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COMPUTATION OF UNSTEADY FLOWS IN RIVERS AND
ESTUARIES BY THE METHOD OF CHARACTERISTICS

GEOLOGICAL SURVEY

JUNE 1976

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMPUTATION OF UNSTEADY FLOWS IN RIVERS
AND ESTUARIES BY THE METHOD OF CHARACTERISTICS

By

Chintu Lai
Charles A. Onions

Computer Contribution

Reston, Virginia

June 1976

Program Number: J 416
Operating System: IBM 370/155, IBM 360/65
Equipment: IBM OS/360 with HASP
Language: Fortran IV (G-level)

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English-Metric Unit Conversion Factors

Both the English and the metric (SI) systems of units can be used in this program system. The following table lists those units used in this publication.

To convert	To	Multiply by
inches (in.)	meters (m)	0.02540
feet (ft)	meters (m)	0.3048
miles (mi)	kilometers (km)	1.609
square feet (ft ²)	square meters (m ²)	0.09290
cubic feet (ft ³)	cubic meters (m ³)	0.02832
ft ^{1/3}	m ^{1/3}	0.6730
ft ^{2/3}	m ^{2/3}	0.4529
meters (m)	inches (in)	39.370
meters (m)	feet (ft)	3.2808
kilometers (km)	miles (mi)	0.6214
square meters (m ²)	square feet (ft ²)	10.764
cubic meters (m ³)	cubic feet (ft ³)	35.313
m ^{1/3}	ft ^{1/3}	1.486
m ^{2/3}	ft ^{2/3}	2.208

COMPUTATION OF UNSTEADY FLOWS IN RIVERS
AND ESTUARIES BY THE METHOD OF CHARACTERISTICS

Chintu Lai and Charles A. Onions

ABSTRACT

A series of computer programs based on the method of characteristics have been written by the U.S. Geological Survey to compute unsteady flows in rivers and estuaries. This report is a program documentation to the latest revision (1975) of Version 13, in the series which employs a multiple-reach scheme treating each subreach as a prismatic shape. A long waterway is first divided into a number of subreaches (as many as 20 but including a single reach), each of which may be considered to have uniform geometry as well as other constant parameters. The basic method of characteristics using specified time intervals is applied to each subreach, and additional boundary conditions are imposed at the junctions between subreaches.

For the user's convenience, the program incorporates several types of options covering input, accuracy, boundary conditions, data formats, output, and continuation. The program accepts input data in three forms—data cards only, cards and user-supplied subroutines, and cards and disk stage data. To start the computation, reach identification and parameters, options, reach geometry, coefficients and initial data are read into the computer. Boundary values are either stage or velocity and are given either in numerical data or equation form. If in data form, the boundary values, which have been recorded at specified time intervals, are read in sets by the computer and a pair of such data are fetched at the beginning of each time step for computation. The user may employ or bypass the extrapolation procedures by weighing the trade-off between accuracy and computer time. Eight diverse output options are available in this program by which the user can tailor his outputs to suit his need and convenience.

INTRODUCTION

A number of technical reports and computer programs have been written since the U.S. Geological Survey began computer solution of unsteady flows in waterways. In connection with the task of determining one-dimensional unsteady flows by the method of characteristics (Lai, 1965; and Lai, 1967), a few dozen different versions of computer programs have been written and applied to various problems.

The computer program described in this report is known within the Geological Survey as "Unsteady flow in rivers and estuaries, Calculation for multiple reaches by the method of characteristics, Version 13." This version, which has been in use for several years, is a comprehensive computer program to compute and analyze one-dimensional unsteady flows in rivers and estuaries by the multiple-reach method of characteristics. The computation algorithm is based on an earlier report by Lai (1967). The program has a flexible input system capable of accepting combinations of boundary data in numerical or equation form, and is equipped with a number of output options which produce information tailored to the user's need.

This program is intended for use in natural or artificial waterways having relatively straight or gently meandering alignment with relatively simple channel geometry and mild channel bed slope. The water density in the channel is assumed to be substantially homogeneous, and the flow velocity is assumed to be fairly uniform over any cross section. The program requires two boundary values, one at each end of the entire reach, for its flow computation, hence it is designed for subcritical flow.

There are different multiple-reach schemes (Lai, 1967; Fletcher and Hamilton, 1967; and Lai, Ruggles, and Weiss, 1971): one scheme is to assume each subreach as prismatic, others assume each subreach to have linear variation of cross-sectional area with distance independent of either stage (Version 21) or flow depth (Version 22). In this program, the first scheme is used. The assumption of prismatic subreaches will impose additional boundary conditions and require special treatment at each junction. The programs using linearly varying cross-sections (Version 21 and Version 22) will be documented in future reports.

The program is not new, and has been applied by many persons using several different computers for various problems. Inasmuch as the current form of the program was attained through such evolution, there are places where program statements may appear circumlocutory or non-uniform in style, reflecting remnants of outmoded computers and languages. Realizing that the program can be constantly updated, the writers found it necessary to set a cutoff line because of the demand for this report.

The purpose of this report is to provide computer program documentation to those users who have some programming knowledge or background and who wish to understand the internal structure of the program system. The material should be helpful for trouble-shooting or for more flexible application to various problems.

The initial section of this report briefly reviews the governing partial differential equations, the characteristic equations, the corresponding finite-difference forms and the numerical procedures to carry out solutions for different boundary conditions described in earlier technical reports. Program description then follows; stating the purpose and function of all subprograms involved, starting with the main program. An organizational chart depicts the structure of the entire system and relationships between subprograms.

The subsequent chapters deal with restrictions, input requirements and data description, preparation for program runs, variety of output options and formats available with this version of the program. These are all vital in the effective use of the program. Some diagnostic messages provided in this program, together with standard FORTRAN diagnostic messages, should be useful in guiding the user in a better command of the program system. Also given in this report are source program listings, the index and definitions to the program variables, and example runs, which are believed to be essential and useful, in the proper operation of the unsteady flow simulation model.

TECHNICAL DESCRIPTION

The derivation of the basic partial differential equations, their numerical solution by the method of characteristics using the specified time intervals, and the appropriate computer algorithm and procedures to carry out the computation have been presented in previous reports (Lai, 1965; and Lai, 1967). For the sake of continuity and for providing an opportunity for a review, some essential equations are listed and computation procedures are outlined in the following pages.

Review of Mathematical Equations

A. Basic Partial Differential Equations

The following set of partial differential equations that represent one-dimensional transient open-channel flows of homogeneous density is used as the basic equations for the numerical simulation.

Equation of Continuity

$$\bar{H} \frac{\partial u}{\partial x} + u \frac{\partial Z}{\partial x} + \frac{\partial Z}{\partial t} + u S_o - \frac{q}{B} = 0 \quad (1)$$

Equation of Motion

$$\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + g \frac{\partial Z}{\partial x} + g \frac{k}{R^{4/3}} u|u| + \frac{qu}{A} = 0 \quad (2)$$

in which

x = distance along the longitudinal axis (x-axis) of channel

t = time

u = flow velocity (averaged over the cross section)

Z = elevation of water surface

A = cross-sectional area

B = top width of cross section

$\bar{H}$ = average depth of flow ($=A/B$)

R = hydraulic radius of cross section

S_o = slope of the channel bottom

g = acceleration of gravity

k = parameter depending on flow-resistant coefficient, η .

$k = \eta^2$ for metric system

$= \left(\frac{\eta}{1.486}\right)^2$ for English system

q = lateral inflow per unit length of channel

The above equations are a set of hyperbolic, first-order, quasi-linear partial differential equations of two dependent variables (u, Z) and two independent variables (x, t).

B. Characteristic Equations

The type of partial differential equations shown above can be transformed to the following simple characteristic equations each of which contains only total derivatives.

$$dt - \frac{dx}{u \pm c} = 0 \quad (3)$$

along $C_{\pm}$ curve,

$$dZ \pm \frac{c}{g} du + F_{\pm} dt = 0 \quad (4)$$

in which

$$F_{\pm} = uS_o \pm \frac{ck}{R^{4/3}} u|u| - \frac{g}{B} \left(1 \mp \frac{u}{c}\right) \quad (5)$$

$c = \sqrt{g\bar{H}}$ = the celerity of gravity wave

C_+ , C_- = (+) and (-) characteristic curves, also called forward and backward characteristics

C. Finite Difference Approximations

For the numerical solution by computer, equations (3) and (4) can be expressed in their corresponding finite difference forms:

$$(t_P - t_L) - \left(\frac{1}{u+c}\right)_L (x_P - x_L) = 0 \quad (6)$$

$$(Z_P - Z_L) + \frac{c_L}{g}(u_P - u_L) + (F_+)_L (t_P - t_L) = 0 \quad (7)$$

$$(t_P - t_R) - \left(\frac{1}{u-c}\right)_R (x_P - x_R) = 0 \quad (8)$$

$$(Z_P - Z_R) - \frac{c_R}{g}(u_P - u_R) + (F_-)_R (t_P - t_R) = 0 \quad (9)$$

in which the subscript indicates the point in figure 1 to which each quantity is referred. These equations will be solved by the specified-time-interval scheme using Δt as the time interval and Δx as the segment length on a rectangular grid system.

By linear interpolation, the values of u_L , u_R , Z_L and Z_R may be expressed in terms of the corresponding values at points A, B, and C, as follows:

$$u_L = u_B [1 - \theta(u+c)_B] + u_A \theta(u+c)_B \quad (10)$$

$$u_R = u_B [1 + \theta(u-c)_B] - u_C \theta(u-c)_B \quad (11)$$

$$Z_L = Z_B [1 - \theta(u+c)_B] + Z_A \theta(u+c)_B \quad (12)$$

$$Z_R = Z_B [1 + \theta(u-c)_B] - Z_C \theta(u-c)_B \quad (13)$$

in which $\theta = \frac{\Delta t}{\Delta x}$, and the assumption that $(u+c)_L \approx (u+c)_B$, $(u-c)_R \approx (u-c)_B$, is made.



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From these values (equations 10-13) and further assuming that $c_L \approx c_B$, $c_R \approx c_B$,

$$(F_+)_L \approx (F_+)_B, (F_-)_R \approx (F_-)_B,$$

$$Z_P = \frac{c_B}{2g} (u_L - u_R) + \frac{1}{2} (Z_L + Z_R) - (u_{S_0} - \frac{q}{B})_B \Delta t \quad (14)$$

$$u_P = \frac{1}{2} (u_L + u_R) + \frac{g}{2c_B} (Z_L - Z_R) - [\frac{gk}{R^{4/3}} u|u| + \frac{uq}{A}]_B \Delta t \quad (15)$$

In the multiple-reach scheme, the above equations have to be expressed in two-dimensional form, that is, two subscripts should be added to variables and parameters to indicate what nodal point or segment, in what subreach, they belong to. For example, if point B is on the i th node of the j th subreach, then u_B may be expressed as $u_{i,j}$, Z_A as $Z_{i-1,j}$, Z_P as $(Z_P)_{i,j}$ or $Z_{i,j}^{k+1}$, u_P as $(u_P)_{i,j}$ or $u_{i,j}^{k+1}$ and so forth. The length of the j th subreach is expressed by ΔL_j . (See figures 1 and 2; Point $x_{i,j}$ is expressed as $(x_j)_i$ in figure 1)

D. Boundary Conditions

Four boundary equations, derived from equations 7 and 9, are: at the left boundary ($x = 0$),

$$u_P = u_R + \frac{g}{c_B} (Z_P - Z_R) + \frac{g}{c_B} (F_-)_B \Delta t \quad (16)$$

$$\text{or } Z_P = Z_R + \frac{c_B}{g} (u_P - u_R) - (F_-)_B \Delta t \quad (17)$$

at the right boundary ($x = L$), (L = total reach length)

$$u_P = u_L - \frac{g}{c_B} (Z_P - Z_L) - \frac{g}{c_B} (F_+)_B \Delta t \quad (18)$$

$$\text{or } Z_P = Z_L - \frac{c_B}{g} (u_P - u_L) - (F_+)_B \Delta t \quad (19)$$

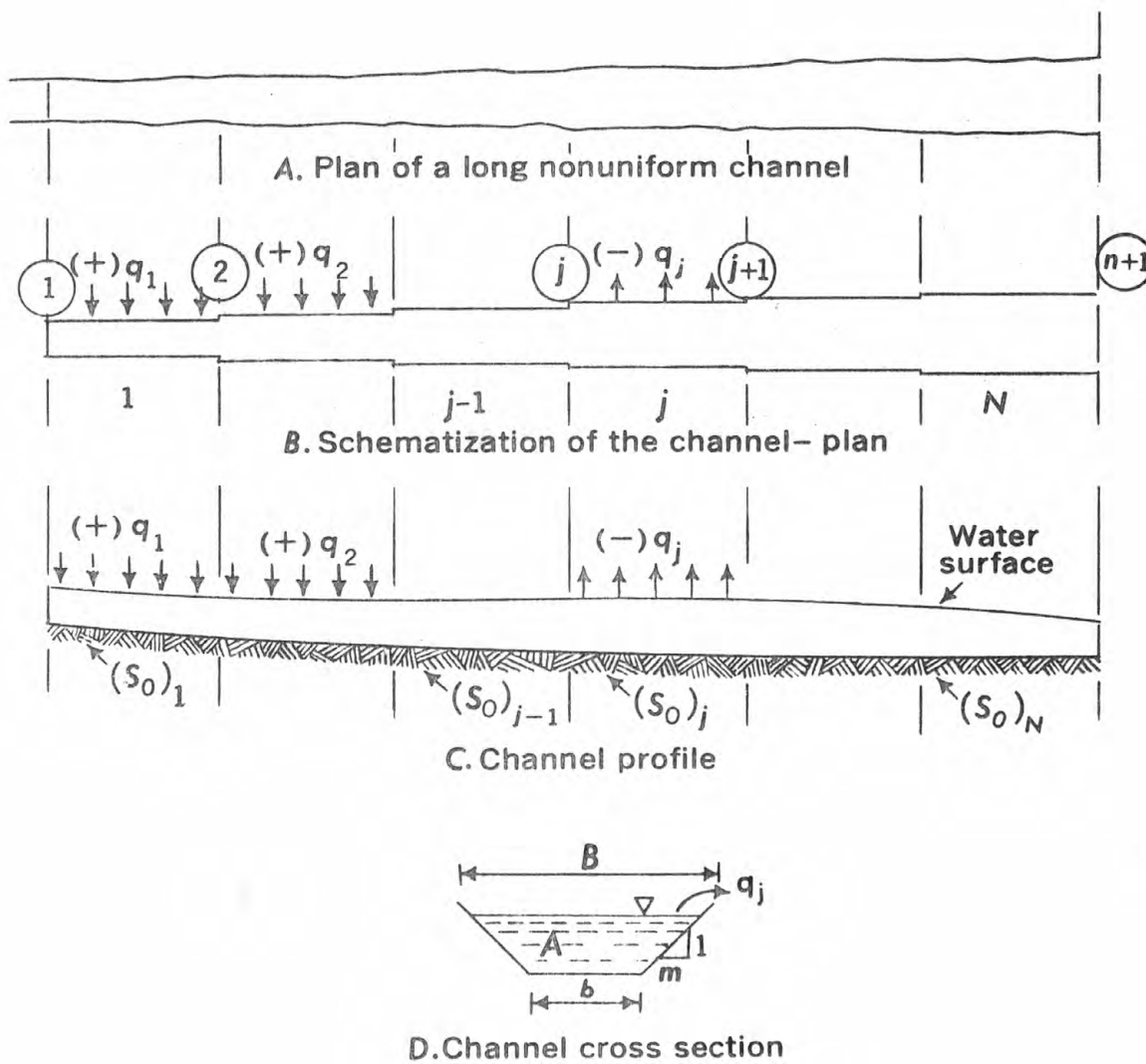


Figure 2. Schematization of a long nonuniform channel.

One equation from each end of the reach ($x = 0$ and $x = L$) should be chosen for boundary value computation (for subcritical flow, of course). The choice depends on which type of boundary-value data (stage or velocity) is obtainable at each end.

For any junction between two subreaches, say the $(j + 1)$ th junction, the following four boundary equations may be used.

$$(Z_P)_{n_j+1,j} = (Z_P)_{1,j+1} \quad (20)$$

$$(u_P A_P)_{n_j+1,j} = (u_P A_P)_{1,j+1} \quad \text{i.e.} \quad Q_{n_j+1,j} = Q_{1,j+1} \quad (21)$$

$$(u_P)_{n_j+1,j} = (u_L)_{n_j+1,j} - \frac{g}{c_{n_j+1,j}} [(Z_P)_{n_j+1,j} - (Z_L)_{n_j+1,j}] - \frac{g}{c_{n_j+1,j}} (F_+)_{n_j+1,j} \Delta t \quad (22)$$

$$(u_P)_{1,j+1} = (u_R)_{1,j+1} + \frac{g}{c_{1,j+1}} [(Z_P)_{1,j+1} - (Z_R)_{1,j+1}] + \frac{g}{c_{1,j+1}} (F_-)_{1,j+1} \Delta t \quad (23)$$

in which Q is the discharge.

To solve these equations, a value Z_P at the junction is estimated by quadratic extrapolation from the previous elevations. Substitute the assumed Z_P value into both equations (22) and (23) and compute $(u_P)_{n_j+1,j}$ and $(u_P)_{1,j+1}$. Using the same Z_P value, $(A_P)_{n_j+1,j}$ and $(A_P)_{1,j+1}$ can be evaluated. Then $(u_P A_P)_{n_j+1,j}$ and $(u_P A_P)_{1,j+1}$ are computed and the difference of the two is tested. The computation is iterated until the difference becomes less than a maximum tolerable error, ϵ .

E. Extrapolation Procedures

When the scheme of specified time intervals is used, it is possible to increase the accuracy of computation by extrapolation procedures (Lister and Roberts, 1959). The linear system of the numerical solution explained hitherto can be raised to the second-order accuracy by an extrapolation procedure defined as

$$\bar{f}(x, 2n\Delta t) = 2f_2(x, t) - f_1(x, t) \quad (24)$$

in which

$$t = 2n\Delta t$$

$f_1(x, t)$ = the value of $f(x, t)$ obtained by repeating n steps of computation, at a constant value of x , using step size $2\Delta t$

$f_2(x, t)$ = the value of $f(x, t)$ obtained by repeating $2n$ steps of computation, at a constant value of x , using step size Δt

$\bar{f}(x, 2n\Delta t)$ = the value of $f(x, t)$ at $t=2n\Delta t$ in terms of its given value at $t=0$, obtained by using the extrapolation procedure defined by (24)

$f(x, t) = u(x, t)$ or $Z(x, t)$;

accordingly, u and Z values corresponding to the above three definitions are expressed as U_1, Z_1 ; U_2, Z_2 ; and U_e, Z_e ; respectively.

Computation Procedure

A. Outline of the Computation Procedure

The machine computation is carried out according to the following steps:

- (a) Read reach geometry data.
- (b) Organize or compile depth versus cross-sectional area, depth versus top width relationships.
- (c) Read data describing the initial values and other parameters.
- (d) Divide each subreach into n segments (or elements) of length Δx (that is, $\Delta x_j = \Delta L_j / n_j$), and call pivotal points between segments, including end points, as nodal points. Assign the initial values for u and Z at each nodal point throughout the entire reach.
- (e) Prepare the boundary values for each end of the entire reach for designed time intervals.
- (f) Estimate (Z_p)-values at each junction between subreaches.
- (g) From upstream (left) to downstream (right) calculate u_p and Z_p for a time interval $2\Delta t$ at each nodal point for each subreach, using equations (10) through (19). At the upstream end (the left end of the 1st subreach) use equation (16) or (17) and at

- the downstream end (the right end of the last subreach) use (18) or (19) to calculate u_p or Z_p , and at each junction use equations (22) and (23) to calculate u_p .
- (h) Use equations (20) through (23) repeatedly to find satisfactory u_p and Z_p values at each junction. Call steps (f) through (h) as " $m = 1$ cycle".
 - (i) Calculate u and Z for a time interval Δt using the same equations and following the same steps described in (f) through (h). Call this step " $m = 2$ cycle".
 - (j) Using the results of step (i), calculate u and Z for Δt again. Call this step " $m = 3$ cycle".
 - (k) Repeat steps (f) through (j) as far as desired.
 - (l) Whenever appropriate, combine the results of (g), (h) and (j) through the use of equation (24), and obtained extrapolated values of u and Z .

When only the first-order approximation is required, steps (i) (j), and (l) are bypassed and only (f) through (h) are repeated; that is, only $m = 1$ cycle is needed.

B. Schematic Flow Diagram

The schematic flow diagram shown in figure 3 illustrates the preceding computation procedure. The diagram shows only those operational steps of the program that are related to the computational algorithm of the flow simulation.

PROGRAM DESCRIPTION

The entire system is organized in the form of a main program called TCM-Version 13 and 20 subprograms comprising 19 executable subprograms and one "BLOCK DATA" subprogram. The organization chart of the program system is given in the next section, followed by a more specific description of each subprogram.

Organization Chart Showing Key Functions

Unlike the flow diagram in figure 3, which shows the important mathematical functions or operations, and the flow direction or the executing sequence by which such numerical procedure is carried out, the following organization chart (figure 4) displays all the subprograms appearing in the system in their relative position of importance, function, and communication. The name appearing in each subprogram is the subprogram name and at the same time the standard entry, and those, if any, listed in the following parentheses are other entry points. All the subprograms (including the MAIN) are numbered in the order they

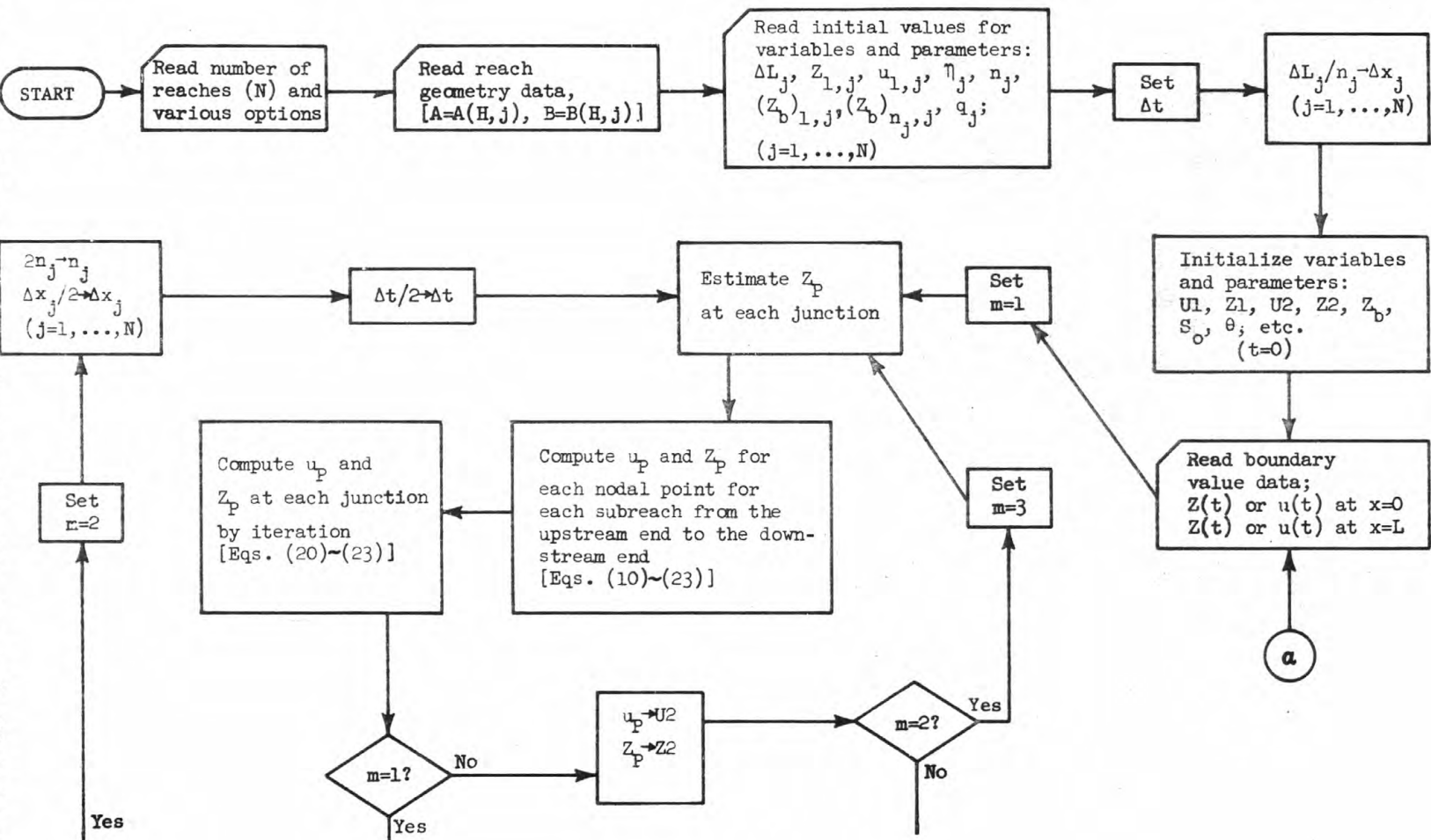
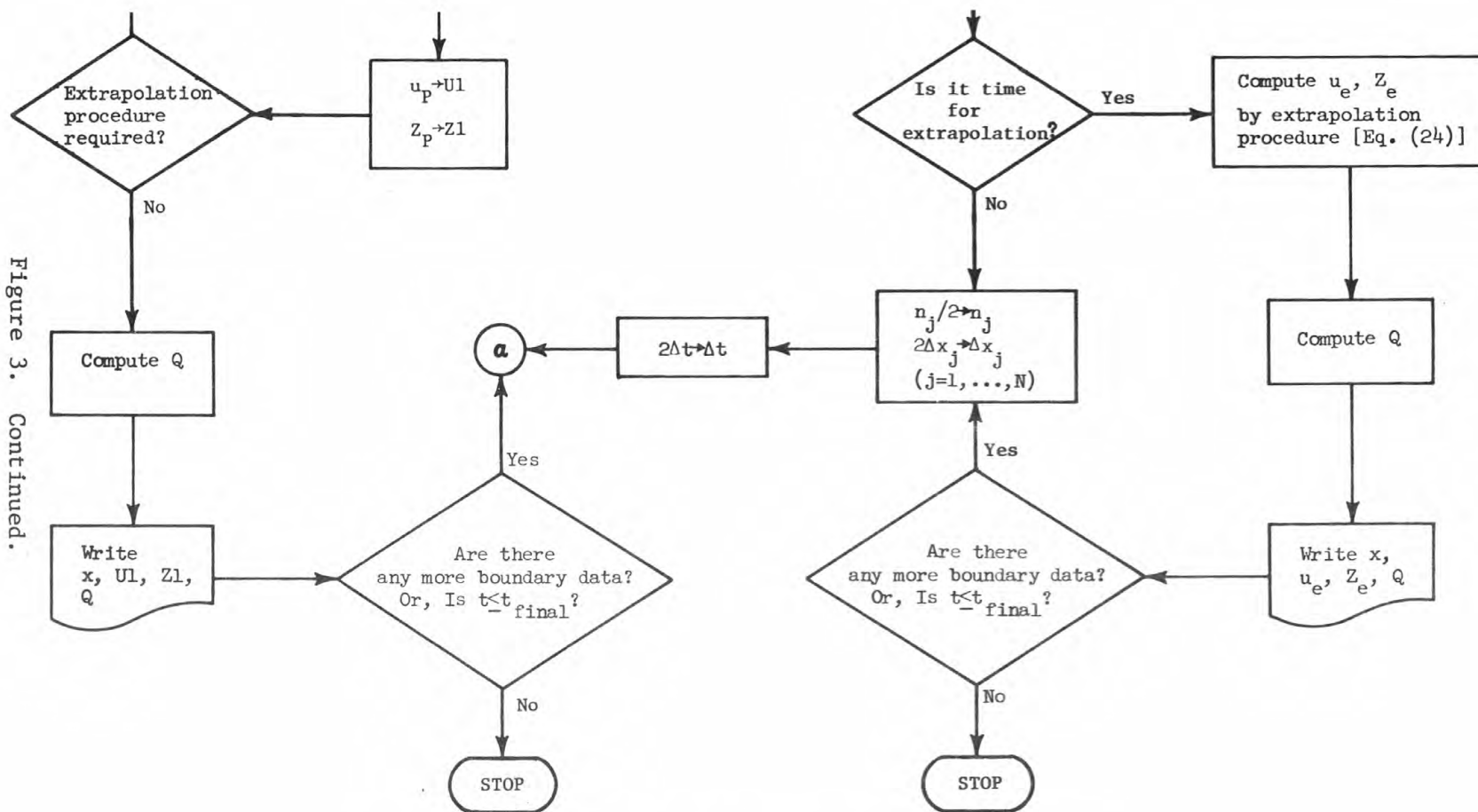


Figure 3.

Schematic flow diagram for the unsteady flow computation by the multiple-reach method of characteristics.



NOTE: The word "Read" here is used rather conceptually, and may mean reading data physically or evaluating the same kind of data by user-supplied equations. Likewise, "Initialize" may mean operating some preliminary calculation to set up initial values or bringing in the initial data directly.

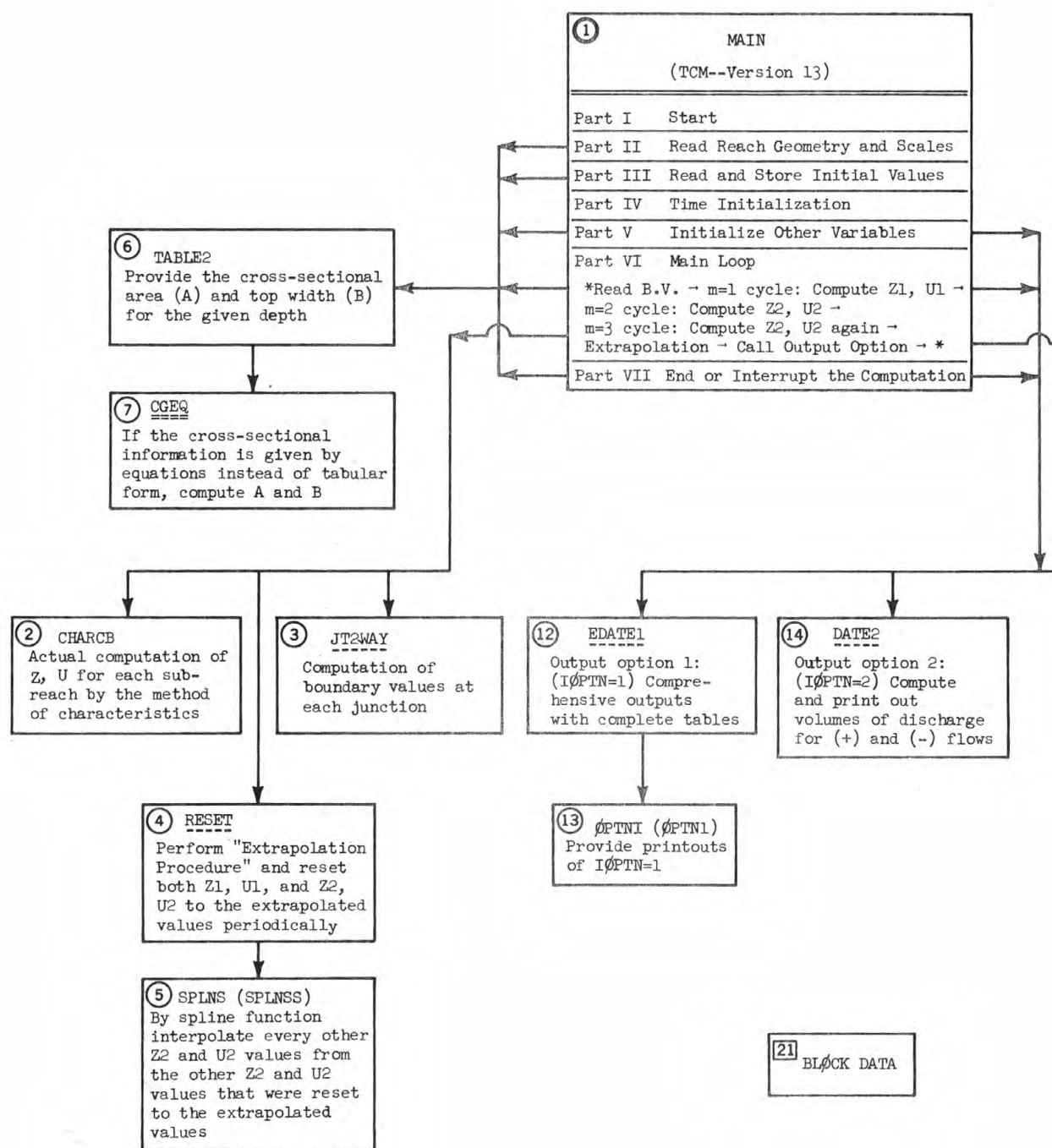
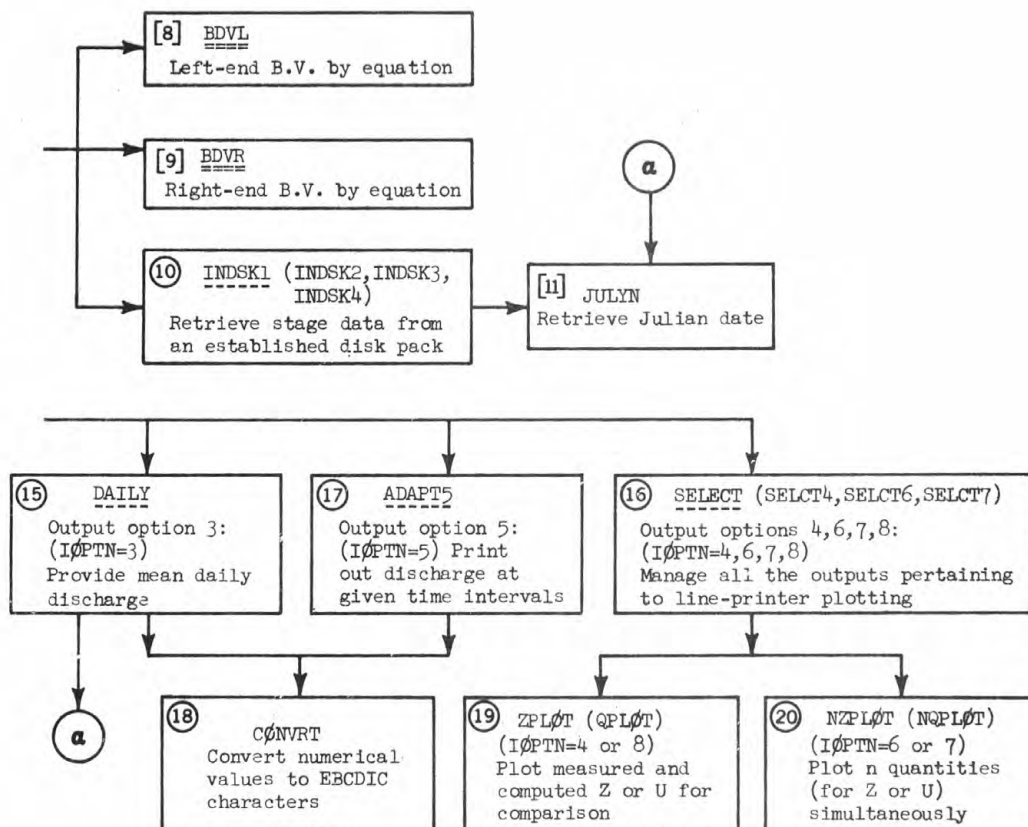


Figure 4. Organization chart showing key functions.



Note: Arrow head indicates the direction from the calling program to the called program.

Classification of programs

- Main Program
- Subroutine Subprogram
- [] Function Subprogram
- Block Data Subprogram
- Program that is replaceable by a dummy one
- === Program that is to be supplied by the user if called. Otherwise use a dummy subprogram.

Figure 4. Continued

appear in the following section and in the program listing in the attachment. The symbols, $\odot$, $\circ$, [], and $\square$ used with the subprogram numbers stand for the main program, subroutine subprogram, function subprogram, and block data subprogram, respectively. Subprogram names underlined with single or double dashed lines indicate that they can be substituted with dummy subprograms when a particular run or option does not require their use. Substitution of any of these subprograms by a dummy program implies that the lower level subprograms under it can be automatically removed from the system unless they have other lines of communication with other subprograms.

The subprograms with double underlines indicate that, if used, the user has to supply his own subprograms.

Functions of Subprograms

The purpose, functions, and features of each subprogram are described as follows:

1. MAIN--The principal functions of the main program, TCM-version 13, are to control the start and end of the computations, to regulate the flow of inputs and outputs, to allocate and initialize some variables and parameters, to review and coordinate the functions of various subprograms, and to supervise the advance of the over-all computing process.

The MAIN program consists of seven parts. Part 1 starts the computer simulation process by reading the reach identification, number of subreaches, and several options the user has to choose for his particular run. Part 2 reads reach geometry information in either data or equation form, and sets up scales and other parameters for graphical outputs if relevant. Part 3 reads, organizes, and allocates initial values necessary for the computation. In Part 4, the time is set to zero and other time-related parameters are initialized. Before proceeding with the principal computation of the unsteady flow, some variables and parameters are initialized in Part 5, involving some amount of computation. Part 6 is the core of the whole system where the principal flow computation is carried out, the extrapolation procedure is executed or bypassed, and outputs are continuously generated in an appropriate format, until a signal (MØPTN) to stop or halt is sensed. Upon sensing such a signal, Part 7 takes charge in finishing up or cleaning up the remaining task, or interrupting the computation for change of parameter values, and then directs the computer either to stop or to return to an appropriate point in the beginning part of the program for further action.

2. CHARCB--This is a subroutine to actually carry out the flow computation by the method of characteristics using the specified time intervals. Except for the "SUBROUTINE" statement, a few "COMMON" blocks, and RETURN statement, the routine is by itself practically an independent computer program for a single reach unsteady flow computation by the method of characteristics. With the exception of the extrapolation procedure, all the essential mathematical operations for the interior nodal points and the two boundary points are included in this subroutine. (Equations 10 through 19.).

3. JT2WAY -- This is a subroutine to handle boundary value problems at each two-way junction for the multiple-reach method of characteristics. With the estimated value of Z_p at a junction, the program computes velocities, u_p , at the junction point for the left and right subreaches using appropriate boundary equations (equations 22 and 23). The corresponding cross-sectional areas, A_p , are computed from the same Z_p , and the discharges, $Q_p = u_p A_p$, are obtained for both subreaches. The difference of the two discharges is then tested and the whole process iterated until the difference becomes less than the tolerance limit. The successive improvement on the estimation of Z_p value is carried out as follows. If the discharge for the left subreach is algebraically greater (less) than that for the right subreach, indicating that the estimated Z_p value makes the water surface too steep (mild) for the left and too mild (steep) for the right, Z_p is added (deducted) by a small quantity $DZ1$ for the next trial. The process is repeated until the change in sign for the difference of the two computed discharges is sensed. After sensing the sign change, the halving process is applied to $DZ1$ until the zero is found (in terms of the tolerance limit).

4. RESET -- When the extrapolation procedure is employed, computed Z and u values using the step size of Δt_1 are stored in $Z1$, $U1$, and those using the step size of Δt_2 , where $\Delta t_1 = 2\Delta t_2$, are stored in $Z2$, $U2$. The computer will operate the extrapolation using equation (24) and print out the result with second-order accuracy only when the output is required; for the normal computation cycles two sets of computation results are stored separately in the above-mentioned locations. As the computation process extends, the gap between the results of the two sets may some times enlarge undesirably. This subroutine resets both sets, ($Z1$, $U1$) and ($Z2$, $U2$), to the common values obtained by the extrapolation procedure at a suitable interval.

5. SPLNS -- When an attempt is made to reset Z1, U1 and Z2, U2 in the subroutine RESET, equation (24) provides the extrapolated values for every element of Z1 and U1, but only for every other element of Z2 and U2. The missing elements of Z2 and U2 are interpolated from the known (extrapolated) values of Z2 and U2 using spline functions in this subroutine. Z2 values are brought in through SPLNS and U2 values through SPLNSS.
6. TABLE2 -- This is a subroutine to find the cross-sectional area, A, and the top width, B, for a given depth, D. If the given cross-sectional information is from field-measured data and in the form of depth versus area and depth versus width tables, then this routine performs table look-ups and linear interpolations to find the required A and B. Although the hydraulic mean radius HRD is approximated from the average depth HAV in the natural channel, which usually is the case, $HRD = A/P$ can be used when the channel is small and deep and the wetted perimeter P is obtainable. If the cross-section geometry is given by algebraic equations, the routine in turn calls CGEQ for the appropriate calculation.
7. CGEQ -- When the cross-section geometry is regular, and should be expressed by algebraic equations, the user should provide all the necessary equations in this subroutine. Enter the routine with the information of depth D and the subreach number J, and return with the calculated values of A, B, HAV and HRD.
8. BDVL -- When the left boundary value is given in equation form, the user should express the equation(s) in this function subprogram.
9. BDVR -- When the right boundary value is given in equation form, the user should express the equation(s) in this function subprogram.
10. INDSK1 -- This is a subroutine used to retrieve stage data from an established disk pack. The routine reads and checks the station numbers, reads ending time and date, and other appropriate parameters for data correction or coefficient change if needed. After the initialization of time, variables, and parameters, it brings in two blocks of stage data, one for the upstream end and the other for downstream, periodically from "INPUT"* and, in turn, supplies them pair by pair to the main program before the start of each main loop of flow computation. When any data corrections

*The subroutine "INPUT" is the program to actually perform the fetch of the stage data from the disk. From the given beginning and ending time and date, "INPUT" searches the files that cover the required range of (to be continued on next page)

(for example, datum correction), coefficient changes (for example, change of flow resistance coefficient) or parameter changes (for example, change in lateral inflow) are needed, the subroutine first sorts and rearranges them in proper time sequence, and delivers them to the main program one by one at each specified time.

11. JULYN -- This is a short function to convert a Gregorian date to the corresponding Julian date. "Julian date" is defined in this manual as the number of days counting from the first day of the year to and including the day in question.
12. EDATE1 -- This is a subroutine to perform a managerial task for output option 1 (IØPTN=1) and to bridge the main program and subroutine ØPTNI. Output option 1 is for printing detailed and comprehensive information about velocities, water-surface elevations, discharges, and the lateral inflows, at every station at every time interval in tabular form. The routine keeps track of time and date advance, prints out different headings or formats at appropriate intervals, calls ØPTNI for tabulation of the comprehensive outputs, and also keeps records of the accumulated volumes of the lateral in-(out-)flows.
13. ØPTNI -- This is a subroutine to actually tabulate the comprehensive outputs for IØPTN=1. If the extrapolation is required in the system, the routine operates the procedure before printout.
14. DATE2 -- This is the subroutine for output option 2 (IØPTN=2) which is to compute and print out volumes of discharge for positive and negative flows. Partial days are footnoted with the beginning or ending hour. Each value of printout consists of the volume of flow in the same direction until flow reverses, the day ends, or the computation terminates.

(continued from page 18)

data and makes such data available for the "INDSK1" to transmit. The CALL statements to subprogram "INPUT" are not activated in this program set because a manual describing transcribe-edit-and-file disk stage data has not been published and there are no explicit input and output formats or procedures to refer to at this moment. Nonetheless, such a program system (for transcribing, editing and filing stage data on disk) is available in the U.S. Geological Survey and has been in use for some time. Those users who are interested in using disk input should contact the U.S. Geological Survey, National Center, Reston, Va. 22092, for further information.

15. DAILY -- This is a subroutine to print out mean daily discharges in a tabular form throughout or for part of a water year (IØPTN=3). The "water year" is the 12-month period, October 1 through September 30. The user is cautioned in applying this output option to such reaches where the positive and negative flows are about the same magnitude, because the net difference of the two flows may not retain sufficient accuracy and precision.
16. SELECT -- This subroutine is designed to handle four output options, IØPTN=4,6,7,8, and has four entries for this purpose. All these options are for generating outputs in graphical forms by a line printer. However, the actual plotting work is done by two lower level subroutines ZPLØT and NZPLØT. The real function of this routine is to bridge the main program and the plot subroutines and to take care of a variety of managerial tasks related to plotting options, such as printing captions, headings, legends, readings, scales, keeping tallies of data, time, and number of data points processed. The four entries are named SELCT4, SELCT6, SELCT7, and SELECT and serve as entries for, respectively, IØPTN=4,6,7, and 8. The main program selects which entry to enter according to the value assigned to IØPTN. IØPTN=4 gives simultaneous plottings of measured and computed discharges at a specified station for comparison. Both values are also printed out in numerical form to the left of the plotting margin. IØPTN=8 is the counterpart of 4 for recorded and computed stage plotting with corresponding numerical values given on the left margin also. IØPTN=6 gives simultaneous plottings of computed discharges at various user-selected stations along the reach. Space is provided on the left side of the plot for two of these discharge curves to be printed in a more precise digital form according to the user's choice. IØPTN=7 is the counterpart of 6 for multiple-stage plotting with numerical values for the two selected curves listed.
17. ADAPT5 -- This subroutine prints out only discharge at given time intervals in a tabular form. This was the Survey's oldest form used for digital computer printouts in unsteady flow computation.
18. CØNVRT -- This subroutine converts numerical values to the corresponding EBCDIC characters. The subroutine calls CØRE to perform the actual conversion. CØRE is a U.S. Geological Survey implemented subroutine and resides in the U.S. Geological Survey computer center library, however, many other computer centers

should have access to a form a subroutine performing the same function.

