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CONSTITUENTS OF HIGHWAY RUNOFF

Vol. V. Highway Runoff Data Storage Program and Computer User's Manual

February 1981

Final Report

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Prepared for
FEDERAL HIGHWAY ADMINISTRATION
Offices of Research & Development
Environmental Division
Washington, D.C. 20590

FOREWORD

This report is composed of six volumes: Volume I documents the constituents of highway stormwater runoff and their pollutional effects; Volume II contains detailed procedures for conducting a monitoring and analysis program for highway runoff pollutant data; Volume III describes a simple predictive procedure for estimating runoff quantity and quality from highway systems; Volume IV is the research report discussing research approach and findings; Volume V contains the computer users manual for a highway runoff data storage program, and Volume VI is an executive summary. The report will be of interest to planners, designers and researchers involved in evaluation of highway stormwater runoff contributions to non-point sources of water pollution.

Research in Water Quality Changes due to Highway Operations is included in the Federally Coordinated Program of Highway Research and Development as Task 3 of Project 3E, "Reduction of Environmental Hazards to Water Resources Due to the Highway System." Mr. Byron N. Lord is the Project and Task Manager.

Sufficient copies of the report are being distributed to provide a minimum of one copy to each FHWA Regional Office, Division office and State highway agency. Direct distribution is being made to the Division offices.

Charles F. Scheffey
Director, Office of Research
Federal Highway Administration

NOTICE

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16. Abstract

The Data Storage Program (DSP) was developed as part of a FHWA-DOT Research and Development project to determine the characteristics of highway runoff. The data collected during the study is readily available to interested parties on magnetic tape with access provided by DSP. DSP was developed to:

1. Retain a large quantity of field generated data in an organized and easily accessible format.
2. Permit conversion of standard units to metric.
3. Provide a mechanism by which the data can be recalled for optional plotting or statistical analysis.

The titles of the volumes of this report are:

FHWA-RD-	Subtitle	
81/042	Vol. I	State-of-the-Art Report
81/043	Vol. II	Procedural Manual for Monitoring of Highway Runoff
81/044	Vol. III	Predictive Procedure for Determining Pollutant Characteristics in Highway Runoff
81/045	Vol. IV	Characteristics of Runoff from Operating Highways, Research Report
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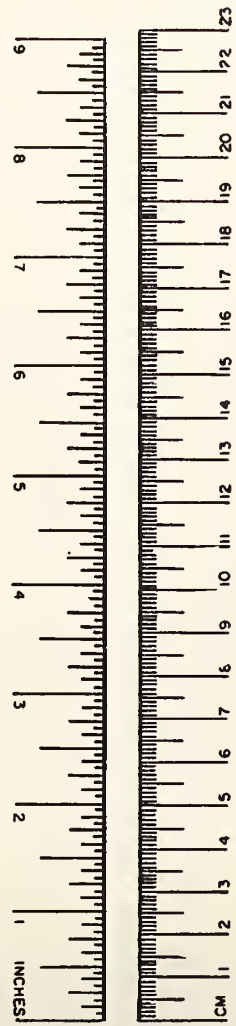
METRIC CONVERSION FACTORS

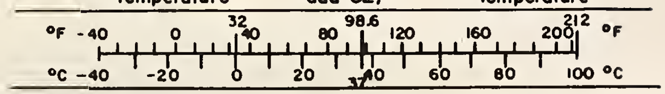
APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
	LENGTH			
In	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.6	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons(2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	In
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares(10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	8.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	36	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Louisiana Department of Transportation and Development
Pennsylvania Department of Transportation
Tennessee Department of Transportation
Wisconsin Department of Transportation

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Review and assistance in the preparation of the final reports was provided by: Richard Howell, California Department of Transportation and Roderick Moe, Texas State Department of Highways and Public Transportation.

In addition to those agencies and individuals acknowledged above, sincere appreciation is expressed for the work of Frank K. Stovicek, (deceased), FHWA, Office of Research who thoroughly reviewed the final report.

SECTION I
INTRODUCTION

This manual is intended to present the program logic and user instructions for a Data Storage Program (DSP), with plotting and statistical options. The Program was developed to store, display and analyze both raw and transformed data collected as part of a DOT/FHWA Project, Constituents of Highway Runoff DOT-FH-11-8600.

The program allows researchers and other interested users ready access to the project data. The program also provides a readily available and convenient means for storage and analysis of environmental and operational data collected during future highway runoff studies.

This manual is divided into two sections. The first section includes the systems logic, computer requirements, a description of the variables and the program flow charts. The later section presents the users manual, operating instructions, and the program source listing.

The manual has been written to aid the engineer or computer analyst in installing and using DSP on their computer. The manual assumes that the reader is familiar with FORTRAN IV and has a working knowledge of the specific job control language for the computer system being utilized.

SECTION II
DATA STORAGE PROGRAM (DSP) SYSTEM

COMPUTER REQUIREMENTS

DSP is designed to operate in a batch mode on computer systems having the following devices and capabilities:

1. A FORTRAN compiler.
2. The ability to create permanent and/or temporary data sets with random access capabilities.
3. 100K bytes of core storage for DSP.
4. 180 bytes of core storage for DSP and plotting option.
5. Access to a peripheral plotting device if plots are desired.

SYSTEM OVERVIEW

DSP is designed to be flexible and operate in various modes depending on the user's needs. The standard mode illustrated in Figure 1 is to assemble the input on punched cards and execute DSP, storing the plotting data and statistical data on permanent data sets. The input and output from DSP should then be checked for errors. Once it has been determined that the data is correct the user may use the plot generating option illustrated in Figure 2. This program option reads the input from the permanent data set and generates the x, y coordinates and pen movements for a peripheral plotting device.

The main program has three subroutines--TIMCON, FORMUP, and FORMN2 (Figure 1). Subroutine TIMCON (Figure 3) is used to convert military time into alpha characters. Subroutines FORMUP and FORMN2 are called to build the format statements for each of the thirty possible discrete or composite quality parameters that are input to the program. These subroutines therefore allow selective print format of the desired parameters.

By using the proper job control cards, permanent data sets may be created to store:

1. Input card images.
2. Plotting information.
3. Statistical information.

In this way, a data handling and storage system which can be tailored to the user's needs is built around the DSP. For example, if the plot generating option is not utilized the JCL creating the plot files is simply omitted.

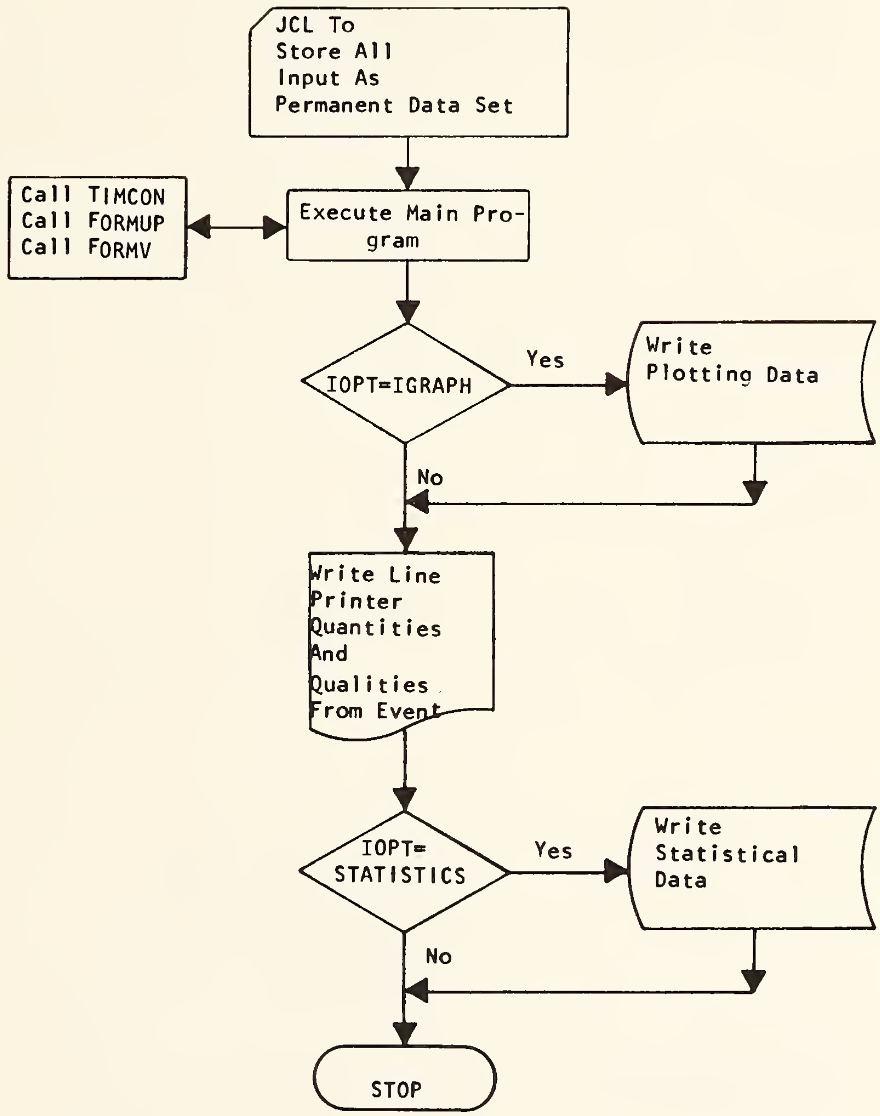

Figure 1. DSP standard operating mode.

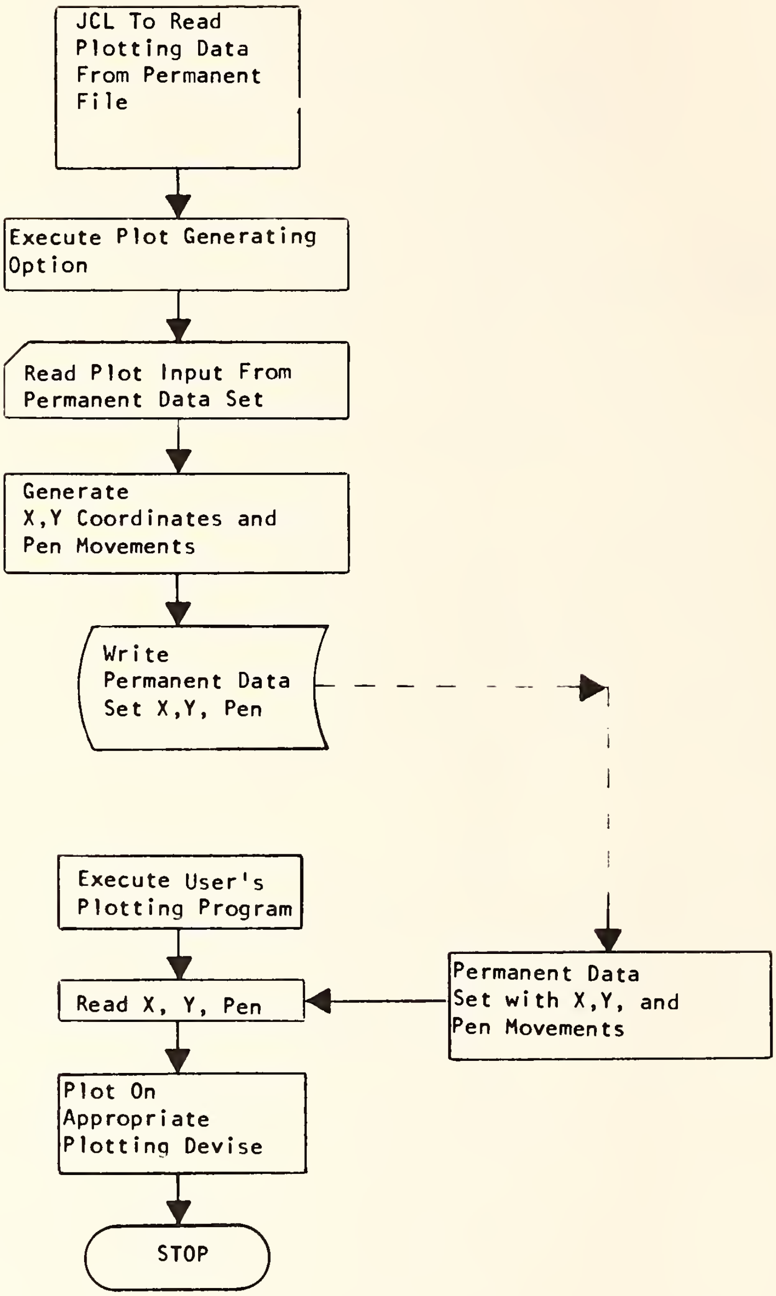

Figure 2. Plot generating option flow chart.

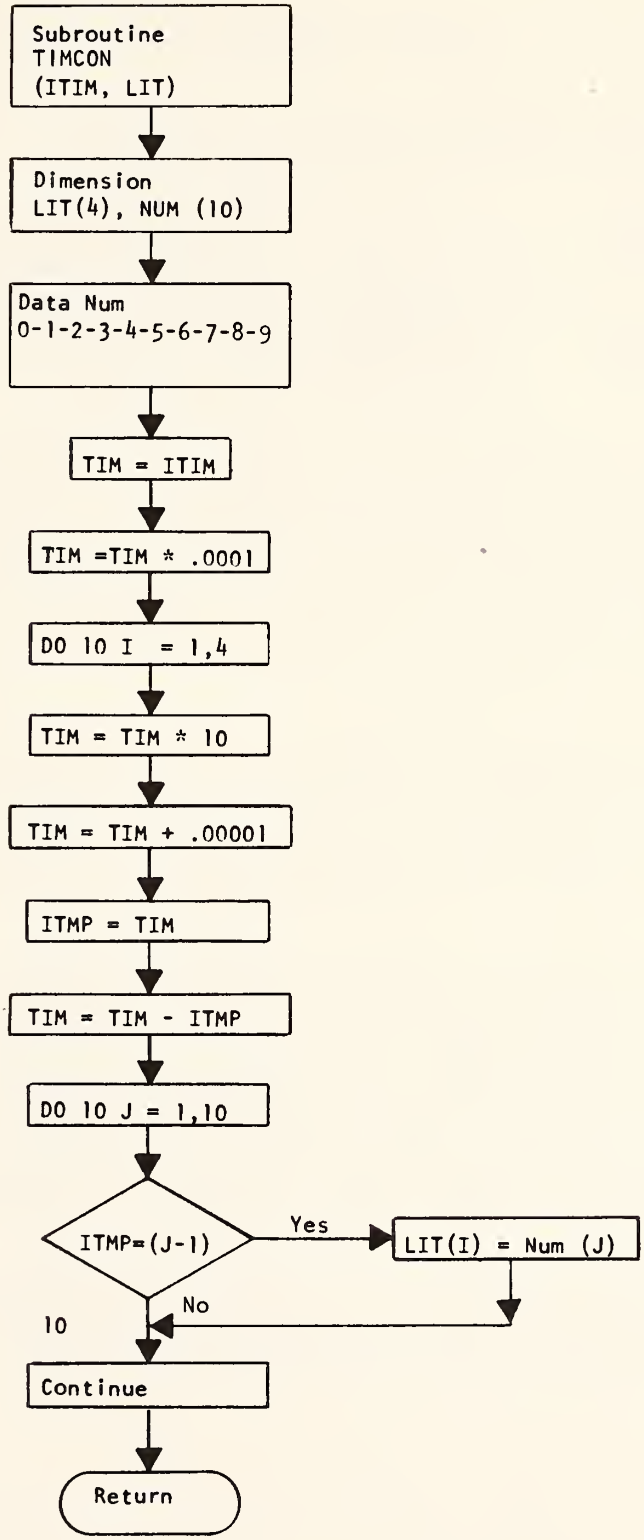

Figure 3. Flow chart of subroutine TIMCON

JCL For IBM/AMDAHL 370 System

On the 370 System the Data Storage Program requires that data be assigned to input and output data sets as follows:

//FT05F001	is assigned to the input data set, data set 5.
//FT06F001	is assigned to the output print set, data set 6.
//FT09F001	is assigned as an output (permanent or temporary) for the plot generating program, data set 9.
//FT10F001	is assigned to the statistical data set, data set 10.
//FT40F001	is assigned to the output data set for input to the user's Plotter, data set 40.

The monitoring and background data for each event, data set 5, is input to the data storage program. The output print, data set 6, is generated onto the line printer. The plotting program is an optional step. If the card //FT09F001 DD SYSOUT=A is present, data set 9 will be generated onto the line printer. If instead the card //FT09F001 DD DSN=name is present, data set 9 will be stored as a permanent file (name). If the card //FT09F001 DD DUMMY or if no card is entered, the plotting option is cancelled.

The Plot Generating program reads data set 9 (see plot generating JCL Figure 2) and generates the actual x and y coordinates and pen movements. The //FT40F001 DD DSN=name JCL card directs the x and y coordinates and pen movements to be stored as data set 40. The user's in-house plotter then utilizes data set 40, FT40F001 DD DSN=name, to create the desired plots.

DSP may also be used to generate statistical data for each monitoring event. The parameters available for analysis are shown in Table 1. The statistical file, which is in the form of coordinates, is written on FT10F001 for each event and should be kept as a permanent file. The user may then use the data on the permanent files for correlation analysis or to generate summary statistics (Figure 4). Statistical programs such as Statistical Package for the Social Scientist (SPSS), Statistical Analysis System (SAS) or Biomedical Computer Programs (BMD) can be used to perform the statistical analyses.

DSP, the Plotting Option, and the user's plotting software can be linked together as shown in Figure 5, although this configuration is not the only possible scheme for setting up these programs.

Table 1. Parameters available for statistical analysis.

STAT(1)	= Total precipitation (cm)
STAT(2)	= Average precipitation (cm)
STAT(3)	= Maximum intensity (cm/hr)
STAT(4)	= Number of dry days
STAT(5)	= Number of dry days less than one inch accumulation
STAT(6)	= Average daily traffic (vehicles/day)
STAT(7)	= Average traffic for period before storm with less than one inch accumulation (vehicles/day)
STAT(8)	= Average truck traffic (trucks/day)
STAT(9)	= Air particulate fallout rate (gm/m^2/day)
STAT(10)	= Total runoff (m^3)
STAT(11)	= Length of event (minutes)
STAT(12)	= Average runoff (m^3/minute)
STAT(13)	= Maximum runoff (m^3/minute)
STAT(14)	= Time into event of maximum runoff (minutes)
STAT(15)	= *
STAT(16)	= *
STAT(17)	= *
STAT(18)	= *
STAT(19)	= *
STAT(20)	= *
STAT(21)	= *
STAT(22)	= *
STAT(23)	= *
STAT(24)	= *
STAT(25)	= *
STAT(26)	= Composite coliforms (counts/100 ml)
STAT(27)	= Composite pH
STAT(28)	= Composite Hg (kilograms)
STAT(29)	= Composite SS (kilograms)
STAT(30)	= Composite VSS (kilograms)
STAT(31)	= Composite BOD_5 (kilograms)
STAT(32)	= Composite TOC (kilograms)
STAT(33)	= Composite COD (kilograms)
STAT(34)	= Composite TKN (kilograms)
STAT(35)	= Composite NO_2 (kilograms)
STAT(36)	= Composite NO_3 (kilograms)
STAT(37)	= Composite TN (kilograms)
STAT(38)	= Composite TPO_4 (kilograms)
STAT(39)	= Composite Cl- (kilograms)
STAT(40)	= Composite Pb (kilograms)
STAT(41)	= Composite Zn (kilograms)
STAT(42)	= Composite Sn (kilograms)
STAT(43)	= Composite Fe (kilograms)
STAT(44)	= Composite Cu (kilograms)
STAT(45)	= Composite Cd (kilograms)
STAT(46)	= Composite Cr (kilograms)
STAT(47)	= Composite TS (kilograms)
STAT(48)	= Composite oil and grease (kilograms)
STAT(49)	= Composite PCB's (kilograms)
STAT(50)	= Composite pesticides (kilograms)

*Not used.

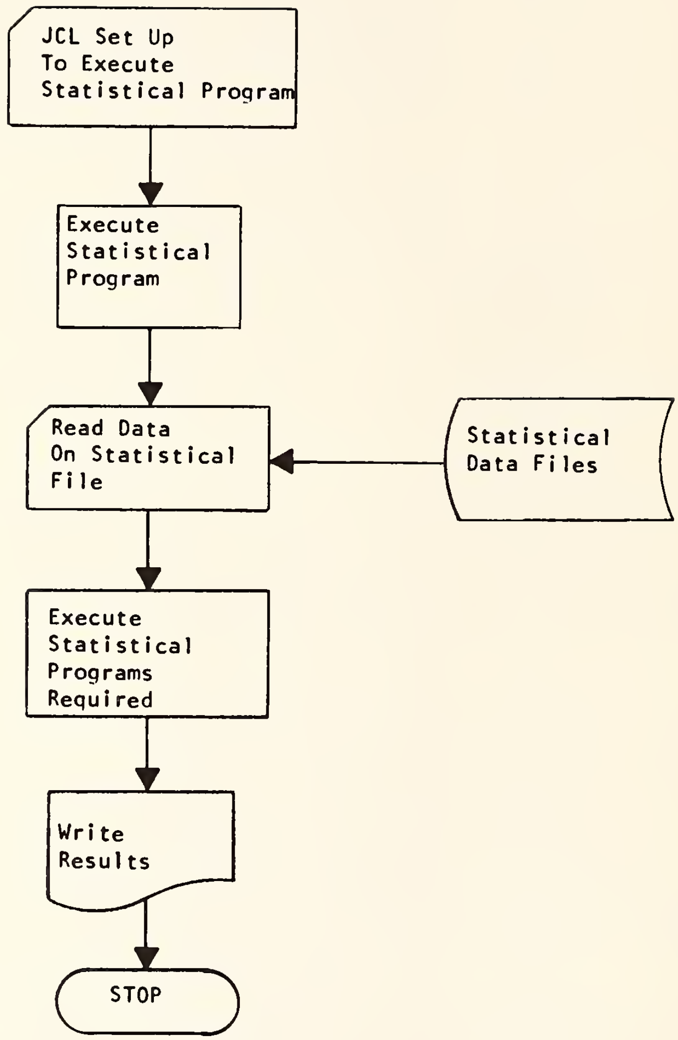

Figure 4. Flow chart for using statistical programs.

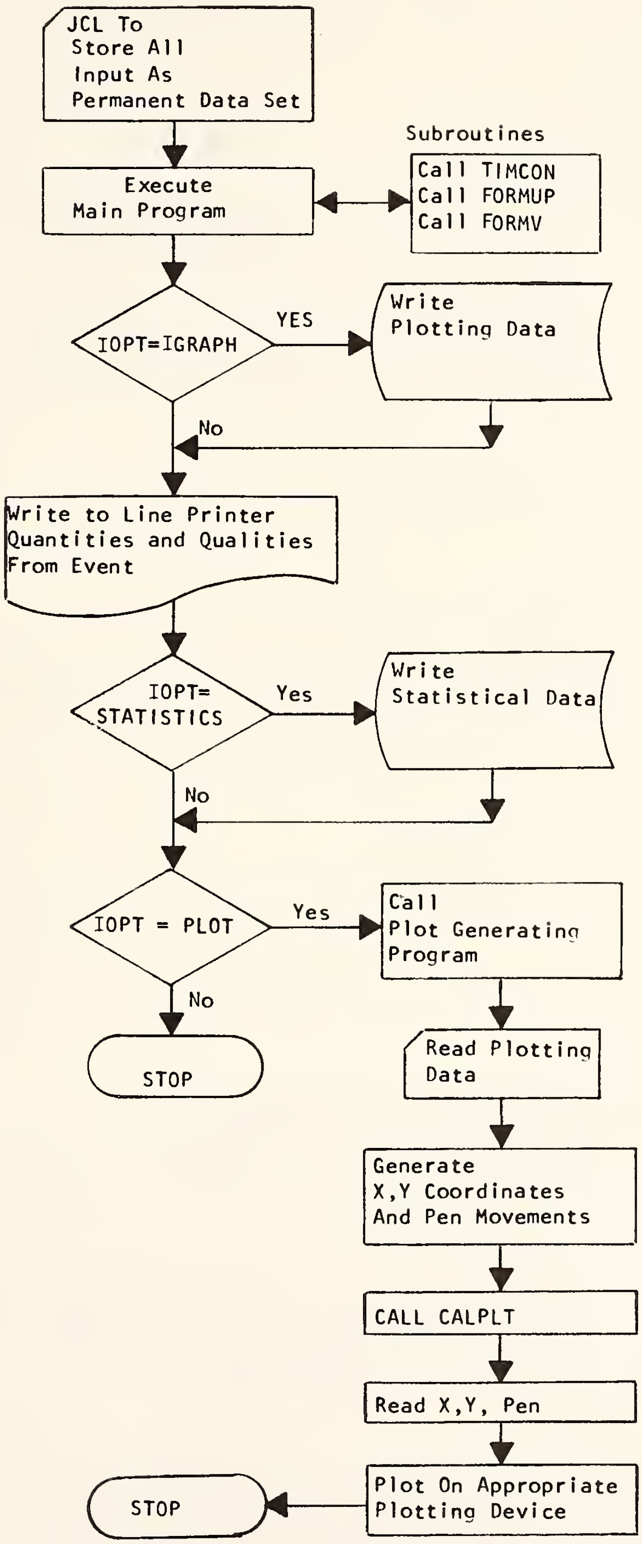

Figure 5. Flow chart of DSP and PGP linked program.

JCL For Running and Storing DSP - The following JCL deck is required:

```
1.  //JOB CARD,
2.  //MESSAGE CLASS
3.  //STPNM EXEC PGM=DOTPGM,REGION=100K,TIME=1
4.  //FT06F001 SYSOUT=A
5.  //FT09F001 DD DSN=PLT01,VOL=SER=NNNNNN,UNIT=DISK,
                SPACE=(CYL,(1,1)),DCB=(RECFM=FB,LRECL=80,
                BLKSIZE=800),DISP=(NEW,CATLG,DELETE)
6.  //FT10F001 DD DSN=STAT1,VOL=SER=NNNNNN,UNIT=DISK,
                SPACE=(CYL,(1,1)),DCB=(RECFM=FB,LRECL=80,
                BLKSIZE=800),DISP=(NEW,CATLG,DELETE)
7.  //FT05F001 DD *

    (Insert Input Card Deck Here)

8.  /*
9.  //
```

In the above example, data set 9 is assigned the name PLT01. This data set is stored on disc which is identified by NNNNNN and has an allocation of one primary cylinder and one secondary cylinder. The fixed block record format has a logical record length of 80 and a block size of 800. The disposition of the data set named PLT01 is:

1. It becomes a new data set.
2. It will be cataloged.
3. If execution terminates before completion of the program, the data set will be deleted.

JCL For Plot Generating Program - The following JCL deck is required:

```
1.  //JOB CARD,
2.  //MESSAGE CLASS
3.  //STPNM EXEC PGM=PCTGEN,REGION=100K,TIME=1
4.  //FT40F001 DD DSN=PGEN1,VOL=SER=NNNNNN,UNIT=DISC,
               SPACE=(CYL,(1,1)),

    (Insert Plot Driver Program Here)

5.  //         DCB(RECFM=FB,LRECL=80,BLKSIZE=800),
               DISP=(NEW,CATLG,DELETE)
6.  //FT09F001 DD DSN=PLT01,DISP=(OLD)
7.  /*
8.  //
```

Data set 40 is stored as PGEN1 and has the same characteristics as data set 9 from DSP. In the above example, data set 9 is an old data set being used as input to the plot generating program.

Link Edit JCL For DSP - The following JCL deck is required:

```
1.  //JOB CARD,
2.  //MESSAGE CLASS
3.  //STPNM EXEC FORTGCLR
4.  //FORT.SYSIN DD *
5.  //LKED.SYSIN DD *
6.           ENTRY MAIN
7.           NAME DOTPGM(R)
```

This JCL deck is assembled to compile, link edit and resolve an input program using a "G" compiler. The entry point for execution of the program is the "MAIN" subroutine. The program will be stored as an executable program called DOTPGM and will replace any other program on the load library which has the name DOTPGM.

JCL For Input To The User's Plotter - The following card is required:

```
//FT40F001 DD DSN=PGEN1,DNP=(OLD)
```

JCL for Control Data 7600 System

Compile Step - Control cards which make up the compile portion are as follows:

```
1.  COMP,STTCZ,Pn,Tnnn.
2.  ACCOUNT,Tnnnn.
3.  REQUEST(LGO,*PF)
4.  ATTACH(OLDPL,DSP)
5.  UPDATE(F,C)
6.  REWIND(COMPILE)
7.  FTN(A,I)
8.  CATALOG(LGO,DSPLGO)
9.  7/8/9
10. 6/7/8/9
```

Card one indicates the job's name, designation code, priority and time limit. The job in this example (COMP) is designated to run on STTCZ (System Twin Cities-Z), which is the identification code for the CDC 7600 located in Minnesota. Pn sets the priority level where "n" can have a value of 2 (lowest priority), 4, or 6 (highest priority). Tnnn sets the execution time (maximum=100 seconds). Card two contains the account number, Tnnnn. The third card reserves local file space which is designated LGO. Upon completion of program execution LGO becomes a permanent file. If execution terminates before program completion, the data set (LGO) will be deleted.

Cards four, five and six must be included if the input data is to be obtained from a storage device. Card four calls the data file named OLDPL and the compiled program file DSP (Data Storage Program) from the storage device. Card five specifies that this is a full (F) update, rather than partial update. The C indicates a compiled file. Card six commands the device to backspace to file start in preparation for the next program execution. Cards four, five and six must be omitted if cards are used to input the data. The input card deck would be inserted after card nine. The designation code I on card seven indicates input data. The designation code A on the same card indicates that program execution should be terminated if a job control error is detected. Card eight catalogs the data under file name LGO and compile name DSPLGO. Card nine is an 'end of file' statement, indicating that the file is complete. It is followed by the program card deck only if cards four, five and six were omitted. Card ten is an 'end of job' statement, indicating that this job is complete. The same job can be run for PLOT, changing DSP and DSPLGO accordingly.

Execution Step - Control cards which make up the execution portion are as follows:

1. DSP,STTCZ,Pn,Tnnn.
2. ACCOUNT,Tnnnn.
3. REQUEST(TAPE9,*PF)
4. REQUEST(TAPE10,*PF)
5. ATTACH(LGO,DSPLGO)
6. MAP(OFF)
7. LDSET(PRESET=ZERO)
8. LGO.
9. CATALOG(TAPE9,DSP9)
10. CATALOG(TAPE10,DSP10)
11. 7/8/9
12. 6/7/8/9

Cards three and four create local file spaces named TAPE9 and TAPE10, respectively. After execution these local files become permanent files (*PF). The fifth card calls the data file named LGO and the compiled program file DSPLGO from the storage device. These files were created previously during the Compile Step. Card six terminates the MAP option which would otherwise list relative storage locations of control sections. When the map option is used, an estimate is obtained of the required program region size. Card seven presets all variables in core to zero. Card eight executes LGO. Card nine and ten catalog the data under file/compile names TAPE9/DSP9 and TAPE10/DSP10, respectively.

Plot Device Procedure - Control cards required for the plot device procedure are as follows:

1. PLOT,STTCZ,Pn,Tnnn.
2. ACCOUNT,Tnnnn.
3. REQUEST(TAPE40,*PF)
4. ATTACH(TAPE9,DSP9)
5. ATTACH(LGO,PLOTLGO)

6. MAP(OFF)
7. LGO.
8. CATALOG(TAPE40,PLOT40)

Card three reserves a local file space named TAPE40 and, after execution, it becomes a permanent file (*PF). Cards four and five call the data files/compiled files named TAPE9/DSP9 and LGO/PLOTLGO, respectively. Card seven executes LGO, and card eight catalogs the data under file name TAPE40 and compile name PLOT40.

