	1824.	1580.
25 SEP 0900	24	0.00	0.00	0.00	1827.	1530.
25 SEP 1000	25	0.00	0.00	0.00	1811.	1482.
25 SEP 1100	26	0.00	0.00	0.00	1778.	1473.
25 SEP 1200	27	0.00	0.00	0.00	1731.	1491.
25 SEP 1300	28	0.00	0.00	0.00	1673.	1491.
25 SEP 1400	29	0.00	0.00	0.00	1612.	1491.
25 SEP 1500	30	0.00	0.00	0.00	1554.	1491.
25 SEP 1600	31	0.00	0.00	0.00	1497.	1491.
25 SEP 1700	32	0.00	0.00	0.00	1442.	1482.
25 SEP 1800	33	0.00	0.00	0.00	1390.	1473.
25 SEP 1900	34	0.00	0.00	0.00	1339.	1464.
25 SEP 2000	35	0.00	0.00	0.00	1290.	1455.
25 SEP 2100	36	0.00	0.00	0.00	1243.	1437.
25 SEP 2200	37	0.00	0.00	0.00	1198.	1419.
25 SEP 2300	38	0.00	0.00	0.00	1154.	1392.
26 SEP 0000	39	0.00	0.00	0.00	1112.	1363.
26 SEP 0100	40	0.00	0.00	0.00	1071.	1347.
26 SEP 0200	41	0.00	0.00	0.00	1032.	1320.
26 SEP 0300	42	0.00	0.00	0.00	995.	1298.
26 SEP 0400	43	0.10	0.01	0.09	961.	1264.
26 SEP 0500	44	0.00	0.00	0.00	934.	1240.
26 SEP 0600	45	0.00	0.00	0.00	912.	1200.
26 SEP 0700	46	0.00	0.00	0.00	893.	1184.
26 SEP 0800	47	0.00	0.00	0.00	877.	1146.
26 SEP 0900	48	0.19	0.01	0.19	869.	1111.
26 SEP 1000	49	0.10	0.01	0.09	874.	1090.
26 SEP 1100	50	0.00	0.00	0.00	891.	1055.
26 SEP 1200	51	0.00	0.00	0.00	914.	1027.
26 SEP 1300	52	0.00	0.00	0.00	940.	992.
26 SEP 1400	53	0.00	0.00	0.00	968.	957.
26 SEP 1500	54	0.10	0.01	0.09	994.	920.
26 SEP 1600	55	0.00	0.00	0.00	1017.	890.
26 SEP 1700	56	0.00	0.00	0.00	1036.	854.
26 SEP 1800	57	0.00	0.00	0.00	1052.	818.
26 SEP 1900	58	0.00	0.00	0.00	1057.	782.
26 SEP 2000	59	0.00	0.00	0.00	1049.	752.
26 SEP 2100	60	0.00	0.00	0.00	1031.	734.
26 SEP 2200	61	0.00	0.00	0.00	1010.	700.
26 SEP 2300	62	0.00	0.00	0.00	987.	675.
27 SEP 0000	63	0.00	0.00	0.00	962.	645.
27 SEP 0100	64	0.00	0.00	0.00	935.	620.
27 SEP 0200	65	0.00	0.00	0.00	903.	592.
27 SEP 0300	66	0.00	0.00	0.00	870.	565.
27 SEP 0400	67	0.00	0.00	0.00	838.	547.
27 SEP 0500	68	0.00	0.00	0.00	808.	523.
27 SEP 0600	69	0.00	0.00	0.00	778.	498.
27 SEP 0700	70	0.00	0.00	0.00	750.	471.
27 SEP 0800	71	0.00	0.00	0.00	722.	451.
27 SEP 0900	72	0.00	0.00	0.00	696.	431.
27 SEP 1000	73	0.00	0.00	0.00	670.	411.
27 SEP 1100	74	0.00	0.00	0.00	646.	391.
27 SEP 1200	75	0.00	0.00	0.00	622.	374.
27 SEP 1300	76	0.00	0.00	0.00	600.	367.
27 SEP 1400	77	0.00	0.00	0.00	578.	355.
27 SEP 1500	78	0.00	0.00	0.00	557.	344.
27 SEP 1600	79	0.00	0.00	0.00	536.	337.
27 SEP 1700	80	0.00	0.00	0.00	517.	327.

TOTAL RAINFALL = 2.12, TOTAL LOSS = 0.12, TOTAL EXCESS = 2.00

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	79.00-HR
1827.	23.00	(CFS)	1798.	1508.	1044.	960.
		(INCHES)	0.250	0.839	1.743	1.760
		(AC-FT)	891.	2990.	6210.	6270.

CUMULATIVE AREA = 66.80 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 200. 400. 600. 800. 1000. 1200. 1400. 1600. 1800. 2000.
(L) PRECIP, (X) EXCESS

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                                         HEC-1 INPUT                                              PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID      NEWTOWN CREEK 09-26-75
   2          ID      UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
   3          IT      60 24SEP75    1800     114
   4          IO       1       2
   5          OU       5      58
   6          PG      EL    4.75
   7          PG      SP    4.65
   8          PG      AF
   9          PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .03
  10          PI     .02     .10     .15     .00     .19     .11     .10     .20     .09     .06
  11          PI     .03     .16     .07     .19     .10     .14     .04     .07     .09     .10
  12          PI     .21     .35     .40     .15     .30     .15     .20     .15     .01     .17
  13          PI     .02     .00     .00     .00     .00     .00     .00     .00     .00     .00

  14          KK  ELMIRA
  15          QO     256     250     242     232     224     216     206     206     202     206
  16          QO     216     224     238     281     367     466     637     951    1173    1290
  17          QO    1383    1422    1434    1437    1434    1413    1422    1473    1530    1578
  18          QO    1635    1722    1797    1833    1857    1905    1965    2160    2498    2939
  19          QO    3224    3525    3725    3860    3932    3938    3896    3842    3775    3700
  20          QO    3640    3560    3430    3255    3062    2838    2614    2391    2174    1971
  21          QO    1785    1611    1455    1320    1200    1095    1002     921     855     805
  22          QO     763     729     698     682     676     665     651     637     623     604
  23          QO     589     573     558     545     530     513     495     484     463     442
  24          QO     420     398     380     367     354     345     336     327     318     310
  25          QO     303     294     288     283     279     272     270     266     262     256
  26          QO     250     246     242     238       0       0       0       0       0       0
  27          PT      EL      SP      AF
  28          PW     .47     .06     .47
  29          PR      AF
  30          PW    1.00
  31          BA    77.5      0.
  32          BF    256.    295.  1.0346
  33          UC    -10.    -16.
  34          LU     -.6    -.08
  35          ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 5 THROUGH 58)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.029		29.50			
COMPUTED HYDROGRAPH	104121.	2.082	1928.	42.25	12.75	4225.	45.00
OBSERVED HYDROGRAPH	104121.	2.082	1928.	40.92	11.43	3938.	45.00
DIFFERENCE	0.	0.000	0.	1.32	1.32	287.	0.00
PERCENT DIFFERENCE	0.00				11.56	7.29	

STANDARD ERROR 317. AVERAGE ABSOLUTE ERROR 229.
OBJECTIVE FUNCTION 311. AVERAGE PERCENT ABSOLUTE ERROR 16.83

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 114)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.029		29.50			
COMPUTED HYDROGRAPH	155692.	3.113	1366.	52.75	23.25	4225.	45.00
OBSERVED HYDROGRAPH	140523.	2.810	1233.	49.67	20.18	3938.	45.00
DIFFERENCE	15169.	0.303	133.	3.07	3.07	287.	0.00
PERCENT DIFFERENCE	10.79				15.23	7.29	

STANDARD ERROR 342. AVERAGE ABSOLUTE ERROR 244.
OBJECTIVE FUNCTION 367. AVERAGE PERCENT ABSOLUTE ERROR 26.99

UNIT HYDROGRAPH
116 END-OF-PERIOD ORDINATES

38.	144.	297.	479.	684.	907.	1137.	1349.	1526.	1666.
1765.	1817.	1830.	1727.	1645.	1567.	1493.	1422.	1354.	1290.
1229.	1171.	1115.	1062.	1012.	964.	918.	875.	833.	794.
756.	720.	686.	653.	622.	593.	565.	538.	512.	488.
465.	443.	422.	402.	383.	365.	347.	331.	315.	300.
286.	272.	259.	247.	235.	224.	214.	204.	194.	185.
176.	168.	160.	152.	145.	138.	131.	125.	119.	114.
108.	103.	98.	94.	89.	85.	81.	77.	73.	70.
67.	63.	60.	58.	55.	52.	50.	47.	45.	43.
41.	39.	37.	35.	34.	32.	31.	29.	28.	26.
25.	24.	23.	22.	21.	20.	19.	18.	17.	16.
15.	15.	14.	13.	13.	12.				

HYDROGRAPH AT STATION ELMIRA

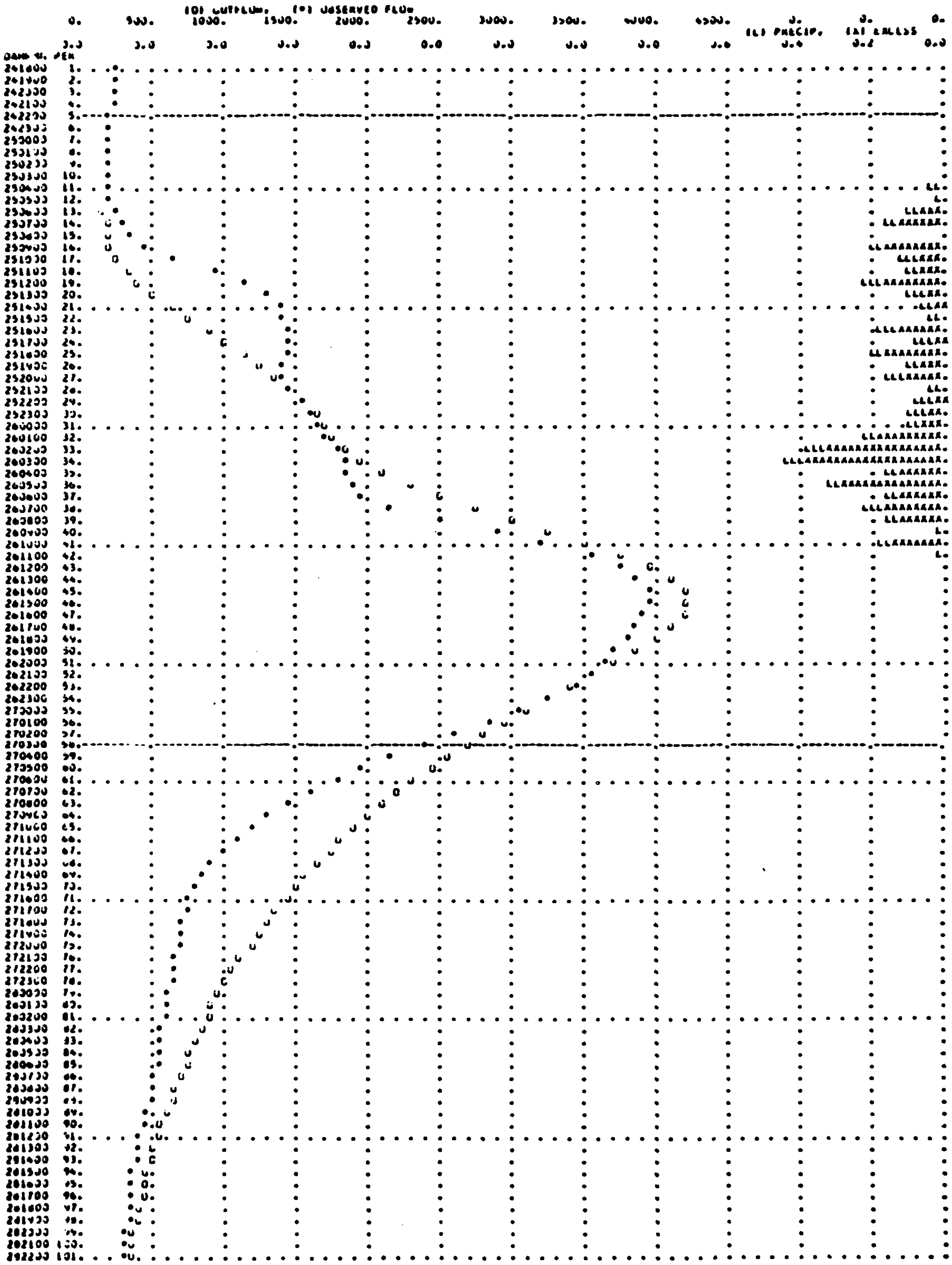
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24 SEP 1800	1	0.00	0.00	0.00	256.	256.
24 SEP 1900	2	0.00	0.00	0.00	247.	250.
24 SEP 2000	3	0.00	0.00	0.00	239.	242.
24 SEP 2100	4	0.00	0.00	0.00	231.	232.
24 SEP 2200	5	0.00	0.00	0.00	223.	224.
24 SEP 2300	6	0.00	0.00	0.00	216.	216.
25 SEP 0000	7	0.00	0.00	0.00	209.	208.
25 SEP 0100	8	0.00	0.00	0.00	202.	206.
25 SEP 0200	9	0.00	0.00	0.00	195.	202.
25 SEP 0300	10	0.00	0.00	0.00	188.	206.
25 SEP 0400	11	0.03	0.03	0.00	182.	216.
25 SEP 0500	12	0.02	0.02	0.00	176.	224.
25 SEP 0600	13	0.11	0.05	0.06	172.	238.
25 SEP 0700	14	0.16	0.05	0.11	177.	281.
25 SEP 0800	15	0.00	0.00	0.00	192.	367.
25 SEP 0900	16	0.20	0.05	0.15	219.	468.
25 SEP 1000	17	0.12	0.05	0.07	265.	637.
25 SEP 1100	18	0.11	0.05	0.06	328.	951.
25 SEP 1200	19	0.22	0.05	0.16	411.	1173.
25 SEP 1300	20	0.10	0.05	0.05	516.	1293.
25 SEP 1400	21	0.06	0.05	0.01	633.	1383.
25 SEP 1500	22	0.03	0.03	0.00	757.	1422.
25 SEP 1600	23	0.17	0.05	0.12	883.	1434.
25 SEP 1700	24	0.08	0.05	0.02	1010.	1437.
25 SEP 1800	25	0.20	0.05	0.15	1134.	1434.
25 SEP 1900	26	0.11	0.05	0.06	1251.	1413.
25 SEP 2000	27	0.15	0.05	0.10	1362.	1422.
25 SEP 2100	28	0.04	0.04	0.00	1464.	1473.
25 SEP 2200	29	0.08	0.05	0.02	1555.	1530.
25 SEP 2300	30	0.10	0.05	0.05	1636.	1578.
26 SEP 0000	31	0.11	0.05	0.06	1706.	1635.
26 SEP 0100	32	0.23	0.05	0.17	1772.	1722.
26 SEP 0200	33	0.38	0.05	0.33	1851.	1797.
26 SEP 0300	34	0.43	0.05	0.38	1964.	1833.
26 SEP 0400	35	0.16	0.05	0.11	2139.	1857.
26 SEP 0500	36	0.32	0.05	0.27	2286.	1905.
26 SEP 0600	37	0.16	0.05	0.11	2493.	1965.
26 SEP 0700	38	0.22	0.05	0.16	2726.	2163.
26 SEP 0800	39	0.16	0.05	0.11	2983.	2498.
26 SEP 0900	40	0.01	0.01	0.00	3250.	2909.
26 SEP 1000	41	0.18	0.05	0.13	3511.	3224.
27 SEP 0200	57	0.00	0.00	0.00	2839.	2614.
27 SEP 0300	58	0.00	0.00	0.00	2676.	2391.
27 SEP 0400	59	0.00	0.00	0.00	2550.	2174.
27 SEP 0500	60	0.00	0.00	0.00	2429.	1971.
27 SEP 0600	61	0.00	0.00	0.00	2314.	1785.
27 SEP 0700	62	0.00	0.00	0.00	2205.	1611.
27 SEP 0800	63	0.00	0.00	0.00	2101.	1455.
27 SEP 0900	64	0.00	0.00	0.00	2002.	1320.
27 SEP 1000	65	0.00	0.00	0.00	1907.	1200.
27 SEP 1100	66	0.00	0.00	0.00	1817.	1095.
27 SEP 1200	67	0.00	0.00	0.00	1731.	1002.
27 SEP 1300	68	0.00	0.00	0.00	1649.	921.
27 SEP 1400	69	0.00	0.00	0.00	1572.	855.
27 SEP 1500	70	0.00	0.00	0.00	1497.	805.
27 SEP 1600	71	0.00	0.00	0.00	1427.	763.
27 SEP 1700	72	0.00	0.00	0.00	1359.	729.
27 SEP 1800	73	0.00	0.00	0.00	1295.	698.
27 SEP 1900	74	0.00	0.00	0.00	1234.	682.
27 SEP 2000	75	0.00	0.00	0.00	1176.	676.
27 SEP 2100	76	0.00	0.00	0.00	1120.	665.
27 SEP 2200	77	0.00	0.00	0.00	1067.	651.
27 SEP 2300	78	0.00	0.00	0.00	1017.	637.
28 SEP 0000	79	0.00	0.00	0.00	969.	623.
28 SEP 0100	80	0.00	0.00	0.00	923.	604.
28 SEP 0200	81	0.00	0.00	0.00	880.	589.
28 SEP 0300	82	0.00	0.00	0.00	838.	573.
28 SEP 0400	83	0.00	0.00	0.00	799.	558.
28 SEP 0500	84	0.00	0.00	0.00	761.	545.
28 SEP 0600	85	0.00	0.00	0.00	725.	530.
28 SEP 0700	86	0.00	0.00	0.00	691.	513.
28 SEP 0800	87	0.00	0.00	0.00	658.	499.
28 SEP 0900	88	0.00	0.00	0.00	627.	484.
28 SEP 1000	89	0.00	0.00	0.00	598.	463.
28 SEP 1100	90	0.00	0.00	0.00	570.	442.
28 SEP 1200	91	0.00	0.00	0.00	543.	420.
28 SEP 1300	92	0.00	0.00	0.00	517.	398.
28 SEP 1400	93	0.00	0.00	0.00	493.	380.
28 SEP 1500	94	0.00	0.00	0.00	470.	367.
28 SEP 1600	95	0.00	0.00	0.00	447.	354.
28 SEP 1700	96	0.00	0.00	0.00	426.	345.
28 SEP 1800	97	0.00	0.00	0.00	406.	336.
28 SEP 1900	98	0.00	0.00	0.00	387.	327.
29 SEP 1100	114	0.00	0.00	0.00	207.	238.

TOTAL RAINFALL = 4.46, TOTAL LOSS = 1.43, TOTAL EXCESS = 3.03

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	113.00-HR
4225.	45.00	(CFS)	4139.	3438.	1997.	1376.
		(INCHES)	0.497	1.635	2.876	3.108
		(AC-FT)	2052.	6759.	11886.	12848.

CUMULATIVE AREA = 77.50 SQ MI

STATION ELMIRA



HEC-1 INPUT PAGE 1

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LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        ID        NEWTOWN CREEK 10-09-76
        ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
        IT      60 07OCT76    1300      95
        IO       1       2
        OU      42      65
        PG      EL    3.44
        PG      SP    3.38
        PG      AF
        PI     .00     .00     .00     .00     .10     .10     .00     .00     .00     .10
        PI     .20     .30     .00     .00     .10     .10     .00     .00     .00     .00
        PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
        PI     .00     .10     .00     .00     .00     .00     .10     .10     .10     .10
        PI     .10     .10     .10     .10     .20     .30     .40     .20     .00     .20
        PI     .10     .10     .00     .10     .00     .10     .00     .00     .00     .00

        KK  ELMIRA                                     ERROR 32 not 320
        QO      32      32      32      32      32      32      32      33      34      34
        QO      35      37      44      46      46      55      55      60      64      64
        QO      76     110     156     168     167     159     152     142     136     130
        QO     123     118     116     110     108     103     100      99      99     100
        QO     104     115     138     178     220     463     670     865    1055    1205
        QO    1288    1435    1555    1765    1940    2042    2105    2100    2055    1985
        QO    1900    1803    1678    1505    1313    1120     965     865     792     740
        QO     692     652     620     593     555     530     494     455     448     433
        QO     402     376     358     342     330     318     306     298     290     282
        QO     272     268     260     252     248       0       0       0       0       0
        PT      EL      SP      AF
        PW     .47     .06     .47
        PR      AF
        PW    1.00
        BA    77.5      0.
        BF     32.    320.  1.0346
        UC     -9.    -12.
        LU     -1.     -1.
        ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 42 THROUGH 65)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.388		38.62			
COMPUTED HYDROGRAPH	31377.	0.627	1307.	56.52	17.90	2155.	56.00
OBSERVED HYDROGRAPH	31378.	0.627	1307.	56.44	17.83	2105.	56.00
DIFFERENCE	-1.	-0.000	-0.	0.07	0.07	50.	0.00
PERCENT DIFFERENCE	-0.00				0.41	2.39	

STANDARD ERROR	162.	AVERAGE ABSOLUTE ERROR	128.
OBJECTIVE FUNCTION	149.	AVERAGE PERCENT ABSOLUTE ERROR	28.90

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 95)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.388		38.62			
COMPUTED HYDROGRAPH	66285.	1.325	698.	56.02	17.40	2155.	56.00
OBSERVED HYDROGRAPH	49627.	0.992	522.	60.00	21.38	2105.	56.00
DIFFERENCE	16658.	0.333	175.	-3.98	-3.98	50.	0.00
PERCENT DIFFERENCE	33.57				-18.60	2.39	

STANDARD ERROR	153.	AVERAGE ABSOLUTE ERROR	95.
OBJECTIVE FUNCTION	183.	AVERAGE PERCENT ABSOLUTE ERROR	33.89

UNIT HYDROGRAPH
95 END-OF-PERIOD ORDINATES

70.	262.	539.	868.	1233.	1591.	1888.	2107.	2236.	2234.
2129.	2007.	1891.	1782.	1680.	1583.	1492.	1406.	1325.	1249.
1177.	1109.	1045.	985.	928.	875.	825.	777.	732.	690.
650.	613.	578.	544.	513.	484.	456.	429.	405.	381.
359.	337.	319.	301.	284.	267.	252.	237.	224.	211.
199.	187.	176.	166.	157.	148.	139.	131.	124.	117.
110.	103.	98.	92.	87.	82.	77.	73.	68.	64.
61.	57.	54.	51.	48.	45.	43.	40.	38.	36.
34.	32.	30.	28.	26.	25.	24.	22.	21.	20.
19.	17.	16.	16.	15.					

HYDROGRAPH AT STATION ELMIRA

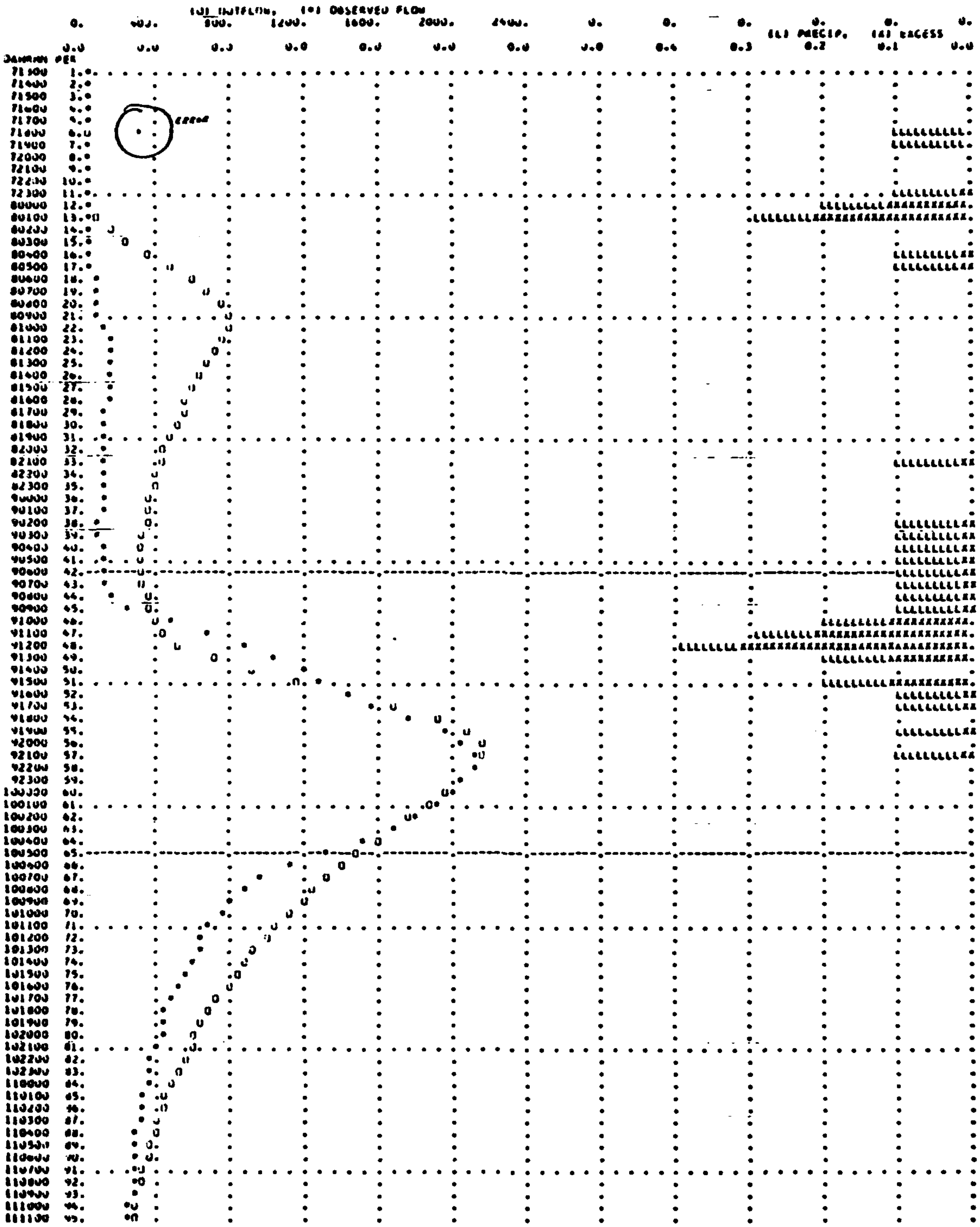
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7 OCT 1300	1	0.00	0.00	0.00	32.	32.	9 OCT 1300	49	0.20	0.08	0.11	703.	1055.
7 OCT 1400	2	0.00	0.00	0.00	31.	32.	9 OCT 1400	50	0.00	0.00	0.00	918.	1205.
7 OCT 1500	3	0.00	0.00	0.00	30.	32.	9 OCT 1500	51	0.20	0.08	0.11	1166.	1288.
7 OCT 1600	4	0.00	0.00	0.00	29.	32.	9 OCT 1600	52	0.10	0.08	0.01	1433.	1435.
7 OCT 1700	5	0.00	0.00	0.00	28.	[illegible] ERROR	9 OCT 1700	53	0.10	0.08	0.01	1688.	1555.
7 OCT 1800	6	0.10	0.10	0.00	27.	320. 32.	9 OCT 1800	54	0.00	0.00	0.00	1904.	1765.
7 OCT 1900	7	0.10	0.10	0.00	26.	32.	9 OCT 1900	55	0.10	0.08	0.01	2061.	1940.
7 OCT 2000	8	0.00	0.00	0.00	25.	33.	9 OCT 2000	56	0.00	0.00	0.00	2147.	2042.
7 OCT 2100	9	0.00	0.00	0.00	24.	34.	9 OCT 2100	57	0.10	0.08	0.01	2155.	2105.
7 OCT 2200	10	0.00	0.00	0.00	24.	34.	9 OCT 2200	58	0.00	0.00	0.00	2109.	2100.
7 OCT 2300	11	0.10	0.09	0.01	23.	35.	9 OCT 2300	59	0.00	0.00	0.00	2038.	2055.
8 OCT 0000	12	0.20	0.08	0.11	31.	37.	10 OCT 0000	60	0.00	0.00	0.00	1954.	1985.
8 OCT 0100	13	0.29	0.08	0.21	64.	44.	10 OCT 0100	61	0.00	0.00	0.00	1861.	1900.
8 OCT 0200	14	0.00	0.00	0.00	141.	46.	10 OCT 0200	62	0.00	0.00	0.00	1767.	1803.
8 OCT 0300	15	0.00	0.00	0.00	237.	48.	10 OCT 0300	63	0.00	0.00	0.00	1675.	1678.
8 OCT 0400	16	0.10	0.08	0.01	349.	53.	10 OCT 0400	64	0.00	0.00	0.00	1585.	1505.
8 OCT 0500	17	0.10	0.09	0.01	470.	55.	10 OCT 0500	65	0.00	0.00	0.00	1497.	1313.
8 OCT 0600	18	0.00	0.00	0.00	586.	60.	10 OCT 0600	66	0.00	0.00	0.00	1413.	1120.
8 OCT 0700	19	0.00	0.00	0.00	681.	64.	10 OCT 0700	67	0.00	0.00	0.00	1332.	965.
8 OCT 0800	20	0.00	0.00	0.00	750.	64.	10 OCT 0800	68	0.00	0.00	0.00	1255.	865.
8 OCT 0900	21	0.00	0.00	0.00	786.	76.	10 OCT 0900	69	0.00	0.00	0.00	1183.	792.
8 OCT 1000	22	0.00	0.00	0.00	782.	110.	10 OCT 1000	70	0.00	0.00	0.00	1115.	740.
8 OCT 1100	23	0.00	0.00	0.00	752.	156.	10 OCT 1100	71	0.00	0.00	0.00	1051.	692.
8 OCT 1200	24	0.00	0.00	0.00	717.	168.	10 OCT 1200	72	0.00	0.00	0.00	991.	652.
8 OCT 1300	25	0.00	0.00	0.00	682.	167.	10 OCT 1300	73	0.00	0.00	0.00	934.	620.
8 OCT 1400	26	0.00	0.00	0.00	645.	159.	10 OCT 1400	74	0.00	0.00	0.00	880.	593.
8 OCT 1500	27	0.00	0.00	0.00	608.	152.	10 OCT 1500	75	0.00	0.00	0.00	829.	555.
8 OCT 1600	28	0.00	0.00	0.00	574.	142.	10 OCT 1600	76	0.00	0.00	0.00	782.	530.
8 OCT 1700	29	0.00	0.00	0.00	541.	136.	10 OCT 1700	77	0.00	0.00	0.00	737.	494.
8 OCT 1800	30	0.00	0.00	0.00	510.	130.	10 OCT 1800	78	0.00	0.00	0.00	694.	455.
8 OCT 1900	31	0.00	0.00	0.00	481.	123.	10 OCT 1900	79	0.00	0.00	0.00	654.	448.
8 OCT 2000	32	0.00	0.00	0.00	454.	118.	10 OCT 2000	80	0.00	0.00	0.00	617.	433.
8 OCT 2100	33	0.10	0.08	0.01	429.	116.	10 OCT 2100	81	0.00	0.00	0.00	581.	402.
8 OCT 2200	34	0.00	0.00	0.00	407.	110.	10 OCT 2200	82	0.00	0.00	0.00	548.	376.
8 OCT 2300	35	0.00	0.00	0.00	388.	108.	10 OCT 2300	83	0.00	0.00	0.00	516.	358.
9 OCT 0000	36	0.00	0.00	0.00	371.	103.	11 OCT 0000	84	0.00	0.00	0.00	487.	342.
9 OCT 0100	37	0.00	0.00	0.00	356.	100.	11 OCT 0100	85	0.00	0.00	0.00	459.	330.
9 OCT 0200	38	0.10	0.08	0.01	342.	99.	11 OCT 0200	86	0.00	0.00	0.00	432.	318.
9 OCT 0300	39	0.10	0.08	0.01	332.	99.	11 OCT 0300	87	0.00	0.00	0.00	408.	306.
9 OCT 0400	40	0.10	0.08	0.01	326.	100.	11 OCT 0400	88	0.00	0.00	0.00	384.	298.
9 OCT 0500	41	0.10	0.08	0.01	324.	104.	11 OCT 0500	89	0.00	0.00	0.00	362.	290.
9 OCT 0600	42	0.10	0.08	0.01	326.	115.	11 OCT 0600	90	0.00	0.00	0.00	341.	282.
9 OCT 0700	43	0.10	0.09	0.01	332.	138.	11 OCT 0700	91	0.00	0.00	0.00	322.	272.
9 OCT 0800	44	0.10	0.08	0.01	344.	174.	11 OCT 0800	92	0.00	0.00	0.00	310.	268.
9 OCT 0900	45	0.10	0.08	0.01	359.	220.	11 OCT 0900	93	0.00	0.00	0.00	300.	260.
9 OCT 1000	46	0.20	0.08	0.11	383.	403.	11 OCT 1000	94	0.00	0.00	0.00	290.	252.
9 OCT 1100	47	0.29	0.08	0.21	414.	670.	11 OCT 1100	95	0.00	0.00	0.00	280.	248.
9 OCT 1200	48	0.39	0.08	0.31	537.	965.							

TOTAL RAINFALL = 3.51, TOTAL LOSS = 2.12, TOTAL EXCESS = 1.39

PEAK FLOW (CFS)	TIME (HR)		6-HR	24-HR	72-HR	94.00-HR
			MAXIMUM AVERAGE FLOW			
2155.	56.00	(CFS)	2373.	1551.	874.	703.
		(INCHES)	0.249	0.744	1.258	1.322
		(AC-FT)	1020.	3075.	5201.	5465.

CUMULATIVE AREA = 77.50 SQ MI

STATION ELMIRA



(-) LIMITS OF OPTIMIZATION

HEC-1 INPUT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LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1        ID        NEWTOWN CREEK 10-21-76
  2        ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3        IT      60 200CT76    1300      46
  4        IO       1       2
  5        OU       5      25
  6        PG      EL    1.57
  7        PG      SP    1.46
  8        PG      AF
  9        PI     .10     .10     .10     .10     .10     .10     .10     .10     .20     .10
 10        PI     .10     .20     .00     .10     .10     .10     .00     .00     .00     .00
 11        PG      HR
 12        PI     .00     .00     .20     .10     .10     .00     .10     .10     .20     .10
 13        PI     .20     .10     .00     .10     .00     .00     .00     .00     .00     .00

 14        KK  ELMIRA
 15        QO      53      53      54      56      59      63      69      80     110     168
 16        QO     328     670    1024    1190    1285    1407    1492    1590    1672    1700
 17        QO    1685    1593    1473    1270    1067     893     782     705     648     600
 18        QO     568     537     512     489     465     441     420     402     383     370
 19        QO     358     358     356     338     320     322       0       0       0       0
 20        PT      EL      SP      AF     HOR
 21        PW     .46     .06     .47     .01
 22        PR      AF     HOR
 23        PW     .85     .15
 24        BA    77.5      0.
 25        BF     53.    600.  1.0346
 26        UC    -1.0    -1.0
 27        LU     -1.     -1.
 28        ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 25)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.476		11.05			
COMPUTED HYDROGRAPH	19978.	0.399	951.	18.48	7.43	1807.	18.00
OBSERVED HYDROGRAPH	19995.	0.400	952.	18.46	7.41	1700.	19.00
DIFFERENCE	-17.	-0.000	-1.	0.02	0.02	107.	-1.00
PERCENT DIFFERENCE	-0.08				0.29	6.32	

STANDARD ERROR	102.	AVERAGE ABSOLUTE ERROR	78.
OBJECTIVE FUNCTION	108.	AVERAGE PERCENT ABSOLUTE ERROR	14.26

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 46)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.476		11.05			
COMPUTED HYDROGRAPH	30269.	0.605	658.	23.71	12.67	1807.	18.00
OBSERVED HYDROGRAPH	30478.	0.609	663.	23.64	12.60	1700.	19.00
DIFFERENCE	-209.	-0.004	-5.	0.07	0.07	107.	-1.00
PERCENT DIFFERENCE	-0.69				0.54	6.32	

STANDARD ERROR	73.	AVERAGE ABSOLUTE ERROR	48.
OBJECTIVE FUNCTION	91.	AVERAGE PERCENT ABSOLUTE ERROR	9.62

UNIT HYDROGRAPH
32 END-OF-PERIOD ORDINATES

181.	663.	1297.	1992.	2703.	3397.	3961.	4306.	4436.	4370.
4068.	3491.	2837.	2306.	1874.	1523.	1236.	1006.	818.	664.
540.	439.	357.	290.	236.	191.	156.	126.	103.	84.
68.	55.								