19. ZPLOT -- This subroutine is a general-purpose line-printer plotting program and is designed to plot measured and computed quantities against time for comparison. The entry ZPLOT is used when the quantities to be plotted are real numbers, while the entry QPLOT is used for integers. In this program system (Version 13) the former is used to actually plot the recorded and computed stages and the latter for the measured and computed discharges. Curves can be offset to the center whenever they exceed the upper or lower margin. Corresponding numerical values for both curves are listed on the left (lower) margin. For each call of this subroutine, it plots a single line of quantities for a particular point in time. Continuous curves can be plotted by repeated calls.
20. NZPLOT -- This subroutine is a general-purpose line-printer plotting program which plots n ($N\emptyset$) quantities against time simultaneously. The entry NZPLOT is used when the quantities to be plotted (ZN) are real numbers, and the entry NQPLOT is used for integers (NQT). In this system the former is used to plot computed stages and the latter for computed discharges at several stations along the reach. Curves can be offset to the center whenever they exceed the upper or lower margin. Two of the n curves, say, the i th ($L1$) and the j th ($L2$) curves in which $1 < i < j < n$, are numerically listed on the left (lower) margin. For each call of this subroutine, it plots a single line of quantities for a particular point in time. Continuous curves can be plotted by repeated calls.
21. BL/CK DATA -- This nonexecutable subprogram is used to initialize variables in some of the labeled common blocks used in this program system. This subprogram is particularly convenient when assigning values to those constants associated with the metric system or the English system of units.

RESTRICTIONS

The current form of this program (TCM-Version 13) allows a maximum of 20 subreaches with as many as 10 nodal points (that is, 9 segments) for each subreach. When the extrapolation procedure is used, the above restriction on nodal points applies to $m = 1$ cycle, that is the cycle with the larger time step, Δt_1 , whereas for $m = 2$ and 3 cycles, that is, cycles with the smaller time step, Δt_2 ($\Delta t_1 = 2\Delta t_2$), the maximum number of nodal points is 19 (that is, 18 segments).

Although the program is written for the multiple-reach scheme, it is equally applicable to a single reach. The ideal length of a subreach,

ΔL (=DELL), is from a few to several miles. A subreach length of more than 10 mi (16 km) is not recommended. Once the length, ΔL , and the number of equal segments, $n(=N)$, are chosen for a subreach, the segment length, Δx (=DELX), for that subreach is fixed. The time interval for the numerical computation, Δt , is then controlled by the following relationship,

$$\Delta t < \frac{\Delta x}{|u \pm c|} \quad (25)$$

In applying the above relationship, use the expected maximum absolute value of $u \pm c$ through the total reach for the desired period of time.

When field-recorded data are used as the input boundary values, the time interval IDELT between data points is often greater than Δt specified above. Hence, it is necessary to divide IDELT by a factor, TP, so that the computational time interval Δt (=DELT) satisfies the above restriction. According to the foregoing arguments, it is advantageous to select the number of segments, $n_j [=N(J)]$, in each subreach such that

$$\frac{\Delta x_1}{\max |u_1 \pm c_1|} \approx \frac{\Delta x_2}{\max |u_2 \pm c_2|} \approx \dots \approx \frac{\Delta x_j}{\max |u_j \pm c_j|} \approx \dots \quad (26)$$

By this selection, not only is the computational efficiency improved, but the inaccuracy resulting from the linear interpolation will be minimized, as well.

To compile reach geometry data (not using the reach-geometry equations), the program permits a maximum of 20 data points for both depth versus area and depth versus width tables for each subreach. The lateral inflow (negative if outflow) has a dimension of cubic feet per second per foot or cubic meters per second per meter and should flow into the channel normal to or with an insignificant component in the main flow direction. When it has a substantial velocity or momentum component in the main flow direction, the basic partial differential equations should be modified. When the output option for multiple discharge (Q) or stage (Z) plotting is used, the maximum number of curves to be plotted simultaneously, $N\emptyset$, is 5, at present, but the user can easily increase it by changing the proper dimensions and adding more symbols, MARK, for actual plotting. The numerical display of graphical quantities appearing on the left (lower) margin of the plot is limited to two curves only.

In this version, the boundary values are to be supplied at each end of the total reach, hence, the program is applicable only to sub-critical flow problems. For the restrictions on the selection of the reaches and waterways, the user is referred to the assumptions stated in the INTRODUCTION of this manual or to earlier reports (Lai, 1965; and Lai, 1967). In treating a waterway connecting two rivers, use the end with smaller station number (according to the U.S. Geological Survey numbering system) as the upstream boundary.

When points in time are treated as discrete points, the cut-off point for the day may often be a problem. Some people prefer to consider the midnight between two consecutive days as the last data point of the first day, some like to include it as the first point of the second day. As far as the input is concerned, this program accepts both systems equally. The only restriction is that those who prefer the former must call midnight 2400 of the first day, whereas the latter are asked to call it 0000 of the second day. (For example, 2400 December 31, 1969, or 0000 January 1, 1970.) For a fraction of an hour after the midnight, say 35 minutes after midnight, always use 0035 and never 2435. For output in regards to cut-off, see chapter OUTPUT.

The user can, without much difficulty, find other minor restrictions, or "guide lines" concerning I/O details, when he reads the actual program, or follows the companion volume of this manual, "Instruction for automatic computation of unsteady flows in rivers and estuaries (in preparation)," which is intended for hydraulic engineers with field application in mind.

INPUT

Input for this program has three different forms: data cards only, data cards and user-supplied subprograms, and data cards and disks. These are listed and described in the following pages, and summarized as a chart (figure 5) for quick reference.

When more than one set of input data is to be processed in a single run, the data cards needed for the second and the subsequent data sets may be slightly different from the first one. Such special data cards are explained in the fourth section of this chapter, and the data set-up involving these cards are treated in the following chapter, "Program run preparation."

Although the information given here and in the attachments is sufficient to run the program, much more detailed description about organization, compilation and preparation of the field data for inputs to the

computer, from the viewpoint of a hydraulic engineer, will be given in the companion volume of this manual, "Instruction manual for automatic computation of unsteady flows in rivers and estuaries (in preparation)."

Data Cards Only

On each card, column 80 is used for card type identification, except for the boundary value cards.* There are nine types of cards in the data set. When the run with a particular option does not require certain types of data cards, dummy cards still have to be sequenced. The following list shows the order and the types of data cards and the number of each required.

<u>Column 80</u>	<u>Type of Cards</u>	<u>Number of Cards Needed</u>
1	Option card (including the number of sub-reaches)	1
2	Reach (stream, waterway, river, estuary) identification	1
3	Type of reach geometry	1
4	Scale or location	1
5	Reach geometry	as needed
6	Initial values and parameters (pertaining to each subreach and junction)	NR+1
7	Initial data and parameters	1
(B)*	Boundary values	as needed
M	MOPTN card	1

The specifications for each type of input card is given in the following lists. For convenience in programming and for saving of storage, some format statements shown in the program listing (Attachment A) may be slightly different from the formats listed here (for example, a same FORMAT statement may be used for many different READ statements instead of writing one FORMAT for each READ statement). Whenever this is noticed the user is advised to follow the instruction in the following lists. Variables with no format shown are card identifications. These variables, which are allocated specific columns, are intended to help the user identify and sequence input cards, but will not be read in by the computer.

*Columns 71 through 80 of boundary value cards are usually reserved for punching year, month, day, hour, and minute of the boundary values appearing on the same card, each occupying two columns. Thus the character "B" may not be physically punched on column 80. It is shown in parentheses in this table to represent the type of the card.

<u>Card</u> <u>Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
1	Option card (including the number of subreaches)			
	NR	1-2	I2	Number of subreaches
	IØPTN	4	I1	Output option (For detail, see PROGRAM DESCRIPTION and OUTPUT) Set IØPTN = 1 for comprehensive print-outs = 2 for (+) and (-) volumes of flow = 3 for daily average discharges = 4 for measured and computed discharge plotting = 5 for simple discharge table = 6 for multiple-discharge plotting = 7 for multiple-stage plotting = 8 for recorded and computed stage plotting
	JØPTN	6		Accuracy option: Set JØPTN = 1 when extrapolation procedure is requested = 0 when no extrapolation procedure is requested
	LØPTN	8	I1	Option for form of boundary values; LØPTN=1 is required here. For boundary values in equation form, see page 35.
	NØPTN	10	I1	Option for boundary conditions Set NØPTN = 1 for stages given at both ends = 2 for stage given at the upstream end and velocity at the downstream end = 3 for velocity given at the upstream end and stage at the downstream end = 4 for velocities given at both ends

Card Type	Variable	Columns	Format	Description
1 (cont'd)	DØPTN	12	I1	Input access option; Set DØPTN=0. For disk data storage, see page 39.
	KTYPE	80		Punch "1".
2	Reach (stream, waterway, river, estuary) identification card			
	IDENT	1-76	19A4	Any alphanumeric information may be used as the reach identification
	KTYPE	80		Punch "2".
3	Type of reach geometry card			
	JEØMET	1-40	20I2	Reach geometry option; Punch NR "0"'s, or leave it as a blank card. For reach geometry in equation form, see page 36.
	KTYPE	80		Punch "3".
4	Location and scale card			
	If IØPTN=1	1-79		Blank
	If IØPTN=2 through 8			(Not all of the following variables are required in any IØPTN run. The relevant IØPTN numbers for each variable are indicated within the parentheses following the variable name.)
	ISTA	1-2	I2	Nodal point number in subreach
	(2,3,4,5,8)			JRCH
	JRCH	3-4	I2	Subreach number
	(2,3,4,5,8)			
	KTP	5-6	I2	Output line (data) group size.
	(4,5,6,7,8)			For IØPTN=4,6,7,8, indicate the line interval at which to have "hour" printed. For IØPTN=5, indicate the number of discharge values per row or per group. (See examples of output printouts in Attachment B.)
	IJSTG (8)	7-8	I2	Those stations where stage records are taken and are available for comparison with computed stages are numbered (1,2,3,...) from up-stream toward downstream.

I	Card	Variable	Columns	Format	Description
	Type				
	4	IJSTG (8)	7-8	I2	However, the comparison can be made only one station at a time. (See examples: input card for IØPTN=8, page 111, output printout for IØPTN=8, page 146.) IJSTG stores the ordinal number of the station at which the observed stage record is to be compared with the computed one for that particular run of computation.
	(cont'd)				
		ISCL (4,6)	9-13	I5	Scale for plotting discharges by line printer (ft ³ /s/column or m ³ /s/column)
		SCALE (7,8)	9-13	F5.3	Scale for plotting stages by line printer (ft/column or m/column)
		MINQ (4,6)	14-20	I7	Expected minimum discharge (for lower margin of plotting) (ft ³ /s or m ³ /s)
		ZMIN (7,8)	14-20	F7.3	Expected minimum stage (for lower margin of plotting) (ft or m)
		IQØRD (4,6)	21-24 25-28 29-32 33-36 37-40	5I4	Discharge readings in line-printer plotting; begin with MINQ+10xISCL, and increment it by 20xISCL until the fifth reading is reached. (Unit is 1000 ft ³ /s or 100m ³ /s)
		ZØRD (7,8)	21-24 25-28 29-32 33-36 37-40	5F4.1	Stage readings in line printer plotting; begin with ZMIN+10xSCALE and increment it by 20xSCALE until the fifth reading is reached. (ft or m).
		NØ (6,7)	41-42	I2	Number of curves to be plotted (maximum 5)
		M1 (6,7)	43-44	I2	Subreach number

<u>Card</u> <u>Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
4 (cont'd)	N1 (6,7)	45-46	I2	Nodal point number in sub-reach M1; (N1, M1) defines the location for which the discharge or stage is to be printed in numerical form on the first column.* (See output example for IØPTN=6 or 7, page 144 or 145.)
	M2 (6,7)	47-48	I2	Subreach number
	N2 (6,7)	49-50	I2	Nodal point number in sub-reach M2; (N2, M2) defines the location for which the discharge or stage is to be printed in numerical form on the second column.* (See output example for IØPTN=6 or 7, page 144 or 145.)
	MRCH (6,7)	51-52	I2	Subreach number
		55-56	I2	
		59-60	I2	
		63-64	I2	
		67-68	I2	
	NSTA (6,7)	53-54	I2	Point number in subreach
		57-58	I2	MRCH, (NSTA(I), MRCH(I))
		61-62	I2	defines the location for
		65-66	I2	which the Ith discharge or
		69-70	I2	stage curve is to be plotted.
	KTYPE	80		Punch "4".
5	Reach geometry cards -- For each subreach, J, (J=1,...,NR), prepare the following cards. For reach geometry in equation form, see page 36.			
	a) Area-table leading card			
	NA	1-2	I2	Number of data points used in the cross-sectional area table in the immediately following cards (maximum 20 points)

*Not the character column of the line printer.

Card Type	Variable	Columns	Format	Description
5 (cont'd)	KN	76		Subcard number: Punch "0".
	A	77		Area card: Punch "A".
	J	78-79		Punch subreach number, right justified
	KTYPE	80		Punch "5".
b) Area-table cards				
	YA	1-5	F5.2	Depth of channel for the
		16-20	F5.2	area table
		31-35	F5.2	
		46-50	F5.2	
		61-65	F5.2	
	AREA	6-15	F10.1	Cross-sectional area
		21-30	F10.1	One pair of YA and AREA
		36-45	F10.1	determines one data point,
		51-60	F10.1	(YA, AREA), in the area
		66-75	F10.1	table.
				For example, columns 1
				through 15 determine the
				first data point (the 6th
				point if the second card)
				and 16 through 30, the
				second point (the 7th point
				if the second card), and so
				forth.
	KN	76		Subcard number: Punch sequen-
				tial number (1,2,3, or 4)
				for area cards (maximum 4).
	A	77		Area card: Punch "A".
	J	78-79		Punch subreach number, right
				justified.
	KTYPE	80		Punch "5".
				Repeat the above card if necessary until
				NA data points are listed.
c) Width-table leading card				
	NB	1-2	I2	Number of data points used in
				the width table in the immed-
				ately following cards (max-
				imum 20 points)
	KN	76		Subcard number: Punch "0".
	B	77		Width card: Punch "B".
	J	78-79		Punch subreach number, right
				justified.

<u>Card Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
5				
(cont'd)	KTYPE	80		Punch "5".
	Width-table cards			
d)	YB	1-5	F5.2	Depth of channel for the
		16-20	F5.2	width table
		31-35	F5.2	
		46-50	F5.2	
		61-65	F5.2	
	WIDTH	6-15	F10.1	Top width of cross section
		21-30	F10.1	One pair of YB and WIDTH
		36-45	F10.1	determines one data point
		51-60	F10.1	(YB,WIDTH), in the width
		66-75	F10.1	table. For example, col-
				umns 1 through 15 determine
				the first data point (the
				6th point if the second
				card) and 16 through 30, the
				second point (the 7th point
				if the second card), and so
				forth.
	KN	76		Subcard number: Punch sequen-
				tial number (1,2,3, or 4)
				for width cards (maximum
				4).
	B	77		Width card: Punch "B".
	J	78-79		Punch subreach number, right
				justified.
	KTYPE	80		Punch "5".
				Repeat the above card if necessary until NB
				data points are listed.
6	Initial value and parameter cards (pertaining to each subreach and junction) - Prepare one card for each subreach and junction. For the Jth card [Jth subreach (J=1,...,NR) and Jth junction (J=1,...,NR + 1)],			
	DELL	1-7	F7.1	Subreach length (ft or m)
	Z1	8-14	F7.3	Stage at the Jth junction
				(the upstream end of Jth
				subreach) (ft or m)

Card Type	Variable	Columns	Format	Description
6 (cont'd)	U1	15-21	F7.3	Velocity at the Jth Junction (the upstream end of the Jth subreach) (ft/s,m/s)
	ETA	22-26	F5.4	Flow-resistance coefficient, η , of the Jth subreach (same dimension as Manning's n)
	N	27-28	I2	Number of segments in the Jth subreach
	CØR	29-33	F5.3	Datum correction at the Jth junction (the upstream end of the Jth subreach) (ft or m)
	ZBL =ZB(1,J)	34-40	F7.3	Channel bottom elevation at the upstream (left) end of the Jth subreach (=Jth junction + 0) (ft or m)
	ZBR =ZB(2,J)	41-47	F7.3	Channel bottom elevation at the downstream (right) end of Jth subreach [(J+1)th junction - 0] (ft or m)
	SQ	48-54	F7.4	Lateral inflow or outflow. (+) sign for inflow and (-) sign for outflow [(ft ³ /s)/ft or (m ³ /s)/m]
	STANAM	60-75	4A4	Station name referring to the Jth junction (the upstream end of the Jth subreach)
	J	78-79		Punch subreach number, right justified.
	KTYPE	80		Punch "6".
	At the downstream end [(NR+1)th card], only Z1, U1, CØR, and STANAM are relevant.			
7	Initial data and parameters			
	IDELT	1-2	I2	Time interval between two consecutive data points (min.)

<u>Card Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
7 (cont'd)	TP	4-5	I2	Number of subinter- vals in IDELT (See RESTRICTIONS.)
	MØ	7-8	I2	Beginning month of com- putation
	DAY	10-11	I2	Beginning day of comp- utation
	YR	13-14	I2	Beginning year of comp- utation (last 2 digits)
	HOUR	16-17	I2	Beginning hour of comp- utation
	MNT	19-20	I2	Beginning minute of comp- utation
	EPS	22-25	F4.1	The tolerable error limit used in the iterative solution of boundary equations at junctions
	DZ	27-30	F4.2	Increment of Z for the solution of boundary equations at junctions
	KTYPE	80		Punch "7".
B	Boundary value cards			
	MØPTN	1	I1	Blank
	ZPE1 or UPE1	2-7	F6.2	Stage or velocity data at the upstream end
	ZPEL or UPEL	8-13	F6.2	Stage or velocity data at the downstream end
	MQ	15-23	I9	Measured discharge (re- quired in IØPTN=4)
	RZ	26-30 31-35 36-40 41-45 46-50 51-55 56-60 61-65 66-70	9F5.2	As many as 9 recorded stages, excluding those used as the boundary data, can be punched here. (requir- ed in IØPTN=8)

<u>Card</u> <u>Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
B (cont'd)	ID	71-80		Any identification for the boundary data. Usually, date and time for the given boundary data are punched; for example, "6609071415" indicates 1966, September 7th, the time 1415 hours
No limit for the number of cards. It is absolutely necessary that all the data on the same card are synchronized.				
M	MØPTN card -- Each boundary value data deck has to end with this card. In the following description, "location" means any point within the reach, that is, nodal point, junction, or boundary. Also, "a data deck" is defined as a set of boundary values (either in data or equation** form) preceded by initial data that includes at least Type 6 and 7 cards. Thus, cards sequenced from Type 1 to Type M as described in this section constitutes a valid data deck, whereas only a deck of Type B cards does not. A sequence of Type 4→6→7→B→M (see page 50) cards is another example of a valid data deck, whereas merely combining two sets of boundary data, or a group of initial value and parameter cards without accompanying boundary values, does not constitute a valid data deck. Likewise, splitting a deck of boundary data by inserting a Q card (see page 41) does not constitute two new data decks, because the part after the Q card is not preceded by Type 6 and 7 cards.			
	MØPTN	1	I1	Option for specifying the action to be followed when the computation of the current set is terminated or interrupted. Set MØPTN

**When both the boundary values are expressed in equations (LØPTN=4; see the following section), there is no card deck for the boundary values. The definition "data deck" in this manual is used conceptually and inclusively, instead of physically, unless the specific distinction has to be made.

Card Type	Variable	Columns	Format	Description
M	MØPTN	1	I1	
(cont'd)				= 1, when the next data deck contains data for a different reach = 2, when the rate of lateral inflow, q, has changed = 3, when the computation of the data contained in the next data deck is for the same reach, IØPTN, and scale (if appropriate) as the current set, but for a different location = 4, when the computation of the data contained in the next data deck is for the same reach but for a different IØPTN = 6, when the data contained in the next data deck is to be computed for the same reach, IØPTN, location and scale (if appropriate) = 7, for discontinuous data. Insert, in the data gap, this card followed by the initial value and parameter cards (KTYPE = 6 and 7) to restart the computation = 8, for termination of computation. No more data deck following. = 9, when the computation for data contained in the next data deck is for the same reach and IØPTN but for a different location using different scale

KTYPE

80

Punch "M".

When two or more data decks are sequenced together, the first deck should be prepared according to the above-described input procedure, and any subsequent data deck(s) should be set up according to the point of return in the main program indicated by the value of MØPTN. For the information about the point of return, see Part VII of the main program listing.

Data Cards and User-Supplied Subprograms

Algebraic equations are often used in place of area versus depth or width versus depth tables, when the channel is man-made or has a simple and regular geometrical shape. [Set JEØMET(J)=1 in this case.] If the flow is man-regulated or has simple boundary conditions, again equations may sometimes be substituted for field recorded or measured boundary data. [Set LØPTN=2, 3, or 4 in this case.] The most obvious example of such a condition is when the channel has a dead end, at which $u=0$. Geometrical and boundary equations are also frequently used when the program is used for planning and design purposes.

When the user desires to substitute a part or all of the channel geometry data or the field boundary data, he should proceed as follows.

A. Preparation and Sequencing of the Input Cards.

Card Type	Variable	Columns	Format	Description
1	Option card (including the number of subreaches) Prepare this card as shown in "Data Cards Only" except for the following variable.			
	LØPTN	8	I1	Option for form of boundary values Set LØPTN = 1, when both boundary values are in data format and to be read in = 2, when the left boundary values are in data format and to be read in and the right boundary value is to be given by equation = 3, when the left boundary value is to be given by equation and the right boundary value is in data format and to be read in = 4, when both boundary values are to be given by equations
2	Reach identification card The same as in "Data Cards Only"			
3	Type of reach geometry card			
	JEØMET	1-40	20I2	Channel geometry option; counting from upstream to downstream, for each subreach

Card Type	Variable	Columns	Format	Description
3 (cont'd)	JEOMET	1-40	2012	punch "1", right-justified, if the cross-sectional geometry is to be given by equations; punch "0" otherwise.
	KTYPE	80		Punch "3".
4	Location and scale card The same as in "Data Cards Only"			
5	Reach geometry cards Prepare the reach geometry cards as described in "Data Cards Only" for only those subreaches for which the cross-sectional data are to be given in tabular form [JEOMET(J)=0]. For those subreaches for which the cross-sectional geometry is to be expressed in equation form [JEOMET(J)=1], prepare KTYPE=5 cards as follows, and also write a FORTRAN subroutine called "CGEQ" to carry out the actual numerical computation of geometrical equations. (See "B. Preparation of User-Supplied Subprograms" of this section.) The user should recognize that while Type 5 cards (KTYPE=5) for JEOMET(J)=0 contain the geometrical data that are actually used by the computer in the computation, the information given on these cards for JEOMET(J)=1 is only documentary. The actual executable information in the latter is programed in "CGEQ".			
	JEQ	1-76	19A4	Reach Geometry Equations or Information: If reach geometry equations are simple ones, they may be displayed in these columns. Or, if preferred, appropriate information concerning the cross-sectional shape may be given, for example, "THE X-SECTION IS A TRAPEZOID WITH BASE 10 FT AND SIDE SLOPE 1H:4V." Limit the information to one card.
	E	77		Geometry equation card: Punch "E".

Card Type	Variable	Columns	Format	Description
5 (cont'd)	J	78-79		Punch subreach number, right justified.
	KTYPE	80		Punch "5".
	Sequence all the reach geometry cards regardless of "E" or "A, B" type (column 77), subreach by subreach in the order from upstream toward downstream.			
6	Initial value and parameter cards (pertaining to each subreach and junction).			
	The same as in "Data Cards Only"			
7	Initial data and parameter card			
	The same as in "Data Cards Only" except when LØPTN=4 add the following variables.			
	FINALT	32-38	F7.3	Final computation time, in hours. Converted to seconds in program
	NMP2	39-40	I2	Number of times the computation has to be interrupted for changes of SQ (lateral inflow) values (maximum = 5)
	TCSQ	41-47 48-54 55-61 62-68 69-75	5F7.3	Time to change SQ values. TCSQ is given in hours, which are converted to seconds in the program.
	If NMP2≠0, see page 41 for preparation of Q cards (lateral inflow cards).			
	NMP2=0, omit TCSQ's			
B	Boundary value cards			
	If LØPTN=1, prepare the boundary value cards exactly as shown in "Data Cards Only". If LØPTN=2 or 3, prepare the cards as shown in "Data Cards Only", except those columns reserved for the right or left boundary values that are to be given by equations may be left unfilled. If LØPTN=4 prepare none.			
M	MØPTN card			
	The same as in "Data Cards Only"			

B. Preparation of User-Supplied Subprograms

- a. Reach geometry: The user should prepare a subroutine subprogram which contains a set of channel geometry equations for each subreach that has JEØMET(J)=1. The first statement in the subroutine must be

SUBROUTINE CGEQ(H,J,A,B,HAV,HRD)

in which

H = depth of flow

J = subreach number (integer)

A = Cross-sectional area

B = top width

HAV = average depth ($=A/B$)

HRD = hydraulic mean radius ($=A/P$ where P is the wetted perimeter)

The first two dummy arguments are the input variables, and the last four are the return variables. For example, for a trapezoidal cross-section with the bottom width 10 ft (3m), the side slope 1H:4V, at the 3rd subreach, the user might have the following statements in his subroutine:

IF (J.EQ.3) GO TO 120

.....

.....

120 A = (10.0 + 0.25*H)*H

B = 10.0 + 0.5*H

P = 10.0 + 2.06155*H

HAV = A/B

HRD = A/P

RETURN

130

.....

The subroutine CGEQ is called from subroutine TABLE2.

b. Boundary values:

If LØPTN=1, the user has to furnish one or two boundary functions according to LØPTN value. These function subprograms are listed as follows.

If LØPTN=3 or 4, prepare BDVL(T).

If LØPTN=2 or 4, prepare BDVR(T).

Here, BDVL and BDVR are function subprograms to supply left and right boundary values, respectively, for the given time, T (the elapsed time in seconds from the start of the computation). The first statement in the subprogram must be

FUNCTION BDVL(T), or

FUNCTION BDVR(T).

BDVL or BDVR must be assigned a value within the subprogram before returning to the calling program.

If NØPTN=1 or 2, BDVL has to return a stage value, otherwise, it must return a velocity value. Similarly, if NØPTN=1 or 3, BDVR has to return a stage value, otherwise, a velocity value is returned.

Data Cards and Disk

When a large quantity of boundary value data is collected by automatic digital stage recorders, such input data are first stored on a disk for each gaging station according to some specified formats and blocking procedures. These data are then carefully edited (by computer) and made ready as input for computer processing.*

The user who desires to use the stage data from the disk should prepare his input set up as follows.

A. Preparation and Sequencing of the Input Cards.

<u>Card Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
1	Option card (including the number of subreaches) Prepare this card as shown in "Data Cards Only" except for the following variable. DØPTN 12 I1 Input access option: set DØPTN=1			
2	Reach identification card The same as in "Data Cards Only"			
3	Type of reach geometry card The same as in "Data Cards Only" or "Data Cards and User-Supplied Subprograms."			
4	Location and scale card The same as in "Data Cards Only"			
5	Reach geometry cards The same as in "Data Cards Only" or "Data Cards and User-Supplied Subprograms."			
6	Initial value and parameter cards (pertaining to each subreach and junction) The same as in "Data Cards Only"			
7	Initial data and parameter card The same as in "Data Cards Only"			

The following two types of cards, special for disk option, have to be prepared in addition to the above-mentioned cards. They are

8	Disk input information card (Number of Cards=1) IPE1 8-15 I8 Gaging station number at the upstream boundary			
---	---	--	--	--

*The manual explaining the procedure of stage data transcription, edition, and filing with regard to disk has not been published yet. Those users who desire to know more about the disk data storage system should contact R. A. Baltzer of the U.S. Geological Survey, National Center, Reston Virginia, 22092.

<u>Card</u> <u>Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
8				
(cont'd)	IPE2	23-30	I8	Gaging station number at the downstream boundary. Gaging station numbers are according to U.S. Geological Survey numbering system (8 digits).
	MØE	35-36	I2	Ending month of computation
	DAYE	38-39	I2	Ending day of computation
	HRE	41-42	I2	Ending hour of computation
	MNTE	44-45	I2	Ending minute of computation
	KTYPE	80		Punch "8".
9	Parameter correction cards (Number of cards = as needed)			
	The first card, whether there is any correction to be made or not, must be prepared.			
	NCØRR	1-2	I2	The number of corrections to be made. (Maximum 50 corrections) If no corrections at all, punch "0".
	KTYPE	80		Punch "9".
	If no correction is needed at all, prepare no more cards. Otherwise prepare one card for each correction, as shown below. The order of correction cards is immaterial, although it is preferable that they be in chronological order.			
	MØ1	1-2	I2	Month of correction
	DAY1	4-5	I2	Day of correction
	YR1	7-8	I2	Year of correction (Last two digits)
	HR1	10-11	I2	Hour of correction
	MNT1	13-14	I2	Minute of correction
	ISUBR	16-17	I2	Subreach or junction number in which the correction is to be made.
	ITYPC	19-20	I2	Type of correction: = 1, for flow resistance coefficient (ETA) to be changed = 2, for datum correction = 3, for lateral inflow (SQ) to be changed
	CØRR1	22-31	F10.4	Give the corrected value.

<u>Card Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
9 (cont'd)	KTYPE	80		Punch "9".

Special Data Cards

The following few special cards will not appear in a single data deck or in the first data deck of a multiple data deck set up. They are used in the subsequent data decks of the multiple data decks. (See Program Run Preparation, page 48.)

<u>Card Type</u>	<u>Variable</u>	<u>Columns</u>	<u>Format</u>	<u>Description</u>
Q	Lateral in (out-)flow card (SQ-card)			- One or two cards are needed
	SQ	1-7 8-14 : 64-70	10F7.4	When the lateral in-(out-) flows are to be changed, supply new set of SQ(J) values. If no change occurred in some sub-reaches, supply the old values. The preceding part of the data deck must be interrupted by MØPTN=2 card, which is followed by one or two Type Q cards. (No limit in number of interruptions) When LØPTN=4, there are no Type B cards nor MØPTN=2 card. The computation in this case is interrupted by TCSQ's (see page 37), and new SQ values are fed by NMP2 (or 2xNMP2 if NR>10) SQ-cards that are placed after Type 7 card.
	KTYPE	80		Punch "Q".
L	Location card (L-card),			(One card) - This card is needed when the preceding data deck ends with MØPTN=3
	ISTA	1-2	I2	
	JRCH	3-4	I2	The same as the first part of location and scale card
	KTP	5-6	I2	(Type 4 card) (See "Data Cards Only".)
	IJSTG	7-8	I2	
	KTYPE	80		Punch "L".

Figure 5. Input data chart

PROGRAMMER _____	DIVISION _____	U. S. DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY	NUMBER _____	SHEET
LOCATION _____	PHONE _____	COMPUTER CODING FORM	PROJECT _____	3 OF 5

IDENTIFICATION: **TCM V-13 INPUT DATA CHART**

INFORMATION: _____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
(JEOMET = 1)																																																																															
JEC																																																																															
alphanumeric field																																								E J K T P																																							
II II																																								II II																																							
II II																																								II II																																							
II II																																								II II																																							

Notes: 1. J = 1, ..., NR (Max. NR = 20) ; J = Subreach number.
 2. For each J value of type 5 cards, either form A-B or form E (Col. 77) cards should be prepared and sequenced in the order of increasing J.
 3. KN = 0, 1, ..., r (Max. r = 4) : form A cards $r = [(NA+4)/5]$; form B cards $r = [(NB+4)/5]$; [] = the integer part of the quotient.

TYPE 6 CARD: INITIAL VALUES AND PARAMETERS

DELL	ZI	UT	ETA	N	COR	ZBL	ZBR	SQ	STANAM		J
alphanumeric field											
II II									II II		
II II									II II		
II II									II II		
II II									II II		

TYPE 7 CARD: INITIAL DATA AND PARAMETERS

DELT	TP	MO	DAY	YR	HOUR	MIN	EPS	DZ																																																																									
(LOPTN = 4)																																																																																	
FINAL									NMP2																		TCSQ																																																						

or

DELT	TP	MO	DAY	YR	HOUR	MIN	EPS	DZ																																																																									
(LOPTN = 4)																																																																																	
FINAL									NMP2																		TCSQ																																																						

FORM 9-1633
JULY 1967

0 = ZERO Ø = ALPHA O 1 = ONE I = ALPHA I 2 = TWO Z = ALPHA Z / = SLASH | = VERT. BAR - = MINUS _ = HORZ. BAR

DATA CODING FORM

Figure 5(c)
45

PROGRAMMER _____	DIVISION _____	U. S. DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY	NUMBER _____
LOCATION _____	PHONE _____	COMPUTER CODING FORM	PROJECT _____
IDENTIFICATION: TCM V-13 INPUT DATA CHART			SHEET 5 OF 5
INFORMATION: _____			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Notes: 1. Hatched lines indicate irrelevant fields. 2. Shaded areas indicate (optional) card identification. 3. For DOPTN=0 prepare type 1-7, B and M cards. For DOPTN=1 prepare type 1-9 cards.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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FORM 9-1633 JULY 1967	0 = ZERO	Ø = ALPHA O	-1 = ONE	I = ALPHA I	2 = TWO	z = ALPHA Z	/ = SLASH	= VERT. BAR	- = MINUS	□ = HORZ. BAR	DATA CODING FORM
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Figure 5(e)
47

<u>Card</u> <u>Type</u>	<u>Variable</u>	<u>Columns</u> (one card)	<u>Format</u>	<u>Description</u>
P	IØPTN card			This card is needed when the preceeding data deck ends with MØPTN=4
	IØPTN	1	I1	Output option. (See "Data Cards Only".)
	KTYPE	80		Punch "P".

PROGRAM RUN PREPARATION

Examples of card deck setup for compiling and executing with IBM 360 or 370 equipment are shown as follows:

A. Data Cards only

```
// Standard JØB card
//RUNJØB EXEC FØRTGCG,REGION.FØRT=170K,TIME.FØRT=(1.05),
// TIME.GØ=(4,30),REGION.GØ=175K
//FØRT.SYSIN DD *
```

. . .
FORTRAN source program deck
. . .

```
/*
//GØ.SYSIN DD *
```

. . .
Input data cards
. . .

```
/* End-of-file card
```

- i) TIME.GØ, in integer minutes (and seconds), must be supplied by user.
- ii) The user may replace some of the subprograms by dummy subprograms to save compilation time, if he knows they will not be called in his particular run(s). (See figure 4.)
- iii) A dummy subroutine subprogram consists of legitimate SUB-RØUTINE card as the first card and END card as the last, preceded by RETURN or RETURN i cards as the case requires. Any irrelevant but legal FØRTRAN statement or comment cards may be inserted. If the original program has multiple entries, the dummy program must have the same number of entries with the same formats.
- iv) A dummy function subprogram consists of a legitimate FUNCTION card as the first card and END card as the last, preceded by a RETURN card. Any irrelevant but legal FØRTRAN statement or comment cards may be inserted, but the function name must appear at least once on the left side of the equal sign in such FØRTRAN statements.

- v) When any subprogram is substituted by a dummy subprogram, all the lower level subprograms commanded by this subprogram and not referenced by any other program remaining in the deck can be automatically removed from the deck. (See figure 4.)
- vi) The types and order of "Input data cards" have been described in "INPUT".

B. Data Cards and User-Supplied Subprograms

The deck setup and JCL (Job Control Language cards) are exactly the same as above except the user has to supply his own subprogram(s) for the reach geometry or boundary conditions.

- i) TIME.FØRT may have to be increased if the user has large subprogram(s) to supply.
- ii) For the details concerning the types and order of "Input data cards", see the preceding pages "INPUT".
- iii) When the user supplies any subprogram of his own, make sure the corresponding dummy subprogram is removed from the deck.

C. Data Cards and Disk

As stated in the preceding chapter, the U.S. Geological Survey maintains a set of programs to transcribe, edit, and file, a large amount of stage data on the disk. Before the report explaining such procedures is published the user desiring to use disk stage data should contact the U.S. Geological Survey. The following is a conceptual deck setup for computer run using disk stage input.

```
// Standard JØB card.
//RUNJØB EXEC FØRTGCG,REGION.FØRT=170K,TIME.FØRT=(1,05)
// TIME.GØ=(tt,tt),REGION.GØ=175K
//FØRT.SYSIN DD *
```

. . .
FORTRAN source program deck
. . .

```
/*
//GØ.FT08F001 DD UNIT=uuuu,VØL=SER=ssssss,
// DISP=SHR,DSNAME=nnnnn
//GØ.FT09F001 DD UNIT=uuuu,VØL=SER=ssssss,
// DISP=SHR,DSNAME=nnnnn
//GØ.FT98F001 DD UNIT=uuuu,VOL=SER=ssssss,
// DISP=SHR,DSNAME=nnnnn
//GØ.SYSIN DD *
```

. . .
Input data cards
. . .

```
/* End-of-file card
```

- i) The lower case letters within the JCL indicate fields to be filled in later

- ii) 08=Geographic index file
- iii) 09=Time dependent data index file
- iv) 98=Time dependent data file
- v) For other information, see "A. Data Cards Only" of the preceding page.
- vii) For the details concerning the type and order of "Input data cards", see "INPUT".

D. Multiple Data Decks

When the user runs a single data deck, (see page 33 for the definition of data deck), the MØPTN card at the end of the deck must have a value of "8", except in the case of disk input, for which no MØPTN card is necessary. When more than one data deck is to be processed, all the decks should be sequenced in the order the user would like them to be processed, with one MØPTN card each serving as a divider between data decks. (See the exception on the footnote.) The value of MØPTN depends on the type of the following data deck, and has already been described in "INPUT."

For the preparation of multiple data decks for computer execution, the user should always set up the first deck according to the procedures described in "INPUT". The subsequent decks should follow the card sequence shown below.

If the previous deck ends with MØPTN =	Prepare the following types of cards in the sequence shown.
1	the same as the first deck
2*	Q→B→M** or Q→B→Q→B→...→Q→B→M
3	L→6→7→B(unnecessary if LØPTN=4)→M
4	P→4→6→7→B(unnecessary if LØPTN=4)→M
6	6→7→B(unnecessary if LØPTN=4)→M
7	6→7→B→M
9	4→6→7→B(unnecessary if LØPTN=4)→M

When the user is not too sure how to set up his multiple data decks, prepare each data deck according to the first deck (see INPUT) ended by MØPTN=1 card except the last deck which should be ended by MØPTN=8.

*MØPTN=2 is an interruption card and is used within a data deck to change the values of the lateral inflow, SQ. The new values of SQ are provided by Type Q card(s) which is (are) placed after the MØPTN=2 card. As defined on page 33, the part of boundary value cards following Q card(s) does not constitute a separate data deck. There is no limit in the number of interruptions.

**When LØPTN=4, the computation is interrupted by TCSQ(KMP2) instead of MØPTN=2. The card sequencing in this case is, following Type 7 card, NMP2 (or 2 x NMP2 if NR>10) Q's→M. See page 37 and page 41.

OUTPUT

The output is printed in the following form and order. (See examples in Attachment B)

1. Title and version number.
2. Reach identification.
3. Heading for the reach geometry and the number of subreaches.
4. Cross-section numbers and
 - a. (JEOMET=0) area versus depth and width versus depth tables,
or
 - b. (JEOMET=1) equations or information describing the cross-sections.
5. Initial values and parameters for stations (junctions) (such as U, Z, DATUM CØR), or for subreaches (such as DELL, ZBL, ZBR, ETA, N). Junctions, including the boundary points, are numbered in sequence from upstream end to downstream. Their geographical names are also given. Variables belonging to the subreach between junctions j and j+1 are listed on line j.
6. Other parameters and variables.
7. Computed results. There are eight output options in this version. They are described in "PROGRAM DESCRIPTION", but are also summarized in the following table (Table 1).

Table 1. Output options

<u>IOPTN</u>	<u>Description</u>	<u>Items/Quantities Printed</u>	<u>Quantities Plotted</u>	<u>Number of Locations Printed or Plotted</u>	<u>Frequency of Printing</u>
1	Prints complete output tables	Date, time, station name, distance, velocity (U), elevation (stage, Z), discharge, lateral in-(out-)flow.		At every nodal point (determined by M=1 cycle) for every subreach, i.e., at (I,J); I = 1,...,N(J); J=1,...,NR; plus (N(NR) + 1, NR)	At time interval of IDELT
2	Prints (+) and (-) volumes of flow	Date, station (in subreach number and nodal point number, i.e., J-I), accumulated volumes of flow, footnote for partial day.		One; at user selected station	Whenever flow reverses, the day ends, or the computation terminates; the maximum interval is daily for unidirectional flow
3	Prints mean daily discharges.	Date for a water year, station (in subreach number and nodal point number, i.e., J-I), mean daily discharge, footnote for partial day.		One, at user selected station (J-I)	Discharge — daily; table-yearly
4	Plots measured and computed discharge	Date, station (in subreach number and nodal point	Measured (observed) discharge (*)	One, at user selected	At time interval

curves (by line printer) for comparison.

number, i.e., J-I), measured discharge (numerical), computed discharge (numerical), number of gage records, sums of measured and computed discharges, mean measured and computed discharges.

station (J-I). of IDELT; HOUR-reading—KTP; mean values—daily or partial day

5 Prints compact discharge tables.

Date, station (subreach number and nodal point number, i.e., J-I), hour, discharge.

One, at user-selected station (J-I).

Discharge—at time interval of IDELT; table-daily

6 Plots computed discharge curves for selected stations (by line printer).

Date, stations (subreach number and nodal point number, i.e., J-I; max.=5 sta.), computed discharges (numerical) for two user-selected stations, number of gage records, mean discharges, symbols used for curve plotting.

Computed discharge curves (max. 5), discharge scale, time scale, grid points (+)

Varies, 1, ..., N $\emptyset$, max. N $\emptyset$ = 5

At time interval of IDELT; HOUR-reading—KTP; mean values—daily or partial day

7 Plots computed stage curves for selected stations (by line printer).

Date, stations (in subreach number and nodal point number, i.e., J-I; max.=5 sta.), computed stages (numerical) for two user-selected stations, number of records, mean stages, symbols used for curve plotting.

Computed stage curves (max. 5) stage scale, time scale, grid points (+)

Varies, 1, ..., N $\emptyset$, max. N $\emptyset$ =5

At time interval of IDELT; HOUR-reading—KTP; mean values—daily or partial day

8 Plots recorded and computed stage (elevation) curves (by line printer)

Date, station (in subreach number and nodal point number, i.e., J-I), recorded stage (numerical), computed stage (numerical), number of gage records, sums of recorded and computed stages, mean recorded and computed stages.

Recorded (observed) stage (*) curve, computed stage (0) curve, stage scale, time scale, grid points (+)

One, at user-selected station (J-I)

At time interval of IDELT; HOUR-reading—KTP; mean values—daily or partial day

When the user has more than one deck of input data to process, the output for the second or higher order data deck may not give all the output forms listed above, but depends on the MØPTN value that will direct the computer to a point of return in the main program. For example, if a preceding data deck ends with MØPTN=6, the computation for the following data deck begins from the statement labelled "310" in the main program (see Part 7 and Part 3 of the main program in the program listing, Attachment A), and the next output printing starts from form 5 (page 51). Output forms 1 through 4 will not be printed.

The program set is capable of furnishing output either in the metric system (M) or in the English system (E). The program also makes a distinction between two systems of cut-off point for a day, that is, to consider midnight as the last data point of the previous day (A) or as the first point of the following day (B). [IØPTN=2 and 3 make no distinction for (A) or (B).] Therefore, there are four different combinations of output systems; namely (M,A), (M,B), (E,A), and (E, B)*. They are marked in the beginning part of those subprograms that are relevant. The user should choose one of these four for his program deck setup.

DIAGNOSTIC MESSAGES

In addition to standard FORTRAN-supplied error messages, the following diagnostic messages are provided in this program.

MAIN

1. THERE IS NO SUCH OPTION IN THIS PROGRAM.
The option number punched is not within the specified range or the user forgot to punch the option number and there is no specified number by default in that particular run.
2. ERROR IN STATION NUMBERING.
When stage data are stored on disks, stations are numbered according to U.S. Geological Survey station numbering system which has numbers increasing toward downstream. When the upstream and downstream gages are reversed this message is printed.
3. ERROR--GAGE HEIGHT EQUAL TO ZERO.
This message occurs only when the disk input is used (DØPTN=1). According to the mechanism of the automatic digital stage recorder currently in use in the U.S. Geological Survey, a

*The U.S. Geological Survey has prepared four such program sets and made them available for users. The program listing in Attachment A belongs to the set (E,A).

stage reading of "0000" will not be punched. Hence, the zero reading of stage indicates malfunctioning of the digital recorder or data lost during the transcribe-edit-file process.

4. ***** ATTENTION *****

DISCONTINUOUS DATA

This is a warning message used as a spacer. When there is a discontinuity in the input boundary data, the user inserts a MØPTN=7 card in the gap, and the computer prints this message upon sensing this number. This program by itself does not perform the boundary data editing job.

JT2WAY

5. DQ1 DOES NOT CONVERGE.

Unsuccessful iteration. ABS(DQ1) does not reduce to less than EPS within the specified number of iterations. Debug DQ1 and observe the manner and rate with which its value changes. Try with other values of DZ and/or EPS.