Tape Update Procedure - Control cards required for tape update are:

1. TAPE,STTCZ,Pn,Tnnn.
2. ACCOUNT,Tnnnn.
3. ATTACH(OLDPL1,DSP)
4. ATTACH(OLDPL2,PLOT)
5. UPDATE(P=OLDPL1,F,N=NEWPL1,W)
6. UPDATE(P=OLDPL2,F,N=NEWPL2,W)
7. STAGE(TPAE,POST,NT,PE)
8. REWIND(NEWPL1,NEWPL2)
9. COPYBF(NEWPL1,TAPE)
10. COPYBF(NEWPL2,TAPE)
11. 6/7/8/9

Cards three and four call the data files/compiled files named OLDPL1/DSP and OLDPL2/PLOT. Cards five and six obtain update information from data files (P) named OLDPL1 and OLDPL2, respectively. These cards also create new (N) updated local files named NEWPL1 and NEWPL2, respectively. The letter "F" indicates that this is a full update, rather than a partial update, while the letter "W" indicates that the files are to be placed on the magnetic tape in sequential order. Card seven commands the storage device to write on a magnetic tape (TAPE), in nine tracks (NT), phase and code at 1600 bytes per inch (PE), with even parity (POST). Card eight commands the storage device to rewind the tape. Cards nine and ten unload the data, which are in local files named NEWPL1 and NEWPL2, onto a magnetic tape (TAPE) in binary file language (BF).

Card Update Procedure - Control cards which make up the update portion are as follows (cards to magnetic tape):

1. TAPE,STTCZ,P6,T100.
2. ACCOUNT,Tnnnn.
3. UPDATE(F,N=NEWPL1,W)
4. UPDATE(F,N=NEWPL2,W)
5. STAGE(TAPE,POST,NT,PE)
6. REWIND(NEWPL1,NEWPL2)
7. COPYBF(NEWPL1,TAPE)
8. COPYBF(NEWPL2,TAPE)

9. 7/8/9

(Insert Data Storage Program)

10. 7/8/9

(Insert Plot Program)

11. 6/7/8/9

Cards one through eight were already discussed in the previous section on tape update control cards. Card nine is an 'end of file' statement. In this JCL configuration it acts as a partition between the control cards and the first deck which updates DSP. Card ten functions as a partition between the first deck and the second deck which update DSP and PLOT, respectively.

DATA STORAGE PROGRAM

Figure 6 is a detailed flow chart of the data storage program and Table 2 lists the variable names and their descriptions. This flow chart does not include the subroutines or the plotting option. The DSP is divided into seven blocks, with entry into each block controlled by a computed GØ TØ depending on the value of the variable KKK. Appendix Table I contains the Data Storage Program listing and Appendix Table II contains the plot program listing.

The first block, B1 START to B1 END, is the controlling or "Executive" block. In this block, all arrays are dimensioned and the first four data cards are read in. The first card contains the event number, a snow melt option indicator, and a plot option indicator. The second card contains the area of the site in acres, and a 20 character title which appears on each page of the output and on all plots. This title normally contains site location, event number and any other pertinent information. The third card contains the month, day and year of the start of the event and the starting time of the rainfall and runoff. The fourth card contains the date (month, day and year) and time the rainfall event ended. The remainder of the block converts military time into alpha characters using the subroutine TIMCON. Initially the variable for the computed GØ TØ statement (KKK) is set to a value of one, preventing the DOT banner from being written on the first two pages. The DØ statement which drives the program is next (DØ 111 I = 1, 2). The remaining segment of program logic writes the DOT banner (if KKK > 1), run title, rainfall starting date, rainfall starting time, and event number on each page of output. This loop also contains the computed GØ TØ statement which determines which block of program logic is executed next.

Upon completion of the DØ loop in block one, control is passed to block two which extends from B2 START to B2 END. This block determines if the graph option will be used. If the graph option is selected

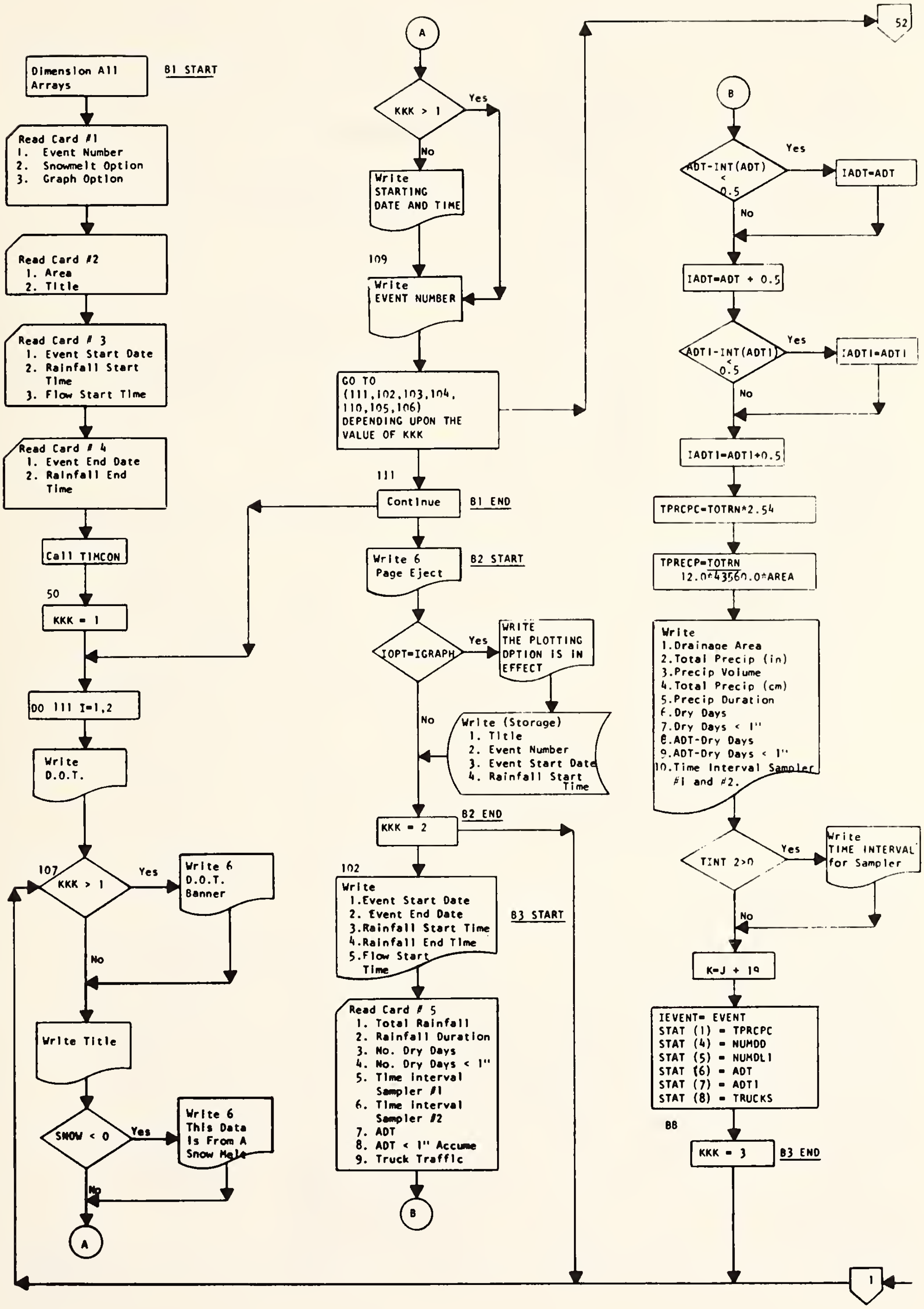

Figure 6. Flow chart of data storage program.

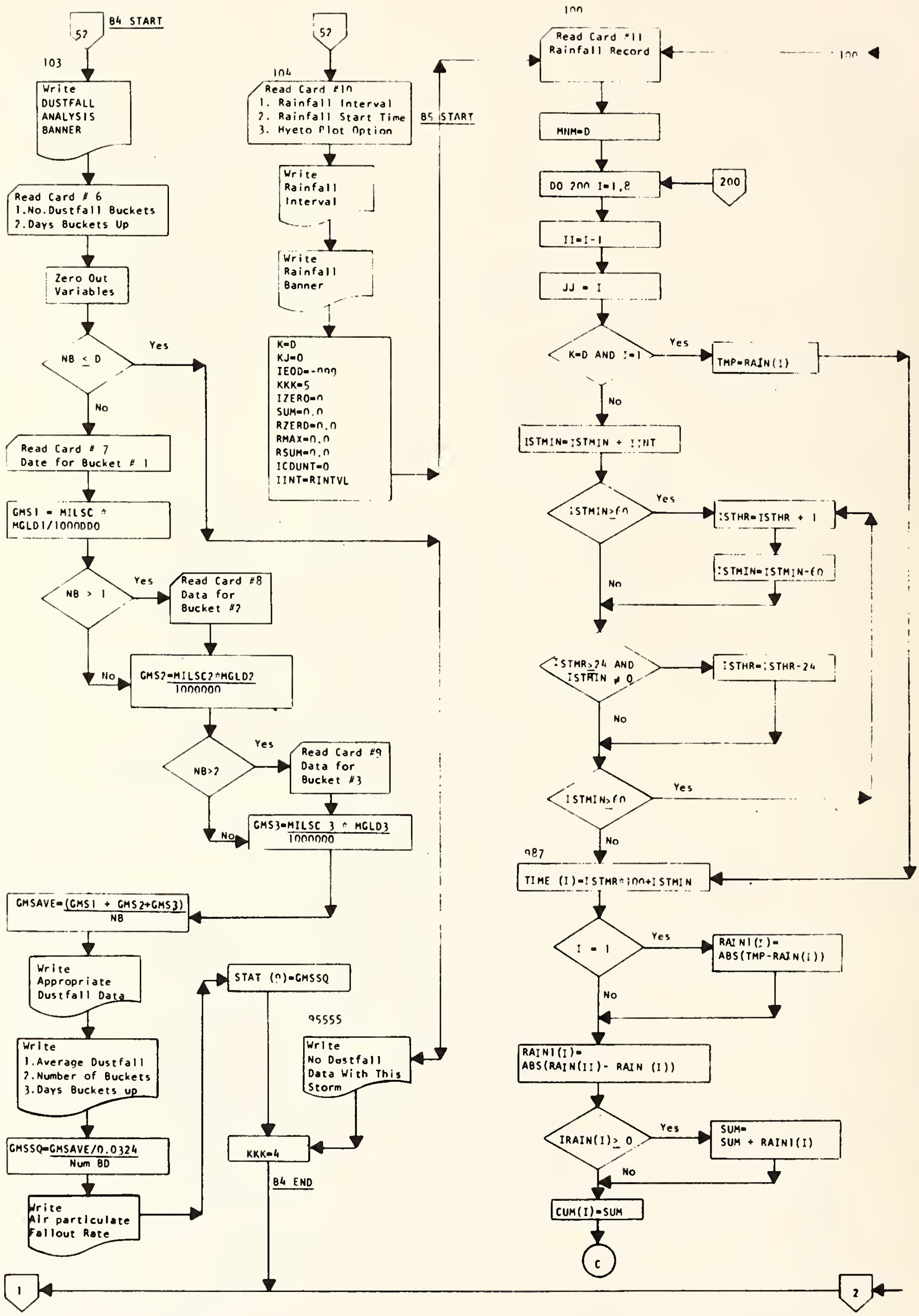

Figure 6. (continued).

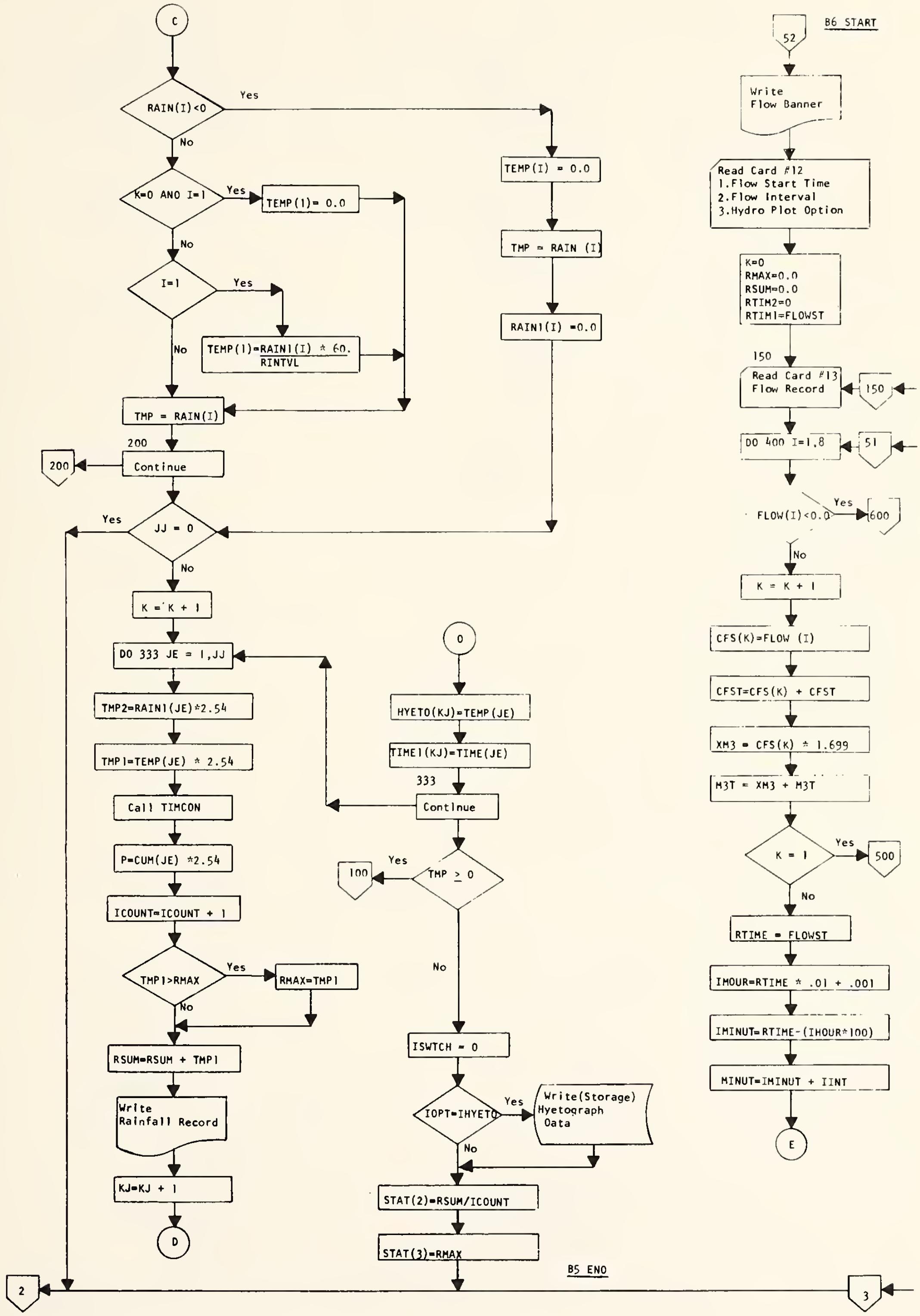

Figure 6. (continued).

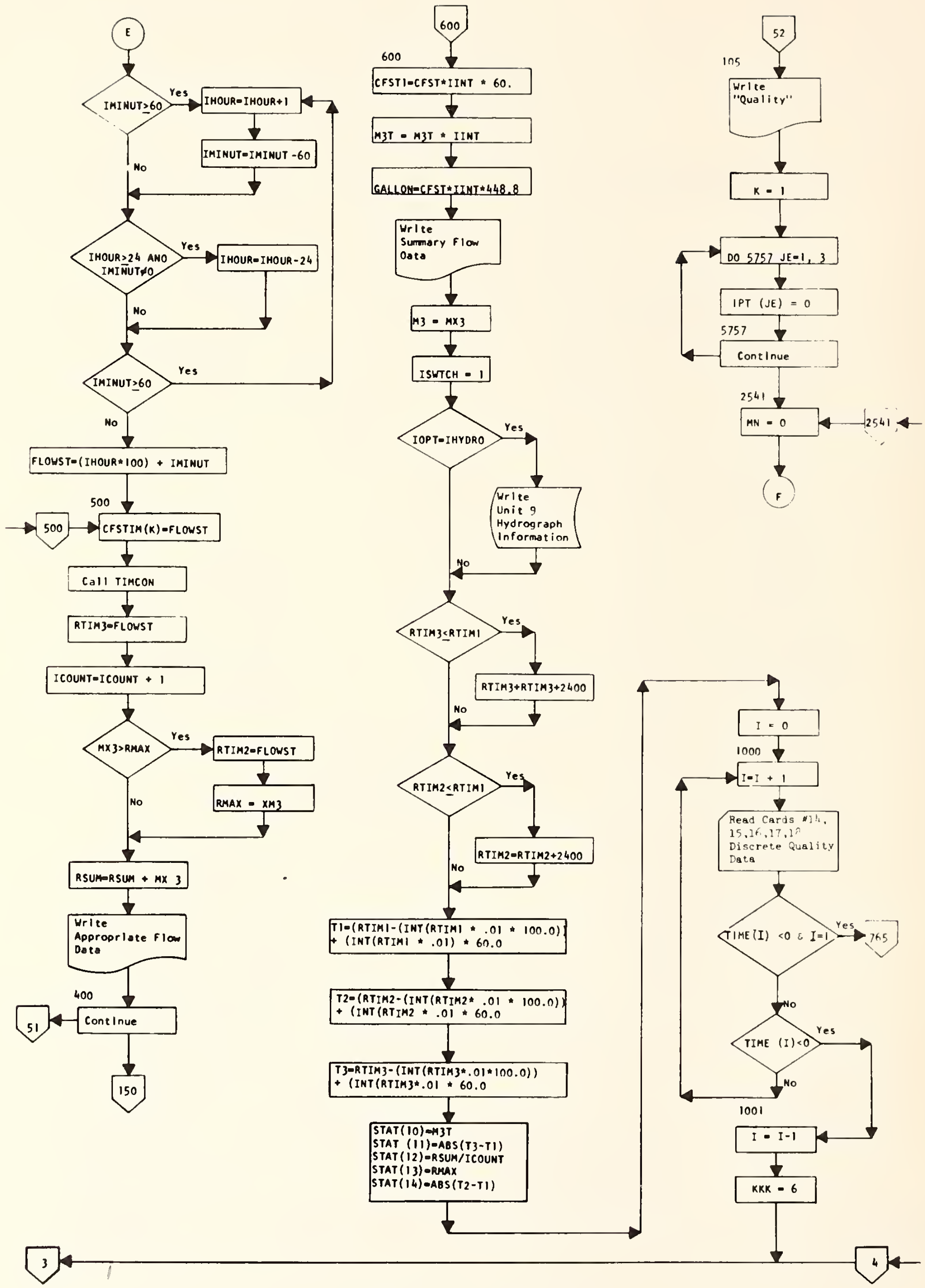

Figure 6. (continued).

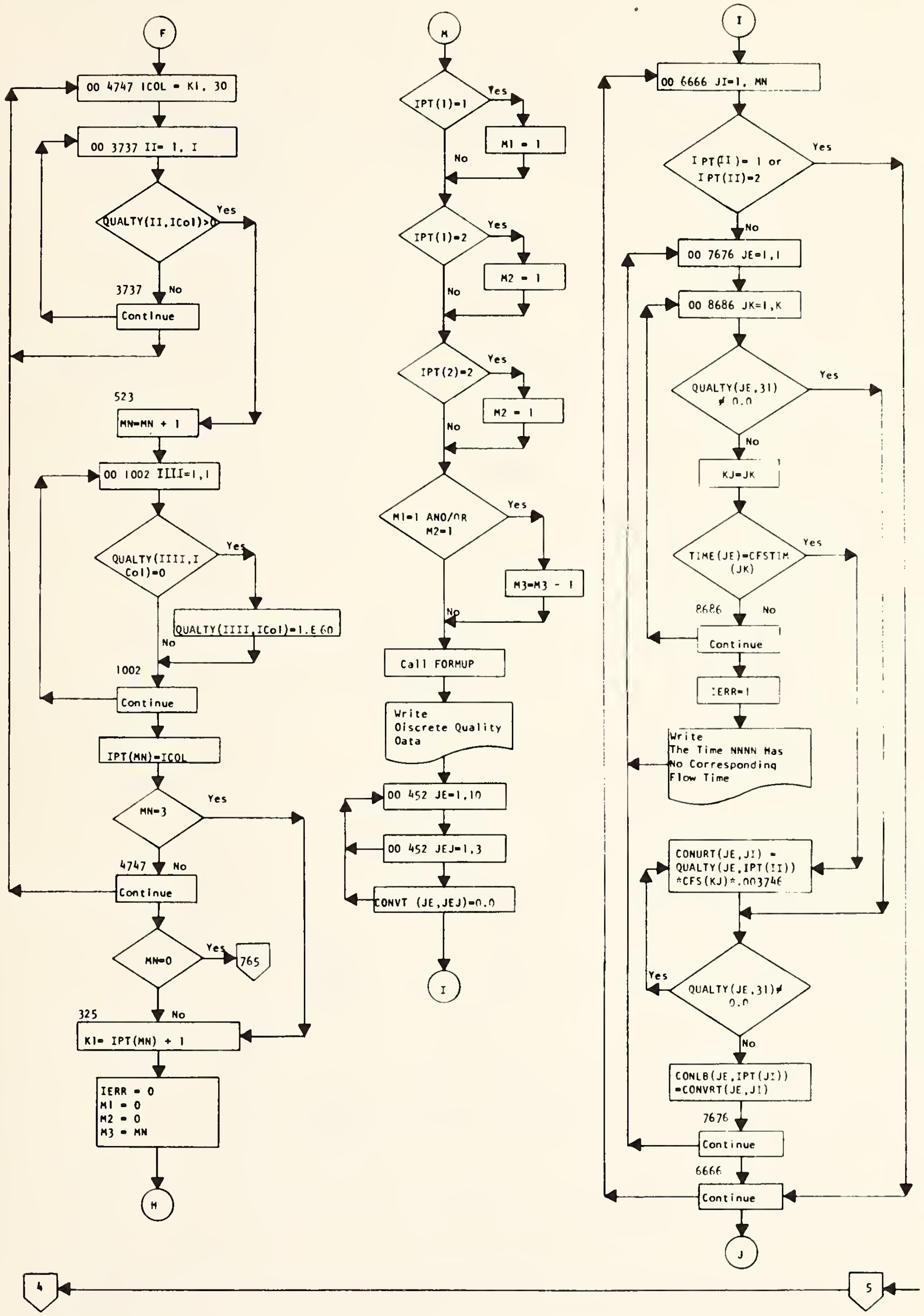

Figure 6. (continued).

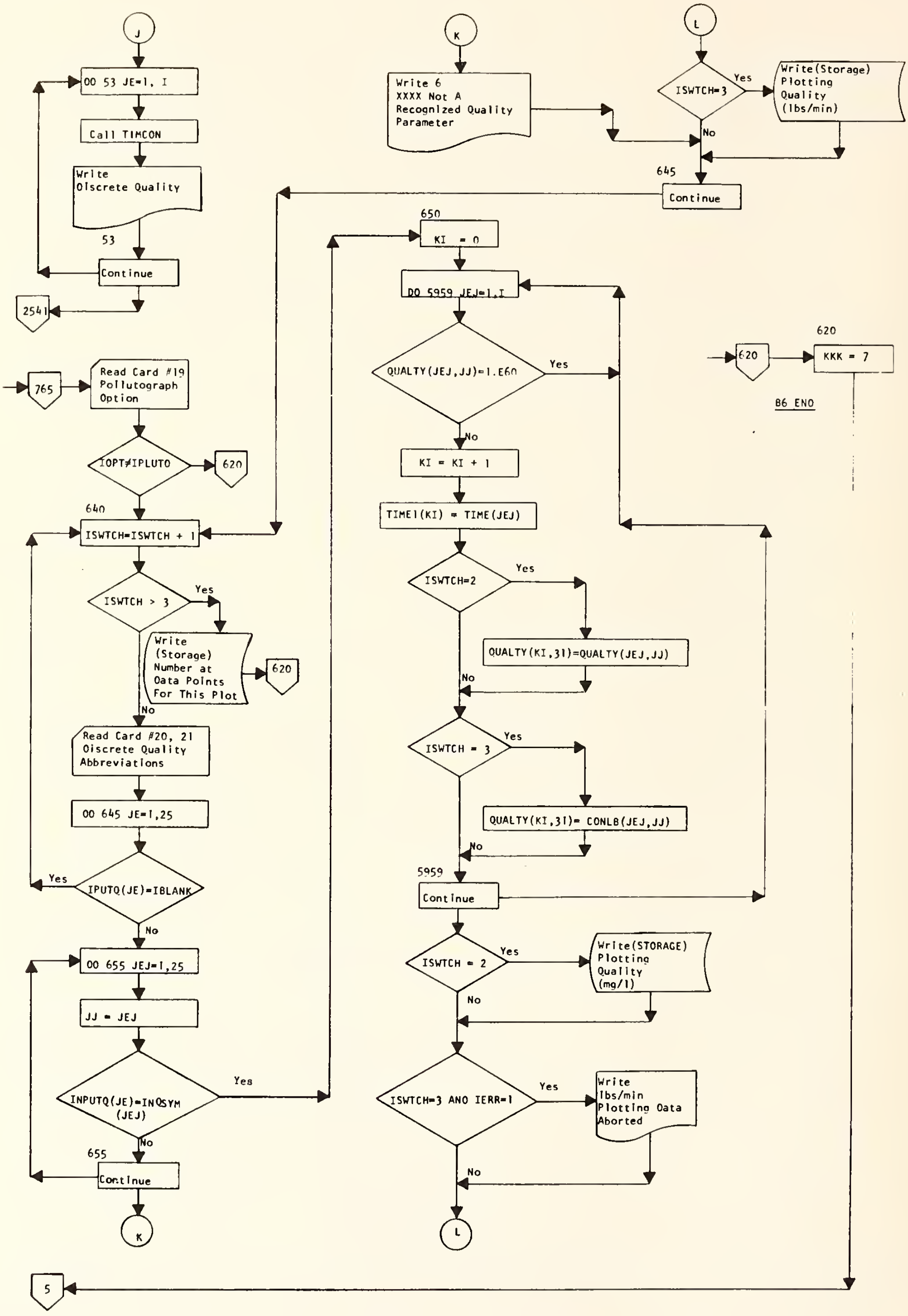

Figure 6. (continued).

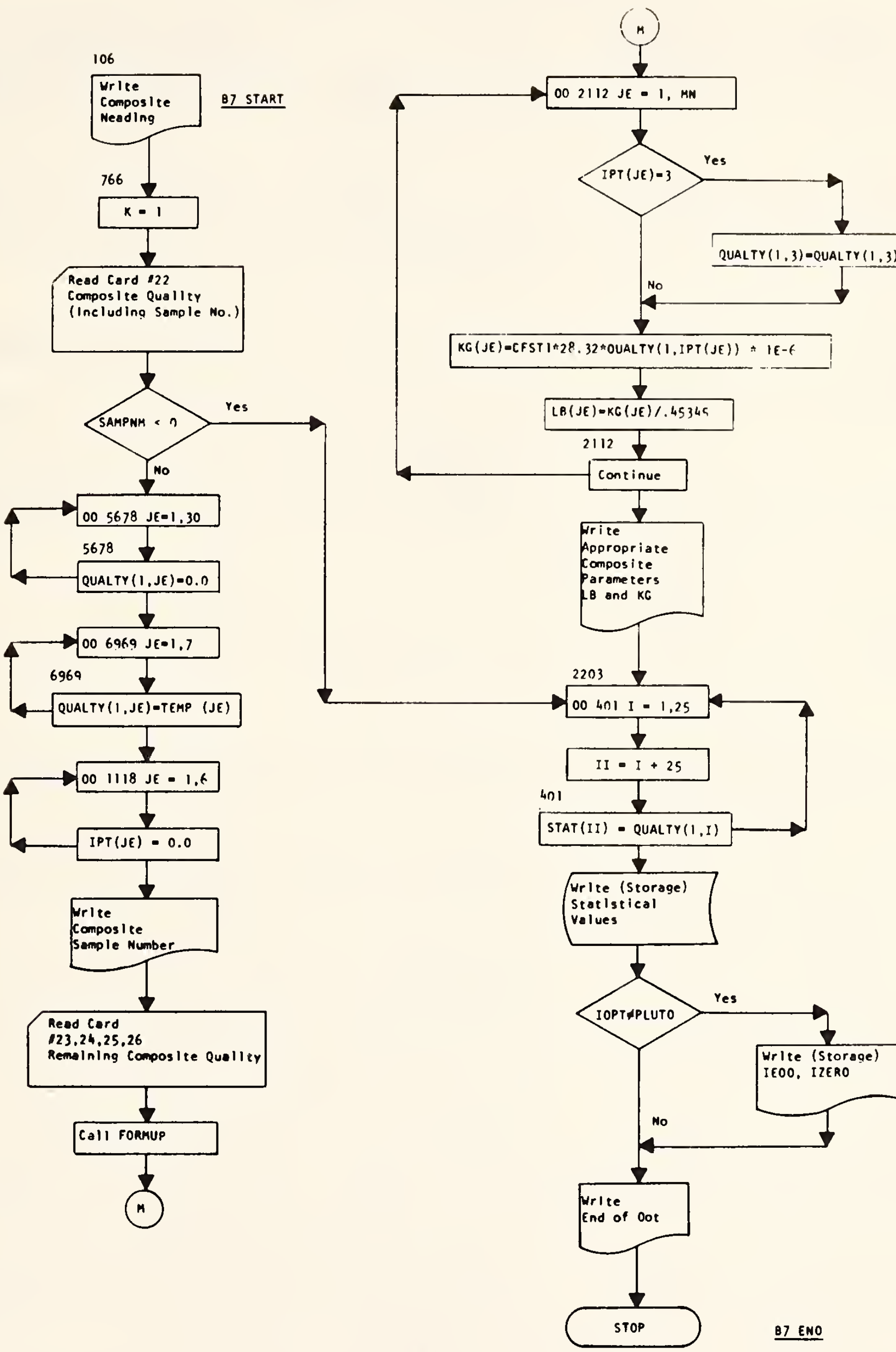

Figure 6. (continued).

Table 2. Variable names and description.

Variable name	Format	Description
ADT	Real	Input variable for average daily traffic since last event (vehicles per day)
ADTI	Real	Input variable for average daily traffic for period before the storm event with an accumulation of less than one inch of rainfall (vehicles per day)
AREA	Real	Input variable for site area (acres)
BAREA	Real	One of two possible values; 1) area of dustfall bucket which is read in, or 2) defaults to the area of a standard eight inch dustfall bucket (0.0324 square inches)
CFS (K)	Real	Array for storing input flows
CFST	Real	Sum of the input flow rates (cubic feet per second)
CFSTIM (K)	Real	Used to associate the incremented flow time with the appropriate input flow
CFSTI	Real	Total flow (cubic feet) as defined by the equation: CFST * time interval * 60
CONLB (JE, IPT, (JI))	Real	Array for storing discrete quality pollutant loading values (lbs/min)
CONVRT (JE, JI)	Real	Array for computing discrete quality pollutant loading values (lbs/min)
CUM	Real	Cumulative rainfall sum (inches)
DURATN	Real	Input variable for duration of the rainfall event (hundredths of an hour)
ENDD (I)	Integer	Three position array for storing end of event (month, day, year)
ENDT	Integer	Input variable for time event ended (military time, e.g., 2400 hours)
EVENT	Integer	Input variable for event number

Table 2. (continued).