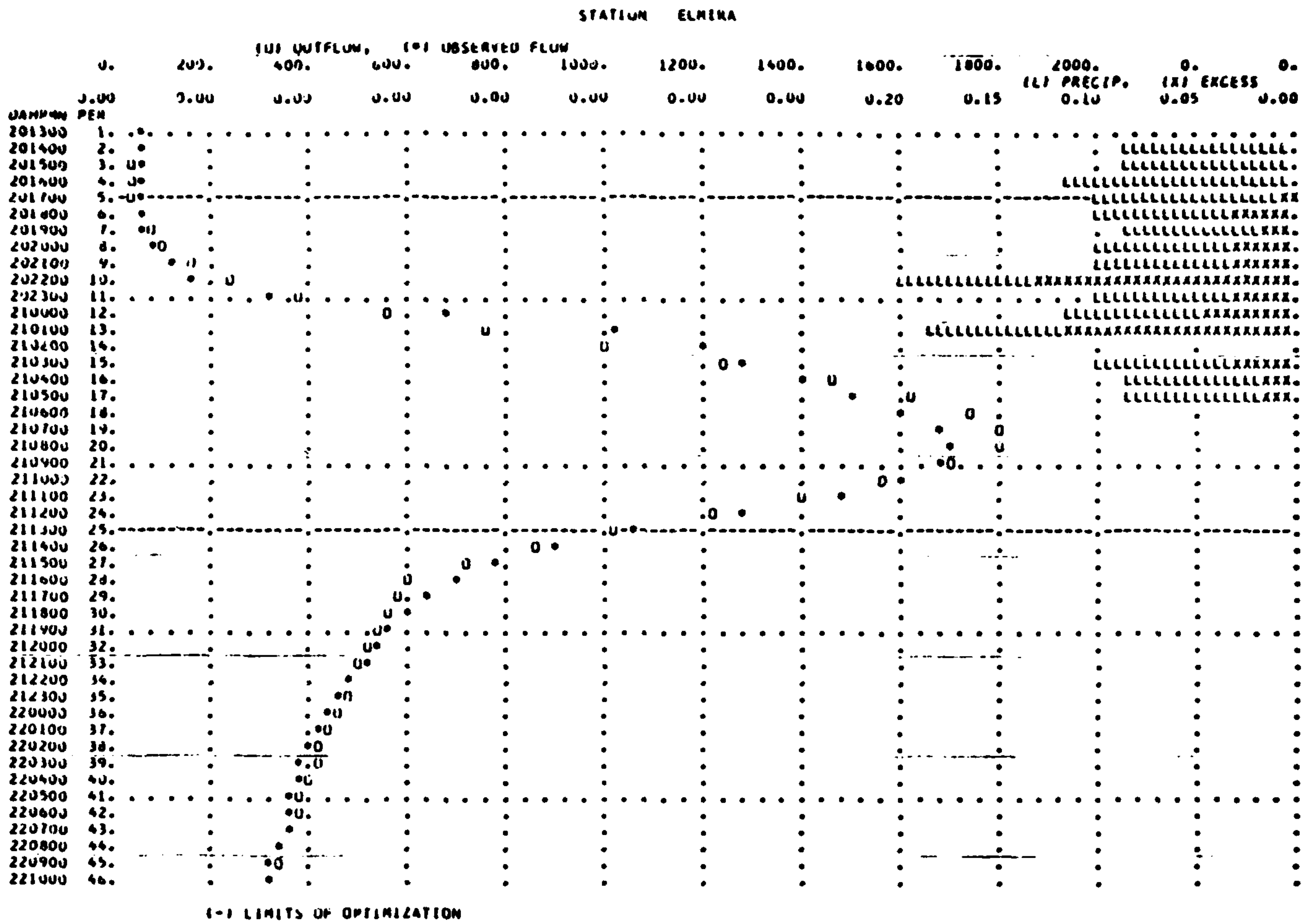
HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
20 OCT 1300	1	0.00	0.00	0.00	53.	53.	21 OCT 1200	24	0.00	0.00	0.00	1215.	1270.
20 OCT 1400	2	0.08	0.08	0.00	51.	53.	21 OCT 1300	25	0.00	0.00	0.00	1030.	1067.
20 OCT 1500	3	0.08	0.08	0.00	50.	54.	21 OCT 1400	26	0.00	0.00	0.00	863.	893.
20 OCT 1600	4	0.11	0.11	0.00	48.	56.	21 OCT 1500	27	0.00	0.00	0.00	715.	782.
20 OCT 1700	5	0.10	0.09	0.01	48.	59.	21 OCT 1600	28	0.00	0.00	0.00	598.	705.
20 OCT 1800	6	0.10	0.07	0.03	55.	63.	21 OCT 1700	29	0.00	0.00	0.00	578.	648.
20 OCT 1900	7	0.08	0.07	0.01	74.	69.	21 OCT 1800	30	0.00	0.00	0.00	559.	600.
20 OCT 2000	8	0.10	0.07	0.03	108.	80.	21 OCT 1900	31	0.00	0.00	0.00	540.	568.
20 OCT 2100	9	0.10	0.07	0.03	160.	110.	21 OCT 2000	32	0.00	0.00	0.00	522.	537.
20 OCT 2200	10	0.20	0.07	0.13	249.	168.	21 OCT 2100	33	0.00	0.00	0.00	504.	512.
20 OCT 2300	11	0.10	0.07	0.03	386.	328.	21 OCT 2200	34	0.00	0.00	0.00	488.	489.
21 OCT 0000	12	0.11	0.07	0.04	556.	670.	21 OCT 2300	35	0.00	0.00	0.00	471.	465.
21 OCT 0100	13	0.18	0.07	0.11	762.	1024.	22 OCT 0000	36	0.00	0.00	0.00	455.	441.
21 OCT 0200	14	0.00	0.00	0.00	998.	1190.	22 OCT 0100	37	0.00	0.00	0.00	440.	420.
21 OCT 0300	15	0.10	0.07	0.03	1236.	1285.	22 OCT 0200	38	0.00	0.00	0.00	426.	402.
21 OCT 0400	16	0.08	0.07	0.01	1453.	1407.	22 OCT 0300	39	0.00	0.00	0.00	411.	383.
21 OCT 0500	17	0.08	0.07	0.01	1626.	1492.	22 OCT 0400	40	0.00	0.00	0.00	398.	370.
21 OCT 0600	18	0.00	0.00	0.00	1749.	1590.	22 OCT 0500	41	0.00	0.00	0.00	384.	358.
21 OCT 0700	19	0.00	0.00	0.00	1807.	1672.	22 OCT 0600	42	0.00	0.00	0.00	371.	358.
21 OCT 0800	20	0.00	0.00	0.00	1792.	1700.	22 OCT 0700	43	0.00	0.00	0.00	359.	356.
21 OCT 0900	21	0.00	0.00	0.00	1705.	1685.	22 OCT 0800	44	0.00	0.00	0.00	347.	338.
21 OCT 1000	22	0.00	0.00	0.00	1568.	1593.	22 OCT 0900	45	0.00	0.00	0.00	335.	320.
21 OCT 1100	23	0.00	0.00	0.00	1403.	1473.	22 OCT 1000	46	0.00	0.00	0.00	324.	322.

TOTAL RAINFALL = 1.62, TOTAL LOSS = 1.15, TOTAL EXCESS = 0.48

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	45.00-HR
1807.	18.00	(CFS)	1698.	1329.	668.	668.
		(INCHES)	0.204	0.494	0.601	0.601
		(AC-FT)	842.	2341.	2486.	2486.

CUMULATIVE AREA = 77.50 SQ MI


STATION ELMIRA
(U) OUTFLOW, (*) OBSERVED FLOW
0. 200. 400. 600. 800. 1000. 1200. 1400. 1600. 1800. 2000.
(L) PRECIP. (X) EXCESS
0.00 0.05 0.10 0.15 0.20
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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                                              HEC-1 INPUT                                               PAGE  1

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1            ID        NEWTOWN CREEK 09-25-77
   2            ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
   3            IT      60 24SEP77    1300      46
   4            IO       1       2
   5            OU       5      30
   6            PG      EL    2.21
   7            PG      SP    2.60
   8            PG      AF
   9            PI     .00     .10     .20     .20     .10     .20     .20     .30     .10     .20
  10            PI     .20     .10     .10     .10     .10     .00     .00     .00     .00     .00
  11            PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  12            PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  13            PI     .00     .00     .10     .10     .10     .00     .00     .00     .00     .00
  14            PG     HOR
  15            PI     .00     .10     .20     .10     .30     .20     .00     .20     .10     .10
  16            PI     .10     .10     .20     .00     .00     .00     .00     .00     .00     .00
  17            PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  18            PI     .00     .00     .00     .00     .00     .00     .00     .00     .10     .00
  19            PI     .00     .00     .00     .20     .10     .00     .00     .00     .00     .00

  20            KK  ELMIRA
  21            QO      62      62      62      62      66      66      80      92     112     163
  22            QO     320     670    1015    1175    1250    1400    1435    1494    1555    1633
  23            QO    1685    1708    1670    1575    1443    1280    1103     962     860     782
  24            QO     724     676     635     598     555     512     472     449     428     410
  25            QO     395     381     370     360     358     360       0       0       0       0
  26            PT      EL      SP      AF     HOR
  27            PW     .46     .06     .47     .01
  28            PR      AF     HOR
  29            PW     .85     .15
  30            BA    77.5      0.
  31            BF     62.    860.  1.0346
  32            UC    -11.    -13.
  33            LU     -1.     -1.
  34            ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 5 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.810		13.64			
COMPUTED HYDROGRAPH	25511.	0.510	981.	20.65	7.00	1715.	18.00
OBSERVED HYDROGRAPH	25594.	0.512	984.	20.48	6.84	1708.	21.00
DIFFERENCE	-83.	-0.002	-3.	0.17	0.17	7.	-3.00
PERCENT DIFFERENCE	-0.32				2.44	0.41	

STANDARD ERROR	112.	AVERAGE ABSOLUTE ERROR	91.
OBJECTIVE FUNCTION	119.	AVERAGE PERCENT ABSOLUTE ERROR	13.52

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 46)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.810		13.64			
COMPUTED HYDROGRAPH	36552.	0.731	795.	25.59	11.95	1715.	18.00
OBSERVED HYDROGRAPH	33525.	0.670	729.	24.23	10.58	1708.	21.00
DIFFERENCE	3027.	0.061	66.	1.37	1.37	7.	-3.00
PERCENT DIFFERENCE	9.03				12.91	0.41	

STANDARD ERROR	144.	AVERAGE ABSOLUTE ERROR	120.
OBJECTIVE FUNCTION	148.	AVERAGE PERCENT ABSOLUTE ERROR	24.93

UNIT HYDROGRAPH
78 END-OF-PERIOD ORDINATES

75.	280.	571.	918.	1300.	1692.	2040.	2308.	2490.	2574.
2518.	2359.	2192.	2036.	1892.	1758.	1633.	1517.	1409.	1309.
1216.	1130.	1050.	975.	906.	842.	782.	727.	675.	627.
583.	541.	503.	467.	434.	403.	375.	348.	323.	300.
279.	259.	241.	224.	208.	193.	179.	167.	155.	144.
134.	124.	115.	107.	100.	93.	86.	80.	74.	69.
64.	59.	55.	51.	48.	44.	41.	38.	36.	33.
31.	29.	26.	25.	23.	21.	20.	18.		

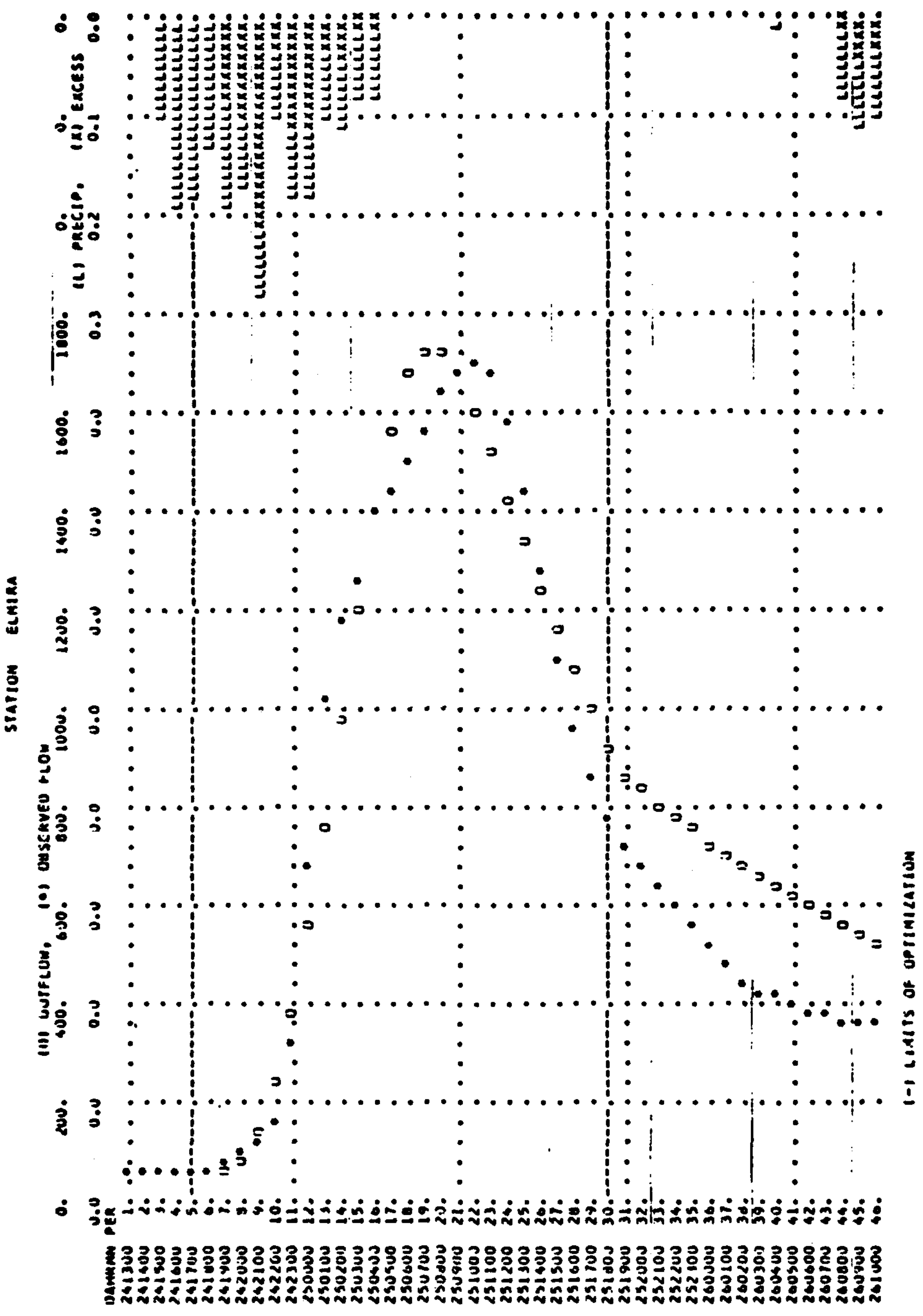
HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24 SEP 1300	1	0.00	0.00	0.00	62.	62.	25 SEP 1200	24	0.00	0.00	0.00	1425.	1575.
24 SEP 1400	2	0.00	0.00	0.00	60.	62.	25 SEP 1300	25	0.00	0.00	0.00	1331.	1443.
24 SEP 1500	3	0.10	0.10	0.00	58.	62.	25 SEP 1400	26	0.00	0.00	0.00	1239.	1280.
24 SEP 1600	4	0.19	0.19	0.00	56.	62.	25 SEP 1500	27	0.00	0.00	0.00	1153.	1103.
24 SEP 1700	5	0.18	0.18	0.00	54.	66.	25 SEP 1600	28	0.00	0.00	0.00	1072.	962.
24 SEP 1800	6	0.13	0.13	0.00	52.	66.	25 SEP 1700	29	0.00	0.00	0.00	997.	860.
24 SEP 1900	7	0.19	0.11	0.08	57.	80.	25 SEP 1800	30	0.00	0.00	0.00	927.	782.
24 SEP 2000	8	0.17	0.07	0.10	83.	92.	25 SEP 1900	31	0.00	0.00	0.00	862.	724.
24 SEP 2100	9	0.28	0.07	0.21	138.	112.	25 SEP 2000	32	0.00	0.00	0.00	832.	676.
24 SEP 2200	10	0.10	0.07	0.03	237.	163.	25 SEP 2100	33	0.00	0.00	0.00	804.	635.
24 SEP 2300	11	0.18	0.07	0.11	375.	320.	25 SEP 2200	34	0.00	0.00	0.00	777.	598.
25 SEP 0000	12	0.18	0.07	0.11	553.	670.	25 SEP 2300	35	0.00	0.00	0.00	751.	555.
25 SEP 0100	13	0.10	0.07	0.03	763.	1015.	26 SEP 0000	36	0.00	0.00	0.00	726.	512.
25 SEP 0200	14	0.11	0.07	0.04	988.	1175.	26 SEP 0100	37	0.00	0.00	0.00	702.	472.
25 SEP 0300	15	0.08	0.07	0.01	1208.	1250.	26 SEP 0200	38	0.00	0.00	0.00	679.	449.
25 SEP 0400	16	0.08	0.07	0.01	1406.	1400.	26 SEP 0300	39	0.00	0.00	0.00	656.	428.
25 SEP 0500	17	0.00	0.00	0.00	1565.	1435.	26 SEP 0400	40	0.01	0.01	0.00	634.	410.
25 SEP 0600	18	0.00	0.00	0.00	1670.	1494.	26 SEP 0500	41	0.00	0.00	0.00	613.	395.
25 SEP 0700	19	0.00	0.00	0.00	1715.	1555.	26 SEP 0600	42	0.00	0.00	0.00	592.	381.
25 SEP 0800	20	0.00	0.00	0.00	1712.	1633.	26 SEP 0700	43	0.00	0.00	0.00	572.	370.
25 SEP 0900	21	0.00	0.00	0.00	1673.	1685.	26 SEP 0800	44	0.08	0.07	0.01	553.	360.
25 SEP 1000	22	0.00	0.00	0.00	1605.	1708.	26 SEP 0900	45	0.11	0.07	0.04	535.	358.
25 SEP 1100	23	0.00	0.00	0.00	1518.	1670.	26 SEP 1000	46	0.10	0.07	0.03	517.	360.

TOTAL RAINFALL = 2.37, TOTAL LOSS = 1.56, TOTAL EXCESS = 0.81

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	45.00-HR
1715.	18.00	(CFS)	1653.	1195.	806.	806.
		(INCHES)	0.198	0.574	0.725	0.725
		(AC-FT)	819.	2371.	2997.	2997.

CUMULATIVE AREA = 77.50 SQ MI


STATION ELMIRA
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP.
(X) EXCESS
(-) LIMITS OF OPTIMIZATION

HEC-1 INPUT

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ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

ID        NEWTOWN CREEK 10-17-77
ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
IT      60 16OCT77    0400      62
IO       1       2
OU       5      45
PG      EL    2.18
PG      SP    3.06
PG      AF
PI     .00     .00     .10     .00     .10     .10     .00     .10     .10     .00
PI     .00     .10     .10     .10     .00     .10     .20     .10     .10     .20
PI     .30     .20     .10     .10     .10     .00     .10     .10     .00     .10
PI     .00     .10     .00     .10     .00     .00     .00     .00     .00     .00
PG     HUR
PI     .10     .00     .10     .10     .10     .10     .10     .00     .00     .00
PI     .10     .00     .10     .00     .00     .00     .10     .00     .10     .00
PI     .00     .00     .10     .10     .00     .10     .00     .00     .00     .00
PI     .00     .00     .00     .00     .10     .30     .00     .00     .00     .00

KK  ELMIRA
QO      77      77      77      78      81      87      92      99     110     131
QO     178     286     396     470     534     577     628     686     743     802
QO     906    1074    1155    1221    1332    1431    1530    1650    1761    1821
QO    1844    1830    1776    1728    1662    1578    1482    1383    1287    1200
QO    1128    1077    1035     990     945     864     838     791     746     701
QO     662     628     601     575     555     534     518     499     482     468
QO     458     450       0       0       0       0       0       0       0       0
PT      EL      SP      AF     HUR
PW     .46     .06     .47     .01
PR      AF     HUR
PW     .85     .15
BA    77.5      0.
BF     77.    570.  1.0346
UC     -9.    -15.
LU    -.04    -.03
ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 45)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.076		19.65			
COMPUTED HYDROGRAPH	40462.	0.809	987.	30.47	10.82	1863.	29.00
OBSERVED HYDROGRAPH	40726.	0.814	993.	30.21	10.56	1844.	30.00
DIFFERENCE	-264.	-0.005	-6.	0.26	0.26	19.	-1.00
PERCENT DIFFERENCE	-0.65				2.50	1.05	

STANDARD ERROR 103. AVERAGE ABSOLUTE ERROR 86.
OBJECTIVE FUNCTION 102. AVERAGE PERCENT ABSOLUTE ERROR 16.80

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 62)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.076		19.65			
COMPUTED HYDROGRAPH	51167.	1.023	825.	34.86	15.21	1863.	29.00
OBSERVED HYDROGRAPH	51405.	1.028	829.	34.63	14.98	1844.	30.00
DIFFERENCE	-238.	-0.005	-4.	0.23	0.23	19.	-1.00
PERCENT DIFFERENCE	-0.46				1.53	1.05	

STANDARD ERROR 84. AVERAGE ABSOLUTE ERROR 61.
OBJECTIVE FUNCTION 91. AVERAGE PERCENT ABSOLUTE ERROR 12.52

UNIT HYDROGRAPH
90 END-OF-PERIOD ORDINATES

49.	337.	691.	1112.	1556.	1946.	2233.	2396.	2385.	2256.
2119.	1991.	1871.	1757.	1651.	1551.	1457.	1369.	1286.	1208.
1135.	1066.	1002.	941.	884.	831.	780.	733.	689.	647.
608.	571.	537.	504.	474.	445.	418.	393.	369.	347.
326.	306.	287.	270.	254.	238.	224.	210.	198.	186.
174.	164.	154.	145.	136.	128.	120.	113.	106.	99.
93.	88.	82.	77.	73.	68.	64.	60.	57.	53.
50.	47.	44.	41.	39.	37.	34.	32.	30.	29.
27.	25.	24.	22.	21.	20.	18.	17.	16.	15.

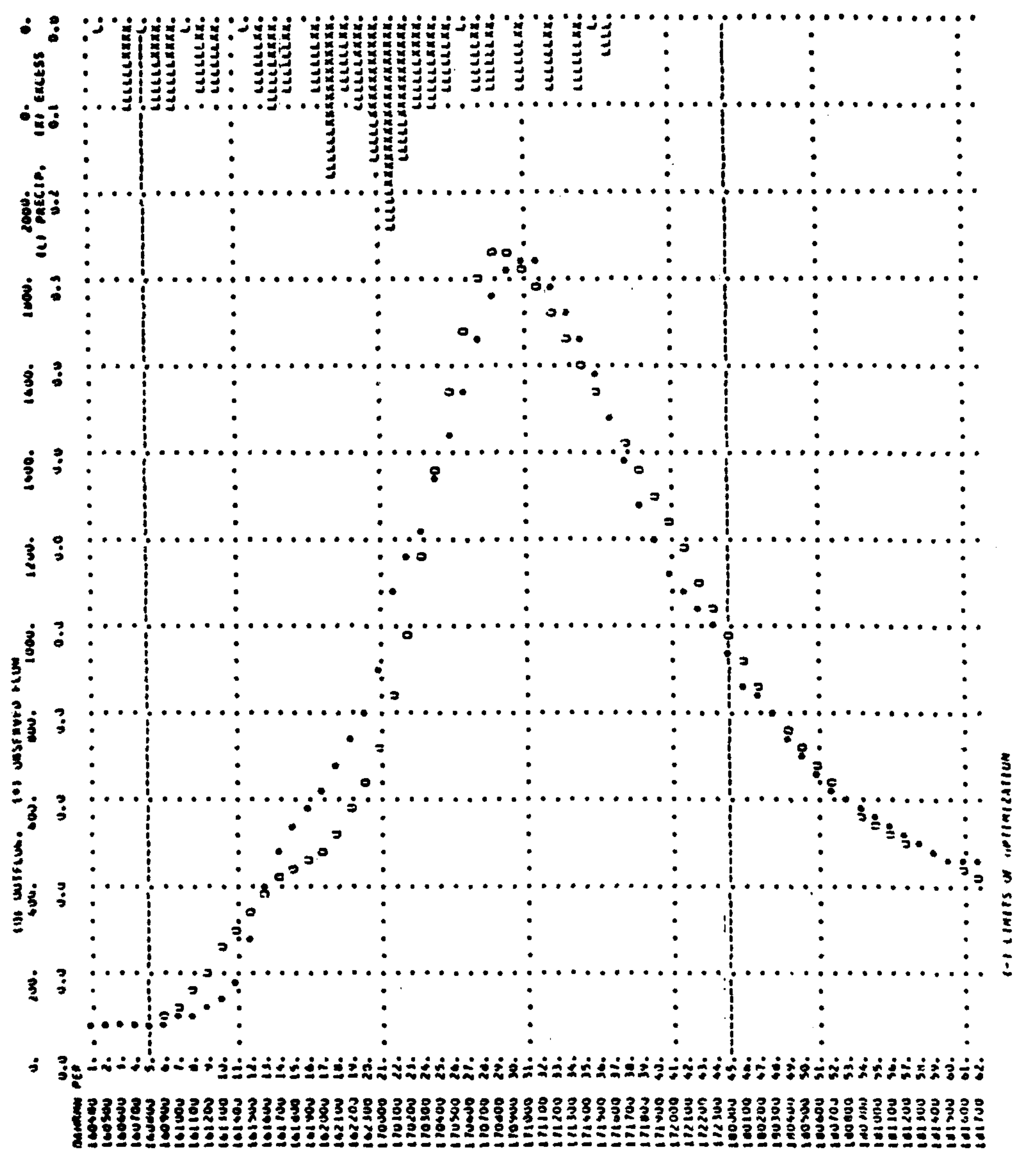
HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
16 OCT 0400	1	0.00	0.00	0.00	77.	77.	17 OCT 1100	32	0.00	0.00	0.00	1777.	1830.
16 OCT 0500	2	0.01	0.01	0.00	74.	77.	17 OCT 1200	33	0.08	0.06	0.02	1718.	1776.
16 OCT 0600	3	0.00	0.00	0.00	72.	77.	17 OCT 1300	34	0.00	0.00	0.00	1658.	1728.
16 OCT 0700	4	0.10	0.06	0.04	73.	78.	17 OCT 1400	35	0.08	0.06	0.02	1599.	1662.
16 OCT 0800	5	0.01	0.01	0.00	80.	81.	17 OCT 1500	36	0.01	0.01	0.00	1542.	1578.
16 OCT 0900	6	0.10	0.06	0.04	95.	87.	17 OCT 1600	37	0.04	0.04	0.00	1484.	1482.
16 OCT 1000	7	0.10	0.06	0.04	122.	92.	17 OCT 1700	38	0.00	0.00	0.00	1425.	1383.
16 OCT 1100	8	0.01	0.01	0.00	160.	99.	17 OCT 1800	39	0.00	0.00	0.00	1365.	1287.
16 OCT 1200	9	0.08	0.06	0.02	205.	110.	17 OCT 1900	40	0.00	0.00	0.00	1302.	1200.
16 OCT 1300	10	0.08	0.06	0.02	255.	131.	17 OCT 2000	41	0.00	0.00	0.00	1237.	1128.
16 OCT 1400	11	0.00	0.00	0.00	306.	178.	17 OCT 2100	42	0.00	0.00	0.00	1170.	1077.
16 OCT 1500	12	0.01	0.01	0.00	349.	286.	17 OCT 2200	43	0.00	0.00	0.00	1103.	1035.
16 OCT 1600	13	0.08	0.06	0.02	382.	396.	17 OCT 2300	44	0.00	0.00	0.00	1037.	990.
16 OCT 1700	14	0.10	0.06	0.04	411.	470.	18 OCT 0000	45	0.00	0.00	0.00	975.	945.
16 OCT 1800	15	0.08	0.06	0.02	435.	534.	18 OCT 0100	46	0.00	0.00	0.00	916.	864.
16 OCT 1900	16	0.00	0.00	0.00	459.	577.	18 OCT 0200	47	0.00	0.00	0.00	861.	838.
16 OCT 2000	17	0.08	0.06	0.02	485.	628.	18 OCT 0300	48	0.00	0.00	0.00	810.	791.
16 OCT 2100	18	0.18	0.06	0.12	519.	686.	18 OCT 0400	49	0.00	0.00	0.00	761.	746.
16 OCT 2200	19	0.08	0.06	0.02	572.	743.	18 OCT 0500	50	0.00	0.00	0.00	715.	701.
16 OCT 2300	20	0.10	0.06	0.04	638.	802.	18 OCT 0600	51	0.00	0.00	0.00	672.	662.
17 OCT 0000	21	0.16	0.06	0.11	721.	906.	18 OCT 0700	52	0.00	0.00	0.00	632.	628.
17 OCT 0100	22	0.24	0.06	0.19	833.	1074.	18 OCT 0800	53	0.00	0.00	0.00	594.	601.
17 OCT 0200	23	0.16	0.06	0.11	982.	1155.	18 OCT 0900	54	0.00	0.00	0.00	564.	575.
17 OCT 0300	24	0.10	0.06	0.04	1159.	1221.	18 OCT 1000	55	0.00	0.00	0.00	545.	555.
17 OCT 0400	25	0.10	0.06	0.04	1350.	1332.	18 OCT 1100	56	0.00	0.00	0.00	527.	534.
17 OCT 0500	26	0.08	0.06	0.02	1530.	1431.	18 OCT 1200	57	0.00	0.00	0.00	509.	518.
17 OCT 0600	27	0.01	0.01	0.00	1680.	1530.	18 OCT 1300	58	0.00	0.00	0.00	492.	499.
17 OCT 0700	28	0.08	0.06	0.02	1792.	1650.	18 OCT 1400	59	0.00	0.00	0.00	476.	482.
17 OCT 0800	29	0.08	0.06	0.02	1855.	1761.	18 OCT 1500	60	0.00	0.00	0.00	460.	468.
17 OCT 0900	30	0.00	0.00	0.00	1863.	1821.	18 OCT 1600	61	0.00	0.00	0.00	444.	458.
17 OCT 1000	31	0.08	0.06	0.02	1829.	1844.	18 OCT 1700	62	0.00	0.00	0.00	430.	450.

TOTAL RAINFALL = 2.52, TOTAL LOSS = 1.44, TOTAL EXCESS = 1.08

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	61.00-HR
1863.	29.00	(CFS)	1803.	1430.	835.	835.
		(INCHES)	0.216	0.686	1.018	1.018
		(AC-FT)	894.	2835.	4208.	4208.

CUMULATIVE AREA = 77.50 SQ MI


STATION ELMIRA

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                                               HEC-1 INPUT                                                    PAGE  1
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        NEWTOWN CREEK 11-04-77
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT     60 03NOV77     2300       68
  4           IO      1       2
  5           OU     10      35
  6           PG     EL    2.24
  7           PG     SP    2.28
  8           PG     AF
  9           PI    .00     .00     .00     .10     .10     .00     .00     .10     .30     .10
 10           PI    .00     .10     .00     .10     .00     .20     .20     .20     .00     .10
 11           PG    HOR
 12           PI    .00     .10     .10     .10     .10     .00     .00     .00     .00     .00
 13           PI    .00     .00     .10     .00     .10     .00     .00     .00     .00     .00

 14           KK  ELMIRA
 15           QO     54      54      54      55      57      58      63      66      68      89
 16           QO    101     138     204     212     307     329     465     571     350    1083
 17           QO   1248    1368    1497    1653    1785    1842    1800    1710    1596    1446
 18           QO   1296    1161    1053     969     900     844     796     754     718     679
 19           QO    637     599     571     542     525     506     486     475     465     451
 20           QO    439     428     420     409     400     391     381     373     367     356
 21           QO    340     329     323     316     310     303     299     292       0       0
 22           PT     EL      SP      AF     HOR
 23           PW    .46     .06     .47     .01
 24           PR     AF     HOR
 25           PW    .85     .15
 26           BA   77.5      0.
 27           BF    54.    500.  1.0346
 28           UC   -10.    -13.
 29           LU    -.4    -.05
 30           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 10 THROUGH 35)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.714		16.33			
COMPUTED HYDROGRAPH	25830.	0.516	993.	25.81	9.48	1829.	25.00
OBSERVED HYDROGRAPH	25673.	0.513	987.	25.74	9.41	1842.	25.00
DIFFERENCE	157.	0.003	6.	0.07	0.07	-13.	0.00
PERCENT DIFFERENCE	0.61				0.78	-0.70	

STANDARD ERROR	54.	AVERAGE ABSOLUTE ERROR	46.
OBJECTIVE FUNCTION	54.	AVERAGE PERCENT ABSOLUTE ERROR	9.19

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 68)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.714		16.33			
COMPUTED HYDROGRAPH	39765.	0.795	585.	33.22	16.89	1829.	25.00
OBSERVED HYDROGRAPH	41726.	0.834	614.	34.17	17.84	1842.	25.00
DIFFERENCE	-1961.	-0.039	-29.	-0.95	-0.95	-13.	0.00
PERCENT DIFFERENCE	-4.70				-5.32	-0.70	

STANDARD ERROR	57.	AVERAGE ABSOLUTE ERROR	48.
OBJECTIVE FUNCTION	60.	AVERAGE PERCENT ABSOLUTE ERROR	12.74

UNIT HYDROGRAPH
68 END-OF-PERIOD ORDINATES

103.	386.	784.	1251.	1758.	2231.	2597.	2836.	2931.	2826.
2604.	2396.	2202.	2025.	1861.	1711.	1573.	1446.	1330.	1223.
1124.	1033.	950.	873.	803.	738.	679.	624.	574.	527.
485.	446.	410.	377.	346.	318.	293.	269.	247.	228.
209.	192.	177.	163.	149.	137.	126.	116.	107.	98.
90.	83.	76.	70.	64.	59.	54.	50.	46.	42.
39.	36.	33.	30.	28.	26.	24.	22.		