ZPLØT
NZPLØT

6. QUANTITY MUCH TOO LARGE TO PLOT.
Self-explanatory

7. QUANTITY MUCH TOO SMALL TO PLOT.
Self-explanatory

ESTIMATION OF STORAGE AND TIME

Storage and time requirements vary greatly with forms of I/Ø and options selected. The organization chart given in Figure 4 serves as a guide in judging what subprograms may be omitted in any particular run to reduce storage requirements. The following are data from some sample runs.

The program system listed in Attachment A requires 158K bytes for FORTRAN G compilation and 134K for execution, through MVT (multiprogramming with a variable number of tasks) system using an IBM 370/155. The time needed for compilation varies from less than 1 minute to 1 minute 20 seconds. If the output option 5 (IØPTN=5) is planned for a computer run of a single reach with first-order accuracy (i.e., NR=1, JØPTN=0),

subprograms JT2WAY, RESET, INDSK1, EDATE1, DATE2, DAILY, and SELECT may be replaced by corresponding dummy subprograms, and subprograms SPLNS, JULYN, ØPTNI, ZPLØT, and NZPLØT may be removed from the system. (See figure 4.) The storage requirements for such a program set-up are 158K for compilation and 86K for execution, whereas the time needed for compilation is approximately 39 seconds. In the same set-up, if the second-order accuracy (JØPTN=1) is desired instead of the first-order, and hence, adding RESET AND SPLNS to the program deck, the storage and time requirements are 158K and 46 seconds for compilation and 90K storage for execution.

The execution time for the first output example in Attachment B (the Connecticut River, NR=11, IØPTN=1, JØPTN=1 NØPTN=1, DØPTN=0, JEØMET(1,...,NR)=0, the period of boundary data = 0445 to 1900 of the same day) is about 2 minutes 5 seconds to 2 minutes 15 seconds, but reduces to about 50 seconds if the extrapolation procedure is bypassed (JØPTN=0). For estimating execution time for a long period of data, the following approximation is made from sample runs of Threemile Slough near Rio Vesta, Calif. (Lai, 1965). The execution times for running a 1-year period of stage data, treating the slough as a single reach, are 13.2 minutes for the first-order computation and 40.2 minutes for the second-order computation.

As a rule of thumb, assume a 3 to 1 ratio of execution times between runs with and without the extrapolation procedure, but the ratio may be somewhat reduced in the multiple-reach scheme because of the extra computation time required at junctions, which is needed regardless of whether one uses or bypasses the extrapolation.

The fact that almost countless combinations of options and parameter values can be conceived, indicates that there would be nearly an infinite number of variations of run time.

REFERENCES

- Fletcher, A. G., and Hamilton, W. S., 1967, Flood routing in an irregular channel: Am. Soc. Civil Engrs., v. 93, no. EM3, paper 5282, p. 45-62.
- Lai, Chintu, 1965, Flows of homogeneous density in tidal reaches, solution by the method of characteristics: U.S. Geol. Survey open-file report, 58 p.
- Lai, Chintu, 1967, Computation of transient flows in rivers and estuaries by the multiple-reach method of characteristics, in Geol. Survey Research, U.S. Geol. Survey Prof. Paper 575-D, p. D273-D280.
- Lai, Chintu, Ruggles, F. H., and Weiss, L. A., 1971, Evaluation of flow in tidal reaches of the Connecticut River by mathematical model, U.S. Geol. Survey open-file report, 40 p.
- Lister, M. and Roberts, L., 1959, On the numerical solutions of spherical waves of finite amplitude, Technical Report on the Project of Machine Methods of Computation, MIT-Proj. DIC 6915.

ATTACHMENT A: SOURCE PROGRAM LISTING

The subprograms are arranged in the following order. The number in the parentheses indicates the beginning page number.

1. MAIN (59)	8. BDVL (81)	15. DAILY (93)
2. CHARCB (72)	9. BDVR (82)	16. SELECT (95)
3. JT2WAY (73)	10. INDSK1 (83)	17. ADAPT5 (100)
4. RESET (76)	11. JULYN (86)	18. CØNVRT (102)
5. SPINS (77)	12. EDATE1 (87)	19. ZPLØT (103)
6. TABLE2 (79)	13. ØPTNI (89)	20. NZPLØT (105)
7. CGEQ (80)	14. DATE2 (91)	21. BLØCK DATA (107)

C TCM00000
C UNSTEADY FLOWS IN RIVERS AND ESTUARIES TCM00010
C CALCULATION FOR MULTIPLE REACHES BY THE METHOD OF CHARACTERISTICS TCM00020
C THIS PROGRAM IS ONE OF THE VERSIONS WHICH WERE BASED ON AN TCM00030
C EARLIER REPORT, 'COMPUTATION OF TRANSIENT FLOWS IN RIVERS AND TCM00040
C ESTUARIES BY THE MULTIPLE-REACH METHOD OF CHARACTERISTICS', BY TCM00050
C CHINTU LAI, U.S. GEOLOGICAL SURVEY PROF. PAPER 575-D, 1967. TCM00060
C TCM00070
C PROGRAMED BY C. LAI, TCM00080
C VERSION 13 (E) BY C. LAI, JAN. 23, 1968 TCM00090
C UPDATED BY C. A. ONIONS AND C. LAI, FEB. 7, 1975 TCM00100
C TCM00110
C **** SUBROUTINES & FUNCTIONS NECESSARY FOR VERSION 13 **** (E) TCM00120
C * SUBROUTINE CHARCB REFERENCE DATE - FEB. 1, 1972 TCM00130
C * SUBROUTINE JT2WAY REFERENCE DATE - FEB. 1, 1972 TCM00140
C * SUBROUTINE RESET REFERENCE DATE - MAR. 28, 1974 TCM00150
C * SUBROUTINE SPLNS REFERENCE DATE - MAR. 28, 1974 TCM00160
C * SUBROUTINE TABLE2 REFERENCE DATE - FEB. 1, 1972 TCM00170
C * SUBROUTINE CGEQ (NO DATE) TCM00180
C * FUNCTION BDVL (NO DATE) TCM00190
C * FUNCTION BDVR (NO DATE) TCM00200
C * SUBROUTINE INDSK1 REFERENCE DATE - JULY 30, 1974 TCM00210
C * FUNCTION JULYN REFERENCE DATE - JULY 31, 1974 TCM00220
C * SUBROUTINE EDATE1 REFERENCE DATE - AUG. 7, 1974 TCM00230
C * SUBROUTINE OPTNI REFERENCE DATE - JUNE 1, 1973 TCM00240
C * SUBROUTINE DATE2 REFERENCE DATE - AUG. 5, 1974 TCM00250
C * SUBROUTINE DAILY REFERENCE DATE - AUG. 6, 1974 TCM00260
C * SUBROUTINE SELECT REFERENCE DATE - FEB. 1, 1972 TCM00270
C * SUBROUTINE ADAPT5 REFERENCE DATE - FEB. 1, 1972 TCM00280
C * SUBROUTINE CONVRT REFERENCE DATE - FEB. 9, 1974 TCM00290
C * SUBROUTINE ZPLOT REFERENCE DATE - FEB. 1, 1972 TCM00300
C * SUBROUTINE NZPLOT REFERENCE DATE - MAY 16, 1974 TCM00310
C * BLOCK DATA (NO DATE) TCM00320
C TCM00330
C *** SEVERAL OPTIONS ARE USED IN THIS PROGRAM. TCM00340
C *** THEIR PURPOSES ARE AS FOLLOWS-- TCM00350
C IOPTN FOR OUTPUT OPTION, JOPTN FOR ACCURACY OPTION, TCM00360
C DOPTN FOR INPUT ACCESS OPTION, MOPTN FOR CONTINUATION OPTION, TCM00370
C LOPTN FOR B.V. FORMAT OPTION, NOPTN FOR BOUNDARY COND. OPTION, TCM00380
C JEOMET FOR CHANNEL GEOMETRY OPTION. TCM00390
C TCM00400
C SET IOPTN = 1 FOR COMPLETE OUTPUT TABLE TCM00410
C = 2 FOR (+) AND (-) VOLUME TCM00420
C = 3 FOR DAILY AVERAGE DISCHARGE TCM00430
C = 4 FOR MO AND CO PLOTTING TCM00440
C = 5 FOR SIMPLE DISCHARGE TABLE TCM00450
C = 6 FOR MULTI-Q PLOTTING TCM00460
C = 7 FOR MULTI-Z PLOTTING TCM00470
C = 8 FOR RZ AND CZ PLOTTING TCM00480
C TCM00490
C SET JOPTN = 1 FOR EXTRAPOLATION TCM00500
C = 0 FOR NO EXTRAPOLATION TCM00510

60

```

C
C      SET DOPTN = 0 FOR CARD INPUT
C              = 1 FOR DISK INPUT
C
C      SET MOPTN = 1 FOR DIFFERENT REACH
C              = 2 FOR DIFFERENT LATERAL INFLOW
C              = 3 FOR SAME IOPTN, SCALE, REACH, BUT DIFFERENT LOCATN
C              = 4 FOR SAME REACH, BUT DIFFERENT IOPTN
C              = 6 FOR SAME IOPTN, SCALE, LOCATION, AND REACH
C              = 7 FOR DISCONTINUOUS DATA
C              = 8 FOR TERMINATION OF COMPUTATION
C              = 9 FOR SAME IOPTN, REACH, BUT DIFFERENT LOCATION,
C                  SCALE
C
C      SET NOPTN = 1 FOR STAGES GIVEN AT BOTH ENDS.
C              = 2 FOR STAGE GIVEN AT THE UPSTREAM END AND VELOCITY
C                  GIVEN AT THE DOWNSTREAM END.
C              = 3 FOR VELOCITY GIVEN AT THE UPSTREAM END AND STAGE
C                  GIVEN AT THE DOWNSTREAM END.
C              = 4 FOR VELOCITIES GIVEN AT BOTH ENDS.
C
C      SET LOPTN = 1 FOR BOTH BOUNDARY VALUES TO BE READ IN.
C              = 2 FOR THE LEFT BOUNDARY VALUE TO BE READ IN.
C              = 3 FOR THE RIGHT BOUNDARY VALUE TO BE READ IN.
C              = 4 FOR BOTH BOUNDARY VALUES TO BE GIVEN BY EQUATIONS.
C
0001      INTEGER TREC, DAY, YR, HOUR, TP, DOPTN
C
0002      COMMON MNT, IDELT, DELT, QK(10,20), ZK(10,20)
0003      COMMON /BINDSK/NN, IFIN, ISTART, LJ, NOB, CORL, COR(21)
0004      COMMON /BTABL2/A, B, YA(20,20), SAJ(20,20), CAJ(20,20), YB(20,20),
1          SBJ(20,20), CBJ(20,20), HAV, JEOMET(20), HRD,
2          NOPA(20), NOPB(20)
0005      COMMON /BQPLGT/IBLANK(105), ISCL, ISCLH, MINQ
0006      COMMON /BDATEA/HOUR, DAY, MD, YR, LDM(12), IFLAG, LABEL
0007      COMMON /BDATB2/MONTH(36), IQORD(5), JRCH, ISTA
0008      COMMON /BCARCB/U(20), Z(20), UPT(20), ZPT(20), H(20)
0009      COMMON /BZPLOT/SCALE, SCALH, ZMIN
0010      COMMON /BDATEC/ZORD(5), M1, M2, N1, N2, MRCH(5), NSTA(5), NO
0011      COMMON /BJT2WY/Z1(10,20), U1(10,20), ZB(10,20), ZB2(20,20),
1          SO(20), ETA(20), N(20), Z2(20,20), U2(20,20),
2          SO(20), TH(20), CFRIC(20), ZP(20,20),
3          UP(20,20), EPS
0012      COMMON /BPRMTR/DELL(20), DELX(20)
0013      COMMON /BLABEL/STANAM(4,21)
0014      COMMON /BMECNV/G, SOMC, FFCOU
0015      COMMON /BINOUT/MU, NU
C
0016      DIMENSION QF(20), QL(20), IDENT(19), AREA(20,20), WIDTH(20,20),
1          RZ(10), DELZT1(20), DELZT2(20), HDLZT1(20),
2          HDLZT2(20), JEQ(19), TCSQ(5)
0017      EQUIVALENCE (IDENT(1), JEQ(1))

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TCM00520
TCM00530
TCM00540
TCM00550
TCM00560
TCM00570
TCM00580
TCM00590
TCM00600
TCM00610
TCM00620
TCM00630
TCM00640
TCM00650
TCM00660
TCM00670
TCM00680
TCM00690
TCM00700
TCM00710
TCM00720
TCM00730
TCM00740
TCM00750
TCM00760
TCM00770
TCM00780
TCM00790
TCM00800
TCM00810
TCM00820
TCM00830
TCM00840
TCM00850
TCM00860
TCM00870
TCM00880
TCM00890
TCM00900
TCM00910
TCM00920
TCM00930
TCM00940
TCM00950
TCM00960
TCM00970
TCM00980
TCM00990
TCM01000
TCM01010
TCM01020
TCM01030

T9

```

0018      C      DATA JBLANK/1H /, SCFCTR/1000.0/, MOPTN/0/
      C
0019      11 FORMAT (1H1,10X,'UNSTEADY FLOW IN RIVERS AND ESTUARIES, '/
      1CALCULATION FOR MULTIPLE REACHES BY THE METHOD OF CHARACTERISTICS'
      2      /1H ,25X,'VERSION 13 (E)')
0020      12 FORMAT (11,4I2)
0021      14 FORMAT (19A4)
0022      15 FORMAT (1H0/1H ,10X,20A4)
0023      20 FORMAT ( 1H0/1H ,20X,18H***** /1H ,20X,18H* REACH GET
      1OMETRY * / 1H ,20X,18H***** /1H0,19X,23HNUMBER OF SUT
      2BREACHES = , I2 )
0024      21 FORMAT (1H0/1H ,5X, 18HCROSS SECTION NO. , I2 )
0025      22 FORMAT (I2/(F5.2,F10.1,F5.2,F10.1,F5.2,F10.1,F5.2,F10.1,
      1      F5.2,F10.1))
0026      23 FORMAT (1H0/1H ,18X,12HAREA TABLE ,10X,5HNA = ,I2 /1H0,6X,5HDEPTH
      1      ,9X,4HAREA,11X, 3HSAJ, 12X, 3HCAJ / 1H ,5X,F6.2, F15.3 /
      2      (1H , 5X, F6.2, 3F15.3 ))
0027      24 FORMAT (1H0/1H , 18X, 12HWIDTH TABLE , 10X, 5HNB = , I2 /1H0, 6X,
      1      5HDEPTH , 8X, 5HWIDTH, 11X, 3HSBJ , 12X, 3HCBJ / 1H ,5X,
      2      F6.2, F15.3 / (1H , 5X, F6.2, 3F15.3 ))
0028      25 FORMAT ( 1H0, 10X,67HCHANNEL GEOMETRY OF THIS CROSS SECTION HAS BE
      1EN GIVEN BY EQUATIONS /1H0,15X,19A4)
0029      32 FORMAT (3I2,2X,I5,I7,5I4,15I2)
0030      33 FORMAT (20I2)
0031      34 FORMAT (F7.1,2F7.3,F5.4,I2,F5.3,2F7.3,F7.4,5X,4A4)
0032      35 FORMAT (7X,2F7.3,7X,F5.3,26X,4A4/ 7(I2,1X),F4.1,1X,F4.2,1X,F7.3,
      1      I2,5(F7.3))
0033      36 FORMAT ('0'/6X,'NO.',7X,'STATION',10X,'DELL',9X,'U',9X,'Z',9X,
      1      'ZBL',8X,'ZBR',7X,'ETA',7X,'N',6X,'DATUM COR' //
      2      (6X,I2,4X,4A4,3X,F8.1,3X,3(F7.3,4X),F7.3,3X,F7.5,4X,I2,
      3      7X,F6.3))
0034      37 FORMAT (1H ,5X,I2,4X,4A4,14X,2(F7.3,4X),F7.3,34X,F6.3 / 1H0,3X,
      1      8HIDELT = ,I2,6X,5HTP = ,I2,6X,8HJOPTN = ,I2,
      2      6X,6HEPS = ,F8.3,6X,5HDZ = ,F5.2)
0035      39 FORMAT (10F7.4)
0036      42 FORMAT (4I2,F5.3,F7.3,5F4.1,15I2)
0037      61 FORMAT (11,2F6.2,1X,I9,2X,9F5.2)
0038      70 FORMAT (1H0/1H0,53X,25H***** ATTENTION ***** /1H0,56X,
      1      20HDISCONTINUOUS DATA /1H0,58X,15H***** )
0039      75 FORMAT (43H0 THERE IS NO SUCH OPTION IN THIS PROGRAM )
0040      84 FORMAT (1H0/1H ,5X,28H ERROR IN STATION NUMBERING )
0041      85 FORMAT (1H0/1H ,5X,35H ERROR - GAGE HEIGHT EQUAL TO ZERO )
0042      87 FORMAT (7(1H0))
0043      88 FORMAT (1H1)
      C
      C      EXECUTABLE STATEMENTS START HERE
      C
      C      A STATEMENT FUNCTION
0044      EOLR(X,C) = FTREC*X+C
      C
      C      PART1 START

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TCM01040
TCM01050
TCM01060
TCM01070
TCM01080
TCM01090
TCM01100
TCM01110
TCM01120
TCM01130
TCM01140
TCM01150
TCM01160
TCM01170
TCM01180
TCM01190
TCM01200
TCM01210
TCM01220
TCM01230
TCM01240
TCM01250
TCM01260
TCM01270
TCM01280
TCM01290
TCM01300
TCM01310
TCM01320
TCM01330
TCM01340
TCM01350
TCM01360
TCM01370
TCM01380
TCM01390
TCM01400
TCM01410
TCM01420
TCM01430
TCM01440
TCM01450
TCM01460
TCM01470
TCM01480
TCM01490
TCM10000
TCM10010
TCM10020
TCM10030
TCM10040
TCM10050

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0045	C	100	WRITE (NU,11)	TCM10060	
0046			READ (MU,33) NR, IOPTN, JOPTN, LOPTN, NOPTN, DOPTN	TCM10070	
0047			GO TO (110,110,110,101,110,101,101,101), IOPTN	TCM10080	① Option card
0048			GO TO 7495	TCM10090	
0049		101	DO 102 I=1,105	TCM10100	
0050		102	IBLANK(I) = JBLANK	TCM10110	
0051		110	READ (MU,14) (IDENT(I),I=1,19)	TCM10120	
0052			WRITE (NU,15) (IDENT(I),I=1,19)	TCM10130	② Reach identification
	C			TCM10140	
	C		PART 2 READ REACH GEOMETRY AND SCALE CARDS	TCM20000	
	C			TCM20010	
	C		SET JEOMET(J) = 0 FOR TABLE LOOK UP	TCM20020	
	C		= 1 FOR COMPUTATION BY EQUATIONS	TCM20030	
	C			TCM20040	
0053			NRPI = NR+1	TCM20050	
0054			READ (MU,33) (JEOMET(J),J=1,NR)	TCM20060	
0055			WRITE (NU,20) NR	TCM20070	③ Type of reach geometry
0056		200	GO TO (201,202,202,202,202,202,203,203), IOPTN	TCM20080	
0057			GO TO 7495	TCM20090	
0058		201	READ (MU,33) NONE	TCM20100	
0059			GO TO 209	TCM20110	← IOPTN=1
0060		202	READ (MU,32) ISTA, JRCH, KTP, ISCL, MINQ, (IQORD(I),I=1,5),	TCM20120	
		1	NG, M1, N1, M2, N2, (MRCH(I), NSTA(I),I=1,NG)	TCM20130	← IOPTN=2~6
			GO TO 204	TCM20140	
0061		203	READ (MU,42) ISTA, JRCH, KTP, IJSTG, SCALE, ZMIN, (ZORD(I),I=1,5),	TCM20150	
0062		1	NC, M1, N1, M2, N2, (MRCH(I), NSTA(I),I=1,NC)	TCM20160	← IOPTN=7~8
			MINQ = SCFCTR*ZMIN + SIGN(0.5,ZMIN)	TCM20170	
0063			ISCL = SCFCTR*SCALE + 0.5	TCM20180	
0064		204	ISCLH = ISCL/2	TCM20190	
0065		209	IF (MOPTN.GT.1) GO TO 310	TCM20200	
0066			DO 213 J=1,NR	TCM20210	
0067			WRITE (NU,21) J	TCM20220	
0068			IF (JEOMET(J).EQ.0) GO TO 210	TCM20230	
0069			READ (MU,14) (JEQ(K),K=1,19)	TCM20240	
0070			WRITE (NU,25) (JEQ(K),K=1,19)	TCM20250	← E
0071			GO TO 213	TCM20260	
0072		210	READ (MU,22) NA, (YA(I,J),AREA(I,J), I=1,NA)	TCM20270	
0073			DO 211 I=2,NA	TCM20280	← A
0074			SAJ(I,J) = (AREA(I,J)-AREA(I-1,J))/(YA(I,J)-YA(I-1,J))	TCM20290	
0075		211	CAJ(I,J) = AREA(I,J) - SAJ(I,J)*YA(I,J)	TCM20300	
0076			WRITE (NU,23) NA,YA(1,J),AREA(1,J),(YA(I,J),AREA(I,J),SAJ(I,J),	TCM20310	
0077		1	CAJ(I,J),I=2,NA)	TCM20320	
			READ (MU,22) NB,(YB(I,J),WIDTH(I,J), I=1,NB)	TCM20330	
0078			DO 212 I=2,NB	TCM20340	← B
0079			SBJ(I,J) = (WIDTH(I,J)-WIDTH(I-1,J))/(YB(I,J)-YB(I-1,J))	TCM20350	
0080		212	CBJ(I,J) = WIDTH(I,J)-SBJ(I,J)*YB(I,J)	TCM20360	
0081			WRITE (NU,24) NB,YB(1,J),WIDTH(1,J),(YB(I,J),WIDTH(I,J),	TCM20370	
0082		1	SBJ(I,J),CBJ(I,J),I=2,NB)	TCM20380	
			NOPA(J) = NA	TCM20390	
0083			NOPB(J) = NB	TCM20400	
0084		213	CONTINUE	TCM20410	
0085				TCM20420	

④ Scale or location

⑤ Reach geometry

42

	C		TCM30000	
	C	PART 3 INITIAL VALUES	TCM30010	
	C		TCM30020	
0086	310	READ (MU,34) (DELL(J),Z1(1,J),U1(1,J),ETA(J),N(J),COR(J),ZB(1,J),	TCM30030	⑥ Initial values and
	1	ZB(2,J),SQ(J),(STANAM(K,J),K=1,4),J=1,NR)	TCM30040	parameters
0087		LL = N(NR)+1	TCM30050	
0088		READ (MU,35) Z1(LL,NR),U1(LL,NR),CORL,(STANAM(K,NRP1),K=1,4),	TCM30060	
	1	IDELT,TP,MO,DAY,YR,HOUR,MNT,EPS,DZ,FINALT,	TCM30070	⑦ Initial data and
	2	NMP2,(TCSQ(I),I=1,NMP2)	TCM30080	parameters
	C	IF LOPTN=4, FINALT HAS TO BE GIVEN. FINALT IS GIVEN IN HOURS.	TCM30090	
	C	IF SQ(I) HAS TO BE CHANGED BEFORE FINALT IS REACHED,	TCM30100	
	C	NUMBER OF INTERRUPTIONS, NMP2, AND THEIR TIME, TCSQ (IN HOURS),	TCM30110	
	C	MUST BE GIVEN.	TCM30120	
0089		ZB(LL,NR)=ZB(2,NR)	TCM30130	
0090		IF (DOPTN.EQ.1) CALL INDSK1(YR,MO,DAY,HOUR,MNT,IDELT,6748)	TCM30140	
0091		WRITE (NU,36) (J,(STANAM(K,J),K=1,4),DELL(J),U1(1,J),Z1(1,J),	TCM30150	
	1	ZB(1,J),ZB(2,J),ETA(J),N(J),COR(J),J=1,NR)	TCM30160	
0092		WRITE (NU,37) (NRP1,(STANAM(K,NRP1),K=1,4),U1(LL,NR),Z1(LL,NR),	TCM30170	
	1	ZB(LL,NR),CORL,IDELT,TP,JOPTN,EPS,DZ)	TCM30180	
0093		DO 320 J=1,NR	TCM30190	
0094		Z1(1,J)=Z1(1,J)+COR(J)	TCM30200	
0095	320	CFRIC(J) = ETA(J)*ETA(J)/SQMC	TCM30210	
0096		IF (NR.EQ.1) GO TO 325	TCM30220	
0097		NRM1 = NR-1	TCM30230	
0098		DO 321 J=1,NRM1	TCM30240	
0099		L=N(J)+1	TCM30250	
0100		Z1(L,J) = Z1(1,J+1)	TCM30260	
0101		ZB(L,J) = ZB(2,J)	TCM30270	
0102		CALL TABLE2(Z1(1,J+1)-ZB(1,J+1),J+1)	TCM30280	
0103		QTEMP = U1(1,J+1)*A	TCM30290	
0104		CALL TABLE2(Z1(L,J)-ZB(L,J),J)	TCM30300	
0105		U1(L,J) = QTEMP/A	TCM30310	
0106		Z2(1,J) = Z1(1,J)	TCM30320	
0107		ZB2(1,J) = ZB(1,J)	TCM30330	
0108	321	U2(1,J) = U1(1,J)	TCM30340	
0109	325	Z2(1,NR)= Z1(1,NR)	TCM30350	
0110		ZB2(1,NR)= ZB(1,NR)	TCM30360	
0111		U2(1,NR)= U1(1,NR)	TCM30370	
0112		Z1(LL,NR) = Z1(LL,NR) + CORL	TCM30380	
	C		TCM40000	
	C	PART 4 TIME INITIALIZATION	TCM40010	
	C		TCM40020	
0113		DELT = 60*IDELT/TP	TCM40030	
0114		IFLAG=2	TCM40040	
0115		TREC = 0	TCM40050	
0116		KOUNTP = 0	TCM40060	
0117		TIME=0.0	TCM40070	
0118		IF (LOPTN.NE.4) GO TO 501	TCM40080	
0119		FINALT = FINALT*3600.-DELT	TCM40090	
0120		KMP2 = 1	TCM40100	
0121		DO 410 I=1,NMP2	TCM40110	
0122	410	TCSQ(I) = 3600.*TCSQ(I)	TCM40120	

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C
C      PART 5  INITIALIZE OTHER VARIABLES
C
0123      501      DO 508  J=1,NR
0124              L=N(J)
0125              DIFZB= ZB(1,J)-ZB(L+1,J)
0126              SO(J)=DIFZB/DELL(J)
0127              FN = L
0128              DELZ =(Z1(1,J)-Z1(L+1,J))/FN
0129              DELZB=DIFZB/FN
0130              DELU =(U1(1,J)-U1(L+1,J))/FN
0131              DELX(J)=DELL(J)/FN
0132              TH(J) = DELT/DELX(J)
0133              DO 502  I=1,L
0134                  Z1(I+1,J)=Z1(I,J)-DELZ
0135                  ZB(I+1,J)=ZB(I,J)-DELZB
0136      502      U1(I+1,J)=U1(I,J)-DELU
0137      IF (JOPTN.EQ.0) GO TO 507
0138          L=2*L
0139          DELZH=0.5*DELZ
0140          DELZBH=0.5*DELZB
0141          DELUH =0.5*DELU
0142          DO 506  I=1,L
0143              Z2(I+1,J)=Z2(I,J)-DELZH
0144              ZB2(I+1,J)=ZB2(I,J)-DELZBH
0145      506      U2(I+1,J) =U2(I,J) -DELUH
0146              HDLZT1(J) = 0.0
0147              HDLZT2(J) = 0.0
0148      507      DELZT1(J) = 0.0
0149      508      DELZT2(J) = 0.0
C      INITIALIZE OUTPUT SUBROUTINES
GO TO (540,510,510,510,510,526,515,515), IOPTN
0151      510      CALL TABLE2 ( Z1(ISTA,JRCH)-ZB(ISTA,JRCH), JRCH )
0152              QK(ISTA,JRCH) = U1(ISTA,JRCH)*A
0153      GO TO 520
0154      515      DO 518  J=1,NR
0155              L=N(J)+1
0156              DO 518  I=1,L
0157                  ZK(I,J) = Z1(I,J)
0158      520      GO TO (540,522,523,524,525,526,537,538), IOPTN
0159      522      CALL DATE2(QK(ISTA,JRCH),&600)
0160      523      CALL DAILY(QK(ISTA,JRCH),&600)
0161      524      MQ = QK(ISTA,JRCH)
0162              CALL SELCT4(KTP,MQ,&600)
0163      525      CALL ADAPT5(KTP,QK(ISTA,JRCH),&600)
0164      526      DO 530  I=1,N0
0165              MSTATN = MRCH(I)
0166              NSTATN = NSTA(I)
0167              CALL TABLE2(Z1(NSTATN,MSTATN)-ZB(NSTATN,MSTATN),MSTATN)
0168      530      QK(NSTATN,MSTATN) = U1(NSTATN,MSTATN)*A
0169              CALL SELCT6(KTP,&600)
0170      537      CALL SELCT7(KTP,&600)

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TCM50000
TCM50010
TCM50020
TCM50030
TCM50040
TCM50050
TCM50060
TCM50070
TCM50080
TCM50090
TCM50100
TCM50110
TCM50120
TCM50130
TCM50140
TCM50150
TCM50160
TCM50170
TCM50180
TCM50190
TCM50200
TCM50210
TCM50220
TCM50230
TCM50240
TCM50250
TCM50260
TCM50270
TCM50280
TCM50290
TCM50300
TCM50310
TCM50320
TCM50330
TCM50340
TCM50350
TCM50360
TCM50370
TCM50380
TCM50390
TCM50400
TCM50410
TCM50420
TCM50430
TCM50440
TCM50450
TCM50460
TCM50470
TCM50480
TCM50490
TCM50500
TCM50510

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0171      538 RZK = Z1(ISTA,JRCH)
0172      CALL SELECT(KTP,RZK,&600)
0173      540 CALL EDATE1(MNT,IDELE,NR,JOPTN,&600)
C
C      PART6 ENTER THE MAIN LOOP
C
0174      600 FTP=TP
0175      IF (LOPTN.EQ.4) GO TO 610
0176      IF (DOPTN.EQ.1) CALL INDSK2(ZPE1,ZPEL,NRP1,&6061)
C      READ BOUNDARY DATA (AND OBSERVED DATA IF APPROPRIATE); LOPTN=4 OR
C      DOPTN=1 WILL BYPASS THIS.
0177      601 GO TO (602,603,604,605), NOPTN
0178      GO TO 7495
0179      602 READ (MU,61) MOPTN, ZPE1, ZPEL, MQ, (RZ(I),I=1,9)
0180      GO TO 606
0181      603 READ (MU,61) MOPTN, ZPE1, UPEL, MQ, (RZ(I),I=1,9)
0182      GO TO 606
0183      604 READ (MU,61) MOPTN, UPE1, ZPEL, MQ, (RZ(I),I=1,9)
0184      GO TO 606
0185      605 READ (MU,61) MOPTN, UPE1, UPEL, MQ, (RZ(I),I=1,9)
0186      606 IF (MOPTN.NE.0) GO TO 710
0187      IF (LOPTN.EQ.3) GO TO 608
0188      GO TO 6062
0189      6061 IF (ZPE1.EQ.0.0.OR.ZPEL.EQ.0.0) GO TO 749
C      FIND INCREMENTS BETWEEN TWO CONSECUTIVE BOUNDARY DATA
0190      6062 IF (NOPTN.GE.3) GO TO 607
0191      ZPE1=ZPE1+COR(1)
0192      ZPB1=Z1(1,1)
0193      DELZ1=(ZPE1-ZPB1)/FTP
0194      HDLZ1=DELZ1/2.
0195      607 IF (NOPTN.LE.2) GO TO 6071
0196      UPB1=U1(1,1)
0197      DELU1=(UPE1-UPB1)/FTP
0198      HDLU1=DELU1/2.
0199      6071 IF (LOPTN.EQ.2) GO TO 610
0200      608 IF (NOPTN.EQ.2.OR.NOPTN.EQ.4) GO TO 609
0201      ZPEL=ZPEL+CORL
0202      ZPBL=Z1(LL,NR)
0203      DELZL=(ZPEL-ZPBL)/FTP
0204      HDLZL=DELZL/2.
0205      609 IF (NOPTN.EQ.1.OR.NOPTN.EQ.3) GO TO 610
0206      UPBL=U1(LL,NR)
0207      DELUL=(UPEL-UPBL)/FTP
0208      HDLUL=DELUL/2.
C      BEGINNING OF M=1 CYCLE
0209      610 TREC = TREC + 1
0210      FTREC=TREC
0211      M=1
0212      IF (LOPTN.NE.4) GO TO 6110
0213      IF (TIME.GT.FINALT) GO TO 700
0214      IF (KMP2.GT.NMP2.OR.TIME.LT.TCSQ(KMP2)) GO TO 612
0215      GO TO 7102

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TCM50520
TCM50530
TCM50540
TCM60000
TCM60010
TCM60020
TCM60030
TCM60040
TCM60050
TCM60060
TCM60070
TCM60080
TCM60090
TCM60100 ← NOPTN=1
TCM60110
TCM60120 ← NOPTN=2
TCM60130
TCM60140 ← NOPTN=3
TCM60150
TCM60160 ← NOPTN=4
TCM60170
TCM60180
TCM60190
TCM60200
TCM60210
TCM60220
TCM60230
TCM60240
TCM60250
TCM60260
TCM60270
TCM60280
TCM60290
TCM60300
TCM60310
TCM60320
TCM60330
TCM60340
TCM60350
TCM60360
TCM60370
TCM60380
TCM60390
TCM60400
TCM60410
TCM60420
TCM60430
TCM60440
TCM60450
TCM60460
TCM60470
TCM60480

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(B) Boundary values

(M) MOPTN card

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C      INTERPOLATE BOUNDARY VALUES BETWEEN INPUT BOUNDARY DATA POINTS      TCM60490
0216      6110 IF (NOPTN.GT.2) GO TO 6111      TCM60500
0217      ZP(1,1)=EQLR(DELZ1,ZPB1)      TCM60510
0218      GO TO 6112      TCM60520
0219      6111 UP(1,1)=EQLR(DELU1,UPB1)      TCM60530
0220      6112 IF (MOD(NOPTN,2).EQ.0) GO TO 6114      TCM60540
0221      ZP(LL,NR)=EQLR(DELZL,ZPBL)      TCM60550
0222      GO TO 6116      TCM60560
0223      6114 UP(LL,NR)=EQLR(DELUL,UPBL)      TCM60570
0224      6116 IF (LOPTN.EQ.1) GO TO 6130      TCM60580
C      FIND BOUNDARY VALUES BY EQUATION      TCM60590
0225      612 TIME=TIME+DELT      TCM60600
0226      IF ((NOPTN.LE.2).AND.LOPTN.NE.2) ZP(1,1) = BDVL(TIME)      TCM60610
0227      IF ((NOPTN.EQ.1.OR.NOPTN.EQ.3).AND.LOPTN.NE.3)      TCM60620
1      ZP(LL,NR)=BDVR(TIME)      TCM60630
0228      IF ((NOPTN.GE.3).AND.LOPTN.NE.2) UP(1,1) = BDVL(TIME)      TCM60640
0229      IF ((NOPTN.EQ.2.OR.NOPTN.EQ.4).AND.LOPTN.NE.3)      TCM60650
1      UP(LL,NR)=BDVR(TIME)      TCM60660
C      FLOW COMPUTATION FOR M=1      TCM60670
0230      6130 DO 621 J=1,NR      TCM60680
0231      L=N(J)+1      TCM60690
0232      IF (J.EQ.NR) GO TO 613      TCM60700
0233      ZP(L,J) = Z1(L,J) + 2.0*DELZT1(J) - DELZT2(J)      TCM60710
0234      ZP(1,J+1) = ZP(L,J)      TCM60720
C      MOVE U1,Z1 VALUES TO U,Z AND CALL 'CHARCB' TO COMPUTE THE FLOW,      TCM60730
C      SUBREACH BY SUBREACH. PLACE THE COMPUTED RESULTS IN UP,ZP.      TCM60740
0235      613 DO 614 I=1,L      TCM60750
0236      U(I) = U1(I,J)      TCM60760
0237      Z(I) = Z1(I,J)      TCM60770
0238      614 H(I)=Z(I)-ZB(I,J)      TCM60780
0239      IF (J.EQ.1.AND.(NOPTN.GE.3)) GO TO 616      TCM60790
0240      ZPT(1) = ZP(1,J)      TCM60800
0241      INOPTN = 0      TCM60810
0242      GO TO 617      TCM60820
0243      616 UPT(1) = UP(1,1)      TCM60830
0244      INOPTN = 1      TCM60840
0245      617 IF (J.EQ.NR.AND.(NOPTN.EQ.2.OR.NOPTN.EQ.4)) GO TO 618      TCM60850
0246      ZPT(L) = ZP(L,J)      TCM60860
0247      GO TO 619      TCM60870
0248      618 UPT(L) = UP(LL,NR)      TCM60880
0249      INOPTN = INOPTN + 2      TCM60890
0250      619 CONTINUE      TCM60900
0251      CALL CHARCB (N(J),J,TH(J),SO(J),SQ(J),DELT,CFRIC(J),INOPTN)      TCM60910
0252      DO 620 I=1,L      TCM60920
0253      UP(I,J) = UPT(I)      TCM60930
0254      620 ZP(I,J) = ZPT(I)      TCM60940
C      SATISFY THE BOUNDARY CONDITIONS AT EACH JUNCTION BY CALLING      TCM60950
C      'JT2WAY'.      TCM60960
0255      IF (NR.EQ.1) GO TO 640      TCM60970
0256      CALL TABLE2(ZPT(1)-ZB(1,J),J)      TCM60980
0257      QF(J) = A*UPT(1)      TCM60990
0258      CALL TABLE2(ZPT(L)-ZB(L,J),J)      TCM61000

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0259      621  QL(J) = A*UPT(L)                                TCM61010
0260      DO 630 J=2,NR                                         TCM61020
0261      IF (ABS(QF(J)-QL(J-1)).LT.EPS) GO TO 630              TCM61030
0262      L = N(J-1) + 1                                         TCM61040
0263      CALL JT2WAY( DZ , QF(J) - QL(J-1) , J-1 , J , M,&750 ) TCM61050
0264      ZP(L,J-1) = ZP(L,J)                                    TCM61060
0265      630  CONTINUE                                          TCM61070
0266      640  DO 645 J=1,NR                                       TCM61080
0267      L=N(J)+1                                                TCM61090
0268      IF (J.EQ.NR) GO TO 642                                   TCM61100
0269      DELZT2(J) = DELZT1(J)                                    TCM61110
0270      DELZT1(J) = ZP(L,J) - Z1(L,J)                          TCM61120
C      REPLACE THE PREVIOUS U1,Z1 VALUES BY THE NEWLY COMPUTED TCM61130
C      VALUES (UP,ZP)                                          TCM61140
0271      642  DO 645 I=1,L                                         TCM61150
0272      U1(I,J) = UP(I,J)                                       TCM61160
0273      645  Z1(I,J) = ZP(I,J)                                    TCM61170
0274      IF (JOPTN.EQ.0) GO TO 690                                TCM61180
C      BEGINNING OF M=2 CYCLE                                    TCM61190
M=2                                                         TCM61200
0275      DELT = DELT/2.0                                         TCM61210
0276      IF(LOPTN.EQ.4) GO TO 6452                                TCM61220
C      INTERPOLATE BOUNDARY VALUES                               TCM61230
0278      IF ((NOPTN.LE.2).AND.LOPTN.NE.3) ZP(1,1) = ZP(1,1) - HDLZ1 TCM61240
0279      IF ((NOPTN.EQ.1.OR.NOPTN.EQ.3).AND.LOPTN.NE.2)          TCM61250
1      ZP(2*LL-1,NR)=ZP(LL,NR)-HDLZL                             TCM61260
0280      IF ((NOPTN.GE.3).AND.LOPTN.NE.3) UP(1,1) = UP(1,1) - HDLUI TCM61270
0281      IF ((NOPTN.EQ.2.OR.NOPTN.EQ.4).AND.LOPTN.NE.2)          TCM61280
1      UP(2*LL-1,NR)=UP(LL,NR)-HDLUL                             TCM61290
0282      6452 LL = 2*LL-1                                         TCM61300
0283      IF(LOPTN.EQ.1) GO TO 646                                  TCM61310
C      FIND BOUNDARY VALUES BY EQUATIONS                         TCM61320
0284      TIME=TIME-DELT                                           TCM61330
0285      6455 IF ((NOPTN.LE.2).AND.LOPTN.NE.2) ZP(1,1) = BDVL(TIME) TCM61340
0286      IF ((NOPTN.EQ.1.OR.NOPTN.EQ.3).AND.LOPTN.NE.3)          TCM61350
1      ZP(LL,NR)=BDVR(TIME)                                       TCM61360
0287      IF ((NOPTN.GE.3).AND.LOPTN.NE.3) UP(1,1) = BDVL(TIME)  TCM61370
0288      IF ((NOPTN.EQ.2.OR.NOPTN.EQ.4).AND.LOPTN.NE.3)          TCM61380
1      UP(LL,NR)=BDVR(TIME)                                       TCM61390
C      FLOW COMPUTATION FOR M=2 OR M=3                           TCM61400
0289      646  DO 651 J=1,NR                                       TCM61410
0290      IF(M.EQ.2) N(J)=2*N(J)                                   TCM61420
0291      L=N(J)+1                                                TCM61430
0292      IF (J.EQ.NR) GO TO 647                                   TCM61440
0293      ZP(L,J) = Z2(L,J) + 2.0*HDLZT1(J) - HDLZT2(J)          TCM61450
0294      ZP(1,J+1) = ZP(L,J)                                     TCM61460
C      MOVE U2,Z2 VALUES TO U,Z AND CALL 'CHRCB' TO COMPUTE THE FLOW, TCM61470
C      SUBREACH BY SUBREACH. PLACE THE COMPUTED VALUES IN UP,ZP. TCM61480
0295      647  DO 648 I=1,L                                         TCM61490
0296      U(I) = U2(I,J)                                           TCM61500
0297      Z(I) = Z2(I,J)                                           TCM61510
0298      648  H(I) = Z(I)-ZB2(I,J)                                TCM61520

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0299      IF(J.EQ.1.AND.(NOPTN.GE.3)) GO TO 649      TCM61530
0300      ZPT(1) = ZP(1,J)      TCM61540
0301      INOPTN = 0      TCM61550
0302      GO TO 6491      TCM61560
0303      649 UPT(1) = UP(1,1)      TCM61570
0304      INOPTN = 1      TCM61580
0305      6491 IF(J.EQ.NR.AND.(NOPTN.EQ.2.OR.NOPTN.EQ.4)) GO TO 6492      TCM61590
0306      ZPT(L) = ZP(L,J)      TCM61600
0307      GO TO 6493      TCM61610
0308      6492 UPT(L) = UP(LL,NR)      TCM61620
0309      INOPTN = INOPTN + 2      TCM61630
0310      6493 CONTINUE      TCM61640
0311      CALL CHARCB (N(J),J,TH(J),SO(J),SQ(J),DELT,CFRIC(J),INOPTN)      TCM61650
0312      DO 650 I=1,L      TCM61660
0313      UPT(I,J) = UPT(I)      TCM61670
0314      ZP(I,J) = ZPT(I)      TCM61680
      C      SATISFY THE BOUNDARY CONDITIONS AT EACH JUNCTION BY CALLING      TCM61690
      C      'JT2WAY'.      TCM61700
0315      IF (NR.EQ.1) GO TO 6525      TCM61710
0316      CALL TABLE2(ZPT(1)-ZB2(1,J),J)      TCM61720
0317      QF(J) = A*UPT(1)      TCM61730
0318      CALL TABLE2(ZPT(L)-ZB2(L,J),J)      TCM61740
0319      651 QL(J) = A*UPT(L)      TCM61750
0320      DO 652 J=2,NR      TCM61760
0321      IF (ABS(QF(J)-QL(J-1)).LT.EPS) GO TO 652      TCM61770
0322      L=N(J-1)+1      TCM61780
0323      CALL JT2WAY( DZ , QF(J) - QL(J-1) , J-1 , J , M,6750 )      TCM61790
0324      ZP(L,J-1) = ZP(1,J)      TCM61800
0325      652 CONTINUE      TCM61810
0326      6525 DO 654 J=1,NR      TCM61820
0327      L=N(J)+1      TCM61830
0328      IF (J.EQ.NR) GO TO 653      TCM61840
0329      HDLZT2(J) = HDLZT1(J)      TCM61850
0330      HDLZT1(J) = ZP(L,J) - Z2(L,J)      TCM61860
      C      REPLACE THE PREVIOUS U2,Z2 VALUES BY THE NEWLY      TCM61870
      C      COMPUTED VALUES (UP,ZP).      TCM61880
0331      653 DO 654 I=1,L      TCM61890
0332      U2(I,J) = UP(I,J)      TCM61900
0333      654 Z2(I,J) = ZP(I,J)      TCM61910
0334      IF (M.EQ.3) GO TO 673      TCM61920
      C      ENTERING M=3 CYCLE      TCM61930
0335      M=3      TCM61940
0336      IF(LOPTN.EQ.4) GO TO 667      TCM61950
0337      IF ((NOPTN.LE.2).AND.LOPTN.NE.3) ZP(1,1) = Z2(1,1) + HDLZ1      TCM61960
0338      IF((NOPTN.EQ.1.OR.NOPTN.EQ.3).AND.LOPTN.NE.2)      TCM61970
      1 ZP(LL,NR) = Z2(LL,NR)+HDLZL      TCM61980
0339      IF ((NOPTN.GE.3).AND.LOPTN.NE.3) UP(1,1) = U2(1,1) + HDLU1      TCM61990
0340      IF((NOPTN.EQ.2.OR.NOPTN.EQ.4).AND.LOPTN.NE.2)      TCM62000
      1 UP(LL,NR) = U2(LL,NR)+HDLUL      TCM62010
0341      IF(LOPTN.EQ.1) GO TO 646      TCM62020
0342      667 TIME=TIME+DELT      TCM62030
0343      GO TO 6455      TCM62040