Variable name	Format	Description
FLOW (I)	Real	Array for storing input flow values (cubic feet per second)
FLOWST	Real	Input variable for flow start time (military time) from which all other flow times are calculated using the input flow time interval
GALLON	Real	Total flow in gallons
GMSAVE	Real	Average grams of dust for number of buckets sampled
GMSSQ	Real	Air particulate fallout rate ($gm/m^2/day$)
GMS1	Real	Grams of dust for bucket #1
GMS2	Real	Grams of dust for bucket #2
GMS3	Real	Grams of dust for bucket #3
HYETO	Alpha-Numeric	If IOPT = HYETO, the hyetograph data will be written to the plotting file
I	Integer	Array positional value (row)
IADT	Integer	Rounded up or down integer value of ADT which is read in as a real number
IADT1	Integer	Rounded up or down integer value of ADT1 which is read in as a real number
ICOL	Integer	Array positional value
ICOUNT	Integer	Counts number of input rainfall values, used to compute average rainfall
IEOD	Integer	Used as end of data set (-999)
IEVENT	Integer	Integer value of real variable "EVENT" used for plotting
IHOUR	Integer	Time in hundreds of hours, e.g., 2200 = 22
IIII	Integer	Array positional value

Table 2. (continued)

Variable name	Format	Description
IINT	Integer	Integer value of RINTVL, rainfall interval
IMINUT	Integer	Used to save integer value for minutes part of military time designation, nnnn
INPUTQ (JE)	Alpha-Numeric	Input variable for discrete quality abbreviations, e.g., SS FE, COD, etc.
INQSYM	Alpha-Numeric	Data statement containing 30 possible input quality parameters and 4 blanks
IOPT	Integer	Graph option if IOPT = IGRAPH the program writes plotting data on Unit 9 for IHYETO, IHYDRO, and IPLUTO
ISTHR	Integer	Input variable for hour rainfall started (military time)
ISTMIN	Integer	Input variable for minute rainfall started
ISWTCH	Integer	Position pointer, counter
JE	Integer	Array positional value
K	Integer	Value set equal to zero and incremented by one for determining the first time through a loop; later used as the length of another DO loop.
KG (JE)	Integer	Composite quality (kilograms)
KI	Integer	Positioner for various arrays
KJ	Integer	Positioner for various arrays
KKK	Integer	KKK is used to transfer from one section of program to another depending upon its value
LB (JE)	Real	Composite quality (pounds)
LNUM, LNUM1, and LNUM2	Alpha-Numeric	Transfer variables for the subroutine TIMCON representing the alpha equivalence of time; these variables are also used for plotting

Table 2. (continued)

Variable name	Format	Description
LOC	Alpha-Numeric	Input variable for two letter optional site abbreviation
MN, M1 M2 & M3	Integer	Main body program pointers and counters used to hold program position while the subroutines FORMUP and FORMN2 which build formats for the quality parameters are called
M3	Real	Flow in cubic feet per minute
M3T	Real	Total flow in cubic meters (M3T * IINT)
MGLD1	Real	Input variable for milligrams per liter of dust and dirt in bucket No. 1
MGLD2	Real	Input variable for milligrams per liter of dust and dirt in bucket No. 2
MGLD3	Real	Input variable for milligrams per liter of dust and dirt in bucket No. 3
MILSC1	Real	Input variable for milliliters of samples collected from dustfall bucket No. 1
MILSC2	Real	Input variable for milliliters of samples collected from dustfall bucket No. 2
MILSC3	Real	Input variable for milliliters of samples collected from dustfall bucket No. 3
NB	Real	Input variable for number of dustfall bucket samples associated with this event
NUMBD	Real	Input variable for number of days the dustfall buckets were up collecting the sample
NUMDD	Integer	Input variable for number of dry days before this event
NUMDL1	Integer	Input variable for number of dry days before this event with less than one inch rainfall accumulated
P	Real	Cumulative rainfall sum (centimeters)

Table 2. (continued).

Variable name	Format	Description
PLUTO	Alpha-Numeric	If IOPT = PLUTO, pollutographs will be plotted
QUALTY(I,M)	Real	Array for storage of quality parameters
RAIN(I)	Real	Array for storing rainfall record
RAIN1(I)	Real	Used to hold the absolute value of the differences between the rainfalls
RAIN1(II)	Real	Rainfall value for time one minus rainfall value for time two
RINTVL	Real	Input rainfall interval for rainfall record (minutes)
RMAX	Real	Maximum rainfall intensity for an event
RSUM	Real	Variable used in two different program sections: 1) Rainfall Sum (centimeters) 2) Flow Sum (cubic meters)
RTIM1	Real	Actual flow start time
RTIM2	Real	Time of maximum flow (hours, minutes); later converted to minutes
RTIM3	Real	Time of last flow in the loop (hours, minutes)
RTIME	Real	Current time used to convert flow start time in the cases where IHOUR > 24 or IMINUT > 60
RTITLE	Alpha-Numeric	Site name
SAMPLE(I)	Integer	Input variable for sample number (usually a laboratory identification number)
SNOW	Integer	Input variable with two possible values: 1) One signals data from snow melt 2) Blank signals rainfall event

Table 2. (continued).

Variable name	Format	Description
STARTD(I)	Integer	Three position array for event start (month, day, year)
STARTD	Integer	Input variable for overflow start time
STARTT	Integer	Input variable for rainfall start time
SUM	Real	Variable used to sum rainfall
T1	Real	RTIM1 in minutes
T2	Real	RTIM2 in minutes
T3	Real	RTIM3 in minutes
TEMP(I)	Real	Array for storing rainfall intensity values (inches per hour)
TIME(I)	Integer	Array to store time values
TINT	Integer	Time interval between discrete samples for sampler No. 1
TINT2	Integer	Time interval between discrete samples for sampler No. 2
TMP	Real	Storage location for first rainfall input value used for determining length of event
TMP1	Real	The running value of rainfall intensity in centimeters; used in a loop to determine maximum rainfall intensity
TMP2	Real	The running value of the absolute value of the difference between rainfall value in centimeters
TOTRN	Real	Input variable for total rainfall (inches)
TPRCP	Real	Total rainfall (centimeters)
TPRECP	Real	Total rainfall volume (cubic feet)
TRUCKS	Real	Input variable for average truck traffic (trucks per day)
XM3	Real	Flow (cubic feet per minute)

(IOPT = IGRAPH), the program will write to the line printer that the plotting option is in effect. This block of program logic will also write the title of the run, event number, event starting date and rainfall start time to a permanent data file which has been set up by the user's JCL (Figure 2). If the graph option is not selected (IOPT ≠ IGRAPH), control will bypass the plot write statements. KKK is set equal to 2 and control is returned to statement 107.

The computed GØ TØ statement then moves execution to B3 START. The program logic of block three writes the event starting date, event ending date, rainfall start time, rainfall end time and flow start time to the line printer. Card number five is also read and contains the following information:

1. Total rainfall volume (inches).
2. Rainfall duration (hundredths of an hour).
3. Number of dry days before this event (days).
4. Number of dry days before this event with an accumulative rainfall less than one inch (days).
5. The time interval between flow samples for sampler number one (minutes).
6. The time interval between flow samples for sample number two (minutes).
7. The Average Daily Traffic (vehicles per day).
8. The Average Daily Traffic during the dry period with less than one inch of accumulated rainfall (vehicles per day).
9. Average truck traffic (trucks per day).

The next two IF statements are used to round up to a whole number the average daily traffic and average daily traffic during the dry period with less than one inch of accumulated rainfall. Next, total rainfall in inches is converted to total rainfall in centimeters and the total rainfall volume in cubic feet is computed. After these calculations are completed, the drainage area, appropriate precipitation and dry day data, and flow sampler time intervals are written to the line printer. Next, precipitation data, dry day data and traffic data are stored in the statistical array (STAT). KKK is set equal to 3 and control is returned to statement 107.

The next block (B4 START to B4 END) contains the equations and conversion factors required to calculate the air particulate fallout rate. First the dustfall banner is written to the line printer. Next, card number six is read which contains number of dustfall buckets, number of days these buckets were in place, and area of dustfall bucket in square meters, if different from the standard eight inch dustfall bucket. A test is made to determine the number of dustfall buckets that are to be read in. If the number is less than or equal to zero the series of dustfall calculations are skipped. If the number of dustfall buckets is greater than zero, dustfall data for each dustfall bucket will then be read in, one card for each bucket containing the milliliters of sample collected and milligrams per liter of dust and dirt for the associated sample. The program then converts this data into grams of dust and dirt as follows:

$$\text{Grams of dust and dirt} = \frac{\text{sample volume (ml)} * \text{concentration (mg/l)}}{1{,}000{,}000}$$

The grams of dust and dirt collected by each of the dustfall buckets at a particular site is then averaged:

Average weight (grams) =

$$\frac{\text{sample weight (bucket no. 1)} + \text{sample weight (bucket no. 2)} + \text{sample weight (bucket no. 3)}}{\text{number of dustfall buckets analyzed}}$$

Program logic assigns a zero weight to buckets for which no dustfall data was entered by setting all MGLD variables (mg/l dust and dirt) to zero before the calculations are initiated. The program then writes to the line printer the appropriate dustfall data which is read in for each dustfall bucket and the grams of dust and dirt associated with each sample along with the number of days the dustfall buckets were in place collecting data. The air particulate fallout rate is then computed for the collection period;

Air particulate fallout rate (gm/m^2/day) =

$$\frac{\text{Average weight (grams)/bucket area } (m^2)}{\text{Number of days dustfall buckets were in place}}$$

Note: The value 0.0324 is the surface area of a standard 8 inch dustfall bucket in square meters (default value).

The program then writes to the line printer the air particulate fallout rate, and stores the value in the statistical array (STAT). KKK is set equal to 4 and control is transferred to statement number 107.

The next block of program logic controls the rainfall analysis (B5 START to B5 END). This block first reads card number eleven which contains the rainfall interval (time in minutes between rainfall input values), rainfall start time and hyetograph plotting option (IHYETO). Upon completion of this read statement, the rainfall banner and rainfall interval are written to the line printer. The next step is to read the rainfall data (inches) from the rainfall cards. Each card contains eight rainfall values RAIN (I), I = 1,8. The last value in the rainfall record must end with a -99 to signal the end of the read statement.

A time value is associated with each rainfall value read in, using rainfall start time and rainfall interval. The running sum (SUM) and accumulated sum CUM (I) are associated in DØ loop 200. The rainfall record is then converted to metric (inches * 2.54) and total rainfall and maximum rainfall intensity are found. The rainfall record with associated times is then written to the line printer. If the hyetograph option is called for (IOPT = IHYETO), the information is also written to a storage file. The maximum rainfall and average intensity are written to the statistical array and control returns to statement 107.

The next block of program logic deals with the flow data (B6 START to B6 END). First the flow banner is written out to the line printer. Next, card number thirteen which contains the flow start time (hours), flow interval (minutes between values), and hydrograph plotting option is read. If IOPT = IHYDRØ the input hydrograph information will be written to a storage file. Next, the flow record is read in one value at a time with a maximum of eight values per card. The program will continue to read these cards until it encounters a -99. on the last flow card. When this is encountered, control shifts to writing flow summaries. Actual flow values, FLØW (I) are read in a list directed read statement with the array positioner "I" ranging from one to eight for each value on a specific card. These flow values are then moved to another array CFS (K); here the K array positioner is assigned a value from one to the number of flow points which are read into the program. Array positioner K is incremented each time a flow value is processed. Each flow value CFS (K) is converted from cubic feet per second (cfs) to cubic meters per minute by multiplying CFS * 1.699. The cubic feet per minute values are then summed. The cfs values are converted to total gallons as follows:

$$\text{Total gallons} = \Sigma \text{cfs} * \text{time interval(sec)} * 448.8\left(\frac{7.48 \text{ gal}}{\text{ft}^3} * \frac{60 \text{ sec}}{\text{min}}\right)$$

Each flow value is assigned a time by using the flow start time and incrementing it by the flow interval for each value.

After total cubic feet (CFSTI), total cubic meters (M3T), and total gallons (GALLØN) have been computed, a flow summary of these values is written to the line printer. Next, a maximum flow in cubic meters and an average flow in cubic meters is calculated and stored in the statistical array (STAT). The time variable flow data is then written to the line printer in cubic feet per second and cubic meters per minute. The values for total cubic meters (M3T), length of the event in minutes, average flow in cubic meters, maximum flow in cubic meters (RMAX) and time in minutes from start of storm to maximum flow are written to the statistical array (STAT).

Next, the discrete flow quality cards are read in. A blank card must be inserted into the run deck if no discrete quality parameters are to be read into the program. The blank card causes program logic to increment KKK to 7 and transfer control back to statement 107 to read in composite quality. If discrete quality data is available, the program reads five discrete quality sample cards per sample time.

The first card contains the discrete analysis time, laboratory sample number and the first seven of thirty possible discrete quality parameters. The second and third cards contain eight possible discrete flow quality parameters while seven possible parameters can be listed on the fourth card. This procedure is repeated for each discrete sample analysis time until the program reads a -99. at which point the program will GØ TØ 100. Discrete flow quality values are stored in the array QUALTY (I,M) where I indicates the discrete sample time and the M's are the appropriate sample values.

It is possible that some discrete analyses were performed for one time period and not another. When program logic detects this condition, it sets that parameter to the value of $1.0 * 10^{60}$. Because this value is much too large for the format statement defining discrete quality parameter values, astericks appear in that position for that time period. A program note appears under the quality heading on the output to explain this situation.

The program then calls the subroutine FORMUP which builds the format statements needed for the selected discrete flow quality parameters used. The discrete quality parameters analyzed are then converted to pounds per minute as follows:

> lb/min = discrete quality concentrations (mg/l) *
> the appropriate flow rate (cfs) at that time * 0.003746
> (0.003746 converts mg/l * cfs to lb/min)

For each discrete quality parameter, the program writes out sample time, identification number, parameter analyzed and its value in both mg/l and lb/min.

The program next reads the pollutograph option, card number 20. If the option IOPT equals IPLUTØ the program writes the pollutograph data to storage, and reads cards 21 and 22. These two cards are used to designate the abbreviations for the selected discrete quality parameters which will appear on the pollutographs. The program then writes mg/l and lb/min data to be plotted for all parameters analyzed. The variable KKK is set equal to 7 and control is transferred back to statement number 107.

The next block (B7 START to B7 END) handles the flow composite quality data. The program first writes out the composite quality banner and then reads in card number 23 containing the composite laboratory sample number and the first seven composite quality parameters. There must be a total of five cards as the program will continue to read composite quality until it reads a -99. on the fifth card. The program then writes the composite laboratory sample number and reads the remaining four composite quality cards (similar to discrete quality cards). The second card contains the appropriate 8th through 15th sample values, the third the 16th through 23rd, the fourth the 24th through the 30th, and the fifth the -99. value. The program then begins building the format statements needed to write out the appropriate flow composite quality parameters. The composite parameters are then converted to kilograms (kg) as follows:

$$\text{Sample value in kg} = \text{total cubic feet discharged} * 28.32 \text{ (liters per cubic feet)} * \text{sample concentration in mg/l} * (1 * 10^{-6})$$

and then to pounds (lbs) as follows:

$$\text{Sample value in lb} = \frac{\text{sample value in kg}}{0.45345 \ (\frac{kg}{lb})}$$

The appropriate composite samples are then written to the line printer in mg/l, pounds and kilograms. The program then stores all composite quality parameters in kilograms in the statistical array (STAT) and checks the option (IPLUTØ). If the option is not equal to IPLUTØ the program writes a -999 to the storage file for pollutograph plotting. The -999 indicates to the plot generating program that this is the end of the plot data. The program then writes to the line printer END OF DOT and program flow for DSP is halted.

SECTION III

DATA STORAGE PROGRAM (DSP) USER'S MANUAL

The Data Storage Program was developed as part of a FHWA/DOT Research and Development project to determine the characteristics of highway runoff. Due to the nature of the study, an extensive data collection and chemical analysis program was required and more than 14,000 pieces of data were generated. DSP was developed to:

a. Retain a large quantity of field generated data in an organized and easily accessible format.
b. Permit conversion of standard units to metric.
c. Provide a mechanism by which the data can be recalled for optional plotting or statistical analysis.

The data base developed during the project is perhaps the most extensive highway runoff quantity/quality data in existence. This data is available to interested parties on magnetic tape with access provided by DSP. It is further thought that DSP will be valuable as a vehicle for data storage and retrival to anyone embarking on highway runoff studies.

In its basic form DSP is merely a convenient method for collating and producing a report of data collected in a highway runoff study. Storage of data by use of DSP will permit a user to apply optional plotting and/or statistical techniques on individual runoff events or series of events.

Highway runoff is highly variable in that it results primarily from precipitation or snowmelts and as such its description contains a rainfall hyetograph, a runoff hydrograph, various quality parameters (described by either discrete or composite quality analyses), dustfall data and various site characteristics. A description of how to set up input for DSP follows.

DESCRIPTION OF THE INPUT

Input to the data storage program is coded onto 27 card groups, each consisting of one or more cards. Table 3 is an abbreviated listing of these card groups for quick reference. Table 4 contains a more detailed explanation including format requirements, card columns used and corresponding variable names.

Several of the values are inputted more than once. For example, "start of rainfall" is coded onto card group three and card group eleven. Table 5 lists a few guidelines for setting up the data storage system.

Table 3. Summary of card groups.

Card group	Description of card groups
1.	Event number, smowmelt indicator and plot option
2.	Drainage area and title
3.	Starting date, start of rainfall and start of overflow
4.	Ending date and end of rainfall
5.	Blank card for additional parameters
6.	Total rainfall, rain duration, dry days, discrete time interval and average daily traffic
7.	Number of dustfall buckets, days of sample and area of bucket
8.	Milliliters of sample and milligrams per liter in bucket 1
9.	Milliliters of sample and milligrams per liter in bucket 2
10.	Milliliters of sample and milligrams per liter in bucket 3
11.	Rainfall interval, start of rainfall and hyetograph option
12.	Rainfall data at each interval
13.	Start of overflow, flow interval, and hydrograph option
14.	Flow data at each interval
15.	Discrete sample time, laboratory number, coliform, pH, HG, SS, VSS, BOD_5, TOC
16.	COD, TKN, NO_2, NO_3, TN, TPO_3, CL^-, PB
17.	ZN, SN, FE, CU, CD, CR, TS, O&G
18.	PCB, Pesticides and flow data for discrete
19.	Terminates discrete input
20.	Pollutograph option
21.	Additional plot information
22.	Additional plot information
23.	Composite sample number, coliform, pH, HG, SS, VSS, BOD_5, TOC
24.	COD, TKN, NO_2, NO_3, TN, TPO_3, CL^-, PB
25.	ZN, SN, FE, CU, CD, CR, TS, O&G
26.	PCB and Pesticides
27.	Terminates composite input and signals end of job

Table 4. DSP input format.

Card group	Format	Card columns	Description	Variable name
1	A2	1-2	Site location, two letter abbreviation of site	LOC
	I4	5-8	Storm event number	EVENT
	I2	14-15	Snowmelt indicator (-1 if event was a snowmelt)	SNOW
	A5	22-26	Graph option indicator ('GRAPH' if option is desired, otherwise leave blank)	IOPT
2	F10.0	1-10	Area of site (acres)	AREA
	5A4	21-40	Title i.e. Los Angeles HY-5	RTITLE
3	3I2	1-6	Date storm began (month, day, year) i.e. 091576	STARTD
	I4	9-12	Rainfall start time (military) i.e. 0800	STARTT
	I4	15-18	Time overflow started	STARTO
4	3I2	1-6	Date storm stopped (month, day, year) i.e. 091676	ENDD
	I4	9-12	Time storm stopped (military time) i.e. 0200	ENDT
5	F10.2	1-10	Total rainfall (inches)	TOTRN
	F10.2	11-20	Duration of storm (to the nearest 1/100 hour) i.e. 1.25 = 1 hour 15 minutes	DURATN
	F10.2	21-30	Number of dry days before the storm	NUMDD
	F10.2	31-40	Number of dry days before the storm with an accumulation of less than one inch of rainfall	NUMDI
	I5	41-45	Not used	NUMDS

Table 4. (continued).

Card group	Format	Card columns	Description	Variable name
	I5	46-50	Time interval between discrete samples (in minutes) for sampler number one	TINT
	I5	51-55	Time interval between discrete samples (in minutes) for sampler number two	TINT2
	I5	56-60	Not used	NUMPMS
	F10.2	61-70	Average traffic/dry day since last storm event	ADT
	F10.2	71-80	Average traffic for period before the storm with an accumulation of less than one inch of rainfall	ASTI
6	F10.2	1-10	Insert a blank card (must be included). Reserved for additional data or parameters	
7	F10.0	1-10	This card must be included even if blank. Number of dustfall buckets to be analyzed (Maximum = 3)	NB
	F10.0	11-20	Number of days buckets were up	NUMBD
	F10.0	21-30	Area of dustfall bucket if not standard	BAREA
8	F10.2	1-10	(if NB > 0 (card group 6), include card group 7). Milliliters of sample collected for dustfall bucket number one	MILSCI
	F10.2	11-20	Milligrams/liter of dust from dustfall bucket number one	MGLDI
9	F10.2	1-10	(if NB > 1 (card group 6), include card group 8). Milliliters of sample collected for dustfall bucket number two	MILSC2
	F10.2	11-20	Milligrams/liter of dust from dustfall bucket number two	MGLD2

Table 4. (continued).

Card group	Format	Card columns	Description	Variable name
10	F10.2	1-10	(if NB > 2 (card group 6), include card group 9). Milliliters of sample collected for dustfall bucket number three	MILSC3
	F10.2	11-20	Milligrams/liter of dust from dustfall bucket number three	MGLD3
11	F10.2	1-10	Rainfall interval (in minutes) for the rainfall record	RINTVL
	2I2	17-20	Time of rainfall start, i.e. 0800	ISTHR & ISTMIN
	A5	22-26	Hyetograph plot option indicator ('HYETO' if plot is desired)	IOPT
12	F10.2	1-10	Rainfall measurement for the first time interval (actual inches from the rainfall chart, this is NOT inches/hour; inches/hour will be computed)	RAIN(1)
	F10.2	11-20	Rainfall measurement for the second time interval	RAIN(2)
	F10.2 . . .	21-30	Rainfall measurement for the third time interval	RAIN(3)
	F10.2 . . .	71-80	Rainfall measurement for the eighth time interval	RAIN(8)
	F10.2		Rainfall measurement for the Nth time interval	RAIN(N)
	F10.2		-99., this value terminates the rainfall record, it may occur in any field and on any card	RAIN(N+1)
13	I4	1-4	Flow start time (military time)	FLOWST
	I4	7-10	Time interval between flow values	INT
	A5	22-26	Hydrograph plot option indicator ('HYDRO' if plot is desired)	IOPT

Table 4. (continued).

Card group	Format	Card columns	Description	Variable name
14	F10.2	1-10	Flow value (in CFS) for the first time interval	FLOW(1)
	F10.2	11-20	Flow value (in CFS) for the second time interval	FLOW(2)
	F10.2	21-30	Flow value (in CFS) for the third time interval	FLOW(3)
	⋮			
	F10.2	71-80	Flow value (in CFS) for the eighth time interval	FLOW(8)
	⋮			
	F10.2		Flow value (in CFS) for the Nth time interval	FLOW(N)
	F10.2		-99., This value terminates the flow record, it may occur in any field and on any card	FLOW(N+1)
15	I4	1-4	Time first discrete quality sample was taken (military time) i.e. 0915	TIME(1)
	I4	7-10	Sample ID no. for discrete quality samples (usually an ID number assigned by the laboratory performing the quality analyses)	SAMPLE(1)
	E10.4	11-20	Coliform value for the first sample (COLF) (number/100 ml)	QUALTY(1,1)
	F10.2	21-30	pH value for the first sample(PH)	QUALTY(1,2)
	F10.2	31-40	Mercury (HG) (μg/l)	QUALTY(1,3)
	F10.2	41-50	Suspended solids (SS) (mg/l)	QUALTY(1,4)
	F10.2	51-60	Volatile suspended solids (VSS) (mg/l)	QUALTY(1,5)
	F10.2	61-70	BOD_5 (BOD5) (mg/l)	QUALTY(1,6)
	F10.2	71-80	Total organic carbon (TOC)(mg/l)	QUALTY(1,7)
16	F10.2	1-10	COD (COD) (mg/l)	QUALTY(1,8)
	F10.2	11-20	TKN (TKN) (mg/l)	QUALTY(1,9)

Table 4. (continued).

Card group	Format	Card columns	Description	Variable name
	F10.2	21-30	NO_2 (NO2) (mg/l)	QUALTY(1,10)
	F10.2	31-40	NO_3 (NO3) (mg/l)	QUALTY(1,11)
	F10.2	41-50	Total nitrogen (TN) (mg/l)	QUALTY(1,12)
	F10.2	51-60	TPO_4 (TPO4) (mg/l)	QUALTY(1,13)
	F10.2	61-70	Chlorides (CL-) (mg/l)	QUALTY(1,14)
	F10.2	71-80	Lead (PB) (mg/l)	QUALTY(1,15)
17	F10.2	1-10	Zinc (ZN) (mg/l)	QUALTY(1,16)
	F10.2	11-20	Tin (SN) (mg/l)	QUALTY(1,17)
	F10.2	21-30	Iron (FE (mg/l)	QUALTY(1,18)
	F10.2	31-40	Copper (CU) (mg/l)	QUALTY(1,19)
	F10.2	41-50	Cadmium (CD) (mg/l)	QUALTY(1,20)
	F10.2	51-60	Chromium (CR) (mg/l)	QUALTY(1,21)
	F10.2	61-70	Total Solids (TS) (mg/l)	QUALTY(1,22)
	F10.2	71-80	Oil and grease (O&G) (mg/l)	QUALTY(1,23)
18	F10.2	1-10	PCB (PCB) (mg/l)	QUALTY(1,24)
	F10.2	11-20	Pesticides (PEST) (mg/l)	QUALTY(1,25)
	F10.2	71-80	Flow (in CFS) at the time this sample was taken if taken at a different time from those points input in card group 14	QUALTY(1,31)
19	I4	1-4	-99., this value terminates discrete quality input. (One card to terminate discrete quality must be included.)	
20	A5	1-5	Pollutograph plot option indication ('PLUTO' if plot is desired) (if IOPT = 'PLUTO', include card groups 21 and 22)	IOPT

Table 4. (continued).

Card Group	Format	Card Columns	Description	Variable name
21	1st card 20A4 2nd card 5A4		Discrete quality abbreviation from card group 15, 16, 17, 18 (right-justified) for each pollutograph to be plotted. Units for this set of plots will be (mg/l). Second card must be included even if blank	INPUTQ
22	1st card 20A4 2nd card 5A4		Discrete quality abbreviation from card group 15, 16, 17, 18 (right-justified) for each pollutograph to be plotted. Units for this set of plots will be (lb/min). Second card must be included even if blank	INPUTQ
23	I4	1-10	Sample ID no. of composite quality (usually an ID no. assigned by the laboratory performing the quality analyses).	SAMPNM
	E10.4	11-20	Coliform value for the composite sample (COLF) (number/100 ml)	QUALTY(1,1)
	F10.2	21-30	pH value for the composite sample (pH) (A value must be input and must be greater than 0.0)	QUALTY(1,2)
	F10.1	31-40	Mercury (HG) (µg/l)	QUALTY(1,3)
	F10.2	41-50	Suspended solids (SS) (mg/l)	QUALTY(1,4)
	F10.2	51-60	Volatile suspended solids (VSS) (mg/l)	QUALTY(1,5)
	F10.2	61-70	BOD_5 (BOD5) (mg/l)	QUALTY(1,6)
	F10.2	71-80	Total Organic Carbon (TOC) (mg/l)	QUALTY(1,7)

Table 4. (continued).

Card group	Format	Card columns	Description	Variable name
24	F10.2	1-10	COD (mg/l)	QUALTY(1,8)
	F10.2	11-20	TKN (mg/l)	QUALTY(1,9)
	F10.2	21-30	NO_2 (NO2) (mg/l)	QUALTY(1,10)
	F10.2	31-40	NO_3 (NO3) (mg/l)	QUALTY(1,11)
	F10.2	41-50	Total nitrogen (TN) (mg/l)	QUALTY(1,12)
	F10.2	51-60	TPO_4 (TPO4) (mg/l)	QUALTY(1,13)
	F10.2	61-70	Chlorides (CL-) (mg/l)	QUALTY(1,14)
	F10.2	71-80	Lead (PB) (mg/l)	QUALTY(1,15)
25	F10.2	1-10	Zinc (ZN) (mg/l)	QUALTY(1,16)
	F10.2	11-20	Tin (SN) (mg/l)	QUALTY(1,17)
	F10.2	21-30	Iron (FE) (mg/l)	QUALTY(1,18)
	F10.2	31-40	Copper (CU) (mg/l)	QUALTY(1,19)
	F10.2	41-50	Cadmium (CD) (mg/l)	QUALTY(1.20)
	F10.2	51-60	Chromium (CR) (mg/l)	QUALTY(1,21)
	F10.2	61-70	Total Solids (TS) (mg/l)	QUALTY(1,22)
	F10.2	71-80	Oil and Grease (O&G) (mg/l)	QUALTY(1,23)
26	F10.2	1-10	PCB (PCB) (mg/l)	QUALTY(1,24)
	F10.2	11-20	Pesticides (PEST) (mg/l) Include blank card if no data	QUALTY(1,25)
27	F10.2	1-10	-99. This value terminates the composite quality input, and the job	

Table 5. Guidelines for executing DSP.

The following are a few guidelines for executing the data storage program.

--Usually only rainfalls greater than 0.1 inches (0.13 cm) are used when calculating the number of dry days before an event.

--The start of precipitation (card group 3) must correspond to the time of rainfall start (card group 11) and must not be greater than the flow start time (card group 13).

--Card 6 must be included; it should be blank.

--The flow record does not stop with the end of the precipitation period, but should be continued for a reasonable period afterwards to ensure proper total volume for the lb/min composite calculations.

--Repeat cards 15 through 18 for each time interval a discrete sample was taken even though some of the parameters were not analyzed.

--If no discrete samples were analyzed, only composite, delete cards 15 through 18 and use card 19 only.

--Card 20 must be included whether pollutographs are to be generated or not.

--If the pollutograph plot option is called, cards 21 and 22 (both consisting of two cards) must be included.

--If an oil and grease grab sample is taken at the same time as a discrete sample (two separate samples with different sample numbers), the discrete parameters (four cards) must precede the sample number containing only the oil and grease (four cards).

--If the storm event under consideration is a snowmelt (i.e., no input hyetograph), card 11 should be BLANK and card 12 should have a -99. in columns 1 to 10.

--If an event is a snowmelt, do not use the water equivalent for that melt as total rainfall (i.e., leave columns 1-10 on card group 5 BLANK).

--On card 23 there must be a value for pH and it must be greater than 0.0.

An example of the input data for an individual rainfall runoff event is shown in Table 6. Card group numbers have been shown in the right hand column as a means of identifying input data. The output and plots shown later in this section will have this data as input.

DESCRIPTION OF THE OUTPUT

The output from the data storage program is largely an organized review of the input data. Units are conveniently shown in both standard and metric systems. Associated sample time and laboratory number are displayed alongside the data for easy access. The output is listed in nine sections namely:

1. Title block
2. Plotting signal
3. Site characteristics
4. Dustfall analysis
5. Rainfall record
6. Flow record
7. Quality parameters
8. Composite parameters
9. End of run signal

Each output section will be listed on at least one individual page, whether there is input data to be displayed or not. The number of total output pages is directly proportionate to the amount of input data and number of options used.

The title block section, Table 7, identifies the program source as Department of Transportation and identifies the site by highway name, snowmelt event (if applicable), date of storm, beginning of precipitation (in military time) and a unique event number. All but the first are input by the user. The program source name, highway name, snowmelt event (if applicable) and event number are also displayed at the top of sections two through eight.

The plotting signal section, Table 8, is designed to be displayed if the user has chosen to put the plotting option into effect. That is, whether the user intends to make a hyetograph, hydrograph and/or pollutograph.