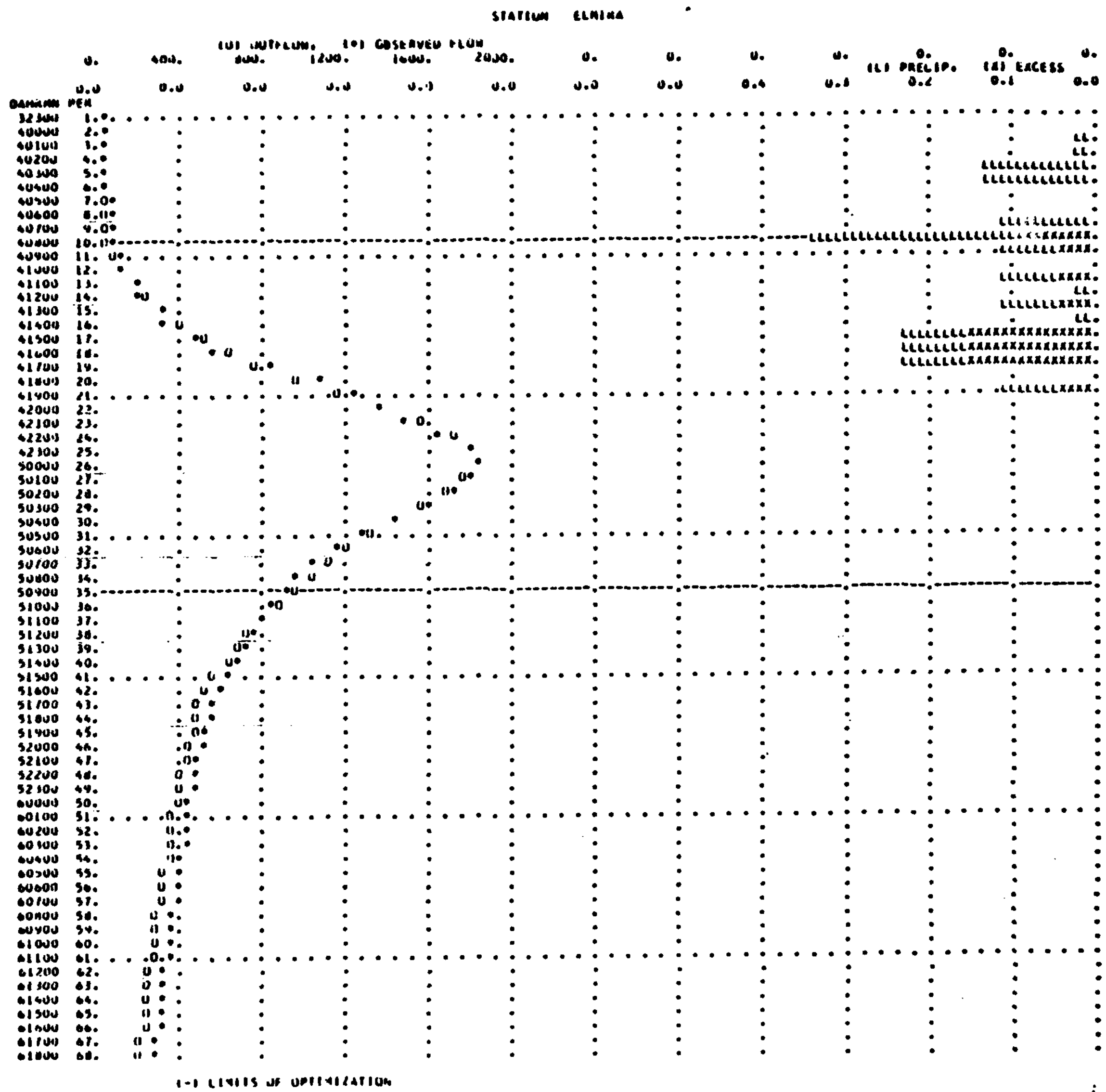
HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
3 NOV 2300	1	0.00	0.00	0.00	54.	54.
4 NOV 0000	2	0.00	0.00	0.00	52.	54.
4 NOV 0100	3	0.02	0.02	0.00	50.	54.
4 NOV 0200	4	0.02	0.02	0.00	49.	55.
4 NOV 0300	5	0.13	0.13	0.00	47.	57.
4 NOV 0400	6	0.13	0.13	0.00	46.	58.
4 NOV 0500	7	0.00	0.00	0.00	44.	63.
4 NOV 0600	8	0.00	0.00	0.00	43.	66.
4 NOV 0700	9	0.11	0.11	0.00	41.	68.
4 NOV 0800	10	0.34	0.25	0.09	49.	89.
4 NOV 0900	11	0.11	0.07	0.04	76.	101.
4 NOV 1000	12	0.00	0.00	0.00	122.	138.
4 NOV 1100	13	0.11	0.07	0.04	182.	204.
4 NOV 1200	14	0.02	0.02	0.00	256.	212.
4 NOV 1300	15	0.11	0.07	0.04	338.	307.
4 NOV 1400	16	0.02	0.02	0.00	419.	329.
4 NOV 1500	17	0.23	0.07	0.15	507.	465.
4 NOV 1600	18	0.23	0.07	0.15	622.	571.
4 NOV 1700	19	0.23	0.07	0.15	773.	853.
4 NOV 1800	20	0.00	0.00	0.00	954.	1083.
4 NOV 1900	21	0.11	0.07	0.04	1161.	1248.
4 NOV 2000	22	0.00	0.00	0.00	1374.	1368.
4 NOV 2100	23	0.00	0.00	0.00	1568.	1497.
4 NOV 2200	24	0.00	0.00	0.00	1719.	1653.
4 NOV 2300	25	0.00	0.00	0.00	1810.	1785.
5 NOV 0000	26	0.00	0.00	0.00	1829.	1842.
5 NOV 0100	27	0.00	0.00	0.00	1776.	1800.
5 NOV 0200	28	0.00	0.00	0.00	1674.	1710.
5 NOV 0300	29	0.00	0.00	0.00	1554.	1596.
5 NOV 0400	30	0.00	0.00	0.00	1436.	1446.
5 NOV 0500	31	0.00	0.00	0.00	1321.	1296.
5 NOV 0600	32	0.00	0.00	0.00	1215.	1161.
5 NOV 0700	33	0.00	0.00	0.00	1118.	1053.
5 NOV 0800	34	0.00	0.00	0.00	1029.	969.
5 NOV 0900	35	0.00	0.00	0.00	947.	900.
5 NOV 1000	36	0.00	0.00	0.00	871.	844.
5 NOV 1100	37	0.00	0.00	0.00	802.	796.
5 NOV 1200	38	0.00	0.00	0.00	738.	754.
5 NOV 1300	39	0.00	0.00	0.00	679.	718.
5 NOV 1400	40	0.00	0.00	0.00	625.	679.
5 NOV 1500	41	0.00	0.00	0.00	575.	637.
5 NOV 1600	42	0.00	0.00	0.00	530.	599.
5 NOV 1700	43	0.00	0.00	0.00	495.	571.
5 NOV 1800	44	0.00	0.00	0.00	478.	542.
5 NOV 1900	45	0.00	0.00	0.00	462.	525.
5 NOV 2000	46	0.00	0.00	0.00	447.	506.
5 NOV 2100	47	0.00	0.00	0.00	432.	486.
5 NOV 2200	48	0.00	0.00	0.00	418.	475.
5 NOV 2300	49	0.00	0.00	0.00	404.	465.
6 NOV 0000	50	0.00	0.00	0.00	390.	451.
6 NOV 0100	51	0.00	0.00	0.00	377.	439.
6 NOV 0200	52	0.00	0.00	0.00	364.	428.
6 NOV 0300	53	0.00	0.00	0.00	352.	420.
6 NOV 0400	54	0.00	0.00	0.00	341.	409.
6 NOV 0500	55	0.00	0.00	0.00	329.	400.
6 NOV 0600	56	0.00	0.00	0.00	318.	391.
6 NOV 0700	57	0.00	0.00	0.00	307.	381.
6 NOV 0800	58	0.00	0.00	0.00	297.	373.
6 NOV 0900	59	0.00	0.00	0.00	287.	367.
6 NOV 1000	60	0.00	0.00	0.00	278.	356.
6 NOV 1100	61	0.00	0.00	0.00	268.	340.
6 NOV 1200	62	0.00	0.00	0.00	259.	329.
6 NOV 1300	63	0.00	0.00	0.00	251.	323.
6 NOV 1400	64	0.00	0.00	0.00	242.	316.
6 NOV 1500	65	0.00	0.00	0.00	234.	310.
6 NOV 1600	66	0.00	0.00	0.00	226.	303.
6 NOV 1700	67	0.00	0.00	0.00	219.	299.
6 NOV 1800	68	0.00	0.00	0.00	212.	292.

TOTAL RAINFALL = 1.93, TOTAL LOSS = 1.21, TOTAL EXCESS = 0.71

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	67.00-HR
1829.	25.00	(CFS)	1728.	1172.	592.	592.
		(INCHES)	0.207	0.563	0.792	0.792
		(AC-FT)	857.	2325.	3275.	3275.

CUMULATIVE AREA = 77.53 SQ MI


STATION ELMIRA
(O) OUTFLOW, (*) OBSERVED FLOW
0. 400. 800. 1200. 1600. 2000.
(L) PRECIP.
(X) EXCESS
DAMHAN PER
(-) LIMITS OF OPTIMIZATION

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID      NEWTOWN CREEK 11-08-77
  2           ID      UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT     60 07NOV77    0500      68
  4           IO      1       2
  5           OU      1      40
  6           PG     EL     .74
  7           PG     SP    1.29
  8           PG     AF
  9           PI    .10     .00     .00     .10     .00     .10     .00     .00     .20     .00
 10           PI    .10     .00     .10     .10     .10     .00     .00     .00     .00     .00
 11           PI    .00     .00     .20     .20     .10     .00     .00     .00     .00     .00
 12           PG    HOR
 13           PI    .10     .00     .00     .10     .10     .10     .00     .00     .10     .00
 14           PI    .00     .10     .00     .00     .00     .00     .00     .00     .00     .10
 15           PI    .10     .10     .10     .10     .00     .00     .00     .00     .00     .00

 16           KK  ELMIRA
 17           QO    248     246     246     246     248     256     270     290     321     349
 18           QO    391     477     560     656     816     939     981     984     984     972
 19           QO    945     894     836     777     760     766     930    1062    1206    1296
 20           QO   1383    1428    1434    1392    1287    1158    1048     942     858     799
 21           QO    752     712     679     651     628     607     589     565     542     525
 22           QO    508     501     492     480     468     452     444     431     417     406
 23           QO    398     389     382     376     367     360     354     349       0       0
 24           PT     EL      SP      AF     HCK
 25           PW    .46     .06     .47     .01
 26           PR     AF     HOR
 27           PW    .85     .15
 28           BA   77.5      0.
 29           BF   248.    410.  1.0346
 30           UC    -8.    -15.
 31           LU   -.50    -.05
 32           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 1 THROUGH 40)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.736		17.04			
COMPUTED HYDROGRAPH	31599.	0.632	790.	25.24	8.20	1351.	31.00
OBSERVED HYDROGRAPH	31697.	0.634	792.	25.16	8.11	1434.	32.00
DIFFERENCE	-98.	-0.002	-2.	0.08	0.08	-83.	-1.00
PERCENT DIFFERENCE	-0.31				1.05	-5.79	

STANDARD ERROR	81.	AVERAGE ABSOLUTE ERROR	62.
OBJECTIVE FUNCTION	85.	AVERAGE PERCENT ABSOLUTE ERROR	8.22

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 68)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.736		17.04			
COMPUTED HYDROGRAPH	43047.	0.861	633.	32.25	15.21	1351.	31.00
OBSERVED HYDROGRAPH	45521.	0.910	669.	33.52	16.47	1434.	32.00
DIFFERENCE	-2474.	-0.049	-36.	-1.27	-1.27	-83.	-1.00
PERCENT DIFFERENCE	-5.44				-7.69	-5.79	

STANDARD ERROR	87.	AVERAGE ABSOLUTE ERROR	72.
OBJECTIVE FUNCTION	90.	AVERAGE PERCENT ABSOLUTE ERROR	13.13

UNIT HYDROGRAPH
82 END-OF-PERIOD ORDINATES

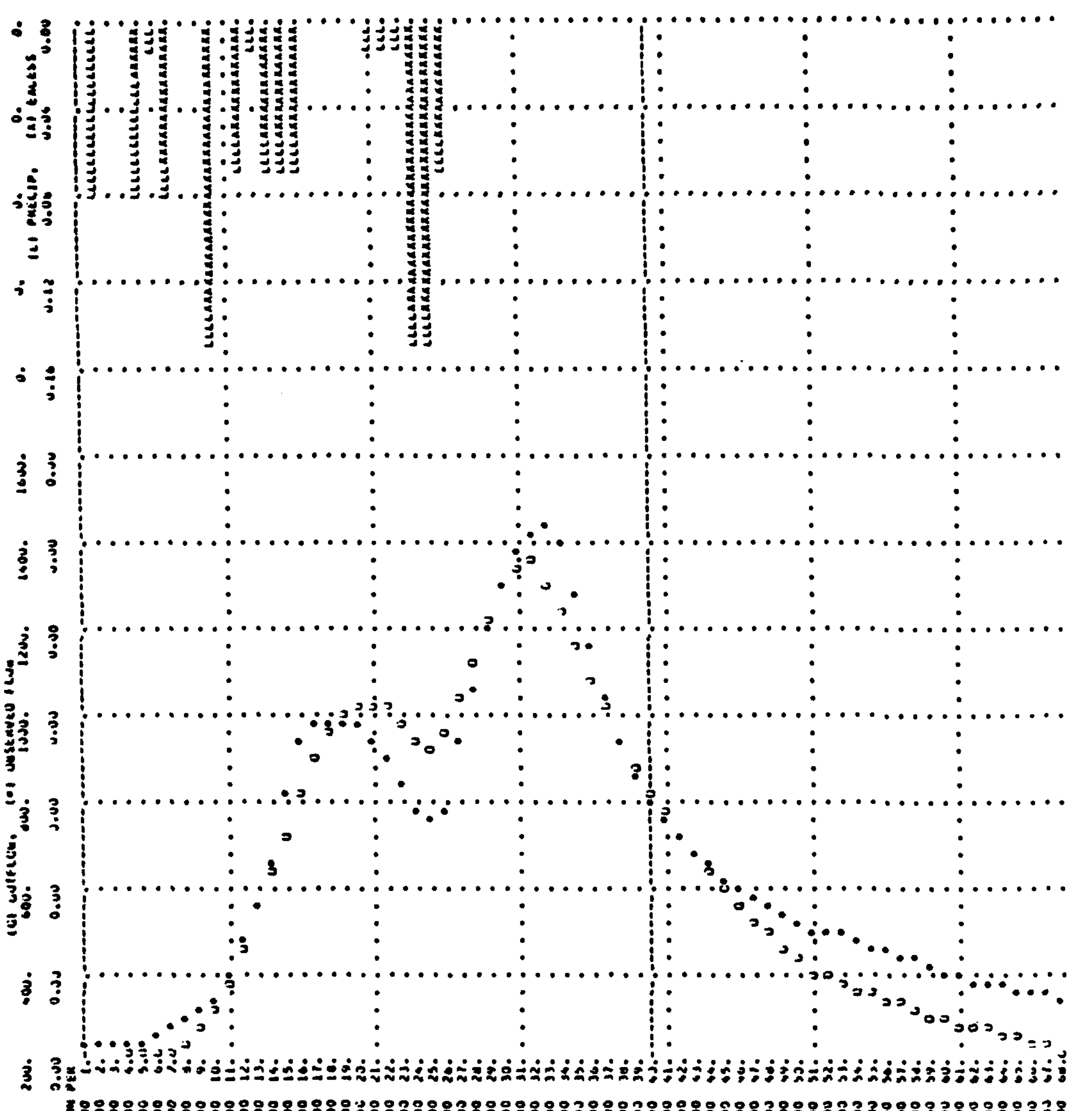
96.	363.	743.	1192.	1667.	2087.	2394.	2571.	2562.	2417.
2250.	2106.	1966.	1835.	1713.	1599.	1493.	1394.	1301.	1214.
1134.	1058.	988.	922.	861.	803.	750.	700.	654.	610.
570.	532.	496.	463.	432.	404.	377.	352.	328.	307.
286.	267.	249.	233.	217.	203.	189.	177.	165.	154.
144.	134.	125.	117.	109.	102.	95.	89.	83.	77.
72.	67.	63.	59.	55.	51.	48.	45.	42.	39.
36.	34.	32.	30.	28.	26.	24.	22.	21.	20.
18.	17.								

HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7 NOV 0500	1	0.00	0.00	0.00	248.	248.	8 NOV 1500	35	0.00	0.00	0.00	1155.	1287.
7 NOV 0600	2	0.00	0.00	0.00	240.	246.	8 NOV 1600	36	0.00	0.00	0.00	1081.	1158.
7 NOV 0700	3	0.00	0.00	0.00	232.	246.	8 NOV 1700	37	0.00	0.00	0.00	1012.	1048.
7 NOV 0800	4	0.00	0.00	0.00	224.	246.	8 NOV 1800	38	0.00	0.00	0.00	947.	942.
7 NOV 0900	5	0.08	0.06	0.02	219.	248.	8 NOV 1900	39	0.00	0.00	0.00	886.	858.
7 NOV 1000	6	0.01	0.01	0.00	218.	256.	8 NOV 2000	40	0.00	0.00	0.00	829.	799.
7 NOV 1100	7	0.08	0.02	0.06	226.	270.	8 NOV 2100	41	0.00	0.00	0.00	776.	752.
7 NOV 1200	8	0.00	0.00	0.00	247.	290.	8 NOV 2200	42	0.00	0.00	0.00	727.	712.
7 NOV 1300	9	0.00	0.00	0.00	275.	321.	8 NOV 2300	43	0.00	0.00	0.00	680.	679.
7 NOV 1400	10	0.15	0.02	0.13	323.	349.	9 NOV 0000	44	0.00	0.00	0.00	637.	651.
7 NOV 1500	11	0.00	0.00	0.00	386.	391.	9 NOV 0100	45	0.00	0.00	0.00	597.	628.
7 NOV 1600	12	0.07	0.02	0.05	466.	477.	9 NOV 0200	46	0.00	0.00	0.00	559.	607.
7 NOV 1700	13	0.01	0.01	0.00	552.	563.	9 NOV 0300	47	0.00	0.00	0.00	523.	589.
7 NOV 1800	14	0.07	0.02	0.05	641.	656.	9 NOV 0400	48	0.00	0.00	0.00	490.	565.
7 NOV 1900	15	0.07	0.02	0.05	727.	816.	9 NOV 0500	49	0.00	0.00	0.00	459.	542.
7 NOV 2000	16	0.07	0.02	0.05	812.	939.	9 NOV 0600	50	0.00	0.00	0.00	430.	525.
7 NOV 2100	17	0.00	0.00	0.00	894.	981.	9 NOV 0700	51	0.00	0.00	0.00	407.	508.
7 NOV 2200	18	0.00	0.00	0.00	958.	984.	9 NOV 0800	52	0.00	0.00	0.00	393.	501.
7 NOV 2300	19	0.00	0.00	0.00	1000.	984.	9 NOV 0900	53	0.00	0.00	0.00	380.	492.
8 NOV 0000	20	0.00	0.00	0.00	1025.	972.	9 NOV 1000	54	0.00	0.00	0.00	367.	480.
8 NOV 0100	21	0.01	0.01	0.00	1029.	945.	9 NOV 1100	55	0.00	0.00	0.00	355.	468.
8 NOV 0200	22	0.01	0.01	0.00	1013.	894.	9 NOV 1200	56	0.00	0.00	0.00	343.	452.
8 NOV 0300	23	0.01	0.01	0.00	976.	836.	9 NOV 1300	57	0.00	0.00	0.00	332.	444.
8 NOV 0400	24	0.15	0.02	0.13	937.	777.	9 NOV 1400	58	0.00	0.00	0.00	320.	431.
8 NOV 0500	25	0.15	0.02	0.13	929.	760.	9 NOV 1500	59	0.00	0.00	0.00	310.	417.
8 NOV 0600	26	0.07	0.02	0.05	964.	788.	9 NOV 1600	60	0.00	0.00	0.00	299.	408.
8 NOV 0700	27	0.00	0.00	0.00	1036.	930.	9 NOV 1700	61	0.00	0.00	0.00	289.	398.
8 NOV 0800	28	0.00	0.00	0.00	1129.	1062.	9 NOV 1800	62	0.00	0.00	0.00	280.	389.
8 NOV 0900	29	0.00	0.00	0.00	1225.	1200.	9 NOV 1900	63	0.00	0.00	0.00	270.	382.
8 NOV 1000	30	0.00	0.00	0.00	1304.	1296.	9 NOV 2000	64	0.00	0.00	0.00	261.	376.
8 NOV 1100	31	0.00	0.00	0.00	1350.	1383.	9 NOV 2100	65	0.00	0.00	0.00	253.	367.
8 NOV 1200	32	0.00	0.00	0.00	1351.	1428.	9 NOV 2200	66	0.00	0.00	0.00	244.	360.
8 NOV 1300	33	0.00	0.00	0.00	1306.	1434.	9 NOV 2300	67	0.00	0.00	0.00	236.	354.
8 NOV 1400	34	0.00	0.00	0.00	1233.	1392.	10 NOV 0000	68	0.00	0.00	0.00	228.	349.

TOTAL RAINFALL = 1.09, TOTAL LOSS = 0.35, TOTAL EXCESS = 0.74

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	67.00-HR
1351.	31.00	(CFS)	1289.	1065.	639.	639.
		(INCHES)	0.155	0.511	0.856	0.856
		(AC-FT)	639.	2112.	3538.	3538.


STATION ELMIRA
(-) LIMITS OF OPTIMIZATION

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                                   HEC-1 INPUT                                                          PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID       NEWTOWN CREEK 11-11-77
  2           ID       UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT      60 10NOV77    1300      48
  4           IO       1       2
  5           OU       5      25
  6           PG      EL     .50
  7           PG      SP     .91
  8           PG      AF
  9           PI     .00     .00     .10     .10     .10     .20     .00     .10     .10     .20
 10           PI     .00     .10     .00     .00     .00     .00     .00     .00     .00     .00
 11           PG     HOR
 12           PI     .00     .10     .00     .10     .10     .10     .10     .10     .00     .00
 13           PI     .10     .00     .00     .00     .00     .00     .00     .00     .00     .00

 14           KK  ELMIRA
 15           QO     288     285     282     277     277     282     294     321     362     422
 16           QO     584     830    1026    1134    1206    1278    1311    1311    1284    1224
 17           QO    1116     993     880     794     726     676     637     602     591     555
 18           QO     537     520     508     494     480     468     451     437     424     415
 19           QO     404     398     389     382     375     367     360     354       0       0
 20           PT      EL      SP      AF     HOR
 21           PW     .46     .06     .47     .01
 22           PR      AF     HOR
 23           PW     .85     .15
 24           BA    77.5      0.
 25           BF    266.    410.  1.0346
 26           UC     -8.    -15.
 27           LU    -.09    -.01
 28           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 25)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.457		9.24			
COMPUTED HYDROGRAPH	17652.	0.353	841.	16.90	7.66	1287.	16.00
OBSERVED HYDROGRAPH	17655.	0.353	841.	16.81	7.57	1311.	16.00
DIFFERENCE	-3.	-0.000	-0.	0.08	0.08	-24.	0.00
PERCENT DIFFERENCE	-0.02				1.11	-1.81	

STANDARD ERROR	51.	AVERAGE ABSOLUTE ERROR	44.
OBJECTIVE FUNCTION	51.	AVERAGE PERCENT ABSOLUTE ERROR	6.62

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 48)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.457		9.24			
COMPUTED HYDROGRAPH	28841.	0.577	601.	22.64	13.40	1287.	16.00
OBSERVED HYDROGRAPH	29611.	0.592	617.	23.18	13.94	1311.	16.00
DIFFERENCE	-770.	-0.015	-16.	-0.54	-0.54	-24.	0.00
PERCENT DIFFERENCE	-2.60				-3.87	-1.81	

STANDARD ERROR	56.	AVERAGE ABSOLUTE ERROR	48.
OBJECTIVE FUNCTION	57.	AVERAGE PERCENT ABSOLUTE ERROR	10.29

UNIT HYDROGRAPH
76 END-OF-PERIOD ORDINATES

119.	431.	882.	1412.	1947.	2387.	2680.	2780.	2673.	2482.
2304.	2140.	1987.	1845.	1713.	1590.	1476.	1371.	1273.	1182.
1097.	1019.	946.	878.	816.	757.	703.	653.	606.	563.
523.	485.	450.	418.	388.	361.	335.	311.	289.	268.
249.	231.	215.	199.	185.	172.	159.	148.	137.	128.
113.	110.	102.	95.	88.	82.	76.	70.	65.	61.
56.	52.	49.	45.	42.	39.	36.	34.	31.	29.
27.	25.	23.	22.	20.	19.				

HYDROGRAPH AT STATION ELMIRA

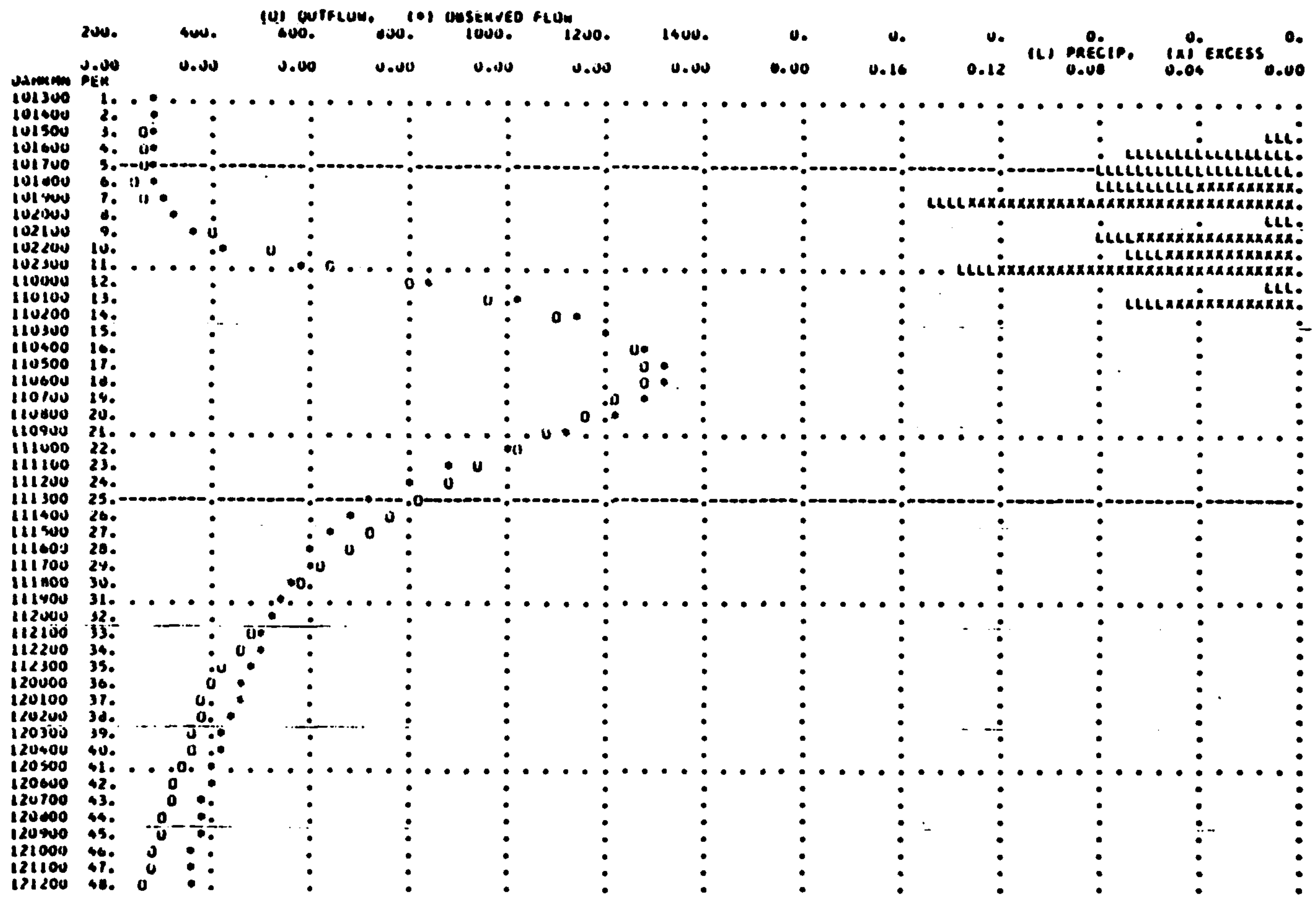
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
10 NOV 1300	1	0.00	0.00	0.00	288.	288.	11 NOV 1300	25	0.00	0.00	0.00	823.	726.
10 NOV 1400	2	0.00	0.00	0.00	278.	285.	11 NOV 1400	26	0.00	0.00	0.00	769.	676.
10 NOV 1500	3	0.01	0.01	0.00	269.	282.	11 NOV 1500	27	0.00	0.00	0.00	719.	637.
10 NOV 1600	4	0.07	0.07	0.00	260.	277.	11 NOV 1600	28	0.00	0.00	0.00	672.	602.
10 NOV 1700	5	0.08	0.08	0.00	251.	277.	11 NOV 1700	29	0.00	0.00	0.00	628.	591.
10 NOV 1800	6	0.08	0.04	0.04	248.	282.	11 NOV 1800	30	0.00	0.00	0.00	588.	555.
10 NOV 1900	7	0.15	0.02	0.13	268.	294.	11 NOV 1900	31	0.00	0.00	0.00	550.	537.
10 NOV 2000	8	0.01	0.01	0.00	320.	321.	11 NOV 2000	32	0.00	0.00	0.00	514.	520.
10 NOV 2100	9	0.08	0.02	0.06	400.	362.	11 NOV 2100	33	0.00	0.00	0.00	481.	508.
10 NOV 2200	10	0.07	0.02	0.05	510.	422.	11 NOV 2200	34	0.00	0.00	0.00	451.	494.
10 NOV 2300	11	0.14	0.02	0.12	650.	584.	11 NOV 2300	35	0.00	0.00	0.00	422.	480.
11 NOV 0000	12	0.01	0.01	0.00	807.	830.	12 NOV 0000	36	0.00	0.00	0.00	402.	468.
11 NOV 0100	13	0.07	0.02	0.05	963.	1026.	12 NOV 0100	37	0.00	0.00	0.00	389.	451.
11 NOV 0200	14	0.00	0.00	0.00	1100.	1134.	12 NOV 0200	38	0.00	0.00	0.00	376.	437.
11 NOV 0300	15	0.00	0.00	0.00	1200.	1206.	12 NOV 0300	39	0.00	0.00	0.00	363.	424.
11 NOV 0400	16	0.00	0.00	0.00	1262.	1278.	12 NOV 0400	40	0.00	0.00	0.00	351.	415.
11 NOV 0500	17	0.00	0.00	0.00	1287.	1311.	12 NOV 0500	41	0.00	0.00	0.00	339.	404.
11 NOV 0600	18	0.00	0.00	0.00	1271.	1311.	12 NOV 0600	42	0.00	0.00	0.00	328.	398.
11 NOV 0700	19	0.00	0.00	0.00	1221.	1284.	12 NOV 0700	43	0.00	0.00	0.00	317.	389.
11 NOV 0800	20	0.00	0.00	0.00	1154.	1224.	12 NOV 0800	44	0.00	0.00	0.00	307.	382.
11 NOV 0900	21	0.00	0.00	0.00	1082.	1116.	12 NOV 0900	45	0.00	0.00	0.00	296.	375.
11 NOV 1000	22	0.00	0.00	0.00	1010.	993.	12 NOV 1000	46	0.00	0.00	0.00	286.	367.
11 NOV 1100	23	0.00	0.00	0.00	943.	880.	12 NOV 1100	47	0.00	0.00	0.00	277.	360.
11 NOV 1200	24	0.00	0.00	0.00	881.	794.	12 NOV 1200	48	0.00	0.00	0.00	268.	354.

TOTAL RAINFALL = 0.76, TOTAL LOSS = 0.30, TOTAL EXCESS = 0.46

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	47.00-HR
1287.	16.00	(CFS)	1228.	877.	808.	808.
		(INCHES)	0.147	0.421	0.571	0.571
		(AC-FT)	609.	1740.	2361.	2361.

CUMULATIVE AREA = 77.50 SQ MI

STATION ELMIRA



(-) LIMITS OF OPTIMIZATION

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  1           ID        NEWTOWN CREEK 10-06-79
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT      60 05OCT79    0700      48
  4           IO       1       2
  5           OU       5      30
  6           PG      EL    1.95
  7           PG      SP    2.35
  8           PG      AF
  9           PI     .00     .00     .10     .00     .10     .30     .10     .00     .10     .40
 10           PI     .10     .50     .00     .00     .40     .10     .10     .10     .00     .00
 11           PG     HOR
 12           PI     .10     .00     .00     .10     .20     .30     .10     .20     .10     .20
 13           PI     .10     .00     .10     .20     .10     .10     .00     .10     .00     .00

 14           KK  ELMIRA
 15           QO      41      41      41      41      42      46      57      63      77     102
 16           QO     155     419     745     946    1043    1103    1164    1186    1217    1277
 17           QO    1336    1375    1348    1262    1112     948     811     691     608     537
 18           QO     483     440     409     379     354     332     315     299     283     270
 19           QO     259     248     240     232     224     218     212     206       0       0
 20           PT      EL      SP      AF     HOR
 21           PW     .46     .06     .47     .01
 22           PR      AF     HOR
 23           PW     .85     .15
 24           BA    77.5      0.
 25           BF     41.    250.  1.0346
 26           UC    -9.0    -13.
 27           LU     -.5    -.08
 28           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.656		13.28			
COMPUTED HYDROGRAPH	19799.	0.396	761.	20.82	7.54	1424.	17.00
OBSERVED HYDROGRAPH	19670.	0.393	757.	20.48	7.20	1375.	21.00
DIFFERENCE	129.	0.003	5.	0.34	0.34	49.	-4.00
PERCENT DIFFERENCE	0.65				4.66	3.57	

STANDARD ERROR 130. AVERAGE ABSOLUTE ERROR 105.
OBJECTIVE FUNCTION 140. AVERAGE PERCENT ABSOLUTE ERROR 21.81

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 48)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.656		13.28			
COMPUTED HYDROGRAPH	28626.	0.572	596.	25.95	12.67	1424.	17.00
OBSERVED HYDROGRAPH	25237.	0.505	526.	24.15	10.87	1375.	21.00
DIFFERENCE	3389.	0.068	71.	1.80	1.80	49.	-4.00
PERCENT DIFFERENCE	13.43				16.54	3.57	

STANDARD ERROR 150. AVERAGE ABSOLUTE ERROR 125.
OBJECTIVE FUNCTION 162. AVERAGE PERCENT ABSOLUTE ERROR 37.43

UNIT HYDROGRAPH
100 END-OF-PERIOD ORDINATES

434.	1506.	2306.	2400.	2282.	2162.	2048.	1940.	1838.	1741.
1650.	1563.	1481.	1403.	1329.	1259.	1193.	1130.	1070.	1014.
961.	910.	862.	817.	774.	733.	695.	658.	623.	591.
560.	530.	502.	476.	451.	427.	405.	383.	363.	344.
326.	309.	292.	277.	263.	249.	236.	223.	211.	200.
190.	180.	170.	161.	153.	145.	137.	130.	123.	117.
111.	105.	99.	94.	89.	84.	80.	76.	72.	68.
64.	61.	58.	55.	52.	49.	47.	44.	42.	40.
37.	36.	34.	32.	30.	29.	27.	26.	24.	23.
22.	21.	20.	19.	18.	17.	16.	15.	14.	13.