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0344      673 DO 674 J=1,NR                      TCM62050
0345      674 N(J)=N(J)/2                      TCM62060
0346      DELT = 2.0*DELT                      TCM62070
0347      LL = (LL+1)/2                      TCM62080
C      END OF M=3 CYCLE                      TCM62090
0348      IF (TREC.NE.TP) GO TO 610          TCM62100
C      OUTPUTS FOR JOPTN=1; ACCORDING TO THE 'IOPTN' VALUE, TCM62110
C      CALL THE CORRESPONDING OUTPUT SUBROUTINE. TCM62120
      GO TO (671,678,678,678,678,679,679,678), IOPTN TCM62130
0349      671 CALL EDATE1(MNT,IDELT,NR,JOPTN,&697) TCM62140
0350      678 UE = 2.0*U2(2*ISTA-1,JRCH)-U1(ISTA,JRCH) TCM62150
0351      ZK(ISTA,JRCH) = 2.0*Z2(2*ISTA-1,JRCH)-Z1(ISTA,JRCH) TCM62160
0352      CALL TABLE2(ZK(ISTA,JRCH)-ZB(ISTA,JRCH),JRCH) TCM62170
0353      QK(ISTA,JRCH) = UE * A              TCM62180
0354      GO TO 681                          TCM62190
0355      679 DO 680 I=1,NQ                  TCM62200
0356      MSTATN = MRCH(I)                  TCM62210
0357      NSTATN = NSTA(I)                  TCM62220
0358      UE = 2.0*U2(2*NSTATN-1,MSTATN)-U1(NSTATN,MSTATN) TCM62230
0359      ZK(NSTATN,MSTATN) = 2.0*Z2(2*NSTATN-1,MSTATN)-Z1(NSTATN,MSTATN) TCM62240
0360      CALL TABLE2(ZK(NSTATN,MSTATN)-ZB(NSTATN,MSTATN),MSTATN) TCM62250
0361      680 QK(NSTATN,MSTATN) = UE*A      TCM62260
0362      GO TO (697,682,683,684,685,686,687,688), IOPTN TCM62270
0363      682 CALL DATE2( QK(ISTA,JRCH) , &697 ) TCM62280
0364      683 CALL DAILY( QK(ISTA,JRCH) , &697 ) TCM62290
0365      684 CALL SELCT4 (KTP, MQ, &697) TCM62300
0366      685 CALL ADAPT5( KTP , QK(ISTA,JRCH) , &697 ) TCM62310
0367      686 CALL SELCT6( KTP , QK(ISTA,JRCH) , &697 ) TCM62320
0368      687 CALL SELCT7( KTP , &697 ) TCM62330
0369      688 RZ1 = RZ(IJSTG) + COR(JRCH) TCM62340
0370      IF (JRCH.FQ.NR.AND.ISTA.EQ.N(NR)+1) RZ1 = RZ(IJSTG) + CORL TCM62350
0371      CALL SELECT( KTP , RZ1, &697 ) TCM62360
0372      C IF IT IS TIME TO PRINT FOR JOPTN=0 LOOP, CALL THE CORRESPONDING TCM62370
C      OUTPUT SUBROUTINE ACCORDING TO THE 'IOPTN' VALUE. TCM62380
      690 IF (TREC.NE.TP) GO TO 610          TCM62390
      GO TO(6901,693,693,693,693,693,695,695,6968),IOPTN TCM62400
0373      6901 CALL EDATE1(MNT,IDELT,NR,JOPTN,&697) TCM62410
0374      693 CALL TABLE2(Z1(ISTA,JRCH)-ZB(ISTA,JRCH),JRCH) TCM62420
0375      QK(ISTA,JRCH) = U1(ISTA,JRCH) * A TCM62430
0376      GO TO 6960                          TCM62440
0377      695 DO 696 I=1,NQ                  TCM62450
0378      MSTATN = MRCH(I)                  TCM62460
0379      NSTATN = NSTA(I)                  TCM62470
0380      ZK(NSTATN,MSTATN) = Z1(NSTATN,MSTATN) TCM62480
0381      CALL TABLE2(Z1(NSTATN,MSTATN)-ZB(NSTATN,MSTATN),MSTATN) TCM62490
0382      696 QK(NSTATN,MSTATN) = U1(NSTATN,MSTATN)*A TCM62500
0383      6960 GO TO (697,6962,6963,6964,6965,6966,6967,6968), IOPTN TCM62510
0384      6962 CALL DATE2( QK(ISTA,JRCH) , &697 ) TCM62520
0385      6963 CALL DAILY( QK(ISTA,JRCH) , &697 ) TCM62530
0386      6964 CALL SELCT4 (KTP, MQ, &697) TCM62540
0387      6965 CALL ADAPT5( KTP , QK(ISTA,JRCH) , &697 ) TCM62550
0388      6966 CALL SELCT6( KTP , &697 ) TCM62560
0389
0390

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0391	6967 CALL SELCT7(KTP , &697)	TCM62570	
0392	6968 ZK(ISTA,JRCH) = Z1(ISTA,JRCH)	TCM62580	
0393	RZ1 = RZ(IJSTG) + COR(JRCH)	TCM62590	
0394	IF (JRCH.EQ.NR.AND.ISTA.EQ.N(NR)+1) RZ1 = RZ(IJSTG) + CORL	TCM62600	
0395	CALL SELECT(KTP , RZ1, &697)	TCM62610	
	C END OF COMPUTATION LOOP FOR BOTH JOPTN=0 AND 1. IF DOPTN=0 RETURN	TCM62620	
	C TO A BEGINNING POINT IN PART 6.	TCM62630	
	C IF DOPTN=1 FETCH THE NEXT STAGE DATA FROM DISC AND RETURN	TCM62640	
	C TO A BEGINNING POINT IN PART 6.	TCM62650	
0396	697 TREC = 0	TCM62660	
0397	KOUNTP = KOUNTP + 1	TCM62670	
0398	IF (JOPTN.EQ.1.AND.MOD(KOUNTP,24).EQ.0) CALL RESET(NR)	TCM62680	
0399	IF (LOPTN.EQ.4) GO TO 610	TCM62690	
0400	IF(DOPTN.EQ.0) GO TO 601	TCM62700	
0401	NN=NN+1	TCM62710	
0402	IF(NN.LE.IFIN) CALL INDSK3 (&6061)	TCM62720	
0403	ISTART=1	TCM62730	
0404	LJ=LJ+1	TCM62740	
0405	IF(LJ.LE.NOB) CALL INDSK4 (&6061)	TCM62750	
0406	MOPTN=8	TCM62760	
0407	GO TO 710	TCM62770	
	C	TCM70000	
	C PART7 END OR INTERRUPT THE COMPUTATION	TCM70010	
	C	TCM70020	
0408	700 TIME = 0.0	TCM70030	
0409	READ (MU,12) MOPTN	TCM70040	← (M) MOPTN card
0410	710 IF (MOPTN.NE.2) GO TO 711	TCM70050	
0411	7102 READ (MU,39) (SQ(J),J=1,NR)	TCM70060	← (Q) Lateral flow
0412	LABEL = 1	TCM70070	
0413	IF (LOPTN.NE.4) GO TO 601	TCM70080	
0414	KMP2 = KMP2+1	TCM70090	
0415	GO TO 612	TCM70100	
	C NORMAL ENDING	TCM70110	
0416	711 IFLAG = 3	TCM70120	
0417	GO TO (719,712,713,714,715,716,717,718), IOPTN	TCM70130	
0418	712 CALL DATE2(OK(ISTA,JRCH) , &740)	TCM70140	
0419	713 CALL DAILY(OK(ISTA,JRCH) , &740)	TCM70150	
0420	714 CALL SELCT4(KTP,MO,&740)	TCM70160	
0421	715 CALL ADAPT5(KTP , OK(ISTA,JRCH) , &740)	TCM70170	
0422	716 CALL SELCT6(KTP, &740)	TCM70180	
0423	717 CALL SELCT7(KTP,&740)	TCM70190	
0424	718 CALL SELECT(KTP , RZ(IJSTG), &740)	TCM70200	
0425	719 CALL EDATE1(MNT,IDELT,NR,JOPTN,&740)	TCM70210	
0426	740 GO TO (100,750,747,745,7495,747,742,750,746), MOPTN	TCM70220	
0427	742 WRITE (NU,70)	TCM70230	
0428	GO TO 310	TCM70240	
0429	745 READ (MU,12) IOPTN	TCM70250	← (P) IOPTN card
0430	WRITE (NU,68)	TCM70260	
0431	GO TO 200	TCM70270	
0432	746 WRITE (NU,87)	TCM70280	
0433	747 WRITE (NU,87)	TCM70290	
0434	IF (MOPTN.EQ.3) READ(MU,33) ISTA, JRCH, KTP, IJSTG	TCM70300	← (L) Location

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0435          JUMP = MOPTN/3
0436          GO TO (310,310,200), JUMP
          C      ABNORMAL ENDING
0437      748 WRITE (NU,84)
0438          GO TO 750
0439      749 WRITE (NU,85)
0440          GO TO 750
0441      7495 WRITE (NU,75)
0442      750 STOP
0443          END
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TCM70310
TCM70320
TCM70330
TCM70340
TCM70350
TCM70360
TCM70370
TCM70380
TCM70390
TCM70400
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0001      SUBROUTINE CHARCB(N,J,TH,S,Q,DELT,CFRIC,INOPTN)      SCRC0000
      C      **** REFERENCE DATE - FEB. 1, 1972 ****      SCRC0010
      C      THIS IS A SUBROUTINE TO CARRY OUT FLOW COMPUTATION BY      SCRC0020
      C      THE METHOD OF CHARACTERISTICS      SCRC0030
      C      PROGRAMED BY C. LAI      SCRC0040
0002      COMMON /BCARCB/ U(20),Z(20),UPT(20),ZPT(20),H(20)      SCRC0050
0003      COMMON /BTABL2/A,B,YA(20,20),SAJ(20,20),CAJ(20,20),YB(20,20),      SCRC0060
      1      SBJ(20,20),CBJ(20,20),HAV,JEOMET(20),HRD      SCRC0070
      2      ,NOPA(20),NOPB(20)      SCRC0080
0004      COMMON /BMECNV/ G, SQMC, FFCOU      SCRC0090
0005      IF (N.LT.2) GO TO 1061      SCRC0100
      C      FLOW COMPUTATION FOR INTERIOR NODAL POINTS      SCRC0110
      DO 1060 I=2,N      SCRC0120
      CALL TABLE2(H(I),J)      SCRC0130
      CELI = SQRT(G*HAV)      SCRC0140
      THUMC = TH*(U(I)-CELI)      SCRC0150
      THUPC = TH*(U(I)+CELI)      SCRC0160
      UL = U(I)*(1.0-THUPC)+U(I-1)*THUPC      SCRC0170
      UR = U(I)*(1.0+THUMC)-U(I+1)*THUMC      SCRC0180
      ZL = Z(I)*(1.0-THUPC)+Z(I-1)*THUPC      SCRC0190
      ZR = Z(I)*(1.0+THUMC)-Z(I+1)*THUMC      SCRC0200
      ZPT(I) = (UL-UR)*CELI/(2.0*G) + 0.5*(ZL+ZR)-(U(I)*S-Q/B)*DELT      SCRC0210
0016      1060 UPT(I)=0.5*(UL+UR)+0.5*G*(ZL-ZR)/CELI-(G*CFRIC*ABS(U(I))*U(I)/      SCRC0220
      1      HRD**1.33333+U(I)*Q/A)*DELT      SCRC0230
      C      FLOW COMPUTATION FOR THE LEFT BOUNDARY      SCRC0240
0017      1061 CALL TABLE2(H(1),J)      SCRC0250
0018      CELI = SQRT(G*HAV)      SCRC0260
0019      THUMC = TH*(U(1)-CELI)      SCRC0270
0020      UR = U(1)*(1.0+THUMC)-U(2)*THUMC      SCRC0280
0021      ZR = Z(1)*(1.0+THUMC)-Z(2)*THUMC      SCRC0290
0022      IF (INOPTN.EQ.1.OR.INOPTN.EQ.3) GO TO 1065      SCRC0300
0023      UPT(1) = UR+G*(ZPT(1)-ZR)/CELI+G*(U(1)*S-CELI*CFRIC*U(1)*ABS(U(1))      SCRC0310
      1      /HRD**1.33333 - Q*(1.0+U(1)/CELI)/B)*DELT/CELI      SCRC0320
0024      GO TO 1068      SCRC0330
0025      1065 ZPT(1) = ZR+CELI*(UPT(1)-UR)/G-(U(1)*S-CELI*CFRIC*U(1)*ABS(U(1))      SCRC0340
      1      /HRD**1.33333-Q*(1.0+U(1)/CELI)/B)*DELT      SCRC0350
      C      FLOW COMPUTATION FOR THE RIGHT BOUNDARY      SCRC0360
0026      1068 I=N+1      SCRC0370
0027      CALL TABLE2(H(I),J)      SCRC0380
0028      CELI = SQRT(G*HAV)      SCRC0390
0029      THUPC = TH*(U(I)+CELI)      SCRC0400
0030      UL = U(I)*(1.0-THUPC)+U(I-1)*THUPC      SCRC0410
0031      ZL = Z(I)*(1.0-THUPC)+Z(I-1)*THUPC      SCRC0420
0032      IF (INOPTN.GE.2) GO TO 1070      SCRC0430
0033      UPT(I) = UL-G*(ZPT(I)-ZL)/CELI-G*(U(I)*S+CELI*CFRIC*U(I)*ABS(U(I))      SCRC0440
      1      /HRD**1.33333 - Q*(1.0-U(I)/CELI)/B)*DELT/CELI      SCRC0450
0034      RETURN      SCRC0460
0035      1070 ZPT(I) = ZL-CELI*(UPT(I)-UL)/G-(U(I)*S+CELI*CFRIC*U(I)*ABS(U(I))      SCRC0470
      1      /HRD**1.33333 - Q*(1.0-U(I)/CELI)/B)*DELT      SCRC0480
0036      RETURN      SCRC0490
0037      END      SCRC0500

```

```

0001      SUBROUTINE JT2WAY(DZ,DQ,JL,JR,M,*)
C          **** REFERENCE DATE - FEB. 1, 1972 ****
C          THIS IS A SUBROUTINE TO HANDLE BOUNDARY VALUE PROBLEMS AT EACH
C          TWO-WAY JUNCTION FOR MULTIPLE REACH METHOD OF CHARACTERISTICS
C          PROGRAMED BY C. LAI
C          MODIFIED BY A. SCHNEIDER
0002      COMMON MNT , IDELT , DELT , QK(10,20) , ZK(10,20)
0003      COMMON /BJT2WY/ Z1(10,20), U1(10,20) , ZB(10,20) , ZB2(20,20) ,
1          SQ(20) , ETA(20) , N(20) , Z2(20,20) , U2(20,20) ,
2          SO(20) , TH(20) , CFRIC(20) , ZP(20,20) ,
3          UP(20,20) , EPS
0004      COMMON /BTABL2/A,B,YA(20,20),SAJ(20,20),CAJ(20,20),YB(20,20),
1          SBJ(20,20),CBJ(20,20),HAV,JEOMET(20),
2          HRD,NOPA(20),NOPB(20)
0005      COMMON /BMECNV/ G, SQMC, FFCOU
0006      COMMON /BINOUT/ MU, NU
0007      501 FORMAT (1H0/1H0,30X,25H***** ATTENTION ***** /1H ,31X,
1          25H DQ1 DOES NOT CONVERGE )
C          STORE PARAMETERS FOR SPECIFIED LOCATIONS
0008      THL = TH(JL)
0009      THR = TH(JR)
0010      S1 = SO(JL)
0011      S2 = SO(JR)
0012      CFRIC1 = CFRIC(JL)
0013      CFRIC2 = CFRIC(JR)
0014      SQ1 = SQ(JL)
0015      SQ2 = SQ(JR)
0016      LL = N(JL) + 1
0017      ZPJ = ZP(LL,JL)
0018      IF(M.NE.1) GO TO 100
C          STORE VARIABLES FOR M=1 CYCLE
0019      ZJT = Z1(1,JR)
0020      ULST = U1(LL,JL)
0021      U2LT = U1(LL-1,JL)
0022      Z2LT = Z1(LL-1,JL)
0023      ZBL = ZB(LL,JL)
0024      U1ST = U1(1,JR)
0025      U2ND = U1(2,JR)
0026      Z2ND = Z1(2,JR)
0027      ZBR = ZB(1,JR)
0028      GO TO 200
C          STORE VARIABLES FOR M=2 OR M=3 CYCLE
0029      100 ZJT = Z2( 1,JR)
0030      ULST = U2(LL,JL)
0031      U2LT = U2(LL-1,JL)
0032      Z2LT = Z2(LL-1,JL)
0033      ZBL = ZB2(LL,JL)
0034      U1ST = U2(1,JR)
0035      U2ND = U2(2,JR)
0036      Z2ND = Z2(2,JR)
0037      ZBR = ZB2(1,JR)
C          INITIALIZE COUNTERS, INDICATORS, AND PARAMETERS

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0038      200 DZ1 = DZ                      S2WJ0520
0039      KOUNT=1                          S2WJ0530
0040      KTR2 = 1                          S2WJ0540
0041      CALL TABLE2(ZJT-ZBL,JL)         S2WJ0550
0042      HAVL = HAV                        S2WJ0560
0043      HRDL = HRD                        S2WJ0570
0044      BL = B                            S2WJ0580
0045      CELL=SORT(G*HAVL)                 S2WJ0590
0046      THUPC = THL*(ULST+CELL)           S2WJ0600
0047      UL = ULST*(1.0-THUPC)+U2LT*THUPC S2WJ0610
0048      ZL = ZJT *(1.0-THUPC)+Z2LT*THUPC S2WJ0620
0049      CALL TABLE2(ZJT-ZBR,JR)         S2WJ0630
0050      HAVR = HAV                        S2WJ0640
0051      HRDR = HRD                        S2WJ0650
0052      BR = B                            S2WJ0660
0053      CELR = SORT(G*HAVR)               S2WJ0670
0054      THUMC = THR*(U1ST-CELR)           S2WJ0680
0055      UR = U1ST*(1.0+THUMC)-U2ND*THUMC S2WJ0690
0056      ZR = ZJT*(1.0+THUMC)-Z2ND*THUMC S2WJ0700
0057      GO TO 1515                        S2WJ0710
C      ITERATION STARTS HERE              S2WJ0720
0058      1510 ZPJ = ZPJ - DZ1 * SIGN(1.0,DQ) S2WJ0730
0059      1515 UPL = UL- G*(ZPJ-ZL)/CELL - G*(ULST*S1+CELL*CFRIC1*ULST*ABS(ULST) S2WJ0740
1          /HRDL**1.33333 - SQ1*(1.0-ULST/CELL)/BL)*DELT/CELL S2WJ0750
0060      CALL TABLE2(ZPJ-ZBL,JL)         S2WJ0760
74 0061      QL = A*UPL                     S2WJ0770
0062      UPR = UR + G*(ZPJ-ZR)/CELR + C*(U1ST*S2-CELR*CFRIC2*U1ST*ABS(U1ST) S2WJ0780
1          /HRDR**1.33333-SQ2*(1.0+U1ST/CELR)/BR)*DELT/CELR S2WJ0790
0063      CALL TABLE2(ZPJ-ZBR,JR)         S2WJ0800
0064      QR = A*UPR                       S2WJ0810
0065      DQ1 = QR-QL                      S2WJ0820
0066      IF (KTR2 .EQ. 1) DQ = DQ1        S2WJ0830
0067      IF (ABS(DQ1).LT.EPS) GO TO 1570 S2WJ0840
0068      IF (KOUNT.GT.1) GO TO 1545       S2WJ0850
0069      IF (DQ*DQ1.LT.0.0) GO TO 1546    S2WJ0860
0070      DQ = DQ1                         S2WJ0870
0071      IF (KTR2 .EQ. 1) KTR2 = 0        S2WJ0880
0072      GO TO 1510                       S2WJ0890
0073      1545 IF (KOUNT.GT.30) GO TO 1560 S2WJ0900
0074      1546 KOUNT = KOUNT+1              S2WJ0910
0075      DZ1 = 0.5*SIGN(DZ1,DQ*DQ1)       S2WJ0920
0076      GO TO 1510                       S2WJ0930
C      UNSUCCESSFUL ITERATION             S2WJ0940
0077      1560 WRITE (NU,501)              S2WJ0950
0078      RETURN 1                         S2WJ0960
C      SUCCESSFUL ITERATION; STORE THE RESULTS IN THE CORRESPONDING S2WJ0970
C      LOCATIONS AND RETURN              S2WJ0980
0079      1570 ZP(LL,JL) = ZPJ             S2WJ0990
0080      ZP(1,JR) = ZPJ                   S2WJ1000
0081      UP(LL,JL) = UPL                  S2WJ1010
0082      UP(1,JR) = UPR                   S2WJ1020
0083      RETURN                           S2WJ1030

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JT2WAY

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END

S2WJ1040

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0001      SUBROUTINE RESET(NR)                                REST0000
C      **** REFERENCE DATE - MARCH 28, 1974 ****            REST0010
C      THIS SUBROUTINE RESETS BOTH VARIABLES COMPUTED WITH THE FULL- REST0020
C      SIZE DELT (U1,Z1), AND THE HALF-SIZE DELT (U2,Z2), TO THE COMMON REST0030
C      VALUES OBTAINED BY THE EXTRAPOLATION PROCEDURES.      REST0040
0002      COMMON /BJT2WY/Z1(10,20),U1(10,20),ZB(10,20),ZB2(20,20), REST0050
1          SQ(20),ETA(20),N(20),Z2(20,20),U2(20,20),      REST0060
2          SO(20),TH(20),CFRIC(20),ZP(20,20),              REST0070
3          UP(20,20),EPS                                    REST0080
0003      COMMON /BPRMTR/ DELL(20), DELX(20)                  REST0090
0004      DIMENSION DX(100), UE(10), USM(9), ZE(101), ZSM(100) REST0100
0005      DATA EPSLNU, EPSLNZ / 0.001, 0.001 /                REST0110
0006      K = 0                                                  REST0120
C      OPERATE EXTRAPOLATION PROCEDURE ON VELOCITIES, AND RESET U1'S REST0130
C      AND EVERY OTHER U2 TO THE EXTRAPOLATED VALUES.        REST0140
0007      DO 100 J=1,NR                                         REST0150
0008          L = N(J)                                           REST0160
0009          M = L + 1                                          REST0170
0010          IHT = -1                                           REST0180
0011              DO 90 I=1,M                                    REST0190
0012                  IHT = IHT + 2                               REST0200
0013                  UE(I) = 2.0*U2(IHT,J) - U1(I,J)           REST0210
0014                  U1(I,J) = UE(I)                           REST0220
0015                  U2(IHT,J) = UE(I)                         REST0230
C      90      RESET THE REMAINING U2 VALUES BY SPLINE INTERPOLATION REST0240
0016      CALL SPLNSS(L,EPSLNU,UE,USM)                          REST0250
0017      IHT = -1                                               REST0260
0018          DO 100 I=1,L                                       REST0270
0019              U2(2*I,J) = USM(I)                             REST0280
C      OPERATE EXTRAPOLATION PROCEDURE ON STAGES, AND RESET Z1'S AND REST0290
C      EVERY OTHER Z2 TO THE EXTRAPOLATED VALUES             REST0300
0020      K = K + 1                                              REST0310
0021      DX(K) = DELX(J)                                        REST0320
0022      IHT = IHT + 2                                          REST0330
0023      ZE(K) = 2.0*Z2(IHT,J) - Z1(I,J)                      REST0340
0024      Z1(I,J) = ZE(K)                                       REST0350
0025      100      Z2(IHT,J) = ZE(K)                            REST0360
0026      ZE(K+1) = Z1(M,NR)                                    REST0370
C      RESET THE REMAINING Z2 VALUES BY SPLINE INTERPOLATION REST0380
0027      CALL SPLNS(K,EPSLNZ,DX,ZE,ZSM)                       REST0390
0028      K = 0                                                  REST0400
0029      DO 110 J=1,NR                                         REST0410
0030          L = 2*N(J)                                         REST0420
0031              DO 105 I=2,L,2                                  REST0430
0032                  K = K + 1                                    REST0440
0033      105      Z2(I,J) = ZSM(K)                             REST0450
0034                  IF (J.EQ.NR) GO TO 110                    REST0460
0035                  Z1(N(J)+1,J) = Z1(1,J+1)                  REST0470
0036                  Z2(L+1,J) = Z2(1,J+1)                     REST0480
0037      110      CONTINUE                                      REST0490
0038      RETURN                                                REST0500
0039      END                                                    REST0510

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0001      SUBROUTINE SPLNS(N, EPS, DX, Y, SM)                                SPLN0000
C      **** REFERENCE DATE - MARCH 28, 1974 ****                        SPLN0010
C      THIS IS A SUBROUTINE TO INTERPOLATE Y-VALUES AT THE MID-POINT OF SPLN0020
C      EVERY DELTA X INTERVAL, DX(I), USING THIRD-DEGREE NATURAL SPLINE SPLN0030
C      FUNCTIONS. A NUMBER OF SIMPLIFICATIONS CAN BE MADE WHEN THE INTER-SPLN0040
C      POLATION IS MADE AT THE MID-POINT AND IN EVERY INTERVAL. N IS THE SPLN0050
C      NUMBER OF INTERVALS, AND EPS IS A TOLERANCE LIMIT FOR OVER RELAXA-SPLN0060
C      TION. THE INTERPOLATED VALUES ARE RETURNED TO THE CALLING PROGRAM SPLN0070
C      VIA SM.                                                            SPLN0080
C      VERSION 2 ( MARCH 28, 1974 )                                       SPLN0090
0002      DIMENSION DX(1), Y(1), WX(100), B(100), DELSQY(100), C(100),    SPLN0100
1          DYDX(100), S2(101), SM(1)                                       SPLN0110
0003      DATA OMEGA / 1.0717968 /                                       SPLN0120
0004      M = N + 1                                                         SPLN0130
0005      DO 10 I=1,N                                                       SPLN0140
0006      10      DYDX(I) = (Y(I+1)-Y(I)) / DX(I)                         SPLN0150
0007      DO 20 I=2,N                                                       SPLN0160
0008      WX(I) = DX(I-1) + DX(I)                                          SPLN0170
0009      B(I) = 0.5*DX(I-1)/WX(I)                                         SPLN0180
0010      DELSQY(I) = (DYDX(I)-DYDX(I-1)) / WX(I)                       SPLN0190
0011      S2(I) = 2.0*DELSQY(I)                                           SPLN0200
0012      20      C(I) = 3.0*DELSQY(I)                                     SPLN0210
0013      S2(1) = 0.                                                       SPLN0220
0014      S2(M) = 0.                                                       SPLN0230
0015      25      ETA = 0.                                                 SPLN0240
0016      DO 30 I=2,N                                                       SPLN0250
0017      R = (C(I) - B(I)*S2(I-1) - S2(I) - (0.5-B(I))*S2(I+1)) * OMEGA SPLN0260
0018      IF (ABS(R).LE.ETA) GO TO 30                                       SPLN0270
0019      ETA = ABS(R)                                                      SPLN0280
0020      30      S2(I) = S2(I) + R                                         SPLN0290
0021      IF (ETA.GT.EPS) GO TO 25                                          SPLN0300
0022      DO 40 I=1,N                                                       SPLN0310
0023      40      SM(I) = 0.5*(Y(I)+Y(I+1)) - DX(I)*DX(I)*(S2(I)+S2(I+1))/16.0 SPLN0320
0024      RETURN                                                            SPLN0330
C      SPLN0340
0025      ENTRY SPLNSS(N, EPS, Y, SM)                                       SPLN0350
C      THIS IS AN ENTRY FOR A SPECIAL CASE WHEN ALL DELTA X'S ARE OF    SPLN0360
C      THE SAME LENGTH.                                                   SPLN0370
0026      M = N + 1                                                         SPLN0380
0027      DO 70 I=2,N                                                       SPLN0390
0028      S2(I) = Y(I+1)-2.0*Y(I)+Y(I-1)                                   SPLN0400
0029      70      C(I) = 1.5*S2(I)                                          SPLN0410
0030      S2(1) = 0.                                                       SPLN0420
0031      S2(M) = 0.                                                       SPLN0430
0032      75      ETA = 0.                                                 SPLN0440
0033      DO 80 I=2,N                                                       SPLN0450
0034      R = (C(I)-0.25*(S2(I-1)+S2(I+1))-S2(I)) * OMEGA                SPLN0460
0035      IF (ABS(R).LE.ETA) GO TO 80                                       SPLN0470
0036      ETA = ABS(R)                                                      SPLN0480
0037      80      S2(I) = S2(I) + R                                         SPLN0490
0038      IF (ETA.GT.EPS) GO TO 75                                          SPLN0500
0039      DO 90 I=1,N                                                       SPLN0510

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```
0040      90      SM(I) = 0.5*(Y(I)+Y(I+1)) - (S2(I)+S2(I+1)) / 16.0
0041      RETURN
0042      END
```

```
SPLN0520
SPLN0530
SPLN0540
```

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0001      SUBROUTINE TABLE2(D,J)                                STL20000
          C      **** REFERENCE DATE - FEB. 1, 1972 ****        STL20010
          C      THIS SUBROUTINE FINDS AREA, WIDTH, AVERAGE DEPTH AND STL20020
          C      HYDRAULIC RADIUS FROM GIVEN DEPTH FOR SUBREACH J. STL20030
0002      COMMON /BTABL2/A,B,YA(20,20),SAJ(20,20),CAJ(20,20),YB(20,20), STL20040
          1      SBJ(20,20),CBJ(20,20),HAV,JEOMET(20),          STL20050
          2      HRD,NOPA(20),NOPB(20)                          STL20060
0003      IF (JEOMET(J).EQ.1) GO TO 1450                        STL20070
0004      NA = NOPA(J)                                          STL20080
0005      NB = NOPB(J)                                          STL20090
0006      DO 1410 I=2,NA                                        STL20100
0007      IF ( D.LT.YA(I,J)) GO TO 1420                         STL20110
0008      1410 CONTINUE                                         STL20120
0009      I = NA                                                STL20130
0010      1420 A = SAJ(I,J)*D +CAJ(I,J)                        STL20140
0011      DO 1430 I=2,NB                                        STL20150
0012      IF ( D.LT.YB(I,J)) GO TO 1440                        STL20160
0013      1430 CONTINUE                                         STL20170
0014      I = NB                                                STL20180
0015      1440 B = SBJ(I,J)*D +CBJ(I,J)                        STL20190
0016      HAV = A/B                                              STL20200
0017      HRD = HAV                                             STL20210
          C      IN A WIDE NATURAL CHANNEL, THE HYDRAULIC MEAN RADIUS "HRD" STL20220
          C      CAN BE APPROXIMATED BY THE AVERAGE DEPTH "HAV". WHEN THE STL20230
          C      CHANNEL CROSS SECTION IS NARROW AND DEEP, AND THE WETTED STL20240
          C      PERIMETER "P" IS KNOWN, REPLACE THE ABOVE STATEMENT STL20250
          C      BY THE FOLLOWING STATEMENT:                     STL20260
          C      HRD = A/P                                        STL20270
0018      RETURN                                              STL20280
0019      1450 CALL CGEQ(D,J,A,B,HAV,HRD)                     STL20290
0020      RETURN                                              STL20300
0021      END                                                  STL20310

```


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CGEQ

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```
0001      SUBROUTINE CGEQ(H,J,A,B,HAV,HRD)
          C      THIS IS A DUMMY SUBROUTINE
0002      10 CONTINUE
0003      RETURN
0004      END
```

```
CGEQ0000
CGEQ0010
CGEQ0020
CGEQ0030
CGEQ0040
```

FORTRAN IV G LEVEL 21

BDVL

DATE = 75044

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```
0001      C      FUNCTION BDVL(T)
0002          THIS IS A DUMMY PROGRAM.
0003          BDVL = 1.0
0004          RETURN
          END
```

```
BDVL0000
BDVL0010
BDVL0020
BDVL0030
BDVL0040
```

FORTRAN IV G LEVEL 21

BDVR

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PAGE 0001

```
0001      FUNCTION BDVR(T)
          C      THIS IS A DUMMY PROGRAM.
0002          BDVR=10.0
0003          RETURN
0004          END
```

```
BDVR0000
BDVR0010
BDVR0020
BDVR0030
BDVR0040
```

```

0001      SUBROUTINE INDSK1(YR,MOB,DAYB,HRB,MNTB,DELTA,*)
C          **** REFERENCE DATE - JULY 30, 1974 ****
C          THIS IS A SUBROUTINE USED TO RETRIEVE STAGE DATA FROM
C          AN ESTABLISHED DISK PACK. THE DATA ON DISK SHOULD BE EDITED
C          AND PUT IN BLOCK FORM BEFORE THIS SUBROUTINE CAN BE USED.
C          PROGRAMED BY C. A. ONIONS (FEB. 9, 1973)
C          MODIFIED BY C. LAI (JULY 30, 1974)
C
0002      INTEGER YR, DAYB, HRB, DAYE, HRE, YR1, DAY1, HR1, TIMA
0003      COMMON /BINDSK/NN,IFIN,ISTART,LJ,NOB,CORL,COR(21)
0004      COMMON /BJT2WY/ Z1(10,20), U1(10,20), ZB(10,20), ZB2(20,20),
1          SQ(20), ETA(20), N(20), Z2(20,20), U2(20,20),
2          SO(20), TH(20), CFRIC(20), ZP(20,20),
3          UP(20,20), EPS
0005      COMMON /BMECNV/ G, SQMC, FFCOU
0006      COMMON /BINOUT/ MU, NU
0007      DIMENSION MO1(50),DAY1(50),YR1(50),HR1(50),MNT1(50),ITYPC(50),
1          CORR1(50),TIMA(50),ISUBR(50),ZPE11(1728),ZPE12(1728)
0008      DATA LKSIZE/1728/
0009      91 FORMAT (2(7X,I8),4X,4(I2,1X))
0010      92 FORMAT (I2)
0011      93 FORMAT (7(I2,1X),F10.4)
C
C      READ DISC INPUT INFORMATION
C
0012      READ (MU,91) IPE1, IPE2, MOE, DAYE, HRE, MNT1
0013      IF(IPE2.LE.IPE1) RETURN
C
C      *** SORT CORRECTIONS ***
C
0014      INDEX=1440/DELTA
0015      NDAYS = LKSIZE/INDEX
0016      READ (MU,92) NCORR
0017      IF(NCORR.EQ.0) GO TO 130
0018      DO 100 I=1,NCORR
0019      READ (MU,93) (MO1(I),DAY1(I),YR1(I),HR1(I),MNT1(I),ISUBR(I),
1          ITYPE(I),CORR1(I))
0020      100 TIMA(I) = 1440*(JULYN(MO1(I),DAY1(I),YR1(I))-1) + 60*HR1(I)
1          + MNT1(I)
0021      NCOR1 = NCORR-1
0022      DO 120 I=2,NCORR
0023      K=0
0024      DO 110 J=1,NCOR1
0025      JP1=J+1
0026      IF (TIMA(J).LE.TIMA(JP1)) GO TO 110
0027      K = 1
0028      KEEP1=TIMA(J)
0029      KEEP2=ISUBR(J)
0030      KEEP3=ITYPC(J)
0031      AKEEP4=CORR1(J)
0032      TIMA(J)=TIMA(JP1)
0033      ISUBR(J)=ISUBR(JP1)

```

SDSK0000
SDSK0010
SDSK0020
SDSK0030
SDSK0040
SDSK0050
SDSK0060
SDSK0070
SDSK0080
SDSK0090
SDSK0100
SDSK0110
SDSK0120
SDSK0130
SDSK0140
SDSK0150
SDSK0160
SDSK0170
SDSK0180
SDSK0190
SDSK0200
SDSK0210
SDSK0220
SDSK0230
SDSK0240
SDSK0250
SDSK0260
SDSK0270
SDSK0280
SDSK0290
SDSK0300
SDSK0310
SDSK0320
SDSK0330
SDSK0340
SDSK0350
SDSK0360
SDSK0370
SDSK0380
SDSK0390
SDSK0400
SDSK0410
SDSK0420
SDSK0430
SDSK0440
SDSK0450
SDSK0460
SDSK0470
SDSK0480
SDSK0490
SDSK0500
SDSK0510