The site characteristics, Table 9, are largely user input. They include storm date, precipitation period, start of overflow, drainage area in acres, total precipitation (for this storm only), duration of precipitation, number of dry days before the storm and number of dry days to an accumulation of one inch, average daily traffic during dry days and average daily traffic during dry days to an accumulation of less than one inch of rainfall, and time interval between discrete flow samples (in minutes) for sampler 1 and for sampler 2. The program will convert and display total precipitation in inches and centimeters. Total rainfall volume over the entire drainage area (in cubic feet) is also calculated and displayed. It should be noted that while cubic feet will often be reported in six or more digits, it is only significant to the number of digits in the smaller of the two multipliers (total

Table 6. Sample input.

```
 A . O .   S M I T H   C O R P O R A T I O N                VER     07/18/78     PAGE     SERIAL
 RX.GRPX873.SOURCE2                                          9.0     11.41.11      1       009315

                                               PANVALET
                                THE PROGRAM MANAGEMENT AND SECURITY SYSTEM

                PROGRAMS AND ALL SUPPORTING MATERIALS COPYRIGHT 1975 BY PANSOPHIC SYSTEMS, INCORPORATED
                                                                                       CARD GROUP NUMBER
 **INSERT WORK                                                                                 1
 M7     24           GRAPH                                                                     2
              MILWAUKEE 794                                                                    3
 061777  1910  1925                                                                            4
 061777  2005                                                                                  5
        0.61      0.92                          3    15                                        6
          1.         9.                                                                        7
        260.       387.                                                                        8
         5.0      1910 HYETO                                                                   11
        0.00      0.01      0.02      0.22      0.39      0.46      0.53      0.55             12
        0.57      0.59      0.60      0.61      -99.
 1925      5          HYDRO                                                                    13
        0.01      0.10      3.65      4.05      2.40      1.65      1.15      0.75
        0.55      0.55      0.30      0.20      0.10      0.01      0.01      0.01             14
        0.01      0.01      0.01      0.01      0.01      0.01      -99.
 1925   5807                 6.8                23.0                                           15
                                                                              0.4              16
        0.21                0.77                                    986.0                      17
                                                                              0.005            18
 1932   5806                6.48               654.0                                           15
                                                                              3.5              16
        0.64               10.90                                    704.0                      17
                                                                              0.40             18
 1934   5792                6.75              1307.0                                           15
                                                                              36.0             16
        6.60               82.40                                   3030.0                      17
                                                                              4.05             18
 1939   5793                7.05               391.0                                           15
                                                                              8.20             16
        1.42               36.30                                   1160.0                      17
                                                                              4.95             18
 2004   5799                7.10                69.0                                           15
                                                                              1.40             16
        0.22                4.83                                    252.0                      17
                                                                              0.75             18
  -99                                                                                          19
 PLUTO                                                                                         20
   55   TS   PB   ZN   FE                                                                      21
   55   TS   PB   ZN   FE                                                                      22
        5219                 6.8      0.50     169.0     144.0                18.0             23
        94.0       1.5                          0.84      0.44      30.0       2.1             24
        0.36                 8.2      0.09      0.05      0.01     407.0                       25
                                                                                               26
         -99                                                                                   27
 ***** ABOVE ACTION SATISFACTORILY COMPLETED *****
```

Table 7. Sample output - title.

DEPARTMENT OF TRANSPORTATION

MILWAUKEE 794

6/17/77 1910 HRS.

EVENT: 24

Table 8. Sample output - plot option is selected.

```
THE PLOTTING OPTION IS IN EFFECT.
```

Table 9. Sample output - site characteristics.

```
                              OEPARTMENT OF TRANSPORTATION
                              ----------------------------

                                  MILWAUKEE - 1794

                                     EVENT: 24
STORM OATE:   6/17/77 - 6/17/77

STORM TIME (PRECIPITATION PERIOO): 1910 - 2005

START OF OVERFLOW:  1925

ORAINAGE AREA (ACRES):    2.10

TOTAL PRECIPITATION (INCHES):    .610

RAINFALL VOLUME ON ORAINAGE AREA (CUBIC FEET):     4650.03

TOTAL PRECIPITATION (CENTIMETERS):    1.549

OURATION OF PRECIPITATION (HOURS):    .92

NUMBER OF ORY OAYS BEFORE THE STORM:   -0.0

NUMBER OF OAYS BEFORE THE STORM WITH AN ACCUMULATION OF LESS THAN ONE INCH OF PRECIPITATION:   -0.0

AVERAGE TRAFFIC OURING ORY OAYS:       -0

AVERAGE TRAFFIC FOR OAYS BEFORE THE STORM WITH AN ACCUMULATION OF LESS THAN ONE INCH OF PRECIPITATION:       -0

TIME INTERVAL BETWEEN OISCRETE SAMPLES (IN MINUTES) FOR SAMPLER #1:     3

TIME INTERVAL BETWEEN OISCRETE SAMPLES (IN MINUTES) FOR SAMPLER #2:    15
```

rainfall and site area).

The dustfall analysis section, Table 10, prints the number of days the dustfall buckets were up and the amount of sample (in mililiters) and dustfall concentration (in miligrams per liter) in buckets number 1, 2 and 3. All of the above are user supplied input. Total grams are calculated for bucket number 1. If bucket number 1 is the only bucket operational the program skips to the end of the dustfall analysis. If bucket number 2 or buckets number 2 and 3 are operational the program will repeat this above sequence and then go to the end. At the end of the dustfall analysis the program calculates amounts of dustfall in average grams and grams per square meter per day.

The rainfall record section, Table 11, displays and underlines the interval used (in minutes). A chart with four columns, time (military), precipitation (in inches and centimeters), intensity (in inches per hour and centimeters per hour) and cumulative precipitation (in inches and centimeters) is then displayed. The rainfall start time (military), time (interval) and precipitation record are user supplied, all others are calculated by the program.

The flow record section, Table 12, is identified by the heading "flow" which is underlined. Below this, three columns are listed: time (military), cubic feet per second and cubic meters per minute. The user supplies the start time, end time and interval between flow-points. The program will use this to generate the flow times for the list. The corresponding cfs values are recalled from the input and converted to cubic meters per minute and both columns are listed opposite their respective times. Finally, the cubic feet and cubic meters are totalled and displayed.

The quality parameter section, Table 13, is identified by the heading "quality" which is underlined. Below the heading are several columns. Time (military) and sample number are always the first two columns from the left. Three quality parameters can be displayed in columns to the right of this. These columns include the parameter's name and, except for pH, its concentration in milligrams per liter and pounds per minute. If more than three parameters are input a new row of five columns will be displayed below the first. Again the first two columns from the left are time (military) and sample number. Three new parameters can then fill the remaining three columns. This sequence is repeated until all input quality parameters are displayed. If a value is missing (not inputed) a ten character type "#" will occupy the otherwise blank space in the column. Time, sample number and milligrams per liter values (or pH values) for each quality parameter are user supplied.

The composite parameter section, Table 14, is identified by the heading "composite" which is underlined. Below are up to thirty quality parameters in five rows of six columns. Each displays the chemical analysis information about its respective parameter. The parameter

Table 10. Sample output - dustfall characteristics.

```
                         DEPARTMENT OF TRANSPORTATION
                         ----------------------------

                            MILWAUKEE 794

                               EVENT:  24


                      DUSTFALL ANALYSIS
                      -----------------

MLS OF SAMPLE COLLECTED FROM OUSTFALL BUCKET NO. 1:    260.00
                MG/L OF DUST COLLECTED FROM SAMPLE NO. 1:     387.00
                                     GRAMS OF DUST:     0.10062


AVERAGE GRAMS OF DUST, 0.1006 FOR 1.0 DUSTFALL BUCKETS.
NUMBER OF DAYS BUCKETS WERE UP:   9.0

                           AIR PARTICULATE FALLOUT RATE
                           ----------------------------

                       0.3451 GRAMS PER SQUARE METER PER DAY
```

Table 11. Sample output - rainfall record.

DEPARTMENT OF TRANSPORTATION

MILWAUKEE 794

EVENT: 24

PRECIPITATION RECORD
IN 5.0 MINUTE INTERVALS.

TIME	PRECIPITATION		INTENSITY		CUMULATIVE PRECIPITATION	
(HR)	(IN)	(CM)	(IN/HR)	(CM/HR)	(IN)	(CM)
1910	0.0	0.0	0.0	0.0	0.0	0.0
1915	0.01	0.03	0.12	0.30	0.01	0.03
1920	0.01	0.03	0.12	0.30	0.02	0.05
1925	0.20	0.51	2.40	6.10	0.22	0.56
1930	0.17	0.43	2.04	5.18	0.39	0.99
1935	0.07	0.18	0.84	2.13	0.46	1.17
1940	0.07	0.18	0.84	2.13	0.53	1.35
1945	0.02	0.05	0.24	0.61	0.55	1.40
1950	0.02	0.05	0.24	0.61	0.57	1.45
1955	0.02	0.05	0.24	0.61	0.59	1.50
2000	0.01	0.03	0.12	0.30	0.60	1.52
2005	0.01	0.03	0.12	0.30	0.61	1.55
2010	0.0	0.0	0.0	0.0	0.61	1.55

Table 12. Sample output - flow record.

DEPARTMENT OF TRANSPORTATION

MILWAUKEE 794

EVENT: 24

	FLOW	
TIME	CFS	M3/MIN
1925	0.01	0.02
1930	0.10	0.17
1935	3.65	6.20
1940	4.05	6.88
1945	2.40	4.08
1950	1.65	2.80
1955	1.15	1.95
2000	0.75	1.27
2005	0.55	0.93
2010	0.55	0.93
2015	0.30	0.51
2020	0.20	0.34
2025	0.10	0.17
2030	0.01	0.02
2035	0.01	0.02
2040	0.01	0.02
2045	0.01	0.02
2050	0.01	0.02
2055	0.01	0.02
2100	0.01	0.02
2105	0.01	0.02
2110	0.01	0.02

TOTAL CUBIC FEET: 4665.00 TOTAL CUBIC METERS : 132.10

TOTAL GALLONS: 34894.16

Table 13. Sample output - discrete quality characteristics.

OEPARTMENT OF TRANSPORTATION

MILWAUKEE 794

EVENT: 24

QUALITY

NOTE: **********INDICATES NO ANALYSIS PERFORMED FOR A PARTICULAR PARAMETER AT THE SAMPLE TIME INDICATED.

TIME	SAMPLE NO.	PH	SS (MG/L)	SS (LB/MIN)	PB (MG/L)	PB (LB/MIN)
1925	5807	6.8000	23.0000	0.0004	0.4000	0.0000
1932	5806	6.4800	654.0000	0.9800	3.5000	0.0052
1934	5792	6.7500	1307.0000	19.8289	36.0000	0.5462
1939	5793	7.0500	391.0000	7.2502	8.2000	0.1521
2004	5799	7.1000	69.0000	0.1939	1.4000	0.0039

TIME	SAMPLE NO.	ZN (MG/L)	ZN (LB/MIN)	FE (MG/L)	FE (LB/MIN)	TS (MG/L)	TS (LB/MIN)
1925	5807	0.2100	0.0000	0.7700	0.0000	986.0000	0.0185
1932	5806	0.6400	0.0010	10.9000	0.0163	704.0000	1.0549
1934	5792	6.6000	0.1001	82.4000	1.2501	3030.0000	45.9690
1939	5793	1.4200	0.0263	36.3000	0.6731	1160.0000	21.5095
2004	5799	0.2200	0.0006	4.8300	0.0136	252.0000	0.7080

Table 14. Sample output - composite quality characteristics.

DEPARTMENT OF TRANSPORTATION

MILWAUKEE 794

EVENT: 24

COMPOSITE

SAMPLE NO. 5219

Parameter	Concentration	Conc. value	(KG)	(LB)
< PH >		6.800	6.80	
< HG >	CONC. (UG/L)	.500000	.66E-04	.15E-03
< SS >	CONC. (MG/L)	169.000	22.33	49.24
<VSS >	CONC. (MG/L)	144.000	19.02	41.95
<TOC >	CONC. (MG/L)	18.000	2.38	5.24
<COD >	CONC. (MG/L)	94.000	12.42	27.39
<TKN >	CONC. (MG/L)	1.50000	0.20	0.44
< TN >	CONC. (MG/L)	0.840	0.11	0.24
<TPO4>	CONC. (MG/L)	0.440	0.06	0.13
<CL- >	CONC. (MG/L)	30.000	3.96	8.74
< PB >	CONC. (MG/L)	2.100	0.28	0.61
< ZN >	CONC. (MG/L)	0.360	0.05	0.10
< FE >	CONC. (MG/L)	8.20000	1.08	2.39
< CU >	CONC. (MG/L)	0.090	0.01	0.03
< CO >	CONC. (MG/L)	0.050	0.01	0.01
< CR >	CONC. (MG/L)	0.010	0.00	0.00
< TS >	CONC. (MG/L)	407.000	53.77	118.58

abbreviations appear within brackets "<>". User supplied concentrations are shown in milligrams per liter, micrograms per liter for mercury or as a pH value. These values are converted (except pH) to total kilograms and total pounds for the event. The sample number is printed directly below the heading.

The end of run signal section, Table 15, indicates that the run has completed all steps of the data storage program. That is, all cards have been read in and they appear to conform to the twenty-seven card group format.

OPTIONS

Highway runoff studies by their very nature tend to generate a substantial amount of data which is not easily handled by manual procedures. The Data Storage Program has been set up to utilize a Plotting and/or Statistical Option to capitalize on the computational potential of the already stored data.

The plotting option can be used to generate reproduction quality graphics of hyetographs, hydrographs and pollutographs of the stored data. This option is particularly useful in that it allows an analyst a graphic display of how specific monitored parameters varied during a rainfall-runoff event.

A plot storage file for the input data of the example is shown in Table 16. The sequence of individual plots within this file is hyetograph, hydrograph and pollutographs in the order the parameter abbreviations were assigned on cards twenty-one and twenty-two. The hyetograph, Figure 7, plots rainfall in inches per hour against time (from the start to the end of the rainstorm). The hydrograph, Figure 8, plots flow in cubic feet per second against time (from the start to the end of the flow). The pollutographs, Figures 9 to 18, plot concentrations and loadings of a quality parameter in milligrams per liter and pounds per minute, respectively, against discrete sample times (from the start to the end of the sampling period). There is a possibility of two plots per each parameter when plotting pollutographs--one for concentrations (mg/l) and one for loadings (lbs/min). Each event will consist of one hyetograph, one hydrograph and selected paired pollutographs. That is, one pair for each parameter set inputted. Any one or all three of these graphs may be plotted indepently of the others. However, once the storage file has been created, the pollutographs must be plotted in the sequence defined on cards twenty-one and twenty-two.

In our example, if mercury had no plot file, our first plot would be suspended solids since coliforms and pH are considered meaningless as plotted data. Plots can be skipped over in the storage file until a desirable parameter is found. However, once skipped, the file cannot be recalled for plotting at this time. The event would have to be entirely rerun to plot a skipped pollutograph plot file. Concentration plots precede loading plots. The plots illustrated in Figures 7 through

Table 15. Sample output - end of output.

```
END OF DOT.
```

Table 16. Example of plotting file.

```
         PLOTTING DATA FROM DSP
         MILWAUKEE 794          24 617771910
       0  13  13
    1910 .0
    1915 .1200
    1920 .1200
    1925 2.400
    1930 2.040
    1935 .8400
    1940 .8400
    1945 .2400
    1950 .2400
    1955 .2400
    2000 .1200
    2005 .1200
    2010 .0

       1  22  22
    1925 .1000E-01
    1930 .1000
    1935 3.650
    1940 4.050
    1945 2.400
    1950 1.650
    1955 1.150
    2000 .7500
    2005 .5500
    2010 .5500
    2015 .3000
    2020 .2000
    2025 .1000
    2030 .1000E-01
    2035 .1000E-01
    2040 .1000E-01
    2045 .1000E-01
    2050 .1000E-01
    2055 .1000E-01
    2100 .1000E-01
    2105 .1000E-01
    2110 .1000E-01

       2   5   4
     5
    1925 23.00
    1932 654.0
    1934 1307.
    1939 391.0
    2004 69.00

       2   5  22
     5
    1925 986.0
    1932 704.0
    1934 3030.
    1939 1160.
    2004 252.0

       2   5  15
     5
    1925 .4000
    1932 3.500
    1934 36.00
    1939 8.200
    2004 1.400

       2   5  16
     5
    1925 .2100
    1932 .6400
    1934 6.600
    1939 1.420
    2004 .2200

       2   5  18
     5
    1925 .7700
    1932 10.90
    1934 82.40
    1939 36.30
    2004 4.830

       3   5   4
     5
    1925 .4308E-03
    1932 .9800
    1934 19.83
    1939 7.250
    2004 .1939

       3   5  22
     5
    1925 .1847E-01
    1932 1.055
    1934 45.97
    1939 21.51
    2004 .7080

       3   5  15
     5
    1925 .7492E-05
    1932 .5244E-02
    1934 .5462
    1939 .1521
    2004 .3933E-02

       3   5  16
     5
    1925 .3933E-05
    1932 .9590E-03
    1934 .1001
    1939 .2633E-01
    2004 .6181E-03

       3   5  18
     5
    1925 .1442E-04
    1932 .1633E-01
    1934 1.250
    1939 .6731
    2004 .1357E-01

    -999    0
```

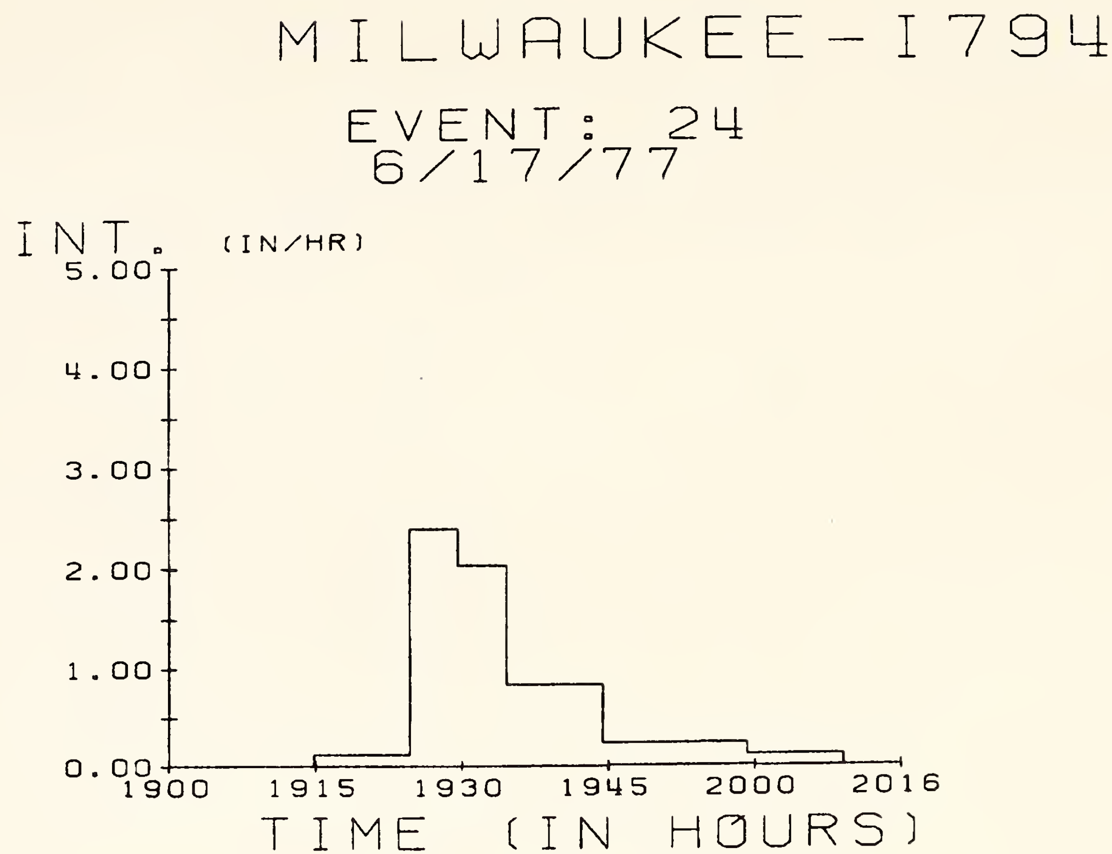

Figure 7. Sample output - hyetograph.

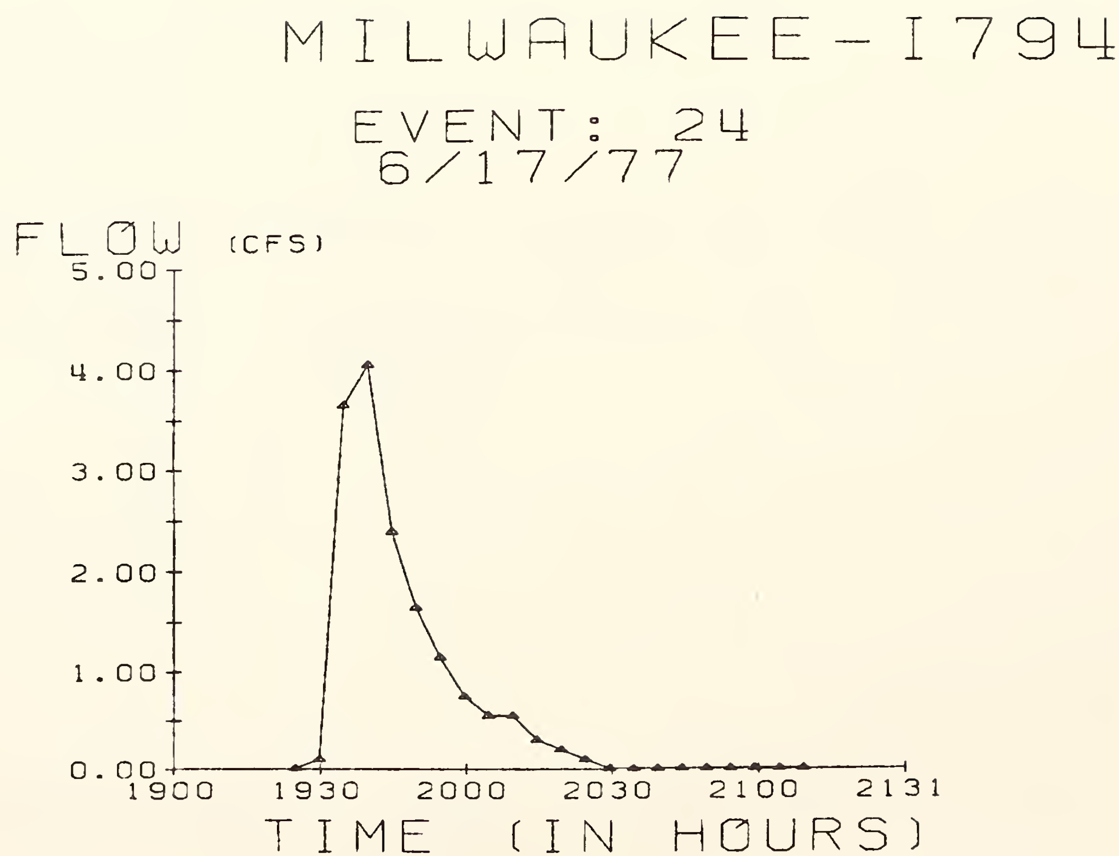

Figure 8. Sample output - hydrograph.

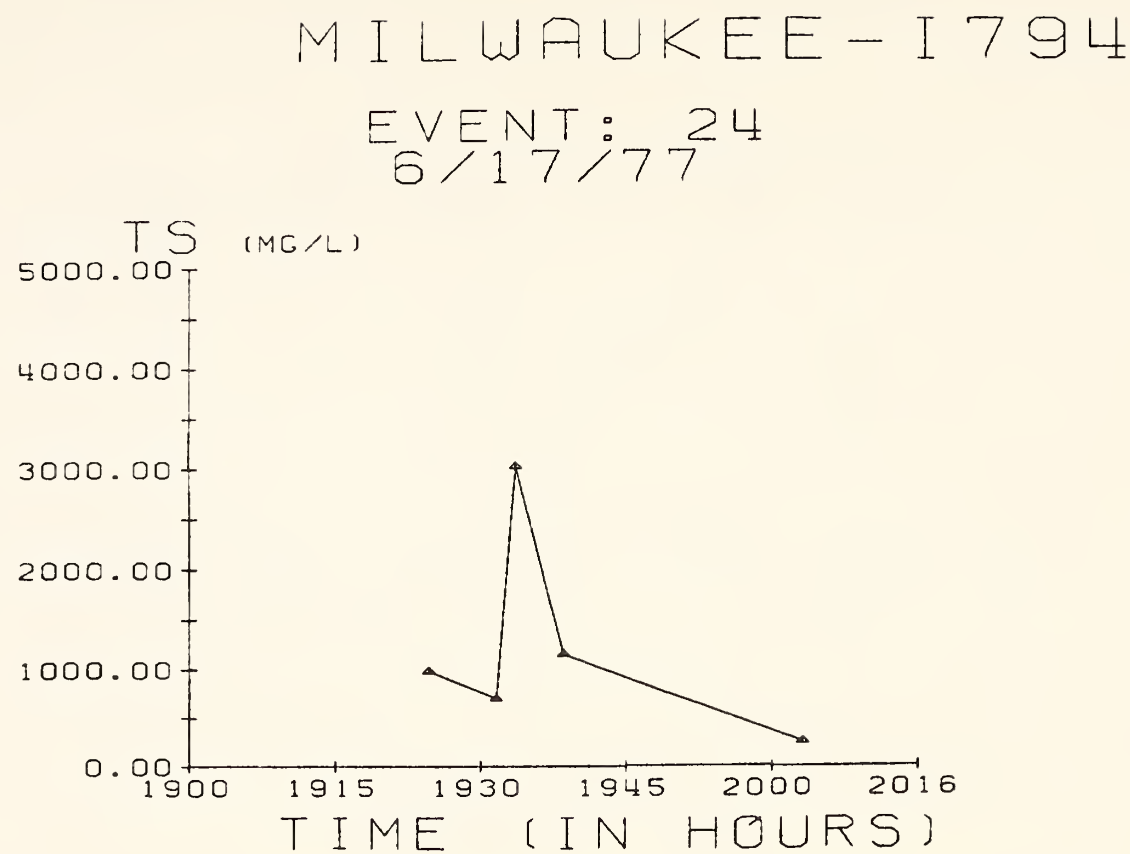

Figure 9. Sample output - total solids (concentration).

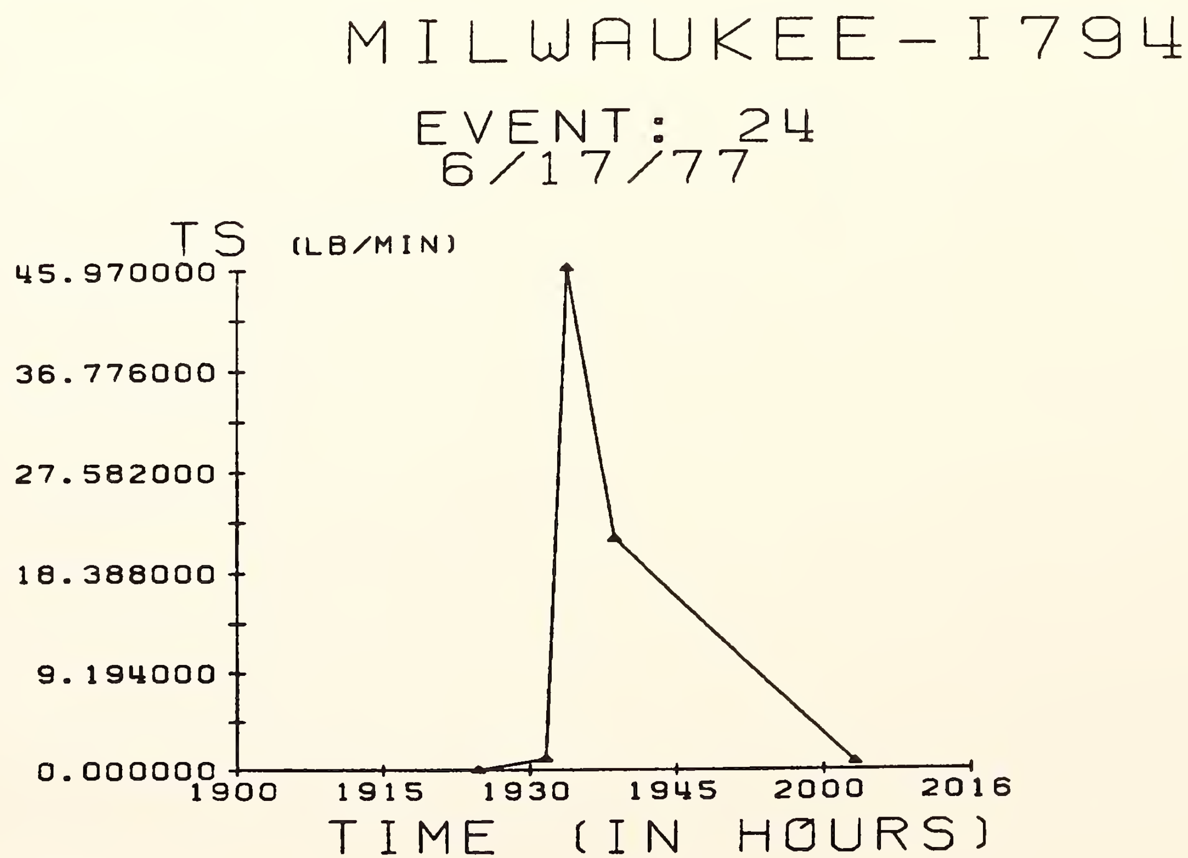

Figure 10. Sample output - total solids (loadings).

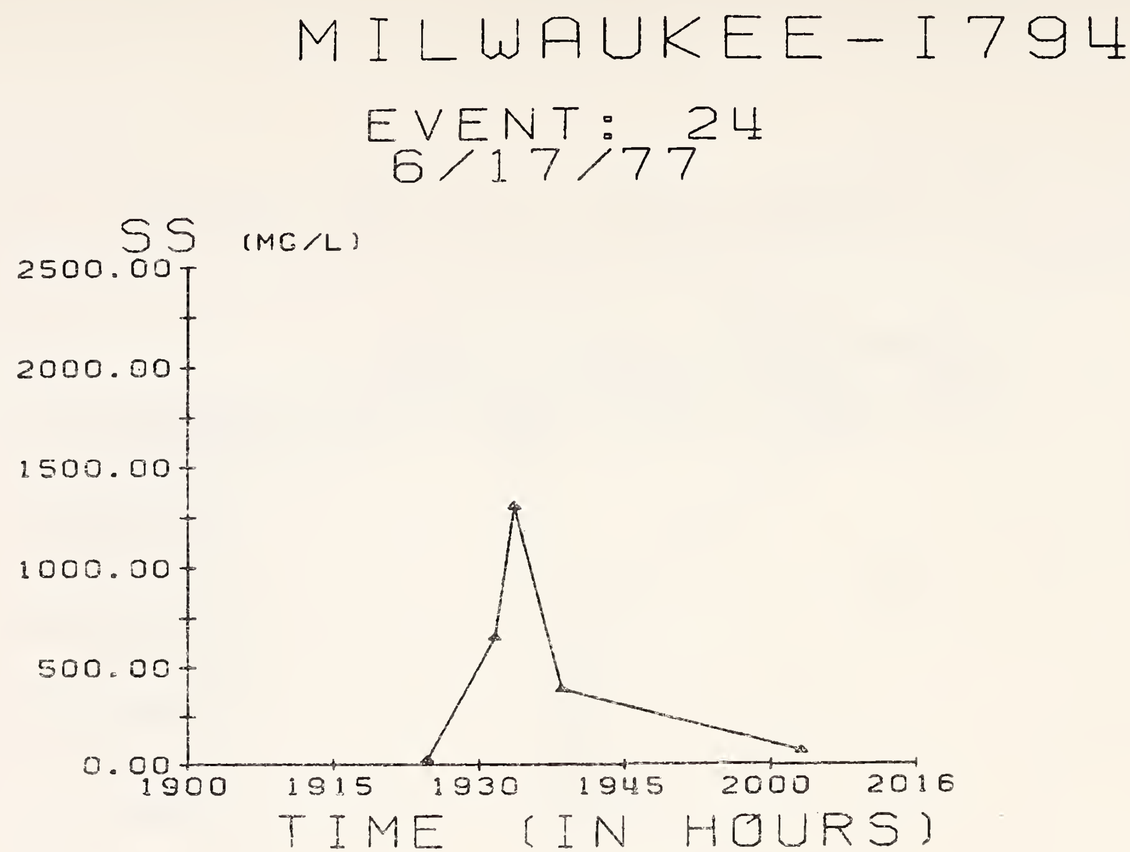

Figure 11. Sample output - suspended solids (concentration).