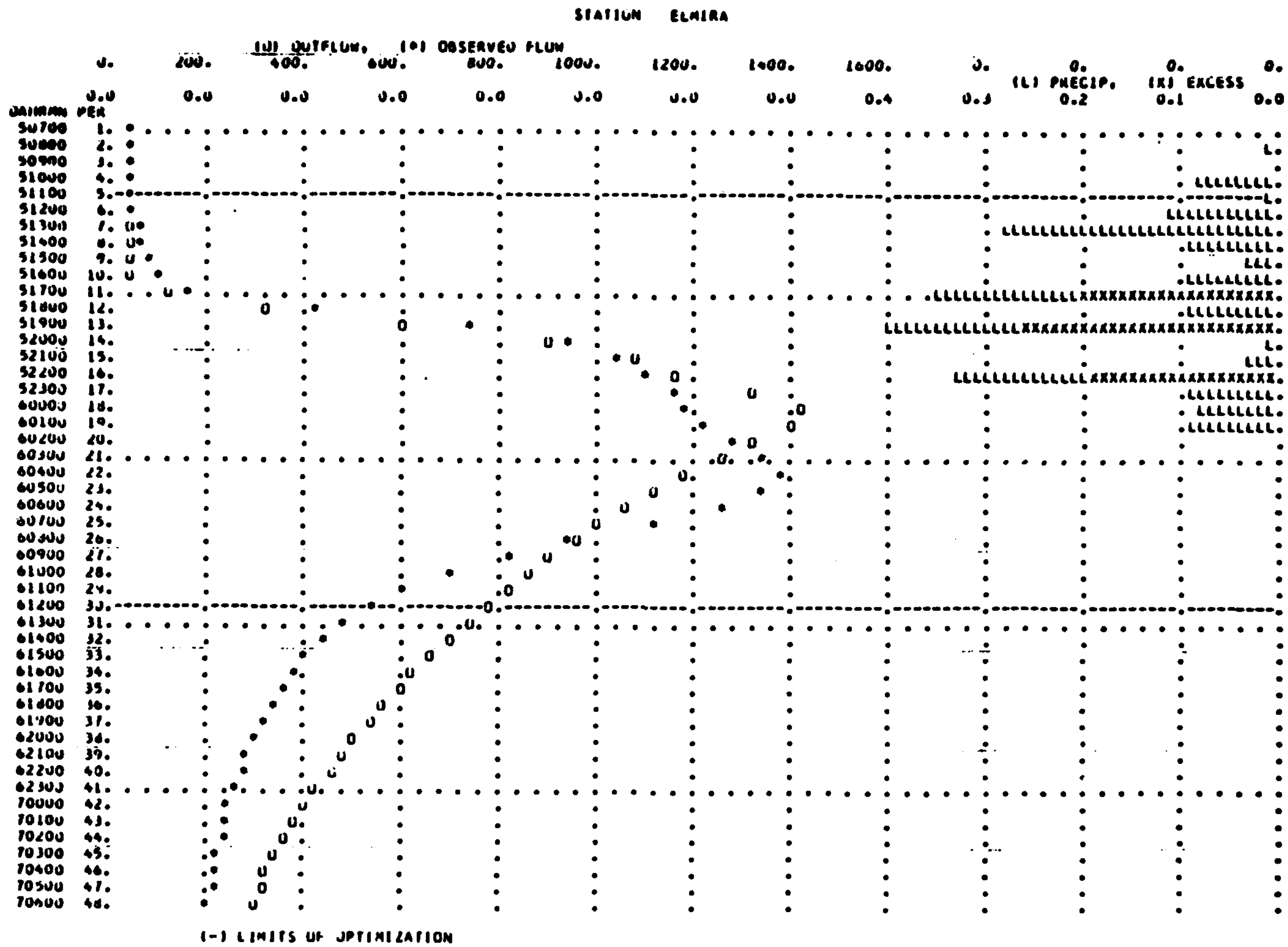
HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	URO	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	URO	RAIN	LOSS	EXCESS	COMP Q	OBS Q
5 OCT 0700	1	0.00	0.00	0.00	41.	41.	6 OCT 0700	25	0.00	0.00	0.00	1009.	1112.
5 OCT 0800	2	0.01	0.01	0.00	40.	41.	6 OCT 0800	26	0.00	0.00	0.00	956.	948.
5 OCT 0900	3	0.00	0.00	0.00	38.	41.	6 OCT 0900	27	0.00	0.00	0.00	906.	811.
5 OCT 1000	4	0.08	0.08	0.00	37.	41.	6 OCT 1000	28	0.00	0.00	0.00	859.	691.
5 OCT 1100	5	0.01	0.01	0.00	36.	42.	6 OCT 1100	29	0.00	0.00	0.00	814.	608.
5 OCT 1200	6	0.11	0.11	0.00	35.	46.	6 OCT 1200	30	0.00	0.00	0.00	772.	537.
5 OCT 1300	7	0.28	0.28	0.00	33.	57.	6 OCT 1300	31	0.00	0.00	0.00	731.	483.
5 OCT 1400	8	0.09	0.09	0.00	32.	63.	6 OCT 1400	32	0.00	0.00	0.00	693.	440.
5 OCT 1500	9	0.03	0.03	0.00	31.	77.	6 OCT 1500	33	0.00	0.00	0.00	657.	409.
5 OCT 1600	10	0.09	0.09	0.00	30.	102.	6 OCT 1600	34	0.00	0.00	0.00	623.	379.
5 OCT 1700	11	0.35	0.15	0.20	116.	155.	6 OCT 1700	35	0.00	0.00	0.00	590.	354.
5 OCT 1800	12	0.09	0.09	0.00	330.	419.	6 OCT 1800	36	0.00	0.00	0.00	559.	332.
5 OCT 1900	13	0.40	0.14	0.26	603.	745.	6 OCT 1900	37	0.00	0.00	0.00	530.	315.
5 OCT 2000	14	0.01	0.01	0.00	901.	946.	6 OCT 2000	38	0.00	0.00	0.00	502.	299.
5 OCT 2100	15	0.03	0.03	0.00	1083.	1043.	6 OCT 2100	39	0.00	0.00	0.00	476.	283.
5 OCT 2200	16	0.33	0.14	0.19	1169.	1103.	6 OCT 2200	40	0.00	0.00	0.00	451.	270.
5 OCT 2300	17	0.09	0.09	0.00	1321.	1164.	6 OCT 2300	41	0.00	0.00	0.00	428.	259.
6 OCT 0000	18	0.08	0.08	0.00	1424.	1186.	7 OCT 0000	42	0.00	0.00	0.00	405.	248.
6 OCT 0100	19	0.09	0.09	0.00	1393.	1217.	7 OCT 0100	43	0.00	0.00	0.00	384.	240.
6 OCT 0200	20	0.00	0.00	0.00	1320.	1277.	7 OCT 0200	44	0.00	0.00	0.00	364.	232.
6 OCT 0300	21	0.00	0.00	0.00	1251.	1336.	7 OCT 0300	45	0.00	0.00	0.00	345.	224.
6 OCT 0400	22	0.00	0.00	0.00	1185.	1375.	7 OCT 0400	46	0.00	0.00	0.00	327.	218.
6 OCT 0500	23	0.00	0.00	0.00	1123.	1348.	7 OCT 0500	47	0.00	0.00	0.00	310.	212.
6 OCT 0600	24	0.00	0.00	0.00	1065.	1262.	7 OCT 0600	48	0.00	0.00	0.00	294.	206.

TOTAL RAINFALL = 2.19, TOTAL LOSS = 1.53, TOTAL EXCESS = 0.66

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	47.00-HR
1424.	17.00	(CFS)	1314.	957.	605.	605.
		(INCHES)	0.158	0.459	0.569	0.569
		(AC-FT)	652.	1898.	2352.	2352.

CUMULATIVE AREA = 77.50 SQ MI


STATION ELMIRA
(U) OUTFLOW, (*) OBSERVED FLOW
0. 200. 400. 600. 800. 1000. 1200. 1400. 1600.
0. 0. 0. 0.
(L) PRECIP. (X) EXCESS
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.4 0.3 0.2 0.1 0.0
DAIMAN PER
50700 1.
50800 2.
50900 3.
51000 4.
51100 5.
51200 6.
51300 7.
51400 8.
51500 9.
51600 10.
51700 11.
51800 12.
51900 13.
52000 14.
52100 15.
52200 16.
52300 17.
60000 18.
60100 19.
60200 20.
60300 21.
60400 22.
60500 23.
60600 24.
60700 25.
60800 26.
60900 27.
61000 28.
61100 29.
61200 30.
61300 31.
61400 32.
61500 33.
61600 34.
61700 35.
61800 36.
61900 37.
62000 38.
62100 39.
62200 40.
62300 41.
70000 42.
70100 43.
70200 44.
70300 45.
70400 46.
70500 47.
70600 48.
(-) LIMITS OF OPTIMIZATION

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID       NEWTOWN CREEK 11-26-79
  2           ID       UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT      60 26NOV79    0600      41
  4           IO       1       2
  5           QU       1      25
  6           PG      EL    2.21
  7           PG      SP    1.59
  8           PG      AF
  9           PI     .00     .00     .10     .30     .30     .20     .20     .20     .20     .10
 10           PI     .00     .00     .10     .00     .00     .00     .00     .00     .00     .00
 11           PG     HOR
 12           PI     .00     .10     .40     .40     .40     .60     .10     .20     .00     .00
 13           PI     .00     .10     .00     .00     .00     .00     .00     .00     .00     .00

 14           KK  ELMIRA
 15           QO      78      77      79     118     155     467     805    1250    1381    1494
 16           QO    1652    1797    1911    2011    2099    2115    2036    1930    1763    1531
 17           QO    1295    1100     969     863     770     708     659     613     580     547
 18           QO     518     491     464     437     419     401     389     374     364     351
 19           QO     342       0       0       0       0       0       0       0       0       0
 20           PT      EL      SP      AF     HOR
 21           PW     .46     .06     .47     .01
 22           PR      AF     HOR
 23           PW     .85     .15
 24           BA    77.5      0.
 25           BF     78.    420.  1.0346
 26           UC    -10.    -13.
 27           LU     -.1    -.08
 28           ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 1 THROUGH 25)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.927		6.69			
COMPUTED HYDROGRAPH	29709.	0.594	1188.	15.66	8.97	2081.	12.00
OBSERVED HYDROGRAPH	29746.	0.595	1190.	15.22	8.53	2115.	15.00
DIFFERENCE	-37.	-0.001	-1.	0.44	0.44	-34.	-3.00
PERCENT DIFFERENCE	-0.12				5.17	-1.60	

STANDARD ERROR	205.	AVERAGE ABSOLUTE ERROR	171.
OBJECTIVE FUNCTION	211.	AVERAGE PERCENT ABSOLUTE ERROR	17.06

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 41)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.927		6.69			
COMPUTED HYDROGRAPH	41019.	0.820	1000.	20.25	13.56	2081.	12.00
OBSERVED HYDROGRAPH	37403.	0.748	912.	18.75	12.06	2115.	15.00
DIFFERENCE	3616.	0.072	88.	1.50	1.50	-34.	-3.00
PERCENT DIFFERENCE	9.67				12.44	-1.60	

STANDARD ERROR	219.	AVERAGE ABSOLUTE ERROR	194.
OBJECTIVE FUNCTION	231.	AVERAGE PERCENT ABSOLUTE ERROR	28.59

UNIT HYDROGRAPH
94 END-OF-PERIOD ORDINATES

144.	541.	1112.	1714.	2185.	2406.	2371.	2237.	2111.	1991.
1879.	1772.	1672.	1577.	1488.	1404.	1324.	1250.	1179.	1112.
1049.	990.	934.	881.	831.	784.	740.	698.	658.	621.
586.	553.	522.	492.	464.	438.	413.	390.	368.	347.
327.	309.	291.	275.	259.	245.	231.	218.	205.	194.
183.	172.	163.	153.	145.	137.	129.	122.	115.	108.
102.	96.	91.	86.	81.	76.	72.	68.	64.	60.
57.	54.	51.	48.	45.	43.	40.	38.	36.	34.
32.	30.	28.	27.	25.	24.	22.	21.	20.	19.
18.	17.	16.	15.						

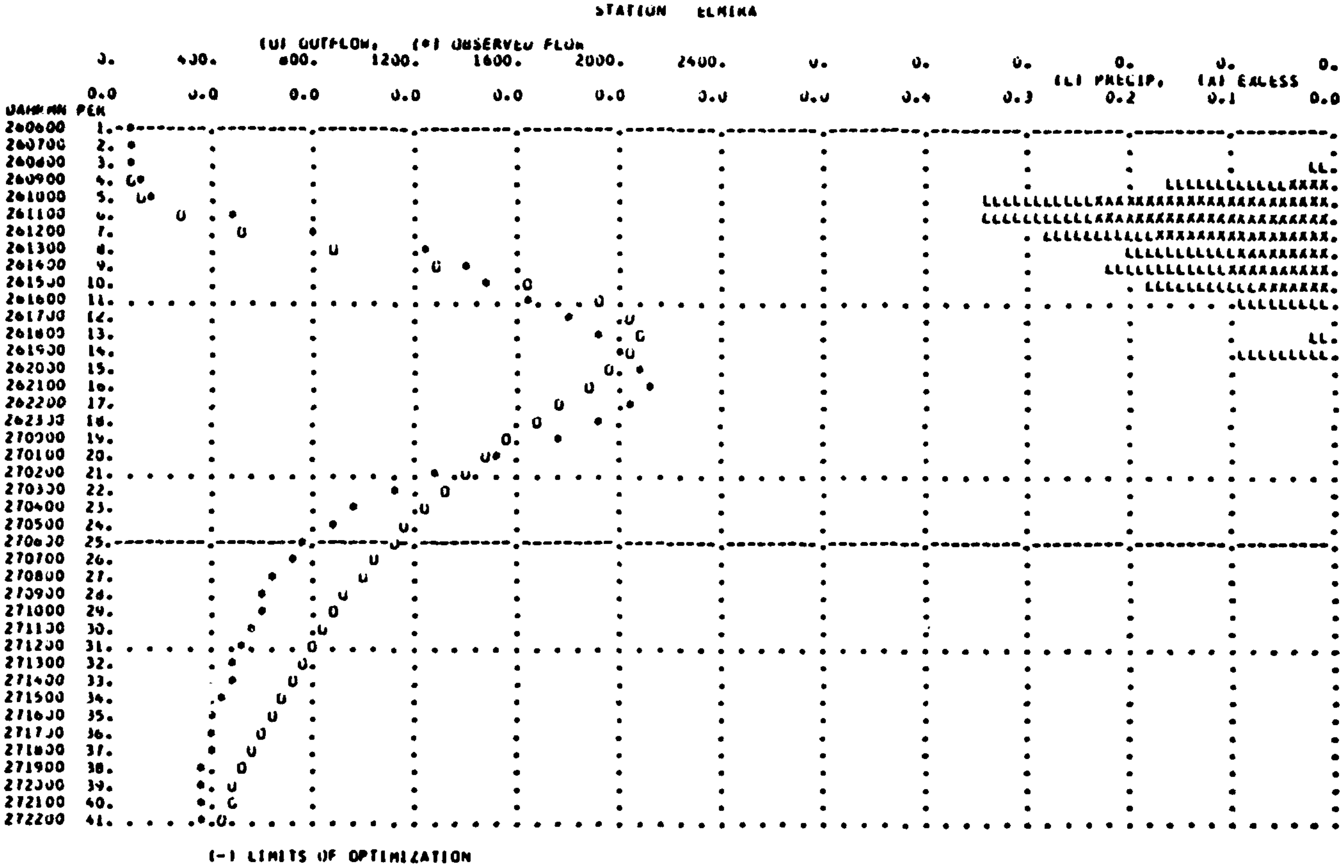
HYDROGRAPH AT STATION ELMIRA

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
26 NOV 0600	1	0.00	0.00	0.00	78.	76.	27 NOV 0300	22	0.00	0.00	0.00	1322.	1100.
26 NOV 0700	2	0.00	0.00	0.00	75.	77.	27 NOV 0400	23	0.00	0.00	0.00	1246.	969.
26 NOV 0800	3	0.02	0.02	0.00	73.	79.	27 NOV 0500	24	0.00	0.00	0.00	1176.	863.
26 NOV 0900	4	0.16	0.12	0.04	76.	118.	27 NOV 0600	25	0.00	0.00	0.00	1112.	770.
26 NOV 1000	5	0.34	0.11	0.23	122.	155.	27 NOV 0700	26	0.00	0.00	0.00	1050.	708.
26 NOV 1100	6	0.34	0.11	0.23	265.	467.	27 NOV 0800	27	0.00	0.00	0.00	991.	659.
26 NOV 1200	7	0.28	0.11	0.17	531.	805.	27 NOV 0900	28	0.00	0.00	0.00	936.	613.
26 NOV 1300	8	0.20	0.11	0.09	894.	1250.	27 NOV 1000	29	0.00	0.00	0.00	884.	580.
26 NOV 1400	9	0.22	0.11	0.10	1292.	1381.	27 NOV 1100	30	0.00	0.00	0.00	834.	547.
26 NOV 1500	10	0.18	0.11	0.07	1649.	1494.	27 NOV 1200	31	0.00	0.00	0.00	788.	516.
26 NOV 1600	11	0.09	0.09	0.00	1905.	1652.	27 NOV 1300	32	0.00	0.00	0.00	744.	491.
26 NOV 1700	12	0.00	0.00	0.00	2042.	1797.	27 NOV 1400	33	0.00	0.00	0.00	703.	464.
26 NOV 1800	13	0.02	0.02	0.00	2081.	1911.	27 NOV 1500	34	0.00	0.00	0.00	663.	437.
26 NOV 1900	14	0.09	0.09	0.00	2050.	2011.	27 NOV 1600	35	0.00	0.00	0.00	626.	419.
26 NOV 2000	15	0.00	0.00	0.00	1970.	2099.	27 NOV 1700	36	0.00	0.00	0.00	592.	401.
26 NOV 2100	16	0.00	0.00	0.00	1867.	2115.	27 NOV 1800	37	0.00	0.00	0.00	559.	389.
26 NOV 2200	17	0.00	0.00	0.00	1763.	2036.	27 NOV 1900	38	0.00	0.00	0.00	528.	374.
26 NOV 2300	18	0.00	0.00	0.00	1664.	1930.	27 NOV 2000	39	0.00	0.00	0.00	498.	364.
27 NOV 0000	19	0.00	0.00	0.00	1571.	1763.	27 NOV 2100	40	0.00	0.00	0.00	471.	351.
27 NOV 0100	20	0.00	0.00	0.00	1483.	1531.	27 NOV 2200	41	0.00	0.00	0.00	444.	342.
27 NOV 0200	21	0.00	0.00	0.00	1400.	1295.							

TOTAL RAINFALL = 1.93, TOTAL LOSS = 1.01, TOTAL EXCESS = 0.93

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	40.00-HR
2081.	12.00	(CFS)	1974.	1412.	1019.	1019.
		(INCHES)	0.237	0.678	0.815	0.815
		(AC-FT)	979.	2801.	3368.	3368.

CUMULATIVE AREA = 77.50 SQ MI


STATION ELMIRA
(O) OUTFLOW, (*) OBSERVED FLOW
0. 400. 800. 1200. 1600. 2000. 2400.
(L) PRECIP, (X) EXCESS
0.0 0.3 0.2 0.1 0.0
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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                                        HEC-1 INPUT                                                   PAGE  1

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1             ID        NEWTOWN CREEK 10-28-81
  2             ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3             IT      60 26OCT81    0500      83
  4             IO       1       2
  5             QU      25      65
  6             PG      EL    2.83
  7             PG      SP    4.59
  8             PG      AF
  9             PI     .00     .00     .00     .00     .10     .00     .00     .00     .00     .00
 10             PI     .00     .00     .10     .00     .00     .00     .00     .10     .00     .10
 11             PI     .20     .00     .10     .10     .10     .10     .10     .00     .00     .10
 12             PI     .00     .00     .00     .00     .00     .00     .00     .00     .10     .00
 13             PI     .00     .10     .20     .40     .50     .50     .30     .10     .10     .10
 14             PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 15             PG     HOR
 16             PI     .10     .00     .00     .00     .10     .00     .00     .00     .00     .00
 17             PI     .00     .00     .00     .00     .00     .00     .00     .10     .10     .10
 18             PI     .10     .20     .20     .00     .20     .10     .30     .00     .00     .00
 19             PI     .10     .00     .00     .00     .00     .00     .00     .00     .00     .00
 20             PI     .50     .10     .30     .50     .20     .20     .10     .10     .00     .00
 21             PI     .00     .00     .10     .00     .00     .00     .00     .00     .00     .00

 22             KK  ELMIRA
 23             QO      34      34      34      34      34      35      35      36      36      36
 24             QO      37      37      37      37      37      38      39      41      42      45
 25             QO      48      52      56      60      71     106     281     412     523     625
 26             QO     722     753     728     668     591     526     469     427     389     359
 27             QO     334     318     311     322     419     630    1164    1372    1479    1733
 28             QO    2182    2773    3038    3104    3069    2955    2748    2552    2357    2147
 29             QO    1945    1745    1562    1387    1256    1143    1049     978     920     866
 30             QO     822     776     739     703     665     636     613     591     572     545
 31             QO     510     475     448       0       0       0       0       0       0       0
 32             PT      EL      SP      AF     HOR
 33             PW     .46     .06     .47     .01
 34             PR      AF     HOR
 35             PW     .85     .15
 36             BA    77.5      0.
 37             BF     34.   1000.  1.0346
 38             UC    -10.    -12.
 39             LU     -.1    -.08
 40             ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 25 THROUGH 65)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.531		42.69			
COMPUTED HYDROGRAPH	50546.	1.011	1233.	52.76	10.07	3072.	53.00
OBSERVED HYDROGRAPH	50552.	1.011	1233.	51.87	9.18	3104.	53.00
DIFFERENCE	-6.	-0.000	-0.	0.89	0.89	-32.	0.00
PERCENT DIFFERENCE	-0.01				9.72	-1.04	

STANDARD ERROR	184.	AVERAGE ABSOLUTE ERROR	137.
OBJECTIVE FUNCTION	184.	AVERAGE PERCENT ABSOLUTE ERROR	20.56

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 83)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.531		42.69			
COMPUTED HYDROGRAPH	70019.	1.400	844.	57.80	15.11	3072.	53.00
OBSERVED HYDROGRAPH	64557.	1.291	778.	55.60	12.91	3104.	53.00
DIFFERENCE	5462.	0.109	66.	2.20	2.20	-32.	0.00
PERCENT DIFFERENCE	8.46				17.07	-1.04	

STANDARD ERROR	197.	AVERAGE ABSOLUTE ERROR	136.
OBJECTIVE FUNCTION	221.	AVERAGE PERCENT ABSOLUTE ERROR	27.83

UNIT HYDROGRAPH
92 END-OF-PERIOD ORDINATES

84.	316.	654.	1052.	1478.	1861.	2148.	2324.	2340.	2231.
2099.	1975.	1858.	1748.	1645.	1548.	1456.	1370.	1289.	1213.
1142.	1074.	1011.	951.	895.	842.	792.	745.	701.	660.
621.	584.	550.	517.	487.	458.	431.	405.	381.	359.
338.	318.	299.	281.	265.	249.	234.	220.	207.	195.
184.	173.	163.	153.	144.	135.	127.	120.	113.	106.
100.	94.	88.	83.	78.	74.	69.	65.	61.	58.
54.	51.	48.	45.	43.	40.	38.	35.	33.	31.
30.	28.	26.	25.	23.	22.	20.	19.	18.	17.
16.	15.								

HYDROGRAPH AT STATION ELMIRA

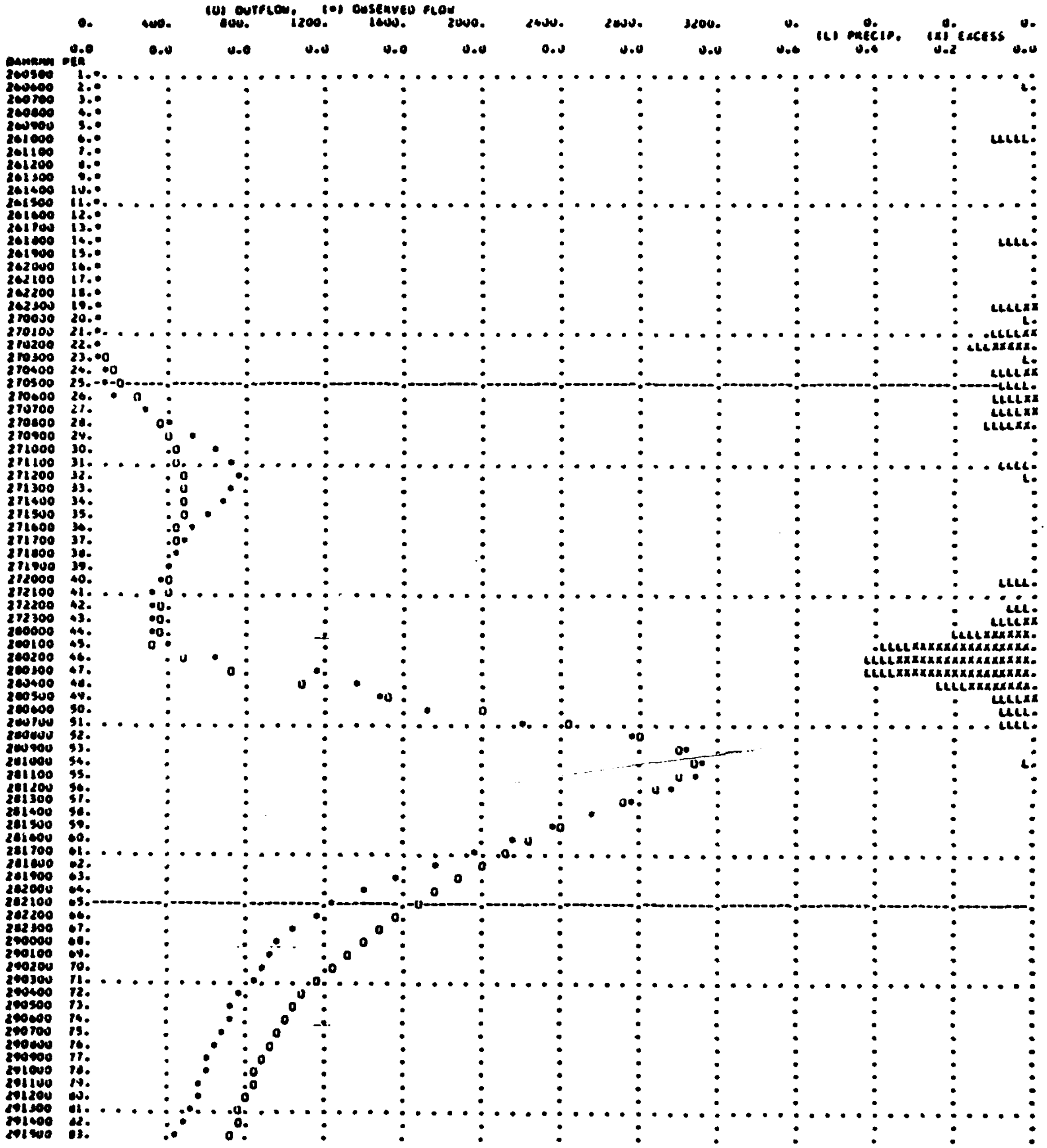
DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
26 OCT 0500	1	0.00	0.00	0.00	34.	34.
26 OCT 0600	2	0.01	0.01	0.00	33.	34.
26 OCT 0700	3	0.00	0.00	0.00	32.	34.
26 OCT 0800	4	0.00	0.00	0.00	31.	34.
26 OCT 0900	5	0.00	0.00	0.00	30.	34.
26 OCT 1000	6	0.09	0.09	0.00	29.	35.
26 OCT 1100	7	0.00	0.00	0.00	28.	35.
26 OCT 1200	8	0.00	0.00	0.00	27.	36.
26 OCT 1300	9	0.00	0.00	0.00	26.	36.
26 OCT 1400	10	0.00	0.00	0.00	25.	36.
26 OCT 1500	11	0.00	0.00	0.00	24.	37.
26 OCT 1600	12	0.00	0.00	0.00	23.	37.
26 OCT 1700	13	0.00	0.00	0.00	23.	37.
26 OCT 1800	14	0.08	0.08	0.00	22.	37.
26 OCT 1900	15	0.00	0.00	0.00	21.	37.
26 OCT 2000	16	0.00	0.00	0.00	21.	38.
26 OCT 2100	17	0.00	0.00	0.00	20.	39.
26 OCT 2200	18	0.00	0.00	0.00	20.	41.
26 OCT 2300	19	0.09	0.08	0.01	21.	42.
27 OCT 0000	20	0.01	0.01	0.00	24.	45.
27 OCT 0100	21	0.09	0.08	0.01	29.	48.
27 OCT 0200	22	0.17	0.08	0.09	46.	52.
27 OCT 0300	23	0.03	0.03	0.00	77.	56.
27 OCT 0400	24	0.10	0.08	0.03	121.	60.
27 OCT 0500	25	0.08	0.08	0.00	174.	71.
27 OCT 0600	26	0.10	0.08	0.03	233.	106.
27 OCT 0700	27	0.09	0.08	0.01	291.	281.
27 OCT 0800	28	0.12	0.08	0.04	346.	412.
27 OCT 0900	29	0.00	0.00	0.00	397.	523.
27 OCT 1000	30	0.00	0.00	0.00	434.	625.
27 OCT 1100	31	0.08	0.08	0.00	459.	722.
27 OCT 1200	32	0.01	0.01	0.00	475.	753.
27 OCT 1300	33	0.00	0.00	0.00	482.	728.
27 OCT 1400	34	0.00	0.00	0.00	480.	668.
27 OCT 1500	35	0.00	0.00	0.00	468.	591.
27 OCT 1600	36	0.00	0.00	0.00	452.	526.
27 OCT 1700	37	0.00	0.00	0.00	437.	469.
27 OCT 1800	38	0.00	0.00	0.00	422.	427.
27 OCT 1900	39	0.00	0.00	0.00	408.	389.
27 OCT 2000	40	0.08	0.08	0.00	394.	359.
27 OCT 2100	41	0.00	0.00	0.00	381.	334.
27 OCT 2200	42	0.07	0.07	0.00	366.	318.
27 OCT 2300	43	0.09	0.08	0.01	356.	311.
28 OCT 0000	44	0.20	0.08	0.12	344.	322.
28 OCT 0100	45	0.38	0.08	0.30	335.	419.
28 OCT 0200	46	0.41	0.08	0.34	465.	630.
28 OCT 0300	47	0.41	0.08	0.34	713.	1164.
28 OCT 0400	48	0.25	0.08	0.17	1083.	1372.
28 OCT 0500	49	0.09	0.08	0.01	1537.	1479.
28 OCT 0600	50	0.08	0.08	0.00	2015.	1733.
28 OCT 0700	51	0.08	0.08	0.00	2457.	2182.
28 OCT 0800	52	0.00	0.00	0.00	2804.	2773.
28 OCT 0900	53	0.00	0.00	0.00	3012.	3038.
28 OCT 1000	54	0.01	0.01	0.00	3072.	3104.
28 OCT 1100	55	0.00	0.00	0.00	3010.	3069.
28 OCT 1200	56	0.00	0.00	0.00	2873.	2955.
28 OCT 1300	57	0.00	0.00	0.00	2711.	2748.
28 OCT 1400	58	0.00	0.00	0.00	2551.	2552.
28 OCT 1500	59	0.00	0.00	0.00	2401.	2357.
28 OCT 1600	60	0.00	0.00	0.00	2259.	2147.
28 OCT 1700	61	0.00	0.00	0.00	2126.	1945.
28 OCT 1800	62	0.00	0.00	0.00	2000.	1745.
28 OCT 1900	63	0.00	0.00	0.00	1882.	1562.
28 OCT 2000	64	0.00	0.00	0.00	1771.	1387.
28 OCT 2100	65	0.00	0.00	0.00	1667.	1256.
28 OCT 2200	66	0.00	0.00	0.00	1568.	1163.
28 OCT 2300	67	0.00	0.00	0.00	1476.	1069.
29 OCT 0000	68	0.00	0.00	0.00	1388.	978.
29 OCT 0100	69	0.00	0.00	0.00	1307.	920.
29 OCT 0200	70	0.00	0.00	0.00	1229.	866.
29 OCT 0300	71	0.00	0.00	0.00	1157.	822.
29 OCT 0400	72	0.00	0.00	0.00	1089.	776.
29 OCT 0500	73	0.00	0.00	0.00	1024.	739.
29 OCT 0600	74	0.00	0.00	0.00	980.	703.
29 OCT 0700	75	0.00	0.00	0.00	947.	665.
29 OCT 0800	76	0.00	0.00	0.00	916.	636.
29 OCT 0900	77	0.00	0.00	0.00	885.	613.
29 OCT 1000	78	0.00	0.00	0.00	855.	591.
29 OCT 1100	79	0.00	0.00	0.00	827.	572.
29 OCT 1200	80	0.00	0.00	0.00	799.	545.
29 OCT 1300	81	0.00	0.00	0.00	772.	510.
29 OCT 1400	82	0.00	0.00	0.00	747.	475.
29 OCT 1500	83	0.00	0.00	0.00	722.	446.

TOTAL RAINFALL = 3.31, TOTAL LOSS = 1.78, TOTAL EXCESS = 1.53

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	82.00-HR
3072.	53.00	(CFS)	2893.	2037.	963.	849.
		(INCHES)	0.347	0.987	1.387	1.392
		(AC-FT)	1434.	4079.	5732.	5755.

CUMULATIVE AREA = 77.50 SQ MI

STATION ELMIRA



(-) LIMITS OF OPTIMIZATION

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ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

ID        OTSELIC RIVER    7-03-74
ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
IT      60 03MAR74    0400      60
IO       1       2
OU       1      25
PG     CIN    1.31
PG    LINC    3.60
PG    DERU    3.17
PG    PLYM
PI     .05     .44     .91     .40     .05     .10     .00     .00     .00     .00
PI     .00     .00     .01     .00     .01     .01     .01     .01     .00     .00

KK  CINCIN
QO      53      53      52      52      57      66     102     419    1130    1824
QO    2549    3010    3110    3010    2675    2460    2265    2090    1964    1915
QO    1873    1810    1705    1600    1516    1432    1348    1260    1180    1100
QO    1024     947     872     808     748     700     656     622     595     570
QO     546     525     504     486     473     461     449     437     428     419
QO     410     401     395     389     383     380     374     372     366     360
PT     CIN    LINC    DERU    PLYM
PW     .18     .64     .16     .02
PR    PLYM
PW    1.00
BA    147.      0.
BF     53.    400.  1.0163
UC    -9.0    -13.
LU     -1.     -1.
ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 1 THROUGH 60)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.627		4.80			
COMPUTED HYDROGRAPH	59776.	0.630	996.	22.64	17.84	2970.	13.00
OBSERVED HYDROGRAPH	59780.	0.630	996.	24.63	15.83	3110.	12.00
DIFFERENCE	-4.	-0.000	-0.	-1.99	-1.99	-140.	1.00
PERCENT DIFFERENCE	-0.01				-10.03	-4.50	

STANDARD ERROR	197.	AVERAGE ABSOLUTE ERROR	135.
OBJECTIVE FUNCTION	190.	AVERAGE PERCENT ABSOLUTE ERROR	41.43

UNIT HYDROGRAPH
81 END-OF-PERIOD ORDINATES

136.	512.	1049.	1682.	2383.	3104.	3744.	4237.	4574.	4729.
4626.	4343.	4049.	3774.	3519.	3280.	3058.	2851.	2657.	2477.
2309.	2153.	2007.	1871.	1744.	1626.	1516.	1413.	1317.	1228.
1145.	1067.	995.	927.	865.	806.	751.	700.	653.	609.
567.	529.	493.	460.	429.	400.	372.	347.	324.	302.
281.	262.	244.	228.	212.	198.	185.	172.	160.	150.
139.	130.	121.	113.	105.	98.	92.	85.	80.	74.
69.	64.	60.	56.	52.	49.	45.	42.	39.	37.
34.									