⑧ Disk input information

⑨ Parameter correction cards

```

0034          ITYPE(J)=ITYPE(JP1)                      SDSK0520
0035          CORR1(J)=CORR1(JP1)                      SDSK0530
0036          TIMA(JP1)=KEEP1                          SDSK0540
0037          ISUBR(JP1)=KEEP2                         SDSK0550
0038          ITYPE(JP1)=KEEP3                         SDSK0560
0039          CORR1(JP1)=AKEEP4                        SDSK0570
0040          110    CONTINUE                          SDSK0580
0041          IF (K.EQ.0) GO TO 130                    SDSK0590
0042          120    NCOR1 = NCOR1-1                   SDSK0600
C                                                    SDSK0610
C          COMPUTING BLOCK ENTRY BY TIME             SDSK0620
C                                                    SDSK0630
0043          130    JULYNB = JULYN(MOB,DAYB,YR)        SDSK0640
0044          JULYNE = JULYN(MOE,DAYE,YR)              SDSK0650
0045          MDPT = (JULYNB-1)*INDEX + (60*HRB+MNTB)/IDELT SDSK0660
0046          NDPT = (JULYNE-1)*INDEX + (60*HRE+MNTE)/IDELT SDSK0670
0047          NBB=(MDPT-1)/LKSIZE                      SDSK0680
0048          NBE=(NDPT-1)/LKSIZE + 1                 SDSK0690
0049          NOB=NBE-NBB                             SDSK0700
0050          ISTART = MOD(MDPT,LKSIZE) + 1           SDSK0710
0051          JULE = MOD(JULYNE-1,NDAYS)              SDSK0720
0052          RETURN                                  SDSK0730
C                                                    SDSK0740
0053          ENTRY INDSK2(ZPE1,ZPEL,NRP1,*)          SDSK0750
C                                                    SDSK0760
C          TIME INITIALIZATION                      SDSK0770
C                                                    SDSK0780
0054          LK=1                                    SDSK0790
0055          IFIN=LKSIZE                             SDSK0800
0056          LJ=1                                    SDSK0810
0057          IF (ISTART.EQ.1) LJ = 2                 SDSK0820
0058          IF (NCORR.NE.0) ITIM = 1440*(JULYNB-1) + 60*HRB + MNTB SDSK0830
C                                                    SDSK0840
0059          ENTRY INDSK4(ZPE1,ZPEL,*)              SDSK0850
C                                                    SDSK0860
0060          IF (LJ.EQ.NOB) IFIN = INDEX*JULE + (60*HRE+MNTE)/IDELT SDSK0870
C                                                    SDSK0880
C          CALL INPUT STAGE FROM DISK                SDSK0890
C                                                    SDSK0900
C          CALL INPUT (IPE1,JULYNB,HRB,MNTR,JULYNE,HRE,MNTE,LJ,ZPE11) SDSK0910
C          CALL INPUT (IPE2,JULYNB,HRB,MNTB,JULYNE,HRE,MNTE,LJ,ZPE12) SDSK0920
0061          NN=ISTART                              SDSK0930
C                                                    SDSK0940
0062          ENTRY INDSK3(ZPE1,ZPEL,*)              SDSK0950
C                                                    SDSK0960
0063          ZPE1=ZPE11(NN)                         SDSK0970
0064          ZPEL=ZPE12(NN)                         SDSK0980
C                                                    SDSK0990
C          ***CORRECTION SEGMENT***                 SDSK1000
C          IF ITYPE = 1  ETA CHANGES                SDSK1010
C          IF ITYPE = 2  DATUM CORR. CHANGES        SDSK1020
C          IF ITYPE = 3  SIDE FLOW CHANGES          SDSK1030

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0065	C	IF (LK.GT.NCORR) RETURN 1	SDSK1040
0066		KK=LK	SDSK1050
0067		ITIM = ITIM + IDELT	SDSK1060
0068		DO 320 I=KK,NCORR	SDSK1070
0069		IF (TIMA(I).GT.ITIM) RETURN 1	SDSK1080
0070		IK = ITPC(I)	SDSK1090
0071		GO TO (270,280,290),IK	SDSK1100
0072	270	CFRIC(ISUBR(I)) = CORR1(I)*CORR1(I)/SQMC	SDSK1110
0073		GO TO 320	SDSK1120
0074	280	COR(ISUBR(I)) = CORR1(I)	SDSK1130
0075		IF (ISUBR(I).EQ.NRP1) CORL = COR(NRP1)	SDSK1140
0076		GO TO 320	SDSK1150
0077	290	SQ(ISUBR(I)) = CORR1(I)	SDSK1160
0078	320	LK=LK+1	SDSK1170
0079		RETURN 1	SDSK1180
0080		END	SDSK1190
			SDSK1200

0001		FUNCTION JULYN(JMONTH,JDAY,JYEAR)	JULD0000
	C	**** REFERENCE DATE - JULY 31, 1974 ****	JULD0010
	C	THIS FUNCTION CHANGES GREGORIAN MONTH & DAYS TO JULIAN DAYS	JULD0020
0002		INTEGER MONTH(12)/0,31,59,90,120,151,181,212,243,273,304,334/	JULD0030
0003		JULYN=MONTH(JMONTH)+JDAY+(JMONTH+7)/10*((4-MOD(JYEAR,4))/4)	JULD0040
0004		RETURN	JULD0050
0005		END	JULD0060

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0001      SUBROUTINE EDATE1(MNT, IDELT, NR, JOPTN, *)          SED10000
C          **** REFERENCE DATE - AUG. 7, 1974 **** (E,A)    SED10010
C          THIS SUBROUTINE LABELS AND CALLS OTHER SUBROUTINES SED10020
C          FOR COMPLETE TABLE OUTPUT (IOPTN = 1).          SED10030
C          PROGRAMED BY C. LAI                               SED10040
C          REVISED BY C. A. ONIONS AND C. LAI               SED10050
0002      INTEGER HOUR, DAY, YR                               SED10060
0003      COMMON /BDATEA/HOUR, DAY, MO, YR, LDM(12), IFLAG, LABEL SED10070
0004      COMMON /BJT2WY/Z1(10,20), U1(10,20), ZB(10,20), ZB2(20,20), SED10080
1          SQ(20), ETA(20), N(20), Z2(20,20), U2(20,20),    SED10090
2          SO(20), TH(20), CFRIC(20), ZP(20,20),            SED10100
3          UP(20,20), EPS                                    SED10110
0005      COMMON /BPRMTR/ DELL(20), DELX(20)                 SED10120
0006      COMMON /BINOUT/ MU, NU                               SED10130
0007      DIMENSION VOLSQ(20), HSQ(20), SQSUM(20)              SED10140
0008      DATA KTITLE/1/, IHDSP/2/                          SED10150
0009      8 FORMAT (1H0/1H , I2, 1H/, I2, 1H/, I2/ 8H0  TIME, 29X, 8HDISTANCE, 9X, SED10160
1          8HVELOCITY, 6X, 9HELEVATION, 7X, 9HDISCHARGE, 5X, SED10170
2          12HLATERAL FLOW )                                SED10180
0010      9 FORMAT (4H0 , I2, 1H-, I2)                        SED10190
0011      10 FORMAT (1H0, 16X, 18HVOLSQ(1,...,NR) = , 5(E12.4, 6X ) /(1H , SED10200
1          34X, E12.4, 6X, E12.4, 6X, E12.4, 6X, E12.4, 6X, E12.4 ) SED10210
0012      11 FORMAT (1H , 37X, 7H(MILES), 9X, 8H(FT/SEC), 8X, 6H(FEET), 10X, 5H(CFS), SED10220
1          9X, 8H(CFS/FT) )                                SED10230
0013      GO TO (501, 508, 570, 501), IFLAG                  SED10240
C          TIME AND DATE ADVANCING                           SED10250
0014      501 MNT = MNT + IDELT                                SED10260
0015      IF (MNT.GE.60) GO TO 504                            SED10270
0016      IF (IFLAG.NE.4) GO TO 520                           SED10280
0017      GO TO 506                                             SED10290
0018      504 MNT = MNT - 60                                    SED10300
0019      HOUR = HOUR + 1                                       SED10310
0020      IF (HOUR-24) 510, 505, 506                           SED10320
0021      505 IFLAG = 4                                         SED10330
0022      GO TO 520                                             SED10340
0023      506 HOUR = HOUR - 24                                  SED10350
0024      DAY = DAY + 1                                         SED10360
0025      IFLAG = 1                                             SED10370
0026      IF (DAY.LE.LDM(MO)) GO TO 510                        SED10380
0027      DAY = 1                                               SED10390
0028      MO = MO + 1                                           SED10400
0029      IF (MO.LE.12) GO TO 510                              SED10410
0030      MO = 1                                                SED10420
0031      YR = YR + 1                                           SED10430
C          FIRST ENTRY POINT                                  SED10440
0032      508 LDM(2) = 29 - (MOD(YR,4)+3)/4                    SED10450
0033      IF (IFLAG.NE.2.OR.HOUR+MNT.NE.0) GO TO 510          SED10460
0034      HOUR = 24                                             SED10470
0035      DAY = DAY - 1                                         SED10480
0036      IF (DAY.GT.0) GO TO 510                              SED10490
0037      MO = MO - 1                                           SED10500
0038      IF (MO.GT.0) GO TO 509                               SED10510

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0039	MO = 12	SED10520
0040	YR = YR - 1	SED10530
0041	509 DAY = LDM(MO)	SED10540
	C PRINT THE HEADINGS	SED10550
0042	510 WRITE (NU,8) MO, DAY, YR	SED10560
0043	LABEL = 1	SED10570
0044	IF (KTITLE.EQ.1.OR.MOD(HOUR,IHDSP).EQ.0) WRITE (NU,11)	SED10580
0045	KTITLE = 0	SED10590
0046	520 WRITE (NU,9) HOUR, MNT	SED10600
	C CALL OPTNI OR OPTNI TO PRINT COMPREHENSIVE OUTPUTS, AT THE	SED10610
	C SAME TIME KEEP RECORDS OF LATERAL IN-(OUT-)FLOW VOLUME	SED10620
	C ACCUMULATION.	SED10630
0047	IF (IFLAG.EQ.2) GO TO 550	SED10640
0048	CALL OPTNI(JOPTN,NR,LABEL)	SED10650
0049	DO 532 J=1,NR	SED10660
0050	532 SQSUM(J) = SQSUM(J) + SQ(J)	SED10670
0051	IF (IFLAG.EQ.1) RETURN 1	SED10680
0052	DO 540 J=1,NR	SED10690
0053	HSQ(J) = 0.5*SQ(J)	SED10700
0054	540 VOLSQ(J) = 60.0*FLOAT(IDELT)*(SQSUM(J)-HSQ(J))*DELL(J)	SED10710
0055	WRITE (NU,10) (VOLSQ(J),J=1,NR)	SED10720
0056	DO 546 J=1,NR	SED10730
0057	546 SQSUM(J) = HSQ(J)	SED10740
0058	KTITLE = 1	SED10750
0059	RETURN 1	SED10760
0060	550 CALL OPTNI(0,NR,LABEL)	SED10770
0061	DO 560 J=1,NR	SED10780
0062	560 SQSUM(J) = 0.5 *SQ(J)	SED10790
0063	IFLAG = 1	SED10800
0064	IF (HOUR.EQ.24) IFLAG=4	SED10810
0065	RETURN	SED10820
	C LAST ENTRY POINT	SED10830
0066	570 IF (HOUR.GE.24) RETURN 1	SED10840
0067	DO 575 J=1,NR	SED10850
0068	HSQ(J) = 0.5*SQ(J)	SED10860
0069	575 VOLSQ(J) = 60.0*FLOAT(IDELT)*(SQSUM(J)-HSQ(J))*DELL(J)	SED10870
0070	WRITE (NU,10) (VOLSQ(J),J=1,NR)	SED10880
0071	KTITLE = 1	SED10890
0072	RETURN 1	SED10900
0073	END	SED10910

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0001      SUBROUTINE OPTNI(JOPTN,NR,LABEL)
C          **** REFERENCE DATE - JUNE 1, 1973 ****
C          THIS IS A SUBROUTINE TO PROVIDE PRINTOUTS OF IOPTN1.
C          PROGRAMED BY C. LAI
C          MODIFIED BY C. A. ONIONS
0002      COMMON /BJT2WY/Z1(10,20),U1(10,20),ZB(10,20),ZB2(20,20),
1          SQ(20),ETA(20),N(20),Z2(20,20),U2(20,20),
2          SO(20),TH(20),CFRIC(20),ZP(20,20),
3          UP(20,20),EPS
0003      COMMON /BPRMTR/ DELL(20), DELX(20)
0004      COMMON /BTABL2/A,B,YA(20,20),SAJ(20,20),CAJ(20,20),YB(20,20),
1          SBJ(20,20),CBJ(20,20),HAV,JEOMET(20),HRD,
2          NOPA(20),NOPB(20)
0005      COMMON /BLABEL/STANAM(4,21)
0006      COMMON /BMECNV/ G, SQMC, FFCOU
0007      COMMON /BINOUT/ MU, NU
0008      DIMENSION X(100)
0009      54 FORMAT (1H ,36X,F7.3,8X,F8.3,8X,F8.3,6X,F10.2,8X,F8.3)
0010      55 FORMAT (1H ,16X,4A4,4X,F7.3,8X,F8.3,8X,F8.3,6X,F10.2,8X,F8.3)
0011      56 FORMAT (1H )
C          FIRST ENTRY; INITIALIZE X(I) VALUES
0012      NOPTS = 1
0013      X(1) = 0.0
0014      DO 115 J=1,NR
0015          L = N(J)
0016      89 DELXM = DELX(J)/FFCOU
0017          DO 115 I=1,L
0018              NOPTS = NOPTS + 1
0019      115      X(NOPTS) = X(NOPTS-1) + DELXM
C
0020      ENTRY OPTNI(JOPTN,NR,LABEL)
C          ROUTINE ENTRY
C
0021      NOPTS = 0
0022      DO 128 J=1,NR
0023          L = N(J)
0024          IF (J.EQ.NR) L=L+1
0025          DO 126 I=1,L
0026              NOPTS = NOPTS + 1
0027          IF (JOPTN.EQ.1) GO TO 124
C          OUTPUT PRINTING FOR JOPTN=0
0028          CALL TABLE2 (Z1(I,J)-ZB(I,J),J)
0029          Q = U1(I,J) * A
0030          IF (LABEL.EQ.1.AND.I.EQ.1) GO TO 120
0031          IF (LABEL.EQ.1.AND.J.EQ.NR.AND.I.EQ.L) GO TO 121
0032          IF (I.NE.1) GO TO 116
0033          WRITE (NU,54) X(NOPTS), U1(I,J), Z1(I,J), Q, SQ(J)
0034          GO TO 126
0035      116      WRITE (NU,54) X(NOPTS), U1(I,J), Z1(I,J), Q
0036          GO TO 126
0037      120      WRITE (NU,55) (STANAM(K,J),K=1,4),X(NOPTS),U1(I,J),Z1(I,J),
1          Q,SQ(J)

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OPTN0000
OPTN0010
OPTN0020
OPTN0030
OPTN0040
OPTN0050
OPTN0060
OPTN0070
OPTN0080
OPTN0090
OPTN0100
OPTN0110
OPTN0120
OPTN0130
OPTN0140
OPTN0150
OPTN0160
OPTN0170
OPTN0180
OPTN0190
OPTN0200
OPTN0210
OPTN0220
OPTN0230
OPTN0240
OPTN0250
OPTN0260
OPTN0270
OPTN0280
OPTN0290
OPTN0300
OPTN0310
OPTN0320
OPTN0330
OPTN0340
OPTN0350
OPTN0360
OPTN0370
OPTN0380
OPTN0390
OPTN0400
OPTN0410
OPTN0420
OPTN0430
OPTN0440
OPTN0450
OPTN0460
OPTN0470
OPTN0480
OPTN0490
OPTN0500
OPTN0510

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0038		GO TO 126	OPTN0520
0039	121	WRITE (NU,55) (STANAM(K,J+1),K=1,4),X(NOPTS),U1(I,J),Z1(I,J),Q	OPTN0530
0040		LABEL = 0	OPTN0540
0041		GO TO 126	OPTN0550
	C	OUTPUT PRINTING FOR JOPTN=1	OPTN0560
0042	124	UE = 2.0*U2(2*I-1,J)-U1(I,J)	OPTN0570
0043		ZE = 2.0*Z2(2*I-1,J)-Z1(I,J)	OPTN0580
0044		CALL TABLE2 (ZE-ZB(I,J),J)	OPTN0590
0045		Q = UE*A	OPTN0600
0046		IF (LABEL.EQ.1.AND.I.EQ.1) GO TO 1250	OPTN0610
0047		IF (LABEL.EQ.1.AND.J.EQ.NR.AND.I.EQ.L) GO TO 1251	OPTN0620
0048		IF (I.NE.1) GO TO 125	OPTN0630
0049		WRITE (NU,54) X(NOPTS), UE, ZE, Q, SQ(J)	OPTN0640
0050		GO TO 126	OPTN0650
0051	125	WRITE (NU,54) X(NOPTS), UE, ZE, Q	OPTN0660
0052		GO TO 126	OPTN0670
0053	1250	WRITE (NU,55) (STANAM(K,J),K=1,4),X(NOPTS),UE,ZE,Q,SQ(J)	OPTN0680
0054		GO TO 126	OPTN0690
0055	1251	WRITE (NU,55) (STANAM(K,J+1),K=1,4),X(NOPTS),UE,ZE,Q	OPTN0700
0056		LABEL = 0	OPTN0710
0057	126	CONTINUE	OPTN0720
0058	128	WRITE (NU,56)	OPTN0730
0059		RETURN	OPTN0740
0060		END	OPTN0750

I6

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0001      SUBROUTINE DATE2(QPRES,*)                      SDT20000
C      **** REFERENCE DATE - AUG. 5, 1974 **** (E)      SDT20010
C      THIS IS A SUBROUTINE TO COMPUTE AND PRINT OUT VOLUMES OF DISCHARGE SDT20020
C      IN MILLIONS OF CUBIC FEET FOR POSITIVE AND NEGATIVE FLOWS. SDT20030
C      PROGRAMED BY C. LAI SDT20040
C      VERSION 3 BY C. LAI ( AUG. 5, 1974 ) SDT20050
0002      INTEGER HOUR, DAY, YR, QVOL SDT20060
0003      COMMON MNT, IDELT, DELT SDT20070
0004      COMMON /BDATEA/HOUR, DAY, MO, YR, LDM(12), IFLAG, LABEL SDT20080
0005      COMMON /BDATB2/MONTH(36), IQORD(5), JRCH, ISTA SDT20090
0006      COMMON /BINOUT/ MU, NU SDT20100
0007      DIMENSION QVOL(12) SDT20110
0008      22 FORMAT (1H, 20X, I2, 3X, 8I12 / (1H, 25X, 8I12) ) SDT20120
0009      24 FORMAT (1H0/1H, 40X, 3A4, 2H19, I2, I2X, 20HDISCHARGE AT STATION, I2, 1H- SDT20130
0010      1, I2 / 1H0, 19X, 3HDAY, 20X, 32HVOLUME IN MILLIONS OF CUBIC FEET ) SDT20140
0010      26 FORMAT (1H, 25X, 57H* THE LAST DAY IS A PARTIAL DAY. THE COMPUTATION SDT20150
0011      1N ENDS AT, I2, 1H-, I2 ) SDT20160
0011      28 FORMAT (1H, 25X, 60H* THE FIRST DAY IS A PARTIAL DAY. THE COMPSD SDT20170
0012      1UTATION BEGINS AT, I2, 1H-, I2 ) SDT20180
0012      GO TO (210, 230, 240, 205), IFLAG SDT20190
C      PRINT YEAR, MONTH, AND STATION SDT20200
0013      205 WRITE (NU, 24) MONTH(3*MO-2), MONTH(3*MO-1), MONTH(3*MO), YR, JRCH, ISTA SDT20210
0014      IFLAG = 1 SDT20220
C      AT EVERY ROUTINE ENTRY, CHECK WHETHER THE FLOW HAS CHANGED ITS SDT20230
C      DIRECTION OR NOT. FOR EVERY REVERSAL OF FLOW START A NEW 'QSUM'. SDT20240
0015      210 IF (QPREV*QPRES.GT.0.0) GO TO 220 SDT20250
0016      QVPS = ABS(QPREV)+ABS(QPRES) SDT20260
0017      QSUM = QSUM + 0.5*QPREV*ABS(QPREV)/QVPS SDT20270
0018      QVOL(N) = DELT*QSUM/1000000.0 SDT20280
0019      QSUM = 0.5*QPRES*ABS(QPRES)/QVPS SDT20290
0020      N=N+1 SDT20300
0021      GO TO 222 SDT20310
0022      220 QSUM = QSUM + 0.5*(QPREV+QPRES) SDT20320
0023      222 QPREV = QPRES SDT20330
C      IF MIDNIGHT HAS BEEN REACHED, PRINT VOLUME INTERCHANGES FOR THE SDT20340
C      DAY, RESET VARIABLES, AND ADVANCE THE DATE. SDT20350
0024      MNT = MNT+IDELT SDT20360
0025      IF (MNT.LT.1440) RETURN 1 SDT20370
0026      QVOL(N) = DELT*QSUM/1000000.0 SDT20380
0027      WRITE (NU, 22) DAY, (QVOL(I), I=1, N) SDT20390
0028      N=1 SDT20400
0029      QSUM = 0.0 SDT20410
0030      225 DAY = DAY+1 SDT20420
0031      MNT = MNT-1440 SDT20430
0032      IF (DAY.LE.LDM(MO)) RETURN 1 SDT20440
0033      DAY = 1 SDT20450
0034      MO = MO+1 SDT20460
0035      IFLAG = 4 SDT20470
0036      IF (MO.LE.12) RETURN 1 SDT20480
0037      MO = 1 SDT20490
0038      YR = YR+1 SDT20500
C      INITIALIZATION AT THE FIRST ENTRY SDT20510

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0039	230	LDM(2) = 29-(MOD(YR,4)+3)/4	SDT20520
0040		IF (IFLAG.NE.2) RETURN 1	SDT20530
0041		QPREV = QPRES	SDT20540
0042		MNT = 60*HOUR+MNT	SDT20550
0043		JFTNT1 = MOD(MNT,1440)	SDT20560
0044		IFLAG = 4	SDT20570
0045		N=1	SDT20580
0046		QSUM = 0.0	SDT20590
0047		IF (MNT.EQ.1440) GO TO 225	SDT20600
0048		RETURN 1	SDT20610
	C	FINISHING-UP JOB FOR LAST ENTRY	SDT20620
0049	240	IF (MNT.LT.IDELT) GO TO 250	SDT20630
0050		QVOL(N) = DELT*QSUM/1000000.0	SDT20640
0051		WRITE (NU,22) DAY, (QVOL(I),I=1,N)	SDT20650
0052	250	IF (JFTNT1.EQ.0) GO TO 260	SDT20660
0053		MNT1 = MOD(JFTNT1,60)	SDT20670
0054		WRITE (NU,28) HOUR, MNT1	SDT20680
0055	260	IF (MNT.LT.IDELT) RETURN 1	SDT20690
0056		HOUR = MNT/60	SDT20700
0057		MNT = MNT-60*HOUR	SDT20710
0058		WRITE (NU,26) HOUR, MNT	SDT20720
0059		RETURN 1	SDT20730
0060		END	SDT20740

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0001      SUBROUTINE DAILY(CQ,*)                      SDAY0000
C      **** REFERENCE DATE - AUG. 6, 1974 **** (E)    SDAY0010
C      THIS IS A SUBROUTINE TO PRINT OUT MEAN DAILY DISCHARGES IN SDAY0020
C      A TABULAR FORM THROUGHOUT A WATER YEAR          SDAY0030
C      PROGRAMED BY C. LAI ,                          SDAY0040
C      REVISED BY C.A. ONIONS AND C. LAI              SDAY0050
0002      INTEGER HOUR, DAY, YR, YR1                  SDAY0060
0003      REAL*8 MDQT(31,12),DASHES/' - - '/          SDAY0070
0004      COMMON MNT, IDELT                             SDAY0080
0005      COMMON /BDATEA/HOUR, DAY, MO, YR, LDM(12), IFLAG, LABEL SDAY0090
0006      COMMON /BDATB2/MONTH(36), IQORD(5), JRCH, ISTA SDAY0100
0007      COMMON /BINOUT/ MU, NU                       SDAY0110
0008      DIMENSION MDQ(31,12)                         SDAY0120
0009      DATA M, N /31,12/                          SDAY0130
0010      32 FORMAT (1H1/1H ,25X, 57HDISCHARGE IN CUBIC FEET PER SECOND, WATER SDAY0140
1YEAR OCTOBER 19,I2,16H TO SEPTEMBER 19,I2,6H, STA.,I2,1H-,I2/ SDAY0150
2129HO DAY OCT. NOV. DEC. JAN. FEB. SDAY0160
3 MAR. APR. MAY JUNE JULY AUG. SEPTSDAY0170
4. / (1H ,4X,I2,3X,12(1X,A8,1X))) SDAY0180
0011      34 FORMAT ( 46HO * THE FIRST DAY IS A PARTIAL DAY. ) SDAY0190
0012      35 FORMAT ( 46HO * THE LAST DAY IS A PARTIAL DAY. ) SDAY0200
0013      GO TO (210,330,340), IFLAG SDAY0210
C      ROUTINE ENTRY SDAY0220
0014      210 KOUNT = KOUNT+1 SDAY0230
0015      CQSUM = CQSUM+CQ SDAY0240
0016      MNT = MNT + IDELT SDAY0250
0017      IF (MNT.LT.1440) RETURN 1 SDAY0260
C      IF THE DAY ENDS, COMPUTE THE MEAN DISCHARGE OF THE DAY. SDAY0270
0018      MDQ(DAY,MO) = (CQSUM-0.5*CQ)/KOUNT SDAY0280
0019      KOUNT = 0 SDAY0290
0020      CQSUM = 0.5*CQ SDAY0300
C      ADVANCE THE DATE SDAY0310
0021      215 DAY = DAY + 1 SDAY0320
0022      MNT = MNT-1440 SDAY0330
0023      IF (DAY.LE.LDM(MO)) RETURN 1 SDAY0340
0024      DAY = 1 SDAY0350
0025      MO = MO+1 SDAY0360
0026      IF (MO.NE.10) GO TO 225 SDAY0370
C      IF THE WATER YEAR ENDS, PRINT OUT ALL THE COMPUTED MEAN DAILY SDAY0380
C      DISCHARGES OF THE YEAR SDAY0390
0027      IF (JFTNT1.EQ.0.AND.JFTNT2.EQ.0) GO TO 225 SDAY0400
0028      YR1 = YR - 1 SDAY0410
0029      CALL CONVRT (MDQ,MDQT,M,N) SDAY0420
0030      WRITE (NU,32) YR1, YR, JRCH, ISTA, (I,(MDQT(I,J),J=10,12), SDAY0430
1 (MDQT(I,J),J=1,9),I=1,31) SDAY0440
0031      DO 220 J=1,12 SDAY0450
0032      DO 270 I=1,31 SDAY0460
0033      MDQT(I,J) = DASHES SDAY0470
0034      220 MDQ(I,J) = 0 SDAY0480
0035      RETURN 1 SDAY0490
0036      225 IF (MO.LE.12) RETURN 1 SDAY0500
C      ADVANCE THE CALENDAR YEAR SDAY0510

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0037      MO = 1                                SDAY0520
0038      YR = YR+1                            SDAY0530
      C FIRST ENTRY; INITIALIZE COUNTERS AND VARIABLES. CHECK TO SEE IF SDAY0540
      C THE BEGINNING TIME IS MIDNIGHT OR NOT SDAY0550
0039      330 LDM(2) = 29-(MOD(YR,4)+3)/4        SDAY0560
0040      IF (IFLAG.NE.2) RETURN 1              SDAY0570
0041      JFTNT2 = 1                            SDAY0580
0042      KOUNT = 0                            SDAY0590
0043      CQSUM = 0.5*CQ                       SDAY0600
0044      MNT = 60*HOUR + MNT                   SDAY0610
0045      JFTNT1 = MOD(MNT,1440)                SDAY0620
0046      IFLAG = 1                            SDAY0630
0047      DO 335 J = 1,12                      SDAY0640
0048      DO 335 I = 1,31                      SDAY0650
0049      MDQT(I,J)=DASHES                     SDAY0660
0050      335 MDQ(I,J) = 0                     SDAY0670
0051      IF (MNT.NE.1440) RETURN 1             SDAY0680
0052      JFTNT2 = JULYN(MO,DAY,YR) - JULYN(9,30,YR) SDAY0690
0053      GO TO 215                             SDAY0700
      C LAST ENTRY; PRINT OUT THE OUTSTANDING MEAN DAILY DISCHARGES SDAY0710
      C AND WRITE FOOTNOTES IF NECESSARY SDAY0720
0054      340 IF (KOUNT.GT.0) MDQ(DAY,MO) = (CQSUM-0.5*CQ) / KOUNT SDAY0730
0055      IF (MO.GE.10) YR = YR + 1             SDAY0740
0056      YR1 = YR - 1                          SDAY0750
0057      CALL CONVRT (MDQ,MDQT,M,N)           SDAY0760
0058      WRITE (NU,32) YR1, YR, JRCH, ISTA, (I,(MDQT(I,J),J=10,12), SDAY0770
      1 (MDQT(I,J),J=1,9),I=1,31)              SDAY0780
0059      IF (JFTNT1.GT.0) WRITE (NU,34)        SDAY0790
0060      IF (KOUNT.GT.0) WRITE (NU,35)        SDAY0800
0061      RETURN 1                             SDAY0810
0062      END                                  SDAY0820

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0001      SUBROUTINE SELECT(KTP,RZ,*)                      SLCT0000
          C      **** REFERENCE DATE - FEB. 1, 1972 **** (E,A)      SLCT0010
          C      THIS IS A SUBROUTINE TO BRIDGE THE MAIN PROGRAM AND THE PLOT SUB- SLCT0020
          C      ROUTINES AND ALSO TO TAKE CARE OF SOME HOUSE-KEEPING JOBS. THE  SLCT0030
          C      PROGRAM HAS SEVERAL ENTRIES FOR DIFFERENT OUTPUT OPTIONS.      SLCT0040
          C      PROGRAMED BY C. LAI                                SLCT0050
          C      MODIFIED BY C. A. ONIONS                          SLCT0060
0002      INTEGER HOUR, DAY, YR                                SLCT0070
0003      COMMON MNT, IDELT, DELT, QK(10,20), ZK(10,20)          SLCT0080
0004      COMMON /BDATEA/HOUR, DAY, MO, YR, LDM(12), IFLAG, LABEL SLCT0090
0005      COMMON /BDATB2/MONTH(36), IQORD(5), JRCH, ISTA          SLCT0100
0006      COMMON /BDATEC/ ZORD(5), M1, M2, N1, N2, MRCH(5), NSTA(5), NO SLCT0110
0007      COMMON /BINOUT/ MU, NU                                SLCT0120
0008      DIMENSION KDISA(3), KELVA(3), MARK(5), KNQSUM(5),      SLCT0130
          1      KOMPNO(5), CNZSUM(5), COMPNZ(5), MEANNQ(5),      SLCT0140
          2      AVENZ(5)                                         SLCT0150
0009      EQUIVALENCE (MDSUM,KNQSUM(1)), (KDSUM,KNQSUM(2)),      SLCT0160
          1      (MEANMD,MEANNQ(1)), (MEANKD,MEANNQ(2)),          SLCT0170
          2      (RZSUM,CNZSUM(1)), (CZSUM,CNZSUM(2)), (AVERZ,AVENZ(1)), SLCT0180
          3      (AVECZ,AVENZ(2))                                  SLCT0190
0010      DATA MARK(1)/1H*/ , MARK/1H* , 1H0 , 1HX , 1H8 , 1HS / , SLCT0200
          1      KDISA,KELVA/ 4H DIS , 4HCHAR , 4HGES , 4H ELE , 4HVATI , 4HONS / , SLCT0210
          2      MEA, IQA, KOA, IZA / 4H OBS. , 4H DIS. , 4HCOM. , 4HELVA. / SLCT0220
0011      51 FORMAT (25H NO. OF GAGE RECORDS = , I3, 5X, 6HMQSUM= , I9, 5X, SLCT0230
          1      6HCQSUM= , I9, 5X, 7HMEANMQ= , I7, 5X, 7HMEANCQ= , I7 ) SLCT0240
0012      52 FORMAT (1H0/1H , 40X, 3A4, 2H19, I2, 11X, 3A4, 14H AT STATION , I2, SLCT0250
          1      1H- , I2, 4X, 1A1/ (1H , 85X, 8HSTATION , I2, 1H- , I2, 4X, 1A1)) SLCT0260
0013      53 FORMAT (2H , I2, 1X, I2, 13X, 5(19X, 1H+))          SLCT0270
0014      54 FORMAT (1H )                                         SLCT0280
0015      56 FORMAT (8HODAY HR , 2(1X, 2A4, 1X), 41X, 21HDISCHARGE IN .000CFS /1H , SLCT0290
          1      11X, 1A1, 9X, 1A1, 14X, I4, 4(16X, I4))          SLCT0300
0016      57 FORMAT (8HODAY HR , 2(1X, 2A4, 1X), 41X, 37HELEVATION OF WATER SURFACE SLCT0310
          1      IN FEET / 1H , 11X, 1A1, 9X, 1A1, 13X, F5.1, 4(15X, F5.1 )) SLCT0320
0017      58 FORMAT (1H , 19X, 11(9X, 1HI) / 1H , 19X, 11(9X, 1HI)) SLCT0330
0018      59 FORMAT (25H NO. OF GAGE RECORDS = , I3, 7X, 7HMEANRZ= , F8.3, SLCT0340
          1      7X, 7HMEANCZ= , F8.3 )                          SLCT0350
0019      61 FORMAT (25H NO. OF GAGE RECORDS = , I3, 6X, 14HMEANQ(1...N)= , SLCT0360
          1      5(I9, 5H , ))                                    SLCT0370
0020      62 FORMAT (25H NO. OF GAGE RECORDS = , I3, 6X, 14HMEANZ(1...N)= , SLCT0380
          1      5(F7.3, 5H , ))                                  SLCT0390
          C      SLCT0400
          C      ENTRY POINT FOR IOPTN=8                          SLCT0410
          C      SLCT0420
0021      GO TO (8080, 8075, 8761), IFLAG                        SLCT0430
0022      8075 INTOPN = 4                                         SLCT0440
0023      GO TO 8765                                              SLCT0450
          C      INCREMENT COUNTERS AND ADDERS AND CALL ZPLOT FOR STAGE PLOTTING SLCT0460
0024      8080 KTREC = KTREC+1                                    SLCT0470
0025      KOUNT = KOUNT+1                                         SLCT0480
0026      IF (KTREC.GE.KTP) GO TO 8750                          SLCT0490
0027      8090 CALL ZPLOT(IDAY, IHR, RZ, ZK(ISTA, JRCH) )      SLCT0500
0028      RZSUM = RZSUM + RZ                                     SLCT0510

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0029      CZSUM = CZSUM +ZK(ISTA,JRCH)          SLCT0520
0030      IF (HOUR.LT.24) RETURN1              SLCT0530
0031      GO TO 8751                             SLCT0540
          C                                     SLCT0550
0032      ENTRY SELCT4(KTP,MQ,*)              SLCT0560
          C      ENTRY POINT FOR IOPTN=4        SLCT0570
          C                                     SLCT0580
0033      GO TO (8410,8405,8755), IFLAG        SLCT0590
0034      8405 INTOPN = 1                      SLCT0600
0035      GO TO 8765                             SLCT0610
          C      INCREMENT COUNTERS AND ADDERS, AND CALL QPLOT FOR DISCHARGE
          C      PLOTTING                      SLCT0620
0036      8410 KTREC = KTREC+1                 SLCT0630
0037      KOUNT = KOUNT+1                      SLCT0640
0038      IF (KTREC.GE.KTP) GO TO 8750          SLCT0650
0039      8415 KQ = QK(ISTA,JRCH)              SLCT0660
0040      CALL QPLOT(IDAY,IHR,MQ,KQ )          SLCT0670
0041      KDSUM = KDSUM+KQ                     SLCT0680
0042      MDSUM = MDSUM+MQ                     SLCT0690
0043      IF (HOUR.LT.24) RETURN1              SLCT0700
0044      GO TO 8751                             SLCT0710
          C                                     SLCT0720
0045      ENTRY SELCT6(KTP,*)                 SLCT0730
          C      ENTRY POINT FOR IOPTN=6        SLCT0740
          C                                     SLCT0750
          C                                     SLCT0760
0046      GO TO (8605,8603,8755), IFLAG        SLCT0770
0047      8603 INTOPN = 2                      SLCT0780
0048      DO 8604 I=1,NO                      SLCT0790
0049      IF (MRCH(I).EQ.M1.AND.NSTA(I).EQ.N1) L10 = I  SLCT0800
0050      8604 IF (MRCH(I).EQ.M2.AND.NSTA(I).EQ.N2) L20 = I  SLCT0810
0051      GO TO 8765                             SLCT0820
          C      INCREMENT COUNTERS AND ADDERS, AND CALL NQPLOT FOR MULTIPLE-
          C      DISCHARGE PLOTTING            SLCT0830
0052      8605 KTREC = KTREC+1                 SLCT0840
0053      KOUNT = KOUNT+1                      SLCT0850
0054      IF (KTREC.GE.KTP) GO TO 8750          SLCT0860
0055      8608 DO 8610 I=1,NO                  SLCT0870
0056      MSTATN = MRCH(I)                     SLCT0880
0057      NSTATN = NSTA(I)                     SLCT0890
0058      KOMPNO(I) = QK(NSTATN,MSTATN)        SLCT0900
0059      8610 KNQSUM(I) = KNQSUM(I)+KOMPNO(I)  SLCT0910
0060      CALL NQPLOT(IDAY,IHR,KOMPNO,NO,L10,L20) SLCT0920
0061      IF (HOUR.LT.24) RETURN1              SLCT0930
0062      GO TO 8751                             SLCT0940
          C                                     SLCT0950
          C                                     SLCT0960
0063      ENTRY SELCT7(KTP,*)                 SLCT0970
          C      ENTRY POINT FOR IOPTN=7        SLCT0980
          C                                     SLCT0990
0064      GO TO (8705,8703,8761), IFLAG        SLCT1000
0065      8703 INTOPN = 3                      SLCT1010
0066      DO 8704 I=1,NO                      SLCT1020
0067      IF (MRCH(I).EQ.M1.AND.NSTA(I).EQ.N1) L10 = I  SLCT1030

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0068      8704  IF (MRCH(I).EQ.M2.AND.NSTA(I).EQ.N2) L20 = I          SLCT1040
0069      GO TO 8765                                                  SLCT1050
C      INCREMENT COUNTERS AND ADDERS, AND CALL NZPLOT FOR MULTIPLE-  SLCT1060
C      STAGE PLOTTING                                              SLCT1070
0070      8705  KTREC = KTREC+1                                       SLCT1080
0071      KOUNT = KOUNT+1                                             SLCT1090
0072      IF (KTREC.GE.KTP) GO TO 8750                               SLCT1100
0073      8708  DO 8710 I=1,NO                                         SLCT1110
0074      MSTATN = MRCH(I)                                           SLCT1120
0075      NSTATN = NSTA(I)                                           SLCT1130
0076      COMPNZ(I) = ZK(NSTATN,MSTATN)                               SLCT1140
0077      8710  CNZSUM(I) = CNZSUM(I)+COMPNZ(I)                       SLCT1150
0078      CALL NZPLOT(IDAY,IHR,COMPNZ,NO,L10,L20)                     SLCT1160
0079      IF (HOUR.LT.24) RETURN1                                     SLCT1170
0080      GO TO 8751                                                  SLCT1180
C      HOUR INCREMENT                                              SLCT1190
0081      8750  HOUR = HOUR+IN HOUR                                     SLCT1200
0082      IHR = HOUR                                                  SLCT1210
0083      KTREC = 0                                                    SLCT1220
0084      IF (HOUR.GT.24) GO TO 8751                                   SLCT1230
0085      GO TO (8415,8608,8708,8090), INTOPN                         SLCT1240
C      DAY INCREMENT                                              SLCT1250
0086      8751  DAY = DAY + 1                                          SLCT1260
0087      IDAY = DAY                                                  SLCT1270
0088      HOUR = 0                                                    SLCT1280
0089      IHR = 0                                                    SLCT1290
0090      IF (INTOPN.GE.3) GO TO 8761                                 SLCT1300
0091      8755  IF (IFLAG.EQ.3.AND.KOUNT.EQ.0) RETURN1               SLCT1310
C      PRINT MEAN DAILY VALUES AND RESET THE ADDERS              SLCT1320
0092      DO 8757 I=1,NO                                             SLCT1330
0093      8757  MEANNQ(I) = KNQSUM(I)/KOUNT                           SLCT1340
0094      IF (INTOPN.EQ.1) WRITE(NU,51) KOUNT,MDSUM,KDSUM,MEANMD,MEANKD SLCT1350
0095      IF (INTOPN.EQ.2) WRITE(NU,61) KOUNT,(MEANNQ(I),I=1,NO)     SLCT1360
0096      IF (IFLAG.EQ.3) RETURN 1                                    SLCT1370
0097      DO 8760 I=1,NO                                             SLCT1380
0098      8760  KNQSUM(I) = 0                                          SLCT1390
0099      GO TO 8764                                                  SLCT1400
0100      8761  IF (IFLAG.EQ.3.AND.KOUNT.EQ.0) RETURN1               SLCT1410
0101      DO 8762 I=1,NO                                             SLCT1420
0102      8762  AVENZ(I) = CNZSUM(I)/FLOAT(KOUNT)                   SLCT1430
0103      IF (INTOPN.EQ.4) WRITE(NU,59) KOUNT,AVERZ,AVECZ           SLCT1440
0104      IF (INTOPN.EQ.3) WRITE(NU,62) KOUNT,(AVENZ(I),I=1,NO)     SLCT1450
0105      IF (IFLAG.EQ.3) RETURN 1                                    SLCT1460
0106      DO 8763 I=1,NO                                             SLCT1470
0107      8763  CNZSUM(I) = 0.0                                       SLCT1480
C      MONTH AND YEAR INCREMENT                                   SLCT1490
0108      8764  KOUNT = 0                                             SLCT1500
0109      IF (DAY.LE.LDM(MO)) RETURN1                                 SLCT1510
0110      DAY = 1                                                     SLCT1520
0111      IDAY = 1                                                    SLCT1530
0112      MO = MO + 1                                                 SLCT1540
0113      IF (MO.LE.12) GO TO 8768                                   SLCT1550

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0114      MO = 1                                SLCT1560
0115      YR = YR + 1                            SLCT1570
0116      8765 LDM(2) = 29-(MOD(YR,4)+3)/4        SLCT1580
C      PRINT HEADINGS, READINGS, AND SCALES FOR THE PLOTTING SLCT1590
0117      8768 GO TO (8770,8772,8776,8774), INTOPN SLCT1600
0118      8770 WRITE (NU,52) MONTH(3*MO-2),MONTH(3*MO-1),MONTH(3*MO), YR, SLCT1610
1          (KDISA(I),I=1,3), JRCH,ISTA          SLCT1620
0119      WRITE (NU,56) MEA, IQA, KOA, IQA, MARK(1), MARK(2), SLCT1630
1          (IQORD(I),I=1,5)                     SLCT1640
0120      GO TO 8780                            SLCT1650
0121      8772 WRITE (NU,52) MONTH(3*MO-2),MONTH(3*MO-1),MONTH(3*MO), YR, SLCT1660
1          (KDISA(I),I=1,3), (MRCH(I),NSTA(I),MARK(1),I=1,NO) SLCT1670
0122      WRITE (NU,56) KOA, IQA, KOA, IQA, MARK(L10), MARK(L20), SLCT1680
1          (IQORD(I),I=1,5)                     SLCT1690
0123      GO TO 8780                            SLCT1700
0124      8774 WRITE (NU,52) MONTH(3*MO-2),MONTH(3*MO-1),MONTH(3*MO), YR, SLCT1710
1          (KELVA(I),I=1,3), JRCH,ISTA          SLCT1720
0125      WRITE (NU,57) MEA, IZA, KOA, IZA, MARK(1), MARK(2), SLCT1730
1          (ZORD(I),I=1,5)                     SLCT1740
0126      GO TO 8780                            SLCT1750
0127      8776 WRITE (NU,52) MONTH(3*MO-2),MONTH(3*MO-1),MONTH(3*MO), YR, SLCT1760
1          (KELVA(I),I=1,3), (MRCH(I),NSTA(I),MARK(1),I=1,NO) SLCT1770
0128      WRITE (NU,57) KOA, IZA, KOA, IZA, MARK(L10), MARK(L20), SLCT1780
1          (ZORD(I),I=1,5)                     SLCT1790
0129      8780 WRITE (NU,58)                    SLCT1800
0130      IF (IFLAG.EQ.1) RETURN 1              SLCT1810
0131      IFLAG = 1                             SLCT1820
C      CLEAR THE ADDERS                        SLCT1830
0132      IF(INTOPN.EQ.1 .OR. INTOPN.EQ.4) NO = 2 SLCT1840
0133      IF(INTOPN.EQ.3 .OR. INTOPN.EQ.4) GO TO 8795 SLCT1850
0134      DO 8790 I=1,NO                        SLCT1860
0135      8790 KNQSUM(I) = 0                    SLCT1870
0136      GO TO 8800                            SLCT1880
0137      8795 DO 8797 I=1,NO                  SLCT1890
0138      8797 CNZSUM(I) = 0.0                 SLCT1900
C      INITIALIZE COUNTERS, SPACERS, AND TIME PARAMETERS SLCT1910
0139      8800 KOUNT = 1                       SLCT1920
0140      INHOUR =KTP*IDELT/60                  SLCT1930
0141      LFHR = MOD(HOUR,INHOUR)               SLCT1940
0142      HOUR = HOUR-LFHR                     SLCT1950
0143      KTREC=(60*LFHR+MNT)/IDELT            SLCT1960
0144      IDAY = DAY                           SLCT1970
0145      IHR = HOUR                           SLCT1980
0146      IF(KTREC.EQ.0) GO TO 8890             SLCT1990
0147      WRITE (NU,53) IDAY, IHR              SLCT2000
0148      IDAY = 0                             SLCT2010
0149      IHR = 0                              SLCT2020
0150      KT2=KTREC-1                          SLCT2030
0151      IF (KT2.LT.1) GO TO 8900             SLCT2040
0152      DO 8880 I=1,KT2                      SLCT2050
0153      8880 WRITE (NU,54)                   SLCT2060
0154      GO TO 8900                           SLCT2070

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0155      8890 IF (HOUR.NE.0) GO TO 8900
0156          DAY = DAY-1
0157          IDAY = 0
0158          HOUR = 24
0159          IHR = HOUR
0160      8900 GO TO (8415,8608,8708,8090), INTOPN
0161          END
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SLCT2080
SLCT2090
SLCT2100
SLCT2110
SLCT2120
SLCT2130
SLCT2140
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Line	Code	Statement	Address
0001		SUBROUTINE ADAPT5(TP,CQ,*)	SAD50000
	C	**** REFERENCE DATE - FEB. 1, 1972 **** (E,A)	SAD50010
	C	THIS IS A SUBROUTINE TO PRINT OUT DISCHARGE AT GIVEN TIME INTERVAL	SAD50020
	C	IN TABULAR FORM	SAD50030
	C	PROGRAMED BY C. LAI	SAD50040
	C	REVISED BY C. A. ONIONS AND V. S. FOSTER	SAD50050
0002		INTEGER HOUR, DAY, YR, TREC, TP, Q	SAD50060
0003		REAL*8 IQT(20,1), BLANKS/' '	SAD50070
0004		COMMON MNT, IDELT	SAD50080
0005		COMMON /BDATEA/HOUR, DAY, MO, YR, LDM(12), IFLAG, LABEL	SAD50090
0006		COMMON /BINOUT/ MU, NU	SAD50100
0007		DIMENSION Q(20,1)	SAD50110
0008		DATA M, N /20,1/	SAD50120
0009		16 FORMAT (1H, 12X, I2, 4X, 10(2X, A8)/1H, 18X, 10(2X, A8))	SAD50130
0010		17 FORMAT (1HO/2H, I2, 1H/, I2, 1H/, I2, 3X, 2HHR, 15X, 30HDISCHARGE (	SAD50140
		1IN CFS) AT EVERY, I2, 17H MINUTE INTERVAL)	SAD50150
	C		SAD50160
0011		GO TO (700, 709, 715), IFLAG	SAD50170
	C	ROUTINE ENTRY	SAD50180
0012		700 TREC = TREC+1	SAD50190
0013		Q(TREC,1) = CQ	SAD50200
0014		IF (TREC.NE.TP) RETURN 1	SAD50210
0015		704 CALL CONVRT (Q, IQT, M, N)	SAD50220
0016		IF (HOUR.EQ.24) TREC = 1	SAD50230
	C	PRINT ONE LINE (OR ONE GROUP) OF DISCHARGES	SAD50240
0017		705 WRITE (NU, 16) HOUR, (IQT(I,1), I=1, TREC)	SAD50250
0018		TREC = 0	SAD50260
	C	TIME AND DATE ADVANCING	SAD50270
0019		HOUR = HOUR+IN HOUR	SAD50280
0020		IF (HOUR.LT.25) RETURN 1	SAD50290
0021		TREC = TP-ITP	SAD50300
0022		IF (TREC.EQ.1) RETURN 1	SAD50310
0023		IQT(1,1) = BLANKS	SAD50320
0024		DAY = DAY+1	SAD50330
0025		HOUR = 0	SAD50340
0026		IF (DAY.LE.LDM(MO)) GO TO 710	SAD50350
0027		DAY = 1	SAD50360
0028		MO = MO+1	SAD50370
0029		IF (MO.LE.12) GO TO 710	SAD50380
0030		MO = 1	SAD50390
0031		YR = YR+1	SAD50400
0032		709 LDM(2) = 29-(MOD(YR,4)+3)/4	SAD50410
0033		IF (IFLAG.EQ.1.OR.HOUR+MNT.NE.0) GO TO 710	SAD50420
0034		HOUR = 24	SAD50430
0035		DAY = DAY -1	SAD50440
0036		GO TO 712	SAD50450
	C	FIRST ENTRY; PRINT DATE AND HEADING, INITIALIZE COUNTERS AND	SAD50460
	C	TIME PARAMETERS	SAD50470
0037		710 WRITE (NU, 17) MO, DAY, YR, IDELT	SAD50480
0038		IF (IFLAG.NE.2) GO TO 705	SAD50490
0039		712 IFLAG = 1	SAD50500
0040		ITP = 0	SAD50510

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0041      INHOUR = TP*IDELT/60
0042      LFHR = MOD(HOUR,INHOUR)
0043      HOUR = HOUR-LFHR
0044      TREC = (60*LFHR+MNT)/IDELT
0045          DO 713 I=1,TREC
0046              IQT(I,1)=BLANKS
0047 713      Q(I,1) = 0
0048          GO TO 700
0049 715 IF (TREC.EQ.0) RETURN 1
0050      ITP = TP-TREC
0051      GO TO 704
0052      END
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SAD50520
SAD50530
SAD50540
SAD50550
SAD50560
SAD50570
SAD50580
SAD50590
SAD50600
SAD50610
SAD50620
SAD50630
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0001	SUBROUTINE CONVRT (INQ,IOUTQ,M,N)	CONV0000
	C **** REFERENCE DATE - FEB. 9, 1974 ****	CONV0010
	C THIS SUBROUTINE CONVERTS NUMERICAL VALUES TO BCD CHARACTERS,	CONV0020
	C USED IN CONJUNCTION WITH SUBROUTINES ADAPT5 & DAILY.	CONV0030
0002	REAL*8 IOUTQ(M,N)	CONV0040
0003	COMMON /BINOUT/ MU, NU	CONV0050
0004	DIMENSION INQ(M,N)	CONV0060
0005	10 FORMAT (I8)	CONV0070
0006	DO 100 I=1,M	CONV0080
0007	DO 100 J=1,N	CONV0090
0008	IF (INQ(I,J).EQ.0) GO TO 100	CONV0100
0009	CALL CORE(IOUTQ(I,J),8)	CONV0110
0010	WRITE (NU,10) INQ(I,J)	CONV0120
0011	100 CONTINUE	CONV0130
0012	RETURN	CONV0140
0013	END	CONV0150

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0001      SUBROUTINE ZPLOT (IDAY,IHR,RZ,CZ)                                SZPL0000
C      **** REFERENCE DATE - FEB. 1, 1972 ****                          SZPL0010
C      THIS IS A SUBROUTINE TO PLOT MEASURED AND COMPUTED QUANTITIES    SZPL0020
C      AGAINST TIME FOR COMPARISON.                                       SZPL0030
C      INTEGER VALUES ARE ENTERED FROM QPLOT AND REALS FROM ZPLOT.     SZPL0040
C      PROGRAMED BY C. LAI                                                SZPL0050
C      CHECKED BY C. LAI ,                                                SZPL0060
0002      COMMON /BQPLOT/ IBLANK(105),ISCL,ISCLH,MINQ                     SZPL0070
0003      COMMON /BINOUT/ MU, NU                                           SZPL0080
0004      DATA JBLANK,ISTAR,IZER0,IPLUS / 1H ,1H*,1H0,1H+ /           SZPL0090
1      , FCTR /1000.0/                                                    SZPL0100
0005      21 FORMAT (7H **** , 2I10,6X,32H QUANTITY MUCH TOO LARGE TO PLOT) SZPL0110
0006      22 FORMAT (7H **** , 2I10,6X,32H QUANTITY MUCH TOO SMALL TO PLOT) SZPL0120
0007      23 FORMAT (2H ,I2,1X,I2,2I10,105A1)                             SZPL0130
0008      24 FORMAT (2H ,5X, 2I10, 105A1 )                                SZPL0140
0009      25 FORMAT (2H , 3X, I2, 2I10, 105A1 )                           SZPL0150
0010      33 FORMAT (2H ,I2,1X,I2,2F10.3, 105A1)                          SZPL0160
0011      34 FORMAT (2H , 5X,      2F10.3, 105A1)                         SZPL0170
0012      35 FORMAT (2H , 3X, I2,2F10.3, 105A1)                           SZPL0180
0013      M =1                                                              SZPL0190
0014      MQ = FCTR*RZ                                                       SZPL0200
0015      KQ = FCTR*CZ                                                       SZPL0210
0016      GO TO 2005                                                         SZPL0220
C      ENTRY QPLOT (IDAY,IHR,MQT,KQT)                                     SZPL0230
C      M = 2                                                                SZPL0240
0018      MQ = MQT                                                            SZPL0250
0019      KQ = KQT                                                            SZPL0260
0020      KQ = KQT                                                            SZPL0270
C      CONVERT MEASURED AND COMPUTED QUANTITIES TO NUMBER OF COLUMNS    SZPL0280
C      COUNTING FROM THE LOWER MARGIN                                     SZPL0290
0021      2005 MQMMIN = MQ-MINQ                                              SZPL0300
0022      KQMMIN = KQ-MINQ                                                  SZPL0310
0023      MQS = ( MQMMIN + ISIGN(ISCLH,MQMMIN)) / ISCL + 3                 SZPL0320
0024      KQS = ( KQMMIN + ISIGN(ISCLH,KQMMIN)) / ISCL + 3                 SZPL0330
C      OFFSET ANY CURVE TO CENTER WHENEVER THE UPPER OR LOWER MARGIN    SZPL0340
C      MARGIN IS EXCEEDED                                                 SZPL0350
C      DO 2010 I=1,10                                                      SZPL0360
0025      IF (MQS.LE.103) GO TO 2020                                        SZPL0370
0026      MQS=MQS-50                                                         SZPL0380
0027      2010 MQS=MQS-50                                                    SZPL0390
0028      GO TO 2040                                                         SZPL0400
0029      2020 DO 2030 I=1,10                                                SZPL0410
0030      IF (KQS.LE.103) GO TO 2050                                        SZPL0420
0031      KQS=KQS-50                                                         SZPL0430
0032      2040 WRITE (NU,21) MQ, KQ                                         SZPL0440
0033      GO TO 2140                                                         SZPL0450
0034      2050 DO 2060 I=1,10                                                SZPL0460
0035      IF (MQS.GE.3) GO TO 2070                                          SZPL0470
0036      MQS=MQS+50                                                         SZPL0480
0037      GO TO 2090                                                         SZPL0490
0038      2070 DO 2080 I=1,10                                                SZPL0500
0039      IF (KQS.GE.3) GO TO 2100                                          SZPL0510