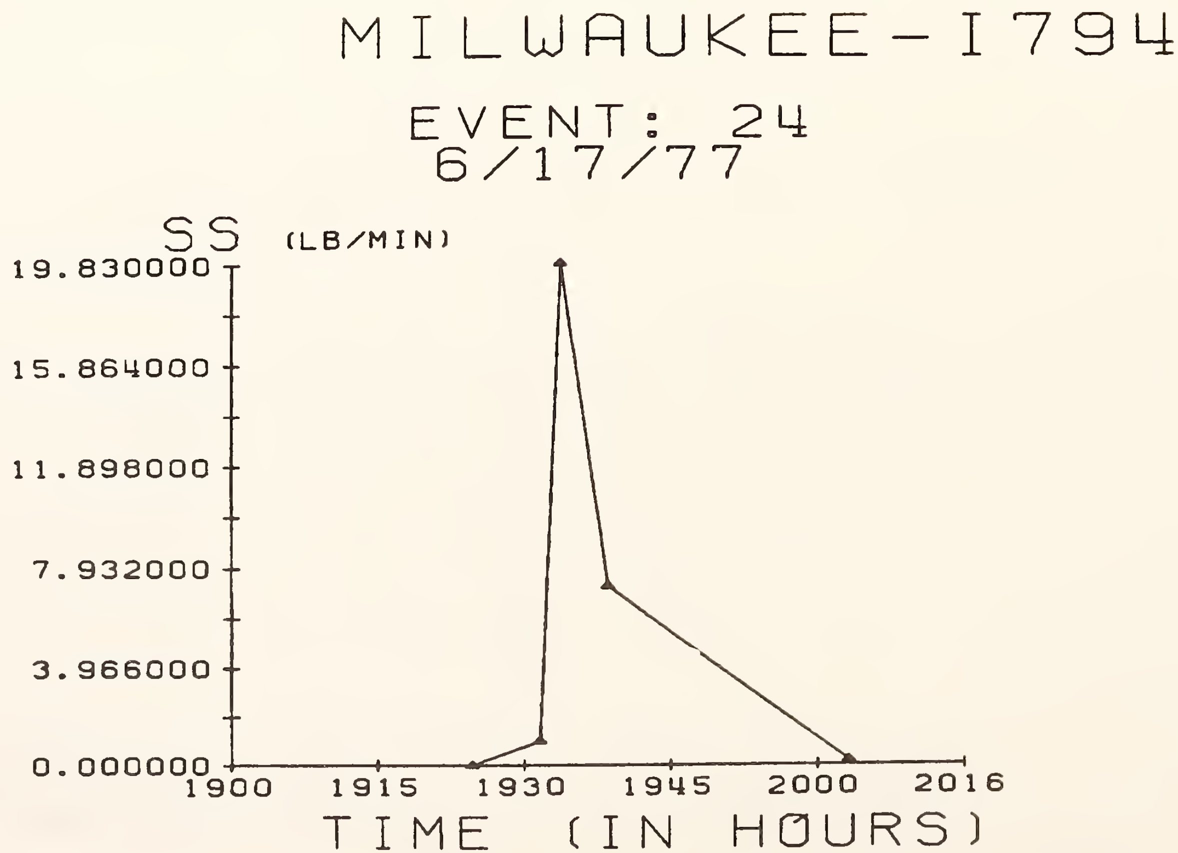

Figure 12. Sample output - suspended solids (loadings).

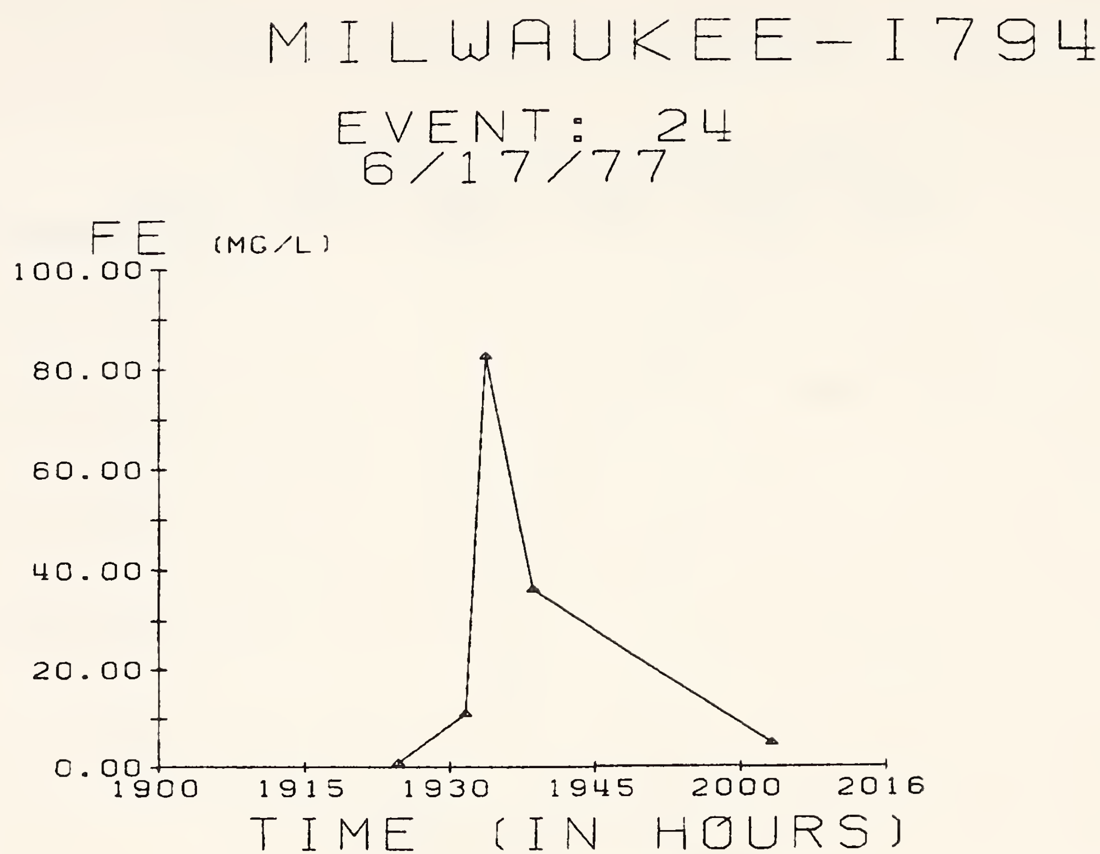

Figure 13. Sample output - iron (concentration).

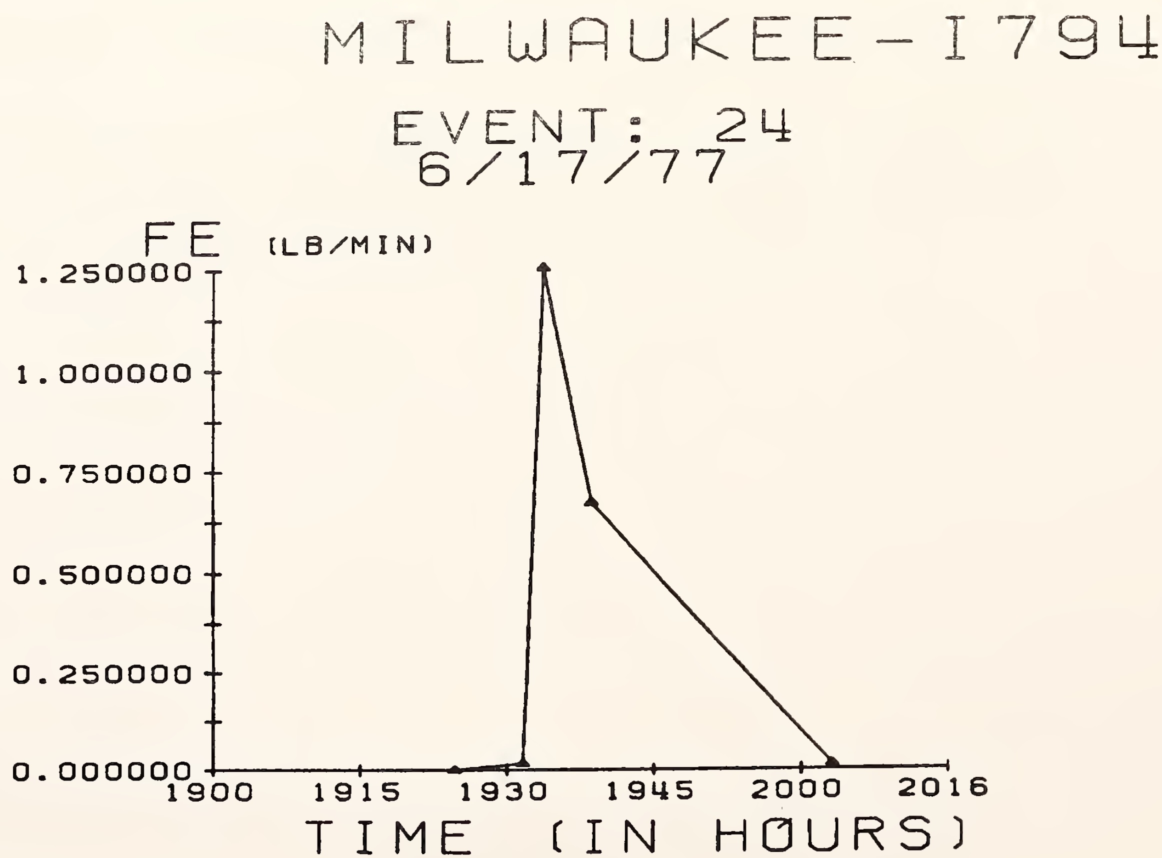

Figure 14. Sample output - iron (loadings).

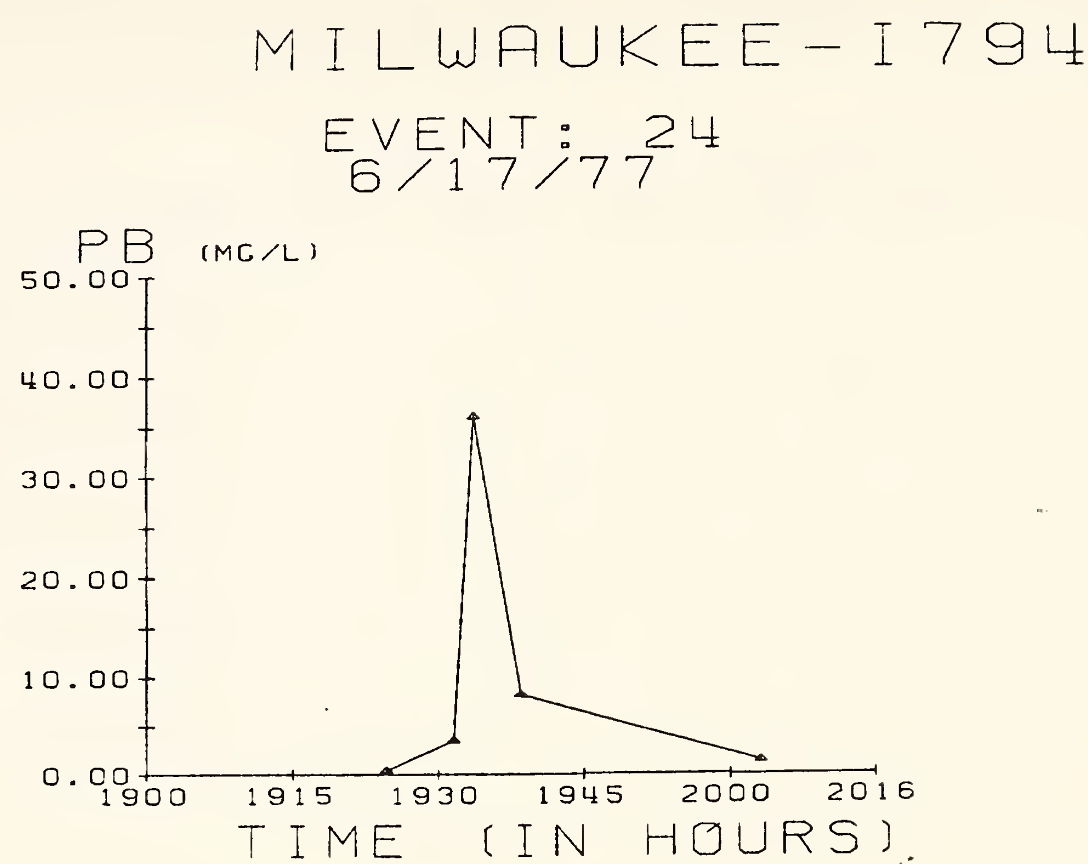

Figure 15. Sample output - lead (concentration).

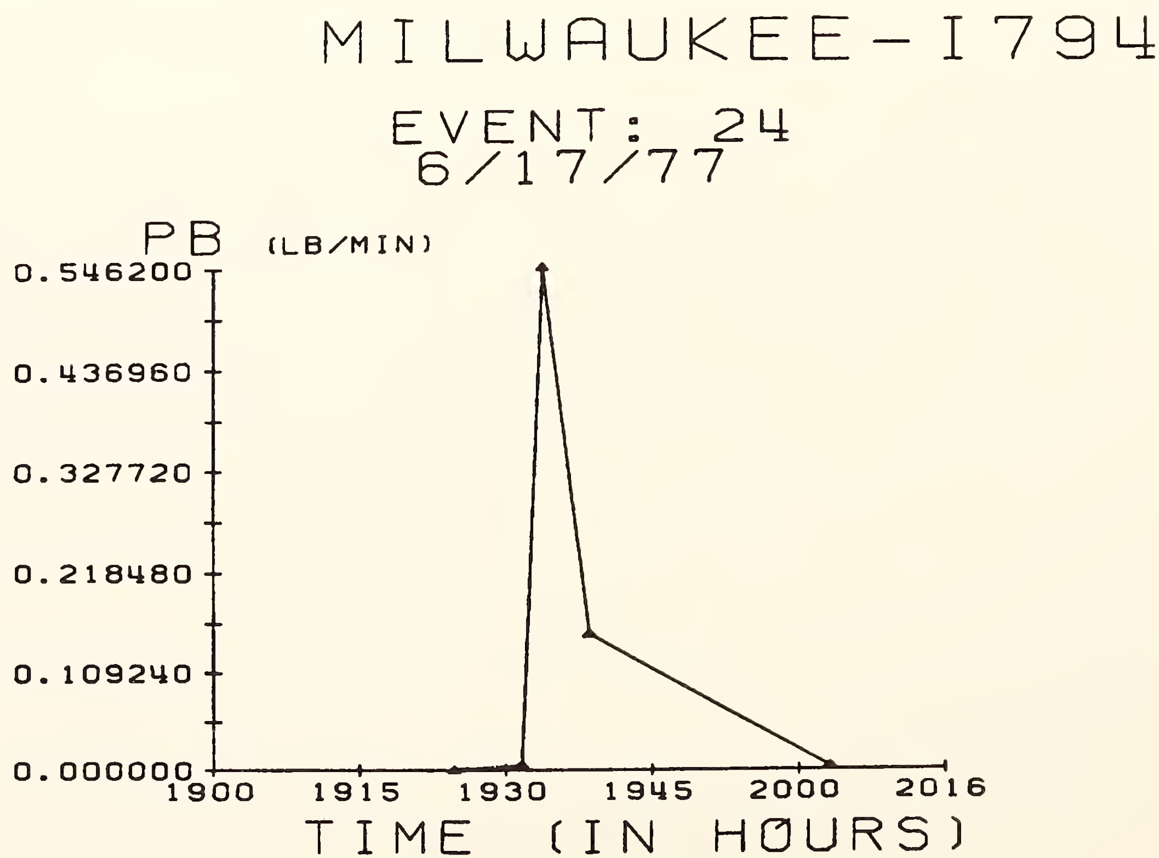

Figure 16. Sample output - lead (loadings).

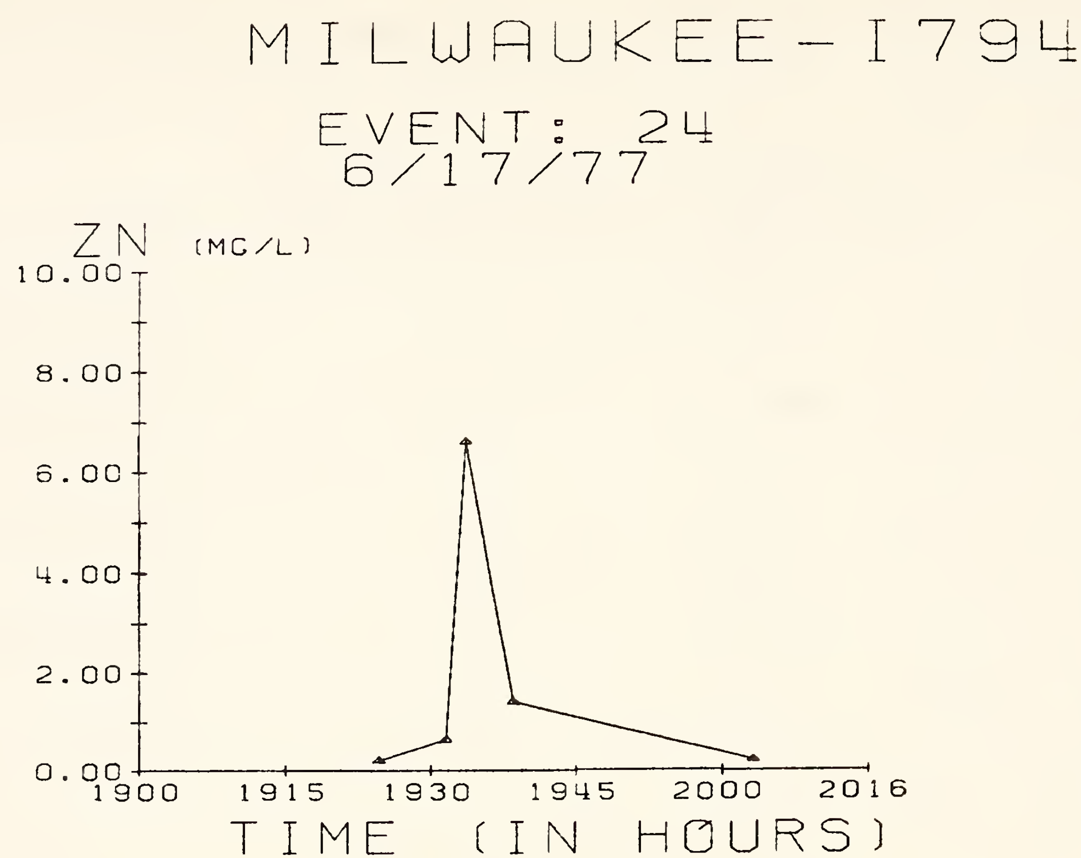

Figure 17. Sample output - zinc (concentration).

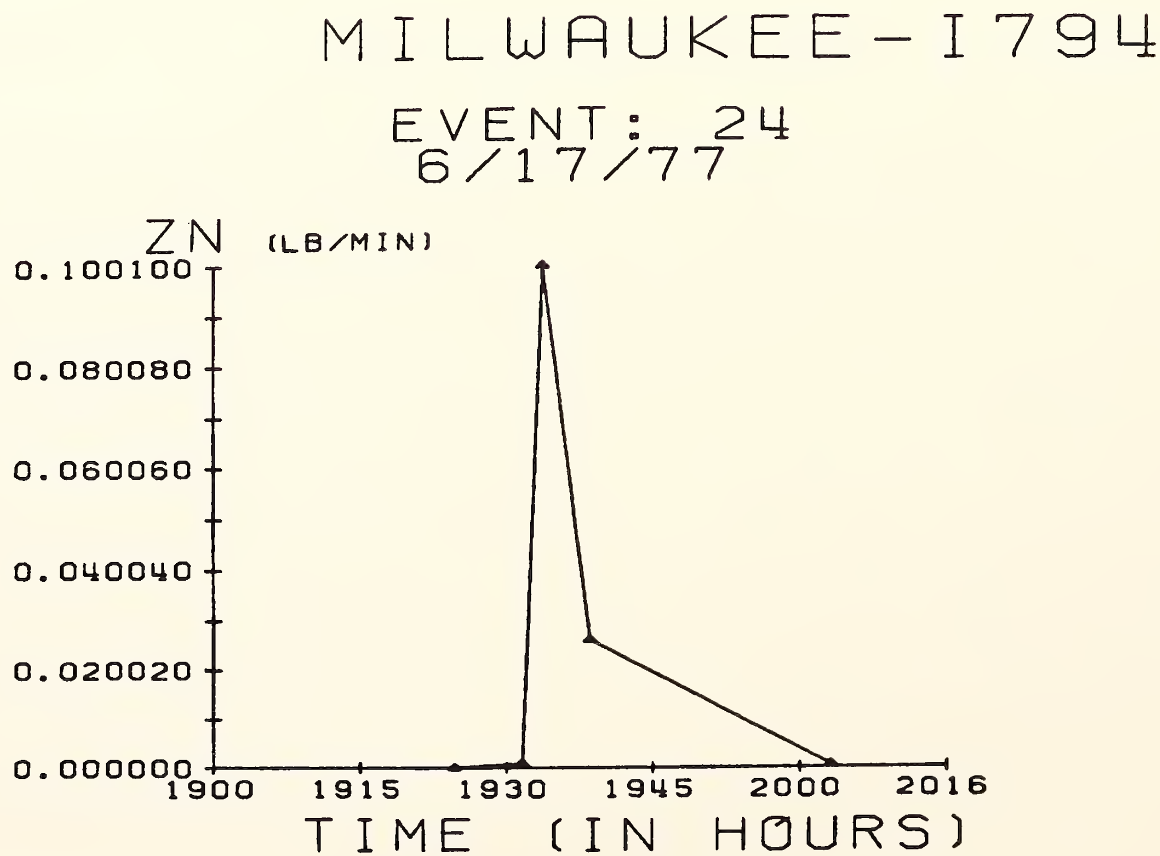

Figure 18. Sample output - zinc (loadings).

18 were made using a TEXTRONIX 4014-1 catnode ray tube and printed with a TEXTRONIX HARDCOPIER. However, most graphic printers can be utilized to plot data generated by DSP.

In the statistical analysis option several canned statistical packages are available including the Statistical Analysis System (SAS), Statistical Package for the Social Sciences (SPSS) and Biomedical Computer Programs (BMD). These statistical packages contain a wide assortment of subroutines which will perform Analysis of Variance, Scatter Plotting and Prediction of a Best Variable Model, to name only a few of their features. An example of the statistical analysis file and the statistical output are presented in Table 17 and 18, respectively.

The data storage program is an invaluable tool for the organization, conversion and correlation of raw data into a useful and accessible storage unit, from which unlimited options become available for the prediction of quality and quantity characteristics associated with highway runoff.

Table 17. Example of statistical analysis file.

```
    STATISTICAL DATA, REFER TO MANUAL FOR SPECIFIC PARAMETERS
    MILWAUKEE 794        24
 1.549
 1.430
 6.096
 .0
 .0
 .0
 .0
 .0
 .3451
 132.1
 105.0
 1.201
 6.881
 15.00
 .0
 .0
 .0
 .0
 .0
 .0
 .0
 .0
 .0
 .0
 .0
 .0
 6.800
 .5000E-03
 169.0
 144.0
 .0
 18.00
 94.00
 1.500
 .0
 .0
 .8400
 .4400
 30.00
 2.100
 .3600
 .0
 8.200
 .9000E-01
 .5000E-01
 .1000E-01
 407.0
 .0
 .0
 .0
```

Table 18. Sample statistical output.

```
BMDO2R - STEPWISE REGRESSION - REVISED JULY 17, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

PROBLEM CODE                    HARBRG
NUMBER OF CASES                      7
NUMBER OF ORIGINAL VARIABLES        26
NUMBER OF VARIABLES ADDED            2
TOTAL NUMBER OF VARIABLES           28
NUMBER OF SUB-PRCBLEMS               1
THE VARIABLE FORMAT IS   (10X,3(G10.4),20X/2(G10.4),20X,G10.4,10X/20X,2(G10.4),20X/
                        10X,5(G10.4)/40X,2(G10.4)/G10.4,10X,G10.4,30X/20X,
                        4(G10.4)/10X,5(G10.4)/30X)
```

VARIABLE	MEAN	STANDARD DEVIATION
1	1C6C.81689	778.66846
2	.72806	.77374
3	3.48348	3.24905
4	7.85714	9.02641
5	17.57143	6.29436
6	.10725	.04306
7	18654C.00000	245912.56250
8	389654.25000	181419.06250
9	605.25830	964.72119
10	570.71411	359.24023
11	.95271	.87676
12	8.96790	16.52380
13	134.28571	173.83965
14	10.61148	21.00615
15	51.09932	81.04865
16	9451.07812	15681.77734
17	1C178.63281	15260.75000
18	299.95166	495.81470
19	71157.31250	83604.75000
20	64.69279	95.24921
21	48.99829	53.18062
22	2C67.52612	3328.92041
23	2C.47960	19.09634
24	8.10330	9.15673
25	33.25188	59.90019
26	27C.76782	242.34479
27	#############	############
28	.00000	.00000

Table 18. (continued).

CORRELATION MATRIX

VARIABLE NUMBER	1	2	3	4	5	6	7	8	9	10
1	1.000	.367	.767	.052	-.163	.699	.148	.109	.833	.572
2		1.000	.815	-.417	-.294	.871	-.348	-.112	.455	-.141
3			1.000	-.462	-.499	.840	-.380	-.277	.861	.397
4				1.000	.805	-.088	.985	.841	-.365	-.273
5					1.000	-.100	.774	.923	-.624	-.295
6						1.000	.020	.158	.584	-.005
7							1.000	.871	-.305	-.288
8								1.000	-.427	-.338
9									1.000	.64[illegible]
10										1.000

Table 18. (continued).

VARIABLE NUMBER	11	12	13	14	15	16	17	18	19	20
1	.674	.824	.037	.022	.751	.768	.805	.804	-.353	.796
2	.847	.583	-.488	-.233	.515	.442	.438	.440	-.310	.436
3	.94C	.925	-.241	-.052	.872	.836	.844	.847	-.252	.835
4	-.476	-.397	-.023	-.203	-.480	-.430	-.394	-.389	-.400	-.385
5	-.568	-.606	.285	.214	-.721	-.704	-.659	-.634	-.592	-.674
6	.872	.674	-.364	-.250	.577	.533	.552	.550	-.431	.551
7	-.371	-.335	-.020	-.216	-.422	-.376	-.338	-.340	-.424	-.326
8	-.299	-.404	.173	.071	-.534	-.520	-.472	-.463	-.665	-.477
9	.8C5	.988	-.196	-.148	.988	.993	.998	.997	.050	.996
10	.188	.582	.505	.499	.589	.627	.652	.677	.026	.621
11	1.CCC	.865	-.398	-.285	.843	.801	.797	.784	-.043	.801
12		1.000	-.253	-.152	.984	.977	.982	.983	-.038	.978
13			1.000	.909	-.265	-.239	-.203	-.190	-.157	-.240
14				1.000	-.195	-.193	-.160	-.135	-.362	-.206
15					1.000	.996	.992	.988	.138	.992
16						1.000	.998	.994	.153	.998
17							1.000	.998	.104	.999
18								1.000	.078	.994
19									1.000	.129
20										1.000

Table 18. (continued)

VARIABLE NUMBER	21	22	23	24	25	26	27	28
1	.808	.759	.645	.801	.818	.255	5556185.000	.000
2	.385	.549	.102	.588	.560	.081	2309401.000	.000
3	.804	.891	.548	.900	.923	.360	3528453.000	.000
4	-.356	-.471	-.364	-.418	-.435	-.539	2218833.000	.000
5	-.663	-.702	-.687	-.645	-.609	-.836	2065865.000	.000
6	.530	.609	.278	.698	.638	.070	4915919.000	.000
7	-.293	-.413	-.300	-.338	-.378	-.512	2954893.000	.000
8	-.458	-.511	-.516	-.411	-.427	-.756	3838612.000	.000
9	.991	.987	.851	.972	.984	.657	2890018.000	.000
10	.631	.573	.631	.505	.640	.394	1732606.000	.000
11	.782	.859	.602	.909	.839	.495	3190450.000	.000
12	.962	.990	.773	.977	.995	.587	3010291.000	.000
13	-.206	-.282	-.047	-.284	-.178	-.250	1200464.000	.000
14	-.206	-.199	-.193	-.244	-.063	-.377	765955.375	.000
15	.982	.999	.850	.980	.979	.718	2207377.000	.000
16	.993	.992	.876	.971	.972	.730	2241368.000	.000
17	.994	.989	.870	.971	.979	.696	2596112.000	.000
18	.986	.986	.851	.963	.983	.673	2609022.000	.000
19	.162	.101	.477	.094	-.053	.784	###########	.000
20	.996	.989	.878	.973	.971	.714	2505894.000	.000
21	1.000	.976	.910	.969	.953	.736	2642244.000	.000
22		1.000	.827	.983	.984	.691	2338733.000	.000
23			1.000	.842	.765	.888	1768790.000	.000
24				1.000	.961	.684	3073008.000	.000
25					1.000	.570	2918110.000	.000
26						1.000	###########	.000
27							1.000	.000
28								.000

Table 18. (continued).

```
SUB-PROBLM    1
 DEPENDENT VARIABLE             9
 MAXIMUM NUMBER CF STEPS        1
 F-LEVEL FOR INCLUSICN      .010000
 F-LEVEL FOR DELETICN       .005000
 TOLERANCE LEVEL            .001000


  STEP NUMBER     1
  VARIABLE ENTERED    27

  MULTIPLE R               #########
  STD. ERROR OF EST.           .0000

  ANALYSIS OF VARIANCE
                         DF     SUM OF SQUARES     MEAN SQUARE     F RATIO
          REGRESSION      1###########################             .000
          RESIDUAL        5###############                .000

              VARIABLES IN EQUATION                    :             VARIABLES NOT IN EQUATION
    VARIABLE        COEFFICIENT  STD. ERROR  F TO REMOVE  :   VARIABLE    PARTIAL CORR.     TOLERANCE     F TO ENTER

  (CONSTANT       ########### )                        :
       27                .00000      .00000       .0000 (2) :     1        -1.00000 ############             .0000 (2)
                                                       :      2        -1.00000 ############             .0000 (2)
                                                       :      3        -1.00000 ############             .0000 (2)
                                                       :      4        -1.00000 ############             .0000 (2)
                                                       :      5        -1.00000 ############             .0000 (2)
                                                       :      6        -1.00000 ############             .0000 (2)
                                                       :      7        -1.00000 ############             .0000 (2)
                                                       :      8        -1.00000 ############             .0000 (2)
                                                       :     10        -1.00000 ############             .0000 (2)
                                                       :     11        -1.00000 ############             .0000 (2)
                                                       :     12        -1.00000 ############             .0000 (2)
                                                       :     13        -1.00000 ############ ########### (2)
                                                       :     14        -1.00000 ############             .0000 (2)
                                                       :     15        -1.00000 ############             .0000 (2)
                                                       :     16        -1.00000 ############             .0000 (2)
                                                       :     17        -1.00000 ############             .0000 (2)
                                                       :     18        -1.00000 ############             .0000 (2)
                                                       :     19         1.00000 ############             .0000 (2)
                                                       :     20        -1.00000 ############             .0000 (2)
                                                       :     21        -1.00000 ############             .0000 (2)
                                                       :     22        -1.00000 ############             .0000 (2)
                                                       :     23        -1.00000 ############             .0000 (2)
                                                       :     24        -1.00000 ############             .0000 (2)
                                                       :     25        -1.00000 ############             .0000 (2)
                                                       :     26         1.00000 ############ 9769525.0000 (2)
                                                       :     28          .00000       1.0000             .0000 (2)
SPECIFIED STEP REACHED


FINISH CARD ENCOUNTERED
PROGRAM TERMINATED
```