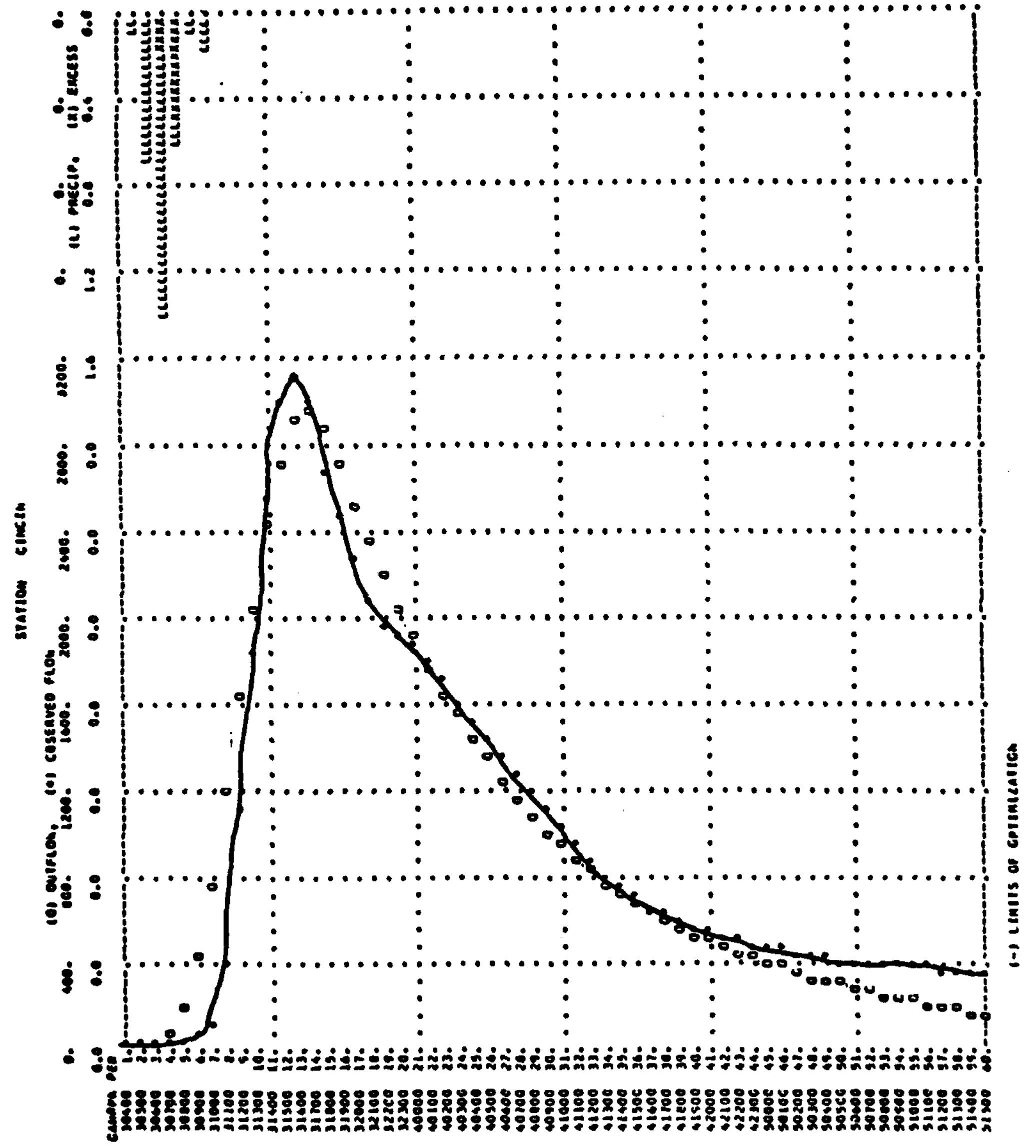
HYDROGRAPH AT STATION CINCIN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COPP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	CCMP C	OBS C
3 MAR 0400	1	0.00	0.00	0.00	53.	53.	4 MAR 1000	31	0.00	0.00	0.00	947.	1024.
3 MAR 0500	2	0.08	0.08	0.00	50.	53.	4 MAR 1100	32	0.00	0.00	0.00	882.	947.
3 MAR 0600	3	0.68	0.68	0.00	47.	52.	4 MAR 1200	33	0.00	0.00	0.00	823.	872.
3 MAR 0700	4	1.40	1.26	0.15	64.	52.	4 MAR 1300	34	0.00	0.00	0.00	767.	808.
3 MAR 0800	5	0.62	0.15	0.47	181.	57.	4 MAR 1400	35	0.00	0.00	0.00	722.	748.
3 MAR 0900	6	0.08	0.08	0.00	434.	66.	4 MAR 1500	36	0.00	0.00	0.00	681.	700.
3 MAR 1000	7	0.15	0.15	0.01	779.	102.	4 MAR 1600	37	0.00	0.00	0.00	642.	656.
3 MAR 1100	8	0.00	0.00	0.00	1182.	419.	4 MAR 1700	38	0.00	0.00	0.00	606.	622.
3 MAR 1200	9	0.00	0.00	0.00	1620.	1130.	4 MAR 1800	39	0.00	0.00	0.00	572.	595.
3 MAR 1300	10	0.00	0.00	0.00	2058.	1824.	4 MAR 1900	40	0.00	0.00	0.00	539.	570.
3 MAR 1400	11	0.00	0.00	0.00	2436.	2549.	4 MAR 2000	41	0.00	0.00	0.00	509.	546.
3 MAR 1500	12	0.00	0.00	0.00	2723.	3010.	4 MAR 2100	42	0.00	0.00	0.00	480.	525.
3 MAR 1600	13	0.00	0.00	0.00	2909.	3110.	4 MAR 2200	43	0.00	0.00	0.00	453.	504.
3 MAR 1700	14	0.02	0.02	0.00	2970.	3010.	4 MAR 2300	44	0.00	0.00	0.00	427.	486.
3 MAR 1800	15	0.00	0.00	0.00	2882.	2675.	5 MAR 0000	45	0.00	0.00	0.00	403.	473.
3 MAR 1900	16	0.02	0.02	0.00	2705.	2460.	5 MAR 0100	46	0.00	0.00	0.00	380.	461.
3 MAR 2000	17	0.02	0.02	0.00	2524.	2265.	5 MAR 0200	47	0.00	0.00	0.00	359.	449.
3 MAR 2100	18	0.02	0.02	0.00	2354.	2090.	5 MAR 0300	48	0.00	0.00	0.00	338.	437.
3 MAR 2200	19	0.02	0.02	0.00	2194.	1964.	5 MAR 0400	49	0.00	0.00	0.00	319.	428.
3 MAR 2300	20	0.00	0.00	0.00	2046.	1915.	5 MAR 0500	50	0.00	0.00	0.00	301.	419.
4 MAR 0000	21	0.00	0.00	0.00	1907.	1873.	5 MAR 0600	51	0.00	0.00	0.00	284.	410.
4 MAR 0100	22	0.00	0.00	0.00	1778.	1810.	5 MAR 0700	52	0.00	0.00	0.00	268.	401.
4 MAR 0200	23	0.00	0.00	0.00	1658.	1705.	5 MAR 0800	53	0.00	0.00	0.00	253.	395.
4 MAR 0300	24	0.00	0.00	0.00	1546.	1600.	5 MAR 0900	54	0.00	0.00	0.00	238.	389.
4 MAR 0400	25	0.00	0.00	0.00	1441.	1516.	5 MAR 1000	55	0.00	0.00	0.00	225.	383.
4 MAR 0500	26	0.00	0.00	0.00	1344.	1432.	5 MAR 1100	56	0.00	0.00	0.00	212.	380.
4 MAR 0600	27	0.00	0.00	0.00	1253.	1348.	5 MAR 1200	57	0.00	0.00	0.00	200.	374.
4 MAR 0700	28	0.00	0.00	0.00	1168.	1260.	5 MAR 1300	58	0.00	0.00	0.00	189.	372.
4 MAR 0800	29	0.00	0.00	0.00	1089.	1180.	5 MAR 1400	59	0.00	0.00	0.00	178.	366.
4 MAR 0900	30	0.00	0.00	0.00	1015.	1100.	5 MAR 1500	60	0.00	0.00	0.00	168.	360.

TOTAL RAINFALL = 3.09, TOTAL LOSS = 2.46, TOTAL EXCESS = 0.63

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	59.00-HR
2970.	13.00	(CFS)	2778.	1903.	1011.	1011.
		(INCHES)	0.176	0.481	0.629	0.629
		(AC-FT)	1378.	3774.	4931.	4931.

CUMULATIVE AREA = 147.00 SQ MI


STATION CINCIN
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP., (X) EXCESS
(-) LIMITS OF OPTIMIZATION

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                                  HEC-1 INPUT                                           PAGE  1

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID        UTSELIC RIVER     9-26-75
  2         ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3         IT      60 24SEP75    2400      90
  4         IO       1       2
  5         OO       5      55
  6         PG     CIN    4.86
  7         PG    LINC    4.97
  8         PG    DERJ    4.40
  9         PG    WHPT
 10         PI     .10     .10     .00     .10     .00     .10     .20     .30     .30     .40
 11         PI     .10     .20     .00     .10     .00     .10     .30     .30     .00     .00
 12         PI     .00     .00     .00     .10     .10     .10     .10     .00     .00     .10
 13         PI     .30     .30     .20     .10     .20     .10     .10     .10     .00     .10
 14         PI     .00     .00     .10     .00     .00     .00     .00     .00     .00     .00

 15         KK  CINCIN
 16         QO     186     186     186     186     188     194     202     217     248     349
 17         QO     522     838    1128    1465    1732    1902    1999    2013    2083    2279
 18         QO    2444    2693    2830    2810    2756    2675    2549    2444    2356    2324
 19         QO    2308    2356    2612    2970    3486    3978    4480    4792    4974    5026
 20         QO    5000    4909    4805    4714    4626    4532    4458    4402    4302    4170
 21         QO    4002    3774    3541    3300    3060    2830    2639    2476    2316    2188
 22         QO    2076    1964    1878    1794    1721    1683    1605    1550    1500    1455
 23         QO    1410    1370    1330    1290    1250    1215    1182    1150    1119    1092
 24         QO    1060    1034    1007     980     957     935     914     894     878     862
 25         PT     CIN    LINC    DERU
 26         PW     .18     .66     .16
 27         PR    WHPT
 28         PW    1.00
 29         BA    147.      0.
 30         BF    186.    850.  1.0163
 31         UC    -7.0    -20.
 32         LU     -.9    -.05
 33         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 55)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.281		25.04			
COMPUTED HYDROGRAPH	143822.	1.516	2820.	36.90	11.86	4906.	39.00
OBSERVED HYDROGRAPH	143817.	1.516	2820.	36.78	11.74	5026.	39.00
DIFFERENCE	5.	0.000	0.	0.12	0.12	-120.	0.00
PERCENT DIFFERENCE	0.00				1.03	-2.39	

STANDARD ERROR	300.	AVERAGE ABSOLUTE ERROR	239.
OBJECTIVE FUNCTION	286.	AVERAGE PERCENT ABSOLUTE ERROR	14.08

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 90)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.281		25.04			
COMPUTED HYDROGRAPH	205143.	2.163	2279.	46.33	21.29	4906.	39.00
OBSERVED HYDROGRAPH	196165.	2.068	2180.	45.27	20.23	5026.	39.00
DIFFERENCE	8978.	0.095	100.	1.05	1.05	-120.	0.00
PERCENT DIFFERENCE	4.58				5.21	-2.39	

STANDARD ERROR	294.	AVERAGE ABSOLUTE ERROR	236.
OBJECTIVE FUNCTION	304.	AVERAGE PERCENT ABSOLUTE ERROR	14.95

UNIT HYDROGRAPH
140 END-OF-PERIOD ORDINATES

169.	639.	1322.	2080.	2732.	3145.	3229.	3114.	2995.	2881.
2771.	2665.	2563.	2465.	2371.	2281.	2193.	2110.	2029.	1952.
1877.	1805.	1737.	1670.	1606.	1545.	1486.	1429.	1375.	1322.
1272.	1223.	1177.	1132.	1088.	1047.	1007.	968.	931.	896.
862.	829.	797.	767.	737.	709.	682.	656.	631.	607.
584.	561.	540.	519.	500.	481.	462.	445.	428.	411.
396.	380.	366.	352.	338.	326.	313.	301.	290.	279.
268.	258.	248.	238.	229.	221.	212.	204.	196.	189.
182.	175.	168.	162.	155.	149.	144.	138.	133.	128.
123.	118.	114.	109.	105.	101.	97.	94.	90.	87.
83.	80.	77.	74.	71.	69.	66.	63.	61.	59.
56.	54.	52.	50.	48.	46.	45.	43.	41.	40.
38.	37.	35.	34.	33.	31.	30.	29.	28.	27.
26.	25.	24.	23.	22.	21.	21.	20.	19.	18.

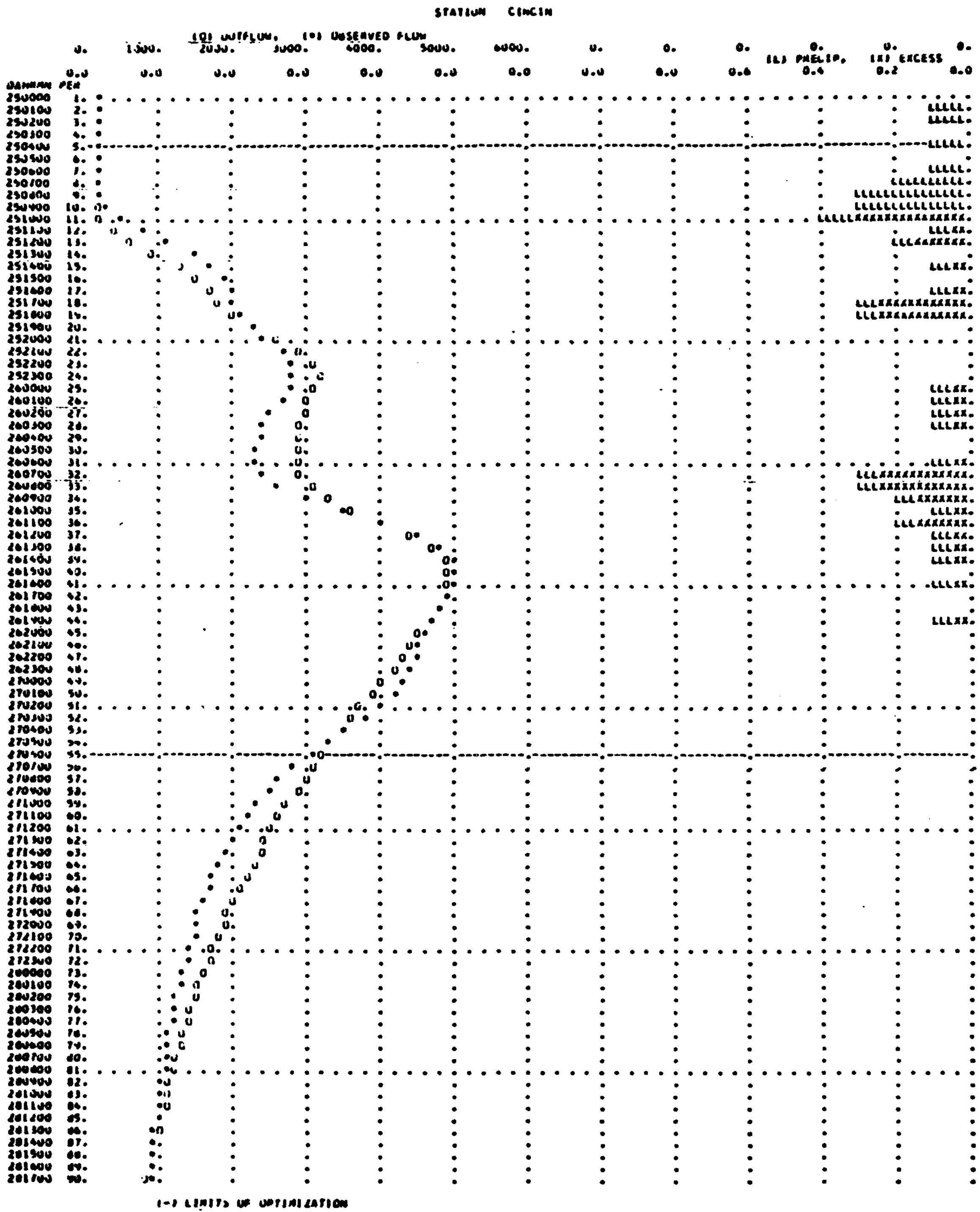
HYDROGRAPH AT STATION CINCIN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
25 SEP 0000	1	0.00	0.00	0.00	186.	186.
25 SEP 0100	2	0.10	0.10	0.00	183.	186.
25 SEP 0200	3	0.10	0.10	0.00	180.	186.
25 SEP 0300	4	0.00	0.00	0.00	177.	186.
25 SEP 0400	5	0.10	0.10	0.00	174.	188.
25 SEP 0500	6	0.00	0.00	0.00	172.	194.
25 SEP 0600	7	0.10	0.10	0.00	169.	202.
25 SEP 0700	8	0.20	0.20	0.00	166.	217.
25 SEP 0800	9	0.30	0.30	0.00	163.	240.
25 SEP 0900	10	0.30	0.30	0.00	161.	349.
25 SEP 1000	11	0.40	0.10	0.30	209.	522.
25 SEP 1100	12	0.10	0.06	0.04	355.	838.
25 SEP 1200	13	0.20	0.06	0.14	602.	1128.
25 SEP 1300	14	0.00	0.00	0.00	924.	1465.
25 SEP 1400	15	0.10	0.06	0.04	1253.	1732.
25 SEP 1500	16	0.00	0.00	0.00	1530.	1902.
25 SEP 1600	17	0.10	0.06	0.04	1698.	1999.
25 SEP 1700	18	0.30	0.06	0.24	1815.	2013.
25 SEP 1800	19	0.30	0.06	0.24	1995.	2083.
25 SEP 1900	20	0.00	0.00	0.00	2266.	2279.
25 SEP 2000	21	0.00	0.00	0.00	2591.	2444.
25 SEP 2100	22	0.00	0.00	0.00	2892.	2693.
25 SEP 2200	23	0.00	0.00	0.00	3097.	2830.
25 SEP 2300	24	0.00	0.00	0.00	3158.	2810.
26 SEP 0000	25	0.10	0.06	0.04	3099.	2756.
26 SEP 0100	26	0.10	0.06	0.04	3012.	2675.
26 SEP 0200	27	0.10	0.06	0.04	2955.	2549.
26 SEP 0300	28	0.10	0.06	0.04	2934.	2444.
26 SEP 0400	29	0.00	0.00	0.00	2937.	2356.
26 SEP 0500	30	0.00	0.00	0.00	2942.	2324.
26 SEP 0600	31	0.10	0.06	0.04	2932.	2308.
26 SEP 0700	32	0.30	0.06	0.24	2944.	2356.
26 SEP 0800	33	0.30	0.06	0.24	3050.	2612.
26 SEP 0900	34	0.20	0.06	0.14	3291.	2970.
26 SEP 1000	35	0.10	0.06	0.04	3642.	3486.
26 SEP 1100	36	0.20	0.06	0.14	4047.	3978.
26 SEP 1200	37	0.10	0.06	0.04	4427.	4480.
26 SEP 1300	38	0.10	0.06	0.04	4701.	4792.
26 SEP 1400	39	0.10	0.06	0.04	4850.	4974.
26 SEP 1500	40	0.00	0.00	0.00	4906.	5026.
26 SEP 1600	41	0.10	0.06	0.04	4904.	5000.
26 SEP 1700	42	0.00	0.00	0.00	4853.	4909.
26 SEP 1800	43	0.00	0.00	0.00	4760.	4805.
26 SEP 1900	44	0.10	0.06	0.04	4650.	4714.
26 SEP 2000	45	0.00	0.00	0.00	4533.	4626.
26 SEP 2100	46	0.00	0.00	0.00	4413.	4532.
26 SEP 2200	47	0.00	0.00	0.00	4288.	4458.
26 SEP 2300	48	0.00	0.00	0.00	4157.	4402.
27 SEP 0000	49	0.00	0.00	0.00	4022.	4302.
27 SEP 0100	50	0.00	0.00	0.00	3878.	4170.
27 SEP 0200	51	0.00	0.00	0.00	3733.	4002.
27 SEP 0300	52	0.00	0.00	0.00	3592.	3774.
27 SEP 0400	53	0.00	0.00	0.00	3456.	3541.
27 SEP 0500	54	0.00	0.00	0.00	3326.	3300.
27 SEP 0600	55	0.00	0.00	0.00	3201.	3060.
27 SEP 0700	56	0.00	0.00	0.00	3080.	2830.
27 SEP 0800	57	0.00	0.00	0.00	2965.	2639.
27 SEP 0900	58	0.00	0.00	0.00	2853.	2476.
27 SEP 1000	59	0.00	0.00	0.00	2746.	2316.
27 SEP 1100	60	0.00	0.00	0.00	2642.	2188.
27 SEP 1200	61	0.00	0.00	0.00	2543.	2076.
27 SEP 1300	62	0.00	0.00	0.00	2448.	1964.
27 SEP 1400	63	0.00	0.00	0.00	2356.	1878.
27 SEP 1500	64	0.00	0.00	0.00	2267.	1794.
27 SEP 1600	65	0.00	0.00	0.00	2182.	1721.
27 SEP 1700	66	0.00	0.00	0.00	2100.	1643.
27 SEP 1800	67	0.00	0.00	0.00	2022.	1605.
27 SEP 1900	68	0.00	0.00	0.00	1946.	1550.
27 SEP 2000	69	0.00	0.00	0.00	1873.	1500.
27 SEP 2100	70	0.00	0.00	0.00	1803.	1455.
27 SEP 2200	71	0.00	0.00	0.00	1735.	1410.
27 SEP 2300	72	0.00	0.00	0.00	1670.	1370.
28 SEP 0000	73	0.00	0.00	0.00	1608.	1330.
28 SEP 0100	74	0.00	0.00	0.00	1548.	1290.
28 SEP 0200	75	0.00	0.00	0.00	1490.	1250.
28 SEP 0300	76	0.00	0.00	0.00	1434.	1215.
28 SEP 0400	77	0.00	0.00	0.00	1381.	1182.
28 SEP 0500	78	0.00	0.00	0.00	1329.	1150.
28 SEP 0600	79	0.00	0.00	0.00	1280.	1119.
28 SEP 0700	80	0.00	0.00	0.00	1232.	1092.
28 SEP 0800	81	0.00	0.00	0.00	1186.	1060.
28 SEP 0900	82	0.00	0.00	0.00	1142.	1034.
28 SEP 1000	83	0.00	0.00	0.00	1099.	1007.
28 SEP 1100	84	0.00	0.00	0.00	1058.	980.
28 SEP 1200	85	0.00	0.00	0.00	1019.	957.
28 SEP 1300	86	0.00	0.00	0.00	981.	935.
28 SEP 1400	87	0.00	0.00	0.00	945.	914.
28 SEP 1500	88	0.00	0.00	0.00	910.	894.
28 SEP 1600	89	0.00	0.00	0.00	876.	878.
28 SEP 1700	90	0.00	0.00	0.00	847.	862.

TOTAL RAINFALL = 4.78, TOTAL LOSS = 2.58, TOTAL EXCESS = 2.20

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	89.00-HR
4906.	39.00	(CFS)	4825.	4072.	2746.	2299.
		(INCHES)	0.305	1.030	2.084	2.157
		(AC-FT)	2392.	8076.	16340.	16911.

CUMULATIVE AREA = 147.00 SQ MI


STATION CINCIN
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP, (X) EXCESS
(-) LIMITS OF OPTIMIZATION

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                                                      HEC-1 INPUT                                                       PAGE  1

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1            ID        UTSELIC RIVER    10-09-76
  2            ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3            IT      60 07OCT76    1900      90
  4            IO       1       2
  5            QO      35       6
  6            PG     CIN     3.7
  7            PG    LINC    3.66
  8            PG    DERU    3.47
  9            PG   HUCOR
 10            PI     .10     .10     .00     .00     .10     .10     .10     .00     .00     .00
 11            PI     .00     .00     .00     .00     .10     .00     .00     .00     .00     .00
 12            PI     .10     .00     .00     .00     .00     .00     .00     .00     .00     .00
 13            PI     .00     .10     .10     .20     .00     .10     .20     .20     .20     .30
 14            PI     .30     .40     .20     .00     .10     .00     .00     .00     .00     .00

 15            KK  CINCIN
 16            QO     115     115     118     121     125     139     156     172     204     248
 17            QO     297     334     364     377     384     391     391     391     391     395
 18            QO     395     399     402     413     420     424     428     424     416     409
 19            QO     406     399     395     391     399     436     532     680     870    1146
 20            QO    1475    1996    2846    4000    5143    5806    5946    5848    5918    5750
 21            QO    5532    5428    5330    5358    5386    5386    5247    5036    4760    4431
 22            QO    4090    3790    3530    3292    3067    2854    2654    2478    2310    2166
 23            QO    2059    1961    1877    1793    1723    1653    1590    1534    1481    1436
 24            QO    1304    1336    1294    1252    1204    1168    1126    1090    1048    1019
 25            PT     CIN    LINC    DERU
 26            PW     .18     .66     .16
 27            PR   HUCOR
 28            PW    1.00
 29            BA    147.      0.
 30            BF    115.    750.  1.0163
 31            UC    -7.0    -18.
 32            LU     -.2     -.1
 33            ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 35 THROUGH 65)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.047		37.18			
COMPUTED HYDROGRAPH	117938.	1.243	3804.	52.18	15.00	6350.	48.00
OBSERVED HYDROGRAPH	118504.	1.249	3823.	52.53	15.36	5946.	46.00
DIFFERENCE	-566.	-0.006	-18.	-0.35	-0.35	404.	2.00
PERCENT DIFFERENCE	-0.48				-2.30	6.79	

STANDARD ERROR 371. AVERAGE ABSOLUTE ERROR 322.
OBJECTIVE FUNCTION 392. AVERAGE PERCENT ABSOLUTE ERROR 13.20

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 90)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		2.047		37.18			
COMPUTED HYDROGRAPH	180040.	1.898	2000.	55.18	18.00	6350.	48.00
OBSERVED HYDROGRAPH	170943.	1.802	1899.	56.14	18.97	5946.	46.00
DIFFERENCE	9097.	0.096	101.	-0.97	-0.97	404.	2.00
PERCENT DIFFERENCE	5.32				-5.11	6.79	

STANDARD ERROR 243. AVERAGE ABSOLUTE ERROR 158.
OBJECTIVE FUNCTION 344. AVERAGE PERCENT ABSOLUTE ERROR 11.46

UNIT HYDROGRAPH
117 END-OF-PERIOD ORDINATES

154.	582.	1202.	1937.	2666.	3251.	3632.	3716.	3581.	3416.
3259.	3109.	2966.	2829.	2699.	2574.	2456.	2342.	2234.	2132.
2033.	1940.	1850.	1765.	1684.	1606.	1532.	1461.	1394.	1330.
1269.	1210.	1154.	1101.	1050.	1002.	956.	912.	870.	830.
792.	755.	720.	687.	655.	625.	596.	569.	543.	518.
494.	471.	449.	429.	409.	390.	372.	355.	339.	323.
308.	294.	280.	267.	255.	243.	232.	221.	211.	202.
192.	183.	175.	167.	159.	152.	145.	138.	132.	126.
120.	114.	109.	104.	99.	95.	90.	86.	82.	78.
75.	71.	68.	65.	62.	59.	56.	54.	51.	49.
47.	45.	42.	41.	39.	37.	35.	34.	32.	31.
29.	28.	27.	25.	24.	23.	22.			

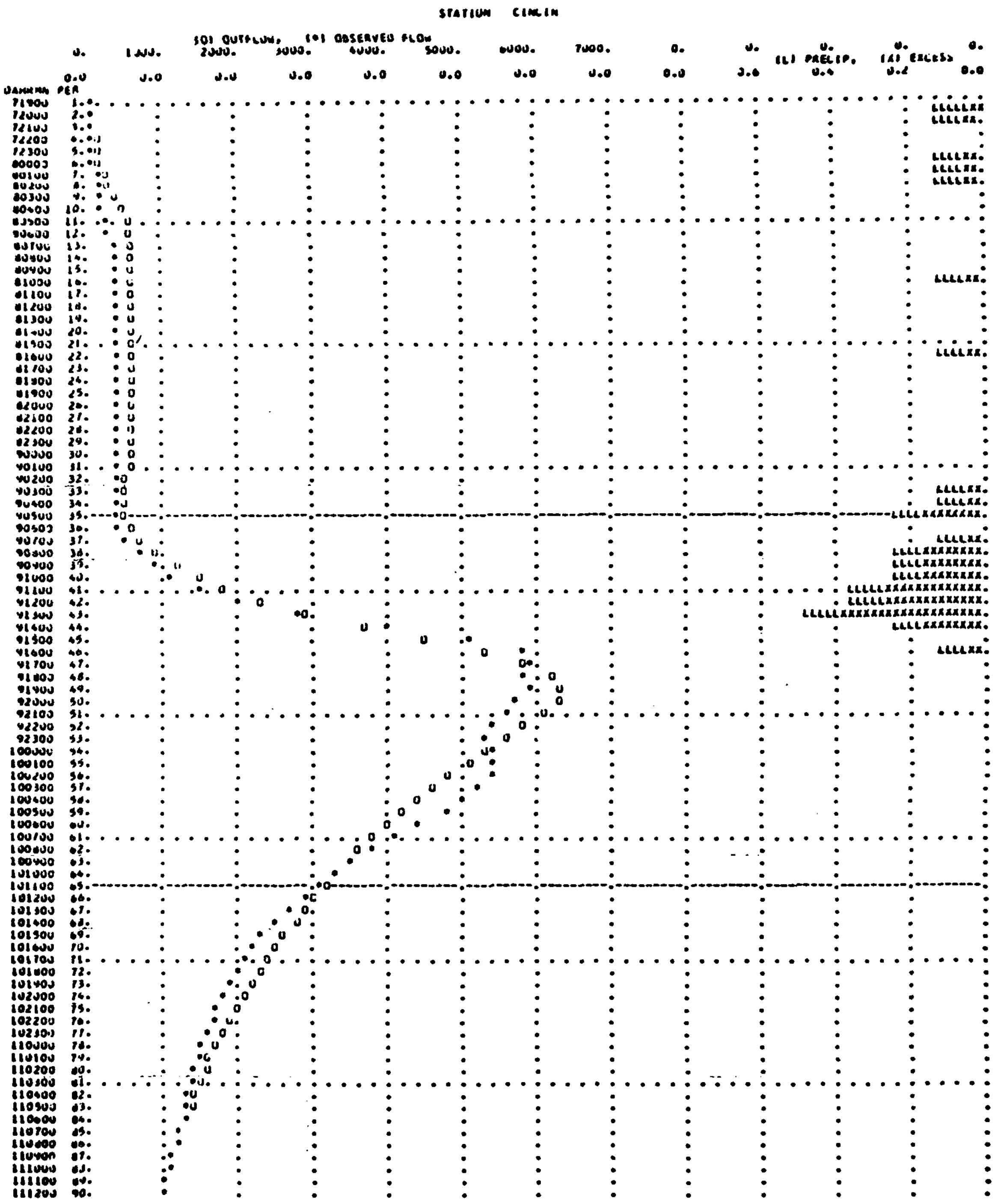
HYDROGRAPH AT STATION LINCIN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7 OCT 1900	1	0.00	0.00	0.00	115.	115.
7 OCT 2000	2	0.12	0.10	0.02	114.	115.
7 OCT 2100	3	0.12	0.08	0.03	128.	118.
7 OCT 2200	4	0.00	0.00	0.00	152.	121.
7 OCT 2300	5	0.00	0.00	0.00	186.	125.
8 OCT 0000	6	0.12	0.08	0.03	228.	139.
8 OCT 0100	7	0.12	0.08	0.03	282.	156.
8 OCT 0200	8	0.12	0.08	0.03	349.	172.
8 OCT 0300	9	0.00	0.00	0.00	423.	204.
8 OCT 0400	10	0.00	0.00	0.00	493.	248.
8 OCT 0500	11	0.00	0.00	0.00	553.	297.
8 OCT 0600	12	0.00	0.00	0.00	601.	334.
8 OCT 0700	13	0.00	0.00	0.00	627.	364.
8 OCT 0800	14	0.00	0.00	0.00	629.	377.
8 OCT 0900	15	0.00	0.00	0.00	619.	384.
8 OCT 1000	16	0.12	0.08	0.03	609.	391.
8 OCT 1100	17	0.00	0.00	0.00	599.	391.
8 OCT 1200	18	0.00	0.00	0.00	590.	391.
8 OCT 1300	19	0.00	0.00	0.00	585.	391.
8 OCT 1400	20	0.00	0.00	0.00	588.	395.
8 OCT 1500	21	0.00	0.00	0.00	588.	395.
8 OCT 1600	22	0.12	0.08	0.03	587.	399.
8 OCT 1700	23	0.00	0.00	0.00	586.	402.
8 OCT 1800	24	0.00	0.00	0.00	585.	413.
8 OCT 1900	25	0.00	0.00	0.00	587.	420.
8 OCT 2000	26	0.00	0.00	0.00	590.	424.
8 OCT 2100	27	0.00	0.00	0.00	590.	428.
8 OCT 2200	28	0.00	0.00	0.00	583.	424.
8 OCT 2300	29	0.00	0.00	0.00	573.	416.
9 OCT 0000	30	0.00	0.00	0.00	564.	409.
9 OCT 0100	31	0.00	0.00	0.00	555.	406.
9 OCT 0200	32	0.00	0.00	0.00	546.	399.
9 OCT 0300	33	0.12	0.08	0.03	538.	395.
9 OCT 0400	34	0.12	0.08	0.03	529.	391.
9 OCT 0500	35	0.24	0.08	0.15	524.	399.
9 OCT 0600	36	0.00	0.00	0.00	617.	436.
9 OCT 0700	37	0.12	0.08	0.03	749.	532.
9 OCT 0800	38	0.24	0.08	0.15	927.	680.
9 OCT 0900	39	0.24	0.08	0.15	1164.	870.
9 OCT 1000	40	0.24	0.08	0.15	1462.	1146.
9 OCT 1100	41	0.35	0.08	0.27	1840.	1475.
9 OCT 1200	42	0.35	0.08	0.27	2323.	1996.
9 OCT 1300	43	0.47	0.08	0.39	2944.	2846.
9 OCT 1400	44	0.24	0.08	0.15	3711.	4000.
9 OCT 1500	45	0.00	0.00	0.00	4920.	5143.
9 OCT 1600	46	0.12	0.08	0.03	5259.	5806.
9 OCT 1700	47	0.00	0.00	0.00	5848.	5946.
9 OCT 1800	48	0.00	0.00	0.00	6217.	5848.
9 OCT 1900	49	0.00	0.00	0.00	6350.	5918.
9 OCT 2000	50	0.00	0.00	0.00	6274.	5750.
9 OCT 2100	51	0.00	0.00	0.00	6064.	5582.
9 OCT 2200	52	0.00	0.00	0.00	5809.	5428.
9 OCT 2300	53	0.00	0.00	0.00	5552.	5330.
10 OCT 0000	54	0.00	0.00	0.00	5299.	5358.
10 OCT 0100	55	0.00	0.00	0.00	5056.	5386.
10 OCT 0200	56	0.00	0.00	0.00	4825.	5386.
10 OCT 0300	57	0.00	0.00	0.00	4604.	5247.
10 OCT 0400	58	0.00	0.00	0.00	4393.	5036.
10 OCT 0500	59	0.00	0.00	0.00	4192.	4760.
10 OCT 0600	60	0.00	0.00	0.00	4000.	4431.
10 OCT 0700	61	0.00	0.00	0.00	3817.	4090.
10 OCT 0800	62	0.00	0.00	0.00	3643.	3790.
10 OCT 0900	63	0.00	0.00	0.00	3476.	3530.
10 OCT 1000	64	0.00	0.00	0.00	3317.	3292.
10 OCT 1100	65	0.00	0.00	0.00	3165.	3067.
10 OCT 1200	66	0.00	0.00	0.00	3021.	2854.
10 OCT 1300	67	0.00	0.00	0.00	2883.	2654.
10 OCT 1400	68	0.00	0.00	0.00	2751.	2478.
10 OCT 1500	69	0.00	0.00	0.00	2626.	2310.
10 OCT 1600	70	0.00	0.00	0.00	2506.	2166.
10 OCT 1700	71	0.00	0.00	0.00	2391.	2059.
10 OCT 1800	72	0.00	0.00	0.00	2282.	1961.
10 OCT 1900	73	0.00	0.00	0.00	2178.	1877.
10 OCT 2000	74	0.00	0.00	0.00	2079.	1793.
10 OCT 2100	75	0.00	0.00	0.00	1984.	1723.
10 OCT 2200	76	0.00	0.00	0.00	1894.	1653.
10 OCT 2300	77	0.00	0.00	0.00	1808.	1590.
11 OCT 0000	78	0.00	0.00	0.00	1725.	1534.
11 OCT 0100	79	0.00	0.00	0.00	1647.	1481.
11 OCT 0200	80	0.00	0.00	0.00	1572.	1436.
11 OCT 0300	81	0.00	0.00	0.00	1500.	1384.
11 OCT 0400	82	0.00	0.00	0.00	1432.	1336.
11 OCT 0500	83	0.00	0.00	0.00	1367.	1294.
11 OCT 0600	84	0.00	0.00	0.00	1305.	1252.
11 OCT 0700	85	0.00	0.00	0.00	1246.	1204.
11 OCT 0800	86	0.00	0.00	0.00	1189.	1168.
11 OCT 0900	87	0.00	0.00	0.00	1135.	1126.
11 OCT 1000	88	0.00	0.00	0.00	1084.	1090.
11 OCT 1100	89	0.00	0.00	0.00	1035.	1048.
11 OCT 1200	90	0.00	0.00	0.00	988.	1019.