```

0040	2080	KQS=KQS+50	SZPL0520
0041	2090	WRITE (NU,22) MQ, KQ	SZPL0530
0042	2140	IHR = 0	SZPL0540
0043		RETURN	SZPL0550
	C	PLOT MEASURED AND COMPUTED QUANTITIES ON THE SAME LINE. PLOT	SZPL0560
	C	GRID POINTS AT SPECIFIED TIME INTERVALS	SZPL0570
0044	2100	IF (IHR.EQ.0) GO TO 2300	SZPL0580
0045		DO 2200 I=13,93,20	SZPL0590
0046	2200	IBLANK(I) = IPLUS	SZPL0600
0047		IBLANK(KQS) = IZERO	SZPL0610
0048		IBLANK(MQS) = ISTAR	SZPL0620
0049		IF (IDAY.NE.0) GO TO 2205	SZPL0630
0050		IF (M.EQ.2) GO TO 2202	SZPL0640
0051		WRITE (NU,35) IHR, RZ, CZ, (IBLANK(J),J=1,105)	SZPL0650
0052		GO TO 2207	SZPL0660
0053	2202	WRITE (NU,25) IHR, MQ, KQ, (IBLANK(J),J=1,105)	SZPL0670
0054		GO TO 2207	SZPL0680
0055	2205	IF (M.EQ.2) GO TO 2206	SZPL0690
0056		WRITE (NU,33) IDAY, IHR, RZ, CZ, (IBLANK(J),J=1,105)	SZPL0700
0057		GO TO 22061	SZPL0710
0058	2206	WRITE (NU,23) IDAY, IHR, MQ, KQ, (IBLANK(J),J=1,105)	SZPL0720
0059	22061	IDAY = 0	SZPL0730
0060	2207	IHR = 0	SZPL0740
0061		DO 2210 J=1,105	SZPL0750
0062	2210	IBLANK(J) = JBLANK	SZPL0760
0063		RETURN	SZPL0770
0064	2300	IBLANK(KQS) = IZERO	SZPL0780
0065		IBLANK(MQS) = ISTAR	SZPL0790
0066		IF (M.EQ.2) GO TO 2302	SZPL0800
0067		WRITE (NU,34) RZ, CZ, (IBLANK(J),J=1,105)	SZPL0810
0068		GO TO 2305	SZPL0820
0069	2302	WRITE (NU,24) MQ, KQ, (IBLANK(J),J=1,105)	SZPL0830
0070	2305	IBLANK(KQS) = JBLANK	SZPL0840
0071		IBLANK(MQS) = JBLANK	SZPL0850
0072		RETURN	SZPL0860
0073		END	SZPL0870

```

0001      SUBROUTINE NZPLOT(IDAY,IHR,ZN,NO,L1,L2)
C          **** REFERENCE DATE - MAY 16, 1974
C          THIS IS A SUBROUTINE TO PLOT N QUANTITIES SIMULTANEOUSLY. CURVES
C          CAN BE OFFSET TO THE CENTER WHENEVER THEY EXCEED THE UPPER OR
C          LOWER MARGINS. NOTICE THE PRIORITY OF CURVES WHEN THEY COINCIDE.
C          PROGRAMED BY C. LAI
C          CHECKED BY C. LAI ,
C          VERSION 3 ( MAY 26, 1974 )
0002      COMMON /BQPLOT/ IBLANK(105),ISCL,ISCLH,MINQ
0003      COMMON /BINOUT/ MU, NU
0004      DIMENSION NQ(5),NQS(5),ZN(5),NQMMIN(5),MARK(5),NQT(5)
0005      DATA JBLANK, IPLUS, MARK / ' ', '+', '*', '0', 'X', '8', 'S' /,
1          FCTR / 1000.0 /
0006      31 FORMAT (6H NQ(,I1,4H) = ,I12, 10X,
1          32HQQUANTITY MUCH TOO LARGE TO PLOT )
0007      32 FORMAT (6H NQ(,I1,4H) = ,I12, 10X,
1          32HQQUANTITY MUCH TOO SMALL TO PLOT )
0008      33 FORMAT (2H ,I2,1X,I2,2I10,105A1)
0009      34 FORMAT (2H ,5X, 2I10, 105A1 )
0010      35 FORMAT (2H , 3X, I2, 2I10, 105A1 )
0011      43 FORMAT (2H ,I2,1X,I2,2F10.3, 105A1)
0012      44 FORMAT (2H , 5X, 2F10.3, 105A1)
0013      45 FORMAT (2H , 3X, I2,2F10.3, 105A1)
0014      DO 3005 I=1,NO
0015      3005 NQ(I) = FCTR*ZN(I)
0016      M = 1
0017      GO TO 3008
C
0018      ENTRY NQPLOT (IDAY,IHR,NQT,NO,L1,L2)
C
0019      DO 3006 I=1,5
0020      3006 NQ(I) = NQT(I)
0021      M = 2
C      CONVERT THE COMPUTED QUANTITIES TO NUMBER OF COLUMNS
0022      3008 DO 3110 I=1,NO
0023      NQMMIN(I) = NQ(I)-MINQ
0024      NQS(I) = (NQMMIN(I)+ISIGN(ISCLH,NQMMIN(I)))/ISCL + 3
C      OFFSET ANY CURVE TO THE CENTER IF IT RUNS OUT OF MARGINS
0025      DO 3010 J=1,10
0026      IF (NQS(I).LE.103) GO TO 3050
0027      3010 NQS(I) = NQS(I)-50
0028      WRITE (NU,31) I, NQ(I)
0029      GO TO 3100
0030      3050 DO 3060 J=1,10
0031      IF (NQS(I).GE.3) GO TO 3110
0032      3060 NQS(I) = NQS(I)+50
0033      WRITE (NU,32) I, NQ(I)
0034      3100 IHR = 0
0035      RETURN
0036      3110 CONTINUE
C      PLOT COMPUTED QUANTITIES ON THE SAME LINE. PLOT GRID POINTS AT
C      SPECIFIED TIME INTERVALS.

```

NZQP0000
 NZQP0010
 NZQP0020
 NZQP0030
 NZQP0040
 NZQP0050
 NZQP0060
 NZQP0070
 NZQP0080
 NZQP0090
 NZQP0100
 NZQP0110
 NZQP0120
 NZQP0130
 NZQP0140
 NZQP0150
 NZQP0160
 NZQP0170
 NZQP0180
 NZQP0190
 NZQP0200
 NZQP0210
 NZQP0220
 NZQP0230
 NZQP0240
 NZQP0250
 NZQP0260
 NZQP0270
 NZQP0280
 NZQP0290
 NZQP0300
 NZQP0310
 NZQP0320
 NZQP0330
 NZQP0340
 NZQP0350
 NZQP0360
 NZQP0370
 NZQP0380
 NZQP0390
 NZQP0400
 NZQP0410
 NZQP0420
 NZQP0430
 NZQP0440
 NZQP0450
 NZQP0460
 NZQP0470
 NZQP0480
 NZQP0490
 NZQP0500
 NZQP0510

```

0037      IF (IHR.EQ.0) GO TO 3300
0038      DO 3200 I=13,93,20
0039      3200  IBLANK(I) = IPLUS
0040      3300  DO 3310 I=1,N0
0041      3310  IBLANK(NQS(I)) = MARK(I)
0042      IF (IHR.EQ.0) GO TO 3330
0043      IF (IDAY.EQ.0) GO TO 3320
0044      IF (M.EQ.1) WRITE(NU,43) IDAY, IHR, ZN(L1), ZN(L2),
1          (IBLANK(J),J=1,105)
0045      IF (M.EQ.2) WRITE(NU,33) IDAY, IHR, NQ(L1), NQ(L2),
1          (IBLANK(J),J=1,105)
0046      IDAY = 0
0047      GO TO 3325
0048      3320 IF (M.EQ.1) WRITE(NU,45) IHR, ZN(L1),ZN(L2), (IBLANK(J),J=1,105)
0049      IF (M.EQ.2) WRITE(NU,35) IHR, NQ(L1),NQ(L2), (IBLANK(J),J=1,105)
0050      3325 IHR = 0
0051      GO TO 3340
0052      3330 IF (M.EQ.1) WRITE(NU,44) ZN(L1), ZN(L2), (IBLANK(J),J=1,105)
0053      IF (M.EQ.2) WRITE(NU,34) NQ(L1), NQ(L2), (IBLANK(J),J=1,105)
0054      3340 DO 3350 J=1,105
0055      3350  IBLANK(J) = JBLANK
0056      RETURN
0057      END

```

NZQP0520
 NZQP0530
 NZQP0540
 NZQP0550
 NZQP0560
 NZQP0570
 NZQP0580
 NZQP0590
 NZQP0600
 NZQP0610
 NZQP0620
 NZQP0630
 NZQP0640
 NZQP0650
 NZQP0660
 NZQP0670
 NZQP0680
 NZQP0690
 NZQP0700
 NZQP0710
 NZQP0720
 NZQP0730
 NZQP0740

0001		BLOCK DATA	BLKD0000
	C	(E)	BLKD0010
0002		COMMON /BDATB2/MONTH(36),IQORD(5),JRCH,ISTA	BLKD0020
0003		COMMON /BDATEA/HOUR,DAY,MO,YR,LDM(12),IFLAG,LABEL	BLKD0030
0004		COMMON /BMECNV/ G, SQMC, FFCOU	BLKD0040
0005		COMMON /BINOUT/ MU, NU	BLKD0050
0006		DATA MONTH / 'JANU','ARY ',' ','FEBR','UARY',' ','MARC',	BLKD0060
	1	'H ',' ','APRI','L ',' ','MAY ',' '	BLKD0070
	2	' ','JUNE',' ',' ','JULY',' ',' '	BLKD0080
	3	'AUGU','ST ',' ','SEPT','EMBE','R ','OCTO',	BLKD0090
	4	'BER ',' ','NOVE','MBER',' ','DECE','MBER',	BLKD0100
	5	' /, LDM /31,28,31,30,31,30,31,31,30,31,30,31/,	BLKD0110
	6	MU/5/, NU/6/, G/32.16/, SQMC/2.2082/, FFCOU/5280./	BLKD0120
0007		END	BLKD0130

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Sample set up of input data decks

11 1 1 1 1 0

CONNECTICUT RIVER BETWEEN BISSEL BRIDGE AND HADDAM MARINA

0 0 0 0 0 0 0 0 0 0

10	373	2075	623	3884	723	4740	823	5735	923	6818	0A015
	1023	7959	1123	9155	1223	10407	1323	11713	1423	13074	1A015
10	373	556	623	813	723	926	823	1055	923	1068	0B015
	1023	1169	1123	1224	1223	1279	1323	1334	1423	1389	1B015
9	807	6622	957	7523	1057	8820	1157	9775	1257	10781	0A025
	1357	11838	1457	12946	1557	14105	1657	15314			1A025
9	807	821	957	885	1057	928	1157	981	1257	1032	0B025
	1357	1082	1457	1133	1557	1184	1657	1235			1B025
10	899	6638	999	7392	1099	8174	1199	9005	1299	10032	0A035
	1399	11068	1499	12863	1599	14666	1699	16720	1799	19050	1A035
10	899	739	999	768	1099	797	1199	897	1299	1156	0B035
	1399	1415	1499	1674	1599	1933	1699	2192	1799	2451	1B035
10	894	5163	1094	6416	1194	7108	1294	7847	1394	8635	0A045
	1494	9474	1594	10366	1694	11310	1794	12306	1894	13354	1A045
10	894	578	1094	673	1194	710	1294	762	1394	814	0B045
	1494	866	1594	918	1694	970	1794	1022	1894	1074	1B045
10	849	6119	1049	7016	1149	7858	1249	8758	1349	9717	0A055
	1449	10716	1549	11757	1649	12837	1749	13959	1849	15120	1A055
10	849	721	1049	816	1149	869	1249	904	1349	979	0B055
	1449	1020	1549	1060	1649	1101	1749	1142	1849	1182	1B055
10	831	4881	1031	6141	1131	6854	1231	7636	1331	8493	0A065
	1431	9432	1531	10418	1631	11468	1731	12575	1831	13754	1A065
10	831	587	1031	686	1131	742	1231	804	1331	888	0B065
	1431	953	1531	1018	1631	1082	1731	1147	1831	1212	1B065
10	935	7318	1135	8974	1235	9893	1335	10900	1435	12010	0A075
	1535	13222	1635	14537	1735	15954	1835	17473	1935	19095	1A075
10	935	781	1135	865	1235	956	1335	1058	1435	1161	0B075
	1535	1264	1635	1366	1735	1469	1835	1571	1935	1673	1B075
7	742	44430	942	60080	1142	78400	1342	100890	1542	124600	0A085
	1742	152490	1942	185500							1A085
4	1342	11750	1542	12550	1742	13550	1942	14580			0B085
4	843	49400	1243	76900	1843	131000	2643	214000			1B085
5	843	5860	1043	6980	1443	8720	1843	9980	2643	10900	0A095
10	797	51230	997	65550	1197	82800	1397	106280	1597	123070	1A095
	1797	145380	1997	169120	2197	194290	2397	220900	2597	248960	0B095
10	797	6420	997	7900	1197	9370	1397	10020	1597	10800	1B095
	1797	11510	1997	12230	2197	12950	2397	13670	2597	14390	2B095

1 a. Options, reach identification, reach geom
2 initial data, stage and discharge data for
3 the Connecticut River between Bissel Bri
4 and Haddam Marina, Sept. 7, 1966 (IØPTN :

109-

10	591	35750	791	49260	991	60420	1191	87320	1391	1140601A115
10	1591	146060	1791	182660	1991	224580	2191	271860	2391	3244602A115
10	591	6060	791	7420	991	9440	1191	11740	1391	1500018115
10	1591	17000	1791	19600	1991	22310	2191	24970	2391	2762028115
10	18800	1218	065	00270	3-0245000	19400000400				
10	12330	1175	0450	262	2	-180	-242			
10	18600	1179	034	255	3	-274	-314			
10	19625	1182	020	248	3	-315	-385			
10	19720	1185	003	246	3	-422	-450			
10	18210	1187	-014	242	3	-539	-679			
10	14330	1188	-030	240	2	-690	-740			
10	120000	1194	-0475	258	2	-742	-755			
10	204000	1195	-0485	256	3	005	-903	-915		
10	189100	11940	-0500	253	3	004	-997	-1010		
10	139900	11915	-0515	254	2	004	-851	-855		
10	11890	11890	-052	005	005					
15	4	9	7	66	4	45	500	005	005	005
15	1223i)	1186ii)	-	7065iii)	1243	1202	1199	1198	6609070500	viii)
15	1228	1179	-	5993	1256	1204	1201	1196	6609070515	
15	1235	1170	-	4798	1269	1205	1201	1193	6609070530	
15	1242	1160	-	3387	1280	1207	1199	1187	6609070545	
15	1250	1149	-	1215	1291	1206	1195	1179	6609070600	
15	1258	1139		1252	1301	1202	1189	1171	6609070615	
15	1265	1127		3609	1306	1195	1181	1162	6609070630	
15	1270	1116		6429	1311	1188	1173	1154	6609070645	
15	1275	1105		8529	1313	1180	1165	1144	6609070700	
15	1278	1094		10207	1312	1172	1155	1135	6609070715	
15	1278	1084		11953	1309	1163	1147	1125	6609070730	
15	1274	1074		13248	1303	1155	1135	1117	6609070745	
15	1276	1064		14069	1296	1148	1126	1106	6609070800	
15	1272	1053		14595	1299	1139	1116	1097	6609070815	
15	1268	1043		15017	1282	1130	1106	1087	6609070830	
15	1264	1034		15427	1275	1122	1098	1076	6609070845	
15	1259	1026		15666	1268	1112	1087	1057	6609070900	
15	1254	1019		16318	1261	1105	1079	1058	6609070915	
15	1250	1012		16206	1254	1097	1071	1050	6609070930	
15	1244	1004		16197	1247	1088	1061	1041	6609070945	
15	1240	999		16030	1240	1080	1053	1036	6609071000	
15	1235	994		15695	1232	1072	1045	1026	6609071015	
15	1230	990		15527	1226	1064	1039	1020	6609071030	
15	1226	986		15265	1219	1058	1032	1015	6609071045	
15	1221	985		14755	1212	1050	1025	1010	6609071100	
15	1216	984		14593	1205	1045	1020	1006	6609071115	
15	1211	986		14507	1198	1039	1015	1003	6609071130	
15	1206	992		14101	1190	1034	1011	1001	6609071145	
15	1202	999		13660	1184	1030	1004	1001	6609071200	
15	1199	1009		13209	1177	1027	1006	1003	6609071215	
15	1195	1022		12683	1171	1026	1009	1009	6609071230	
15	1192	1037		11544	1165	1025	1014	1017	6609071245	
15	1190	1054		10189	1158	1029	1020	1029	6609071300	
15	1189	1072		9168	1153	1034	1031	1044	6609071315	
15	1188	1090		7382	1148	1043	1045	1064	6609071330	
15	1187	1107		5164	1144	1057	1063	1083	6609071345	
15	1187	1126		2107	1139	1076	1082	1100	6609071400	
15	1187	1139	-	927	1136	1095	1101	1118	6609071415	
15	1187	1151	-	3302	1134	1113	1119	1133	6609071430	
15	1186	1165	-	5644	1133	1130	1135	1147	6609071445	
15	1186	1180	-	7154	1135	1145	1149	1161	6609071500	
15	1187	1189	-	8673	1140	1159	1163	1173	6609071515	
15	1188	1199	-	9620	1152	1171	1175	1185	6609071530	
15	1190	1207	-	10337	1170	1183	1187	1197	6609071545	
15	1194	1214	-	11247	1193	1193	1197	1206	6609071600	
15	1199	1220	-	11890	1215	1202	1206	1213	6609071615	
15	1209	1226	-	12090	1235	1210	1213	1221	6609071630	

0A115

87320 1391 1140601A115

271860 2391 3244602A115

0B115

11740 1391 1500018115

24970 2391 2762028115

BISSEL BRIDGE 16

HARTFORD 26

HOCKANUM 36

GLASTONBURY 46

S. GLASTONBURY 56

DIVIDEND 66

GILDERSLEEVE 76

ARRIGONI BRIDGE 86

BODKIN ROCK 96

CANAL PIER 106

ROCK LANDING BAR 116

HADDAM MARINA 126

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1221	1227	-12042	1254	1217	1220	1226
1233	1226	-11813	1271	1224	1226	1230
1246	1221	-11253	1286	1230	1231	1231
1258	1216	-10599	1300	1237	1234	1231
1269	1208	-8478	1312	1241	1236	1228
1280	1198	-6618	1324	1245	1236	1224
1291	1189	-3449	1334	1245	1235	1218
1300	1179	-953	1343	1244	1231	1213
1311	1169	2472	1352	1241	1227	1206
1318	1159	5709	1357	1235	1220	1198

6609071645
6609071700
6609071715
6609071730
6609071745
6609071800
6609071815
6609071830
6609071845
6609071900

The first data deck ends with MØPTN = 4. For the selection of MØPTN value, see page 33. For the card sequence of the second data deck see page 50.

4	8	1	9	8	2	05	90	95	105	115	125	135
		18800		1307		068	00270	3-02450001	19400000	0400		
		12330		1221		0708	262	2-055	-180	-242		
		18600		1213		0744	255	3	-274	-314		
		19625		1186		1276	248	3	-315	-385		
		19720		1145		1125	246	3	-422	-450		
		18210		1114		1302	242	3	-539	-679		
		14330		1080		1020	240	2	-690	-740		
		120000		1064		1127	258	2	-742	-755		
		204000		1034		1372	256	3	005	-903	-915	
		189100		1010		1400	253	3	004	-997	-1010	
		139900		998		1450	258	2	004	-851	-855	
				986		1500		0005				

	P
BISSEL BRIDGE	16
HARTFORD	26
HOCKANUM	36
GLASTONBURY	46
S. GLASTONBURY	56
DIVIDEND	66
GILDERSLEEVE	76
ARRIGONI BRIDGE	86
BODKIN ROCK	96
CANAL PIER	106
ROCK LANDING BAR	116
HADDAM MARINA	126

IØPTN, initial data, stage and discharge data for the Connecticut River between Bissel Bridge and Haddam Marina, July 5, 1967. IØPTN=8 is requested at Bodkin Rock, sta. 9-1.

15	4	7	5	67	5	45	500	005	1214	1031	1010	v)
		i)		990	ii)				1207	1030	1012	
				998					1200	1029	1017	
				1014					1194	1031	1022	
				1030					1187	1035	1033	
				1044					1180	1043	1048	
				1068					1174	1054	1067	
				1087					1167	1069	1085	
				1102					1161	1085	1103	
				1116					1156	1107	1121	
				1130					1151	1123	1134	
				1140					1146	1137	1146	
				1154					1142	1149	1157	
				1162					1141	1161	1171	
				1176					1141	1174	1181	
				1186					1145	1185	1191	
				1194					1155	1196	1201	
				1202					1166	1203	1207	
				1202					1176	1207	1210	
				1204					1184	1212	1212	
				1202					1201	1215	1215	
				1190					1216	1217	1213	
				1180					1226	1218	1208	
				1164					1237	1213	1199	
				1152					1246	1206	1187	
				1136					1254	1196	1175	
				1122					1260	1185	1262	
				1110					1265	1174	1152	
				1090					1266	1164	1142	
				1082					1265	1154	1132	
				1074					1262	1144	1122	
				1062					1255	1135	1112	
				1052					1248	1126	1102	
				1040					1240	1116	1090	
				1028					1234	1106	1079	
				1016					1229	1096	1068	
				1006					1222	1087	1061	
				998					1217	1077	1050	
				986					1212	1068	1040	
				986					1207	1050	1021	

6707050600 vi) i) stage at upstream end - Bissel Bridge, sta. 1-1
6707050615 ii) stage at downstream end - Haddam Marina, sta. 11-3
6707050630
6707050645
6707050700 iii) stage at Bulkeley Bridge, sta. 2-1
6707050715 iv) stage at Bodkin Rock, sta. 9-1
6707050730 v) stage at CANEL pier, sta. 10-1
6707050745
6707050800 vi) date and time
6707050815
6707050830
6707050845
6707050900
6707050915
6707050930
6707050945
6707051000
6707051015
6707051030
6707051045
6707051100
6707051115
6707051130
6707051145
6707051200
6707051215
6707051230
6707051245
6707051300
6707051315
6707051330
6707051345
6707051400
6707051415
6707051430
6707051445
6707051500
6707051515
6707051530
6707051545

Because the recorded stage at Bodkin Rock (iv) is the second one among the three recorded stages (iii, iv, and v) punched as intermediate stages on the boundary value cards (Card Type B), IJSTG is given the value of 2 (the 4th digit in Card Type 4). The other two stage data (iii and v) will not be used in this particular run, neither will the measured discharge which is not punched in this data deck.

1283	978	1201	1050	1023	6707051600	b.
1282	976	1195	1043	1016	6707051615	c.
HUDSON RIVER BETWEEN KINGSTON - RHINECLIFF AND CLINTON POINT						
2382	63300	2882	77300	3382	93400	3882
4882	156000					
2382	2660	2882	2830	3382	3250	3882
4882	4580					
3035	77500	3535	90600	4035	104000	4535
5535	148000					
3035	2550	3535	2600	4035	2680	4535
5535	3030					
4021	874000	4521	983000	5021	1090000	5521
6521	1450000					
4021	21500	4521	22000	5021	22600	5521
6521	24300					
3837	888000	4337	1000000	4837	1120000	5337
6337	1500000					
3837	22900	4337	23300	4837	23900	5337
6337	25900					
25800	1110	-050	023	2	-25	-33
25800	1131	-052	022	2	-33	-36
3170	1152	-054	019	2	-36	-45
29400	1173	-056	019	2	-45	-43
	1194	-058			-0140	
15	4	10	17	67	9	30
1129	1205	1129	1205	1129	1205	1129
1150	1217	1150	1217	1150	1217	1150
1169	1227	1169	1227	1169	1227	1169
1185	1236	1185	1236	1185	1236	1185
1208	1247	1208	1247	1208	1247	1208
1224	1251	1224	1251	1224	1251	1224
1238	1260	1238	1260	1238	1260	1238
1250	1258	1250	1258	1250	1258	1250
1259	1264	1259	1264	1259	1264	1259
1271	1264	1271	1264	1271	1264	1271
1276	1260	1276	1260	1276	1260	1276
1278	1252	1278	1252	1278	1252	1278
1281	1243	1281	1243	1281	1243	1281
1281	1232	1281	1232	1281	1232	1281
1275	1215	1275	1215	1275	1215	1275
1268	1196	1268	1196	1268	1196	1268
1257	1175	1257	1175	1257	1175	1257
1244	1154	1244	1154	1244	1154	1244
1224	1135	1224	1135	1224	1135	1224
1202	1117	1202	1117	1202	1117	1202
1178	1100	1178	1100	1178	1100	1178
1154	1083	1154	1083	1154	1083	1154
1135	1068	1135	1068	1135	1068	1135
1115	1047	1115	1047	1115	1047	1115
1099	1038	1099	1038	1099	1038	1099
1082	1026	1082	1026	1082	1026	1082
1067	1014	1067	1014	1067	1014	1067
1051	1005	1051	1005	1051	1005	1051
1037	0997	1037	0997	1037	0997	1037

The second data deck ends with MOPTN=1.
For the selection of MOPTN value, see
page 33. For the card sequence of
the third data deck see page 50.

Options, reach identification, reach
geometry, initial data, and stage data
for the Hudson River between Rhinecliff
and Clinton Point. Oct. 17 to Nov. 3,
1967 (partial listing). IOPTN=5 is
requested at Clinton Point, Sta. 4-3.

RHINECLIFF 16
STAATSBURG 26
HYDE PARK 36
POUGHKEEPSIE 46
CLINTON POINT 56

6710170945	iv)	i)
6710171000	ii)	stage at upstream end - Rhinecliff, sta. 1-1
6710171015		stage at downstream end - Clinton Point,
6710171030		sta. 4-3
6710171045	iii)	stage at Poughkeepsie, sta. 4-1 - not used in
6710171100		this run
6710171115	iv)	date and time
6710171130		
6710171145		
6710171200		
6710171215		
6710171230		
6710171245		
6710171300		
6710171315		
6710171330		
6710171345		
6710171400		
6710171415		
6710171430		
6710171445		
6710171500		
6710171515		
6710171530		
6710171545		
6710171600		
6710171615		
6710171630		
6710171645		

1022 0990
1005 0981
0992 0973
0978 0968
0963 0964
0951 0963
0939 0967

0987
0977
0967
0959
0951
0946
0945

6710171700
6710171715
6710171730
6710171745
6710171800
6710171815
6710171830

•
•
•

•
•
•

0884 0941
0881 0958
0881 0979
0885 1000
0898 1023
0915 1043
0934 1060
0957 1080
0982 1095
1007 1111
1033 1124
1055 1134
1075 1143
1094 1152
1111 1159

0912
0924
0941
0961
0982
1003
1023
1043
1061
1079
1092
1107
1118
1128
1137

6710202030
6710202045
6710202100
6710202115
6710202130
6710202145
6710202200
6710202215
6710202230
6710202245
6710202300
6710202315
6710202330
6710202345
6710202400

M

Table 2.--Scheme for selecting reach lengths used in flow computation of the Connecticut River

Reaches for Unsteady Flow Computation in the Connecticut River Estuary

Reach Number	Junctions along the Estuary	Reach Length (miles)	Stream Direction
1	Bissel Bridge	3.56	upstream ↑
	Bulkeley Bridge (Hartford)		
2	Hockanum	2.34	
3	Glastonbury	3.52	
4	South Glastonbury	3.72	
5	Dividend	3.73	
6	Gildersleeve	3.45	
7	Arrigoni Bridge (Middletown)	2.71	downstream ↓
8	Bodkin Rock	2.27	
9	CANEL pier (United Aircraft Plant)	3.87	
10	Rock Landing Bar	3.58	
11	Haddam Marina	2.65	
12	Haddam Bridge	2.46	
13	Hadlyme Ferry	2.99	

Table 3. Examples of Cross-Section Properties

Average Cross Section in Reach (8)			Average Cross Section in Reach (9)		
Depth (ft)	Width (ft)	Area (ft ²)	Depth (ft)	Width (ft)	Area (ft ²)
13.42	1,175	10,090	8.43	586	4,940
15.42	1,225	12,460	10.43	698	6,190
17.42	1,355	15,250	12.43	872	7,690
19.42	1,458	18,550	18.43	998	13,100
			26.43	1,090	21,400

UNSTEADY FLOW IN RIVERS AND ESTUARIES,
CALCULATION FOR MULTIPLE REACHES BY THE METHOD OF CHARACTERISTICS
VERSION 13 (F)

Examples of eight output options

CONNECTICUT RIVER BETWEEN RISSEL BRIDGE AND HADDAM MARINA

- a. Example of complete output
(Forms 1 ~ 7, cf. p. 51) with
IØPTN=1

* REACH GEOMETRY *

NUMBER OF SUBREACHES = 11

CROSS SECTION NO. 1

AREA TABLE		NA = 10	
DEPTH	AREA	SAJ	CAJ
3.73	2075.000		
6.23	3884.000	723.600	-624.023
7.23	4740.000	856.000	-1448.879
8.23	5735.000	995.000	-2453.848
9.23	6818.000	1053.000	-3178.086
10.23	7959.000	1141.000	-3713.426
11.23	9155.000	1196.000	-4276.078
12.23	10407.000	1252.000	-4904.957
13.23	11713.000	1306.000	-5565.379
14.23	13074.000	1361.000	-6293.027

WIDTH TABLE		NB = 10	
DEPTH	WIDTH	SBJ	CBJ
3.73	556.000		
6.23	813.000	102.800	172.556
7.23	926.000	113.000	109.010
8.23	1055.000	129.000	-6.670
9.23	1068.000	13.000	948.010
10.23	1169.000	101.000	135.770
11.23	1224.000	55.000	606.350
12.23	1279.000	55.000	606.350
13.23	1334.000	55.000	606.350
14.23	1389.000	55.000	606.350

CROSS SECTION NO. 2

AREA TABLE		NA = 9	
DEPTH	AREA	SAJ	CAJ
8.07	6622.000		
9.57	7523.000	600.667	1774.625
10.57	8820.000	1297.000	-4889.289
11.57	9775.000	955.000	-1274.348
12.57	10781.000	1006.000	-1864.418
13.57	11838.000	1057.000	-2505.488
14.57	12946.000	1108.000	-3197.559

15.57	14105.000	1159.000	-3940.629
16.57	15314.000	1209.009	-4719.270

WIDTH TABLE

NB = 9

DEPTH	WIDTH	SAJ	CAJ
8.07	821.000		
9.57	865.000	42.667	476.680
10.57	928.000	43.000	473.490
11.57	981.000	53.000	367.790
12.57	1032.000	51.000	390.930
13.57	1082.000	50.000	403.500
14.57	1133.000	51.000	389.930
15.57	1184.000	51.000	389.930
16.57	1235.000	51.000	389.924

CROSS SECTION NO. 3

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
8.99	6638.000		
9.99	7392.000	754.000	-140.457
10.99	8174.000	782.000	-420.180
11.99	9005.000	831.000	-958.688
12.99	10032.000	1027.000	-3308.727
13.99	11068.000	1036.000	-3425.637
14.99	12863.000	1795.000	-14044.047
15.99	14666.000	1803.000	-14163.969
16.99	16720.000	2054.020	-18177.770
17.99	19050.000	2330.000	-22866.676

WIDTH TABLE

NB = 10

DEPTH	WIDTH	SAJ	CAJ
8.99	739.000		
9.99	768.000	29.000	478.290
10.99	797.000	29.000	478.290
11.99	897.000	100.000	-302.000
12.99	1156.000	259.000	-2208.410
13.99	1415.000	259.000	-2208.410
14.99	1674.000	259.000	-2208.410
15.99	1933.000	259.000	-2208.406
16.99	2192.000	259.002	-2208.445
17.99	2451.000	259.000	-2208.406

CROSS SECTION NO. 4

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
8.94	5163.000		
10.94	6416.000	626.500	-437.906
11.94	7108.000	692.000	-1154.477
12.94	7847.000	739.000	-1715.656

13.94	8635.000	788.000	-2349.719
14.94	9474.000	839.000	-3060.656
15.94	10366.000	892.000	-3852.477
16.94	11310.000	944.011	-4681.539
17.94	12306.000	996.000	-5562.227
18.94	13354.000	1048.000	-6495.105

WIDTH TABLE

NB = 10

DEPTH	WIDTH	SBJ	CBJ
8.94	578.000		
10.94	673.000	47.500	153.350
11.94	710.000	37.000	268.220
12.94	762.000	52.000	89.120
13.94	814.000	52.000	89.120
14.94	866.000	52.000	89.120
15.94	918.000	52.000	89.120
16.94	970.000	52.001	89.110
17.94	1022.000	52.000	89.121
18.94	1074.000	52.000	89.121

CROSS SECTION NO. 5

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
8.49	6119.000		
10.49	7016.000	448.500	2311.238
11.49	7858.000	842.000	-1816.578
12.49	8758.000	900.000	-2482.996
13.49	9717.000	959.000	-3219.906
14.49	10716.000	999.000	-3759.508
15.49	11757.000	1041.000	-4368.086
16.49	12837.000	1080.010	-4972.355
17.49	13959.000	1122.000	-5664.766
18.49	15120.000	1161.000	-6346.875

WIDTH TABLE

NB = 10

DEPTH	WIDTH	SBJ	CBJ
8.49	721.000		
10.49	816.000	47.500	317.725
11.49	869.000	53.000	260.030
12.49	904.000	35.000	466.850
13.49	979.000	75.000	-32.750
14.49	1020.000	41.000	425.910
15.49	1060.000	40.000	440.400
16.49	1101.000	41.000	424.904
17.49	1142.000	41.000	424.910
18.49	1182.000	40.000	442.400

CROSS SECTION NO. 6

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
8.31	4881.000		
10.31	6141.000	630.000	-354.297
11.31	6854.000	713.000	-1210.027
12.31	7636.000	782.000	-1990.418
13.31	8493.000	857.000	-2913.668
14.31	9432.000	939.000	-4005.086
15.31	10418.000	986.000	-4677.656
16.31	11468.000	1050.002	-5657.527
17.31	12575.000	1107.000	-6587.164
18.31	13754.000	1179.000	-7833.484

WIDTH TABLE

NB = 10

DEPTH	WIDTH	SRJ	CRJ
8.31	587.000		
10.31	686.000	49.500	175.655
11.31	742.000	56.000	108.640
12.31	804.000	62.000	40.780
13.31	888.000	84.000	-230.040
14.31	953.000	65.000	22.850
15.31	1018.000	65.000	22.850
16.31	1082.000	64.000	38.158
17.31	1147.000	65.000	21.850
18.31	1212.000	65.000	21.850

CROSS SECTION NO. 7

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
9.35	7318.000		
11.35	8974.000	828.000	-423.797
12.35	9893.000	919.000	-1456.648
13.35	10900.000	1007.000	-2543.449
14.35	12010.000	1110.000	-3918.496
15.35	13222.000	1212.000	-5382.199
16.35	14537.000	1315.011	-6963.418
17.35	15954.000	1417.000	-8630.934
18.35	17473.000	1519.000	-10400.633
19.35	19095.000	1622.000	-12290.684

WIDTH TABLE

NB = 10

DEPTH	WIDTH	SRJ	CRJ
9.35	781.000		
11.35	885.000	52.000	294.800
12.35	956.000	71.000	79.150
13.35	1058.000	102.000	-303.700
14.35	1161.000	103.000	-317.050
15.35	1264.000	103.000	-317.050
16.35	1366.000	102.001	-301.713
17.35	1469.000	103.000	-318.049
18.35	1571.000	102.000	-300.699
19.35	1673.000	102.000	-300.699

CROSS SECTION NO. 8

AREA TABLE

NA = 7

DEPTH	AREA	SAJ	CAJ
7.42	4443.000		
9.42	6008.000	782.500	-1363.148
11.42	7840.000	916.000	-2620.719
13.42	10089.000	1124.500	-5001.785
15.42	12460.000	1185.500	-5820.406
17.42	15249.000	1394.500	-9043.195
19.42	18550.000	1650.500	-13502.703

WIDTH TABLE

NB = 4

DEPTH	WIDTH	SHJ	CBJ
13.42	1175.000		
15.42	1255.000	40.000	638.200
17.42	1355.000	50.000	484.000
19.42	1458.000	51.500	457.870

CROSS SECTION NO. 9

AREA TABLE

NA = 4

DEPTH	AREA	SAJ	CAJ
8.43	4940.000		
12.43	7690.000	687.500	-855.621
18.43	13100.000	901.667	-3517.723
26.43	21400.000	1037.500	-6021.117

WIDTH TABLE

NB = 5

DEPTH	WIDTH	SHJ	CBJ
8.43	586.000		
10.43	698.000	56.000	113.920
14.43	872.000	43.500	244.295
18.43	998.000	31.500	417.455
26.43	1090.000	11.500	786.055

CROSS SECTION NO. 10

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
7.97	5123.000		
9.97	6555.000	716.000	-583.516
11.97	8280.000	862.500	-2044.121
13.97	10628.000	1174.000	-5772.777
15.97	12307.000	839.500	-1099.813
17.97	14538.000	1115.507	-5507.648
19.97	16912.000	1187.000	-6792.371
21.97	19429.000	1258.500	-8220.227
23.97	22090.000	1330.500	-9802.063

25.97 24890.000 1403.000 -11539.887

WIDTH TABLE

NH = 10

DEPTH	WIDTH	SAJ	CAJ
7.97	642.000		
9.97	790.000	74.000	52.220
11.97	937.000	73.500	57.205
13.97	1002.000	32.500	547.975
15.97	1080.000	39.000	457.170
17.97	1151.000	35.500	513.062
19.97	1223.000	36.000	504.081
21.97	1295.000	36.000	504.081
23.97	1367.000	36.000	504.081
25.97	1439.000	36.000	504.081

CROSS SECTION NO.11

AREA TABLE

NA = 10

DEPTH	AREA	SAJ	CAJ
5.91	3575.000		
7.91	4926.000	675.500	-417.203
9.91	6042.000	558.000	512.223
11.91	6732.000	1345.000	-7286.949
13.91	11406.000	1337.000	-7191.668
15.91	14606.000	1600.000	-10849.996
17.91	18266.000	1830.010	-14509.461
19.91	22458.000	2096.000	-19273.332
21.91	27186.000	2364.000	-24609.211
23.91	32446.000	2630.000	-30437.266

WIDTH TABLE

NH = 10

DEPTH	WIDTH	SAJ	CAJ
5.91	606.000		
7.91	742.000	68.000	204.120
9.91	944.000	101.000	-56.910
11.91	1174.000	115.000	-195.650
13.91	1500.000	163.000	-767.330
15.91	1700.000	100.000	109.000
17.91	1960.000	130.001	-368.312
19.91	2231.000	135.500	-466.803
21.91	2447.000	133.000	-417.028
23.91	2762.000	132.500	-406.073

NO.	STATION	DELL	U	Z	ZBL	ZBR	ETA	N	DATUM COR
1	RISSEL BRIDGE	18800.0	0.650	12.180	1.940	0.400	0.02700	3	-0.245
2	HARTFORD	12330.0	0.450	11.750	-1.800	-2.420	0.02620	2	0.0
3	HOCKANUM	18600.0	0.340	11.790	-2.740	-3.140	0.02550	3	0.0
4	GLASTONHURY	19625.0	0.200	11.820	-3.150	-3.850	0.02480	3	0.0
5	S. GLASTONHURY	19720.0	0.030	11.850	-4.220	-4.500	0.02460	3	0.0
6	DIVIDEND	18210.0	-0.140	11.870	-5.390	-6.790	0.02420	3	0.0
7	GILDERSLEEVE	14330.0	-0.300	11.980	-6.900	-7.400	0.02400	2	0.0
8	ARRIGONI BRIDGE	12000.0	-0.475	11.940	-7.420	-7.550	0.02580	2	0.0

9	BODKIN ROCK	20400.0	-0.485	11.950	-9.030	-9.150	0.02560	3	0.050
10	CANAL PIER	18910.0	-0.500	11.940	-9.970	-10.100	0.02530	3	0.040
11	ROCK LANDING BAR	13990.0	-0.515	11.915	-8.510	-8.550	0.02580	2	0.040
12	HADDAM MARINA		-0.520	11.890	-8.550				0.050

IDELT = 15 TP = 4 JOPTN = 1 EPS = 50.000 DZ = 0.05

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TIME		DISTANCE (MILES)	VELOCITY (FT/SEC)	ELEVATION (FEET)	DISCHARGE (CFS)	LATERAL FLOW (CFS/FT)
4-45						
	BISSEL BRIDGE	0.0	0.650	11.935	4999.06	0.0
		1.187	0.624	11.873	5126.64	
		2.374	0.598	11.812	5234.33	
	HARTFORD	3.561	0.450	11.750	5317.59	0.0
	(Bulkeley Bridge)	4.728	0.388	11.770	4727.54	
	HUCKANUM	5.896	0.340	11.790	4092.68	0.0
		7.070	0.276	11.800	3394.71	
		8.244	0.212	11.810	2663.87	
	GLASTONBURY	9.419	0.200	11.820	1900.15	0.0
		10.658	0.146	11.830	1414.25	
		11.896	0.091	11.840	904.70	
	S. GLASTONBURY	13.135	0.030	11.850	371.50	0.0
		14.380	-0.026	11.857	-324.49	
		15.625	-0.082	11.863	-1032.57	
	DIVIDEND	16.870	-0.140	11.870	-1752.75	0.0
		18.020	-0.221	11.873	-2894.90	
		19.169	-0.303	11.877	-4127.06	
	GILDEMSLEEVE	20.319	-0.300	11.880	-5451.14	0.0
		21.676	-0.380	11.910	-7071.48	
	ARRIGONI BRIDGE	23.033	-0.475	11.940	-8764.20	0.0
		24.169	-0.442	11.970	-8218.22	
	BODKIN ROCK	25.306	-0.485	12.000	-7661.79	0.0
		26.594	-0.527	11.993	-8338.94	
		27.882	-0.568	11.987	-9018.99	
	CANAL PIER	29.169	-0.500	11.980	-9701.92	0.0
		30.363	-0.542	11.972	-10544.05	
		31.557	-0.584	11.963	-11390.85	
	ROCK LANDING BAR	32.751	-0.515	11.955	-12241.57	0.0
		34.076	-0.517	11.947	-12316.28	
	HADDAM MARINA	35.400	-0.520	11.940	-12391.14	

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TIME	DISTANCE	VELOCITY	ELEVATION	DISCHARGE	LATERAL FLOW
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5- 0