APPENDIX TABLE I

Data Storage Program Listing

```
A. O. S M I T H  C O R P O R A T I O N                    VER      07/12/78      PAGE      SERIAL
RX.GRPX873.SOURCE2                                           9.0      14.51.26       1         009315

                                        PANVALET
                          THE PROGRAM MANAGEMENT AND SECURITY SYSTEM

        PROGRAMS AND ALL SUPPORTING MATERIALS COPYRIGHT 1975 BY PANSOPHIC SYSTEMS, INCORPORATED

**WRITE PRINT,DOTNIKK
C         DATA SET DOTNIKK     AT LEVEL 035 AS OF 07/11/78
      DIMENSION QUALTY(75,31),RAIN(8),TEMP(8),CFS(500),CFSTIM(500),
     I    FLOW(8),IPT(6),CONVRT(75,3),CUM(8),LNUM1(4),LNUM2(4),
     ICONLB(75,30),LNUM(4),HYETO(500),RAIN1(8),STAT(50),INQSYM(30),INPUT
     IQ(30),RTITLE(5),ILOCAT(5)
      REAL NUMDU,NUMULI,NUMUS,NUMPMS,M3T,MILSC1,MGLDI,MILSC2,MGLD2,
     IMILSC3,MGLD3,LB(10),KG(10),NB,NUMBD
      INTEGER EVENT,STARTD(3),ENDD(3),ENDT,FLOWST,SAMPLE(75),TIME(75),FO
     IRMT(30),STARTT,TINT,SAMPNM,SNOW,TINT2,STARTO,TIME1(500)
      INTEGER CFSTIM
      COMMON /FORMET/FORMV(100)
      DATA FORMT/'COLF','  PH ',' HG ',' SS','VSS ','BOD5','TOC ',
     I     'COD ','TKN ','NO2 ','NO3 ',' TN ','TPO4','CL- ',' PB ',
     1     ' ZN ',' SN ',' FE ',' CU ',' CD ',' CR ',' TS ','O&G ',
     1     'PCB ','PEST','5*'     '/,TMP,CFST,M3T/3*0./,IHYETO,IHYDRO,
     1     IQUAL/'HYET','HYDR','QUAL'/
      DATA STAT/50*0./,IGRAPH,IPLUTO/'GRAP','PLOT'/
      DATA INQSYM/'COLF',' PH',' HG',' SS',' VSS','BOD5',' TOC',
     1     ' COD',' TKN',' NO2',' NO3','  TN','TPO4',' CL-',' PB',
     I     '  ZN','  SN','  FE','  CU','  CD','  CR','  TS',' O&G',
     I     ' PCG','PEST',5*'     '/
      DATA IBLANK/'    '/
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C         THIS PROGRAM USES ONE INPUT UNIT, UNIT 5.
C         THERE ARE THREE OUTPUT UNITS, UNIT 6 = LINE PRINTER
C                                       UNIT 9 = STORAGE FILE FOR PLOTS
C                                       UNIT 10= STORAGE FILE FOR STAT-
C                                                ISTICAL ANALYSES (BMD)
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
    8 FORMAT(1H1)
      WRITE(6,8)
C ******* READ IN CARD NUMBER (I)
      READ(5,11) LOC,EVENT,SNOW,IOPT
   11 FORMAT(A2,2X,I4,5X,I2,6X,A4)
      IL = LOC
C ************* READ IN CARD NUMBER (2) AREA OF LOCATION (ACRES)
C *************      AND RUN TITLE.
      READ(5,3535) AREA,RTITLE
 3535 FORMAT(F10.0,5A4)
C ******* READ IN CARD NUMBER (3)
      READ(5,12)  (STARTD(I),I=1,3),STARTT,STARTO
   12 FORMAT(3I2,2X,I4,2X,I4)
C ******* READ IN CARD NUMBER (4)
      READ(5,12)  (ENDD(I),I=1,3),ENDT
      CALL TIMCON(STARTT,LNUM)
      CALL TIMCON(ENDT,LNUM1)
      CALL TIMCON(STARTO,LNUM2)
```

```
C ************** KKK  IS A COUNTER USED TO WRITE THE HEADER AND TITLE
C **************       ON EACH PAGE OF OUTPUT AND MOVE TO DIFFERENT
C **************       SECTIONS OF THE PROGRAM DEPENDING UPON ITS VALUE.
   50 KKK=1
      DO 111 I=1,2
      WRITE(6,8)
   10 FORMAT(////////// 50X,'DEPARTMENT OF  TRANSPORTATION'///)
      WRITE(6,10)
  107 IF (KKK.GT.1) WRITE(6,108)
  108 FORMAT(///50X,'DEPARTMENT OF TRANSPORTATION'/50X,28('=')//)
      WRITE(6,1) RTITLE
    1 FORMAT(50X,5A4)
      IF (SNOW.LT.0) WRITE(6,114)
  114 FORMAT(/50X,'THIS DATA IS FROM A SNOW MELT.'/50X,30('-'))
      IF(KKK.GT.1) GOTO 109
  113 WRITE(6,13)(STARTD(L),L=1,3),(LNUM(III),III=1,4)
   13 FORMAT(///53X,I2,'/',I2,'/',I2,2X,4A1,' HRS.')
  109 WRITE(6,14) EVENT
   14 FORMAT(//58X,'EVENT: ',I3)
      GOTO (111,102,103,104,110,105,106),KKK
  111 CONTINUE
      WRITE(6,8)
      IF (IOPT.EQ.IGRAPH) WRITE(6,405)
C ************** IF OPTION IS EQUAL TO IGRAPH WRITE TITLE, EVENT NUMBER,
C ************** STARTING MONTH, DAY, AND YEAR ON UNIT 9,
C      *****     *****     *****     *****     *****     *****     *
C ************** IF YOU INTEND TO MAKE PLOTS USING THIS DATA YOU "MUST"
C ************** MAKE UNIT 9 (FT09F001) A PERMINENT OR TEMPORARY DATA
C ************** SET FOR INPUT TO THE PLOTTING PROGRAM.
  405 FORMAT(1H1,30(/),49X,'THE PLOTTING OPTION IS IN EFFECT.')
      IF(IOPT.EQ.IGRAPH) WRITE(9,406) RTITLE,EVENT,(STARTD(II),II=1,3),
     1     STARTT
  406 FORMAT(5X,'PLOTTING DATA FROM OSP',/1X,5A4,4X,I3,3(I2),I4)
      WRITE(6,8)
      KKK=2
      GOTO 107
  102 WRITE(6,15)(STARTD(I),I=1,3),(ENDD(I),I=1,3),(LNUM(I),I=1,4),(LN
     1UM1(I),I=1,4),(LNUM2(I),I=1,4)
   15 FORMAT(/' STORM DATE:  ',I2,'/',I2,'/',I2,' - ',I2,'/',
     1I2,'/',I2///' STORM TIME (PRECIPITATION PERIDO): ',4A1,' - ',4A1
     1///' START OF OVERFLOW:  ',4A1)
C ******* READ IN CARD NUMBER (5)
      READ(5,16) TOTRN,DURATN,NUMDD,NUMDL1,TINT,TINT2,ADT,ADT1,TRUCKS
      IF((ADT-INT(ADT)).LT..5) IADT=ADT
      IF((ADT-INT(ADT)).GE..5) IADT=ADT+.5
      IF((ADT1-INT(ADT1)).LT..5) IADT1=ADT1
      IF((ADT1-INT(ADT1)).GE..5) IADT1=ADT1+.5
C ******** CONVERT TOTAL RAINFALL IN INCHES TO CENTIMETERS
      TPRCPC=TOTRN*2.54
C ******** CONVERT TOTAL RAINFALL TO CUBIC FEET
      TPRECP=TOTRN/12.*43560.*AREA
   16 FORMAT(4(F10.0),5X,2(I5),5X,2(F10,0),/F10.0)
      WRITE(6,17)AREA,TOTRN,TPRECP,TPRCPC,DURATN,NUMDD,NUMDL1
```

```
     1,IADT,IADT1,TINT
  17 FORMAT(//' DRAINAGE AREA (ACRES):  ',F6.2
     1///' TOTAL PRECIPITATION (INCHES): ',F7.3
     1///' RAINFALL VOLUME ON DRAINAGE AREA (CUBIC FEET):  ',F10.2
     1///' TOTAL PRECIPITATION (CENTIMETERS):  ',F7.3
     1///' DURATION OF PRECIPITATION (HOURS):  ',F5.2
     1///' NUMBER OF DRY DAYS BEFORE THE STORM:',F5.2
     1///' NUMBER OF DAYS BEFORE THE STORM WITH AN ACCUMULATION OF LESS
     1THAN ONE INCH OF PRECIPITATION:  ',F5.1
     1///' AVERAGE TRAFFIC DURING DRY DAYS: ',I8
     1///' AVERAGE TRAFFIC FOR DAYS BEFORE THE STORM WITH AN ACCUMULATIO
     1N OF LESS THAN ONE INCH OF PRECIPITATION:  ',I8
     1///' TIME INTERVAL BETWEEN DISCRETE SAMPLES (IN MINUTES) FOR SAMPL
     1ER #1: ',I5)
      IF(TINT2.GT.0) WRITE(6,162) TINT2
 162 FORMAT(//' TIME INTERVAL BETWEEN DISCRETE SAMPLES (IN MINUTES) FOR
     1 SAMPLER #2: ',I5)
      K=J+19
      IEVENT=EVENT
C ************* STORE PARAMETERS FOR STATICAL ANALYSIS IN STAT ARRAY.
      STAT(1)=TPRCPC
      STAT(4)=NUMDD
      STAT(5)=NUMDL1
      STAT(6)=ADT
      STAT(7)=ADT1
      STAT(8)=TRUCKS
      WRITE(6,8)
      KKK=3
      GOTO 107
 103 WRITE(6,55)
  55 FORMAT(////45X,'DUSTFALL ANALYSIS'/45X,17('-'))
C ******* READ IN CARD NUMBER (6)
C ************* THE DEFAULT VALUE 0.0324 IS THE AREA IN SQUARE METERS
C ************* OF A STANDARD 8 INCH DUSTFALL BUCKET.
      READ(5,95) NB,NUMBD,BAREA
  95 FORMAT(3(F10.0))
      MILSC1=0.
      MILSC2=0.
      MILSC3=0.
      IF(BAREA.LE.0.0) BAREA = 0.0324
      IF(NB.LE.0) GO TO 95555
C ************* READ CARD NUMBER (7) IF AIR PARTICULATE FALLOUT IS
C ************* ASSOCIATED WITH THIS RUN (MLS OF SAMPLE COLLECTED FROM
C ************* DUSTFALL BUCKET NUMBER ONE AND MG/L OF DUST AND DIRT)
      IF (NB.GT.0) READ(5,95)MILSC1,MGLD1
C ************* CONVERT TO GRAMS OF DUST AND DIRT FOR SAMPLE # ONE.
      GMS1=MILSC1*MGLD1/1000000
C ************* READ CARD NUMBER (8) IF MORE THAN ONE DUSTFALL BUCKET
C ************* IS USED FOR ANALYSIS OF AIR PARTICULATE FOR THIS SITE
      IF (NB.GT.1) READ(5,95)MILSC2,MGLD2
C ************* CONVERT TO GRAMS OF DUST AND DIRT FOR SAMPLE # TWO.
      GMS2=MILSC2*MGLD2/1000000
      IF (NB.GT.2) READ(5,95)MILSC3,MGLD3
```

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C ************** READ CARD NUMBER (9) IF MORE THAN TWO DUSTFALL BUCKETS   00153*32
C ************** ARE USED FOR ANALYSIS OF AIR PARTICULATE FOR THIS SITE   00154*32
      GMS3=MILSC3*MGLO3/1000000                                          00155
C ************** CONVERT TO GRAMS OF DUST AND DIRT FOR SAMPLE # THREE.    00156*32
      GMSAVE=(GMS1+GMS2+GMS3)/NB                                         00157
      IF (NB.GT.0) WRITE(6,98)MILSC1,MGLD1,GMS1                          00158
   98 FORMAT(///      ' MLS OF SAMPLE COLLECTED FROM DUSTFALL BUCKET ND. 00159**3
     I1: ',F10.2,//,20X,'MG/L OF DUST COLLECTED FROM SAMPLE NO. 1: ',F1000160**3
     1.2,//,60X,'GRAMS OF DUST:  ',F10.5                                 00161**3
     1//)                                                                00162
      IF (NB.GT.1) WRITE(6,90)MILSC2,MGLD2,GMS2                          00163
   90 FORMAT(' MLS OF SAMPLE COLLECTED FROM DUSTFALL BUCKET NO. 2:',F10.00164**5
     12,//,20X,'MG/L OF DUST COLLECTED FROM SAMPLE NO. 2: ',F10.2,//,60X00165**3
     1,'GRAMS OF DUST:  ',F10.5                                          00166**3
     1//)                                                                00167
      IF (NB.GT.2) WRITE(6,91)MILSC3,MGLD3,GMS3                          00168
   91 FORMAT(' MLS OF SAMPLE COLLECTED FROM DUSTFALL BUCKET NO. 3:',F10.00169**5
     12,//,20X,'MG/L OF DUST COLLECTED FROM SAMPLE NO. 3: ',F10.2,//,60X00170**3
     1,'GRAMS OF DUST:  ',F10.5                                          00171**3
     1//)                                                                00172
      WRITE(6,92) GMSAVE,NB,NUMBD                                        00173
   92 FORMAT(//' AVERAGE GRAMS OF DUST, ',F6.4,' FOR ',F3.1,             00174**8
     1' DUSTFALL BUCKETS.'//' NUMBER OF DAYS BUCKETS WERE UP: ',F5.1)    00175**7
      GMSSQ=(GMSAVE/BAREA)/NUMBD                                         00176*35
C ************** GMSSQ = AIR PARTICULATE FALLOUT RATE FOR THIS SITE IN   00177*32
C **************          GRAMS/SQUARE METER/DAY.                        00178*32
      WRITE(6,797)                                                       00179
  797 FORMAT(//52X,'AIR PARTICULATE FALLOUT RATE'/52X,28('-'))           00180**3
      WRITE(6,96)GMSSQ                                                   00181
   96 FORMAT(//43X,F10.4,' GRAMS PER SQUARE METER PER DAY')              00182**3
C ************** STORE AIR PARTICULATE FALLOUT RATE IN STAT ARRAY.       00183*33
      STAT(9)=GMSSQ                                                      00184*32
      GOTO 90000                                                         00185
95555 WRITE(6,96666)                                                     00186
96666 FORMAT(/////,30X,'NO DUSTFALL DATA ASSOCIATED WITH THIS SAMPLING P00187**3
     1ERIOD',/30X,53('-'))                                               00188**3
90000 WRITE(6,8)                                                         00189
      KKK=4                                                              00190
      GOTO 107                                                           00191
C ************** READ CARD NUMBER (10)                                   00192*32
  104 READ(5,30)RINTVL,ISTHR,ISTMIN,IOPT                                 00193
   30 FORMAT(F10.2,6X,2I2,1X,A4)                                         00194
      WRITE(6,99999)RINTVL                                               00195
99999 FORMAT(//55X,'PRECIPITATION RECORD'/53X,'IN ',F4.1,1X,             00196*21
     1' MINUTE INTERVALS.'/53X,25('-')//)                                00197**3
C ************** WRITE HEADER FOR RAINFALL RECORD.                       00198*32
      WRITE(6,343)                                                       00199
  343 FORMAT(95X,'CUMULATIVE'/23X,'TIME',7X'PRECIPITATION',19X,          00200**3
     1'INTENSITY',19X,'PRECIPITATION'/23X,'(HR)',7X,'(IN)',5X,'(CM)',    00201**3
     115X,'(IN/HR)',3X,'(CM/HR)',15X,'(IN)',5X,'(CM)'/                   00202**3
     123X,'----',7X,'----',5X,'----',15X,7('-'),3X,7('-'),15X,           00203**3
     1'----',5X,'----')                                                  00204**3
      K=0                                                                00205
```

```
      KJ=0
      IEOU=-999
      KKK=5
      IZERO=0
      SUM=0.
      RZERO=0.
      RMAX=0.
      RSUM=0.
      ICOUNT=0
      IINT=RINTVL
C ******* READ IN CARD NUMBER (II)
  100 READ(5,32) (RAIN(I),I=1,8)
   32 FORMAT(8(F10.2))
      MNM=0
      DO 200 I=1,8
      II=I-1
      JJ=I
      IF(K.EQ.0.AND.I.EQ.1) TMP=RAIN(I)
      IF(K.EQ.0.AND.I.EQ.1) GOTO 987
      ISTMIN=ISTMIN+IINT
C ************* INCREMENT HOUR AND MINUTES FOR OUTPUT, TIME(I) IS
C ************* ACTUAL MILITARY TIME.

  789 IF(ISTMIN.GE.60) ISTHR=ISTHR+1
      IF(ISTMIN.GE.60)ISTMIN=ISTMIN-60
      IF (ISTHR.GE.24.AND.ISTMIN.NE.0) ISTHR=ISTHR-24
      IF(ISTMIN.GE.60) GOTO 789
  987 TIME(I)=ISTHR*100+ISTMIN
      IF (I.EQ.1) RAINI(I)=ABS(TMP-RAIN(I))
      IF (I.NE.1) RAINI(I)=ABS(RAIN(II)-RAIN(I))
      IF(RAIN(I).GE.0.)  SUM=SUM+RAINI(I)
C ************* CUM = CUMULITIVE RAINFALL SUM IN INCHES.
      CUM(I)=SUM
      IF(RAIN(I).LT.0.)TEMP(I)=0.
      IF(RAIN(I).LT.0.) TMP=RAIN(I)
      I (RAIN(I).LT.0.) RAINI(I)=0.
      IF(RAIN(I).LT.0.) GOTO 300
      IF(K.EQ.0.AND.I.EQ.1)TEMP(I)=0.
      IF(K.EQ.0.AND.I.EQ.1) GOTO 201
      IF(I.EQ.1)TEMP(I)=RAINI(I)*60./RINTVL
      IF(I.EQ.1)GOTO 201
      TEMP(I)=RAINI(I)*60./RINTVL
  201 TMP=RAIN(I)
  200 CONTINUE
  300 IF(JJ.EQ.0) WRITE(6,8)
      IF(JJ.EQ.0) GOTO 107
      K=K+1
      DO 333 JE=1,JJ
C ************* CONVERT RAINFALL INCHES TO CENTIMETERS.
      TMP2=RAINI(JE)*2.54
      TMP1=TEMP(JE)*2.54
      CALL TIMCON(TIME(JE),LNUM)
C ************* P = CUMULATIVE RAINFALL SUM IN CENTIMETERS.
```

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      P=CUM(JE)*2.54
      ICOUNT=ICOUNT+1
      IF(TMP1.GT.RMAX) RMAX=TMP1
      RSUM=RSUM+TMP1
      WRITE(6,33)(LNUM(I),I=1,4),RAIN1(JE),TMP2,TEMP(JE),TMP1,CUM(JE),
     1P
   33 FORMAT(23X,4A1,5X,F5.2,4X,F5.2,16X,F5.2,5X,F5.2,14X,E6.2,3X,F6.2)
      KJ=KJ+1
      HYETO(KJ)=TEMP(JE)
      TIME1(KJ)=TIME(JE)
  333 CONTINUE
      IF(TMP.GE.0) GOTO 100
      ISWTCH=0
C ************* WRITE HYDROGRAPH DATA TO UNIT FOR PLOTTING
      IF (IOPT.EQ.IHYETO) WRITE(9,408) ISWTCH,KJ,KJ,((TIME1(II),HYETO(II
     1)),II=1,KJ)
  408 FORMAT(1X,3(I4),/,200(1X,I4,G10.4,/))
C ************* STORE AVERAGE RAINFALL AND MAXIMUM RAINFALL IN
C ************* STAT ARRAY.
      STAT(2)=RSUM/ICOUNT
      STAT(3)=RMAX
      WRITE(6,8)
      GOTO 107
  110 WRITE(6,34)
   34 FORMAT(//////44X,'FLOW'/43X,6('-')///30X,'TIME',
     111X,'CFS',12X,'M3/MIN'/30X,'----',11X,'---',12X,'------')
      READ(5,35)FLOWST,IINT,IOPT
C ******* READ IN CARD NUMBER (I2)
   35 FORMAT(2(I4,2X),9X,A4)
      K=0
      ICOUNT=0
      RMAX=0.
      RSUM=0.
      RTIM2=0
      RTIM1=FLOWST
C ******* READ IN CARD NUMBER (I3)
  150 READ(5,32)(FLOW(I),I=1,8)
      DO 400 I=1,8
      IF(FLOW(I).LT.0) GOTO 600
      K=K+1
      CFS(K)=FLOW(I)
      CFST=CFS(K)+CFST
C ************* M3T  = TOTAL CUBIC METERS
C ************* CFST = TOTAL CUBIC FEET
C ************* XM3  = CUBIC FEET/MINUTE
      XM3=CFS(K)*1.699
      M3T=XM3+M3T
      IF(K.EQ.1)GOTO 500
      RTIME=FLOWST
      IHOUR=RTIME*.01  + .001
      IMINUT=RTIME-(IHOUR*100)
      IMINUT=IMINUT+IINT
  499 IF(IMINUT.GE.60)IHOUR=IHOUR+1
```

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      IF(IMINOT.GE.60)IMINUT=IMINUT-60.                                00312
      IF(IHOUR.GE.24.AND.IMINOT.NE.0)IHOUR=IHOUR-24                    00313
      IF(IMINOT.GE.60) GOTO 499                                        00314
      FLOWST=(IHOOR*100)+IMINOT                                        00315
  500 CFSTIM(K)=FLOWST                                                 00316
      CALL TIMCON(FLOWST,LNOM)                                         00317
      RTIM3=FLOWST                                                     00318
      ICOONT=ICOONT+1                                                  00319
      IF(XM3.GT.RMAX) RTIM2=FLOWST                                     00320
      IF(XM3.GT.RMAX) RMAX=XM3                                         00321
      RSOM=RSOM+XM3                                                    00322
      WRITE(6,36) (LNUM(III),III=1,4),CFS(K),XM3                       00323
   36 FORMAT(30X,4A1,5X,F10.2,7X,F10.2)                                00324
  400 CONTINOE                                                         00325
      GOTO 150                                                         00326
  600 CFSTI=CFST*IINT*60.                                              00327
      M3T=M3T*IINT                                                     00328
C ************* CONVERT TOTAL CFS TO TOTAL GALLONS                     00329*32
      GALLON=CFST*IINT*448.8                                           00330
      WRITE(6,37)CFSTI,M3T,GALLON                                      00331
   37 FORMAT(///10X,'TOTAL CUBIC FEET: ',F12.2,5X,'TOTAL CUBIC METERS :'00332**3
     1,F12.2//10X,'TOTAL GALLONS: ',E12.2)                             00333**3
      M3=XM3                                                           00334
      ISWTCH=I                                                         00335
C *********** WRITE HYETOGRAPH DATA TO STORAGE UNIT FOR PLOTTING *******00336*24
      IF(IOPT.EQ.IHYDRO) WRITE(9,408) ISWTCH,K,K,((CFSTIM(II),CFS(II)) 00337
     I,II=I,K)                                                         00338
      IF(RTIM3.LE.RTIM1) RTIM3=RTIM3+2400                              00339
      IF(RTIM2.LE.RTIM1) RTIM2=RTIM2+2400                              00340
      T1=(RTIM1-(INT(RTIM1*.01)*100.))+(INT(RTIM1*.01)*60.)            00341
      T2=(RTIM2-(INT(RTIM2*.01)*100.))+(INT(RTIM2*.01)*60.)            00342
      T3=(RTIM3-(INT(RTIM3*.01)*100.))+(INT(RTIM3*.01)*60.)            00343
C ************* READ IN CARD NOMBER (I4) TIME, SAMPLE NOMBER AND FIRST 00344*32
C ************* SEVEN QUALITY PARAMETERS.                              00345*32
      STAT(10)=M3T                                                     00346*32
      STAT(11)=ABS(T3-T1)                                              00347*32
      STAT(12)=RSOM/ICOUNT                                             00348*32
      STAT(13)=RMAX                                                    00349*32
      STAT(14)=ABS(T2-T1)                                              00350*32
      I=0                                                              00351
 1000 I=I+I                                                            00352
C ******* READ IN CARD NUMBER (I3,14,15,16,17)                         00353*24
      READ(5,39)TIME(I),SAMPLE(I),(QUALTY(I,M),M=I,7)                  00354**2
      IF (TIME(I).LT.0.AND.I.EQ.1) GOTO 765                            00355
      IF (TIME(I).LT.0) GOTO 1001                                      00356
   39 FORMAT(I4,2X,I4,E10.4,     6(F10.2))                             00357
C ************* READ IN CARD NUMBER (15) QUALITY 8 THROUGH QUALITY 15. 00358*32
      READ(5,32)(QUALTY(I,M),M=8,15)                                   00359**2
C ************* READ IN CARD NUMBER (I6) QUALITY I6 THROUGH QUALITY 23. 00360*32
      READ(5,32)(QUALTY(I,M),M=16,23)                                  00361**2
C ************* READ IN CARD NUMBER (17) QUALITY 24 THROUGH QUALITY 31. 00362*32
      READ(5,32)(QUALTY(I,M),M=24,31)                                  00363**2
      GOTO 1000                                                        00364
```

```
 1001 I=I-1
      WRITE(6,8)
      KKK=6
      GOTO 107
  105 WRITE(6,41)
   41 FORMAT(///62X,'QUALITY'/62X,7('-')//' NOTE: ',10('*'),
     1    'INDICATES NO ANALYSIS PERFORMED FOR A PARTICULAR PARAMETER AT
     2 THE SAMPLE TIME INDICATED.')
      KI=I
C ************* BEGIN SETTING UP POINTERS (IPT) AND (MN) FOR
C ************* FORMAT STATEMENTS.
      DO 5757 JE=1,3
 5757 IPT(JE)=0
 2541 MN=0
      DO 4747 ICOL=KI,30
      DO 3737 II=I,I
      IF (QUALTY(II,ICOL).GT.0)GO TO 523
 3737 CONTINUE
      GOTO 4747
  523 MN=MN+1
      DO  1002 IIII=1,I
      IF(QUALTY(IIII,ICOL).EQ.0)  QUALTY(IIII,ICOL)=1.E60
 1002 CONTINUE
      IPT(MN)=ICOL
      IF (MN.EQ.3)GOTO 325
 4747 CONTINUE
      IF (MN.EQ.0) GOTO 765
  325 KI=IPT(MN)+I
      IERR=0
      M1=0
      M2=0
      M3=MN
      WRITE(6,27)
   27 FORMAT(//)
      WRITE(6,42) (FORMT(IPT(KK)),KK=1,MN)
   42 FORMAT(42X,4(A4,22X))
      IF (IPT(I).EQ.1) MI=1
      IF (IPT(I).EQ.2) M2=I
      IF (IPT(2).EQ.2) M2=I
      IF (MI.EQ.I.OR.M2.EQ.I) M3=M3-1
      IF (MI.EQ.I.AND.M2.EQ.I) M3=M3-1
      CALL FORMUP(2,MI,M2,M3)
      WRITE(6,FORMV)
      CALL FORMUP(I,MI,M2,M3)
      WRITE(6,FORMV)
      DO 452 JE=I,10
      DO 452 JEJ=1,3
  452 CONVRT(JE,JEJ)=0.
      DO 6666 JI=1,MN
      IF (IPT(JI).EQ.I.OR.IPT(JI).EQ.2) GOTO 6666
      DO 7676 JE=I,I
      DO 8686 JK=I,K
      IF (QUALTY(JE,3I).NE.0.) GOTO 40
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          KJ=JK
          IF (TIME(JE).EQ.CFSTIM(JK)) GOTO 9696
     8686 CONTINUE
          IERR=1
          WRITE(6,44) TIME(JE)
       44 FORMAT(///,'--THE TIME, ',I4,',HAS NO CORRESPONDING FLOW TIME--',
         1///)
          GOTO 7676
     9696 CONVRT(JE,JI)=QUALTY(JE,IPT(JI))*CFS(KJ)*.003746
       40 IF (QUALTY(JE,31).NE.0.) CONVRT(JE,JI)=QUALTY(JE,IPT(JI))*QUALTY(J
         1E,31)*.003746
          CONLB(JE,IPT(JI))=CONVRT(JE,JI)
     7676 CONTINUE
     6666 CONTINUE
          J1=0
          J2=0
          J3=1
          M=1+M1+M2
          DO 53 JE=1,I
          CALL TIMCON(TIME(JE),LNUM)
          GOTO (46,47,48),M
       46 WRITE(6,1111) (LNUM(JEJ),JEJ=1,4),SAMPLE(JE),((QUALTY(JE,IPT
         1(JEJ)),CONVRT(JE,JEJ)),JEJ=1,MN)
     1111 FORMAT(8X,4A1,8X,I4,8X,4(F10.4,3X,F10.4,3X))
          GOTO 53
       47 IF (M1.EQ.1) J1=1
          IF (M2.EQ.1) J2=1
          IF (M2.EQ.1) J3=2
          IF (MN.LT.2) GOTO 247
          CALL FORMOP(3,J1,J2,M3)
          WRITE(6,FORMV)(LNUM(JEJ),JEJ=1,4),SAMPLE(JE),QUALTY(JE,J3),
         1  (QUALTY(JE,IPT(JEJ)),CONVRT(JE,JEJ),JEJ=2,MN)
          GOTO 53
      247 CALL FORMOP(3,J1,J2,M3)
          WRITE(6,FORMV)(LNUM(JEJ),JEJ=1,4),SAMPLE(JE),QUALTY(JE,J3)
          GOTO 53
       48 IF (MN.LT.3) GOTO 3838
     7979 FORMAT(8X,4A1,8X,I4,15X,F10.4,13X,F10.4,12X(F10.4,3X,F10.4,3X))
          IF(M5.EQ.1) WRITE(6,FORMV)
          WRITE(6,7979)(LNUM(JEJ),JEJ=1,4),SAMPLE(JE),(QUALTY(JE,JEJ),
         1JEJ=1,2), (QUALTY(JE,IPT(JEJ)),CONVRT(JE,JEJ),JEJ=3,MN)
          IF(M5.EQ.1) WRITE(6,1618) KG(1),LB(1),M3
          GOTO 53
     3838 WRITE(6,7979) (LNUM(JEJ),JEJ=1,4),SAMPLE(JE),(QUALTY(JE,JEJ),JE
         1J=1,2),M3
       53 CONTINUE
          GOTO 2541
      765 WRITE(6,8)
C ************************ DISCRETE QUALITY ************************
C ************* READ IN CARD NUMBER (19).
          READ(5,618) IOPT
      618 FORMAT(A4)
          IF(IOPT.NE.IPLOTO) GOTO 620
```