TOTAL RAINFALL = 3.65, TOTAL LOSS = 1.60, TOTAL EXCESS = 2.05

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	89.00-HR
6350.	48.00	(CFS)	6069.	4638.	2396.	2317.
		(INCHES)	0.384	1.173	1.819	1.892
		(AC-FT)	3009.	9200.	14260.	14834.

CUMULATIVE AREA = 147.00 SQ MI



(-) LIMITS OF OPTIMIZATION

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                                            HEC-1 INPUT                                                    PAGE  1

LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10

  1            ID        OTSELIC RIVER    10-17-77
  2            ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3            IT      60 16OCT77    1100      70
  4            IO       1       2
  5            QU       1      50
  6            PG     CIN    2.14
  7            PG    LINC    2.47
  8            PG    DERU    2.53
  9            PG   HUCUR
 10            PI     .10     .10     .10     .00     .00     .10     .00     .10     .10     .10
 11            PI     .00     .00     .10     .20     .00     .00     .20     .10     .10     .10
 12            PI     .10     .00     .10     .00     .10     .00     .00     .00     .00     .00
 13            PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 14            PI     .00     .00     .00     .00     .00     .00     .10     .00     .00     .00

 15            KK  CINCIN
 16            QO     460     468     480     512     585     675     757     815     855     890
 17            QO     931     969     991    1014    1084    1234    1436    1653    1856    2045
 18            QO    2230    2398    2550    2710    2846    2968    3058    3157    3238    3319
 19            QO    3364    3391    3391    3382    3346    3301    3256    3193    3130    3058
 20            QO    2986    2907    2822    2734    2646    2558    2470    2382    2302    2222
 21            QO    2136    2073    2010    1961    1905    1870    1835    1793    1758    1723
 22            QO    1681    1646    1611    1576    1541    1507    1481    1455    1422    1391
 23            PT     CIN    LINC    DERU
 24            PW     .18     .66     .16
 25            PR   HUCUR
 26            PW    1.00
 27            BA    147.      0.
 28            BF    460.   1400.  1.0163
 29            UC    -13.    -30.
 30            LU    -.03    -.03
 31            ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 1 THROUGH 50)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.645		16.18			
COMPUTED HYDROGRAPH	106233.	1.120	2125.	31.22	15.05	3461.	32.00
OBSERVED HYDROGRAPH	107020.	1.128	2140.	31.12	14.94	3391.	31.00
DIFFERENCE	-787.	-0.008	-16.	0.10	0.10	70.	1.00
PERCENT DIFFERENCE	-0.74				0.69	2.06	

STANDARD ERROR 89. AVERAGE ABSOLUTE ERROR 70.
OBJECTIVE FUNCTION 82. AVERAGE PERCENT ABSOLUTE ERROR 5.31

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 70)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.645		16.18			
COMPUTED HYDROGRAPH	141390.	1.490	2020.	38.30	22.12	3461.	32.00
OBSERVED HYDROGRAPH	141395.	1.491	2020.	38.08	21.91	3391.	31.00
DIFFERENCE	-5.	-0.000	-0.	0.21	0.21	70.	1.00
PERCENT DIFFERENCE	-0.00				0.97	2.06	

STANDARD ERROR 91. AVERAGE ABSOLUTE ERROR 65.
OBJECTIVE FUNCTION 77. AVERAGE PERCENT ABSOLUTE ERROR 4.64

UNIT HYDROGRAPH
150 END-OF-PERIOD ORDINATES
VOLUME = 0.99

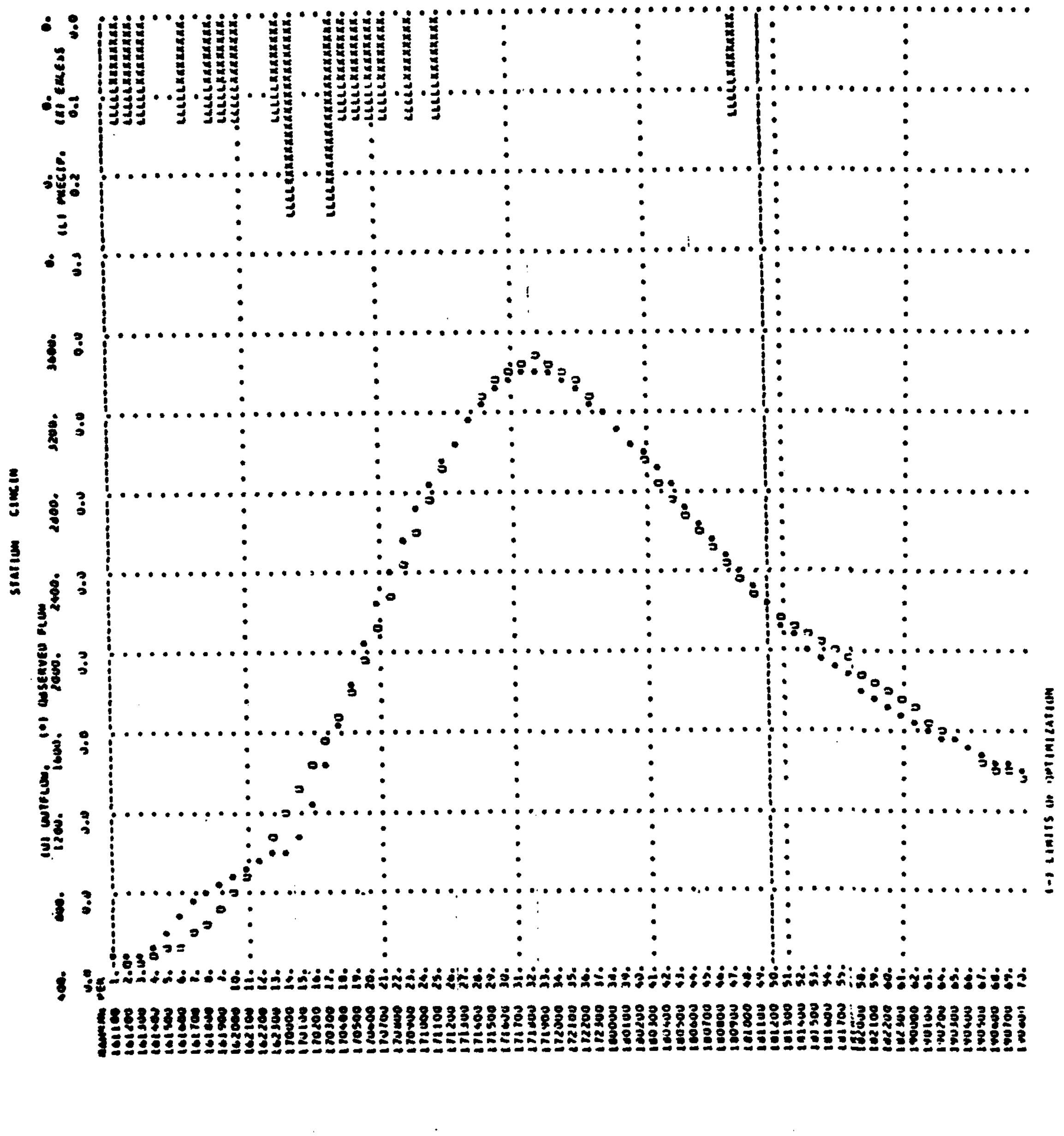
37.	139.	269.	469.	674.	897.	1137.	1390.	1639.	1864.
2060.	2223.	2354.	2447.	2496.	2478.	2407.	2326.	2249.	2174.
2102.	2032.	1964.	1899.	1835.	1774.	1715.	1658.	1603.	1549.
1498.	1448.	1400.	1353.	1308.	1265.	1222.	1182.	1142.	1104.
1068.	1032.	998.	964.	932.	901.	871.	842.	814.	787.
761.	736.	711.	687.	665.	642.	621.	600.	580.	561.
542.	524.	507.	490.	474.	458.	443.	428.	414.	400.
387.	374.	361.	349.	338.	326.	315.	305.	295.	285.
275.	266.	257.	249.	241.	233.	225.	217.	210.	203.
196.	190.	183.	177.	171.	166.	160.	155.	150.	145.
140.	135.	131.	126.	122.	118.	114.	110.	107.	103.
100.	96.	93.	90.	87.	84.	81.	79.	76.	74.
71.	69.	66.	64.	62.	60.	58.	56.	54.	52.
51.	49.	47.	46.	44.	43.	41.	40.	39.	37.
36.	35.	34.	33.	32.	30.	29.	28.	28.	27.

HYDROGRAPH AT STATION CINCIN

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
16	OCT	1100	1	0.00	0.00	0.00	460.	460.
16	OCT	1200	2	0.13	0.05	0.08	455.	468.
16	OCT	1300	3	0.13	0.05	0.08	459.	480.
16	OCT	1400	4	0.13	0.05	0.08	475.	512.
16	OCT	1500	5	0.00	0.00	0.00	502.	585.
16	OCT	1600	6	0.00	0.00	0.00	538.	675.
16	OCT	1700	7	0.13	0.05	0.08	583.	757.
16	OCT	1800	8	0.00	0.00	0.00	638.	815.
16	OCT	1900	9	0.13	0.05	0.08	704.	855.
16	OCT	2000	10	0.13	0.05	0.08	783.	890.
16	OCT	2100	11	0.13	0.05	0.08	876.	931.
16	OCT	2200	12	0.00	0.00	0.00	977.	969.
16	OCT	2300	13	0.00	0.00	0.00	1082.	991.
17	OCT	0000	14	0.13	0.05	0.08	1149.	1014.
17	OCT	0100	15	0.25	0.05	0.21	1305.	1084.
17	OCT	0200	16	0.00	0.00	0.00	1433.	1234.
17	OCT	0300	17	0.00	0.00	0.00	1560.	1436.
17	OCT	0400	18	0.25	0.05	0.21	1687.	1653.
17	OCT	0500	19	0.13	0.05	0.08	1819.	1856.
17	OCT	0600	20	0.13	0.05	0.08	1960.	2045.
17	OCT	0700	21	0.13	0.05	0.08	2113.	2230.
17	OCT	0800	22	0.13	0.05	0.08	2275.	2398.
17	OCT	0900	23	0.00	0.00	0.00	2438.	2550.
17	OCT	1000	24	0.13	0.05	0.08	2599.	2710.
17	OCT	1100	25	0.00	0.00	0.00	2753.	2846.
17	OCT	1200	26	0.13	0.05	0.08	2900.	2968.
17	OCT	1300	27	0.00	0.00	0.00	3040.	3058.
17	OCT	1400	28	0.00	0.00	0.00	3169.	3157.
17	OCT	1500	29	0.00	0.00	0.00	3277.	3238.
17	OCT	1600	30	0.00	0.00	0.00	3358.	3319.
17	OCT	1700	31	0.00	0.00	0.00	3414.	3364.
17	OCT	1800	32	0.00	0.00	0.00	3450.	3391.
17	OCT	1900	33	0.00	0.00	0.00	3461.	3391.
17	OCT	2000	34	0.00	0.00	0.00	3445.	3382.
17	OCT	2100	35	0.00	0.00	0.00	3408.	3346.
17	OCT	2200	36	0.00	0.00	0.00	3354.	3301.
17	OCT	2300	37	0.00	0.00	0.00	3286.	3256.
18	OCT	0000	38	0.00	0.00	0.00	3210.	3193.
18	OCT	0100	39	0.00	0.00	0.00	3127.	3130.
18	OCT	0200	40	0.00	0.00	0.00	3038.	3058.
18	OCT	0300	41	0.00	0.00	0.00	2947.	2986.
18	OCT	0400	42	0.00	0.00	0.00	2854.	2902.
18	OCT	0500	43	0.00	0.00	0.00	2763.	2822.
18	OCT	0600	44	0.00	0.00	0.00	2675.	2734.
18	OCT	0700	45	0.00	0.00	0.00	2590.	2646.
18	OCT	0800	46	0.00	0.00	0.00	2507.	2558.
18	OCT	0900	47	0.00	0.00	0.00	2428.	2470.
18	OCT	1000	48	0.13	0.05	0.08	2354.	2382.
18	OCT	1100	49	0.00	0.00	0.00	2288.	2302.
18	OCT	1200	50	0.00	0.00	0.00	2228.	2222.
18	OCT	1300	51	0.00	0.00	0.00	2173.	2136.
18	OCT	1400	52	0.00	0.00	0.00	2122.	2073.
18	OCT	1500	53	0.00	0.00	0.00	2075.	2010.
18	OCT	1600	54	0.00	0.00	0.00	2031.	1961.
18	OCT	1700	55	0.00	0.00	0.00	1991.	1905.
18	OCT	1800	56	0.00	0.00	0.00	1952.	1870.
18	OCT	1900	57	0.00	0.00	0.00	1914.	1835.
18	OCT	2000	58	0.00	0.00	0.00	1874.	1793.
18	OCT	2100	59	0.00	0.00	0.00	1834.	1758.
18	OCT	2200	60	0.00	0.00	0.00	1793.	1725.
18	OCT	2300	61	0.00	0.00	0.00	1750.	1681.
19	OCT	0000	62	0.00	0.00	0.00	1706.	1646.
19	OCT	0100	63	0.00	0.00	0.00	1657.	1611.
19	OCT	0200	64	0.00	0.00	0.00	1606.	1576.
19	OCT	0300	65	0.00	0.00	0.00	1555.	1541.
19	OCT	0400	66	0.00	0.00	0.00	1506.	1507.
19	OCT	0500	67	0.00	0.00	0.00	1459.	1481.
19	OCT	0600	68	0.00	0.00	0.00	1413.	1455.
19	OCT	0700	69	0.00	0.00	0.00	1384.	1422.
19	OCT	0800	70	0.00	0.00	0.00	1362.	1391.

TOTAL RAINFALL = 2.42, TOTAL LOSS = 0.78, TOTAL EXCESS = 1.64

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	69.00-HR
3461.	32.00	(CFS)	3422.	3044.	2036.	2036.
		(INCHES)	0.216	0.770	1.481	1.481
		(AC-FT)	1697.	6038.	11610.	11610.


STATION CINCIN
(U) OUTFLOW, (O) OBSERVED FLOW
(L) PRECIP.
(E) EXCESS
(-) LIMITS OF OPTIMIZATION

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        OTSELIC RIVER     4-05-78
   2          ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
   3          IT      60 04APR78    1300       52
   4          IO       1       2
   5          OU       5      35
   6          PG     CIN    1.26
   7          PG    DERU     .92
   8          PG   HUCOR
   9          PI     .00     .00     .00     .00     .10     .10     .10     .20     .10     .30
  10          PI     .10     .10     .00     .00     .10     .00     .00     .00     .00     .00

  11          KK  CINCIN
  12          QO     926     920     926     931     947     986    1036    1144    1324    1569
  13          QO    1800    2246    2590    2798    2918    2997    2968    2934    2894    2418
  14          QO    2986    3040    3067    3040    2959    2870    2782    2678    2566    2470
  15          QO    2358    2270    2174    2101    2031    1961    1898    1842    1786    1737
  16          QO    1688    1639    1597    1555    1520    1494    1462    1436    1409    1397
  17          QO    1384    1378       0       0       0       0       0       0       0       0
  18          PT     CIN    DERU
  19          PW     .46     .54
  20          PK   HUCOR
  21          PW    1.00
  22          BA    147.      0.
  23          BF    926.   1600.  1.0163
  24          UC     -7.    -21.
  25          LU     -1.    -.05
  26          ZZ
```

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                                        HEC-1 INPUT                                               PAGE  1

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID        OTSELIC RIVER    4-05-78
  2         ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3         IT      60 04APR78    1300      52
  4         IO       1       2
  5         OU       5      35
  6         PG     CIN    1.26
  7         PG    DERU     .92
  8         PG   HUCUR
  9         PI     .00     .00     .00     .00     .10     .10     .10     .20     .10     .00
 10         PI     .10     .10     .00     .00     .10     .00     .00     .00     .00     .00

 11         KK  CINCIN
 12         QO     926     920     926     931     947     986    1036    1144    1324    1569
 13         QO    1800    2246    2590    2798    2918    2997    2968    2934    2894    2918
 14         QO    2986    3040    3067    3040    2959    2870    2782    2678    2566    2470
 15         QO    2358    2270    2174    2101    2031    1961    1898    1842    1786    1737
 16         QO    1688    1639    1597    1555    1520    1494    1462    1436    1409    1397
 17         QO    1384    1378       0       0       0       0       0       0       0       0
 18         PT     CIN    DERU
 19         PW     .46     .54
 20         PR   HUCUR
 21         PW    1.00
 22         BA    147.      0.
 23         BF    926.   1600.  1.0163
 24         UC     -7.    -21.
 25         LU     -1.    -.05
 26         ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 35)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.963		10.19			
COMPUTED HYDROGRAPH	73470.	0.774	2370.	21.30	11.10	3265.	18.00
OBSERVED HYDROGRAPH	73461.	0.774	2370.	21.28	11.08	3067.	22.00
DIFFERENCE	9.	0.000	0.	0.02	0.02	198.	-4.00
PERCENT DIFFERENCE	0.01				0.20	6.45	

STANDARD ERROR	147.	AVERAGE ABSOLUTE ERROR	114.
OBJECTIVE FUNCTION	152.	AVERAGE PERCENT ABSOLUTE ERROR	5.31

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 52)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		0.963		10.19			
COMPUTED HYDROGRAPH	104504.	1.102	2010.	26.46	16.27	3265.	18.00
OBSERVED HYDROGRAPH	104347.	1.100	2007.	26.38	16.19	3067.	22.00
DIFFERENCE	157.	0.002	3.	0.08	0.08	198.	-4.00
PERCENT DIFFERENCE	0.15				0.47	6.45	

STANDARD ERROR	114.	AVERAGE ABSOLUTE ERROR	73.
OBJECTIVE FUNCTION	128.	AVERAGE PERCENT ABSOLUTE ERROR	3.79

UNIT HYDROGRAPH
144 END-OF-PERIOD ORDINATES

156.	592.	1225.	1940.	2575.	3004.	3131.	3044.	2931.	2823.
2716.	2617.	2521.	2427.	2337.	2251.	2168.	2087.	2010.	1936.
1864.	1795.	1729.	1665.	1603.	1544.	1487.	1432.	1379.	1328.
1279.	1231.	1186.	1142.	1100.	1059.	1020.	982.	946.	911.
877.	844.	813.	783.	754.	726.	699.	673.	649.	625.
601.	579.	558.	537.	517.	498.	480.	462.	445.	428.
412.	397.	382.	368.	355.	342.	329.	317.	305.	294.
283.	272.	262.	253.	243.	234.	226.	217.	209.	201.
194.	187.	180.	173.	167.	161.	155.	149.	143.	138.
133.	128.	123.	119.	114.	110.	106.	102.	98.	95.
91.	88.	85.	81.	78.	76.	73.	70.	67.	65.
63.	60.	58.	56.	54.	52.	50.	48.	46.	45.
43.	41.	40.	38.	37.	36.	34.	33.	32.	31.
29.	28.	27.	26.	25.	24.	23.	23.	22.	21.
20.	19.	19.	18.						

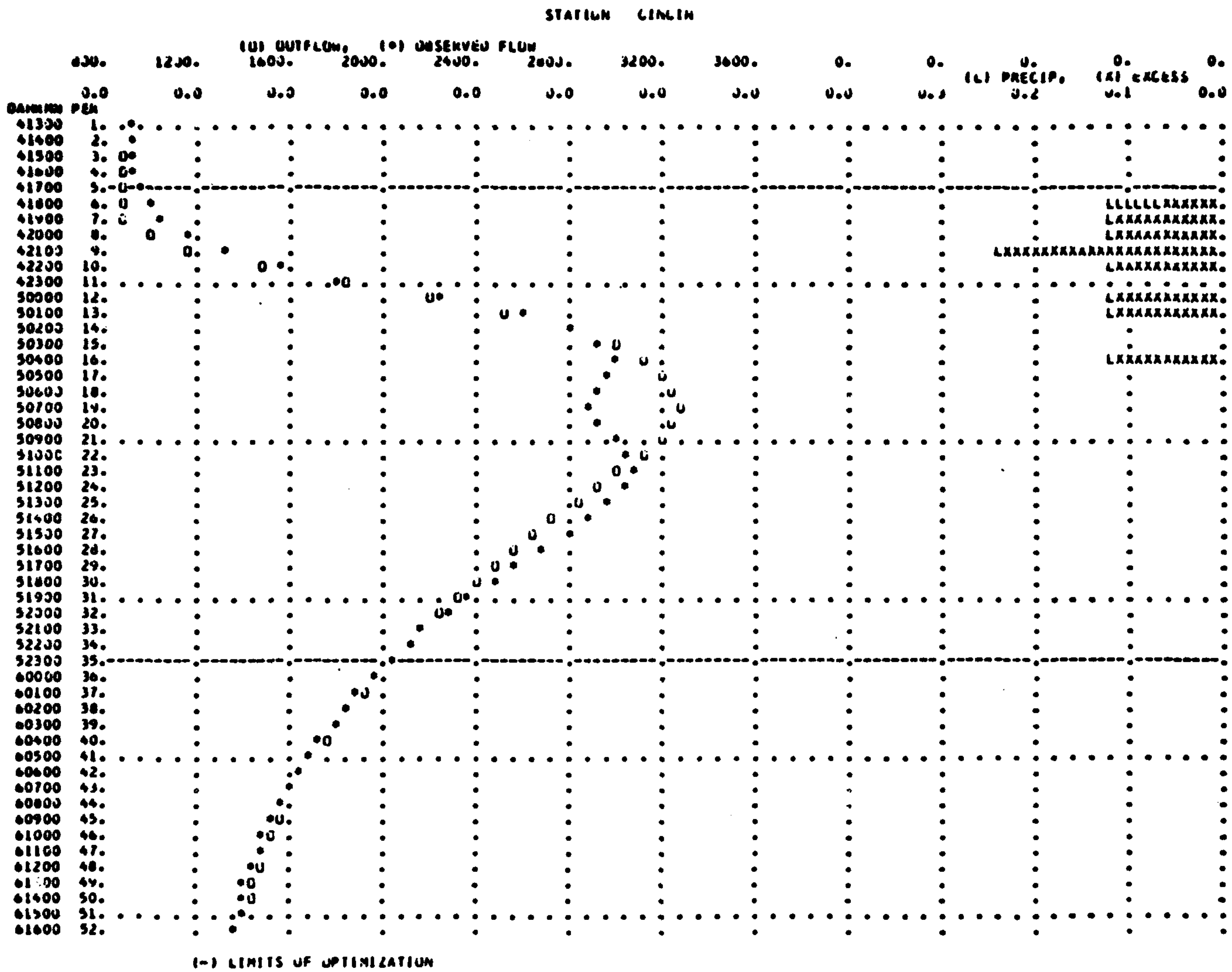
HYDROGRAPH AT STATION CINCIN

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
4 APR 1300	1	0.00	0.00	0.00	926.	926.
4 APR 1400	2	0.00	0.00	0.00	911.	920.
4 APR 1500	3	0.00	0.00	0.00	897.	926.
4 APR 1600	4	0.00	0.00	0.00	882.	931.
4 APR 1700	5	0.00	0.00	0.00	868.	947.
4 APR 1800	6	0.12	0.06	0.06	864.	986.
4 APR 1900	7	0.12	0.01	0.11	895.	1036.
4 APR 2000	8	0.12	0.01	0.11	987.	1144.
4 APR 2100	9	0.24	0.01	0.23	1174.	1324.
4 APR 2200	10	0.12	0.01	0.11	1470.	1569.
4 APR 2300	11	0.00	0.00	0.00	1829.	1800.
5 APR 0000	12	0.12	0.01	0.11	2196.	2246.
5 APR 0100	13	0.12	0.01	0.11	2533.	2590.
5 APR 0200	14	0.00	0.00	0.00	2807.	2798.
5 APR 0300	15	0.00	0.00	0.00	2993.	2918.
5 APR 0400	16	0.12	0.01	0.11	3112.	2997.
5 APR 0500	17	0.00	0.00	0.00	3202.	2968.
5 APR 0600	18	0.00	0.00	0.00	3256.	2934.
5 APR 0700	19	0.00	0.00	0.00	3265.	2894.
5 APR 0800	20	0.00	0.00	0.00	3240.	2918.
5 APR 0900	21	0.00	0.00	0.00	3193.	2986.
5 APR 1000	22	0.00	0.00	0.00	3116.	3040.
5 APR 1100	23	0.00	0.00	0.00	3017.	3067.
5 APR 1200	24	0.00	0.00	0.00	2919.	3040.
5 APR 1300	25	0.00	0.00	0.00	2825.	2959.
5 APR 1400	26	0.00	0.00	0.00	2733.	2670.

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
5 APR 1500	27	0.00	0.00	0.00	2645.	2762.
5 APR 1600	28	0.00	0.00	0.00	2560.	2678.
5 APR 1700	29	0.00	0.00	0.00	2478.	2566.
5 APR 1800	30	0.00	0.00	0.00	2398.	2470.
5 APR 1900	31	0.00	0.00	0.00	2322.	2358.
5 APR 2000	32	0.00	0.00	0.00	2248.	2270.
5 APR 2100	33	0.00	0.00	0.00	2176.	2174.
5 APR 2200	34	0.00	0.00	0.00	2107.	2101.
5 APR 2300	35	0.00	0.00	0.00	2041.	2031.
6 APR 0000	36	0.00	0.00	0.00	1977.	1961.
6 APR 0100	37	0.00	0.00	0.00	1914.	1898.
6 APR 0200	38	0.00	0.00	0.00	1854.	1842.
6 APR 0300	39	0.00	0.00	0.00	1796.	1786.
6 APR 0400	40	0.00	0.00	0.00	1740.	1737.
6 APR 0500	41	0.00	0.00	0.00	1686.	1688.
6 APR 0600	42	0.00	0.00	0.00	1634.	1639.
6 APR 0700	43	0.00	0.00	0.00	1592.	1597.
6 APR 0800	44	0.00	0.00	0.00	1566.	1555.
6 APR 0900	45	0.00	0.00	0.00	1541.	1520.
6 APR 1000	46	0.00	0.00	0.00	1516.	1494.
6 APR 1100	47	0.00	0.00	0.00	1492.	1462.
6 APR 1200	48	0.00	0.00	0.00	1468.	1436.
6 APR 1300	49	0.00	0.00	0.00	1445.	1409.
6 APR 1400	50	0.00	0.00	0.00	1421.	1397.
6 APR 1500	51	0.00	0.00	0.00	1399.	1384.
6 APR 1600	52	0.00	0.00	0.00	1376.	1378.

TOTAL RAINFALL = 1.08, TOTAL LOSS = 0.11, TOTAL EXCESS = 0.96

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	51.00-HR
3265.	18.00	(CFS)	3212.	2720.	2027.	2027.
		(INCHES)	0.203	0.688	1.089	1.089
		(AC-FT)	1593.	5395.	8542.	8542.


STATION CINCIN
(U) OUTFLOW, (*) OBSERVED FLOW
800. 1200. 1600. 2000. 2400. 2800. 3200. 3600. 0. 0. 0. 0. 0.
(L) PRECIP, (X) EXCESS
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.3 0.2 0.1 0.0
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        OWEGO CREEK    11-08-72
  2           ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
  3           IT      60 07NOV72    2200      70
  4           IO       1       2
  5           OU      15      40
  6           PG     CAN    3.21
  7           PG  NEWVAL
  8           PI     .00     .00     .01     .03     .06     .03     .07     .09     .02     .09
  9           PI     .02     .08     .07     .29     .26     .31     .20     .23     .13     .06
 10           PI     .02     .04     .05     .08     .06     .08     .08     .05     .00     .01
 11           PI     .01     .00     .00     .00     .00     .00     .00     .00     .00     .00
 12           PG   HUCOR
 13           PI     .00     .10     .00     .00     .10     .00     .10     .10     .10     .00
 14           PI     .10     .10     .10     .30     .20     .30     .10     .20     .10     .20
 15           PI     .00     .10     .10     .10     .10     .00     .10     .10     .00     .00
 16           PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
 17           PG    MTPL
 18           PI     .01     .03     .01     .00     .05     .01     .03     .05     .05     .06
 19           PI     .15     .07     .12     .26     .31     .24     .26     .22     .16     .06
 20           PI     .06     .05     .06     .07     .06     .05     .04     .01     .00     .01
 21           PI     .01     .02     .01     .04     .00     .00     .00     .00     .00     .00

 22           KK   OWEGO
 23           QO      75      75      75      75      76      76      76      77      79      80
 24           QO      81      85      89      98     107     301     495    1398    2300    3335
 25           QO    4370    4753    5136    5292    5448    5399    5350    5249    5148    5129
 26           QO    5110    5015    4920    4711    4502    4145    3787    3457    3127    2884
 27           QO    2640    2435    2230    2060    1890    1765    1640    1541    1441    1369
 28           QO    1296    1227    1158    1115    1072    1042    1012     985     958     931
 29           QO     904     880     856     838     820     801     781     765     748     735
 30           PT     CAN  NEWVAL   HUCOR    MTPL
 31           PW     .13     .40     .31     .11
 32           PR  NEWVAL   HUCOR    MTPL
 33           PW     .56     .31     .13
 34           BA    185.      0.
 35           BF     75.    580.  1.0224
 36           UL    -7.0    -16.
 37           LU     -.7     -.3
 38           ZZ
```

AD-A129 964 WATERSHED MODELLING IN THE CHEMUNG AND UPPER SUSQUEHANNA RIVER BASINS USI..(U) ARMY MILITARY PERSONNEL CENTER ALEXANDRIA VA J C STYRON 20 MAY 83

4/4

UNCLASSIFIED F/G 8/8 NL

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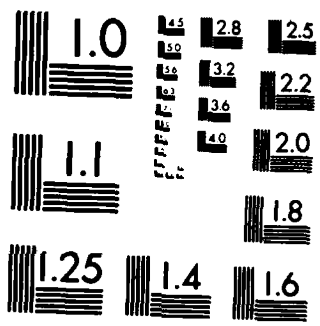


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 15 THROUGH 40)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.324		17.25			
COMPUTED HYDROGRAPH	100917.	0.845	3881.	28.76	11.51	5698.	24.00
OBSERVED HYDROGRAPH	100868.	0.845	3880.	28.95	11.70	5448.	24.00
DIFFERENCE	49.	0.000	2.	-0.19	-0.19	250.	0.00
PERCENT DIFFERENCE	0.05				-1.66	4.59	

STANDARD ERROR 282. AVERAGE ABSOLUTE ERROR 246.
OBJECTIVE FUNCTION 275. AVERAGE PERCENT ABSOLUTE ERROR 24.84

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 70)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.324		17.25			
COMPUTED HYDROGRAPH	149007.	1.248	2129.	35.70	18.45	5698.	24.00
OBSERVED HYDROGRAPH	139920.	1.172	1999.	35.08	17.83	5448.	24.00
DIFFERENCE	9087.	0.076	130.	0.62	0.62	250.	0.00
PERCENT DIFFERENCE	6.49				3.47	4.59	

STANDARD ERROR 287. AVERAGE ABSOLUTE ERROR 218.
OBJECTIVE FUNCTION 319. AVERAGE PERCENT ABSOLUTE ERROR 23.23

UNIT HYDROGRAPH
105 END-OF-PERIOD ORDINATES

180.	680.	1400.	2259.	3175.	3994.	4610.	4983.	5009.	4788.
4542.	4308.	4087.	3877.	3677.	3488.	3309.	3138.	2977.	2824.
2679.	2541.	2410.	2286.	2169.	2057.	1951.	1851.	1756.	1665.
1580.	1499.	1421.	1348.	1279.	1213.	1151.	1092.	1035.	982.
932.	884.	838.	795.	754.	716.	679.	644.	611.	579.
549.	521.	494.	469.	445.	422.	400.	380.	360.	342.
324.	307.	292.	277.	262.	249.	236.	224.	212.	201.
191.	181.	172.	163.	155.	147.	139.	132.	125.	119.
113.	107.	101.	96.	91.	87.	82.	78.	74.	70.
66.	63.	60.	57.	54.	51.	48.	46.	44.	41.
39.	37.	35.	33.	32.					