BISSEL BRIDGE	0.0	0.773	11.985	6933.86	0.0
	1.187	0.669	11.888	5917.91	
	2.374	0.539	11.845	4743.22	
HARTFORD	3.561	0.342	11.834	4184.62	0.0
	4.728	0.294	11.845	3606.55	
HUCKANUM	5.896	0.259	11.854	3272.67	0.0
	7.070	0.196	11.858	2481.23	
	8.244	0.146	11.869	1849.25	
GLASTONBURY	9.419	0.125	11.882	1243.37	0.0
	10.658	0.079	11.899	785.61	
	11.896	0.038	11.916	376.71	
S. GLASTONBURY	13.135	-0.011	11.932	-135.77	0.0
	14.380	-0.073	11.945	-920.32	
	15.625	-0.135	11.964	-1719.85	
DIVIDEND	16.870	-0.208	11.982	-2854.35	0.0
	18.020	-0.271	12.002	-3726.51	
	19.169	-0.335	12.026	-4629.25	
GILDEMSLEEVE	20.319	-0.291	12.026	-5478.98	0.0
	21.676	-0.334	12.009	-6271.61	
ARRIGONI BRIDGE	23.033	-0.398	11.990	-7423.36	0.0
	24.169	-0.434	11.981	-8084.28	
BODKIN ROCK	25.306	-0.545	11.983	-8638.43	0.0
	26.594	-0.554	11.995	-8796.27	
	27.882	-0.536	12.029	-8533.94	
CANAL PIER	29.169	-0.422	12.050	-8270.17	0.0
	30.363	-0.423	12.032	-8288.52	
	31.557	-0.433	12.006	-8458.38	
ROCK LANDING BAR	32.751	-0.354	11.977	-8477.77	0.0
	34.076	-0.353	11.946	-8418.88	
HAUDAM MARINA	35.400	-0.340	11.910	-8089.59	

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	0.0	0.737	12.035	6648.91	0.0
	1.187	0.630	11.984	5648.81	
	2.374	0.517	11.946	4608.75	
	3.561	0.313	11.917	3858.75	0.0
	4.728	0.248	11.911	3060.39	
	5.896	0.207	11.914	2631.29	0.0
	7.070	0.141	11.918	1791.08	
	8.244	0.086	11.929	1094.53	
	9.419	0.035	11.940	353.59	0.0
	10.658	-0.012	11.964	-117.86	
	11.896	-0.061	11.992	-609.88	
	13.135	-0.098	12.023	-1246.33	0.0
	14.380	-0.164	12.047	-2094.75	

15.625	-0.226	12.074	-2897.75	
16.870	-0.272	12.087	-3779.81	0.0
18.020	-0.287	12.083	-3974.02	
19.169	-0.294	12.079	-4127.52	
20.319	-0.239	12.076	-4512.05	0.0
21.676	-0.269	12.072	-5080.07	
23.033	-0.311	12.069	-5845.16	0.0
24.169	-0.347	12.063	-6509.54	
25.306	-0.458	12.048	-7294.15	0.0
26.594	-0.481	12.023	-7650.46	
27.882	-0.489	12.002	-7770.37	
29.169	-0.391	11.978	-7632.15	0.0
30.363	-0.354	11.969	-6913.11	
31.557	-0.303	11.961	-5908.64	
32.751	-0.197	11.943	-4707.37	0.0
34.076	-0.128	11.899	-3047.60	
35.400	-0.075	11.840	-1765.34	
0.0	0.688	12.105	6270.85	0.0
1.187	0.577	12.051	5220.79	
2.374	0.475	12.018	4277.78	
3.561	0.305	12.002	3789.92	0.0
4.728	0.257	12.001	3193.33	
5.896	0.207	12.001	2666.06	0.0
7.070	0.114	11.996	1462.97	
8.244	0.025	12.003	316.81	
9.419	-0.088	12.019	-889.83	0.0
10.658	-0.146	12.055	-1480.21	
11.896	-0.200	12.086	-2028.18	
13.135	-0.193	12.111	-2551.57	0.0
14.380	-0.221	12.116	-2844.08	
15.625	-0.231	12.120	-2976.03	
16.870	-0.246	12.119	-3417.63	0.0
18.020	-0.256	12.119	-3562.41	
19.169	-0.270	12.121	-3751.02	
20.319	-0.220	12.122	-4182.36	0.0
21.676	-0.242	12.120	-4581.55	
23.033	-0.258	12.112	-4857.09	0.0
24.169	-0.261	12.094	-4919.32	
25.306	-0.306	12.073	-4879.73	0.0
26.594	-0.296	12.039	-4705.17	
27.882	-0.282	11.995	-4471.80	
29.169	-0.218	11.938	-4247.62	0.0
30.363	-0.192	11.889	-3734.12	

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31.557	-0.156	11.843	-3011.52	
32.751	-0.082	11.797	-1930.95	0.0
34.076	0.027	11.763	627.41	
35.400	0.116	11.750	2721.99	
0.0	0.664	12.175	6105.53	0.0
1.187	0.556	12.123	5079.14	
2.374	0.454	12.091	4131.64	
3.561	0.286	12.077	3586.07	0.0
4.728	0.221	12.078	2772.29	
5.896	0.161	12.087	2101.82	0.0
7.070	0.069	12.103	907.54	
8.244	-0.032	12.119	-417.60	
9.419	-0.177	12.129	-1804.86	0.0
10.658	-0.227	12.131	-2315.09	
11.896	-0.246	12.131	-2506.85	
13.135	-0.211	12.132	-2716.28	0.0
14.380	-0.216	12.137	-2781.57	
15.625	-0.229	12.143	-2955.98	
16.870	-0.251	12.147	-3502.58	0.0
18.020	-0.253	12.152	-3526.22	
19.169	-0.249	12.149	-3468.36	
20.319	-0.184	12.141	-3494.31	0.0
21.676	-0.170	12.123	-3231.60	
23.033	-0.151	12.099	-2847.87	0.0
24.169	-0.133	12.071	-2499.71	
25.306	-0.120	12.036	-1909.90	0.0
26.594	-0.083	11.983	-1323.57	
27.882	-0.041	11.924	-655.48	
29.169	0.009	11.856	181.72	0.0
30.363	0.060	11.808	1165.10	
31.557	0.092	11.763	1762.67	
32.751	0.088	11.721	2055.87	0.0
34.076	0.114	11.685	2644.45	
35.400	0.167	11.650	3869.72	

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TIME

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BISSEL BRIDGE

DISTANCE (MILES)	VELOCITY (FT/SEC)	ELEVATION (FEET)	DISCHARGE (CFS)	LATERAL FLOW (CFS/FT)
0.0	0.667	12.255	6196.70	0.0
1.187	0.545	12.204	5027.26	
2.374	0.421	12.178	3869.12	

HARTFORD	3.561	0.236	12.172	2979.02	0.0
	4.728	0.165	12.186	2079.89	
HOCKANUM	5.896	0.097	12.199	1280.41	0.0
	7.070	0.005	12.206	70.06	
	8.244	-0.061	12.203	-805.61	
GLASTONBURY	9.419	-0.141	12.195	-1441.37	0.0
	10.658	-0.167	12.186	-1711.15	
	11.896	-0.203	12.176	-2075.52	
S. GLASTONBURY	13.135	-0.192	12.171	-2486.94	0.0
	14.380	-0.221	12.164	-2858.90	
	15.625	-0.231	12.159	-2987.77	
DIVIDEND	16.870	-0.229	12.154	-3199.57	0.0
	18.020	-0.206	12.144	-2866.58	
	19.169	-0.174	12.128	-2426.45	
GILDERSLEEVE	20.319	-0.107	12.104	-2022.50	0.0
	21.676	-0.054	12.076	-1025.93	
ARRIGONI BRIDGE	23.033	0.005	12.034	95.63	0.0
	24.169	0.057	11.993	1060.96	
BODKIN ROCK	25.306	0.133	11.947	2110.66	0.0
	26.594	0.179	11.884	2818.24	
	27.882	0.217	11.828	3413.51	
CANAL PIER	29.169	0.203	11.783	3907.85	0.0
	30.363	0.218	11.748	4184.47	
	31.557	0.246	11.711	4719.32	
ROCK LANDING HAR	32.751	0.233	11.664	5405.57	0.0
	34.076	0.318	11.611	7336.29	
HADDAM MARINA	35.400	0.405	11.540	9272.13	
	0.0	0.628	12.335	5900.89	0.0
	1.187	0.499	12.304	4668.63	
	2.374	0.363	12.295	3389.16	
	3.561	0.198	12.294	2523.93	0.0
	4.728	0.135	12.290	1716.52	
	5.896	0.091	12.279	1216.04	0.0
	7.070	0.041	12.269	545.54	
	8.244	-0.009	12.259	-117.21	
	9.419	-0.089	12.253	-921.18	0.0
	10.658	-0.128	12.239	-1317.94	
	11.896	-0.153	12.225	-1572.03	
	13.135	-0.135	12.208	-1758.00	0.0
	14.380	-0.139	12.188	-1807.03	
	15.625	-0.136	12.159	-1759.08	
	16.870	-0.120	12.127	-1666.27	0.0
	18.020	-0.088	12.090	-1216.01	
	19.169	-0.032	12.051	-439.91	

20.319	0.027	12.011	498.17	0.0
21.676	0.109	11.968	2044.21	
23.033	0.195	11.925	3617.95	0.0
24.169	0.244	11.894	4502.87	
25.306	0.331	11.864	5209.44	0.0
26.594	0.362	11.825	5675.52	
27.882	0.392	11.778	6142.19	
29.169	0.354	11.719	6796.15	0.0
30.363	0.404	11.670	7728.04	
31.557	0.453	11.615	8634.77	
32.751	0.422	11.559	9676.42	0.0
34.076	0.496	11.501	11314.75	
35.400	0.571	11.440	12924.60	

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0.0	0.510	12.405	4838.37	0.0
1.187	0.413	12.393	3913.61	
2.374	0.336	12.382	3180.17	
3.561	0.220	12.364	2822.25	0.0
4.728	0.186	12.353	2384.04	
5.896	0.145	12.343	1957.95	0.0
7.070	0.084	12.331	1126.85	
8.244	0.033	12.319	440.60	
9.419	-0.011	12.305	-114.48	0.0
10.658	-0.032	12.275	-328.00	
11.896	-0.033	12.242	-344.00	
13.135	-0.020	12.203	-264.87	0.0
14.380	0.004	12.163	47.49	
15.625	0.045	12.115	581.30	
16.870	0.097	12.061	1347.81	0.0
18.020	0.150	12.005	2066.43	
19.169	0.202	11.951	2764.74	
20.319	0.194	11.903	3602.81	0.0
21.676	0.241	11.867	4469.96	
23.033	0.296	11.837	5436.44	0.0
24.169	0.342	11.813	6269.76	
25.306	0.464	11.780	7256.27	0.0
26.594	0.522	11.728	8149.75	
27.882	0.583	11.670	9058.19	
29.169	0.526	11.609	10012.68	0.0
30.363	0.575	11.566	10920.62	
31.557	0.618	11.519	11704.79	
32.751	0.554	11.469	12590.02	0.0
34.076	0.635	11.401	14325.36	
35.400	0.726	11.320	16241.73	

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0.0	0.450	12.455	4291.04	0.0
1.187	0.385	12.428	3657.96	
2.374	0.334	12.414	3173.34	
3.561	0.233	12.405	3002.63	0.0
4.728	0.201	12.402	2591.27	
5.896	0.181	12.396	2462.64	0.0
7.070	0.148	12.380	2004.51	
8.244	0.123	12.356	1667.54	
9.419	0.153	12.325	1589.73	0.0
10.658	0.158	12.272	1634.75	
11.896	0.184	12.212	1887.21	
13.135	0.184	12.146	2372.60	0.0
14.380	0.232	12.087	2981.01	
15.625	0.288	12.028	3681.71	
16.870	0.339	11.971	4656.29	0.0
18.020	0.367	11.923	5020.47	
19.169	0.389	11.881	5304.43	
20.319	0.317	11.840	5869.55	0.0
21.676	0.359	11.799	6595.61	
23.033	0.422	11.751	7703.34	0.0
24.169	0.472	11.709	8577.22	
25.306	0.617	11.667	9581.02	0.0
26.594	0.665	11.614	10291.30	
27.882	0.712	11.561	10988.97	
29.169	0.629	11.508	11902.36	0.0
30.363	0.681	11.464	12836.59	
31.557	0.735	11.413	13826.21	
32.751	0.661	11.363	14839.18	0.0
34.076	0.745	11.292	16633.08	
35.400	0.836	11.210	18505.48	

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TIME

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	DISTANCE	VELOCITY	ELEVATION	DISCHARGE	LATERAL FLOW
RISSEL BRIDGE	0.0	0.473	12.505	4548.48	0.0
	1.187	0.398	12.474	3807.81	
	2.374	0.335	12.450	3195.21	
HARTFORD	3.561	0.235	12.432	3034.41	0.0
	4.728	0.221	12.417	2845.52	
HOCKANUM	5.896	0.224	12.406	3049.53	0.0
	7.070	0.235	12.382	3185.89	
	8.244	0.260	12.348	3510.92	

GLASTONBURY	9.419	0.407	12.303	4206.70	0.0
	10.658	0.434	12.228	4460.97	
	11.896	0.469	12.149	4784.74	
S. GLASTONBURY	13.135	0.412	12.072	5285.91	0.0
	14.380	0.446	12.017	5688.36	
	15.625	0.475	11.966	6039.75	
DIVIDEND	16.870	0.505	11.916	6900.08	0.0
	18.020	0.518	11.868	7048.95	
	19.169	0.539	11.817	7299.34	
GILDERSLEEVE	20.319	0.445	11.765	8176.45	0.0
	21.676	0.494	11.719	9051.75	
ARRIGONI BRIDGE	23.033	0.554	11.671	10032.71	0.0
	24.169	0.590	11.630	10640.05	
HODKIN ROCK	25.306	0.736	11.586	11368.22	0.0
	26.594	0.777	11.526	11963.55	
	27.882	0.823	11.463	12607.64	
CANAL PIER	29.169	0.717	11.400	13463.22	0.0
	30.363	0.763	11.353	14283.49	
	31.557	0.811	11.306	15130.64	
ROCK LANDING HAR	32.751	0.722	11.255	16047.40	0.0
	34.076	0.810	11.186	17891.90	
HADDAM MARINA	35.400	0.897	11.100	19648.62	

0.0	0.463	12.535	4465.50	0.0
1.187	0.413	12.503	3969.00	
2.374	0.385	12.472	3682.88	
3.561	0.298	12.436	3845.17	0.0
4.728	0.297	12.409	3821.97	
5.896	0.312	12.377	4236.09	0.0
7.070	0.354	12.337	4773.27	
8.244	0.402	12.290	5396.18	
9.419	0.632	12.239	6505.37	0.0
10.658	0.663	12.169	6782.54	
11.896	0.685	12.099	6964.79	
13.135	0.568	12.030	7264.66	0.0
14.380	0.590	11.977	7503.21	
15.625	0.613	11.924	7759.16	
16.870	0.662	11.865	9004.95	0.0
18.020	0.674	11.803	9125.82	
19.169	0.684	11.744	9216.55	
20.319	0.545	11.691	9959.56	0.0
21.676	0.579	11.647	10541.43	
23.033	0.640	11.603	11513.87	0.0
24.169	0.677	11.558	12135.30	

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25.306	0.847	11.513	13018.63	0.0
26.594	0.884	11.448	13530.01	
27.882	0.924	11.381	14080.21	
29.169	0.792	11.313	14795.44	0.0
30.363	0.828	11.263	15405.87	
31.557	0.868	11.212	16095.34	
32.751	0.771	11.158	16991.18	0.0
34.076	0.852	11.082	18647.40	
35.400	0.939	10.990	20355.29	
0.0	0.469	12.535	4524.72	0.0
1.187	0.452	12.492	4336.98	
2.374	0.457	12.450	4358.64	
3.561	0.387	12.400	4978.50	0.0
4.728	0.410	12.367	5268.52	
5.896	0.440	12.331	5929.76	0.0
7.070	0.480	12.282	6429.41	
8.244	0.517	12.231	6883.64	
9.419	0.756	12.181	7741.10	0.0
10.658	0.772	12.118	7857.02	
11.896	0.793	12.054	8031.68	
13.135	0.669	11.983	8519.74	0.0
14.380	0.711	11.930	9002.94	
15.625	0.743	11.871	9371.30	
16.870	0.779	11.807	10548.88	0.0
18.020	0.782	11.748	10531.95	
19.169	0.785	11.688	10526.80	
20.319	0.623	11.632	11318.94	0.0
21.676	0.654	11.583	11824.69	
23.033	0.714	11.533	12777.81	0.0
24.169	0.746	11.486	13278.42	
25.306	0.914	11.436	13976.55	0.0
26.594	0.954	11.373	14533.06	
27.882	0.993	11.305	15053.83	
29.169	0.847	11.233	15730.79	0.0
30.363	0.886	11.184	16393.27	
31.557	0.924	11.129	17041.10	
32.751	0.820	11.071	17911.20	0.0
34.076	0.892	10.988	19339.23	
35.400	0.970	10.890	20833.38	

7-45

0.0	0.567	12.535	5467.20	0.0
1.187	0.548	12.463	5236.39	
2.374	0.553	12.395	5232.78	

3.561	0.459	12.334	5872.96	0.0
4.728	0.482	12.305	6156.63	
5.896	0.505	12.278	6766.52	0.0
7.070	0.543	12.238	7239.38	
8.244	0.576	12.191	7620.47	
9.419	0.835	12.137	8518.35	0.0
10.658	0.856	12.066	8676.34	
11.896	0.880	11.994	8862.30	
13.135	0.743	11.923	9411.90	0.0
14.380	0.772	11.868	9733.95	
15.625	0.806	11.815	10113.51	
16.870	0.852	11.753	11487.59	0.0
18.020	0.863	11.695	11571.43	
19.169	0.867	11.633	11563.32	
20.319	0.680	11.571	12298.04	0.0
21.676	0.709	11.522	12764.67	
23.033	0.767	11.469	13629.77	0.0
24.169	0.800	11.423	14155.80	
25.306	0.975	11.372	14851.56	0.0
26.594	1.007	11.304	15262.46	
27.882	1.045	11.230	15759.38	
29.169	0.889	11.153	16426.93	0.0
30.363	0.929	11.103	17100.66	
31.557	0.970	11.048	17799.51	
32.751	0.860	10.989	18646.23	0.0
34.076	0.932	10.897	20036.36	
35.400	1.015	10.790	21592.18	

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11-4F

8- 0

	DISTANCE (MILES)	VELOCITY (FT/SEC)	ELEVATION (FEET)	DISCHARGE (CFS)	LATERAL FLOW (CFS/FT)
BISSEL BRIDGE	0.0	0.668	12.515	6422.76	0.0
	1.187	0.652	12.432	6207.66	
	2.374	0.645	12.357	6077.40	
HARTFORD	3.561	0.508	12.288	6477.43	0.0
	4.728	0.515	12.259	6548.97	
HOCKANUM	5.896	0.535	12.232	7125.31	0.0
	7.070	0.570	12.189	7540.42	
	8.244	0.611	12.140	8026.01	
GLASTONBURY	9.419	0.889	12.083	9023.12	0.0
	10.658	0.915	12.016	9236.34	
	11.896	0.936	11.943	9388.37	

S. GLASTONBURY	13.135	0.789	11.870	9944.24	0.0
	14.380	0.814	11.812	10209.71	
	15.625	0.849	11.756	10593.70	
DIVIDEND	16.870	0.897	11.690	12026.07	0.0
	18.020	0.908	11.632	12103.22	
	19.169	0.911	11.571	12088.53	
GILDERSLEEVE	20.319	0.720	11.511	12937.93	0.0
	21.676	0.749	11.466	13403.03	
ARRIGONI BRIDGE	23.033	0.805	11.412	14233.27	0.0
	24.169	0.842	11.360	14815.96	
BOOKIN ROCK	25.306	1.017	11.303	15407.85	0.0
	26.594	1.053	11.234	15887.34	
	27.882	1.093	11.160	16403.68	
CANAL PIER	29.169	0.925	11.078	17006.95	0.0
	30.363	0.965	11.023	17671.52	
	31.557	1.004	10.964	18305.73	
ROCK LANDING BAR	32.751	0.891	10.898	19140.83	0.0
	34.076	0.970	10.803	20659.49	
HADDAM MARINA	35.400	1.056	10.690	22223.33	

8-15

0.0	0.699	12.475	6689.79	0.0
1.187	0.694	12.399	6580.56	
2.374	0.689	12.328	6465.63	
3.561	0.547	12.256	6964.12	0.0
4.728	0.560	12.226	7107.14	
5.896	0.578	12.193	7659.98	0.0
7.070	0.606	12.141	7962.16	
8.244	0.637	12.088	8314.48	
9.419	0.918	12.029	9272.71	0.0
10.658	0.943	11.960	9466.21	
11.896	0.966	11.885	9631.53	
13.135	0.812	11.809	10188.36	0.0
14.380	0.848	11.756	10581.33	
15.625	0.885	11.697	10989.76	
16.870	0.930	11.632	12404.53	0.0
18.020	0.933	11.569	12379.12	
19.169	0.938	11.508	12374.02	
20.319	0.735	11.444	13130.59	0.0
21.676	0.771	11.398	13714.65	
23.033	0.831	11.346	14614.77	0.0
24.169	0.870	11.296	15215.47	
25.306	1.056	11.240	15939.21	0.0
26.594	1.091	11.166	16384.57	
27.882	1.133	11.087	16923.27	

8-30

29.169	0.960	11.000	17549.75	0.0
30.363	1.000	10.942	18208.88	
31.557	1.044	10.880	18922.38	
32.751	0.929	10.813	19801.88	0.0
34.076	1.008	10.705	21253.98	
35.400	1.101	10.580	22935.93	

0.0	0.708	12.435	6737.90	0.0
1.187	0.705	12.358	6647.24	
2.374	0.708	12.283	6604.00	
3.561	0.569	12.210	7213.36	0.0
4.728	0.585	12.184	7399.11	
5.896	0.608	12.154	8012.90	0.0
7.070	0.638	12.102	8342.81	
8.244	0.670	12.044	8696.50	
9.419	0.953	11.983	9594.14	0.0
10.658	0.966	11.905	9654.41	
11.896	0.987	11.829	9800.11	
13.135	0.830	11.749	10351.38	0.0
14.380	0.866	11.697	10751.97	
15.625	0.899	11.638	11113.83	
16.870	0.955	11.573	12668.91	0.0
18.020	0.961	11.509	12672.31	
19.169	0.964	11.444	12639.86	
20.319	0.755	11.383	13422.34	0.0
21.676	0.783	11.332	13839.79	
23.033	0.846	11.278	14782.91	0.0
24.169	0.890	11.226	15461.16	
25.306	1.084	11.170	16283.03	0.0
26.594	1.121	11.093	16751.41	
27.882	1.165	11.013	17302.74	
29.169	0.991	10.922	18011.47	0.0
30.363	1.036	10.861	18755.18	
31.557	1.083	10.793	19506.52	
32.751	0.965	10.720	20373.99	0.0
34.076	1.043	10.608	21789.58	
35.400	1.132	10.480	23338.39	

8-45

0.0	0.725	12.395	6865.01	0.0
1.187	0.722	12.312	6761.48	
2.374	0.721	12.235	6686.39	
3.561	0.579	12.165	7307.84	0.0
4.728	0.588	12.136	7402.12	
5.896	0.617	12.108	8079.76	0.0

7.070	0.652	12.058	8479.31	
8.244	0.687	12.002	8860.22	
9.419	0.980	11.937	9817.67	0.0
10.658	1.000	11.859	9953.57	
11.896	1.016	11.777	10035.86	
13.135	0.849	11.695	10538.13	0.0
14.380	0.878	11.634	10845.70	
15.625	0.914	11.573	11231.14	
16.870	0.962	11.508	12688.04	0.0
18.020	0.969	11.444	12710.07	
19.169	0.977	11.379	12739.45	
20.319	0.763	11.313	13476.48	0.0
21.676	0.801	11.266	14079.54	
23.033	0.869	11.210	15080.45	0.0
24.169	0.910	11.153	15704.96	
25.306	1.104	11.094	16490.34	0.0
26.594	1.144	11.010	16985.79	
27.882	1.195	10.926	17649.43	
29.169	1.021	10.836	18454.60	0.0
30.363	1.062	10.771	19105.49	
31.557	1.107	10.703	19826.53	
32.751	0.989	10.631	20701.30	0.0
34.076	1.064	10.519	22011.89	
35.400	1.146	10.390	23415.81	

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TIME	DISTANCE	VELOCITY	ELEVATION	DISCHARGE	LATERAL FLOW
9- 0					
BISSEL BRIDGE	0.0	0.719	12.345	6764.89	0.0
	1.187	0.724	12.267	6736.82	
	2.374	0.730	12.191	6722.69	
HARTFORD	3.561	0.583	12.118	7320.30	0.0
	4.728	0.591	12.089	7412.68	
HUCKANUM	5.896	0.625	12.062	8126.37	0.0
	7.070	0.662	12.010	8551.14	
	8.244	0.697	11.951	8922.03	
GLASTONBURY	9.419	0.996	11.887	9933.61	0.0
	10.658	1.017	11.808	10077.33	
	11.896	1.038	11.724	10207.66	
S. GLASTONBURY	13.135	0.870	11.642	10748.72	0.0
	14.380	0.898	11.580	11036.99	
	15.625	0.933	11.516	11407.51	
DIVIDEND	16.870	0.979	11.445	12834.68	0.0
	18.020	0.982	11.378	12801.75	

	19.169	0.985	11.313	12770.62	
GILDERSLEEVE	20.319	0.775	11.243	13598.61	0.0
	21.676	0.816	11.194	14245.95	
ARRIGONI BRIDGE	23.033	0.887	11.136	15282.07	0.0
	24.169	0.929	11.077	15917.10	
BODKIN ROCK	25.306	1.123	11.010	16687.80	0.0
	26.594	1.172	10.932	17315.84	
	27.882	1.220	10.843	17914.21	
CANAL PIER	29.169	1.038	10.750	18638.37	0.0
	30.363	1.075	10.685	19219.88	
	31.557	1.118	10.619	19903.43	
ROCK LANDING BAR	32.751	0.996	10.546	20666.16	0.0
	34.076	1.071	10.437	21978.25	
HADDAM MARINA	35.400	1.144	10.310	23165.89	

9-15

0.0	0.716	12.295	6688.06	0.0
1.187	0.720	12.217	6656.32	
2.374	0.724	12.142	6628.11	
3.561	0.582	12.068	7286.04	0.0
4.728	0.599	12.041	7478.46	
5.896	0.634	12.014	8188.16	0.0
7.070	0.668	11.960	8563.75	
8.244	0.706	11.900	8981.12	
9.419	1.007	11.834	10003.29	0.0
10.658	1.029	11.754	10141.50	
11.896	1.050	11.670	10275.21	
13.135	0.884	11.587	10879.04	0.0
14.380	0.910	11.525	11137.21	
15.625	0.944	11.461	11481.66	
16.870	1.004	11.391	13107.54	0.0
18.020	1.006	11.320	13043.93	
19.169	1.010	11.248	13010.91	
20.319	0.794	11.174	13834.23	0.0
21.676	0.833	11.117	14449.53	
23.033	0.908	11.061	15527.36	0.0
24.169	0.945	10.997	16073.68	
25.306	1.141	10.932	16861.26	0.0
26.594	1.187	10.851	17429.81	
27.882	1.231	10.763	17968.17	
29.169	1.045	10.668	18659.83	0.0
30.363	1.085	10.607	19293.53	
31.557	1.123	10.541	19875.97	
32.751	1.003	10.473	20659.85	0.0
34.076	1.063	10.363	21660.26	

9-30

35.400	1.128	10.240	22684.62	
0.0	0.730	12.255	6782.18	0.0
1.187	0.728	12.170	6685.21	
2.374	0.728	12.090	6615.89	
3.561	0.581	12.016	7238.47	0.0
4.728	0.596	11.988	7404.90	
5.896	0.632	11.960	8097.51	0.0
7.070	0.674	11.909	8581.68	
8.244	0.715	11.848	9020.14	
9.419	1.018	11.783	10062.86	0.0
10.658	1.035	11.701	10153.16	
11.896	1.057	11.618	10296.27	
13.135	0.890	11.532	10893.29	0.0
14.380	0.925	11.467	11252.89	
15.625	0.963	11.399	11656.12	
16.870	1.020	11.326	13237.71	0.0
18.020	1.024	11.250	13193.50	
19.169	1.030	11.177	13183.80	
20.319	0.816	11.104	14139.60	0.0
21.676	0.854	11.046	14720.61	
23.033	0.917	10.986	15568.89	0.0
24.169	0.953	10.923	16091.79	
25.306	1.151	10.856	16910.81	0.0
26.594	1.197	10.777	17495.43	
27.882	1.235	10.690	17940.94	
29.169	1.045	10.594	18562.95	0.0
30.363	1.083	10.535	19155.56	
31.557	1.115	10.470	19637.29	
32.751	0.995	10.403	20355.93	0.0
34.076	1.059	10.294	21413.38	
35.400	1.125	10.170	22461.32	

9-45

0.0	0.708	12.195	6529.86	0.0
1.187	0.722	12.119	6588.43	
2.374	0.733	12.044	6620.98	
3.561	0.586	11.968	7268.92	0.0
4.728	0.602	11.939	7450.23	
5.896	0.637	11.909	8107.77	0.0
7.070	0.676	11.855	8544.26	
8.244	0.717	11.795	8979.22	
9.419	1.016	11.726	9995.39	0.0
10.658	1.044	11.646	10196.20	
11.896	1.070	11.558	10360.49	

13.135	0.896	11.467	10904.61	0.0
14.380	0.936	11.403	11326.97	
15.625	0.979	11.334	11776.48	
16.870	1.038	11.258	13387.23	0.0
18.020	1.041	11.181	13327.68	
19.169	1.048	11.107	13332.95	
20.319	0.822	11.033	14154.75	0.0
21.676	0.858	10.976	14703.85	
23.033	0.929	10.915	15675.98	0.0
24.169	0.968	10.855	16230.43	
25.306	1.158	10.789	16933.33	0.0
26.594	1.196	10.706	17381.11	
27.882	1.233	10.618	17817.48	
29.169	1.043	10.528	18439.66	0.0
30.363	1.076	10.466	18952.43	
31.557	1.111	10.402	19477.36	
32.751	0.992	10.331	20134.67	0.0
34.076	1.064	10.220	21345.98	
35.400	1.137	10.090	22511.08	

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TIME

10- 0

	DISTANCE (MILFS)	VELOCITY (FT/SEC)	ELEVATION (FEET)	DISCHARGE (CFS)	LATERAL FLOW (CFS/FT)
BISSEL BRIDGE	0.0	0.730	12.155	6693.11	0.0
	1.187	0.727	12.068	6587.30	
	2.374	0.730	11.986	6546.41	
HARTFORD	3.561	0.583	11.911	7187.22	0.0
	4.728	0.601	11.884	7392.57	
HOCKANUM	5.896	0.648	11.859	8194.47	0.0
	7.070	0.685	11.801	8582.49	
	8.244	0.727	11.739	9027.12	
GLASTONBURY	9.419	1.026	11.667	10030.02	0.0
	10.658	1.053	11.584	10223.21	
	11.896	1.079	11.495	10387.02	
S. GLASTONBURY	13.135	0.911	11.405	11023.06	0.0
	14.380	0.949	11.338	11418.57	
	15.625	0.991	11.266	11845.26	
DIVIDEND	16.870	1.047	11.190	13420.83	0.0
	18.020	1.051	11.112	13366.15	
	19.169	1.056	11.039	13341.16	
GILDEMSLEEVE	20.319	0.829	10.963	14194.90	0.0
	21.676	0.865	10.908	14724.76	

ARRIGONI BRIDGE	23.033	0.932	10.849	15619.68	0.0
	24.169	0.969	10.787	16121.23	
BODKIN ROCK	25.306	1.154	10.722	16799.49	0.0
	26.594	1.192	10.640	17247.98	
	27.882	1.233	10.554	17725.73	
CANAL PIER	29.169	1.045	10.461	18390.75	0.0
	30.363	1.080	10.397	18922.01	
	31.557	1.116	10.329	19462.00	
ROCK LANDING BAR	32.751	0.999	10.260	20127.02	0.0
	34.076	1.053	10.155	20979.30	
HADDAM MARINA	35.400	1.103	10.040	21715.64	

10-15

0.0	0.730	12.105	6645.88	0.0
1.187	0.735	12.021	6618.97	
2.374	0.739	11.940	6585.32	
3.561	0.589	11.863	7233.08	0.0
4.728	0.601	11.829	7359.43	
5.896	0.643	11.798	8061.42	0.0
7.070	0.691	11.745	8588.83	
8.244	0.736	11.683	9065.32	
9.419	1.040	11.611	10119.29	0.0
10.658	1.066	11.525	10293.69	
11.896	1.092	11.432	10454.07	
13.135	0.919	11.339	11060.35	0.0
14.380	0.956	11.272	11428.80	
15.625	0.995	11.202	11824.83	
16.870	1.058	11.124	13470.10	0.0
18.020	1.061	11.048	13422.86	
19.169	1.061	10.971	13324.71	
20.319	0.832	10.897	14147.92	0.0
21.676	0.861	10.842	14570.53	
23.033	0.929	10.782	15460.41	0.0
24.169	0.966	10.722	15991.45	
25.306	1.150	10.654	16653.68	0.0
26.594	1.194	10.572	17189.66	
27.882	1.235	10.483	17666.97	
29.169	1.041	10.387	18221.54	0.0
30.363	1.076	10.331	18759.78	
31.557	1.103	10.270	19147.13	
32.751	0.986	10.208	19756.38	0.0
34.076	1.034	10.104	20497.64	
35.400	1.082	9.990	21190.97	

10-30

0.0	0.728	12.055	6584.77	0.0
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UNSTEADY FLOW IN RIVERS AND ESTUARIES,
CALCULATION FOR MULTIPLE REACHES BY THE METHOD OF CHARACTERISTICS
VERSION 13 (E)

HUDSON RIVER BETWEEN KINGSTON - RHINECLIFF AND CLINTON POINT

* REACH GEOMETRY *

NUMBER OF SUBREACHES = 4

CROSS SECTION NO. 1

AREA TABLE		NA = 6	
DEPTH	AREA	SAJ	CAJ
23.82	63300.000		
28.82	77300.000	2800.000	-3395.938
33.82	93400.000	3220.000	-15500.313
38.82	112000.000	3720.000	-32410.313
43.82	134000.000	4400.000	-58807.938
48.82	156000.000	4400.000	-58807.938

WIDTH TABLE		NB = 6	
DEPTH	WIDTH	SRJ	CRJ
23.82	2660.000		
28.82	2830.000	34.000	1850.120
33.82	3250.000	84.000	409.121
38.82	4400.000	230.000	-4528.598
43.82	4490.000	18.000	3701.240
48.82	4580.000	18.000	3701.240

CROSS SECTION NO. 2

AREA TABLE		NA = 6	
DEPTH	AREA	SAJ	CAJ
30.35	77500.000		
35.35	90600.000	2620.000	-2016.938
40.35	104000.000	2680.000	-4137.938
45.35	118000.000	2800.000	-8979.938
50.35	132000.000	2800.000	-8979.938
55.35	148000.000	3200.000	-29119.938

WIDTH TABLE		NB = 6	
DEPTH	WIDTH	SRJ	CRJ
30.35	2550.000		
35.35	2600.000	10.000	2246.500
40.35	2680.000	16.000	2034.400
45.35	2920.000	48.000	743.200

b. Example of complete output (Forms 1~7,
cf. p. 51) with IØPTN=2

(+) and (-) volumes of flow at Clinton
Point

50.35	2980.000	12.000	2375.800
55.35	3030.000	10.000	2476.500

CROSS SECTION NO. 3

AREA TABLE		NA = 6	
DEPTH	AREA	SAJ	CAJ
40.21	87400.000		
45.21	98300.000	2180.000	-257.750
50.21	109000.000	2140.000	1550.625
55.21	121000.000	2400.000	-11503.938
60.21	133000.000	2400.000	-11503.938
65.21	145000.000	2400.000	-11503.938

WIDTH TABLE		NB = 6	
DEPTH	WIDTH	SBJ	CHJ
40.21	2150.000		
45.21	2200.000	10.000	1747.900
50.21	2260.000	12.000	1657.480
55.21	2320.000	12.000	1657.480
60.21	2360.000	12.000	1657.480
65.21	2430.000	10.000	1777.900

CROSS SECTION NO. 4

AREA TABLE		NA = 6	
DEPTH	AREA	SAJ	CAJ
38.37	88800.000		
43.37	100000.000	2240.000	2851.250
48.37	112000.000	2400.000	-4087.938
53.37	124000.000	2400.000	-4087.938
58.37	137000.000	2600.000	-14761.938
63.37	150000.000	2600.000	-14761.938

WIDTH TABLE		NB = 6	
DEPTH	WIDTH	SBJ	CHJ
38.37	2290.000		
43.37	2330.000	8.000	1983.040
48.37	2390.000	12.000	1809.560
53.37	2480.000	18.000	1519.340
58.37	2530.000	10.000	1946.300
63.37	2590.000	12.000	1829.560

NO.	STATION	DELL	U	Z	ZBL	ZBR	FTA	N	DATUM COR
1	RHINECLIFF	25800.0	-0.500	11.100	-25.000	-33.000	0.02300	2	0.0
2	STAATSBURG	25800.0	-0.520	11.310	-33.000	-36.000	0.02200	2	0.0
3	HYDE PARK	31700.0	-0.540	11.520	-36.000	-45.000	0.01900	2	0.0
4	POUGHKEEPSIE	29400.0	-0.560	11.730	-45.000	-43.000	0.01900	2	0.0
5	CLINTON POINT		-0.580	11.940	-43.000				-0.140

IDELT = 15 TP = 4 JUPIN = 1 EPS = 50.000 DZ = 0.50

	OCTOBER	1967	DISCHARGE AT STATION 4- 3			
DAY	VOLUME IN MILLIONS OF CUBIC FEET					
17	-347	950	-638			
18	-135	792	-919	806	-614	
19	-178	1323	-458	1105	-213	
20	-269	712	-815	970	-308	

* THE FIRST DAY IS A PARTIAL DAY. THE COMPUTATION BEGINS AT 9-30

- c. Example of output with IØPTN=3 (only Form 7 is shown, cf. p. 51)
Hudson River between Rhinecliff and Clinton point

DISCHARGE IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968, STA. 4- 3

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	- -	20495	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
2	- -	10181	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
3	- -	31914	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
4	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
5	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
6	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
7	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
8	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
9	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
10	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
11	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
12	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
13	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
14	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
15	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
16	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
17	-2768	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
18	-3264	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
19	73059	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
20	8783	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
21	17801	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
22	4184	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
23	-7054	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
24	6157	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
25	-6017	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
26	36390	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
27	708	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
28	12820	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
29	-55648	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
30	-96227	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
31	-33073	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

* THE FIRST DAY IS A PARTIAL DAY.

* THE LAST DAY IS A PARTIAL DAY.

d. Example of output with IØPTN=5 (only Form 7 is shown, cf. p.51)
Hudson River between Rhinecliff and Clinton Point

10/17/67	HR	DISCHARGE (IN CFS) AT EVERY 15 MINUTE INTERVAL							
	8							-74076	-91808
	10	-113371	-145628	-154386	-147732	-137234	-134482	-117630	-116971
	12	-115646	-98787	-73222	-45001	-19086	6646	29312	59115
	14	93281	127851	158374	182647	197307	204551	217925	219525
	16	227084	233569	235248	231277	226958	225064	219616	211463
	18	200221	186833	167316	140126	107479	74615	38370	8149
	20	-29408	-67851	-103212	-130956	-160536	-183037	-197330	-210908
	22	-215569	-220970	-220783	-220086	-215695	-207753	-195608	-180623
	24	-164263							

10/18/67	HR	DISCHARGE (IN CFS) AT EVERY 15 MINUTE INTERVAL							
	0	-147083	-126811	-102475	-77279	-50451	-20278	11913	
	2	42222	70192	99817	126458	148689	166181	180095	189775
	4	194132	196571	199768	199119	201648	203071	200628	195023
	6	187358	175722	160353	138904	112265	80452	43894	3885
	8	-33915	-69651	-105388	-140138	-171944	-196517	-218598	-237990
	10	-244676	-237087	-245637	-243759	-231667	-227394	-222806	-210870
	12	-200195	-190366	-167894	-142102	-116611	-96367	-72714	-49626
	14	-20170	11770	47195	77053	100412	123685	148126	171823
	16	186876	199781	207423	211279	214391	217016	216976	217616
	18	213346	200514	188534	172835	145677	125348	92840	64709
	20	32736	2455	-32152	-74701	-116538	-154682	-179008	-203703
	22	-217838	-226644	-240159	-243547	-242101	-238884	-235945	-225693
	24	-199559							

10/19/67	HR	DISCHARGE (IN CFS) AT EVERY 15 MINUTE INTERVAL							
	0	-191998	-157708	-138381	-114493	-71750	-25497	15595	
	2	53259	88093	115012	156531	198876	231981	250930	265031
	4	265093	267627	278330	276225	277465	269983	270156	262327
	6	255030	265893	244790	235234	227024	217346	205006	193564
	8	175956	140659	93583	59601	28941	1789	-21346	-41400
	10	-69608	-108186	-133728	-142449	-151873	-149089	-149350	-158769
	12	-166031	-158328	-149320	-129747	-106016	-82914	-63849	-41852
	14	-18401	7116	49702	82775	110962	135683	151632	168320
	16	187330	211102	222678	224397	222905	223412	225032	228366
	18	231590	232541	226948	218399	212712	203814	196433	187927
	20	174640	157475	136484	112255	88815	60789	27989	-5549
	22	-33464	-61168	-68766	-111683	-129543	-141438	-155572	-164570
	24	-159554							

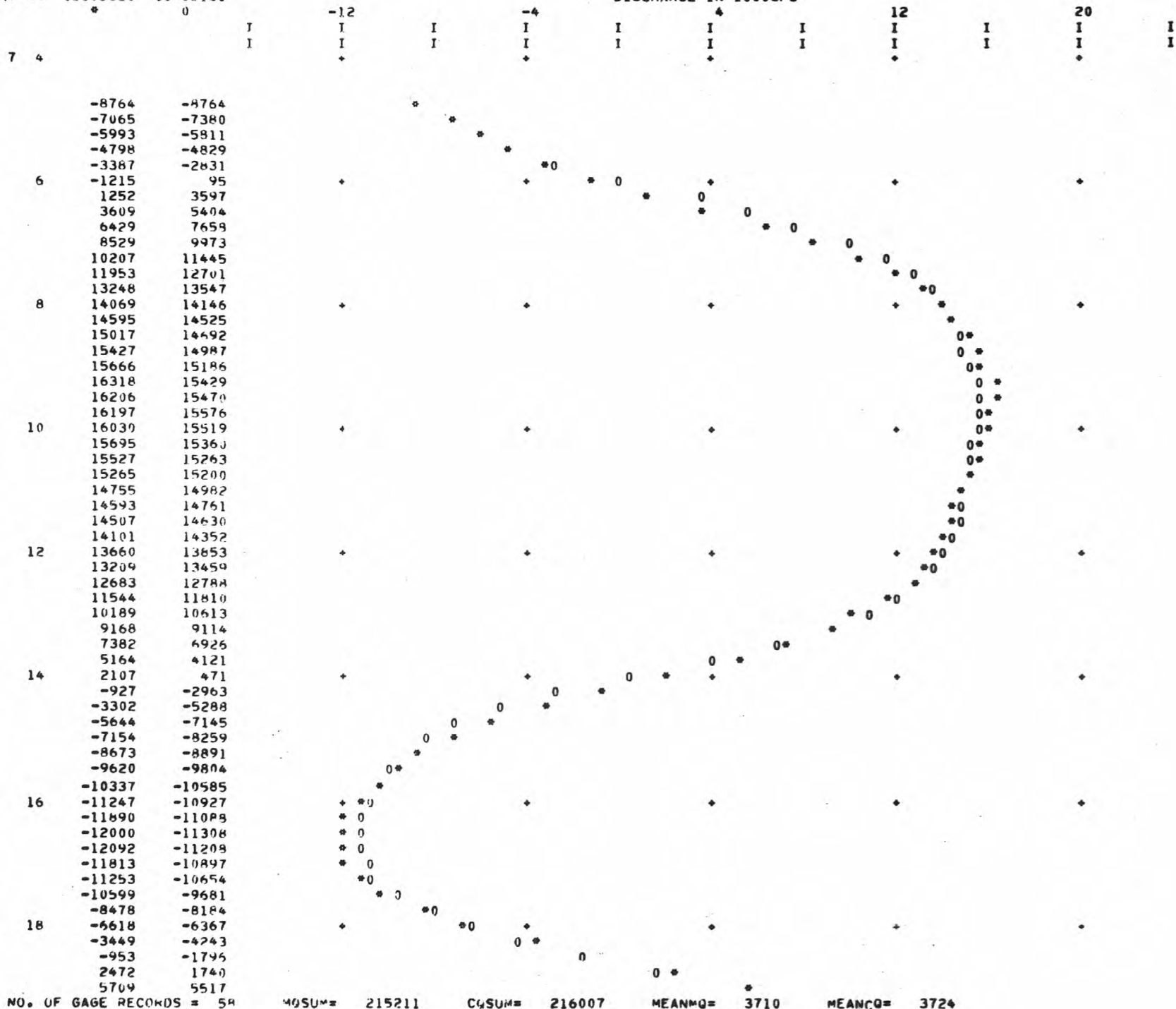
10/20/67	HR	DISCHARGE (IN CFS) AT EVERY 15 MINUTE INTERVAL							
	0	-150170	-162141	-164943	-151509	-136843	-117301	-92297	
	2	-67386	-47764	-26538	-391	25905	52663	79794	101269
	4	120022	138322	157735	170011	178566	185773	190056	189189
	6	187423	187667	184847	182270	177505	168642	155048	134492
	8	106589	66497	28141	4905	-41101	-79322	-113525	-141674
	10	-167820	-186082	-196600	-203545	-209996	-210904	-211242	-207032
	12	-198293	-193708	-194111	-173251	-170479	-161751	-138942	-119926
	14	-108431	-87743	-55927	-39827	-12745	24596	57445	80627
	16	113514	140194	160629	182088	197301	205782	210875	216294
	18	219924	223460	223805	224253	213802	205326	195068	181345
	20	164845	145278	120414	89530	55350	22933	-10507	-42539
	22	-73529	-105219	-130922	-159548	-181023	-191086	-193461	-191680
	24	-188874							

SEPTEMBER 1966

DISCHARGES AT STATION 8-1

DAY HR OBS.DIS. COH.DIS.