```
  640 ISWTCH=ISWTCH+I                                                    00471
      IF(ISWTCH.GT.3) WRITE(9,470) IEOO,IZERO                            00472
  470 FORMAT(1X,3(I4))                                                   00473
      IF(ISWTCH.GT.3) GOTO 620                                           00474
C ************* READ IN CARDS NUMBER (20,21).                            00475*32
      READ(5,630) (INPUTQ(JE),JE=1,25)                                   00476
  630 FORMAT(20(A4)/5(A4))                                               00477
      DO 645 JE=I,25                                                     00478
      IF(INPUTQ(JE).EQ.IBLANK) GOTO 640                                  00479
      DO 655 JEJ=1,25                                                    00480
      JJ=JEJ                                                             00481
      IF(INPUTQ(JE).EQ.INQSYM(JEJ)) GOTO 650                             00482
  655 CONTINUE                                                           00483
      WRITE(6,652) INPUTQ(JE)                                            00484
  652 FORMAT(30(/),44X,A4,' IS NOT A RECOGNIZED QUALITY PARAMETER.')     00485*21
      GOTO 645                                                           00486
  650 KI=0                                                               00487
      DO 5959 JEJ=I,I                                                    00488
      IF(QUALTY(JEJ,JJ).EQ.I.E60) GOTO 5959                              00489**2
      KI=KI+1                                                            00490
      TIMEI(KI)=TIME(JEJ)                                                00491
      IF(ISWTCH.EQ.2) QUALTY(KI,31)=QUALTY(JEJ,JJ)                       00492**2
      IF(ISWTCH.EQ.3) QUALTY(KI,31)=CONLB(JEJ,JJ)                        00493**2
 5959 CONTINUE                                                           00494
C *********** WRITE QUALITY TO BE PLOTTED TO UNIT (9) **********          00495*24
      IF(ISWTCH.EQ.2) WRITE(9,480) ISWTCH,KI,JJ,KI,((TIMEI(JEJ),QUALTY   00496**2
     I(JEJ,31)),JEJ=1,KI)                                                00497
      IF(ISWTCH.EQ.3.AND.IERR.EQ.I) WRITE(6,490)                         00498
  490 FORMAT(/52X,'(LB/MIN)--PLOT DATA ABORTED!')                        00499**3
      IF(ISWTCH.EQ.3) WRITE(9,480) ISWTCH,KI,JJ,KI,((TIMEI(JEJ),QUALTY   00500**2
     I(JEJ,3I)),JEJ=1,KI)                                                00501
  480 FORMAT(1X,3(I4)/IX,I2/75(1X,I4,G10.4,/))                           00502*26
  645 CONTINUE                                                           00503
      GOTO 640                                                           00504
  620 KKK=7                                                              00505
      GOTO I07                                                           00506
  I06 WRITE(6,3008)                                                      00507
 3008 FORMAT(//////6IX,'COMPOSITE'/6IX,9('-')///)                        00508**3
  766 K=1                                                                00509
C ************************* COMPOSIT QUALITY ************************    00510*24
C ******* READ IN CARD NUMBER (2I)                                        00511*24
      READ(5,2469) SAMPNM,(TEMP(JE),JE=I,7)                              00512
 2469 FORMAT (6X,I4,E10.3,6(F10.2))                                      00513
      IF(SAMPNM.LT.0) GOTO 2203                                          00514
      DO 5678  JE=I,30                                                   00515
 5678 QUALTY(I,JE)=0.                                                    00516**2
      DO 6969 JE=1,7                                                     00517
 6969 QUALTY(1,JE)=TEMP(JE)                                              00518**2
      DO III8 JE=I,6                                                     00519
 III8 IPT(JE)=0.                                                         00520
      WRITE(6,768) SAMPNM                                                00521
  768 FORMAT (58X,'SAMPLE NO. ',I4)                                      00522**3
C ******* READ IN CARD NUMBER (22)                                        00523*24
```

```
      READ(5,2468) (QUALTY(1,JE),JE=8,30)
 2468 FORMAT (8(F10.2))
 1023 MN=0.
      DO 1119 ICOL=K,30
      IF(QUALTY(I,ICOL).EQ.0.) GOTO 1119
      MN=MN+1
      IPT(MN)=ICOL
      IF(MN.EQ.6) GOTO 1076
 1119 CONTINUE
 1076 K=IPT(MN)+1
      IF(MN.EQ.0) WRITE(6,767)
  767 FORMAT(/////)
      IF(MN.EQ.0) GOTO 766
      CALL FORMUP(8,MN,0,0)
      WRITE(6,FORMV)(FORMT(IPT(KK)),KK=1,MN)
 2871 FORMAT(1H0,////,8X,('<',A4,'>',14X))
      MI=0
      M2=0
      M3=MN
      M4=MN
      M5=0
      DO 7777 JE=1,MN
      KK=JE
      IF(IPT(JE).EQ.3)   M5=I
      IF (M5.EQ.I) GOTO 1005
 7777 CONTINUE
 1005 M7=KK-1
      M8=MN-KK
      M9=KK+1
      IF(IPT(1).EQ.1)M1=I
      IF(IPT(1).EQ.2)M2=I
      IF(IPT(2).EQ.2)M2=I
      IF(M1.EQ.1.OR.M2.EQ.1.OR.M5.EQ.1)M3=M3-1
      IF((M1.EQ.I.AND.M2.EQ.1).OR.(M2.EQ.I.AND.M5.EQ.1).OR.(M5.EQ.1.
     1AND.MI.EQ.I)) M3=M3-1
      IF(MI.EQ.1.AND.M2.EQ.1.AND.M5.EQ.1)M3=M3-1
      CALL FORMUP(5,M1,M2,M3)
      IF(M5.EQ.0)WRITE(6,FORMV)
      M13=M7
      M13=M13-M1-M2
      M12=M7+M8+1-M1-M2
      CALL FORMN2(M1,M2,M13,M8,M12)
      IF(M5.EQ.1)WRITE(6,FORMV)
      CALL FORMUP(9,M4,0,0)
      IF(M5.EQ.0)WRITE(6,FORMV)(QUALTY(1,IPT(JEJ)),JEJ=1,M4)
      IF(M5.EQ.1.AND.M7.EQ.0.AND.M8.EQ.0) WRITE(6,26) QUALTY(1,3)
   26 FORMAT(/X,G12.6)
      CALL FORMUP(10,M8,0,0)
      IF(M5.EQ.1.AND.M7.EQ.0.AND.M8.NE.0)WRITE(6,FORMV)QUALTY(1,3),
     1(QUALTY(1,IPT(JEJ)),JEJ=M9,M4)
      CALL FORMUP(4,M7,0,0)
      IF(M5.EQ.1.AND.M7.NE.0.AND.M8.EQ.0)WRITE(6,FORMV)(QUALTY(1,IPT(
     1JEJ)),JEJ=I,M7),QUALTY(1,3)
```

```
      CALL FORMOP(6,M7,M8,0)
      IF(M5.EQ.1.AND.M7.NE.0.AND.M8.NE.0) WRITE(6,FORMV)
     1(QUALTY(1,IPT(JEJ)),JEJ=1,M7),QUALTY(1,3),
     2(QUALTY(1,IPT(JEJ)),JEJ=M9,M4)
      IF(M5.EQ.0)CALL FORMOP(7,M1,M2,M3)
      IF(M5.EQ.1)CALL FORMOP(7,M1,M2,M12)
      IF(M5.EQ.0.OR.M5.EQ.1)WRITE(6,FORMV)
      DO 2112 JE=1,MN
      IF(IPT(JE).EQ.1.OR.IPT(JE).EQ.2) GOTO 2112
C ******** CONVERT MECORY TO MILIGRAMS FOR CONVERSION TO LBS. & KG.
      IF(IPT(JE).EQ.3)  QUALTY(1,3)=QUALTY(1,3)/1000
C ******** CONVERT ALL QUALITY PARAMETERS TO LBS. & KG. FROM MG/L
      KG(JE)=CFST1*28.32*QUALTY(1,IPT(JE))*1E-6
      LB(JE)=KG(JE)/.45345
 2112 CONTINUE
      M=1+M1+M2+M5
      GOTO(616,6161,61616,16161),M
  616 WRITE(6,161)((KG(JE),LB(JE)),JE=1,MN)
  161 FORMAT(2X,6(F8.2,2X,F8.2,2X))
      GOTO 1023
 6161 IF(MN.LT.2)GOTO 2617
      IF(M1.EQ.1)WRITE(6,1617)QUALTY(1,1),((KG(JE),LB(JE)),JE=2,MN
     1)
 1617 FORMAT(5X,G8.2,9X,6(F8.2,2X,F8.2,2X))
      IF(M2.EQ.1)WRITE(6,1616)QUALTY(1,2),((KG(JE),LB(JE)),JE=2,MN
     1)
 1616 FORMAT(5X,F8.2,9X,6(2(F8.2,2X)))
      IF(M5.EQ.1) WRITE(6,1618) KG(1),LB(1),M3,((KG(JE),LB(JE)),JE=2
     1,MN)
 1618 FORMAT(2X,2(G8.2,2X),(12(F8.2,2X)))
      GOTO 1023
 2617 M3=0
      IF(M1.EQ.1) WRITE(6,1617)QUALTY(1,1),M3
      IF(M2.EQ.1) WRITE(6,1616)QUALTY(1,2)
      GOTO 1023
61616 IF(MN.LT.3) GOTO 21616
      IF(M1.EQ.1.AND.M2.EQ.1) WRITE(6,66611)QUALTY(1,1),QUALTY(1,2)
     1,((KG(JE),LB(JE)),JE=3,MN)
66611 FORMAT(5X,G8.2,12X,F8.2,8X,(12(F8.2,2X)))
      IF(M1.EQ.1.AND.M5.EQ.1) WRITE(6,66661)QUALTY(1,1),KG(2),
     1LB(2),((KG(JE),LB(JE)),JE=3,MN)
66661 FORMAT(5X,G8.2,9X,2(G8.2,2X),(12(F8.2,2X )))
      IF(M2.EQ.1.AND.M5.EQ.1) WRITE(6,66666) QUALTY(1,2),KG(2),
     1LB(2),((KG(JE),LB(JE)),JE=3,MN)
66666 FORMAT(5X,F8.2,9X,2(G8.2,2X),(12(F8.2,2X )))
      GOTO 1023
21616 M3=0
      IF(M1.EQ.1.AND.M2.EQ.1) WRITE(6,66611)QUALTY(1,1), QUALTY(1,2)
     1,M3
      IF(M1.EQ.1.AND.M5.EQ.1) WRITE(6,66661) QUALTY(1,1),KG(2),
     1LB(2),M3
      IF(M2.EQ.1.AND.M5.EQ.1) WRITE(6,66666) QUALTY(1,2),KG(2),
     1LB(2),M3
```

```
      GOTO 1023                                                         00630
16161 IF(MN.LT.4) GOTO 31616                                            00631
      WRITE(6,11666) QUALTY(1,1),QUALTY(1,2),KG(3),LB(3),               00632**2
     1((KG(JE),LB(JE)),JE=4,MN)                                         00633
11666 FORMAT(5X,G3.2,14X,F8.2,9X,2(G8.2,2X),(12(F8.2,2X )))             00634*12
      GOTO 1023                                                         00635
31616 M3=0                                                              00636
      WRITE(6,11666) QUALTY(1,1),QUALTY(1,2),KG(3),LB(3),M3             00637**2
      GOTO 1023                                                         00638
 2203 WRITE(6,8)                                                        00639
      DO 401 I=1,25                                                     00640
      II=I+25                                                           00641
C ************ WRITE OUT COMPOSIT QUALITY FOR STATISTICAL ANALYSIS      00642*24
  401 STAT(II)=QUALTY(I,1)                                              00643**2
      WRITE(10,402) RTITLE,IEVENT,(STAT(I),I=1,50)                      00644*31
  402 FORMAT(5X,'STATISTICAL DATA, REFER TO MANUAL FOR SPECIFIC PARAMETE00645*30
     1RS',/1X,5A4,4X,I3,/50(1X,G10.4,/))                                00646*30
      IF(IOPT.NE.IPLOTU) WRITE(9,470) IEOU,IZERO                        00647
      WRITE(6,888)                                                      00648
  888 FORMAT(30(/),60X,'END OF DOT.')                                   00649**3
      WRITE(6,8)                                                        00650
      STOP                                                              00651
      END                                                               00652
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * 00653*24
C        SUBROUTINE FORMUP AND FORMN2 ARE USED TO BUILD FORMAT          00654*24
C          STATMENTS USED IN WRITING OUT THE VARIOUS QUALITY PARAMETERS 00655*24
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * 00656*24
      SUBROUTINE FORMUP(IPOINT,I1,I2,I3)                                00657
      COMMON /FORMET/ FOR(100)                                          00658
      DIMENSION D100(7)                                                 00659*12
      DIMENSION D110(4)                                                 00660*12
      DIMENSION D120(4)                                                 00661*12
      DIMENSION D130(5)                                                 00662*12
      DIMENSION D200(8)                                                 00663*12
      DIMENSION D210(6)                                                 00664*12
      DIMENSION D230(7)                                                 00665*18
      DIMENSION D300(4)                                                 00666*12
      DIMENSION D321(2)                                                 00667*12
      DIMENSION D350(5)                                                 00668*21
      DIMENSION D410(3)                                                 00669*12
      DIMENSION D411(3)                                                 00670*12
      DIMENSION D530(5)                                                 00671*12
      DIMENSION D531(2)                                                 00672*16
      DIMENSION D560(3)                                                 00673*19
      DIMENSION D610(3)                                                 00674*12
      DIMENSION D611(3)                                                 00675*12
      DIMENSION D620(3)                                                 00676*12
      DIMENSION D710(5)                                                 00677*12
      DIMENSION D730(5)                                                 00678*12
      DIMENSION D731(2)                                                 00679*12
      DIMENSION D740(5)                                                 00680*12
      DIMENSION D760(4)                                                 00681*12
      DIMENSION D800(3)                                                 00682*12
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A . D .   S M I T H   C O R P O R A T I O N                    VER     07/12/78     PAGE     SERIAL
RX.GRPX873.SOURCE2                                              9.0     14.51.26      14      009315
 .
      DIMENSION D810(4)                                                 00683*12
      DIMENSION D910(3)                                                 00684*12
      DIMENSION D1000(4)                                                00685*12
      DIMENSION D1010(3)                                                00686*12
      DIMENSION D1100(3)                                                00687*12
      DIMENSION D1200(3)                                                00688*12
      DIMENSION D1300(3)                                                00689*12
      DATA D100/ 28H(8X,'----',5X,10('-'),8X,   /                      00690*12
      DATA D110/ 16H3X,12('-'),11X, /                                   00691*12
      DATA D120/ 16H7X,'----',15X,  /                                   00692*12
      DATA D130/ 20H6('-'),6X,8('-'),6X,/                               00693*12
      DATA D01X/ 4H1X) /                                                00694*12
      DATA D200/ 32H(8X,'TIME',5X,'SAMPLE NO.',8X,  /                   00695*12
      DATA D210/ 24H3X,'(NUM/100 ML)',11X,   /                          00696*12
      DATA D220/ 4H26X,/                                                00697*12
      DATA D230/ 28H'(MG/L)',6X,'(LB/MIN)',6X,  /                       00698*18
      DATA D300/ 16H(8X,4A1,8X,I4,  /                                   00699*12
      DATA D310/ 4H15X,/                                                00700*12
      DATA D320/ 4H13X,/                                                00701*12
      DATA D321/ 8HF10.4,  /                                            00702*12
      DATA D330/ 4H9X, /                                                00703*12
      DATA D340/ 4H11X,/                                                00704*12
      DATA D350/ 20HF10.4,3X,F10.4,3X,  /                               00705*21
      DATA D400/ 4H(3X,/                                                00706*12
      DATA D410/12HF10.3,10X,  /                                        00707*12
      DATA D411/12H1X,G12.6)   /                                        00708*12
      DATA D500/ 4H(5X,/                                                00709*12
      DATA D20X/ 4H20X,/                                                00710*12
      DATA D530/ 20H'CONC. (MG/L)',8X,  /                               00711*12
      DATA D531/ 5H/,5X,   /                                            00712*16
      DATA D560/ 12H12('-'),8X, /                                       00713*19
      DATA D600/ 4H(3X,/                                                00714*12
      DATA D610/ 12HF10.3,10X,  /                                       00715*12
      DATA D611/ 12H4X,G12.6,4X,/                                       00716*12
      DATA D620/ 12HF10.3,10X,  /                                       00717*12
      DATA D700/ 4H(4X,/                                                00718*12
      DATA D710/ 20H'(NUM/100ML)',8X,   /                               00719*12
      DATA D730/ 20H'(KG)',6X,'(LB)',6X,/                               00720*12
      DATA D731/ 8H/,4X,   /                                            00721*12
      DATA D740/ 20H12('-'),8X,10('-'), /                               00722*12
      DATA D760/ 16H2('----',6X),   /                                   00723*12
      DATA D800/ 12H(1X,////,8X,/                                       00724*12
      DATA D810/ 16H'<',A4,'>',14X, /                                   00725*12
      DATA D900/ 4H(3X,/                                                00726*12
      DATA D910/ 12HF10.3,10X,  /                                       00727*12
      DATA D1000/ 16H(7X,G12.6,4X,   /                                  00728*12
      DATA D1010/ 12HF10.3,10X,  /                                      00729*12
      DATA D1100/ 12H('F.1100')  /                                      00730*12
      DATA D1200/ 12H('F.1200')  /                                      00731*12
      DATA D1300/ 12H('F.1300')  /                                      00732*12
      GO TO (100,200,300,400,500,600,700,800,900,1000,1100,1200,1300),  00733
    1    IPOINT                                                         00734
C                                                                       00735
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C     FORMAT 43                                          00736
  100 CONTINUE                                           00737*12
      DO 105 I=1,7                                       00738*12
        FOR(I)=D100(I)                                   00739*12
  105 CONTINUE                                           00740*12
      ISPOT=8                                            00741*12
      IF(I1.LE.0) GO TO 111                              00742*12
      DO 110 J1=1,I1                                     00743*12
        FOR(ISPOT)=D110(1)                               00744*12
        FOR(ISPOT+1) = D110(2)                           00745*12
        FOR(ISPOT+2) = D110(3)                           00746*12
        FOR(ISPOT+3) = D110(4)                           00747*12
        ISPOT=ISPOT+4                                    00748*17
  110 CONTINUE                                           00749*12
  111 IF(I2.LE.0) GO TO 121                              00750*12
      DO 120 J2=1,I2                                     00751*12
        FOR(ISPOT) = D120(1)                             00752*12
        FOR(ISPOT+1) = D120(2)                           00753*12
        FOR(ISPOT+2) = D120(3)                           00754*12
        FOR(ISPOT+3) = D120(4)                           00755*12
        ISPOT=ISPOT+4                                    00756*12
  120 CONTINUE                                           00757*12
  121 IF(I3.LE.0) GO TO 131                              00758*12
      DO 130 J3=1,I3                                     00759*12
        FOR(ISPOT)=D130(1)                               00760*12
        FOR(ISPOT+1) = D130(2)                           00761*12
        FOR(ISPOT+2) = D130(3)                           00762*12
        FOR(ISPOT+3) = D130(4)                           00763*12
        FOR(ISPOT+4) = D130(5)                           00764*12
        ISPOT=ISPOT+5                                    00765*12
  130 CONTINUE                                           00766*12
  131 FOR(ISPOT) = D01X                                  00767*12
       RETURN                                            00768*12
C                                                        00769
C     FORMAT 2727                                        00770
  200 CONTINUE                                           00771*12
      DO 205 I=1,9                                       00772*12
        FOR(I) = D200(I)                                 00773*12
  205 CONTINUE                                           00774*12
      ISPOT = 9                                          00775*12
      IF(I1.LE.0) GO TO 211                              00776*12
      DO 210 J1=1,I1                                     00777*12
       FOR(ISPOT) = D210(1)                              00778*12
       FOR(ISPOT+1) = D210(2)                            00779*12
       FOR(ISPOT+2) = D210(3)                            00780*12
       FOR(ISPOT+3) = D210(4)                            00781*12
       FOR(ISPOT+4) = D210(5)                            00782*12
       FOR(ISPOT+5) = D210(6)                            00783*12
       ISPOT = ISPOT + 6                                 00784*12
  210 CONTINUE                                           00785*12
  211 IF(I2.LE.0) GO TO 221                              00786*12
       DO 220 J2=1,I2                                    00787*12
        FOR(ISPOT) = D220                                00788*12
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      ISPOT = ISPOT + 1                                  00789*12
  220 CONTINUE                                           00790*12
  221 IF(I3.LE.0) GO TO 231                              00791*12
       DO 230 J3=1,I3                                    00792*12
        FOR(ISPOT  ) = D230(1)                           00793*12
        FOR(ISPOT+1) = D230(2)                           00794*12
        FOR(ISPOT+2) = D230(3)                           00795*12
       FOR(ISPOT+3) = D230(4)                            00796*18
       FOR(ISPOT+4) = D230(5)                            00797*18
       FOR(ISPOT+5) = D230(6)                            00798*18
       FOR(ISPOT+6) = D230(7)                            00799*18
       ISPOT = ISPOT + 7                                 00800*18
  230 CONTINUE                                           00801*12
  231 CONTINUE                                           00802*12
      FOR(ISPOT) = D0IX                                  00803*12
      RETURN                                             00804
C                                                        00805
C     FORMAT 2222                                        00806
  300 CONTINUE                                           00807*12
      DO 305 I=1,4                                       00808*12
        FOR(I) = D300(I)                                 00809*12
  305 CONTINUE                                           00810*12
       ISPOT = 5                                         00811*12
      IF(I1.LE.0) GO TO 311                              00812*12
      DO 310 J1=1,I1                                     00813*12
        FOR(ISPOT) = D310                                00814*12
        ISPOT = ISPOT + 1                                00815*12
  310 CONTINUE                                           00816*12
  311 IF(I2.LE.0) GO TO 321                              00817*12
       DO 320 J2=1,I2                                    00818*12
        FOR(ISPOT) = D320                                00819*12
        ISPOT = ISPOT + 1                                00820*12
  320 CONTINUE                                           00821*12
  321 CONTINUE                                           00822*21
        FOR(ISPOT  ) = D321(1)                           00823*12
        FOR(ISPOT+1) = D321(2)                           00824*12
        ISPOT = ISPOT + 2                                00825*12
  325 CONTINUE                                           00826*12
      IF(I1.LE.0) GO TO 331                              00827*12
      DO 330 J1=1,I1                                     00828*12
        FOR(ISPOT) = D330                                00829*12
        ISPOT = ISPOT + 1                                00830*12
  330 CONTINUE                                           00831*12
  331 IF(I2.LE.0) GO TO 341                              00832*12
      DO 340 J2=1,I2                                     00833*12
        FOR(ISPOT) = D340                                00834*12
        ISPOT = ISPOT + 1                                00835*12
  340 CONTINUE                                           00836*12
  341 CONTINUE                                           00837*12
      DO 350 I3=1,3                                      00838*12
        FOR(ISPOT  ) = D350(1)                           00839*12
        FOR(ISPOT+1) = D350(2)                           00840*12
        FOR(ISPOT+2) = D350(3)                           00841*12
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         FOR(ISPOT+3) = D350(4)                       00842*12
         FOR(ISPOT+4) = D350(5)                       00843*22
         ISPOT = ISPOT + 5                            00844*22
  350  CONTINUE                                       00845*12
       FOR(ISPOT) = 001X                              00846*12
       RETURN                                         00847
C                                                     00848
C      FORMAT 24                                      00849
  400  CONTINUE                                       00850*12
        FOR(1) = D400                                 00851*12
       ISPOT = 2                                      00852*12
       IF(I1.LE.0) GO TO 411                          00853*12
       DO 410 J1=1,I1                                 00854*12
         FOR(ISPOT  ) = D410(1)                       00855*12
         FOR(ISPOT+1) = D410(2)                       00856*12
         FOR(ISPOT+2) = D410(3)                       00857*12
         ISPOT = ISPOT +3                             00858*12
  410  CONTINUE                                       00859*12
  411  CONTINUE                                       00860*12
       FOR(ISPOT  ) = D411(1)                         00861*12
       FOR(ISPOT+1) = D411(2)                         00862*12
       FOR(ISPOT+2) = D411(3)                         00863*12
       RETURN                                         00864
C                                                     00865
C      FORMAT 5333                                    00866
  500  CONTINUE                                       00867*12
       FOR(1)=D500                                    00868*12
       ISPOT=2                                        00869*12
       IF(I1.LE.0) GO TO 511                          00870*12
       DO 510 J1=1,I1                                 00871*12
         FOR(ISPOT)=D20X                              00872*12
         ISPOT=ISPOT+1                                00873*12
  510  CONTINUE                                       00874*12
  511  IF(I2.LE.0) GO TO 521                          00875*12
       DO 520 J2=1,I2                                 00876*12
         FOR(ISPOT)= D20X                             00877*12
         ISPOT=ISPOT+1                                00878*12
  520  CONTINUE                                       00879*12
  521  IF(I3.LE.0) GO TO 531                          00880*12
        DO 530 J3=1,I3                                00881*12
         FOR(ISPOT  ) = D530(1)                       00882*12
         FOR(ISPOT+1) = D530(2)                       00883*12
         FOR(ISPOT+2) = D530(3)                       00884*12
         FOR(ISPOT+3) = D530(4)                       00885*12
         FOR(ISPOT+4) = D530(5)                       00886*12
         ISPOT=ISPOT+5                                00887*12
  530  CONTINUE                                       00888*12
  531  CONTINUE                                       00889*12
       FOR(ISPOT) = D531(1)                           00890*16
       FOR(ISPOT+1) = D531(2)                         00891*16
       ISPOT = ISPOT + 2                              00892*16
       IF(I1.LE.0) GO TO 541                          00893*12
       DO 540 I = 1,I1                                00894*16
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      FOR(ISPOT) = D20X                            00895*16
      ISPOT = ISPOT + 1                            00896*16
  540 CONTINUE                                     00897*12
  541 IF(I2.LE.0) GO TO 551                        00898*12
      DO 550 J2=1,I2                               00899*12
        FOR(ISPOT) = D20X                          00900*12
        ISPOT=ISPOT+1                              00901*12
  550 CONTINUE                                     00902*12
  551 IF(I3.LE.0) GO TO 561                        00903*12
      DO 560 J3=1,I3                               00904*12
        FOR(ISPOT  ) = D560(1)                     00905*12
        FOR(ISPOT+1) = D560(2)                     00906*12
        FOR(ISPOT+2) = D560(3)                     00907*19
        ISPOT = ISPOT + 3                          00908*19
  560 CONTINUE                                     00909*12
  561 CONTINUE                                     00910*12
      FOR(ISPOT)=D01X                              00911*12
      RETURN                                       00912
C                                                  00913
C     FORMAT 7878 IS IN SUBROUTINE FORMN2          00914
C                                                  00915
C     FORMAT 28                                    00916
  600 CONTINUE                                     00917*12
      FOR(1)=D600                                  00918*12
      ISPOT=2                                      00919*12
      IF(I1.LE.0) GO TO 611                        00920*12
      DO 610 J1=1,I1                               00921*12
        FOR(ISPOT  ) = D610(1)                     00922*12
        FOR(ISPOT+1) = D610(2)                     00923*12
        FOR(ISPOT+2) = D610(3)                     00924*12
        FOR(ISPOT+3) = D610(4)                     00925*12
        ISPOT=ISPOT+4                              00926*12
  610 CONTINUE                                     00927*12
  611 CONTINUE                                     00928*12
      DO 615 I=1,3                                 00929*12
        FOR(ISPOT  ) = D611(1)                     00930*12
        FOR(ISPOT+1) = D611(2)                     00931*12
        FOR(ISPOT+2) = D611(3)                     00932*12
        ISPOT=ISPOT+3                              00933*12
  615 CONTINUE                                     00934*12
       IF(I2.LE.0) GO TO 620                       00935*15
       DO 620 J2=1,I2                              00936*12
        FOR(ISPOT  ) = D620(1)                     00937*12
        FOR(ISPOT+1) = D620(2)                     00938*12
        FOR(ISPOT+2) = D620(3)                     00939*12
        ISPOT=ISPOT+3                              00940*12
  620 CONTINUE                                     00941*12
      FOR(ISPOT)=D01X                              00942*12
      RETURN                                       00943
C                                                  00944
C     FORMAT 1213                                  00945
  700 CONTINUE                                     00946*12
      FOR(1)=D700                                  00947*12
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      ISPOT=2
      IF(I1.LE.0) GO TO 711
      DO 710 J1=1,I1
        FOR(ISPOT  ) = D710(1)
        FOR(ISPOT+1) = D710(2)
        FOR(ISPOT+2) = D710(3)
        FOR(ISPOT+3) = D710(4)
        FOR(ISPOT+4) = D710(5)
        ISPOT=ISPOT+5
  710 CONTINUE
  711 IF(I2.LE.0) GO TO 721
      DO 720 I2=1,I2
        FOR(ISPOT) = D20X
        ISPOT=ISPOT+1
  720 CONTINUE
  721 IF(I3.LE.0) GO TO 731
      DO 730 J3=1,I3
        FOR(ISPOT  ) = D730(1)
        FOR(ISPOT+1) = D730(2)
        FOR(ISPOT+2) = D730(3)
        FOR(ISPOT+3) = D730(4)
        FOR(ISPOT+4) = D730(5)
        ISPOT=ISPOT+5
  730 CONTINUE
  731 CONTINUE
       FOR(ISPOT)=D731(1)
        FOR(ISPOT+1)=D731(2)
      ISPOT=ISPOT+2
      IF(I1.LE.0) GO TO 741
      DO 740 J1=1,I1
        FOR(ISPOT  ) = D740(1)
        FOR(ISPOT+1) = D740(2)
        FOR(ISPOT+2) = D740(3)
        FOR(ISPOT+3) = D740(4)
        FOR(ISPOT+4) = D740(5)
        ISPOT=ISPOT+5
  740 CONTINUE
  741 IF(I2.LE.0) GO TO 751
      DO 750 J2=1,I2
        FOR(ISPOT)=D20X
        ISPOT=ISPOT+1
  750 CONTINUE
  751 IF(I3.LE.0) GO TO 761
      DO 760 J3=1,I3
        FOR(ISPOT  ) = D760(1)
        FOR(ISPOT+1) = D760(2)
        FOR(ISPOT+2) = D760(3)
        FOR(ISPOT+3) = D760(4)
        ISPOT=ISPOT+4
  760 CONTINUE
  761 CONTINUE
      FOR(ISPOT)=D01X
      RETURN
```

```
C
C     FORMAT 2871
  800 FOR(1)=D800(1)
      FOR(2)=D800(2)
      FOR(3)=D800(3)
      ISPOT=4
      IF(I1.LE.0) GO TO 810
      DO 810 J1=1,I1
        FOR(ISPOT  ) = D810(1)
        FOR(ISPOT+1) = D810(2)
        FOR(ISPOT+2) = D810(3)
        FOR(ISPOT+3) = D810(4)
        ISPOT=ISPOT+4
  810 CONTINUE
      FOR(ISPOT)= D01X
      RETURN
C
  900 CONTINUE
      FOR(1)=D900
      ISPOT=2
      IF(I1.LE.0) GO TO 911
      DO 910 J1=1,I1
        FOR(ISPOT  ) = D910(1)
        FOR(ISPOT+1) = D910(2)
        FOR(ISPOT+2) = D910(3)
        ISPOT=ISPOT+3
  910 CONTINUE
  911 CONTINUE
      FOR(ISPOT)=D01X
 1000 CONTINUE
      DO 1005 I=1,4
        FOR(I)=D1000(I)
 1005 CONTINUE
      ISPOT=5
      IF(I1.LE.0) GO TO 1010
      DO 1010 J1=1,I1
        FOR(ISPOT  ) = D1010(1)
        FOR(ISPOT+1) = D1010(2)
        FOR(ISPOT+2) = D1010(3)
        ISPOT=ISPOT+3
 1010 CONTINUE
      FOR(ISPOT)=D01X
      RETURN
 1100 CONTINUE
      FOR(1)=D1100(1)
      FOR(2)=D1100(2)
      FOR(3)=D1100(3)
      RETURN
 1200 CONTINUE
      FOR(1)=D1200(1)
      FOR(2)=D1200(2)
      FOR(3)=D1200(3)
 1300 CONTINUE
```