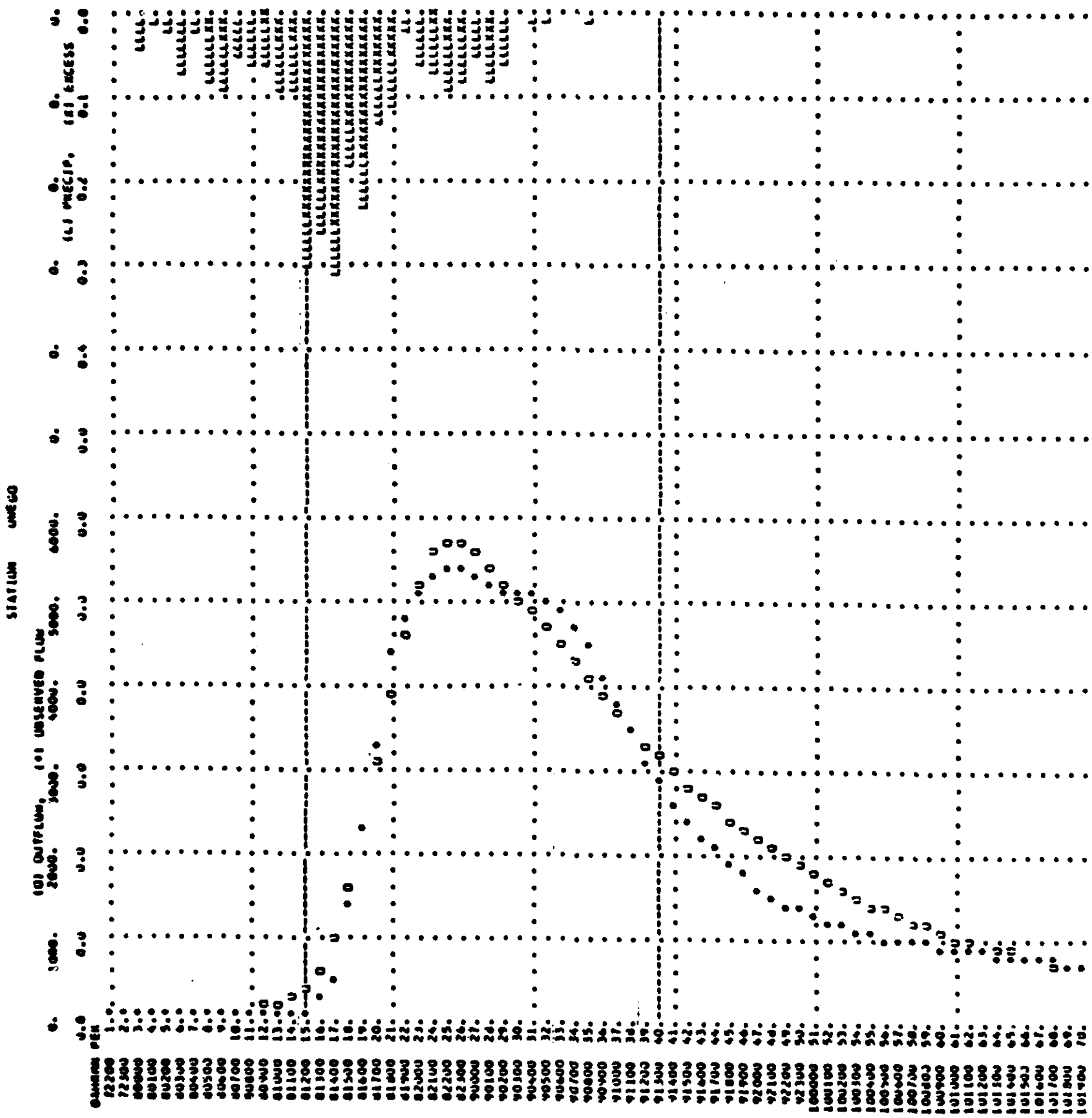
HYDROGRAPH AT STATION OWEGO

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7	NOV	2200	1	0.00	0.00	0.00	75.	75.	9	NOV	0900	36	0.00	0.00	0.00	3887.	4145.
7	NOV	2300	2	0.00	0.00	0.00	73.	75.	9	NOV	1000	37	0.00	0.00	0.00	3690.	3787.
8	NOV	0000	3	0.04	0.04	0.00	72.	75.	9	NOV	1100	38	0.00	0.00	0.00	3502.	3457.
8	NOV	0100	4	0.01	0.01	0.00	70.	75.	9	NOV	1200	39	0.00	0.00	0.00	3323.	3127.
8	NOV	0200	5	0.02	0.02	0.00	69.	76.	9	NOV	1300	40	0.00	0.00	0.00	3153.	2884.
8	NOV	0300	6	0.07	0.07	0.00	67.	76.	9	NOV	1400	41	0.00	0.00	0.00	2991.	2640.
8	NOV	0400	7	0.02	0.02	0.00	66.	76.	9	NOV	1500	42	0.00	0.00	0.00	2838.	2435.
8	NOV	0500	8	0.08	0.06	0.02	66.	77.	9	NOV	1600	43	0.00	0.00	0.00	2693.	2230.
8	NOV	0600	9	0.09	0.06	0.03	81.	79.	9	NOV	1700	44	0.00	0.00	0.00	2556.	2060.
8	NOV	0700	10	0.05	0.05	0.00	110.	80.	9	NOV	1800	45	0.00	0.00	0.00	2425.	1890.
8	NOV	0800	11	0.06	0.06	0.00	149.	81.	9	NOV	1900	46	0.00	0.00	0.00	2301.	1765.
8	NOV	0900	12	0.06	0.06	0.01	195.	85.	9	NOV	2000	47	0.00	0.00	0.00	2184.	1640.
8	NOV	1000	13	0.09	0.06	0.03	248.	89.	9	NOV	2100	48	0.00	0.00	0.00	2072.	1541.
8	NOV	1100	14	0.09	0.06	0.03	312.	98.	9	NOV	2200	49	0.00	0.00	0.00	1966.	1441.
8	NOV	1200	15	0.30	0.06	0.24	425.	107.	9	NOV	2300	50	0.00	0.00	0.00	1866.	1369.
8	NOV	1300	16	0.26	0.06	0.20	649.	301.	10	NOV	0000	51	0.00	0.00	0.00	1771.	1296.
8	NOV	1400	17	0.31	0.06	0.25	1025.	495.	10	NOV	0100	52	0.00	0.00	0.00	1680.	1227.
8	NOV	1500	18	0.18	0.06	0.13	1571.	1398.	10	NOV	0200	53	0.00	0.00	0.00	1595.	1158.
8	NOV	1600	19	0.23	0.06	0.17	2274.	2300.	10	NOV	0300	54	0.00	0.00	0.00	1513.	1115.
8	NOV	1700	20	0.13	0.06	0.07	3080.	3335.	10	NOV	0400	55	0.00	0.00	0.00	1436.	1072.
8	NOV	1800	21	0.11	0.06	0.05	3899.	4370.	10	NOV	0500	56	0.00	0.00	0.00	1363.	1042.
8	NOV	1900	22	0.02	0.02	0.00	4638.	4753.	10	NOV	0600	57	0.00	0.00	0.00	1294.	1012.
8	NOV	2000	23	0.06	0.06	0.00	5205.	5136.	10	NOV	0700	58	0.00	0.00	0.00	1228.	985.
8	NOV	2100	24	0.07	0.06	0.01	5552.	5292.	10	NOV	0800	59	0.00	0.00	0.00	1165.	954.
8	NOV	2200	25	0.09	0.06	0.03	5698.	5448.	10	NOV	0900	60	0.00	0.00	0.00	1106.	931.
8	NOV	2300	26	0.08	0.06	0.02	5692.	5399.	10	NOV	1000	61	0.00	0.00	0.00	1050.	904.
9	NOV	0000	27	0.05	0.05	0.00	5583.	5350.	10	NOV	1100	62	0.00	0.00	0.00	996.	880.
9	NOV	0100	28	0.08	0.06	0.03	5413.	5249.	10	NOV	1200	63	0.00	0.00	0.00	946.	856.
9	NOV	0200	29	0.06	0.06	0.00	5227.	5148.	10	NOV	1300	64	0.00	0.00	0.00	897.	838.
9	NOV	0300	30	0.00	0.00	0.00	5040.	5129.	10	NOV	1400	65	0.00	0.00	0.00	852.	820.
9	NOV	0400	31	0.01	0.01	0.00	4858.	5110.	10	NOV	1500	66	0.00	0.00	0.00	809.	801.
9	NOV	0500	32	0.01	0.01	0.00	4675.	5015.	10	NOV	1600	67	0.00	0.00	0.00	768.	781.
9	NOV	0600	33	0.00	0.00	0.00	4485.	4920.	10	NOV	1700	68	0.00	0.00	0.00	729.	765.
9	NOV	0700	34	0.00	0.00	0.00	4288.	4711.	10	NOV	1800	69	0.00	0.00	0.00	692.	748.
9	NOV	0800	35	0.01	0.01	0.00	4086.	4502.	10	NOV	1900	70	0.00	0.00	0.00	656.	735.

TOTAL RAINFALL = 2.75, TOTAL LOSS = 1.42, TOTAL EXCESS = 1.32

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	69.00-HR
5698.	24.00	(CFS)	5526.	4304.	2154.	2154.
		(INCHES)	0.278	0.865	1.245	1.245
		(AC-FT)	2740.	8536.	12284.	12284.

CUMULATIVE AREA = 105.00 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
(L) PRECIP, (X) EXCESS

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                                       HEC-1 INPUT                                                   PAGE  1

 LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1         ID        OWEGO CREEK    9-26-75
   2         ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
   3         IT      60 24SEP75    2200       88
   4         IO       1       2
   5         OU      10      55
   6         PG     CAN     5.9
   7         PG   LISLE    3.38
   8         PG    CORT    4.50
   9         PG  NEWVAL
  10         PI     .00     .10     .00     .10     .00     .00     .10     .00     .30     .30
  11         PI     .40     .30     .10     .20     .10     .00     .00     .10     .20     .20
  12         PI     .10     .00     .00     .10     .00     .10     .00     .10     .10     .00
  13         PI     .10     .40     .40     .50     .10     .40     .30     .10     .10     .10
  14         PI     .00     .00     .00     .10     .00     .00     .00     .00     .00     .00
  15         PG    WHPT
  16         PI     .00     .00     .10     .10     .00     .10     .00     .10     .20     .30
  17         PI     .30     .40     .10     .20     .00     .10     .00     .10     .30     .30
  18         PI     .00     .00     .00     .00     .00     .10     .10     .10     .10     .00
  19         PI     .00     .10     .30     .30     .20     .10     .20     .10     .10     .10
  20         PI     .00     .10     .00     .00     .10     .00     .00     .00     .00     .00
  21         PG    MTPL
  22         PI     .01     .04     .05     .05     .06     .04     .02     .08     .20     .60
  23         PI     .25     .15     .00     .10     .05     .05     .03     .00     .02     .39
  24         PI     .07     .10     .04     .02     .03     .00     .01     .14     .35     .11
  25         PI     .14     .25     .40     .47     .07     .21     .19     .10     .06     .00
  26         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00

  27         KK   OWEGO
  28         QO     530     502     484     466     452     457     475     502     540     595
  29         QO     618    1083    1947    2969    3783    4492    4828    5140    5368    5514
  30         QO    5710    5934    6018    6088    6046    5948    5962    6046    6060    6088
  31         QO    6022    5934    5836    6004    6564    7332    8628   10400   12000   13350
  32         QO   14110   14165   14220   13560   12650   11820   11270   10680   10295    9750
  33         QO    9330    8620    8304    7674    7132    6676    6214    5724    5296    4900
  34         QO    4528    4190    3904    3651    3431    3233    3079    2936    2796    2705
  35         QO    2540    2437    2342    2275    2194    2160    2075    1998    1947    1896
  36         QO    1854    1811    1769    1712    1672    1632    1608    1568       0       0
  37         PT     CAN  NEWVAL   LISLE    CORT    MTPL
  38         PW     .18     .42     .12     .03     .25
  39         PR  NEWVAL    WHPT    MTPL
  40         PW     .58     .13     .29
  41         BA    185.      0.
  42         BF    530.   2000.  1.0224
  43         UC    -6.0    -14.
  44         LU     -.7    -.05
  45         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 10 THROUGH 55)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.583		27.28			
COMPUTED HYDROGRAPH	340783.	2.854	7408.	37.56	10.28	13774.	41.00
OBSERVED HYDROGRAPH	341887.	2.864	7432.	37.50	10.22	14220.	42.00
DIFFERENCE	-1104.	-0.009	-24.	0.06	0.06	-446.	-1.00
PERCENT DIFFERENCE	-0.32				0.62	-3.13	

STANDARD ERROR	440.	AVERAGE ABSOLUTE ERROR	350.
OBJECTIVE FUNCTION	422.	AVERAGE PERCENT ABSOLUTE ERROR	7.91

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 88)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		3.583		27.28			
COMPUTED HYDROGRAPH	442682.	3.708	5030.	43.85	16.57	13774.	41.00
OBSERVED HYDROGRAPH	445048.	3.728	5057.	43.91	16.64	14220.	42.00
DIFFERENCE	-2366.	-0.020	-27.	-0.07	-0.07	-446.	-1.00
PERCENT DIFFERENCE	-0.53				-0.40	-3.13	

STANDARD ERROR	331.	AVERAGE ABSOLUTE ERROR	234.
OBJECTIVE FUNCTION	379.	AVERAGE PERCENT ABSOLUTE ERROR	6.81

UNIT HYDROGRAPH
85 END-OF-PERIOD ORDINATES

284.	1070.	2194.	3501.	4737.	5656.	6149.	6082.	5703.	5341.
5001.	4683.	4385.	4107.	3846.	3601.	3372.	3158.	2957.	2769.
2593.	2428.	2274.	2129.	1994.	1867.	1748.	1637.	1533.	1436.
1344.	1259.	1179.	1104.	1034.	968.	907.	849.	795.	744.
697.	653.	611.	572.	536.	502.	470.	440.	412.	386.
361.	338.	317.	297.	278.	260.	244.	228.	214.	200.
187.	175.	164.	154.	144.	135.	126.	118.	111.	104.
97.	91.	85.	80.	75.	70.	66.	61.	57.	54.
50.	47.	44.	41.	39.					

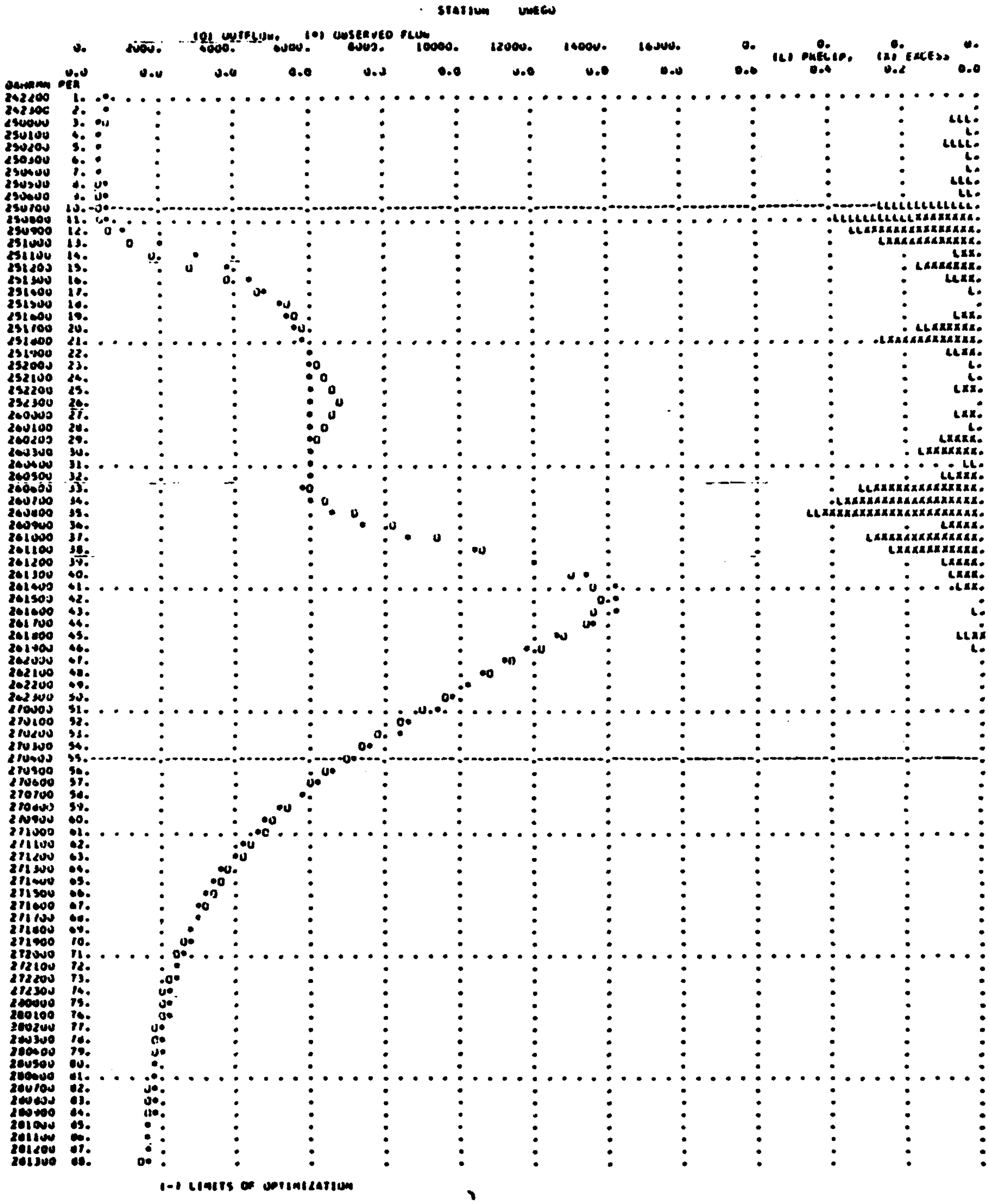
HYDROGRAPH AT STATION UNEGO

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24	SEP	2200	1	0.00	0.00	0.00	530.	530.
24	SEP	2300	2	0.00	0.00	0.00	514.	502.
25	SEP	0000	3	0.07	0.07	0.00	507.	484.
25	SEP	0100	4	0.03	0.03	0.00	496.	466.
25	SEP	0200	5	0.08	0.08	0.00	485.	452.
25	SEP	0300	6	0.02	0.02	0.00	474.	457.
25	SEP	0400	7	0.02	0.02	0.00	464.	475.
25	SEP	0500	8	0.06	0.06	0.00	454.	502.
25	SEP	0600	9	0.04	0.04	0.00	444.	540.
25	SEP	0700	10	0.25	0.25	0.00	434.	595.
25	SEP	0800	11	0.38	0.22	0.15	469.	618.
25	SEP	0900	12	0.34	0.03	0.31	608.	1083.
25	SEP	1000	13	0.26	0.03	0.24	1143.	1947.
25	SEP	1100	14	0.07	0.03	0.04	1880.	2969.
25	SEP	1200	15	0.17	0.03	0.14	2804.	3783.
25	SEP	1300	16	0.07	0.03	0.04	3797.	4492.
25	SEP	1400	17	0.03	0.03	0.00	4686.	4828.
25	SEP	1500	18	0.01	0.01	0.00	5319.	5140.
25	SEP	1600	19	0.07	0.03	0.04	5624.	5368.
25	SEP	1700	20	0.16	0.03	0.13	5705.	5514.
25	SEP	1800	21	0.26	0.03	0.23	5765.	5710.
25	SEP	1900	22	0.08	0.03	0.05	5913.	5934.
25	SEP	2000	23	0.03	0.03	0.00	6135.	6018.
25	SEP	2100	24	0.01	0.01	0.00	6398.	6088.
25	SEP	2200	25	0.06	0.03	0.03	6623.	6046.
25	SEP	2300	26	0.01	0.01	0.00	6726.	5948.
26	SEP	0000	27	0.07	0.03	0.04	6668.	5962.
26	SEP	0100	28	0.02	0.02	0.00	6461.	6046.
26	SEP	0200	29	0.11	0.03	0.08	6205.	6060.
26	SEP	0300	30	0.17	0.03	0.14	6032.	6088.
26	SEP	0400	31	0.03	0.03	0.00	5963.	6022.
26	SEP	0500	32	0.10	0.03	0.07	5966.	5934.
26	SEP	0600	33	0.31	0.03	0.28	6098.	5836.
26	SEP	0700	34	0.38	0.03	0.35	6455.	6004.
26	SEP	0800	35	0.46	0.03	0.43	7144.	6564.
26	SEP	0900	36	0.10	0.03	0.07	8145.	7332.
26	SEP	1000	37	0.30	0.03	0.27	9338.	8628.
26	SEP	1100	38	0.25	0.03	0.22	10662.	10400.
26	SEP	1200	39	0.10	0.03	0.07	11940.	12000.
26	SEP	1300	40	0.09	0.03	0.06	12943.	13350.
26	SEP	1400	41	0.07	0.03	0.04	13562.	14110.
26	SEP	1500	42	0.00	0.00	0.00	13774.	14165.
26	SEP	1600	43	0.01	0.01	0.00	13675.	14220.
26	SEP	1700	44	0.00	0.00	0.00	13325.	13560.
26	SEP	1800	45	0.06	0.03	0.03	12762.	12650.
26	SEP	1900	46	0.01	0.01	0.00	12108.	11820.
26	SEP	2000	47	0.00	0.00	0.00	11437.	11270.
26	SEP	2100	48	0.00	0.00	0.00	10774.	10680.
26	SEP	2200	49	0.00	0.00	0.00	10160.	10295.
26	SEP	2300	50	0.00	0.00	0.00	9539.	9750.
27	SEP	0000	51	0.00	0.00	0.00	8965.	9330.
27	SEP	0100	52	0.00	0.00	0.00	8411.	8820.
27	SEP	0200	53	0.00	0.00	0.00	7884.	8304.
27	SEP	0300	54	0.00	0.00	0.00	7390.	7874.
27	SEP	0400	55	0.00	0.00	0.00	6927.	7132.
27	SEP	0500	56	0.00	0.00	0.00	6493.	6876.
27	SEP	0600	57	0.00	0.00	0.00	6087.	6214.
27	SEP	0700	58	0.00	0.00	0.00	5706.	5724.
27	SEP	0800	59	0.00	0.00	0.00	5350.	5296.
27	SEP	0900	60	0.00	0.00	0.00	5016.	4900.
27	SEP	1000	61	0.00	0.00	0.00	4703.	4528.
27	SEP	1100	62	0.00	0.00	0.00	4410.	4190.
27	SEP	1200	63	0.00	0.00	0.00	4135.	3904.
27	SEP	1300	64	0.00	0.00	0.00	3878.	3651.
27	SEP	1400	65	0.00	0.00	0.00	3637.	3431.
27	SEP	1500	66	0.00	0.00	0.00	3411.	3233.
27	SEP	1600	67	0.00	0.00	0.00	3199.	3079.
27	SEP	1700	68	0.00	0.00	0.00	3001.	2936.
27	SEP	1800	69	0.00	0.00	0.00	2815.	2796.
27	SEP	1900	70	0.00	0.00	0.00	2641.	2705.
27	SEP	2000	71	0.00	0.00	0.00	2478.	2540.
27	SEP	2100	72	0.00	0.00	0.00	2325.	2437.
27	SEP	2200	73	0.00	0.00	0.00	2182.	2342.
27	SEP	2300	74	0.00	0.00	0.00	2048.	2275.
28	SEP	0000	75	0.00	0.00	0.00	1973.	2194.
28	SEP	0100	76	0.00	0.00	0.00	1930.	2160.
28	SEP	0200	77	0.00	0.00	0.00	1887.	2075.
28	SEP	0300	78	0.00	0.00	0.00	1846.	1998.
28	SEP	0400	79	0.00	0.00	0.00	1806.	1947.
28	SEP	0500	80	0.00	0.00	0.00	1766.	1896.
28	SEP	0600	81	0.00	0.00	0.00	1727.	1854.
28	SEP	0700	82	0.00	0.00	0.00	1689.	1811.
28	SEP	0800	83	0.00	0.00	0.00	1652.	1769.
28	SEP	0900	84	0.00	0.00	0.00	1616.	1712.
28	SEP	1000	85	0.00	0.00	0.00	1581.	1672.
28	SEP	1100	86	0.00	0.00	0.00	1546.	1632.
28	SEP	1200	87	0.00	0.00	0.00	1512.	1608.
28	SEP	1300	88	0.00	0.00	0.00	1479.	1568.

TOTAL RAINFALL = 5.19, TOTAL LOSS = 1.61, TOTAL EXCESS = 3.58

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	87.00-HR
13774.	41.00	(CFS)	13272.	9995.	5985.	5077.
		(INCHES)	0.667	2.009	3.609	3.703
		(AC-FT)	6581.	19825.	35611.	36502.

CUMULATIVE AREA = 185.00 SQ MI


STATION OWEGO
(O) OUTFLOW, (*) OBSERVED FLOW
0. 2000. 4000. 6000. 8000. 10000. 12000. 14000. 16000.
0. (L) PRECIP, 0. (X) EXCESS 0.
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.6 0.4 0.2 0.0
DAHRMN PER
(-) LIMITS OF OPTIMIZATION

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ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

ID        OWEGO CREEK    10-09-76
ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
IT      60 07OCT76    1700      90
IO       1       2
OU      35      65
PG     CAN    3.13
PG  NEWVAL
PI     .00     .00     .00     .00     .00     .10     .10     .10     .00     .00
PI     .00     .10     .00     .00     .00     .00     .00     .00     .00     .00
PI     .00     .10     .00     .00     .00     .00     .00     .00     .10     .00
PI     .00     .00     .10     .10     .10     .20     .10     .10     .10     .20
PI     .30     .30     .50     .40     .10     .00     .10     .00     .00     .00
PI     .00     .00     .00     .00     .10     .00     .00     .00     .00     .00
PG   HUCOR
PI     .00     .00     .10     .10     .00     .00     .10     .10     .10     .00
PI     .00     .00     .00     .00     .00     .00     .10     .00     .00     .00
PI     .00     .00     .10     .00     .00     .00     .00     .00     .00     .00
PI     .00     .00     .00     .10     .10     .20     .00     .10     .20     .20
PI     .20     .30     .30     .40     .20     .00     .10     .00     .00     .00
PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
PG    MTPL
PI     .10     .01     .07     .05     .02     .03     .14     .27     .05     .01
PI     .09     .06     .00     .00     .05     .00     .00     .01     .04     .00
PI     .00     .00     .00     .00     .00     .00     .00     .00     .03     .02
PI     .00     .01     .03     .09     .10     .11     .11     .05     .07     .18
PI     .19     .26     .29     .26     .06     .04     .04     .03     .02     .01
PI     .04     .01     .00     .00     .00     .00     .00     .00     .00     .00

KK   OWEGO
QO      45      45      45      46      46      46      47      48      51      51
QO      51      51      51      51      52      52      52      54      54      55
QO      57      60      66      79      89      98     121     139     139     139
QO     139     137     135     137     142     147     149     173     218     293
QO     457     760    1277    2194    3266    4256    4948    5536    6074    6508
QO    6876    6956    6764    6172    5356    4852    4540    4408    4360    4201
QO    4058    3761    3387    2947    2550    2329    2168    2057    1947    1769
QO    1744    1672    1616    1528    1464    1416    1345    1300    1247    1210
QO    1172    1143    1097    1053    1025    1004     976     948     920     900
PT     CAN  NEWVAL   HUCOR    MTPL
PW     .18     .40     .31     .11
PR  NEWVAL   HUCOR    MTPL
PW     .56     .31     .13
BA    185.      0.
BF     45.   1100.  1.0224
UC    -6.0    -16.
LU     -.7    -.05
ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 35 THROUGH 65)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.290		42.92			
COMPUTED HYDROGRAPH	107045.	0.897	3453.	53.67	10.75	6882.	50.00
OBSERVED HYDROGRAPH	107586.	0.901	3471.	53.46	10.54	6956.	51.00
DIFFERENCE	-541.	-0.005	-17.	0.21	0.21	-74.	-1.00
PERCENT DIFFERENCE	-0.50				1.97	-1.06	

STANDARD ERROR	284.	AVERAGE ABSOLUTE ERROR	225.
OBJECTIVE FUNCTION	304.	AVERAGE PERCENT ABSOLUTE ERROR	15.54

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 90)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.290		42.92			
COMPUTED HYDROGRAPH	146909.	1.231	1632.	59.11	16.19	6882.	50.00
OBSERVED HYDROGRAPH	145164.	1.216	1613.	58.34	15.42	6956.	51.00
DIFFERENCE	1745.	0.015	19.	0.77	0.77	-74.	-1.00
PERCENT DIFFERENCE	1.20				5.02	-1.06	

STANDARD ERROR	209.	AVERAGE ABSOLUTE ERROR	122.
OBJECTIVE FUNCTION	293.	AVERAGE PERCENT ABSOLUTE ERROR	12.71

UNIT HYDROGRAPH
91 END-OF-PERIOD ORDINATES

258.	473.	1949.	3201.	4359.	5245.	5764.	5772.	5456.	5132.
4827.	4560.	4270.	4017.	3778.	3553.	3342.	3144.	2957.	2781.
2616.	2460.	2314.	2177.	2047.	1926.	1811.	1704.	1602.	1507.
1418.	1333.	1254.	1180.	1109.	1044.	982.	923.	868.	817.
768.	723.	680.	639.	601.	565.	532.	500.	471.	443.
416.	392.	368.	346.	326.	306.	288.	271.	255.	240.
226.	212.	200.	188.	177.	166.	156.	147.	138.	130.
122.	115.	108.	102.	96.	90.	85.	80.	75.	70.
66.	62.	59.	55.	52.	49.	46.	43.	41.	38.
36.									

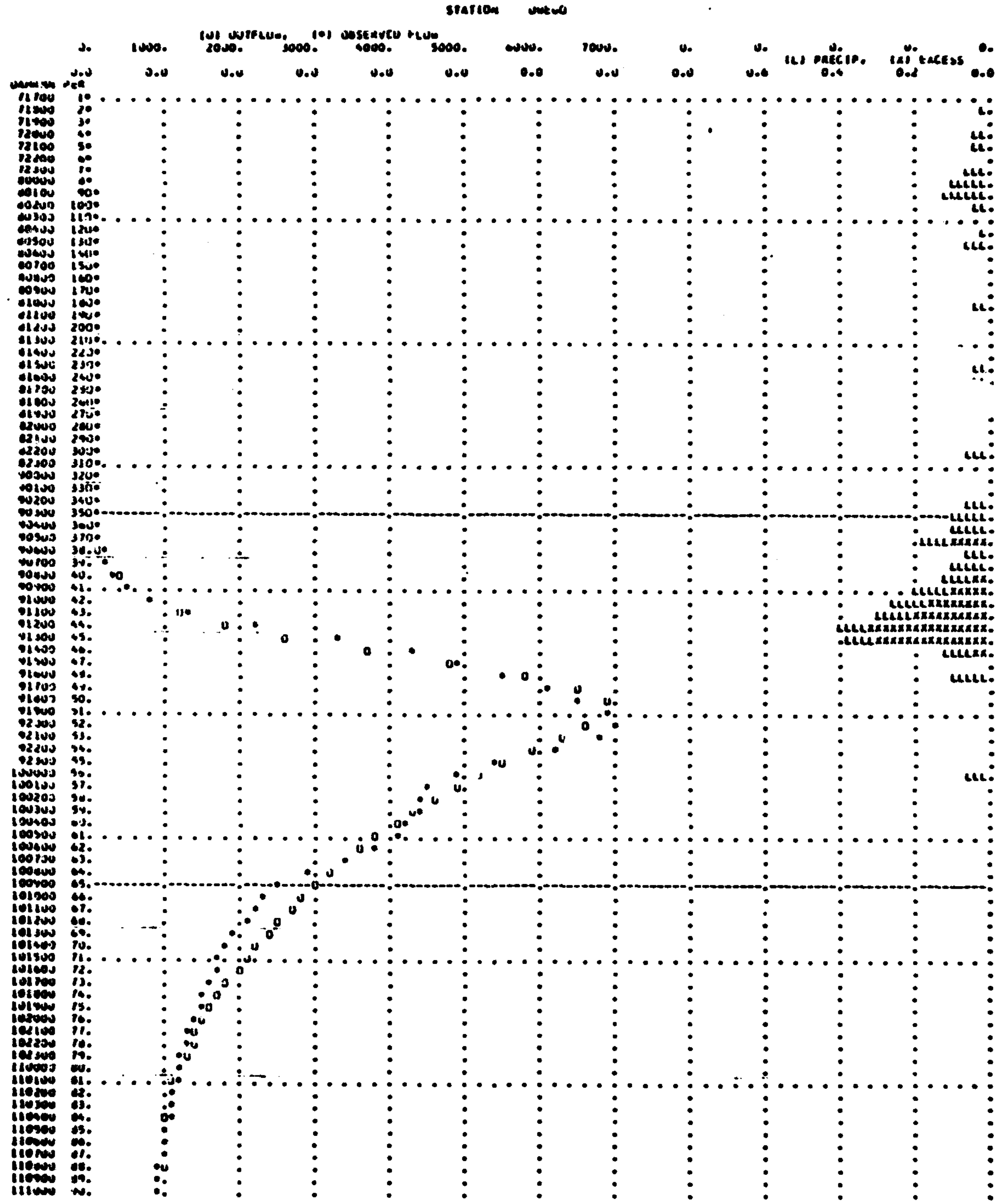
HYDROGRAPH AT STATION OWEGO

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q	DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
7 OCT 1700	1	0.00	0.00	0.00	45.	45.	9 OCT 1400	46	0.12	0.09	0.04	3714.	4256.
7 OCT 1800	2	0.01	0.01	0.00	44.	45.	9 OCT 1500	47	0.01	0.01	0.00	4836.	4968.
7 OCT 1900	3	0.00	0.00	0.00	43.	45.	9 OCT 1600	48	0.09	0.09	0.01	5424.	5536.
7 OCT 2000	4	0.04	0.04	0.00	42.	46.	9 OCT 1700	49	0.00	0.00	0.00	6528.	6074.
7 OCT 2100	5	0.04	0.04	0.00	41.	46.	9 OCT 1800	50	0.00	0.00	0.00	6677.	6508.
7 OCT 2200	6	0.00	0.00	0.00	40.	46.	9 OCT 1900	51	0.00	0.00	0.00	6882.	6876.
7 OCT 2300	7	0.06	0.06	0.00	39.	47.	9 OCT 2000	52	0.01	0.01	0.00	6626.	6956.
8 OCT 0000	8	0.10	0.10	0.00	39.	48.	9 OCT 2100	53	0.00	0.00	0.00	6261.	6764.
8 OCT 0100	9	0.12	0.12	0.00	38.	51.	9 OCT 2200	54	0.00	0.00	0.00	5896.	6172.
8 OCT 0200	10	0.04	0.04	0.00	37.	51.	9 OCT 2300	55	0.00	0.00	0.00	5548.	5356.
8 OCT 0300	11	0.00	0.00	0.00	36.	51.	10 OCT 0000	56	0.06	0.06	0.00	5219.	4852.
8 OCT 0400	12	0.01	0.01	0.00	35.	51.	10 OCT 0100	57	0.00	0.00	0.00	4909.	4540.
8 OCT 0500	13	0.06	0.06	0.00	34.	51.	10 OCT 0200	58	0.00	0.00	0.00	4618.	4408.
8 OCT 0600	14	0.00	0.00	0.00	34.	51.	10 OCT 0300	59	0.00	0.00	0.00	4344.	4360.
8 OCT 0700	15	0.00	0.00	0.00	33.	52.	10 OCT 0400	60	0.00	0.00	0.00	4086.	4201.
8 OCT 0800	16	0.01	0.01	0.00	32.	52.	10 OCT 0500	61	0.00	0.00	0.00	3844.	4058.
8 OCT 0900	17	0.00	0.00	0.00	32.	52.	10 OCT 0600	62	0.00	0.00	0.00	3616.	3761.
8 OCT 1000	18	0.03	0.03	0.00	31.	54.	10 OCT 0700	63	0.00	0.00	0.00	3402.	3381.
8 OCT 1100	19	0.00	0.00	0.00	30.	54.	10 OCT 0800	64	0.00	0.00	0.00	3200.	2947.
8 OCT 1200	20	0.01	0.01	0.00	30.	55.	10 OCT 0900	65	0.00	0.00	0.00	3010.	2550.
8 OCT 1300	21	0.00	0.00	0.00	29.	57.	10 OCT 1000	66	0.00	0.00	0.00	2832.	2329.
8 OCT 1400	22	0.00	0.00	0.00	28.	60.	10 OCT 1100	67	0.00	0.00	0.00	2664.	2168.
8 OCT 1500	23	0.06	0.06	0.00	28.	66.	10 OCT 1200	68	0.00	0.00	0.00	2506.	2057.
8 OCT 1600	24	0.03	0.03	0.00	27.	79.	10 OCT 1300	69	0.00	0.00	0.00	2357.	1947.
8 OCT 1700	25	0.00	0.00	0.00	26.	89.	10 OCT 1400	70	0.00	0.00	0.00	2218.	1769.
8 OCT 1800	26	0.00	0.00	0.00	26.	98.	10 OCT 1500	71	0.00	0.00	0.00	2086.	1744.
8 OCT 1900	27	0.00	0.00	0.00	25.	121.	10 OCT 1600	72	0.00	0.00	0.00	1963.	1672.
8 OCT 2000	28	0.00	0.00	0.00	25.	139.	10 OCT 1700	73	0.00	0.00	0.00	1846.	1616.
8 OCT 2100	29	0.00	0.00	0.00	24.	139.	10 OCT 1800	74	0.00	0.00	0.00	1737.	1528.
8 OCT 2200	30	0.06	0.06	0.00	24.	139.	10 OCT 1900	75	0.00	0.00	0.00	1634.	1464.
8 OCT 2300	31	0.00	0.00	0.00	23.	139.	10 OCT 2000	76	0.00	0.00	0.00	1537.	1416.
9 OCT 0000	32	0.00	0.00	0.00	23.	137.	10 OCT 2100	77	0.00	0.00	0.00	1446.	1345.
9 OCT 0100	33	0.00	0.00	0.00	22.	135.	10 OCT 2200	78	0.00	0.00	0.00	1361.	1300.
9 OCT 0200	34	0.06	0.06	0.00	22.	137.	10 OCT 2300	79	0.00	0.00	0.00	1280.	1247.
9 OCT 0300	35	0.10	0.10	0.00	21.	142.	11 OCT 0000	80	0.00	0.00	0.00	1204.	1210.
9 OCT 0400	36	0.10	0.10	0.00	21.	147.	11 OCT 0100	81	0.00	0.00	0.00	1133.	1172.
9 OCT 0500	37	0.19	0.09	0.10	48.	149.	11 OCT 0200	82	0.00	0.00	0.00	1088.	1145.
9 OCT 0600	38	0.07	0.07	0.00	121.	173.	11 OCT 0300	83	0.00	0.00	0.00	1064.	1097.
9 OCT 0700	39	0.09	0.09	0.01	224.	218.	11 OCT 0400	84	0.00	0.00	0.00	1041.	1053.
9 OCT 0800	40	0.13	0.09	0.04	367.	293.	11 OCT 0500	85	0.00	0.00	0.00	1018.	1025.
9 OCT 0900	41	0.19	0.09	0.11	549.	457.	11 OCT 0600	86	0.00	0.00	0.00	996.	1004.
9 OCT 1000	42	0.25	0.09	0.17	811.	760.	11 OCT 0700	87	0.00	0.00	0.00	974.	976.
9 OCT 1100	43	0.29	0.09	0.21	1205.	1277.	11 OCT 0800	88	0.00	0.00	0.00	952.	948.
9 OCT 1200	44	0.41	0.09	0.32	1791.	2194.	11 OCT 0900	89	0.00	0.00	0.00	932.	920.
9 OCT 1300	45	0.38	0.09	0.29	2641.	3266.	11 OCT 1000	90	0.00	0.00	0.00	911.	900.