DISCHARGE IN 1000CFS



e. Example of output with IOPTN=4 (only Form 7 is shown, cf. p. 51)

Connecticut River between Bissel Bridge and Haddam Marina,
Discharge at Arrigoni Bridge

SEPTEMBER 1966

DISCHARGES AT STATION 1- 1
STATION 2- 1
STATION 8- 1 X
STATION 10- 1 8
STATION 11- 3 S

DAY HR COM.DIS. CO.DIS.

DISCHARGE IN 1000CFS

7 4

5317 -8764
4067 -7389
3751 -5811
3685 -4829
3487 -2831
2897 95
2455 3597
2746 5414
2922 7658
2953 9973
3742 11445
4845 12761
5715 13547
6303 14146
6776 14525
7017 14692
7108 14987
7120 15186
7086 15429
7038 15470
7067 15576
6987 15519
7030 15360
7038 15263
6970 15200
7101 14982
7065 14761
7070 14630
7105 14352
7087 13853
7159 13459
7254 12788
7340 11810
7363 10613
7540 9114
7657 6926
7785 4121
7922 471
8091 -2963
8206 -5288
8121 -7145
7966 -8259
7611 -8891
6948 -9804
5937 -10585
4707 -10927
3628 -11088
2795 -11308
2511 -11208
2399 -10897
2247 -10654
2488 -9681
2876 -8184
3086 -6367
3327 -4243
3705 -1796
3925 1740
4521 5517

NO. OF GAGE RECORDS = 59

MEAN(1...N) =

5988

5563

3724

3688

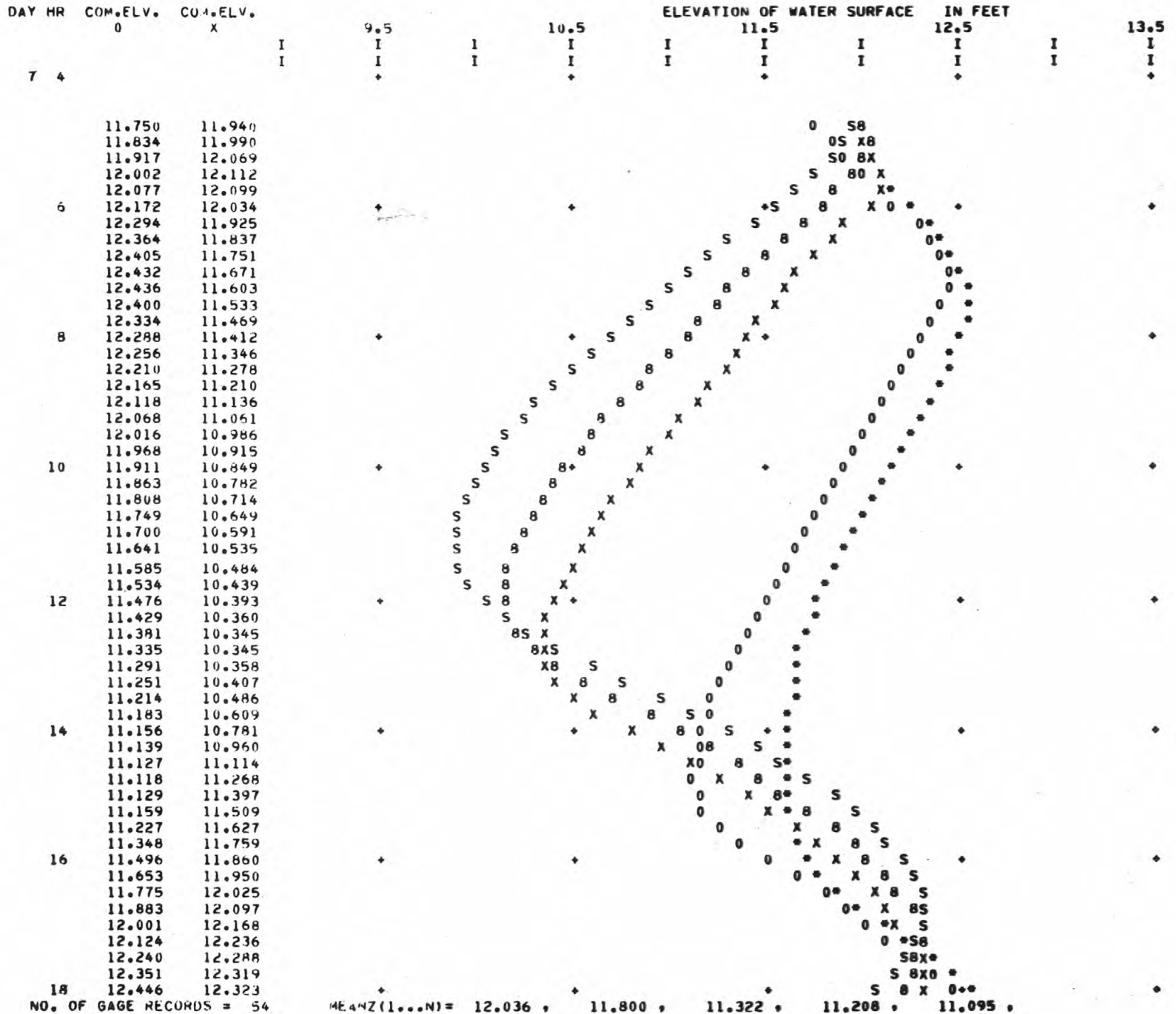
3894

F. Example of output with IFFT=6 (only Form 7 is shown, cf. p. 51)

Connecticut River between Bissel Bridge and Haddam Marina,
Multiple-discharge plotting

SEPTEMBER 1966

ELEVATIONS AT STATION 1- 1 *
STATION 2- 1 0
STATION 8- 1 X
STATION 10- 1 8
STATION 11- 3 S



8. Example of output with IOPTN=7 (only Form 7 is shown, cf. P. 51)
Connecticut River between Bissel Bridge and Haddam Marina,
Multiple-stage plotting

JULY

1967

ELEVATIONS AT STATION 9-1

DAY HR OBS. ELV. COM. ELV.

ELEVATION OF WATER SURFACE IN FEET

9.5

10.5

11.5

12.5

13.5

I
II
II
II
II
II
II
II
II
II
II
I

h. 5 4

10.390	10.390
10.360	10.358
10.350	10.325
10.340	10.334
10.360	10.363
10.400	10.411
10.480	10.484
10.590	10.563
10.740	10.687
10.900	10.908
11.120	11.100
11.280	11.231
11.420	11.379
11.540	11.514
11.660	11.626
11.790	11.751
11.900	11.853
12.010	11.973
12.080	12.060
12.120	12.113
12.170	12.134
12.200	12.184
12.220	12.186
12.230	12.193
12.180	12.154
12.110	12.027
12.010	11.932
11.900	11.816
11.790	11.724
11.690	11.624
11.590	11.531
11.490	11.440
11.400	11.326
11.310	11.253
11.210	11.189
11.110	11.108
11.010	11.036
10.920	10.950
10.820	10.868
10.730	10.785
10.640	10.711
10.550	10.640
10.480	10.553

NO. OF GAGE RECORDS = 43

MEANRZ= 11.293

MEANCZ= 11.274

Example of output with IOPTN=8 (only Form 7 is shown, cf. p.51)
Connecticut River between Bissel Bridge and Haddam Marina, Stage
at Bodkin Rock

ATTACHMENT C. TABLE OF PROGRAM VARIABLES

The abbreviations in the parentheses are defined as follows:

- 1d = One-dimensional array, shown only when necessary.
Those variables under "ARRAY" heading are not shown
if they are one-dimensional.
- 2d = Two-dimensional array.
- i = Integer (used for only those explicitly declared).
- r = Real (used for only those explicitly declared).
- A = A-format code.
- e = EQUIVALENCE
- in = Input argument of subprogram.
- ret = Return argument of subprogram.

Symbols are arranged in the following order. The number preceding the subprogram name is the program number and the number in the parenthesis indicates the beginning page number.

- | | | |
|-----------------|------------------|----------------------|
| 1. MAIN (148) | 8. BDVL (169) | 15. DAILY (177) |
| 2. CHARCB (160) | 9. BDVR (170) | 16. SELECT (178) |
| 3. JT2WAY (162) | 10. INDSK1 (170) | 17. ADAPT5 (181) |
| 4. RESET (166) | 11. JULYN (173) | 18. CØNVRT (182) |
| 5. SPLNS (167) | 12. EDATE1 (174) | 19. ZPLØT (183) |
| 6. TABLE2 (168) | 13. ØPTNI (175) | 20. NZPLØT (184) |
| 7. CGEQ (169) | 14. DATE2 (176) | 21. BLØCK DATA (186) |

For reader's convenience, all the symbols appearing in this table are also listed alphabetically in the INDEX (Attachment D), with the corresponding program numbers and page numbers.

Version 13

<u>Symbol</u>	<u>Description</u>	<u>Metric</u>	<u>Units</u> <u>English</u>
1. <u>MAIN</u>			
COMMON BLOCK / /			
DELT	Δt	s	s
IDELT	Time interval between two consecutive data points	m	m
MNT	Minute	m	m
QK (2d)	Computed discharge	m ³ /s	ft ³ /s
ZK (2d)	Computed stage	m	ft
COMMON BLOCK /BINDSK/			
CØR (1d)	Datum correction	m	ft
CØRL	Datum correction to the downstreammost station	m	ft
IFIN	Location of the finishing point within block in the input disc		
ISTART	Location of the starting point within block in the input disc		
LJ	Counter for NØB		
NN	Counter associated with the location of data in the input disc		
NØB	Number of blocks to be copied from the disc		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
COMMON BLOCK/BTABL2/			
A	Cross-sectional area	m ²	ft ²
B	Top width of channel	m	ft
CAJ (2d)	Constant of a linear equation associated with area table	m	ft
CBJ (2d)	Constant of a linear equation associated with width table		
HAV	Average depth, Hydraulic depth (= $\frac{A}{B}$)	m	ft
HRD	Hydraulic mean radius	m	ft
JEØMET (1d)	Channel geometry option (see the main program)		
NØPA (1d)	Number of data points in the area table of the jth sub- reach		
NØPB (1d)	Number of data points in the width table of the jth sub- reach		
SAJ (2d)	Slope of a linear equation associated with area table	m ² /m	ft ² /ft
SBJ (2d)	Slope of a linear equation associated with width table		
YA (2d)	Depth of channel associated with area table	m	ft
YB (2d)	Depth of channel associated with width table	m	ft

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
COMMON BLOCK /BQPLØT/			
IBLANK (1d)	Blank character, used in plotting; location for a specified symbol used in plotting		
ISCL	Scale for line-printer plotting	m ³ /s /column	ft ³ /s /column
ISCLH	One-half of ISCL	m ³ /s /column	ft ³ /s /column
MINQ	Expected minimum discharge; also used as the minimum value for other integer quantities	(m ³ /s)	(ft ³ /s)
COMMON BLOCK /BDATEA/			
DAY (i)	Day		(T)
HØUR (i)	Hour	hr	hr
IFLAG	Indicator for various (output) subroutines associated with the nature of the entry such as the initial, subsequent, normal, special or last entry		
LABEL	Indicator used in the printout of IØPTN=1, associated with the printing of the station name		
LDM (1d)	Last day of the month		
MØ	Month		(T)
YR (i)	Year		(T)

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
COMMON BLOCK /BDATB2/			
IQØRD (1d)	Discharge readings in line-printer plotting	(10 m ³ /s)	(10 ³ ft ³ /s)
ISTA	Point number in subreach JRCH		
JRCH	Subreach number		
MONTH (1d)	Months expressed in alphameric characters		
COMMON BLOCK /BCARCB/			
H (1d)	Depth of flow (used in any single subreach)	m	ft
U (1d)	Velocity at the current time line $t=t_k$ (used in any single subreach)	m/s	ft/s
UPT (1d)	Velocity at the advanced time line $t=t_{k+1}$ (used in any single subreach)	m/s	ft/s
Z (1d)	Water surface elevation (stage) at the current time line $t=t_k$ (used in any single subreach)	m	ft
ZPT (1d)	Water surface elevation (stage) at the advanced time line $t=t_{k+1}$	m	ft
COMMON BLOCK /BZPLØT/			
SCALE	Scale for plotting stages	m/column	ft/column
SCALH	One-half of SCALE	m/column	ft/column

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ZMIN	Expected minimum water surface elevation (stage)	m	ft
COMMON BLOCK /BADATEC/			
MRCH (1d)	Subreach number (see NSTA)		
M1	Subreach number (see N1)		
M2	Subreach number (see N2)		
NØ	Number of curves to be plotted		
NSTA (1d)	Point number in subreach MRCH; (NSTA(I),MRCH(I)) defines the location for which the ith discharge (stage) curve is to be plotted.		
N1	Point number in subreach M1; (N1, M1) defines the location of the quantities printed in the first column of IØPTN=6, or 7		
N2	Point number in subreach M2; (N2, M2) defines the location of the quantities printed in the second column of IØPTN=6, or 7		
ZØRD (1d)	Stage readings in line-printer plotting	m	ft
COMMON BLOCK /BJT2WY/			
CFRIC (1d)	Coefficient used in the friction term	$\frac{\text{sec}^2}{\text{m}^{2/3}}$	$\frac{\text{sec}^2}{\text{ft}^{2/3}}$
EPS	ϵ , tolerable error, some small quantity	m^3/s	ft^3/s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ETA (1d)	Flow-resistance coefficient, η	(The same as Manning's n)	
N (1d)	Number of segments (elements) in the Jth subreach		
SQ (1d)	Lateral in-(out-)flow, q; (+) for inflow, (-) for outflow	(m ³ /s)/m	(ft ³ /s)/ft
SO (1d)	S ₀ , slope of the channel bottom		
TH (1d)	The ratio of Δt to Δx ($\theta = \Delta t / \Delta x$)	s/m	s/ft
UP (2d)	Velocity at the intersection of two characteristic lines, at $t = t_{k+1}$	m/s	ft/s
U1(2d)	Velocity computed with full size Δt	m/s	ft/s
U2(2d)	Velocity computed with half size Δt	m/s	ft/s
ZB (2d)	Channel bottom elevation used for the computation with full size Δt	m	ft
ZB2 (2d)	Channel bottom elevation used for the computation with half size Δt	m	ft
ZP (2d)	Water surface elevation at the intersection of two character- istic lines at $t = t_{k+1}$	m	ft
Z1(2d)	Water surface elevation (stage) computed with full size Δt	m	ft

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
Z2 (2d)	Water surface elevation (stage) computed with half size Δt	m	ft
COMMON BLOCK /BPRMTR/			
DELL (1d)	Subreach length	m	ft
DELX (1d)	Δx , element length, segment length	m	ft
COMMON BLOCK /BLABEL/			
STANAM (2d, A)	Station name		
COMMON BLOCK /BMECNV/			
FFCØU	Factor for conversion of unit	(m)	(ft)
G	Acceleration of gravity	m/s ²	ft/s ²
SQMC	Square of the coefficient in Manning's formula, 1 in metric system and 2.208 (=1.486 ²) in English system	(m ^{1/3})	(ft ^{1/3})
COMMON BLOCK /BINØUT/			
MU	Input data set reference number		
NU	Output data set reference number		
STATEMENT FUNCTION			
EQLR	Linear equation	m or m/s	ft or ft/s
SCALAR			
DELU	Decrement in flow velocity (per segment)	m/s	ft/s
DELUH	One-half of DELU	m/s	m/s
DELUL	Time based increment of velocity at the downstream end of the entire reach (per Δt)	m/s	m/s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
DELU1	Time based increment of velocity at the upstream end of the entire reach (per Δt)	m/s	m/s
DELZ	Decrement in surface elevation (per segment)	m	ft
DELZB	Decrement in bottom elevation (per segment)	m	ft
DELZBH	One-half of DELZB	m	ft
DELZH	One-half of DELZ	m	ft
DELZL	Time based increment of water surface elevation (stage) at the downstream end of the entire reach (per Δt)	m	ft
DELZ1	Time based increment of water surface elevation (stage) at the upstream end of the entire reach (per Δt)	m	ft
DIFZB	Difference of channel bottom elevations between the upstream and downstream ends of a subreach	m	ft
DØPTN	Input access option (see the main program)		
DZ	Increment of Z for the solution of boundary equations at a junction	m	ft
FINALT	The final time (t) at which the current set of computation should be terminated	hr, s	hr, s
FN	Float of N		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
FTP	Float of TP		
FTREC	Float of TREC		
HDLUL	One-half of DELUL	m/s	ft/s
HDLU1	One-half of DELU1	m/s	ft/s
HDLZL	One-half of DELZL	m	ft
HDLZ1	One-half of DELZ1	m	ft
I	Counter; subscript, often associated with a point number in a subreach, sometimes with area or width tables, etc.		
IJSTG	An ordinal number (counting from upstream toward downstream) for stations where stage records are taken and not used as boundary data		
INØPTN	Indicator to subroutine "CHARCB" showing a combination of known boundary values for a single subreach		
IØPTN	Output option (see the main program)		
J	Counter; subscript, associated with a subreach		
JBLANK	Blank character, used in plotting		
JØPTN	Option to use the extrapolation procedure or to bypass it		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
JUMP	An auxiliary MØPTN variable to indicate a point of return in the beginning part of the main program		
K	Counter; subscript		
KMP2	Counter for NMP2		
KØUNTP	Counter associated with RESET		
KTP	Output line (data) group size, used in plotting or tabulation		
L	Temporary storage for N(J) or N(J)+1		
LL	Point number of the downstream boundary, N(NR)+1, (the last point of the last subreach)		
LØPTN	Option for boundary value format		
M	Cycle for indicator in extrapolation procedures		
MØPTN	Option for specifying what action to follow when the computation of the current set is terminated. (See the main program)		
MQ	Measured discharge	m ³ /s	ft ³ /s
MSTATN	Subreach number; temporal storage for MRCH(I)		
NA	Number of data points (YA, AREA) used in a cross-sectional area table		
NB	Number of data points (YB, WIDTH) used in a top width table		
NMP2	Number of interruptions for changing the values of lateral inflow (SQ)		
NØNE	A dummy card or statement		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
NØPTN	Option for boundary conditions		
NR	Number of subreaches		
NRM1	NR minus 1		
NRP1	NR plus 1		
NSTATN	Point number within MSTATN, temporal storage for NSTA(I)		
QTEMP	Temporal storage for Q	m ³ /s	ft ³ /s
RZK	Recorded water surface elevation (stage)	m	ft
RZ1	Temporal storage for RZ(IJSTG)	m	ft
SCFCTR	Scale factor, used in plotting		
TIME	Total elapsed time since the beginning of the computation	s	s
TP (i)	Number of subintervals in IDELT		
TREC (i)	Counter for TP		
UE	Velocity obtained by applying the extrapolation procedure	m/s	ft/s
UPBL	Velocity data at the downstream end of the entire reach at the beginning of IDELT	m/s	ft/s
UPB1	Velocity data at the upstream end of the entire reach at the beginning of IDELT	m/s	ft/s
UPEL	Velocity data at the downstream end of the entire reach at the end of IDELT	m/s	ft/s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
UPE1	Velocity data at the upstream end of the entire reach at the end of IDELT	m/s	ft/s
ZPBL	Stage data at the downstream end of the entire reach at the beginning of IDELT	m	ft
ZPB1	Stage data at the upstream end of the entire reach at the beginning of IDELT	m	ft
ZPEL	Stage data at the downstream end of the entire reach at the end of IDELT	m	ft
ZPE1	Stage data at the upstream end of the entire reach at the end of IDELT	m	ft
ARRAY			
AREA (2d)	Cross-section area	m ²	ft ²
DELZT1	Increment in stage (Z) from t_k to t_{k+1}	m	ft
DELZT2	Increment in stage (Z) from t_{k-1} to t_k	m	ft
HDLZT1	Half of DELZT1	m	ft
HDLZT2	Half of DELZT2	m	ft
IDENT (e, A)	Heading information, reach identification		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
JEQ (e, A)	An "A field" for expressing cross-sectional geometry equations		
QF	Discharge at the first point of a subreach	m ³ /s	ft ³ /s
QL	Discharge at the last point of a subreach	m ³ /s	ft ³ /s
RZ	Recorded stage	m	ft
TCSQ	Time to change lateral inflow (SQ)	hr, s	hr, s
WIDTH (2d)	Top width of cross section	m	ft

2. CHARCB

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/BCARCB/, /BTABL2/, /BMECNV/

SCALAR

CELI	Celerity of gravity wave at point I	m/s	ft/s
CFRIC (in)	Coefficient used in the friction term	s ² /m ^{2/3}	s ² /ft ^{2/3}
DELT (in)	Δt	s	s
I	DØ variable; subscript, associated with point number in the subreach		
INØPTN (in)	Indicator showing the combination of known boundary values		
J (in)	Subscript associated with subreach		
N (in)	Number of segments in the subreach		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
Q (in)	Lateral flow, q; (+) for inflow, (-) for outflow	(m ³ /s)/m	(ft ³ /s)/ft
S (in)	Slope of the channel bottom, S _o		
TH (in)	The ratio of Δt to Δx ($\theta = \Delta t / \Delta x$)	s/m	s/ft
THUMC	TH* (U-CELI)		
THUPC	TH* (U+CELI)		
UL	Velocity at the intersection of the current time line ($t=t_k$) and the positive characteristic curve C ₊ that passes through point I at time Δt later	m/s	ft/s
UR	Velocity at the intersection of the current time line ($t=t_k$) and the negative characteristic curve C ₋ that passes through point I at time Δt later	m/s	ft/s
ZL	Water-surface elevation at the intersection of the current time line ($t=t_k$) and the positive characteristic curve C ₊ that passes through point I at time Δt later	m	ft
ZR	Water-surface elevation at the intersection of the current time line ($t=t_k$) and the negative characteristic curve C ₋ that passes through point I at time Δt later	m	ft

<u>Symbol</u>	<u>Description</u>	<u>Metric</u>	<u>Units</u> <u>English</u>
3. <u>JT2WAY</u>			
The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.			
/ /, /BJT2WY/, /BTABL2/, /BMECNV/, /BINOUT/			
SCALAR			
BL	Top width of the left channel at the junction	m	ft
BR	Top width of the right channel at the junction	m	ft
CELL	Celerity of the gravity wave in left subreach at the junction	m/s	ft/s
CELR	Celerity of the gravity wave in right subreach at the junction	m/s	ft/s
CFRIC1	Coefficient used in friction term for the left subreach	$s^2/m^{2/3}$	$s^2/ft^{2/3}$
CFRIC2	Coefficient used in friction term for the right subreach	$s^2/m^{2/3}$	$s^2/ft^{2/3}$
DQ (in)	Initial or previous difference of discharge between the left and right subreaches at the junction	m^3/s	ft^3/s
DQ1	Current difference of discharge between the left and right subreaches at the junction	m^3/s	ft^3/s
DZ (in)	A fixed increment for ZPJ for the purpose of searching the "zero" for (QL-QR) variable	m	ft
DZ1	A small variable increment (Δz_1) used in adjusting a new trial value of ZPJ	m	ft

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
HAVL	Average depth of the left subreach at the junction	m	ft
HAVR	Average depth of the right subreach at the junction	m	ft
HRDL	Hydraulic mean radius of the left subreach at the junction	m	ft
HRDR	Hydraulic mean radius of the right subreach at the junction	m	ft
JL (in)	The subreach number at the left (upstream) side of the junction		
JR (in)	The subreach number at the right (downstream) side of the junction		
KØUNT	Counter for the number of halving iterations after the DZ interval for "zero" has been found		
KTR2	Indicator for iteration loops: KTR2 is set to 1 for the first loop and 0 for the subsequent loops		
LL	Point number of the right end of the upstream subreach		
M (in)	Cycle indicator in extrapolation procedures		
QL	Discharge of the left subreach at the junction	m ³ /s	ft ³ /s
QR	Discharge of the right subreach at the junction	m ³ /s	ft ³ /s
SQ1	The lateral in-(out-)flow of the left subreach	(m ³ /s)/m	(ft ³ /s)/ft

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
SQ2	The lateral in-(out-)flow of the right subreach	(m ³ /s)/m	(ft ³ /s)/ft
S1	Channel bottom slope of the left subreach		
S2	Channel bottom slope of the right subreach		
THL	Theta ($\theta = \Delta t / \Delta x_{j-1}$) of the left subreach at the junction		
THR	Theta ($\theta = \Delta t / \Delta x_j$) of the right subreach at the junction		
THUMC	THR*(ULST-CELR)		
THUPC	THL*(ULST+CELL)		
UL	Velocity at the intersection of the current time line ($t=t_k$) and the positive characteristic curve C_+ that passes through the junction at time Δt later	m/s	ft/s
ULST	Velocity at the junction for the left subreach	m/s	ft/s
UPL	Computed velocity at the junction at $t=t_{k+1}$ for the left subreach	m/s	ft/s
UPR	Computed velocity at the junction at $t=t_{k+1}$ for the right subreach	m/s	ft/s
UR	Velocity at the intersection of the current time line ($t=t_k$) and the negative characteristic curve C_- that passes through the junction at time Δt later	m/s	ft/s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
U1ST	Velocity at the junction for the right subreach	m/s	ft/s
U2LT	Velocity at the point next to the junction in the left subreach	m/s	ft/s
U2ND	Velocity at the point next to the junction in the right subreach	m/s	ft/s
ZBL	Channel bottom elevation of the left subreach at the junction	m	ft
ZBR	Channel bottom elevation of the right subreach at the junction	m	ft
ZJT	Water-surface elevation at the junction at the current time line $t=t_k$	m	ft
ZL	Water-surface elevation at the intersection of the current time line ($t=t_k$) and the positive characteristic curve C_+ that passes through the junction at time Δt later	m	ft
ZPJ	Water-surface elevation at the junction at the advanced time line $t=t_{k+1}$	m	ft
ZR	Water-surface elevation at the intersection of the current time line ($t=t_k$) and the negative characteristic curve C_- that passes through the junction at time Δt later	m	ft

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
Z2LT	Water-surface elevation at the point next to the junction in the left subreach	m	ft
Z2ND	Water-surface elevation at the point next to the junction in the right subreach	m	ft

4. RESET

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/BJT2WY/, /BPRMTR/

SCALAR

EPSLNU	Tolerance limit in iterative solution of equations for spline function associated with velocity U
EPSLNZ	Tolerance limit in iterative solution of equations for spline function associated with stage Z
I	DØ variable
IHT	Subscript used in U2 or Z2
J	DØ variable
K	Counter for number of segments for the entire reach
L	Temporary storage for N(J)
M	= L + 1
NR (in)	Number of subreaches

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ARRAY			
DX	Δx used in the spline function	m	ft
UE	Velocity obtained by applying the extrapolation procedure	m/s	ft/s
USM	Velocity interpolated by spline function at the mid-point of each segment	m/s	ft/s
ZE	Stage obtained by applying the extrapolation procedure	m	ft
ZSM	Stage interpolated by spline function at the mid-point of each segment	m	ft

5. SPLNS

ENTRY: SPLNSS

SCALAR

EPS (in)	Tolerance limit in iterative solution of equations for spline function parameters
ETA	The largest (in absolute value) adjustment made in any S2(I) during a given iteration
I	DØ variable
M	= N + 1, number of data points
N (in)	Number of intervals (segments)
ØMEGA	Relaxation factor
R	The adjustment to be made in the value of S2(I)

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ARRAY			
B	Coefficient which appears in the overrelaxation equation		
C	Quantity which appears in the overrelaxation equation		
DELSQY	Second-order divided difference		
DX (in)	Δx , the interval width, segment length	m	ft
DYDX	First-order divided difference		
SM (ret)	Return values interpolated by spline function	m or m/s	ft or ft/s
S2	The second derivative of the spline function S(x)		
WX	Double-interval width, $\Delta x_{i-1} + \Delta x_i$	m	ft
Y (in)	The given Y-value at the given X-point	m or m/s	ft or ft/s

6. TABLE2

The following "COMMON BLOCK"s appear in this subroutine. Its variables have been defined in the "MAIN" program.

/BTABL2/

SCALAR

D (in)	Depth of flow	m	ft
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<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
I	DØ variable used as a counter for the data points or segments between two adjacent data points in the area or depth table		
J (in)	Subreach number		
NA	Number of data points in the area table		
NB	Number of data points in the depth table		
7. <u>CGEQ</u>			
SCALAR			
A (ret)	Cross-sectional area	m ²	ft ²
B (ret)	Top width of channel	m	ft
H (in)	Depth of flow	m	ft
HAV (ret)	Average depth (=A/B)	m	ft
HRD (ret)	Hydraulic mean radius	m	ft
J (in)	Subreach number		
8. <u>BDVL</u>			
BDVL (ret)	Boundary value at the upstream (left) end of the entire reach to be evaluated by equation(s)	variable m or ft or m/s ft/s	
T (in)	Time	s	s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>

9. BDVR

BDVR (ret)	Boundary value at the downstream (right) end of the entire reach, to be evaluated by equation(s)	m or m/s	ft or ft/s
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T (in)	Time	s	s
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10. INDSK1

ENTRY: INDSK2, INDSK3, INDSK4

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/BINDSK/, /BJT2WY/, /BMECNV/, /BINOUT/

SCALAR

AKEEP4	Temporary storage for CORR1(J)	(variable)
DAYB (i, in)	Beginning day of computation	(T)
DAYE (i)	Ending day of computation	(T)
HRB (i, in)	Beginning hour of computation	(T)
HRE (i)	Ending hour of computation	(T)
I	DØ variable	
IDELT (in)	Time interval between readings	min min
IK	Type of correction	
INDEX	Number of readings per day	day ⁻¹ day ⁻¹
IPE1	Upstream station number	
IPE2	Downstream station number	
ITIM	Current time measured from the beginning of the year	min min

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
J	DØ variable		
JP1	J + 1		
JULE	(JULYNE-1) (module NDAYS) Number of days within the block preceding the ending day of computation	day	day
JULYNB	Julian date of the beginning day of computation	day	day
JULYNE	Julian date of the ending day of computation	day	day
K	Indicator used in sorting. If K=1, quantities associated with TIMA(J) and those associated with TIMA(JP1) are intercharged. If K=0, no interchange occurs.		
KEEP1	Temporary storage for TIMA(J)	min	min
KEEP2	Temporary storage for ISUBR(J)		
KEEP3	Temporary storage for ITYPE(J)		
KK	Initial value for DØ loop		
LK	Next correction number		
LKSIZE	Size of one block on the disk		
MDPT	Number of data points counting from the beginning of the year to the beginning of computation		
MNTB (in)	Beginning minute of computation	min	min
MNTE	Ending minute of computation	min	min
MØB (in)	Beginning month of computation		(T)

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
MØE	Ending month of computation		(T)
NBB	Number of blocks preceding the block in which the first data point resides		
NBE	Number of blocks preceding and including the block in which the ending data point resides		
NCØRR	Number of corrections to be made		
NCØR1	Test value of the inner DØ loop in sorting correction values		
NDAYS	Number of days per block of data	day	day
NDPT	Number of data points, counting from the beginning of the year, to the end of computation		
NRPl (in)	NR + 1, number of subreaches plus one		
YR (i, in)	Year of boundary data		(T)
ZPEL (in)	Stage data at the upstream end of the entire reach	m	ft
ZPE1 (in)	Stage data at the downstream end of the entire reach	m	ft
ARRAY			
CØRR1	Correction value		(variable)
DAY1 (i)	Day of correction	day	day
HR1 (i)	Hour of correction	hr	hr
ISUBR	Subreach number in which correction is to be made		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ITYPC	Type of correction		
MNT1	Minute of correction	min	min
MØ1	Month of correction		(T)
TIMA (i)	Time of correction measured from the beginning of the year	min	min
YR1 (i)	Year of correction		(T)
ZPE11	One block of upstream-end stage data retrieved from disk	m	ft
ZPE12	One block of downstream-end stage data retrieved from disk	m	ft

11. JULYN

SCALAR

JDAY (in)	Any day of the month		(T)
JMØNTH (in)	Any month of the year		(T)
JULYN (ret)	Number of days counting from the first day of the year to the given date	day	day
JYEAR (int)	Any year		(T)

ARRAY

MØNTH	Number of days counting from the first day of the year to the last day of the (j-1)th month (j=1, 2, ..., 12).	day	day
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<u>Symbol</u>	<u>Description</u>	<u>Metric</u>	<u>Units</u> <u>English</u>
12. <u>EDATE1</u>			
The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.			
/BDATEA/, /BJT2WY/, /BPRMTR/, /BINØUT/			
SCALAR			
IDELT (in)	Time interval between two consecutive data points	min	min
IHDSP	Indicator for spacing the heading printing		
J	DØ variable; subscript associated with a subreach		
JØPTN (in)	Accuracy option (See the main program.)		
KTITLE	Indicator for printing or skipping the heading		
MNT (in)	Minute	min	min
NR (in)	Number of subreaches		
ARRAY			
HSQ	One-half of lateral inflow	(m ³ /s)/m	(ft ³ /s)/ft
SQSUM	Sum of lateral inflow	(m ³ /s)/m	(ft ³ /s)/ft
VOLSQ	Volume of lateral inflow	m ³	ft ³

<u>Symbol</u>	<u>Description</u>	<u>Metric</u>	<u>Units</u>	<u>English</u>
13. ØPTNI				
ENTRY: ØPTN1				
The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.				
/BJT2WY/, /BPRMTR/, /BTABL2/, /BLABEL/, /BMECNV/, /BINØUT/				
SCALAR				
DELXM	Δx (converted to a different unit from DELX(J))	km		mi
I	DØ variable; subscript, associated with a point number in the subreach			
J	DØ variable; subscript, associated with a subreach			
JØPTN (in)	Accuracy option (See the main program.)			
K	DØ variable in implied DØ loop			
L	Temporary storage of N(J) or N(J)+1			
LABEL (in)	Indicator for printing station names			
NØPTS	Point number counting from the upstream end			
NR (in)	Number of subreaches			
Q	Discharge	m ³ /s		ft ³ /s
UE	Velocity obtained by applying the extra-polation procedure	m/s		ft/s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ZE	Stage obtained by applying the extrapolation procedure	m	ft
ARRAY			
X	Distance along the reach	km	mi

14. DATE2

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/ /, /BDATEA/, /BDATB2/, /BINOUT/

SCALAR

I	Subscript for volume interchanges		
JFTNT1	Indicator for footnote. If JFTNT1 $\neq$ 0, print a footnote.	min	min
MNTI	Beginning minute	min	min
N	Counter for volume interchanges		
QPRES (in)	Present computed discharge	m ³ /s	ft ³ /s
QPREV	Previous computed discharge, the discharge value at Δt preceding the current t	m ³ /s	ft ³ /s
QSUM	Sum of the computed discharges	m ³ /s	ft ³ /s
QVPS	Sum of the absolute values of the previous and present computed discharges	m ³ /s	ft ³ /s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ARRAY			
QVØL (in)	Accumulated volume of flow in the same direction until flow reverses, the day ends, or the computation terminates	10 ³ m ³	10 ⁶ ft ³

15. DAILY

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/ /, /BDATEA/, /BDATB2/, /BINØUT/

CQ (in)	Computed discharge	m ³ /s	ft ³ /s
CQSUM	Summation of computed discharges	m ³ /s	ft ³ /s
DASHES (r)	Name of variable for '--'		
I	DØ variable; subscript for days		
J	DØ variable; subscript for months		
JFTNT1	Initial value of MNT	min	min
JFTNT2	Difference between the beginning day and Sept. 30 (the last day of the water year)	(day)	(day)
KØUNT	Counter for number of data points		
M	Maximum value for the first subscript of a 2-dimensional array		
N	Maximum value for the second subscript of a 2-dimensional array		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
YR1	The preceding year		(T)
ARRAY			
MDQ (2d)	Mean daily discharge	m ³ /s	ft ³ /s
MDQT (2d, r)	Temporal storage for mean daily discharge	m ³ /s	ft ³ /s

16. SELECT

ENTRY: SELCT4, SELCT6, SELCT7

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/ /, /BDATEA/, /BDATB2/, /BDATEC/, /BINØUT/

SCALAR

AVECZ (e)	Average value of computed stages	m	ft
AVERZ (e)	Average value of recorded stages	m	ft
CZSUM (e)	Sum of computed stages	m	ft
I	DØ variable, index, subscript, counter		
IDAY	Day (used as t-axis reading in plotting)		(T)
IHR	Hour (used as t-axis reading in plotting)	hr	hr
INHØUR	Interval of hours for plotting	hr	hr
INTØPN	An output option that is used internally in subroutine "SELECT". The value of the option is determined by the point of entry		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
IQA	Name of variable for 'DIS.'		
IZA	Name of variable for 'ELV.'		
KDSUM (e)	Sum of computed discharges	m ³ /s	ft ³ /s
KØA	Name of variable for 'CØM.'		
KØUNT	Counter for output data points		
KQ	Computed discharge at point (ISTA, JRCH)	m ³ /s	ft ³ /s
KTP (in)	Line group size or data group size used in plotting		
KTREC	Counter for KTP		
KT2	Number of blank lines at the beginning of plotting		
LFHR	Left over hour--a fraction of INHØUR; the remainder of HØUR after being divided by INHØUR	hr	hr
L10	The curve number that is selected for listing its numerical values (discharges or stages) in the first column		
L20	The curve number that is selected for listing its numerical values (discharges or stages) in the second column		
MDSUM (e)	Sum of measured discharges	m ³ /s	ft ³ /s
MEA	Name of variable for 'ØBS.'		
MEANKD (e)	Mean value of computed discharge	m ³ /s	ft ³ /s

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
MEANMD (e)	Mean value of measured discharge	m ³ /s	ft ³ /s
MQ	Measured discharge; measured or recorded quantity in integer	m ³ /s (variable)	ft ³ /s
MSTATN	Subreach number (See NSTATN)		
NSTATN	Point number in subreach MSTATN; (NSTATN, MSTATN) defines the location for which a discharge or stage curve is to be plotted		
RZ (in)	Recorded stage; measured or recorded quantity in real number	m	ft
RZSUM (e)	Sum of recorded stages	m	ft
ARRAY			
AVENZ (e)	Average value of computed stages over plotting interval	m	ft
CNZSUM (e)	Sum of computed stages	m	ft
CØMPNZ	Computed stage at (NSTATN, MSTATN)	m	ft
KDISA	Heading for discharge plotting		
KELVA	Heading for stage plotting		
KNQSUM (e)	Sum of computed discharges	m ³ /s	ft ³ /s
KØMPNQ	Computed discharge at (NSTATN, MSTATN)	m ³ /s	ft ³ /s
MARK	Various symbols used for multiple plotting		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
MEANNQ (e)	Mean value of computed discharges for one day or one plotting interval	m ³ /s	ft ³ /s

17. ADAPT5

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/ /, /BDATEA/, /BINØUT/

SCALAR

BLANKS (r)	Blank characters used in tabulation		
CQ (in)	Computed discharge	m ³ /s	ft ³ /s
I	DØ variable, subscript for Q		
INHØUR	Interval of hours for line printing	hr	hr
ITP	An auxiliary TREC counter used as an indicator for starting, ending, or cutting-off of a line printing		
LFHR	A fraction of INHØUR; the remainder of HØUR after being divided by INHØUR	hr	hr
M	Maximum value for the first subscript of a 2-dimensional array		
N	Maximum value for the second subscript of a 2-dimensional array		
TP (i, in)	Number of subintervals in IDELT		
TREC (i)	Counter for TP		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
ARRAY			
IQT (2d, r)	Q values converted to EBCDIC form	m ³ /s	ft ³ /s
Q (2d, i)	Computed discharges in the time interval INHOUR	m ³ /s	ft ³ /s

18. CONVRT

The following "COMMON BLOCK" appears in this subroutine. Its variables have been defined in the "MAIN" program.

/BINOUT/

SCALAR

I	DØ variable
J	DØ variable
M (in)	Test value in a DØ loop; maximum value for the first subscript of a 2-dimensional array
N (in)	Test value in a DØ loop; maximum value for the second subscript of a 2-dimensional array

ARRAY

INQ (in)	Input quantity that is to be converted to EBCDIC form	(variable)
IOUTQ (r, ret)	Return variable that has been converted to EBCDIC form	(variable)

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
19. <u>ZPLØT</u>			
ENTRY: QPLØT			
The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.			
/BQPLØT/, /BINØUT/			
SCALAR			
CZ (in)	Computed quantity (real) (e.g., computed stage)	(m)	(ft)
FCTR	Scale factor used in plotting		
I	DØ variable		
IDAY (in)	Day used as t-axis reading in plotting	day	day
IHR (in)	Hour used as t-axis reading in plotting	hr	hr
IPLUS	Name of variable for '+' used in plotting		
ISTAR	Name of variable for '*' used in plotting		
IZERØ	Name of variable for '0' used in plotting		
J	DØ variable		
JBLANK	Blank character used in plotting		
KQ	Integer of the computed quantity that is to be plotted	(variable)	
KQMMIN	KQ-MINQ or KQ minus a lower margin of the quantity to be plotted	(variable)	

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
KQS	Value of KQ scaled for plotting (number of columns from the lower margin)		
KQT (in)	Computed quantity (integer) (e.g., computed discharge)	(m ³ /s)	(ft ³ /s)
M	Indicator for entry, M=1 when the quantities to be plotted are real, M=2 when integer		
MQ	Integer of the observed quantity that is to be plotted	(variable)	
MQMMIN	MQ-MINQ or MQ minus a lower margin of the quantity to be plotted	(variable)	
MQS	Value of MQ scaled for plotting (number of columns from the lower margin)		
MQT (in)	Measured quantity (integer) (e.g., measured discharge)	(m ³ /s)	(ft ³ /s)
RZ (in)	Recorded or measured quantity (real) (e.g., recorded stage)	(m)	(ft)

20. NZPLØT

ENTRY: NQPLØT

The following "COMMON BLOCK"s appear in this subroutine. Their variables have been defined in the "MAIN" program.

/BQPLØT/, /BINØUT/

SCALAR

FCTR	Scale factor used in plotting		
I	DØ variable		
IDAY (in)	Day used as t-axis reading in plotting	day	day

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
IHR (in)	Hour used as t-axis reading in plotting	hr	hr
IPLUS	Name for symbol '+' used in plotting		
J	DØ variable		
JBLANK	Blank character used in plotting		
L1 (in)	The curve number that is selected for listing its numerical values (discharges or stages) in the first column		
L2 (in)	The curve number that is selected for listing its numerical values (discharges or stages) in the second column		
M	Indicator for entry, M=1 when the quantities to be plotted are real, M=2 when integer		
NØ (in)	Number of curves to be plotted		
ARRAY			
MARK	Various symbols used for multiple plotting		
NQ	Integer of the computed quantity that is to be plotted	(variable)	
NQMMIN	NQ-MINQ or NQ minus lower margin of the quantity to be plotted	(variable)	
NQS	Value of NQ scaled for plotting (number of columns from the lower margin)		

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	
		<u>Metric</u>	<u>English</u>
NQT (in)	Computed quantity (integer) (e.g., computed discharge)	(m ³ /s)	(ft ³ /s)
ZN (in)	Computed quantity (real) (e.g., computed stage)	(m)	(ft)

21. BLØCK DATA

The following "COMMON BLOCK"s appear in this subprogram. Their variables have been defined in the "MAIN" program.

/BDATB2/, /BDATEA/, /BMECNV/, /BINØUT/

ATTACHMENT D. INDEX

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YA	(1)149; in /BTABL2/
YB	(1)149; in /BTABL2/
YR	(1)150; in /BDATEA/; (10)172
YR1	(10)173; (15)178
Z	(1)151; in /BCARCB/
ZB	(1)153; in /BJT2WY/
ZBL	(3)165
ZBR	(3)165
ZB2	(1)153; in /BJT2WY/
ZE	(4)167; (13)176
ZJT	(3)165
ZK	(1)148; in / /
ZL	(2)161; (3)165
ZMIN	(1)152; in /BZPLØT/
ZN	(20)186
ZØRD	(1)152; in /BDATEC/
ZP	(1)153; in /BJT2WY/
ZPBL	(1)159
ZPB1	(1)159
ZPEL	(1)159; (10)172
ZPE1	(1)159; (10)172
ZPE11	(10)173
ZPE12	(10)173
ZPJ	(3)165
<u>ZPLØT</u>	(19)183
ZPT	(1)151; in /BCARCB/
ZR	(2)161; (3)165
ZSM	(4)167
Z1	(1)153; in /BJT2WY/
Z2	(1)154; in /BJT2WY/
Z2LT	(3)166
Z2ND	(3)166
/ /	(1)148; (3)162; (14)176; (15)177; (16)178; (17)181