```
      FOR(1)=D1300(1)                                    01054*12
      FOR(2)=D1300(2)                                    01055*12
      FOR(3)=D1300(3)                                    01056*12
      RETURN                                             01057*12
      END                                                01058
      SUBROUTINE FORMN2(M1,M2,M13,M8,M12)                01059
      COMMON /FORMET/F(100)                              01060
      DATA DP5XC/ 4H(5X,/                                01061*12
      DATA D20X/ 4H20X,/                                 01062*12
      DIMENSION D030(5)                                  01063*12
      DATA D030/ 20H'CONC. (MG/L)',8X,  /                01064*13
      DIMENSION D031(5)                                  01065*12
      DATA D031/ 20H'CONC. (UG/L)',8X,  /                01066*13
      DATA D55XP/ 4H/5X,/                                01067*18
      DIMENSION D070(5)                                  01068*12
      DATA D070/ 20H12('-'),8X,         /                01069*12
      DATA D01X/ 4H1X) /                                 01070*12
      F(1)=DP5XC                                         01071*12
      I=2                                                01072*12
      IF(M1.LE.0) GO TO 11                               01073*12
      DO 10 J1=1,M1                                      01074*12
        F(I)=D20X                                        01075*12
        I=I+1                                            01076*12
   10 CONTINUE                                           01077*12
   11 IF(M2.LE.0) GO TO 21                               01078*12
      DO 20 J2=1,M2                                      01079*12
        F(I)=D20X                                        01080*12
        I=I+1                                            01081*12
   20 CONTINUE                                           01082*12
   21 IF(M13.LE.0) GO TO 31                              01083*12
      DO 30 J13=1,M13                                    01084*12
        F(I  ) = D030(1)                                 01085*12
        F(I+1) = D030(2)                                 01086*12
        F(I+2) = D030(3)                                 01087*12
        F(I+3) = D030(4)                                 01088*12
        F(I+4) = D030(5)                                 01089*12
      I=I+5                                              01090*12
   30 CONTINUE                                           01091*12
   31 DO 32 J=1,5                                        01092*12
        F(I)=D031(J)                                     01093*12
        I=I+1                                            01094*12
   32 CONTINUE                                           01095*12
      IF(M8.LE.0) GO TO 41                               01096*12
      DO 40 J8=1,M8                                      01097*12
        F(I  ) = D030(1)                                 01098*12
        F(I+1) = D030(2)                                 01099*12
        F(I+2) = D030(3)                                 01100*12
        F(I+3) = D030(4)                                 01101*12
        F(I+4) = D030(5)                                 01102*12
        I=I+5                                            01103*12
   40 CONTINUE                                           01104*12
   41 F(1)=D55XP                                         01105*12
      I=I+1                                              01106*12
```

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RX.GRPX873.SOURCE2                                       9.0      14.51.26       22       009315

         IF(M1.LE.0) GO TO 51                                     01107*12
         DO 50 J1=1,M1                                            01108*12
           F(I)=D20X                                              01109*12
           I=I+1                                                  01110*12
      50 CONTINUE                                                 01111*12
      51 IF(M2.LE.0) GO TO 61                                     01112*12
         DO 60 J2=1,M2                                            01113*12
           F(I)=D20X                                              01114*12
           I=I+1                                                  01115*12
      60 CONTINUE                                                 01116*12
      61 IF(M12.LE.0) GO TO 71                                    01117*12
         DO 70 J12=1,M12                                          01118*12
           F(I  ) = D070(1)                                       01119*12
           F(I+1) = D070(2)                                       01120*12
           F(I+2) = D070(3)                                       01121*12
           F(I+3) = D070(4)                                       01122*12
           F(I+4) = D070(5)                                       01123*12
           I=I+5                                                  01124*12
      70 CONTINUE                                                 01125*12
      71 F(I)=D01X                                                01126*12
         RETURN                                                   01127
         END                                                      01128
         SUBROUTINE TIMCON(ITIM,LIT)                              01129
         DIMENSION LIT(4),NUM(10)                                 01130
         DATA NUM/'0','1','2','3','4','5','6','7','8','9'/        01131*12
         TIM=ITIM                                                 01132
         TIM=TIM*.0001                                            01133
         DO 10 I=1,4                                              01134
         TIM=TIM*10                                               01135
         TIM=TIM+.00001                                           01136
         ITMP=TIM                                                 01137
         TIM=TIM-ITMP                                             01138
         DO 10 J=1,10                                             01139
         IF (ITMP.EQ.(J-1)) LIT(I)=NUM(J)                         01140
      10 CONTINUE                                                 01141
         RETURN                                                   01142
         END                                                      01143
***** ABOVE ACTION SATISFACTORILY COMPLETED *****
```

APPENDIX TABLE II

Listing of Plot Generating Program
and Subroutine TIMCON

```
0001          SUBROUTINE PLTR(ISWTCH)                                          00026
0002          DIMENSION INQSYM(30),ISTRTD(3),ITIME(500),DATA(500),LNUM(4),STARTO00027
             1(3),RTITLE(5)                                                    00028*19
0003          COMMON LOC,IEVNT,ISTRTO,ISTART,NUMOP,ITIME,DATA,ICOL,RTITLE      00029*19
0004          DATA INQSYM/'COLF',' PH',' HG',' SS',' VSS',                     00030
             1'BOD5',' TOC',' COD',' TKN',' NO2',' NO3',' TH','TPO4',' CL-',  00031
             1' PB',' ZN',' SN',' FE',' CU',' CD',' CR',' TS',' O&G',        00032
             I' PCB','PEST',5*'    '/,IFINAL,IBLANK/1,'    '/                 00033
0005          STARTT=ISTART                                                    00034
0006          EVENT=IEVNT                                                      00035
0007          DO 1000 I=1,3                                                    00036
0008     1000 STARTO(I)=ISTRTD(I)                                              00037
0009        1 FORMAT(1X,I2)                                                    00038
0010          CALL PLOT(0.,0.,3)                                               00039
        C                                                                         *22
        C =====> LIMITS, NUPAGE, FACTOR, CLRPLT ARE DUMMY SUBROUTINES              *22
        C                                                                         *22
0011          CALL LIMITS(0.,11.,315.)                                         00040
0012          CALL NUPAGE(1.)                                                  00041
0013          CALL FACTOR(1.000001)                                            00042
0014          CALL CLRPLT                                                      00043
        C                                                                         *22
        C =====> PLOT Y-AXIS                                                      *22
        C                                                                         *22
0015          CALL PLOT(0.,-.063,2)                                            00044
0016          CALL PLOT(0.,0.,2)                                               00045
0017          CALL PLOT(-.063,.0,2)                                            00046
0018          CALL PLOT(0.,0.,3)                                               00047
0019          Y=0.                                                             00048
0020          DO 20 KK=1,10                                                    00049
0021          Y=Y+.6                                                           00050
0022          CALL PLOT(0.,Y,2)                                                00051
0023          CALL PLOT(.063,Y,2)                                              00052
0024          CALL PLOT(-.063,Y,2)                                             00053
0025          CALL PLOT(0.,Y,2)                                                00054
0026       20 CONTINUE                                                         00055
        C                                                                         *22
        C =====> DETERMINE: START,END, & INCREMENTS OF TIME FOR PLOTTING          *22
        C                                                                         *22
0027          CFSEND=ITIME(NUMOP)                                              00056
0028          XX=0.                                                            00057
0029          STRT=STARTT*.01                                                  00058
0030          STARTF=STRT-INT(STRT)+.001                                       00059
0031          IF(STARTF.GT..45) STARTF=.45                                     00060
0032          IF(STARTF.GT..30.AND.STARTF.LT..45)STARTF=.30                    00061
0033          IF(STARTF.GT..15.AND.STARTF.LT..30)STARTF=.15                    00062
0034          IF(STARTF.GT..0.AND.STARTF.LT..15)STARTF=.0                      00063
0035          STARTT=INT(STRT)*100+STARTF*100                                  00064
```

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```
            CFSENT=CFSEND*.01                                                00065
            CFSENF=CFSENT-AINT(CFSENT)                                       00066
            IF(CFSENF.GT..0.AND.CFSENF.LT..15)CFSENF=.15                     00067
            IF(CFSENF.GT..15.AND.CFSENF.LT..30)CFSENF=.30                    00068
            IF(CFSENF.GT..30.AND.CFSENF.LT..45)CFSENF=.45                    00069
            IF(CFSENF.GT..45) CFSENT=CFSENT+1                                00070
            IF(CFSENF.GT..45) CFSENF=0.                                      00071
            CFSEND=(AINT(CFSENT)*100.)+(CFSENF*100.)                         00072
            CFSTMP=CFSEND                                                    00073
            IF (CFSTMP.LT.STARTT) CFSTMP=CFSTMP+2400                         00074
            T1 = CFSTMP - 100.*INT(CFSTMP/100.) + 60.*INT(CFSTMP/100.)       00075*11
            T2 = STARTT - 100.*INT(STARTT/100.) + 60.*INT(STARTT/100.)       00076*11
            TOTMIN=ABS(T1-T2)                                                00077
            TIMINC=7.5                                                       00078
      1001  TIMINC=TIMINC*2.                                                 00079
            RNUMIN=TOTMIN/TIMINC                                             00080
            IF(RNUMIN.GT.6) GOTO 1001                                        00081
            XX=(1-(RNUMIN-INT(RNUMIN)))                                      00082
            IF(XX.EQ.1) XX=0.                                                00083
            XX=XX*TIMINC                                                     00084
            IHOUR = CFSEND/100.                                              00085*11
            RMIN=CFSEND-IHOUR*100                                            00086
            RMIN=RMIN+XX+1                                                   00087
      1100  IF(RMIN.GE.60) IHOUR=IHOUR+1                                     00088
            IF(RMIN.GE.60) RMIN=RMIN-60                                      00089
            IF(IHOUR.GE.24.AND.RMIN.NE.0) IHOUR=IHOUR-24                     00090
            IF(RMIN.GE.60) GOTO 1100                                         00091
            CFSEND=IHOUR*100+RMIN                                            00092
            CFSTMP=CFSEND                                                    00093
            IF(CFSEND.LT.STARTT)  CFSTMP=CFSTMP+2400                         00094
            T1 = CFSTMP - 100.*INT(CFSTMP/100.) + 60.*INT(CFSTMP/100.)       00095*12
            TOTMIN=ABS(T1-T2)                                                00096
            NUMINC=TOTMIN/TIMINC                                             00097
            RNUMIN=NUMINC                                                    00098
      C                                                                           *22
      C =====> PLOT X-AXIS                                                        *22
      C                                                                           *22
            SPACE=6./RNUMIN                                                  00099
            X=0.                                                             00100
            CALL PLOT(0.,0.,3)                                               00101
            DO 10 KK=1,NUMINC                                                00102
            X=X+SPACE                                                        00103
            CALL PLOT(X,0.,2)                                                00104
            CALL PLOT(X,.063,2)                                              00105
            CALL PLOT(X,-.063,2)                                             00106
            CALL PLOT(X,0.,2)                                                00107
         10 CONTINUE                                                         00108
      C                                                                           *22
```

```
                C =====> PLOT X-AXIS VALUES                                         *22
                C                                                                   *22
      0080            X=-(SPACE)                                                 00109
      0081            ITIM=STARTT+.5                                             00110
      0082            DO 30 KK=1,NUMINC                                          00111
      0083            X=X+SPACE                                                  00112
      0084            X1=X-.39                                                   00113
      0085            IF (X.EQ.0.) GOTO 200                                      00114
      0086            IHOUR = ITIM/100                                           00115*11
      0087            IMIN=ITIM-IHOUR*100                                        00116
      0088            IMIN=IMIN+TIMINC                                           00117
      0089         40 IF (IMIN.GE.60)  IHOUR=IHOUR+1                             00118
      0090            IF (IMIN.GE.60)  IMIN=IMIN-60                              00119
      0091            IF(IHOUR.GE.24.AND.IMIN.NE.0) IHOUR=IHOUR-24               00120
      0092            IF (IMIN.GE.60)  GOTO 40                                   00121
      0093            ITIM=(IHOUR*100+IMIN)                                      00122
      0094            IF(ITIM.EQ.0) ITIM=2400                                    00123
      0095        200 IF (ITIM.LT.1000) X1=X1+.125                               00124
      0096            CALL TIMCON(ITIM,LNUM)                                     00125
      0097            DO 2200 I=1,4                                              00126
      0098            CALL SYMBOL (X1,-.35,.1875,LNUM(I),0.,1)                   00127
      0099            X1=X1+.195                                                 00128
      0100       2200 CONTINUE                                                   00129
      0101         30 CONTINUE                                                   00130
                C                                                                   *22
                C =====> PLOT FINAL X-AXIS VALUE                                    *22
                C                                                                   *22
      0102            X1=5.61                                                    00131
      0103            ICFS=CFSENO                                                00132
      0104            IF(ICFS.EQ.0) ICFS=2400                                    00133
      0105            CALL TIMCON(ICFS,LNUM)                                     00134
      0106            DO 1200 I=1,4                                              00135
      0107            CALL SYMBOL(X1,-.35,.1875,LNUM(I),0.,1)                    00136
      0108            X1=X1+.195                                                 00137
      0109       1200 CONTINUE                                                   00138
      0110            YMAX=0                                                     00139
                C                                                                   *22
                C =====> GET Y-MAX                                                  *22
                C                                                                   *22
      0111            DO 320 II=1,NUMDP                                          00140
      0112            IF (DATA(II).GT.YMAX) YMAX=DATA(II)                        00141
      0113        320 CONTINUE                                                   00142
      0114            IF(ISWTCH.EQ.3) GOTO 400                                   00143
                C                                                                   *22
                C =====> GET PROPER INTEGER VALUE FOR Y-MAX                         *22
                C                                                                   *22
      0115            IF(YMAX.GT.0.AND.YMAX.LE..5) YMAX=.5                       00144
      0116            IF(YMAX.GT..5.AND.YMAX.LE.1) YMAX=1                        00145
```

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 0117              IF(YMAX.GT.1.AND.YMAX.LE.5) YMAX=5                                        00146
 0118              IF(YMAX.GT.5.AND.YMAX.LE.10) YMAX=10                                      00147
 0119              IF(YMAX.GT.10.AND.YMAX.LE.25) YMAX=25                                     00148
 0120              IF(YMAX.GT.25.AND.YMAX.LE.50) YMAX=50                                     00149
 0121              IF(YMAX.GT.50.AND.YMAX.LE.100) YMAX=100                                   00150
 0122              IF(YMAX.GT.100.AND.YMAX.LE.250) YMAX=250                                  00151
 0123              IF(YMAX.GT.250.AND.YMAX.LE.500) YMAX=500                                  00152
 0124              IF(YMAX.GT.500.AND.YMAX.LE.1000) YMAX=1000                                00153
 0125              IF(YMAX.GT.1000.AND.YMAX.LE.2500) YMAX=2500                               00154
 0126              IF(YMAX.GT.2500.AND.YMAX.LE.5000) YMAX=5000                               00155
 0127              IF(YMAX.GT.5000.AND.YMAX.LE.10000) YMAX=10000                             00156
 0128              IF(YMAX.GT.10000.AND.YMAX.LE.20000) YMAX=20000                            00157
             C                                                                                  *22
             C =====> PLOT Y-AXIS VALUES                                                        *22
             C                                                                                  *22
 0129          400 YINC=YMAX/10.                                                             00158
 0130              Y=-.6                                                                     00159
 0131              YSTART = -YINC                                                            00160*14
 0132              DO 50 KK=1,11                                                             00161
 0133              Y=Y+.6                                                                    00162
 0134              R=KK                                                                      00163
 0135              YVAL = YSTART + R*YINC                                                    00164*14
 0136              RRK=(R/2-INT(R/2))                                                        00165
 0137              IF(RRK.EQ.0) GOTO 50                                                      00166
 0138              X=-.65                                                                    00167
 0139              IF(YVAL.LT.1.0) X=-.8375                                                  00168
 0140              IF(ISWTCH.EQ.3) X=-1.435                                                  00169
 0141              IF(ISWTCH.EQ.3.AND.YVAL.LT.1.0) X=-1.6225                                 00170
 0142              RMAG=.0999999                                                             00171
 0143           60 RMAG=RMAG*10                                                              00172
 0144              IF (YVAL.GT.RMAG) X=X-.1875                                               00173
 0145              IF (YVAL.GT.RMAG) GOTO 60                                                 00174
 0146              Y1=Y-.09375                                                               00175
 0147              IF(ISWTCH .EQ. 3) X = X + 0.5625                                          00176*15
 0148              IF (ISWTCH.EQ.3) CALL NUMBER (X,Y1,.1875,YVAL,0.,4)                       00177*13
 0149              IF ((SWTCH.LT.3) CALL NUMBER(X,Y1,.1875,YVAL,0.,2)                        00178
 0150           50 CONTINUE                                                                  00179
 0151              WRITE(6,1) ISWTCH                                                         00180
             C                                                                                  *22
             C =====> PLOT X-AXIS IDENTIFICATION                                                *22
             C                                                                                  *22
 0152              CALL SYMBOL(.75,-1.,.375,'TIME (IN HOURS)',0.,15)                         00181
             C                                                                                  *22
             C =====> PLOT Y-AXIS IDENTIFICATION                                                *22
             C                                                                                  *22
 0153              IF((SWTCH.EQ.1)CALL SYMBOL(-1.3,6.2,.375,'FLOW',0.,4)                     00182
 0154              IF((SWTCH.EQ.1)CALL SYMBOL(999.,999.,.1875,' (CFS)',0.,6)                 00183
 0155              IF(ISWTCH.GT.1)CALL SYMBOL(-1.3,6.2,.375,INQSYM(ICOL),0.,4)               00184
```

```
 0156              IF(ISWTCH.EQ.2)CALL SYMBOL(999.,999.,.1875,' (MG/L)',0.,7)      00185
 0157              IF(ISWTCH.EQ.3)CALL SYMBOL(999.,999.,.1875,' (LB/MIN)',0.,9)    00186
 0158              IF(ISWTCH.EQ.0)CALL SYMBOL(-1.3,6.2,.375,'INJ.',0.,4)           00187
 0159              IF(ISWTCH.EQ.0)CALL SYMBOL(999.,999.,.1875,' (IN/HR)',0.,8)     00188
 0160              CALL PLOT(0.,0.,3) .                                            00189
 0161              WRITE(6,1) ISWTCH                                               00190
           C       WRITE(6,9991) T2,STARTT,TOTMIN                                  00191*16
 0162              ITESTT = STARTT                                                 00192*10
           C9991 FORMAT(' ',3G20.6)                                                00193*16
           C                                                                         *22
           C =====> PLOT TIME VS DATA-VALUE                                          *22
           C                                                                         *22
 0163              DO 70 KK=1,NUMDP                                                00194
 0164              IF (ITIME(KK).LT.ITESTT) ITIME(KK)=ITIME(KK)+2400.              00195*10
 0165              X = ITIME(KK) - (ITIME(KK)/100)*100 + (ITIME(KK)/100)*60        00196*10
 0166              X=ABS(X-T2)                                                     00197
 0167              X=X/TOTMIN*6.                                                   00198
 0168              Y=DATA(KK)/YMAX*6.                                              00199
           C       WRITE(6,9992) X,Y,ITIME(KK)                                     00200*16
           C9992 FORMAT(' ',2G20.6,I15)                                            00201*16
 0169              IF(ISWTCH.LT.1) GOTO 505                                        00202
 0170      •       IF (KK.EQ.1) CALL PLOT(X,Y,3)                                   00203
 0171              IF(KK .EQ. 1) CALL SYMBOL(X,Y,0.1,2,0.0,-2)                     00204**8
 0172              IF (KK.EQ.1) GOTO 70                                            00205
 0173              CALL PLOT(X,Y,2)                                                00206
 0174              CALL SYMBOL(X,Y,0.1,2,0.0,-2)                                   00207**8
 0175              GOTO 70                                                         00208
 0176          505 IF(KK.EQ.1) YTEMP=Y                                             00209
 0177              IF(KK.EQ.1) CALL PLOT(X,0.,3)                                   00210
 0178              IF(KK.EQ.1) CALL PLOT(X,0.,2)                                   00211
 0179              CALL PLOT(X,YTEMP,2)                                            00212
 0180              CALL PLOT(X,Y,2)                                                00213
 0181              YTEMP=Y                                                         00214
 0182           70 CONTINUE                                                        00215
 0183              J=LOC                                                           00216
           C                                                                         *22
           C =====> PLOT GRAPH IDENTIFICATION                                        *22
           C                                                                         *22
 0184              CALL SYMBOL(0.75,9.5,.5,RTITLE,0.,20)                           00217*17
 0185              X=1.6625                                                        00218
 0186              IF(IEVNT.GT.9) X=X-.1875                                        00219
 0187              CALL SYMBOL(X,7.5,.375,'EVENT:     ',0.,7)                      00220
 0188              CALL NUMBER(999.,999.,.375,EVENT,0.,-1)                         00221
 0189              WRITE(6,1) ISWTCH                                               00222
 0190              X=1.875                                                         00223
 0191              IF(ISTRTD(1).GT.9) X=X-.1875                                    00224
 0192              IF(ISTRTD(2).GT.9) X=X-.1875                                    00225
 0193              CALL NUMBER(X,7.,.375,STARTD(1),0.,-1)                          00226
```

```
0194        CALL SYMBOL(999.,999.,.375,'/',0.,1)                   00227
0195        CALL NUMBER(999.,999.,.375,STARTD(2),0.,-1)            00228
0196        WRITE(6,1) ISWTCH                                      00229
0197        CALL SYMBOL(999.,999.,.375,'/',0.,1)                   00230
0198        CALL NUMBER(999.,999.,.375,STARTD(3),0.,-1)            00231
0199        WRITE(6,1) ISWTCH                                      00232
      C                                                              *22
      C =====> TO MOVE TO NEXT GRAPH                                 *22
      C                                                              *22
0200        CALL PLOT(14.0,0.0,-3)                                 00233**7
0201        RETURN                                                 00234
0202        END                                                    00235
```

COMMON BLOCK / / MAP SIZE FD4

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LOC	0	IEVNT	4	ISTRTD	8	ISTART	14	NUMDP	18
ITIME	1C	DATA	7EC	ICOL	FBC	RTITLE	FCD		

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
PLOT	210	LIMITS	214	NUPAGE	218	FACTOR	21C	CLRPLT	220
TIMCON	224	SYMBOL	228	NUMBER	22C	IBCOM#	230		

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IFINAL	5AC	IBLANK	5B0	STARTT	5B4	EVENT	5B8	I	59C
Y	5C0	KK	5C4	CFSEND	5C8	XX	5CC	STRT	5D0
STARTF	5D4	CFSENT	5D8	CFSGNF	5DC	CFSTMP	5E0	T1	5E4
T2	5E8	TOTMIN	5EC	TIMINC	5F0	RNUMIN	5F4	THOUR	5F8
RMIN	5FC	O	600	NUMINC	604	SPACE	608	X	60C
ITIM	610	XI	614	IMIN	618	ICES	61C	YMAX	620
II	624	ISWTCH	628	YINC	62C	YSTAPT	630	R	634
YVAL	638	RPK	63C	RMAG	640	Y1	644	ITESTT	648
YTEMP	64C	J	650						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
INQSYM	654	LNUM	6CC	STARTD	6DC				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
1	749								

```
*OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = PLTR     , LINECNT =       50
*STATISTICS*     SOURCE STATEMENTS =       202,PROGRAM SIZE =      7410
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                LIMITS            DATE = 78201          14/16/49            PAGE 0001

    0001              SUBROUTINE LIMITS(X,Y,Z)                                        00236
    0002              RETURN                                                          00237
    0003              END                                                             00238
```

```
FORTRAN IV G LEVEL  21              LIMITS            DATE = 78201          14/16/40            PAGE 0002

                                  SCALAR MAP
 SYMBOL     LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION        SYMBOL     LOCATION
 X                90        Y                94        Z                98

    *OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
    *OPTIONS IN EFFECT*  NAME = LIMITS   , LINECNT =       50
    *STATISTICS*    SOURCE STATEMENTS =        3,PROGRAM SIZE =       324
    *STATISTICS*  NO DIAGNOSTICS GENERATED
```

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```
FORTRAN IV G LEVEL  21           NUPAGE           DATE = 78201        14/16/48          PAGE 0001

      0001          SUBROUTINE NUPAGE(X)                                       00239
      0002          CALL NEWPLT(0,0.,0.,0.,0.,0,1H )                           00240
      0003          RETURN                                                     00241
      0004          END                                                        00242
```

```
                              SUBPROGRAMS CALLED
 SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION
 NEWPLT       90

                              SCALAR MAP
 SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION    SYMBOL    LOCATION
 X            80

    *OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
    *OPTIONS IN EFFECT*  NAME = NUPAGE  , LINECNT =       50
    *STATISTICS*    SOURCE STATEMENTS =        4,PROGRAM SIZE =      326
    *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21                CLRPLT          DATE = 78201        14/16/48          PAGE 0001

      0001              SUBROUTINE CLRPLT                                          00243
      0002              RETURN                                                     00244
      0003              END                                                        00245
```

```
*OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = CLRPLT  , LINECNT =       50
*STATISTICS*    SOURCE STATEMENTS =        3,PROGRAM SIZE =       246
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21              POINT            DATE = 78201          14/16/49             PAGE 0001

    0001            SUBROUTINE POINT(I)                                         00246
    0002            IF(I.GE.1)CALL SYMBOL(999.,999.,0.1,2,0.,-2)                00247
    0003            RETURN                                                      00248
    0004            END                                                         00249
```

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```
FORTRAN IV G LEVEL  21                POINT            DATE = 78201        14/16/48            PAGE 0002

                                 SUBPROGRAMS CALLED
 SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
 SYMBOL        94

                                 SCALAR MAP
 SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
 I             80

    *OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
    *OPTIONS IN EFFECT*  NAME = POINT    , LINECNT =       50
    *STATISTICS*     SOURCE STATEMENTS =         4,PROGRAM SIZE =       352
    *STATISTICS*  NO DIAGNOSTICS GENERATED
```

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```
FORTRAN IV G LEVEL  21            TIMCON          DATE = 78201        14/16/48          PAGE 0001

0001              SUBROUTINE TIMCON(ITIM,LIT)                                  00250
            C                                                                    *22
            C =====> CONVERT TO 4 CHARACTERS FOR PLOTTING                        *22
            C                                                                    *22
0002              DIMENSION LIT(4),NUM(10)                                     00251
0003              DATA NUM/'0','1','2','3','4','5','6','7','8','9'/            00252
0004              TIM=ITIM                                                     00253
0005              TIM=TIM*.0001                                                00254
0006              DO 10 I=1,4                                                  00255
0007              TIM=TIM*10                                                   00256
0008              TIM=TIM+.00001                                               00257
0009              ITMP=TIM                                                     00258
0010              TIM=TIM-ITMP                                                 00259
0011              DO 10 J=1,10                                                 00260
0012              IF (ITMP.EQ.(J-1)) LIT(I)=NUM(J)                             00261
0013           10 CONTINUE                                                     00262
0014              RETURN                                                       00263
0015              END                                                          00264
```

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```
FORTRAN IV G LEVEL  21              TIMCON           DATE = 78201         14/16/48              PAGE 0002

                                SCALAR MAP
 SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
 TIM             9C      ITIM            A0      I               A4      ITMP            A8      J               AC

                                ARRAY MAP
 SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
 LIT             80      NUM             84

    *OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
    *OPTIONS IN EFFECT*  NAME = TIMCON  , LINECNT =       50
    *STATISTICS*    SOURCE STATEMENTS =       15,PROGRAM SIZE =       624
    *STATISTICS*  NO DIAGNOSTICS GENERATED
```

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```
FORTRAN IV G LEVEL  21              NEWPLT           DATE = 78201        14/16/48            PAGE 0001

      0001              SUBROUTINE NEWPLT(DUM1,DUM2,DUM3,DUM4,DUM5,DUM6,DUM7)               00265**6
      0002              RETURN                                                              00266**6
      0003              END                                                                 00267**6
```

```
FORTRAN IV G LEVEL  21              NEWPLT           DATE = 78201        14/16/48           PAGE 0002

                              SCALAR MAP
 SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION      SYMBOL    LOCATION
 DUM1          90        DUM2          94        DUM3          98        DUM4          9C        DUM5          A0
 DUM6          A4        DUM7          A8

   *OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
   *OPTIONS IN EFFECT*  NAME = NEWPLT   , LINECNT =       50
   *STATISTICS*    SOURCE STATEMENTS =        3,PROGRAM SIZE =       420
   *STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL  21              ERRON          DATE = 78201        14/16/48           PAGE 0001

    0001              SUBROUTINE ERRON                                   00268**6
    0002              RETURN                                             00269**6
    0003              END                                                00270**6
```

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```
FORTRAN IV G LEVEL  21                ERRON             DATE = 78201          14/16/48              PAGE 0002

      *OPTIONS IN EFFECT*  NOID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
      *OPTIONS IN EFFECT*  NAME = ERRON    , LINECNT =        50
      *STATISTICS*    SOURCE STATEMENTS =        3,PROGRAM SIZE =      246
      *STATISTICS*  NO DIAGNOSTICS GENERATED

      *STATISTICS*  NO DIAGNOSTICS THIS STEP
```

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FEDERALLY COORDINATED PROGRAM (FCP) OF HIGHWAY RESEARCH AND DEVELOPMENT

The Offices of Research and Development (R&D) of the Federal Highway Administration (FHWA) are responsible for a broad program of staff and contract research and development and a Federal-aid program, conducted by or through the State highway transportation agencies, that includes the Highway Planning and Research (HP&R) program and the National Cooperative Highway Research Program (NCHRP) managed by the Transportation Research Board. The FCP is a carefully selected group of projects that uses research and development resources to obtain timely solutions to urgent national highway engineering problems.*

The diagonal double stripe on the cover of this report represents a highway and is color-coded to identify the FCP category that the report falls under. A red stripe is used for category 1, dark blue for category 2, light blue for category 3, brown for category 4, gray for category 5, green for categories 6 and 7, and an orange stripe identifies category 0.

FCP Category Descriptions

1. Improved Highway Design and Operation for Safety

Safety R&D addresses problems associated with the responsibilities of the FHWA under the Highway Safety Act and includes investigation of appropriate design standards, roadside hardware, signing, and physical and scientific data for the formulation of improved safety regulations.

2. Reduction of Traffic Congestion, and Improved Operational Efficiency

Traffic R&D is concerned with increasing the operational efficiency of existing highways by advancing technology, by improving designs for existing as well as new facilities, and by balancing the demand-capacity relationship through traffic management techniques such as bus and carpool preferential treatment, motorist information, and rerouting of traffic.

3. Environmental Considerations in Highway Design, Location, Construction, and Operation

Environmental R&D is directed toward identifying and evaluating highway elements that affect the quality of the human environment. The goals are reduction of adverse highway and traffic impacts, and protection and enhancement of the environment.

4. Improved Materials Utilization and Durability

Materials R&D is concerned with expanding the knowledge and technology of materials properties, using available natural materials, improving structural foundation materials, recycling highway materials, converting industrial wastes into useful highway products, developing extender or substitute materials for those in short supply, and developing more rapid and reliable testing procedures. The goals are lower highway construction costs and extended maintenance-free operation.

5. Improved Design to Reduce Costs, Extend Life Expectancy, and Insure Structural Safety

Structural R&D is concerned with furthering the latest technological advances in structural and hydraulic designs, fabrication processes, and construction techniques to provide safe, efficient highways at reasonable costs.

6. Improved Technology for Highway Construction

This category is concerned with the research, development, and implementation of highway construction technology to increase productivity, reduce energy consumption, conserve dwindling resources, and reduce costs while improving the quality and methods of construction.

7. Improved Technology for Highway Maintenance

This category addresses problems in preserving the Nation's highways and includes activities in physical maintenance, traffic services, management, and equipment. The goal is to maximize operational efficiency and safety to the traveling public while conserving resources.

0. Other New Studies

This category, not included in the seven-volume official statement of the FCP, is concerned with HP&R and NCHRP studies not specifically related to FCP projects. These studies involve R&D support of other FHWA program office research.

* The complete seven-volume official statement of the FCP is available from the National Technical Information Service, Springfield, Va. 22161. Single copies of the introductory volume are available without charge from Program Analysis (HRD-3), Offices of Research and Development, Federal Highway Administration, Washington, D.C. 20590.