TOTAL RAINFALL = 3.22, TOTAL LOSS = 1.93, TOTAL EXCESS = 1.29

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	89.00-HR
6882.	50.00	(CFS)	6506.	4573.	2025.	1645.
		(INCHES)	0.327	0.919	1.221	1.227
		(AC-FT)	3226.	9069.	12049.	12102.

CUMULATIVE AREA = 185.00 SQ MI



(-) LIMITS OF OPTIMIZATION

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1         ID        OWEGO CREEK    9-25-77
   2         ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
   3         IT      60 24SEP77    1300       84
   4         IO       1       2
   5         JU       5      30
   6         PG     CAN    2.51
   7         PG  NEWVAL
   8         PI     .10     .00     .00     .00     .20     .00     .10     .00     .20     .10
   9         PI     .40     .20     .10     .20     .10     .20     .00     .00     .00     .00
  10         PI     .00     .00     .00     .00     .00     .00     .00     .10     .00     .00
  11         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  12         PI     .00     .00     .10     .10     .00     .10     .00     .00     .00     .00
  13         PI     .00     .00     .20     .00     .00     .00     .00     .00     .00     .00
  14         PG   HUCCR
  15         PI     .00     .00     .20     .10     .10     .10     .00     .10     .10     .10
  16         PI     .30     .30     .20     .20     .10     .00     .00     .10     .00     .00
  17         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  18         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  19         PI     .00     .10     .00     .10     .10     .00     .00     .00     .00     .10
  20         PI     .10     .00     .00     .00     .00     .00     .00     .00     .00     .00
  21         PG    MTPL
  22         PI     .00     .00     .08     .10     .07     .05     .06     .09     .13     .27
  23         PI     .27     .22     .11     .11     .04     .00     .00     .00     .00     .00
  24         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  25         PI     .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
  26         PI     .00     .00     .00     .05     .11     .01     .00     .00     .00     .04
  27         PI     .00     .10     .00     .00     .00     .00     .00     .00     .00     .00

  28         KK   OWEGO
  29         QO     380     376     376     380     380     389     389     412     470     621
  30         QO    1097    1712    2374    3178    4014    4864    5570    6000    6382    6494
  31         QO    6456    6326    6004    5548    5104    4768    4492    4311    4190    3981
  32         QO    3739    3453    3035    2643    2410    2266    2160    2066    1981    1913
  33         QO    1854    1794    1760    1744    1752    1794    1836    1905    1964    2032
  34         QO    2075    2083    2075    2049    2049    2092    2176    2248    2284    2284
  35         QO    2230    2143    2058    1981    1913    1828    1752    1672    1608    1552
  36         QO    1488    1440    1390    1360    1315    1277    1248    1202    1173    1135
  37         QO    1098    1067    1039    1011       0       0       0       0       0       0
  38         PT     CAN  NEWVAL   HUCOR    MTPL
  39         PW     .18     .40     .31     .11
  40         PR  NEWVAL   HUCOR    MTPL
  41         PW     .56     .31     .13
  42         BA    185.      0.
  43         BF    380.   1500.  1.0224
  44         UC    -7.0    -18.
  45         LU     -.3    -.05
  46         ZZ
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COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION
(ORDINATES 5 THROUGH 30)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.532		17.72			
COMPUTED HYDROGRAPH	96061.	0.805	3695.	20.93	3.21	6478.	19.00
OBSERVED HYDROGRAPH	95526.	0.800	3674.	20.95	3.23	6494.	19.00
DIFFERENCE	535.	0.004	21.	-0.02	-0.02	-16.	0.00
PERCENT DIFFERENCE	0.56				-0.52	-0.25	

STANDARD ERROR	138.	AVERAGE ABSOLUTE ERROR	114.
OBJECTIVE FUNCTION	134.	AVERAGE PERCENT ABSOLUTE ERROR	8.35

STATISTICS BASED ON FULL HYDROGRAPH
(ORDINATES 1 THROUGH 84)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.532		17.72			
COMPUTED HYDROGRAPH	196727.	1.648	2342.	36.35	18.63	6478.	19.00
OBSERVED HYDROGRAPH	198531.	1.663	2363.	37.68	19.96	6494.	19.00
DIFFERENCE	-1804.	-0.015	-21.	-1.32	-1.32	-16.	0.00
PERCENT DIFFERENCE	-0.91				-6.63	-0.25	

STANDARD ERROR	304.	AVERAGE ABSOLUTE ERROR	232.
OBJECTIVE FUNCTION	301.	AVERAGE PERCENT ABSOLUTE ERROR	13.42

UNIT HYDROGRAPH
98 END-OF-PERIOD ORDINATES

303.	1143.	2351.	3677.	4795.	5464.	5544.	5258.	4970.	4698.
4441.	4198.	3969.	3751.	3546.	3352.	3169.	2995.	2832.	2677.
2530.	2392.	2261.	2137.	2020.	1910.	1805.	1707.	1613.	1525.
1441.	1363.	1289.	1218.	1151.	1088.	1028.	972.	919.	869.
821.	776.	734.	694.	656.	620.	586.	554.	524.	495.
468.	442.	418.	395.	374.	353.	334.	316.	298.	282.
267.	252.	238.	225.	213.	201.	190.	180.	170.	161.
152.	144.	136.	128.	121.	115.	108.	102.	97.	92.
87.	82.	77.	73.	69.	65.	62.	58.	55.	52.
49.	47.	44.	42.	39.	37.	35.	33.		

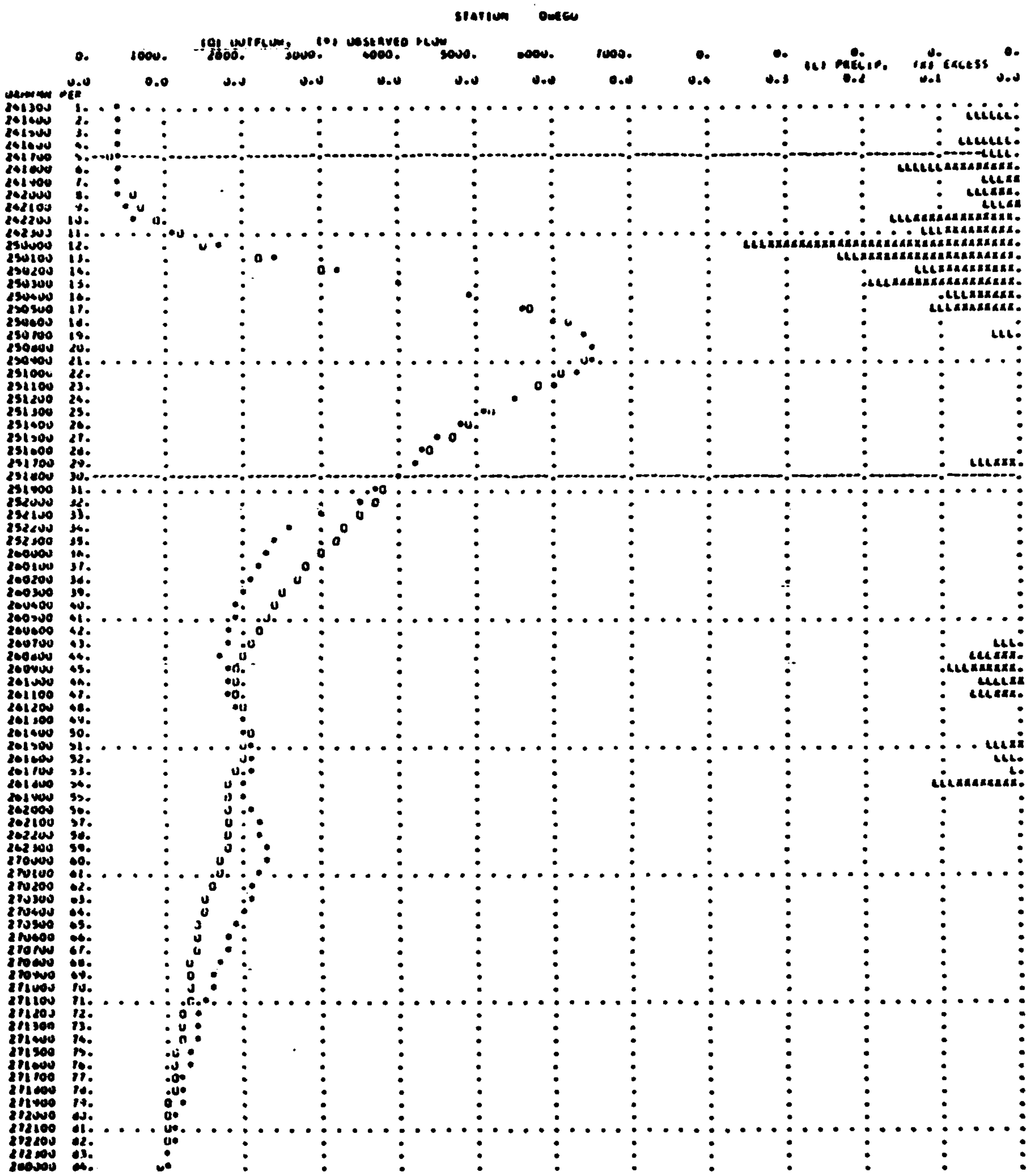
HYDROGRAPH AT STATION OWEGO

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
24 SEP 1300	1	0.00	0.00	0.00	380.	380.
24 SEP 1400	2	0.06	0.06	0.00	372.	376.
24 SEP 1500	3	0.00	0.00	0.00	364.	376.
24 SEP 1600	4	0.07	0.07	0.00	356.	380.
24 SEP 1700	5	0.04	0.04	0.00	348.	380.
24 SEP 1800	6	0.15	0.06	0.09	368.	389.
24 SEP 1900	7	0.04	0.03	0.01	439.	389.
24 SEP 2000	8	0.06	0.03	0.03	557.	412.
24 SEP 2100	9	0.04	0.03	0.01	709.	470.
24 SEP 2200	10	0.16	0.03	0.13	901.	621.
24 SEP 2300	11	0.12	0.03	0.09	1157.	1097.
25 SEP 0000	12	0.35	0.03	0.32	1544.	1712.
25 SEP 0100	13	0.23	0.03	0.20	2163.	2374.
25 SEP 0200	14	0.13	0.03	0.10	2997.	3178.
25 SEP 0300	15	0.19	0.03	0.16	3952.	4014.
25 SEP 0400	16	0.09	0.03	0.06	4885.	4864.
25 SEP 0500	17	0.11	0.03	0.08	5660.	5570.
25 SEP 0600	18	0.00	0.00	0.00	6184.	6000.
25 SEP 0700	19	0.03	0.03	0.00	6433.	6382.
25 SEP 0800	20	0.00	0.00	0.00	6478.	6494.
25 SEP 0900	21	0.00	0.00	0.00	6357.	6456.
25 SEP 1000	22	0.00	0.00	0.00	6120.	6326.
25 SEP 1100	23	0.00	0.00	0.00	5824.	6004.
25 SEP 1200	24	0.00	0.00	0.00	5515.	5548.
25 SEP 1300	25	0.00	0.00	0.00	5220.	5104.
25 SEP 1400	26	0.00	0.00	0.00	4942.	4768.
25 SEP 1500	27	0.00	0.00	0.00	4679.	4492.
25 SEP 1600	28	0.00	0.00	0.00	4430.	4311.
25 SEP 1700	29	0.06	0.03	0.03	4202.	4190.
25 SEP 1800	30	0.00	0.00	0.00	4000.	3981.
25 SEP 1900	31	0.00	0.00	0.00	3820.	3739.
25 SEP 2000	32	0.00	0.00	0.00	3656.	3453.
25 SEP 2100	33	0.00	0.00	0.00	3493.	3035.
25 SEP 2200	34	0.00	0.00	0.00	3331.	2640.
25 SEP 2300	35	0.00	0.00	0.00	3165.	2410.
26 SEP 0000	36	0.00	0.00	0.00	2998.	2266.
26 SEP 0100	37	0.00	0.00	0.00	2839.	2160.
26 SEP 0200	38	0.00	0.00	0.00	2690.	2066.
26 SEP 0300	39	0.00	0.00	0.00	2548.	1981.
26 SEP 0400	40	0.00	0.00	0.00	2414.	1913.
26 SEP 0500	41	0.00	0.00	0.00	2287.	1854.
26 SEP 0600	42	0.00	0.00	0.00	2167.	1794.
26 SEP 0700	43	0.03	0.03	0.00	2054.	1760.
26 SEP 0800	44	0.06	0.03	0.03	1954.	1764.
26 SEP 0900	45	0.09	0.03	0.06	1892.	1752.
26 SEP 1000	46	0.05	0.03	0.01	1883.	1794.
26 SEP 1100	47	0.06	0.03	0.03	1921.	1836.
26 SEP 1200	48	0.00	0.00	0.00	1966.	1905.
26 SEP 1300	49	0.00	0.00	0.00	2042.	1964.
26 SEP 1400	50	0.00	0.00	0.00	2060.	2032.
26 SEP 1500	51	0.04	0.03	0.01	2025.	2075.
26 SEP 1600	52	0.03	0.03	0.00	1954.	2083.
26 SEP 1700	53	0.01	0.01	0.00	1867.	2075.
26 SEP 1800	54	0.11	0.03	0.08	1802.	2049.
26 SEP 1900	55	0.00	0.00	0.00	1783.	2049.
26 SEP 2000	56	0.00	0.00	0.00	1798.	2092.
26 SEP 2100	57	0.00	0.00	0.00	1823.	2176.
26 SEP 2200	58	0.00	0.00	0.00	1835.	2248.
26 SEP 2300	59	0.00	0.00	0.00	1814.	2204.
27 SEP 0000	60	0.00	0.00	0.00	1749.	2284.
27 SEP 0100	61	0.00	0.00	0.00	1658.	2230.
27 SEP 0200	62	0.00	0.00	0.00	1570.	2143.
27 SEP 0300	63	0.00	0.00	0.00	1495.	2058.
27 SEP 0400	64	0.00	0.00	0.00	1462.	1981.
27 SEP 0500	65	0.00	0.00	0.00	1430.	1913.
27 SEP 0600	66	0.03	0.00	0.00	1399.	1826.
27 SEP 0700	67	0.00	0.00	0.00	1368.	1752.
27 SEP 0800	68	0.00	0.00	0.00	1338.	1672.
27 SEP 0900	69	0.00	0.00	0.00	1309.	1608.
27 SEP 1000	70	0.00	0.00	0.00	1280.	1552.
27 SEP 1100	71	0.00	0.00	0.00	1252.	1488.
27 SEP 1200	72	0.00	0.00	0.00	1225.	1440.
27 SEP 1300	73	0.00	0.00	0.00	1198.	1390.
27 SEP 1400	74	0.00	0.00	0.00	1172.	1360.
27 SEP 1500	75	0.00	0.00	0.00	1146.	1315.
27 SEP 1600	76	0.00	0.00	0.00	1121.	1277.
27 SEP 1700	77	0.00	0.00	0.00	1096.	1240.
27 SEP 1800	78	0.00	0.00	0.00	1072.	1202.
27 SEP 1900	79	0.00	0.00	0.00	1049.	1173.
27 SEP 2000	80	0.00	0.00	0.00	1026.	1135.
27 SEP 2100	81	0.00	0.00	0.00	1003.	1098.
27 SEP 2200	82	0.00	0.00	0.00	981.	1067.
27 SEP 2300	83	0.00	0.00	0.00	960.	1039.
28 SEP 0000	84	0.00	0.00	0.00	939.	1011.

TOTAL RAINFALL = 2.44, TOTAL LOSS = 0.91, TOTAL EXCESS = 1.53

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	83.00-HR
6478.	19.00	(CFS)	6219.	4626.	2639.	2562.
		(INCHES)	0.313	0.930	1.591	1.642
		(AC-FT)	3084.	9175.	15702.	16204.

CUMULATIVE AREA = 185.00 SQ MI



(-) LIMITS OF OPTIMIZATION

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ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

ID        OWEGO CREEK     10-17-77
ID        UNIT GRAPH (CLARK) AND LOSS RATE OPTIMIZATION (UNIFORM)
IT      60 160CT77    0400      75
IO       1       2
OU      10      50
PG     CAN    2.92
PG   LISLE    3.63
PG  NEWVAL
PI     .00     .00     .00     .00     .00     .00     .00     .00     .20     .00
PI     .10     .00     .10     .10     .00     .20     .10     .00     .10     .20
PI     .00     .20     .00     .20     .10     .20     .10     .10     .10     .10
PI     .00     .10     .00     .00     .00     .00     .00     .00     .00     .00
PG    WHPT
PI     .00     .00     .00     .00     .00     .00     .10     .10     .00     .10
PI     .00     .00     .10     .00     .10     .10     .00     .10     .10     .10
PI     .10     .10     .00     .20     .00     .10     .10     .00     .10     .00
PI     .20     .00     .00     .00     .00     .00     .00     .00     .00     .00
PG   HUCOR
PI     .00     .10     .00     .00     .00     .00     .00     .10     .10     .10
PI     .00     .00     .10     .00     .10     .10     .10     .00     .00     .10
PI     .20     .00     .00     .20     .10     .10     .10     .10     .00     .10
PI     .00     .10     .00     .00     .00     .00     .00     .00     .00     .00
PG    MTPL
PI     .01     .06     .07     .00     .04     .04     .05     .11     .09     .05
PI     .06     .06     .14     .08     .05     .12     .15     .05     .07     .08
PI     .15     .10     .08     .13     .20     .12     .04     .00     .00     .00
PI     .00     .00     .00     .00     .00     .00     .05     .02     .00     .00

KK   OWEGO
QO     340     332     328     324     324     320     316     316     316     320
QO     324     336     372     443     565     718     927    1120    1338    1592
QO    1888    2365    2936    3464    3805    4025    4267    4624    4936    5140
QO    5320    5416    5556    5654    5640    5542    5440    5332    5224    5104
QO    5008    4876    4732    4528    4289    3992    3717    3453    3222    3035
QO    2881    2738    2620    2512    2419    2320    2230    2151    2066    2006
QO    1921    1868    1845    1794    1760    1728    1704    1680    1656    1640
QO    1624    1600    1576    1544    1520       0       0       0       0       0
PT     CAN   LISLE  NEWVAL   HUCOR    MTPL
PW     .18     .01     .40     .30     .11
PR  NEWVAL    WHPT   HUCOR    MTPL
PW     .56     .01     .30     .13
BA    185.      0.
8F    340.   1800.  1.0224
UC    -7.0    -18.
LU     -.2    -.05
ZZ
```

COMPARISON OF COMPUTED AND OBSERVED HYDROGRAPHS

STATISTICS BASED ON OPTIMIZATION REGION (ORDINATES 10 THROUGH 50)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.523		21.82			
COMPUTED HYDROGRAPH	140954.	1.181	3438.	34.45	12.64	5910.	34.00
OBSERVED HYDROGRAPH	140585.	1.178	3429.	34.72	12.91	5654.	33.00
DIFFERENCE	369.	0.003	9.	-0.27	-0.27	256.	1.00
PERCENT DIFFERENCE	0.26				-2.09	4.52	

STANDARD ERROR	257.	AVERAGE ABSOLUTE ERROR	225.
OBJECTIVE FUNCTION	258.	AVERAGE PERCENT ABSOLUTE ERROR	12.09

STATISTICS BASED ON FULL HYDROGRAPH (ORDINATES 1 THROUGH 75)

	SUM OF FLOWS	EQUIV DEPTH	MEAN FLOW	TIME TO CENTER OF MASS	LAG C.M. TO C.M.	PEAK FLOW	TIME OF PEAK
PRECIPITATION EXCESS		1.523		21.82			
COMPUTED HYDROGRAPH	188426.	1.578	2512.	40.38	18.56	5910.	34.00
OBSERVED HYDROGRAPH	192924.	1.616	2572.	41.16	19.35	5654.	33.00
DIFFERENCE	-4498.	-0.038	-60.	-0.79	-0.79	256.	1.00
PERCENT DIFFERENCE	-2.33				-4.07	4.52	

STANDARD ERROR	222.	AVERAGE ABSOLUTE ERROR	186.
OBJECTIVE FUNCTION	245.	AVERAGE PERCENT ABSOLUTE ERROR	11.45

UNIT HYDROGRAPH
97 END-OF-PERIOD ORDINATES

148.	557.	1144.	1843.	2622.	3419.	4123.	4669.	5044.	5209.
5090.	4810.	4539.	4284.	4043.	3815.	3601.	3398.	3207.	3027.
2857.	2696.	2544.	2401.	2266.	2139.	2018.	1905.	1798.	1697.
1601.	1511.	1426.	1346.	1270.	1199.	1131.	1068.	1008.	951.
898.	847.	799.	755.	712.	672.	634.	599.	565.	533.
503.	475.	448.	423.	399.	377.	356.	336.	317.	299.
282.	266.	251.	237.	224.	211.	199.	188.	178.	168.
158.	149.	141.	133.	125.	118.	112.	105.	100.	94.
89.	84.	79.	74.	70.	66.	63.	59.	56.	53.
50.	47.	44.	42.	39.	37.	35.			

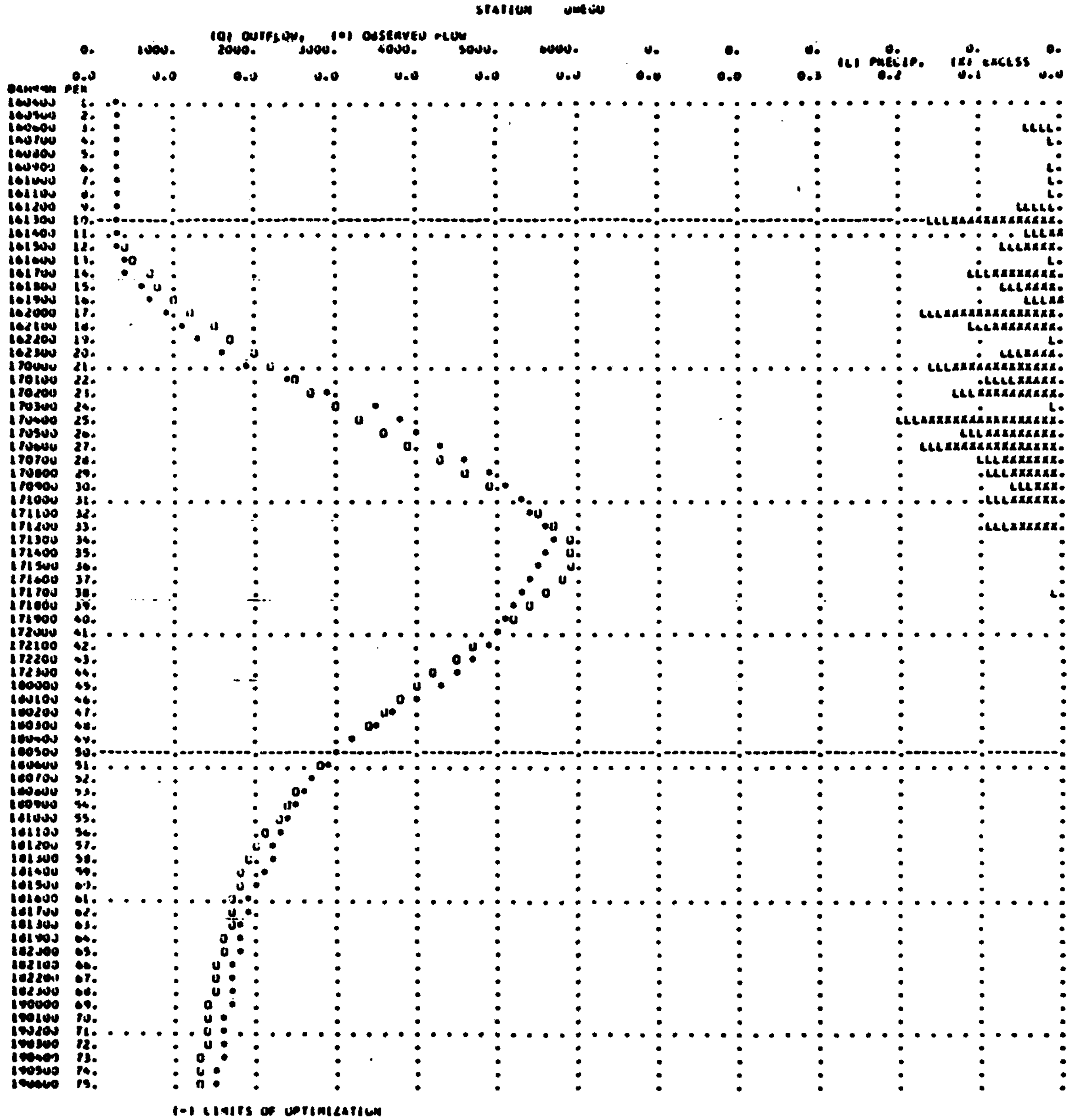
HYDROGRAPH AT STATION OREGO

DA MON HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	OBS Q
16 OCT 0400	1	0.00	0.00	0.00	340.	340.
16 OCT 0500	2	0.00	0.00	0.00	333.	332.
16 OCT 0600	3	0.04	0.04	0.00	325.	328.
16 OCT 0700	4	0.01	0.01	0.00	318.	324.
16 OCT 0800	5	0.00	0.00	0.00	311.	324.
16 OCT 0900	6	0.01	0.01	0.00	304.	320.
16 OCT 1000	7	0.01	0.01	0.00	298.	316.
16 OCT 1100	8	0.01	0.01	0.00	291.	316.
16 OCT 1200	9	0.05	0.05	0.00	285.	316.
16 OCT 1300	10	0.16	0.03	0.13	297.	320.
16 OCT 1400	11	0.04	0.03	0.01	345.	324.
16 OCT 1500	12	0.07	0.03	0.04	424.	336.
16 OCT 1600	13	0.01	0.01	0.00	528.	372.
16 OCT 1700	14	0.11	0.03	0.08	662.	443.
16 OCT 1800	15	0.07	0.03	0.04	830.	565.
16 OCT 1900	16	0.04	0.03	0.01	1016.	718.
16 OCT 2000	17	0.17	0.03	0.14	1220.	927.
16 OCT 2100	18	0.11	0.03	0.08	1457.	1120.
16 OCT 2200	19	0.01	0.01	0.00	1712.	1338.
16 OCT 2300	20	0.07	0.03	0.04	1951.	1592.
17 OCT 0000	21	0.16	0.03	0.13	2193.	1884.
17 OCT 0100	22	0.09	0.03	0.05	2462.	2365.
17 OCT 0200	23	0.13	0.03	0.10	2748.	2936.
17 OCT 0300	24	0.01	0.01	0.00	3030.	3464.
17 OCT 0400	25	0.20	0.03	0.17	3312.	3805.
17 OCT 0500	26	0.12	0.03	0.09	3618.	4025.
17 OCT 0600	27	0.17	0.03	0.14	3935.	4267.
17 OCT 0700	28	0.10	0.03	0.07	4261.	4624.
17 OCT 0800	29	0.09	0.03	0.06	4605.	4936.
17 OCT 0900	30	0.06	0.03	0.03	4948.	5140.
17 OCT 1000	31	0.09	0.03	0.06	5256.	5320.
17 OCT 1100	32	0.00	0.00	0.00	5513.	5416.
17 OCT 1200	33	0.09	0.03	0.06	5713.	5556.
17 OCT 1300	34	0.00	0.00	0.00	5852.	5654.
17 OCT 1400	35	0.00	0.00	0.00	5910.	5640.
17 OCT 1500	36	0.00	0.00	0.00	5880.	5342.
17 OCT 1600	37	0.00	0.00	0.00	5777.	5440.
17 OCT 1700	38	0.01	0.01	0.00	5620.	5332.
17 OCT 1800	39	0.00	0.00	0.00	5426.	5224.
17 OCT 1900	40	0.00	0.00	0.00	5205.	5104.
17 OCT 2000	41	0.00	0.00	0.00	4966.	5008.
17 OCT 2100	42	0.00	0.00	0.00	4719.	4876.
17 OCT 2200	43	0.00	0.00	0.00	4469.	4732.
17 OCT 2300	44	0.00	0.00	0.00	4223.	4528.
18 OCT 0000	45	0.00	0.00	0.00	3990.	4289.
18 OCT 0100	46	0.00	0.00	0.00	3770.	3992.
18 OCT 0200	47	0.00	0.00	0.00	3562.	3717.
18 OCT 0300	48	0.00	0.00	0.00	3366.	3453.
18 OCT 0400	49	0.00	0.00	0.00	3181.	3222.
18 OCT 0500	50	0.00	0.00	0.00	3006.	3035.
18 OCT 0600	51	0.00	0.00	0.00	2841.	2881.
18 OCT 0700	52	0.00	0.00	0.00	2685.	2738.
18 OCT 0800	53	0.00	0.00	0.00	2538.	2620.
18 OCT 0900	54	0.00	0.00	0.00	2399.	2512.
18 OCT 1000	55	0.00	0.00	0.00	2267.	2419.
18 OCT 1100	56	0.00	0.00	0.00	2143.	2320.
18 OCT 1200	57	0.00	0.00	0.00	2026.	2230.
18 OCT 1300	58	0.00	0.00	0.00	1916.	2151.
18 OCT 1400	59	0.00	0.00	0.00	1811.	2066.
18 OCT 1500	60	0.00	0.00	0.00	1765.	2006.
18 OCT 1600	61	0.00	0.00	0.00	1726.	1921.
18 OCT 1700	62	0.00	0.00	0.00	1689.	1888.
18 OCT 1800	63	0.00	0.00	0.00	1652.	1845.
18 OCT 1900	64	0.00	0.00	0.00	1615.	1794.
18 OCT 2000	65	0.00	0.00	0.00	1580.	1760.
18 OCT 2100	66	0.00	0.00	0.00	1545.	1728.
18 OCT 2200	67	0.00	0.00	0.00	1512.	1704.
18 OCT 2300	68	0.00	0.00	0.00	1478.	1680.
19 OCT 0000	69	0.00	0.00	0.00	1446.	1656.
19 OCT 0100	70	0.00	0.00	0.00	1414.	1640.
19 OCT 0200	71	0.00	0.00	0.00	1383.	1624.
19 OCT 0300	72	0.00	0.00	0.00	1353.	1600.
19 OCT 0400	73	0.00	0.00	0.00	1323.	1576.
19 OCT 0500	74	0.00	0.00	0.00	1294.	1544.
19 OCT 0600	75	0.00	0.00	0.00	1266.	1520.

TOTAL RAINFALL = 2.30, TOTAL LOSS = 0.78, TOTAL EXCESS = 1.52

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	74.00-HR
5910.	34.00	(CFS)	5703.	4743.	2597.	2535.
		(INCHES)	0.291	0.953	1.566	1.572
		(AC-FT)	2868.	9407.	15451.	15506.

CUMULATIVE AREA = 185.00 SQ MI


STATION
(O) OUTFLOW, (*) OBSERVED FLOW
0. 1000. 2000. 3000. 4000. 5000. 6000.
(L) PRECIP. (X) EXCESS
(-) LIMITS OF OPTIMIZATION

Appendix D -- Statistical Results of Verification Storms

Basin/Storm	% Lag C.M. to C.M.	% Peak Flow	Time to Peak	Avg % Abs Error	OBJ Func
Butternut Ck.					
10-18-75	1.37	-14.92	0.	15.39	248
Canasawacta Ck.					
7-31-71	5.73	130.85	3.	238.17	1514
Corey Ck.					
10-09-76	3.35	9.79	-2.	37.96	62
Elk Run Ck.					
8-06-78	44.73	109.13	0.	118.80	197
Five Mile Ck.					
9-25-77	-10.92	-40.37	2.	31.17	529
Newtown Ck.					
10-09-76	1.17	28.91	-1.	32.62	450
10-28-81	38.41	9.49	0.	37.62	331
Ostelic River					
10-09-76	9.85	-20.67	5.	27.60	1223
Owego Ck.					
10-09-76	3.15	36.59	0.	47.24	1903

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